Multimodal Coordination for Bus Priority Hot Spots

Task 2 Technical Memorandum - Development of Regional Hot Spots List

Submitted to:

National Capital Region Transportation Planning Board

Submitted by:

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FOURSQUARE INTEGRATED TRANSPORTATION PLANNING

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CONTENTS

1 Project Purpose and Background 1
1.1 Project Scope 1
1.2 Previous Hot Spots Study 2
2 Summary of Data Collection Efforts 3
2.1 Agency Groupings and Data Collected 3
2.2 Manipulation of Data for Analysis 6
2.2.1 Travel Speed Data 6
2.2.2 Timepoint Data 7
2.3 GIS Analysis 7
2.3.1 Originally Planned Methodology 7
2.3.2 Creation of Routes using NavTeq Data 8
2.3.3 Creation of the Timepoint Data 9
3 Analysis Methodology 11
3.1 Overview 11
3.2 Aggregating Data by Agency 14
3.3 Aggregating Data Across Agencies 14
4 Identification and Prioritization Methodology 16
4.1 Application of Primary Evaluation Factors 16
4.2 Application of Secondary Evaluation Factors 18
4.2.1 Frequency of Non-Core Buses 18
4.2.2 Route Level Ridership 19
4.2.3 Agency Defined Hot Spots 19
5 Analysis Results 21
5.1 Roadway Segment Travel Speeds 21
5.2 Roadway Segment Scores 21
5.3 Hot Spot Maps and Lists 25

Appendix A-1

TABLES

Table 1: Transit Agency Contacts 3
Table 2: Transit Agency Descriptions 4
Table 3: Data Collected by Transit Agency Type 5
Table 4: Travel Time Data by Transit Agency 6
Table 5: Average Bus Speed by Jurisdiction 16
Table 6: Agency Identified Hot Spot Locations 19
Table 7: District of Columbia Hot Spot Locations - All Day 41
Table 8: District of Columbia Hot Spot Locations – AM Peak (6:00 – 9:00) 43
Table 9: District of Columbia Hot Spot Locations – PM Peak (3:00-7:00) 45
Table 10: Maryland Hot Spot Locations – All Day 47
Table 11: Maryland Hot Spot Locations – AM Peak (6:00 – 9:00) 49
Table 12: Maryland Hot Spot Locations – PM Peak (3:00-7:00) 51
Table 13: Virginia Hot Spot Locations – All Day 53
Table 14: Virginia Hot Spot Locations – AM Peak (6:00 – 9:00) 55
Table 15: Virginia Hot Spot Locations – PM Peak (3:00-7:00) 57

Table A-1 DC Hot Spot Max Links – All Day A-4
Table A-2 DC Hot Spot Max Links – AM Peak A-4
Table A-3 DC Hot Spot Max Links – PM Peak A-5
Table A-4 MD Hot Spot Max Links – All Day A-5
Table A-5 MD Hot Spot Max Links – AM Peak A-6
Table A-6 MD Hot Spot Max Links – PM Peak A-6
Table A-7 VA Hot Spot Max Links – All Day A-7
Table A-8 VA Hot Spot Max Links – AM Peak A-7
Table A-9 VA Hot Spot Max Links – PM Peak A-8

FIGURES

Figure 1: Example of Bus Route Drawn from NavTeq Road Links 8
Figure 2: Hot Spot Database Development Methodology 12
Figure 3: Analysis Methodology 12
Figure 4: Data Aggregation Process 14
Figure 5: Hot Spot Identification Process 17
Figure 6: Regionwide Hot Spot Scores – All Day 22
Figure 7: Regionwide Hot Spot Scores - AM Peak (6:00 - 9:00) 23
Figure 8: Regionwide Hot Spot Scores – PM Peak (3:00-7:00) 24
Figure 9: Hot Spot Locations in Washington DC 26
Figure 10: Detail Maps of District of Columbia Hotspots 27
Figure 11: Hot Spot Locations in Maryland 31

Figure 12: Detail Maps of Maryland Hot Spots 32
Figure 13: Hot Spot Locations in Virginia 36
Figure 14: Detail Maps of Virginia Hot Spots 36

Figures A-1: Regionwide Bus Speeds: All Day A-1
Figures A-2: Regionwide Bus Speeds: AM Peak A-2
Figures A-3: Regionwide Bus Speeds: PM Peak A-3

1 PROJECT PURPOSE AND BACKGROUND

1.1 Project Scope

The *Multimodal Coordination for Bus Priority Hot Spots* study represents further advancement of the implementation of key bus priority improvements on the roadway network in the Washington, DC Metropolitan Area. For the purposes of this study, the area is defined as the District of Columbia (DC); Montgomery, Prince George's and Frederick Counties in Maryland; and Arlington, Fairfax, Prince William, and Loudoun Counties and the Cities of Alexandria, Fairfax, and Falls Church in Virginia. The study is intended to build on the MWCOG Priority Corridor Network (PCN) Studies, the Regional Bus Priority Guidelines Study, and WMATA's initial bus priority "hot spot" analysis to identify a refined set of implementable bus priority improvements within the DC region. The WMATA study included an analytical framework for relating Metrobus service frequency and speed to priority improvement needs.

This new study is intended to broaden the scope of "hot spot" identification for bus priority treatments by including other local and regional transit systems in the Washington region, including the core agencies of Ride On, The Bus, Fairfax Connector, DASH, ART, CUE, and DC Circulator. In many cases these systems have bus routes that share roadways with Metrobus service, but there are several roadways where only the regional partner systems operate. Thus a key objective of this study is to expand the database and evaluation framework WMATA had initially applied to include a comprehensive assessment of all bus routes and roadway segments in the region. A key challenge is that the smaller transit systems in general do not have as great of a capability as WMATA to provide actual travel time and delay data. Thus an innovative yet cost-effective approach to providing added information on the smaller bus system operation was required. For this expanded study, frequency and speed information are still the primary evaluation measures in identifying an expanded set of bus priority "hot spot" locations. However, additional information including route level ridership and agency assessments of known hot spots will also be utilized in the prioritization process.

Another key phase in this study will be the identification of the most cost-effective bus priority treatment at particular locations after the database has been expanded and locations have been prioritized. This will require site-specific operational assessments as well as proven experience with assessing the tradeoff between intersection and corridor-based bus priority improvements. Later phases of the study will also consider whether passive or active transit signal priority might be best at particular locations.

The study will conclude with the advancement of design development for bus priority treatments at a subset of locations on the refined "hot spot" list. This design would represent approximately a 15% design, and identify the scope of infrastructure improvements, but will reflect more of a plan and typical section layouts without detailed assessment of storm water or utility impacts. This phase of the study included coordination between the consultant team, Project Management Team and TPB's

Management, Operations and ITS Technical Subcommittee (MOITS), and the Regional Bus Subcommittee (RBS). The committees were briefed on the study and the data needed to complete the hot spot list development in late October/early November, and the recommendations will also be reviewed with representatives from each jurisdiction before subsequent study phases begin.

1.2 Previous Hot Spots Study

To better understand operating conditions and identify specific locations in need of speed-enhancing improvements, WMATA contracted with a consultant in 2009 to evaluate bus performance by roadway segment. The analysis used GPS data collected through WMATA's Automatic Vehicle Location (AVL) system for the month of November 2009, and was summarized for weekday total, weekday PM peak (3:30pm – 6:30pm), and weekday AM peak (6:00am – 9:00am) conditions.

That analysis was performed using a GIS program that calculated average speeds based on the recorded time elapsed between WMATA timepoints. The November 2009 analysis showed that there are numerous roadway segments within the WMATA system with average operating speeds of less than 10 miles per hour (mph), and several with speeds of under 5 mph. The vast majority of these segments are within DC, but also occur in Maryland and Virginia suburban areas (particularly around Silver Spring and several Arlington County locations). The analysis also showed that PM peak speeds are generally lower than AM peak speeds, though the differences are small in most cases. For instance, the bridges over the Anacostia River in DC all show a noticeable decline in travel speed during the afternoon peak.

The differences between the peak periods and the all-day speeds were smaller than one might typically expect; this indicates that mid-day congestion is heavy on many routes in the service area. In addition, because more bus trips occur during the peak periods the all-day averages are naturally weighted toward the peaks.

In general, the results of the previous analysis show that bus operating conditions vary greatly by corridor within the WMATA system. Many locations, particularly in the downtown core, have operating speeds below 10 mph, indicating high amounts of bus delay. Moreover, many of the slowest locations shown on the map carry very high bus volumes (e.g., I Street in downtown DC has over 400 daily WMATA buses), suggesting that priority improvements at these locations could provide significant transportation benefits.

The previous analysis prioritized roadway segments and intersections in need of improvement through a weighting system based on a combination of travel speeds and bus frequencies. This prioritization was done separately for each WMATA jurisdictions for each analysis time period. Overall, the results of this analysis showed that archived AVL data can be used effectively to estimate bus travel speeds and identify high-priority locations for improvements.

2 SUMMARY OF DATA COLLECTION EFFORTS

2.1 Agency Groupings and Data Collected

At the onset of the project the consultant team began working immediately to acquire data from 12 transit agencies in the MWCOG/TPB region through in-person and phone interviews. The agencies and primary contacts are provided in Table 1.

Table 1: Transit Agency Contacts

Transit Agency	Contact	Contact Information
WMATA	Sean Kennedy	skennedy@wmata.com
DC Circulator	Sarah Powell, Brooke Fossey	sepowell@wmata.com, brooke.fossey@dc.gov
Ride On	Phil McLaughlin	Philip.Mclaughlin@montgomerycountymd.gov
The Bus	Kevin Thornton	kthornton@co.pg.md.us
MTA Commuter Bus	Mark Baskin, Glenn Saffran	mbaskin@mta.maryland.gov, gsaffran@mta.maryland.gov
Frederick County TransIT	Carrie Anderson-Watters	cwatters@frederickcountymd.gov
Connect-a-Ride	Ron Skotz	ron.skotz@cmrtransit.org
DASH	Jim Maslanka, Raymond Mui	Jim.Maslanka@alexandriava.gov, raymond.mui@alexandriava.gov
CUE	Alex Verzosa	Alexis.verzosa@fairfaxva.gov
Fairfax Connector	Christy Wegener, Paul Mounier, Randy White	Christin.wegener@fairfaxcounty.gov, paul.mounier@fairfaxcounty.gov, Randall.white@fairfaxcounty.gov
PRTC OmniRide	Chuck Steigerwald	Csteigerwald@omniride.com
Loudoun County Commuter Bus	Scott Gross	scott.gross@loudoun.gov

The data collected differed by agency type, with more extensive data being collected for what have been designated as “core agencies.” Core agencies represent the transit agencies in the region whose area of operation falls largely within the boundaries of the WMATA Compact Area. The remaining agencies have been designated as non-core agencies, representing smaller systems whose service areas are largely outside the WMATA compact zone as well as agencies that provide only commuter bus service. The list of agencies for which data was acquired, their agency designation, parent agency/jurisdiction, and geographic coverage area, is shown in Table 2.

Table 2: Transit Agency Descriptions

Agency Type	Transit Agency Name	Parent Agency/Jurisdiction	Coverage Area
Core Agencies	WMATA	WMATA	Regionwide
	DC Circulator	DC	DC
	Ride On	Montgomery County, Maryland	Montgomery County and into District of Columbia (DC)
	The Bus	Prince George County, Maryland	Prince George County and into DC
	ART	Arlington County, Virginia	Arlington County
	DASH	City of Alexandria, Virginia	City of Alexandria and Arlington County
	CUE	City of Fairfax, Virginia	City of Fairfax
	Fairfax Connector	Fairfax County, Virginia	Fairfax County and Arlington County
Non-Core Agencies	TransIT	Frederick County, Maryland	Frederick County
	Connect-a-Ride	Central Maryland Regional Transit (CMRT)	Howard County, Anne Arundel County, Prince George County
Commuter Bus	Maryland Transit Administration (MTA) Commuter Bus	State of Maryland	Maryland and to DC
	Omni-Ride	Potomac and Rappahannock Transportation Commission (PRTC)	Prince William County to Northern Virginia and DC
	LC Transit	Loudoun County, Virginia	Loudoun County to Northern Virginia and DC

Working directly with the transit agencies, the consultant team procured a wide array of data to support the analysis and prioritization process. This data included:

- Transit Level of Service (schedule, headway, frequency)
- GIS layers (routes, timepoints, and stops)
- Bus speed (AVL, GeoLogger, GPS, Nextbus)
- Distance between timepoints
- List of agency known hot spots
- Ridership (by route and stop level)

As previously noted, the data collected from each agency varied between core and non-core agencies. Table 3 illustrates the information collected for each agency type. The information on the left side of the table indicates information that is part of the core analysis, whereas information to the right is helpful but not part of the basic methodology.

Table 3: Data Collected by Transit Agency Type

	GIS Route Layers	Level of Service	Vehicle Speed	Information on known Hot Spots	Route-level ridership
Core Agencies	✓	✓	✓	✓	✓
Non-Core Agencies	✓	✓		✓	✓
Commuter Bus	✓	✓		✓	✓

During the data collection process it became evident that both data availability and quality varied greatly from agency to agency. For example, only one core agency had bus speed data that was already in a useable format, while all others required extensive formatting and manipulation before they could be used. One core agency had no bus travel time or speed data at all, in which case the bus speed had to be calculated based on the schedule and distance between timepoints.

2.2 Manipulation of Data for Analysis

2.2.1 Travel Speed Data

A significant amount of data was provided in both text and Excel format. This data required an extensive amount of manipulation to convert it into a usable format so that the speed and level of service data could be assigned to the route and segment GIS layers. Table 4 summarizes the type of vehicle travel time or speed data that was provided by each core agency and the format it was provided in. In general, AVL data was provided as an average by route, by time period, for a recent month.

Table 4: Travel Time Data by Transit Agency

Agency	Vehicle Travel Time Data/Speed Data Source	Format Provided	Time Period of Data
WMATA	AVL	GIS. Bus speed by roadway segment was provided by WMATA as a GIS layer developed during the initial WMATA-only hot spots study.	November 2009 (monthly average)
DC Circulator	Speed between timepoints	Excel. AVL travel time data was provided in Excel.	September 2011 (monthly average)
Ride On	AVL (Beta) and Distance	Text and Excel	AVL from October 3-5 (average over three days); October 2011 Schedules
The Bus	Nextbus	Excel	Past six months through September 2011
ART	AVL and Speed between timepoints	Excel. Bus speed by timepoint segments, as calculated by NextBus, was provided through access to the county's database.	Past year through September 2011
DASH	Schedule	Excel. Schedule data containing time between timepoints was provided.	October 2011 Schedules
CUE	AVL	Text. AVL travel time text files.	September 2011 (monthly average)
Fairfax Connector	Geologger/Schedule and distance between timepoints	Text and Excel. Geologger data for six routes was provided in Excel format. Travel time between timepoints was provided as text files as outputs of the Trapeze scheduling system.	Geologger (Fall 2011); October 2011 Schedules

Some of the data portrayed in Table 4 required significant manipulation before it was ready to link to the GIS-based routes. For example, while Fairfax Connector had actual travel speed for several routes

through an AVL-precursor tool called Geologger, the majority of segments speeds had to be calculated using scheduled travel speeds, necessitating the manipulation of two sets of .txt files, one set with a file for each route containing the scheduled time at each time point and one set with the distance between each time point. In Montgomery County, a combination of scheduled travel time and data from the county's new AVL system was used. While provided in Excel, the system limitations necessitated the provision of three days' worth of AVL data that needed to then be averaged, taking into consideration that many timepoints on many runs did not have data, as Ride On's AVL system does not record the time unless the door is opened. In addition, the timepoint-based data needed to be pulled out of full data sets that included AVL information for all bus stops.

All of the speed data was analyzed in three time periods: AM peak period (6-9am); PM peak period (3:00-7:00pm); and daily (first to last bus). The AM and PM peak time periods were adjusted from the previous study to match with WMATA's time period definitions.

2.2.2 Timepoint Data

In addition to travel time information, each agency needed to provide timepoint locations such that distances could be generated to calculate speed information based on the travel time between the timepoints. In some cases, distance between timepoints was provided in text files as Trapeze outputs, and in some cases the distance needed to be calculated in GIS. The details of how the timepoints were developed are outlined in the section below on GIS Analysis.

2.3 GIS Analysis

2.3.1 Originally Planned Methodology

The consultant team began this analysis with the assumption that the individual bus routes would be split into segments based on timepoints. The ideas was that in order to follow this process, we would assign the timepoints to the appropriate routes and utilize a GIS split line tool function to break the individual routes into segments between timepoints. However, upon further review of the route layers, it became apparent that the bus route layers, which each consist of all the routes for a given provider, had topological errors which make editing their geometry a challenge; the routes had all been drawn in a way that they did not match the roadway centerlines. Furthermore, bus stops (and timepoints) frequently did not correctly overlay with their respective route polylines, further hampering this approach. At that point, it was determined that in order to continue to follow this original methodology, all route segments would need to be verified and would require manual coding of each segment's correct timepoint ID (for approximately 190 "core agency" routes).

Another issue was encountered, concerning combining data for overlapping routes. Since each route has unique timepoints, overlapping segments of routes will frequently not match in length and start/end points. An accurate spatial join would require overlapping segments to have the same start and end points, which simply were not available. At this point, an alternative approach was developed.

2.3.2 Creation of Routes using NavTeq Data

The consultant team developed an alternative methodology that involved re-creating all 190 bus routes based on NavTeq[1] street files, to ensure that the routes were geographically accurate. In the process of re-creating those routes, route segments were manually coded to match their respective timepoints (see Figure 1). Each route was created as its own layer, and multiple routes could be joined together as needed. This approach simplified the process of combining route data because each route from each agency would be based on the same line segment data. If this analysis is carried out again in the future, the map can be recreated even if the timepoints change. In addition, the results from following this process are more accurate and usable on an ongoing basis (beyond this study).

Figure 1: Example of Bus Route Drawn from NavTeq Road Links

(Orange Route, Yellow Timepoints)

In addition to the route layers, timepoint layers for all agency routes required coding with the appropriate Stop ID. Similar to the travel time/speed data, the timepoint data availability and quality varied greatly by agency. Some agencies provided the timepoints in GIS shapefiles, and for that data the process involved simply applying the correct Stop ID to the timepoint. Several agencies provided only the latitude and longitude for their timepoints. For these, a spreadsheet with the lat/long and Stop ID attributes was created and a GIS shapefile generated from that. Finally, some agencies were not able to provide any timepoint data.

[1] NAVTEQ is the leading global provider of maps, traffic and location data (digital location content). NAVTEQ maps provide a highly accurate representation of the detailed road network including up to 260 attributes like turn restrictions, physical barriers and gates, one-way streets, restricted access and relative road heights.

2.3.3 Creation of the Timepoint Data

All of the agencies reported their final travel time data at the timepoint segment level. Once all of the data was cleaned and reformatted, the consultants had to match each unique segment with its respective start and end timepoints. The process involved the following steps:

1. The first step in the process was to create an accurate GIS shapefile of timepoint locations.
    a. Some of the agencies had incomplete timepoint data, requiring the consultant team to manually create or move the timepoints.
    b. Timepoint locations were verified using published route schedules and maps.
2. Once the timepoints were successfully coded, each route's segment data was matched to its respective timepoints.
    a. Agencies identified timepoint segments in one of three manners: timepoint ID, the segment's order along a route, or intersection name.
    b. In the latter two cases, the consultant team had to assign each segment the correct timepoint ID either manually or through a lookup table provided by the agency.
    c. A staff member verified that timepoints had the correct ID and order assigned to them.
3. The refined data was joined to the GIS timepoints by matching timepoint IDs.
    a. The resulting mapped point data describes a segment's attributes from a particular timepoint to the following timepoint along a route.
    b. As no automated process exists for transferring a point attribute accurately to a line segment, timepoint data was manually assigned to each route segment (see following section).

The following steps summarize the GIS workflow applied to recreate all of the agency bus routes using the NavTeq roadway segments.

<u>Route GIS Workflow</u>

1. Using the GIS layers provided by the agencies, individual layers were created for each route.
2. All of the NavTeq segments that overlap with a given route were selected.
    a. The route geometry was verified using the published bus route maps (as agencies frequently make changes to route alignments).
    b. Deviations from the main route were not included, e.g., trips into a shopping center on several runs.
3. Each direction of the route was exported as its own shapefile.
4. Each attribute table (one per route and direction) was populated with route name, direction, and agency.
5. For each given route, the timepoints related to that route were selected.
6. The attribute mapping tool under the spatial relationship toolbar was used to establish data relationships between timepoints and segments.

7. Using the attribute mapping tool, the timepoint attributes were transferred to every NavTeq feature along a given route segment. Attribute mapping allows one to assign attributes from one feature to another by simply clicking on the source feature and then clicking on the target feature. Each timepoint on a route describes attributes for the route segment. In most cases, the data is coded so that the timepoint describes the segment attributes along a segment that stretches from the timepoint to the previous timepoint. For ART the data is coded in the opposite manner, describing attributes from the timepoint to the following attribute.
8. Once all the routes were coded, every agency's routes were merged into a single file by direction.

Calculating Distance and Speed Using GIS/AVL/Timepoint Locations

CUE, DASH and The Bus were unable to report distance or speed data between timepoints. To calculate the final speeds, the consultant had to approximate the distance between timepoints based on the coded NavTeq data. The steps involved in this calculation were:

1. The length of each coded NavTeq segment was calculated in miles in GIS.
2. The GIS data was brought into Excel. A query was run to calculate the length of each timepoint segment by summing up all NavTeq segments that share the same timepoint segment ID.
3. The distance data was appended back to the original timepoint data and speeds were calculated.
   It is important to note that the distance calculations outlined above can only approximate the distance between timepoints. NavTeq data only exists for public roads so any portion of a route on a private street (i.e. parking lots, bus loops and driveways) is not included in the final calculations.

3 ANALYSIS METHODOLOGY

3.1 Overview

This section describes the fundamental methodology followed for combining the agency speed data from which the hot spots were identified and prioritized. Figure 2 shows the overall approach, and subsequent figures further break down some of the key steps.

The starting point was the WMATA GIS layer that contains both speed and frequency for the AM peak period, PM peak period, and daily for WMATA routes throughout the region, based on AVL data from November 2009. This layer provides the foundation to which we added the other agency's data.

- Where both WMATA data and local agency data were available, the speeds are averaged using the bus frequency to weight the speeds. For example, if a segment has 10 WMATA trips per day traveling at an average of 10 mph and 5 Ride On trips traveling at 20 mph, the final average is reported as 13.33 mph instead of 15 mph
- On roadway segments for which there was no WMATA data, the local agency AVL or NextBus speed data was applied.
- For roadway segments for which there was no WMATA data and no local agency travel time or speed data, the bus speeds were calculated based on the scheduled speeds.

With regard to speed by direction, the direction with the lowest speed was reported. Therefore, in instances where only one direction performs poorly, the segment would still come up as a hot spot.

Figure 3 shows the process followed to arrive at assigned speeds by roadway segment. For local buses the speed was determined by timepoint segment, by direction, and by time of day (AM peak, PM peak, all day); Table 4 and Figure 2 summarize the data used from each agency to calculate bus speeds. In several cases the speed was calculated from more than one source for a single agency. For example, ART provided AVL data for some routes and speed data for others. For Fairfax Connector, schedules were used for routes without Geologger data. For Ride On, which recently rolled out their AVL system, schedule data was used where AVL data was not available. In order to then assign one speed to each segment, the lower speed of the two directions was selected for each of the three time periods.

Figure 2: Hot Spot Database Development Methodology

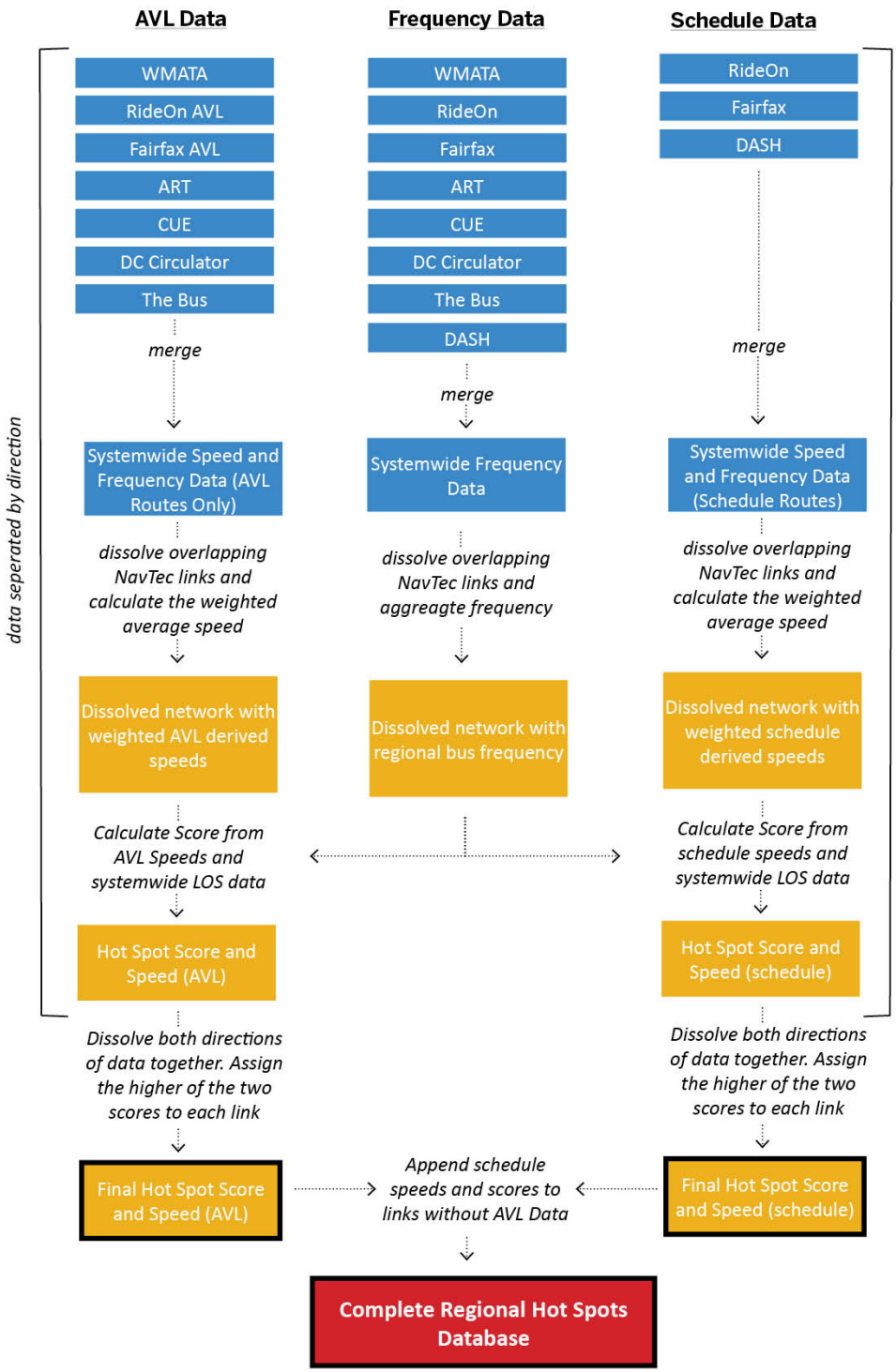
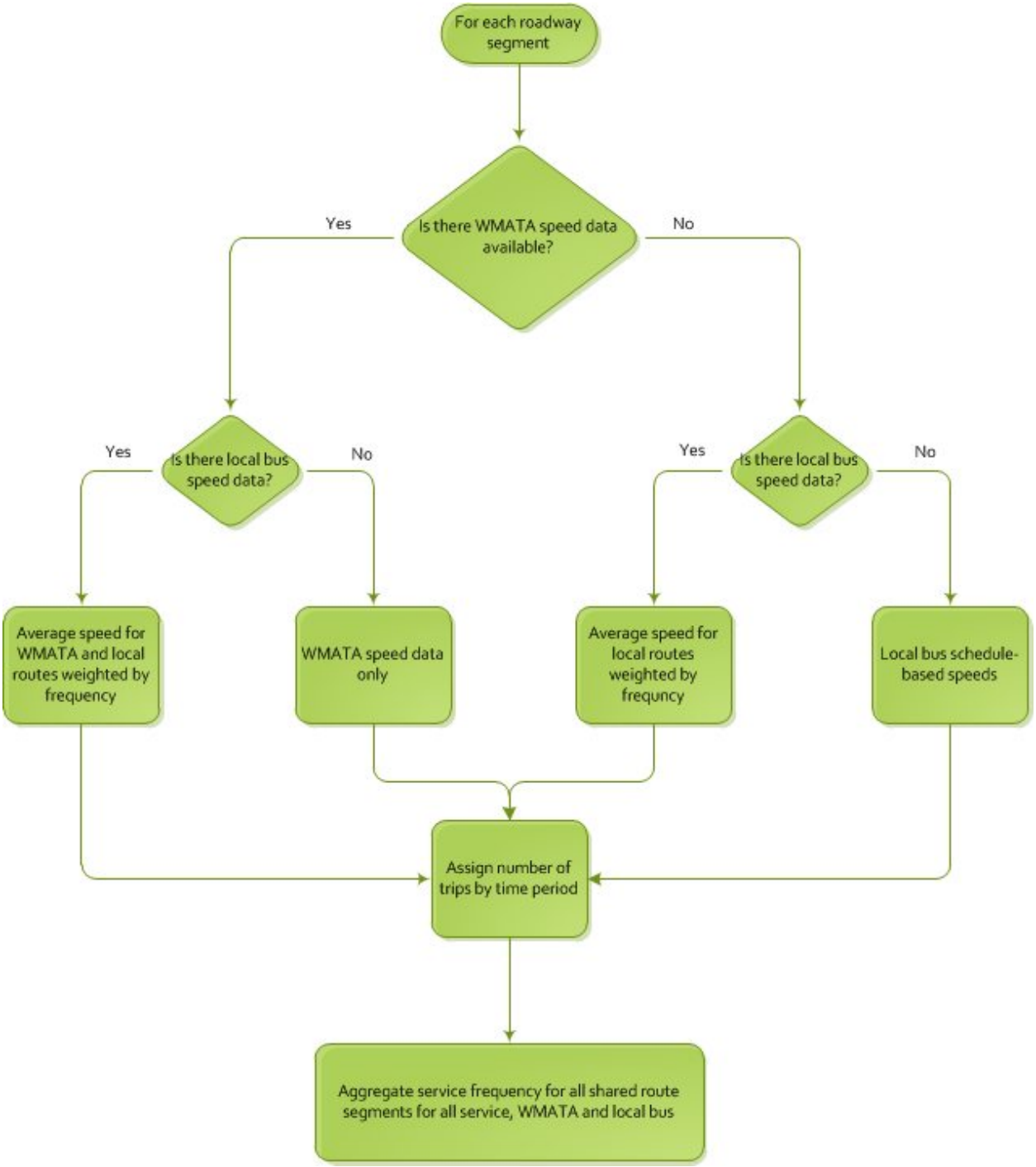


Figure 3: Analysis Methodology


For each roadway segment
Is there WMATA speed data available?
Yes
No
Is there local bus speed data?
Yes
No
Is there local bus speed data?
Yes
No
Average speed for WMATA and local routes weighted by frequency
WMATA speed data only
Average speed for local routes weighted by frequncy
Local bus schedule-based speeds
Assign number of trips by time period
Aggregate service frequency for all shared route segments for all service, WMATA and local bus

3.2 Aggregating Data by Agency

For each agency, the coded NavTeq segments were joined to their related final timepoint data. Once all the route segment data was correctly assigned, each agency's bus network (by direction) was aggregated using a dissolve function. The resulting output summed frequency and averaged speeds for all overlapping NavTeq segments.

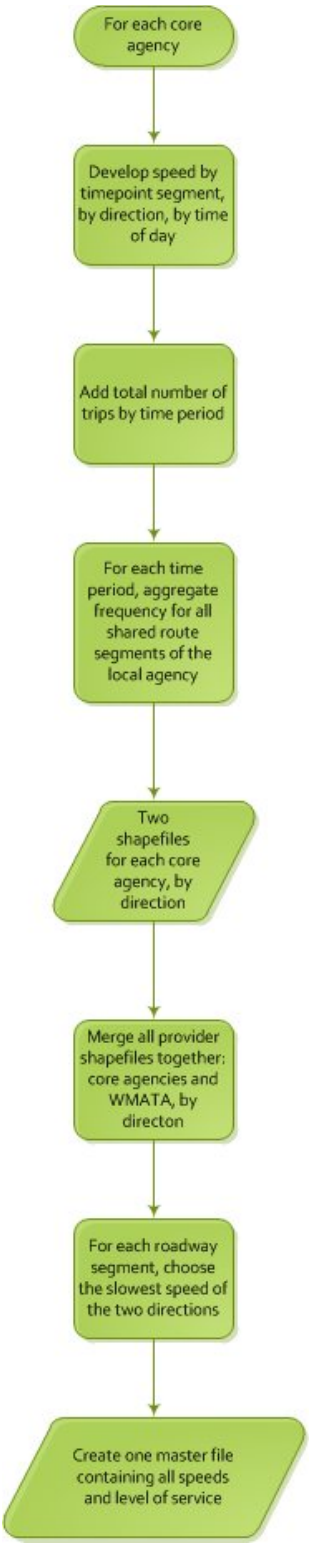
3.3 Aggregating Data Across Agencies

The final data aggregation and calculations were based on the unique Link IDs of the NavTeq road segments. All overlapping bus routes share a unique ID upon which GIS merges and dissolves could be based. Before data could be aggregated to make the final hot spot maps, the WMATA data had to be updated to match the 2011 NavTeq Link IDs, as it had been provided using an older set of NavTeq Link IDs. Using the spatial join function, the 2011 Link IDs replaced the outdated Link IDs on the 2009 WMATA analysis. All other attributes remain unchanged in the WMATA dataset.

At this point, agency specific shapefiles were then merged together to create a single shapefile representing all of the WMATA and local agency routes in the region, with frequency and speed for AM, PM, and daily as attributes. The speed for each timepoint segment represents, where applicable, an average of WMATA and local agency bus speeds, weighted by bus frequency; the average is based on the slowest of both directions, not an average speed of the two directions. Only in cases where no actual speed data existed, speed is represented on the network as the scheduled speed based on scheduled time and distance between timepoints. For example, if WMATA bus speed exists for a given segment and the only other data is local bus speed based on scheduled time, that local bus speed is not averaged into the speed for that segment, and the speed is represented by the WMATA bus speed only.

Utilizing GIS, the scores were generated for each segment for each time period, based on the regional average speed of 15 mph minus the actual speed, multiplied by the level of service:

Figure 4: Data Aggregation Process



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Segment Score =
(15mph – speed) x number of buses in the time *period*
[Number of Buses = total number for all day, buses per hour for AM and PM peak]

Note that for the AM and PM peak scores the speed is multiplied by the number of buses per hour, whereas for the all-day score the speed is multiplied by the number of buses all day, since each bus route has a different span of service. The intent of using the base speed is to set a threshold speed that one might reasonably hope to achieve in a given area. Routes where average speeds are significantly lower than the base speed receive the greatest weight, while segments where buses already travel faster than the speed coefficient will have negative scores and will not likely be prioritized. Regionwide, including WMATA and the other core agencies, the average all day, all directions bus speed is 16.8 mph, so a standard base value of 15 was used for this analysis. This is close to the regional average but also coincides with information provided in *NCHRP Report 616: Multimodal Level of Service for Urban Streets,* which suggests using 15 mph as the base bus speed. While 10 mph is recommended in more urban areas, this study used 15 mph across the board to provide a consistent comparison between the jurisdictions, while noting that the core area is not being compared to the suburban locations in determining hot spot improvements; each jurisdiction will retain its own list.

The calculation for determining the score for each segment is as follows:

[Base Speed – Segment Speed] X Buses Per Hour (or Per Day) = Score

As an example of the weighting formula, the value from an All Day segment in DC -I (*Eye*) Street from 13th NW Street to 18th Street NW- is provided here:

[15 mph (*Base*) – 2.3113 mph (*Segment Speed*)] X 502 (*Buses per Day*) = 6370 (*Score*)

The highest scoring segment of each hot spot location is determined by calculating the score for each segment, as in the formula above, and the highest scoring segment is then taken from among the several segments that make up a hot spot location. The average score of each location is calculated as an average of the scores of all segments making up a hot spot location. The formulas below show how this was done, with a generic formula and an example again using the All Day of I (*Eye*) Street from 13th Street NW to 18th Street NW in DC:

∑ Segment Score / Number of Segments in Hot Spot Location

[2702+3388+3496+3520+4279+4371+4895+5039+5485+6370] / 11 = 4412

Table 5 shows the average bus speed by jurisdiction for this study and in comparison to the previous study that contained only WMATA bus speeds. Note that average speeds across all jurisdictions are

higher than the speeds reported by the 2009 WMATA study. This may be explained by three reasons. First, all road segments with speeds of zero miles per hour, which we believe were included in the calculations of the 2009 study, were screened out in this study as errors. Secondly, the other core agencies operate in less congested suburban conditions then the majority of WMATA service. Finally, certain jurisdictions relied on scheduled speeds for this study which are typically faster than actual speeds, thereby driving up the speed numbers in those jurisdictions.

Table 5: Average Bus Speed by Jurisdiction

Jurisdiction	Average Speed (Regional Hot Spots Study)	Average Speed (WMATA Hot Spots Study)
District of Columbia	9.8 mph	8.8 mph
Maryland	17.1 mph	13.5 mph
Virginia	18.1 mph	12.7 mph
Regionwide	16.8 mph	11.5 mph

The scores that resulted from the aforementioned process were at the NavTeq segment level. Each roadway segment between two cross streets was assigned a score. In cases where the same buses traveled two contiguous roadway segments, they both received the same score. Because a roadway is served by many bus routes that serve different portions of the road, and each bus route has different timepoints, each location is made up of many different segments with different scores and timepoints at various intervals.

4 IDENTIFICATION AND PRIORITIZATION METHODOLOGY

4.1 Application of Primary Evaluation Factors

At this point in the process, the data from the various agencies had been normalized, resulting in a single regional roadway network that contains both speed and frequency data by segment from all of the core agencies and WMATA. The process to identify and prioritize hot spots closely follows that used during the WMATA Transit Corridor Performance Evaluation (the WMATA-only hot spots study) completed in 2010, with the addition of the local bus speeds; thus, the two primary evaluation factors are average bus speed and bus frequency.

In order to define the top fifteen hot spot locations[2] in each jurisdiction for each time period, the speed- and frequency-based scores were compared across thousands of roadway segments in each jurisdiction for each time period. The process followed to identify the top 15 locations is shown in Figure 5.

[2] While the scope of the study only called for the development of lists of 10 hot spots, this analysis included 15 to allow jurisdictional staff to have secondary choices if they do not want to further analyze any of the top ten hot spots. For example, a hot spot may already be undergoing physical improvements.

Figure 5: Hot Spot Identification Process

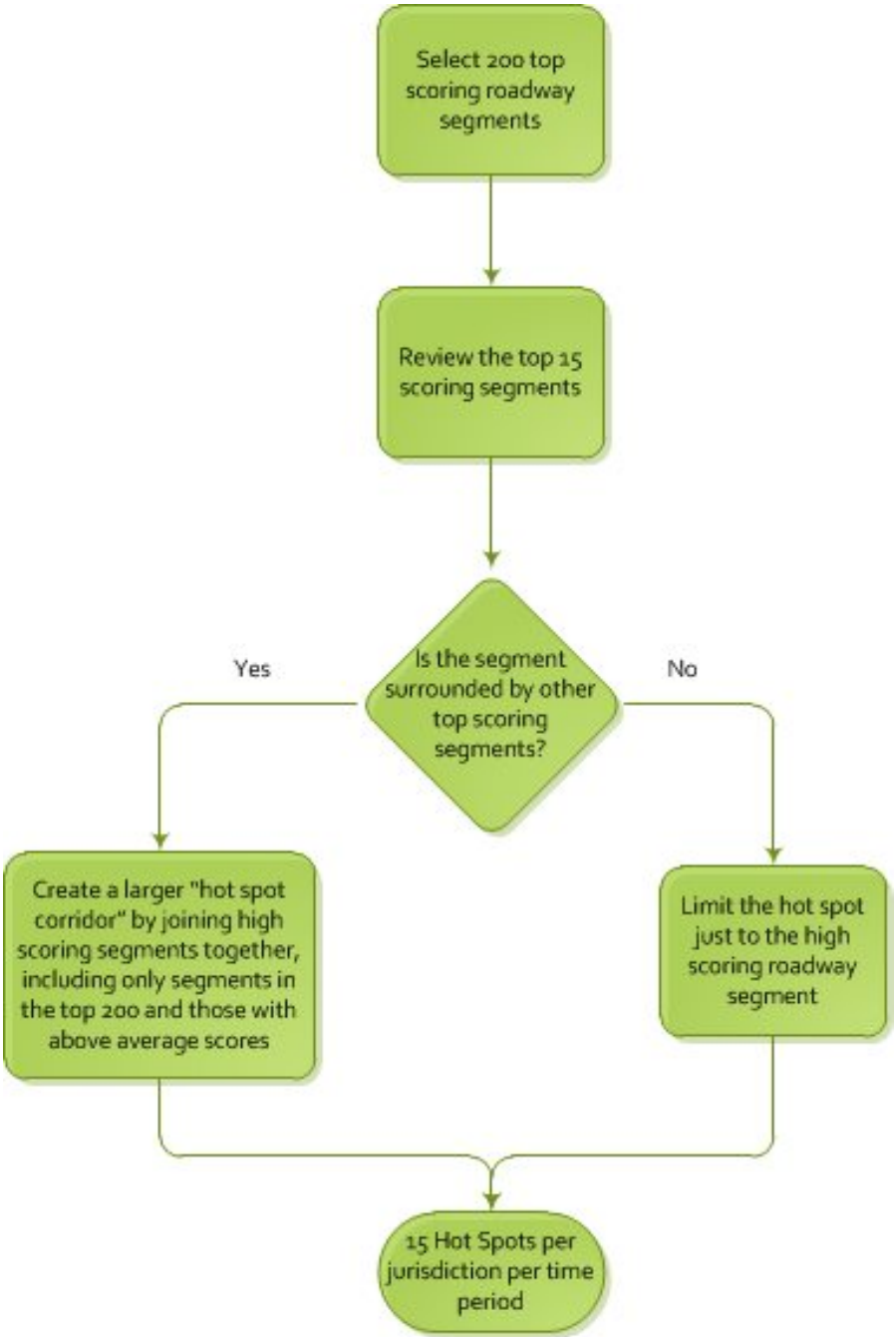

Figure 5 explains that the hot spot locations in each jurisdiction build off of the fifteen worst NavTeq roadway segments but add nearby segments from the top 200 list such that small "corridors," or sets of segments are identified as hot spot locations. Highlighting the top 200 roadway segments in each jurisdiction based on the scores, enabled the identification of hot spot roadway segments that could then be combined in the case where the segments were contiguous or semi-contiguous; many locations rose to the top in areas where many of the top 200 roadway segments came together. The 15 highest-scoring roadway segments were used as the starting point in developing the hot spots lists. Many of the top fifteen segments were contiguous or almost contiguous with several other top 200 segments or other poorly performing roadway segments, in which case the segments were joined together to form a short hot spot corridor. In addition to short corridors, the top hot spots lists for each jurisdiction also includes standalone roadway segments from the top 15, even if that roadway segment was not surrounded by other very poorly performing segments. In some cases the reason for the segment showing up as a problem by itself is a problem at a particular intersection, but in some cases it is due to missing bus frequency data from the WMATA GIS layer, resulting in a low score on adjacent segments even if the speed is slow. In cases where the problem appeared to be missing frequency data on adjacent segments, the segments were included in the hot spot despite their lower score.

In total, there are a nine resulting priority lists, three for each area (District, Virginia, Maryland), comprised of 15 hot spots for the AM Peak, fifteen for the PM Peak, and fifteen based on an entire day of data. Many of the hot spots exist regardless of time of day, but others are heavily dependent on time of day.

The hot spots list based on the all-day score will be the primary list of hot spots for this project moving forward, as it reflects the documented mid-day delays in addition to peak period delays. Regardless, there is significant overlap between hot spots identified in the peak periods and those identified in the daily list.

4.2 Application of Secondary Evaluation Factors

Beyond local bus data, the second addition to the original methodology was to take the segments with the top 15 scores from each jurisdiction (MD, DC, VA), and for each time period, and do some "post processing." This involved three additional data points: frequency of the non-core agencies and commuter bus routes; route level ridership; and anecdotal reports of hot spot locations from the local operators.

4.2.1 Frequency of Non-Core Buses

The addition of the frequency from the other agencies will effectively adjust the scores of the segments from each jurisdiction and for each time period. It did not result in any hot spot priority shifts, but will add another dimension to the analysis and the decision making process as the top hot spots move into

the design phase later in the study. The number of buses from the "non-core" agencies servicing each hot spot location are shown in the hot spots lists in Tables 7 through 15.

4.2.2 Route Level Ridership

In addition to the non-core agency level of service, the route level ridership for the routes traversing the hot spots locations was recorded and reviewed in concert with the other information. The total route level ridership is included for all of the hot spots, but it is important to remember that the ridership represents the total for the entire route length, not necessarily the number of passengers passing through the hot spot. Additionally, WMATA reports ridership by line, so in many cases the ridership is overstated, as only some route variations of each line's route-family may pass through a certain hot spot, but ridership for all route variations of a line are included.

4.2.3 Agency Defined Hot Spots

Finally, the list of hot spot locations provided by the jurisdictions was reviewed vis-à-vis the quantitatively determined hot spots. Some of the key hot spots identified by the operating agencies and how they fared in the quantitative analysis are shown in Table 6. Many of the hot spot locations identified by the agencies are not included in the hot spot lists. In the case of Fairfax County (Fairfax Connector) and Alexandria (DASH), the analysis results are based on scheduled rather than actual speeds, which could explain why the locations identified by those agencies did not show up in the hot spots lists.

Table 6: Agency Identified Hot Spot Locations

Agency Identified Hot Spot Locations	Included in Hot Spot Lists?
Fairfax Connector	
Rte 1 & Huntington Ave (Route 101)	-
South Van Dorn Street (Route 231/232)	-
Telegraph Rd & South Kings Hwy/Telegraph & New VanDorn (Route 301)	-
Rolling Road (Route 304)	-
Fairfax County Parkway – General and @ Backlick, Rte 1, Huntington Ave. (Routes 305, 333, 334, 395, 171)	-
Duke/395 NB/Braddock & 495	-
Reston Town Ctr: Reston Pkwy, Sunrise Valley, Sunset Hills, South Lakes, Elden	-
Roads surrounding Herndon-Monroe P&R esp. Sunrise Valley	-
Fair Lakes Pkwy (by Gov't Ctr and Fair Oaks Mall	-
Stringfellow Road	-
Route 123 & Gallows	Yes
Route 123 at Vienna Metro	-
DASH	
Washington St (peak direction)	-
Duke St @ 395	-
Little River Tpk @ Beauregard St	-

Agency Identified Hot Spot Locations	Included in Hot Spot Lists?
King St Hill (Janney's Lane to Callahan Dr/Russell Rd EB	-
King St Metro/Diagonal Rd	-
King St Metro to King & Fairfax Sts	-
Montgomery St @ Henry St EB	-
Duke St btwn Alfred and Daingerfield	-
Commonwealth Ave btwn Sunset Dr and King St	-
Pentagon (385 ramp @ Rotary Rd NB, Concourse to 395 ramp SB)	Yes
ART	
EB Lee Highway AM Peak beginning at the N. Rhodes intersection to Rosslyn	Yes
SB Glebe Road PM Peak 2nd Street North to Columbia Pike	Yes
WB Columbia Pike PM peak George Mason to Carlin Springs	Yes
SB Washington Blvd PM peak from before Pershing to Rt 50	-
NB Washington Blvd AM Peak from Pershing to 10th Street North	-
NB Walter Reed Drive AM Peak from S. Monroe to Columbia Pike	-
NB Fillmore 6th St. So to 50	-
EB Wilson AM Peak from Jefferson to Glebe	-
NB Carlin Springs AM Peak from 7th Street South to Rt 50	-
NB S. George Mason from Columbia Pike to 50	-
Left-turn from East Falls Station exit onto Sycamore	-
CUE	
Main St @ Pickett Rd	-
Camp Washington (Main St./Lee Hwy/Fairfax Blvd)	-
Jermantown Rd and Route 50*	-
Fairfax Blvd and Route 123	-
Downtown Fairfax area, e.g., Main St.	-
Ride On	
East-West Hwy in Bethesda	-
East-West Hwy in Silver Spring	Yes
MD 355 @ NIH/Medial Center Metro	-
Access to Silver Spring Transit Center*	Yes
Veirs Mill Road	Yes
Georgia Ave	Yes
New Hampshire Ave	Yes
University Blvd	Yes

* Ongoing improvements to these locations suggest that decisions on any additional improvements should wait until current construction projects are complete.

5 ANALYSIS RESULTS

5.1 Roadway Segment Travel Speeds

The results of the analysis were also used to create detailed maps depicting average travel speeds and scores (speed and frequency) for each of the three analysis time periods. A set of maps in the Appendix report average bus travel speeds for 28,172 roadway segments in the region (2,330 miles of roadway). The lines shown on the maps indicate the slower of the two directions during the given period. With few exceptions, this represents “outbound” buses during the PM peak and “inbound” buses during the AM peak.

As with the original Hot Spots Study, the results of this study show that there are numerous roadway segments within the region with average transit operating speeds of less than 10 mph and several with speeds of under 5 mph. The vast majority of these locations are within the District, but some fall in Maryland and Virginia suburban areas (particularly around Silver Spring and several Arlington County locations). The analysis, as shown on the maps in the Appendix, also shows that PM speeds are generally lower than AM speeds, though the differences are small in most cases. For instance, the bridges over the Anacostia River in the District all show a noticeable decline in travel speed during the PM peak.
The differences between the peak periods and the all-day speeds are smaller than might typically be expected. This indicates that mid-day congestion is heavy on many routes in the service areas. In addition, because most bus trips occur during the peak periods the all-day averages are naturally weighted toward the peaks.

In general, the results of the analysis show that bus operating conditions vary greatly by location throughout the region. Many locations, particularly in the downtown core, have operating speeds below 10 mph, indicating high amounts of bus delay.

5.2 Roadway Segment Scores

In addition to slow speeds, many of the slowest corridors shown on the map overlap with the locations carrying the highest bus volumes, as shown by the maps showing regionwide segment scores in Figures 6 through 8. This suggests that priority improvements at these locations could provide significant regional transportation benefits. Scores of zero signify that the buses are performing as expected (15 mph), while negative scores indicate that the buses are moving faster than the 15 mph base threshold.

Figure 6: Regionwide Hot Spot Score – All Day

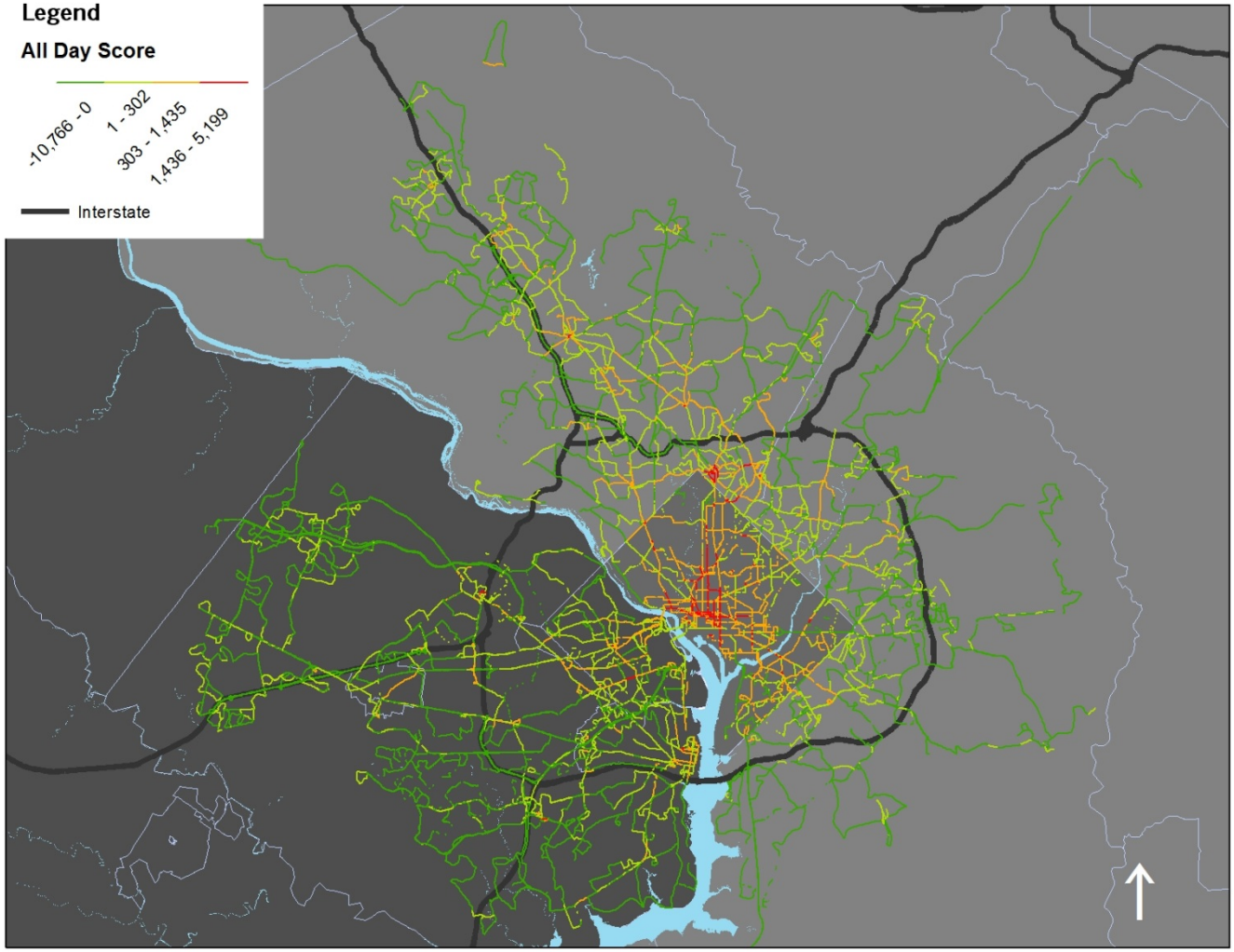

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Figure 7: Regionwide Hot Spot Score – AM Peak (6:00 – 9:00)

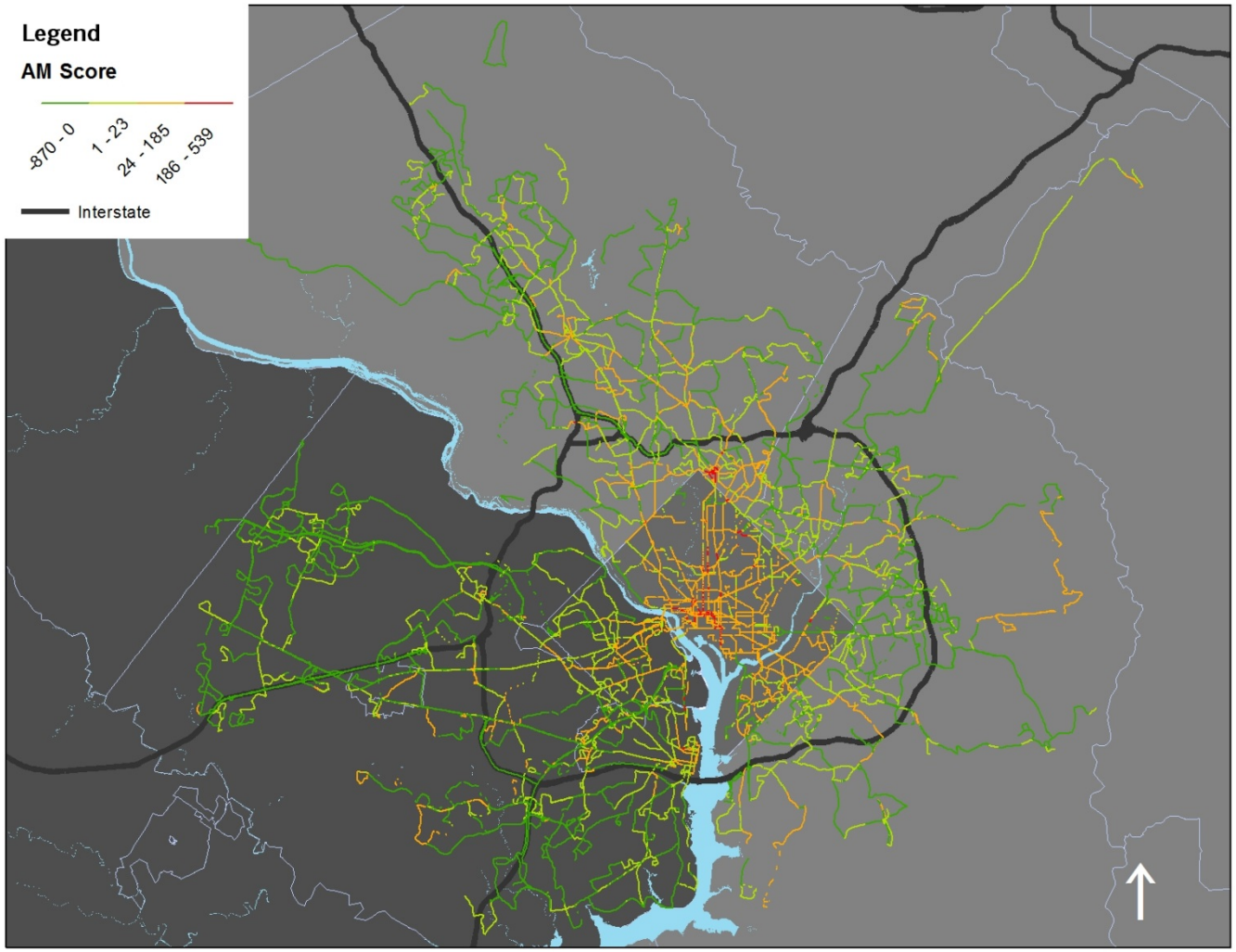
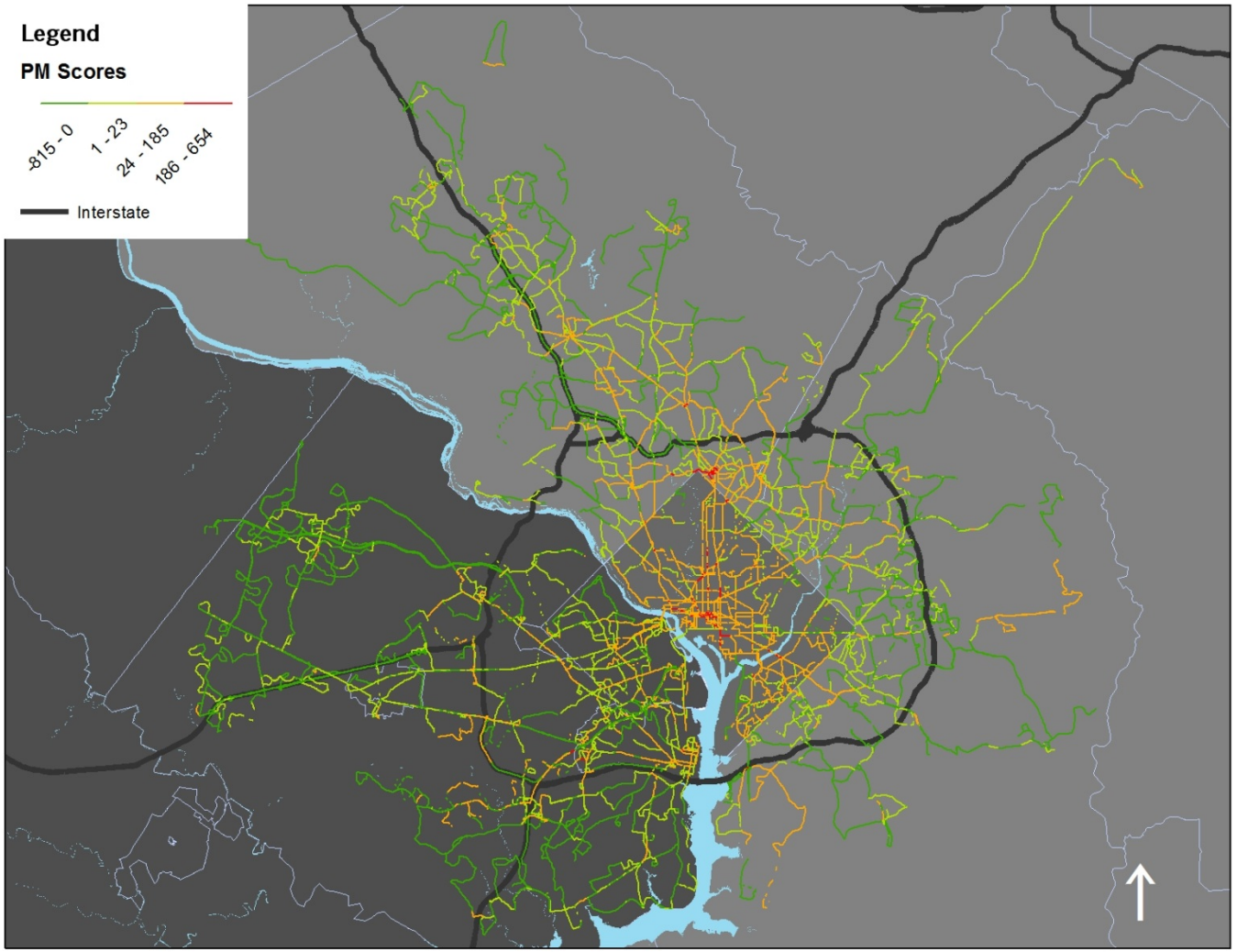


Figure 8: Regionwide Hot Spot Scores – PM Peak (3:00 – 7:00)



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5.3 Hot Spot Maps and Lists

Figures 9 through 14 geographically show all of the 200 highest scoring roadway segments by jurisdiction for the all day period. In each map, the final hot spot locations are labeled 1 through 15, with 1 being the worst-performing area. It should be noted that not all top-200 segments are located in one of the hot spot corridors. Tables 7 through 15 show the highest priority improvement locations for each jurisdiction and time period using the scoring scheme described above. Overall, the tables show that there are many locations within the region with both high bus volumes and low travel speeds, resulting in high scores. The average score of each location is the average score of all individual roadway segments contained in the corridor, whereas the maximum score represents the link within that corridor that has the highest score; in cases where the hot spot is just an intersection (listed in italics), the average and maximum scores are the same. The roadway segment with the maximum score is listed as the "Max Link" and is a number corresponding with the unique identified for the roadway segment in the GIS shapefiles accompanying this report. The roadway limits of these "max links" are shown in tables in the Appendix.

As expected, there is a great deal of overlap between the locations identified during the three analysis periods. In addition, most of the identified locations are located in the CBD or other regional centers (e.g. Silver Spring) where transit ridership and traffic congestion are high. It should be noted that the scores for all day are much higher than for the AM and PM peaks, as the all day speeds are multiplied by the total number of bus trips all day, whereas the peak period speeds are multiplied by the average number of buses per hour during the time period.

Figure 9: Hot Spot Locations in Washington DC

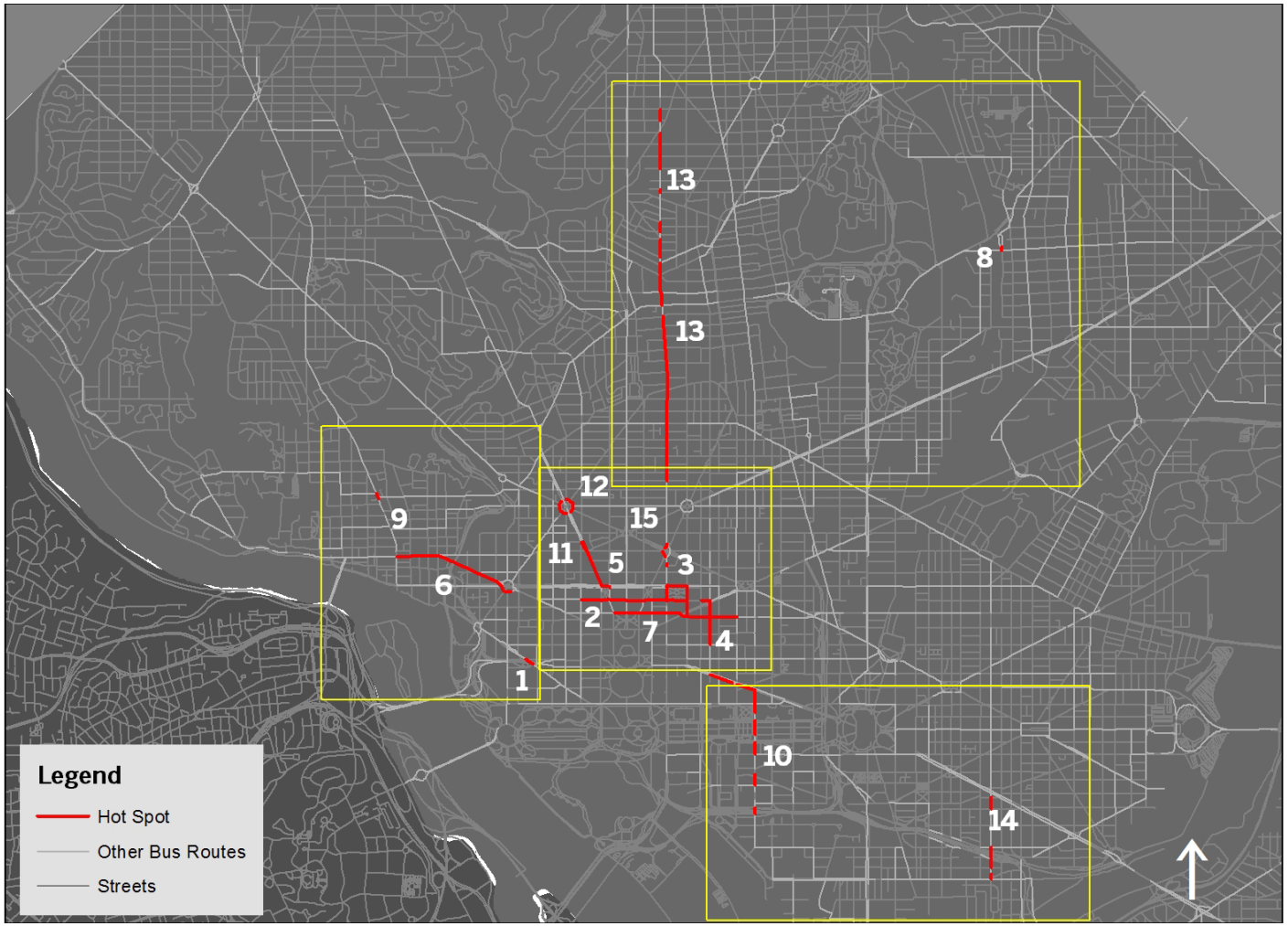

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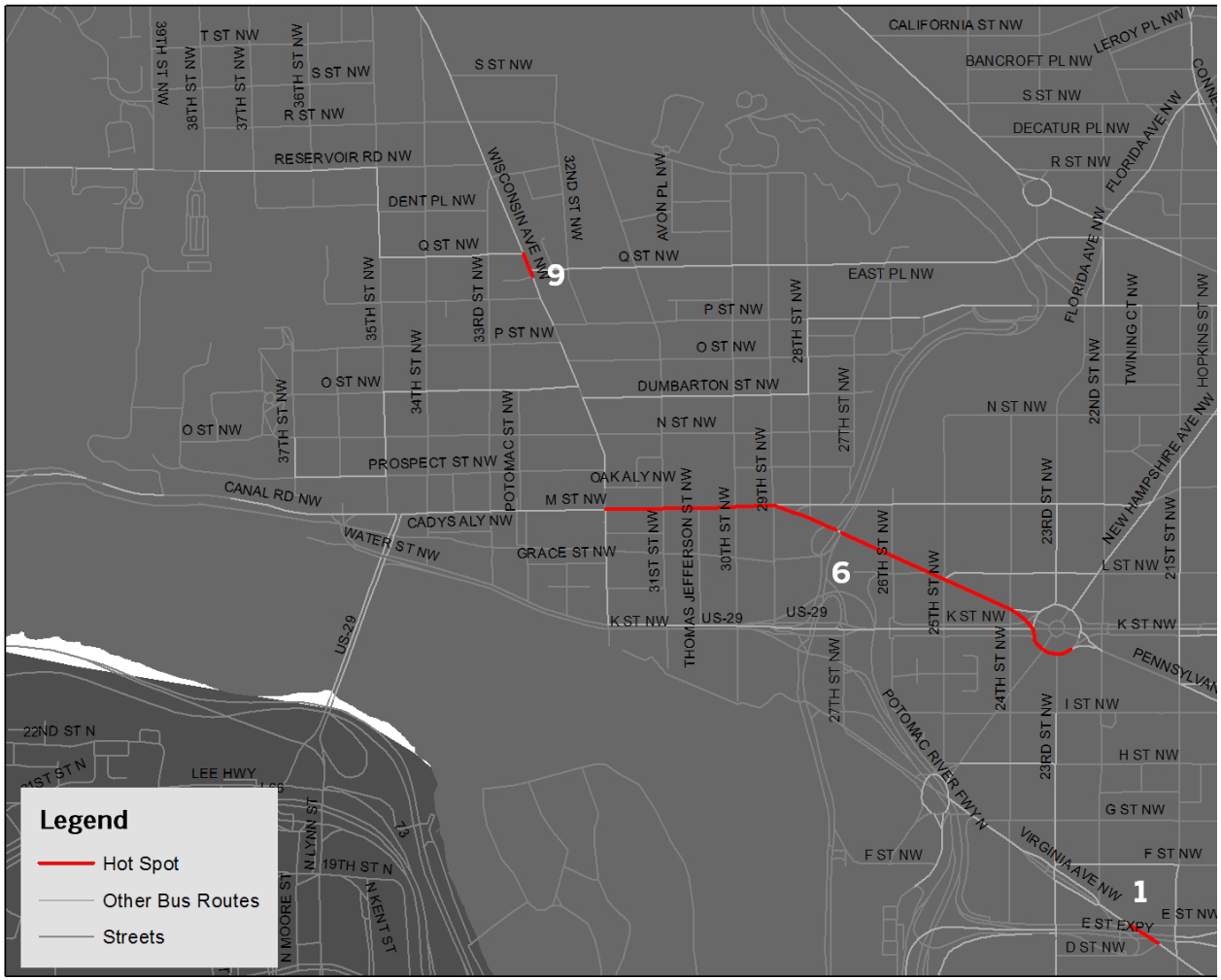
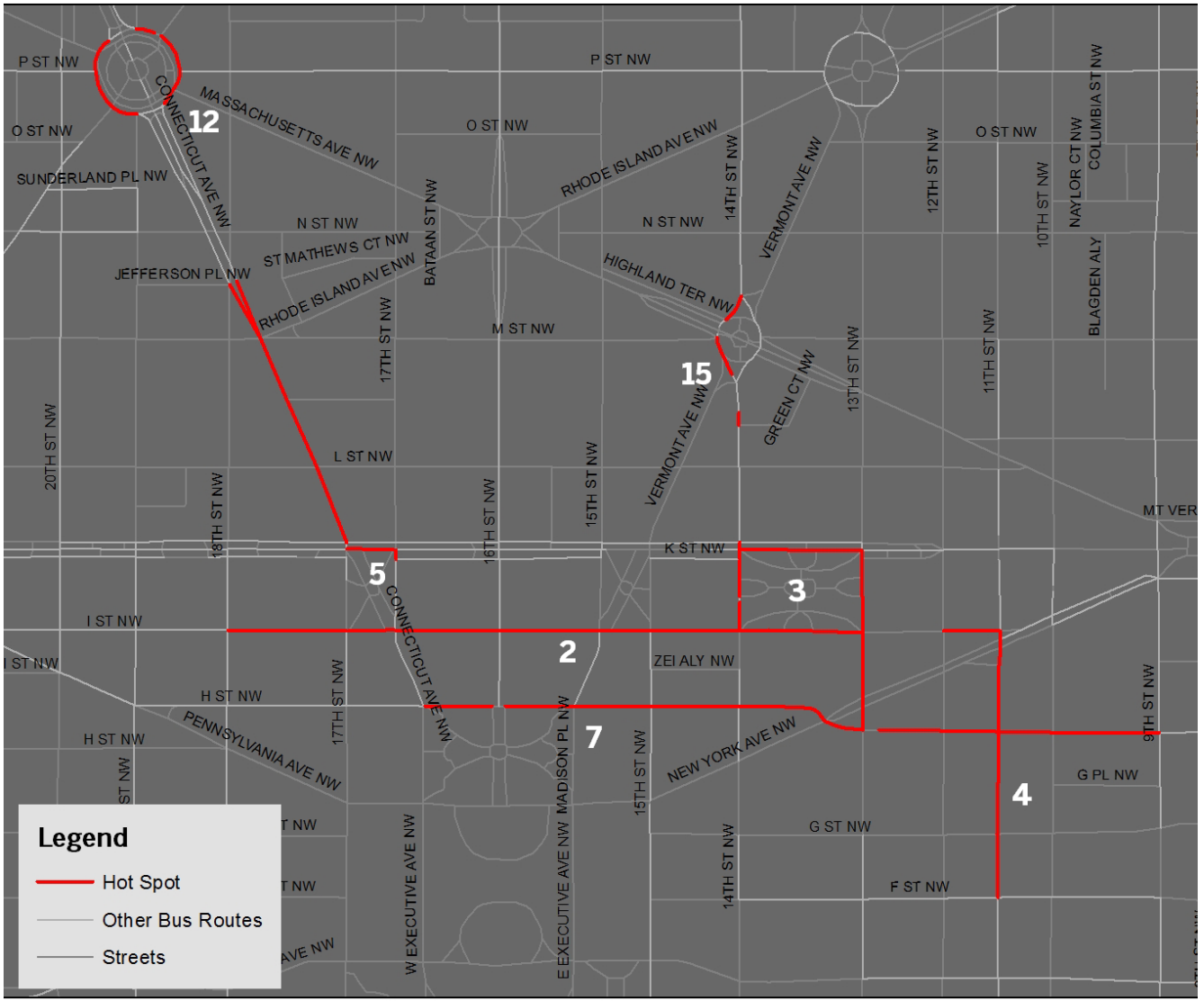
Figure 10: Detail Maps of District of Columbia Hotspots





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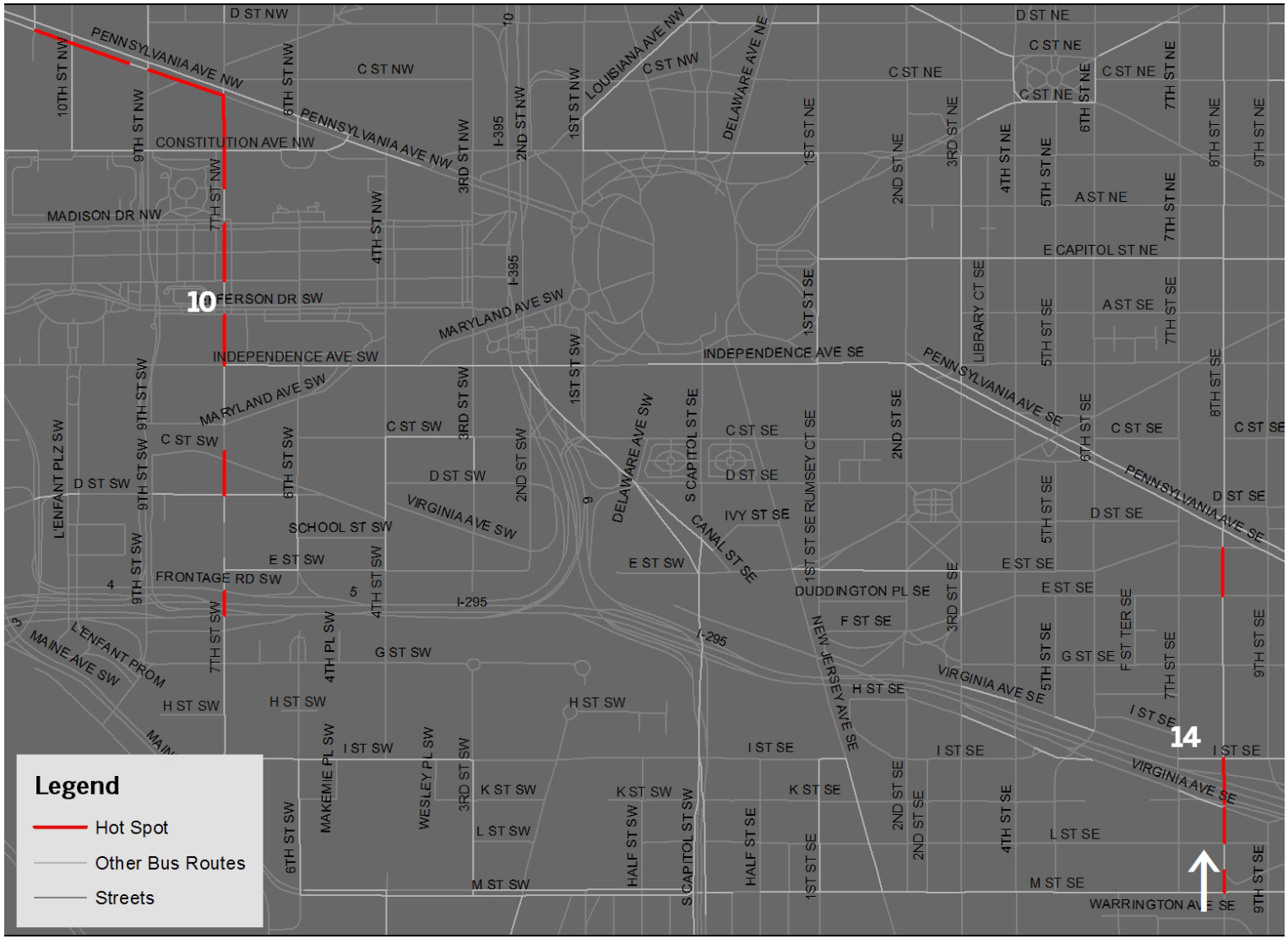
Legend
Hot Spot
Other Bus Routes
Streets
10
14
D ST NW
C ST NW
PENNSYLVANIA AVE NW
CONSTITUTION AVE NW
MADISON DR NW
JEFFERSON DR SW
INDEPENDENCE AVE SW
MARYLAND AVE SW
C ST SW
D ST SW
SCHOOL ST SW
E ST SW
FRONTAGE RD SW
VIRGINIA AVE SW
I-295
G ST SW
H ST SW
I ST SW
K ST SW
L ST SW
M ST SW
L'ENFANT PLZ SW
L'ENFANT PROM
MAINE AVE SW
10TH ST NW
9TH ST NW
7TH ST NW
6TH ST NW
4TH ST NW
3RD ST NW
2ND ST NW
1ST ST NW
LOUISIANA AVE NW
DELAWARE AVE NE
1ST ST NE
2ND ST NE
3RD ST NE
4TH ST NE
5TH ST NE
6TH ST NE
7TH ST NE
8TH ST NE
9TH ST NE
A ST NE
C ST NE
D ST NE
E CAPITOL ST NE
I-395
9TH ST SW
7TH ST SW
6TH ST SW
4TH PL SW
3RD ST SW
2ND ST SW
1ST ST SW
MAKEMIE PL SW
WESLEY PL SW
DELAWARE AVE SW
S CAPITOL ST SE
C ST SE
D ST SE
IVY ST SE
CANAL ST SE
1ST ST SE RUMSEY CT SE
2ND ST SE
3RD ST SE
4TH ST SE
5TH ST SE
6TH ST SE
7TH ST SE
8TH ST SE
9TH ST SE
LIBRARY CT SE
A ST SE
E ST SW
E ST SE
F ST SE
G ST SE
H ST SE
I ST SE
K ST SE
L ST SE
M ST SE
DUDDINGTON PL SE
NEW JERSEY AVE SE
F ST TER SE
HALF ST SW
HALF ST SE
S CAPITOL ST SW
PENNSYLVANIA AVE SE
VIRGINIA AVE SE
WARRINGTON AVE SE

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Figure 11: Hot Spot Locations in Maryland

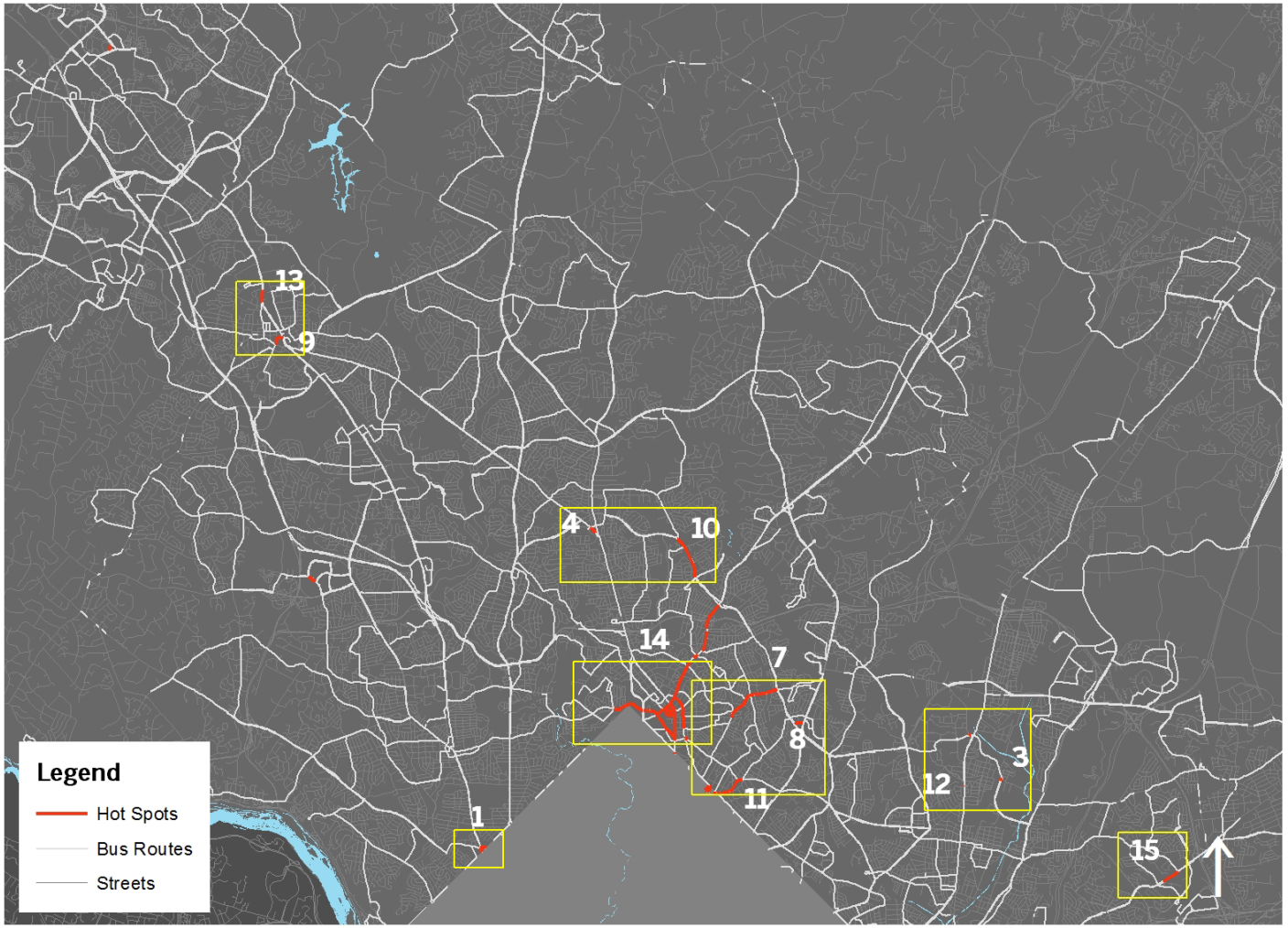

Figure 12: Detail Maps of Maryland Hot Spots

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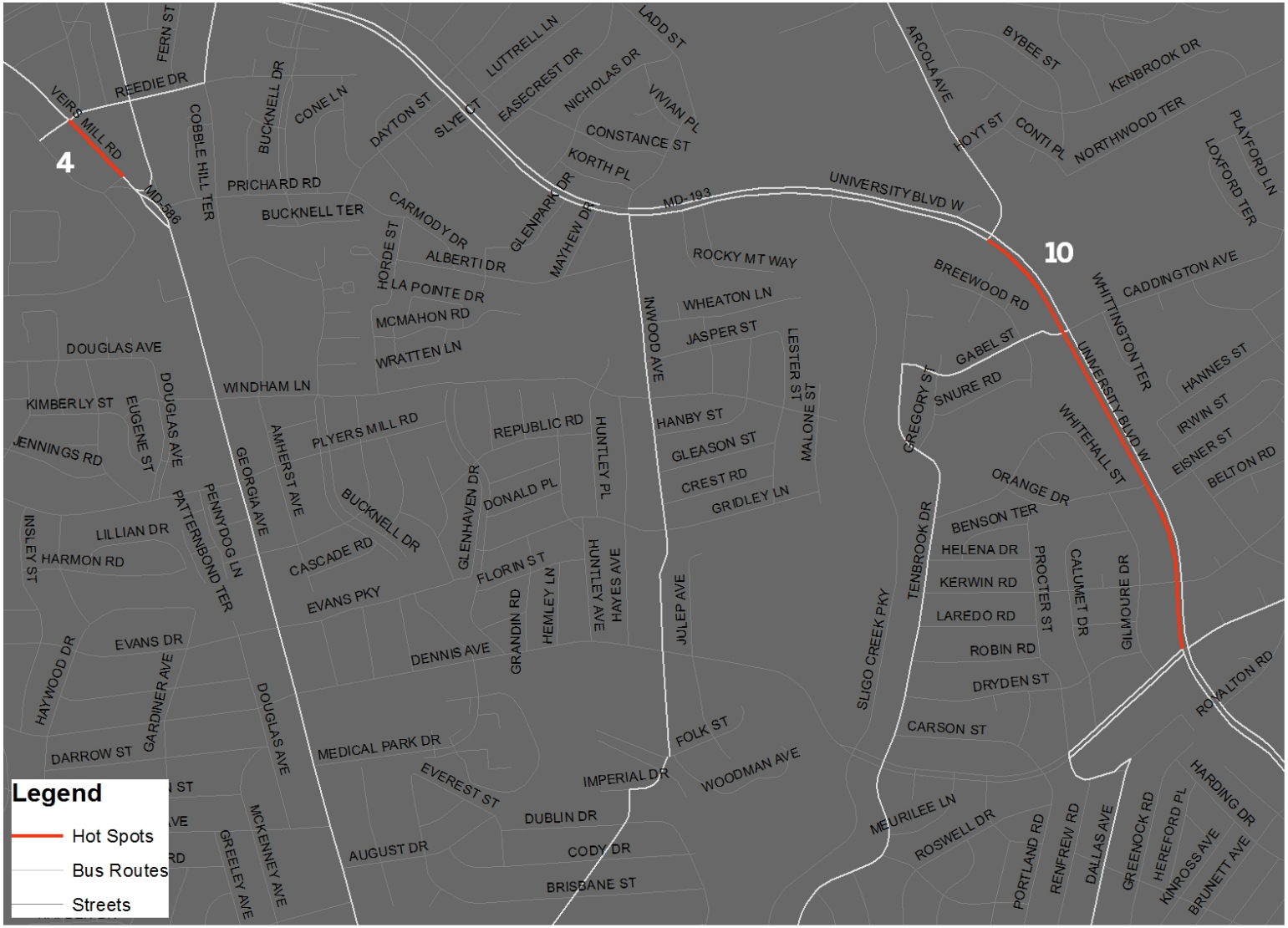
4
10
VEIRS MILL RD
REEDIE DR
FERN ST
COBBLE HILL TER
BUCKNELL DR
CONE LN
DAYTON ST
SLYE CT
LUTTRELL LN
EASECREST DR
LADD ST
NICHOLAS DR
VIVIAN PL
CONSTANCE ST
KORTH PL
GLENPARK DR
MAYHEW DR
MD-586
PRICHARD RD
BUCKNELL TER
CARMODY DR
HORDE ST
ALBERTI DR
LA POINTE DR
MCMAHON RD
WRATTEN LN
MD-193
UNIVERSITY BLVD W
ARCOLA AVE
BYBEE ST
KENBROOK DR
HOYT ST
CONTI PL
NORTHWOOD TER
PLAYFORD LN
LOXFORD TER
ROCKY MT WAY
WHEATON LN
JASPER ST
INWOOD AVE
LESTER ST
MALONE ST
BREEWOOD RD
GABEL ST
SNURE RD
GREGORY ST
WHITTINGTON TER
CADDINGTON AVE
HANNES ST
IRWIN ST
EISNER ST
BELTON RD
WHITEHALL ST
ORANGE DR
BENSON TER
HELENA DR
KERWIN RD
LAREDO RD
ROBIN RD
DRYDEN ST
CARSON ST
PROCTER ST
CALUMET DR
GILMOURE DR
TENBROOK DR
SLIGO CREEK PKY
ROCKALTON RD
HARDING DR
DOUGLAS AVE
KIMBERLY ST
EUGENE ST
JENNINGS RD
WINDHAM LN
PLYERS MILL RD
AMHERST AVE
GEORGIA AVE
PENNYDOG LN
PATTERNBOND TER
INSLEY ST
LILLIAN DR
HARMON RD
REPUBLIC RD
HUNTLEY PL
DONALD PL
GLENHAVEN DR
BUCKNELL DR
CASCADE RD
FLORIN ST
HUNTLEY AVE
HAYES AVE
EVANS PKY
GRANDIN RD
HEMLEY LN
JULEP AVE
DENNIS AVE
EVANS DR
HAYWOOD DR
GARDINER AVE
DARROW ST
MEDICAL PARK DR
FOLK ST
WOODMAN AVE
IMPERIAL DR
EVEREST ST
DUBLIN DR
CODY DR
BRISBANE ST
AUGUST DR
GREELEY AVE
MCKENNEY AVE
MEURILEE LN
ROSWELL DR
PORTLAND RD
RENFREW RD
DALLAS AVE
GREENOCK RD
HEREFORD PL
KNROSS AVE
BRUNETT AVE
Legend
Hot Spots
Bus Routes
Streets

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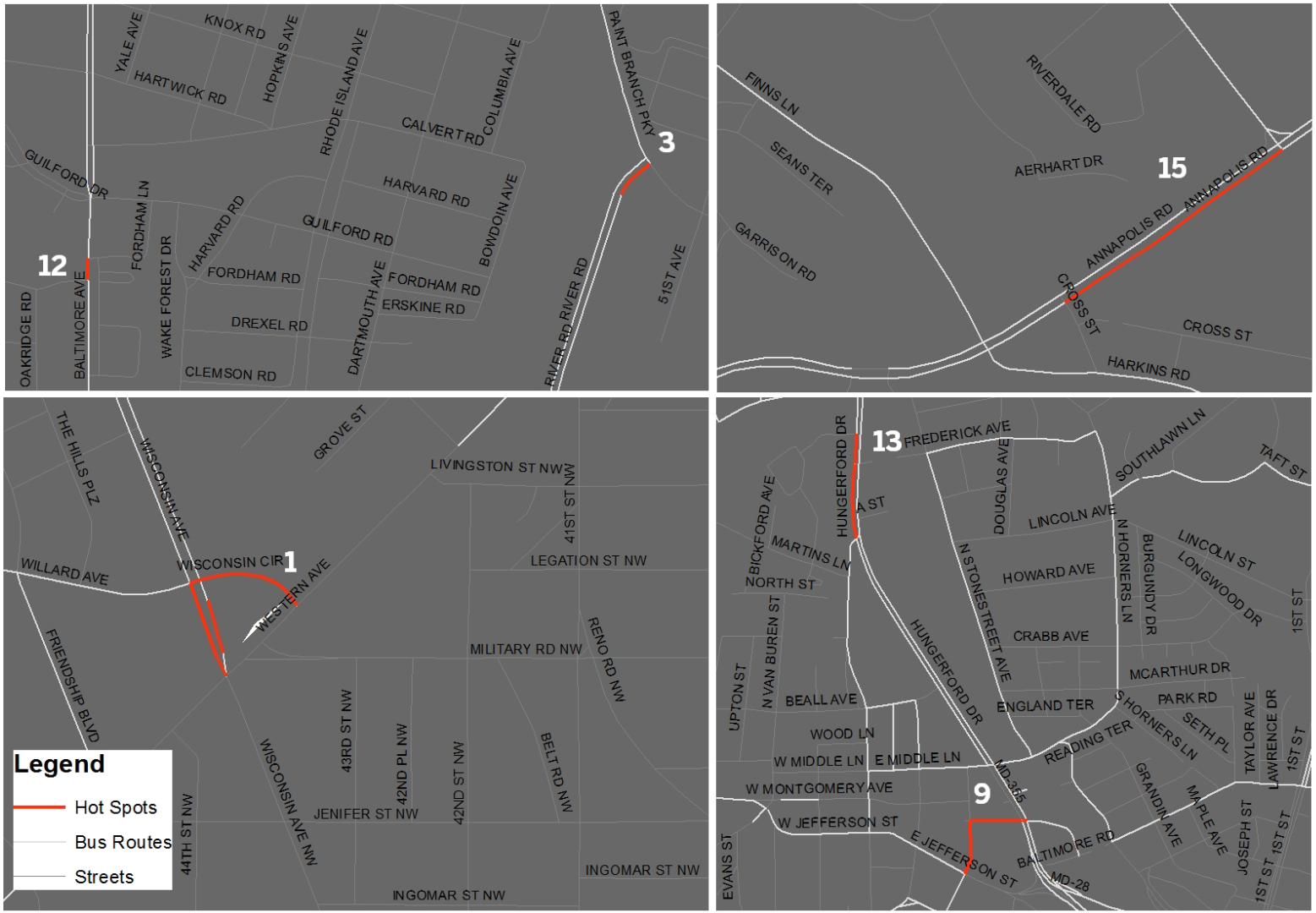
12
3
15
1
13
9
YALE AVE
KNOX RD
HOPKINS AVE
RHODE ISLAND AVE
COLUMBIA AVE
PAINT BRANCH PKY
HARTWICK RD
CALVERT RD
GUILFORD DR
FORDHAM LN
HARVARD RD
HARVARD RD
GUILFORD RD
BOWDOIN AVE
WAKE FOREST DR
FORDHAM RD
DARTMOUTH AVE
FORDHAM RD
ERSKINE RD
OAKRIDGE RD
BALTIMORE AVE
DREXEL RD
CLEMSON RD
RIVER RD
RIVER RD
51ST AVE
FINNS LN
RIVERDALE RD
SEANS TER
AERHART DR
ANNAPOLIS RD
ANNAPOLIS RD
GARRISON RD
CROSS ST
CROSS ST
HARKINS RD
THE HILLS PLZ
WISCONSIN AVE
GROVE ST
LIVINGSTON ST NW
41ST ST NW
WILLARD AVE
WISCONSIN CIR
WESTERN AVE
LEGATION ST NW
FRIENDSHIP BLVD
MILITARY RD NW
RENO RD NW
WISCONSIN AVE NW
43RD ST NW
42ND PL NW
42ND ST NW
BELT RD NW
JENIFER ST NW
44TH ST NW
INGOMAR ST NW
INGOMAR ST NW
Legend
Hot Spots
Bus Routes
Streets
FREDERICK AVE
HUNGERFORD DR
SOUTHLAWN LN
TAFT ST
A ST
DOUGLAS AVE
LINCOLN AVE
BICKFORD AVE
MARTINS LN
N HORNERS LN
BURGUNDY DR
LINCOLN ST
LONGWOOD DR
NORTH ST
HOWARD AVE
1ST ST
N STONESTREET AVE
HUNGERFORD DR
CRABB AVE
MCARTHUR DR
UPTON ST
N VAN BUREN ST
BEALL AVE
ENGLAND TER
S HORNERS LN
PARK RD
WOOD LN
READING TER
SETH PL
TAYLOR AVE
LAWRENCE DR
1ST ST
W MIDDLE LN
E MIDDLE LN
MD-355
W MONTGOMERY AVE
GRANDIN AVE
MAPLE AVE
W JEFFERSON ST
E JEFFERSON ST
BALTIMORE RD
JOSEPH ST
EVANS ST
MD-28
1ST ST
1ST ST

Figure 13: Hot Spot Locations in Virginia

Figure 14: Detail Maps of Virginia Hot Spots

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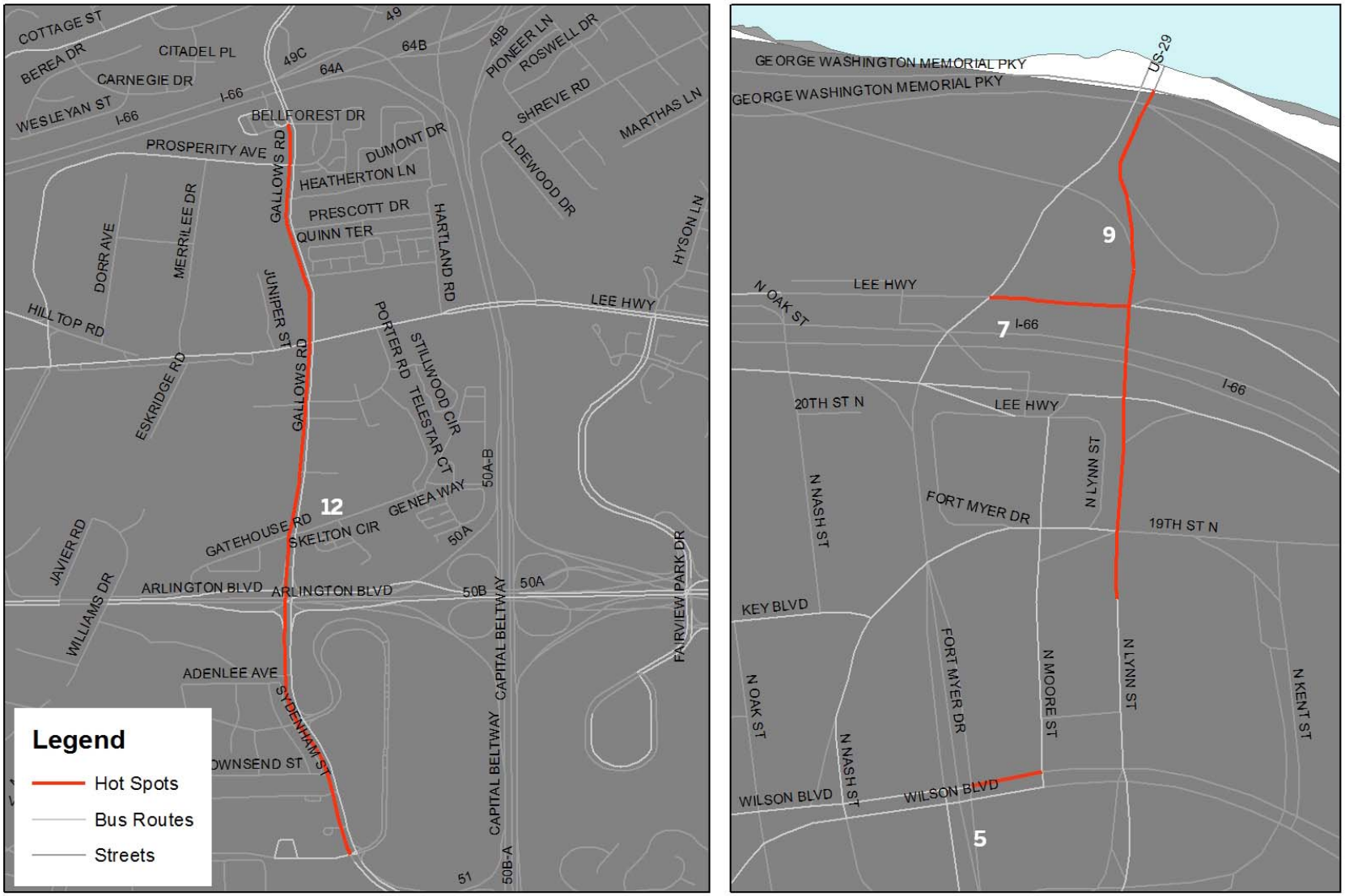
14
10
6
15
8C
8A
8B
SOUTHGATE RD
WASHINGTON BLVD
9TH ST S
S ORME ST
S ODE ST
N ROTARY RD
S ROTARY RD
S LEADS ST
OLD JEFFERSON DAVIS HWY
S BALL ST
S QUINN ST
S ROLFE ST
S SCOTT ST
12TH ST S
13TH ST S
13TH RD S
8A - 8B
S ARLINGTON RIDGE RD
S HAYES ST
14TH ST S
15TH ST S
14TH RD S
16TH ST S
17TH ST S
18TH ST S
19TH ST S
19TH RD S
20TH ST S
21ST ST S
22ND ST S
23RD ST S
24TH ST S
25TH ST S
26TH ST S
26TH PL S
26TH RD S
I-395 HOV LN
I-395
ARMY-NAVY DR
S LYNN ST
S KENT ST
S KNOLL ST
S JOYCE ST
S GRANT ST
AURORA HILN
S QUEEN ST
S PIERCE ST
S NASH ST
S MEADE ST
S JUNE ST
S FERN ST
JEFFERSON DAVIS HWY
S BELL ST
S CLARK PL
CRYSTAL DR
S CLARK ST
VA-233
GEORGE WASHINGTON MEMORIAL PKY
S SMITH BLVD
THOMAS AVE
ABINGDON DR
FORT SCOTT DR
27TH ST S
29TH RD S
31ST ST S
33RD ST
28TH ST S
S INGE ST
S TROY ST
VA-120
FOUR MILE RD
S GLEBE RD
AIR CARGO RD
THOMAS AVE
LEVEE RD
ELBERT AVE
MT VERNON AVE
COMMONWEALTH AVE
W REED AVE
E REED AVE
LYNHAVEN DR
RUSSELL RD
Legend
Hot Spots
Bus Routes
Streets


COTTAGE ST
BEREA DR
CITADEL PL
CARNEGIE DR
WESLEYAN ST
I-66
49
49C
64A
64B
49B
PIONEER LN
ROSWELL DR
SHREVE RD
MARTHAS LN
BELLFOREST DR
PROSPERITY AVE
DUMONT DR
HEATHERTON LN
PRESCOTT DR
QUINN TER
GALLOWS RD
OLDEWOOD DR
HYSON LN
HARTLAND RD
DORR AVE
MERRILEE DR
JUNIPER ST
HILL TOP RD
LEE HWY
PORTER RD
STILLWOOD CIR
TELESTAR CT
ESKRIDGE RD
50A-B
12
GENEA WAY
GATEHOUSE RD
SKELTON CIR
50A
JAVIER RD
WILLIAMS DR
ARLINGTON BLVD
50B
FAIRVIEW PARK DR
ADENLEE AVE
SYDENHAM ST
CAPITAL BELTWAY
50B-A
51
Legend
Hot Spots
Bus Routes
Streets
GEORGE WASHINGTON MEMORIAL PKY
US-29
9
LEE HWY
N OAK ST
7
I-66
20TH ST N
N NASH ST
FORT MYER DR
N LYNN ST
19TH ST N
KEY BLVD
N MOORE ST
N KENT ST
WILSON BLVD
5


13TH ST N
12TH RD N
WASHINGTON BLVD
13TH ST N
N IRVING ST
N IVY ST
N UTAH ST
N TAYLOR ST
N STUART ST
N STAFFORD ST
N QUINCY ST
11TH ST N
N VERMONT ST
11TH ST N
10TH ST N
N NELSON ST
N FAIRFAX DR
10TH ST N
11
N TAYLOR ST
N N FAIRFAX DR
N STUART ST
2
N POLLARD ST
9TH ST N
N MONROE ST
N LINCOLN ST
N LINCOLN ST
WILSON BLVD
N IVY ST
7TH ST N
6TH ST N
N JACKSON ST
N TAZEWELL ST
N VERMONT ST
N GLEBE RD
5TH PL N
5TH RD N
N PIEDMONT ST
N OXFORD ST
N OAKLAND ST
N NORWOOD ST
5TH ST N
N KENMORE ST
N THOMAS ST
4TH ST N
N PERSHING DR
3RD ST N
4TH RD N
3RD RD N
N PARK DR
3RD ST N
4TH ST N
2ND RD N
2ND ST N
N HENDERSON RD
2ND RD N
4TH ST N
N GEORGE MASON DR
N TRENTON ST
CATHEDRAL LN
ARLINGTON BLVD
S GLEBE RD
4
2ND ST N
GTON BLVD
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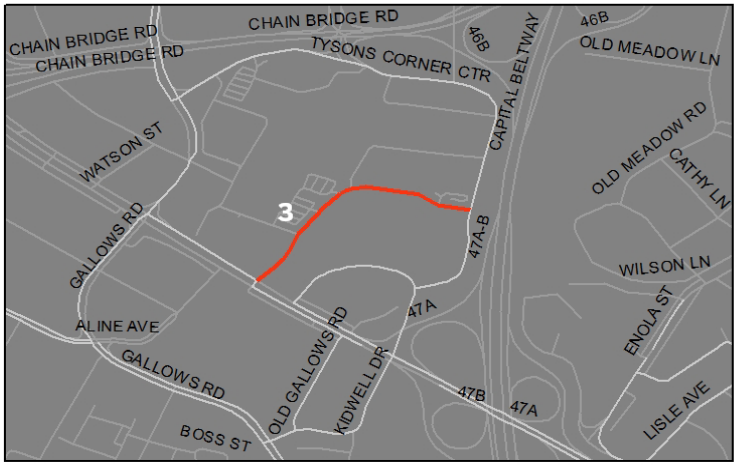
NG DR
6TH ST S
Legend
Hot Spots
Bus Routes
Streets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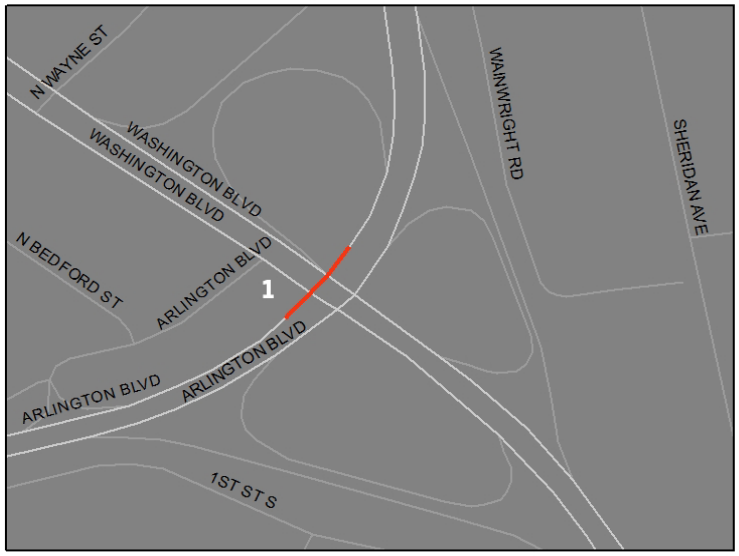
CHAIN BRIDGE RD
TYSONS CORNER CTR
46B
CAPITAL BELTWAY
46B
OLD MEADOW LN
WATSON ST
OLD MEADOW RD
CATHY LN
3
GALLOWS RD
47A-B
WILSON LN
ALINE AVE
47A
ENOLA ST
GALLOWS RD
OLD GALLOWS RD
KIDWELL DR
47B
47A
LISLE AVE
BOSS ST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PARSONS BRINCKERHOFF

Table 7: District of Columbia Hot Spot Locations – All Day

Rank	Direction	Location	Start	End	Avg. Score	Avg. Speed (mph)	Max Score	Max Link	Length	Buses per Time Period (Core Agencies)	Comments	Additional Trips (Non-Core Agencies)	Bus Routes and Avg. Daily Ridership
1	All	*Virginia Avenue NW*	*E Street*	*D Street*	4463	6.27	4463	18893075	0.05	510	-	54	(**WMATA:** S1, N3, 80, X1, 31, 39; **MTA:** 901, 909, 950) ***22,361***
2	All	I Street NW	18th Street	13th Street	4412	5.8	6369	732173176	0.65	493	-	-	(**WMATA:** 32, 11Y, S4, 36, P19, P17, S9, 43, S2, 39, 42, G8, X2, W13, 37) ***55,070***
3	All	McPherson Square (14th/K/I/13th)			4182	6.3	5484	727357000	0.12	514	-	144	(**WMATA:** 80, D3, D1, D4, S4, S9, D6, 34, 54, 52, 16Y, P19, P17, 42, G8, X2, W13, 63; **DCC:** EW, WAM; **MTA:** 901, 902, 904, 905, 909, 915, 950 **LT:** 4, 6, 7, 9, 15) ***113,696***
4	All	11th Street NW	I Street	F Street	4102	1.6	5199	18353306	0.27	302	-	38	(**WMATA:** 64, S4, P19, P17, 63, S2, 42, W13, P6; **MTA:** 904, **PRTC:**CO, X50) ***35,040***
5	All	*K Street*	*17th*	*Connecticut*	3637	8.9	3637	732173170	0.03	535	-	119	(**WMATA:** S1, 3Y, L2, 80, D3, N2, D1, D5, D6, 68, N6, 16Y, N4; **DCC**: EW; **MTA:** 901, 902, 904, 905, 909, 950; **LT:** 4, 6, 7, 15) ***34,626***
6	All	M Street - Pennsylvania Avenue	Wisconsin Avenue	Washington Circle	3420	6.0	4098	724215212	0.78	401	-	-	(**WMATA:** 32, 38B, 36, D5, 31, 36, D51; **DCC:** EW, DGR) ***29,599***

Rank	Direction	Location	Start	End	Avg. Score	Avg. Speed (mph)	Max Score	Max Link	Length	Buses per Time Period (Core Agencies)	Comments	Additional Trips (Non-Core Agencies)	Bus Routes and Avg. Daily Ridership
7	All	H Street NW	Jackson Place	9th Street	3309	6.1	4259	732170798	0.72	377	-	43	(**WMATA:** L2, 32, 11Y, P17, 42, 39, P19, 36, 37, W13, 68; **PRTC:** 4R, X3O, 1O, 2O) ***30,336***
8	All	*9th Street NE*	*Monroe Street*		3302	7.3	3302	18382526	0.03	430	-	-	(**WMATA:** H1, H2, H3, H4, H8, H9, G8, 80) ***21,145***
9	All	*Wisconsin Ave*	*Q Street*		3000	7.1	3127	18464894	0.02	368	-	-	(**WMATA:** 32, 31, 36, D51, G2; **DCC:** EW) ***24,636***
10	All	7th Street & Pennsylvania Ave NW	I-395	9th Street	2850	8.1	4382	720283245	0.75	587	Highest frequency location	133	(**WMATA:** 32, 70, 34, A42, 54, 36, P17, P19, A48, 39, 16F, V8, 71, A46, 70, W13, 13G; **MTA:** 901, 902, 904, 905, 915, 929, 995; **PRTC:** SI, X5O, CO, CI) ***70,776***
11	All	Connecticut Avenue NW	K Street	Jefferson Street	2807	4.7	3601	18352839	0.35	277	-	-	(**WMATA:** 43, 42, N2, N6, N4) ***11,537***
12	All	Dupont Circle	Entire Outer Circle		2686	5.7	3156	18352351	0.20	296	-	12	(**WMATA:** G2, L2, N6, 42, N4; **MTA:** 429 1***8,511***
13	All	14th Street NW	Corcoran St	Otis Pl	2682	6.9	3767	18351368	1.62	347	-	-	(**WMATA:** 52, 53, 54, H8 **DCC:** WAM) ***22,035***
14	All	8th Street SE	E Street	M Street	2678	7.2	5585	733263916	0.42	371	-	-	(**WMATA:** 92, 93, 90; **DCC:** USN) ***15,364***
15	All	Thomas Circle & 14th Street	Green Ct	Highlander NW	2666	6.5	3767	723564731	0.17	278	-	-	(**WMATA:** 52, 53, 54; **DCC:** WAM) ***18,649***

Table 8: District of Columbia Hot Spot Locations – AM Peak (6:00 – 9:00)

Rank	Direction	Location	Start	End	Avg. Score	Avg. Speed (mph)	Max Score	Max Link	Length	Average Buses per Hour (Core Agencies)	Comments	Additional Trips from Non-Core Agencies	Bus Routes and Avg. Daily Ridership
1	All	*K Street*	*Connecticut*	*17th Street*	718	3.8	718	732173158	0.05	66	-	34	(**WMATA:** S1, 3Y, L2, 80, D3, N2, D1, D5, D6, N6, 16Y, N4; **DCC**: EW; **MTA:** 901, 902, 904, 905, 909, 950; **LT:** 4, 6, 7, 15) ***34,626***
2	All	*Virginia Ave*	*E Street*	*D Street*	535	6.1	535	18893075	0.05	60	-	16	(**WMATA:** S1, N3, 80, X1, 31, 39; **MTA:** 901, 909, 950) ***22,361***
3	All	I Street	18th Street	11th Street	475	5.8	755	732173176	0.69	52	-	-	(**WMATA:** 32, 11Y, S4, 36, P19, P17, S9, 43, S2, 39, 42, G8, X2, W13, 37) ***55,070***
4	All	13th Street	H Street	K Street	449	6.8	536	18353199	0.18	59	-	4	(**WMATA**: 80, D1, D3, D6, 63, 53, S9; **MTA:** 915) ***34,263***
5	All	11th Street NW	Pennsylvania	I Street	355	3.1	432	18353306	0.5	30	-	28	(**WMATA:** 64, S4, P19, P17, 63, S2, 42, W13, P6; **MTA:** 904, **PRTC:**CO, X50) ***35,040***
6	All	K Street	15th Street	13th Street	353	6.2	313	811825799	0.26	38	-	34	(**WMATA:** S1, 3Y, L2, 80, D3, N2, D1, D5, D6, N6, 16Y, N4; **DCC**: EW; **MTA:** 901, 902, 904, 905, 909, 950; **LT:** 4, 6, 7, 15) ***34,626***
7	All	Constitution Ave NW	7th Street	5th Street	311	4.6	311	719473638	0.11	30	-	-	(**WMATA:** 32, 36, P19, X1, 54, P2, 16F, W13, P1) ***33,266***

Rank	Direction	Location	Start	End	Avg. Score	Avg. Speed (mph)	Max Score	Max Link	Length	Average Buses per Hour (Core Agencies)	Comments	Additional Trips from Non-Core Agencies	Bus Routes and Avg. Daily Ridership
8	All	8th Street SE	I Street	L Street	304	7.5	442	733263916	0.13	42	-	-	(**WMATA:** 92, 93, 90; **DCC:** USN) ***14,376***
9	All	Georgia Ave	Upshur St	New Hampshire Ave	292	10.1	292	18418099	0.34	60	-	-	(**WMATA:** 60, 62, 70, 71, 79) ***25,380***
10	All	14th Street	R Street	W Street	285	7	290	18351463	0.25	36	-	-	(**WMATA:** 52, 53, 54, H8 **DCC:** WAM) ***22,035***
11	All	*Connecticut*	*Hillyer Street*		281	5.7	281	786393780	0.02	30	-	-	(**WMATA:** H1, 43, 42, L1, L4) ***12,518***
12	All	16th Street	K Street	Shepherd Street	272	5.9	303	18419086	2.36	30	-	4	(**WMATA:** S1, S2, S4, S9; **MTA:** 915) ***18,830***
13	All	M Street - Pennsylvania Avenue	Wisconsin	25th Street	270	6.5	288	724215212	0.52	33	-	-	(**WMATA:** 32, 38B, 36, D5, 31, D51; **DCC:** EW, DGR) ***29,599***
14	All	7th Street	I-395	Constitution Ave	259	6.7	463	782601884	0.56	47	-	45	(**WMATA:** 32, 70, 34, A42, 54, 36, P17, P19, A48, 39, 16F, V8, 71, A46, W13, 13G; **MTA:** 901, 902, 904, 905, 915, 929, 995; **PRTC:** SI, X5O, CO, CI) ***71,434***
15	All	Riggs Road NE	N. Capital	1st Street	258	10.6	290	117281454	0.25	60	-	-	(**WMATA:** E3, K6, 60, 64, K2, E2, E4) ***15,690***

Table 9: District of Columbia Hot Spot Locations – PM Peak (3:00 – 7:00)

Rank	Direction	Location	Start	End	Avg. Score	Avg. Speed (mph)	Max Score	Max Link	Length	Average Buses per Hour (Core Agencies)	Comments	Additional Trips (Non-Core Agencies)	Bus Routes and Avg. Daily Ridership
1	All	H	18th Street	11th Street	392	5.1	600	18353378	0.57	40	-	5	(**WMATA:** L2, 32, 11Y, P17, 42, 39, P19, 36, 37, W13; **PRTC:** 4R, X3O, 1O, 2O) ***30,366***
2	All	*Connecticut*	*M Street*		391	1.9	391	792703738	0.06	30	-	-	(**WMATA:** 43, 42, N2, N6, N4) ***33,233***
3	All	Pennsylvania Ave	13th Street	7th Street	381	6.7	492	719150990	0.26	60	-	39	(**WMATA:** 32, 54, 79, P17, 39, A46, P19, A42, 37, P2, V8, A48, 34, W13, P6, 16F) ***57,102***
4	All	K Street	14th Street	13th Street	380	5.8	380	727356990	0.13	42	-	34	(**WMATA:** S1, 3Y, L2, 80, D3, N2, D1, D5, D6, 68, N6, 16Y, N4; **DCC**: EW; **MTA:** 901, 902, 904, 905, 909, 950; **LT:** 4, 6, 7, 15) ***50,613***
5	All	13th Street	K Street	H Street	344	6	582	18353199	0.12	39	-	4	(**WMATA**: 80, D1, D3, D6, 63, 53, S9; **MTA:** 915) ***34,263***
6	All	I Street	17th Street	13th Street	335	5.5	587	727357000	0.65	36	-	-	(**WMATA:** 32, 11Y, S4, 36, P19, P17, S9, 43, S2, 39, 42, G8, X2, W13, 37) ***55,070***
7	All	7th Street NW	Pennsylvania	G Street	323	8.6	667	719305670	0.7	60	-	45	(**WMATA:** 32, 70, 34, A42, 54, 36, P17, P19, 48, 39, 16F, V8, 71, A46, W13, 13G; **MTA:** 901, 902, 904, 905, 915, 929, 995; **PRTC:** SI, X5O, CO, CI) ***69,509***

Rank	Direction	Location	Start	End	Avg. Score	Avg. Speed (mph)	Max Score	Max Link	Length	Average Buses per Hour (Core Agencies)	Comments	Additional Trips (Non-Core Agencies)	Bus Routes and Avg. Daily Ridership
8	All	14th Street	R Street	Chapin Street	310	6.4	318	18351463	0.25	36	-	-	(**WMATA:** 52, 53, 54, H8 **DCC:** WAM) ***22,035***
9	All	*14th Street*	*Green Ct. NW*		308	5.6	308	723564731	0.01	36	-	-	(**WMATA:** 52, 53, 54, H8 **DCC:** WAM) ***22,035***
10	All	*17th Street NW*	*I Street*		298	5.1	298	732173172	0.05	30	-	-	(**WMATA:** 43, 42, D5, G8) ***11,809***
11	All	*11th Street*	*New York Ave*	*H Street*	291	0.5	291	18353414	0.04	20	-	28	(**WMATA:** 64, S4, P19, P17, 63, S2, 42, W13, P6; **MTA:** 904, **PRTC:**CO, X5O) ***41,199***
12	All	*Dupont Circle*	*P Street*		288	5.4	288	18352320	0.02	30	-	3	(**WMATA:** G2, L2, N6, 42, N4; **MTA:** 429) ***18,511***
13	All	9th Street	Bunker Hill Rd	Monroe St	268	8.3	286	24710673	0.12	30	-	-	(**WMATA:** H1, H2, H3, H4, H8, H9, G8, 80; **PRTC:** 4R, X3O, 1O, 2O) ***22,475***
14	All	*Washington Circle*	*23rd Street*		267	7.5	267	18353240	0.02	36	-	-	(**WMATA:** 38B, 32, N3, 39, L1, 31, 36, D5, H1) ***28,706***
15	All	15 Street	G Street		267	6.1	267	18353663	0.22	30	-	-	(**WMATA:** 32, 36, 11Y, 37, 39) ***13,780***

Table 10: Maryland Hot Spot Locations – All Day

Rank	Direction	Location	Start	End	Avg. Score	Avg. Speed (mph)	Max Score	Max Link	Length	Buses per Time Period (Core Agencies)	Comments	Additional Trips from Non-Core Agencies	Bus Routes and *Avg. Daily Ridership*
1	All	Loop: Willard/ Western/Wisconsin	-	-	2854	8.4	3600	724586253	0.25	394	Friendship Heights Metro	-	(**WMATA:** 36, 37, E2, E4, E3, 31, L8, E6, N3, N6, N4 **RO:** 1, 11, 23, 29, 34) ***36,077***
2	All	Georgia Ave	13th Street	Colesville Rd	2478	7.4	6148	18409940	0.61	349	Approach to Silver Spring Metro	-	(**WMATA:** Q2, Q4, Q1, Y9, Y7, S4, J5, Y5, Y8, 79, 70, 71; **RO:** 8, 12, 13, 14, 16, 17, 20, 21, 22, 28, 8) ***60,949***
3	NB	*River Road*	*Paint Branch Drive*	-	2142	4.3	2142	18899893	0.05	253	-	-	(**WMATA:** 83, C8, J4, R12, 86, R11, F6) ***16,359***
4	All	Veirs Mills Road	Reedie Drive	Wheaton Metro	2125	10.7	2125	18459404	0.12	600	Adjacent to Wheaton Metro	-	(**WMATA:** Q1, Q2, Q4, Y7, Y9, Y5, Y8, C4, C2; **RO:** 31, 34, 38, 48, 8) ***33,209***
5	All	Fenton St	Sligo Avenue	Colesville Rd	2028	5.9	2480	117297384	0.52	256	Approach to Silver Spring	-	(**WMATA:** F2, F4, F6; **RO:** 16, 17, 20, 28) ***18,160***
6	All	East-West Highway	16th Street	Georgia Ave	1794	7.4	1953	18410080	0.73	258	-	-	(**WMATA:** J1, J2, J4, J3, 70, 79, 71; **RO:** 1, 2, 3, 11, 28) ***34,026***
7	All	Piney Branch Road	Manchester Rd	University Blvd	1636	8.9	1725	18376686	0.59	270	-	-	(**WMATA:** J4; **RO:** 14, 15, 16, 20, 24) ***12,582***
8	All	Lebanon Street	MD-193	MD-650	1584	7.6	1584	18377193	0.14	215	-	-	(**WMATA:** F8; **RO:** 15, 17, 18; **The Bus:** 18) **7,187**
9	All	Monroe Street / Monroe Place	Jefferson Street	Rockville Pike	1557	7.8	1557	19451700	0.21	217	-	-	(**RO:** 44, 46, 47, 54, 56, 63) ***10,479***
10	WB	University Blvd W.	Dennis Avenue	Arcola Ave	1526	7.0	1796	18459732	0.72	191	-	-	(**WMATA:** C2, C4; **RO:** 8, 9) ***23,236***
11	All	Carroll Avenue	Maple Street	Grant Ave	1464	6.6	1570	18412691	0.58	171	Approach to Takoma Metro Station	-	(**WMATA:** F4, F6; **RO:** 12, 13, 16, 18) ***13,529***

Rank	Direction	Location	Start	End	Avg. Score	Avg. Speed (mph)	Max Score	Max Link	Length	Buses per Time Period (Core Agencies)	Comments	Additional Trips from Non-Core Agencies	Bus Routes and *Avg. Daily Ridership*
12	All	*Baltimore Ave*	*Pineway*	Fordham	1373	6.0	1373	18378274	0.02	153	-	-	(**WMATA:** 81, 83, 86) ***4,180***
13	All	Hungerford Lane	Ivy League Ln	N Washington St	1306	8.0	1306	19462768	0.21	187	-	-	(**WMATA:** Q2, Q5, Q6, Q1 **RO:** 46, 55) ***20,508***
14	All	Colesville Road	East-West Hwy	Capital Beltway	1236	10.1	5042	18409877	2.69	305	-	33	(**WMATA:** Z29, F4, Z8, Z9, Z2, Z11, Z13, Z6, J3, J2, J4, J1, 70, 71, S4, 79, S2 ; **RO:** 1, 2, 3, 8, 9, 11, 12, 13, 14, 16, 17, 20, 21, 22; **MTA:** 915, 29) ***76,860***
15	All	Annapolis Road	Finns Lane	Riverdale Rd	1069	5.8	1377	18380243	0.39	150	To New Carrollton Metro	-	(**WMATA:** F4, F13, G13, G14, G16, B25, B24, B27) ***10,562***

Table 11: Maryland Hot Spot Locations – AM Peak (6:00 – 9:00)

Rank	Direction	Location	Start	End	Average Score	Avg. Speed (mph)	Max Score	Max Link	Length	Average Buses per Hour (Core Agencies)	Comments	Additional Trips from Non-Core Agencies	Bus Routes and *Avg. Daily Ridership*
1	All	Wayne Ave	Colesville Rd	Georgia Ave	413	7.8	539	18410088	0.18	66	-	-	(**WMATA:** J1, J2, J3, J4, F4, Z8, Z29, S4, 79, Z2, Z11, S2, Z13; **RO** 2, 3, 4, 5, 11, 14, 15, 16, 18, 19, 20, 28) ***52,926***
2	All	Loop: Ramsey/ Bonifat/ Wayne/ Georgia / Dixon			380	7.7	539	18410088	0.5	60	Silver Spring Metro	-	(**WMATA:**Q2, Q4, Q1, Y9, Y7, S4, J5, Y5, Y8; **RO: 1,** 2, 3, 4, 5, 8, 9, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 28) ***54,300***
3	All	*Westlake Terrace*	*Auto Park Ave*		260	3.2	260	18433656	0.09	27	-	-	(**WMATA:** J2, J3; **RO:** 6, 26, 47, 96) ***11,563***
4	All	Georgia Ave	East-West Hwy	Colesville Rd	248	7.6	405	18409940	0.61	33	-	-	(**WMATA:** Q2, Q4, Q1, Y9, Y7, S4, J5, Y5, Y8, 79, 70, 71; **RO:** 8, 12, 13, 14, 16, 17, 20, 21, 22, 28, 8) ***60,318***
5	All	Loop: Willard / Western / Wisconsin			212	9.9	332	724586253	0.18	43	Friendship Heights Metro	-	(**WMATA:** 36, 37, E2, E4, E3, 31, L8, E6, N3, N6, N4 **RO:** 1, 11, 23, 29, 34) ***36,077***
6	All	Fenton	East-West Hwy	Theyer Ave	186	6.3	208	18409765	0.38	28	-	-	(**WMATA:** F2, F4, F6; **RO:** 16, 17, 20, 28) ***18,160***
7	All	East-West Highway	Sundale Dr	Blair Mill Rd	183	5.6	234	18410080	1.10	26	-	-	(**WMATA:** J1, J2, J4, J3, 70, 79, 71; **RO:** 1, 2, 3, 11, 28) ***34,026***

Rank	Direction	Location	Start	End	Average Score	Avg. Speed (mph)	Max Score	Max Link	Length	Average Buses per Hour (Core Agencies)	Comments	Additional Trips from Non-Core Agencies	Bus Routes and *Avg. Daily Ridership*
8	All	Colesville Road	East-West Hwy	Grey Rock Dr	179	6.8	323	18409877	1.04	23	-	10	(**WMATA:** Z29, F4, Z8, Z9, Z2, Z11, Z13, Z6, J3, J2, J4, J1, 70, 71, S4, 79, S2 ; **RO:** 1, 2, 3, 8, 9, 11, 12, 13, 14, 16, 17, 20, 21, 22; **MTA:** 15, 29) ***76,860***
9	North	Annapolis Road	Finn Road	Riverdale Road	160	4.3	160	18380243	0.29	15	To New Carrollton Metro	-	(**WMATA:** F4, F13, G13, G14, G16, B25, B24, B27) ***10,562***
10	All	Piney Branch Road	University Blvd	Sligo Ave	149	8.4	183	18376661	1.05	25	-	-	(**WMATA:** J4; **RO:** 14, 15, 16, 20, 24) ***12,582***
11	All	Lebanon Rd	University Blvd	New Hampshire	148	8.5	148	18377193	0.19	23	-	-	(**WMATA:** F8; **RO:** 15, 17, 18; **The Bus:** 18) ***7,187***
12	All	*Veirs Mill Rd*	*Reedie Dr*	*Mall Driveway*	136	11.8	136	18459404	0.12	46	Wheaton Metro	-	(**WMATA:** Q1, Q2, Q4, Y7, Y9, Y5, Y8, C4, C2; **RO:** 31, 34, 38, 48, 8) ***33,209***
13	Clockwise	Rockledge Dr	Fernwood Rd	Democracy Blvd	134	1.4	163	18904153	1.16	15	-	-	(**WMATA:** J3 **RO:**47, 96) ***8,090***
14	North	*River Road*	*Paint Branch*		133	6.1	133	18899893	0.05	18	-	-	(**WMATA:** 83, C8, J4, R12, 86, R11, F6) ***16,359***
15	North	MD-650	Oakview Rd	Powdermill	132	4.5	132	18569364	0.49	16	-	-	(**WMATA:** C8, K6; **RO:** 20, 24) ***11,290***

Table 12: Maryland Hot Spot Locations – PM Peak (3:00-7:00)

Rank	Direction	Location	Start	End	Avg. Score	Avg. Speed (mph)	Max Score	Max Link	Length	Average Buses per Hour (Core Agencies)	Comments	Additional Trips (Non-Core Agencies	Bus Routes and *Avg. Daily Ridership*
1	All	Wayne Ave	Colesville Road	Georgia Ave	457	6.1	654	18410088	0.18	60	Silver Spring Metro	-	(**WMATA:** J1, J2, J3, J4, F4, Z8, Z29, S4, 79, Z2, Z11, S2, Z13, F16. **RO** 2, 3, 4, 5, 11, 14, 15, 16, 18, 19, 20, 28) ***52,926***
2	All	Loop: Ramsey/ Bonifant/ Wayne/ Georgia / Dixon			439	5.9	654	18410088	0.50	54	Silver Spring Metro	-	(**WMATA:**Q2, Q4, Q1, Y9, Y7, S4, J5, Y5, Y8; **RO: 1,** 2, 3, 4, 5, 8, 9, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 28) ***54,300***
3	All	Loop: Willard / Western / Wisconsin			257	8.6	455	724586253	0.18	41	Friendship Heights Metro	-	(**WMATA:** 36, 37, E2, E4, E3, 31, L8, E6, N3, N6, N4 **RO:** 1, 11, 23, 29, 34) ***36,077***
4	All	Georgia Ave	Colesville Road	East-West Hwy	241	7.1	485	18409940	0.63	32	Silver Spring Metro	-	(**WMATA:** Q2, Q4, Q1, Y9, Y7, S4, J5, Y5, Y8, 79, 70, 71; **RO:** 8, 12, 13, 14, 16, 17, 20, 21, 22, 28, 8) ***60,318***
5	All	East-West Highway	Connecticut Ave	Georgia Ave	220	4.7	456	18410080	3.20	21	-	-	(**WMATA:** J1, J2, J4, J3, 70, 79, 71; **RO:** 1, 2, 3, 11, 28) ***34,026***
6	All	Colesville Rd	East-West Hwy	Brunnett Ave	200	4.7	432	746830826	1.06	22	To Silver Spring	10	(**WMATA:** Z29, F4, Z8, Z9, Z2, Z11, Z13, Z6, J3, J2, J4, J1, 70, 71, S4, 79, S2 ; **RO:** 1, 2, 3, 8, 9, 11, 12, 13, 14, 16, 17, 20, 21, 22; **MTA:** 15, 29) ***76,860***
7	All	Fenton Rd	Colesville Road	Sligo Ave	200	5.2	236	18409765	0.37	23	To Silver Spring	-	(**WMATA:** F2, F4, F6; **RO:** 16, 17, 20, 28) ***18,160***
8	All	Veirs Mill / Reedie/ Amherst	University Blvd	Georgia Ave	182	6.2	211	18459404	0.50	23	-	-	(**WMATA:** Q1, Q2, Q4, Y7, Y9, Y5, Y8, C4, C2; **RO:** 31, 34, 38, 48, 8) ***33,209***

Rank	Direction	Location	Start	End	Avg. Score	Avg. Speed (mph)	Max Score	Max Link	Length	Average Buses per Hour (Core Agencies)	Comments	Additional Trips (Non-Core Agencies	Bus Routes and *Avg. Daily Ridership*
9	All	*Suitland Metro Loop*			160	10	160	773382837	0.13	34	-	-	(**WMATA:** D13, K12, P12, D12, V12, D14, K13; **TheBus:** 34, 53) ***14,114***
10	All	Piney Branch Road	University Blvd	Manchester Rd	159	9	171	18376661	0.59	27	-	-	(**WMATA:** J4; **RO:** 14, 15, 16, 20, 24) ***12,582***
11	South	Southampton/ Northampton Dr	New Hampshire Ave	New Hampshire Ave	143	3.2	143	18435546	0.97	12	-	-	(**WMATA:**K6; **RO:** 20, 24) ***9,095***
12	South	University Blvd	Dennis Ave	Colesville Rd	139	6.6	139	18460847	0.58	17	-	-	(**WMATA:** C2, C4; **RO:** 8, 9) ***12,621***
13	South	University Blvd	Arcola Ave	Gabel St	139	6.6	139	18459732	0.18	17	-	-	(**WMATA:** C2, C4; **RO:** 8, 9) ***12,621***
14	All	*Carrol Ave*	*Philadelphia Ave*	*Ethan Allen Ave*	136	7.4	136	18412691	0.08	18	-	-	(**WMATA:** F4, F6; **RO:** 12, 13, 16, 18) ***13,529***
15	North	Annapolis Road	Finn Road	Riverdale Rd	134	6.1	134	18380243	0.29	15	To New Carrollton Metro	-	(**WMATA:** F4, F13, G13, G14, G16, B25, B24, B27) ***10,562***

Table 13: Virginia Hot Spot Locations – All Day

Rank	DIR	Location	Start	End	Avg. Score	Avg. Speed (mph)	Max Score	Max Link	Length (mi)	Buses per time period (Core Agencies)	Comments	Additional Trips from Non-Core Agencies	Bus Routes and *Avg. Daily Ridership*
1	WB	Arlington Blvd	*Washington Blvd WB Off-ramp*	*End Overpass*	1841	8.2	1841	123638222	0.04	270	Overpass btwn ramps	-	(**WMATA:** 4H, 4A) ***2,018***
2	Both	N Stuart St	N Fairfax Dr	Wilson Blvd	1772	10.7	2003	128081227	0.14	460	Ballston	-	(**WMATA:** 1B, 2A, 1Z, 23C, 22A, 23A, 1F, 25B, 2B, 10B, 1A, 1E, 25A, 2G; **ART:** 51, 42, 75) ***19,337***
3	Both	Fashion Blvd	Tysons Corner Ring Rd	Leesburg Pike (RT 7)	1573	10.4	2002	718134365	0.38	345	-	-	(**WMATA:** 28A, 2C, 2T, 3T, 23A, 15K, 28X, 28T, 15M; **FC:** 401, 402) ***18,481***
4	WB	Arlington Blvd	SB Off-ramp to Glebe	Opposite side of Glebe	1228	8.2	1228	123639007	0.12	180	Arterial Interchange	-	(**WMATA:** 4H, 4W) ***2,018***
5	WB	Wilson Blvd	East of Fort-Meyer Dr	Fort-Meyer Dr	1202	8.5	1202	18420602	0.03	194	Rosslyn Metro	4	(**WMATA:** 4B, 4H, 4A; **ART:** 61; **PRTC:** RI) ***2,357***
6	Both	*S Eads St*	*Army Navy Dr*	*EB 395 Frontage Rd*	1190	10.5	1209	18355174	0.06	305	Pentagon Access	22	(**WMATA:** 13F, 16D, 16E, 16A, 10E, 16K, 16P, 7Y, 10A, 16J, 13G, 16B, 9E, 9A, 16F; **ART:** 42, 87; **FC:** 306, 395; **PRTC:** D2I, L2I, MX40, L2O; **LC**: 53E, 5E, 58E, 12E) ***24,783***
7	WB	*Lee Hwy*	N Lynn St	Fort-Meyer Dr	1149	2.2	1149	762707061	0.06	90	-	-	(**WMATA:** 3Y, 3B, 3A, 5A, 3E) ***3,920***

Rank	DIR	Location	Start	End	Avg. Score	Avg. Speed (mph)	Max Score	Max Link	Length (mi)	Buses per time period (Core Agencies)	Comments	Additional Trips from Non-Core Agencies	Bus Routes and *Avg. Daily Ridership*
8	Both	Columbia Pike	S Greenbrier St	S Walter Reed Dr	1006	8.8	1456	18357562	1.66	278	-	-	(**WMATA:** 16A, 16B, 16D, 16E, 16F, 16G, 16H, 16J, 16K, 16P, 16Y; **ART:** 45, 62) ***12,396***
9	Both	N Lynn St	South of 19th St	Key Bridge	986	8.8	1499	764385668	0.30	213	-	-	(**WMATA:** 38B, 3B, 15K, 5A, 3E, 4A, 4H; **ART:** 61) ***9,952***
10	Both	S Joyce St	Columbia Pike	Army Navy Dr	951	10.6	2075	128062902	0.42	230	-	-	(**WMATA:** 16A, 16B, 16D, 16E, 16F, 16G, 16H, 16J, 16K, 16P, 16Y; **ART:** 42) ***12,593***
11	EB	N Fairfax Dr	N Stuart St	N Randolph St	943	10.3	1173	128081216	0.13	210	Ballston	-	(**WMATA:** 22A, 1Z, 10B, 25A, 23A, 23C; **ART:** 42, 52, 75) ***14,213***
12	SB	Gallows Rd	BelleForest Dr	Inova Hospital Gray Entrance	890	7.0	1320	18453368	1.77	122	-	-	(**WMATA:** 2C, 2T; **FC:** 402, 404, 462, 463) ***5,336***
13	NB	Leesburg Pike	Glen Carlyn Rd	Therne Rd	871	4.7	1449	18356267	1.27	104	-	-	(**WMATA:** 1B, 28X, 4B, 4H, 28A, 1A, 1E, 1F, 4A) ***10,742***
14	Both	Army Navy Dr	S Joyce St	S Hayes St	860	11.6	1113	123639665	0.24	300	-	-	(**WMATA:** 10A, 10E, 16A, 16B, 16D, 16E, 16F, 16G, 16H, 16J, 16K, 16P, 16Y; **ART:** 42, 87) ***16,268***
15	NB	Jefferson Davis Hwy	E Reed Ave	23rd St S	794	6.2	1465	18477645	1.10	90	-	-	(**WMATA:** 9S, 9E, 9A) ***1,668***

Table 14: Virginia Hot Spot Locations – AM Peak (6:00 – 9:00)

Rank	Direction	Location	Start	End	Avg. Score	Avg. Speed (mph)	Max Score	Max Link	Length	Average Buses per Hour (Core Agencies)	Comments	Additional Trips from Non-Core Agencies	Bus Routes and *Avg. Daily Ridership*
1	NB	NB Jefferson Davis Hwy	Reed Ave	20th St South	180	6.2	285	711068331	1.14	20	-	-	(**WMATA:** 9E, 9A) ***1,668***
2	SB	*SB Glebe Rd*	*WB Arlington on-ramp*	*EB Arlington on-ramp*	140	4.2	185	123638204	0.03	13	Arterial Interchange Overpass	-	(**WMATA:** 10B, 23A, 2C; **ART:** 41) ***11,882***
3	Both	Columbia Pike	George Mason Blvd	S Walter Reed Dr	119	9.7	126	18357562	0.82	25	-	-	(**WMATA:** 16A, 16B, 16D, 16E, 16F, 16G, 16H, 16J, 16K, 16P, 16Y; **ART:** 45, 62) ***12,465***
4	Both	Fashion Blvd	Tysons Corner Ring Rd	West of Tysons Corner Ring Rd	118	11.4	118	718134365	0.12	34	Adjacent to Tysons Corner Mall	-	(**WMATA:** 28A, 2C, 2T, 3T, 23A, 15K, 28X, 28T, 15M, 15C; **FC:** 401, 402) ***18,481***
5	Both	*Patriot Dr*	*Lafayette Forest Dr*	*Heritage Dr*	117	5.2	117	18361915	0.04	12	-	-	(**WMATA:** 16B, 3A, 16E, 29G, 29H) ***9,312***
6	Both	N Lynn St	South of 19th St	WB Lee Hwy	109	8.3	126	18420383	0.17	19	-	-	(**WMATA:** 38B, 3B, 15K, 5A, 3E, 4A, 4H; **ART:** 61) ***9,952***
7	Both	N Stuart St	N Fairfax Dr	Wilson Blvd	108	10.6	126	128081227	0.14	28	Ballston	-	(**WMATA:** 1B, 2A, 1Z, 23C, 22A, 23A, 1F, 25B, 2B, 10B, 1A, 1E, 25A, 2G; **ART:** 51, 42, 75) ***19,337***
8	Both	Eisenhower Ave	S Van Dorn St	East of Van Dorn Metro	103	6.8	119	723593430	0.35	15	Van Dorn Metro	-	(**WMATA:** 25B; **DASH:** AT1, AT5, AT7, AT8; **FC:** 232, 322) ***10,876***
9	Both	Pershing Dr	Washington Blvd	Barton St	103	8.4	103	18422062	0.17	17	-	-	(**WMATA:** 4B, 4E; **ART:** 45) ***2,549***
10	Both	Clarendon Blvd	N Veitch St	N Barton St	92	7.7	92	18421142	0.18	20	-	-	(**WMATA:** 4B, 4E, 38B; **ART:** 41, 45, 77) ***9,693***

Rank	Direction	Location	Start	End	Avg. Score	Avg. Speed (mph)	Max Score	Max Link	Length	Average Buses per Hour (Core Agencies)	Comments	Additional Trips from Non-Core Agencies	Bus Routes and Avg. Daily Ridership
11	Both	*S Eads St*	*Army Navy Dr*	*EB 395 Frontage Rd*	91	11.3	91	18354867	0.06	28	Pentagon Entrance	28	**WMATA:** 13F, 16D, 16E, 16A, 10E, 16K, 16P, 7Y, 10A, 16J, 7Y, 13G, 16B, 9E, 9A, 16F; **ART:** 42, 87; **FC:** 306, 395; **PRTC:** D2I, L2I, MX40, L2O; **LC**: 53E, 5E, 58E, 12E) ***24,783***
12	NB	*NB Gallows Rd*	*EB Arlington on-ramp*	*SB Gallows Rd EB Arlington on-ramp*	91	7.5	91	18476426	0.07	16	Single Point Urban Interchange	-	(**WMATA:** 1A, 1C, 1Z**; FC:** 401) ***7,394***
13	Both	19th St N	Rosslyn Metro	Wilson Blvd	88	8.5	96	18420385	0.21	16	Rosslyn Metro	-	(**WMATA:** 38B, 4E, 4B; **ART:** 45, 61) ***6,476***
14	Both	N Barton St	Clarendon Blvd	9th St N	88	3.8	88	18421319	0.46	9	-	-	(**WMATA:** 4E, 4B; **ART:** 45) ***2,549***
15	NB	NB Leesburg Pike	Patrick Henry Dr	Thorne Rd	87	7.7	94	18356267	0.45	12	Seven Corners	-	(**WMATA:** 1B; 28X; 4B; 4H; 28A; 1A; 1E; 1F; 4A) ***10,742***

Table 15: Virginia Hot Spot Locations – PM Peak (3:00 -7:00)

Rank	Direction	Location	Start	End	Avg. Score	Avg. Speed (mph)	Max Score	Max Link	Length	Average Buses per Hour (Core Agencies)	Comments	Additional Trips from Non-Core Agencies	Bus Routes and *Avg. Daily Ridership*
1	SB	*SB Glebe Rd*	*WB Arlington on-ramp*	*EB Arlington on-ramp*	159	3.2	199	123638204	0.03	13	Arterial Interchange Overpass	-	(**WMATA:** 10B, 23A, 2C; **ART:** 41) ***11,882***
2	Both	N Stuart St	N Fairfax Dr	Wilson Blvd	120	9.5	152	128081227	0.14	26	Ballston	-	(**WMATA:** 1B, 2A, 1Z, 23C, 22A, 23A, 1F, 25B, 2B, 10B, 1A, 1E, 25A, 2G; **ART:** 51, 42, 75) ***19,337***
3	Both	Fashion Blvd	Tysons Corner Ring Rd	Leesburg Pike (RT 7)	108	10.6	145	718134365	0.38	26	Adjacent to Tysons Corner Mall	-	(**WMATA:** 28A, 2C, 2T, 3T, 23A, 15K, 28X, 28T, 15M, 15C; **FC:** 401, 402) ***18,481***
4	Both	*Army Navy Dr*	*S Hayes St SB*	*S Hayes St NB*	145	6.1	145	123639665	0.01	21	Intersection	-	(**WMATA:** 16H, 16D, 16A, 16K, 16J, 16B, 10E, 10A, 16G, 16F; **ART:** 84, 87, 42) ***15,165***
5	Both	Columbia Pike	George Mason Blvd	S Walter Reed Dr	114	8.8	120	18357562	0.81	20	-	-	(**WMATA:** 16A, 16B, 16D, 16E, 16F, 16G, 16H, 16J, 16K, 16P, 16Y; **ART:** 45, 62) ***12,396***
6	Both	*Thorne Rd*	*Leesburg Pike*	*Seven Corners Ctr*	120	5	120	18898737	0.03	12	Seven Corners	-	(**WMATA:** 28A, 1B, 28X, 4H, 1A, 1E, 4A) ***10,742***
7	EB	EB N Fairfax Dr	N Stuart St	N Randolph St	118	8.2	118	128081216	0.07	20	Ballston	-	(**WMATA:** 22A, 1Z, 10B, 25A, 23A, 23C; **ART:** 42, 52, 75) ***13,852***

Rank	Direction	Location	Start	End	Avg. Score	Avg. Speed (mph)	Max Score	Max Link	Length	Average Buses per Hour (Core Agencies)	Comments	Additional Trips from Non-Core Agencies	Bus Routes and *Avg. Daily Ridership*
8	Both	N Lynn St	South of 19th St	Key Bridge	100	8.3	114	18420383	0.17	18	-	-	(**WMATA:** 38B, 3B, 15K, 5A, 3E, 4A, 4H; **ART:** 61) ***9,952***
9	NB	NB Jefferson Davis Hwy	Crystal Dr	33rd St	107	6.1	107	711068331	0.08	12	-	-	(**WMATA:** 9E, 9A) 1,668
10	Both	N Barton St	9th St N	Clarendon Blvd	95	3.2	95	18421319	0.46	9	-	-	(**WMATA:** 4E, 4B; **ART:** 45) ***2,549***
11	WB	WB N Beauregard St	Filmore Ave	East of Seminary Rd	94	10.2	94	724923615	0.20	20	-	-	(**WMATA:** 25D, 25B, 7E, 7F, 7Y, 7B, 7A) ***7,507***
12	Both	19th St N	Rosslyn Metro	Key Bridge	90	8.8	90	18420385	0.10	15	Rosslyn Metro	-	(**WMATA:** 38B, 4E, 4B; **ART:** 45,61) ***6,476***
13	Both	7th Rd S	East of S Florida St	West of S Florida St	89	6.9	89	18476879	0.11	11	-	-	(**WMATA:** 16K, 16G; **ART:** 41, 75) ***10,735***
14	Both	Crystal Dr	23rd St S	18th St S	89	9.1	89	18358099	0.30	15	Crystal City Mall/Metro	7	(**WMATA:** 9S, 23C, 23A **PRTC:** D2, L2; **LC:** S8E) ***5,271***
15	WB	*WB Wilson Blvd*	*N Moore St*	*N Fort Meyer Dr*	86	7	86	18420602	0.03	13	Rosslyn Metro	2	(**WMATA:** 4B, 28B, 4H, 4A; **ART:** 61; **PRTC:** RI) ***2,357***

APPENDIX

Figure A - 1: Regionwide Bus Speeds – All Day

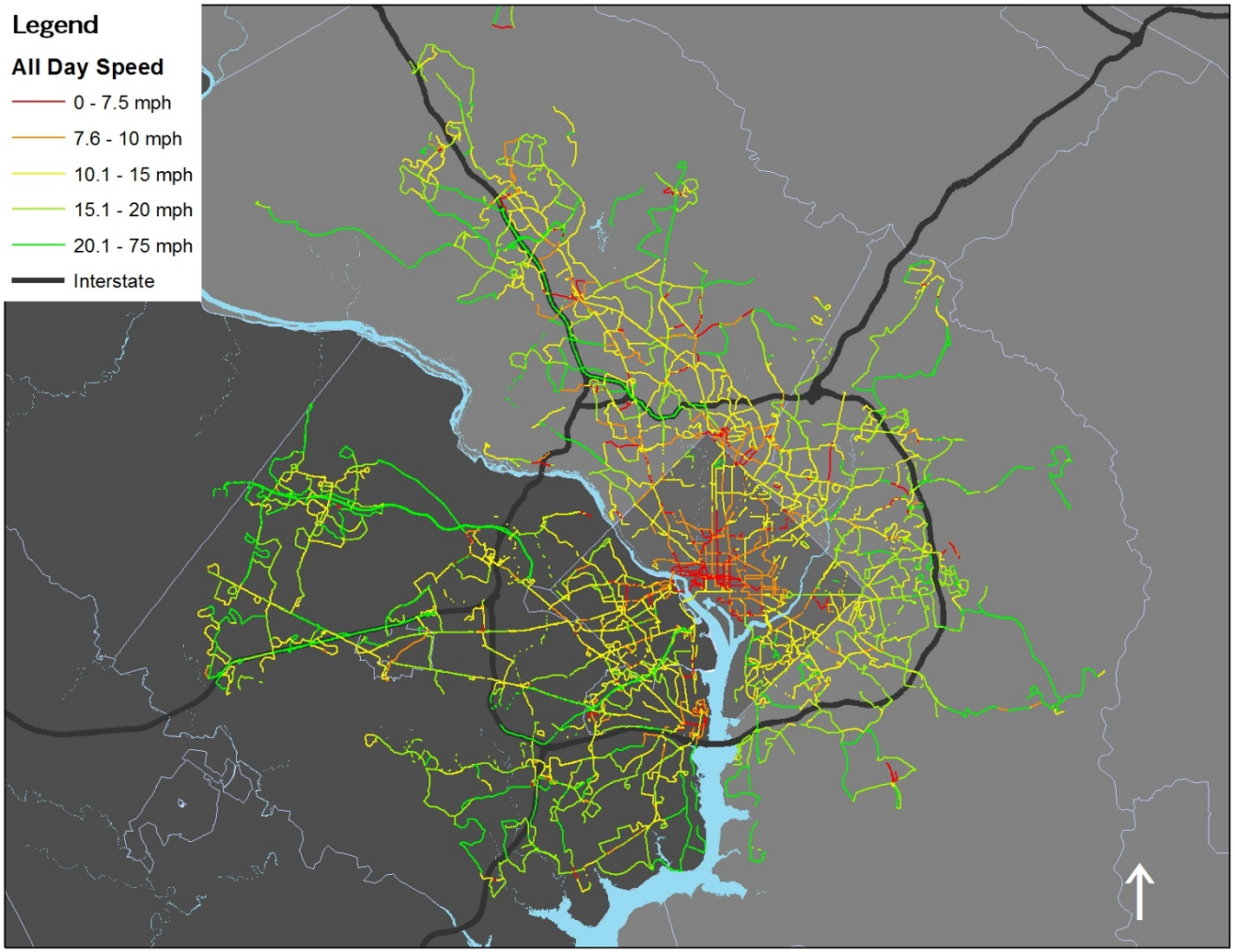
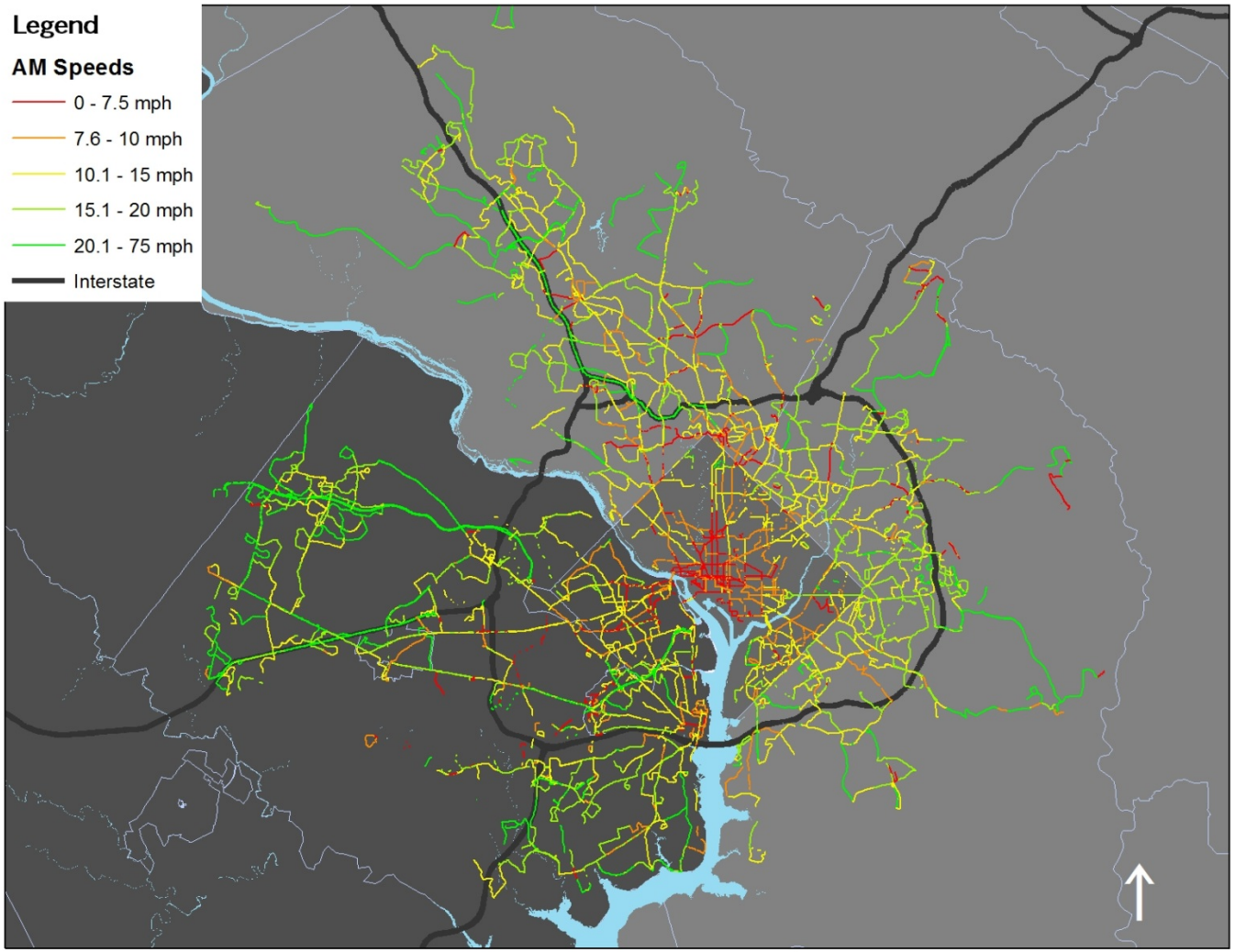
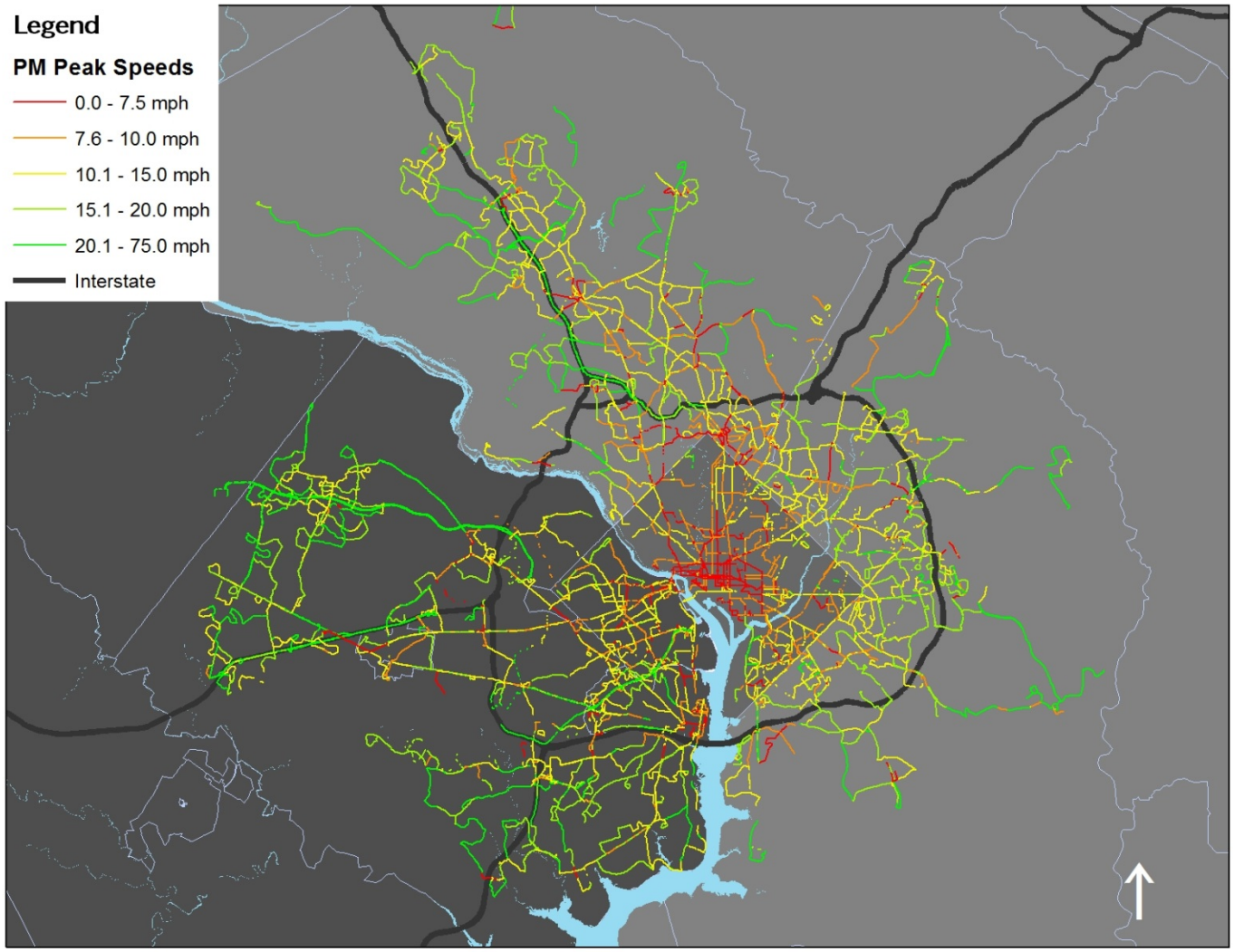


Figure A - 2: Regionwide Bus Speeds – AM Peak



PARSONS BRINCKERHOFF

Figure A - 3: Regionwide Bus Speeds – PM Peak



Start and End Points of Hot Spot Max Links

Table A- 1: DC Hot Spot Max Links – All Day

Rank	Link ID	Start	End	Comments
1	18893075	E Street NW	D Street NW	
2	732173176	17th Street NW	17th Street NW	South side of Farragut Square
3	727357000	I and 13th St	I and 14th St	
4	18353306	I Street NW	New York Ave	
5	732173170	Connecticut Ave	17th Street NW	North side of Farragut Square
6	724215212	M Street	Wisconsin Ave	
7	732170798	16th Street NW	Madison Place	
8	18382526	Monroe St NE	Brookland Station Bus Waiting Area	
9	18464894	Q Street NW	Jones Street	
10	720283245	Jefferson Drive SW	Independence Drive SW	
11	18352839	Jefferson Place NW	M Street	SB Lane of Connecticut
12	18352351	New Hampshire Ave	P Street	
13	18351368	W Street	V Street	
14	733263916	I-295 Ramp	I-295 Ramp	Bridge Across Southeastern Freeway
15	723564731	Greene Street NW		Intersection to half a block north

Table A- 2: DC Hot Spot Max Links – AM Peak

Rank	Link ID	Start	End	Comments
1	732173158	Connecticut Ave	17th Street NW	North side of Farragut Square
2	18893075	E Street NW	D Street NW	
3	732173176	17th Street NW	17th Street NW	Southside of Farragut Square
4	18353199	K Street	K Street	Distance between center lanes of K and side lanes of K
5	18353306	I Street	New York Ave	
6	811825799	14th Street		Intersection to midpoint of McPherson Sq
7	719473638	7th Street NW		Intersection to half a block east
8	733263916	I-295 Ramp	I-295 Ramp	Bridge Across Southeast Freeway
9	18418099	Upshur St	Taylor St	
10	18351463	V Street NW	U Street NW	
11	786393780	Hillyer Street		SB lane from intersection to where inner and outer lanes of Connecticut merge
12	18419086	LeMont Street NW	Sacred Heart Way	

Rank	Link ID	Start	End	Comments
13	724215212	M Street	Wisconsin Ave	
14	782601884	Frontage Rd	I-395 Ramp	Bridge across I-395
15	117281454	N Capital Street NW		East of intersection

Table A- 3: DC Hot Spot Max Links – PM Peak

Rank	Link ID	Start	End	Comments
1	18353378	Vermont Ave	15th Street	
2	792703738	M Street	18th Street	NB Lanes
3	719150990	7th Street	8th Street	Intersection of 7th to midblock
4	727356990	-	-	Midblock of McPherson Square
5	18353199	K Street	K Street	Distance Between center lanes of K and side lanes of K
6	727357000	13th Street		Intersection to midblock of McPherson Square
7	719305670	Constitution Ave		Midblock to Pennsylvania Avenue
8	18351463	V Street NW	U Street NW	
9	723564731	Greene Street NW		Intersection to half a block north
10	732173172	I Street	K Street	
11	18353414	H Street	New York Ave NW	
12	18352320	P Street	Massachusetts Ave	
13	24710673	-	-	Westside of Brookland Station bus loop
14	18353240	23rd Street NW	Pennsylvania Ave	
15	18353663	F Street	Pennsylvania Ave	

Table A- 4: MD Hot Spot Max Links – All Day

Rank	Link ID	Start	End	Comments
1	724586253	Wisconsin Ave	Western Avenue	Wisconsin Circle
2	18409940	Colesville Road		South of Intersection
3	18899893	Paint Branch Road		NB lanes south of intersection
4	18459404	Grand View Road	Georgia Ave	
5	117297384	Ellsworth Drive	Wayne Ave	
6	18410080	W Falkland Lane	E Falkland Lane	
7	18376686	Garland Ave	Barron St	
8	18377193	Tahona Ave	New Hampshire Ave	
9	19451700	Monroe Pl	Jefferson St	

Rank	Link ID	Start	End	Comments
10	18459732	Gabel St	-	EB lanes, north of intersection
11	18412691	Grant Ave	Ethan Allen Ave	
12	18378274	Fordham Lane	Pineway	
13	19462768	Ivy League Ln	Frederick Ave	
14	18409877	Fenton St	Georgia Ave	
15	18380243	Cross St		EB lanes, east of intersection

Table A- 5: MD Hot Spot Max Links – AM Peak

Rank	Link ID	Start	End	Comments
1	18410088	Ramsey Ave	Dixon Ave	
2	18410088	Ramsey Ave	Dixon Ave	same segment as above
3	18433656	Auto Park Ave	Motor City Drive	
4	18409940	Colesville Road	Ellsworth Drive	
5	724586253	Wisconsin Ave	Western Avenue	Wisconsin Circle
6	18409765	Roeder Rd	Ellsworth Drive	
7	18410080	W Falkland Lane	E Falkland Lane	
8	18409877	Fenton St	Georgia Ave	
9	18380243	Cross St		EB lanes, east of intersection
10	18376661	Barron St	University Blvd	
11	18377193	Tahona Ave	New Hampshire Ave	
12	18459404	Grand View Road	Georgia Ave	
13	18904153	Democracy Blvd	Rock Spring Dr	SB Lanes
14	18899893	Paint Branch Road	-	NB lanes south of intersection
15	18569364	Oakview Drive	Capital Beltway Ramp	NB lane

Table A- 6: MD Hot Spot Max Links – PM Peak

Rank	Link ID	Start	End	Comments
1	18410088	Ramsey Ave	Dixon Ave	
2	18410088	Ramsey Ave	Dixon Ave	
3	724586253	Wisconsin Ave	Western Avenue	Wisconsin Circle
4	18409940	Colesville Road	Ellsworth Drive	
5	18410080	W Falkland Lane	E Falkland Lane	
6	746830826	East-West Hwy		North of Intersection
7	18409765	Roeder Rd	Ellsworth Drive	

Rank	Link ID	Start	End	Comments
8	18459404	Grand View Road	Georgia Ave	
9	773382837	-	-	East side of Bus loop
10	18376661	Barron St	University Blvd	
11	18435546	Beacon Rd N	Beacon Rd S	
12	18460847	Brunett Ave	Lorain Ave	
13	18459732	Gabel St	-	EB lanes, north side of intersection
14	18412691	Grant Ave	Ethan Allen Ave	
15	18380243	Cross St		EB lanes, eastside of intersection

Table A- 7: VA Hot Spot Max Links – All Day

Rank	Link ID	Start	End	Comments
1	123638222	Washington Blvd		Bridge over Washington Blvd
2	128081227	Fairfax Drive	Stuart Street	
3	718134365	-	-	Fashion Blvd across from the Tysons Corner Center garage
4	123639007	Glebe Rd	-	Underpass at Glebe Rd.
5	18420602	Fort Meyer Dr	Moore St	
6	18355174	Army Navy Dr	I-395 HOV On-Ramp	
7	762707061	Fort Meyer Dr	-	East of intersection
8	18357562	S. Lincoln St	S. Monroe St	
9	764385668	19th Street	-	South of intersection
10	128062902	Army Navy Dr	WB	
11	128081216	N Stuart St	N Stafford St	EB lanes
12	18453368	Bellforest Dr	Prosperity Dr	SB lanes
13	18356267	Thorne Rd	-	NB lanes south of intersection
14	123639665	S Hayes St	S Hayes St	Segment between NB and SB lanes
15	18477645	S Glebe Rd	Crystal Drive	NB lanes

Table A- 8: VA Hot Spot Max Links – AM Peak

Rank	Link ID	Start	End	Comments
1	711068331	Crystal Drive	33rd St	NB lanes
2	123638204	Arlington Blvd	-	Overpass of Glebe Rd
3	18357562	S Monroe St	S Lincoln St	
4	718134365	-	-	Fashion Blvd across from the Tysons Corner Center garage
5	18361915	Lafayette Dr	Heritage Dr	
6	18420383	Lee Hwy	19th St	

Rank	Link ID	Start	End	Comments
7	128081227	N Fairfax Dr	9th St	
8	723593430	Van Dorn St		East of intersection
9	18422062	N Danville St	N Cleveland St	
10	18421142	15th St	Veitch St	
11	18354867	Army Navy Drive	I-395 on-ramp	
12	18476426	Arlington Blvd		S of Arlington Blvd on NB lanes
13	18420385	Fort Meyer Dr	N Monroe St	
14	18421319	Clarendon Blvd	14th St	
15	18356267	Thorne Rd	-	NB lanes south of intersection

Table A- 9: VA Hot Spot Max Links – PM Peak

Rank	Link ID	Start	End	Comments
1	123638204	Arlington Blvd		SB Lane overpass
2	128081227	Fairfax Dr	9th St	
3	718134365	-	-	Fashion Blvd across from the Tysons Corner Center garage
4	123639665	S Hayes St	S Hayes St	Segment between NB and SB lanes
5	18357562	Monroe St	Lincoln St	
6	18898737	Leesburg Pike	Seven Corners Ctr	
7	128081216	N Stuart St	N Stafford St	EB lanes
8	18420383	Lee Hwy	19th St	
9	711068331	Crystal Dr	33rd St	
10	18421319	Clarendon Blvd	14th St	
11	724923615	Fillmore Ave	Seminary Rd	WB/SB lanes
12	18420385	Fort Meyer Dr	Moore St	
13	18476879	Tyrol Hill Park Crosswalk	Parking lot driveway	
14	18358099	18th St	20th St	
15	18420602	Fort Meyer Dr	Moore St	