

d.

Memorandum

To: Ed Stollof, AICP
Haley Peckett, AICP
District Department of Transportation (DDOT)

From: Maribel N Wong
Daniel Solomon, AICP
Robert B Schiesel, P.E.
Grove Slade Associates, Inc.

Subject: K Street NW Data Collection Results Memo

Date: March 5, 2020

Introduction

This memorandum presents the results of the Data Collection Plan for the K Street NW Traffic Analysis. The various types of data collected as part of this effort are being used in the VISSIM microsimulation traffic analysis for the K Street NW corridor in Downtown Washington, DC.

The VISSIM microsimulation model inputs required for this analysis include roadway geometry, traffic controls, traffic volumes, and calibration data. The data collection results discussed in this memorandum were specifically collected through automated methods for the traffic volume data and field observation methods for calibration data.

Roadway geometry data was collected from geographical information system (GIS) files and field surveys. Traffic control data that include signal timing and phasing settings were provided by DDOT and verified in the field.

Study Area

The study area for the VISSIM microsimulation model, shown in **Figure 1**, includes a total of 25 study intersections. The 16 study intersections along the K Street NW corridor are the following:

1. 22nd Street and K Street NW
2. 21st Street and K Street NW
3. 20th Street and K Street NW
4. 19th Street and K Street NW
5. 18th Street and K Street NW
6. 17th Street (west)/Connecticut Avenue and K Street NW
7. 17th Street (east) and K Street NW
8. 16th Street and K Street NW
9. 15th Street (west) and K Street NW
10. 15th Street (east)/Vermont Avenue and K Street NW
11. 14th Street and K Street NW
12. 13th Street and K Street NW
13. 11th Street and K Street NW
14. 12th Street and K Street NW
15. 10th Street and K Street NW
16. 9th Street and K Street NW

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

In addition to the study intersections along K Street NW, nine (9) cross-street intersections adjacent to K Street NW that process significant volume interacting with the study corridor were also identified to be included in the analysis. Of note, the volumes at these intersections were provided by DDOT and were not part of volume data collection. The K Street NW adjacent cross-street study intersections are:

- | | |
|---|---|
| 17. 21 st Street and L Street NW | 21. 16 th Street and L Street NW |
| 18. 21 st Street, Pennsylvania Avenue
and I Street NW | 22. 16 th Street and I Street NW |
| 19. Connecticut Avenue and L Street
NW | 23. 15 th Street and L Street NW |
| 20. 17 th Street and I Street NW | 24. 14 th Street and L Street NW |
| | 25. 14 th Street and I Street NW |

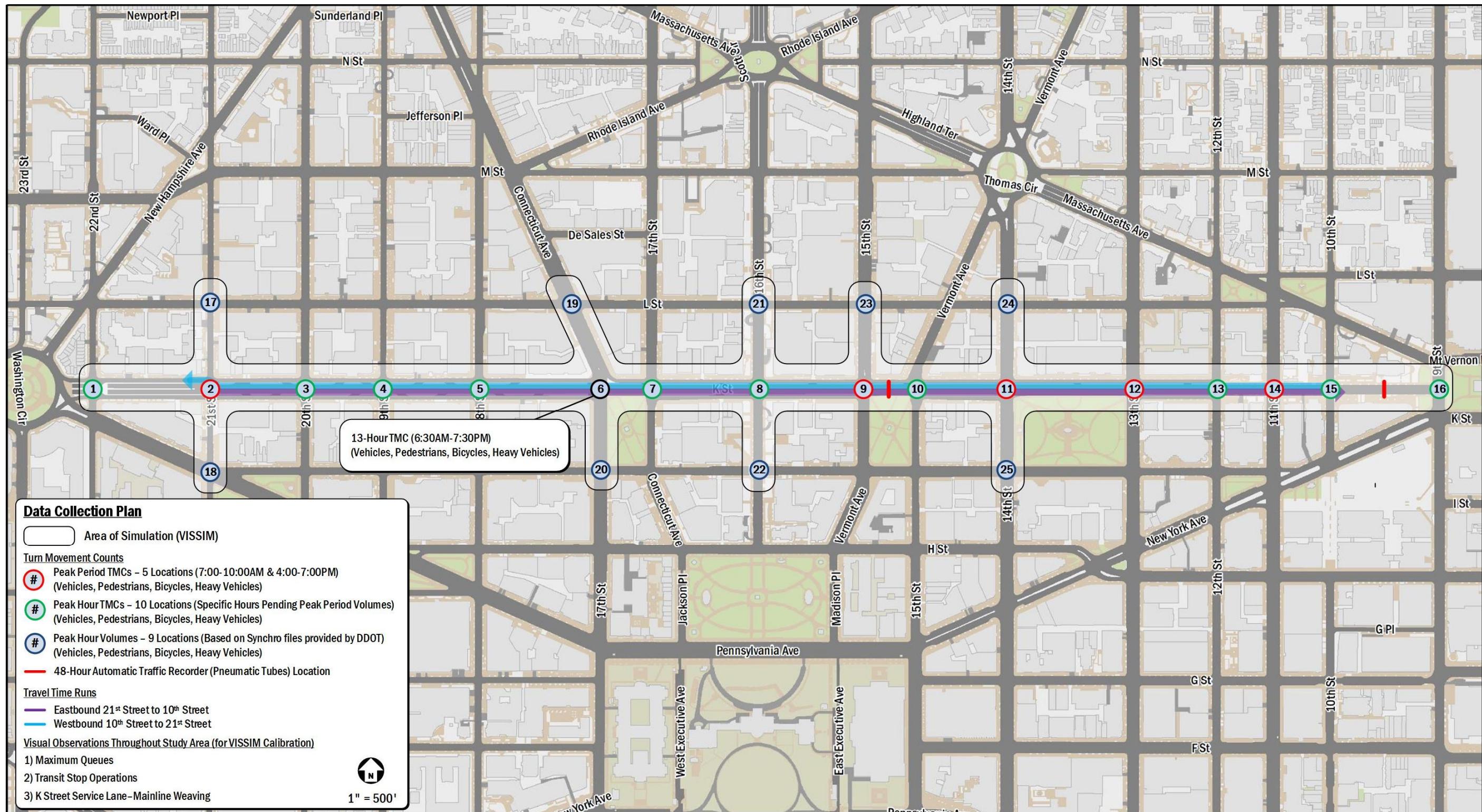


Figure 1: Data Collection Plan Study Area

Data Collection Results

Automated data collection and field observations were conducted to capture multimodal traffic volumes along with corridor travel time runs, queuing, transit, midblock activity, curbside designations, and signal timing observations that will all be used as inputs to the VISSIM microsimulation model. An overview of the methodology along with the general findings and summaries for each data collection category are included in the following sections.

Automated Data Collection

Automated data collection took place along the K Street NW corridor in the form of 24-hour video recordings at every intersection on K Street NW for Turning Movement Counts (TMCs) and peak period time travel runs that were tracked via Kimley Horn's "*Traction*" application and using dashboard mounted cameras. Automated data collection took place on Wednesday December 4, 2019.

Automatic Traffic Recorder (ATR) pneumatic tube counts were also collected for 48-hours at the locations shown in **Figure 1** starting at 12:00 AM on December 3, 2019 to 12:00 AM on December 5, 2019. Issues with data collection in the 1400 block of K Street NW invalidated the data collected in the mainline travel lanes of K Street NW. Data was recollected starting at 12:00 AM on January 15, 2020 to 12:00 AM on January 17, 2020. The recollected data did not include the westbound service lane volumes; therefore, only mainline volumes are discussed at this location.

TMCs

The video recordings were used to capture multimodal traffic volumes that include directionality and turning movement counts of vehicles and bicycles on both the mainline and service lanes. Pedestrian counts were also captured through the video recordings and are discussed in a later section of this memorandum.

With approval from DDOT, one intersection, 17th Street (west)/Connecticut Avenue and K Street NW, was processed for 13-hour TMC data (6:30AM-7:30PM) and five (5) intersections were processed for 6-hours of peak period TMC data (7:00-10:00AM and 4:00-7:00PM). Based on TMCs at these intersections, system peak hours were determined so as to process the remaining K Street NW intersections for one hour during the AM and PM peak periods (8:30-9:30AM and 4:45-5:45PM). The processed intersection categories for TMC data are outlined below:

13-hours (6:30AM-7:30PM) TMC data:

- 17th Street (west)/Connecticut Avenue and K Street NW

6-hours (7:00-10:00AM and 4:00-7:00PM) TMC data:

- | | |
|--|---|
| ▪ 21 st Street and K Street NW | ▪ 13 th Street and K Street NW |
| ▪ 15 th Street (west) and K Street NW | ▪ 11 th Street and K Street NW |
| ▪ 14 th Street and K Street NW | |

2-hours (8:30-9:30AM and 4:45-5:45PM) TMC data:

- | | |
|---|---|
| ▪ 22 nd Street and K Street NW | ▪ 19 th Street and K Street NW |
| ▪ 20 th Street and K Street NW | ▪ 18 th Street and K Street NW |

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

- 17th Street (east) and K Street NW
- 16th Street and K Street NW
- 15th Street (east)/Vermont Avenue and K Street NW
- 12th Street and K Street NW
- 10th Street and K Street NW
- 9th Street, New York Avenue and K Street NW

SYSTEM VEHICLE VOLUMES FINDINGS

Based on the processed 13-hour and peak period intersections, volumes were reviewed to identify the vehicular system peak hours and to compare these to the non-auto peak hours.

Vehicle volumes were reviewed in two categories:

- System volumes: sum of every turning movement at the processed intersections
- K Street NW-only volumes: sum of K Street NW mainline and service lanes thru volumes and cross-street volumes turning onto K Street NW

After reviewing the processed data, the system volumes were found to be consistent with the K Street NW-only volumes. A summary of the hourly system and K Street NW-only vehicular volumes, along with the non-auto system volumes associated with these six (6) intersections is presented in **Table 1**. **Figure 2** compares the morning hourly system vehicle volumes, K Street NW only vehicle volumes, and non-vehicular volumes based on the TMCs processed at these six (6) intersections and **Figure 3** presents the same comparison for the afternoon volumes.

Figure 4 charts the hourly vehicular volumes by intersection across the morning peak period (7:00AM-10:00AM) and **Figure 5** charts the hourly afternoon volumes by intersection across the afternoon peak period (4:00PM-7:00PM).

Based on this review of peak hour volumes across the corridor the system peak hours were determined to be 8:30AM-9:30AM and 4:45PM-5:45PM. These findings were reviewed and approved by DDOT on December 17, 2019. **Attachment A** shows the unbalanced vehicle volumes for both the morning and afternoon peak hours.

17TH STREET (WEST)/CONNECTICUT AVENUE AND K STREET NW

The 13-hours of count data collected at the 17th Street (west)/Connecticut Avenue and K Street NW intersection were processed for hourly volumes, multimodal peak hours, peak hour factors, and percentage of heavy vehicles. These are presented in **Table 2** and **Figure 6**. As shown in **Table 2**, the morning peak hour at this intersection of 7:45AM to 8:45AM overlaps with the system morning peak hour of 8:30AM to 9:30AM by 15 minutes. Similarly, the afternoon peak hour at this intersection occurs during the system peak hour of 4:45PM to 5:45PM.

The highest percentage of heavy vehicles was recorded in the morning between 6:30AM and 8:00AM with range of six (6) to seven (7) percent of heavy vehicles making up the total volume traveling through this intersection. The morning peak hour pedestrian volume occurs between 8:15AM to 9:15AM with 5,728 pedestrians and the afternoon peak hour volume occurs between 5:00PM and 6:00PM with 5,422 pedestrians. The bicycle volumes do not exceed 34 bicycles for any hourly interval during the collection period. The morning bicycle peak hour occurs during the late morning between 11:45AM to 12:45PM, and the afternoon bicycle peak hour occurs between 6:00PM and 7:00PM.

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

Table 1: Summary of Hourly System Volumes Based on Initial Six (6) Intersections Processed

Hour Interval		System Vehicle Volumes based on TMCs Vehicle Intersection Totals	K Street NW Volumes*	Non-Auto Total	Peds Total	Bikes Total	
7:00 AM	-	8:00 AM	11,877	7,052	6,563	6,450	113
7:15 AM	-	8:15 AM	12,901	7,559	8,438	8,266	172
7:30 AM	-	8:30 AM	13,605	7,823	10,437	10,185	252
7:45 AM	-	8:45 AM	14,166	8,050	12,578	12,229	349
8:00 AM	-	9:00 AM	14,424	8,130	14,470	14,055	415
8:15 AM	-	9:15 AM	14,615	8,224	15,624	15,183	441
8:30 AM	-	9:30 AM	14,837	8,356	15,819	15,392	427
8:45 AM	-	9:45 AM	14,576	8,143	15,139	14,790	349
9:00 AM	-	10:00 AM	14,067	7,636	13,443	13,153	290
4:00 PM	-	5:00 PM	15,251	9,351	9,697	9,594	103
4:15 PM	-	5:15 PM	15,497	9,233	10,683	10,559	124
4:30 PM	-	5:30 PM	15,579	9,225	11,716	11,558	158
4:45 PM	-	5:45 PM	15,994	9,457	12,775	12,589	186
5:00 PM	-	6:00 PM	15,970	9,406	13,448	13,209	239
5:15 PM	-	6:15 PM	15,787	9,496	13,060	12,805	255
5:30 PM	-	6:30 PM	15,567	9,463	12,477	12,234	243
5:45 PM	-	6:45 PM	15,185	9,224	11,478	11,230	248
6:00 PM	-	7:00 PM	15,010	9,213	10,363	10,141	222

*Combines intersection EB/WB thru volumes and volumes onto K Street NW from cross streets (SBRs, SBLs, NBRs, NBLs) of mainline and service lanes volumes

Highlighting Key:

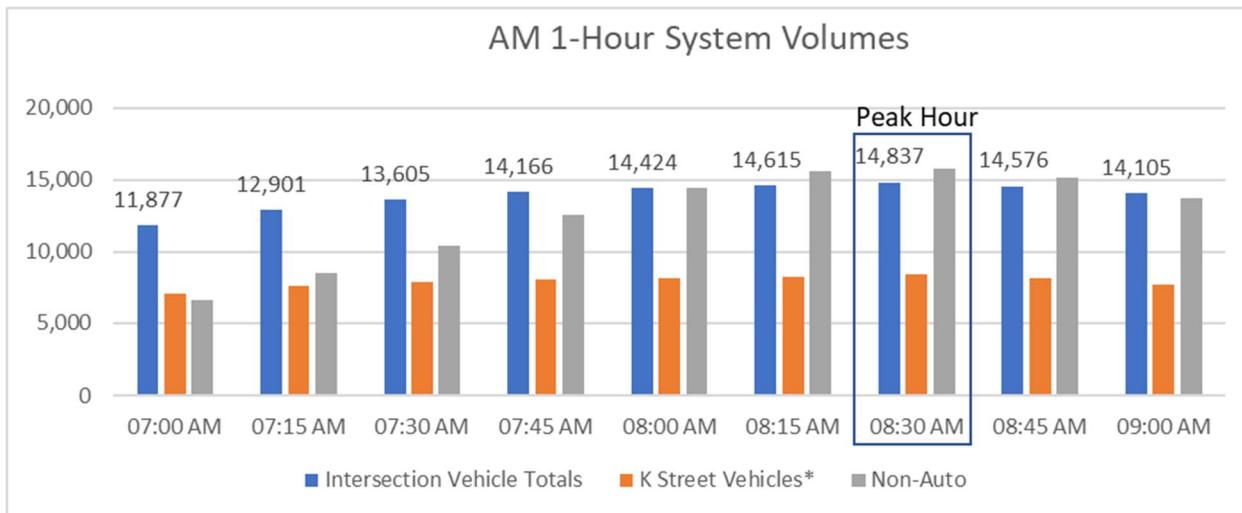
System Vehicle Maximum Volumes

System Vehicle Maximum Volumes on K Street only

System Non-Auto Maximum Volumes

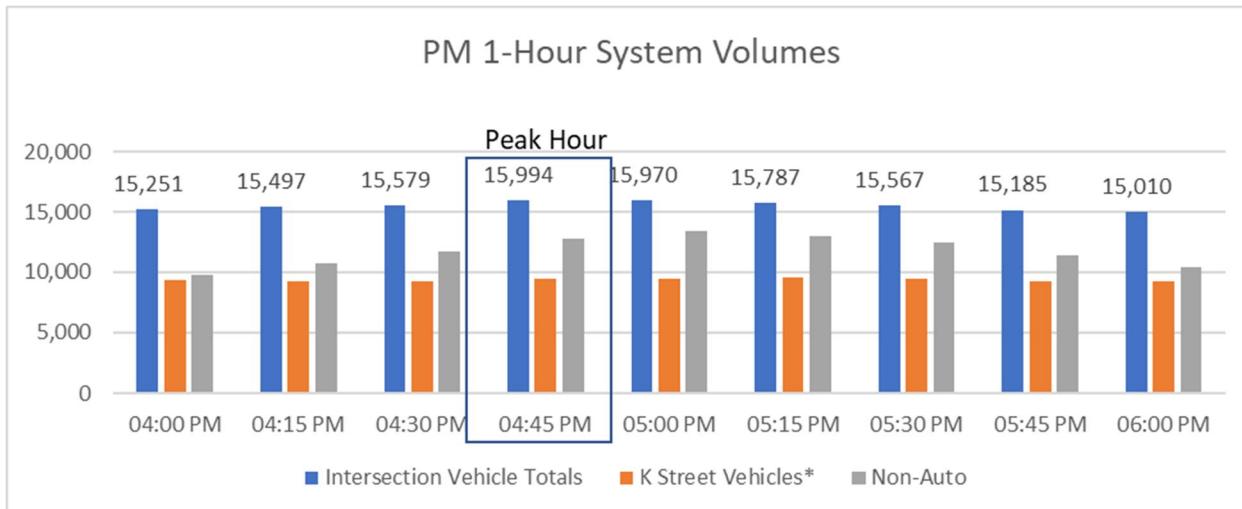
System Maximum Pedestrian Volume

System Maximum Bicycle Volume



*Combines intersection EB/WB thru volumes and volumes onto K Street NW from cross streets (SBRs, SBLs, NBRs, NBLs) of mainline and service lanes volumes

Figure 2: AM Hourly System Volumes Comparison Based on Initial Six (6) Intersections Processed



*Combines intersection EB/WB thru volumes and volumes onto K Street NW from cross streets (SBRs, SBLs, NBRs, NBLs) of mainline and service lanes volumes

Figure 3: PM Hourly System Volumes Comparison Based on Initial Six (6) Intersections Processed

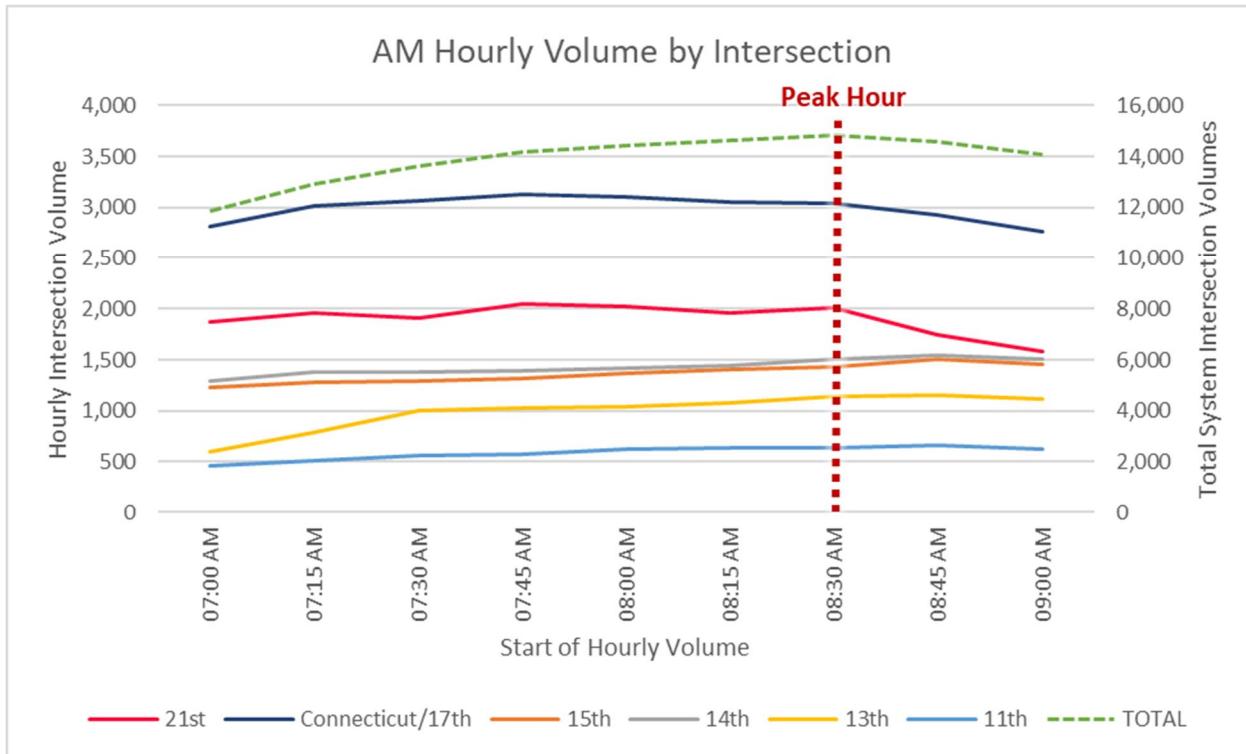


Figure 4: AM Hourly Vehicle Volume Comparison Based on Initial Six (6) Intersections Processed

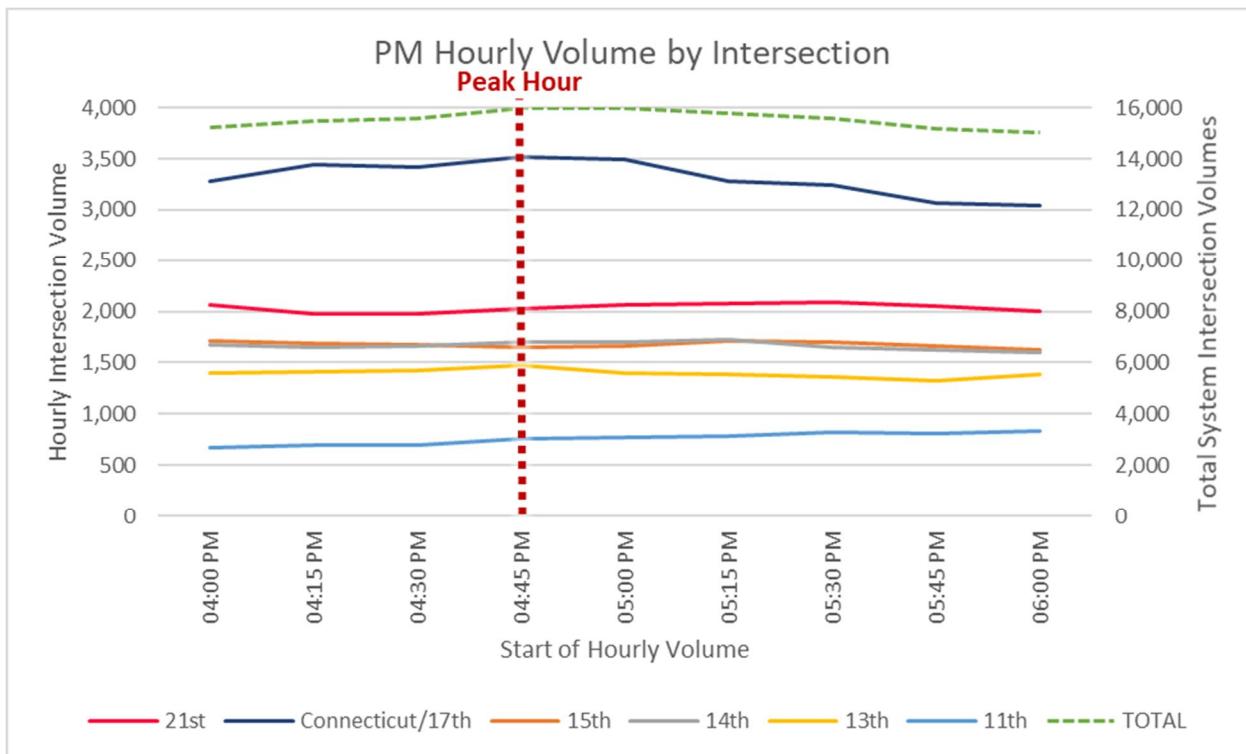


Figure 5: PM Hourly Vehicle Volume Comparison Based on Initial Six (6) Intersections Processed

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

Table 2: 17th Street (west)/Connecticut Avenue and K Street NW - Intersection Multimodal Hourly Volumes

Hour Interval	Vehicle Volumes based on TMCs	K Street Volumes*	PHF	Percentage of Heavy Vehicles	Non-Auto Total	Peds Total	Bikes Total
06:30 AM - 07:30 AM	2,325	1,374	0.83	7%	1,737	1,735	2
06:45 AM - 07:45 AM	2,581	1,468	0.91	6%	2,136	2,134	2
07:00 AM - 08:00 AM	2,809	1,589	0.88	7%	2,865	2,862	3
07:15 AM - 08:15 AM	3,010	1,646	0.93	6%	3,573	3,571	2
07:30 AM - 08:30 AM	3,064	1,670	0.95	6%	4,269	4,266	3
07:45 AM - 08:45 AM	3,124	1,690	0.97	6%	4,878	4,874	4
08:00 AM - 09:00 AM	3,106	1,671	0.96	5%	5,402	5,400	2
08:15 AM - 09:15 AM	3,059	1,688	0.98	5%	5,732	5,728	4
08:30 AM - 09:30 AM	3,041	1,624	0.98	6%	5,717	5,709	8
08:45 AM - 09:45 AM	2,927	1,530	0.94	6%	5,706	5,695	11
09:00 AM - 10:00 AM	2,763	1,360	0.91	6%	5,228	5,215	13
09:15 AM - 10:15 AM	2,629	1,211	0.89	6%	4,747	4,733	14
09:30 AM - 10:30 AM	2,482	1,107	0.95	5%	4,120	4,107	13
09:45 AM - 10:45 AM	2,446	1,095	0.98	5%	3,327	3,307	20
10:00 AM - 11:00 AM	2,343	1,073	0.93	5%	2,845	2,825	20
10:15 AM - 11:15 AM	2,252	1,014	0.91	5%	2,262	2,238	24
10:30 AM - 11:30 AM	2,283	1,026	0.92	5%	2,071	2,045	26
10:45 AM - 11:45 AM	2,271	1,013	0.92	5%	2,021	2,004	17
11:00 AM - 12:00 PM	2,374	1,063	0.96	6%	2,079	2,057	22
11:15 AM - 12:15 PM	2,436	1,129	0.98	6%	2,482	2,460	22
11:30 AM - 12:30 PM	2,420	1,162	0.99	6%	2,868	2,841	27
11:45 AM - 12:45 PM	2,450	1,186	0.97	6%	3,113	3,082	31
12:00 PM - 01:00 PM	2,411	1,163	0.95	5%	3,160	3,128	32
12:15 PM - 01:15 PM	2,385	1,150	0.94	5%	3,150	3,121	29
12:30 PM - 01:30 PM	2,404	1,144	0.95	4%	2,960	2,927	33
12:45 PM - 01:45 PM	2,360	1,102	0.95	5%	2,896	2,866	30
01:00 PM - 02:00 PM	2,376	1,130	0.95	5%	2,858	2,828	30
01:15 PM - 02:15 PM	2,394	1,145	0.96	5%	2,665	2,634	31
01:30 PM - 02:30 PM	2,397	1,166	0.96	6%	2,541	2,521	20
01:45 PM - 02:45 PM	2,492	1,289	0.91	5%	2,502	2,484	18
02:00 PM - 03:00 PM	2,571	1,406	0.94	5%	2,555	2,544	11
02:15 PM - 03:15 PM	2,573	1,459	0.94	5%	2,697	2,685	12
02:30 PM - 03:30 PM	2,715	1,602	0.88	5%	2,888	2,878	10
02:45 PM - 03:45 PM	2,728	1,596	0.89	5%	3,068	3,055	13
03:00 PM - 04:00 PM	2,806	1,621	0.91	5%	3,247	3,234	13
03:15 PM - 04:15 PM	3,015	1,761	0.94	4%	3,611	3,600	11
03:30 PM - 04:30 PM	3,068	1,723	0.93	4%	3,745	3,730	15
03:45 PM - 04:45 PM	3,190	1,808	0.97	4%	3,922	3,908	14
04:00 PM - 05:00 PM	3,274	1,838	0.98	5%	4,023	4,007	16
04:15 PM - 05:15 PM	3,446	1,800	0.89	5%	4,289	4,273	16
04:30 PM - 05:30 PM	3,424	1,800	0.88	5%	4,842	4,828	14
04:45 PM - 05:45 PM	3,517	1,856	0.90	5%	5,158	5,141	17
05:00 PM - 06:00 PM	3,493	1,819	0.90	5%	5,442	5,422	20
05:15 PM - 06:15 PM	3,278	1,803	0.90	5%	5,109	5,085	24
05:30 PM - 06:30 PM	3,238	1,830	0.89	4%	4,652	4,621	31
05:45 PM - 06:45 PM	3,067	1,749	0.95	4%	4,363	4,331	32
06:00 PM - 07:00 PM	3,043	1,761	0.97	4%	4,001	3,967	34
06:15 PM - 07:15 PM	2,892	1,633	0.92	4%	3,570	3,544	26
06:30 PM - 07:30 PM	2,747	1,485	0.88	3%	3,020	3,005	15

*Combines intersection EB/WB thru volumes and volumes onto K street from cross streets (SBRs, SBLs, NBRs, NBLs) of mainline and service lanes volumes

Highlighting Key:

Intersection Vehicle Maximum Volumes
Intersection Vehicle Maximum Volumes on K Street only
Intersection Heavy Vehicle Maximum Percentage
Intersection Non-Auto Maximum Volumes
Intersection Maximum Pedestrian Volume
Intersection Maximum Bicycle Volume

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

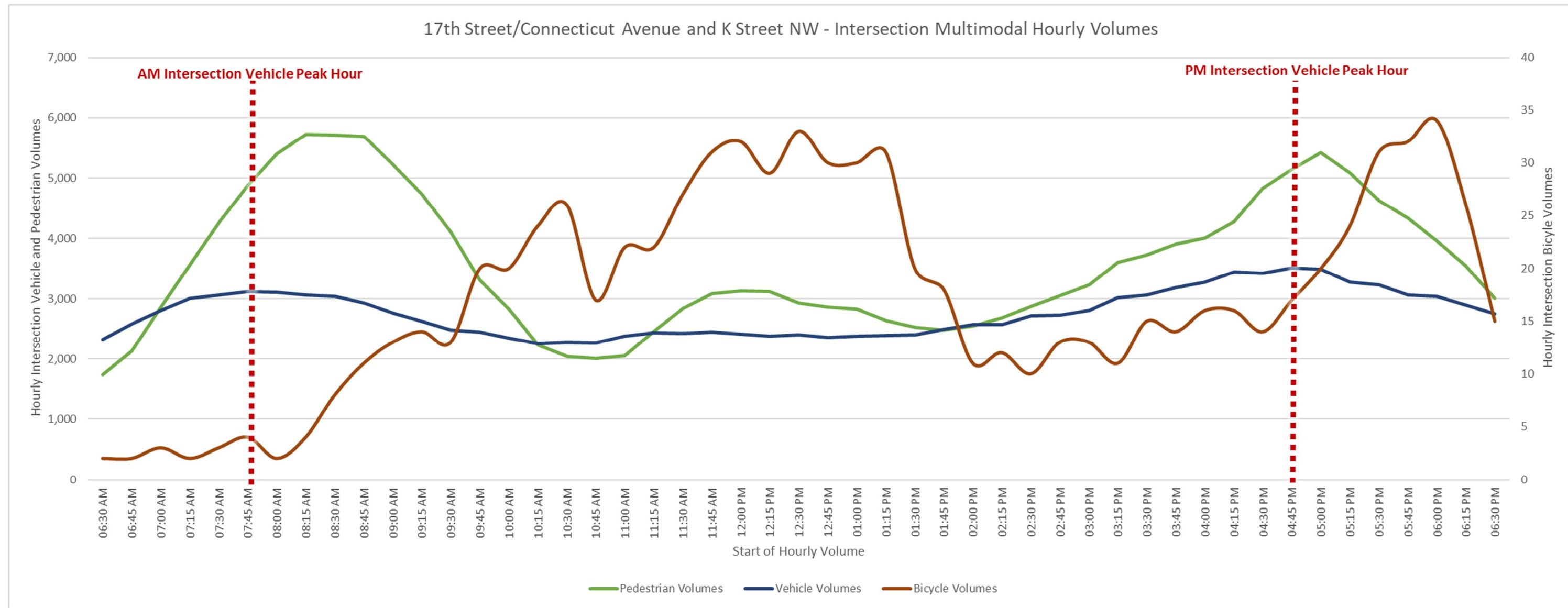


Figure 6: 17th Street (west)/Connecticut Avenue and K Street NW - Intersection Multimodal Hourly Volumes

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

VOLUME BALANCING

Despite processing traffic volume data for the same peak hours, midblock activity, including on-street parking, alleys, and garage driveways in between study intersections, and minor variation in the equipment used for traffic counts, such as variations in video time stamps, can cause fluctuations in volumes between intersections. Comprehensive volume balancing was necessary in order to build a microsimulation model for use in evaluating the operational performance of existing conditions and establish baseline conditions that will be part of forecasting future demand. Volume balancing across all study intersections was conducted to eliminate volume imbalances while considering all segment entry and exit points or midblock “sinks” and “generators”.

Sinks and generators along the K Street NW corridor include 1) on-street parking, 2) garage driveways, and 3) alley access points.

DDOT reviewed the volume balancing methodology and balanced volumes. Feedback received from DDOT was incorporated in the Revised Volume Balancing Technical Memorandum submitted to DDOT on February 5, 2020. The approved volume balancing methodology and balanced volumes are included in **Attachment B**.

PEDESTRIAN AND BICYCLE COUNTS

Video recordings at the study intersections along K Street NW captured pedestrian and directional turning bicycle volumes and these were processed for each study intersection along K Street NW following the same hour processing categories as the vehicle volumes.

The morning and afternoon peak hour pedestrian volumes are presented in **Figure 7**. As shown in **Figure 7**, the highest pedestrian volumes were observed at the 17th Street (west)/Connecticut Avenue and K Street NW intersection, which can be attributed to the intersection's proximity to the Farragut North Metrorail Station.

Figure 8 and **Figure 9** present the morning and afternoon peak hour bicycle volumes. These volumes align with the location of bicycle facilities such as the 15th Street (west) NW cycle track. The highest bicycle volumes were observed at the intersection of 15th Street (west) and K Street NW.

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

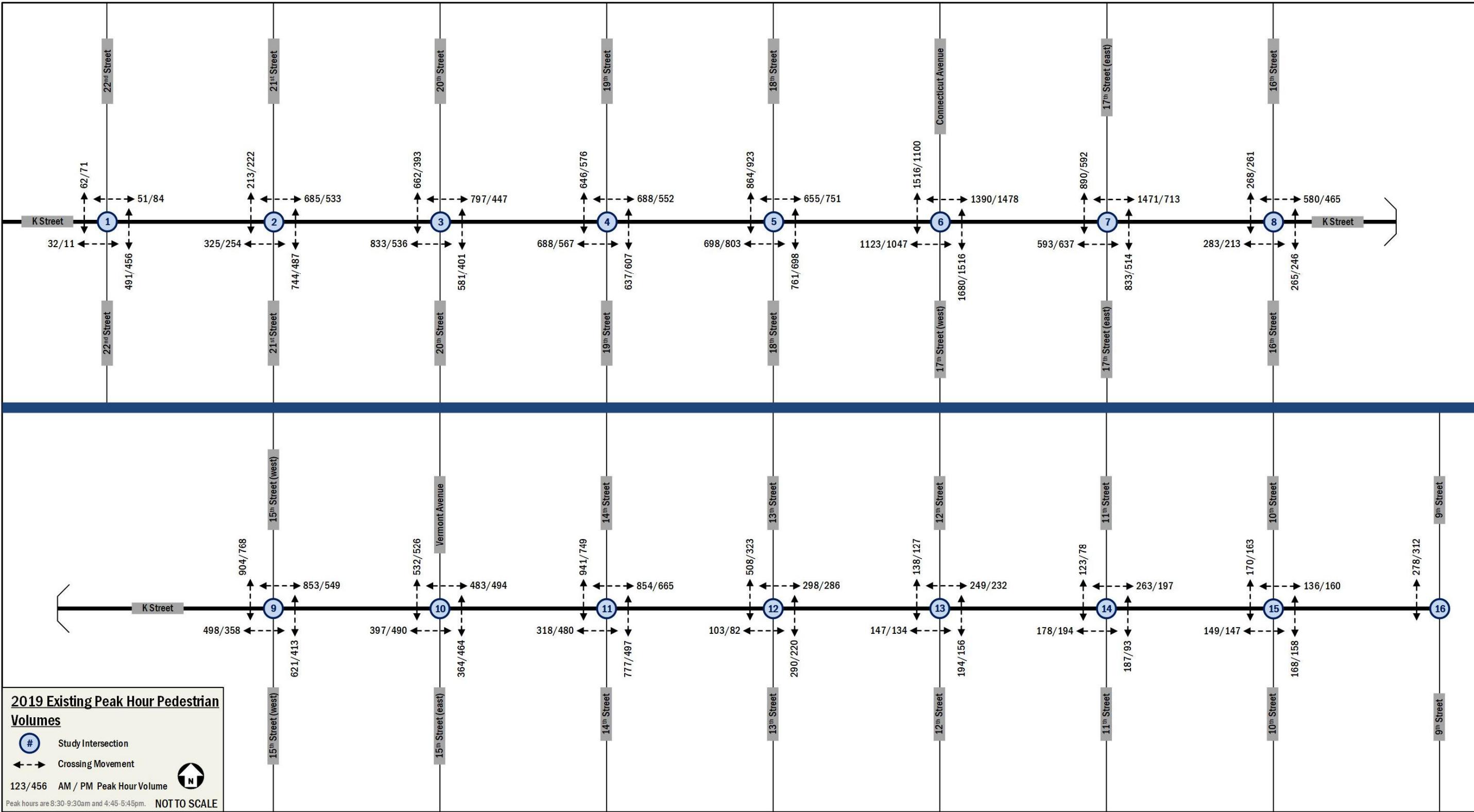


Figure 7: 2019 Existing Peak Hour Pedestrian Volumes

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

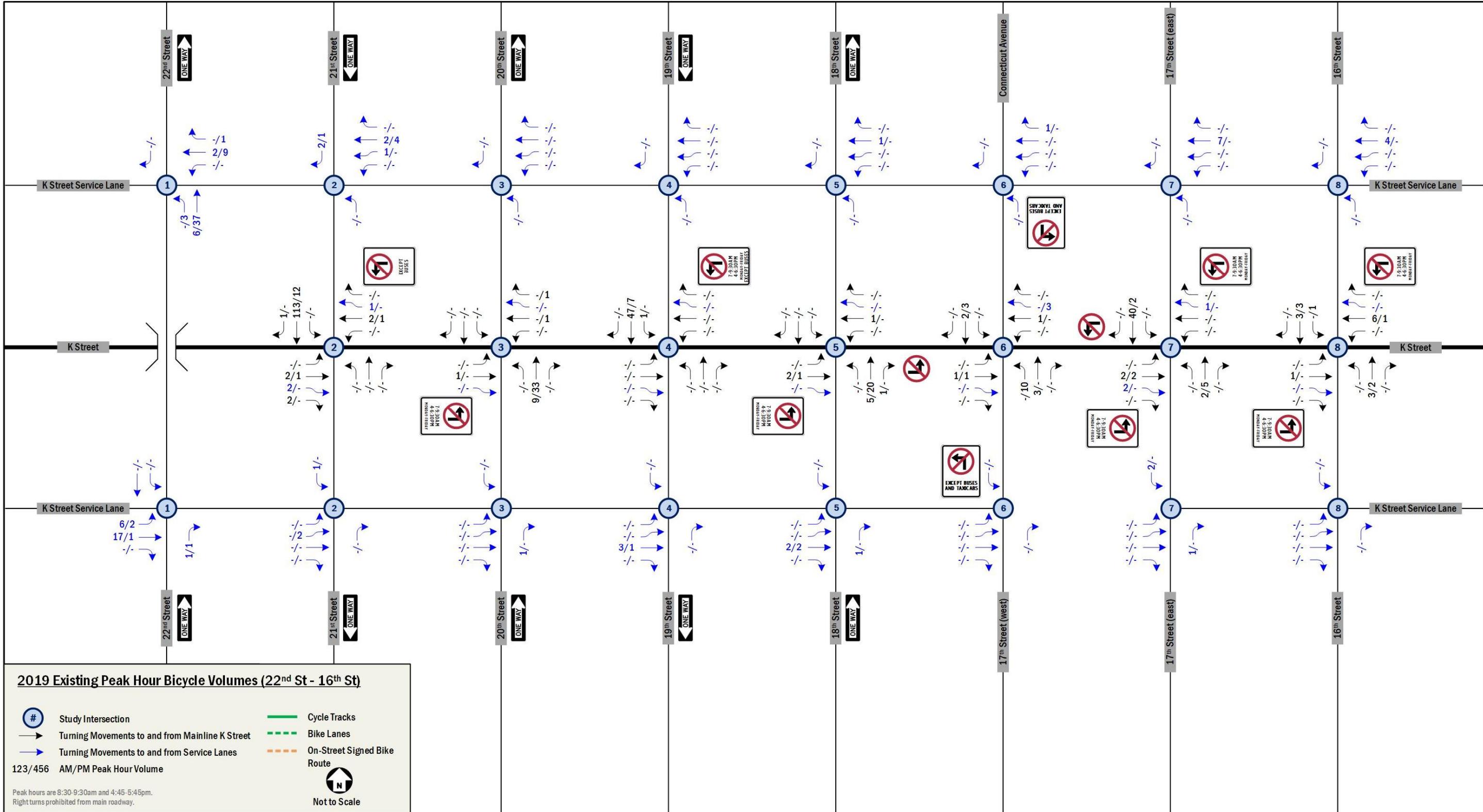


Figure 8: 2019 Existing Peak Hour Bicycle Volumes (22nd St - 16th St)

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

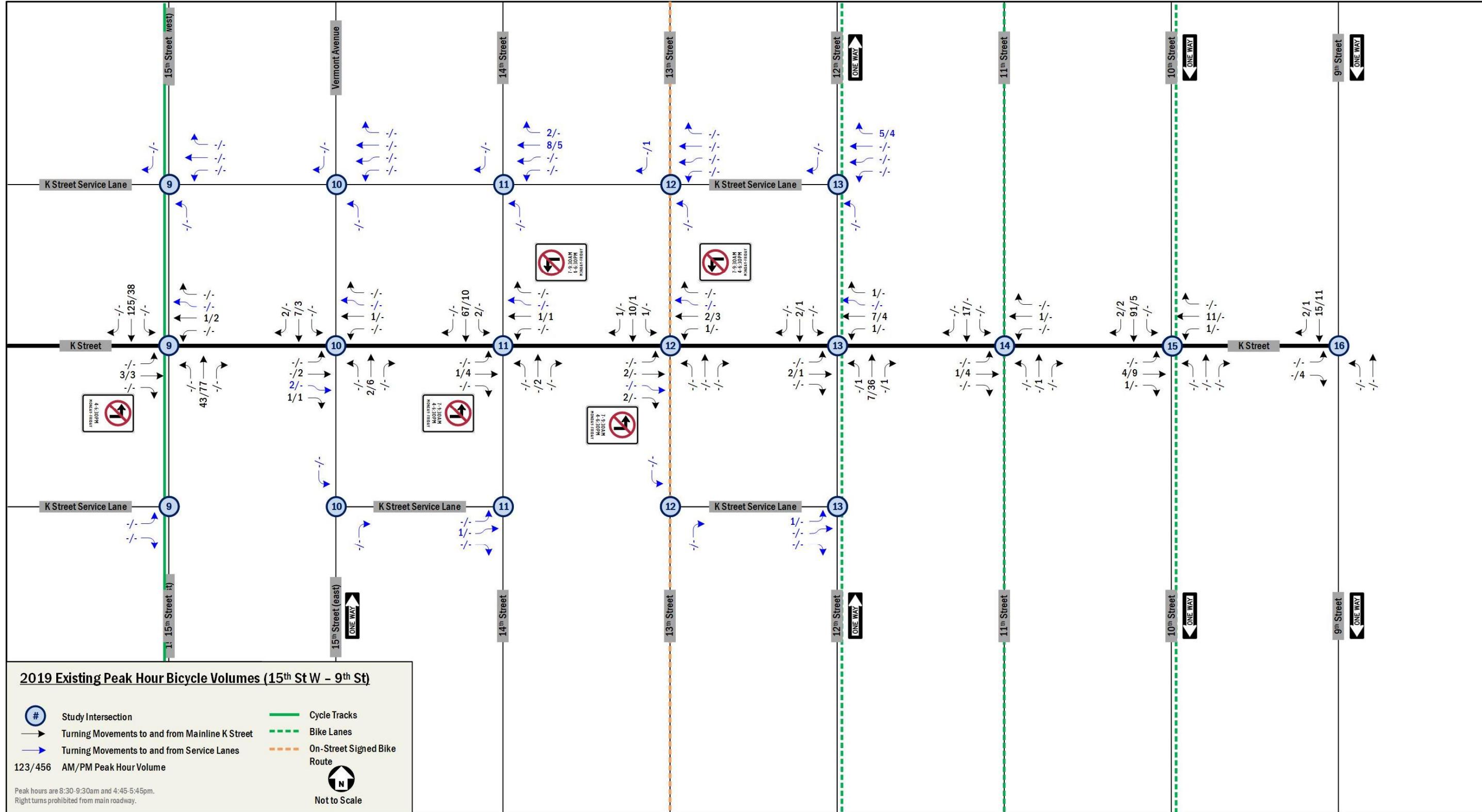


Figure 9: 2019 Existing Peak Hour Bicycle Volumes (15th St W - 9th St)

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

ATR Counts

Mainline K Street NW volumes were also recorded through ATRs in both the westbound and eastbound directions in the 1400 Block (between 15th Street (west) NW and 15th Street (east)/Vermont Avenue NW) starting at 12:00 AM on January 15, 2020 to 12:00 AM on January 17, 2020. ATR volumes in the 900 Block (between 10th Street NW and 9th Street NW) of K Street NW starting at 12:00AM on December 3, 2019 to 12:00 AM on December 5, 2019.

Attachment C presents the hourly volumes derived from the ATR counts for both blocks and highlights the morning, midday, and afternoon peak hours. **Figure 10** presents the hourly volumes derived from the ATR counts for both blocks.

As shown on **Figure 10**, the mainline K Street NW peak volumes collected by ATRs are consistent with the system peak hour volumes as derived from the unbalanced TMCs shown on **Attachment A**.

The westbound mainline volume derived from the TMCs collected at the 15th Street (east)/Vermont Avenue and K Street NW intersection is 890 for the morning peak hour, with a corresponding ATR volume of 687 and 670 on days 1 and 2, respectively; the morning peak hour eastbound volume derived from the TMCs collected at the 15th Street (west) and K Street NW intersection is 544, with a corresponding ATR volume of 575 and 543 on days 1 and 2, respectively. The afternoon peak hour westbound volume derived from the TMCs collected at the 15th Street (east)/Vermont Avenue and K Street NW intersection is 792 with a corresponding ATR volume of 683 and 692 on days 1 and 2, respectively. The afternoon peak hour eastbound volume derived from the TMCs collected at the 15th Street (west) and K Street NW intersection is 809, with a corresponding ATR volume of 612 and 620 on days 1 and 2, respectively. The difference in volumes are attributed to different collection days between the TMC data and ATR data.

Similarly, the morning peak hour westbound volume derived from the TMCs collected at the 9th Street and K Street NW intersection is 124, with a corresponding ATR volume of 137 on day 1 and 142 on day 2; the morning peak hour eastbound mainline volume derived from the TMCs collected at the 10th Street and K Street NW intersection is 99, with a corresponding ATR volume of 92 on day 1 and 74 on day 2. The afternoon peak hour westbound volume derived from the TMCs collected at the 9th Street and K Street NW intersection is 83 with a corresponding ATR volume of 88 and 97 on days 1 and 2, respectively. The afternoon peak hour eastbound volume derived from the TMCs collected at the 10th Street and K Street NW intersection is 180, with a corresponding ATR volume of 164 and 219 on days 1 and 2, respectively. The difference in volumes are attributed to midblock activity which includes on-street parking and a garage.

A tabular summary of the hourly volumes collected by ATR in the 1400 and 900 blocks of K Street NW is presented in **Attachment C**.

The ATR counts will be reference as average daily traffic volumes at these locations and may be used by the microsimulation team in calibrating the microsimulation model.

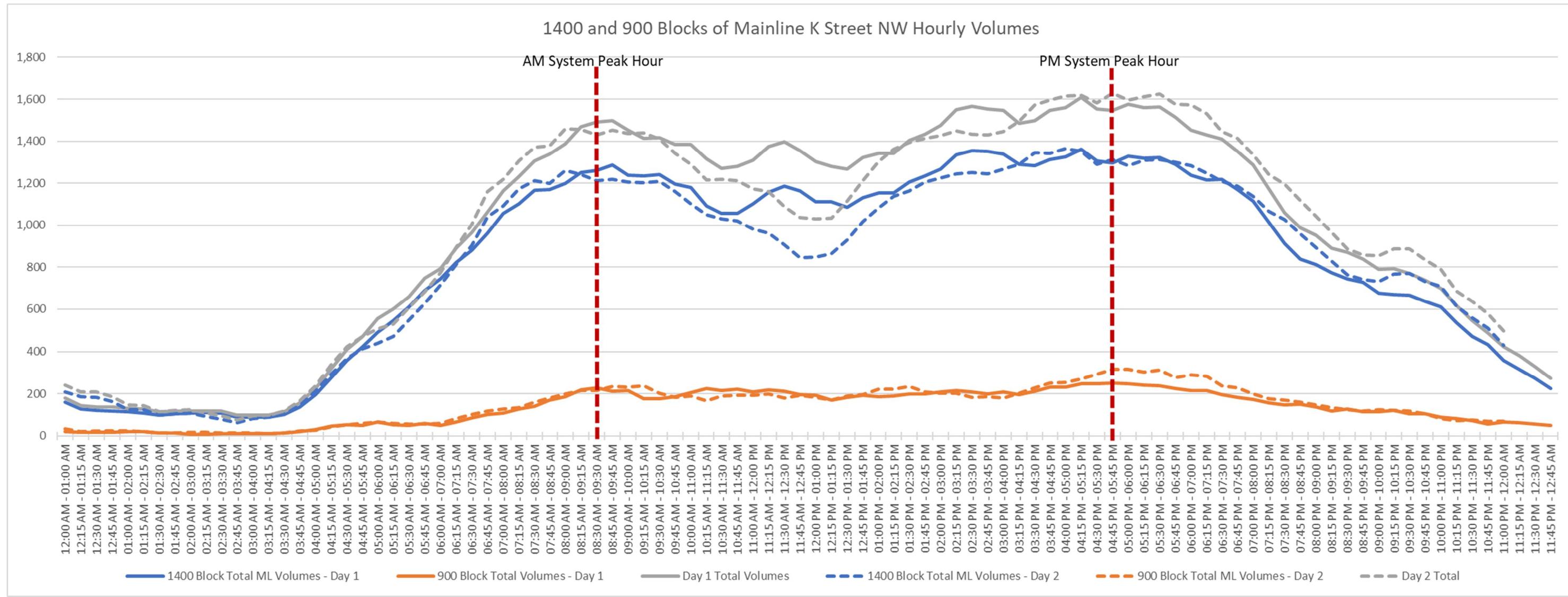


Figure 10: 1400 and 900 Blocks of Mainline K Street NW Hourly Volumes

Field Corridor Travel Time Runs

Travel time runs along the K Street NW study corridor were conducted on the same day TMC data were collected. The travel time runs were recorded using Kimley-Horn's proprietary traffic data collection mobile application, "Traction," supplemented by dashboard video camera recordings. Two (2) personnel in two vehicles (i.e. one person per vehicle) were assigned to perform travel time run data collection.

The westbound travel time run segment is defined as the time it takes a vehicle to travel between the west side of the 10th Street and K Street NW intersection to the west side of the 21st Street and K Street NW intersection. The eastbound travel time run segment is defined as the time it takes a vehicle to travel between the east side of the 21st Street and K Street NW intersection to the east side of the 10th Street and K Street NW intersection. The start and end points of these runs are shown in **Figure 1**.

Table 3 summarizes the travel time data collected. The average travel time ("Avg Travel Time") presented in **Table 3** is the average of the trip durations based on the dashboard video camera recordings. The presented average vehicle speed ("Avg Veh Speed") is based on Traction's "vehicle average speed" output which averages the instantaneous speed at each GPS ping/point during a trip, collected once every second. The presented average trip speed ("Avg Trip Speed") is based on Traction's "trip average speed" output which calculates the speed based on the trip's distance over the duration of the trip. Trips that showed longer travel times with high speeds are reflective of conditions with congested roadway segments coupled with segments that allow free flow travel.

The collected data indicate travel times are longer in the afternoon. Travel times are also longer in the westbound direction for both the morning and afternoon peak periods.

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

Table 3: Travel Time Data Summary

Peak Period Interval	Direction	# of Runs	Avg Travel Time (min:sec)	StdDev of Travel Time (min:sec)	Avg Veh Speed (mph)	StdDev of Veh Speed (mph)	Avg Trip Speed (mph)	StdDev of Trip Speed (mph)
7:00AM - 8:00AM	EB	6	6:53	1:10	17.0	2.3	10.0	1.9
	WB	6	7:35	0:48	17.4	1.7	10.3	3.4
8:00AM - 9:00AM	EB	5	8:07	1:27	15.2	1.0	10.4	4.7
	WB	4	8:36	1:10	16.4	1.4	10.9	3.5
9:00AM - 10:00AM	EB	1*	5:34	N/A	17.0	N/A	11.9	N/A
	WB	2*	9:20	0:03	18.0	1.5	7.3	0.1
Peak Period Morning Average	EB	12	7:17	1:23	16.2	1.8	10.3	3.0
	WB	12	8:13	1:02	17.2	1.5	10.0	3.1
4:00PM - 5:00PM	EB	5	8:33	1:20	13.8	1.9	9.2	2.5
	WB	5	8:52	2:00	13.8	1.8	8.1	1.9
5:00PM - 6:00PM	EB	3	9:19	2:30	13.2	3.9	7.5	2.2
	WB	3	12:05	4:11	11.4	2.7	6.0	2.0
6:00PM - 7:00PM	EB	4	8:25	1:36	14.9	3.1	8.2	1.7
	WB	5	9:02	0:46	15.0	1.2	8.3	1.6
Peak Period Afternoon Average	EB	12	8:42	1:33	14.0	2.5	8.5	2.0
	WB	13	9:40	2:25	13.7	2.1	7.7	1.8

*Note: fewer number of runs due to roadway construction

Field Observations

Field observations were conducted on the same day TMC data collection took place, December 4, 2019, during the peak periods (7:00-10:00AM and 4:00-7:00PM) to capture (1) maximum back of queue data, (2) transit dwell time and bunching data, and (3) information on slip ramp use between the K Street NW mainline and service lanes.

Field observations were recorded using the Field Observation Sheet included with the DDOT approved Data Collection Plan memo. Two (2) data collection personnel were assigned to collect field observations on the north and south side of the study corridor, traversing the study area bound for opposite directions. This means two (2) personnel started data collection on the west end of the study area traveling east, one on the north side of K Street, one on the south side of K Street NW, while two (2) different personnel started data collection on the east side of the study area traveling west on the north and south sides of K Street NW.

Maximum Back of Queue

Field personnel recorded the approximate maximum back of queue data for at least three (3) full signal cycles at study area intersections. In addition to queue lengths, spillback through adjacent intersections was recorded as a “yes/no” condition when observed. Field personnel specifically recorded whether spillback was observed through the adjacent upstream intersection or whether spillback was observed to occur from the downstream intersection. The approximate maximum back of queue observed at each study intersection is summarized in **Table 4** and **Figure 11** for the morning peak period and in **Table 5** and **Figure 12** for the afternoon peak period.

The queue observations indicate spillback occurs more often during the afternoon peak period than it does during the morning peak period. The morning peak period eastbound and westbound queues were observed to be within storage capacity (i.e. block length) with the exception of three (3) intersections, the 21st Street and K Street NW intersection where spillback was observed in the eastbound service lane, the 17th Street (west)/Connecticut Avenue and K Street NW intersection, where westbound mainline spillback was observed through the upstream intersection, and the 14th Street and K Street NW intersection where spillback was observed in the eastbound mainline and northbound direction. During the afternoon peak period, spillback was observed at multiple locations and observed to be more prevalent in the westbound direction than in the eastbound direction. The locations and direction of spillback observed in the afternoon are the following:

- 20th Street and westbound K Street NW ML and SL
- 19th Street and westbound K Street NW ML
- 17th Street (west)/Connecticut Avenue and eastbound K Street NW SL and WB SL
- 17th Street (east) and eastbound K Street NW
- 15th Street (west) and westbound K Street NW ML and SL
- 14th Street and eastbound K Street NW ML
- 12th Street and westbound K Street NW
- 9th Street and eastbound K Street NW

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

Table 4: Morning Peak Period Back of Queue Observations

Study Intersection	Approach	ML or SL	Storage (ft)	Max Queue (ft)	Spillback (Y/N)
1. 22nd Street & K Street	EB	SL	40	0	--
	WB	SL	530	106	--
2. 21st Street & K Street	EB	ML	490	147	--
	EB	SL	490	490	Y
	WB	ML	410	82	--
	WB	SL	410	82	--
3. 20th Street & K Street	SB	ML	300	90	--
	EB	ML	410	328	--
	EB	SL	410	82	--
	WB	ML	320	320	--
4. 19th Street & K Street	WB	SL	320	192	--
	EB	ML	320	288	--
	EB	SL	320	160	--
	WB	ML	410	41	--
5. 18th Street & K Street	WB	SL	410	41	--
	EB	ML	410	205	--
	EB	SL	410	82	--
	WB	ML	520	208	--
6. 17th Street (west)/Connecticut Avenue & K Street	WB	SL	520	156	--
	EB	ML	520	364	--
	EB	SL	520	52	--
	WB	ML	145	145	Y
7. 17th Street (east) & K Street	WB	SL	145	145	--
	NB	ML	310	155	--
	SB	ML	315	63	--
	EB	ML	145	131	--
8. 16th Street & K Street	WB	ML	460	322	--
	WB	SL	460	92	--
	NB	ML	310	31	--
	SB	ML	315	95	--
9. 15th Street (west) & K Street	EB	ML	460	230	--
	EB	SL	460	46	--
	WB	ML	450	225	--
	WB	SL	450	135	--
10. 15th Street (east)/Vermont Avenue & K Street	NB	ML	300	150	--
	SB	ML	305	153	--
	EB	ML	450	360	--
	EB	SL	450	0	--
11. 14th Street & K Street	WB	ML	160	160	--
	WB	SL	160	160	--
	SB	ML	330	66	--
	EB	ML	160	64	--
12. 13th Street & K Street	WB	ML	360	144	--
	WB	SL	360	216	--
	NB	ML	300	120	--
	SB	ML	355	71	--
13. 12th Street & K Street	EB	ML	360	108	--
	EB	SL	360	18	--
	WB	ML	530	371	--
	WB	SL	530	318	--
14. 11th Street & K Street	NB	ML	300	300	Y
	SB	ML	315	252	--
	EB	ML	530	212	--
	WB	ML	330	165	--
15. 10th Street & K Street	WB	SL	330	165	--
	SB	ML	315	126	--
	EB	ML	330	99	--
	EB	SL	330	33	--
16. 9th Street & K Street	WB	ML	200	60	--
	EB	ML	200	80	--
	WB	ML	190	171	--
	NB	ML	340	306	--
15. 10th Street & K Street	SB	ML	370	333	--
	EB	ML	190	171	--
	WB	ML	480	48	--
	SB	ML	270	54	--
16. 9th Street & K Street	EB	ML	480	96	--

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

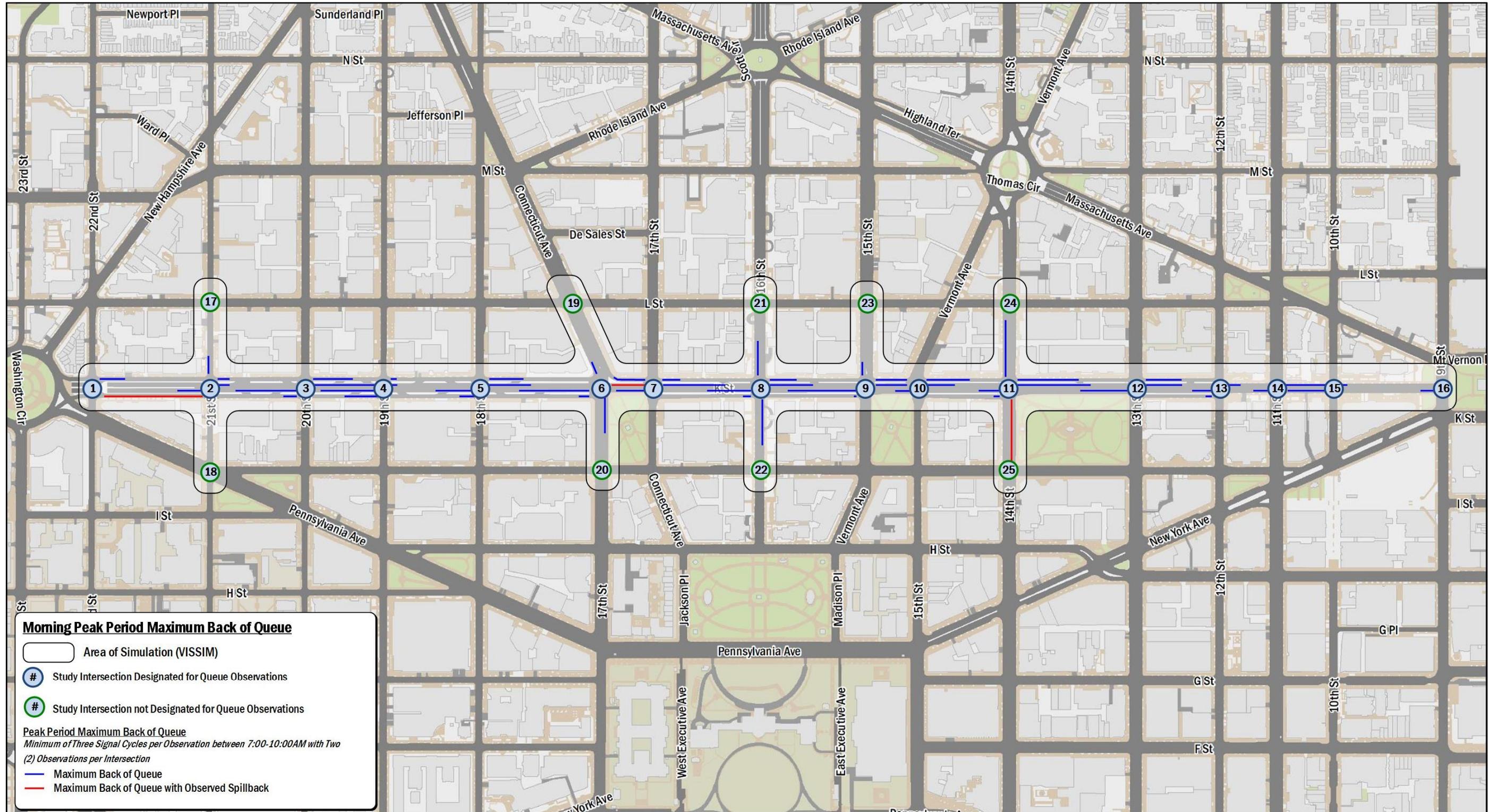


Figure 11: Morning Peak Period Maximum Back of Queue

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

Table 5: Afternoon Peak Period Back of Queue Observations

Intersection	Approach	ML or SL	Storage (ft)	Max Queue (ft)	Spillback (Y/N)
1. 22nd Street & K Street	EB	SL	40	16	--
	WB	SL	530	265	--
2. 21st Street & K Street	EB	ML	490	343	--
	EB	SL	490	294	--
	WB	ML	410	246	--
3. 20th Street & K Street	WB	SL	410	123	--
	EB	ML	410	164	--
	EB	SL	410	123	--
4. 19th Street & K Street	WB	ML	320	320	Y
	WB	SL	320	320	Y
	EB	ML	320	192	--
5. 18th Street & K Street	EB	SL	320	128	--
	WB	ML	410	410	Y
	WB	SL	410	123	--
6. 17th Street (west)/Connecticut Avenue & K Street	EB	ML	410	123	--
	EB	SL	410	41	--
	WB	ML	520	520	--
6. 17th Street (west)/Connecticut Avenue & K Street	WB	SL	520	156	--
	EB	ML	520	520	--
	EB	SL	520	520	Y
7. 17th Street (east) & K Street	WB	ML	145	124	--
	WB	SL	145	145	Y
	NB	ML	310	155	--
8. 16th Street & K Street	SB	ML	315	284	--
	EB	ML	145	145	Y
	WB	ML	460	368	--
8. 16th Street & K Street	WB	SL	460	368	--
	NB	ML	315	158	--
	EB	ML	460	276	--
9. 15th Street (west) & K Street	EB	SL	460	23	--
	WB	ML	450	225	--
	WB	SL	450	180	--
9. 15th Street (west) & K Street	NB	ML	300	270	--
	SB	ML	305	305	--
	EB	ML	305	450	--
10. 15th Street (east)/Vermont Avenue & K Street	EB	SL	450	45	--
	WB	ML	160	160	Y
	WB	SL	160	160	Y
10. 15th Street (east)/Vermont Avenue & K Street	SB	ML	330	165	--
	EB	ML	160	160	--
	WB	ML	360	324	--
11. 14th Street & K Street	WB	SL	360	144	--
	NB	ML	295	148	--
	EB	ML	360	360	Y
11. 14th Street & K Street	EB	SL	360	180	--
	WB	ML	530	265	--
	WB	SL	530	106	--
12. 13th Street & K Street	NB	ML	300	300	--
	SB	ML	315	221	--
	EB	ML	530	265	--
12. 13th Street & K Street	WB	ML	330	198	--
	WB	SL	330	33	--
	SB	ML	315	221	--
13. 12th Street & K Street	EB	ML	330	99	--
	EB	SL	330	0	--
	WB	ML	200	200	Y
14. 11th Street & K Street	EB	ML	200	200	--
	WB	ML	190	95	--
15. 10th Street & K Street	EB	ML	190	190	--
	WB	ML	480	96	--
	SB	ML	270	243	--
16. 9th Street & K Street	EB	ML	480	480	Y

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

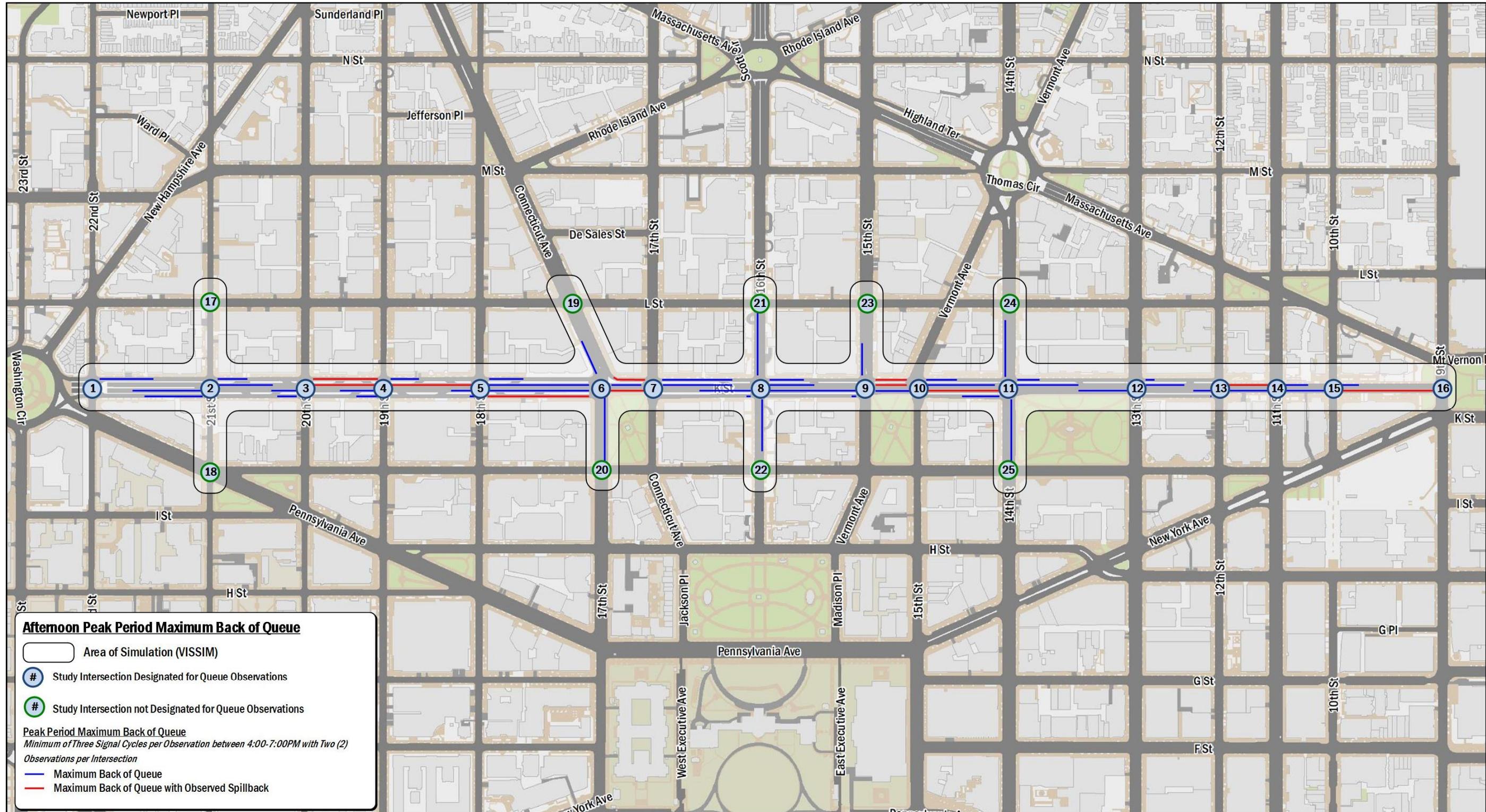


Figure 12: Afternoon Peak Period Maximum Back of Queue

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

Transit Observations

Field personnel recorded transit activity at specific bus stop locations identified in the Data Collection Plan along the study corridor. At each location, personnel observed and recorded (1) bus dwell times, (2) bunching activity, and (3) passenger alighting and boarding activity. Transit activity was specifically recorded at the locations listed below:

1. 14th Street and EB K Street NW
2. 14th Street and WB K Street NW
3. 17th Street and WB K Street NW
4. 17th Street and EB K Street NW
5. 20th Street and EB K Street NW
6. 15th Street and WB K Street NW

Transit activity at other bus stop locations was recorded if there was activity to record as personnel traveled along the corridor.

Table 6 summarizes the transit observation data for the six (6) listed locations. The table combines DDOT-provided dwell times and passenger alighting and boarding data with observed bunching activity. For the DDOT-provided data, each bus trip was counted as a single observation and the bus dwell times and passenger alighting and boarding data are averaged over the number of observations provided over the peak periods. When bunching activity was observed, the number of buses queueing was recorded, and **Table 6** presents the average size of the bunching queue.

Table 6: Transit Field Observations Summary

Bus Stop Location	Peak Hour	Avg Dwell Time (s) ¹	StdDev of Dwell Time (s) ¹	Avg # of Alighting ¹	Avg # of Boarding ¹	Bunching (Y/N) ²	Avg # of Bus in Queue ²
1. 14th Street & EB K Street NW	AM	7	11	1	0	Y	2
	PM	12	16	1	2	N	N/A
2. 14th Street & WB K Street NW	AM	8	8	2	1	N	N/A
	PM	8	8	0	3	N	N/A
3. 17th Street & WB K Street NW	AM	38	68	6	4	Y	2
	PM	21	22	0	4	Y	2
4. 17th Street & EB K Street NW	AM	7	8	4	0	Y	2
	PM	30	34	6	2	N	N/A
5. 20th Street & EB K Street NW	AM	2	4	0	0	N	N/A
	PM	3	4	0	1	N	N/A
6. 15th Street & WB K Street NW	AM	2	4	1	0	N	N/A
	PM	5	7	0	2	N	N/A

Note: 1) DDOT-provided data; 2) Field Observation data

Based on the WMATA-provided dwell time data, the 17th Street and westbound K Street NW bus stop experiences longer dwell times than the other listed locations during both the morning and afternoon peak periods, and the 17th Street and eastbound K Street NW bus stop had significantly longer dwell times during afternoon peak period.

Transit bunching was observed at the 17th Street and westbound K Street NW location during both peak periods, and the average size of the bunching queue was two (2) buses. During the morning peak period, transit bunching was also observed at the eastbound K Street NW bus

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

stops at 14th Street NW and 17th Street NW, both with an average bunching queue size of two (2) buses. Based on field observations, approximately 80 percent of queueing buses allow passenger alighting and boarding before fully arriving at the bus stop location.

Midblock Activity Observations

Field personnel observed midblock activity by recording the number of vehicles using “midblock access points” that include (1) midblock garage or alley driveways that connect directly to mainline K Street NW and (2) midblock slip ramps that allow vehicle travel between the service lanes and mainline K Street NW. These observations included the number of vehicles using the midblock slip ramps to travel to the service lane from mainline K Street NW and the number of vehicles traveling onto mainline K Street NW from the service lane.

Each midblock access point was observed for 10 minutes during the peak periods as data collection personnel traveled along the corridor which resulted in two (2) data points for each access point during each peak period (i.e. two (2) in the morning peak period and two (2) in the afternoon peak period). The observation points closest to the system peak hours were selected to be used in the model and where more than one midblock access point existed between intersections, values were combined. The recorded midblock observations were extrapolated for the peak hour by multiplying the total values by 6. A summary of the observed and extrapolated data selected to be used in the model are presented in **Table 7** for the morning peak period and **Table 8** for the afternoon peak period. As outlined in the Volume Balancing Technical Memorandum in **Attachment B**, these model inputs were considered as a starting point in the balancing process and were adjusted to achieve volume balance between intersections.

Table 7: Morning Peak Period Observed and Extrapolated Midblock Slip Ramp Activity Summary

Location	Peak Hour	Direction	Mainline to Service Lane (veh)		Service Lane to Mainline (veh)	
			Observed	Model Input	Observed	Model Input
Between 12th St/13th St	AM	WB	1	6	0	0
	AM	EB	1	6	2	12
Between 13th St/14th St	AM	WB	1	6	0	0
Between 14th St/Vermont Ave	AM	EB	2	12	2	12
Between 15th St (west)/16th St	AM	WB	33	198	1	6
	AM	EB	0	0	2	12
Between 16th St/17th St (east)	AM	WB	13	78	2	12
	AM	EB	1	6	4	24
Between Connecticut Ave/18th St	AM	WB	21	126	6	36
	AM	EB	16	96	7	42
Between 18th St/19th St	AM	WB	6	36	1	6
	AM	EB	6	36	1	6
Between 19th St/20th St	AM	WB	1	6	0	0
	AM	EB	3	18	2	12
Between 20th St/21st	AM	WB	12	72	2	12
	AM	EB	10	60	6	36

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

Table 8: Afternoon Peak Period Observed and Extrapolated Midblock Slip Ramp Activity Summary

Location	Peak Hour	Direction	Mainline to Service Lane (veh)		Service Lane to Mainline (veh)	
			Observed	Model Input	Observed	Model Input
Between 12th St/13th St	PM	WB	7	42	5	30
	PM	EB	1	6	1	6
Between 13th St/14th St	PM	WB	13	78	1	6
Between 14th St/Vermont Ave	PM	EB	2	12	1	6
Between 15th St (west)/16th St	PM	WB	20	120	24	144
	PM	EB	3	18	1	6
Between 16th St/17th St (east)	PM	WB	20	120	6	36
	PM	EB	4	24	2	12
Between Connecticut Ave/18th St	PM	WB	6	36	18	108
	PM	EB	5	30	8	48
Between 18th St/19th St	PM	WB	9	54	5	30
	PM	EB	3	18	6	36
Between 19th St/20th St	PM	WB	7	42	7	42
	PM	EB	6	36	4	24
Between 20th St/21st	PM	WB	9	54	21	126
	PM	EB	8	48	8	48

Curbside Designation

Curbside designations were recorded by field personnel to confirm (1) lane use, (2) parking and loading areas, and (3) parking and loading restrictions. These data are being used as inputs by the microsimulation team to build the VISSIM microsimulation model.

The recorded curbside designations are presented in **Attachment D**.

Signal Timing Observations

DDOT provided a baseline Synchro model to the analysis team that includes peak period signal timing settings at the study intersections. Field observation and verification of the peak period signal timings was conducted at every study intersection. **Attachment E** outlines where field conditions did not align with the Synchro model.

General Observations

Field personnel also recorded general observations that may assist the microsimulation team in calibrating the microsimulation model. These include notes on driver and bicycle behavior, such as the performance of illegal maneuvers, pedestrian behavior and crossing patterns, and the impact of traffic control officers at intersections.

These general observations are included in **Attachment F**.

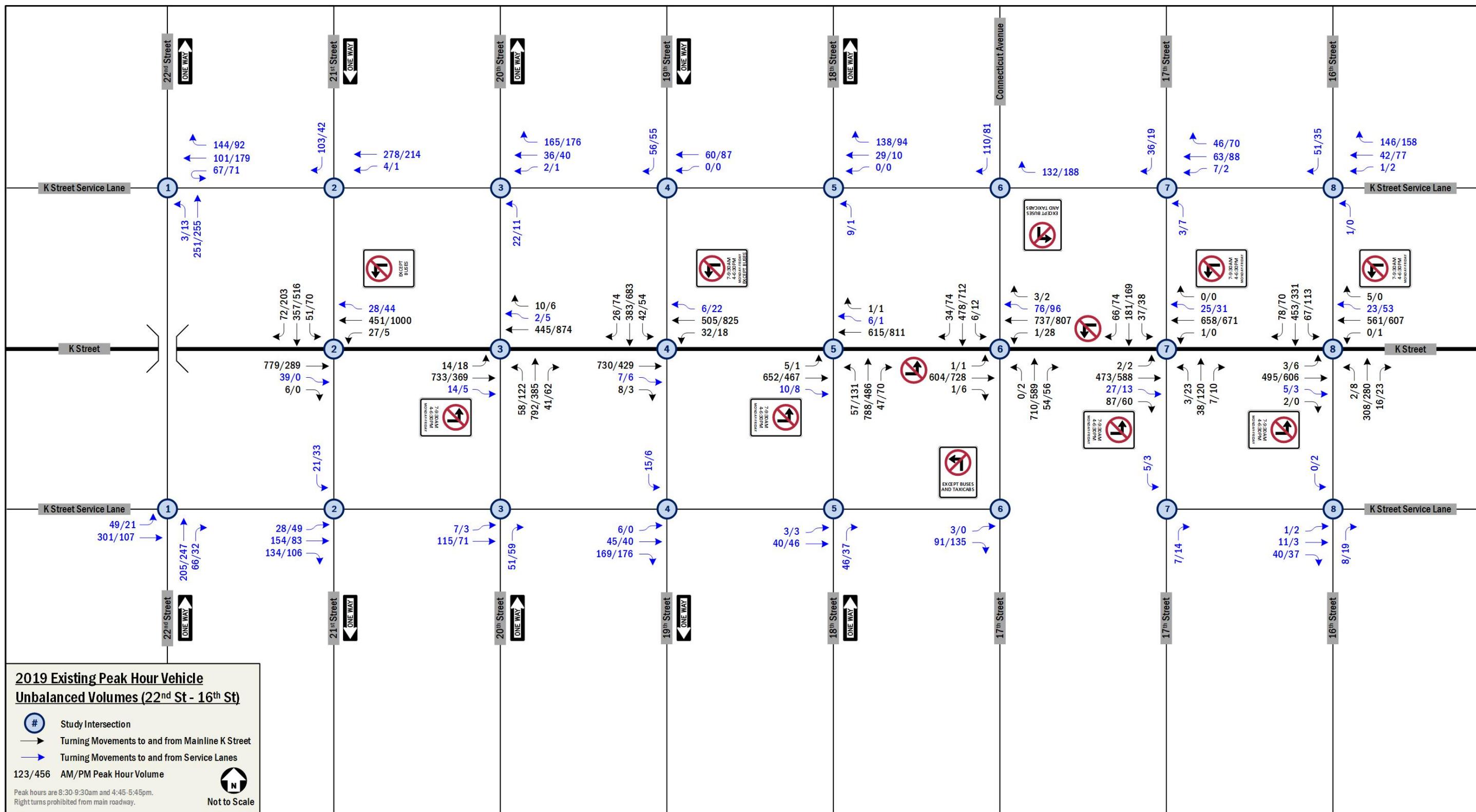
K Street NW Data Collection Results

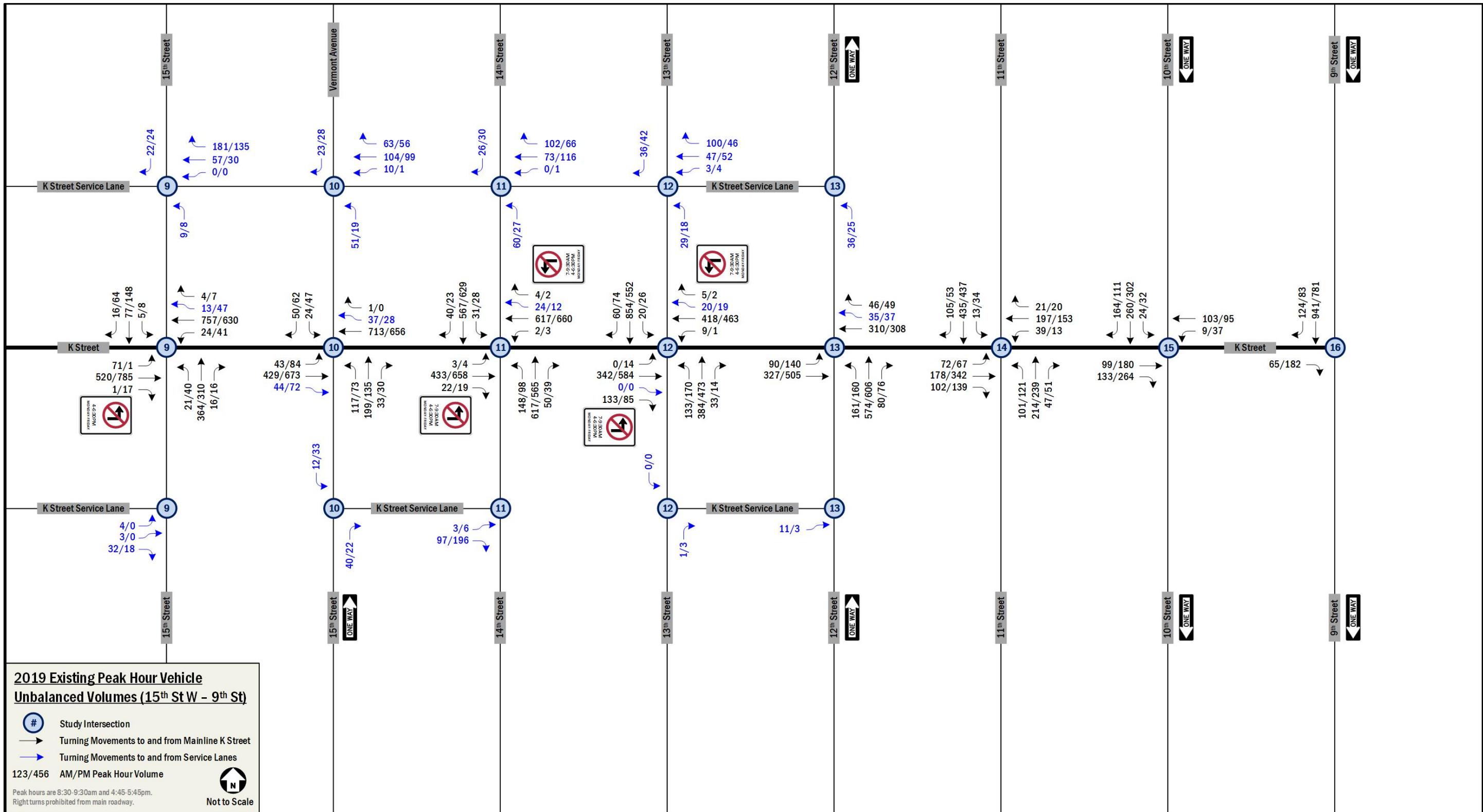
Memorandum Technical Attachments

- A: Unbalanced Volumes
- B: Approved Volume Balancing Technical Memorandum
- C: ATR Hourly Volumes of Mainline K Street NW in the 1400 and 900 Blocks
- D: Field Verified Curbside Designations
- E: Signal Timings Verification Notes
- F: General Observations

March 5, 2020

Attachment A: Unbalanced Volumes





March 5, 2020

Attachment B:
Approved Volume Balancing Technical Memorandum

d.

Memorandum

To: Ed Stollof, AICP
Haley Peckett, AICP
District Department of Transportation (DDOT)

From: Maribel N Wong
Daniel Solomon, AICP
Robert B Schiesel, P.E.
Grove Slade Associates, Inc.

Daniel Markham, P.E.
Kimley-Horn of DC, LLC

Subject: K Street NW Traffic Analysis
REVISED Volume Balancing Technical Memo

Date: February 5, 2020

Introduction

This memorandum presents the unbalanced vehicle volumes collected as part of the Data Collection Plan for the K Street NW Traffic Analysis and the volume balancing methodology with the resulting balanced volumes to be used in the VISSIM microsimulation model.

Study Area

The study area for the VISSIM microsimulation model, shown on **Figure 1**, includes 25 study intersections total. The 16 K Street NW Corridor study intersections are the following:

1. 22nd Street & K Street NW
2. 21st Street and K Street NW
3. 20th Street & K Street NW
4. 19th Street & K Street NW
5. 18th Street & K Street NW
6. 17th Street, Connecticut Avenue & K Street NW
7. 17th Street & K Street NW (east side of Farragut Square)
8. 16th Street and K Street NW
9. 15th Street & K Street NW (west side of McPherson Square)
10. 15th Street, Vermont Avenue & K Street NW (east side of McPherson Square)
11. 14th Street & K Street NW
12. 13th Street & K Street NW
13. 11th Street & K Street NW
14. 12th Street & K Street NW
15. 10th Street & K Street NW
16. 9th Street, New York Avenue & K Street NW (west side of Mt Vernon Square)

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

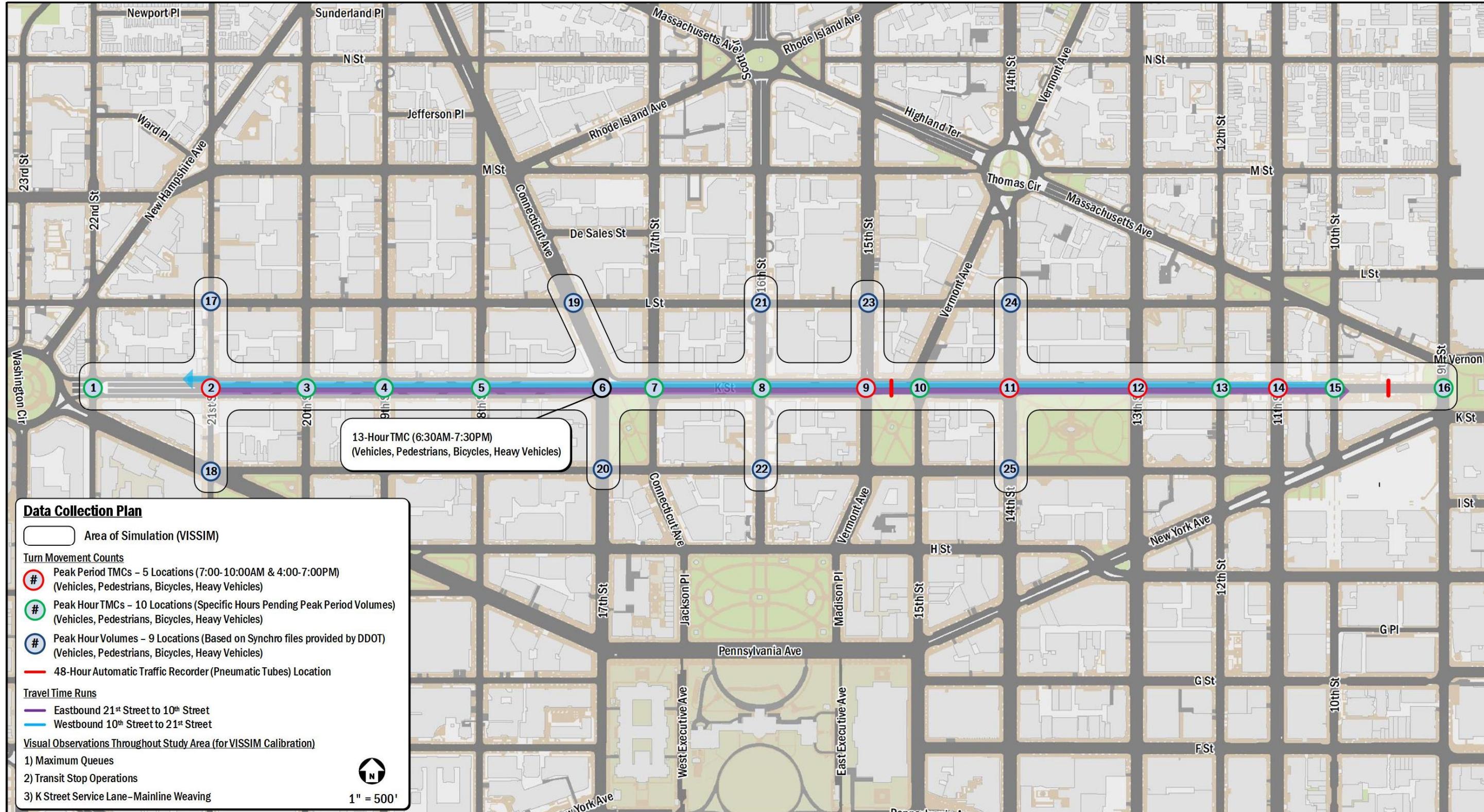


Figure 1: Study Area

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

In addition to the study intersections along K Street, nine (9) cross-street intersections adjacent to K Street NW that process significant volume interacting with the study corridor were also identified to be included in the analysis. Of note, the volumes at these intersections were provided by DDOT and were not part of volume data collection. The K Street NW adjacent cross-street study intersections are:

- | | |
|---|---|
| 17. 21 st Street & L Street NW | 21. 16 th Street & L Street NW |
| 18. 21 st Street, Pennsylvania Avenue & I
Street NW | 22. 16 th Street & I Street NW |
| 19. Connecticut Avenue & L Street NW | 23. 15 th Street & L Street NW |
| 20. 17 th Street & I Street NW | 24. 14 th Street & L Street NW |
| | 25. 14 th Street & I Street NW |

Unbalanced Volumes

Data collection took place along the K Street NW corridor in the form of 24-hour video recordings for Turning Movement Counts (TMCs) on Wednesday December 4, 2019.

With approval from DDOT, one intersection, 17th Street, Connecticut Avenue & K Street NW, was processed for 13-hour TMC data (6:30AM-7:30PM) and five (5) intersections were processed for 6-hours of peak period TMC data (7:00AM-10:00AM and 4:00PM-7:00PM). Based on these intersections, system peak hours were determined to then process the remaining K Street NW intersections for one hour during the AM and PM peak periods (8:30AM-9:30AM and 4:45PM-5:45PM). The processed intersection categories for TMC data are outlined below:

13-hours (6:30AM-7:30PM) TMC data:

- 17th Street, Connecticut Avenue & K Street NW

6-hours (7:00AM-10:00AM and 4:00PM-7:00PM) TMC data:

- | | |
|--|---|
| ▪ 21 st Street and K Street NW | ▪ 14 th Street & K Street NW |
| ▪ 15 th Street & K Street NW (west
side of McPherson Square) | ▪ 13 th Street & K Street NW |
| | ▪ 11 th Street & K Street NW |

2-hours (8:30AM-9:30AM and 4:45PM-5:45PM) TMC data:

- | | |
|---|---|
| ▪ 22 nd Street & K Street NW | ▪ 15 th Street, Vermont Avenue & K
Street NW (east side of
McPherson Square) |
| ▪ 20 th Street & K Street NW | ▪ 12 th Street & K Street NW |
| ▪ 19 th Street & K Street NW | ▪ 10 th Street & K Street NW |
| ▪ 18 th Street & K Street NW | ▪ 9 th Street, New York Avenue & K
Street NW (west side of Mt
Vernon Square) |
| ▪ 17 th Street & K Street NW (east
side of Farragut Square) | |
| ▪ 16 th Street and K Street NW | |

In addition to the collected TMC data, field observations were also conducted at midblock slip ramps, where present, between study intersections along K Street NW during the morning and afternoon peak periods (7:00-10:00AM and 4:00-7:00PM). Observations included a 10-minute

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

sample of vehicle interactions to and from the slip ramps. The 10-minute samples did not necessarily coincide with the peak hours, but counts were used to extrapolate an initial hourly equivalent volume of traffic moving through the slip ramps. The extrapolated values were revised as necessary during volume balancing to minimize adjusting intersection volumes.

Attachment A presents a schematic of the unbalanced volumes for both the morning and afternoon peak hours (8:30AM-9:30AM and 4:45PM-5:45PM) vehicle volumes. These schematics do not include the estimated midblock slip ramp volumes. **Table 1** and **Table 2** summarize the combined mainline and service lane volumes entering and departing at each study intersection with the corresponding imbalances along K Street NW for the morning and afternoon peak hours, respectively. The volumes presented were not adjusted to account for midblock vehicle interactions via the slip ramps and the imbalances represent total vehicle differences between intersections.

Table 1: AM Approach and Departure Summary

Cross Street	Block Length (ft)	Unbalanced AM					
		WB Departure (combines ML & SL volumes)	WB Delta Imbalance	WB %	WB Approach (combines ML & SL volumes)	EB Approach (combines ML & SL volumes)	EB Delta Imbalance
22 nd St <i>delta (SL ONLY)</i>	530		-97	-24%			-118
21 st St <i>delta</i>	415	936	223	39%	788	1,140	-189
20 th St <i>delta</i>	322	565	7	1%	660	883	4
19 th St <i>delta</i>	410	653	-113	-16%	603	965	-135
18 th St <i>delta</i>	520	716	-168	-18%	789	710	-98
17 th W St / CT Ave <i>delta</i>	160	957	88	10%	949	700	-78
17 th E St <i>delta</i>	460	861	41	5%	800	589	1
16 th St <i>delta</i>	445	759	-117	-13%	778	557	28
15 th W St <i>delta</i>	160	895	-69	-6%	1,036	631	-28
15 th E/VT Ave <i>delta</i>	355	1,105	-60	-6%	928	516	-24
14 th St <i>delta</i>	540	988	76	10%	822	558	-42
13 th St <i>delta</i>	330	746	30	5%	602	475	32
12 th St <i>delta</i>	200	572	-12	-3%	391	428	-66
11 th St <i>delta</i>	190	403	-10	-4%	257	352	-6
10 th St <i>delta</i>	480	267	-12	-10%	112	232	-58
9 th St		124			0	65	0

Note: The unbalanced volumes above do not reflect midblock sinks and generators

Highlighting Key:  % absolute percent change is 10% or greater.

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

Table 2: PM Approach and Departure Summary

Cross Street	Block Length (ft)	Unbalanced PM						
		WB Departure (combines ML & SL volumes)	WB Delta		WB Approach (combines ML & SL volumes)	EB Approach (combines ML & SL volumes)	EB Delta	
			Imbalance	%			Imbalance	%
22 nd St delta (SL ONLY)	530		42	3%			28	13%
21 st St delta	415	1,504	211	20%	1,264	527	-58	-11%
20 th St delta	322	1,053	39	4%	1,102	466	85	15%
19 th St delta	410	1,063	-2	0%	952	654	-10	-2%
18 th St delta	520	954			917	525		
17 th W St /CT Ave delta	160	1,060	-143	-13%	1,121	870	239	38%
17 th E St delta	460	915	206	23%	862	663	-133	-17%
16 th St delta	445	852	10	1%	898	657	-9	-1%
15 th W St delta	160	843	55	7%	890	821	50	6%
15 th E/VT Ave delta	355	966	-76	-8%	840	829	20	2%
14 th St delta	540	967	-127	-13%	860	883	6	1%
13 th St delta	330	842	18	2%	587	683	-48	-7%
12 th St delta	200	842	57	11%	394	648	21	3%
11 th St delta	190	530	67	20%	186	548	-36	-6%
10 th St delta	480	327	-20	-10%	132	444	17	4%
9 th St	83	206	49	59%	0	182	-30	-14%

Note: The unbalanced volumes above do not reflect midblock sinks and generators

Highlighting Key:  % absolute percent change is 10% or greater.

Balanced Volumes

Despite processing traffic volume data for the same peak hours, midblock activity, including on-street parking, alleys, and garage driveways in between study intersections, and minor variation in the equipment used for traffic counts, such as variations in video time stamps, can cause fluctuations in volumes between intersections. As an initial step in overcoming these challenges, video data collected as part of the TMC data collection effort was reviewed for a second time at a handful of locations to verify the outcome of the manual post-processing efforts. These locations were identified based upon an assessment of volume imbalances between blocks. Locations that were re-processed included the following:

- 21st Street & K Street NW, all approaches, 8:30-9:30AM
- 17th Street, Connecticut Avenue & K Street NW, westbound approach, 4:45-5:45PM

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

- 17th Street (east side of Farragut Square) & K Street NW, all approaches, 8:30-9:30AM and 4:45-5:45PM
- 15th Street, Vermont Avenue & K Street NW (east side of McPherson Square), westbound approach, 8:30-9:30AM and 4:45-5:45PM

Note that the volume summaries in **Table 1** and **Table 2** reflect the re-processed TMC data. The revised data did result in reductions in imbalances to the east and west of these intersections; however, comprehensive volume balancing was necessary in order to build a microsimulation model for use in evaluating the operational performance of existing conditions and establish baseline conditions that will be part of forecasting future demand. Volume balancing across all study intersections was conducted to eliminate volume imbalances while considering all segment entry and exit points or midblock “sinks” and “generators”.

Sinks and generators along the K Street NW corridor include 1) on-street parking, 2) garage driveways, and 3) alley access points. An inventory of garages and valet parking locations along K Street NW with their respective size, if available, was provided to the analysis team by DDOT and is included in **Attachment B**.

Volume Balancing Methodology

The volume balancing methodology used in this effort was as follows:

1. All illegal midblock maneuvers (midblock left-turns on K Street NW) were reassigned as legal maneuvers (right-turns)
2. Where recorded TMC data show a volume imbalance between two intersections, the imbalance was attributed to midblock generators and sinks. Where segment configuration such as the absence of midblock slip ramps or on-street parking, and/or field observations did not justify the midblock addition/removal of vehicles, vehicle trips were proportionally added or removed to the movements entering/exiting each link;
 - a. For example, if the distribution of vehicles entering a link was 10% SBR, 80% WBT, and 10% NBL, vehicles were added/removed using those proportions.
3. Where intersection volumes were revised to achieve balance, volumes were adjusted upward to match the higher of the two volumes (entering or exiting volumes between segments) as a conservative measure (where possible);
4. Volumes to/from study intersections paralleling K Street NW (L Street and I Street NW), which are based on volumes included in the DDOT-provided Synchro files, were balanced to align with the volumes entering and exiting the adjacent K Street NW intersection.
5. Illegal turning maneuvers recorded as part of a peak hour TMC at a signalized intersection were not reassigned to legal movements

Summary of Balanced Volumes – AM Peak Hour

Attachment C presents the balanced peak hour vehicle volumes for the morning peak hour.

Figure 2 presents a comparison between the unbalanced and balanced volume scenarios of the block-to-block vehicle difference between K Street NW study intersections.

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

In **Figure 2**, the differences shown in the balanced volume scenario (the bottom chart in the figure) are attributed to midblock sinks and generators. Where the block-to-block vehicle difference is the same in the unbalanced and balanced scenarios, the unbalanced differences were attributed solely to midblock sinks and generators. Where the block-to-block vehicle difference does not match in the two charts, turning movement volume adjustments were made at specific intersections to achieve a balanced network. The volume adjustments at specific intersections change the adjacent block-to-block vehicle difference. These locations with high variance are the following:

- 21st Street & K Street NW
- 17th Street (East) & K Street NW
- 15th Street (West) & K Street NW
- 15th Street (East)/Vermont Avenue & K Street NW
- 13th Street & K Street NW
- 12th Street & K Street NW

Intersection turning movement volumes for the unbalanced and balanced scenarios are detailed in **Attachment D**. **Attachment D** includes the slip ramp volumes and the number vehicles generated or removed midblock due to sinks and generators. Details outlining the volume adjustments made to specific intersections (identified above as “high variance” locations) are provided in **Attachment E**.

Attachment F presents a tabular comparison of the approach and departure volumes with the midblock volumes attributed to sinks and generators between the unbalanced and balanced scenarios.

Table 3 summarizes the volume adjustments with the percent change at each K Street NW study intersection. As **Table 3** shows, the volume change to balance in the morning peak hour was greatest at the intersection 21st Street NW and K Street NW. This change was necessary to account for the high number of illegal midblock maneuvers from the eastbound mainline travel lanes between 22nd Street NW and 21st Street NW. Field observations noted a high number of eastbound left-turns traveling onto the westbound service lane. In total 348 vehicles, a 14 percent change, were removed from this intersection. 174 vehicles were removed from entering the eastbound mainline and 174 were removed from exiting the westbound service lane. While the volume of this adjustment represents a 14 percent change, the number of network trips removed is actually half that if you consider these vehicles represent two trips through the intersection to complete their intended route.

All adjustments made at these intersections are shown in **Attachment D** and explained in **Attachment E**. Given the high variability in traffic flow between these “high variance” intersections, further volume adjustments may be considered during microsimulation modeling to achieve calibration. These adjustments will be recorded, if made, during calibration.

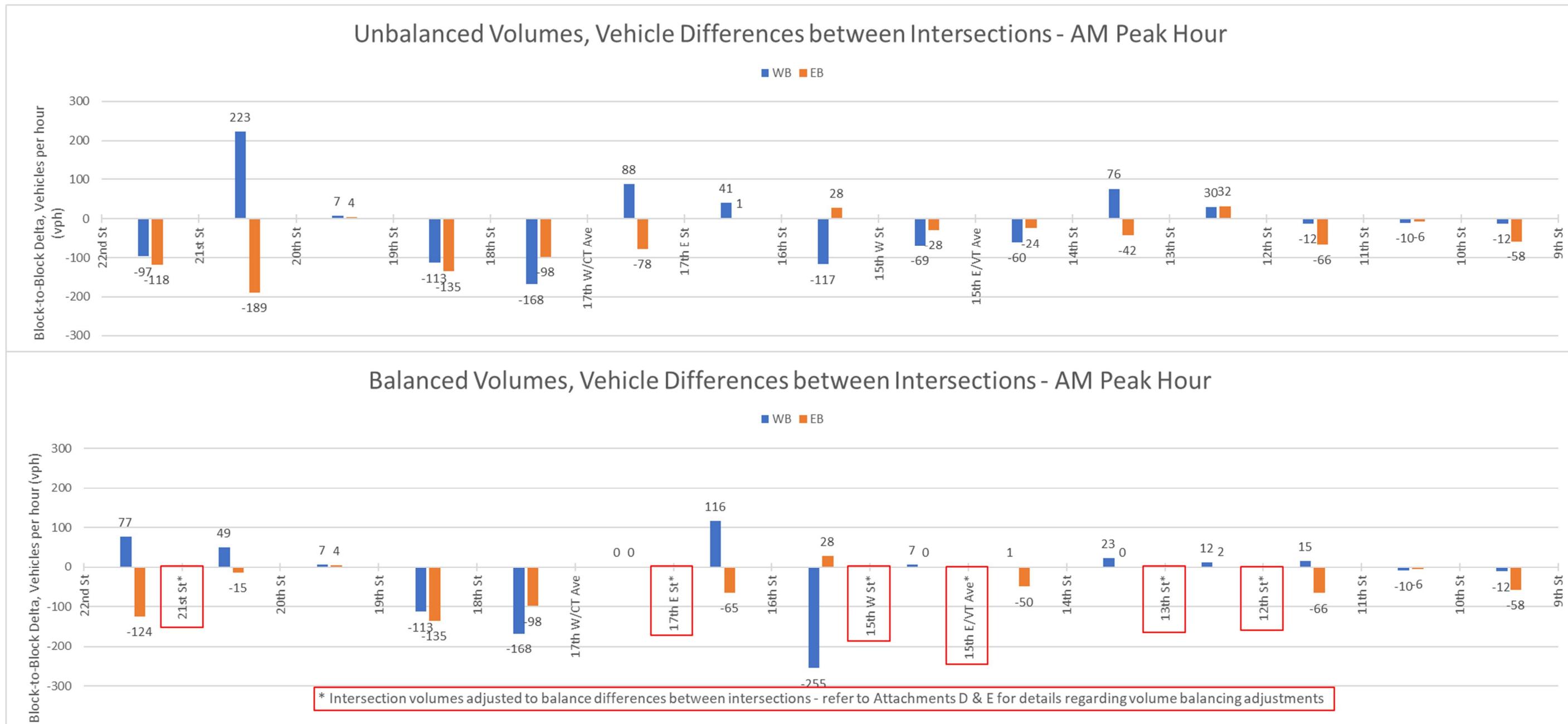


Figure 2: Block-to-Block Differences in Vehicle Volumes, AM Peak Hour

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

Table 3: Volume Adjustments Summary, AM Peak Hour

Intersection Name	AM Peak TMC Adjustments (Difference Between Unbalanced and Balanced Volumes: adjustment value and percent change)																												
	SBR (to SL)	SBR (to ML)	SBT	SBL (to SL)	SBL (to ML)	SL WBR	SL WBT	WBL (to ML)	SL WBL	ML WBR	ML WBT	ML WBL	NBL (to ML)	NBL (to SL)	NBT	NBR (to ML)	NBR (to SL)	ML EBL	ML EBT	ML EBR (to SL)	ML EBR	SL EBL	SL EBT	SL EBR	SL EBR (to ML)	SL EBL	SL EBT	SL EBR	Intersection Overall Input Changes
22nd St & K St	--	--	--	--	--	0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	--	--	--	--	--	0%	0%	0%	--	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
21st St & K St	0	0	0	0	0	-10	0	-174	0	0	0	0	0	--	--	--	--	0	-158	0	0	0	-6	0	0	0	348		
	0%	0%	0%	0%	0%	-20%	0%	-63%	0%	0%	0%	0%	0%	--	--	--	--	0%	-20%	0%	0%	-21%	0%	0%	0%	14%			
20th St & K St	--	--	--	--	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	--	--	--	--	--	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
19th St & K St	0	0	0	0	0	0	0	0	0	0	0	0	0	--	--	--	--	0	0	0	0	0	0	0	0	0	0	0	
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	--	--	--	--	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
18th St & K St	--	--	--	--	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	--	--	--	--	--	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
17th W St/Connecticut Ave & K St	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
17th E St & K St	5	7	0	0	0	0	0	1	0	0	0	74	0	1	0	0	0	0	0	62	4	12	0	0	0	0	0	166	
	14%	11%	0%	0%	0%	0%	0%	14%	0%	0%	0%	11%	0%	33%	0%	0%	0%	0%	0%	13%	15%	14%	0%	0%	0%	0%	0%	9%	
16th St & K St	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
15th W St & K St	0	0	0	0	0	0	0	0	0	1	2	136	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	143	
	0%	0%	0%	0%	0%	0%	0%	0%	0%	25%	15%	18%	17%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	7%	
15th E St & K St	2	0	0	0	0	0	0	7	0	0	0	51	0	0	4	0	0	0	2	23	3	0	0	0	0	0	0	95	
	9%	0%	0%	0%	0%	0%	0%	7%	0%	0%	0%	8%	7%	0%	8%	0%	0%	5%	5%	7%	0%	0%	0%	0%	0%	0%	0%	5%	
14th St & K St	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
13th St & K St	0	5	0	0	0	0	0	1	0	0	0	36	0	11	0	0	0	0	30	0	12	0	0	0	0	0	0	95	
	0%	8%	0%	0%	0%	0%	0%	33%	0%	0%	0%	9%	0%	8%	0%	0%	0%	9%	0%	9%	0%	0%	0%	0%	0%	0%	0%	4%	
12th St & K St	--	--	--	--	--	0	0	0	0	0	0	27	0	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0	55
	--	--	--	--	--	0%	0%	0%	0%	77%	0%	0%	78%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%	
11th St & K St	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
10th St & K St	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
9th St & K St	0	0	0	0	0	0	--	--	--	--	--	--	--	--	--	--	--	0	0	0	0	0	0	0	0	0	0		
	0	0	0	0	0	0	--	--	--	--	--	--	--	--	--	--	--	0	0	0	0	0	0	0	0	0	0		

AM Peak Hour Overall Network Input Changes

902

3%

Summary of Balanced Volumes – PM Peak Hour

Attachment C also presents the balanced peak hour vehicle volumes for the afternoon peak hour. **Figure 3** presents a comparison between the unbalanced and balanced volume scenarios of the block-to-block vehicle difference between K Street NW study intersections.

In **Figure 3**, the differences shown in the balanced volume scenario (the bottom chart in the figure) are again attributed to midblock sinks and generators, and as with AM peak hour volume adjustments, where the block-to-block vehicle difference is the same in the unbalanced and balanced scenarios, the unbalanced differences were attributed to midblock sinks and generators. Where the vehicle difference does not match, turning movement volume adjustments were made at specific intersections to achieve a balanced network. The volume adjustments at specific intersections change the adjacent block-to-block vehicle difference. These locations with high variance are the following:

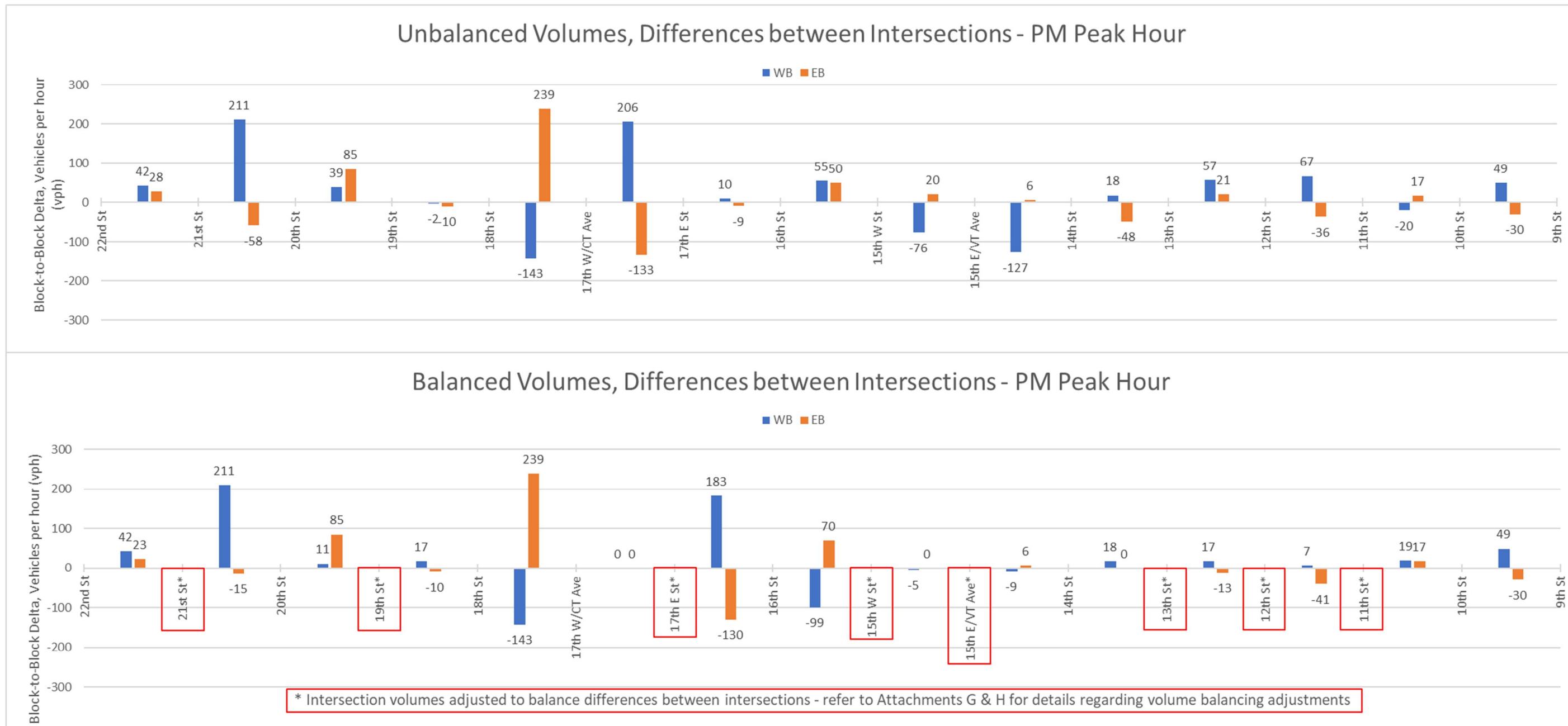
- 21st Street & K Street NW
- 19th Street & K Street NW
- 17th Street (East) & K Street NW
- 15th Street (West) & K Street NW
- 15th Street (East)/Vermont Avenue & K Street NW
- 13th Street & K Street NW
- 12th Street & K Street NW
- 11th Street & K Street NW

Intersection turning movement volumes for the unbalanced and balanced scenarios are detailed in **Attachment G**. **Attachment G** includes the slip ramp volumes and the number of vehicles generated or removed midblock due to sinks and generators. Details outlining the volume adjustments made to specific intersections (identified above as “high variance” locations) are provided in **Attachment H**.

Attachment I presents a tabular comparison of the approach and departure volumes with the midblock volumes attributed to sinks and generators between the unbalanced and balanced scenarios.

Table 4 summarizes the volume adjustments with the percent change at each K Street NW study intersection. As **Table 4** shows, the volume change to balance in the afternoon peak hour was greatest at the intersection of 17th Street (East) and K Street NW. This change was necessary to account for the absence of midblock sinks and generators between this intersection and the adjacent intersection of 17th Street (West)/Connecticut Avenue and K Street NW to the west. A total of 339 vehicles, a 17 percent change, were added to this intersection, of which 206 vehicles were added to the movements entering the westbound mainline and service lanes, and the remaining 133 vehicles were added in the opposite direction to the eastbound approach movements.

All adjustments made at these intersections are shown in **Attachment G** and explained in **Attachment H**. Given the high variability in traffic flow between these “high variance” intersections, further volume adjustments may be considered during microsimulation modeling to achieve calibration. These adjustments will be recorded, if made, during calibration.

**Figure 3: Block-to-Block Differences in Vehicle Volumes, PM Peak Hour**

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

Table 4: Volume Adjustments Summary, AM Peak Hour

Intersection Name	PM Peak TMC Adjustments (Difference Between Unbalanced and Balanced Volumes: adjustment value and percent change)																									
	SBR (to SL)	SBR (to ML)	SBT	SBL (to SL)	SBL (to ML)	SL WBR	SL WBT	WBL (to ML)	SL WBL	ML WBR	ML WBT	NBL (to SL)	NBL (to ML)	NBT	NBR (to SL)	NBR (to ML)	ML EBL	ML EBT	ML EBR (to SL)	ML EBR	SL EBL	SL EBT	SL EBR	Intersection Overall Input Changes		
22nd St & K St	--	--	--	--	--	0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	--	--	--	--	--	0%	0%	0%	--	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
21st St & K St	0	0	0	0	-7	0	0	0	0	0	0	--	--	--	--	--	0	-31	0	0	0	-5	0	0	43	
	0%	0%	0%	0%	-10%	0%	0%	0%	0%	0%	0%	--	--	--	--	--	0%	-11%	0%	0%	0%	-10%	0%	0%	2%	
20th St & K St	--	--	--	--	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	--	--	--	--	--	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
19th St & K St	9	0	0	0	0	0	15	0	0	0	4	0	0	--	--	--	0	0	0	0	0	0	0	0	28	
	16%	0%	0%	0%	0%	0%	17%	0%	0%	0%	18%	0%	0%	--	--	--	0%	0%	0%	0%	0%	0%	0%	0%	1%	
18th St & K St	--	--	--	--	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	--	--	--	--	--	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
17th W St/Connecticut Ave & K St	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
17th E St & K St	10	16	0	0	0	0	23	0	0	0	8	142	0	5	2	0	0	0	0	118	3	12	0	0	0	339
	53%	22%	0%	0%	0%	0%	26%	0%	0%	0%	26%	21%	0%	22%	29%	0%	0%	0%	0%	20%	23%	20%	0%	0%	0%	17%
16th St & K St	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
15th W St & K St	0	0	0	0	0	17	4	0	0	2	10	140	9	0	0	0	0	0	0	20	0	0	0	0	0	202
	0%	0%	0%	0%	0%	13%	13%	0%	0%	29%	21%	22%	22%	0%	0%	0%	0%	0%	0%	3%	0%	0%	0%	0%	0%	9%
15th E St & K St	0	0	0	0	0	7	13	0	0	0	4	94	0	0	0	0	0	0	0	0	0	0	0	0	0	118
	0%	0%	0%	0%	0%	13%	13%	0%	0%	14%	14%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	6%
14th St & K St	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
13th St & K St	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	41	0	6	0	0	0	48
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	7%	7%	0%	7%	0%	0%	0%	2%
12th St & K St	--	--	--	--	--	0	0	0	0	0	24	0	0	0	16	0	0	0	2	5	0	0	0	0	0	47
	--	--	--	--	--	0%	0%	0%	0%	0%	65%	0%	0%	0%	64%	0%	0%	0%	1%	1%	0%	0%	0%	0%	0%	2%
11th St & K St	0	14	0	0	0	0	0	0	0	0	39	0	31	0	0	0	0	0	0	0	0	0	0	0	0	84
	0%	26%	0%	0%	0%	0%	0%	0%	0%	0%	25%	0%	26%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	5%
10th St & K St	0	0	0	0	0	0	0	0	0	0	0	0	0	--	--	--	--	0	0	0	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	--	--	--	--	0%	0%	0%	0%	0%	0%	0%	0%	0%
9th St & K St	0	0	0	0	0	0	--	--	--	--	--	--	--	--	--	--	--	0	0	0	0	0	0	0	0	
	0	0	0	0	0	--	--	--	--	--	--	--	--	--	--	--	--	0	0	0	0	0	0	0	0%	

PM Peak Hour Overall Network Input Changes

909

3%

Overall Balanced Network

As previously noted, volume adjustments were made at locations where the unbalanced volumes showed a high variance between intersections that cannot be attributed to midblock sinks and generators. The locations that were adjusted in both the morning and afternoon peak hours are the following:

- 21st Street & K Street NW
- 17th Street (East) & K Street NW
- 15th Street (West) & K Street NW
- 15th Street (East)/Vermont Avenue & K Street NW
- 13th Street & K Street NW
- 12th Street & K Street NW

Overall, the adjustments made to balance volumes along the K Street NW corridor result in an absolute volume input change of 902 vehicles, a 3 percent change to the unbalanced network turning movement volume total of 32,522 in the morning peak hour. An absolute volume input change of 909 vehicles, also a 3 percent change to the unbalanced network turning movement volume total of 34,140 in the afternoon peak hour. These network volume adjustments are summarized in **Table 5**. Considering the systematic and consistent approach to balancing network volumes, the resultant balanced peak hour volumes provide a solid foundation from which to move forward with microsimulation analyses of existing conditions and future traffic forecasting efforts.

Table 5: K Street NW Intersection Total Volume Balance Summary

K Street Intersection Total Volume Balance Summary				
Totals for K Street NW Intersections	Unbalanced Volume	Absolute Volume Change Total	Percent Change	Balanced Volume
AM Peak Hour	32,522	902	3%	32,728
PM Peak Hour	34,140	909	3%	34,963

Volume Balance Memorandum Technical Attachments

- A: Unbalanced Volumes
- B: Parking Garage Information Provided by DDOT
- C: Balanced Volumes
- D: AM Intersection Movements Comparison
- E: AM Balancing Notes
- F: AM Approach and Departure Summary and Comparison
- G: PM Intersection Movements Comparison
- H: PM Balancing Notes
- I: PM Approach and Departure Summary and Comparison

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

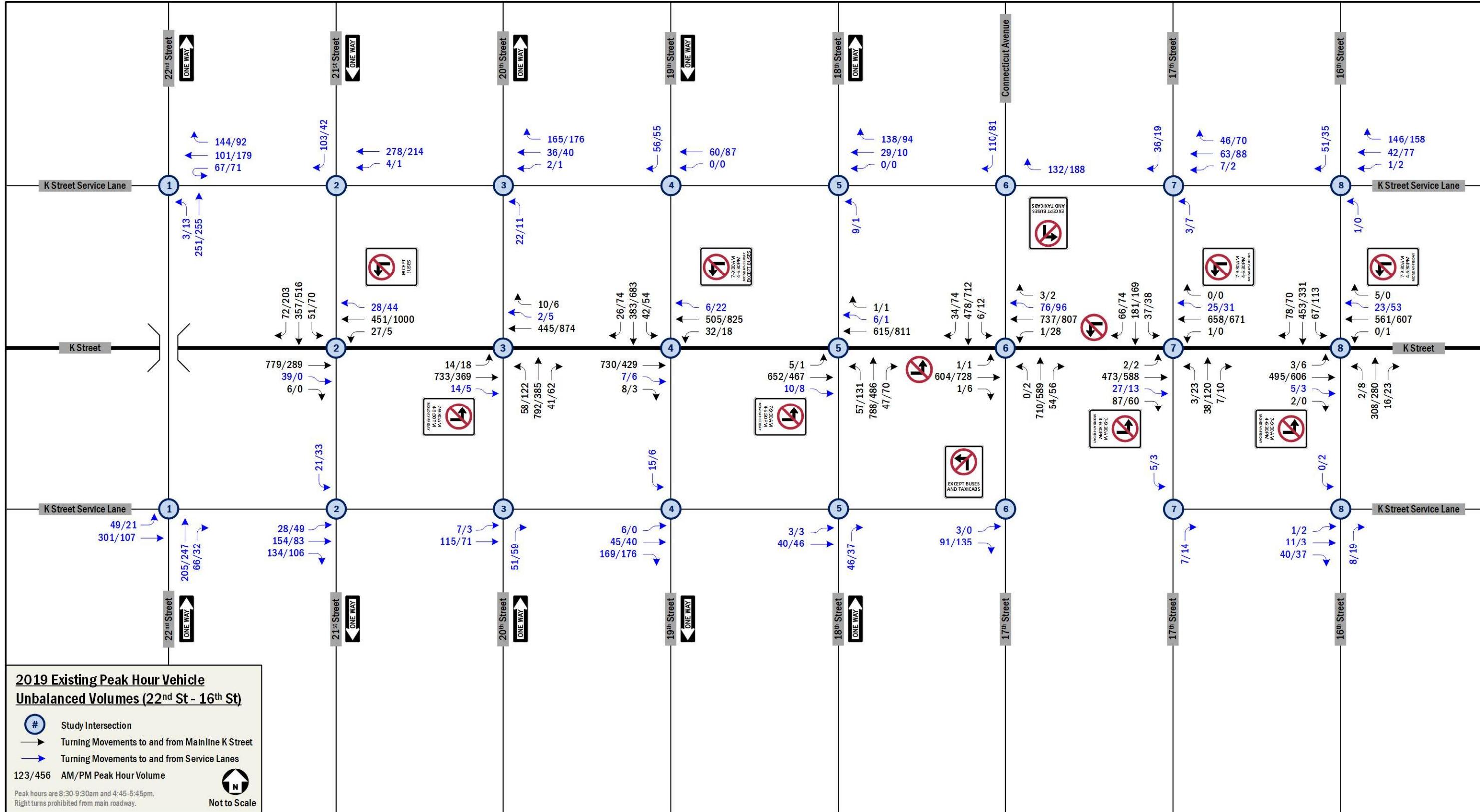
February 5, 2020

Attachment A: Unbalanced Volumes

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

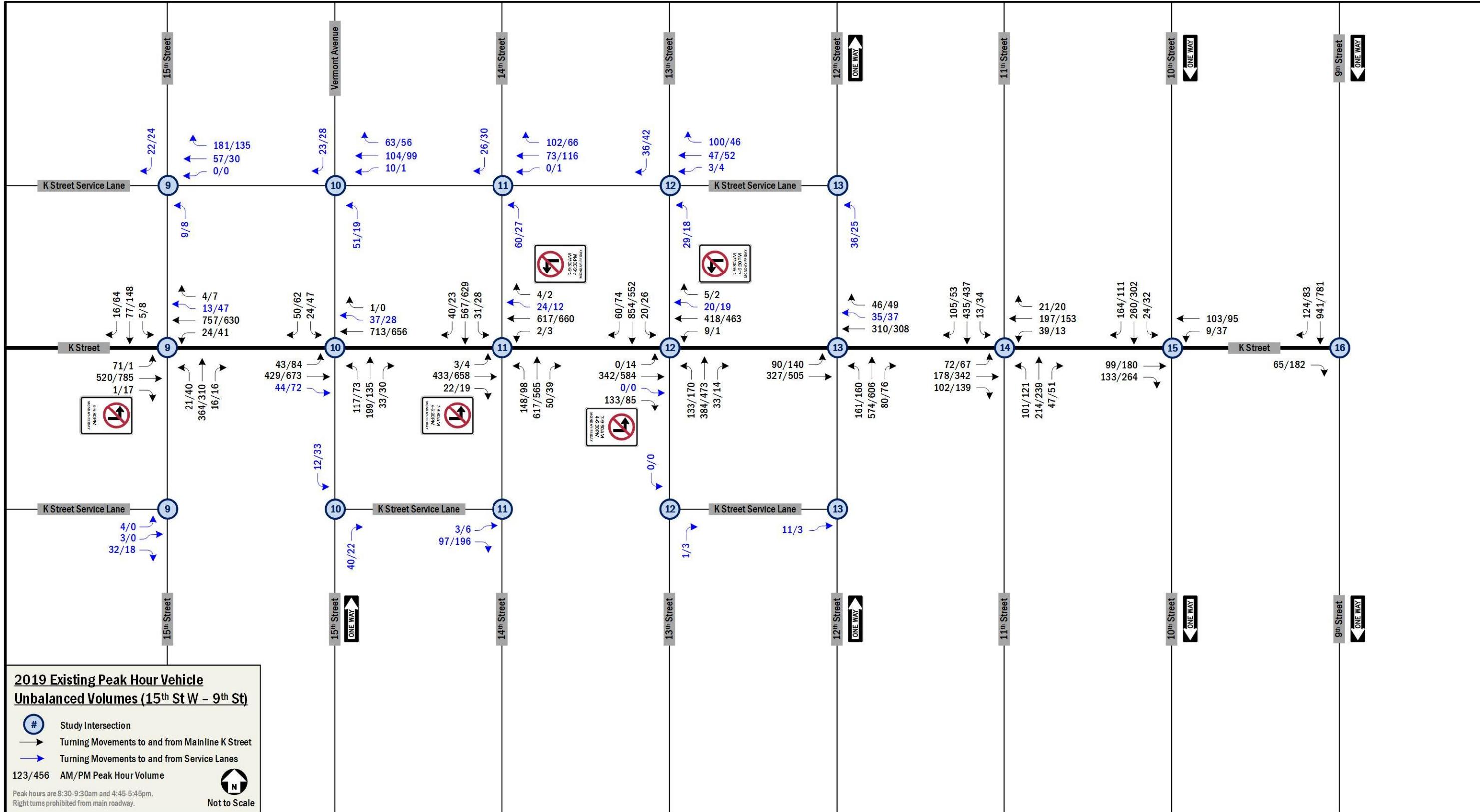
February 5, 2020



K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020



K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

Attachment B:
Parking Garage Information Provided by DDOT

LoadingZones_Garages_Transitway

ADDRESS	OPERATOR NAME	# of Spots	24 Hours?
1601 K ST NW	NATION PARKING	200	No
1666 K ST NW	COLONIAL PARKING	300	No
1667 K ST NW	PARK AMERICA	300	No
1700 K ST NW	COLONIAL PARKING	250	No
1717 K ST NW	COLONIAL PARKING	279	No
1750 K ST NW	MID-TOWN PARKING	183	No
1776 K ST NW	MID-TOWN PARKING	200	No
1800 K ST NW	COLONIAL PARKING	150	No
1825 K ST NW	C&C PARKING	200	No
1850 K ST NW	ONE PARKING	300	No
1875 K ST NW	LAZ PARKING	200	No
1900 K ST NW	ONE PARKING	200	No
1909 K ST NW	MONUMENT PARKING	300	No
1990 K ST NW	ATLANTIC PARKING	225	No
1999 K ST NW	COLONIAL PARKING	30	No
2000 K ST NW	COLONIAL PARKING	145	No
2020 K ST NW	ATLANTIC PARKING	200	No
2021 K ST NW	SP+ PARKING	200	No
2033 K ST NW	QUIK PARK	150	No
2121 K ST NW	SP+ PARKING	116	No
2131 K ST NW	MID-ATLANTIC PARKING	80	No
2141 K ST NW	SP+ PARKING	150	No
2175 K St NW	COLONIAL PARKING	100	No

Parking Garages K Street

Parking Garage Data November 18, 2019

Address	Company	Building Name	Number of Spots	K Street access location	Who has access?	All Access Points
1501 K Street	Atlantic	The Investment Building	114	15th block, northside, entrance mid-block	Public	K and L Streets
1030 15th Street	Penn Parking	The Executive Building	186	15th block, northside, entrance mid-block	Public	K and L Streets
1601 K Street	Nation Parking		38	16th block, northside, entrance eastern end of block	Public	K Street
1522 K Street	Towne Park	Hyatt Place Washington DC/ White House	8	15th block, southside, entrance mid-block	Employees	K Street
1400 K Street	Impark		280	14th block, southside, entrance mid-block	Public	K and I (Eye) Streets
1401 I (Eye) Street	Impark		150	14th block, southside, entrance mid-block	Public	K, I (Eye), 15th Streets
901 15th Street	Impark	The McPherson Building	154	14th block, southside, entrance mid-block	Public	K and I (Eye) Streets

Called 11/22/19. The garage under the hotel is small and only for employees. This number is an estimate from a hotel employee. The valet takes cars to a different parking garage but it is unknown which garage they go to.

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

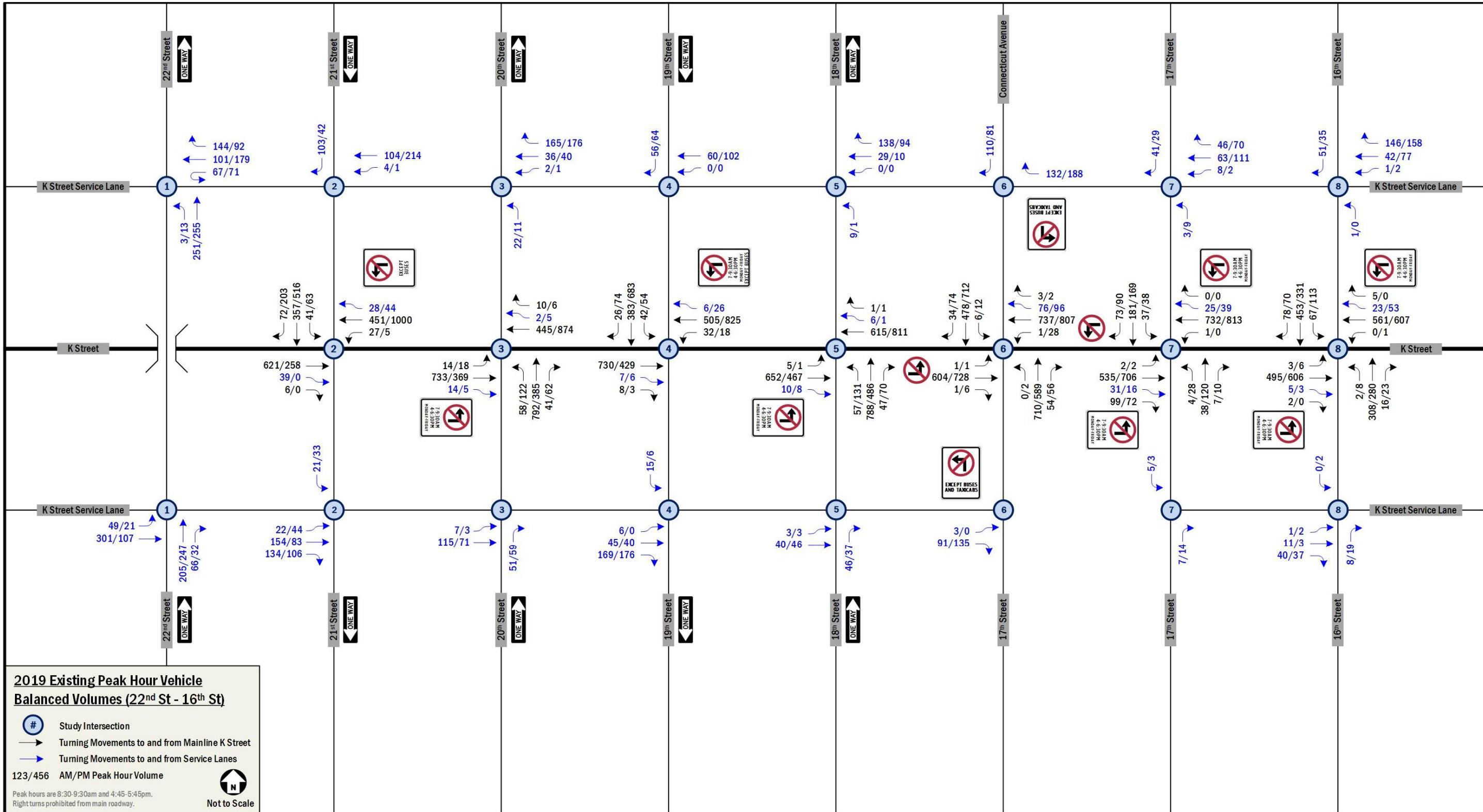
February 5, 2020

Attachment C: Balanced Volumes

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

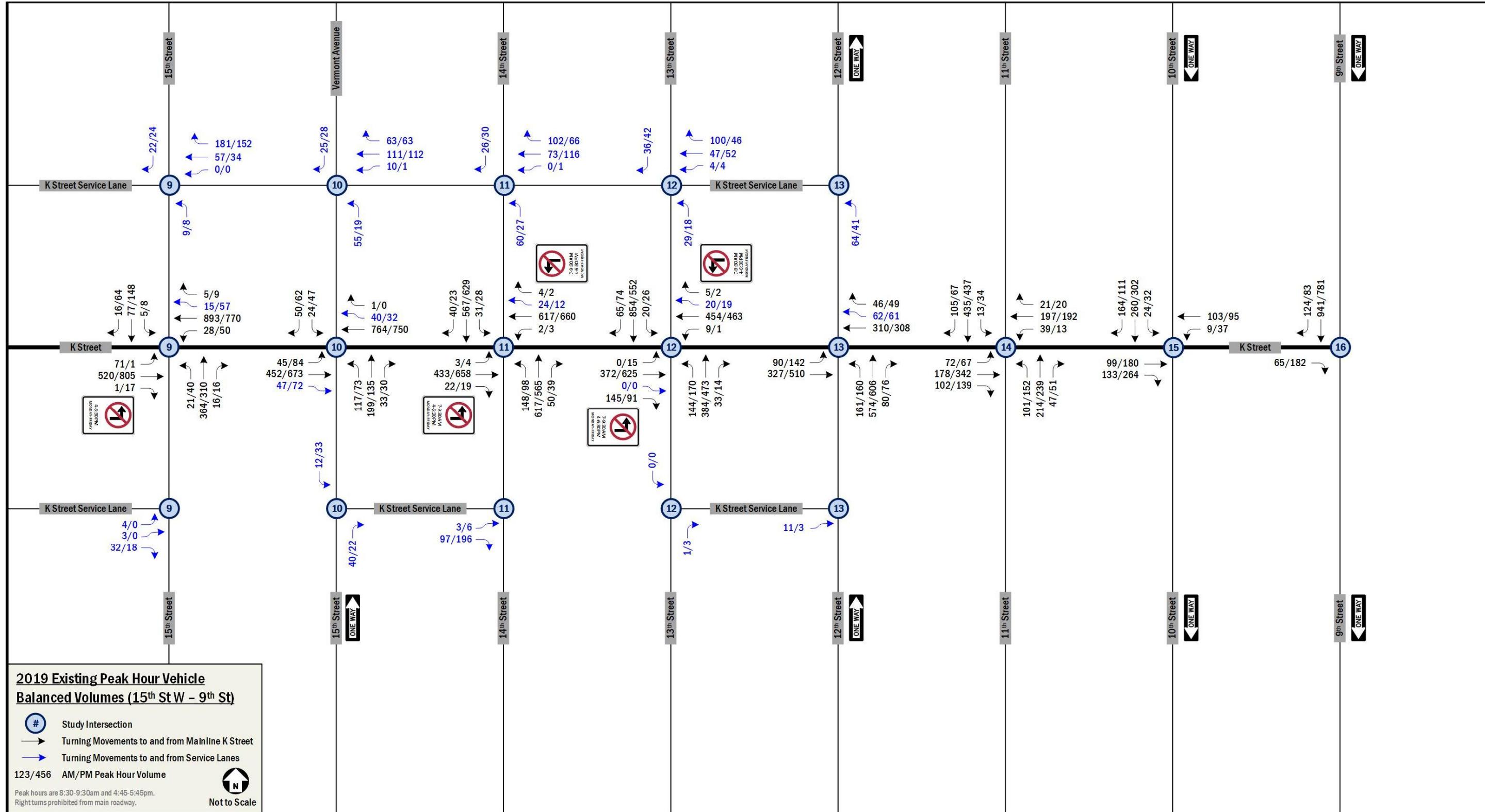
February 5, 2020



K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020



K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

Attachment D:
AM Intersection Movements Comparison

Intersection	Approach Direction	AM							
		Unbalanced Volume		Volume Change		Percent Change		Balanced Volume	
		Volume	Approach Total	Volume	Approach Total	Volume	Approach Total	Volume	Approach Total
22nd St & K St	WB	144	312	0	0	0%	0%	144	312
		101		0		0%		101	
		0		0		0%		0	
		67		0		0%		67	
		0		0		0%		0	
		0		0		0%		0	
	NB	0	271	0	0	0%	0%	0	271
		3		0		0%		3	
		202		0		0%		202	
		0		0		0%		0	
		66		0		0%		66	
	EB	0	350	0	0	0%	0%	0	350
		0		0		0%		0	
		0		0		0%		0	
		0		0		0%		0	
		49		0		0%		49	
		0		0		0%		0	
EB Midblock Sinks/Generators	Vehicles Entering System	--	--	0	--	--	--	0	--
	Vehicles Exiting System	--	--	-124	-124	--	--	-124	-124
WB Midblock Sinks/Generators	Vehicles Entering System	--	--	77	77	--	--	77	77
	Vehicles Exiting System	--	--	0	0	--	--	0	0
21st St & K St	SB	103	604	0	-10	0%	-2%	103	594
		72		0		0%		72	
		357		0		0%		357	
		21		0		0%		21	
		51		-10		-20%		41	
	WB	0	788	0	-174	0%	-22%	0	614
		278		-174		-63%		104	
		4		0		0%		4	
		0		0		0%		0	
		28		0		0%		28	
		451		0		0%		451	
	EB	27	1,140	0	-164	0%	-14%	27	976
		0		0		0%		0	
		779		-158		-20%		621	
		39		0		0%		39	
		6		0		0%		6	
		0		-6		-21%		0	
EB Midblock Sinks/Generators	Vehicles Entering System	--	--	0	-15	--	--	0	-15
	Vehicles Exiting System	--	--	-15	--	--	--	-15	-15
EB Slip Ramp Volumes	ML to SL	60	--	60	--	--	--	60	--
	SL to ML	36	--	137	--	--	--	137	--
WB Slip Ramp Volumes	ML to SL	72	--	54	--	--	--	54	--
	SL to ML	12	--	55	--	--	--	55	--
WB Midblock Sinks/Generators	Vehicles Entering System	--	--	49	49	--	--	49	49
	Vehicles Exiting System	--	--	0	0	--	--	0	0
20th St & K St	WB	165	660	0	0	0%	0%	165	660
		36		0		0%		36	
		2		0		0%		2	
		0		0		0%		0	
		10		0		0%		10	
		2		0		0%		2	
	EB	445	883	0	0	0%	0%	445	883
		0		0		0%		0	
		58		0		0%		58	
		22		0		0%		22	
		792		0		0%		792	
		41		0		0%		41	
EB Midblock Sinks/Generators	Vehicles Entering System	--	--	4	4	--	--	4	4
	Vehicles Exiting System	--	--	0	0	--	--	0	0
EB Slip Ramp Volumes	ML to SL	18	--	48	--	--	--	48	--
	SL to ML	12	--	12	--	--	--	12	--
WB Slip Ramp Volumes	ML to SL	6	--	74	--	--	--	74	--
	SL to ML	0	--	0	--	--	--	0	--
WB Midblock Sinks/Generators	Vehicles Entering System	--	--	7	7	--	--	7	7
	Vehicles Exiting System	--	--	0	0	--	--	0	0

Intersection	Approach Direction	AM							
		Unbalanced Volume		Volume Change		Percent Change		Balanced Volume	
		Volume	Approach Total	Volume	Approach Total	Volume	Approach Total	Volume	Approach Total
19th St & K St	SB	56	522	0	0	0%	0%	56	522
		26		0		0%		26	
		383		0		0%		383	
		15		0		0%		15	
		42		0		0%		42	
	WB	0	603	0	0	0%	0%	0	603
		60		0		0%		60	
		0		0		0%		0	
		0		0		0%		0	
		0		0		0%		0	
		6		0		0%		6	
		505		0		0%		505	
	EB	32	965	0	0	0%	0%	32	965
		0		0		0%		0	
		730		0		0%		730	
		7		0		0%		7	
		8		0		0%		8	
		0		0		0%		0	
		6		0		0%		6	
EB Midblock Sinks/Generators	Vehicles Entering System	--	--	0	--	--	--	0	--
	Vehicles Exiting System	--	--	-135	-135	--	--	-135	-135
EB Slip Ramp Volumes	ML to SL	36	--	117	--	--	--	117	--
	SL to ML	6	--	6	--	--	--	6	--
WB Slip Ramp Volumes	ML to SL	36	--	135	--	--	--	135	--
	SL to ML	6	--	6	--	--	--	6	--
WB Midblock Sinks/Generators	Vehicles Entering System	--	--	0	--	--	--	0	--
	Vehicles Exiting System	--	--	-113	-113	--	--	-113	-113
18th St & K St	WB	138	789	0	0	0%	0%	138	789
		29		0		0%		29	
		0		0		0%		0	
		0		0		0%		0	
		1		0		0%		1	
		6		0		0%		6	
		615		0		0%		615	
	NB	0	947	0	0	0%	0%	0	947
		57		0		0%		57	
		9		0		0%		9	
		788		0		0%		788	
		47		0		0%		47	
	EB	46	710	0	0	0%	0%	46	710
		5		0		0%		5	
		652		0		0%		652	
		10		0		0%		10	
		0		0		0%		0	
		0		0		0%		0	
		3		0		0%		3	
EB Midblock Sinks/Generators	Vehicles Entering System	--	--	0	--	--	--	0	--
	Vehicles Exiting System	--	--	-98	-98	--	--	-98	-98
EB Slip Ramp Volumes	ML to SL	90	--	138	--	--	--	138	--
	SL to ML	42	--	42	--	--	--	42	--
WB Slip Ramp Volumes	ML to SL	90	--	167	--	--	--	167	--
	SL to ML	36	--	18	--	--	--	18	--
WB Midblock Sinks/Generators	Vehicles Entering System	--	--	12	--	--	--	12	--
	Vehicles Exiting System	--	--	-180	-168	--	--	-180	-168
17th W St/Connecticut Ave & K St	SB	110	628	0	0	0%	0%	110	628
		34		0		0%		34	
		478		0		0%		478	
		0		0		0%		0	
		6		0		0%		6	
	WB	132	949	0	0	0%	0%	132	949
		0		0		0%		0	
		0		0		0%		0	
		0		0		0%		0	
		3		0		0%		3	
		76		0		0%		76	
		737		0		0%		737	
	NB	1	764	0	0	0%	0%	1	764
		0		0		0%		0	
		0		0		0%		0	
		710		0		0%		710	
		54		0		0%		54	
	EB	0	700	0	0	0%	0%	0	700
		1		0		0%		1	
		604		0		0%		604	
		0		0		0%		0	
		1		0		0%		1	
		3		0		0%		3	
		0		0		0%		0	
EB Midblock Sinks/Generators	Vehicles Entering System	--	--	0	--	--	--	0	--
	Vehicles Exiting System	--	--	0	--	--	--	0	--
WB Midblock Sinks/Generators	Vehicles Entering System	--	--	0	--	--	--	0	--
	Vehicles Exiting System	--	--	0	--	--	--	0	--

Intersection	Approach Direction	AM							
		Unbalanced Volume		Volume Change		Percent Change		Balanced Volume	
		Volume	Approach Total	Volume	Approach Total	Volume	Approach Total	Volume	Approach Total
17th E St & K St	SB	36	325	5	12	14%	4%	41	337
		66		7		11%		73	
		181		0		0%		181	
		5		0		0%		5	
		37		0		0%		37	
	WB	46	800	0	75	0%	9%	46	875
		63		0		0%		63	
		7		1		14%		8	
		0		0		0%		0	
		0		0		0%		0	
		25		0		0%		25	
		658		74		11%		732	
	NB	1	58	0	1	0%	2%	1	59
		3		1		33%		4	
		3		0		0%		3	
		38		0		0%		38	
		7		0		0%		7	
	EB	7	589	0	78	0%	13%	7	667
		2		0		0%		2	
		473		62		13%		535	
		27		4		15%		31	
		87		12		14%		99	
		0		0		0%		0	
		0		0		0%		0	
EB Midblock Sinks/Generators	Vehicles Entering System	--	--	0	--	--	--	0	-65
	Vehicles Exiting System	--	--	-65	--	--	--	-65	
EB Slip Ramp Volumes	ML to SL	6	--	98	--	--	--	98	--
	SL to ML	24	--	24	--	--	--	24	--
WB Slip Ramp Volumes	ML to SL	78	--	0	--	--	--	0	--
	SL to ML	12	--	116	--	--	--	116	--
WB Midblock Sinks/Generators	Vehicles Entering System	--	--	116	--	--	--	116	
	Vehicles Exiting System	--	--	0	116	--	--	0	116
16th St & K St	SB	51	649	0	0	0%	0%	51	649
		78		0		0%		78	
		453		0		0%		453	
		0		0		0%		0	
		67		0		0%		67	
	WB	146	778	0	0	0%	0%	146	778
		42		0		0%		42	
		1		0		0%		1	
		0		0		0%		0	
		5		0		0%		5	
		23		0		0%		23	
		561		0		0%		561	
	NB	0	335	0	0	0%	0%	0	335
		2		0		0%		2	
		1		0		0%		1	
		308		0		0%		308	
		16		0		0%		16	
	EB	8	557	0	0	0%	0%	8	557
		3		0		0%		3	
		495		0		0%		495	
		5		0		0%		5	
		2		0		0%		2	
		0		0		0%		0	
		1		0		0%		1	
		11		0		0%		11	
		40		0		0%		40	
EB Midblock Sinks/Generators	Vehicles Entering System	--	--	28	--	--	--	28	
	Vehicles Exiting System	--	--	0	28	--	--	0	28
EB Slip Ramp Volumes	ML to SL	12	--	12	--	--	--	12	--
	SL to ML	12	--	25	--	--	--	25	--
WB Slip Ramp Volumes	ML to SL	198	--	347	--	--	--	347	--
	SL to ML	6	--	6	--	--	--	6	--
WB Midblock Sinks/Generators	Vehicles Entering System	--	--	0	--	--	--	0	
	Vehicles Exiting System	--	--	-255	--	--	--	-255	-255

Intersection	Approach Direction	AM							
		Unbalanced Volume		Volume Change		Percent Change		Balanced Volume	
		Volume	Approach Total	Volume	Approach Total	Volume	Approach Total	Volume	Approach Total
15th W St & K St	SB	22	120	0	0	0%	0%	22	120
		16		0		0%		16	
		77		0		0%		77	
		0		0		0%		0	
		5		0		0%		5	
	WB	181	1,036	0	143	0%	14%	181	1,179
		57		0		0%		57	
		0		0		0%		0	
		0		0		0%		0	
		4		1		25%		5	
		13		2		15%		15	
	NB	757	410	136	0	18%	0%	893	410
		24		4		17%		28	
		21		0		0%		21	
		9		0		0%		9	
		364		0		0%		364	
	EB	16	631	0	0	0%	0%	16	631
		0		0		0%		0	
		71		0		0%		71	
		520		0		0%		520	
		0		0		0%		0	
		1		0		0%		1	
		4		0		0%		4	
EB Midblock Sinks/Generators	Vehicles Entering System	--	--	0	0	--	--	0	0
	Vehicles Exiting System	--	--	0	0	--	--	0	0
WB Midblock Sinks/Generators	Vehicles Entering System	--	--	7	7	--	--	7	7
	Vehicles Exiting System	--	--	0	0	--	--	0	0
15th E St & K St	SB	23	109	2	2	9%	2%	25	111
		50		0		0%		50	
		0		0		0%		0	
		12		0		0%		12	
		24		0		0%		24	
	WB	63	928	0	61	0%	7%	63	989
		104		7		7%		111	
		10		0		0%		10	
		0		0		0%		0	
		1		0		0%		1	
		37		3		8%		40	
	NB	713	440	51	4	7%	1%	764	444
		0		0		0%		0	
		117		0		0%		117	
		51		4		8%		55	
		199		0		0%		199	
	EB	33	516	0	28	0%	5%	33	544
		40		0		0%		40	
		43		2		5%		45	
		429		23		5%		452	
		44		3		7%		47	
		0		0		0%		0	
		0		0		0%		0	
EB Midblock Sinks/Generators	Vehicles Entering System	--	--	0	-50	--	--	0	-50
	Vehicles Exiting System	--	--	-50	--	--	--	-50	--
EB Slip Ramp Volumes	ML to SL	12	--	63	--	--	--	63	--
	SL to ML	12	--	12	--	--	--	12	--
WB Midblock Sinks/Generators	Vehicles Entering System	--	--	1	1	--	--	1	1
	Vehicles Exiting System	--	--	0	0	--	--	0	0

Intersection	Approach Direction	AM							
		Unbalanced Volume		Volume Change		Percent Change		Balanced Volume	
		Volume	Approach Total	Volume	Approach Total	Volume	Approach Total	Volume	Approach Total
14th St & K St	SB	26	664	0	0	0%	0%	26	664
		40		0		0%		40	
		567		0		0%		567	
		0		0		0%		0	
		31		0		0%		31	
	WB	102	822	0	0	0%	0%	102	822
		73		0		0%		73	
		0		0		0%		0	
		0		0		0%		0	
		4		0		0%		4	
	NB	24	875	0	0	0%	0%	24	875
		617		0		0%		617	
		2		0		0%		2	
		148		0		0%		148	
		60		0		0%		60	
13th St & K St	EB Midblock Sinks/Generators	Vehicles Entering System	--	0	0	--	--	0	0
		Vehicles Exiting System	--	0		--		0	
	WB Slip Ramp Volumes	ML to SL	24	20	--	--	--	20	--
		SL to ML	0	0		--		0	
	WB Midblock Sinks/Generators	Vehicles Entering System	--	23	23	--	--	23	23
		Vehicles Exiting System	--	0		--		0	
	SB	36	970	0	5	0%	1%	36	975
		60		5		8%		65	
		854		0		0%		854	
		0		0		0%		0	
		20		0		0%		20	
	WB	100	602	0	37	0%	6%	100	639
		47		0		0%		47	
		3		1		33%		4	
		0		0		0%		0	
		5		0		0%		5	
	NB	20	580	0	11	0%	2%	20	591
		418		36		9%		454	
		9		0		0%		9	
		133		11		8%		144	
		29		0		0%		29	
	EB	384	475	0	11	0%	9%	384	517
		33		0		0%		33	
		1		0		0%		1	
		0		0		0%		0	
		342		30		9%		372	
12th St & K St	EB Midblock Sinks/Generators	Vehicles Entering System	--	11	2	--	--	11	2
		Vehicles Exiting System	--	9		--		-9	
	EB Slip Ramp Volumes	ML to SL	6	20	--	--	--	20	--
		SL to ML	12	12		--		12	
	WB Slip Ramp Volumes	ML to SL	18	13	--	--	--	13	--
		SL to ML	0	0		--		0	
	WB Midblock Sinks/Generators	Vehicles Entering System	--	12	12	--	--	12	12
		Vehicles Exiting System	--	0		--		0	
	WB	0	391	0	27	0%	7%	0	418
		0		0		0%		0	
		0		0		0%		0	
		46		0		0%		46	
		35		27		77%		62	
	NB	310	881	0	28	0%	3%	310	909
		0		0		0%		0	
		191		0		0%		191	
		36		28		78%		64	
		574		0		0%		574	
	EB	80	428	0	0	0%	0%	80	428
		0		0		0%		0	
		90		0		0%		90	
		327		0		0%		327	
		0		0		0%		0	
	EB Midblock Sinks/Generators	0	--	0	-66	--	--	0	-66
		Vehicles Entering System	--	-66		--		-66	
	WB Midblock Sinks/Generators	Vehicles Entering System	--	15	15	--	--	15	15
		Vehicles Exiting System	--	0		--		0	

Intersection	Approach Direction	AM												
		Unbalanced Volume		Volume Change		Percent Change		Balanced Volume						
		Volume	Approach Total	Volume	Approach Total	Volume	Approach Total	Volume	Approach Total					
11th St & K St	SB	0	553	0	0	0%	0%	0	553					
		105		0		0%		105						
		435		0		0%		435						
		0		0		0%		0						
		13		0		0%		13						
	WB	0	257	0	0	0%	0%	0	257					
		0		0		0%		0						
		0		0		0%		0						
		0		0		0%		0						
		21		0		0%		21						
	NB	0	362	0	0	0%	0%	0	362					
		197		0		0%		197						
		39		0		0%		39						
		101		0		0%		101						
		0		0		0%		0						
10th St & K St	EB	214	352	0	0	0%	0%	214	352					
		47		0		0%		47						
		0		0		0%		0						
		72		0		0%		72						
		178		0		0%		178						
	SB	0	448	0	0	0%	0%	0	448					
		102		0		0%		102						
		0		0		0%		0						
		0		0		0%		0						
		24		0		0%		24						
	WB	0	112	0	0	0%	0%	0	112					
		0		0		0%		0						
		0		0		0%		0						
		0		0		0%		0						
		103		0		0%		103						
	EB	9	232	0	0	0%	0%	9	232					
		0		0		0%		0						
		99		0		0%		99						
		0		0		0%		0						
		133		0		0%		133						
9th St & K St	SB	0	1,065	0	0	0%	0%	0	1,065					
		124		0		0%		124						
		941		0		0%		941						
		0		0		0%		0						
		0		0		0%		0						
	EB	0	65	0	0	0%	0%	0	65					
		65		0		0%		65						
		0		0		0%		0						
		0		0		0%		0						
		0		0		0%		0						
K Street Intersection Total Volume Balance Summary														
AM Unbalanced Volume		VI Volume Input Change To		AM Percent Change		AM Balanced Volume								
K Street NW Intersections only Total Volume Balance Summary		33,512		902		3%		32,728						

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

**Attachment E:
AM Balancing Notes**

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

Attachment E - Location-Specific Volume Balancing Adjustments, AM Peak Hour

General Methodology:

The volume balancing methodology used in this effort was as follows:

1. Where recorded TMCs show a volume imbalance between two intersections, the imbalance was attributed to midblock generators and sinks. Where segment configuration, existing conditions such as the absence of midblock slip ramps and on-street parking, and/or field observations did not justify the midblock addition/removal of vehicles, vehicle trips were proportionally added or removed to the movements entering/exiting each link;
2. Where TMCs were revised to achieve balance between intersections, TMCs were adjusted upward to match the higher of the two volumes as a conservative measure (where possible);
3. Volumes on adjacent cross-street study intersections (I Street and L Street) were revised to match corresponding balanced volumes to or from K Street.

Main Line – “ML” and Service Lane – “SL”

Notes on Volume Balancing along Segments with Large Volume Variances by Intersection AM Peak Hour

- Between 21st Street and 20th Street
 - Field observations showed a significant number of illegal midblock left-turn maneuvers from the EB ML into the WB SL
 - These maneuvers were removed from the network to achieve balanced volumes and due to how proximate this segment is to the western “edge” of the network
 - WB
 - Unbalanced Volumes:
 - 20th Street: 505 vehicles entering ML and 60 vehicles entering SL
 - 21st Street: 506 vehicles exiting ML and 282 vehicles exiting SL
 - Imbalance: +1 ML difference, +222 SL difference; net +223
 - ML Balancing:
 - 1 additional vehicle generated midblock
 - SL Balancing:
 - 174 vehicles (removed from the EB ML to account for illegal left-turn maneuvers) were removed from the SL WBT movement at the 21st Street intersection;
 - 48 vehicles generated midblock
 - EB
 - Unbalanced Volumes:
 - 21st Street: 858 vehicles entering ML and 214 vehicles entering SL
 - 20th Street: 761 vehicles exiting ML and 122 vehicles exiting SL
 - Imbalance: -97 ML difference, -92 SL difference; net -189

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

- ML Balancing:
 - Field observations indicate a significant number of EB ML traffic turns left midblock into the WB SL; therefore, 174 vehicles were proportionally removed from turning movements into the ML from the 21st Street intersection
- SL Balancing:
 - 15 vehicles were removed from system (on-street parking)
- Between 17th Street W and 17th Street E
 - WB
 - Unbalanced Volumes:
 - 17th Street E: 734 vehicles entering ML and 127 vehicles entering SL,
 - 17th Street W: 817 vehicles exiting ML and 132 vehicles exiting SL
 - Imbalance: +83 ML difference, +5 SL difference; net +88
 - ML Balancing:
 - 83 vehicles were proportionally added to turning movements entering the WB ML from the 17th Street E intersection
 - SL Balancing:
 - 5 vehicles added to volumes entering SL from 17th Street E intersection
 - EB
 - Unbalanced Volumes:
 - 17th Street W: 667 vehicles entering segment, and
 - 17th Street E: 589 vehicles exiting
 - Imbalance: -78 difference
 - ML Balancing:
 - 78 vehicles were proportionally added to turning movements approaching 17th Street E intersection
- Between 15th Street W and 15th Street E
 - WB
 - Unbalanced Volumes:
 - 15th Street E: 890 vehicles entering ML and 215 vehicles entering SL,
 - 15th Street W: 798 vehicles exiting ML and 238 vehicles exiting SL
 - Imbalance: -92 ML difference, +23 SL difference; net -69
 - ML Balancing:
 - Upstream volume balancing between 15th Street E and 14th Street increases ML difference by 51 vehicles (existing imbalance -92, imbalance attributed to upstream balancing -51; -143 net)
 - 143 vehicles proportionally added to turning movements exiting segment at 15th Street W intersection
 - SL Balancing:
 - Upstream volume balancing between 15th Street E and 14th Street decreases SL difference by 3 vehicles
 - 7 vehicles generated midblock from on-street parking

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

- 13 proportionally added to movements entering SL from 15th Street E
- EB
 - Unbalanced Volumes:
 - 15th Street W: 544 vehicles entering ML
 - 15th Street E: 516 vehicles exiting ML
 - Imbalance: -28 vehicle difference
 - Balancing:
 - 28 vehicles proportionally added to turning movements exiting segment at the 15th Street E intersection
- Between 15th Street E and 14th Street
 - WB
 - Unbalanced Volumes:
 - 14th Street: 805 vehicles entering ML and 183 vehicles entering SL
 - 15th Street E: 751 vehicles exiting ML and 177 vehicles exiting SL
 - Imbalance: -54 vehicle ML difference, -6 SL difference; net -60
 - ML Balancing:
 - 54 vehicles proportionally added to turning movements exiting segment at 15th Street E intersection
 - SL Balancing:
 - Volume balancing downstream decreases SL difference by 7 vehicles (existing SL imbalance -6, imbalance attributed to downstream balancing +7; net 1)
 - 1 vehicle generated midblock from on-street parking
 - EB
 - Unbalanced Volumes:
 - 15th Street E: 486 entering ML and 96 entering SL
 - 14th Street: 458 exiting ML and 100 exiting SL
 - Imbalance: -28 ML difference, +4 SL difference; net -24
 - ML Balancing:
 - Volume balancing upstream of intersection (between 15th Street W and 15th Street E) increases volume imbalance in ML by 23 vehicles (existing ML imbalance -28, imbalance attributed to upstream balancing -23; net -51)
 - SL Balancing:
 - Volume balancing upstream of intersection (between 15th Street W and 15th Street E) decreases volume imbalance in SL by 3 vehicles (existing SL imbalance +4, imbalance attributed to upstream balancing -3; net +1)
 - 50 vehicles were removed from ML and system
- Between 14th Street and 13th Street
 - WB
 - Unbalanced Volumes:
 - 13th Street: 614 entering ML and 132 entering SL

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

- 14th Street: 647 exiting ML and 175 exiting SL
- Imbalance: +33 ML difference, +43 in the SL difference; net +76
- ML Balancing:
 - 53 vehicles added proportionally to turning movements entering the ML from 13th Street intersection
 - 20 vehicles routed to SL
- SL Balancing:
 - 23 vehicles generated midblock from on-street parking
 - ML balancing decreases SL imbalance by 20 vehicles
 - Vehicles were not added to movements entering SL to maintain consistency with field observations in which travel from the SL to the ML was minimal
- EB
 - Unbalanced Volumes:
 - 14th Street: 517 entering ML
 - 13th Street: 475 exiting ML
 - Imbalance: -42 difference
 - Balancing:
 - 42 vehicles proportionally added to turning movements exiting segment at the 13th Street intersection
- Between 13th Street and 12th Street
 - WB
 - Unbalanced Volumes:
 - 12th Street: 501 entering ML and 71 entering SL,
 - 13th Street: 452 exiting ML and 150 exiting SL
 - Imbalance: -49 ML difference, +79 SL difference; net +30
 - ML Balancing:
 - Downstream balancing (between 14th Street and 13th Street) decreases ML difference by 36 (existing ML balance -49, imbalance attributed to downstream balancing +36; net -13)
 - Midblock lefts and ML difference routed to the SL (13 vehicles from ML to SL)
 - SL Balancing:
 - Downstream balancing (between 14th Street and 13th Street) increases SL difference by 1 (existing SL imbalance +79, imbalance attributed to downstream balancing +1; net +80)
 - ML balancing decreases imbalance by 13 vehicles
 - 12 vehicles generated from on-street parking
 - 55 vehicles proportionally added to TMCs entering the SL link from the 12th Street intersection

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

Attachment F:
AM Approach and Departure Summary and
Comparison

Highlighting Key:		%	absolute percent change is 10% or greater.																		
Cross Street	Block Length (ft)	Unbalanced AM						Balanced AM						North Side of K St (WB Direction of Travel) Midblock Notes*	South Side of K St (EB Direction of Travel) Midblock Notes*						
		WB Departure (combines ML & SL volumes)	WB Delta Difference	%	WB Approach (combines ML & SL volumes)	EB Approach (combines ML & SL volumes)	EB Delta Difference	%	EB Departure (combines ML & SL volumes)	WB Midblock Vehicles Added/Removed	WB Departure (combines ML & SL volumes)	WB Delta Difference	%	WB Approach (combines ML & SL volumes)	EB Midblock Vehicles Added/Removed	EB Approach (combines ML & SL volumes)	EB Delta Difference	%	EB Departure (combines ML & SL volumes)		
22nd																					
delta (SL ONLY)	530	-97	-24%		788	1,140	-118	-27%	1,072	77	762	0	0%	-124	976	0	0%	898	Two garage driveways and one alley driveway/266 spaces	Two garage driveways/unknown # of spaces	
21st		936	223	39%						49		0	0%	614	-15	976	0	0%	898	One garage driveway/200 spaces	No midblock driveways.
delta	415	565	223	39%	660	883	-189	-18%	961	7	565	0	0%	660	883	0	0%	961	No midblock driveways.	One garage driveway, and one alley driveway present/225 spaces	
20th		7	1%		603	965	4	0%	845	-113		0	0%	603	965	0	0%	845	One garage driveway/200 spaces	Two separate and adjacent garage driveways present/300 spaces	
19th		653	-113	-16%			-135	-16%		-113		0	0%	-135	716	0	0%	798	One garage driveway and one alley driveway/279 spaces	Two garage driveways and one alley driveway/433 spaces	
18th		716	716	0%	789	710	-98	-12%	798	-168		0	0%	-98	716	0	0%	798	No midblock driveways.	No midblock driveways.	
delta	520	-168	-18%		789	710	-98	-12%	798	-168		0	0%	-98	700	0	0%	667	One garage driveway/200 spaces	Two separate and adjacent garage driveways present/300 spaces	
17th W/CT		957	88	10%	949	700	-78	-12%	667	0	957	0	0%	949	0	0%	0	667	No midblock driveways.	No midblock driveways.	
17th E	160	861	41	5%	800	589	1	0%	556	116	949	0	0%	875	667	0	0%	622	One garage driveway and one alley driveway/200 spaces	One alley driveway.	
delta	460	759	-117	-13%		778	557	28	5%	603	-255	759	0	0%	778	557	0	0%	603	One garage/drive way/114 spaces	One alley/drive way.
16th		895	-69	-6%	1,036	631	-28	-5%	544	7	1,033	0	0%	1,179	631	0	0%	544	No midblock driveways.	No midblock driveways.	
15th W		1,105	-60	-6%	928	516	-24	-4%	582	1	1,172	0	0%	989	544	0	0%	608	No midblock driveways.	One alley/garage driveway/430 spaces	
15th E/VT		355	988	76	10%	822	558	-42	-8%	517	23	988	0	0%	822	558	0	0%	517	No midblock driveways.	No midblock driveways.
14th		746	30	5%	602	475	32	8%	396	12	799	0	0%	639	517	0	0%	426	No midblock driveways.	No midblock driveways.	
13th		572	-12	-3%	391	428	-66	-16%	418	15	627	0	0%	418	428	0	0%	418	No midblock driveways.	No midblock driveways.	
delta	200	403	-10	-4%	257	352	-6	-3%	238	-10	403	0	0%	257	352	0	0%	238	No midblock driveways.	One garage driveway/unknown # of spaces	
11th		267	-12	-10%	112	232	-58	-47%	123	-12	267	0	0%	112	232	0	0%	123	No midblock driveways.	One alley driveway	
10th		124	0	0%	65	0	0	0%	0	124	0	0%	0	65	0	0%	0	No midblock driveways.	One garage driveway/154 spaces		
delta	480	-12	-10%																		
9th		124	0	0%	65	0	0	0%	0	124	0	0%	0	65	0	0%	0	0	0	0	

*Note: number of garage spaces based on "LoadingZones_Transitway" and "Parking Garages" files shared with G/S and if garage found to have midblock access point on K Street

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

Attachment G:
PM Intersection Movements Comparison

Intersection	Approach Direction	Movement	PM							
			Unbalanced Volume		Volume Change		Percent Change		Balanced Volume	
			Volume	Approach Total	Volume	Approach Total	Volume	Approach Total	Volume	Approach Total
22nd St & K St	WB	SL WBR	92	342	0	0	0%	0%	92	342
		SL WBT	179		0		0%		179	
		WBL (to ML)	0		0		0%		0	
		SL WBU to EB SL	71		0		0%		71	
		ML WBR	0		0		0%		0	
		ML WBR (to SL)	0		0		0%		0	
		ML WBT	0		0		0%		0	
		ML WBL	0		0		0%		0	
	NB	NBL (to ML)	0	292	0	0	0%	0%	0	292
		NBL (to SL)	13		0		0%		13	
		NBT	247		0		0%		247	
		NBR (to ML)	0		0		0%		0	
		NBR (to SL)	32		0		0%		32	
	EB	ML EBL	0	128	0	0	0%	0%	0	128
		ML EBT	0		0		0%		0	
		ML EBR (to SL)	0		0		0%		0	
		ML EBR	0		0		0%		0	
		SL EBL	21		0		0%		21	
		SL EBL (to ML)	0		0		0%		0	
		SL EBT	107		0		0%		107	
		SL EBR	0		0		0%		0	
EB Midblock Sinks/Generators	Vehicles Entering System	--	--	--	23	23	--	--	23	23
	Vehicles Exiting System	--	--		0		--		0	
21st St & K St	WB	Vehicles Entering System	--	864	42	42	--	--	42	857
		Vehicles Exiting System	--		0		--		0	
		SBR (to SL)	42		0		0%	-1%	42	
		SBR (to ML)	203		0		0%		203	
		SBT	516		0		0%		516	
		SBL (to SL)	33	1,264	0	-7	0%		33	
		SBL (to ML)	70		-7		-10%		63	
		SL WBR	0		0		0%		0	
		SL WBT	214		0		0%		214	
		WBL (to ML)	1		0		0%		1	
	EB	Vehicles Entering System	--	527	0	-36	--	-7%	0	491
		Vehicles Exiting System	--		-15		--		-15	
		ML EBL	0		0		0%		0	
		ML EBT	289		-31		-11%		258	
		ML EBR (to SL)	0		0		0%		0	
EB Slip Ramp Volumes	WB	ML EBR	0	1,102	0	0	0%	-7%	0	491
		SL EBL	0		0		0%		0	
		SL EBL (to ML)	49		-5		-10%		44	
		SL EBT	83		0		0%		83	
		SL EBR	106		0		0%		106	
		ML to SL	--	639	25	--	--	--	25	--
		SL to ML	--		52		--		52	
		ML to SL	--		54		--		54	
		SL to ML	--		106		--		106	
	WB	Vehicles Entering System	--	1,102	211	211	--	--	211	1,102
		Vehicles Exiting System	--		0		--		0	
		SL WBR	176		0		0%		176	
		SL WBT	40		0		0%		40	
		WBL (to ML)	1		0		0%		1	
20th St & K St	NB	SL WBL	0	639	0	0	0%	0%	0	639
		ML WBR	6		0		0%		6	
		ML WBR (to SL)	5		0		0%		5	
		ML WBT	874		0		0%		874	
		ML WBL	0		0		0%		0	
		NBL (to ML)	122	466	0	0	0%	0%	122	466
		NBL (to SL)	11		0		0%		11	
		NBT	385		0		0%		385	
		NBR (to ML)	62		0		0%		62	
		NBR (to SL)	59		0		0%		59	
	EB	ML EBL	18	466	0	0	0%	0%	18	466
		ML EBT	369		0		0%		369	
		ML EBR (to SL)	5		0		0%		5	
		ML EBR	0		0		0%		0	
		SL EBL	0		0		0%		0	
EB Slip Ramp Volumes	Vehicles Entering System	--	--	85	85	85	--	--	85	85
	Vehicles Exiting System	--	--		0		--		0	
	ML to SL	--	36		36		--		36	
	SL to ML	--	24		40		--		40	
WB Slip Ramp Volumes	ML to SL	--	42	11	44	--	--	--	44	

Intersection	Approach Direction	Movement	PM							
			Unbalanced Volume		Volume Change		Percent Change		Balanced Volume	
			Volume	Approach Total	Volume	Approach Total	Volume	Approach Total	Volume	Approach Total
19th St & K St	SB	SBR (to SL)	55	872	9	9	16%	1%	64	881
		SBR (to ML)	74		0		0%		74	
		SBT	683		0		0%		683	
		SBL (to SL)	6		0		0%		6	
		SBL (to ML)	54		0		0%		54	
	WB	SL WBR	0	952	0	19	0%	2%	0	971
		SL WBT	87		15		17%		102	
		WBL (to ML)	0		0		0%		0	
		SL WBL	0		0		0%		0	
		ML WBR	0		0		0%		0	
		ML WBR (to SL)	22		4		18%		26	
		ML WBT	825		0		0%		825	
	EB	ML EBL	0	654	0	0	0%	0%	0	654
		ML EBT	429		0		0%		429	
		ML EBR (to SL)	6		0		0%		6	
		ML EBR	3		0		0%		3	
		SL EBL	0		0		0%		0	
		SL EBL (to ML)	0		0		0%		0	
		SL EBT	40		0		0%		40	
		SL EBR	176		0		0%		176	
18th St & K St	EB Midblock Sinks/Generators	Vehicles Entering System	--	--	15	-10	--	--	15	-10
		Vehicles Exiting System	--	--	-25		--		-25	
	EB Slip Ramp Volumes	ML to SL	18	--	43	--	--	--	43	--
		SL to ML	36		36		--		36	
	WB Slip Ramp Volumes	ML to SL	54	--	107	--	--	--	107	--
		SL to ML	30		34		--		34	
	WB Midblock Sinks/Generators	Vehicles Entering System	--	--	70	17	--	--	70	17
		Vehicles Exiting System	--		-53		--		-53	
	WB	SL WBR	94	917	0	0	0%	0%	94	917
		SL WBT	10		0		0%		10	
		WBL (to ML)	0		0		0%		0	
		SL WBL	0		0		0%		0	
		ML WBR	1		0		0%		1	
		ML WBR (to SL)	1		0		0%		1	
		ML WBT	811		0		0%		811	
	NB	NBL (to ML)	131	725	0	0	0%	0%	131	725
		NBL (to SL)	1		0		0%		1	
		NBT	486		0		0%		486	
		NBR (to ML)	70		0		0%		70	
		NBR (to SL)	37		0		0%		37	
	EB	ML EBL	1	525	0	0	0%	0%	1	525
		ML EBT	467		0		0%		467	
		ML EBR (to SL)	8		0		0%		8	
		ML EBR	0		0		0%		0	
		SL EBL	0		0		0%		0	
		SL EBL (to ML)	3		0		0%		3	
		SL EBT	46		0		0%		46	
		SL EBR	0		0		0%		0	
17th W St/Connecticut Ave & K St	EB Midblock Sinks/Generators	Vehicles Entering System	--	--	239	239	--	--	239	239
		Vehicles Exiting System	--		0		--		0	
	EB Slip Ramp Volumes	ML to SL	30	--	30	--	--	--	30	--
		SL to ML	48		225		--		225	
	WB Slip Ramp Volumes	ML to SL	36	--	70	--	--	--	70	--
		SL to ML	108		0		--		0	
	WB Midblock Sinks/Generators	Vehicles Entering System	--	--	0	-143	--	--	0	-143
		Vehicles Exiting System	--		-143		--		-143	
	SB	SBR (to SL)	81	879	0	0	0%	0%	81	879
		SBR (to ML)	74		0		0%		74	
		SBT	712		0		0%		712	
		SBL (to SL)	0		0		0%		0	
		SBL (to ML)	12		0		0%		12	
	WB	SL WBR	188	1,121	0	0	0%	0%	188	1,121
		SL WBT	0		0		0%		0	
		WBL (to ML)	0		0		0%		0	
		SL WBL	0		0		0%		0	
		ML WBR	2		0		0%		2	
		ML WBR (to SL)	96		0		0%		96	
		ML WBT	807		0		0%		807	
	NB	ML WBL	28		0		0%		28	
		NBL (to ML)	2	647	0	0	0%	0%	2	647
		NBL (to SL)	0		0		0%		0	
		NBT	589		0		0%			

Intersection	Approach Direction	Movement	PM							
			Unbalanced Volume		Volume Change		Percent Change		Balanced Volume	
			Volume	Approach Total	Volume	Approach Total	Volume	Approach Total	Volume	Approach Total
17th E St & K St	SB	SBR (to SL)	19	303	10	26	53%	9%	29	329
		SBR (to ML)	74		16		22%		90	
		SBT	169		0		0%		169	
		SBL (to SL)	3		0		0%		3	
		SBL (to ML)	38		0		0%		38	
	WB	SL WBR	70	862	0	173	0%	20%	70	1,035
		SL WBT	88		23		26%		111	
		WBL (to ML)	2		0		0%		2	
		SL WBL	0		0		0%		0	
		ML WBR	0		0		0%		0	
		ML WBR (to SL)	31		8		26%		39	
		ML WBT	671		142		21%		813	
	NB	ML WBL	0	174	0	7	0%	4%	0	181
		NBL (to ML)	23		5		22%		28	
		NBL (to SL)	7		2		29%		9	
		NBT	120		0		0%		120	
		NBR (to ML)	10		0		0%		10	
	EB	NBR (to SL)	14		0	133	0%	20%	14	796
		ML EBL	2		0		0%		2	
		ML EBT	588		118		20%		706	
		ML EBR (to SL)	13		3		23%		16	
		ML EBR	60		12		20%		72	
		SL EBL	0		0		0%		0	
		SL EBL (to ML)	0		0		0%		0	
EB Midblock Sinks/Generators	Vehicles Entering System	SL EBT	0	663	0	133	0%	20%	0	796
		SL EBR	0		0		0%		0	
	Vehicles Exiting System	--	--		-130		--	--	-130	-130
		--	--		0		--		0	
	EB Slip Ramp Volumes	ML to SL	24		151		--	--	151	--
		SL to ML	12		12		--		12	
	WB Slip Ramp Volumes	ML to SL	120		0		--	--	0	--
		SL to ML	36		165		--		165	
16th St & K St	WB Midblock Sinks/Generators	Vehicles Entering System	--	183	--	183	--	--	183	183
		Vehicles Exiting System	--		0		--		0	
		SBR (to SL)	35		0	0	0%	0%	35	551
		SBR (to ML)	70		0		0%		70	
		SBT	331		0		0%		331	
	WB	SBL (to SL)	2	898	0		0%	0%	2	898
		SBL (to ML)	113		0		0%		113	
		SL WBR	158		0		0%		158	
		SL WBT	77		0		0%		77	
		WBL (to ML)	2		0		0%		2	
		SL WBL	0		0		0%		0	
		ML WBR	0		0		0%		0	
	NB	ML WBR (to SL)	53	330	0	0	0%	0%	53	330
		ML WBT	607		0		0%		607	
		ML WBL	1		0		0%		1	
		NBL (to ML)	8		0		0%		8	
		NBL (to SL)	0		0		0%		0	
	EB	NBT	280	657	0	0	0%	0%	280	657
		NBR (to ML)	23		0		0%		23	
		NBR (to SL)	19		0		0%		19	
		ML EBL	6		0		0%		6	
		ML EBT	606		0		0%		606	
		ML EBR (to SL)	3		0		0%		3	
EB Midblock Sinks/Generators	Vehicles Entering System	ML EBR	0	82	--	70	--	--	82	70
		Vehicles Exiting System	--		-12		--		-12	
	EB Slip Ramp Volumes	ML to SL	18	--	18	--	--	--	18	--
		SL to ML	6		97		--		97	
	WB Slip Ramp Volumes	ML to SL	120	--	213	--	--	--	213	--
		SL to ML	144		0		--		0	
	WB Midblock Sinks/Generators	Vehicles Entering System	--	--	0	-99	--	--	0	-99
		Vehicles Exiting System	--		-99		--		-99	

Intersection	Approach Direction	Movement	PM							
			Unbalanced Volume		Volume Change		Percent Change		Balanced Volume	
			Volume	Approach Total	Volume	Approach Total	Volume	Approach Total	Volume	Approach Total
15th W St & K St	SB	SBR (to SL)	24	244	0	0	0%	0%	24	244
		SBR (to ML)	64		0		0%		64	
		SBT	148		0		0%		148	
		SBL (to SL)	0		0		0%		0	
		SBL (to ML)	8		0		0%		8	
	WB	SL WBR	135	890	17	182	13%	20%	152	1,072
		SL WBT	30		4		13%		34	
		WBL (to ML)	0		0		0%		0	
		SL WBL	0		0		0%		0	
		ML WBR	7		2		29%		9	
	NB	ML WBR (to SL)	47		10		21%	0%	57	374
		ML WBT	630		140		22%		770	
		ML WBL	41		9		22%		50	
		NBL (to ML)	40	374	0	0	0%		40	
		NBL (to SL)	8		0		0%		8	
15th E St & K St	EB	NBT	310		0		0%	0%	310	841
		NBR (to ML)	16		0		0%		16	
		NBR (to SL)	0		0		0%		0	
		ML EBL	1		0	20	0%		1	
		ML EBT	785		20		3%		805	
	WB	ML EBR (to SL)	0		0		0%	2%	0	841
		ML EBR	17		0		0%		17	
		SL EBL	0		0		0%		0	
		SL EBL (to ML)	0		0		0%		0	
		SL EBT	0		0		0%		0	
EB Midblock Sinks/Generators	Vehicles Entering System	SL EBR	18	821	0		0%	2%	18	841
		--	--		0		--		0	
	Vehicles Exiting System	--	--		0		--		0	
		--	--		0		--		0	
	WB Midblock Sinks/Generators	Vehicles Entering System	--		0		--		0	
		Vehicles Exiting System	--		-5		--		-5	
		--	--		--		--		--	
		SBR (to SL)	28	170	0	0	0%	0%	28	170
		SBR (to ML)	62		0		0%		62	
EB Slip Ramp Volumes	SB	SBT	0		0		0%		0	
		SBL (to SL)	33		0		0%		33	
		SBL (to ML)	47		0		0%		47	
		SL WBR	56	840	7	118	13%	14%	63	958
		SL WBT	99		13		13%		112	
	WB	WBL (to ML)	1		0		0%		1	
		SL WBL	0		0		0%		0	
		ML WBR	0		0		0%		0	
		ML WBR (to SL)	28		4		14%		32	
		ML WBT	656		94		14%		750	
WB Midblock Sinks/Generators	NB	ML WBL	0	279	0	0	0%	0%	0	279
		NBL (to ML)	73		0		0%		73	
		NBL (to SL)	19		0		0%		19	
		NBT	135		0		0%		135	
		NBR (to ML)	30		0		0%		30	
	EB	NBR (to SL)	22	829	0	0	0%	0%	22	829
		ML EBL	84		0		0%		84	
		ML EBT	673		0		0%		673	
		ML EBR (to SL)	72		0		0%		72	
		ML EBR	0		0		0%		0	
EB Midblock Sinks/Generators	Vehicles Entering System	SL EBL	0	--	69	6	--	--	69	6
		--	--		-63		--		-63	
	ML to SL	--	12	--	675	--	--	--	675	--
		SL to ML	6		6		--		6	
WB Midblock Sinks/Generators	Vehicles Entering System	--	--	--	0	-9	--	--	0	-9
		--	--		-9		--		-9	

Intersection	Approach Direction	Movement	PM							
			Unbalanced Volume		Volume Change		Percent Change		Balanced Volume	
			Volume	Approach Total	Volume	Approach Total	Volume	Approach Total	Volume	Approach Total
14th St & K St	SB	SBR (to SL)	30	710	0	0	0%	0%	30	710
		SBR (to ML)	23		0		0%		23	
		SBT	629		0		0%		629	
		SBL (to SL)	0		0		0%		0	
		SBL (to ML)	28		0		0%		28	
	WB	SL WBR	66	860	0	0	0%	0%	66	860
		SL WBT	116		0		0%		116	
		WBL (to ML)	1		0		0%		1	
		SL WBL	0		0		0%		0	
		ML WBR	2		0		0%		2	
		ML WBR (to SL)	12		0		0%		12	
		ML WBT	660		0		0%		660	
	NB	ML WBL	3		0		0%		3	
		NBL (to ML)	98	729	0	0	0%	0%	98	729
		NBL (to SL)	27		0		0%		27	
		NBT	565		0		0%		565	
		NBR (to ML)	39		0		0%		39	
	EB	NBR (to SL)	0		0		0%		0	
		ML EBL	4	883	0	0	0%	0%	4	883
		ML EBT	658		0		0%		658	
		ML EBR (to SL)	0		0		0%		0	
		ML EBR	19		0		0%		19	
		SL EBL	0		0		0%		0	
		SL EBL (to ML)	6		0		0%		6	
		SL EBT	0		0		0%		0	
EB Midblock Sinks/Generators		SL EBR	196		0		0%		196	
		Vehicles Entering System	--		0		--		0	
	WB Slip Ramp Volumes	Vehicles Exiting System	--		0		--		0	
		ML to SL	--		35		--		35	
WB Midblock Sinks/Generators		SL to ML	--		1		--		1	
		Vehicles Entering System	--		18		--		18	
		Vehicles Exiting System	--		0		--		0	
13th St & K St	SB	SBR (to SL)	42	694	0	0	0%	0%	42	694
		SBR (to ML)	74		0		0%		74	
		SBT	552		0		0%		552	
		SBL (to SL)	0		0		0%		0	
		SBL (to ML)	26		0		0%		26	
	WB	SL WBR	46	587	0	0	0%	0%	46	587
		SL WBT	52		0		0%		52	
		WBL (to ML)	4		0		0%		4	
		SL WBL	0		0		0%		0	
		ML WBR	2		0		0%		2	
		ML WBR (to SL)	19		0		0%		19	
		ML WBT	463		0		0%		463	
	NB	ML WBL	1		0		0%		1	
		NBL (to ML)	170	678	0	0	0%	0%	170	678
		NBL (to SL)	18		0		0%		18	
		NBT	473		0		0%		473	
		NBR (to ML)	14		0		0%		14	
	EB	NBR (to SL)	3		0		0%		3	
		ML EBL	14	683	1	48	7%	7%	15	731
		ML EBT	584		41		7%		625	
		ML EBR (to SL)	0		0		0%		0	
		ML EBR	85		6		7%		91	
		SL EBL	0		0		0%		0	
		SL EBL (to ML)	0		0		0%		0	
		SL EBT	0		0		0%		0	
EB Midblock Sinks/Generators		SL EBR	0		0		0%		0	
		Vehicles Entering System	--		3		--		3	
	EB Slip Ramp Volumes	Vehicles Exiting System	--		-16		--		-16	
		ML to SL	--		19		--		19	
WB Slip Ramp Volumes		SL to ML	--		6		--		6	
		ML to SL	--		13		--		13	
WB Midblock Sinks/Generators		SL to ML	--		30		--		30	
		Vehicles Entering System	--		17		--		17	
	WB	Vehicles Exiting System	--		0		--		0	
		SL WBR	0	394	0	24	0%	6%	0	418
		SL WBT	0		0		0%		0	
		WBL (to ML)	0		0		0%		0	
		SL WBL	0		0		0%		0	
		ML WBR	49		0		0%		49	
		ML WBR (to SL)	37		24		65%		61	
		ML WBT	308		0		0%		308	
		ML WBL	0		0		0%		0	
		NBL (to ML)	160		0		0%		160	
12th St & K St										

Intersection	Approach Direction	Movement	PM								
			Unbalanced Volume		Volume Change		Percent Change		Balanced Volume		
			Volume	Approach Total	Volume	Approach Total	Volume	Approach Total	Volume	Approach Total	
11th St & K St	SB	SBR (to SL)	0	524	0	14	0%	3%	0	538	
		SBR (to ML)	53		14		26%		67		
		SBT	437		0		0%		437		
		SBL (to SL)	0		0		0%		0		
		SBL (to ML)	34		0		0%		34		
	WB	SL WBR	0	186	0	39	0%	21%	0	225	
		SL WBT	0		0		0%		0		
		WBL (to ML)	0		0		0%		0		
		SL WBL	0		0		0%		0		
		ML WBR	20		0		0%		20		
		ML WBR (to SL)	0		0		0%		0		
		ML WBT	153		39		25%		192		
	NB	ML WBL	13		0		0%		13		
		NBL (to ML)	121	411	31	31	26%	8%	152	442	
		NBL (to SL)	0		0		0%		0		
		NBT	239		0		0%		239		
		NBR (to ML)	51		0		0%		51		
	EB	NBR (to SL)	0		0		0%		0		
		ML EBL	67	548	0	0	0%	0%	67	548	
		ML EBT	342		0		0%		342		
		ML EBR (to SL)	0		0		0%		0		
		ML EBR	139		0		0%		139		
		SL EBL	0		0		0%		0		
		SL EBL (to ML)	0		0		0%		0		
EB Midblock Sinks/Generators	Vehicles Entering System	SL EBT	0		0		0%		0		
		SL EBR	0		0		0%		0		
	Vehicles Exiting System	--	--		17		--		17		
		--	--		0		--		0		
WB Midblock Sinks/Generators	Vehicles Entering System	--	--	--	19	19	--	--	19	19	
		--	--		0		--		0		
	Vehicles Exiting System	--	--		0		--		0		
		--	--		0		--		0		
10th St & K St	SB	SBR (to SL)	0	445	0	0	0%	0%	0	445	
		SBR (to ML)	111		0		0%		111		
		SBT	302		0		0%		302		
		SBL (to SL)	0		0		0%		0		
		SBL (to ML)	32		0		0%		32		
	WB	SL WBR	0	132	0	0	0%	0%	0	132	
		SL WBT	0		0		0%		0		
		WBL (to ML)	0		0		0%		0		
		SL WBL	0		0		0%		0		
		ML WBR	0		0		0%		0		
		ML WBR (to SL)	0		0		0%		0		
		ML WBT	95		0		0%		95		
	EB	ML WBL	37		0		0%		37		
		ML EBL	0	444	0	0	0%	0%	0	444	
		ML EBT	180		0		0%		180		
		ML EBR (to SL)	0		0		0%		0		
		ML EBR	264		0		0%		264		
		SL EBL	0		0		0%		0		
		SL EBL (to ML)	0		0		0%		0		
EB Midblock Sinks/Generators	Vehicles Entering System	SL EBT	0		0		0%		0		
		--	--		-30		--		-30		
	Vehicles Exiting System	--	--		49		--		49		
		--	--		0		--		0		
9th St & K St	SB	SBR (to SL)	0	864	0	0	0%	0%	0	864	
		SBR (to ML)	83		0		0%		83		
		SBT	781		0		0%		781		
		SBL (to SL)	0		0		0%		0		
		SBL (to ML)	0		0		0%		0		
	EB	ML EBL	0	182	0	0	0%	0%	0	182	
		ML EBT	0		0		0%		0		
		ML EBR (to SL)	0		0		0%		0		
		ML EBR	182		0		0%		182		
		SL EBL	0		0		0%		0		
		SL EBL (to ML)	0		0		0%		0		
		SL EBT	0		0		0%		0		
K Street Intersection Total Volume Balance Summary											
			PM Unbalanced Volume		VI Volume Input Change Tot		PM Percent Change		PM Balanced Volume		
K Street NW Intersections only Total Volume Balance Summary			35,586		909		3%		34,963		

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

**Attachment H:
PM Balancing Notes**

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

Attachment H - Location-Specific Volume Balancing Adjustments, PM Peak Hour

General Methodology:

The volume balancing methodology used in this effort was as follows:

1. Where recorded TMCs show a volume imbalance between two intersections, the imbalance was attributed to midblock generators and sinks. Where segment configuration, existing conditions such as the absence of midblock slip ramps and on-street parking, and/or field observations did not justify the midblock addition/removal of vehicles, vehicle trips were proportionally added or removed to the movements entering/exiting each link;
2. Where TMCs were revised to achieve balance between intersections, TMCs were adjusted upward to match the higher of the two volumes as a conservative measure (where possible);
3. Volumes on adjacent cross-street study intersections (I Street and L Street) were revised to match corresponding balanced volumes to or from K Street.

Main Line – “ML” and Service Lane – “SL”

Notes on Volume Balancing along Segments with Large Volume Variances by Intersection PM Peak Hour

- Between 21st Street and 20th Street
 - Field observations showed a significant number of illegal midblock left-turn maneuvers from the EB ML into the WB SL
 - WB
 - Unbalanced Volumes:
 - 20th Street: 997 vehicles entering ML and 56 vehicles entering SL,
 - 21st Street: 1049 vehicles exiting ML and 215 vehicles exiting SL
 - Imbalance: +52 ML difference, +159 SL difference; net +211
 - ML Balancing:
 - 80 vehicles generated midblock from garage and routed to ML
 - 26 vehicles from SL routed to ML
 - 54 vehicles from ML routed to SL
 - SL Balancing:
 - 131 vehicles generated midblock from garage and routed to SL
 - EB
 - Unbalanced Volumes:
 - 21st Street: 408 vehicles entering ML and 116 vehicles entering SL
 - 20th Street: 392 vehicles exiting ML and 74 vehicles exiting SL
 - Imbalance: -16 ML difference, -42 SL difference; net -58
 - ML Balancing:
 - Field observations indicate a significant number of EB ML traffic turns left midblock into the WB SL; therefore, 43 vehicles were proportionally removed from turning movements into the ML from the 21st Street intersection

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

- 25 vehicles routed from ML to SL
- 52 vehicles routed from SL to ML
- SL Balancing:
 - 15 vehicles were removed from system (on-street parking)
- Between 20th Street and 19th Street
 - WB
 - Unbalanced Volumes:
 - 19th Street: 899 vehicles entering ML and 164 vehicles entering SL
 - 20th Street: 885 vehicles exiting ML and 217 vehicles exiting SL
 - Imbalance: -14 ML difference, +53 SL difference; net +39
 - ML Balancing:
 - 6 vehicles generated midblock from on-street parking and routed to ML
 - 30 vehicles from SL routed to ML
 - 50 vehicles from ML routed to SL
 - SL Balancing:
 - 5 vehicles generated midblock from on-street parking and routed to SL
 - 30 vehicles from SL routed to ML
 - 50 vehicles from ML routed to SL
 - 28 vehicles added to turning movements entering SL from the 19th Street intersection
 - EB
 - Unbalanced Volumes:
 - 20th Street: 408 vehicles entering ML and 116 vehicles entering SL
 - 19th Street: 392 vehicles exiting ML and 74 vehicles exiting SL
 - Imbalance: -16 ML difference, -42 SL difference; net -58
 - ML Balancing:
 - Field observations indicate a significant number of EB ML traffic turns left midblock into the WB SL, therefore 43 vehicles were proportionally removed from turning movements into the ML from the 21st Street intersection
 - 25 vehicles routed from ML to SL
 - 52 vehicles routed from SL to ML
 - SL Balancing:
 - 15 vehicles were removed from system (on-street parking)
- Between 17th Street W and 17th Street E
 - WB
 - Unbalanced Volumes:
 - 17th Street E: 770 vehicles entering ML and 145 vehicles entering SL
 - 17th Street W: 933 vehicles exiting ML and 188 vehicles exiting SL
 - Imbalance: +163 ML difference, +43 SL difference; net +206

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

- ML Balancing:
 - 163 vehicles were proportionally added to turning movements entering the WB ML from the 17th Street E intersection
- SL Balancing:
 - 43 vehicles were proportionally added to turning movements entering the WB SL from the 17th Street E intersection
- EB
 - Unbalanced Volumes:
 - 17th Street W: 796 vehicles entering segment
 - 17th Street E: 663 vehicles exiting
 - Imbalance: -133 difference
 - ML Balancing:
 - 133 vehicles were proportionally added to turning movements approaching 17th Street E intersection
- Between 15th Street W and 15th Street E
 - WB
 - Unbalanced Volumes:
 - 15th Street E: 792 vehicles entering ML and 174 vehicles entering SL
 - 15th Street W: 725 vehicles exiting ML and 165 vehicles exiting SL
 - Imbalance: -67 ML difference, -9 SL difference; net -76
 - ML Balancing:
 - Upstream volume balancing between 15th Street E and 14th Street increases ML difference by 94 vehicles (existing imbalance -67, imbalance attributed to upstream balancing -94; -161 net)
 - 161 vehicles proportionally added to turning movements exiting segment at 15th Street W intersection
 - SL Balancing:
 - Upstream volume balancing between 15th Street E and 14th Street increases SL difference by 17 vehicles (existing imbalance -9, imbalance attributed to upstream balancing -17, net -26)
 - 5 vehicles removed midblock from system to on-street parking
 - 21 vehicles added to turning movements exiting SL at 15th Street W intersection
 - EB
 - Unbalanced Volumes:
 - 15th Street W: 809 vehicles entering ML
 - 15th Street E: 829 vehicles exiting ML
 - Imbalance: 20 vehicle difference
 - Balancing:
 - 20 vehicles proportionally added to turning movements entering segment from the 15th Street W intersection

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

- Between 15th Street E and 14th Street
 - WB
 - Unbalanced Volumes:
 - 14th Street: 792 vehicles entering ML and 174 vehicles entering SL
 - 15th Street E: 725 vehicles exiting ML and 165 vehicles exiting SL
 - Imbalance: -98 vehicle ML difference, -29 SL difference; net -127
 - ML Balancing:
 - 98 vehicles proportionally added to turning movements exiting segment at 15th Street E intersection
 - SL Balancing:
 - 14 vehicles removed from system midblock (on-street parking)
 - 20 vehicles proportionally added to turning movements exiting SL segment at the 15th E Street intersection
 - EB
 - Unbalanced Volumes:
 - 15th Street E: 750 entering ML and 127 entering SL
 - 14th Street: 681 exiting ML and 202 exiting SL
 - Imbalance: -69 ML difference, +75 SL difference; net +6
 - ML Balancing:
 - 75 vehicles routed to SL
 - 63 removed from system (to alley)
 - 12 traveling from ML to SL
 - 6 traveling from SL to ML
 - Net 69 removed from ML
 - SL Balancing:
 - 12 vehicles routed from ML to SL
 - 69 vehicles generated midblock from alley (configuration restricts travel from alley to ML)
 - 6 vehicles routed from SL to ML (value consistent with extrapolated slip-ramp field observations)
- Between 14th Street and 13th Street
 - WB
 - Unbalanced Volumes:
 - 13th Street: 711 entering ML and 131 entering SL
 - 14th Street: 677 exiting ML and 183 exiting SL
 - Imbalance: -34 ML difference, +52 in the SL difference; net +18
 - ML Balancing:
 - 35 vehicles routed from ML to SL
 - 1 vehicle routed from SL to ML
 - SL Balancing:
 - 18 vehicles generated midblock from on-street parking
 - 35 vehicles routed from ML to SL

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

- 1 vehicle routed from SL to ML
- EB
 - Unbalanced Volumes:
 - 14th Street: 731 entering ML
 - 13th Street: 683 exiting ML
 - Imbalance: -48 difference
 - Balancing:
 - 48 vehicles proportionally added to turning movements exiting segment at the 13th Street intersection
- Between 13th Street and 12th Street
 - WB
 - Unbalanced Volumes:
 - 12th Street: 468 entering ML and 62 entering SL
 - 13th Street: 485 exiting ML and 102 exiting SL
 - Imbalance: +17 ML difference, +40 in the SL difference; net +57
 - ML Balancing:
 - 13 vehicles routed from ML to SL
 - 30 vehicles routed from SL to ML
 - SL Balancing:
 - 17 vehicles generated midblock from on-street parking
 - 13 vehicles routed from ML to SL
 - 30 vehicles routed from SL to ML
 - 40 vehicles proportionally added to turning movements entering SL from the 12th Street intersection
 - EB
 - Unbalanced Volumes:
 - 13th Street: 624 entering ML
 - 12th Street: 645 exiting ML
 - Imbalance: +21 difference
 - Balancing:
 - Upstream balancing decreases imbalance by 41 (existing imbalance +21, imbalance attributed to upstream balancing -41, net -20)
 - 13 vehicles removed from system (on-street parking)
 - 7 vehicles proportionally added to turning movements exiting segment at the 12th Street intersection
- Between 12th Street and 11th Street
 - WB
 - Unbalanced Volumes:
 - 11th Street: 327 entering ML
 - 12th Street: 394 exiting ML
 - Imbalance: +67 ML difference

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

February 5, 2020

- ML Balancing:
 - Downstream balancing increases imbalance by 24 vehicles (existing imbalance +67, imbalance attributed to downstream balancing +24, net +91)
 - 7 vehicles generated from on-street parking
 - 84 vehicles proportionally added to turning movements entering segment at the 11th Street intersection
- EB
 - Unbalanced Volumes:
 - 12th Street: 584 entering ML
 - 11th Street: 548 exiting ML
 - Imbalance: -36 difference
 - Balancing:
 - Upstream balancing increases imbalance by 5 (existing imbalance -36, imbalance attributed to upstream balancing -5, net -41)
 - 41 vehicles removed from system (garage)

Attachment I:
**PM Approach and Departure Summary and
Comparison**

Highlighting Key:		%	absolute percent change is 10% or greater.															
Cross Street	Block Length (ft)	Unbalanced PM						Balanced PM						North Side of K St (WB Direction of Travel) Midblock Notes*	South Side of K St (EB Direction of Travel) Midblock Notes*			
		WB Departure (combines ML & SL volumes)	WB Delta Difference	WB Approach %	EB Approach (combines ML & SL volumes)	EB Delta Difference	EB Departure (combines ML & SL volumes)	WB Midblock Vehicles Added/Removed	WB Departure (combines ML & SL volumes)	WB Delta Difference	WB Approach (combines ML & SL volumes)	EB Midblock Vehicles Added/Removed	EB Approach (combines ML & SL volumes)	EB Delta Difference	EB Departure (combines ML & SL volumes)			
22nd	530	42	3%		28	-13%	524	42	0	0%	1,264	23	0	0%	481	Two garage driveways and one alley driveway/266 spaces	Two garage driveways/unknown # of spaces	
delta (SL ONLY)		1,504		1,264	527	-58	-11%					-15	491	0	0%			
21st	415	211	20%		1,102	466	85	15%	1,053	0	0%	1,102	85	0	0%	569	One garage driveway/200 spaces	No midblock driveways.
delta		1,053			654	-10	-2%	535	11	0	0%	971	654	0	0%	535	No midblock driveways.	One garage driveway, and one alley driveway present/225 spaces
20th	322	39	4%		952	525	239	38%	1,091	0	0%	917	525	0	0%	631	One garage driveway/200 spaces	Two separate and adjacent garage driveways present/300 spaces
delta		1,063			654	-10	-2%	535	17	0	0%	-10	239	0	0%	796	One garage driveway and one alley driveway/279 spaces	Two garage driveways and one alley driveway/433 spaces
19th	410	-2	0%		917	525	239	38%	954	0	0%	917	870	0	0%		No midblock driveways.	No midblock driveways.
delta		954			525	-10	-2%	631	-143	0	0%	239	870	0	0%			
18th	520	-143	-13%		917	525	239	38%	-143	0	0%	1,121	870	0	0%	796	One garage driveway/200 spaces	Two garage driveways and one alley driveway/433 spaces
delta		1,060			870	-133	-17%	796	0	0	0%	0	0	0	0%		No midblock driveways.	No midblock driveways.
17th W/CT	160	206	23%		1,121	870	206	23%	1,060	0	0%	1,121	796	0	0%	787	One garage driveway and one alley driveway/200 spaces	One alley driveway.
delta		915			862	663	6	1%	1,121	0	0%	1,035	796	0	0%	787	No midblock driveways.	No midblock driveways.
17th E	460	10	1%		898	657	967	18%	852	0	0%	-130	657	0	0%	771	One garage driveway/200 spaces	One garage driveway.
delta		852			657	-9	-1%	771	183	0	0%	70	841	0	0%	829	No midblock driveways.	No midblock driveways.
16th	445	55	7%		890	821	50	6%	997	0	0%	1,072	841	0	0%	829	One garage driveway/114 spaces	One garage driveway.
delta		843			821	20	2%	809	-99	0	0%	0	829	0	0%	877	No midblock driveways.	No midblock driveways.
15th W	160	-76	-8%		890	821	-76	-8%	997	0	0%	1,072	829	0	0%	877	One garage driveway/114 spaces	One garage driveway.
delta		966			829	6	1%	877	-9	0	0%	958	829	0	0%		No midblock driveways.	No midblock driveways.
15th E/VT	355	-127	-13%		840	829	6	1%	1,077	0	0%	958	829	0	0%		No midblock driveways.	No midblock driveways.
delta		967			860	883	731	18%	967	0	0%	860	883	0	0%	731	One garage driveway/430 spaces	One garage driveway.
14th	540	18	2%		860	883	-48	-7%	18	0	0%	0	731	0	0%		No midblock driveways.	No midblock driveways.
delta		842			587	683	627	18%	842	0	0%	587	731	0	0%	668	No midblock driveways.	No midblock driveways.
13th	330	57	11%		394	648	21	3%	17	0	0%	-13	668	0	0%		No midblock driveways.	No midblock driveways.
delta		530			648	584	530	67%	570	0	0%	418	655	0	0%	589	No midblock driveways.	No midblock driveways.
12th	200	67	20%		186	548	-36	-6%	7	0	0%	-41	548	0	0%	427	No midblock driveways.	One garage driveway/unknown # of spaces
delta		327			548	17	4%	427	19	0	0%	225	548	0	0%	427	No midblock driveways.	One garage driveway.
11th	190	-20	-10%		132	444	212	10%	411	0	0%	17	444	0	0%	212	No midblock driveways.	No midblock driveways.
delta		206			444	-30	-14%	0	49	0	0%	-30	444	0	0%	212	No midblock driveways.	One garage driveway/154 spaces
10th	480	49	59%		0	182	0	0%	83	0	0%	0	182	0	0%	0	No midblock driveways.	No midblock driveways.
delta		83			0	0	0	0%										
9th																		

*Note: number of garage spaces based on "LoadingZones_Transitway" and "Parking Garages" files shared with G/S and if garage found to have midblock access point on K Street

Attachment C:
ATR Hourly Volumes of Mainline K Street NW in the
1400 and 900 Blocks

Data Collection Interval	Location	Day 1						Day 2						Day 2 Total	
		1400 Block of K Street NW			900 Block of K Street NW			Day 1 Total	1400 Block of K Street NW			900 Block of K Street NW			
		WB	EB	TOTAL	WB	EB	TOTAL		WB	EB	TOTAL	WB	EB	TOTAL	
12:00 AM - 01:00 AM		67	92	159	6	15	21	180	106	104	210	8	24	32	242
12:15 AM - 01:15 AM		56	72	128	5	12	17	145	93	93	186	4	17	21	207
12:30 AM - 01:30 AM		56	64	120	3	14	17	137	92	92	184	2	22	24	208
12:45 AM - 01:45 AM		57	61	118	1	17	18	136	74	88	162	3	21	24	186
01:00 AM - 02:00 AM		61	52	113	0	19	19	132	54	69	123	3	21	24	147
01:15 AM - 02:15 AM		57	51	108	2	17	19	127	57	67	124	3	18	21	145
01:30 AM - 02:30 AM		50	48	98	2	13	15	113	47	52	99	3	12	15	114
01:45 AM - 02:45 AM		48	56	104	3	11	14	118	55	51	106	0	14	14	120
02:00 AM - 03:00 AM		48	60	108	3	5	8	116	50	58	108	1	15	16	124
02:15 AM - 03:15 AM		51	60	111	1	7	8	119	38	53	91	2	15	17	108
02:30 AM - 03:30 AM		50	57	107	3	7	10	117	30	49	79	2	13	15	94
02:45 AM - 03:45 AM		45	44	89	3	7	10	99	21	42	63	2	10	12	75
03:00 AM - 04:00 AM		36	51	87	4	7	11	98	34	49	83	3	9	12	95
03:15 AM - 04:15 AM		40	48	88	6	4	10	98	35	53	88	4	6	10	98
03:30 AM - 04:30 AM		44	57	101	7	6	13	114	43	60	103	6	8	14	117
03:45 AM - 04:45 AM		55	81	136	11	9	20	156	66	79	145	12	10	22	167
04:00 AM - 05:00 AM		91	103	194	16	14	30	224	101	112	213	14	11	25	238
04:15 AM - 05:15 AM		115	160	275	26	19	45	320	138	155	293	19	25	44	337
04:30 AM - 05:30 AM		160	198	358	28	24	52	410	181	187	368	25	29	54	422
04:45 AM - 05:45 AM		187	236	423	27	21	48	471	191	223	414	24	35	59	473
05:00 AM - 06:00 AM		209	283	492	39	26	65	557	194	245	439	29	38	67	506
05:15 AM - 06:15 AM		237	309	546	30	24	54	600	203	270	473	29	29	58	531
05:30 AM - 06:30 AM		257	354	611	29	21	50	661	229	321	550	26	31	57	607
05:45 AM - 06:45 AM		313	377	690	28	30	58	748	258	368	626	27	28	55	681
06:00 AM - 07:00 AM		351	393	744	24	26	50	794	321	394	715	27	31	58	773
06:15 AM - 07:15 AM		401	422	823	36	31	67	890	387	426	813	38	43	81	894
06:30 AM - 07:30 AM		438	442	880	47	38	85	965	441	462	903	55	46	101	1,004
06:45 AM - 07:45 AM		491	471	962	59	42	101	1,063	554	487	1,041	68	51	119	1,160
07:00 AM - 08:00 AM		553	503	1,056	60	48	108	1,164	584	509	1,093	76	50	126	1,219
07:15 AM - 08:15 AM		597	506	1,103	70	58	128	1,231	648	525	1,173	82	52	134	1,307
07:30 AM - 08:30 AM		642	523	1,165	76	65	141	1,306	694	517	1,211	97	64	161	1,372
07:45 AM - 08:45 AM		635	534	1,169	97	74	171	1,340	680	520	1,200	108	71	179	1,379
08:00 AM - 09:00 AM		657	542	1,199	110	77	187	1,386	710	551	1,261	119	79	198	1,459
08:15 AM - 09:15 AM		669	582	1,251	132	87	219	1,470	696	546	1,242	140	75	215	1,457
08:30 AM - 09:30 AM		687	575	1,262	137	92	229	1,491	670	543	1,213	142	74	216	1,429
08:45 AM - 09:45 AM		703	582	1,285	124	88	212	1,497	679	540	1,219	148	85	233	1,452
09:00 AM - 10:00 AM		664	573	1,237	121	95	216	1,453	678	527	1,205	137	95	232	1,437
09:15 AM - 10:15 AM		670	565	1,235	91	86	177	1,412	670	532	1,202	127	110	237	1,439
09:30 AM - 10:30 AM		656	584	1,240	81	95	176	1,416	668	541	1,209	97	104	201	1,410
09:45 AM - 10:45 AM		626	570	1,196	78	109	187	1,383	640	520	1,160	76	105	181	1,341
10:00 AM - 11:00 AM		601	578	1,179	81	124	205	1,384	620	483	1,103	77	111	188	1,291
10:15 AM - 11:15 AM		560	531	1,091	82	144	226	1,317	604	445	1,049	55	112	167	1,216
10:30 AM - 11:30 AM		535	520	1,055	81	135	216	1,271	597	432	1,029	65	125	190	1,219
10:45 AM - 11:45 AM		523	534	1,057	80	142	222	1,279	594	426	1,020	69	122	191	1,211
11:00 AM - 12:00 PM		552	550	1,102	73	134	207	1,309	549	431	980	63	129	192	1,172
11:15 AM - 12:15 PM		562	595	1,157	80	137	217	1,374	513	450	963	69	129	198	1,161
11:30 AM - 12:30 PM		565	620	1,185	73	138	211	1,396	464	443	907	55	125	180	1,087
11:45 AM - 12:45 PM		567	595	1,162	71	123	194	1,356	415	429	844	56	136	192	1,036
12:00 PM - 01:00 PM		555	556	1,111	67	125	192	1,303	421	426	847	61	121	182	1,029
12:15 PM - 01:15 PM		555	555	1,110	56	113	169	1,279	428	436	864	54	114	168	1,032
12:30 PM - 01:30 PM		551	53												

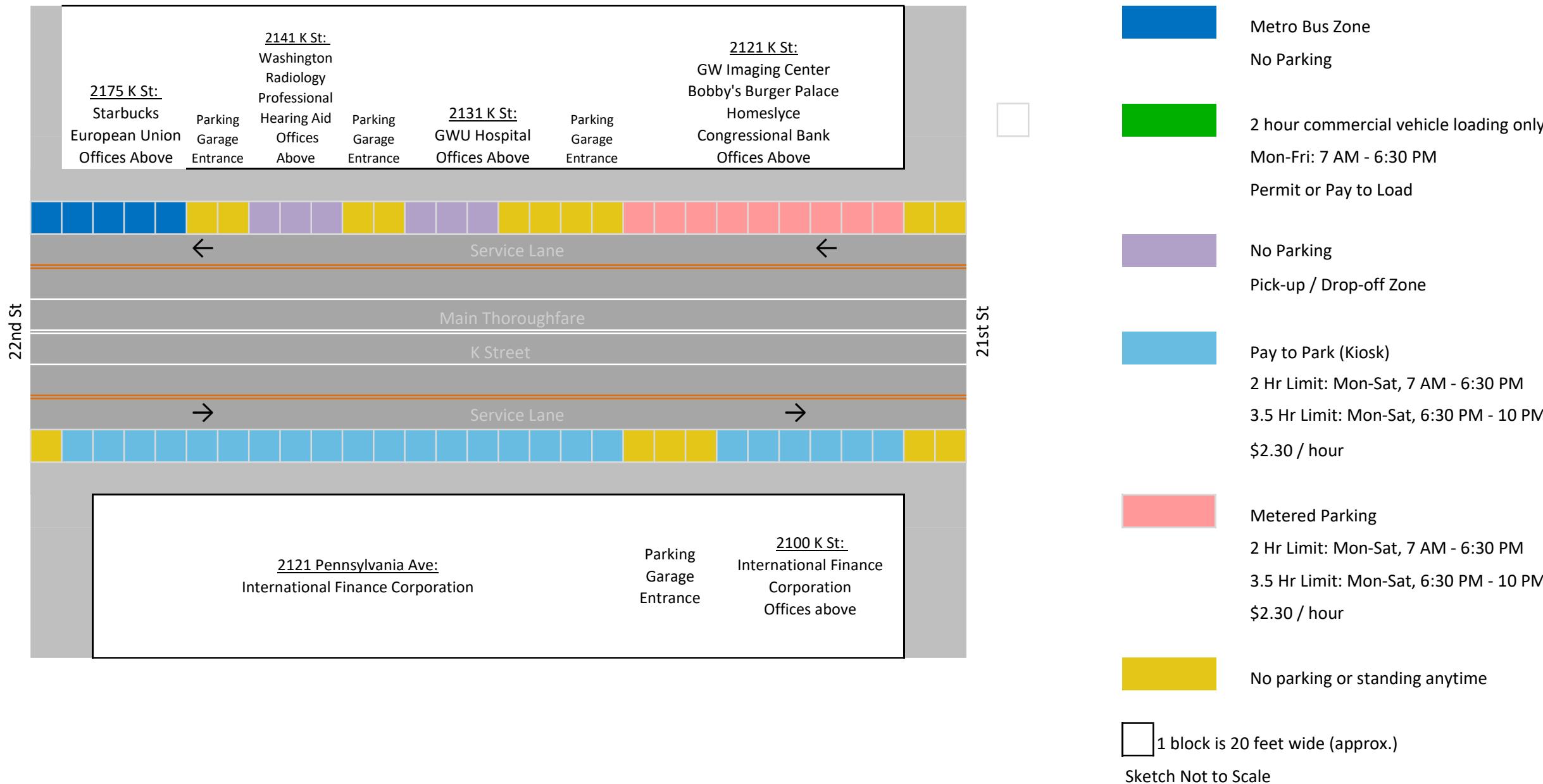
Attachment D: Field Verified Curbside Designations

d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 22nd Street to 21st Street

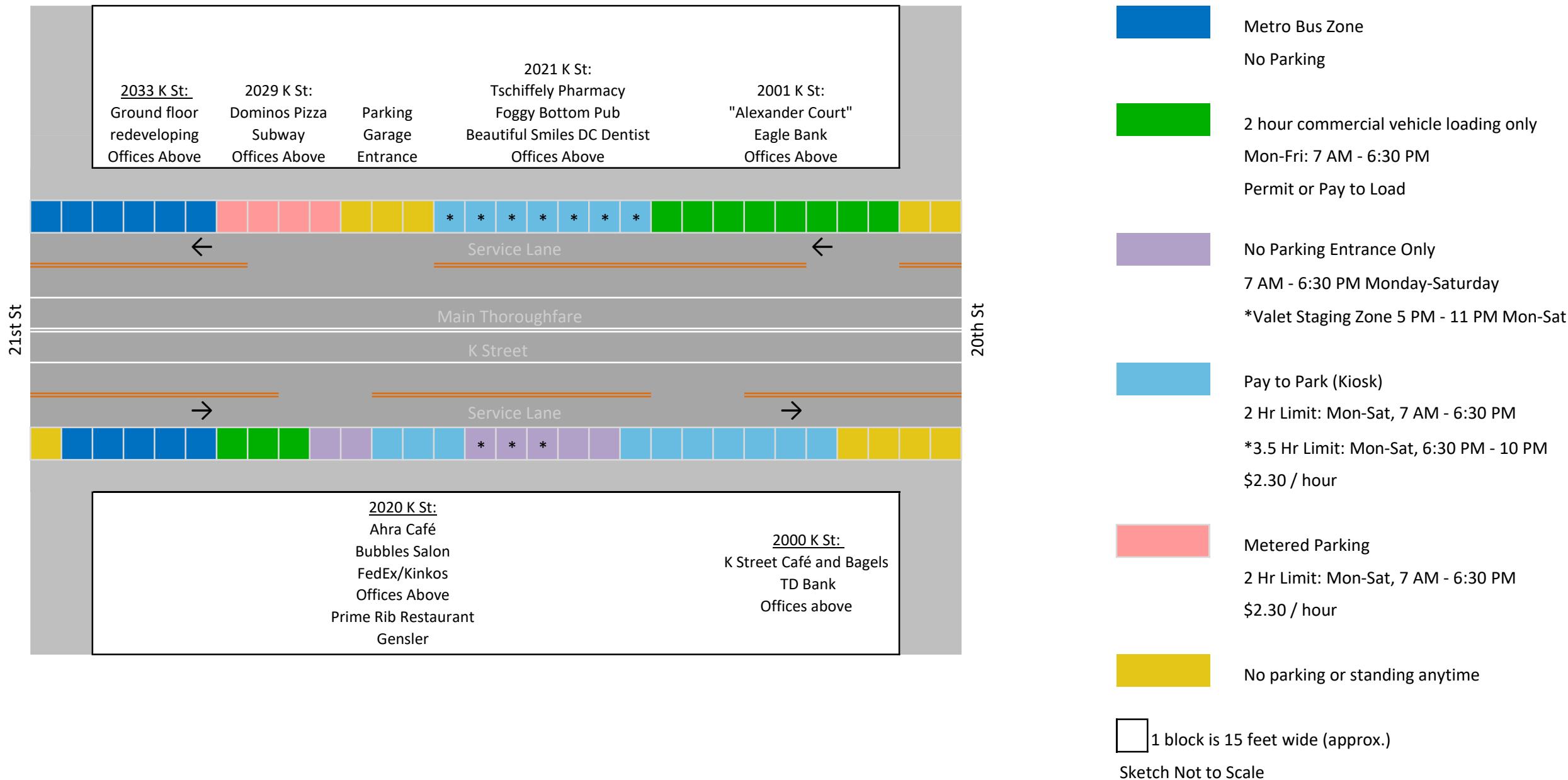


d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 21st Street to 20th Street

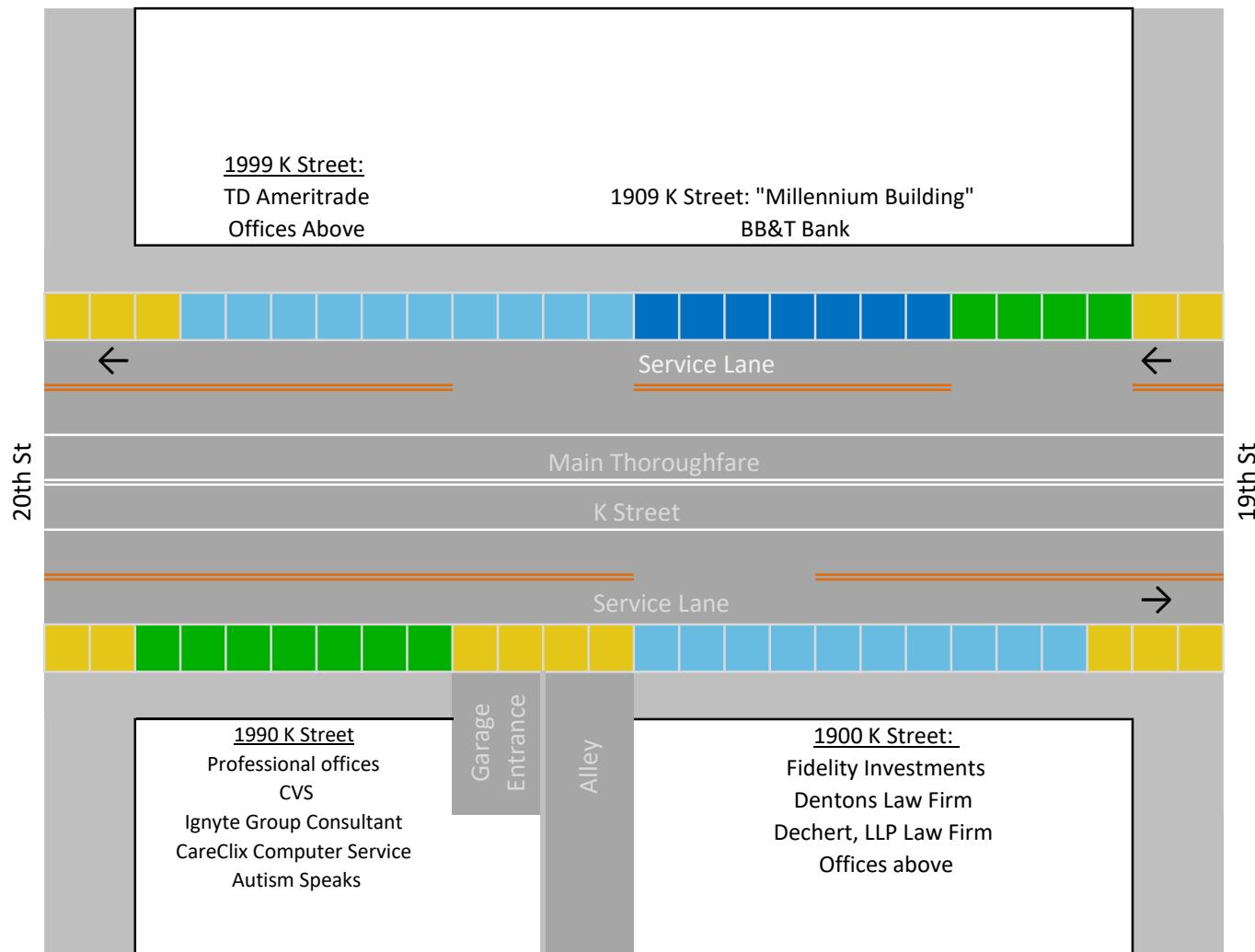


d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 20th Street to 19th Street



No parking or standing anytime

2 hour commercial vehicle loading only

Mon-Fri: 7 AM - 6:30 PM

Permit or Pay to Load

Pay to Park (Kiosk)

2 Hr Limit: Mon-Sat, 7 AM - 6:30 PM

3.5 Hr Limit: Mon-Sat, 6:30 PM - 10 PM

\$2.30 / hour

Metro Bus Zone

1 block is 15 feet wide (approx.)

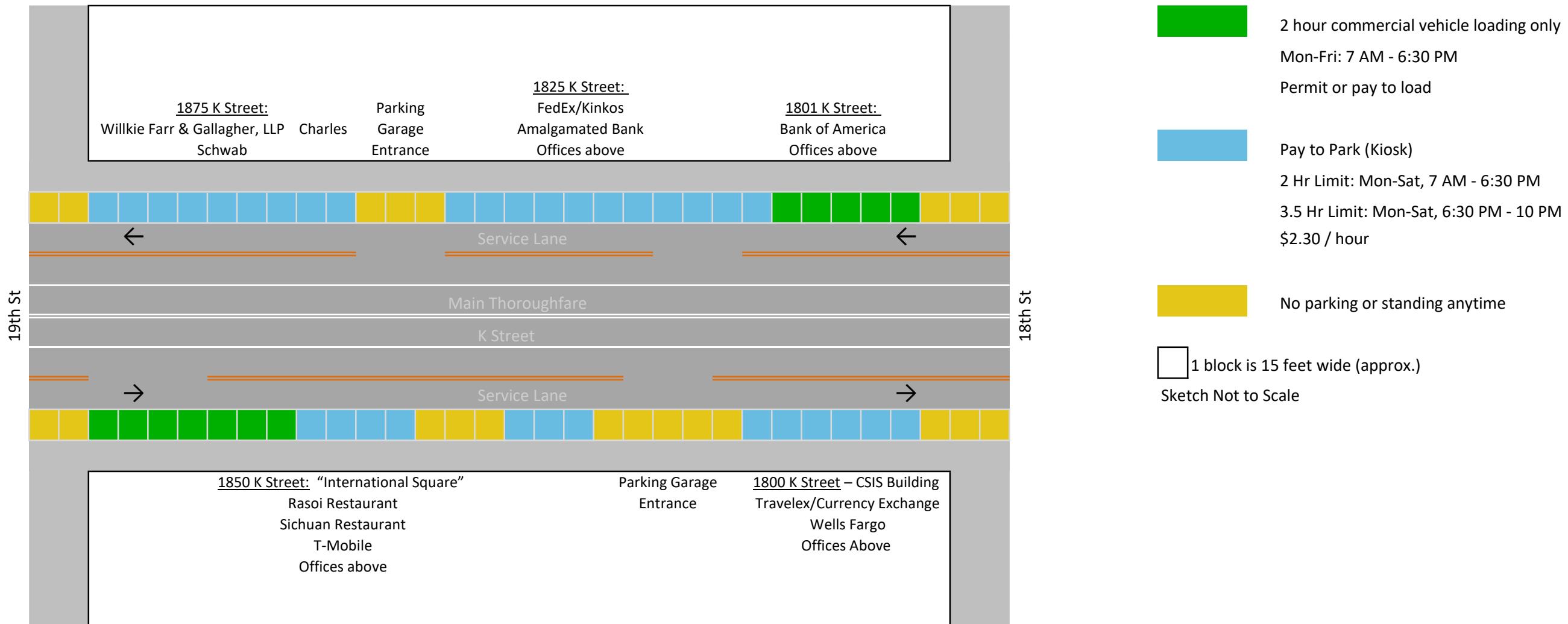
Sketch Not to Scale

d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 19th Street to 18th Street

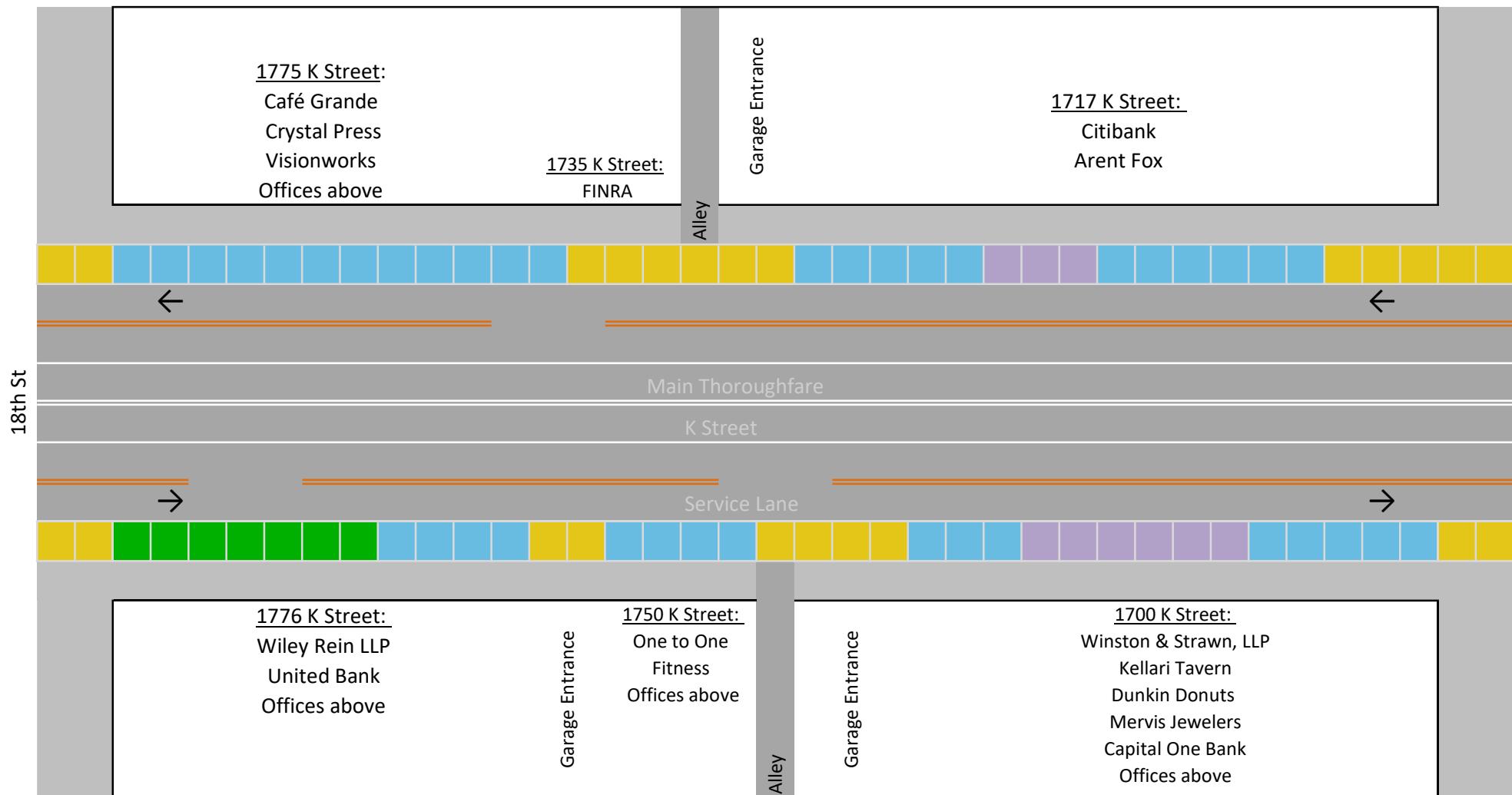


d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 18th Street to Connecticut Ave



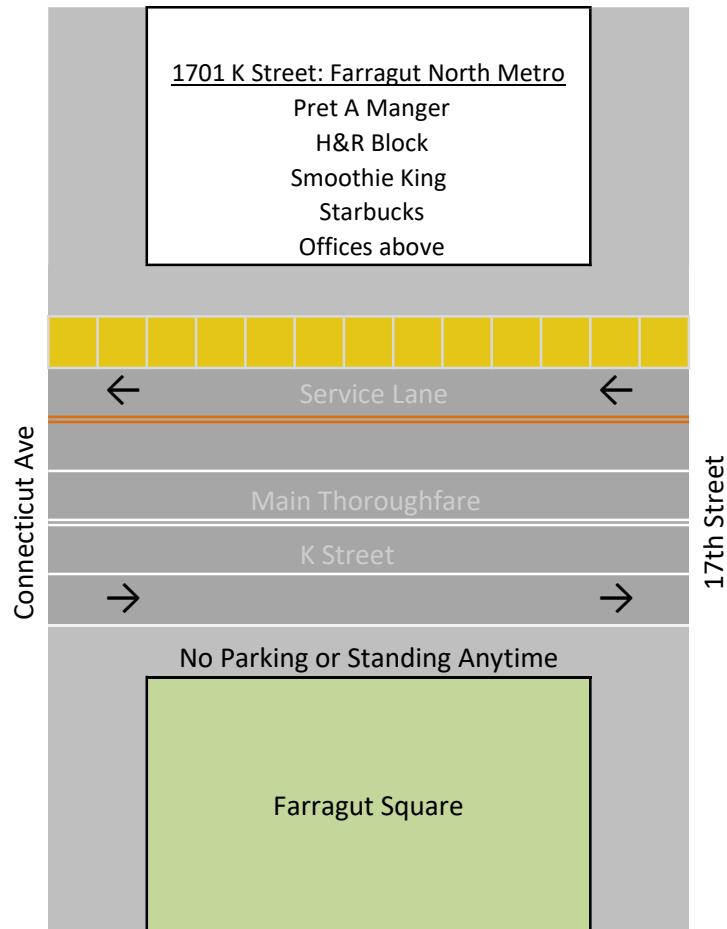
- Green:** 2 hour commercial vehicle loading only
Mon-Fri: 7 AM - 6:30 PM
Permit or Pay to Load
- Purple:** No Parking Entrance Only
7 AM-6:30 PM Monday-Friday
- Blue:** Pay to Park (Kiosk)
2 Hr Limit: Mon-Sat, 7 AM - 6:30 PM
3.5 Hr Limit: Mon-Sat, 6:30 PM - 10 PM
\$2.30 / hour
- Yellow:** No parking or standing anytime
- Sketch Not to Scale**

d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: Connecticut Ave to 17th Street

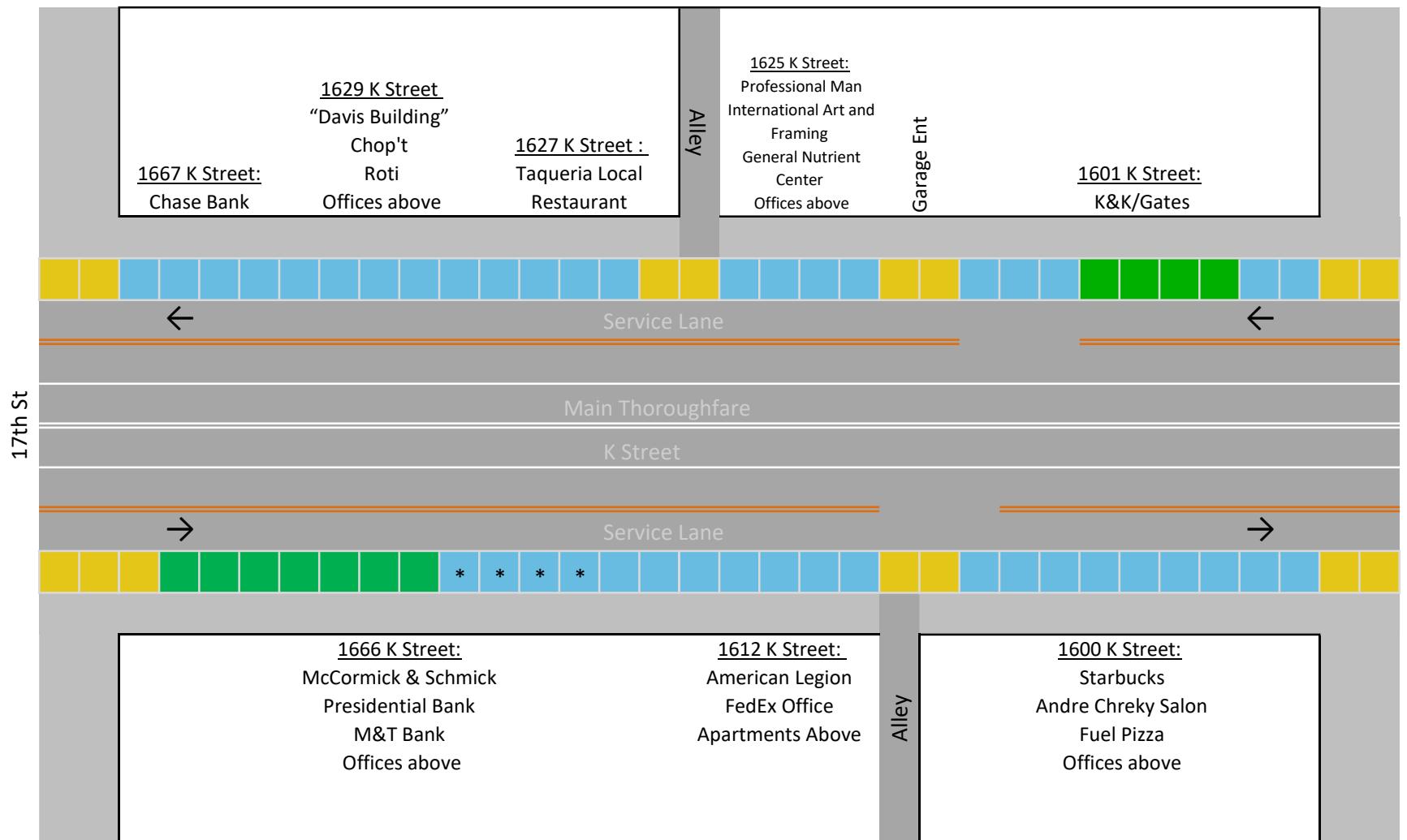


d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 17th Street to 16th Street



2 hour commercial vehicle loading only

Mon-Fri: 7 AM - 6:30 PM

Use Meter Pay to Load

Pay to Park (Kiosk)

2 Hr Limit: Mon-Sat, 7 AM - 6:30 PM

3.5 Hr Limit: Mon-Sat, 6:30 PM - 10 PM

\$2.30 / hour

* Also had signs for valet staging only from

6:30 PM - 11:59 AM Mon-Fri and 5 PM - 1AM Sat-Sun

No parking or standing anytime

1 block is 15 feet wide (approx.)

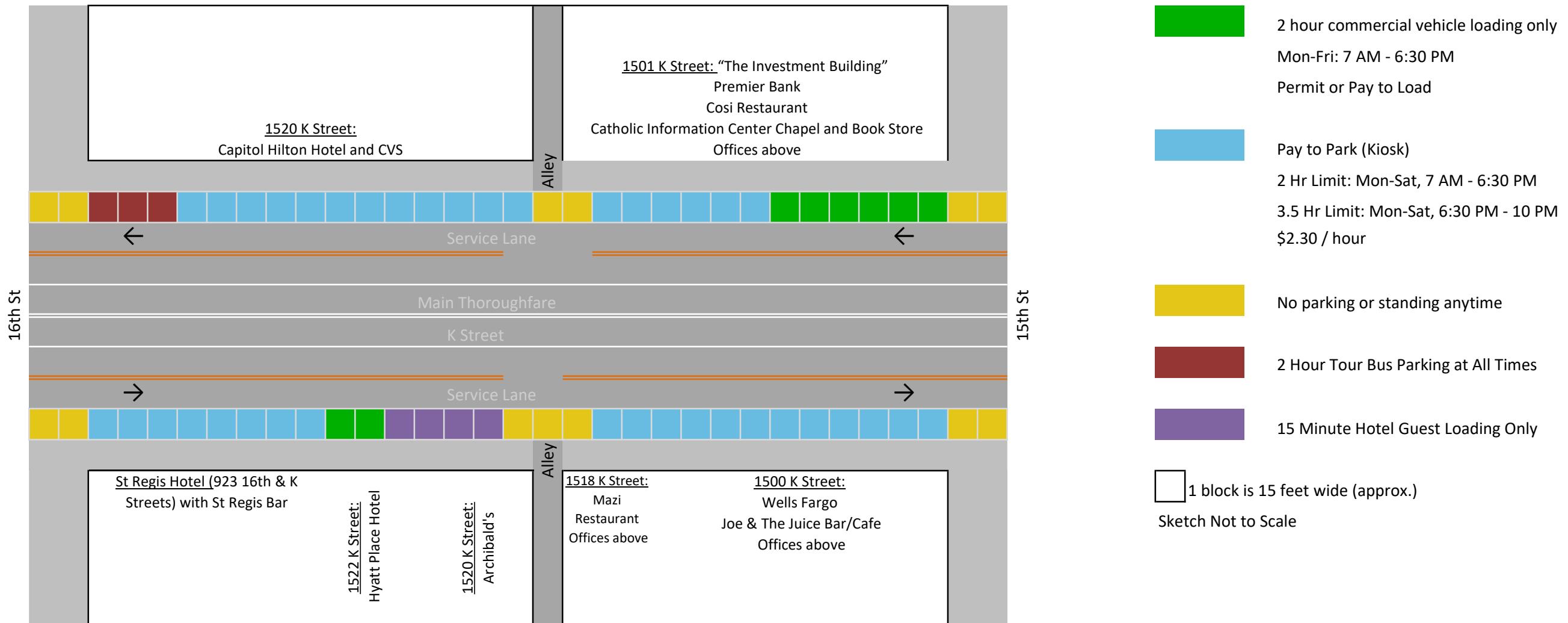
Sketch Not to Scale

d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 16th Street to 15th Street

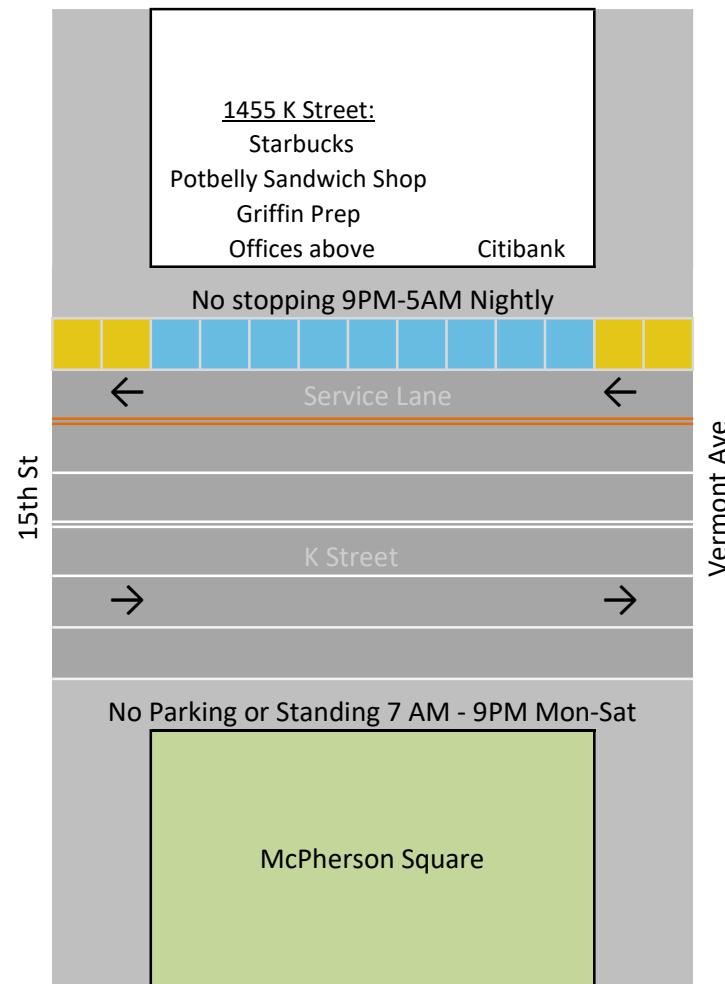


d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 15th Street to Vermont Ave



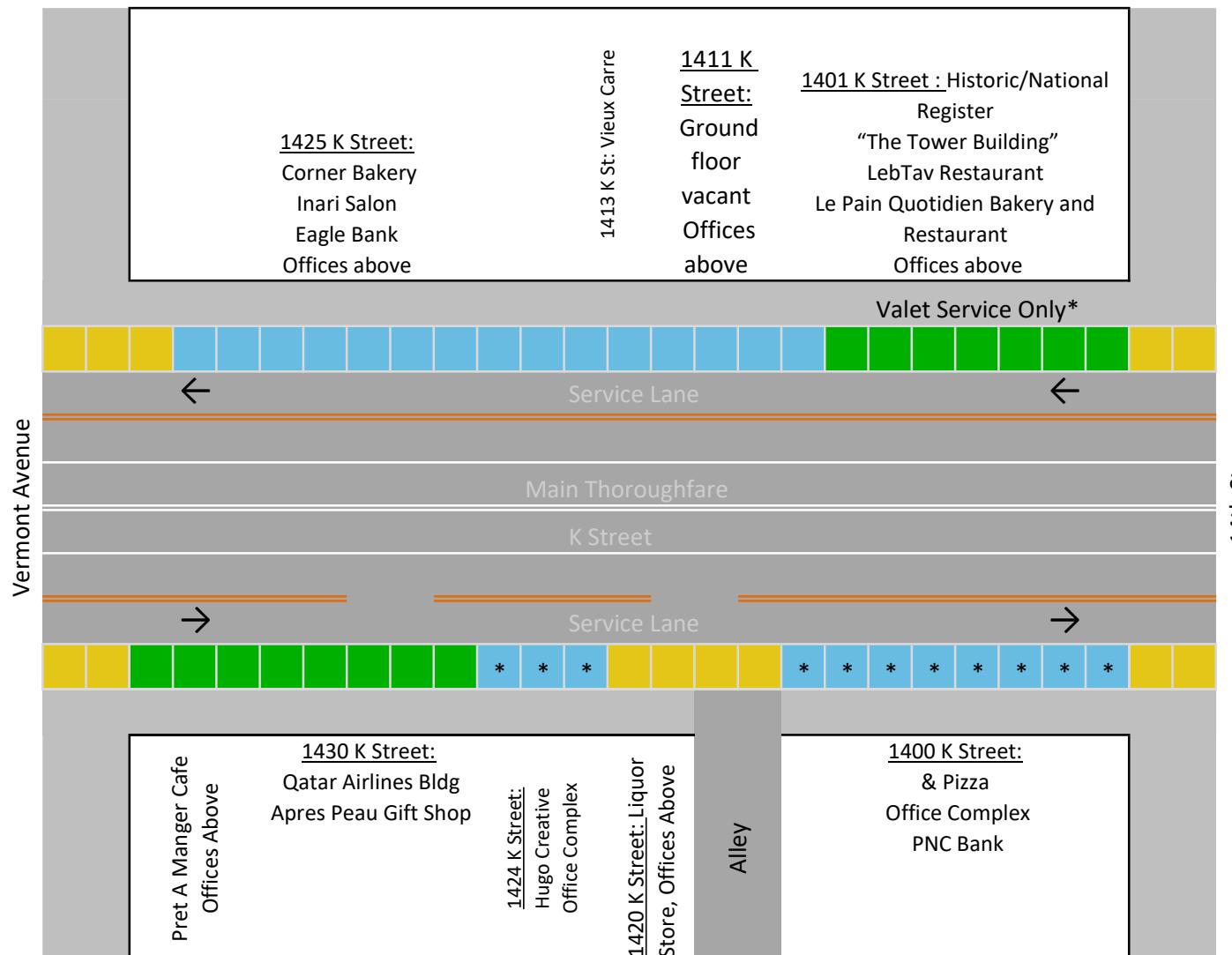
- Pay to Park (Kiosk)
Mon-Sat: 7 AM -10 PM
\$2.30 / hour
- No parking or standing anytime
- 1 block is 15 feet wide (approx.)
Sketch Not to Scale

d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 15th Street to 14th Street

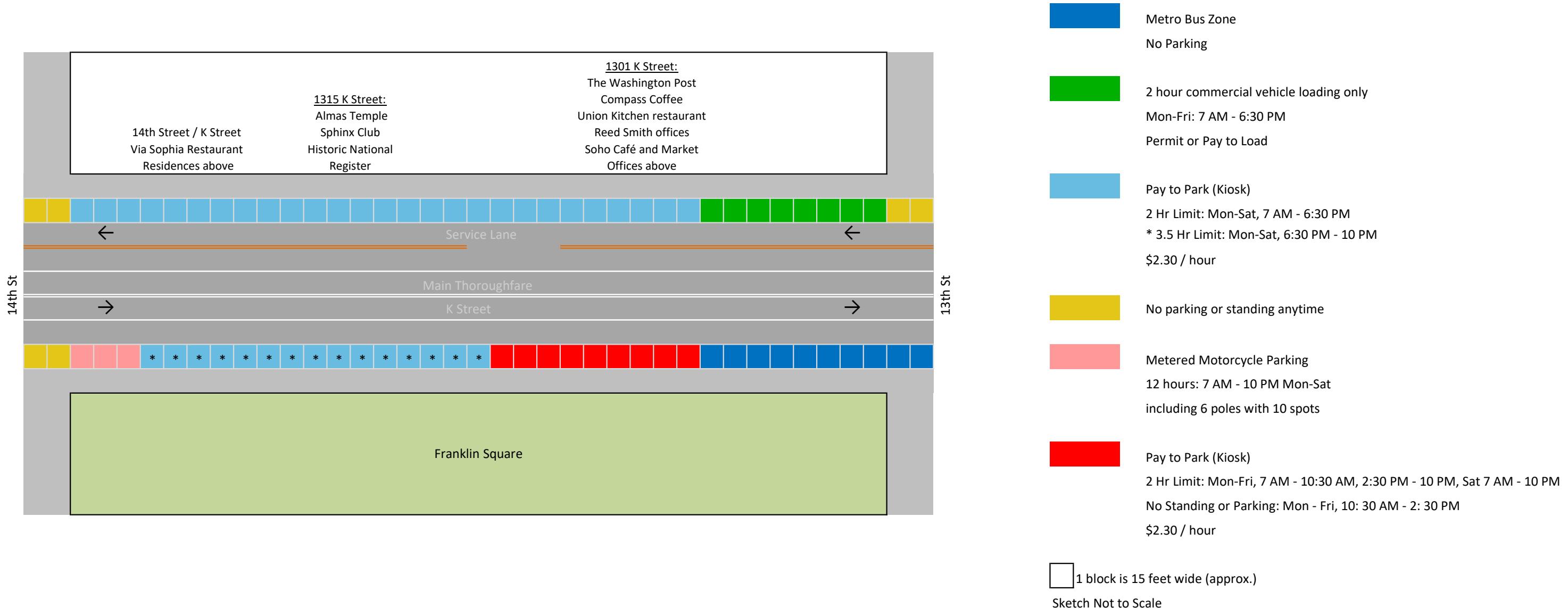


d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 14th Street to 13th Street



d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 13th Street to 12th Street



2 hour commercial vehicle loading only

Mon-Fri: 7 AM - 6:30 PM

Permit or Pay to Load

Pay to Park (Kiosk)

2 Hr Limit: Mon-Sat, 7 AM - 6:30 PM

3.5 Hr Limit: Mon-Sat, 6:30 PM - 10 PM

\$2.30 / hour

No parking or standing anytime

1 block is 15 feet wide (approx.)

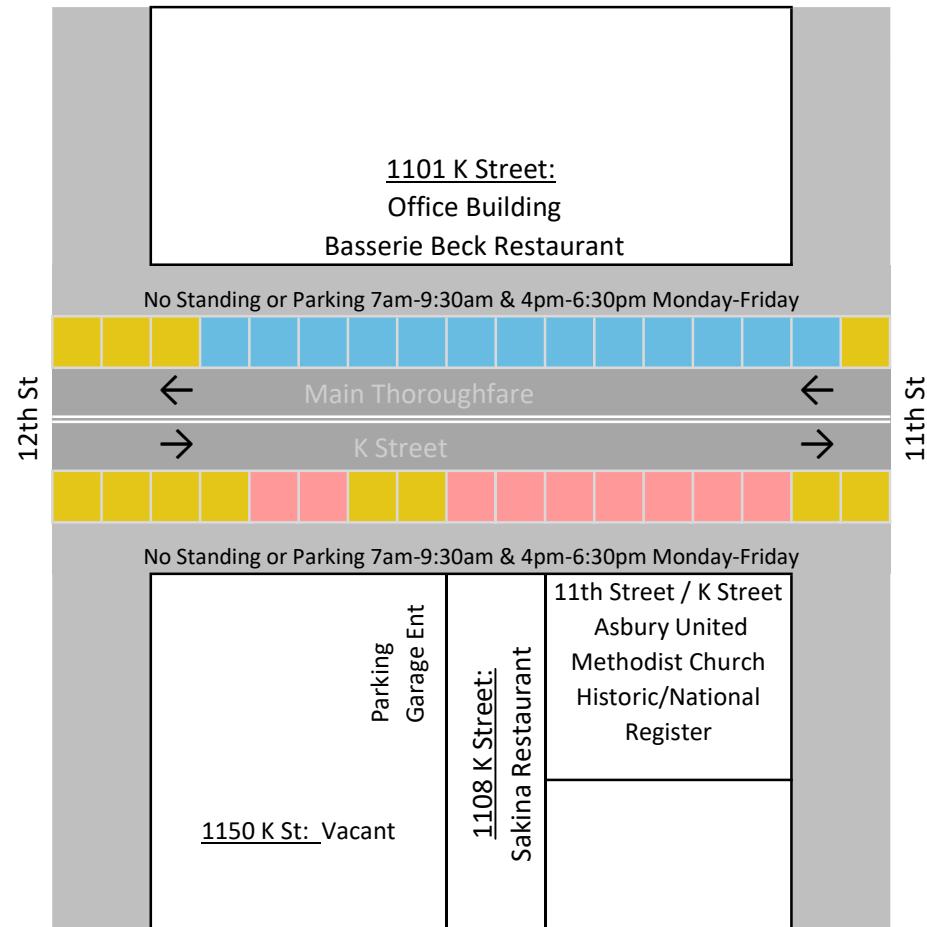
Sketch Not to Scale

d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 12th Street to 11th Street



Pay to Park (Kiosk)

2 Hr Limit: Mon-Fri, 9:30 AM - 4 PM, Sat 7 AM - 6:30 PM

3.5 Hr Limit: Mon-Sat, 6:30 PM - 10 PM

\$2.30 / hour

Metered Parking

2 Hr Limit: Mon-Fri, 9:30 AM - 4 PM, Sat 7 AM - 6:30 PM

3.5 Hr Limit: Mon-Sat, 6:30 PM - 10 PM

\$2.30 / hour

No parking or standing anytime

1 block is 15 feet wide (approx.)

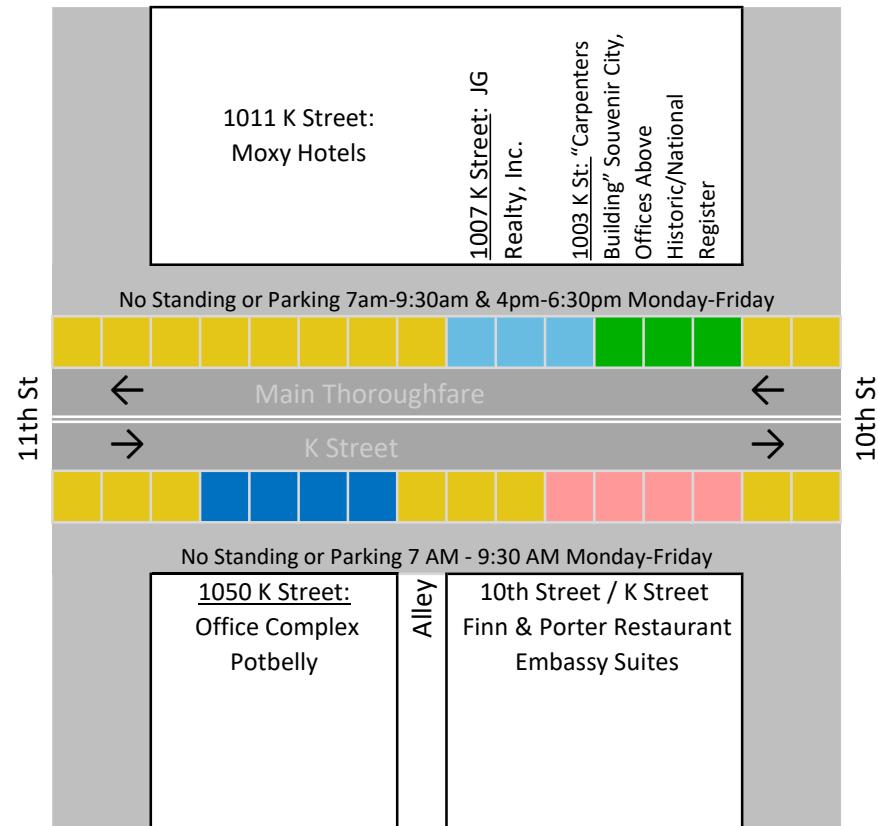
Sketch Not to Scale

d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 11th Street to 10th Street



- 2 hour commercial vehicle loading only
Mon-Sat: 7 AM - 6:30 PM
Permit or Pay to Load
- No parking or standing anytime
- Pay to Park (Kiosk)
2 Hr Limit: Mon-Sat, 7:00 AM - 6:30 PM
\$2.30 / hour
- Metered Parking
2 Hr Limit: Mon-Fri, 9:30 AM - 4 PM, Sat 7:00 AM - 6:30 PM
\$2.30 / hour
- Metro Bus Zone
No Parking

1 block is 15 feet wide (approx.)

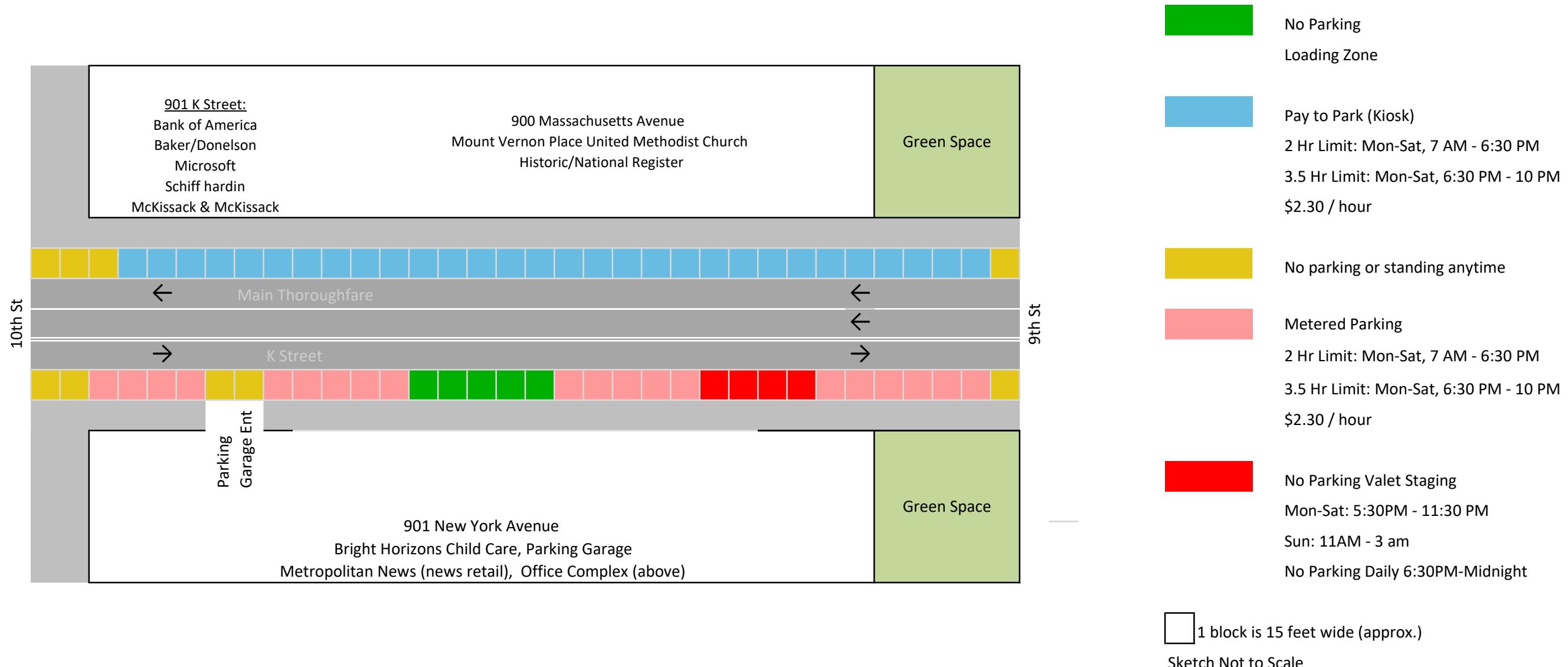
Sketch Not to Scale

d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 10th Street to 9th Street



Attachment E: Signal Timings Verification Notes

K Street Corridor

Changes made to Synchro following Field Visit to confirm Signal Timings and Lane Configurations.

Intersection	Time Period	Change Applied to Synchro Model
22 nd & K Streets, NW	AM	WB Storage lane added on service road.
22 nd & K Streets, NW	PM	WB Storage lane added on service road.
21 st & K Streets, NW	AM	Service lane along on K Street between 20 th & 21 st Streets.
21 st & K Streets, NW	PM	Service lane along on K Street between 20 th & 21 st Streets. SB has 2 receiving lanes.
21 st Street & Pennsylvania Ave, NW	AM	2 SB approach lanes, not 3. Vehicles were parked here and there are no parking restriction signs.
21 st Street & Pennsylvania Ave, NW	PM	2 SB approach lanes, not 3. Vehicles were parked here and there are no parking restriction signs.
Pennsylvania Ave & I Street, NW	AM	
Pennsylvania Ave & I Street, NW	PM	
21 st & L Streets, NW	AM	
21 st & L Streets, NW	PM	
20 th & K Streets, NW	AM	Service lane along on K Street between 19 th & 20 th Streets. NB has 4 receiving lanes.
20 th & K Streets, NW	PM	Service lane along on K Street between 19 th & 20 th Streets.
19 th & K Streets, NW	AM	Service lane along on K Street between 18 th & 19 th Streets. New lagging protected WBL phase. WBL phase is 12 seconds, EBT is 52 seconds, and SBT is 40 seconds.
19 th & K Streets, NW	PM	Service lane along on K Street between 18 th & 19 th Streets. SB has 4 receiving lanes.
19 th & I Streets, NW	AM	Plan 3 was implemented to account for the westbound left phase in operation from 7:00 AM to 9:30 AM. The proper offset was applied for this plan.
19 th & I Streets, NW	PM	
18 th & K Streets, NW	AM	Service lane along on K Street between 17 th & 18 th Streets.
18 th & K Streets, NW	PM	Service lane along on K Street between 17 th & 18 th Streets.
Connecticut & L Streets, NW	AM	Walk time reduced from 10 seconds to 7 seconds on all phases (to account for the 3-second LPI).
Connecticut & L Streets, NW	PM	Walk time reduced from 10 seconds to 7 seconds on all phases (to account for the 3-second LPI).
17 th & K Streets (East), NW	AM	
17 th & K Streets (East), NW	PM	3 northbound receiving lanes, not 2. DDOT personnel on site.
17 th & K Streets (West), NW	AM	No service lane on EB K Street crossing Farragut Square. Walk time for Phase 2 adjusted from 4 seconds to 7 seconds.
17 th & K Streets (West), NW	PM	No service lane on EB K Street crossing Farragut Square. DDOT personnel on site. Walk time for Phase 2 adjusted from 4 seconds to 7 seconds.
17 th & I Streets, NW	AM	Model does not include exclusive bus lanes. Phase 7 did not turn on (restricts north leg pedestrians to allow protected WBR turns).
17 th & I Streets, NW	PM	Model does not include exclusive bus lanes. Phase 7 did not turn on (restricts north leg pedestrians to allow protected WBR turns).
16 th & K Streets, NW	AM	Service lane along on K Street in both directions.
16 th & K Streets, NW	PM	Service lane along on K Street in both directions.
16 th & I Streets, NW	AM	Model does not include exclusive bus lanes.
16 th & I Streets, NW	PM	Model does not include exclusive bus lanes.
15 th & K Streets (East), NW	AM	No service lane on EB K Street crossing McPherson Square.
15 th & K Streets (East), NW	PM	No service lane on EB K Street crossing McPherson Square.
15 th & K Streets (West), NW	AM	No service lane on EB K Street crossing McPherson Square.
15 th & K Streets (West), NW	PM	No service lane on EB K Street crossing McPherson Square.
15 th & L Streets, NW	AM	
15 th & L Streets, NW	PM	Cars observed illegally parked on outer SBT lane near intersection.
14 th & K Streets, NW	AM	Service lane along on K Street between 13 th & 14 th Streets.
14 th & K Streets, NW	PM	Service lane along on K Street between 13 th & 14 th Streets. DDOT personnel on site at intersection.
14 th & I Streets, NW	AM	Model does not include exclusive bus lanes.
14 th & I Streets, NW	PM	Model does not include exclusive bus lanes.
14 th & L Streets, NW	AM	3 NB receiving lanes, not 2.
14 th & L Streets, NW	PM	
13 th & K Streets, NW	AM	Service lane along on K Street between 12 th & 13 th Streets. 125-foot EB storage lane.
13 th & K Streets, NW	PM	Service lane along on K Street between 12 th & 13 th Streets. 125-foot EB storage lane.
12 th & K Streets, NW	AM	NB approach has 2 lanes, not 3. WB approach has 3 lanes (including service lane).
12 th & K Streets, NW	PM	NB approach has 2 lanes, not 3. WB approach has 3 lanes (including service lane).
11 th & K Streets, NW	AM	Storage length changed to match that of PM Peak Hour File.
11 th & K Streets, NW	PM	Storage length for SBR lane changed to reflect bus blocking.
10 th & K Streets, NW	AM	
10 th & K Streets, NW	PM	
9 th & K Streets, NW	AM	
9 th & K Streets, NW	PM	

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

Peak Period	Observation Category	Location	Direction	Observation Notes
AM	Midblock Activity	Between 22nd St & 21st St	WB	Observed midblock left-turns
AM	Queue	21st St & K Street Service Lane	EB	Right turn into garage backed up.
AM	Midblock Activity	Between 19th St & 18th St	WB	Observed midblock left-turns
AM	Midblock Activity	Between 19th St & 18th St	EB	Observed midblock left-turns
AM	Midblock Activity	Between 18th St & Connecticut Ave	WB	Observed midblock left-turns
AM	Midblock Activity	Between 18th St & 17th St	EB	Observed midblock left-turns
AM	Midblock Activity	Between 17th St & 16th St	WB	Observed midblock left-turns
AM	Midblock Activity	Between 16th St & 15th St	WB	Several vehicles from intersection to access midblock driveway; Observed midblock left-turns
AM	Midblock Activity	Between 16th St & 15th St	EB	Observed midblock left-turns
AM	Queue	15th St & K Street Mainline	WB	Short Block; negligible impact to upstream
AM	Queue	15th St & K Street Service Lane	WB	Short Block; negligible impact to upstream
AM	Queue	14th St & K Street Mainline	SB	Queue spillback due to platoon arrival from L St
AM	Queue	13th St & K Street Mainline	EB	Significant impact to queue due to buses/trucks
AM	Midblock Activity	Between 13th St & 12th St	EB	Observed midblock left-turns
AM	Queue	10th St & K Street Mainline	EB	Parking -Right Lane
AM	Queue	9th St & K Street Mainline	EB	Parking -Right Lane
AM	Queue	14th St & L Street Mainline	NB	SBR turn lane queue
PM	Queue	22nd St & K St Service Lane	WB	U-turn blockage observed
PM	Queue	21st St & K St Service Lane	WB	Periodic queue due to PUDO
PM	Midblock Activity	Between 21st St & 20th St	EB	Observed midblock left-turns
PM	Queue	20th St & K St Service Lane	WB	Queue spillback caused by D5 bus
PM	Midblock Activity	Between 20th St & 19th St	WB	Observed midblock left-turns
PM	Midblock Activity	Between 20th St & 19th St	EB	Observed midblock left-turns
PM	Queue	19th St & K St Mainline	WB	Spillback observed due to downstream, and another because bus stopped.
PM	Queue	19th St & K St Mainline	WB	Due to queue spillback from 20th (20th-18th block queued up until 6PM)
PM	Midblock Activity	Between 19th St & 18th St	EB	Observed midblock left-turns
PM	Midblock Activity	Between 19th St & 18th St	EB	Significant number of vehicles entering garage
PM	Midblock Activity	Between 18th St & 17th St	EB	Significant slip ramp activity avoiding queue in SL
PM	Queue	17th St/Connecticut Ave & K St Service Lane	EB	RT restricted by peds, consistent queue.
PM	Queue	17th St/Connecticut Ave & K St	SB	SB Connecticut blocked by LTs
PM	Midblock Activity	Between 17th St & 16th St	EB	Observed midblock left-turns
PM	Queue	16th St & K St	SB	Heavy SBR traffic, poor lane utilization, ped blocking SBR
PM	Midblock Activity	Between 16th St & 15th St	WB	Observed midblock left-turns
PM	Midblock Activity	Between 16th St & 15th St	EB	Observed midblock left-turns
PM	Queue	15th St & K St Mainline	WB	Blocking EBL
PM	Queue	15th St & K St Service Lane	WB	Queue caused by ped conflicts. Minimal impact to WB traffic.
PM	Queue	15th St/Vermont Ave & K St Mainline	WB	ML block downstream due to NBL into SL @ 15/VT blocking intersection.
PM	Queue	14th St & K St	SB	SBR blocked by peds
PM	Midblock Activity	Between 14th St & 13th St	WB	Observed midblock left-turns
PM	Midblock Activity	Between 13th St & 12th St	WB	Observed midblock left-turns
PM	Queue	21st St & I St	SB	Queue builds (0-20%) waiting for SB release
PM	Queue	17th St & I St	SB	crossing guard prevents queue at the intersection

March 5, 2020

Attachment F: General Observations

K Street NW Traffic Analysis

Data Collection Results Memo

March 5, 2020

Peak Period	Observation Category	Location	Direction	Observation Notes
AM	Midblock Activity	Between 22nd St & 21st St	WB	Observed midblock left-turns
AM	Queue	21st St & K Street Service Lane	EB	Right turn into garage backed up.
AM	Midblock Activity	Between 19th St & 18th St	WB	Observed midblock left-turns
AM	Midblock Activity	Between 19th St & 18th St	EB	Observed midblock left-turns
AM	Midblock Activity	Between 18th St & Connecticut Ave	WB	Observed midblock left-turns
AM	Midblock Activity	Between 18th St & 17th St (west)	EB	Observed midblock left-turns
AM	Midblock Activity	Between 17 th (east) St & 16th St	WB	Observed midblock left-turns
AM	Midblock Activity	Between 16th St & 15th St	WB	Several vehicles from intersection to access midblock driveway; Observed midblock left-turns
AM	Midblock Activity	Between 16th St & 15th St	EB	Observed midblock left-turns
AM	Queue	15th St & K Street Mainline	WB	Short Block; negligible impact to upstream
AM	Queue	15th St & K Street Service Lane	WB	Short Block; negligible impact to upstream
AM	Queue	14th St & K Street Mainline	SB	Queue spillback due to platoon arrival from L St
AM	Queue	13th St & K Street Mainline	EB	Significant impact to queue due to buses/trucks
AM	Midblock Activity	Between 13th St & 12th St	EB	Observed midblock left-turns
AM	Queue	10th St & K Street Mainline	EB	Parking -Right Lane
AM	Queue	9th St & K Street Mainline	EB	Parking -Right Lane
AM	Queue	14th St & L Street Mainline	NB	SBR turn lane queue
PM	Queue	22nd St & K St Service Lane	WB	U-turn blockage observed
PM	Queue	21st St & K St Service Lane	WB	Periodic queue due to PUDO
PM	Midblock Activity	Between 21st St & 20th St	EB	Observed midblock left-turns
PM	Queue	20th St & K St Service Lane	WB	Queue spillback caused by D5 bus
PM	Midblock Activity	Between 20th St & 19th St	WB	Observed midblock left-turns
PM	Midblock Activity	Between 20th St & 19th St	EB	Observed midblock left-turns
PM	Queue	19th St & K St Mainline	WB	Spillback observed due to downstream, and another because bus stopped.
PM	Queue	19th St & K St Mainline	WB	Due to queue spillback from 20th (20th-18th block queued up until 6PM)
PM	Midblock Activity	Between 19th St & 18th St	EB	Observed midblock left-turns
PM	Midblock Activity	Between 19th St & 18th St	EB	Significant number of vehicles entering garage
PM	Midblock Activity	Between 18th St & 17th St	EB	Significant slip ramp activity avoiding queue in SL
PM	Queue	17th St (west)/Connecticut Ave & K St Service Lane	EB	RT restricted by peds, consistent queue.
PM	Queue	17th St (west)/Connecticut Ave & K St	SB	SB Connecticut blocked by LTs
PM	Midblock Activity	Between 17th St (east) & 16th St	EB	Observed midblock left-turns
PM	Queue	16th St & K St	SB	Heavy SBR traffic, poor lane utilization, ped blocking SBR
PM	Midblock Activity	Between 16th St & 15th St	WB	Observed midblock left-turns
PM	Midblock Activity	Between 16th St & 15th St	EB	Observed midblock left-turns
PM	Queue	15th St & K St Mainline	WB	Blocking EBL
PM	Queue	15th St & K St Service Lane	WB	Queue caused by ped conflicts. Minimal impact to WB traffic.
PM	Queue	15th St/Vermont Ave & K St Mainline	WB	ML block downstream due to NBL into SL @ 15/VT blocking intersection.
PM	Queue	14th St & K St	SB	SBR blocked by peds
PM	Midblock Activity	Between 14th St & 13th St	WB	Observed midblock left-turns
PM	Midblock Activity	Between 13th St & 12th St	WB	Observed midblock left-turns
PM	Queue	21st St & I St	SB	Queue builds (0-20%) waiting for SB release
PM	Queue	17th St & I St	SB	crossing guard prevents queue at the intersection