

Memorandum

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District Department of Transportation (DDOT)

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Subject: K Street NW Traffic Analysis
FINAL Traffic Analysis Memorandum

Date: November 5, 2020

Executive Summary

The **K Street Transitway** is a priority project being delivered by the District Department of Transportation (DDOT) that will reconfigure one of the District of Columbia's major east-west corridors, K Street NW, with vast improvements to benefit bus riders, motorists, cyclists, and pedestrians. Existing transit operations result in slow travel speeds along the corridor, and mixed vehicle and transit traffic contributes to recurring congestion during weekday commuting periods. The project goal is to provide safe and reliable access for the largest number of people through the downtown corridor by prioritizing transit, pedestrian, and bicycle modes. By focusing on dedicated and protected space for transit riders and cyclists, the ultimate configuration of the corridor will make it easier, faster, and more reliable for more people to get safely to and through downtown DC.

The objective of the **K Street NW Traffic Analysis** is to evaluate multiple build alternatives for the **K Street NW Transitway** in the anticipated opening year 2025 to inform design decisions. To achieve this objective, existing conditions microsimulation models were developed in PTV Vissim 11 software and calibrated to 2019 field conditions in the AM and PM peak periods (refer to *Attachment A* for details from field data collection and refer to *Attachment B* for existing model calibration details). These models were developed to encompass the study area surrounding the K Street NW Transitway, which is highlighted in **Figure 1**. Next, the existing conditions model was adapted to represent two Transitway design alternatives (i.e., Alternative 1 and Alternative 2) in the opening year 2025. The cross sections for these two alternatives are provided in **Figure 2**.

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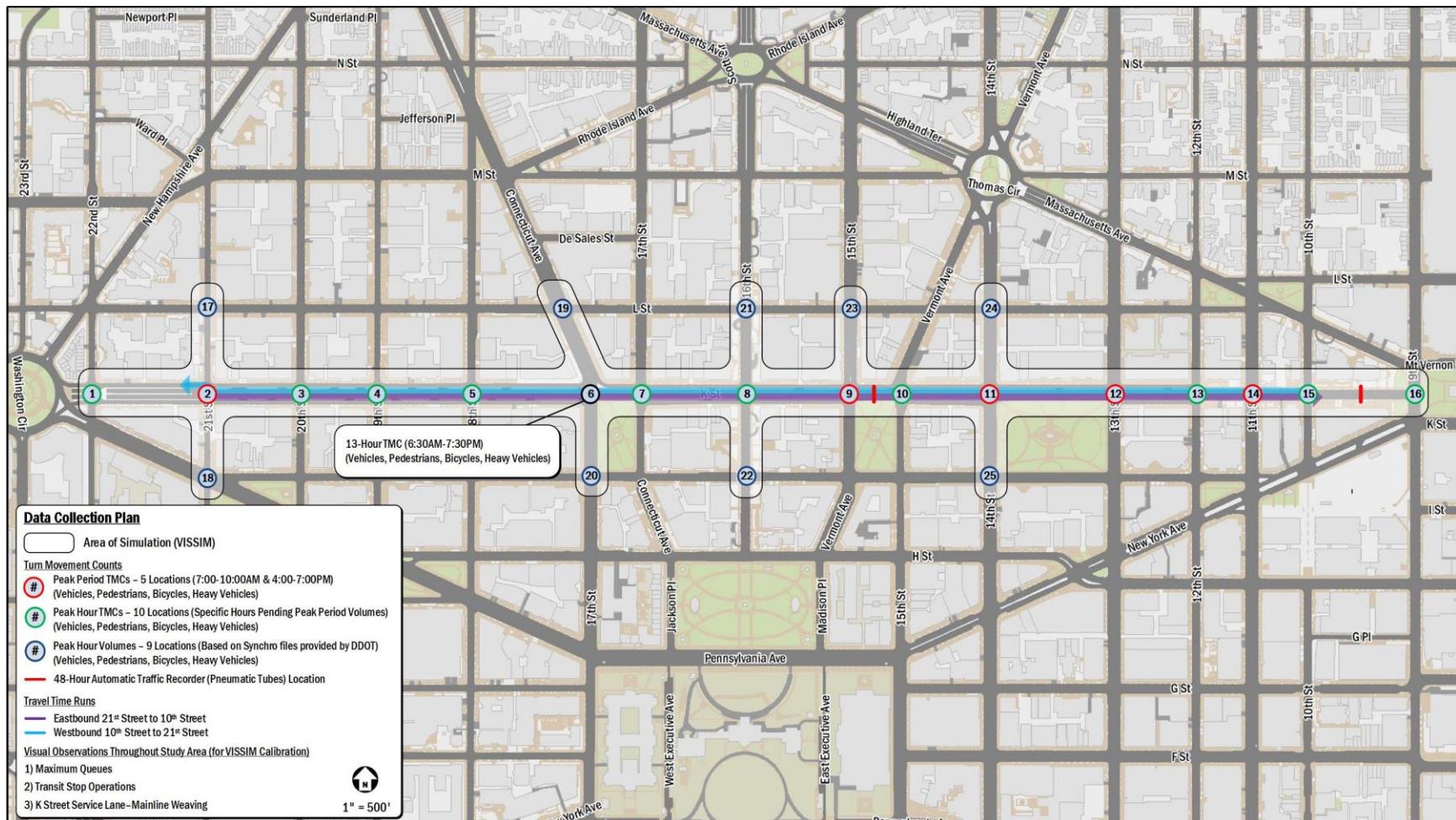


Figure 1: K Street NW Traffic Analysis Study Area and Data Collection Plan

K Street NW Design Alternatives

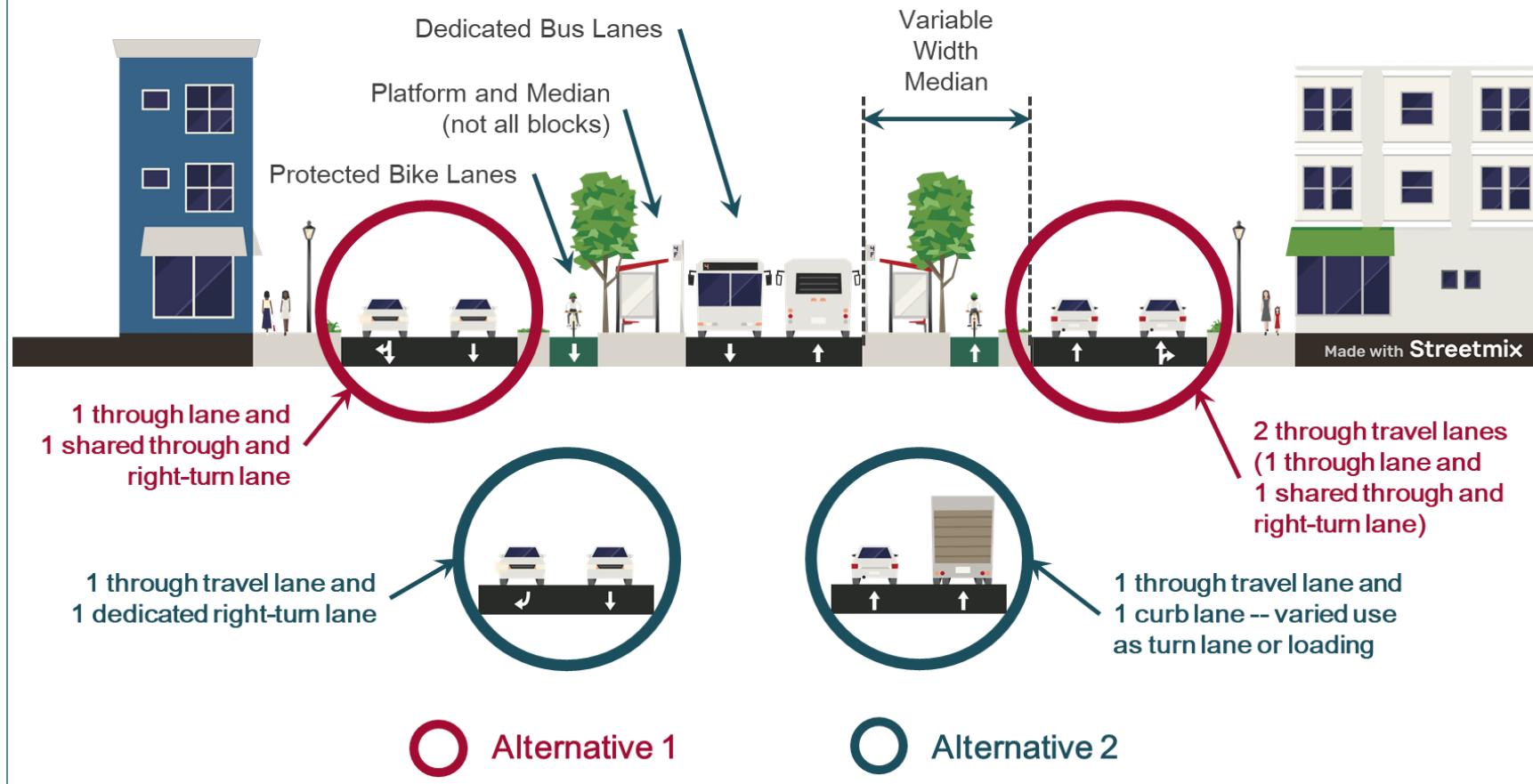


Figure 2: Cross-Section View comparing Alternative 1 and Alternative 2

Alternative 1 represented the design option where two general-purpose through travel lanes were provided at all K Street NW approaches (reference **Figure 3**). Additionally, the Transitway was designed with five bus entry and exit locations, allowing for minimal adjustment to existing bus routes. Traffic analysis results from Alternative 1 illustrated modest benefits to transit performance (20-36%) and minimal disturbance to vehicular throughput and travel time. However, this alternative presented safety risks to cyclists based on constrained cross-section widths at certain segments along the corridor.



Figure 3: Alternative 1 Plan View of Typical Intersection

Alternative 2 represented the design option where one general-purpose through travel lane and one dedicated right-turn lane were provided at all K Street NW approaches (reference **Figure 4**) with the exception of eastbound K Street NW between 21st Street NW and 18th Street NW, where two through travel lanes were provided. In this alternative, the Transitway was designed with four Transitway entry locations and three Transitway exit locations, providing less turning movement disturbance within the Transitway. Initial traffic analysis results from the Alternative 2 PM peak model showed promising mobility improvements for buses along the Transitway; however, it also showed considerable vehicular delay from the reduced vehicular capacity (i.e., reducing the corridor to a single through travel lane in each direction). For this reason, the AM Peak period was not analyzed for Alternative 2. Instead, DDOT pressed forward with the development and evaluation of a Hybrid Alternative.



Figure 4: Alternative 2 Plan View of Typical Intersection

The **Hybrid Alternative** was developed from the most effective components of Alternatives 1 and 2, with the general-purpose travel lane accommodations from Alternative 1 and the Transitway

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design from Alternative 2 (reference **Figure 5**). At most approaches along K Street NW, two general-purpose through travel lanes were maintained, with three exceptions to ensure the configuration would provide adequate buffers for cyclists and fit within allocated right-of-way. In accordance with the Transitway design from Alternative 2 that offered improved bus mobility along the Transitway, four Transitway entry locations and three Transitway exit locations were provided. Initial traffic analysis of the Hybrid Alternative demonstrated greater improvement for transit travel time over Alternatives 1 and 2, as well as minimal general-purpose travel disturbance. The design of the Hybrid Alternative was fine-tuned through a series of data-driven sensitivity analyses to define the preferred configuration presented in the *Technical Details* within this memorandum. These sensitivity analyses included the removal of the 1200 Block Transitway stop, evaluating the optimal location for the 1300 block lane drop, and reconfiguring the 21st Street NW intersection. Ultimately, the preferred configuration of the Hybrid Alternative resulted in transit travel time improvements between 35% and 45% compared to existing conditions.

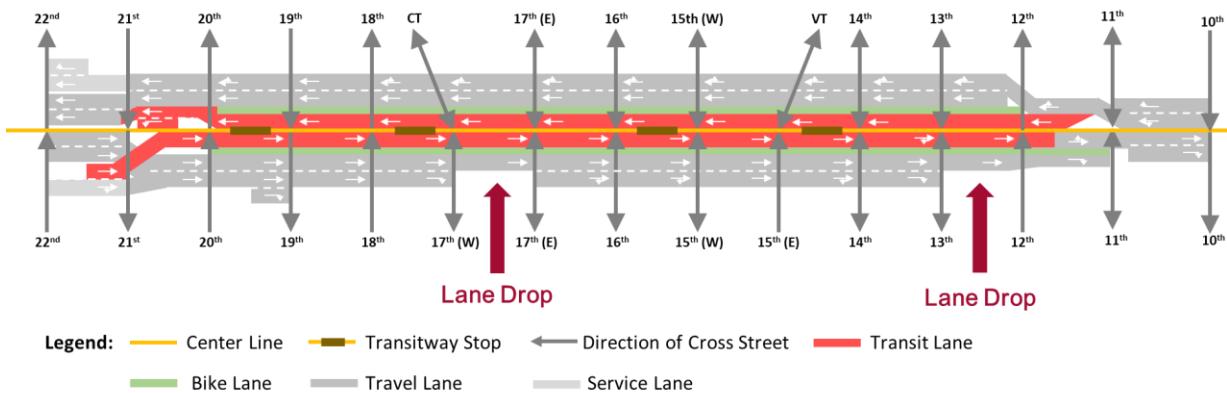


Figure 5: Hybrid Alternative Lane Configuration

A summary of the key findings from each alternative is summarized in **Figure 6** on the following page. As shown, the Hybrid Alternative offers significant transit travel time benefits without substantial increases to general-purpose travel time.

The analysis incorporates existing and planned pedestrian and bicycle infrastructure and needs. Signal timing adjustments influencing pedestrian walk times were only done at intersections with added transit phases to accommodate turning movements from buses along the Transitway. Bicyclist mobility along the corridor is significantly improved with the added center-running cycle track adjacent to the Transitway. All existing cycle tracks and bike lanes within the study area were maintained and planned bicycle facilities on crossing streets within the study area were incorporated.

This **K Street NW Traffic Analysis** is concluding with a recommended preferred configuration for the Hybrid Alternative developed from the most effective elements of Alternative 1 (two through travel lanes and five Transitway entry/exit locations) and Alternative 2 (one through travel lane and four Transitway entry, three exit locations) with additional refinements incorporating the sensitivity analyses described above. Using the information gathered from these data-driven sensitivity analyses, DDOT determined the preferred configuration and the results presented in **Figure 6** and the *Technical Details* illustrate the numerous benefits of this design.



K Street NW Traffic Analysis | Alternatives Comparison

Kimley»Horn

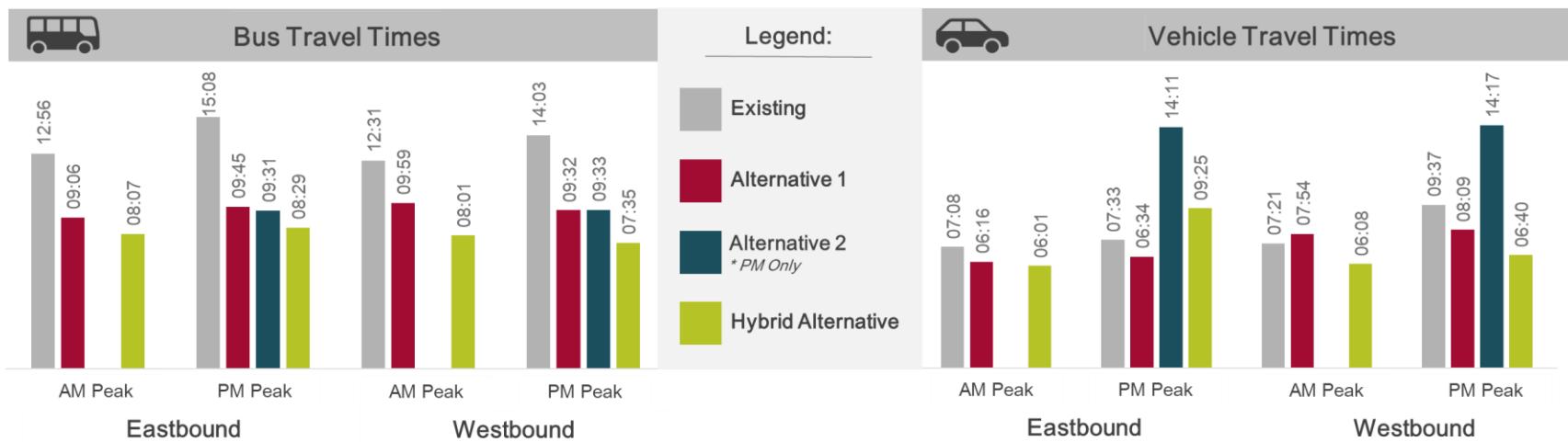
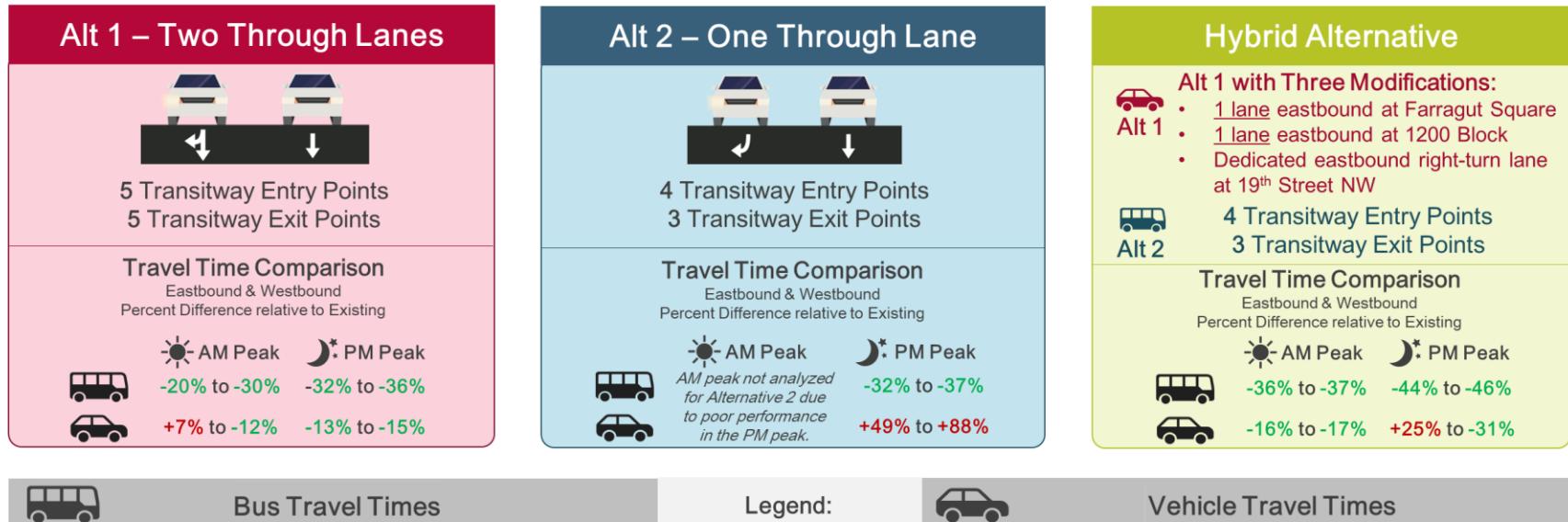


Figure 6: Alternatives Comparison Summary

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Ultimately, the anticipated benefits of the Transitway for multimodal users is summarized in **Figure 7**. As shown, the average transit user can expect to experience reduction in travel time in the range of 35% and 45%, depending on direction and time period, which translates to a better commuting experience, promotes the use of transit, and returns valuable minutes of commuting time. In addition, the new protected bicycle facility improves the connectivity of the bicycle network on and around K Street NW, while improving bicyclist safety. Lastly, pedestrians will enjoy a more comfortable walking experience along K Street with fewer vehicle turning conflicts and enhanced access to transit options. The analysis results also indicate vehicle performance across the K Street NW corridor is not anticipated to change dramatically compared to existing conditions.

Project Benefits

The K Street Transitway will provide mobility and safety benefits for transit riders, cyclists and pedestrians.

Changes in Travel Times:



35% to 45% improvement in bus travel time



Similar driving experience as K Street NW today

Transit User Benefits:



- Provides enhanced reliability for over 40,000 daily bus passengers on 13 bus routes
- Faster bus speeds and improved bus stop amenities
- **101 hours** of travel time savings per peak period

Bike Benefits:



- ~2 cumulative miles of new cycle track
- Connections to 5 crossing bicycle facilities (existing and planned)
- Improves safety by eliminating turn conflicts for through trips

Pedestrian Benefits:



- Fewer conflicts with turning vehicles by removing the existing service lanes and restricting left turns

Figure 7: Anticipated Transitway Benefits

The current and future users of the K Street NW corridor are increasingly traveling on foot, riding bikes, and in buses. The design recommended in this project enhances the safety and mobility of the corridor by balancing the varying needs of these multi-modal users.

Technical Details

The remainder of this memorandum provides background information, modeling assumptions, and detailed results from the **K Street NW Traffic Analysis**.

Background provides detailed information about multi-modal forecasted travel patterns, public transit model considerations, signal timing strategies, and Vissim model coding assumed constant in each build alternative.

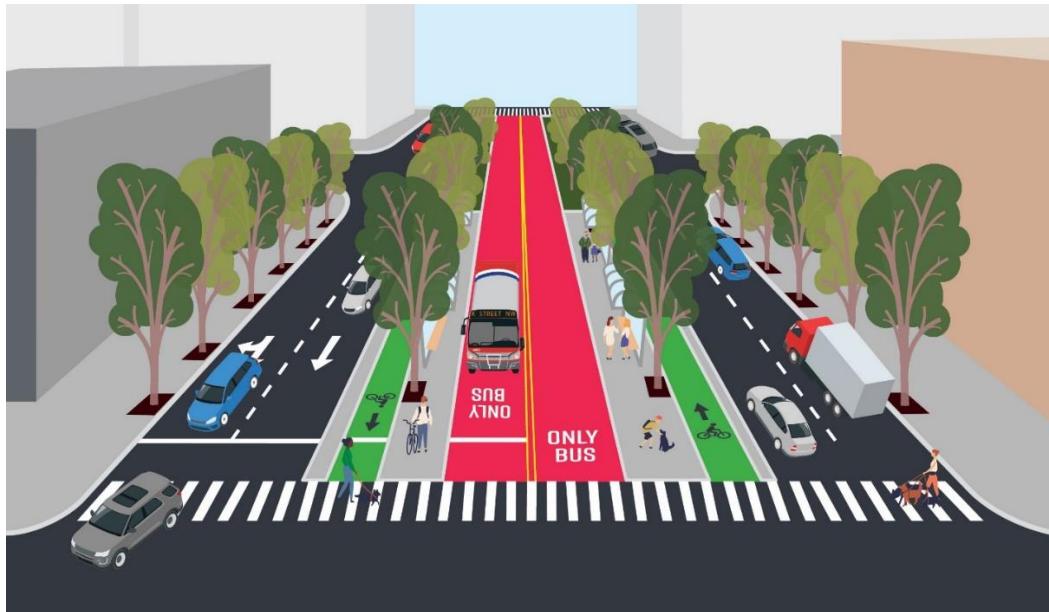
Alternatives 1 and 2 Configuration provides design configuration details for the general-purpose travel lanes and the Transitway entry and exit locations in Alternative 1 and Alternative 2. Additional signal timing adjustments unique to each design configuration are summarized.

Alternatives 1 and 2 Traffic Analysis Results summarizes the Vissim model results for Alternatives 1 and 2.

Hybrid Alternative Configuration provides design configuration details for the Hybrid Alternative, as well as a discussion of the sensitivity analyses performed to result in the preferred configuration.

Hybrid Alternative Traffic Analysis Results summarizes the Vissim model results for the Hybrid Alternative.

Conclusions summarizes the findings from the traffic analysis and highlights key elements of the Transitway entry and exit locations as well as pedestrian safety along the corridor.



Background

This section provides detailed information about multi-modal forecasted travel patterns, public transit model considerations, signal timing strategies, and Vissim model coding assumed constant in each build alternative.

Vehicle Travel Patterns

An evaluation of the MWCOG Travel Demand Model showed little to no growth within the K Street NW Traffic Analysis study area between existing 2019 and opening year 2025. These results were derived from a comparison of the 2019 existing conditions MWCOG model against the 2025 No-Build model. Further, the 2025 MWCOG model was edited to represent the build conditions. This analysis indicated that the proposed build alternatives did not have a direct impact on trip generation along the K Street NW corridor. Refer to *Attachment C* for additional details. Therefore, in order to provide a conservative forecast and produce a model that is comparable with existing conditions, the existing conditions vehicle volumes were maintained. Travel patterns were adjusted at each intersection to represent restricted left turns in accordance with each alternative's design configuration (as agreed upon in the March 2, 2020 bi-weekly meeting).

The first draft of the 2025 re-routed volumes were approved by DDOT via email on March 31, 2020. In this acceptance, DDOT requested that rather than using a fixed redistribution rate, DDOT Traffic Engineering and Signals Division (TESD) staff would prefer the Kimley-Horn team use the first round of Vissim outputs to validate if assigned traffic can achieve an equilibrium state. If this does not occur, a second iteration will be completed to reassign those movements to other nearby locations to achieve less delay. Following this guidance, the Kimley-Horn team redistributed right-turning volumes in the following locations based on the first round of Vissim results in both the AM and PM peak periods.

- Originally, the restricted eastbound right-turn movement at 17th Street NW (east) had been re-routed with 40% to 17th Street NW (west) and 60% to 16th Street NW.
 - In review of the Vissim model results, the existing congestion on 17th Street (west) is worsened with the added vehicles diverting southbound on 17th Street NW (west).
 - Therefore, the eastbound right movement at 17th Street NW (east) was reallocated to 100% at 16th Street NW.
- Originally, the restricted eastbound left movement at Vermont Avenue NW had been re-routed to 14th Street NW.
 - In review of the Vissim model results, the added turning volume at 14th Street NW resulted in a bottleneck at 14th Street NW caused in part by the existing congestion on 14th Street NW southbound as well as the delay from pedestrian conflicts.
 - Therefore, the eastbound left movement at Vermont Avenue NW was reallocated to 13th Street NW.

A complete summary of the re-routed volumes is provided in **Table 1**. The updated volume tables and figures are provided in *Attachment C*.

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Table 1: Peak Hour Volume Re-Routing Assumptions

Restricted Movement	From	To	Alternative Movement	Path
EBL	K St NW	20 th St NW	EBR (x3)	19 th St NW to I St NW to 20 th St NW
		18 th St NW		17 th St NW (west) to I St NW to 18 th St NW
		Connecticut Ave NW		16 th St NW to I St NW to 17 th St NW (west)
		17 th St NW		16 th St NW to I St NW to 17 th St NW (east)
		16 th St NW		15 th St NW (west) to I St NW to 16 th St NW
		15 th St NW (west)		14 th St NW to I St NW to 15 th St NW (west)
		Vermont Ave NW		13 th St NW to I St NW to 15 th St NW (east) ¹
		14 th St NW		13 th St NW to I St NW to 14 th St NW
		13 th St NW		
		12 th St NW		11 th St NW to I St NW to 12 th St NW
EBR		17 th St NW (east)	EBR (split)	100% to 16th St NW ¹
WBL		13 th St NW	WBR (x3)	14 th St NW to L St NW to 13 th St NW
		14 th St NW		Vermont Ave NW to L St NW to 14 th St NW
		15 th St NW (west)		16 th St NW to L St NW to 15 th St NW (west)
		16 th St NW		17 th St NW (east) to L St NW to 16 th St NW
		17 th St NW (east)		Connecticut Ave NW to L St NW to 17 th St NW (east)
		17 th St NW (west)		18th St NW to L St NW to Connecticut Ave NW
		19 th St NW		20 th St NW to L St NW to 19 th St NW
		21 st St NW	WBU, EBR	22 nd St NW (U-turn slip lane) to 21 st St NW

¹ Based on model performance, these rerouting paths were updated.

Pedestrian and Bicycle Volumes

The pedestrian and bicycle volumes from existing conditions were maintained in all existing locations (i.e., all pedestrian crosswalks and existing cycle lanes on 15th Street NW, 12th Street NW, 11th Street NW, and 10th Street NW). The bicycle volumes for the new center-running cycle track on K Street NW were estimated from the demand on the existing bicycle lanes located on 15th Street NW, 12th Street NW, 11th Street NW, and 10th Street NW. These estimates are adequate for alternatives comparison as the center-running bicycle lane design does not conflict with vehicular or transit movements throughout most of the corridor.

Public Transit Model Considerations

Washington Metropolitan Transit Authority (WMATA) and DC Circulator bus lines were rerouted and stops relocated based on DDOT guidance associated with each build alternatives¹. All other WMATA buses that previously used K Street NW were rerouted to reasonable locations within the corridor. Maryland Transit Authority (MTA) and Loudon County commuter buses maintained their existing routes, many along K Street NW; however, these buses were not permitted to use the K Street NW Transitway and were not permitted to stop along K Street NW.

¹ DDOT and WMATA jointly developed assumptions for Metrobus and DC Circulator routes to travel on the Transitway, as well as two build alternatives for these routes to enter and exit. These assumptions were provided to the consultants in January 2020.

Interpretation of Transit Performance between Models

Transit performance was the critical guiding factor in optimizing network operations along the corridor. The following considerations should be kept in mind while reviewing the transit travel time and speed comparisons across all build alternatives:

- Transit travel time includes the dwell time for the transit vehicle.
- Transit travel speeds are calculated from the travel time, thus also incorporate dwell time.
- The travel time and speed comparisons were conducted for designated segments of K Street NW. In existing conditions, these segments were located on the general-purpose travel lanes. In the build alternatives, these segments are located on the Transitway.
- Due to transit route adjustments, these segments do not capture the same number of buses or buses from the same routes. Therefore, the average travel time and speed are reflective of the buses that travel the segment in each alternative.
- Similarly, the Transitway stops in the build alternatives are consolidated and located in different locations than bus stops in existing conditions.

Transit Dwell Times

Considering the observed existing conditions bus dwell time distributions from the WMATA Automatic Vehicle Location (AVL) data, the traffic analysis team determined that there are many industry guidance documents and numerous studies that support a reduction in dwell time on the basis of level-boarding and all-door boarding and alighting in the K Street NW Transitway design. The traffic analysis team developed the following assumptions using numerous references, including nationally accredited guidance documentation, case studies, literature reviews, and discussions with experts:

- **Bus dwell times greater than 15 seconds may be reduced by 20%.** Where the dwell time is at or below 15 seconds, the dwell time shall remain consistent with existing conditions;
- Empirical bus dwell time distributions were adjusted in the traffic model to reflect this reduction.

The 20% reduction in dwell time is supported by a number of references and guidance documents, most notably the Transit Cooperative Research Program (TCRP) Guidance and Documentation (<http://onlinepubs.trb.org/onlinepubs/tcrp/docs/tcrp100/Part4.pdf>). Most case studies and literature referenced this guidance document as the primary resource for forecasting dwell times under new build conditions. The following exhibit from the TCRP provides time savings estimates on the basis of the number of available door channels (Exhibit 4-3). These exhibits represent the *estimated reduction in individual passenger service time* (seconds per passenger).

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<p>Maximum 40% decrease in <u>boarding</u> time with two doors</p> <p>Maximum 43% decrease in <u>alighting</u> time with two doors</p>	<p>Exhibit 4-3 Passenger Service Times with Multiple-Channel Passenger Movement^(R5,R20,R23,R24)</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 30%;">Available Door Channels</th><th colspan="3">Default Passenger Service Time (s/p)</th></tr> <tr> <th></th><th>Boarding*</th><th>Front Alighting</th><th>Rear Alighting</th></tr> </thead> <tbody> <tr> <td>1</td><td>2.5</td><td>3.3</td><td>2.1</td></tr> <tr> <td>2</td><td>1.5</td><td>1.8</td><td>1.2</td></tr> <tr> <td>3</td><td>1.1</td><td>1.5</td><td>0.9</td></tr> <tr> <td>4</td><td>0.9</td><td>1.1</td><td>0.7</td></tr> <tr> <td>6</td><td>0.6</td><td>0.7</td><td>0.5</td></tr> </tbody> </table> <p>*Assumes no on-board fare payment required Increase boarding times by 20% when standees are present. For low-floor buses, reduce boarding times by 20%, front alighting times by 15%, and rear alighting times by 25%.</p>	Available Door Channels	Default Passenger Service Time (s/p)				Boarding*	Front Alighting	Rear Alighting	1	2.5	3.3	2.1	2	1.5	1.8	1.2	3	1.1	1.5	0.9	4	0.9	1.1	0.7	6	0.6	0.7	0.5
Available Door Channels	Default Passenger Service Time (s/p)																												
	Boarding*	Front Alighting	Rear Alighting																										
1	2.5	3.3	2.1																										
2	1.5	1.8	1.2																										
3	1.1	1.5	0.9																										
4	0.9	1.1	0.7																										
6	0.6	0.7	0.5																										

Additional considerations for modifying the bus dwell time for the build conditions include:

- TCRP recommends 2-5 seconds minimum for door opening and closing.
- Level-boarding may reduce dwell time; however, it will also increase bus approach time due to the precise movements drivers will be required to make. In the traffic model, it is not common to adjust the bus acceleration/deceleration behavior to account for this impact, but rather accommodate it within the recommended dwell time.
- Additional considerations regarding fare-payment type should be considered.
- Industry experts recommend limiting dwell time reductions below a 15 second threshold to maintain realistic field operations.

In consideration of these factors and foreseen field operations, the traffic analysis team developed a conservative estimate for overall dwell time reduction of 20% from existing conditions, with the caveat that reductions would not be considered for dwell times below the 15 second threshold.

Signal Timing Strategies

Signal timing parameters (i.e. green time allocation and coordination) were adjusted as needed to accommodate the build alternative designs with the Transitway. Signal operations and timings were modified to accommodate dedicated transit movements as needed in each alternative. Signal timings at all other intersections along the K Street NW corridor were optimized to maximize transit travel time and vehicular throughput.

The only major change to signal operations that was not associated with Transitway operations and that was carried through in Alternative 2 was at 19th Street NW. A protected eastbound right-turn phase was added to 19th Street NW to accommodate the heavy approach volume of 980 vehicles in the AM peak hour, of which 190 vehicles are making the eastbound right-turn movement. The decision to add this protected phase was based on the reduced throughput observed at upstream intersections as a result of congestion in the eastbound direction at 19th Street NW associated with right-turning vehicles. The protected eastbound right-turn phase was coded as the lagging eastbound phase, following the leading permissive phase during which pedestrians would receive the leading pedestrian interval and subsequent pedestrian clearance intervals.

Vissim Model Coding

The 2019 existing conditions Vissim models developed for the AM and PM peak periods were adapted to represent the 2025 K Street Transitway build alternatives. The coding protocols outlined in *Attachment B: Existing Conditions Vissim Calibration Memorandum* provide detailed

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model coding protocols which were maintained in all 2025 build models. A summary of these coding principles are provided below:

Traffic Operations

- Conflict control (i.e., priority rules and conflict areas) were maintained in all applicable locations between the existing and build models. Additional conflict control was added as necessary to handle new conflict points introduced by the alternative designs.
- Turning travel speeds (i.e., reduced speed areas) were coded on all turning connectors following the same speed distributions as the existing models.
- Network travel speed (i.e., assigned to vehicle classes) remained at 25 mph throughout the corridor.
- External congestion outside the study area was coded with desired speed decisions, and these conditions were maintained in the build AM and PM models to match their respective calibrated existing models.

Vehicle 2D & 3D Models

- Vehicle displays in the build models remained consistent with existing models.
 - All passenger cars are displayed in a scale of **red** colors not associated with specific vehicle types.
 - All heavy vehicles are displayed in a **brown** color.
 - All buses are displayed in a blue/green color based on their operator.
 - WMATA Metrobuses are **Navy Blue**
 - Circulator Buses are **Light Blue**
 - MTA Buses are **Dark Teal**
 - MCI (Motor Coach Industries) Loudoun Buses are **Light Teal**
 - While the simulation is running:
 - A bus that is **black**, is delayed.
 - A bus that is **white**, is loading/unloading.
- Vehicle compositions in the build models were maintained from existing conditions: 95% passenger vehicles and 5% Heavy Goods Vehicle (HGV) (i.e., including light trucks). These distributions were determined from the Existing Conditions data collection.
 - A selection of smaller vehicle 2D/3D models were added to better represent the passenger car vehicle fleet (i.e., vehicle lengths) along K Street NW.

Vehicle Inputs and Routing

- The procedure for assigning vehicle inputs remained consistent in the build models as in the existing models.
 - Vehicle inputs were assigned at 15-minute increments following the demand curves from existing conditions.
- Vehicle routes in the build models were coded using the relay-routing adapted from the existing conditions models to account for the new design configurations.

Driving Behavior

- All driving behavior input parameters were carried over to the build alternative AM and PM model from their respective calibrated existing model, as appropriate.

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- New links coded in build alternative models were coded with representative driving behaviors to match existing conditions. For example, the driving behavior defined as “Arterial Oversaturated Segments” in existing conditions was only used in the build models in locations with severe oversaturation caused by the geometric condition.

Priority Rules

- All priority rules and settings were maintained in the AM and PM build models to reflect their respective calibrated Existing model.
 - In instances where the pedestrian conflicts moved from right-turning movements on the service lanes to right-turning movements on the mainline, those priority rules were transferred.
 - Priority rules coded to reflect “Keep Clear” conditions were maintained in all applicable locations.
 - New priority rules were introduced as needed with new movements in the build model alternatives. These priority rules were set up using the same default parameters as in existing conditions.

Alternatives 1 and 2 Configuration

This section provides design configuration details for the general-purpose travel lanes and the Transitway entry and exit locations in Alternative 1 and Alternative 2. Additional signal timing adjustments unique to each design configuration are summarized.

General-Purpose Lane Geometry

As described in the *Executive Summary*, one difference between Alternatives 1 and 2 is the general-purpose travel lane configuration. Alternative 1 was designed to offer greater vehicle capacity by providing two through lanes at each intersection approach, whereas Alternative 2 was designed to introduce more flexible curb space, thus reducing vehicular capacity to one through lane at each intersection approach and exclusive right-turn lanes where turns are permitted. Right-turn lanes were modeled to extend the distance between the downstream intersection and the closest midblock garage entrance or alley access. A plan view representation of a typical intersection for Alternatives 1 and 2 are shown in **Figure 8** and **Figure 9**, respectively.



Figure 8: Alternative 1 Plan View of Typical Intersection



Figure 9: Alternative 2 Plan View of Typical Intersection

Alternative 1 Geometric Details

The Alternative 1 design provides two through vehicle travel lanes at all intersections across the corridor. The provided 30% design files were used to represent the design with the following exceptions confirmed with DDOT in an April 28, 2020 meeting.

- Two travel lanes were maintained eastbound on the Farragut West Square block between Connecticut Avenue NW / 17th Street NW (west) and 17th Street NW (east).
- Two travel lanes were maintained eastbound on the 1200 block between 13th Street NW and 12th Street NW.
- A third travel lane added at the northbound approach to 12th Street NW, just north of the existing garage access to match existing conditions.

Alternative 2 Geometric Details

The Alternative 2 design represents one through vehicle travel lane for most intersections across the corridor (i.e., between 21st Street NW and 12th Street NW). The exception to this occurs in the eastbound direction between 21st Street NW and 17th Street NW (west)/ Connecticut Avenue NW where two through general purpose travel lanes are retained. This alternative deviated from the 30% design plans to evaluate the impact of increasing the amount of flexible curb space.

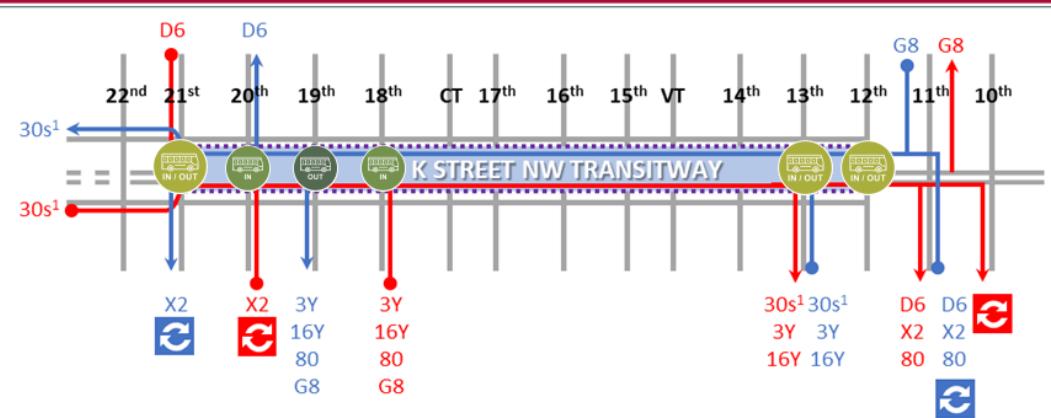
Transitway Entry/Exit Locations

As described in the *Introduction*, a second difference between Alternatives 1 and 2 is the number of locations where buses are permitted to enter and exit the Transitway. Alternative 1 offers five entry and five exit locations, reducing the changes in routing to existing bus routes, while Alternative 2 offers four entry and three exit locations, providing less turning movement disturbance within the Transitway. Bus routes permitted on the Transitway were provided by DDOT (in coordination with WMATA). The entrance and exit locations for each of these routes are shown in **Figure 10**.

Specific consideration of Metrobus route D6 was requested for this analysis, as the westbound route for this bus line would be altered more significantly than other routes with the allotted Transitway entry and exit locations in Alternative 2. In order to evaluate the route detour, which is outside the Vissim study area, Google Typical Traffic was used to estimate average travel time on the existing and proposed routes. As shown in **Figure 11**, under typical AM and PM peak period travel conditions, the detour could result in up to a 9-minute delay. This delay does not account for the travel time savings introduced by the Transitway. At future phases of this project, signal timing and other bus prioritization options may be considered to mitigate delays introduced by this detour.

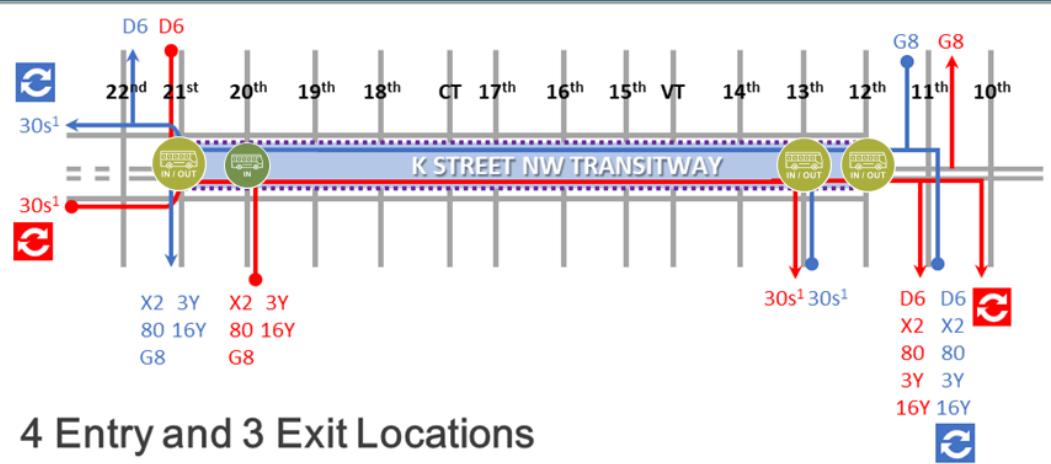
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Alternative 1



5 Entry/Exit Locations

Alternative 2



4 Entry and 3 Exit Locations

	Eastbound	Westbound
Route Origin	●	—
Route Destination	—	→
USGT Circulator	↻	↻
Transitway	—	—
Transitway Entrance Only	—	●
Transitway Exit Only	●	—
Transitway Entrance/Exit	●	●

¹30N, 30S, 32, 33, 36, 37, 39

Figure 10: Alternative 1 and 2 Transit Route Configurations

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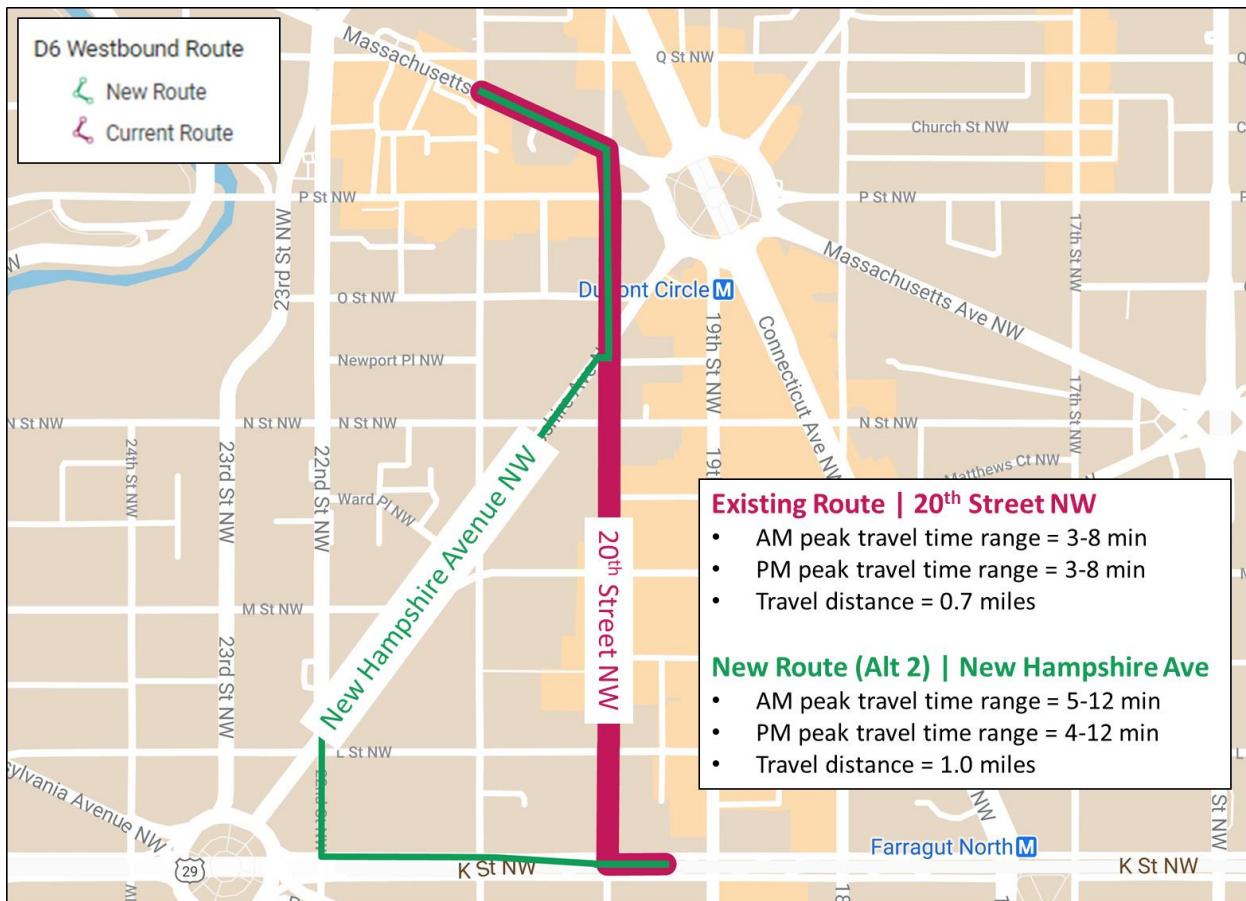


Figure 11: Existing and Alternative 2 Route for Bus Line D6 Westbound

Signal Timing Strategies

As indicated in the *Background* section, all study area intersections were optimized to accommodate the 2025 travel patterns. Additional signal timing and operation changes were made unique to Alternatives 1 and 2 in order to accommodate the dedicated transit movements to and from the planned Transitway.

Alternative 1 Signal Timing

In Alternative 1, five entry and exit locations are provided for buses to access the Transitway; therefore, signal operation at each of these five intersections were evaluated and adjusted in order to accommodate these movements. **Table 2** details the signal timing strategies adopted to accommodate dedicated transit movements along K Street NW.

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Table 2: Signal Timing Strategy for Dedicated Transit Movements in Alternative 1

Intersection	Signal Timing Strategy
K Street NW and 21 st Street NW	<p>EB Transitway entry:</p> <ul style="list-style-type: none"> A dedicated bus storage lane (left curb face) was designated in the existing service lane for buses arriving from Washington Circle. Presence detection was modeled to actuate a transit phase to stop eastbound vehicles from the underpass to allow transit vehicles to enter the Transitway. <ul style="list-style-type: none"> Coded as a lagging signal phase, if a transit vehicle is not present during a cycle, the unused time is returned to the underpass through movement. Westbound through vehicles (general purpose only) were permitted to continue traveling through the intersection during this transit phase. Westbound transit vehicles were not permitted to travel through the intersection during this phase. A separate phase for WB transit (outlined below) was coded to provide safe egress from the Transitway and operational flexibility for transit maneuvers. Note that eastbound service lane vehicles were permitted to travel concurrently with transit vehicles onto K Street NW or southbound onto 21st Street NW. <p>WB Transitway exit:</p> <ul style="list-style-type: none"> Presence detection was modeled to actuate an exclusive transit phase to stop eastbound and westbound vehicles (general purpose) and eastbound transit vehicles. Coded as a leading signal phase, if a transit vehicle is not present during a cycle or does not require the full split, unused time is returned to the eastbound and westbound vehicles.
K Street NW and 20 th Street NW	<ul style="list-style-type: none"> Presence detection was modeled to actuate an exclusive transit phase to stop westbound vehicles (general purpose) and allow transit vehicles to turn right onto 20th Street NW. <ul style="list-style-type: none"> If a transit vehicle is not present during a cycle, the unused time is returned to the westbound through movement. Eastbound through vehicles (general purpose and transit) were permitted to continue traveling through the intersection.
K Street NW and 19 th Street NW	<ul style="list-style-type: none"> Presence detection was modeled to actuate an exclusive transit phase to stop eastbound vehicles (general purpose) and allow transit vehicles to turn left onto 19th Street NW. <ul style="list-style-type: none"> If a transit vehicle is not present during a cycle, the unused time is returned to the eastbound through movement. Westbound through vehicles (general purpose and transit) were permitted to continue traveling through the intersection. The actuated westbound left-turn phase for transit vehicles was coded to follow the protected eastbound right-turn phase. Therefore, when buses are not detected as needing to make a westbound left-turn movement onto 19th Street NW from the Transitway, additional time is allocated to the eastbound right-turn protected movement.
K Street NW and 13 th Street NW	<p>Two transit phases were coded to accommodate the eastbound right-turn movement, available for transit maneuvers during each signal cycle:</p> <ul style="list-style-type: none"> Phase 1: every cycle, turning transit vehicles are permitted to exit the Transitway onto 13th Street NW concurrently with the protected left-turn phase for the northbound left-turn movement from 13th Street NW. Phase 2: presence detection was modeled to actuate an exclusive transit phase to delay the release of eastbound vehicles (general purpose) and allow transit vehicles to turn right onto 13th Street NW. <ul style="list-style-type: none"> If a transit vehicle is not present during a cycle, the unused time is returned to the eastbound through movement. Westbound through vehicles (general purpose and transit) were permitted to continue traveling through the intersection during this transit phase.
K Street NW and 12 th Street NW	<p>WB Transitway entry:</p> <ul style="list-style-type: none"> Transit vehicles travel concurrently with general purpose vehicles and are able to enter the Transitway without an exclusive transit phase. <p>EB Transitway exit (two exclusive transit phases per cycle):</p> <ul style="list-style-type: none"> Phase 1: presence detection was modeled to actuate an exclusive transit phase to delay the release of eastbound vehicles (general purpose) and allow transit vehicles to travel onto the 1100 Block of K Street NW. <ul style="list-style-type: none"> If a transit vehicle is not present during a cycle, the unused time is returned to the eastbound through movement. Phase 2: an eastbound transit-only phase occurs every cycle following the through movements on K Street NW. Eastbound and westbound bicycles also receive an indication to enter and exit the Transitway.

Alternative 2 Signal Timing

In Alternative 2, four entry locations and three exit locations are provided for buses to access the Transitway; therefore, signal operation was adjusted for these specific locations. Specific adjustments to signal timings implemented in Alternative 2 included:

- Prioritization of bus mobility along the Transitway by adjusting progression patterns to reduce stops at traffic signals, accounting for dwell time at transit stops.
- Reducing vehicle green time for movements crossing K Street NW to match the crossing time for pedestrians crossing K Street NW; doing so improved progression opportunities for transit and general-purpose traffic along K Street NW.
- Adjusting progression patterns for general-purpose traffic, while consider bus mobility, to anticipate queue buildup and dissipation at the bottleneck locations, namely Connecticut Avenue NW/17th Street NW (west) and 13th Street NW.
- Strategic lead/lag phase sequence of transit phases at entry and exit points on the Transitway to match bus progression patterns and reduce dwell time for buses waiting to enter or exit the Transitway.
- Specifically, at the east end of the Transitway, strategic progression patterns were implemented to facilitate the departure of transit vehicles from the Transitway at 12th Street NW and travel through 11th Street NW with minimal to no stop.

Alternatives 1 and 2 Traffic Analysis Results

This section summarizes the Vissim model results for Alternatives 1 and 2. The Vissim results are summarized and discussed in this section, and the full model results are provided in *Attachment D: Alternative 1 Vissim Results Summary* and *Attachment E: Alternative 2 Vissim Results Summary*. These attachments can be referenced for support of Alternatives 1 and 2 model validity and performance. In addition, the results for Alternatives 1 and 2 build configurations are included in the results comparison provided in *Attachment G: Vissim Results Comparison*. This attachment provides a side-by-side comparison of Vissim model results for existing conditions and all build alternatives.

Alternative 1 Results

This section provides an overview of Alternative 1 model results. First, model validity is shown through a vehicle loading summary illustrating forecasted demand is met within the model. Next, transit performance traversing the dedicated Transitway is considered as it compares to existing conditions. Finally, vehicular performance is reviewed and compared to existing conditions.

Model Validity

Table 3 and **Table 4** provide the loading summary for the Alternative 1 AM and PM models, respectively. As shown, the model is successfully processing the 2025 vehicular demand and travel patterns described in the *Background* section. A comprehensive summary of model outputs summarizing performance can be found in *Attachment D: Alternative 1 Vissim Results Summary*. Further, model outputs indicate that a sample size of 10 model runs is sufficient for evaluating average model performance.

Table 3: AM Peak Alternative 1 Loading Summary

Calibration Item	Basis	Criteria	Value	Target	Criteria Met
Simulated Vehicular Throughput (Individual Links)	All Segments and Approaches	Within \pm 100 vph for < 700 vph	100%	85%	Yes
		Within \pm 15% for \geq 700 vph to < 2,700 vph			
		Within \pm 400 vph for \geq 2,700 vph			
		GEH < 5 for individual link flows	100%	85%	Yes
Simulated Vehicular Throughput (Network Wide)	Total Volume throughout Network	GEH < 4 for total network volume	0.8	4.0	Yes
		Within 5% of total network volume	0.4%	5%	Yes
Required Sample Size			10		

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Table 4: PM Peak Alternative 1 Loading Summary

Calibration Item	Basis	Criteria	Value	Target	Criteria Met
Simulated Vehicular Throughput (Individual Links)	All Segments and Approaches	Within \pm 100 vph for < 700 vph	100%	85%	Yes
		Within \pm 15% for \geq 700 vph to < 2,700 vph			
		Within \pm 400 vph for \geq 2,700 vph			
		GEH < 5 for individual link flows	100%	85%	Yes
Simulated Vehicular Throughput (Network Wide)	Total Volume throughout Network	GEH < 4 for total network volume	1.3	4.0	Yes
		Within 5% of total network volume	-0.7%	5%	Yes
Required Sample Size			10		

Transit Performance

Transit performance for Alternative 1 is summarized by the average travel time (including dwell time) in **Table 5** and **Table 6** for AM and PM, respectively. From these results the following observations can be made:

- The Alternative 1 design for the Transitway reduces transit end-to-end travel time along the K Street NW corridor by 20 to 36 percent.
 - Eastbound Transit Travel Times: 3.8 minutes of time savings (-30%) in the AM peak period and 5.4 minutes of time savings (-36%) in the PM peak period with the Alternative 1 Transitway design.
 - Westbound Transit Travel Times: 1.5 minutes of time savings (-20%) in the AM peak period and 4.5 minutes of time savings (-32%) in the PM peak period with the Alternative 1 Transitway design.
- In the westbound direction, average bus travel times between 19th Street NW and 22nd Street NW increase over existing conditions (+23 seconds AM, +6 seconds PM) largely impacted by delay incurred by the westbound exit locations from the Transitway at 19th Street NW, 20th Street NW and 21st Street NW. To mitigate this impact, dedicated turning bays were assumed at each exit location² to reduce delay from buses turning at 19th Street NW, 20th Street NW, and 21st Street NW.
- In the eastbound direction, average bus travel times between 14th Street NW and 10th Street NW increase over existing conditions (+13 seconds AM, +22 seconds PM). This modest delay at the far eastern edge of the Transitway can be attributed to the bus entry and exit locations and the 1100 Block design changes that reduce westbound traffic to a single lane prior to providing a transit-entry lane.
- Transit travel speeds were derived from the average travel time and are provided in *Attachment G: Vissim Results Comparison*. Under the Alternative 1 build condition, average speed of buses (including dwell time and intersection delay) increased in the AM peak period by 2.1 mph in the eastbound direction and 1 mph in the westbound

² DDOT notes that these turning bays are not currently included in the 30% design and have not been fully vetted.

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direction. In the PM peak period, travel speeds increased by 2.4 mph in the eastbound direction and 1.8 mph in the westbound direction.

- Bus bunching along the corridor was alleviated by updating routing schedules to headway-based routing contingent on arrival time to the Transitway.

Table 5: AM Average Transit Travel Times between Existing and Alternative 1

Segment ID	Route	Existing Travel Time [MM:SS]	Alternative 1 Travel Time [MM:SS]
1	22 nd Street NW to 19 th Street NW	02:58	02:08
2	19 th Street NW to 17 th Street NW	03:02	01:20
3	17 th Street NW to 14 th Street NW	04:53	03:22
4	14 th Street NW to 10 th Street NW	02:03	02:16
Total Eastbound		12:56	9:06
5	10 th Street NW to 14 th Street NW	03:02	03:06
6	14 th Street NW to 17 th Street NW	05:39	03:00
7	17 th Street NW to 19 th Street NW	01:55	01:35
8	19 th Street NW to 22 nd Street NW	01:55	02:18
Total Westbound		12:31	9:59

* Average travel time includes bus dwell time.

* Blue highlighted cells represent segments where Alternative 1 bus travel time is less than existing conditions.

Table 6: PM Average Transit Travel Times between Existing and Alternative 1

Segment ID	Route	Existing Travel Time [MM:SS]	Alternative 1 Travel Time [MM:SS]
1	22 nd Street NW to 19 th Street NW	03:41	01:48
2	19 th Street NW to 17 th Street NW	03:17	01:39
3	17 th Street NW to 14 th Street NW	05:39	03:25
4	14 th Street NW to 10 th Street NW	02:31	02:53
Total Eastbound		15:08	09:45
5	10 th Street NW to 14 th Street NW	03:49	02:19
6	14 th Street NW to 17 th Street NW	06:03	03:11
7	17 th Street NW to 19 th Street NW	01:41	01:26
8	19 th Street NW to 22 nd Street NW	02:30	02:36
Total Westbound		14:03	09:32

* Average travel time includes bus dwell time.

* Blue highlighted cells represent segments where Alternative 1 bus travel time is less than existing conditions.

General-Purpose Traffic Performance

The impacts of the Alternative 1 K Street Transitway design on general-purpose traffic are summarized in the following sections for the AM and PM peak periods. Overall, the traffic analysis illustrated the Alternative 1 design does not have a large adverse impact on vehicular traffic. Removal of the service lanes, introduction of 24-hour left-turn restrictions from K Street NW, and removal of bus stops along the general-purpose lanes results in some travel time improvements.

While the following sections highlight performance differences, it is plausible that any additional capacity and travel time savings achieved from this design would be reclaimed by redistributed trips from parallel paths in downtown Washington, DC, resulting in comparable vehicular operations along K Street NW to those recorded as part of the Existing Conditions data collection.

The reported intersection level of service reported below is an estimated value from the Vissim model that does not incorporate passenger car equivalents; therefore, it is not congruent with the level of service reported by the Highway Capacity Manual.

AM PEAK HOUR | INTERSECTION PERFORMANCE

- Under existing conditions, bus stops along the K Street NW corridor contributed to a significant amount of delay in the AM peak hour. The removal of stops on the general-purpose lanes at close proximities to intersection approaches and departures resulted in delay reductions. Tables showing all intersection delay and levels of service are provided in *Attachment D* and *Attachment G*.
- The level of service at **K Street NW and 21st Street NW** remains at a LOS C, with the eastbound approaches (i.e., mainline and service lane) experiencing the most significant delay increase. In total, delay at the intersection increased by 12.6 seconds. This increase can be attributed to the two distinct transit phases at this intersection that require one or both directions of travel to stop in the general-purpose lanes.
- The level of service at **K Street NW and Connecticut Avenue NW** improves from LOS D to LOS C, with the eastbound movement experiencing the greatest improvement. In total, delay at the intersection decreased by 15 seconds.
- The level of service at **K Street NW and 15th Street NW (west)** improves from LOS D to LOS B, with the eastbound movement experiencing the greatest reduction in delay with the restriction of eastbound left turning movements. In total, delay at the intersection decreased by 21 seconds.
- The level of service at **K Street NW and Vermont Avenue** improves from LOS D to LOS C, with the southbound and westbound movements experiencing the greatest reduction in delay. In total, delay at the intersection decreased by 11.4 seconds. This can be attributed to signal timing adjustments that allow for greater storage capacity for northbound left and southbound right-turn movements approaching 15th Street NW.
- The level of service at **K Street NW and 12th Street NW** deteriorates from LOS D to LOS E, with the northbound approach incurring the largest increase in delay. In total, delay at the intersection increased by 19.4 seconds. This can be attributed to less receiving capacity on 12th Street NW, north of K Street NW approaching L Street NW, resulting from the increase in eastbound right turns re-routed from left-turning movements at 15th Street NW.
- The level of service at study area intersections parallel to the K Street NW corridor performed consistent with existing conditions or showed slight improvement over existing conditions.

AM PEAK HOUR | INTERSECTION QUEUING

- In Existing conditions, queuing from right-turn movements were largely maintained on the service lanes. With the removal of these lanes, additional queuing on K Street NW general-purpose lanes is observed.
- In the eastbound direction, intersections with the greatest queue length increases include:
 - **21st Street NW** due to transit signal phase impacts and the downstream merge of mainline and service lane traffic.
 - **14th Street NW** due to downstream impacts of the transit signal phase at 13th Street NW and an increase of right turns at 14th Street NW.
- In the westbound direction, intersections with the greatest queue length increases include:
 - **21st Street NW** due to transit signal phase impacts.
 - **20th Street NW** due to transit signal phase impacts.
 - **17th Street NW** due to increased turbulence from right-turning volumes.
 - **16th Street NW** due to the increase in westbound right-turning volumes.
 - **14th Street NW** due to adjustments to signal progression between 12th Street NW and 15th Street NW to account for Transitway operations.
 - **12th Street NW** due to transit signal phase impacts and reduced capacity as a single-lane approach.

AM PEAK PERIOD | TRAVEL TIME

- Average **end-to-end eastbound** passenger vehicle travel time along K Street NW reduced by 52 seconds (-12%) and average end-to-end heavy vehicle travel time reduced by 64 seconds (-14%) compared to existing conditions.
 - Within the end-to-end travel time reductions, a reduction in the eastbound direction is observed between 17th Street NW and 10th Street NW. Whereas, an increase is observed between 22nd Street NW and 19th Street NW. This increase is largely caused by signal timing adjustments required to accommodate Transitway entry and exit within this segment.
- Average **end-to-end westbound** passenger vehicle travel time along K Street NW increased by 33 seconds (+7%) and average end-to-end heavy vehicle travel time increased by 29 seconds (+6%) compared to existing conditions.
 - The travel time increase in the westbound direction is experienced between 10th Street NW and 14th Street NW, as well as between 17th Street NW and 22nd Street NW. This increase in travel time is related to signal timing adjustments favoring Transitway entry and exit, as well as the removal of the service lanes which previously accommodated right-turn queues. In addition, the 1100 block design of K Street NW reduced capacity, such that one travel lane is provided for all vehicles. Moreover, travel time savings is experienced between 14th Street NW and 17th Street NW in the westbound direction.

PM PEAK HOUR | INTERSECTION PERFORMANCE

- Under existing conditions, bus stops along the K Street NW corridor contributed to a significant amount of delay in the PM peak hour. The removal of stops on the general-

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purpose lanes at close proximities to intersection approaches and departures resulted in delay reductions. Tables showing all intersection delay and levels of service are provided in *Attachment D* and *Attachment G*.

- The level of service at **K Street NW and 17th Street NW (east)** improves from LOS C to LOS B, with delay improvements from the southbound, eastbound, and westbound directions. In total, intersection delay decreased by 11.1 seconds. This improvement can be partially attributed to the restricted eastbound right-turning movement and the removal of neighboring bus stops on K Street general-purpose lanes.
- The level of service at **K Street NW and 16th Street NW** improves from LOS C to LOS B, with the greatest improvement in the eastbound travel direction. In total, intersection delay decreased by 8 seconds.
- The level of service at **K Street NW and 15th Street NW (west)** improves from LOS D to LOS C, with significant delay improvements in the southbound and eastbound directions. In total, intersection delay reduced by 25.1 seconds. These improvements can be attributed to increased receiving capacity for southbound left-turning movements and the reduction of the two bus stops located in the eastbound direction of the 1500 block.
- The level of service at **K Street NW and Vermont Avenue NW** improves from LOS D to LOS C, with a significant improvement in southbound delay. In total, intersection delay reduced by 28.5 seconds. This improvement in the southbound direction can be attributed to added receiving capacity in the eastbound and westbound directions of K Street NW. Additional improvements are seen from the removal of eastbound left turns at this intersection.
- The level of service at study area intersections parallel to the K Street NW corridor performed consistent with existing conditions or showed slight improvement over existing conditions. One exception occurred at **L Street NW and Connecticut Avenue NW**, where the level of service worsened from LOS D to LOS E from a delay increase of 19.5 seconds. This condition is attributable to changes to progression along K Street NW to favor Transitway progression.

PM PEAK HOUR | INTERSECTION QUEUING

- In Existing conditions, queuing from right-turn movements were largely maintained on the service lanes. With the removal of these lanes, additional queuing on K Street NW general-purpose lanes is observed.
- In the eastbound direction, intersections with the greatest queue length increases include:
 - **14th Street NW** due to downstream impacts of the transit signal phase at 13th Street NW and an increase of eastbound approach volume.
 - **13th Street NW** due to transit signal phase impacts and an increased volume of eastbound right-turning vehicles.
 - **11th Street NW** due to the increase in eastbound right-turning demand re-routed from 12th Street NW eastbound left turns (i.e., 157 vehicles).
- In the westbound direction, intersections with the greatest queue length increases include:
 - **20th Street NW** due to transit signal phase impacts and an increased volume of westbound right-turning vehicles.

- **Connecticut Avenue NW** due to the increased westbound approach demand and removal of the service lane removing right-turn movements from the general-purpose lanes.
- **16th Street NW** due to the increase in westbound right-turning vehicles.
- **12th Street NW** due to transit signal phase impacts and reduced capacity as a single-lane approach.
- **11th Street NW** due to residual spillback from westbound delay at 12th Street NW.

PM PEAK PERIOD | TRAVEL TIME

- Average **end-to-end eastbound** passenger vehicle travel time along K Street NW reduced by 59 seconds (-13%) and average end-to-end heavy vehicle travel time reduced by 67 seconds (-14%) compared to existing conditions.
 - The travel time reduction in the eastbound direction is largely experienced between 17th Street NW and 14th Street NW, where within this segment, travel time is reduced by more than 90 seconds.
 - Travel time is shown to increase slightly between 22nd Street NW and 19th Street NW and 14th Street NW and 10th Street NW, largely due to signal timing accommodating Transitway entry and exit.
- Average **end-to-end westbound** passenger vehicle travel time along K Street NW reduced by 90 seconds (-22%) and average end-to-end heavy vehicle travel time reduced by 96 seconds (-21%) compared to existing conditions.
 - Travel time reduction in the westbound direction is experienced in all segments, with a reduction of approximately 40 seconds in three of the four travel time segments. A smaller travel time of 9 seconds is experienced between 17th Street NW and 19th Street NW; however, this segment also has the lowest travel time of the four travel time segments.
- Review of travel time standard deviation by seed and by time shows some variation. This fluctuation in travel time is partially a result of expected simulation stochasticity as well as a result of the varied impact of right-turning vehicle conflicts with pedestrians based on arrival patterns. In existing conditions, the standard deviation was smaller on the K Street NW mainline travel time segments because the pedestrian-vehicle conflicts primarily impacted service lane operations rather than mainline operations.
 - The standard deviation of eastbound and westbound passenger vehicle travel times by seed fluctuates between 3 and 21 seconds. This relatively small variation in travel time between the 10 random seeds ran for this analysis illustrates the stability of the model in predicting consistent travel times under varied conditions along the corridor.
 - Similarly, the standard deviation of eastbound and westbound passenger vehicle travel times over the simulation period fluctuates between 5 and 21 seconds. This variation in travel time within a single simulation seed over the simulation time period illustrates how performance of the network fluctuates throughout the peak period under varying loading conditions and queue build ups.

ADDITIONAL GENERAL-PURPOSE TRAFFIC IMPACTS

- Restriction of the eastbound right turn at 17th Street NW (east) significantly improved eastbound performance by preventing queuing on the Farragut West block of K Street NW.
- The transit phases at 21st Street NW, 20th Street NW, 19th Street NW, 13th Street NW, and 12th Street NW do impact vehicular operations. The most severe impacts are observed at the intersection of K Street NW and 21st Street NW.
- The transition from the eastbound service lanes traveling from Washington Circle to K Street NW mainline may present safety concerns. As currently designed, the service lane through movements yield to the mainline through movements immediately past the signal at 21st Street NW at a severely acute approach angle. Following guidance provided by DDOT on April 28, 2020, this movement was maintained in the model and special design considerations are to be considered to minimize this safety concern.

Pedestrian and Bicycle Performance

Pedestrian impacts from the Alternative 1 design are minimal. Signal timing adjustments influencing pedestrian walk times were only done at intersections with added transit phases to accommodate turning movements from buses along the Transitway. Bicyclist accessibility of the K Street NW corridor is significantly improved with the added center-running cycle track adjacent to the Transitway. All other cycle tracks and bike lanes throughout the corridor were maintained.

Alternative 2 Results

This section provides an overview of Alternative 2 model results. As described in the *Introduction*, only the PM peak period was analyzed for Alternative 2 due to the extensive congestion induced by the reduced capacity to a single through travel lane. Therefore, the first section shows the model validity table, which illustrates that demand cannot be met under this geometric condition. Next, transit performance is discussed and compared to the existing conditions and Alternative 1 transit performance. Finally, vehicular performance is reviewed and compared to existing conditions.

Model Validity

Table 7 provides the loading summary for the Alternative 2 PM model. As shown, the model is not capable of successfully processing the 2025 vehicular demand and travel patterns described in the *Background* section due to the lane reduction reducing general-purpose capacity. This translates to 25% of general-purpose peak hour demand not being serviced within the peak hour. A comprehensive summary of model outputs summarizing performance can be found in *Attachment E: Alternative 2 Vissim Results Summary*.

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Table 7: PM Peak Alternative 2 Loading Summary

Calibration Item	Basis	Criteria	Value	Target	Criteria Met
Simulated Vehicular Throughput (Individual Links)	All Segments and Approaches	Within \pm 100 vph for < 700 vph	76%	85%	No
		Within \pm 15% for \geq 700 vph to < 2,700 vph			
		Within \pm 400 vph for \geq 2,700 vph			
		GEH < 5 for individual link flows	75%	85%	No
Simulated Vehicular Throughput (Network Wide)	Total Volume throughout Network	GEH < 4 for total network volume	31.0	4.0	No
		Within 5% of total network volume	-15.4	5%	No
Required Sample Size			10		

Transit Performance

As described in the *Alternatives 1 and 2 Configuration* section, the Transitway design in Alternative 2 reduces the number of entry locations to four and exit locations to three to increase the number of buses using the full extent of the Transitway. The Alternative 2 model results illustrate this configuration has potential to reduce bus travel time over Alternative 1 (**Table 8**); however, due to the vehicular congestion within the network, this impact is difficult to validate within the Alternative 2 model. Specifically, the significant general-purpose congestion creates added delays for buses to access the Transitway; therefore, the reported transit travel times are not representative of the same number of buses as compared to Alternative 1.

Table 8: PM Average Transit Travel Times between Alternative 1 and Alternative 2

Segment ID	Route	Alternative 1 Travel Time [MM:SS]	Alternative 2 Travel Time [MM:SS]
1	22 nd Street NW to 19 th Street NW	01:48	02:09
2	19 th Street NW to 17 th Street NW	01:39	01:33
3	17 th Street NW to 14 th Street NW	03:25	03:02
4	14 th Street NW to 10 th Street NW	02:53	02:47
Total Eastbound		09:45	09:31
5	10 th Street NW to 14 th Street NW	02:19	02:40
6	14 th Street NW to 17 th Street NW	03:11	03:09
7	17 th Street NW to 19 th Street NW	01:26	01:15
8	19 th Street NW to 22 nd Street NW	02:36	02:29
Total Westbound		09:32	09:33

* Average travel time includes bus dwell time.

* Blue highlighted cells represent segments where Alternative 2 bus travel time is less than Alternative 1.

General-Purpose Traffic Performance

The Alternative 2 general-purpose traffic results show very heavy congestion levels that resulted in the re-direction from analyzing Alternative 2 in the AM peak period and shifted focus to the Hybrid Alternative. A discussion of the observed traffic analysis results for the PM peak period are provided below.

- The vehicular demand for K Street NW is too high for a single through travel lane to effectively process.
- The right turn pockets are less effective than the shared right/through lanes because of the relatively low volume of right turning vehicles compared to the high volume of through traveling vehicles.
- Substantial increases in vehicle delay and deterioration of estimated level of service are apparent across K Street NW intersections. As indicated below, the most significant delay increases occurred at the eastern end of the corridor with intersections along K Street NW between Vermont Avenue NW and 11th Street NW performing at a LOS E or F.
 - **K Street NW and 20th Street NW**, intersection delay increases by 15.4 seconds.
 - **K Street NW and 19th Street NW**, intersection delay increases by 20.4 seconds.
 - **K Street NW and 18th Street NW**, intersection delay increases by 49.5 seconds.
 - **K Street NW and Connecticut Avenue NW**, intersection delay increases by 29.8 seconds.
 - **K Street NW and 16th Street NW**, intersection delay increases by 17.2 seconds.
 - **K Street NW and Vermont Avenue NW**, intersection delay increases by 27.1 seconds.
 - **K Street NW and 14th Street NW**, intersection delay increases by 16.5 seconds.
 - **K Street NW and 13th Street NW**, intersection delay increases by 94.2 seconds.
 - **K Street NW and 12th Street NW**, intersection delay increases by 58.9 seconds.
 - **K Street NW and 11th Street NW**, intersection delay increases by 41 seconds.
 - **K Street NW and 10th Street NW**, intersection delay increases by 33.5 seconds.
- Adverse conditions are also prevalent in the travel time increases observed in the eastbound and westbound directions.
 - Average **end to end eastbound** passenger vehicle travel time increased by 6.6 minutes (+88%) over existing conditions.
 - Average **end to end westbound** passenger vehicle travel time increased by 4.7 minutes (+49%) over existing conditions.

It is important to note that these increases in vehicle delay and travel time do not account for the nearly 25% of vehicles that aren't able to make their trip during the peak period (reference **Table 7**). Therefore, these delay and travel time increases may be even more significant than reported by these Vissim results.

Kimley-Horn confirmed the Vissim results from Alternative 2 PM in Synchro to provide additional confidence in existence of the oversaturated condition. In general, Synchro is anticipated to underestimate operational deficiencies compared to Vissim. In this Synchro analysis, all but one intersection west of 13th Street NW illustrated a volume to capacity ratio greater than 1.0 in the eastbound or westbound direction, which indicates most intersections were operating with

vehicular demands greater than the designed capacity. This analysis illustrated that many intersections had volume to capacity ratios less than 0.75 for side street movements; however, additional green time could not be transferred to the K Street NW mainline without reducing pedestrian crossing intervals. DDOT confirmed during 6/11/2020 meeting that one stage crossing is highly preferable for accommodating the high pedestrian crossing needs at all intersections along K Street NW. In other words, it would be theoretically possible to provide more green time to eastbound and westbound through-moving traffic to reduce delay on K Street NW, but doing so would come at the expense of pedestrian crossing intervals and would negatively impact pedestrian safety and convenience.

Pedestrian and Bicycle Performance

Pedestrian impacts from the Alternative 2 design are were nominally higher than Alternative 1 because additional signal timing adjustments were required to process general-purpose vehicular demand. In most locations, pedestrian walk times were minimized; however, the minimum crossing interval for pedestrians at each intersection was maintained for the entire width of K Street NW. Bicyclist mobility along and across the K Street NW corridor is maintained in the Alternative 2 design and offers the same benefits as the Alternative 1 configuration.

Hybrid Alternative Configuration

This section provides design configuration details for the Hybrid Alternative, as well as a discussion of the sensitivity analyses performed to result in the preferred configuration.

General-Purpose Lane Geometry

As described in the *Executive Summary*, the Hybrid Alternative was developed from the most effective components of Alternatives 1 and 2. The general-purpose vehicle design from Alternative 1 illustrates significantly better throughput as compared to Alternative 2, so the two through lane configuration was included in the Hybrid Alternative. At most approaches along K Street NW, two general-purpose through travel lanes were maintained. The design is similar to Alternative 1 with four exceptions to ensure the configuration was constructible and fit within allocated right-of-way.

1. The eastbound approach to 17th Street NW (west)/Connecticut Avenue NW offered a single through lane and a dedicated right turn lane because of right-of-way restrictions limiting a single eastbound lane in the block between 17th Street NW (west) and 17th Street NW (east) (i.e., Farragut Square).
2. At Farragut Square (between 17th Street NW (west)/Connecticut Avenue NW and 17th Street NW (east)), eastbound general-purpose traffic operates in a single lane of traffic.
3. At the eastbound approach to 13th Street NW, where a single through lane and a dedicated right turn lane are offered to general-purpose travelers in order to reduce the 1200 block of K Street NW to a single eastbound lane. This lane reduction was introduced to offer flexible curb space along the 1200 block and to preempt the required lane reduction approaching the 1100 Block.
4. A dedicated eastbound right turn lane was provided at 19th Street NW.

Sensitivity Analysis – Eastbound Lane Drop Location

A sensitivity analysis was completed comparing the impact of moving this lane drop further downstream (i.e., at the eastbound approach of 12th Street NW rather than 13th Street NW). This analysis demonstrated that moving the lane reduction further downstream provided a 9 to 27 second improvement to eastbound vehicular traffic. The complete sensitivity analysis results can be found in *Attachment H: Sensitivity Analysis Eastbound Lane Drop Location*. In consideration of these findings, DDOT elected to represent the conservative design (i.e., the lane drop occurring at the 13th Street NW approach) in the preferred configuration of the Hybrid Alternative.

A sketch of the Hybrid Alternative configuration is provided in **Figure 12**.

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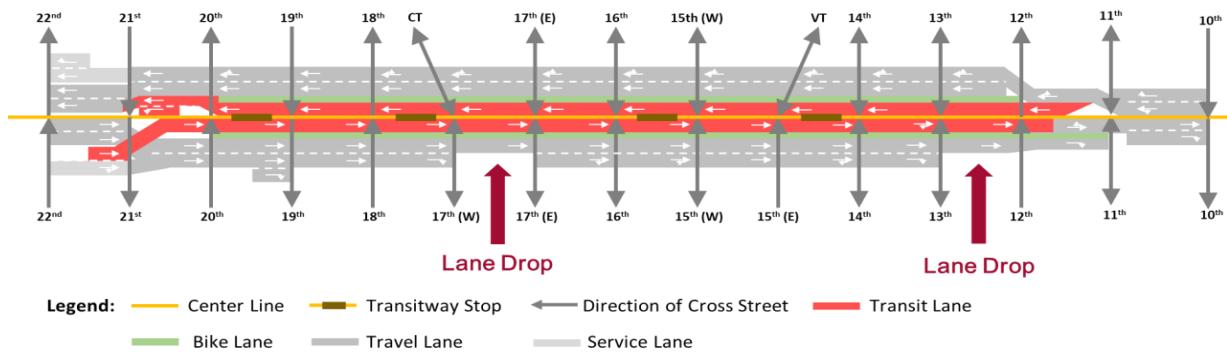
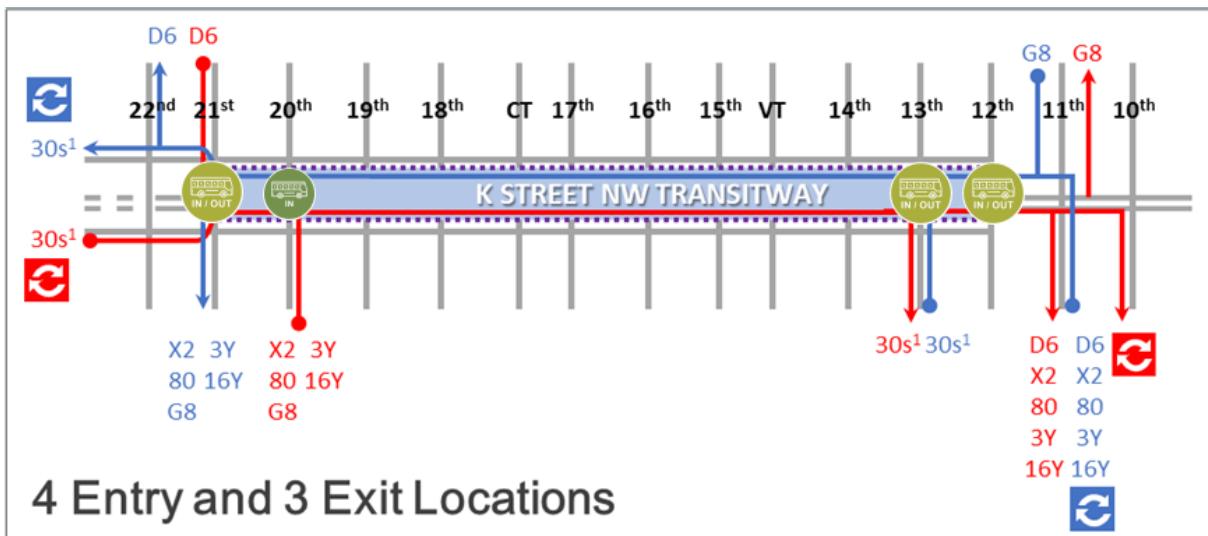


Figure 12: Hybrid Alternative Lane Configuration

Transitway Entry/Exit Locations

As discussed in the *Alternative 2 Results* section, transit performance with limited access (i.e., four Transitway entry locations and three exit locations) showed promise in offering larger travel time savings to transit as compared to the Alternative 1 configuration with five entry and exit locations. However, these results could not be confirmed in Alternative 2 because of the severe vehicular congestion. Therefore, the Hybrid Alternative was modeled with the four entry and three exit location configuration from Alternative 2 (**Figure 13**).

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	Eastbound	Westbound
Route Origin	● —	● —
Route Destination	— →	— →
USGT Circulator	↻	↻
Transitway	—	—
Transitway Entrance Only	● IN	
Transitway Exit Only		● OUT
Transitway Entrance/Exit	● IN / OUT	
	130N, 30S, 32, 33, 36, 37, 39	

Figure 13: Hybrid Alternative Transitway Configuration

Sensitivity Analysis – Number of Transitway Stops

Alternatives 1 and 2 assumed there would be five transit stops along the Transitway; however, in consideration of the Hybrid Alternative, DDOT requested that the impact of removing one transit stop (i.e., the stop located along the 1200 Block) be investigated. The sensitivity analysis results illustrated that eliminating this transit stop provides improvements in eastbound and westbound travel times along the Transitway. Overall eastbound transit travel time was reduced by approximately 20 seconds resulting in total transit travel time improvement over existing conditions of 35% in the AM peak period and 44% in the PM peak period. Overall westbound travel time was reduced by approximately 50 seconds resulting in a total travel time improvement over existing conditions of 41% in the AM peak period and 48% in the PM peak period. These travel time improvements can be attributed to the removal of bus dwell time and resulting signal progression benefits as a result of eliminating the stop. Westbound travel time improvements are more significant because the removal of the 1200 block stop improves the probability that a bus

will not be delayed at 13th Street NW. Conversely, in the eastbound direction, travel time improvements are less significant due to incurred delay at 12th Street NW. Details from this sensitivity analysis can be referenced in *Attachment I: Sensitivity Analysis of Four Transit Stops*.

In consideration of these results, DDOT elected to model four stops in the preferred configuration of the Hybrid Alternative.

Signal Timing Strategies

As indicated in the *Background* section, all study area intersections were optimized to accommodate the 2025 travel patterns. Additional signal timing and operation changes were made unique to the Hybrid Alternative in order to accommodate the dedicated transit movements to and from the planned Transitway, largely building off the optimized signal timings developed in Alternative 2.

For the east end of the Transitway, DDOT and the consultant team considered seven configurations to transition buses and bicycles into and out of the center-running lanes at 12th Street NW while mixing with general purpose traffic. The selected configuration of the 1100 block was determined based on a subjective assessment of safety benefits and analysis to maintain an acceptable level of service for buses and general-purpose traffic.

At the west end of the transitway, multiple design and operations alternatives were evaluated to manage the complex movements at 21st Street NW. Specifically, these movements include the:

- Existing mainline K Street NW movements (entering and exiting the tunnel beneath Washington Circle NW),
- Existing eastbound service lane movements now merging into the K Street NW mainline, and
- New Transitway entry and exit movements onto 21st Street NW and the K Street NW service lanes.

Sensitivity Analysis – Signal Operations and Configuration at 21st Street NW

A sensitivity analysis describing multiple scenarios is provided in *Attachment J: Sensitivity Analysis of 21st Street Reconfiguration*. Ultimately, this analysis showed that shifting the eastbound transit lane from median-side to curbside on the K Street NW service lane as well as adding a westbound-left permissive transit phase provides modest improvements over other tested configurations. However, beyond this, modification of phase sequence (i.e., westbound left transit phase leading and lagging) did not provide additional transit travel time benefits.

In consideration of these results, DDOT elected to move the eastbound transit lane to the curbside and offer a westbound-left permissive transit phase in the preferred configuration of the Hybrid Alternative. In addition, all protected transit phases in eastbound and westbound directions were designated as leading phases. Moving forward into the next project phase, this sensitivity analysis provided evidence that the order of transit phase signal operations at 21st Street NW has little impact to transit operations and travel times. Given this outcome, the operations of the intersection can be fine-tuned based on actual conditions once construction is complete to best accommodate transit and vehicular mobility through the intersection.

Hybrid Alternative Traffic Analysis Results

The Vissim results for the Hybrid Alternative are summarized and discussed in this section; the full model results are provided in *Attachment F: Hybrid Alternative Vissim Results Summary*. This attachment can be referenced for support of the Hybrid Alternative model validity and performance. In addition, the results for the Hybrid Model build configuration is included in the results comparison provided in *Attachment G: Vissim Results Comparison*. This attachment provides a side-by-side comparison of Vissim model results for existing conditions and all build alternatives.

This section summarizes the Vissim model results for the Hybrid Alternative. First, model validity is shown through a vehicle loading summary illustrating forecasted demand is met within the model. Next, transit performance traversing the dedicated Transitway is considered as it compares to existing conditions and the first two build alternatives. Finally, vehicular performance is reviewed and compared to existing conditions.

Model Validity

Table 9 and **Table 10** provide the loading summary for the Hybrid Alternative AM and PM models, respectively. As shown, the model is successfully processing the 2025 vehicular demand and travel patterns described in the *Background* section. A comprehensive summary of model outputs summarizing performance can be found in *Attachment F: Hybrid Alternative Vissim Results Summary*. Further, model outputs indicate that a sample size of 10 model runs is sufficient for evaluating average model performance.

Table 9: AM Peak Hybrid Alternative Loading Summary

Calibration Item	Basis	Criteria	Value	Target	Criteria Met
Simulated Vehicular Throughput (Individual Links)	All Segments and Approaches	Within \pm 100 vph for < 700 vph	100%	85%	Yes
		Within \pm 15% for \geq 700 vph to < 2,700 vph			
		Within \pm 400 vph for \geq 2,700 vph			
		GEH < 5 for individual link flows	100%	85%	Yes
Simulated Vehicular Throughput (Network Wide)	Total Volume throughout Network	GEH < 4 for total network volume	2.1	4.0	Yes
		Within 5% of total network volume	1.1%	5%	Yes
Required Sample Size			10		

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Table 10: PM Peak Hybrid Alternative Loading Summary

Calibration Item	Basis	Criteria	Value	Target	Criteria Met
Simulated Vehicular Throughput (Individual Links)	All Segments and Approaches	Within \pm 100 vph for < 700 vph	100%	85%	Yes
		Within \pm 15% for \geq 700 vph to < 2,700 vph			
		Within \pm 400 vph for \geq 2,700 vph			
		GEH < 5 for individual link flows	100%	85%	Yes
Simulated Vehicular Throughput (Network Wide)	Total Volume throughout Network	GEH < 4 for total network volume	0.8	4.0	Yes
		Within 5% of total network volume	-0.4%	5%	Yes
Required Sample Size			10		

Transit Performance

Transit performance for the Hybrid Alternative is summarized by the average travel time (including dwell time) in **Table 11** and **Table 12** for AM and PM, respectively. From these results the following observations can be made:

- The Hybrid Alternative design for the Transitway reduces transit end-to-end travel time along the K Street corridor by 36 to 46 percent.
 - *Eastbound Transit Travel Times*: 4.8 minutes of time savings (-37%) in the AM peak period and 6.7 minutes of time savings (-44%) in the PM peak period with the Hybrid Alternative Transitway design.
 - *Westbound Transit Travel Times*: 4.5 minutes of time savings (-36%) in the AM peak period and 6.5 minutes of time savings (-46%) in the PM peak period with the Hybrid Alternative Transitway design.
- The only segment in which transit travel times were not reduced over existing conditions is in the westbound direction between 19th Street NW and 22nd Street NW during the AM peak period.
 - Within this segment, the Hybrid Alternative travel time is 59 seconds higher than existing conditions, which is caused by the Transitway terminal conditions at 21st Street NW that require a dedicated signal phase for westbound buses to leave the Transitway.
 - This impact was mitigated with signal timing adjustments to favor transit progression through the corridor as well as the consideration of a westbound left-turn bay for buses to exit the Transitway to 21st Street NW.
- Transit travel speeds were derived from the average travel time and are provided in *Attachment G: Vissim Results Comparison*. Under the Hybrid Alternative build condition, average speed of buses (including dwell time and intersection delay) increased in the AM peak period by 2.9 mph in the eastbound direction and 3.6 mph in the westbound direction. In the PM peak period, travel speeds increased by 3.5 mph in the eastbound direction and 4.7 mph in the westbound direction. This results in average bus speeds

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between 8 mph and 9.9 mph in the Hybrid Alternative as compared to 4.5 mph to 5.7 mph in existing conditions.

- Bus bunching along the corridor was alleviated by updating routing schedules to headway-based routing contingent on arrival time to the Transitway.

Table 11: AM Average Transit Travel Times between Existing and Hybrid Alternative

Segment ID	Route	Existing Travel Time [MM:SS]	Hybrid Alternative Travel Time [MM:SS]
1	22 nd Street NW to 19 th Street NW	02:58	02:01
2	19 th Street NW to 17 th Street NW	03:02	01:17
3	17 th Street NW to 14 th Street NW	04:53	02:56
4	14 th Street NW to 10 th Street NW	02:03	01:53
Total Eastbound		12:56	08:07
5	10 th Street NW to 14 th Street NW	03:02	01:00
6	14 th Street NW to 17 th Street NW	05:39	02:49
7	17 th Street NW to 19 th Street NW	01:55	01:18
8	19 th Street NW to 22 nd Street NW	01:55	02:54
Total Westbound		12:31	08:01

* Average travel time includes bus dwell time.

* Blue highlighted cells represent segments where the Hybrid Alternative bus travel time is less than existing.

Table 12: PM Average Transit Travel Times between Existing and Hybrid Alternative

Segment ID	Route	Existing Travel Time [MM:SS]	Hybrid Alternative Travel Time [MM:SS]
1	22 nd Street NW to 19 th Street NW	03:41	01:51
2	19 th Street NW to 17 th Street NW	03:17	01:15
3	17 th Street NW to 14 th Street NW	05:39	03:15
4	14 th Street NW to 10 th Street NW	02:31	02:08
Total Eastbound		15:08	08:29
5	10 th Street NW to 14 th Street NW	03:49	00:54
6	14 th Street NW to 17 th Street NW	06:03	03:06
7	17 th Street NW to 19 th Street NW	01:41	01:13
8	19 th Street NW to 22 nd Street NW	02:30	02:22
Total Westbound		14:03	07:35

* Average travel time includes bus dwell time.

* Blue highlighted cells represent segments where the Hybrid Alternative bus travel time is less than existing.

General-Purpose Traffic Performance

The impacts of the Hybrid Alternative K Street Transitway design on general-purpose traffic are summarized in the following sections for the AM and PM peak periods.

Overall, the traffic analysis illustrated the Hybrid Alternative design does not have a large adverse impact on vehicular traffic. Removal of the service lanes, introduction of 24-hour left turn restrictions from K Street NW, and removal of bus stops along the general-purpose lanes result in some travel time improvements. While the following sections highlight performance differences, it is assumed that any additional capacity and travel time savings achieved from this design would be filled with redistributed trips from parallel paths in downtown Washington D.C.

AM Peak Hour | Intersection Performance

- Under existing conditions, bus stops along the K Street NW corridor contributed to a significant amount of delay in the AM peak hour. The removal of stops on the general-purpose lanes at close proximities to intersection approaches and departures resulted in delay reductions in the Hybrid Alternative. Tables showing all intersection delay and levels of service are provided in *Attachment F* and *Attachment G*.
- The level of service at **K Street NW and Connecticut Avenue NW** improves from LOS D to LOS B, with the eastbound movement experiencing the greatest improvement. In total, delay at the intersection decreased by 18.8 seconds.
- The level of service at **K Street NW and 15th Street NW (west)** improves from LOS D to LOS B, with the eastbound movement experiencing the greatest reduction in delay with the restriction of eastbound left turning movements. In total, delay at the intersection decreased by 20.8 seconds.
- The level of service at **K Street NW and Vermont Avenue** improves from LOS D to LOS C, with the southbound and westbound movements experiencing the greatest reduction in delay. In total, delay at the intersection decreased by 6.5 seconds. This can be attributed to signal timing adjustments that allow for greater storage capacity for northbound left and southbound right-turn movements approaching 15th Street NW.
- The level of service at **K Street NW and 14th Street NW** improves from LOS D to LOS C, with the eastbound and westbound directions showing the greatest delay reductions resulting from signal timing adjustments improving progression. In total, delay at the intersection decreased by 26.7 seconds as compared to existing conditions and 27.1 seconds as compared to Alternative 1.
- The level of service at **K Street NW and 12th Street NW** improves from LOS D to LOS C, with the northbound approach incurring the largest reduction in delay. In total, delay at the intersection decreased by 7.2 seconds compared to existing conditions and 26.6 seconds compared to Alternative 1. This is a result of signal timing adjustments along the corridor improving progression.
- The level of service at study area intersections parallel to the K Street NW corridor performed consistent with existing conditions or showed slight improvement over existing conditions.

AM Peak Hour | Intersection Queuing

- In Existing conditions, queuing from right-turn movements were largely maintained on the service lanes. With the removal of these lanes, additional queuing on K Street NW general-purpose lanes is observed.
- In the eastbound direction, intersections with the greatest queue length increases include:

- **21st Street NW** due to transit signal phase impacts and the downstream merge of mainline and service lane traffic. These queues are, however, reduced compared to Alternative 1.
- **12th Street NW and 11th Street NW** due to transit signal phase impacts and the 1100 Block design configuration.
- In the westbound direction, intersections with the greatest queue length increases include:
 - **21st Street NW** due to transit signal phase impacts.
 - **12th Street NW and 11th Street NW** due to transit signal phase impacts and the 1100 Block design configuration.

AM Peak Period | Travel Time

- Average **end-to-end eastbound** passenger vehicle travel time along K Street NW reduced by 67 seconds (-16%) and average end-to-end heavy vehicle travel time reduced by 92 seconds (-20%) compared to existing conditions.
 - Within the end-to-end travel time reductions, a reduction in the eastbound direction is observed between 22nd Street NW and 14th Street NW. Whereas, an increase is observed between 14th Street NW and 10th Street NW. This increase is largely caused by signal timing adjustments required to accommodate Transitway entry and exit within this segment and the 1100 Block design configuration.
- Average **end-to-end westbound** passenger vehicle travel time along K Street NW decreased by 73 seconds (-17%) and average end-to-end heavy vehicle travel time decreased by 82 seconds (-18%) compared to existing conditions.
 - This travel time reduction also represents a decrease of more than 1.5 minutes over Alternative 1. This travel time reduction is largely attributed to the removal of the Transitway exit locations at 19th Street NW and 20th Street NW, which reduced the delay incurred by general-purpose traffic and improved signal timing progression in the westbound direction.

PM Peak Hour | Intersection Performance

- Under existing conditions, bus stops along the K Street NW corridor contributed to a significant amount of delay in the PM peak hour. The removal of stops on the general-purpose lanes at close proximities to intersection approaches and departures resulted in delay reductions. Tables showing all intersection delay and levels of service are provided in Attachment F and G.
- The level of service at **K Street NW and 17th Street NW (east)** improves from LOS C to LOS B, with delay improvements from the southbound, eastbound, and westbound directions. In total, intersection delay decreased by 9.8 seconds. This improvement can be partially attributed to the restricted eastbound right-turning movement and the removal of neighboring bus stops on K Street general-purpose lanes.
- The level of service at **K Street NW and 16th Street NW** improves from LOS C to LOS B, with the greatest improvement in the eastbound travel direction. In total, intersection delay decreased by 6.2 seconds.

- The level of service at **K Street NW and 15th Street NW (west)** improves from LOS D to LOS C, with significant delay improvements in the southbound and eastbound directions. In total, intersection delay reduced by 12.3 seconds. These improvements can be attributed to increased receiving capacity for southbound left-turning movements and the reduction of the two bus stops located in the eastbound direction of the 1500 block.
- The level of service at **K Street NW and Vermont Avenue NW** improves from LOS D to LOS C, with a significant improvement in southbound delay. In total, intersection delay reduced by 23.8 seconds. This improvement in the southbound direction can be attributed to added receiving capacity in the eastbound and westbound directions of K Street NW. Additional improvements are seen from the removal of eastbound left turns at this intersection.
- The level of service at **K Street NW and 13th Street NW** deteriorates from LOS C to LOS D, experiencing increasing delay in the eastbound direction. In total, intersection delay increases by 27.7 seconds. This delay is attributable to the lane drop at the eastbound approach only allowing a single lane progressing through the intersection.
- The level of service at study area intersections parallel to the K Street NW corridor performed consistent with existing conditions or showed slight improvement over existing conditions.

PM Peak Hour | Intersection Queuing

- In Existing conditions, queuing from right-turn movements were largely maintained on the service lanes. With the removal of these lanes, additional queuing on K Street NW general-purpose lanes is observed.
- In the eastbound direction, intersections with the greatest queue length increases include:
 - **Connecticut Avenue NW** due to the lane drop at the eastbound approach restricting all through vehicles to a single lane.
 - **14th Street NW** due to downstream impacts of the transit signal phase at 13th Street NW and an increase of eastbound approach volume.
 - **13th Street NW** due to the lane drop at the eastbound approach restricting all through vehicles to a single lane.
 - **12th Street NW and 11th Street NW** due to travel pattern shifts and the 1100 Block design.
- In the westbound direction, intersections with the greatest queue length increases include:
 - **21st Street NW** due to transit signal phase impacts.
 - **20th Street NW** due to transit signal phase impacts and an increased volume of westbound right-turning vehicles.

PM Peak Period | Travel Time

- Average **end-to-end eastbound** passenger vehicle travel time along K Street NW increased by 1.9 minutes (+25%) and average end-to-end heavy vehicle travel time reduced by 1.7 minutes (+21%) compared to existing conditions.
 - The travel time increase in the eastbound direction is primarily attributed to the lane drop at the eastbound approach to the 1300 block, where the approach

- allows a single through lane and dedicated right turn bay. Along this segment, passenger vehicle travel time increases by approximately 2 minutes.
- This impact is more severe in the PM peak as compared to the AM peak because of increased demand in the eastbound direction.
 - Average **end-to-end westbound** passenger vehicle travel time along K Street NW reduced by 3 minutes (-31%) and average end-to-end heavy vehicle travel time reduced by 3.1 minutes (-32%) compared to existing conditions.
 - Travel time reduction in the westbound direction is experienced in all segments across the corridor. This improvement over existing conditions and Alternative 1 is attributed to the Transitway design with limited entry and exit locations, as well as the resulting signal progression.

Additional General-Purpose Traffic Impacts

- Restriction of the eastbound right turn at 17th Street NW (east) significantly improved eastbound performance by preventing queuing on the Farragut West block of K Street NW.
- The transition from the eastbound service lanes traveling from Washington Circle to K Street NW mainline may present safety concerns. As currently designed, the service lane through movements yield to the mainline through movements immediately past the signal at 21st Street NW at a severely acute approach angle. Following guidance provided by DDOT on April 28, 2020, this movement was maintained in the model and special design considerations are to be considered to minimize this safety concern.

Pedestrian and Bicycle Performance

Pedestrian impacts from the Hybrid Alternative design are minimal, consistent with the Alternative 1 design configuration. Signal timing adjustments influencing pedestrian walk times were only done at intersections with added transit phases to accommodate turning movements from buses along the Transitway. Bicyclist accessibility of the K Street NW corridor is also consistent with the Alternatives 1 and 2 design configurations. Mobility is significantly improved with the added center-running cycle track adjacent to the Transitway, and other cycle tracks and bike lanes throughout the corridor were maintained.

Conclusions

The *Technical Details* of this memorandum provided a detailed discussion of the **K Street NW Traffic Analysis** to document analysis assumptions, decisions, and ultimate results. In the following sections, a summary of the findings for each evaluated alternative is provided in addition to discussions of the Transitway entrance and exit intersection configurations and considerations for pedestrian safety along the corridor.

Summary of Traffic Analysis for Each Alternative

All Alternatives

- Benefits
 - Center-running exclusive Transitway for WMATA & DC Circulator buses.
 - Center-running dedicated bicycle lanes.
 - Safety benefits from restricted left-turns on K Street NW.
 - Removal of K Street NW service lanes.
 - Right-in/right-out access at all existing alleys and garages.
- Drawbacks
 - Rerouted left-turning movements to parallel facilities.
 - Additional travel time delay for rerouted left-turns (note that existing peak period operations restrict left turns at most intersections).
 - Removal of K Street NW service lanes results in reduced curb space for loading and unloading.

Alternative 1

- Benefits
 - Minimal impact to existing bus routes by allowing Transitway entry and exit at 5 intersections.
 - Transit travel time improvements (-20% to -36%) compared to existing.
- Drawbacks
 - Modest increase in vehicle travel time in one direction (PM westbound: +7%)
 - Limited right-of-way at Farragut Square for two through lanes.
 - Lack of raised/protected bicycle barriers at Farragut Square due to limited ROW and two through lanes.
 - Limited curb space for loading and unloading.
 - Transitway exit locations at 19th Street NW and 20th Street NW limit transit travel time reductions in the westbound direction.

Alternative 2

- Benefits
 - Transit travel time improvements (-32% to -37%) compared to existing in the PM peak.
 - Constructible cross-section and greater bicyclist protection based on right-of-way constraints at Farragut square.
 - Increased curb space for loading and unloading.
 - Introduction of dedicated eastbound right-turn lane at 19th Street NW.

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- Streamlined Transitway performance by only allowing Transitway entry and exit at three intersections.
- Drawbacks
 - Through-vehicle demand for K Street NW during the PM peak is too high for a single lane to service.
 - Minor route changes to existing bus routes based on limited Transitway access.
 - The observed increase of vehicle travel time compared to existing (+49% to +88%) does not account for the high unserved demand of 25% (i.e., vehicles unable to make their trip during the peak period).
 - Bus performance also impacted by vehicular delay, limiting signal timing optimization options and increasing incurred delay of buses prior to entering the Transitway.

Hybrid Alternative

- Benefits
 - Constructible cross-section based on right-of-way constraints at Farragut Square.
 - Streamline Transitway performance by only allowing Transitway entry and exit at 3 intersections.
 - Transit travel time improvements (-36% to -46%) compared to existing.
- Drawbacks
 - Limited curb space for loading and unloading.
 - Minor route changes to existing bus routes based on limited Transitway access.
 - Eastbound lane drop at 13th Street NW limits vehicular capacity and negatively increases travel time (PM eastbound: +25%).

Overview of Transitway Entry and Exit Points

Through the analysis of the Hybrid Alternative, DDOT explored various geometric and operational configurations of the Transitway entry and exit points at 21st Street NW, 13th Street NW, and 12th Street NW. The preferred configurations described in the previous sections of this memorandum represent the optimal conditions at each intersection to enhance transit operations along the corridor. This section provides high-level considerations for each intersection that should be accounted for in the next phases of design and ultimate operations of the Transitway.

21st Street NW

- Benefits
 - Separate westbound left and through lanes exiting the Transitway provides operational flexibility to match actual transit vehicle demand.
 - Protected-permissive operations for the westbound left-turn maneuver provides additional opportunities within the signal cycle for buses to exit the Transitway, reducing travel times.
 - Leading westbound left-turn and through protected transit phases allow the signal to be responsive to bus demand; in the event only a few buses are present, the unused transit phase time can be returned to general purpose vehicle green time.
 - Curbside placement of the eastbound transit vehicle entry lane positions the bus in an expected location and improves visibility for westbound left-turning buses

exiting the Transitway to identify potential conflicts with oncoming eastbound traffic from the underpass and service lanes.

- Leading eastbound protected transit phase allows the entry of buses within the Transitway to benefit from prioritized progression, reducing travel times.
- Drawbacks
 - Limiting westbound transit vehicle maneuvers to leading protected phases may increase transit travel times depending on the actual arrival pattern of buses at 21st Street NW. There could be instances where a lagging protected phase might better align with the arrival pattern of westbound buses.
 - Transit maneuvers require general purpose traffic to stop in at least one direction when they occur. However, this is ultimately for the safety of operations.

13th Street NW

- Benefits
 - Dual service of eastbound right-turn transit maneuvers reduces intersection delay for buses destined for 13th Street NW.
 - The existing protected northbound left-turn phase provides an opportunity for transit vehicles destined for 13th Street NW to exit the Transitway without inducing delay on general purpose traffic – this is an existing signal phase that allows for a safe departure.
 - Similarly, the existing northbound left-turn phase provides a dedicated window within each signal cycle for buses to enter the Transitway, another benefit to reducing transit travel times.
 - There are no impacts to westbound transit operations.
- Drawbacks
 - Dual service of eastbound right-turn transit maneuvers cannot be accommodated during the PM peak period without significantly impacting eastbound general-purpose traffic, so the opportunities to exit the Transitway for eastbound buses onto 13th Street NW are reduced, potentially increasing travel times.
 - The shared geometry of the eastbound approach within the Transitway creates the potential for a right-turning bus to delay a subsequent through bus from traveling through the intersection if the right-turning bus arrives outside of the exclusive transit phase.
 - Similarly, the shared geometry creates the potential for a through bus to delay a subsequent right-turning bus from exiting the Transitway if a through bus arrives at the beginning of red for K Street NW, which is followed directly by the transit phase to turn onto 13th Street NW.
 - Without route specific signal actuation, the presence of a bus, regardless of the route will call the transit phase the delays the release of eastbound general-purpose traffic. This is most detrimental when a through bus actuates this transit phase but does not intend to turn onto 13th Street NW.

12th Street NW

- Benefits
 - Dual service of eastbound transit maneuvers reduces intersection delay for buses.

- Eastbound buses and bicycles can safely operate concurrently in the eastbound direction without conflict.
- Strategic sequencing of the eastbound transit phase (lagging phase) and coordination with the downstream signal at 11th Street NW has the potential to reduce bus delays by progressing this maneuver through a green signal at 11th Street NW.
- Similarly, this strategic sequencing has the potential to flush the eastbound traffic through 11th Street NW and allow right-turning buses to turn onto 11th Street NW during the overlap phase, positioning buses for an optimal trip southbound.
- A short, dedicated westbound entry lane onto the Transitway allows buses to bypass short queues in the general-purpose lanes.
- Westbound buses are able to take advantage of additional green time to enter the Transitway during protected transit phases for eastbound buses, reducing delay entering the Transitway.
- Drawbacks
 - Dual service of eastbound transit maneuvers cannot be accommodated during the PM peak period without significantly impacting eastbound general-purpose traffic, so the opportunities to exit the Transitway for eastbound buses are reduced, potentially increasing travel times.
 - In order to minimize impacts to general-purpose traffic, the duration of transit phases must be balanced based on concurrent vehicular demand, which may result in only one or two buses being able to exit the Transitway.

Implications of the Transitway on Pedestrian Safety

DDOT is also considering the impact of the K Street Transitway design on pedestrian safety. This section documents factors influencing pedestrian safety along the corridor under the preferred configuration of the Hybrid Alternative.

- Reconfiguration of the K Street NW general-purpose travel lanes and service lanes will result in tighter turning radii and fewer travel lanes that may encourage slower driving speeds, which may improve pedestrian safety and comfort along the corridor.
- Under existing and proposed build conditions, the intersections along the corridor operate with Leading Pedestrian Intervals (LPI) that give pedestrians a three second head start before vehicles are given a green signal indication. This improves pedestrian visibility and reduces turning conflicts.
- Intersections with significant right-turning volume operate with permissive-protected vehicle turning phases; this establishes a dedicated opportunity for turning vehicles to make their maneuver reliably each cycle and balances the needs between pedestrian safety and general-purpose congestion.
- Consolidation of all general-purpose travel lanes and the restriction of left turns along the corridor focuses all turning conflicts to a single location. This reduces the safety risk for pedestrians, only requiring two lanes to be crossed at a time.

- The design of transit stations along the Transitway consolidate the existing transit stations along the corridor and places each station at a highly-visible location proximate to an intersection and crosswalk. Transitway
- The designated location, pavement markings, and curb separation for bicycles along the K Street NW corridor will provide greater visibility for bicyclists, awareness of the presence of bicycles to pedestrians, and will likely reduce pedestrian conflicts with bikes.

Closing Remarks

This **K Street NW Traffic Analysis** is concluding with a recommended preferred configuration for the Hybrid Alternative developed from the most effective elements of Alternative 1 (two through travel lanes and five Transitway entry/exit locations) and Alternative 2 (one through travel lane and four Transitway entry, three exit locations) with additional refinements incorporating the sensitivity analyses described above. Data-driven analyses were conducted to better understand the impact of design decisions including the removal of the 1200 Block Transitway stop, maintaining the lane drop at the eastbound approach to 13th Street NW, and reconfiguring the 21st Street NW intersection. Using the information gathered from these isolated sensitivity analyses, DDOT determined the preferred configuration and the results presented in the previous sections demonstrate the numerous benefits of the **K Street Transitway** for multimodal users.

As described in this memorandum, the average transit user can expect to experience reduction in travel time in the range of 35% and 45%, depending on direction and time period, which translates to a better commuting experience, promotes the use of transit, and returns valuable minutes of commuting time. In addition, the new protected bicycle facility improves the connectivity of the bicycle network on and around K Street NW, while improving bicyclist safety. Lastly, pedestrians will enjoy a more comfortable walking experience along K Street with fewer vehicle turning conflicts and enhanced access to transit options. General purpose traffic will also benefit from safer and more efficient operations due to removal of the service lanes and removal of transit buses from general purpose travel lanes.

The K Street NW corridor redesign will encourage future users to increasingly travel on foot, riding bikes, and in buses. The design recommended in this project enhances the safety and mobility of the corridor by balancing the varying needs of these multi-modal users.

Attachment A:

Data Collection 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.

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

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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 |

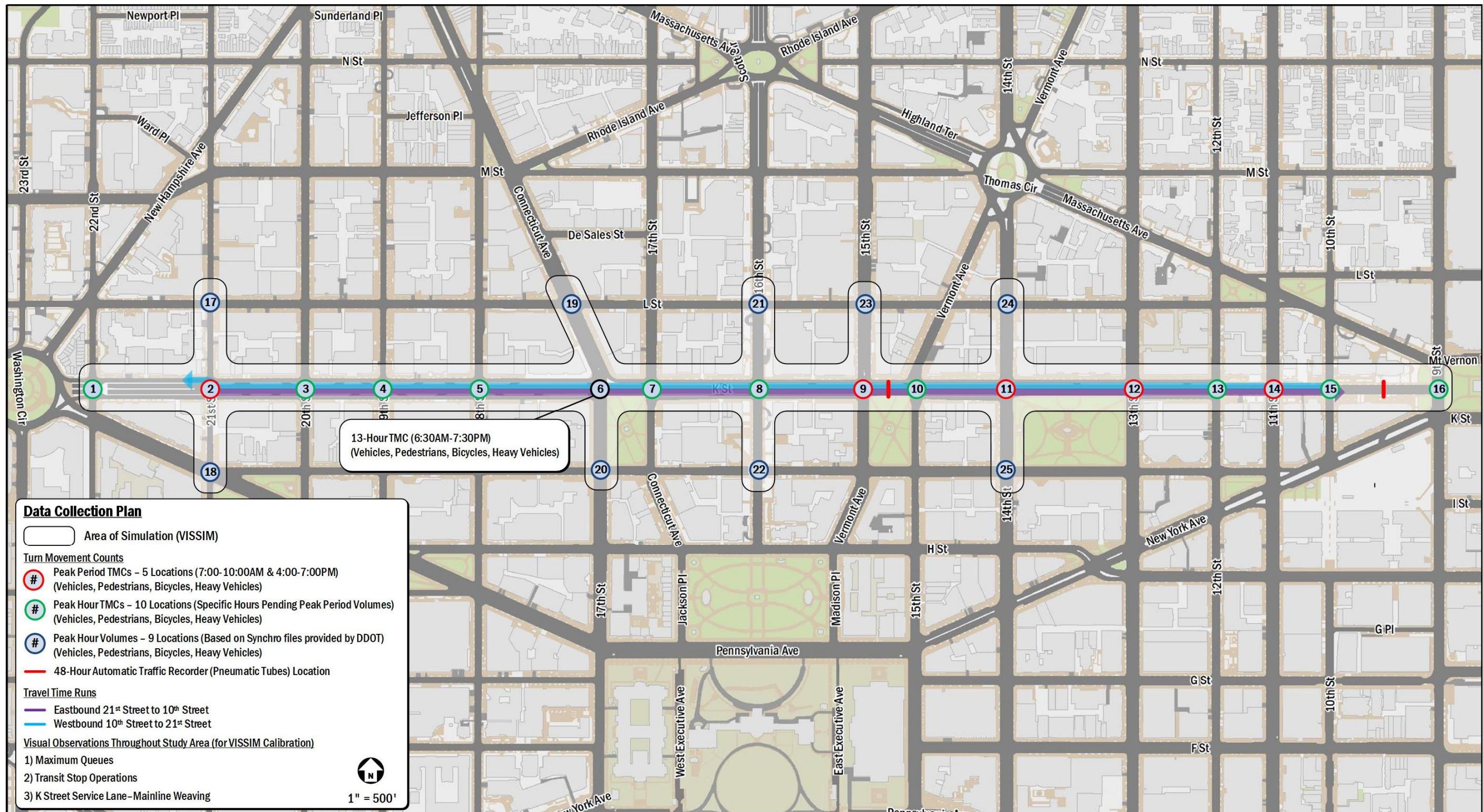


Figure 1: Data Collection Plan Study Area

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 |

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- 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.

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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:

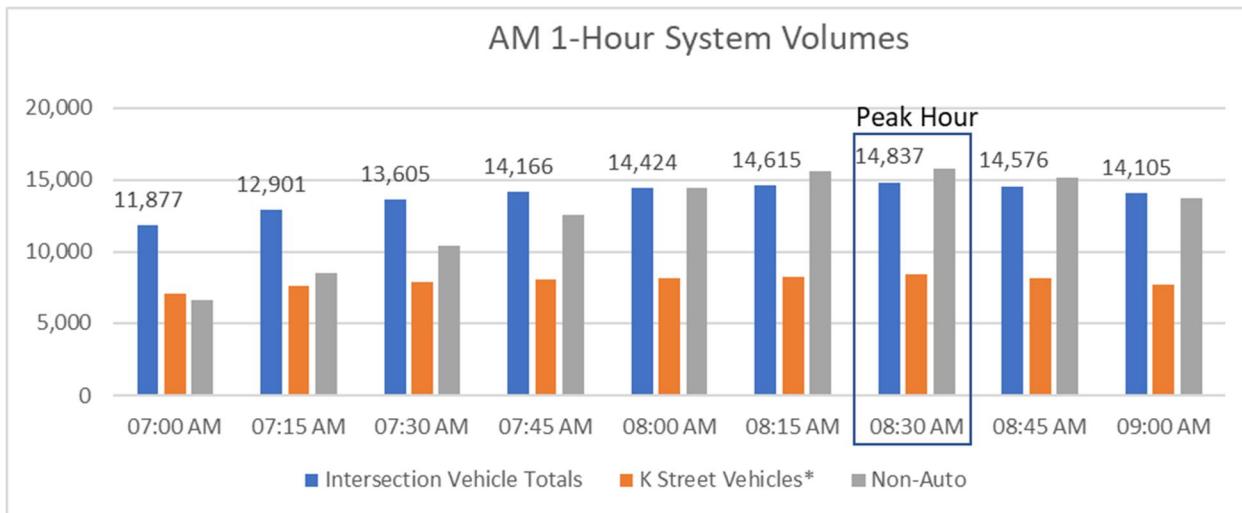
System Vehicle Maximum Volumes

System Vehicle Maximum Volumes on K Street only

System Non-Auto Maximum Volumes

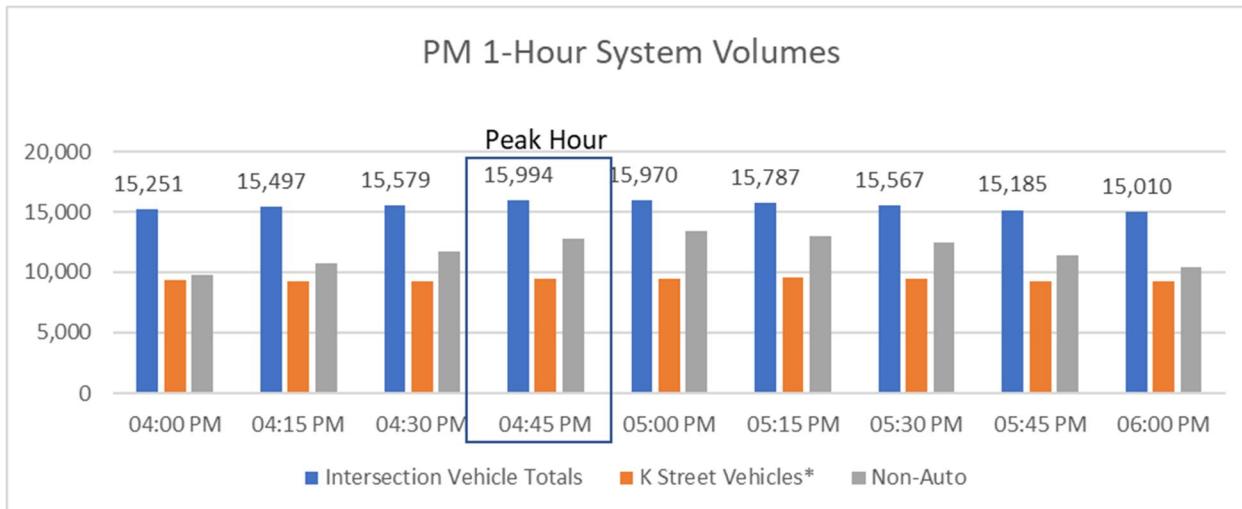
System Maximum Pedestrian Volume

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

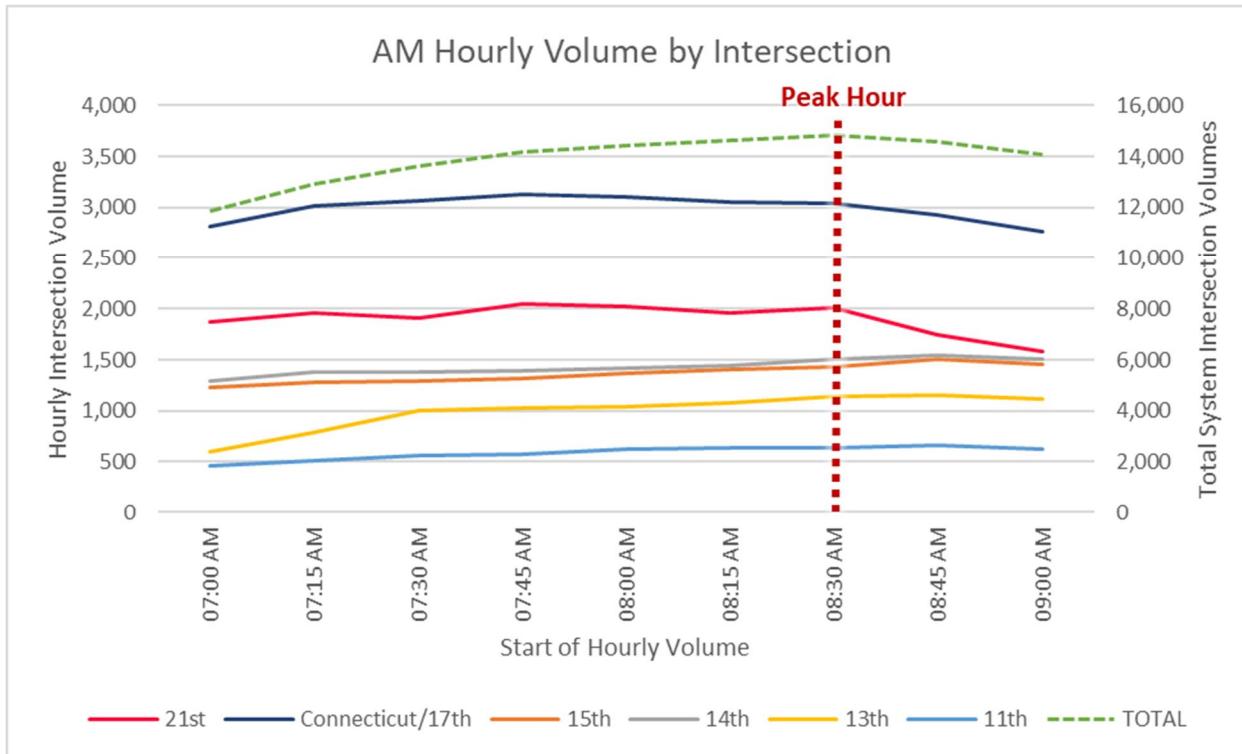


Figure 4: AM Hourly Vehicle Volume Comparison Based on Initial Six (6) Intersections Processed

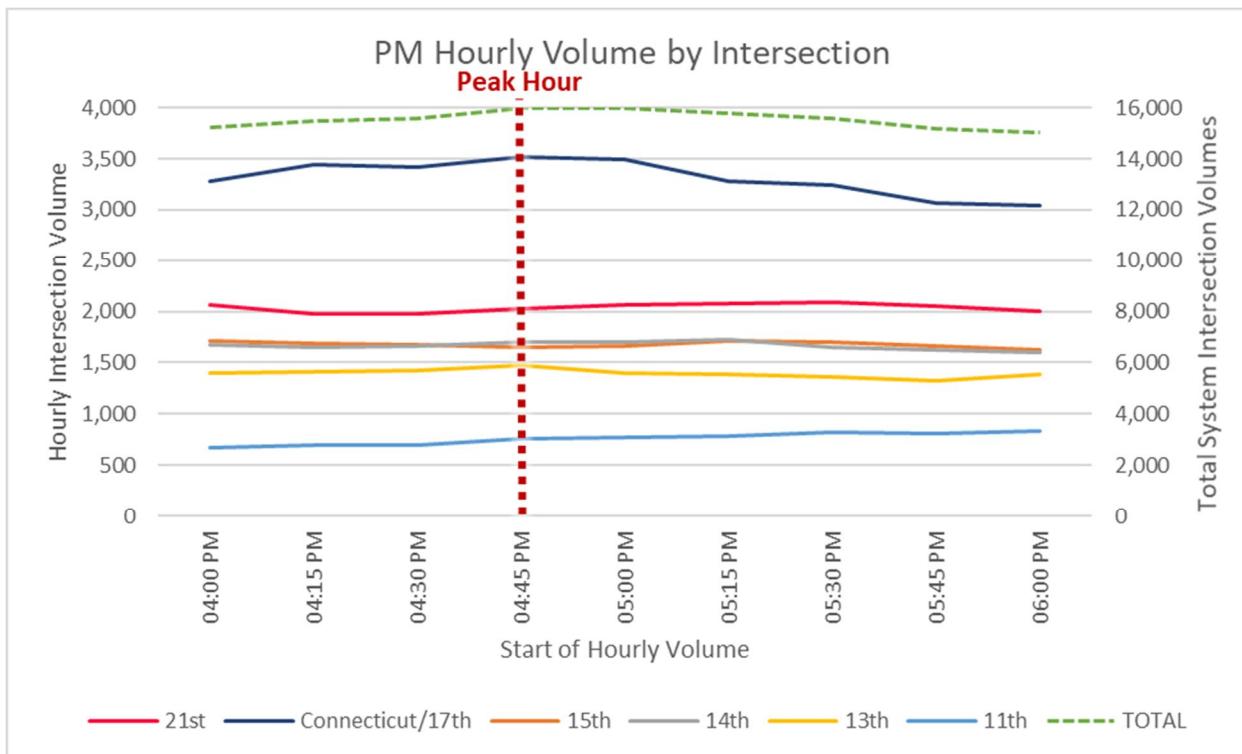


Figure 5: PM Hourly Vehicle Volume Comparison Based on Initial Six (6) Intersections Processed

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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

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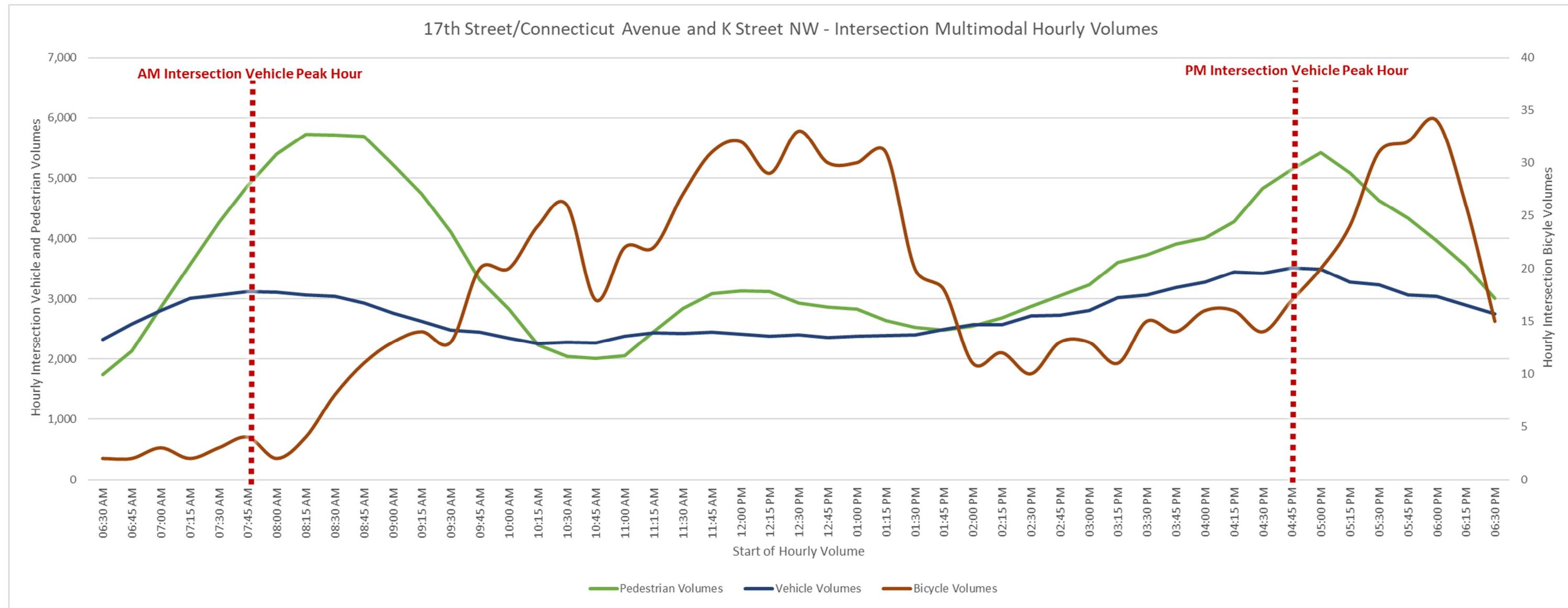


Figure 6: 17th Street (west)/Connecticut Avenue and K Street NW - Intersection Multimodal Hourly Volumes

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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.

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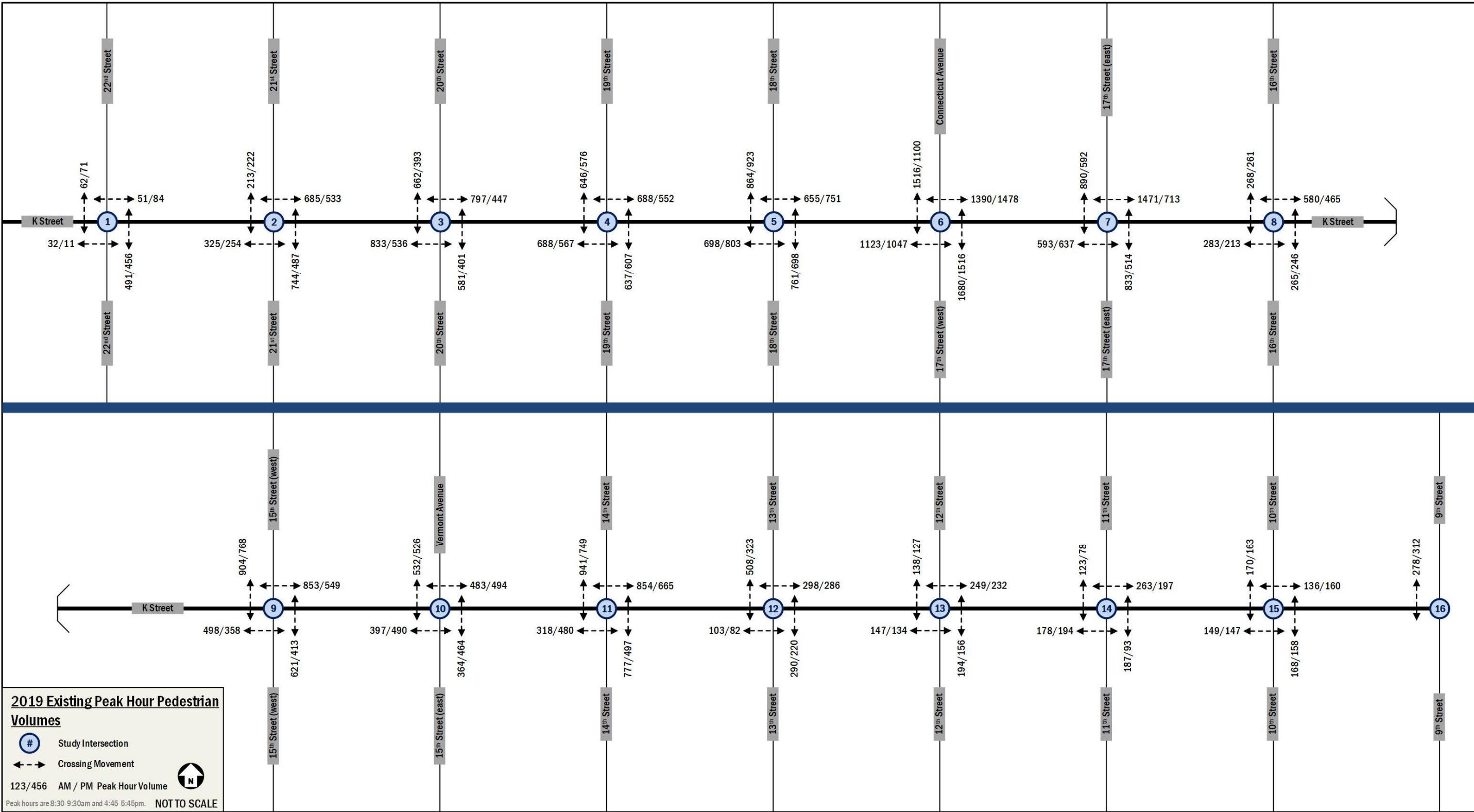


Figure 7: 2019 Existing Peak Hour Pedestrian Volumes

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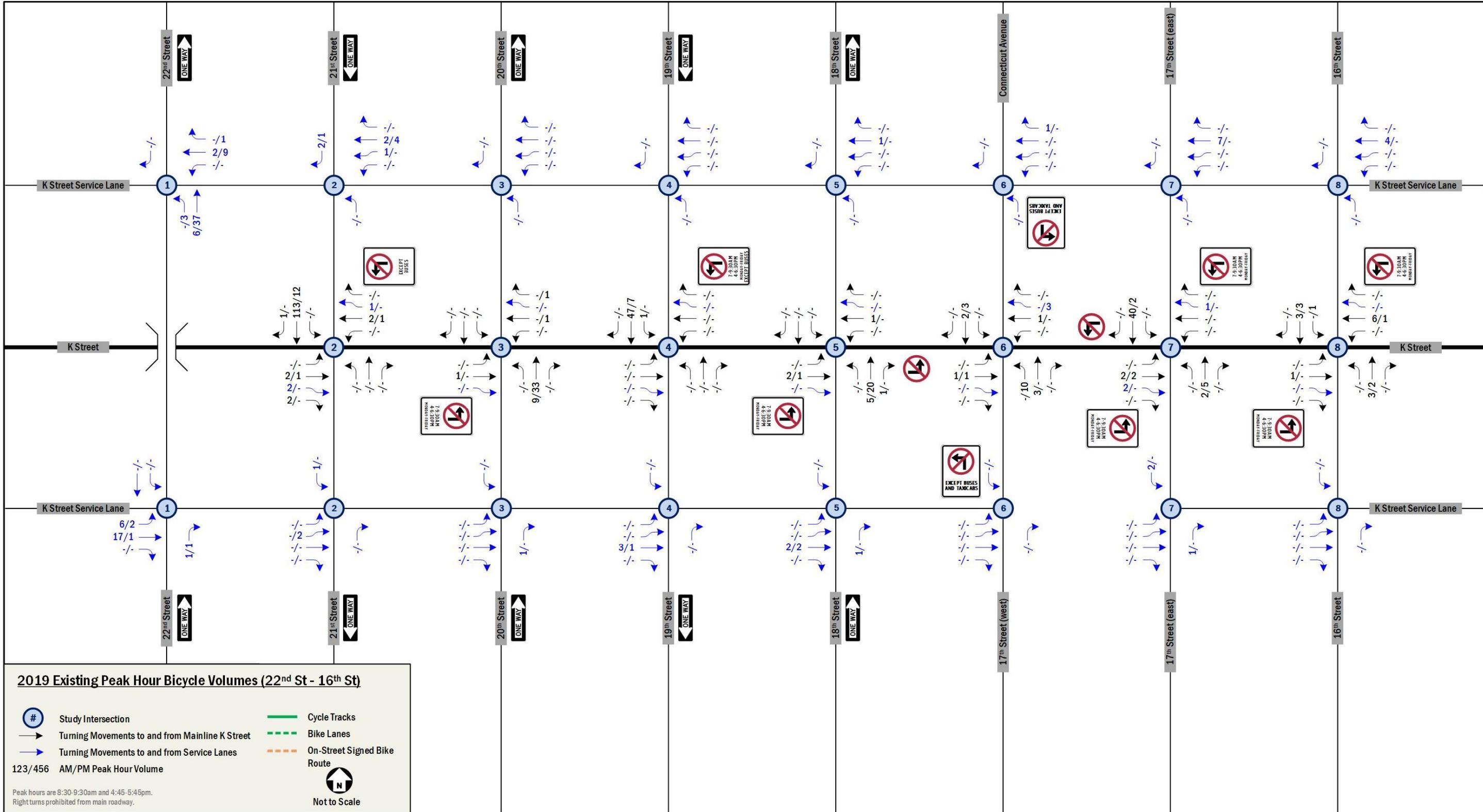


Figure 8: 2019 Existing Peak Hour Bicycle Volumes (22nd St - 16th St)

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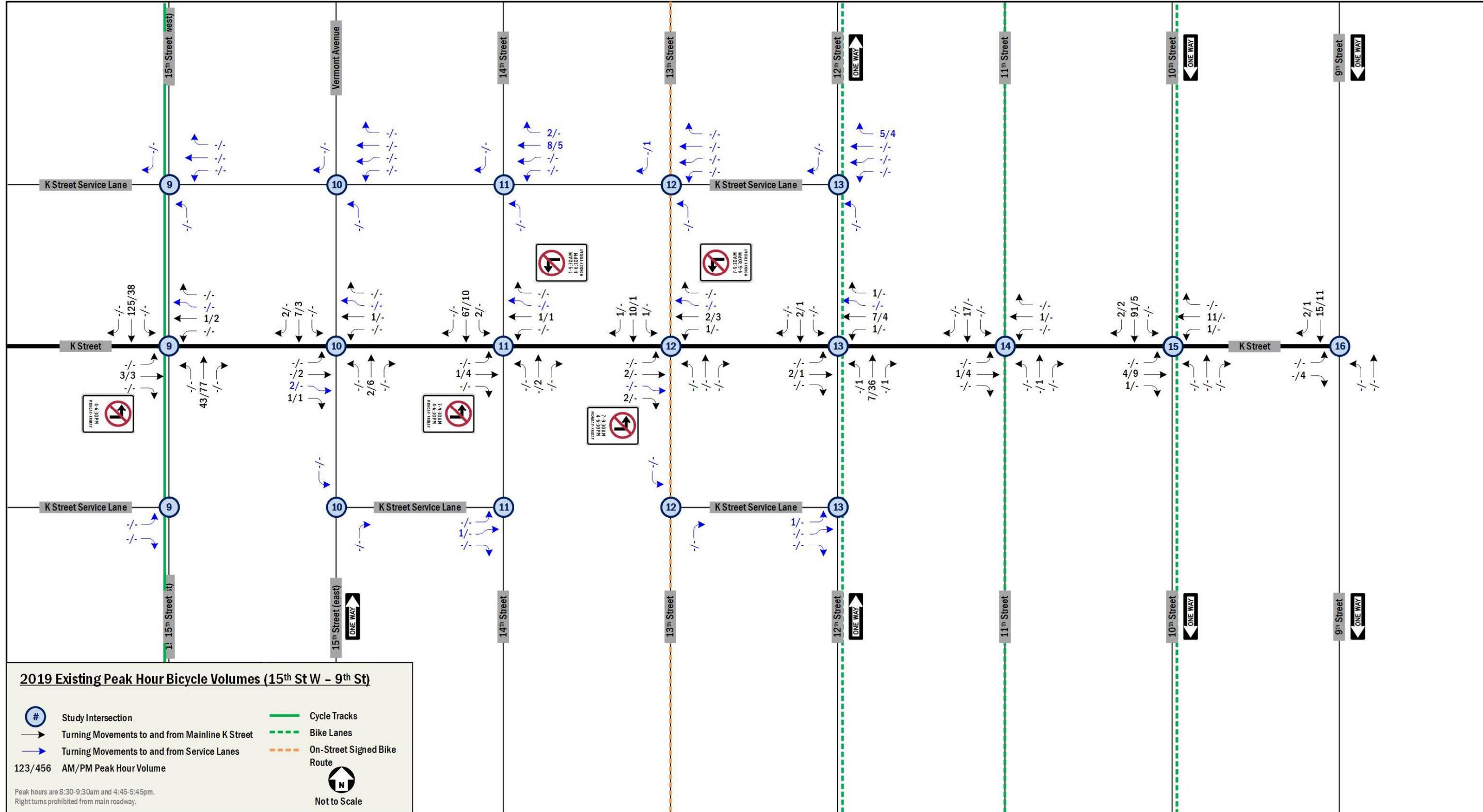


Figure 9: 2019 Existing Peak Hour Bicycle Volumes (15th St W - 9th St)

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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.

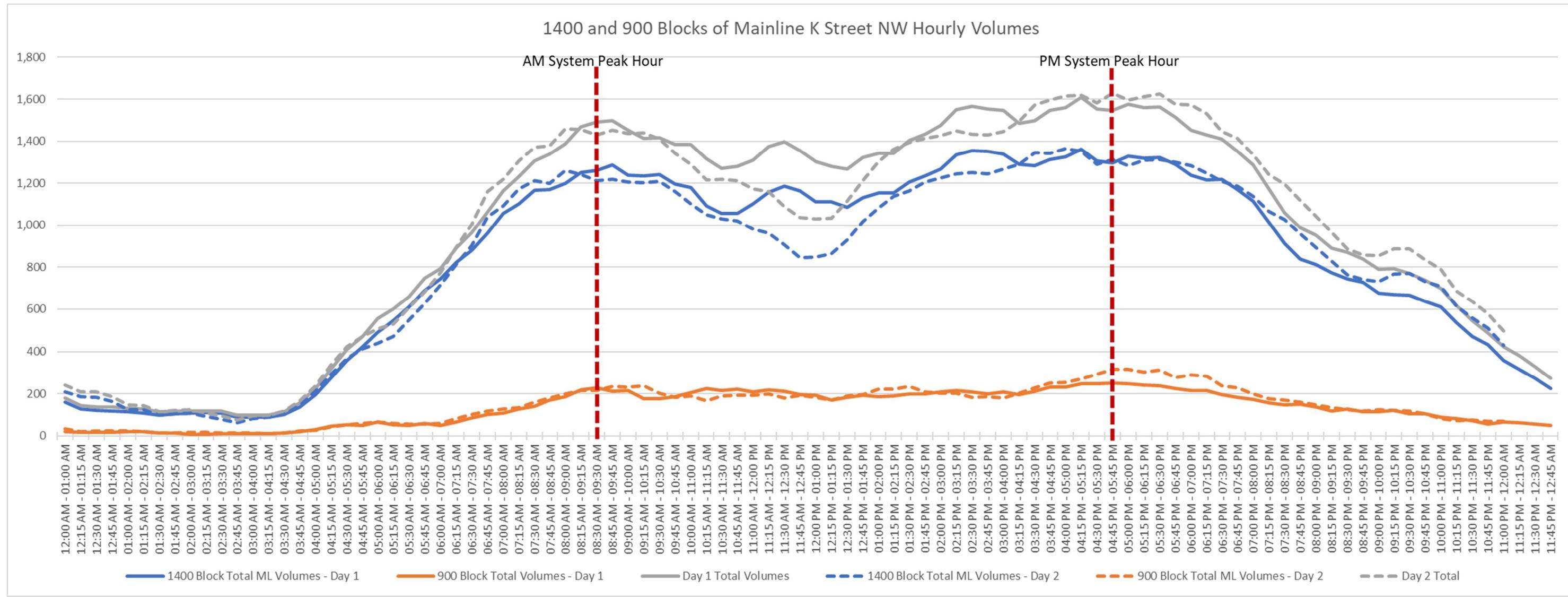


Figure 10: 1400 and 900 Blocks of Mainline K Street NW Hourly Volumes

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.

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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

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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	--
	EB	ML	480	96	--

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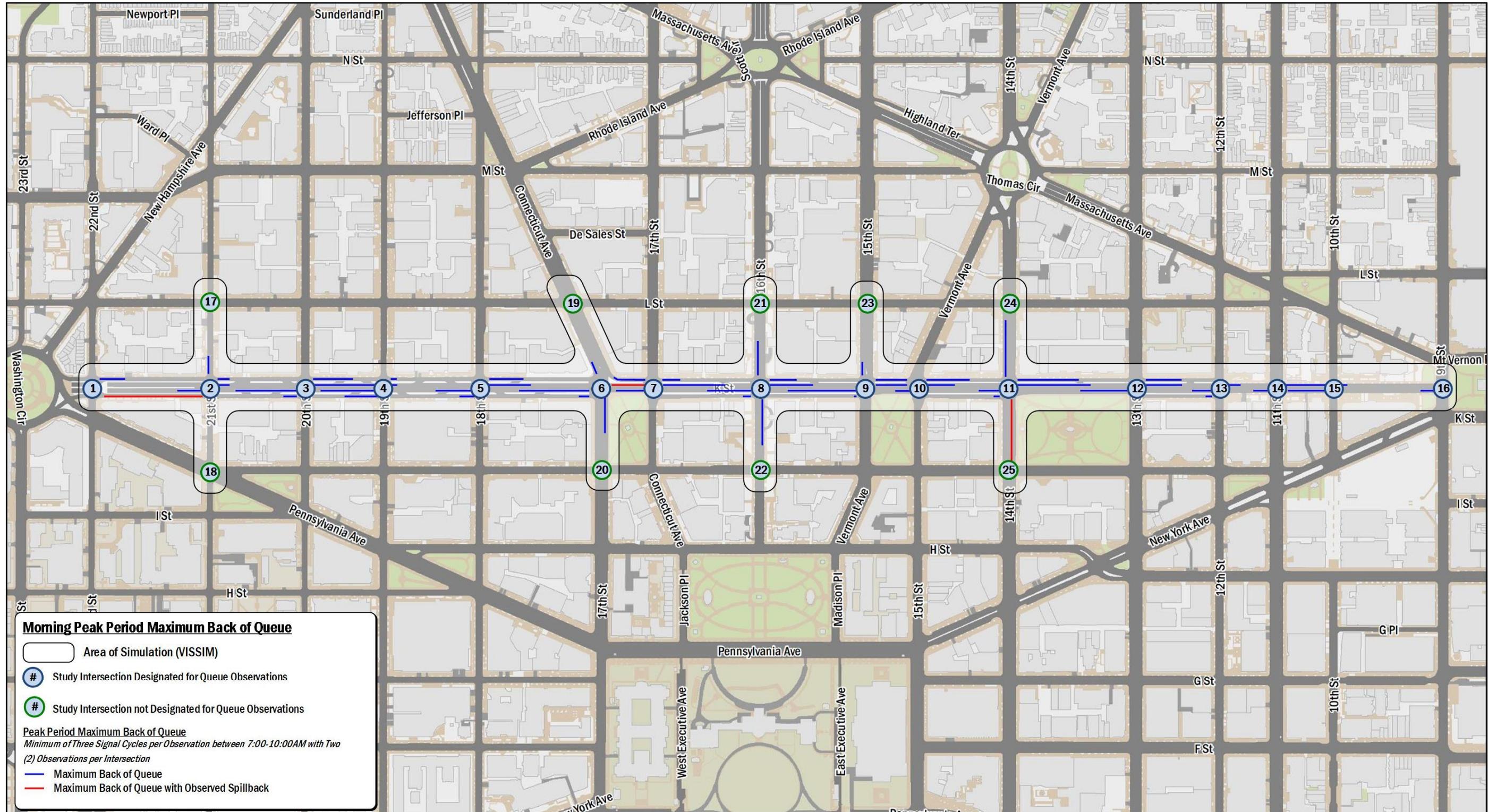


Figure 11: Morning Peak Period Maximum Back of Queue

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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

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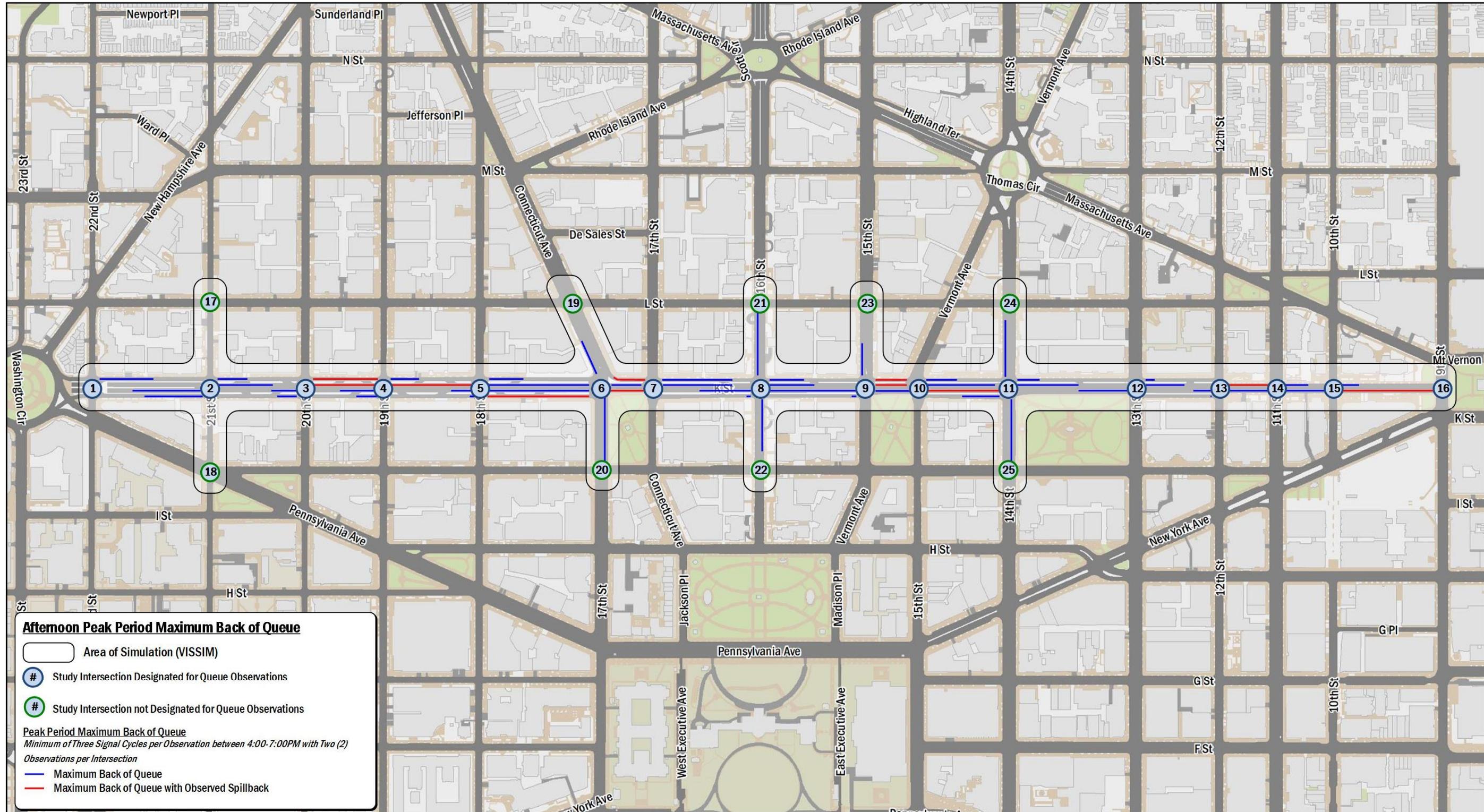


Figure 12: Afternoon Peak Period Maximum Back of Queue

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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

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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

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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

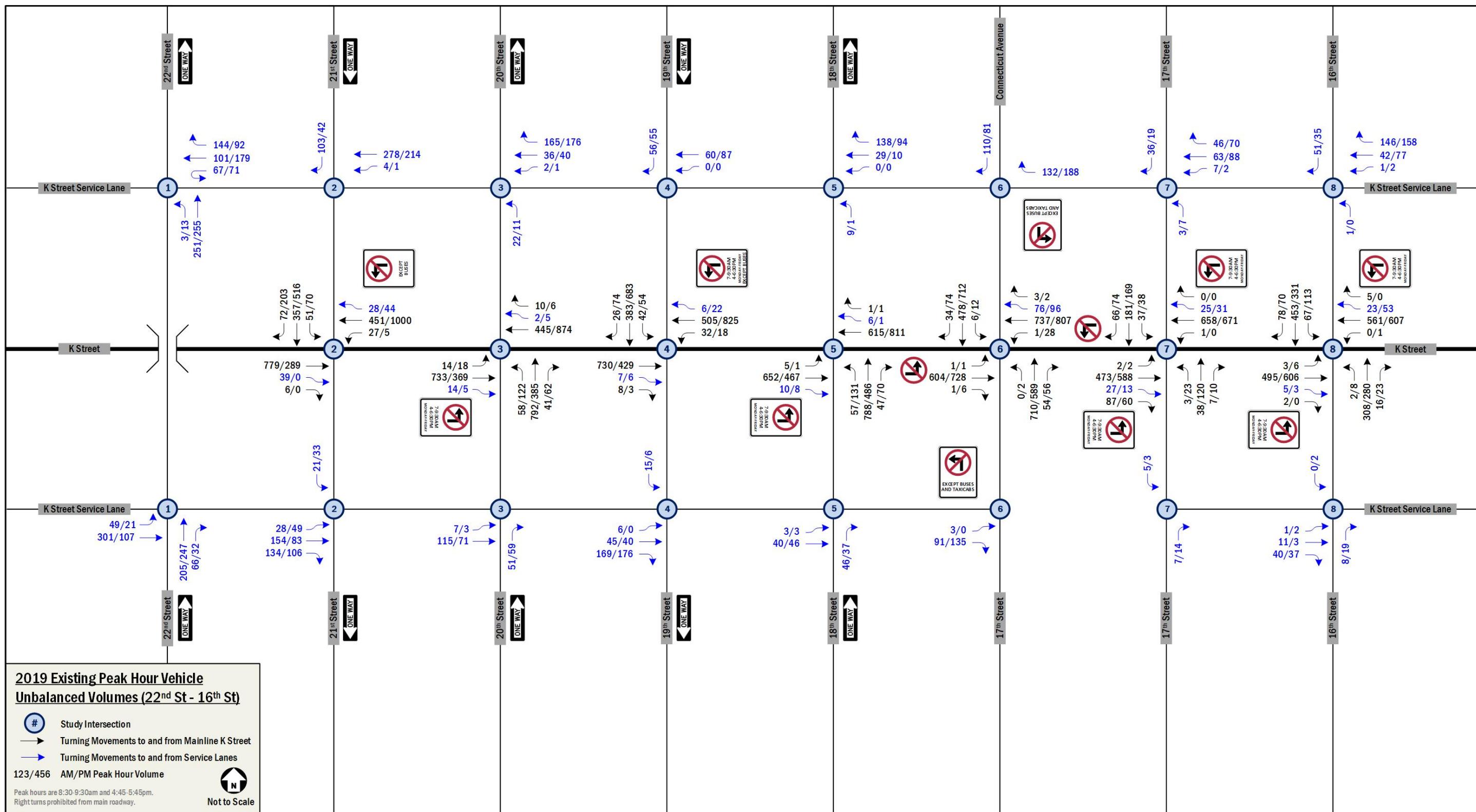
Memorandum Technical Attachments

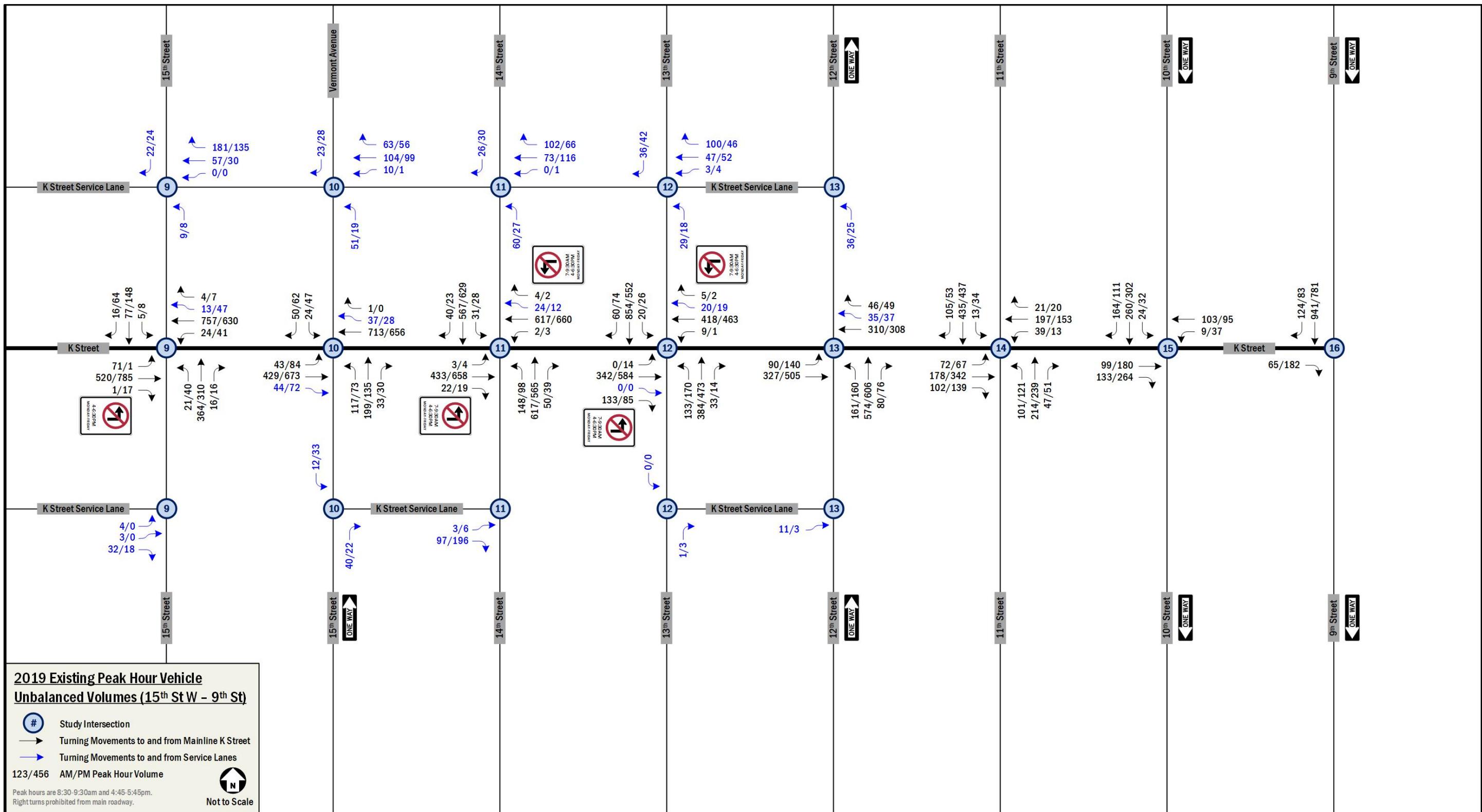
- A: Unbalanced Volumes
- B: Approved Volume Balancing Technical Memorandum
- C: ATR Hourly Volumes of Mainline K Street NW in the 1400 and 900 Blocks
- D: Field Verified Curbside Designations
- E: Signal Timings Verification Notes
- F: General Observations

March 5, 2020

Attachment A: Unbalanced Volumes

d.





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

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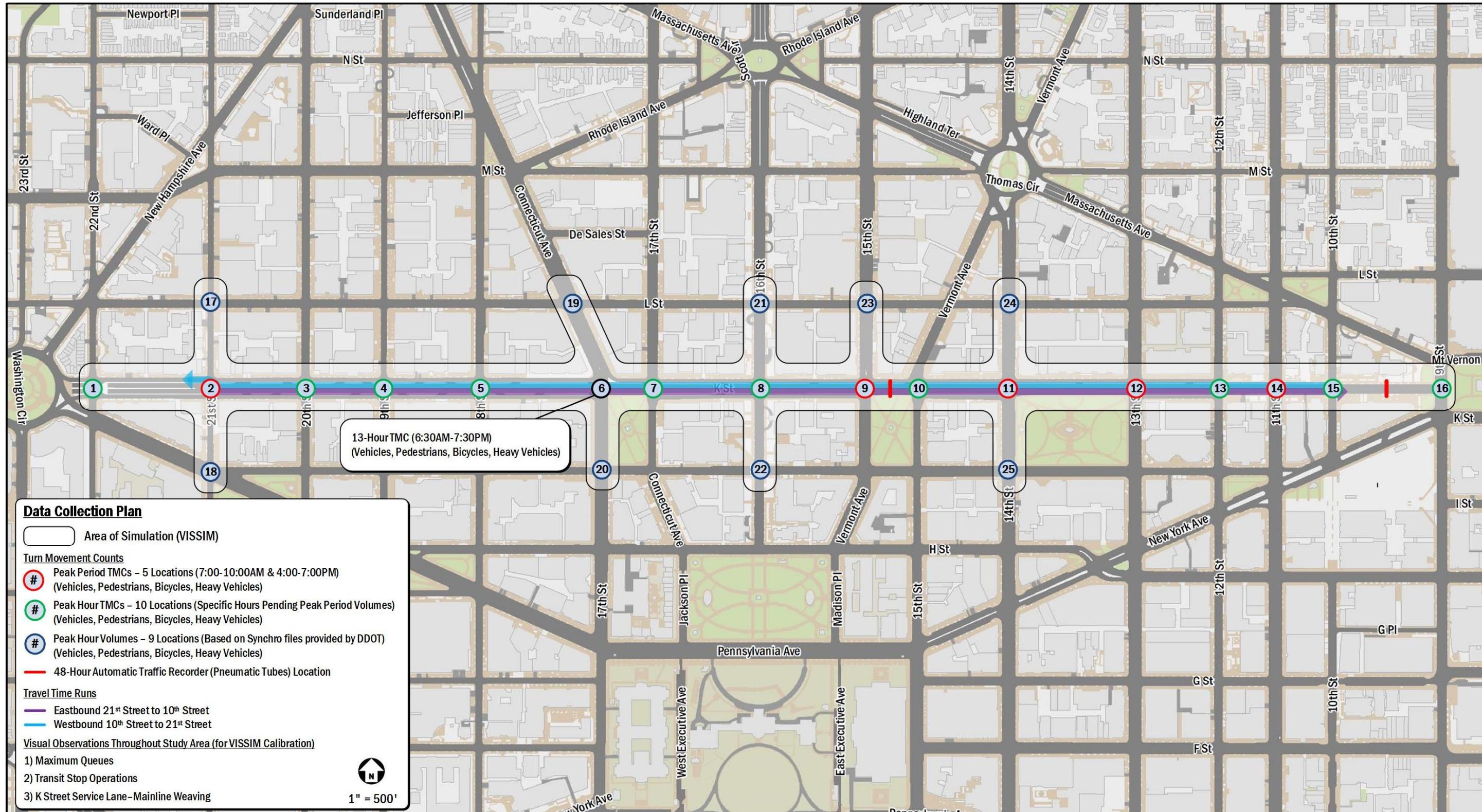


Figure 1: Study Area

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

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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

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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.

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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	10	10	1%			-9	-1%
15 th W St delta	160	852	55	7%	898	657	50	6%
15 th E/VT Ave delta	355	843	-76	-8%	890	821	20	2%
14 th St delta	540	966	-127	-13%	840	829	6	1%
13 th St delta	330	967	18	2%	860	883	-48	-7%
12 th St delta	200	842	57	11%	587	683	21	3%
11 th St delta	190	530	67	20%	394	648	-36	-6%
10 th St delta	480	327	-20	-10%	186	548	17	4%
9 th St	83	206	49	59%	132	444	-30	-14%
		83	0		182		0	

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

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- 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.

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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.

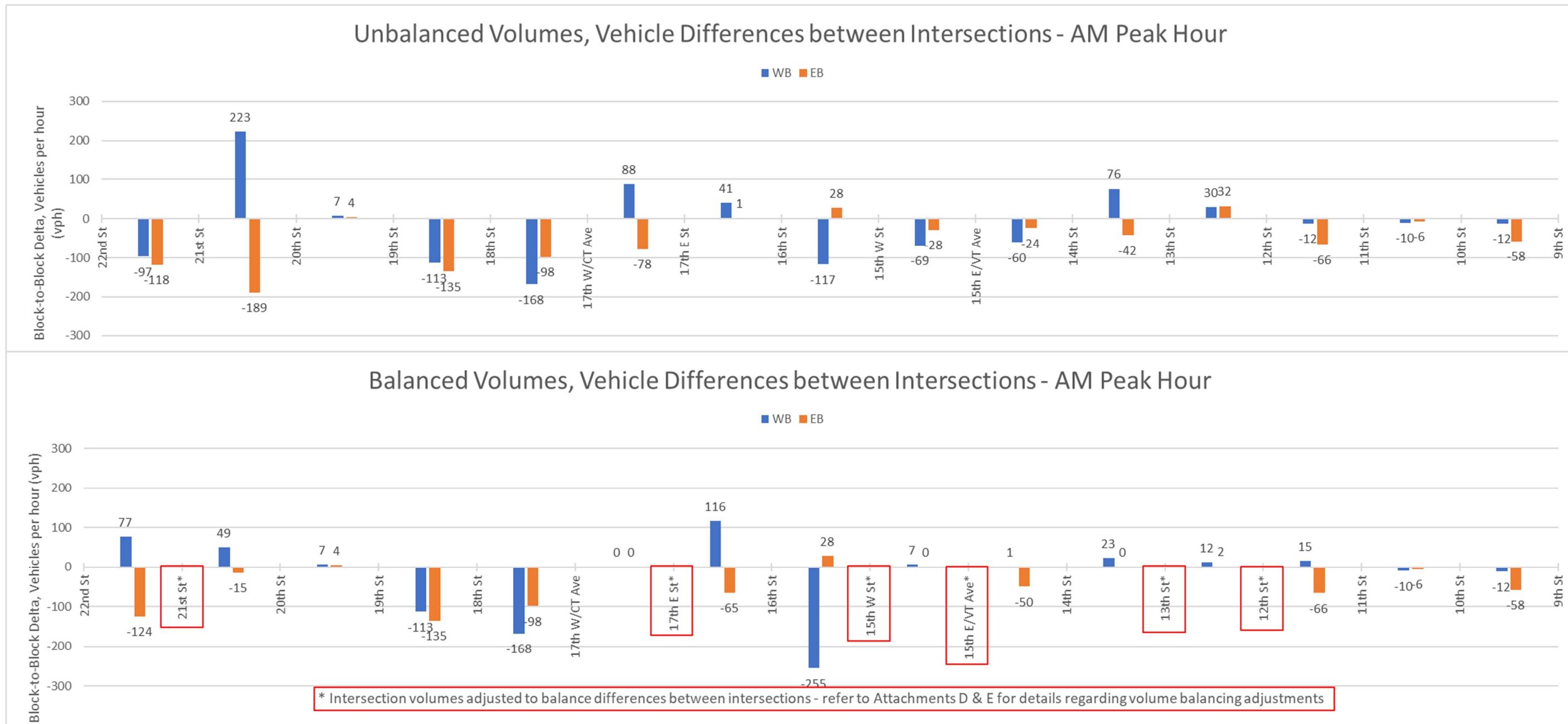


Figure 2: Block-to-Block Differences in Vehicle Volumes, AM Peak Hour

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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	0	1	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%	0%	33%	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%	27	0	0	28	0	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%	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:

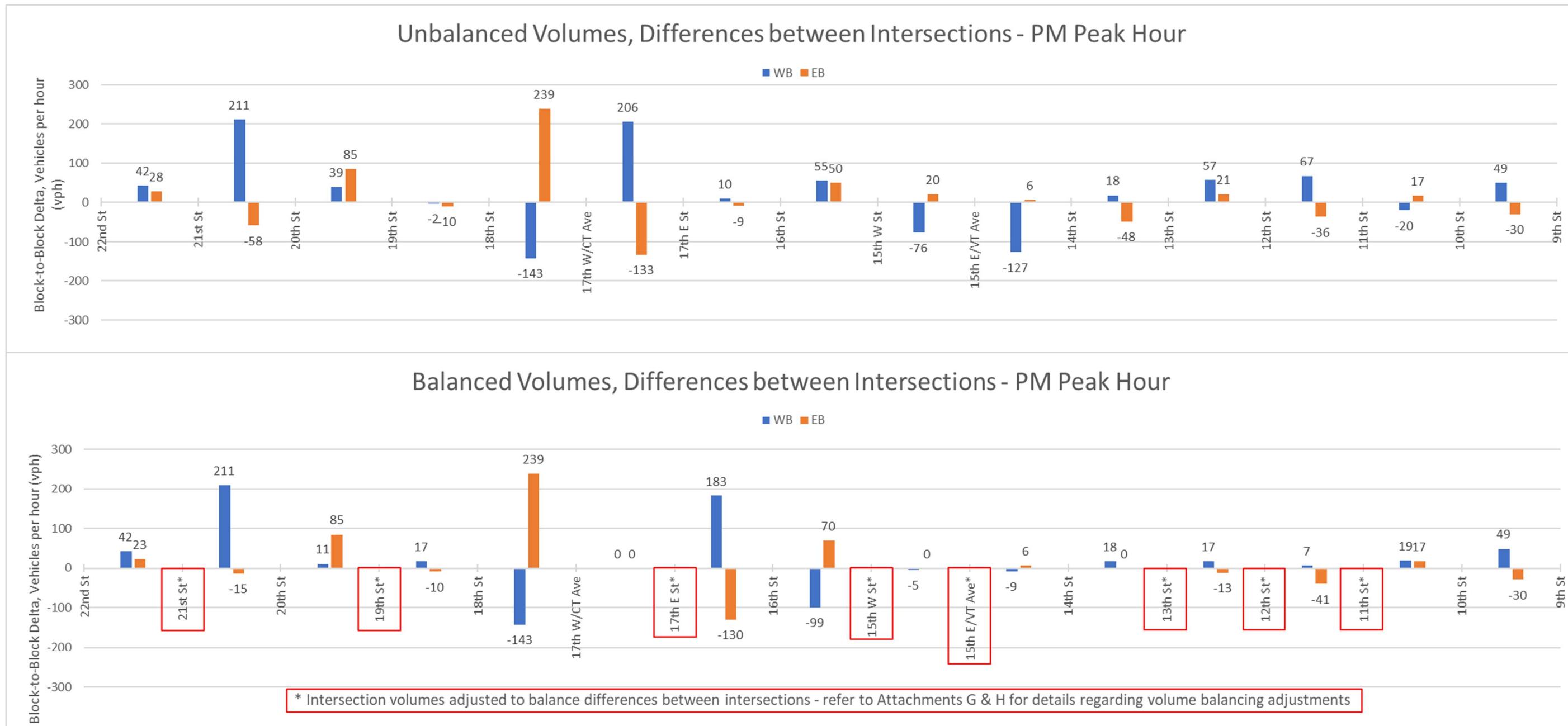
- 21st Street & K Street NW
- 19th Street & K Street NW
- 17th Street (East) & K Street NW
- 15th Street (West) & K Street NW
- 15th Street (East)/Vermont Avenue & K Street NW
- 13th Street & K Street NW
- 12th Street & K Street NW
- 11th Street & K Street NW

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

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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

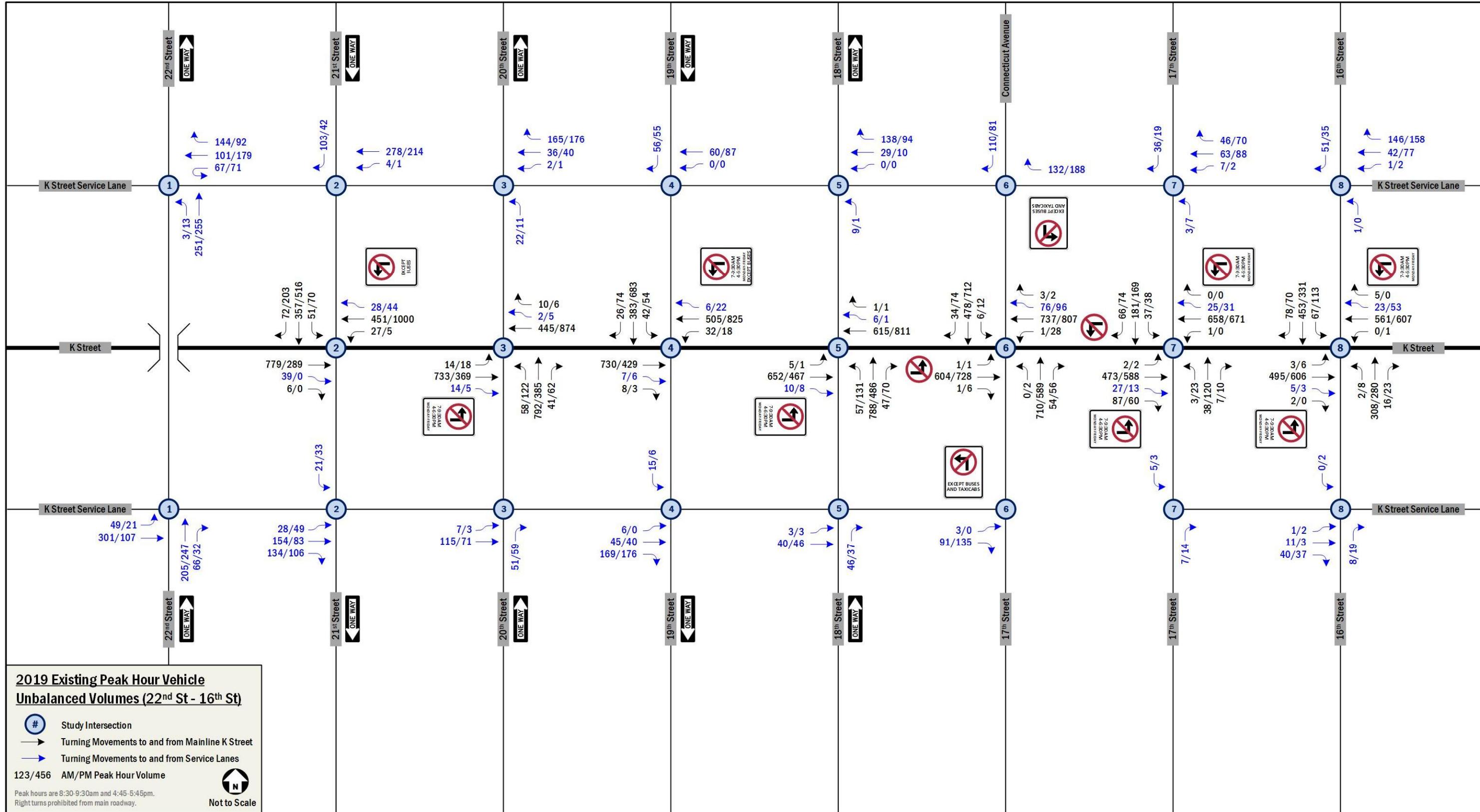
February 5, 2020

Attachment A: Unbalanced Volumes

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

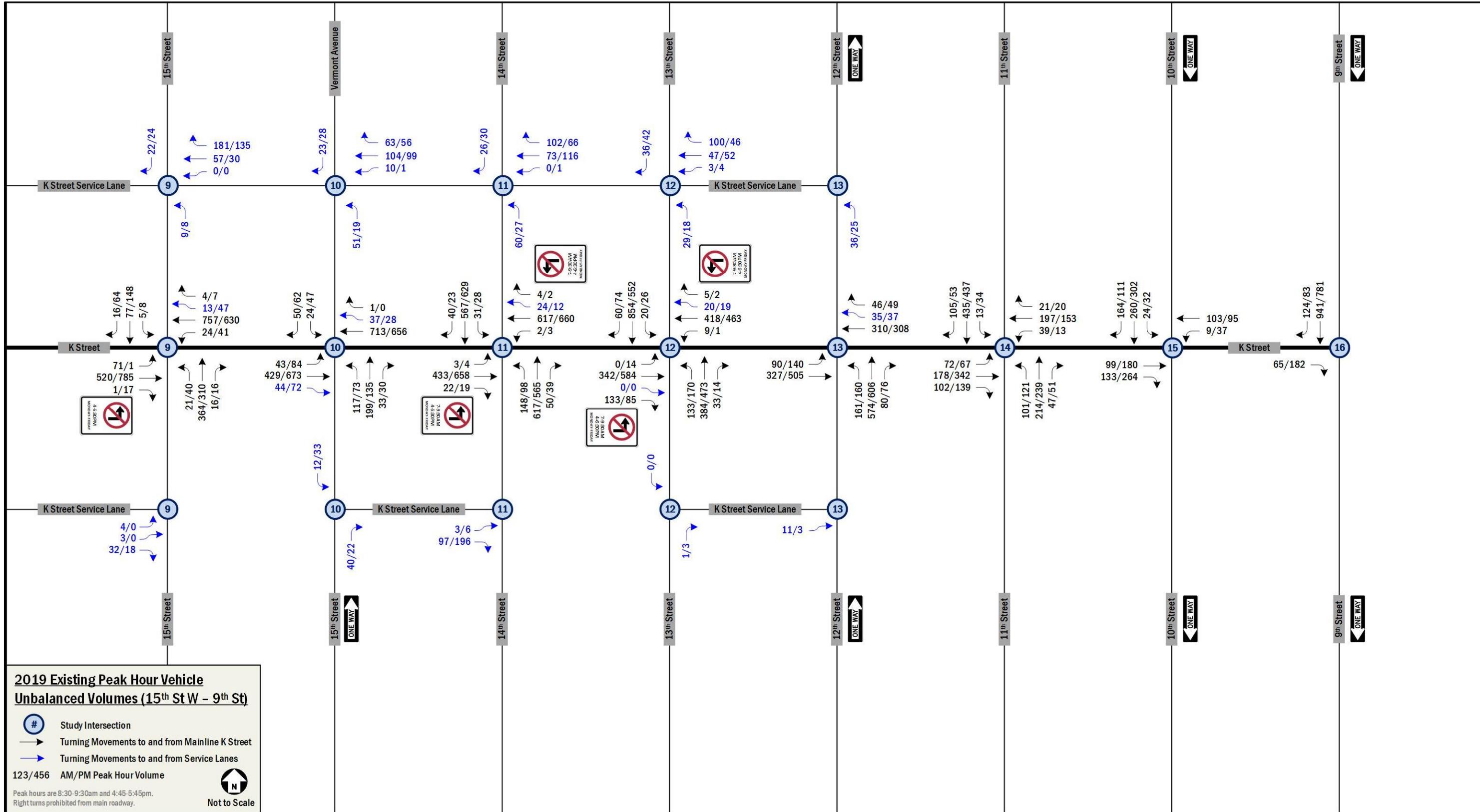
February 5, 2020



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

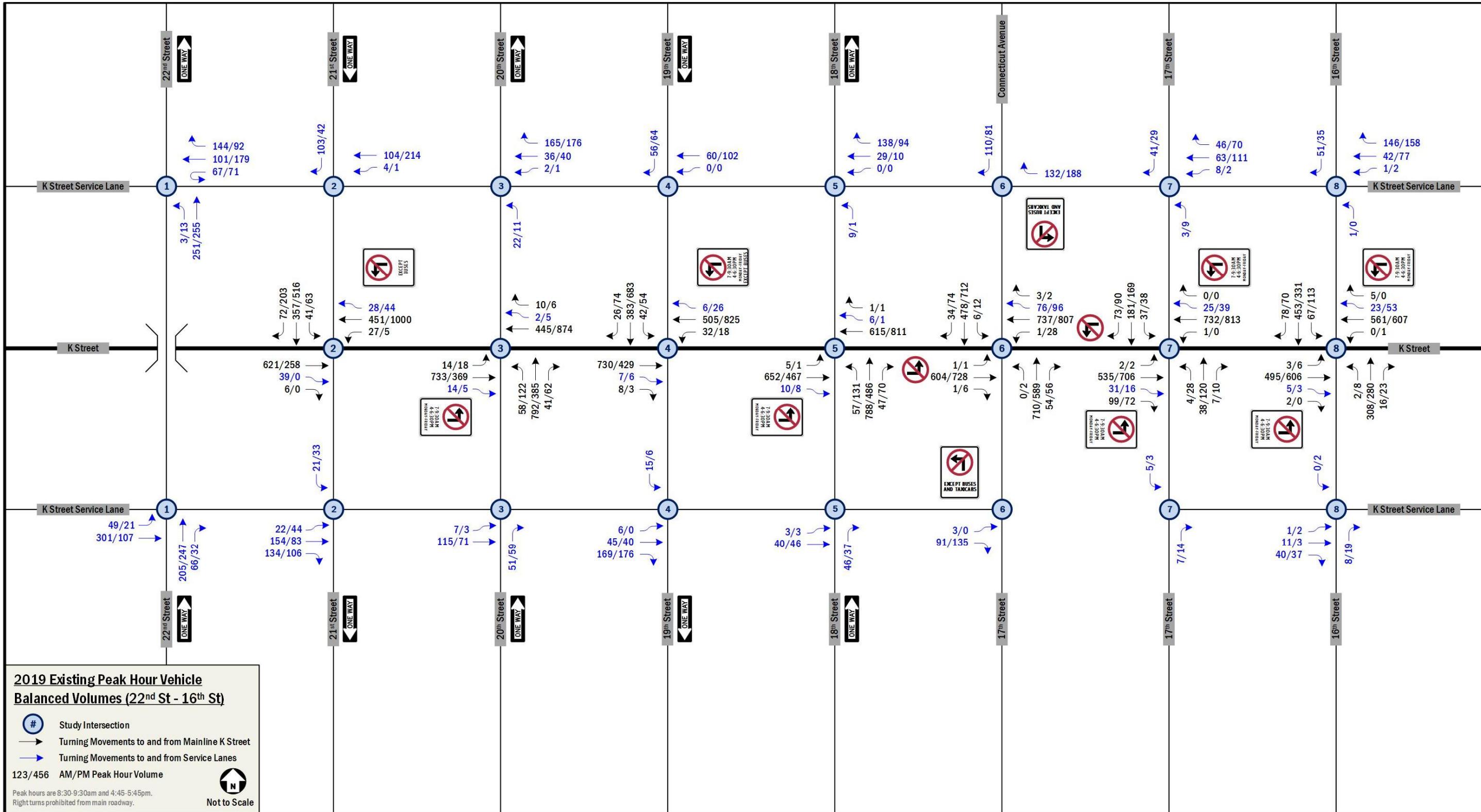
February 5, 2020

Attachment C: Balanced Volumes

K Street NW Traffic Analysis

REVISED Volume Balancing Technical Memo

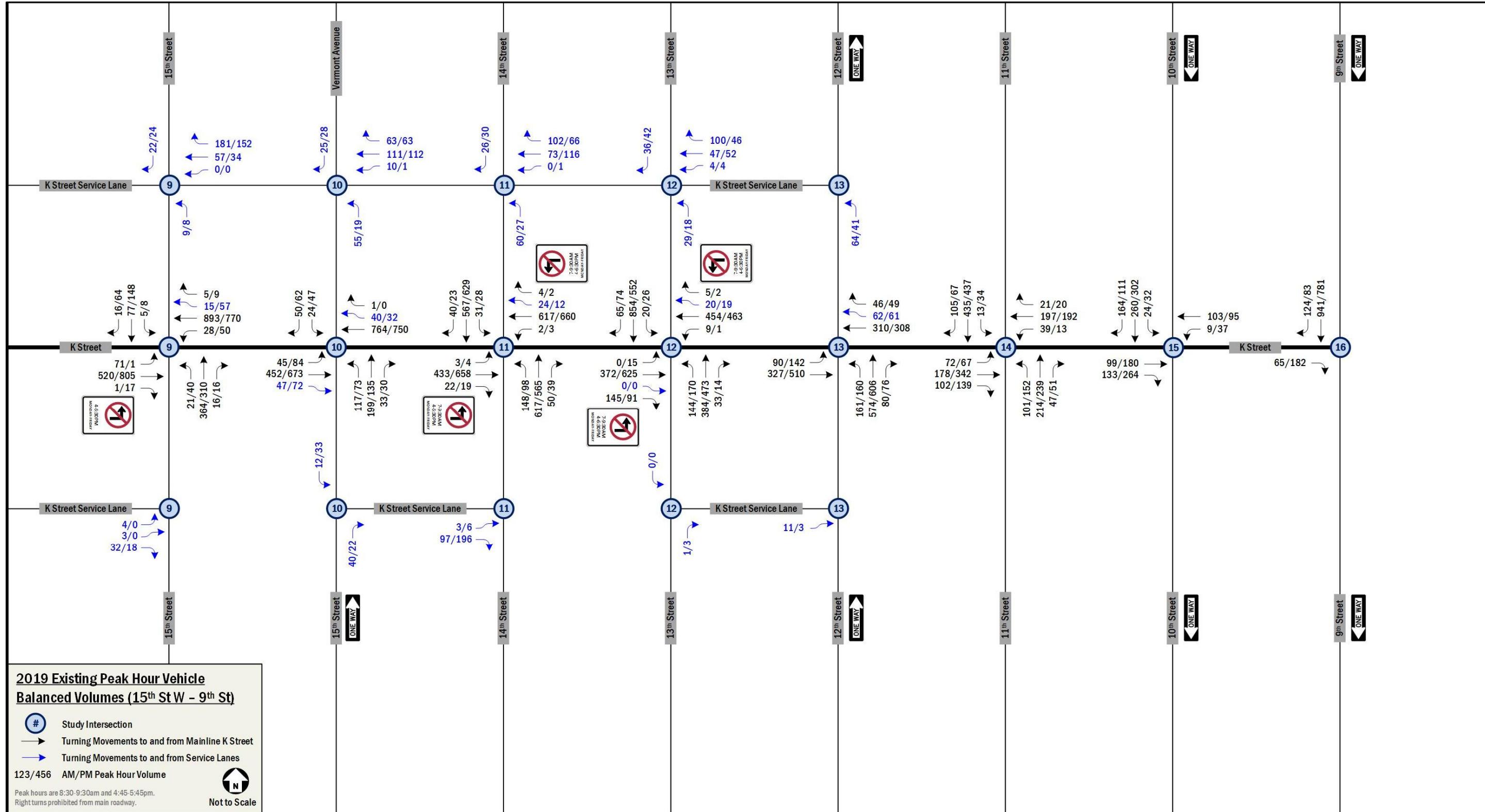
February 5, 2020



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	0	0%	0%	103	594
		72		0		0%		72	
		357		0		0%		357	
		21		0		0%		21	
		51		-10	-10	-20%	-20%	41	
	WB	0	788	0	0	0%	0%	0	614
		278		-174	-174	-63%	-63%	104	
		4		0	0%	4			
		0		0	0%	0			
		28		0	0%	28			
		451		0	0%	451			
	EB	27	1,140	0	0	0%	0%	27	976
		0		0		0%		0	
		779		-158	-158	-20%	-20%	621	
		39		0	0%	39			
		6		0	0%	6			
		0		-6	-6	-21%	-21%	0	
EB Midblock Sinks/Generators	Vehicles Entering System	--	--	0	--	--	--	0	--
	Vehicles Exiting System	--	--	-15	-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	--
	Vehicles Exiting System	--	--	0	0	--	--	0	49
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	
	NB	445	964	0	0	0%	0%	445	964
		0		0		0%		0	
		58		0		0%		58	
		22		0		0%		22	
		792		0		0%		792	
		41		0		0%		41	
	EB	51	883	0	0	0%	0%	51	883
		14		0		0%		14	
		733		0		0%		733	
		14		0		0%		14	
		0		0		0%		0	
		7		0		0%		7	
EB Midblock Sinks/Generators	Vehicles Entering System	--	--	4	4	--	--	4	--
	Vehicles Exiting System	--	--	0	0	--	--	0	4
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	--
	Vehicles Exiting System	--	--	0	0	--	--	0	7

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	
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	-255	--	--	0	-255
	Vehicles Exiting System	--	--	-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						

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**Attachment E:
AM Balancing Notes**

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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

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- 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

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- 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

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- 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

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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

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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		0		0%		33	
		SBL (to ML)	70		-7		-10%		63	
	EB	SL WBR	0	1,264	0	0	0%	0%	0	1,264
		SL WBT	214		0		0%		214	
		WBL (to ML)	1		0		0%		1	
		SL WBL	0		0		0%		0	
		ML WBR	0		0		0%		0	
		ML WBR (to SL)	44		0		0%		44	
EB Midblock Sinks/Generators	ML WBT	1,000			0		0%		1,000	
	ML WBL	5			0		0%		5	
	ML EBL	0			0		0%		0	
	ML EBT	289			-31		-11%		258	
EB Slip Ramp Volumes	WB	ML EBR (to SL)	0	527	0	-36	0%	-7%	0	491
		ML EBR	0		0		0%		0	
		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	
	EB	Vehicles Entering System	--	--	0	-15	--	--	0	-15
		Vehicles Exiting System	--		-15		--		-15	
		ML to SL	48		25		--		25	
		SL to ML	48		52		--		52	
		ML to SL	54		54		--		54	
		SL to ML	126		106		--		106	
WB Slip Ramp Volumes	WB	Vehicles Entering System	--	1,102	211	211	--	--	211	1,102
		Vehicles Exiting System	--		0		--		0	
		SL WBR	176		0		0%	0%	176	
		SL WBT	40		0		0%		40	
		WBL (to ML)	1		0		0%		1	
		SL WBL	0		0		0%		0	
	EB	ML WBR	6	466	0	0	0%	0%	6	466
		ML WBR (to SL)	5		0		0%		5	
		ML WBT	874		0		0%		874	
		ML WBL	0		0		0%		0	
		NBL (to ML)	122		0		0%	0%	122	639
		NBL (to SL)	11		0		0%		11	
20th St & K St	NB	NBT	385	639	0	0	0%	0%	385	639
		NBR (to ML)	62		0		0%		62	
		NBR (to SL)	59		0		0%		59	
		ML EBL	18		0		0%		18	
		ML EBT	369		0		0%		369	
		ML EBR (to SL)	5		0		0%		5	
	EB	ML EBR	0	466	0	0	0%	0%	0	466
		SL EBL	0		0		0%		0	
		SL EBL (to ML)	3		0		0%		3	
		SL EBT	71		0		0%		71	

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%		589	

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	
	NB	ML WBR (to SL)	31	174	8	7	26%	4%	39	181
		ML WBT	671		142		21%		813	
		ML WBL	0		0		0%		0	
		NBL (to ML)	23		5		22%		28	
		NBL (to SL)	7		2		29%		9	
16th St & K St	EB	NBT	120	663	0	133	0%	20%	120	796
		NBR (to ML)	10		0		0%		10	
		NBR (to SL)	14		0		0%		14	
		ML EBL	2		0		0%		2	
		ML EBT	588		118		20%		706	
	WB	ML EBR (to SL)	13	898	3	0	23%	0%	16	898
		ML EBR	60		12		20%		72	
		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	--	--	--	-130	-130	--	--	-130	-130
		Vehicles Exiting System	--		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	
	WB Midblock Sinks/Generators	Vehicles Entering System	--	--	183	183	--	--	183	183
		Vehicles Exiting System	--		0		--		0	
16th St & K St	SB	SBR (to SL)	35	551	0	0	0%	0%	35	551
		SBR (to ML)	70		0		0%		70	
		SBT	331		0		0%		331	
		SBL (to SL)	2		0		0%		2	
		SBL (to ML)	113		0		0%		113	
	WB	SL WBR	158	898	0	0	0%	0%	158	898
		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	
EB Midblock Sinks/Generators	NB	ML WBR (to SL)	53	330	0	0	0%	0%	280	330
		ML WBT	607		0		0%		23	
		ML WBL	1		0		0%		19	
		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	
EB Slip Ramp Volumes	WB	ML EBR (to SL)	3	--	0	0	0%	0%	3	--
		ML EBR	0		0		0%		0	
		SL EBL	0		0		0%		0	
		SL EBL (to ML)	2		0		0%		2	
WB Slip Ramp Volumes	NB	SL EBT	3	--	0	0	0%	0%	3	--
		SL EBR	37		0		0%		37	
		Vehicles Entering System	--	--	82	70	--	--	82	70
		Vehicles Exiting System	--		-12		--		-12	
WB Midblock Sinks/Generators	ML to SL	ML to SL	18	--	18	--	--	--	18	--
		SL to ML	6		97		--		97	
	SL to ML	ML to SL	120	--	213	--	--	--	213	--
		SL to ML	144		0		--		0	
Vehicles Entering System	Vehicles Exiting System	--	--	--	0	-99	--	--	0	-99
		--	--		-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	
		Vehicles Exiting System	--		-16		--		-16	
EB Slip Ramp Volumes		ML to SL	--		19		--		19	
		SL to ML	--		6		--		6	
WB Slip Ramp Volumes		ML to SL	--		13		--		13	
		SL to ML	--		30		--		30	
WB Midblock Sinks/Generators		Vehicles Entering System	--		17	17	--	--	17	17
		Vehicles Exiting System	--		0		--		0	
12th St & K St	WB	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	
	NB	ML WBL	0		0		0%		0	
		NBL (to ML)	160							

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	411	0	31	0%	8%	13	442	
		NBL (to ML)	121		31		26%		152		
		NBL (to SL)	0		0		0%		0		
		NBT	239		0		0%		239		
		NBR (to ML)	51		0		0%		51		
	EB	NBR (to SL)	0	548	0	0	0%	0%	0	548	
		ML EBL	67		0		0%		67		
		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	17	
		SL EBR	0		0		0%		0		
	Vehicles Exiting System	--	--		17		17		--		
		--	--		0		0		17		
WB Midblock Sinks/Generators	Vehicles Entering System	--	--	--	19	19	--	--	19	19	
		--	--		0		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	444	0	0	0%	0%	37	444	
		ML EBL	0		0		0%		0		
		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	-30	--	--	0	-30	
		--	--		-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%	-10	870	0	0%				
18th	520	-143	-13%		917	525	239	38%	-143	0	0%	239	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	1,121	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	0	0	0	787	No midblock driveways.	No midblock driveways.	
delta		915			862	663	666	0	1,121	0	0%	1,035	796	0	0%		One garage driveway and one alley driveway/200 spaces	One alley driveway.	
17th E	460	10	1%		898	657	771	0	1,121	0	0%	-130	657	0	0%	771	One garage driveway/200 spaces	One alley driveway.	
delta		852			898	-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	-99	0	1,072	0	0	0	829	One garage driveway/114 spaces	One garage driveway.	
delta		843			890	821	20	2%	997	-5	0	0%	0	0	0	829	No midblock driveways.	No midblock driveways.	
15th W	160	-76	-8%		890	821	20	2%	1,077	0	0%	958	829	0	0%	877	No midblock driveways.	No midblock driveways.	
delta		966			840	829	6	1%	877	-9	0	0%	6	0	0%	877	No midblock driveways.	One garage driveway/430 spaces	
15th E/VT	355	-127	-13%		860	883	731	0	967	0	0%	860	883	0	0%	731	No midblock driveways.	No midblock driveways.	
delta		967			860	883	-48	-7%	967	18	0	0%	0	0	0	668	No midblock driveways.	No midblock driveways.	
14th	540	18	2%		587	683	627	0	842	0	0%	-13	655	0	0%	589	No midblock driveways.	No midblock driveways.	
delta		842			587	683	21	3%	570	17	0	0%	-13	0	0%	589	No midblock driveways.	No midblock driveways.	
13th	330	57	11%		394	648	584	0	570	0	0%	418	655	0	0%		No midblock driveways.	No midblock driveways.	
delta		530			394	648	-36	-6%	411	7	0	0%	-41	548	0	0%	427	No midblock driveways.	One garage driveway/unknown # of spaces
12th	200	67	20%		186	548	17	4%	427	19	0	0%	17	444	0	0%	212	No midblock driveways.	One garage driveway/unknown # of spaces
delta		327			186	548	212	0	411	206	0	0%	-30	444	0	0%	212	No midblock driveways.	One garage driveway/154 spaces
11th	190	-20	-10%		132	444	-30	-14%	427	49	0	0%	-30	182	0	0%	0	No midblock driveways.	One garage driveway/154 spaces
delta		206			132	444	0	0%	427	0	0	0	0	182	0	0%	0	No midblock driveways.	One garage driveway/154 spaces
10th	480	49	59%		0	182	0	0%	427	83	0	0%	0	182	0	0%	0	No midblock driveways.	One garage driveway/154 spaces
delta		83			0	182	0	0%	427	0	0	0	0	0	0	0	No midblock driveways.	One garage driveway/154 spaces	
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												

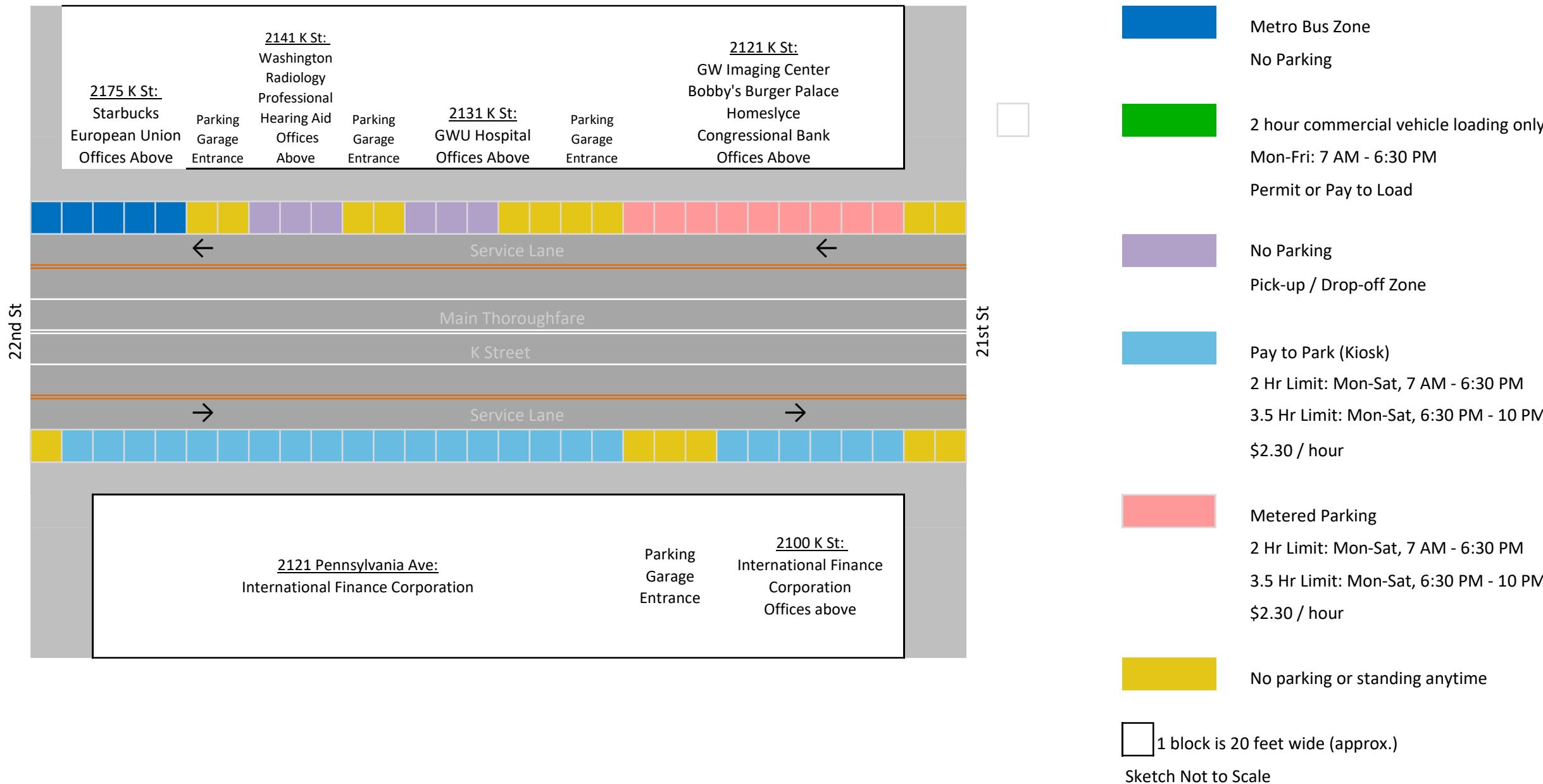
Attachment D: Field Verified Curbside Designations

d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 22nd Street to 21st Street

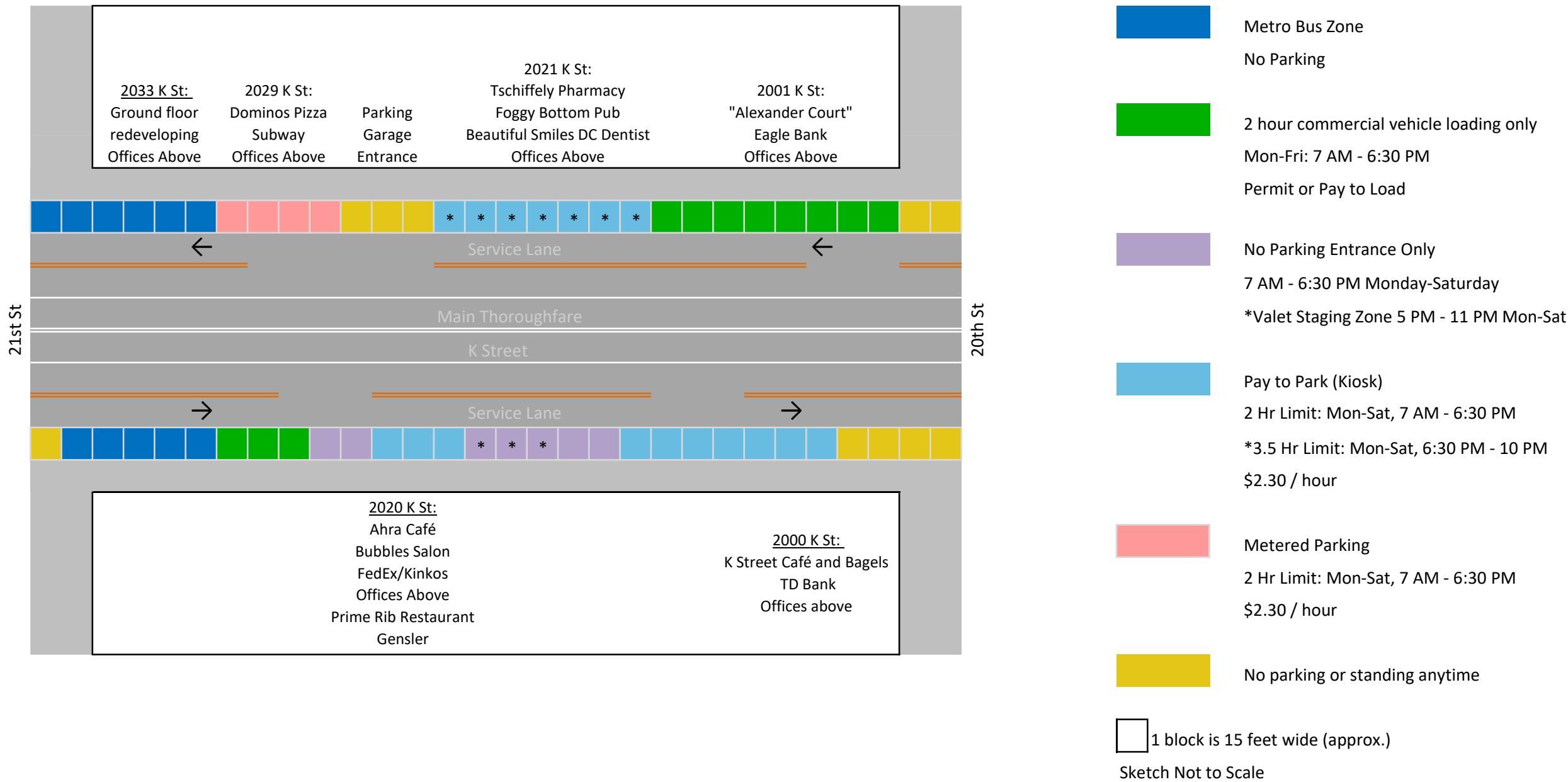


d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 21st Street to 20th Street

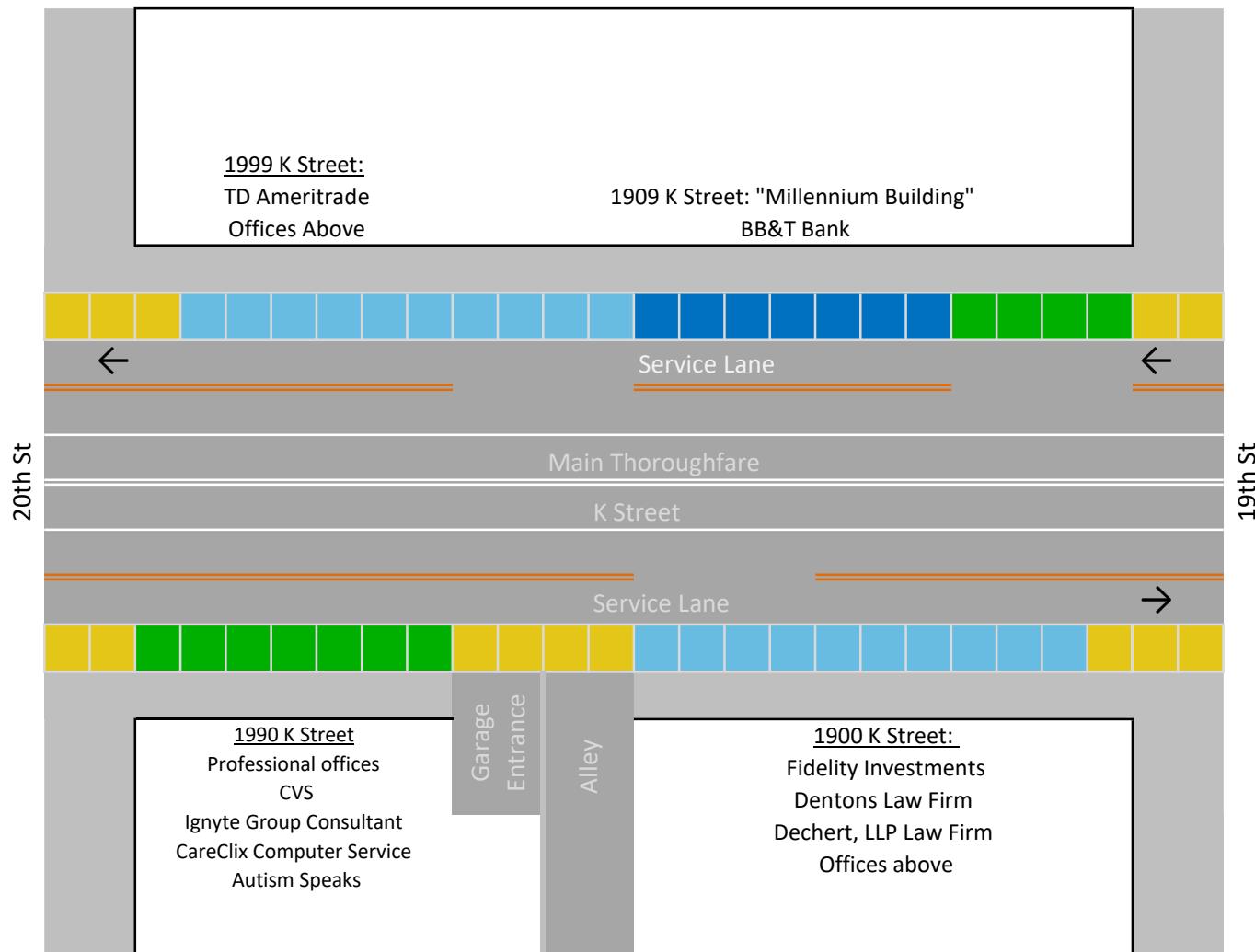


d.

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

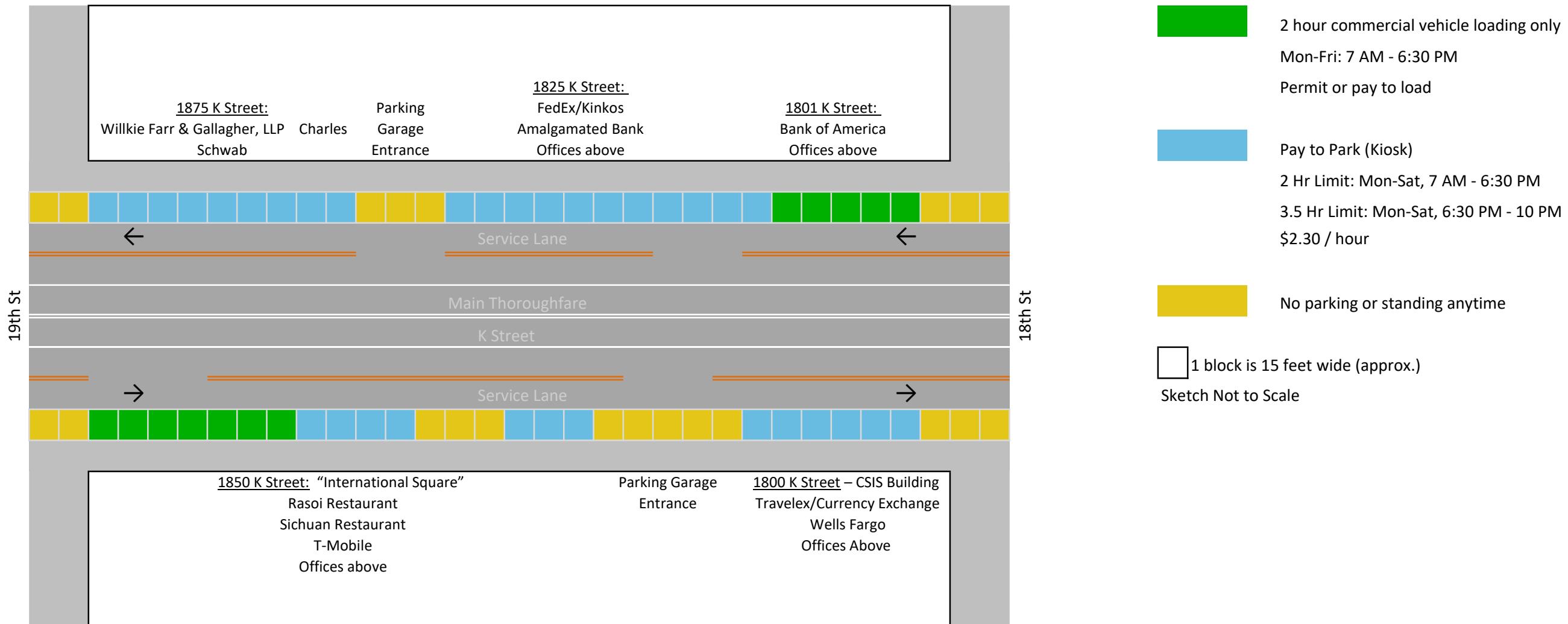
1 block is 15 feet wide (approx.)
Sketch Not to Scale

d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 19th Street to 18th Street

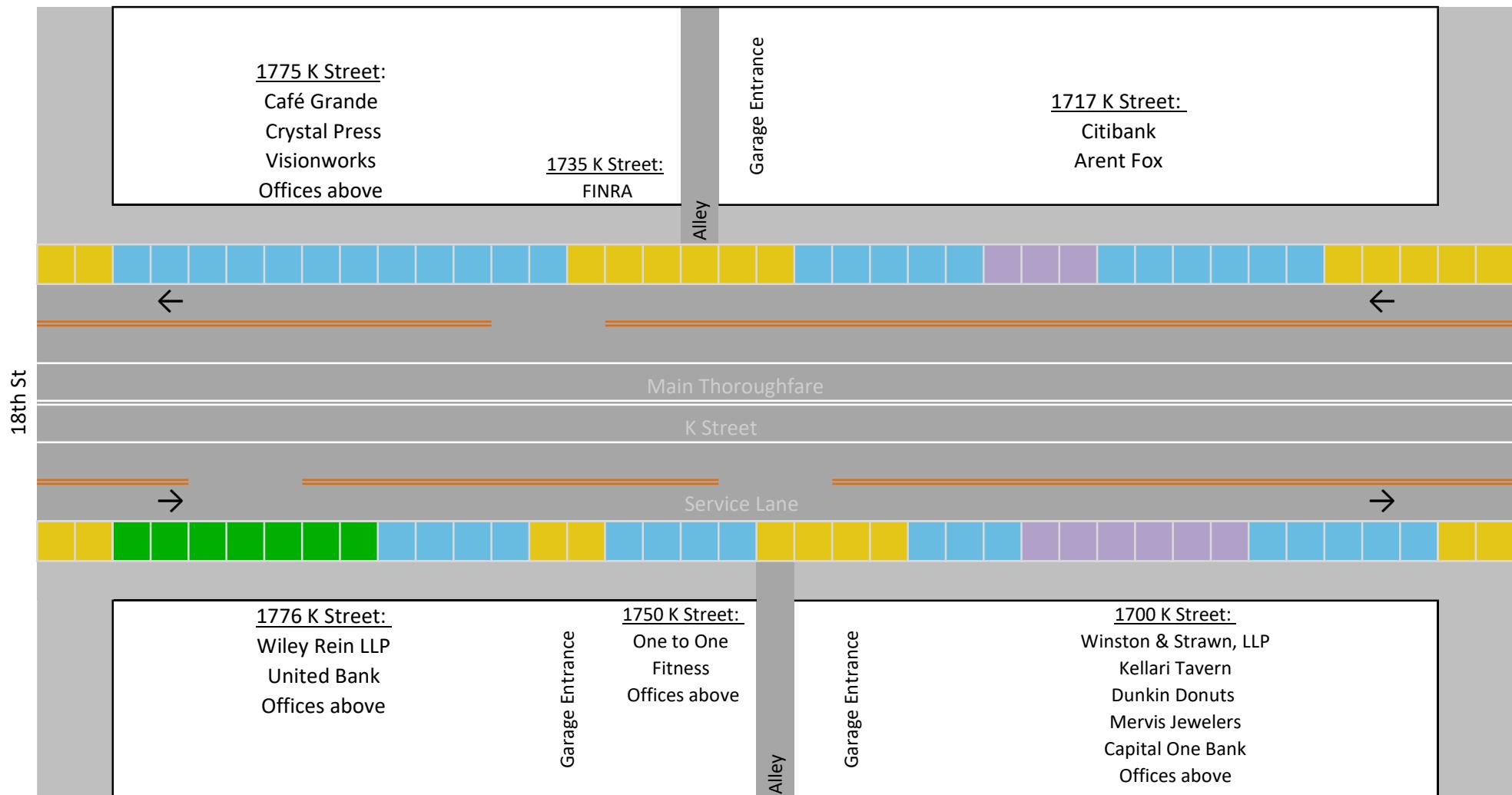


d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 18th Street to Connecticut Ave



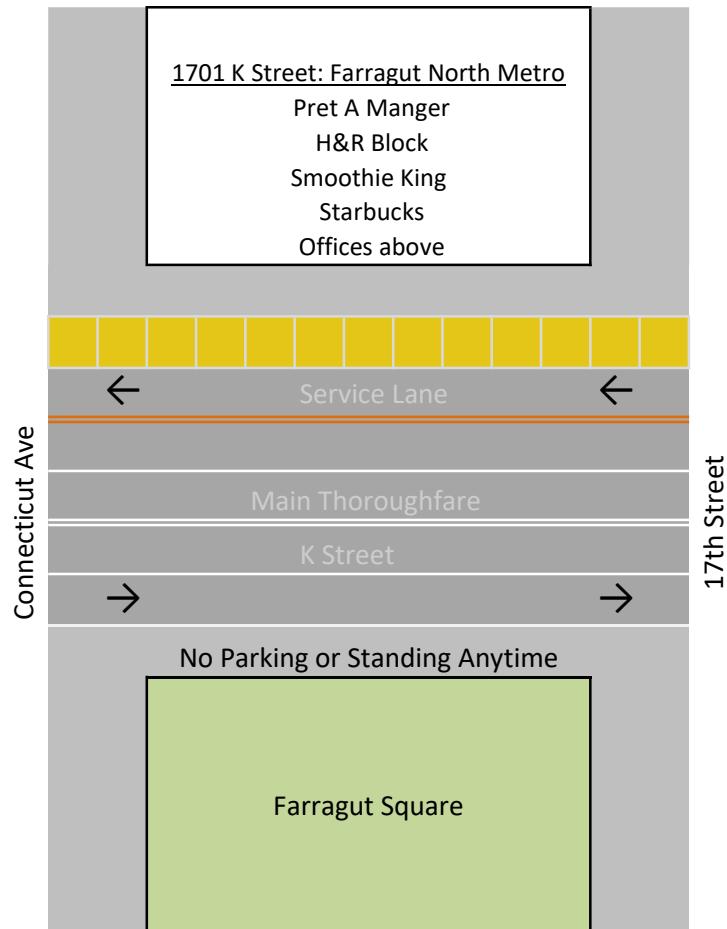
	2 hour commercial vehicle loading only Mon-Fri: 7 AM - 6:30 PM Permit or Pay to Load
	No Parking Entrance Only 7 AM-6:30 PM Monday-Friday
	Pay to Park (Kiosk) 2 Hr Limit: Mon-Sat, 7 AM - 6:30 PM 3.5 Hr Limit: Mon-Sat, 6:30 PM - 10 PM \$2.30 / hour
	No parking or standing anytime
	1 block is 15 feet wide (approx.) Sketch Not to Scale

d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: Connecticut Ave to 17th Street

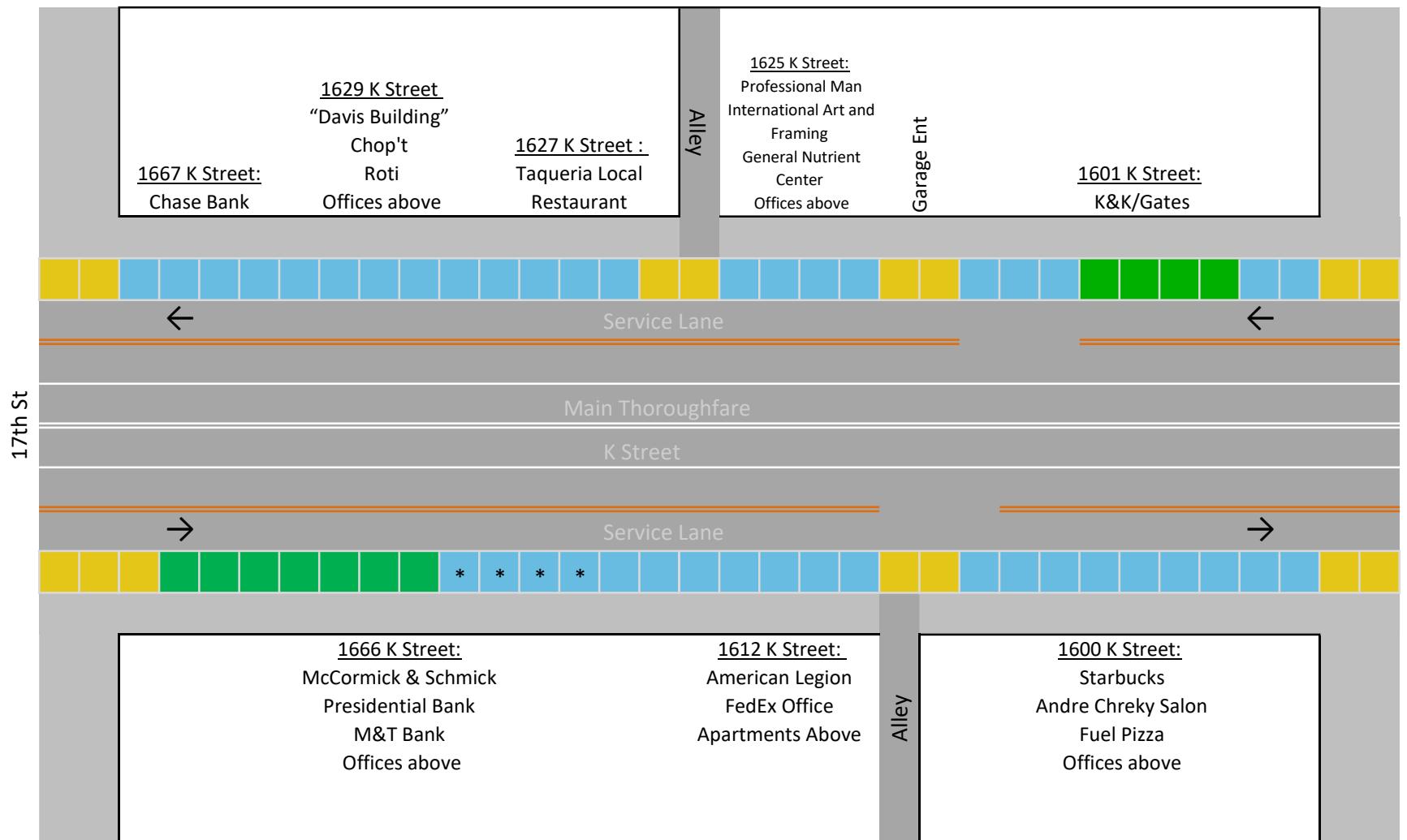


d.

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.)

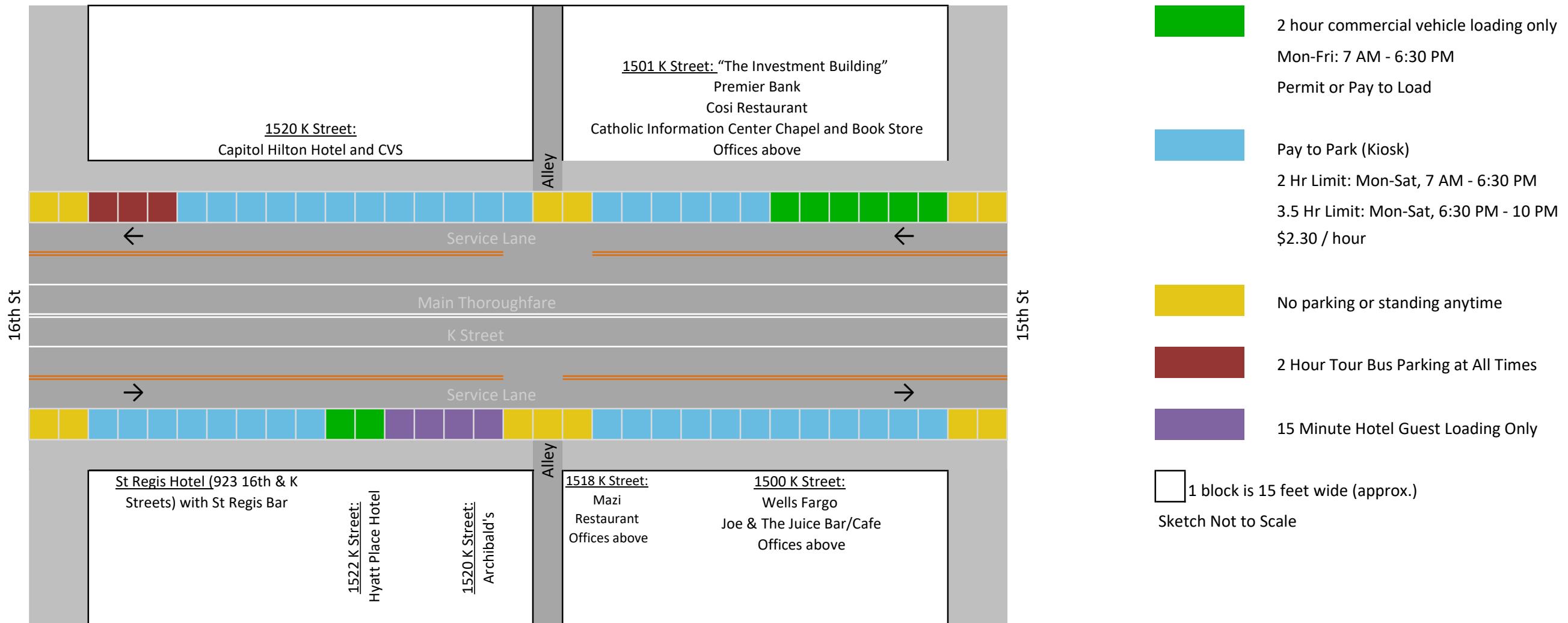
Sketch Not to Scale

d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 16th Street to 15th Street

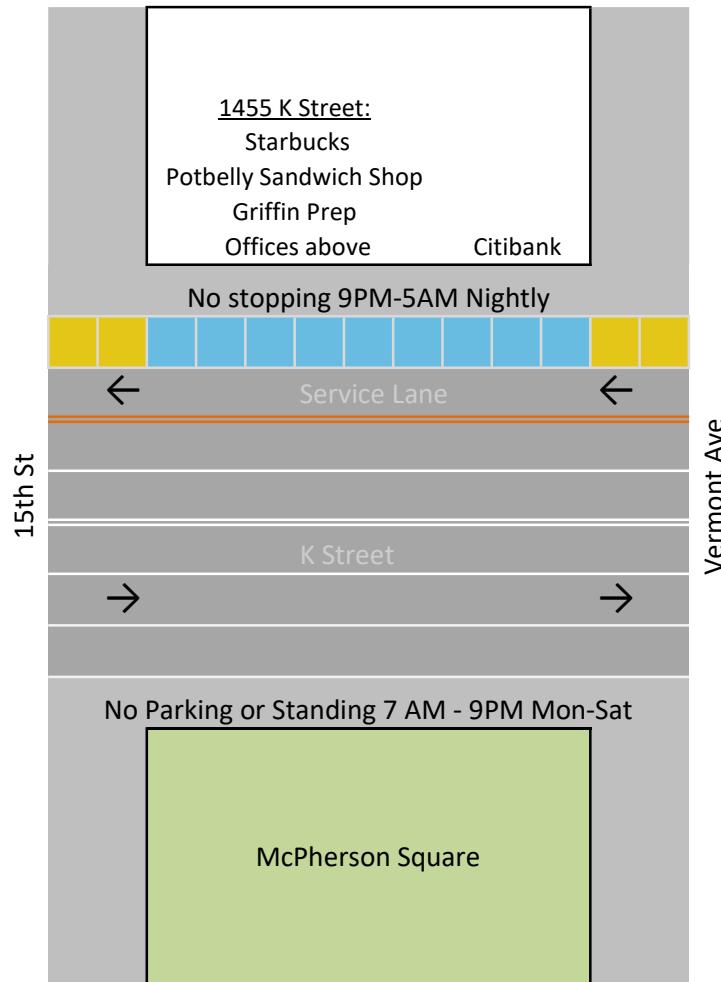


d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 15th Street to Vermont Ave



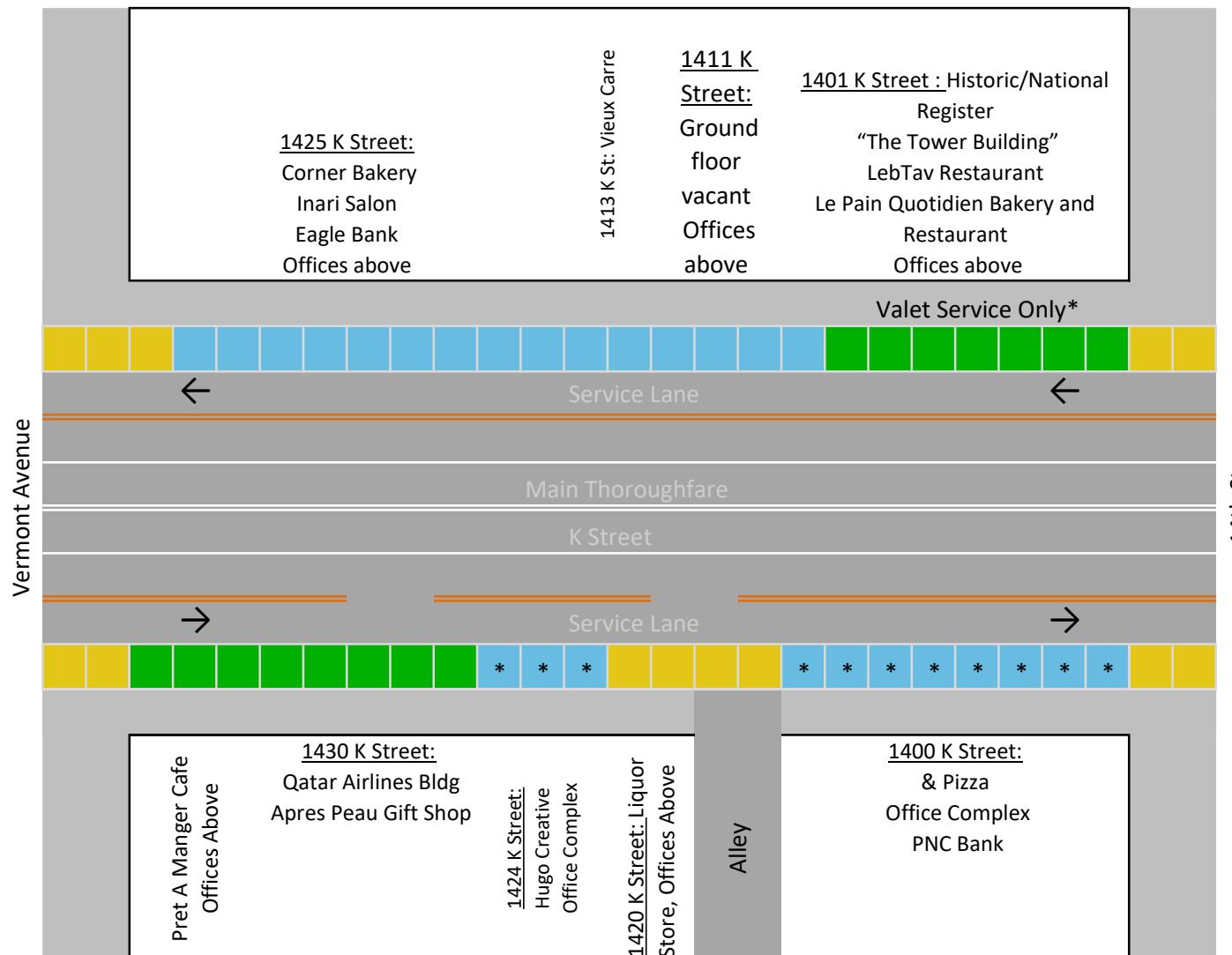
- Pay to Park (Kiosk)
Mon-Sat: 7 AM -10 PM
\$2.30 / hour
- No parking or standing anytime
- 1 block is 15 feet wide (approx.)
Sketch Not to Scale

d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 15th Street to 14th Street



2 hour commercial vehicle loading only

Mon-Fri: 7 AM - 6:30 PM

Permit of Pay to Load

* Valet Service Only no parking 6:30 PM - 11:59 AM daily

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.)

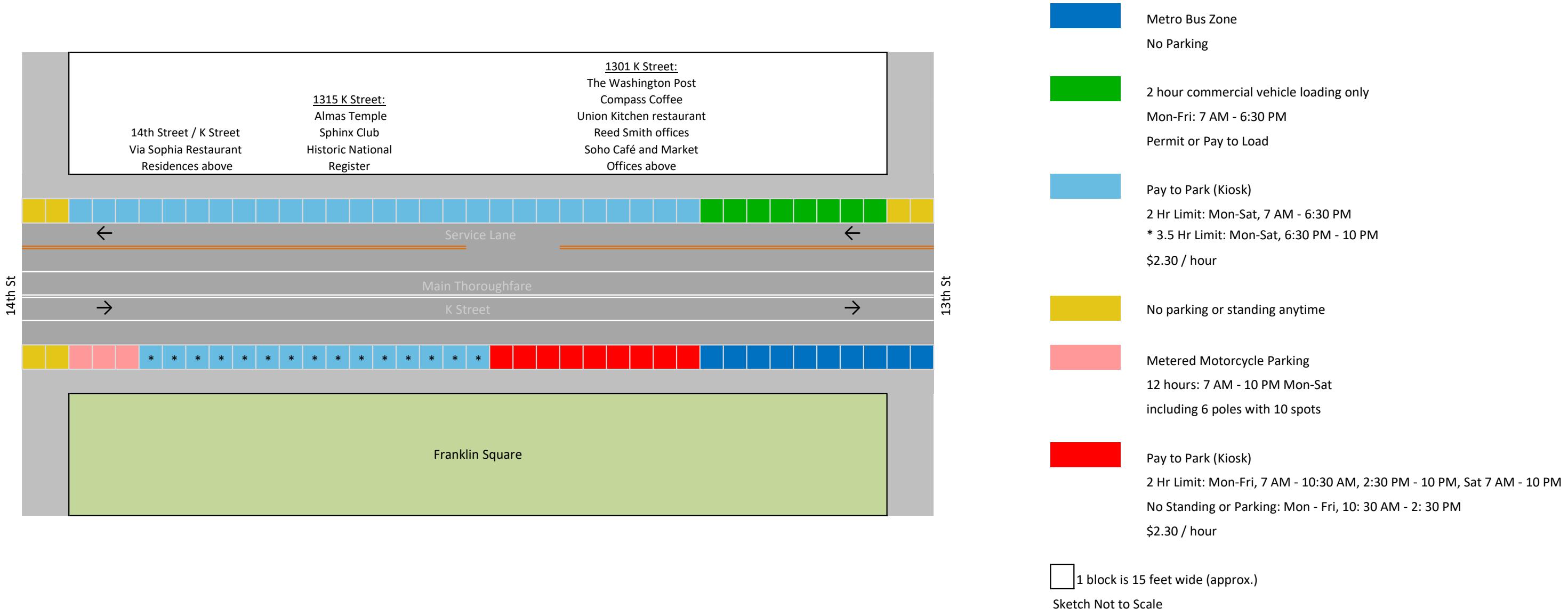
Sketch Not to Scale

d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 14th Street to 13th Street



d.

District Department of Transportation

EXISTING CURBLANE INVENTORY

K Street: 13th Street to 12th Street

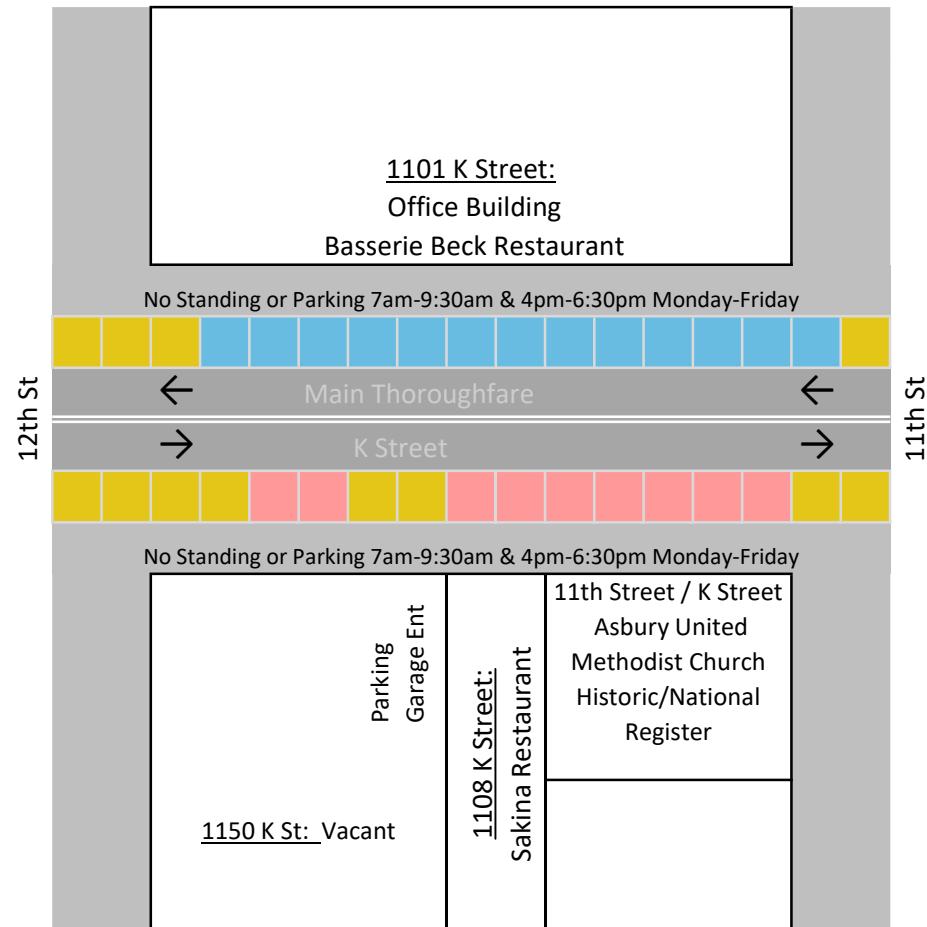


d.

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.)

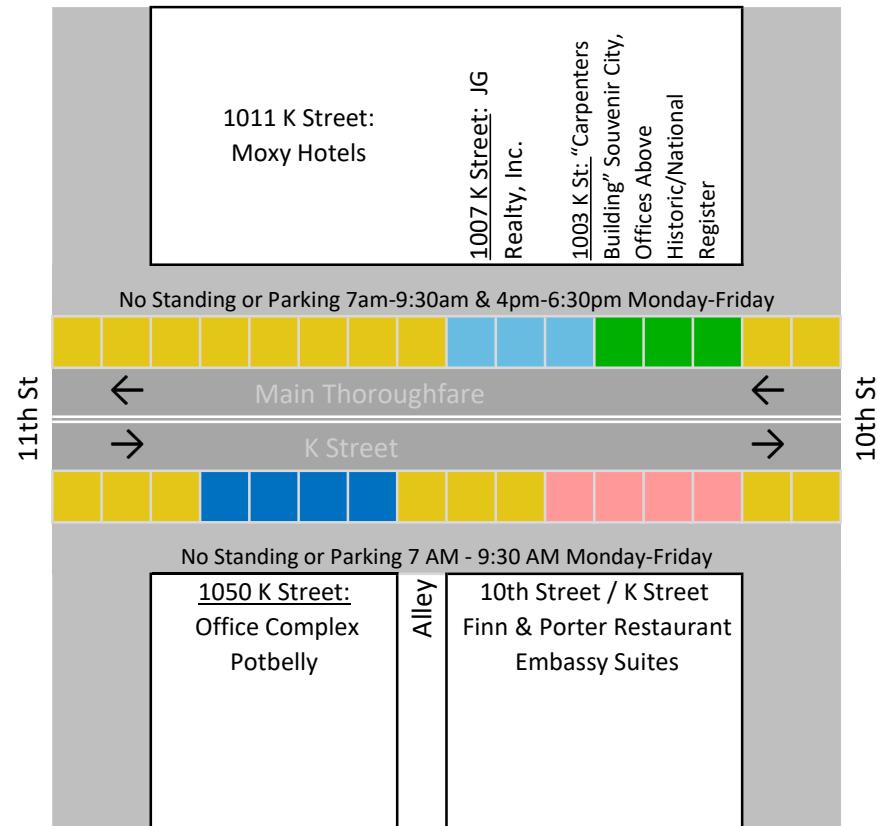
Sketch Not to Scale

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.)

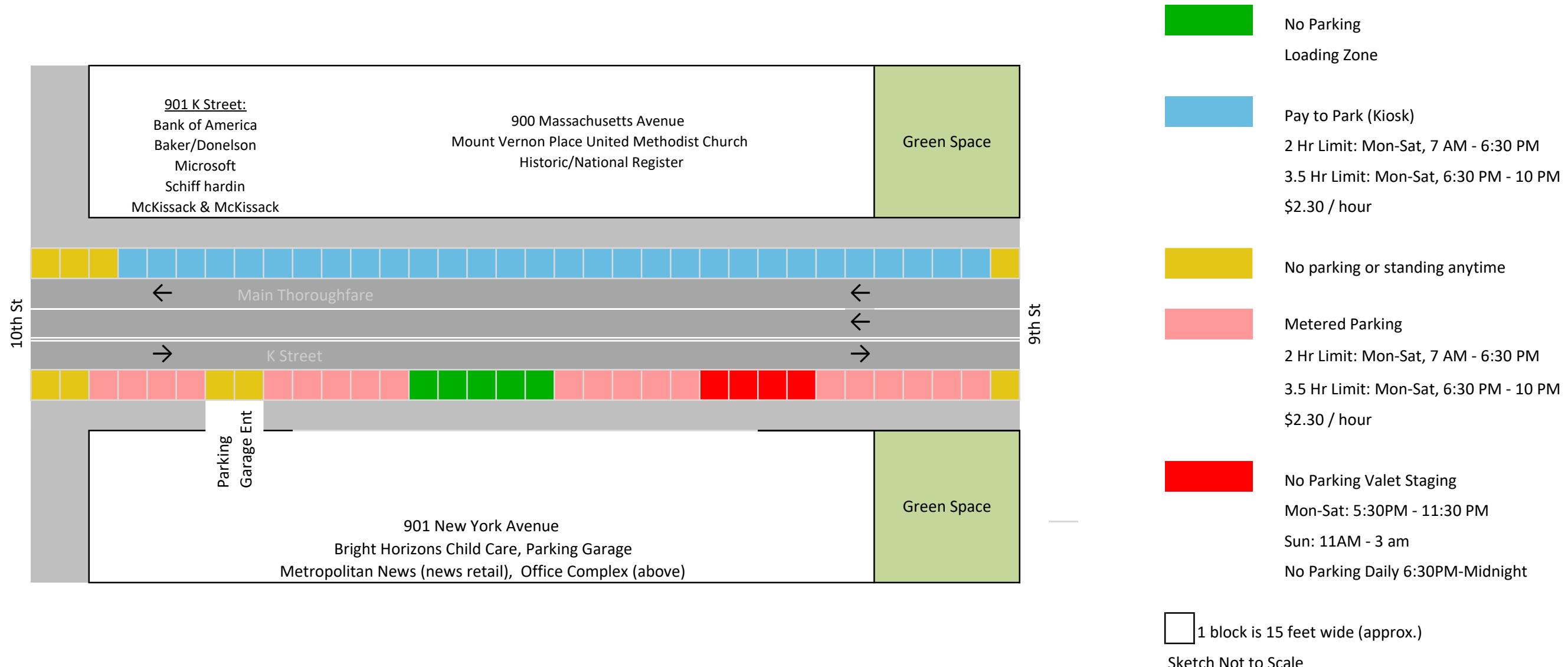
Sketch Not to Scale

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

Attachment B:

Existing Conditions Vissim Calibration Memorandum

Memorandum

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

From: Daniel Markham, P.E.
Britton Hammit, Ph.D., E.I.T.
Tyler Beduhn, P.E.
Jiaxin Tong, P.E.
Carmine Parascandola
Kimley-Horn and Associates, Inc.

Niraja Chandrapu, PE, PTOE
Gorove/Slade

Subject: K Street NW Traffic Analysis
REVISED Existing Conditions Vissim Calibration Memorandum

Date: July 22, 2020

Introduction

This memorandum summarizes the assumptions and results of the 2019 Existing Conditions year Vissim model calibration procedure for the **K Street NW Traffic Analysis** following the agreed-upon methodology as documented in the analysis framework document (dated January 9, 2019). The AM and PM Existing Conditions models have been calibrated to the agreed upon calibration thresholds and to reasonably replicate the observed traffic conditions.

Modeling Assumptions

The following sections summarize the modeling protocols and calibration assumptions prevalent in the K Street NW Existing Conditions models.

Study Area

The model study area is defined by the following elements:

- The extents of the study area are K Street NW, from 22nd Street NW to 9th Street NW.
- Additional intersections one block north and south of K Street NW are modeled at 21st Street NW, 17th Street NW (west)/Connecticut Avenue NW, 16th Street NW, 15th Street NW (west) at L Street NW only, and 14th Street NW.
- In total, the study area includes 25 intersections along K Street NW and the aforementioned side streets.

K Street NW Traffic Analysis: Existing Conditions Vissim Calibration Memorandum

- Pedestrian crosswalks are coded at the intersections, and pedestrian volumes are included as inputs according to collected data.
- All transit stops are included in the model and coded according to available data from WMATA and field observations.
- Bicycle and scooter movements are not included along K Street NW where dedicated bicycle lanes are not present. If calibration cannot be achieved, these movements were to be added into the model at that point (Reference: DDOT meeting 12/09/2019).
 - Calibration was achieved without consideration of these movements. Additional bicycle demand and routes will be discussed as part of the development of 2025 build volumes.
- All dedicated cycle tracks and bike lanes within the study area are coded into the model. These include: the two-way cycle track on the west side of 15th Street NW (west), bi-directional bike lanes on 11th Street NW, and single-direction bike lanes on 12th Street NW (northbound) and 10th Street NW (southbound).

Geometry Coding

- **Lane Width**
 - All basic links are coded with standard 11-foot lanes.
 - Right and left dedicated turning bays that are coded with a width of 10 feet.
- **Basemap**
 - An aerial basemap is used because the Bing imagery available through Vissim was not sufficient for model development.
- **Bicycle lanes**
 - Bicycle lanes are coded with 7.5 foot lanes.
- **Pedestrian Crosswalks**
 - Crosswalks are coded with a width of 7.5 feet per direction to match the approximate 15-foot width of the full crosswalks along K Street NW.
 - Queueing areas were made sufficiently large to allow for adequate pedestrian storage space.
- **Service Lanes**
 - Service lanes are modeled as one lane in each direction (i.e., not considering the second lane used for parallel parking/loading zones).
 - Blocks with heavy parking density (e.g., garage or on-street parking spaces) were identified during volume balancing and were represented as driveways in the Vissim model.
 - Midblock access points to service lanes are modeled as “right-in/right-out”. Although observed in the field, left-turn movements into and out of the service lanes were not coded in the model.

Signal Coding

- **Signal Timing**
 - Signal timing was derived from the DDOT-provided Synchro file and dial sheets.

K Street NW Traffic Analysis: Existing Conditions Vissim Calibration Memorandum

- **Vehicle Signals**

- Signal heads are placed on stop bars or as close as possible.
- Vehicle detectors are not coded because all signals are operating as pre-timed (i.e., on Max Recall).
- Leading left-turn movements combined with permitted left turns are modeled using the “OR” signal group.
- All other overlapping phases (i.e., right turning movements) are modeled using overlaps coded directly into the RBC file.
- Leading pedestrian intervals (LPI) are represented by an overlap associated with the parent signal group. In that overlap, the “delay green” with the maximum split for the LPI (i.e., three seconds) is activated. Parent signal group splits are set to the total split of the vehicle phase plus the LPI, or three seconds greater than the vehicle split coded in Synchro. This would represent the summation of phases 1 and 2 or phases 5 and 6 as shown in the ring and barrier graphic below for mainline K Street NW at 16th Street NW, captures from the Synchro files provided by DDOT.



- **Pedestrian Signals**

- Pedestrian signals are placed outside of the traveled right-of-way to avoid overlap with vehicle movements.
- Pedestrian detectors are not coded because Ped Recall is activated on all study area intersections.
- Rest on walk is coded in RBC timing plan to allow pedestrians maximum walk time until the countdown begins. Pedestrians will not traverse the crosswalk once the countdown starts per default Vissim pedestrian signal settings.

Traffic Operations

- **Conflict Control**

- Pedestrian conflicts are controlled with Priority Rules to clearly define the yield-to-pedestrian zones over the crosswalk and achieve realistic behavior.
- Intersection “Keep Clear” movements are controlled with Priority Rules.
- Protected-Permissive left-turns are controlled with Conflict Areas.
 - In certain cases, these were converted to Priority Rules during calibration to achieve realistic behavior.
- Entry and exit from service lanes on slip ramps are controlled with Priority Rules.

- **Turning Travel Speeds**

- Reduced Speed Areas are coded at all right and left-turning movements.
- Right turns at intersections: linear distribution between 9-13 mph (labeled Right Turn distribution in model).
- Left turns at intersections: linear distribution between 13-17 mph (labeled Left Turn distribution in model).

- **Network Travel Speed**

K Street NW Traffic Analysis: Existing Conditions Vissim Calibration Memorandum

- The K Street NW network has a consistent posted speed limit of 25 mph throughout the corridor. Therefore, the 25mph desired speed distribution is associated with vehicle classes directly and Desired Speed Decision objects are not used to assign regular posted speed.
- The 25-mph speed distribution is a linear distribution between 22-30 mph.
- **External Congestion Coding**
 - External congestion was prevalent during the PM Peak Period and videos from travel time runs show spillback from network termini affected traffic flow.
 - Westbound K Street NW west of 21st Street NW, congestion in the tunnel under Washington Circle.
 - Coded to be 6mph for the full PM analysis period as supported by field data.
 - Congestion at 17th Street NW southbound on both sides of Farragut Square.
 - 17th Street NW (west) congestion was replicated with speed reductions on the southbound and westbound departure of I Street NW and 17th Street NW (west). Speed reductions started at 20mph for the seeding period and decreased to 6mph for the peak period.
 - 17th Street NW (east) congestion was replicated with speed reductions on the southbound departure of K Street NW and 17th Street NW (east). Speed reductions started at 20mph for the seeding period and decreased to 6mph for the peak period.
 - Congestion at 15th Street NW southbound.
 - 15th Street NW congestion was replicated with speed reductions on the southbound departure of K Street NW and 15th Street NW (west). Speed reductions started at 20mph for the seeding period and decreased to 6mph for the peak period.
 - Congestion at 14th Street NW southbound.
 - 14th Street NW congestion was replicated with speed reductions on the southbound and westbound departure of I Street NW and 14th Street NW. Speed reductions started at 20mph for the seeding period and decreased to 7mph for the peak period.
 - These terminal conditions were represented with time-dependent Desired Speed Decision objects in the Vissim models.

Vehicle 2D & 3D Models

- **Vehicle Displays**
 - All passenger cars are displayed in a scale of red colors not associated with specific vehicle types.
 - All heavy vehicles are displayed in a brown color.
 - All buses are displayed in a blue/green color based on their operator.
 - WMATA Metrobuses are **Navy Blue**
 - Circulator Buses are **Light Blue**

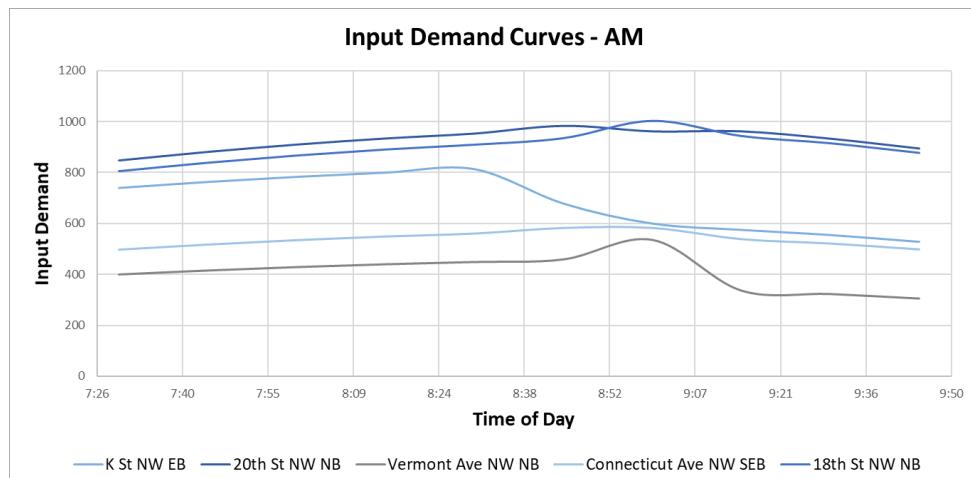
K Street NW Traffic Analysis: Existing Conditions Vissim Calibration Memorandum

- MTA Buses are **Dark Teal**
 - MCI Loudoun Buses are **Light Teal**
- While the simulation is running:
 - A bus that is **black**, is delayed.
 - A bus that is **white**, is loading/unloading.
- **Vehicle Compositions**
 - The collected ATR count data from the 1400 Block of K Street NW were used as the primary source for identifying the proportion of different vehicle types.
 - The AM and PM vehicle percentages were assumed to be consistent and the two days of data collection were aggregated together.
 - Vehicle Compositions:
 - **Cars = 95%**
 - A selection of smaller vehicle 2D/3D models were added to better represent the passenger car vehicle fleet (i.e., vehicle lengths) along K Street NW.
 - The extra *.vd3 design files are included in the model folder.
 - **HGV = 5%, including light trucks**
 - HGV, 22-ft = 71%
 - HGV, 34-ft = 15%
 - HGV, 46-ft = 14%

Inputs and Routing

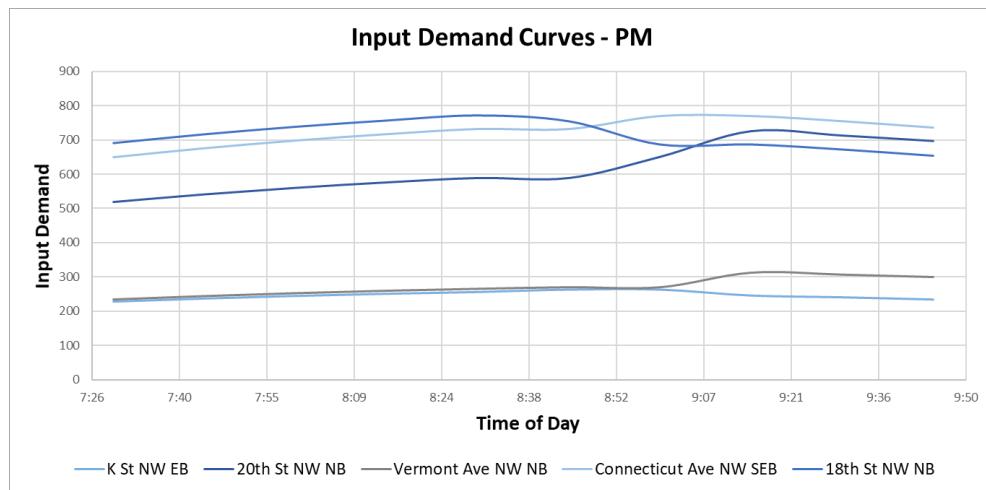
- Vehicle inputs are assigned to the model in 15-minute increments. The relative flow of vehicles during these time periods are based on available TMC data.
- In locations where TMC data were not available for the full analysis period, the proportional demand of a neighboring intersection was used.
 - The traffic flows outside of the peak hour were normalized to better represent demand build-up towards and dissipation after the peak hour.
- The following figures illustrate demand curves from a sample of network input locations.

Figure 1 AM Demand Curves



K Street NW Traffic Analysis: Existing Conditions Vissim Calibration Memorandum

Figure 2 PM Demand Curves



- Inputs and routes were developed from the approved Existing Conditions balanced volumes submitted on February 5, 2020.
- Network routing was developed using a relay-routing system between each decision point (i.e., intersection and service road slip lane).

Public Transportation

- Transit routes were coded using current transit route maps and schedules. Entry time into the network and average headway between buses on each route were coded based on the scheduled stop times at the nearest upstream bus stop to the entry link.
- Dummy links—coded with a transparent fill and red outline—connect side streets along I Street NW and L Street NW in order to connect consecutive transit routes. These links are only used by buses to maintain uniform routes.
- Bus dwell times were derived from data collected in the field and provided by WMATA.
 - WMATA and Circulator buses follow the same empirical distribution derived from WMATA dwell time data.
 - Separate distributions were created for each peak period (i.e., AM, PM) and travel direction (i.e., eastbound, westbound, and north/southbound).
 - Dwell times less than five seconds were removed from consideration to calculate more reasonable average dwell times.
 - Unique distributions were created for stops that showed a higher dwell time average and standard deviation.
 - AM, eastbound K Street NW and Connecticut Avenue
 - AM, eastbound K Street NW and 20th Street NW
 - AM, westbound K Street NW and Connecticut Avenue
 - **Attachment C** contains the WMATA average and standard deviation of dwell times.
 - Loudon County and MTA buses follow a different empirical distribution derived from field observations.
- Bus vehicle 2D/3D models were represented with two vehicle models:

K Street NW Traffic Analysis: Existing Conditions Vissim Calibration Memorandum

- MTA/MCI Loudon County, bus length = 45ft.
- WMATA/Circulator, bus length = 41ft.
- Bus vehicles were modeled with a more conservative acceleration and deceleration profile to match their vehicle size.
- Right-Turn-On-Red (RTOR) was restricted for buses. This is coded using a signal head on the right-turn connector that is only active for Bus vehicle types.
- Based on field-observed behavior, buses were restricted to the right lane to prevent unrealistic overtaking and lane changing.
 - Lanes coded in the model with a **blue** color indicate bus lane restrictions. Blocks where buses are required to complete a left-turn are not restricted.

Pedestrian and Bicycle Inputs

- Pedestrian and Bicycle inputs were developed from field data collected at intersections.
- Pedestrian and Bicycles are only modeled in their dedicated facilities: crosswalks and bicycle lanes. Bicycles are not modeled in vehicle lanes.

Calibration Adjustments

- **Driving Behavior**
 - The Wiedemann 1974 Car-Following model was used on all links, saved in the driving behavior container: "Basic Freeway Segments".
 - The driving behavior parameters were adjusted based on the lead vehicle type; specifically, to alter driving behavior when following a bus versus a passenger car or heavy vehicle.
 - When the lead vehicle is a car, the Wiedemann 1974 parameters were kept at default: AX = 6.56ft, BX Add = 2, BX Mult = 3.
 - When the lead vehicle is a bus, the Wiedemann 1974 parameters were altered to be: AX = 8.00ft, BX Add = 2.2, BX Mult = 3.2.
 - All links in the model use this driving behavior container unless otherwise described below.
 - Driving behavior differences between different vehicles were accounted for with the acceleration and deceleration parameters associated with each vehicle 2D/3D model.
 - An additional driving behavior container: "Oversaturated Arterial Segments" was defined and used in the AM model for two eastbound segments with a significant amount of lane changing.
 - Wiedemann 1974 parameters were adjusted to: AX = 7ft, BX Add = 2, BX Mult = 3.
 - Cooperative Lane Change was activated with a maximum speed difference of 8 mph and maximum collision time of 10 seconds.
 - The minimum headway required for lane changing was reduced to 1.2 feet.
 - Links with this behavior are represented in the model with a **purple** color.
- **Priority Rules**

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- This model is very sensitive to changes in parameter values for priority rules, especially those involving pedestrians. Thus, iterative adjustments were made to the influence area of pedestrian conflict areas to more realistically match field conditions.
 - For example, the eastbound right-turn movement from K Street NW to 15th Street NW (west) was a very sensitive location due to the heavy volume of pedestrians traveling in this area.
 - Bus behavior around pedestrians was also shown to be highly sensitive to pedestrian movements. Due to the reduced acceleration and deceleration parameters for bus vehicle types, buses are even more susceptible to varying delays. This behavior is especially prevalent at 17th Street NW, 15th Street NW, and Connecticut Avenue.
- Priority Rules were used to model “Keep Clear” through intersections on a case-by-case basis based on queueing.
- In a few locations, priority rules were used in place of conflict areas to control left-turn gap acceptance (e.g., eastbound left turn at 15th Street NW (west) in the AM).
- **Combine Routes**
 - In locations where routes were too close to a decision and vehicles were unable to make realistic movements to follow their designated routes, the Vissim “combine routes” feature was used (e.g., routes were combined in the eastbound direction on K Street NW between Connecticut Avenue NW and 17th Street NW (east)).
- **Bus Stop Lengths and Dwell Time**
 - Field observations indicated buses will often allow boarding and alighting in bunches; therefore, bus stop lengths were extended in specific locations to account for this behavior.
 - Example locations where this behavior is exhibited in the model includes:
 - Eastbound between 18th Street NW and Connecticut Avenue NW.
 - Eastbound between 16th Street NW and 15th Street NW (west)
 - Eastbound and westbound between Vermont Avenue NW and 14th Street NW.
 - Westbound between 14th Street NW and 13th Street NW.
 - Similarly, bus dwell times were adjusted from the default distributions for each operator based on stop location. At locations with evidence of significant bus activity, the dwell time distribution was adjusted according to the WMATA dwell time data. Evidence of these differences in dwell time are provided in **Attachment C**.
- **Demand Profile before and after the Peak Hour**
 - Since traffic counts were not collected during the full simulation period for all intersections, and because throughput is not always indicative of true demand, demand curves were normalized with congestion buildup and dissipation based on the balanced peak hour volumes in the AM and PM models.

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- Iterative adjustments to the demand rate in the build-up and dissipation periods were tested in both peak period models.
- **Parking Lots**
 - In both AM and PM field observations, cars were observed to be parallel parked on K Street NW between 10th Street NW and 11th Street NW.
 - Parallel parking vehicles were modeled to represent the reduction in capacity through that block. The assumption was made that the parked vehicles would remain consistent throughout the study period.
 - These vehicles appear in the simulation model in a **white** color. The “Parking Lot” attribute can be activated to identify the parking spots.

Model Results

The complete set of model results are provided in **Attachment A: AM Existing Conditions Calibration Results** and **Attachment B: PM Existing Conditions Calibration Results**. The calibration summary tables are provided below in **Table 1** and **Table 2** for AM and PM, respectfully. As shown, each model is meeting the calibration thresholds agreed upon in the Framework document.

The models were calibrated to individual link-level throughput, based on approach volumes at each intersection. As shown in **Table 1** and **Table 2**, most links fell within the specified volume criteria and met the required GEH statistic. This validates that the model is processing a sufficiently similar amount of throughput at every intersection as demonstrated in the field.

Next, the models were calibrated to overall network throughput focused on the K Street NW corridor. This statistic validates that on a corridor-level a sufficiently similar number of vehicles are traversing the study area intersections. As shown in **Table 1** and **Table 2**, the percent difference in throughput and GEH statistic meet required thresholds.

Field travel time runs were conducted for the full extent of the K Street NW corridor (i.e. east of 10th Street NW to west of 21st Street NW). In each peak period, 12 to 13 runs were completed, and these runs were averaged for model calibration¹. Therefore, simulated travel times were calibrated by assigning travel time segments to match these field travel runs in the Vissim model (i.e., end-to-end travel times of the K Street NW corridor), creating an apples-to-apples comparison for model calibration. The Vissim-reported end-to-end travel times are averaged from a sample of 100 to 200 vehicles. This sample is sufficient for comparing against the measured field conditions.

While segment-by-segment average travel times were not collected in the field, they were computed in Vissim (please reference page 12 of **Attachment A** and **Attachment B**). These segment-by-segment travel times can be used to compare with future build scenarios. However, these travel times do not include delays incurred by vehicles on the service lanes, which will be a consideration for future build scenarios.

Finally, bottleneck locations and queue impacts were confirmed to be adequately calibrated from a numeric comparison of intersection queue lengths on the K Street NW mainline and qualitative observations of model performance. The queue data collected in the field were not comprehensive. As determined in the Data Collection Plan, field observers walked the K Street NW corridor and captured spot queue lengths for three cycles before proceeding to the next intersection. Therefore, these queues are estimates and the maximum queue lengths during the peak hour may not be captured².

The quantitative comparison between observed maximum queue and Vissim-reported average and maximum queue are provided on page 18 of **Attachment A** and **Attachment B**. A variety of statistics are shown to compare the queue lengths. At a corridor-level, the queues captured in

¹ Please reference the **K Street NW Data Collection Memorandum** for information on travel time data collection.

² Please reference the **K Street NW Data Collection Memorandum** for information on queue data collection.

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the model reflect the queue observations reported in the **K Street NW Data Collection Memorandum**.

Along this corridor, bottleneck locations can be defined as locations with frequent bus bunching, a large proportion of vehicle turning movements, or heavy pedestrian activity. The following list describes key field observed characteristics of the network that are captured in the calibrated Vissim models in the AM and PM peak periods.

- **Eastbound K Street NW between Connecticut Avenue NW and 17th Street NW (east) in AM and PM.** The pedestrian volumes at the intersection of 17th Street NW (east) caused significant impact to queuing for the eastbound right-turn movement, which is a shared movement with the through travel lane. This delay was exacerbated by bus turning movements, which were more conservative than vehicles due to their size and different acceleration capabilities.
- **Westbound K Street NW between Connecticut Avenue NW and 17th Street NW (east) in AM and PM.** The large number of buses and observed boarding activity due to the proximity to the Farragut North Metrorail station resulted in noticeable congestion and bus bunching. The queueing from this short block was observed to spill back to upstream blocks.
- **Eastbound K Street NW between 16th Street NW and 15th Street NW (west) in AM.** The eastbound left-turning movement at 15th Street NW (west) causes significant congestion. The model showed sensitivity to driver aggressiveness making this left turning movement. This block is worsened by the two bus stops that incur frequent bus bunching activities. This congestion is shown to cause queue spillback in the upstream blocks.
- **Westbound K Street NW between 15th Street NW (west) and Vermont Avenue in PM.** The short block between 15th Street NW (west) and Vermont Avenue NW, paired with the heavy westbound left-turn volume at 15th Street NW (west) results in queues that spill back to upstream intersections.
- **Bottlenecks and congestion outside of the study area in the PM peak** played a large role in model calibration. Significant delays in the tunnel beneath Washington Circle were the result of speed reductions observed during data collection on K Street NW in the westbound direction. Travel time run data recorded travel speeds in this segment to be between 4 and 7 mph through most of the peak period. In addition, review of travel time runs (i.e., dash camera video) and queue data from the PM peak period show numerous bottlenecks and spillback queues from side streets (e.g., Connecticut Avenue NW, 17th Street NW (west and east), 15th Street NW (west), and 14th Street NW). The model adequately represents these external bottlenecks, and these conditions will be transferrable to future build models.

The number of required random seeds were determined from the VDOT Sample Size Tool, which uses FHWA Traffic Analysis Toolbox guidance to assess the variability of model runs to determine the number of samples needed to achieve statistically representative average model results. As shown on page 17 of **Attachment A** and **Attachment B**, 10 random seeds (i.e., the minimum required number of random seeds) were deemed appropriate for reporting results. Further checks for network-wide gridlock were performed for all 10 seeds.

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Table 1 AM Existing Conditions Calibration Summary

Calibration Item	Basis	Criteria	Value	Target	Criteria Met
Simulated Vehicular Throughput (Individual Links)	All Segments and Approaches	Within \pm 100 vph for < 700 vph	100%	85%	Yes
		Within \pm 15% for \geq 700 vph to < 2,700 vph			
		Within \pm 400 vph for \geq 2,700 vph			
	GEH < 5 for individual link flows	100%	85%	85%	Yes
Simulated Vehicular Throughput (Network Wide)	Total Volume throughout Network on K Street Corridor	GEH < 4 for total network volume	2.5	4.0	Yes
		Within 5% of total network volume	1.3%	5%	Yes
Simulated Travel Time	Travel Time Segments (n=2)	Within \pm 15% for observed travel times on K Street NW	100%	85%	Yes
Bottleneck and Queue Impact Verification	Targeted Critical Locations	Maximum observed queue lengths will be compared with simulated queue lengths at critical intersection approaches. Since full peak period observations of queues were not collected, this comparison will be qualitative.	Qualitative observations of field conditions and simulated conditions are consistent.		Yes
Required Sample Size			10		

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Table 2 PM Existing Conditions Calibration Summary

Calibration Item	Basis	Criteria	Value	Target	Criteria Met
Simulated Vehicular Throughput (Individual Links)	All Segments and Approaches	Within \pm 100 vph for < 700 vph	100%	85%	Yes
		Within \pm 15% for \geq 700 vph to < 2,700 vph			
		Within \pm 400 vph for \geq 2,700 vph			
		GEH < 5 for individual link flows	100%	85%	Yes
Simulated Vehicular Throughput (Network Wide)	Total Volume throughout Network on K Street Corridor	GEH < 4 for total network volume	2.6	4.0	Yes
		Within 5% of total network volume	-1.4%	5%	Yes
Simulated Travel Time	Travel Time Segments (n=2)	Within \pm 15% for observed travel times on K Street NW	100%	85%	Yes
Bottleneck and Queue Impact Verification	Targeted Critical Locations	Maximum observed queue lengths will be compared with simulated queue lengths at critical intersection approaches. Since full peak period observations of queues were not collected, this comparison will be qualitative.	Qualitative observations of field conditions and simulated conditions are consistent.		Yes
Required Sample Size			10		

2025 Future Build Models

Upon DDOT approval of the Existing Conditions models, the 2025 model development will begin. As agreed upon in the Scope of Work, the existing condition model results will be used as the No-Build model for comparison. This is a reasonable assumption based on the decision to maintain Existing Conditions volumes with re-routing for the 2025 Build scenarios (decision at bi-weekly meeting, March 3, 2020). The calibrated demand curve used to assign proportional volumes throughout the simulation period in the existing AM and PM models will be used to assign volumes in future conditions.

The development of these models will be consistent with the calibrated behaviors and parameters from existing conditions. Modifications will be made as needed to alter the network for the design alternatives. Engineering judgement will be used, and justifications will be given for such changes.

In consideration of future conditions model development, it is important to note that queuing was observed on service lanes to make right turning movements. In the absence of these service lanes in future build scenarios, these queues will be propagated to the mainline traffic stream. However, bottlenecks caused by bus traffic and left-turns will be removed; therefore, it is difficult to predict the magnitude of the impact before testing. In addition, as the demand of bicyclists increases in future years, the delay incurred by conflicting vehicle movements is estimated to increase. This is supported by the sensitivity exhibited by the model to pedestrian and bicycle demand in existing conditions.

Attachment A: AM Existing Conditions Calibration Results

AM Existing Conditions Model Calibration Summary

AM Peak Hour: 8:30AM-9:30AM

AM Peak Period: 8:00AM-10:00AM

Calibration Item	Basis	Criteria	Value	Target	Criteria Met
Simulated Vehicular Throughput (Individual Links)	All Segments and Approaches	Within \pm 100 vph for < 700 vph			Yes
		Within \pm 15% for \geq 700 vph to < 2,700 vph			
		Within \pm 400 vph for \geq 2,700 vph			
		GEH < 5 for individual link flows	100%	85%	Yes
Simulated Vehicular Throughput (Network Wide)	Total Volume throughout Network on K Street Corridor	GEH < 4 for total network volume	2.5	4.0	Yes
		Within 5% of total network volume	1.3%	5%	Yes
Simulated Travel Time	Travel Time Segments (n=2)	Within \pm 15% for observed travel times on K Street NW	100%	85%	Yes
Bottleneck and Queue Impact Verification	Targeted Critical Locations	Maximum observed queue lengths will be compared with simulated queue lengths at critical intersection approaches. Since full peak period observations of queues were not collected, this comparison will be qualitative.			Yes
Required Sample Size			10		

*Findings Represent Results from 10 Simulation Runs

Intersection Volume Calibration

AM Peak Hour: 8:30AM-9:30AM

85% of All Intersection Approaches within the following Volume Criteria		Number of Approaches		Passing Approaches		Percent	Target	Target Met
Within \pm 100 vph for < 700 vph	76	103	76	103	100%	85%	Yes	Yes
Within \pm 15% for \geq 700 vph to < 2,700 vph	27		27					
Within \pm 400 vph for \geq 2,700 vph	0		0					

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)	
1	K Street NW and 22nd Street NW	NB	LT - SL	3	274	3	-6	0%
			TH	205		197		-4%
			RT - SL	66		68		3%
		EB	TH	666	666	0	5	0%
			WB	527		523		-1%
		EB Service Lane	LT	49	350	50	1	2%
			TH	301		305		1%
		WB Service Lane	UT	67	312	68	9	1%
			TH	101		110		9%
			RT	144		143		-1%
		Intersection		2,129	2,133		4	0%
2	K Street NW and 21st Street NW	SB	LT - SL	21	594	21	11	0%
			LT	41		52		27%
			TH	357		359		1%
			RT	72		72		0%
			RT - SL	103		101		-2%
		EB	TH	621	666	625	3	1%
			TH - SL	39		38		-3%
			RT	6		6		0%
		WB	LT	27	506	31	1	15%
			TH	451		448		-1%
			TH - SL	28		28		0%
		EB Service Lane	TH - ML	22	310	22	4	0%
			TH	154		158		3%
			RT	134		134		0%
		WB Service Lane	TH - ML	4	108	4	13	0%
			TH	104		117		13%
		Intersection		2,184	2,216		32	1%
3	K Street NW and 20th Street NW	NB	LT - SL	22	964	22	18	0%
			LT	58		57		-2%
			TH	792		807		2%
			RT	41		46		12%
			RT - SL	51		50		-2%
		EB	LT	14	761	13	19	-7%
			TH	733		753		3%
			TH - SL	14		14		0%
		WB	TH	445	457	459	13	3%
			TH - SL	2		2		0%
			RT	10		9		-10%
		EB Service Lane	TH - ML	7	122	7	-1	0%
			TH	115		114		-1%
		WB Service Lane	TH - ML	2	203	3	16	50%
			TH	36		37		3%
			RT	165		179		8%
		Intersection		2,507	2,572		65	3%

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)	
4	K Street NW and 19th Street NW	SB	LT - SL	15	522	14	-1	-7%
			LT	42		45		
			TH	383		390		
			RT	26		26		
			RT - SL	56		54		
		EB	TH	730	745	755	25	3%
			TH - SL	7		7		
			RT	8		8		
		WB	LT	32	543	49	17	53%
			TH	505		524		
			TH - SL	6		14		
		EB Service Lane	TH - ML	6	220	5	-1	-17%
			TH	45		41		
			RT	169		165		
		WB Service Lane	TH	60	60	61	1	2%
		Intersection		2,090	2,158		68	3%
5	K Street NW and 18th Street NW	NB	LT - SL	9	947	9	0	0%
			LT	57		60		
			TH	788		807		
			RT	47		66		
			RT - SL	46		48		
		EB	LT	5	667	4	-1	-20%
			TH	652		669		
			TH - SL	10		10		
		WB	TH	615	622	660	45	3%
			TH - SL	6		5		
			RT	1		2		
		EB Service Lane	TH - ML	3	43	3	0	0%
			TH	40		42		
			TH	29		28		
		WB Service Lane	RT	138	167	133	-5	-4%
		Intersection		2,446	2,546		100	4%
6	K Street NW and Connecticut Avenue	NB	TH	710	764	739	29	4%
			RT	54		63		
			LT - SL	6		11		
		SB	TH	478	628	489	5	83%
			RT	34		30		
			RT - SL	110		114		
		EB	LT	1	608	1	0	0%
			TH	604		633		
			TH - SL	3		3		
		WB	LT	1	817	2	1	100%
			TH	737		781		
			TH - SL	76		77		
		EB Service Lane	RT	3		4	1	6%
			TH - ML	3	94	3		
			RT	91		91		
		WB Service Lane	RT	132	132	143	11	8%
		Intersection		3,043	3,184		141	5%

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)	
7	K Street NW and 17th Street NW (east)	NB	LT - SL	3	59	2	-1	-33%
			LT	4		4		
			TH	38		39		
			RT	7		6		
			RT - SL	7		7		
		SB	LT - SL	5	337	5	1	0%
			LT	37		37		
			TH	181		182		
			RT	73		68		
			RT - SL	41		46		
		EB	LT	2	667	1	-5	-7%
			TH	535		559		
			TH - SL	31		29		
			RT	99		111		
			LT	1		1		
		WB	TH	732	758	782	24	12%
			TH - SL	25		27		
			TH - ML	8		8		
		WB Service Lane	TH	63	117	66	-2	-4%
			RT	46		44		
			Intersection	1,938		2,024	86	4%
8	K Street NW and 16th Street NW	NB	LT - SL	1	335	2	1	100%
			LT	2		2		
			TH	308		309		
			RT	16		15		
			RT - SL	8		9		
		SB	LT	67	649	87	20	30%
			TH	453		472		
			RT	78		87		
			RT - SL	51		52		
		EB	LT	3	505	4	1	33%
			TH	495		511		
			TH - SL	5		4		
			RT	2		2		
		WB	TH	561	589	606	45	8%
			TH - SL	23		21		
			RT	5		5		
		EB Service Lane	TH - ML	1	52	1	0	0%
			TH	11		13		
			RT	40		41		
		WB Service Lane	TH - ML	1	189	1	0	0%
			TH	42		41		
			RT	146		158		
		Intersection		2,319		2,443	124	5%
9	K Street NW and 15th Street NW (west)	NB	LT - SL	9	410	9	0	0%
			LT	21		24		
			TH	364		368		
			RT	16		17		
			LT	5		4		
			TH	77		78		
			RT	16		16		
		SB	RT - SL	22		21		
			LT	71	592	70	-1	-1%
			TH	520		553		
		EB	TH - SL	1		0		
			LT	28	941	25	-3	-11%
			TH	893		935		
			TH - SL	15		22		
		WB	RT	5		5		
			TH - ML	3	35	4	1	33%
			RT	32		31		
		EB Service Lane	TH	57	238	59	2	-3%
			RT	181		180		
			Intersection	2,336		2,421	85	4%

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)	
10	K Street NW and Vermont Avenue	NB	LT - SL	55	444	57	9	4%
			LT	117		123		5%
			TH	199		200		1%
			RT	33		31		-6%
			RT - SL	40		42		5%
		SB	LT - SL	12	111	11	-5	-8%
			LT	24		25		4%
			RT	50		46		-8%
			RT - SL	25		24		-4%
		EB	LT	45	544	42	32	-7%
			TH	452		486		8%
			TH - SL	47		48		2%
			TH	764		804		5%
		WB	TH - SL	40	805	39	39	-3%
			RT	1		1		0%
			TH - ML	10		11		10%
		WB Service Lane	TH	111	184	112	0	1%
			RT	63		61		-3%
			Intersection	2,088		2,163		4%
11	K Street NW and 14th Street NW	NB	LT - SL	60	875	61	53	2%
			LT	148		162		9%
			TH	617		653		6%
			RT	50		52		4%
			LT	31		30		-3%
			TH	567		579		2%
			RT	40		37		-8%
		SB	RT - SL	26	664	24	6	-8%
			LT	3		3		0%
			TH	433		452		4%
			RT	22		37		68%
		WB	LT	2	647	1	32	-50%
			TH	617		645		5%
			TH - SL	24		28		17%
			RT	4		5		25%
		EB Service Lane	TH - ML	3	100	4	2	33%
			RT	97		98		1%
		WB Service Lane	TH	73	175	73	-1	0%
			RT	102		101		-1%
		Intersection		2,919		3,045		4%
12	K Street NW and 13th Street NW	NB	LT - SL	29	591	26	14	-10%
			LT	144		151		5%
			TH	384		395		2%
			RT	33		32		-3%
			RT - SL	1		1		0%
		SB	LT	20	975	23	24	15%
			TH	854		877		3%
			RT	65		62		-5%
			RT - SL	36		37		3%
		EB	TH	372	517	366	12	-2%
			RT	145		163		12%
		WB	LT	9	488	11	29	22%
			TH	454		481		6%
			TH - SL	20		19		-5%
			RT	5		6		20%
		WB Service Lane	TH - ML	4	151	4	0	0%
			TH	47		48		2%
			RT	100		99		-1%
		Intersection		2,722		2,801		3%

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)	
13	K Street NW and 12th Street NW	NB	LT - SL	64	909	67	45	5%
			LT	191		217		14%
			TH	574		592		3%
			RT	80		78		-3%
		EB	LT	90	417	88	-1	-2%
			TH	327		328		0%
			TH	310		318		3%
		WB	TH - SL	62	418	59	5	-5%
			RT	46		46		0%
		EB Service Lane	TH - ML	11	11	9	-2	-18%
		Intersection		1,755	1,802		47	3%
14	K Street NW and 11th Street NW	NB	LT	101	362	109	8	8%
			TH	214		217		1%
			RT	47		44		-6%
			LT	13		11		-15%
			TH	435		433		0%
		EB	RT	105	352	108	-1	3%
			LT	72		73		1%
			TH	178		177		-1%
		WB	RT	102		102		0%
			LT	39	257	40	-2	3%
			TH	197		193		-2%
			RT	21		22		5%
		Intersection		1,524	1,529		5	0%
15	K Street NW and 10th Street NW	SB	LT	24	448	26	-5	8%
			TH	260		255		-2%
			RT	164		162		-1%
			TH	99	232	99	0	0%
		EB	RT	133		131		-2%
		WB	LT	9	112	9	3	0%
			TH	103		106		3%
			Intersection		792	788	-4	-1%
		SB	TH	941	1,065	958	20	2%
			RT	124		127		2%
			RT	65		66		2%
		Intersection		1,130	1,151		21	2%
17	L Street NW and 21st Street NW	SB	LT	177	626	173	3	-2%
			TH	449		456		2%
			TH	784		786		0%
			RT	145		137		-6%
		Intersection		1,555	1,552		-3	0%
18	Pennsylvania Avenue NW and 21st Street NW	SB	LT	105	524	109	7	4%
			TH	391		391		0%
			RT	28		31		11%
			TH	722	836	702	-22	-3%
			RT	114		112		-2%
		WB	LT	123	397	130	13	6%
			TH	274		280		2%
			Intersection		1,757	1,755	-2	0%
			TH	667	846	701	36	5%
			RT	179		181		1%
		SB	TH	566		577		2%
			LT	88	875	85	0	-3%
		EB	TH	725		726		0%
			RT	62		64		3%
		Intersection		2,287	2,334		47	2%
19	L Street NW and Connecticut Avenue	NB	LT	135	765	142	34	5%
			TH	630		657		4%
			TH	479		490		2%
			RT	92		93		1%
		SB	LT	368	571	362	6	-2%
			TH	781		781		0%
			RT	134		146		9%
			Intersection		2,619	2,671	52	2%
			TH	667	882	4%		
			RT	179	181	2%		
			TH	566	577	0%		
			LT	88	85	-3%		
			TH	725	726	0%		
			RT	62	64	3%		
		Intersection		2,287	2,334		47	2%
20	I Street NW and 17th Street NW (west)	NB	LT	135	765	7	34	5%
			TH	630		27		4%
			TH	479		11		2%
			RT	92		1		1%
		SB	LT	368	1,283	-6	6	-2%
			TH	781		0		0%
			RT	134		12		9%
		Intersection		2,619	2,671		52	2%

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)		Difference (vph)		Difference (%)		
21	L Street NW and 16th Street NW	NB	TH	327	462	335	472	8	10	2%	2%
			RT	135		137		2		1%	
			LT	245	845	240	881	-5	36	-2%	
			TH	600		641		41		7%	
		EB	LT	159	750	153	734	-6	-16	-4%	-2%
			TH	542		530		-12		-2%	
			RT	49		51		2		4%	
		Intersection		2,057	2,087		30	1%			
		SB	LT	69	256	67	247	-2	-9	-3%	-4%
			TH	187		180		-7		-4%	
			TH	192	495	203	511	11	16	6%	
			RT	303		308		5		2%	
22	I Street NW and 16th Street NW	WB	LT	19	1,069	23	1,115	4	46	21%	4%
			TH	902		941		39		4%	
			RT	148		151		3		2%	
			Intersection		1,820	1,873		53	3%		
		NB	TH	555	625	561	630	6	5	1%	1%
			RT	70		69		-1		-1%	
			LT	41	105	43	102	2	-3	5%	
			TH	64		59		-5		-8%	
		EB	LT	159	793	157	783	-2	-10	-1%	-1%
			TH	578		568		-10		-2%	
			RT	56		58		2		4%	
		Intersection		1,523	1,515		-8	-1%			
24	L Street NW and 14th Street NW	SB	TH	504	726	524	752	20	26	4%	4%
			RT	222		228		6		3%	
			LT	111	707	112	724	1	17	1%	
			TH	596		612		16		3%	
		EB	LT	36	618	36	616	0	-2	0%	0%
			TH	514		518		4		1%	
			RT	68		62		-6		-9%	
		Intersection		2,051	2,092		41	2%			
25	I Street NW and 14th Street NW	NB	LT	311	1,135	314	1,154	3	19	1%	2%
			TH	824		840		16		2%	
			TH	622	688	643	709	21	21	3%	
			RT	66		66		0		0%	
		WB	LT	88	915	90	973	2	58	2%	6%
			TH	776		808		32		4%	
			RT	51		75		24		47%	
		Intersection		2,738	2,836		98	4%			

*Results show the average from 10 simulation runs.

Intersection Delay and Estimated LOS

AM Peak Hour: 8:30AM-9:30AM

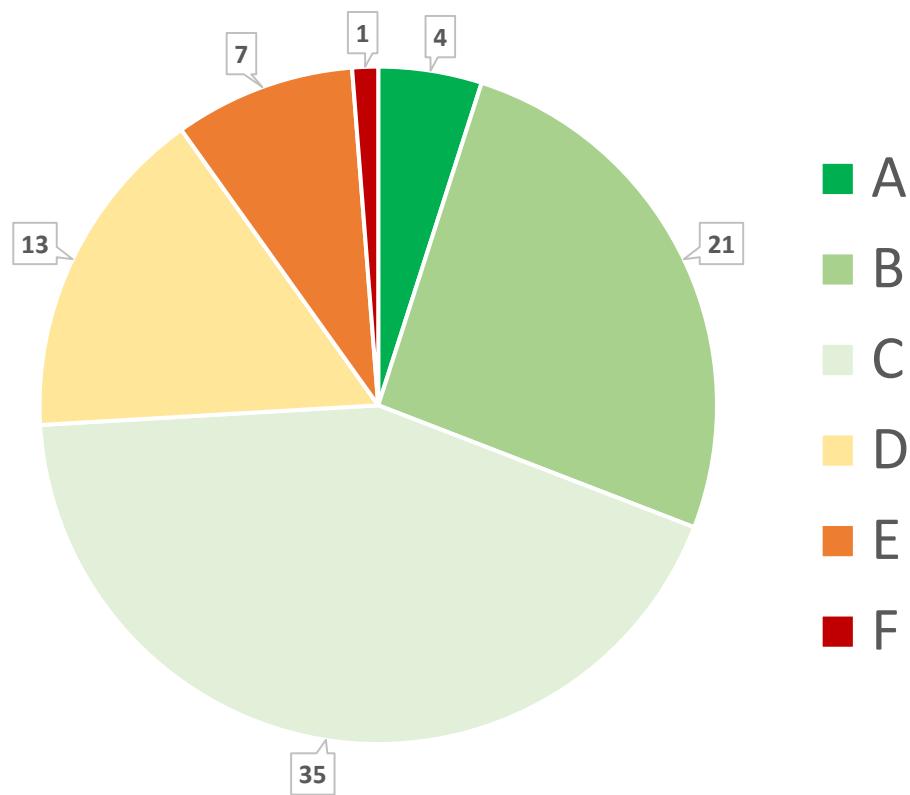
#	Intersection	Approach	Average Delay (sec/veh)	Approach LOS	Intersection Delay	Intersection LOS
1	K Street NW and 22nd Street NW	NB	38.7	D	8.7	A
		SB	-	-		
		EB Service Lane	6.2	A		
		WB Service Lane	18.0	B		
2	K Street NW and 21st Street NW	NB	-	-	20.5	C
		SB	28.5	C		
		EB	17.3	B		
		WB	10.9	B		
3	K Street NW and 20th Street NW	NB	32.1	C	25.7	C
		SB	-	-		
		EB	15.1	B		
		WB	24.8	C		
4	K Street NW and 19th Street NW	NB	-	-	27.3	C
		SB	31.5	C		
		EB	18.3	B		
		WB	18.8	B		
5	K Street NW and 18th Street NW	NB	35.2	D	24.8	C
		SB	-	-		
		EB	14.9	B		
		WB	21.3	C		
6	K Street NW and Connecticut Avenue	NB	37.5	D	35.0	D
		SB	20.2	C		
		EB	62.1	E		
		WB	16.6	B		
7	K Street NW and 17th Street NW (east)	NB	27.9	C	29.0	C
		SB	47.4	D		
		EB	28.6	C		
		WB	23.8	C		
8	K Street NW and 16th Street NW	NB	36.5	D	29.9	C
		SB	26.9	C		
		EB	39.9	D		
		WB	26.0	C		
9	K Street NW and 15th Street NW (west)	NB	28.8	C	38.2	D
		SB	33.0	C		
		EB	81.3	F		
		WB	19.6	B		
10	K Street NW and Vermont Avenue	NB	54.0	D	36.3	D
		SB	60.3	E		
		EB	16.7	B		
		WB	36.8	D		
11	K Street NW and 14th Street NW	NB	34.1	C	52.4	D
		SB	73.5	E		
		EB	40.5	D		
		WB	76.5	E		
12	K Street NW and 13th Street NW	NB	17.0	B	24.5	C
		SB	28.9	C		
		EB	22.1	C		
		WB	29.5	C		

#	Intersection	Approach	Average Delay (sec/veh)	Approach LOS	Intersection Delay	Intersection LOS
13	K Street NW and 12th Street NW	NB	59.1	E	38.8	D
		SB	-	-		
		EB	13.9	B		
		WB	17.9	B		
14	K Street NW and 11th Street NW	NB	17.3	B	20.4	C
		SB	22.9	C		
		EB	12.0	B		
		WB	31.1	C		
15	K Street NW and 10th Street NW	NB	-	-	20.6	C
		SB	17.8	B		
		EB	24.5	C		
		WB	23.5	C		
16	K Street NW and 9th Street NW	NB	-	-	8.2	A
		SB	5.3	A		
		EB	56.5	E		
		WB	-	-		
17	L Street NW and 21st Street NW	NB	-	-	21.2	C
		SB	23.8	C		
		EB	19.4	B		
		WB	-	-		
18	Pennsylvania Avenue NW and 21st Street NW	NB	-	-	27.5	C
		SB	20.8	C		
		EB	28.7	C		
		WB	33.7	C		
19	L Street NW and Connecticut Avenue	NB	42.2	D	30.0	C
		SB	24.1	C		
		EB	21.5	C		
		WB	-	-		
20	I Street NW and 17th Street NW (west)	NB	21.2	C	28.6	C
		SB	16.3	B		
		EB	-	-		
		WB	38.8	D		
21	L Street NW and 16th Street NW	NB	6.8	A	21.2	C
		SB	24.3	C		
		EB	26.7	C		
		WB	-	-		
22	I Street NW and 16th Street NW	NB	14.3	B	28.4	C
		SB	37.7	D		
		EB	-	-		
		WB	27.2	C		
23	L Street NW and 15th Street NW (west)	NB	9.6	A	13.1	B
		SB	23.8	C		
		EB	14.6	B		
		WB	-	-		
24	L Street NW and 14th Street NW	NB	12.3	B	20.6	C
		SB	22.2	C		
		EB	29.1	C		
		WB	-	-		
25	I Street NW and 14th Street NW	NB	27.7	C	40.4	D
		SB	58.7	E		
		EB	-	-		
		WB	42.2	D		

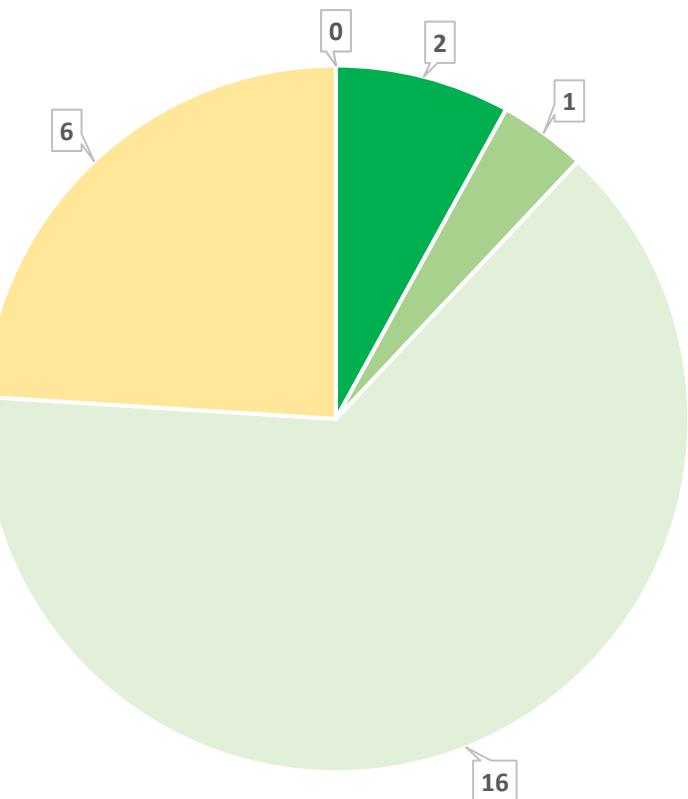
Intersection Delay and Estimated LOS

AM Peak Hour: 8:30AM-9:30AM

Approach LOS Summary



Intersection LOS Summary



Approach LOS	A	B	C	D	E	F	Intersection LOS	A	B	C	D	E	F
Approach LOS	4	21	35	13	7	1	Intersection LOS	2	1	16	6	0	0

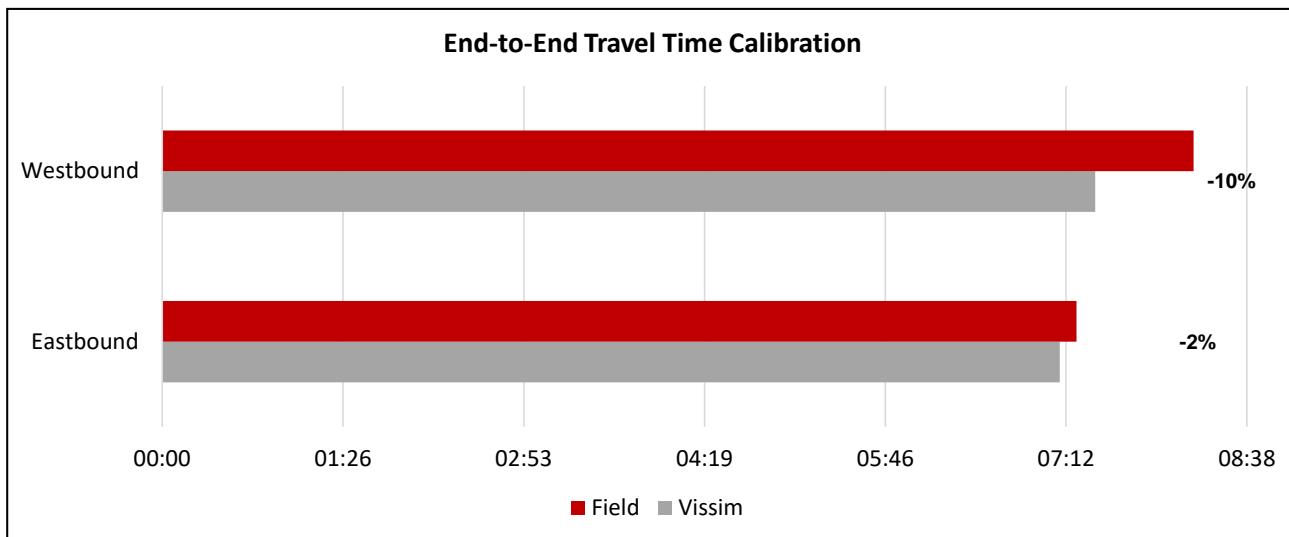
Travel Time | End-to-End Passenger Cars

AM Peak Period: 8:00AM-10:00AM

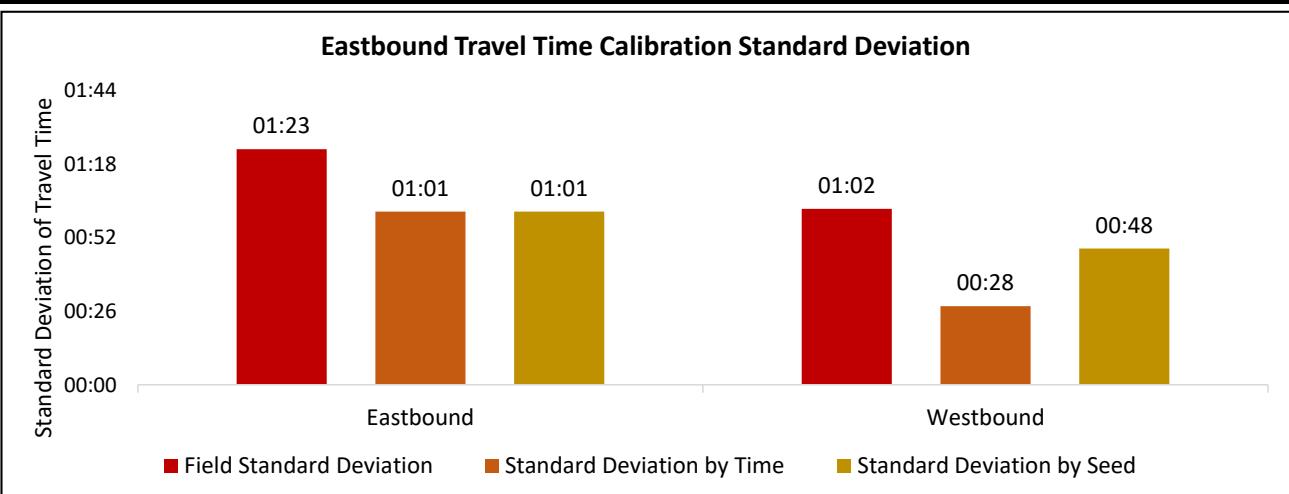
Travel Time Criteria	Number of Segments Passing	Percent	Target	Target Met
85% of Travel Time Segments Within $\pm 15\%$ for observed travel times on K Street NW	2 of 2	100%	85%	Yes

Passenger Vehicle Travel Time Calibration					
Segment ID	Route	Field	Vissim	Difference	
		(MM:SS)	(MM:SS)	(MM:SS)	(%)
9	Eastbound	07:17	07:09	-00:08	-2%
10	Westbound	08:13	07:26	-00:47	-10%

*Results show the average from 10 simulation runs.



Passenger Vehicle Travel Time Statistics					
Segment ID	Route	Field/Vissim Vehicle Count	Field Standard Deviation	Standard Deviation by Time	Standard Deviation by Seed
			(MM:SS)	(MM:SS)	(MM:SS)
9	Eastbound	12 / 139	01:23	01:01	01:01
10	Westbound	12 / 100	01:02	00:28	00:48



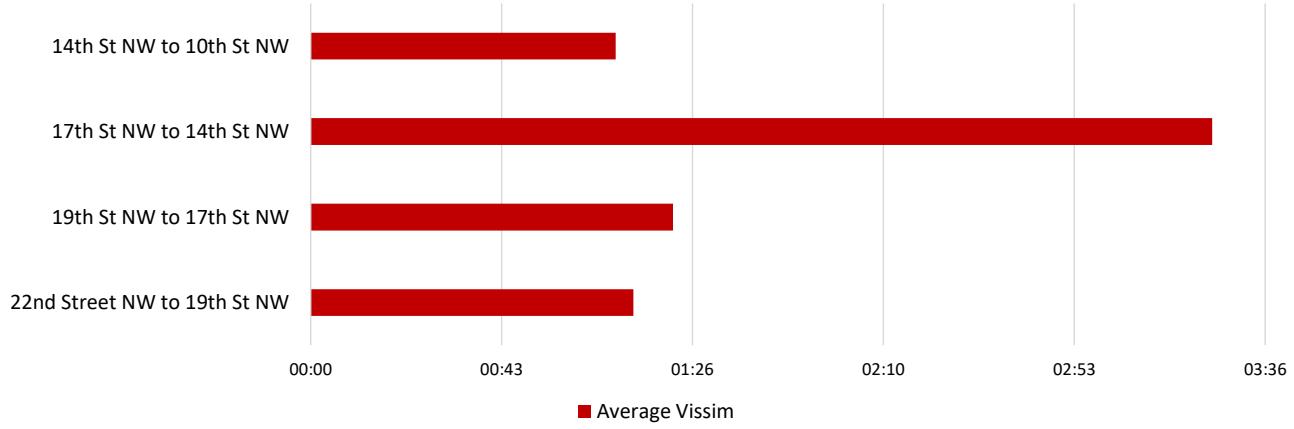
Travel Time | Segment-by-Segment Passenger Cars

AM Peak Period: 8:00AM-10:00AM

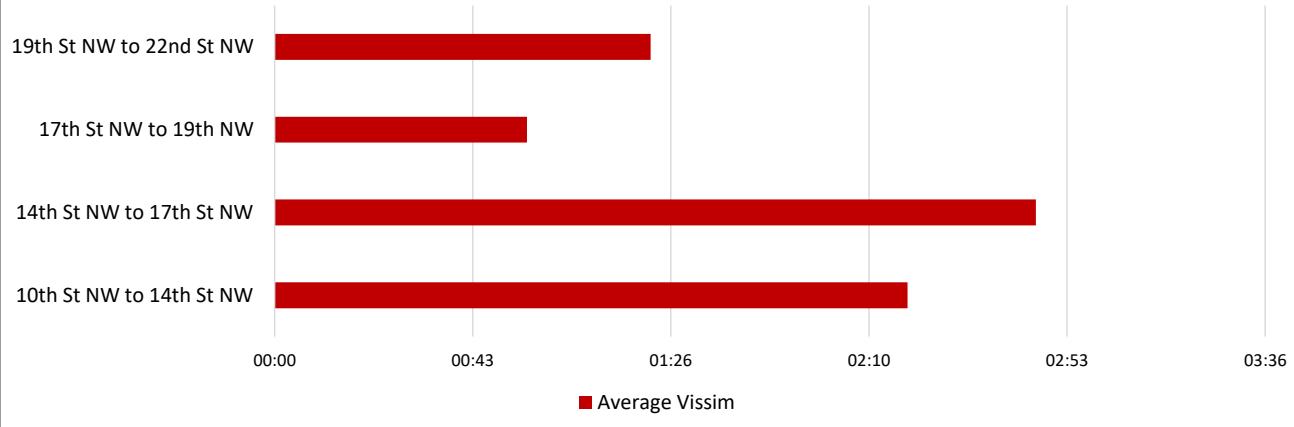
Passenger Vehicle Segment-by-Segment Travel Time Comparison					
Segment ID	Route	Vehicle Count	Average Vissim	Standard Deviation by Time ¹	Standard Deviation by Seed ²
		(MM:SS)	(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	1005	01:13	00:04	00:08
2	19th St NW to 17th St NW	931	01:22	00:26	00:26
3	17th St NW to 14th St NW	496	03:24	00:38	00:56
4	14th St NW to 10th St NW	371	01:09	00:03	00:06
Total	Total Eastbound	2803	07:08	01:10	01:36
5	10th St NW to 14th St NW	495	02:18	00:17	00:34
6	14th St NW to 17th St NW	585	02:46	00:10	00:12
7	17th St NW to 19th NW	873	00:55	00:04	00:06
8	19th St NW to 22nd St NW	646	01:22	00:01	00:04
Total	Total Westbound	2599	07:21	00:32	00:56

*Results show the average from 10 simulation runs.

Eastbound Travel Time Segments



Westbound Travel Time Segments



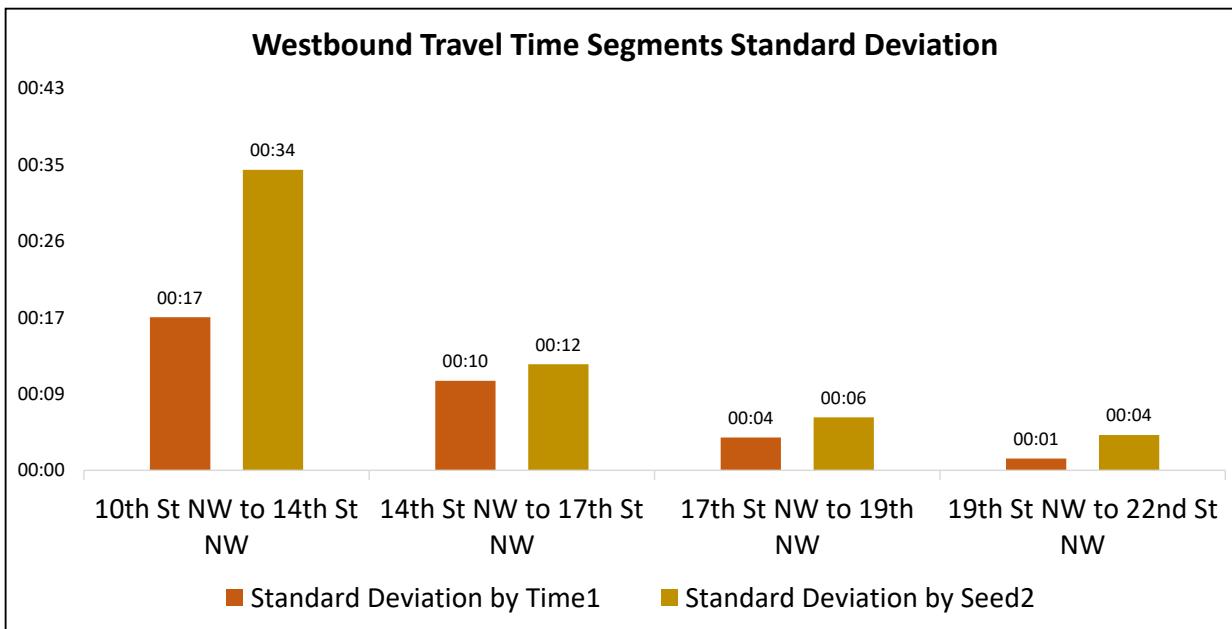
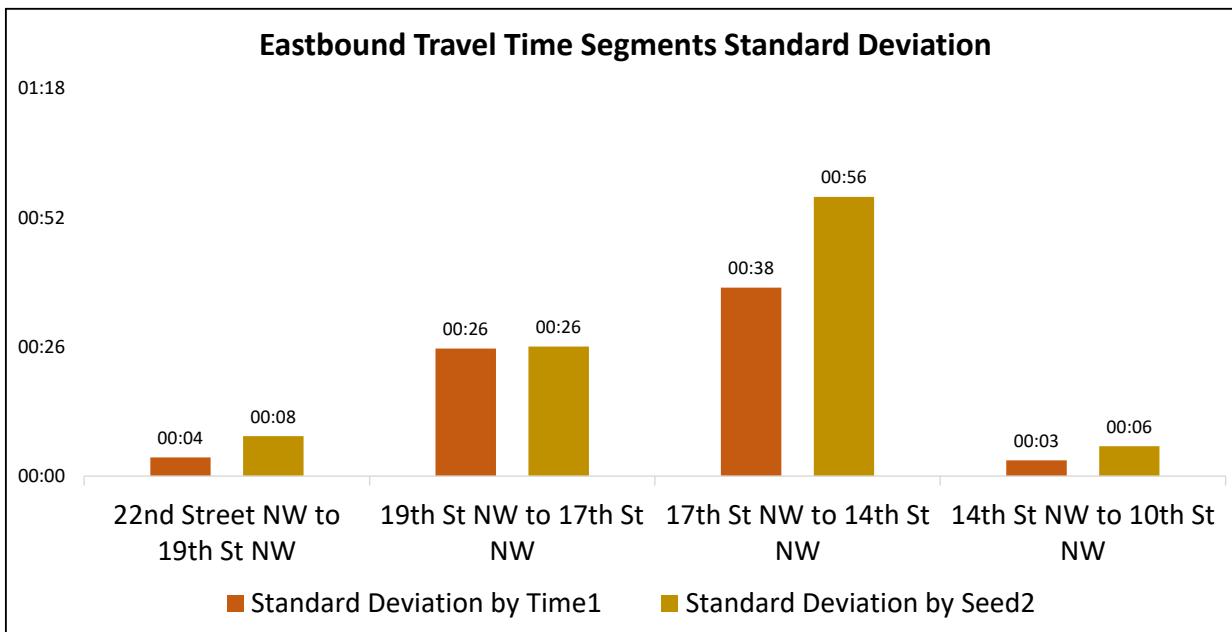
Travel Time | Segment-by-Segment Passenger Cars

AM Peak Period: 8:00AM-10:00AM

*Travel time results collected throughout the 2-hour peak period at 15-minute intervals.

¹Standard deviation by time is standard deviation of the average travel time for all simulation runs in each 15-minute time segment, representing how the average travel time changes throughout the peak period.

²Standard deviation by seed is the average standard deviation of travel times for each 15-minute time segment in the peak period, representing the consistency of travel time throughout the peak period.



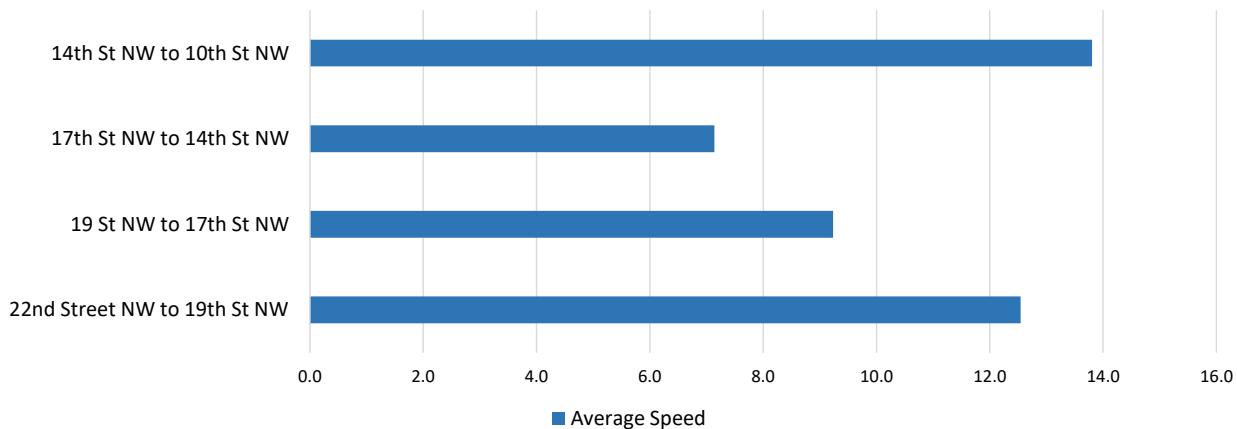
Speed | Segment-by-Segment Passenger Cars

AM Peak Period: 8:00AM-10:00AM

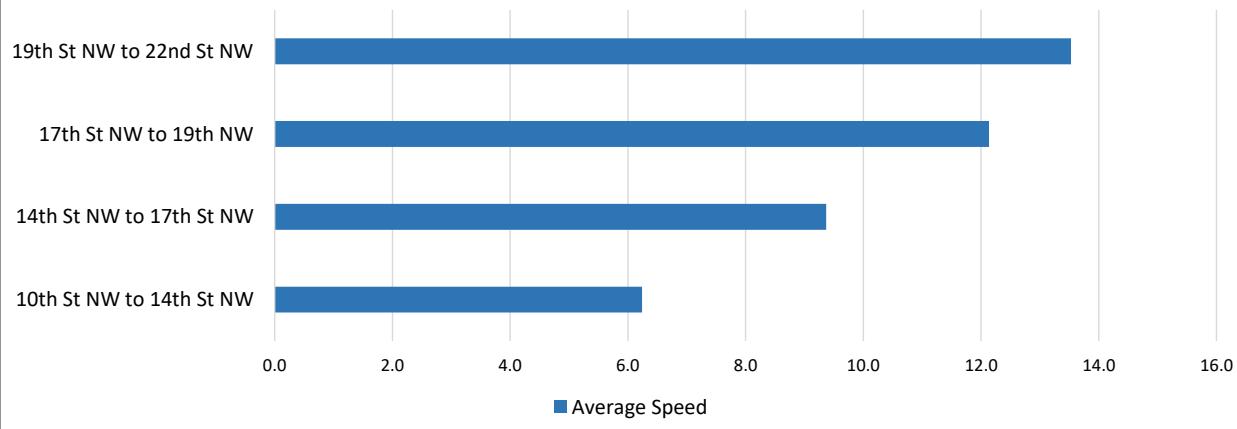
Passenger Vehicle Segment-by-Segment Average Speed Comparison			
Segment ID	Route	Vehicle Count	Average Speed
			MPH
1	22nd Street NW to 19th St NW	1005	12.5
2	19 St NW to 17th St NW	931	9.2
3	17th St NW to 14th St NW	496	7.1
4	14th St NW to 10th St NW	371	13.8
Average Eastbound		2803	10.7
5	10th St NW to 14th St NW	495	6.2
6	14th St NW to 17th St NW	585	9.4
7	17th St NW to 19th NW	873	12.1
8	19th St NW to 22nd St NW	646	13.5
Average Westbound		2599	10.3

*Results show the average from 10 simulation runs.

Eastbound Speed Segments



Westbound Speed Segments

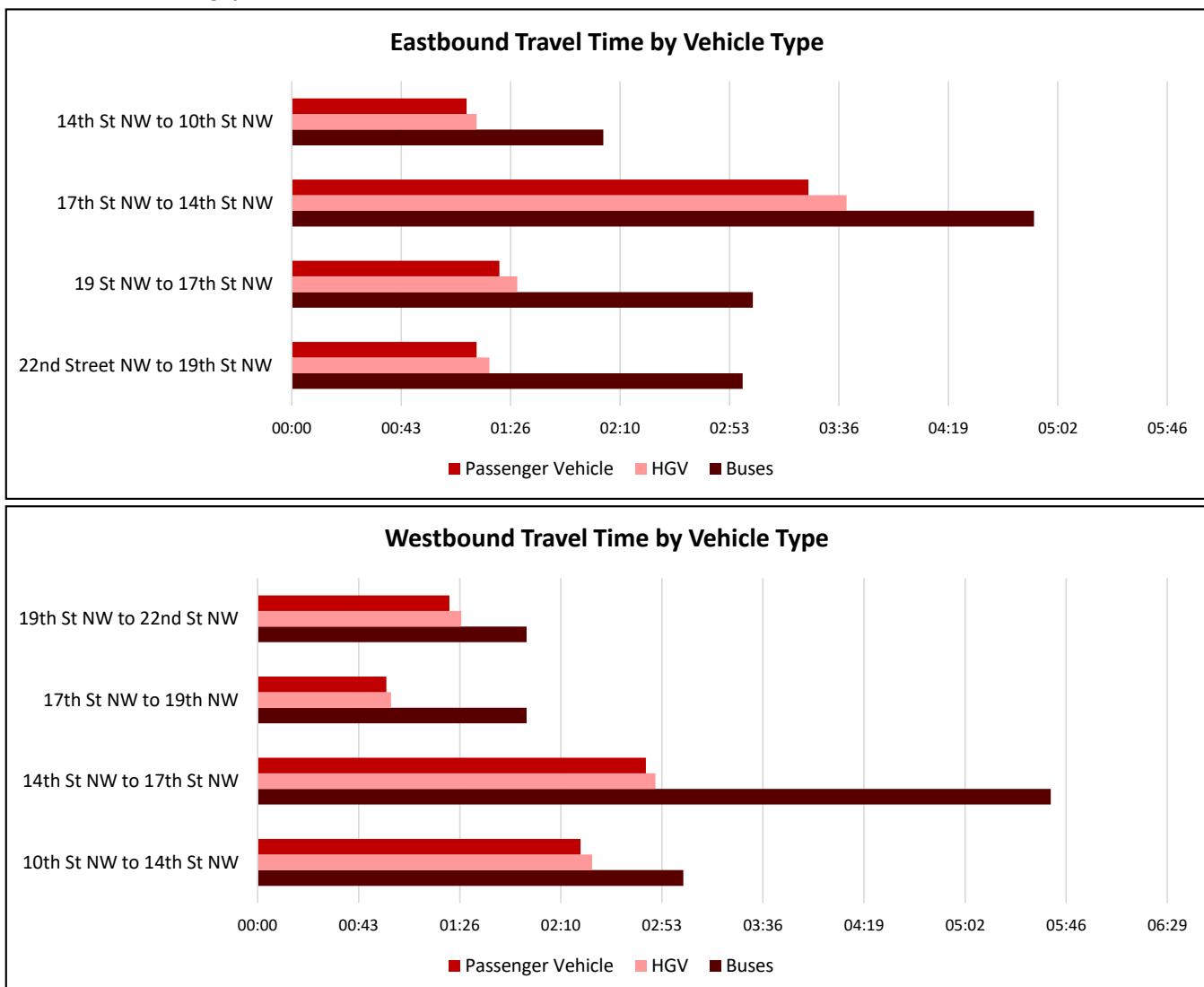


Travel Time | Comparison by Vehicle Type

AM Peak Period: 8:00AM-10:00AM

Travel Time by Vehicle Type				
Segment ID	Route	Passenger Vehicle	HGV	Buses
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:13	01:18	02:58
2	19 St NW to 17th St NW	01:22	01:29	03:02
3	17th St NW to 14th St NW	03:24	03:39	04:53
4	14th St NW to 10th St NW	01:09	01:13	02:03
Total	Total Eastbound	07:08	07:39	12:56
5	10th St NW to 14th St NW	02:18	02:23	03:02
6	14th St NW to 17th St NW	02:46	02:50	05:39
7	17th St NW to 19th NW	00:55	00:57	01:55
8	19th St NW to 22nd St NW	01:22	01:27	01:55
Total	Total Westbound	07:21	07:37	12:31

*Results show the average from 10 simulation runs.

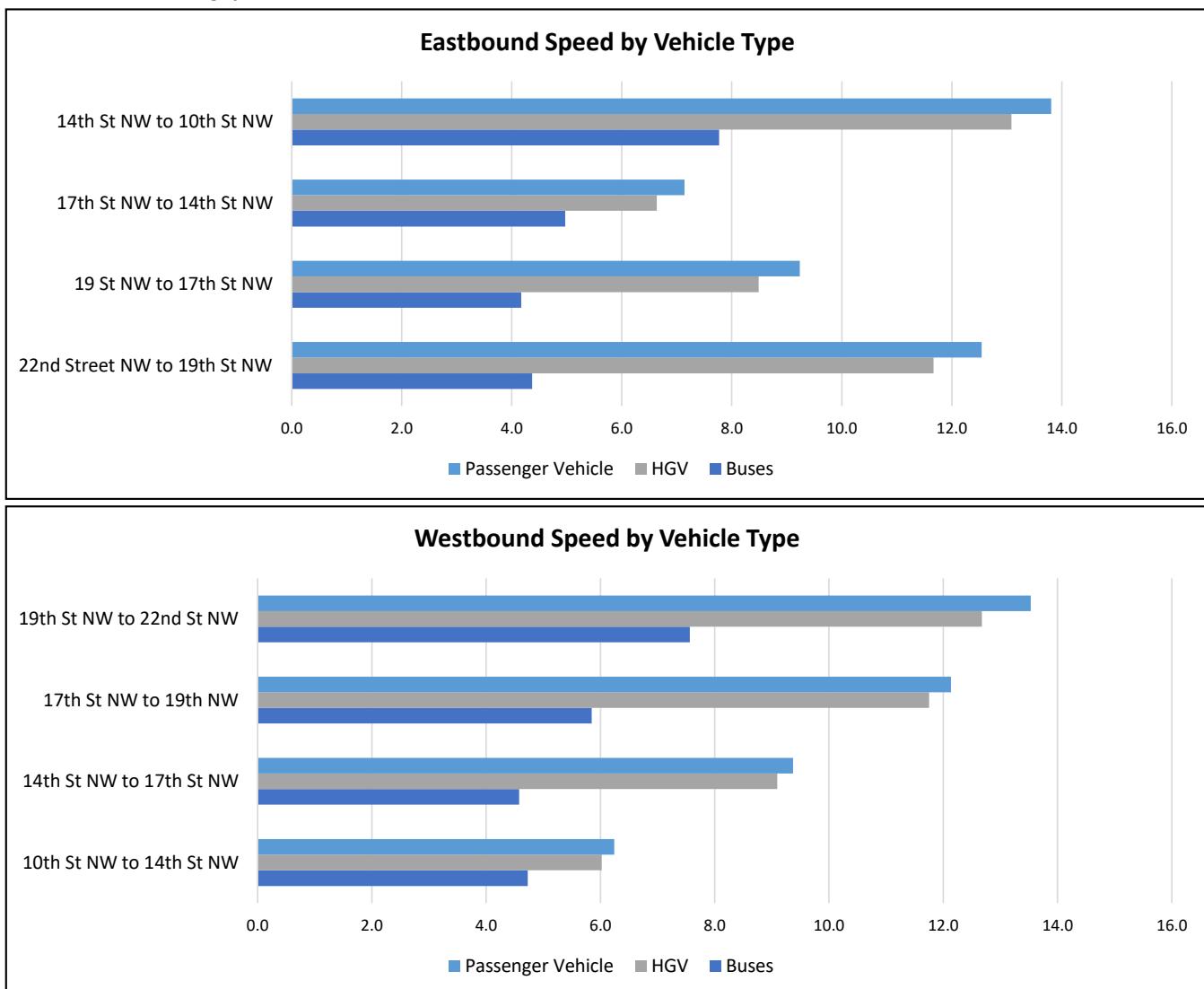


Speed | Comparison by Vehicle Type

AM Peak Period: 8:00AM-10:00AM

Speed by Vehicle Type				
Segment ID	Route	Passenger Vehicle	HGV	Buses
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	12.5	11.7	4.4
2	19 St NW to 17th St NW	9.2	8.5	4.2
3	17th St NW to 14th St NW	7.1	6.6	5.0
4	14th St NW to 10th St NW	13.8	13.1	7.8
Average Eastbound		10.7	10.0	5.3
5	10th St NW to 14th St NW	6.2	6.0	4.7
6	14th St NW to 17th St NW	9.4	9.1	4.6
7	17th St NW to 19th NW	12.1	11.8	5.8
8	19th St NW to 22nd St NW	13.5	12.7	7.6
Average Westbound		10.3	9.9	5.7

*Results show the average from 10 simulation runs.



Travel Time | Comparison by Vehicle Type

AM Peak Period: 8:00AM-10:00AM

Number of Vehicles Represented in Travel Time/Speed by Vehicle Type				
Segment ID	Route	Passenger Vehicle	HGV	Buses
		Vehicle Count	Vehicle Count	Vehicle Count
1	22nd Street NW to 19th St NW	1005	52	15
2	19 St NW to 17th St NW	931	51	43
3	17th St NW to 14th St NW	496	28	66
4	14th St NW to 10th St NW	371	22	13
Total	Total Eastbound	2803	153	137
5	10th St NW to 14th St NW	495	29	12
6	14th St NW to 17th St NW	585	33	69
7	17th St NW to 19th NW	873	49	105
8	19th St NW to 22nd St NW	646	37	20
Total	Total Westbound	2599	148	206

*Total number of vehicles counted in Travel Time runs through the 2-hour peak period.

GEH of Vehicular Throughput

AM Peak Hour: 8:30AM-9:30AM

GEH Criteria	Value	Percent	Target	Target Met
Total Network Volume with GEH < 4	GEH: 2.5	N/A	4	Yes
Total Network Volume %Difference from Balanced Counts	N/A	1.3%	5%	Yes
85% of individual links below GEH < 5	103 of 103	100%	85%	Yes

Total K Street NW Volume	Sum of balanced counts	Sum of all link flows	Percent Difference	GEH
	34,517	34,976	1.3%	2.5

* Bus volume during peak period added to "Sum of balanced counts"

Intersection Approaches	Number of Approaches	Number of Segments with GEH < 5	Number of Segments with GEH >5	Percent Compliance
	103	103	0	100%

The GEH statistic is computed using the following formula:

E = Vissim estimated throughput

V = balanced field count:

$$GEH = \sqrt{\frac{(E-V)^2}{(E+V)/2}}$$

Sample Size Determination Tool, Version 2.0



<p>Step 1: Input number of MOEs (max is 12). Clear out old data.</p> <p>Step 2: Select type of MOEs</p> <p>Step 3: Insert simulation results from four random seeds for selected MOEs</p>		<p>User Inputs</p> <p>Constants</p> <p>Outputs</p> <p>Sample Size (N) = Number of Model Runs $\text{Sample Mean (X}_s\text{)} = (1/N) (X_1 + X_2 + X_3 \dots + X_N)$ $\text{Sample Standard Deviation (S}_s\text{)} = \sqrt{[(\sum(X-X_s)^2)/(N-1)]}$ $\text{Sampling Error} = t (S_s/\sqrt{N})$ $\text{Confidence Level} = X_s \pm t (S_s/\sqrt{N})$ $\% \text{ of Sample Mean (E)} = \% \text{ Tolerance} * X_s$ $\text{Sample Size Needed} = [(t^2 * (S_s)^2) / (E^2)]$</p> <p>The "t" statistic is the hypothesized number of standard deviations away from the mean corresponding to the required confidence level and sample size in a t-distribution.</p>								
<p>Inputs</p> <p>Confidence Interval: <input type="button" value="95%"/></p> <p>Tolerance Error: <input type="button" value="10%"/></p> <p>Number of MOEs: <input type="button" value="10"/></p>		<p>Output</p> <p>Number of Required Runs: 10</p> <p>*Minimum number of required runs = 10</p>								
Location (optional)	EB K Street	WB K Street	EB (17th/18th)	WB (17th/18th)	EB (13th/14th)	WB (13th/14th)	EB (17th/18th)	WB (17th/18th)	EB (13th/14th)	WB (13th/14th)
Runs (Seeds)	Travel Time	Travel Time	Volume	Volume	Volume	Volume	Speed	Speed	Speed	Speed
1	342	333	1399	1691	1042	1319	18.7	18.2	24.7	23.4
2	351	330	1423	1689	1091	1318	18.6	18.2	24.8	21.1
3	335	329	1350	1717	1070	1336	17.6	18.5	24.6	22.9
4	333	313	1400	1634	1063	1368	17.6	18.3	24.5	20.8
<i>*Results from four random seeds</i>										
Statistics										
X_s =	340.3	326.2	1393.0	1682.8	1066.5	1335.3	18.1	18.3	24.6	22.0
S_s =	8.0	8.6	30.7	34.9	20.2	23.3	0.6	0.1	0.1	1.3
E =	34.0	32.6	139.3	168.3	106.7	133.5	1.8	1.8	2.5	2.2
t =	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18
Sampling Error =	12.71	13.75	48.91	55.55	32.15	37.14	0.98	0.23	0.21	2.01
95% Interval Lower =	327.6	312.4	1344.1	1627.2	1034.3	1298.1	17.2	18.1	24.4	20.0
95% Interval Upper =	353.0	339.9	1441.9	1738.3	1098.7	1372.4	19.1	18.5	24.8	24.0
% of Sample Mean =	3.73%	4.22%	3.51%	3.30%	3.01%	2.78%	5.39%	1.26%	0.86%	9.12%
Sample Size Needed =	4	4	4	4	4	4	4	4	4	4

Intersection Queue Lengths

AM Peak Hour: 8:30AM-9:30AM

Intersection		Approach	Storage (ft)	Max Queue Observed (ft)	Vissim Average Queue (ft)	Vissim Max Queue (ft)	Vissim Max Queue			Vissim Average Queue			Is Max Observed Queue between Average and Max Vissim Queue?
							Queue Difference	% Queue Difference (ft)	% Queue Difference wrt Storage Space ¹	Queue Difference	% Queue Difference (ft)	% Queue Difference wrt Storage Space ¹	
1	K Street NW and 22nd Street NW												
2	K Street NW and 21st Street NW	EB	490	147	38	260	113	77%	23%	-109	-74%	-22%	True
		WB	410	82	17	133	51	62%	12%	-65	-79%	-16%	True
		SB	300	90	82	315	225	250%	75%	-8	-9%	-3%	True
3	K Street NW and 20th Street NW	EB	410	328	74	408	80	24%	20%	-254	-77%	-62%	True
		WB	320	320	56	295	-25	-8%	-8%	-264	-83%	-83%	False
	K Street NW and 19th Street NW	EB	320	288	90	357	69	24%	22%	-198	-69%	-62%	True
4	K Street NW and 19th Street NW	WB	410	41	50	266	225	549%	55%	9	21%	2%	False
		EB	410	205	44	323	118	58%	29%	-161	-78%	-39%	True
	K Street NW and 18th Street NW	WB	520	208	109	416	208	100%	40%	-99	-48%	-19%	True
6	K Street NW and Connecticut Avenue	EB	520	364	183	544	180	50%	35%	-181	-50%	-35%	True
		WB	145	145	90	268	123	85%	85%	-55	-38%	-38%	True
		NB	310	155	117	330	175	113%	56%	-38	-25%	-12%	True
		SB	315	63	44	252	189	300%	60%	-19	-30%	-6%	True
7	K Street NW and 17th Street NW (east)	EB	145	131	119	324	193	147%	133%	-12	-9%	-8%	True
		WB	460	322	73	375	53	16%	11%	-249	-77%	-54%	True
		NB	310	31	5	56	25	79%	8%	-26	-85%	-8%	True
		SB	315	95	67	241	146	153%	46%	-28	-30%	-9%	True
8	K Street NW and 16th Street NW	EB	460	230	87	334	104	45%	23%	-143	-62%	-31%	True
		WB	450	225	58	241	16	7%	4%	-167	-74%	-37%	True
		NB	300	150	43	202	52	35%	17%	-107	-71%	-36%	True
		SB	305	153	74	272	119	78%	39%	-79	-51%	-26%	True
9	K Street NW and 15th Street NW (west)	EB	450	360	212	534	174	48%	39%	-148	-41%	-33%	True
		WB	160	160	118	317	157	98%	98%	-42	-26%	-26%	True
		SB	330	66	10	114	48	72%	14%	-56	-85%	-17%	True
10	K Street NW and Vermont Avenue	EB	160	64	34	174	110	171%	69%	-30	-46%	-19%	True
		WB	360	144	141	477	333	231%	92%	-3	-2%	-1%	True
		NB	300	120	70	279	159	133%	53%	-50	-42%	-17%	True
		SB	355	71	18	118	47	67%	13%	-53	-75%	-15%	True
11	K Street NW and 14th Street NW	EB	360	108	96	327	219	203%	61%	-12	-11%	-3%	True
		WB	530	371	203	530	159	43%	30%	-168	-45%	-32%	True
		NB	300	300	67	337	37	12%	12%	-233	-78%	-78%	True
		SB	315	252	128	364	112	44%	35%	-124	-49%	-39%	True
12	K Street NW and 13th Street NW	EB	530	212	72	284	72	34%	14%	-140	-66%	-26%	True
		WB	330	165	84	357	192	116%	58%	-81	-49%	-25%	True
		SB	315	126	74	311	185	147%	59%	-52	-41%	-16%	True
13	K Street NW and 12th Street NW	EB	330	99	21	136	37	38%	11%	-78	-79%	-24%	True
		WB	200	60	28	165	105	175%	52%	-32	-54%	-16%	True
14	K Street NW and 11th Street NW	EB	200	80	13	168	88	110%	44%	-67	-84%	-34%	True
		WB	190	171	60	278	107	63%	56%	-111	-65%	-58%	True
		NB	340	306	22	161	-145	-47%	-43%	-284	-93%	-84%	False
		SB	370	333	28	204	-129	-39%	-35%	-305	-92%	-82%	False
15	K Street NW and 10th Street NW	EB	190	171	28	217	46	27%	24%	-143	-84%	-75%	True
		WB	480	48	14	120	72	151%	15%	-34	-70%	-7%	True
		SB	270	54	30	197	143	264%	53%	-24	-45%	-9%	True
16	K Street NW and 9th Street NW	EB	480	96	23	112	16	16%	3%	-73	-76%	-15%	True

¹ Percent difference with respect to storage space

Intersection Queue Lengths - Service Lanes

AM Peak Hour: 8:30AM-9:30AM

Intersection	Approach	Storage (ft)	Max Queue Observed (ft)	Vissim Average Queue (ft)	Vissim Max Queue (ft)	Vissim Max Queue			Vissim Average Queue			Is Max Observed Queue between Average and Max Vissim Queue?	
						Queue Difference	% Queue Difference (ft)	% Queue Difference wrt Storage Space ¹	Queue Difference	% Queue Difference (ft)	% Queue Difference wrt Storage Space ¹		
1	K Street NW and 22nd Street NW	EB	40	0	8	203	203	--	508%	8	--	21%	False
		WB	530	106	26	178	72	68%	14%	-80	-76%	-15%	True
2	K Street NW and 21st Street NW	EB	490	490	53	392	-98	-20%	-20%	-437	-89%	-89%	False
		WB	410	82	18	138	56	68%	14%	-64	-78%	-16%	True
3	K Street NW and 20th Street NW	EB	410	82	30	216	134	164%	33%	-52	-63%	-13%	True
		WB	320	192	51	293	101	52%	31%	-141	-73%	-44%	True
4	K Street NW and 19th Street NW	EB	320	160	97	353	193	120%	60%	-63	-39%	-20%	True
		WB	410	41	3	55	14	35%	3%	-38	-93%	-9%	True
5	K Street NW and 18th Street NW	EB	410	82	1	40	-42	-51%	-10%	-81	-98%	-20%	False
		WB	520	156	17	212	56	36%	11%	-139	-89%	-27%	True
6	K Street NW and Connecticut Avenue	EB	520	52	44	186	134	258%	26%	-8	-15%	-2%	True
		WB	145	145	50	216	71	49%	49%	-95	-65%	-65%	True
7	K Street NW and 17th Street NW (east)	WB	460	92	12	142	50	55%	11%	-80	-87%	-17%	True
8	K Street NW and 16th Street NW	EB	460	46	2	63	17	37%	4%	-44	-95%	-10%	True
		WB	450	135	14	163	28	21%	6%	-121	-90%	-27%	True
9	K Street NW and 15th Street NW (west)	EB	450	0	1	37	37	--	8%	1	--	0%	False
		WB	160	160	50	278	118	74%	74%	-110	-69%	-69%	True
10	K Street NW and Vermont Avenue	WB	360	216	35	253	37	17%	10%	-181	-84%	-50%	True
11	K Street NW and 14th Street NW	EB	360	18	4	91	73	406%	20%	-14	-76%	-4%	True
		WB	530	318	34	196	-122	-38%	-23%	-284	-89%	-54%	False
12	K Street NW and 13th Street NW	WB	330	165	22	223	58	35%	18%	-143	-87%	-43%	True
13	K Street NW and 12th Street NW	EB	330	33	0	27	-6	-17%	-2%	-33	-99%	-10%	False

¹ Percent difference with respect to storage space

Network Gridlock Check

Inputs

Confidence Interval:	95%
Tolerance Error:	10%

Runs (Seeds)	Ave Delay PVs	Latend Demand	Ave Speed PVs	Ave Delay Stop PVs	Total Delay PVs	PVs Active @ End of Simulation	Total PVs Arrived
1	59.71	0	11.2	44.0	2.6	548	42881
2	62.35	14	10.9	45.6	2.7	631	42646
3	57.05	1	11.5	41.8	2.5	581	42593
4	60.88	0	11.1	44.8	2.6	584	42783
5	60.87	0	11.1	45.0	2.6	607	42467
6	57.32	0	11.5	41.9	2.5	592	42739
7	58.81	0	11.3	43.2	2.5	534	42605
8	60.70	0	11.1	44.6	2.6	589	42730
9	56.92	0	11.5	41.7	2.5	560	42702
10	55.96	0	11.6	41.0	2.4	537	42903

Statistics

X _s =	59.1	1.5	11.3	43.4	2.6	576.3	42704.9
S _s =	2.2	4.4	0.2	1.7	0.1	31.3	133.6
E =	5.9	0.2	1.1	4.3	0.3	57.6	4270.5
t =	3.18	3.18	3.18	3.18	3.18	3.18	3.18

Sampling Error =	3.43	7.01	0.35	2.63	0.15	49.82	212.64
95% Interval Lower =	55.6	-5.5	10.9	40.7	2.4	526.5	42492.3
95% Interval Upper =	62.5	8.5	11.6	46.0	2.7	626.1	42917.5
% of Sample Mean =	5.81%	467.11%	3.10%	6.06%	5.76%	8.65%	0.50%

Attachment B: PM Existing Conditions Calibration Results

PM Existing Conditions Model Calibration Summary

PM Peak Hour: 4:45PM-5:45PM

PM Peak Period: 4:15PM-6:15PM

Calibration Item	Basis	Criteria	Value	Target	Criteria Met
Simulated Vehicular Throughput (Individual Links)	All Segments and Approaches	Within \pm 100 vph for < 700 vph			Yes
		Within \pm 15% for \geq 700 vph to < 2,700 vph			
		Within \pm 400 vph for \geq 2,700 vph			
		GEH < 5 for individual link flows	100%	85%	Yes
Simulated Vehicular Throughput (Network Wide)	Total Volume throughout Network on K Street Corridor	GEH < 4 for total network volume	2.6	4.0	Yes
		Within 5% of total network volume	-1.4%	5%	Yes
Simulated Travel Time	Travel Time Segments (n=2)	Within \pm 15% for observed travel times on K Street NW	100%	85%	Yes
Bottleneck and Queue Impact Verification	Targeted Critical Locations	Maximum observed queue lengths will be compared with simulated queue lengths at critical intersection approaches. Since full peak period observations of queues were not collected, this comparison will be qualitative.			Yes
Required Sample Size			10		

*Findings Represent Results from 10 Simulation Runs

Intersection Volume Calibration

PM Peak Hour: 4:45PM-5:45PM

85% of All Intersection Approaches within the following Volume Criteria		Number of Approaches		Passing Approaches		Percent	Target	Target Met
Within \pm 100 vph for < 700 vph	67	103	67	103	100%	85%	Yes	
Within \pm 15% for \geq 700 vph to < 2,700 vph	36		36					
Within \pm 400 vph for \geq 2,700 vph	0		0					

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)	
1	K Street NW and 22nd Street NW	NB	LT - SL	13	292	11	-2	-15%
			TH	247		226		
			RT - SL	32		32		
		EB	TH	258	258	255	-3	-1%
			WB	1,043		1,162		
		EB Service Lane	LT	21	128	21	0	0%
			TH	107		129		
		WB Service Lane	UT	71	342	71	-1	0%
			TH	179		181		
			RT	92		89		
		Intersection		2,063	2,177		114	6%
2	K Street NW and 21st Street NW	SB	LT - SL	33	857	31	-2	-6%
			LT	63		68		
			TH	516		499		
			RT	203		191		
			RT - SL	42		40		
		EB	TH	258	258	251	-7	-3%
			TH - SL	0		0		
			RT	0		0		
		WB	LT	5	1,049	10	5	100%
			TH	1,000		967		
			TH - SL	44		41		
		EB Service Lane	TH - ML	44	233	46	-3	-3%
			TH	83		96		
			RT	106		109		
		WB Service Lane	TH - ML	1	215	2	1	100%
			TH	214		214		
		Intersection		2,612	2,565		-47	-2%
3	K Street NW and 20th Street NW	NB	LT - SL	11	639	9	-2	-18%
			LT	122		125		
			TH	385		391		
			RT	62		83		
			RT - SL	59		58		
		EB	LT	18	392	17	-1	-6%
			TH	369		387		
			TH - SL	5		4		
		WB	TH	874	885	842	-32	-4%
			TH - SL	5		4		
			RT	6		5		
		EB Service Lane	TH - ML	3	74	3	0	0%
			TH	71		68		
		WB Service Lane	TH - ML	1	217	1	-1	-4%
			TH	40		43		
			RT	176		175		
		Intersection		2,207	2,215		8	0%

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)	
4	K Street NW and 19th Street NW	SB	LT - SL	6	881	7	11	17%
			LT	54		54		0%
			TH	683		691		1%
			RT	74		76		3%
			RT - SL	64		64		0%
		EB	TH	429	438	466	37	9%
			TH - SL	6		5	36	-17%
			RT	3		3		0%
		WB	LT	18	869	32	14	78%
			TH	825		791	-18	-4%
			TH - SL	26		28		8%
		EB Service Lane	TH - ML	0	216	0	0	-
			TH	40		37	3	-8%
			RT	176		182		3%
		WB Service Lane	TH	102	102	100	-2	-2%
		Intersection		2,506	2,536		30	1%
5	K Street NW and 18th Street NW	NB	LT - SL	1	725	1	0	0%
			LT	131		135	4	3%
			TH	486		501	15	3%
			RT	70		75	5	7%
			RT - SL	37		38	1	3%
		EB	LT	1	476	1	0	0%
			TH	467		496	29	6%
			TH - SL	8		7	-1	-13%
		WB	TH	811	813	786	-25	-3%
			TH - SL	1		1	0	0%
			RT	1		1	0	0%
		EB Service Lane	TH - ML	3	49	3	0	0%
			TH	46		44	-2	-4%
		WB Service Lane	TH	10	104	10	0	0%
			RT	94		91	-3	-3%
		Intersection		2,167	2,190		23	1%
6	K Street NW and Connecticut Avenue	NB	TH	589	647	621	32	5%
			RT	56		61	5	9%
			LT - SL	12		12	0	0%
		SB	TH	712	879	645	-67	-9%
			RT	74		62	-12	-16%
			RT - SL	81		74	-7	-9%
		EB	LT	1	729	1	0	0%
			TH	728		742	14	2%
			TH - SL	0		0	0	-
		WB	LT	28	933	26	-2	-7%
			TH	807		794	-13	-2%
			TH - SL	96		93	-3	-3%
		EB Service Lane	RT	2	135	2	0	0%
			TH - ML	0		0	0	-
			RT	135		120	-15	-11%
		WB Service Lane	RT	188	188	186	-2	-1%
		Intersection		3,511	3,439		-72	-2%

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)	
7	K Street NW and 17th Street NW (east)	NB	LT - SL	9	181	9	0	0%
			LT	28		31		
			TH	120		122		
			RT	10		10		
			RT - SL	14		13		
		SB	LT - SL	3	329	3	-3	-1%
			LT	38		38		
			TH	169		168		
			RT	90		85		
			RT - SL	29		32		
		EB	LT	2	796	2	19	2%
			TH	706		722		
			TH - SL	16		16		
			RT	72		75		
		WB	LT	0	852	0	-21	-2%
			TH	813		794		
			TH - SL	39		37		
		WB Service Lane	TH - ML	2	183	2	-2	-1%
			TH	111		108		
			RT	70		71		
Intersection			2,341		2,338	-3	0%	
8	K Street NW and 16th Street NW	NB	LT - SL	0	330	0	-10	-3%
			LT	8		9		
			TH	280		269		
			RT	23		24		
			RT - SL	19		18		
		SB	LT	113	551	118	9	2%
			TH	331		340		
			RT	70		65		
			RT - SL	35		35		
		EB	LT	6	615	9	17	3%
			TH	606		619		
			TH - SL	3		4		
			RT	0		0		
		WB	TH	607	661	606	-1	0%
			TH - SL	53		53		
			RT	0		0		
		EB Service Lane	TH - ML	2	42	3	0	0%
			TH	3		3		
			RT	37		36		
		WB Service Lane	TH - ML	2	237	2	3	1%
			TH	77		73		
			RT	158		165		
Intersection			2,436		2,454	18	1%	
9	K Street NW and 15th Street NW (west)	NB	LT - SL	8	374	7	6	2%
			LT	40		43		
			TH	310		309		
			RT	16		21		
			LT	8		11		
			TH	148		176		
		SB	RT	64	244	73	44	18%
			RT - SL	24		28		
			LT	1		1		
		EB	TH	805	823	0	-11	-1%
			TH - SL	17		811		
			RT	50		0		
		WB	TH	770	886	46	-12	-1%
			TH - SL	57		749		
			RT	9		66		
			TH - ML	0		13		
		EB Service Lane	RT	18	18	0	0	0%
			TH	34		18		
		WB Service Lane	RT	152	186	32	1	1%
			TH	152		155		
Intersection			2,531		2,559	28	1%	

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)	
10	K Street NW and Vermont Avenue	NB	LT - SL	19	279	21	1	11%
			LT	73		71		-3%
			TH	135		136		1%
			RT	30		28		-7%
			RT - SL	22		24		9%
		SB	LT - SL	33	170	30	-29	-9%
			LT	47		41		-13%
			RT	62		48		-23%
			RT - SL	28		22		-21%
		EB	LT	84	829	77	10	-8%
			TH	673		689		2%
			TH - SL	72		73		1%
			TH	750		758		1%
		WB	TH - SL	32	782	33	9	3%
			RT	0		0		-
			TH - ML	1		1		0%
		WB Service Lane	TH	112	176	111	-3	-1%
			RT	63		61		-3%
			Intersection	2,236		2,224		-1%
11	K Street NW and 14th Street NW	NB	LT - SL	27	729	28	49	4%
			LT	98		111		13%
			TH	565		598		6%
			RT	39		41		5%
			LT	28		27		-4%
			TH	629		626		0%
			RT	23		21		-9%
		SB	RT - SL	30	710	28	-8	-7%
			LT	4		4		0%
			TH	658		671		2%
			RT	19		20		5%
		WB	LT	3	677	4	2	33%
			TH	660		662		0%
			TH - SL	12		11		-8%
			RT	2		2		0%
		EB Service Lane	TH - ML	6	202	6	2	0%
			RT	196		198		1%
		WB Service Lane	TH	116	183	115	-3	-1%
			RT	66		64		-3%
		Intersection		3,182		3,238		56
12	K Street NW and 13th Street NW	NB	LT - SL	18	678	18	24	0%
			LT	170		181		6%
			TH	473		485		3%
			RT	14		15		7%
			RT - SL	3		3		0%
		SB	LT	26	694	25	11	-4%
			TH	552		568		3%
			RT	74		71		-4%
			RT - SL	42		41		-2%
		EB	TH	625	731	621	8	-1%
			RT	91		104		14%
		WB	LT	1	485	1	10	1%
			TH	463		473		2%
			TH - SL	19		19		0%
			RT	2		2		0%
		WB Service Lane	TH - ML	4	102	4	0	0%
			TH	52		51		-2%
			RT	46		47		2%
		Intersection		2,690		2,743		53
								2%

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)
13	K Street NW and 12th Street NW	NB	LT - SL	41	883	40	-1
			LT	160		163	
			TH	606		593	
			RT	76		70	
		EB	LT	142	652	133	-2
			TH	510		517	
			TH	308		320	
		WB	TH - SL	61	418	57	8
			RT	49		49	
		EB Service Lane	TH - ML	3	3	2	-1
		Intersection		1,956	1,944		-12
							-1%
14	K Street NW and 11th Street NW	NB	LT	152	442	157	1
			TH	239		238	
			RT	51		48	
			LT	34		32	
			TH	437		427	
		EB	RT	67	538	71	-8
			LT	67		61	
			TH	342		324	
		WB	RT	139	225	164	1
			LT	13		13	
			TH	192		190	
			RT	20		20	
		Intersection		1,753	1,745		-8
							0%
15	K Street NW and 10th Street NW	SB	LT	32	445	33	-9
			TH	302		293	
			RT	111		110	
			TH	180	444	168	-23
			RT	264		253	
		EB	LT	37	132	36	-2
			TH	95		94	
			Intersection		987		-34
							-3%
16	K Street NW and 9th Street NW	SB	TH	781	864	804	20
			RT	83		80	
			RT	182		173	
		Intersection		1,046	1,057		11
							1%
17	L Street NW and 21st Street NW	SB	LT	188	880	192	-2
			TH	692		686	
			TH	492		483	
			RT	165		156	
		Intersection		1,537	1,517		-20
							-1%
18	Pennsylvania Avenue NW and 21st Street NW	SB	LT	142	627	139	-13
			TH	394		386	
			RT	91		89	
			TH	554	654	563	8
			RT	100		99	
		EB	LT	267	825	264	14
			TH	558		575	
			Intersection		2,106		9
							0%
19	L Street NW and Connecticut Avenue	NB	TH	689	780	723	32
			RT	91		89	
			TH	750		695	
		SB	LT	151	1,068	146	-55
			TH	788		779	
			RT	129		126	
			Intersection		2,598		-40
							-2%
20	I Street NW and 17th Street NW (west)	NB	LT	58	591	59	26
			TH	533		558	
			TH	803		724	
			RT	78		69	
		SB	LT	442	881	443	-88
			TH	592		594	
			RT	114		134	
			Intersection		2,620		-39
							-1%

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)		Difference (vph)		Difference (%)		
21	L Street NW and 16th Street NW	NB	TH	377	444	371	437	-6	-7	-2%	-2%
			RT	67		66		-1		-1%	
			LT	103		103		0		0%	
			TH	460		470		10		2%	
		EB	LT	214	967	215	964	1	-3	0%	0%
			TH	662		657		-5		-1%	
			RT	91		92		1		1%	
		Intersection		1,974	1,974		0	0%			
		NB	LT	32	207	32	201	0	-6	0%	-3%
			TH	175		169		-6		-3%	
			TH	165		167		2		1%	
			RT	204		210		6		3%	
22	I Street NW and 16th Street NW	SB	LT	77	369	80	1,000	3	35	4%	4%
			TH	733		765		32		4%	
			RT	155		155		0		0%	
			Intersection		1,541	1,578		37	2%		
		WB	TH	432	965	434	474	2	2	0%	0%
			RT	40		40		0		0%	
			LT	59		58		-1		-2%	
			TH	152		134		-18		-12%	
		EB	LT	225	1,052	173	1,057	-52	5	-23%	0%
			TH	735		719		-16		-2%	
			RT	92		165		73		79%	
		Intersection		1,735	1,723		-12	-1%			
23	L Street NW and 15th Street NW (west)	NB	TH	518	472	538	657	20	20	4%	3%
			RT	119		119		0		0%	
			LT	77		78		1		1%	
			TH	545		552		7		1%	
		EB	LT	71	961	68	950	-3	-11	-4%	-1%
			TH	725		724		-1		0%	
			RT	165		158		-7		-4%	
		Intersection		2,220	2,237		17	1%			
		SB	LT	254	941	256	964	2	23	1%	2%
			TH	687		708		21		3%	
			TH	785		754		-31		-4%	
			RT	62		60		-2		-3%	
25	I Street NW and 14th Street NW	WB	LT	128	777	127	832	-1	55	-1%	7%
			TH	607		633		26		4%	
			RT	42		72		30		71%	
			Intersection		2,565	2,610		45	2%		

*Results show the average from 10 simulation runs.

Intersection Delay and Estimated LOS

PM Peak Hour: 4:45PM-5:45PM

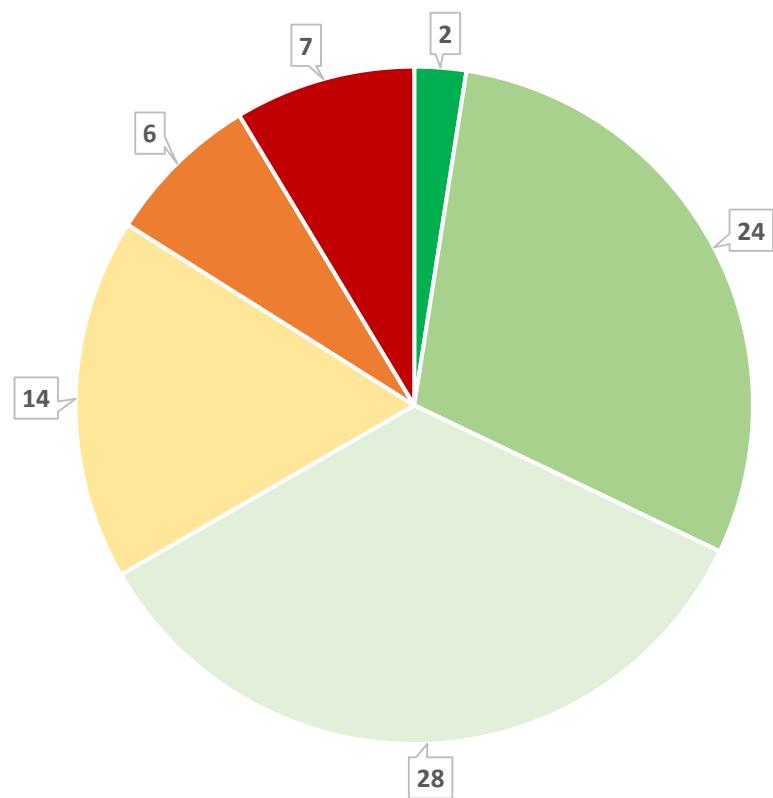
#	Intersection	Approach	Average Delay (sec/veh)	Approach LOS	Intersection Delay	Intersection LOS
1	K Street NW and 22nd Street NW	NB	29.2	C	32.8	C
		SB	-	-		
		EB Service Lane	10.2	B		
		WB Service Lane	34.2	C		
2	K Street NW and 21st Street NW	NB	-	-	43.7	D
		SB	59.6	E		
		EB	15.8	B		
		WB	44.7	D		
3	K Street NW and 20th Street NW	NB	37.3	D	20.0	C
		SB	-	-		
		EB	13.9	B		
		WB	12.0	B		
4	K Street NW and 19th Street NW	NB	-	-	25.2	C
		SB	33.7	C		
		EB	15.4	B		
		WB	14.7	B		
5	K Street NW and 18th Street NW	NB	28.6	C	21.0	C
		SB	-	-		
		EB	15.7	B		
		WB	18.9	B		
6	K Street NW and Connecticut Avenue	NB	21.5	C	45.7	D
		SB	97.6	F		
		EB	33.9	C		
		WB	11.8	B		
7	K Street NW and 17th Street NW (east)	NB	31.6	C	26.5	C
		SB	38.1	D		
		EB	17.8	B		
		WB	30.9	C		
8	K Street NW and 16th Street NW	NB	40.8	D	25.4	C
		SB	14.7	B		
		EB	35.2	D		
		WB	19.2	B		
9	K Street NW and 15th Street NW (west)	NB	28.5	C	45.5	D
		SB	93.4	F		
		EB	60.8	E		
		WB	30.2	C		
10	K Street NW and Vermont Avenue	NB	44.8	D	50.0	D
		SB	201.6	F		
		EB	34.1	C		
		WB	49.0	D		
11	K Street NW and 14th Street NW	NB	25.4	C	43.5	D
		SB	52.6	D		
		EB	38.1	D		
		WB	70.7	E		
12	K Street NW and 13th Street NW	NB	22.5	C	25.1	C
		SB	35.9	D		
		EB	18.2	B		
		WB	24.5	C		

#	Intersection	Approach	Average Delay (sec/veh)	Approach LOS	Intersection Delay	Intersection LOS
13	K Street NW and 12th Street NW	NB	55.4	E	32.8	C
		SB	-	-		
		EB	12.1	B		
		WB	18.2	B		
14	K Street NW and 11th Street NW	NB	28.7	C	20.9	C
		SB	30.4	C		
		EB	9.2	A		
		WB	11.5	B		
15	K Street NW and 10th Street NW	NB	-	-	21.4	C
		SB	26.9	C		
		EB	16.7	B		
		WB	18.3	B		
16	K Street NW and 9th Street NW	NB	-	-	13.5	B
		SB	5.0	A		
		EB	56.7	E		
		WB	-	-		
17	L Street NW and 21st Street NW	NB	-	-	31.8	C
		SB	32.4	C		
		EB	30.9	C		
		WB	-	-		
18	Pennsylvania Avenue NW and 21st Street NW	NB	-	-	92.3	F
		SB	16.7	B		
		EB	46.9	D		
		WB	183.4	F		
19	L Street NW and Connecticut Avenue	NB	20.5	C	45.0	D
		SB	104.9	F		
		EB	24.4	C		
		WB	-	-		
20	I Street NW and 17th Street NW (west)	NB	26.5	C	66.9	E
		SB	135.4	F		
		EB	-	-		
		WB	41.8	D		
21	L Street NW and 16th Street NW	NB	11.4	B	20.5	C
		SB	25.4	C		
		EB	21.7	C		
		WB	-	-		
22	I Street NW and 16th Street NW	NB	17.9	B	26.0	C
		SB	38.8	D		
		EB	-	-		
		WB	22.8	C		
23	L Street NW and 15th Street NW (west)	NB	16.4	B	18.9	B
		SB	70.0	E		
		EB	10.7	B		
		WB	-	-		
24	L Street NW and 14th Street NW	NB	12.7	B	20.5	C
		SB	23.2	C		
		EB	24.0	C		
		WB	-	-		
25	I Street NW and 14th Street NW	NB	21.3	C	45.4	D
		SB	80.5	F		
		EB	-	-		
		WB	39.0	D		

Intersection Delay and Estimated LOS

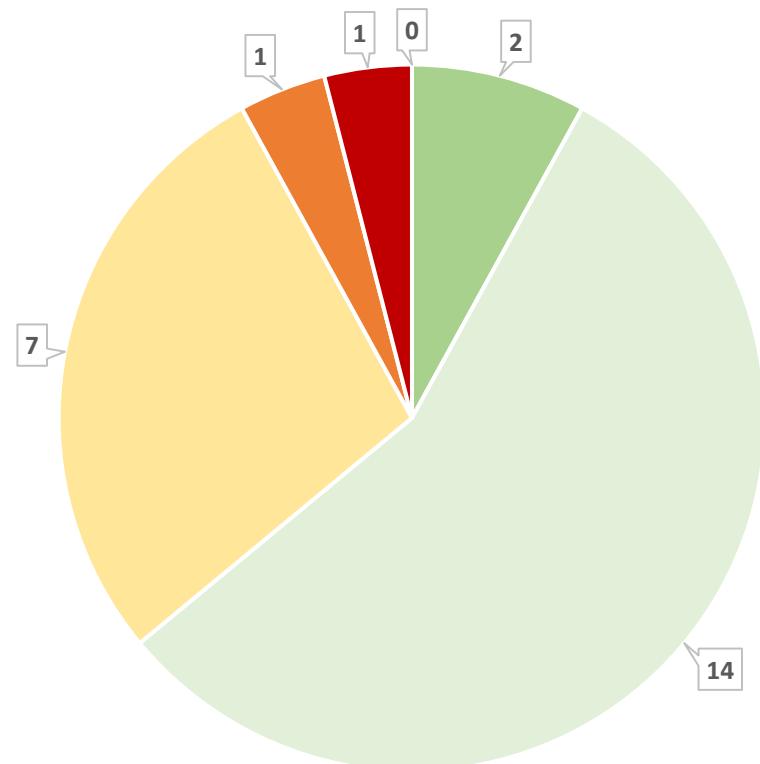
PM Peak Hour: 4:45PM-5:45PM

Approach LOS Summary



Legend:
A
B
C
D
E
F

Intersection LOS Summary



Approach LOS	A	B	C	D	E	F	Intersection LOS	A	B	C	D	E	F
Approach LOS	2	24	28	14	6	7	Intersection LOS	0	2	14	7	1	1

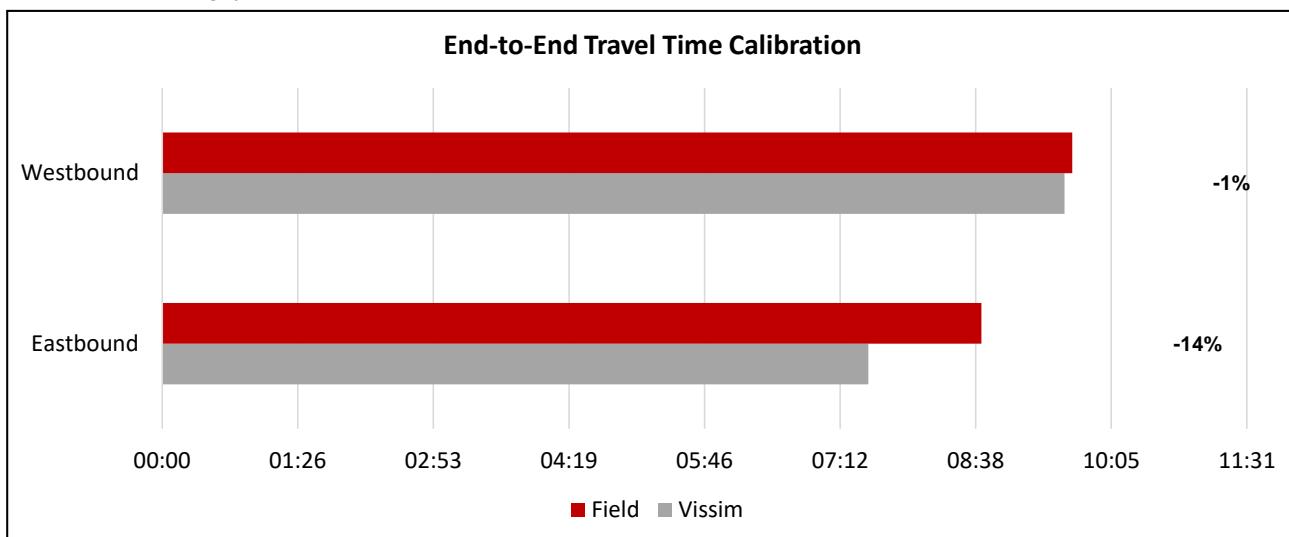
Travel Time | End-to-End Passenger Cars

PM Peak Period: 4:15PM-6:15PM

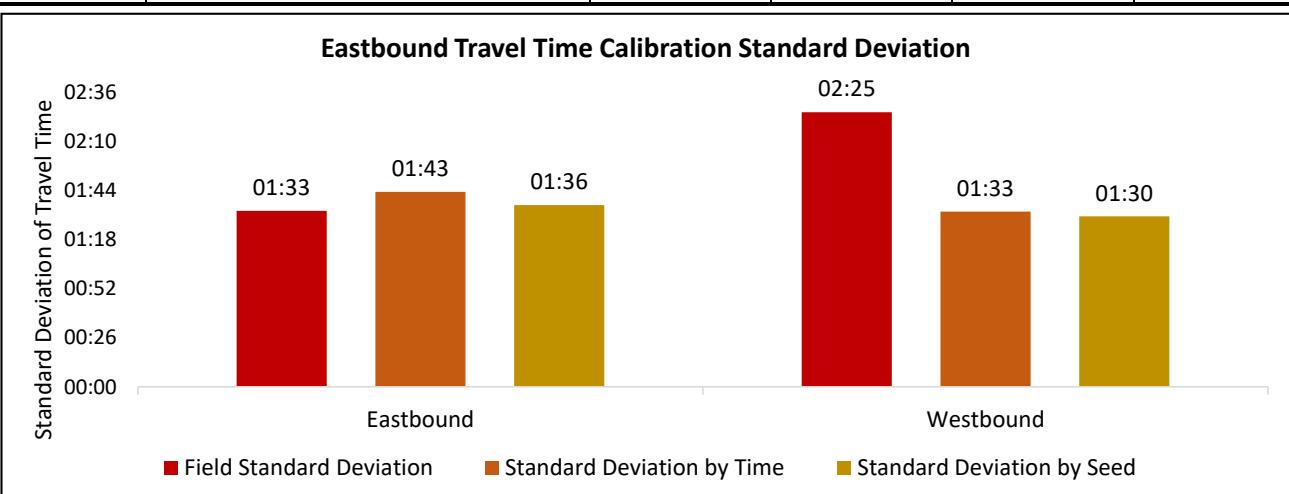
Travel Time Criteria	Number of Segments Passing	Percent	Target	Target Met
85% of Travel Time Segments Within $\pm 15\%$ for observed travel times on K Street NW	2 of 2	100%	85%	Yes

Passenger Vehicle Travel Time Calibration					
Segment ID	Route	Field	Vissim	Difference	
		(MM:SS)	(MM:SS)	(MM:SS)	(%)
9	Eastbound	08:42	07:30	-01:12	-14%
10	Westbound	09:40	09:35	-00:05	-1%

*Results show the average from 10 simulation runs.



Passenger Vehicle Travel Time Statistics					
Segment ID	Route	Field/Vissim Vehicle Count	Field Standard Deviation	Standard Deviation by Time	Standard Deviation by Seed
			(MM:SS)	(MM:SS)	(MM:SS)
9	Eastbound	12 / 102	01:33	01:43	01:36
10	Westbound	13 / 199	02:25	01:33	01:30



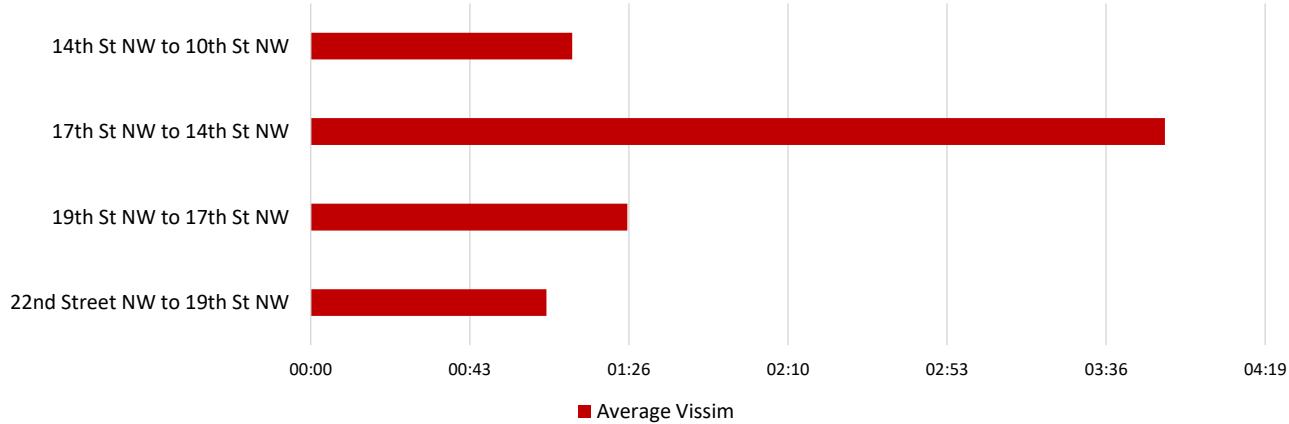
Travel Time | Segment-by-Segment Passenger Cars

PM Peak Period: 4:15PM-6:15PM

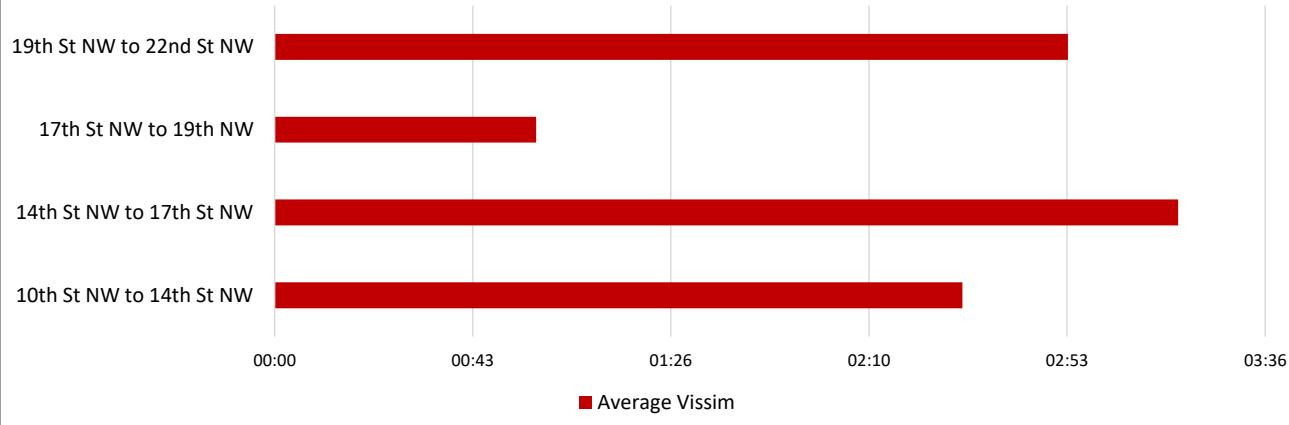
Passenger Vehicle Segment-by-Segment Travel Time Comparison					
Segment ID	Route	Vehicle Count	Average Vissim	Standard Deviation by Time ¹	Standard Deviation by Seed ²
		(MM:SS)	(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	395	01:04	00:04	00:07
2	19th St NW to 17th St NW	710	01:26	00:39	00:40
3	17th St NW to 14th St NW	649	03:52	01:14	01:16
4	14th St NW to 10th St NW	706	01:11	00:03	00:08
Total	Total Eastbound	2460	07:33	02:00	02:11
5	10th St NW to 14th St NW	524	02:30	00:51	01:10
6	14th St NW to 17th St NW	703	03:17	00:23	00:29
7	17th St NW to 19th NW	1321	00:57	00:07	00:11
8	19th St NW to 22nd St NW	1283	02:53	00:22	00:35
Total	Total Westbound	3831	09:37	01:43	02:25

*Results show the average from 10 simulation runs.

Eastbound Travel Time Segments



Westbound Travel Time Segments



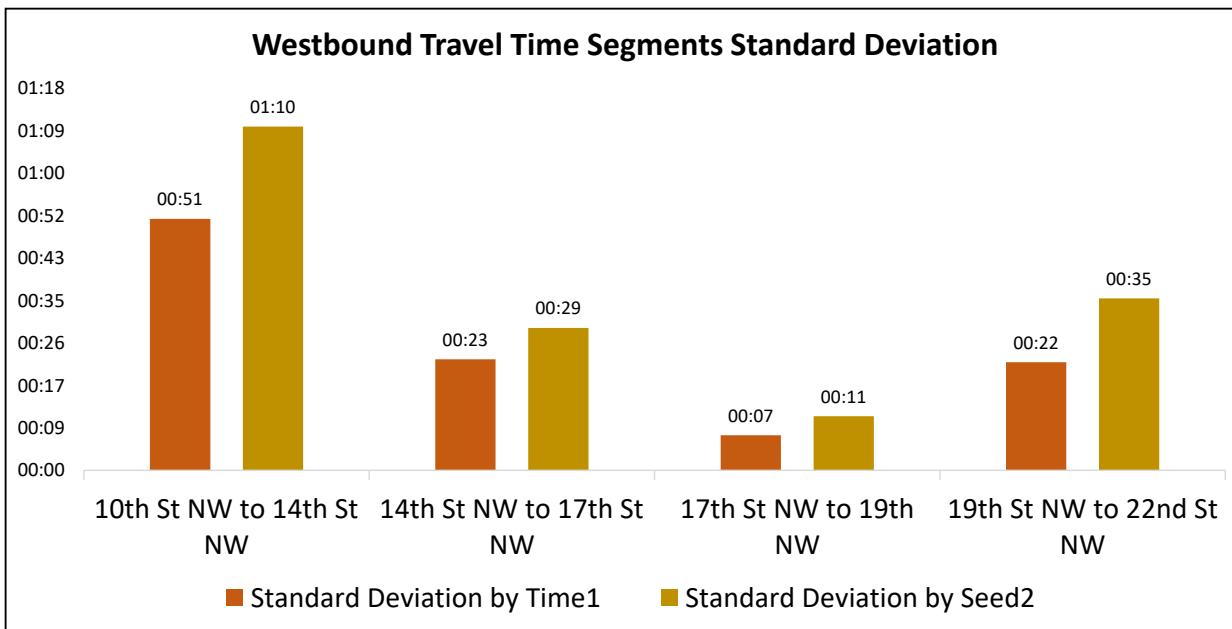
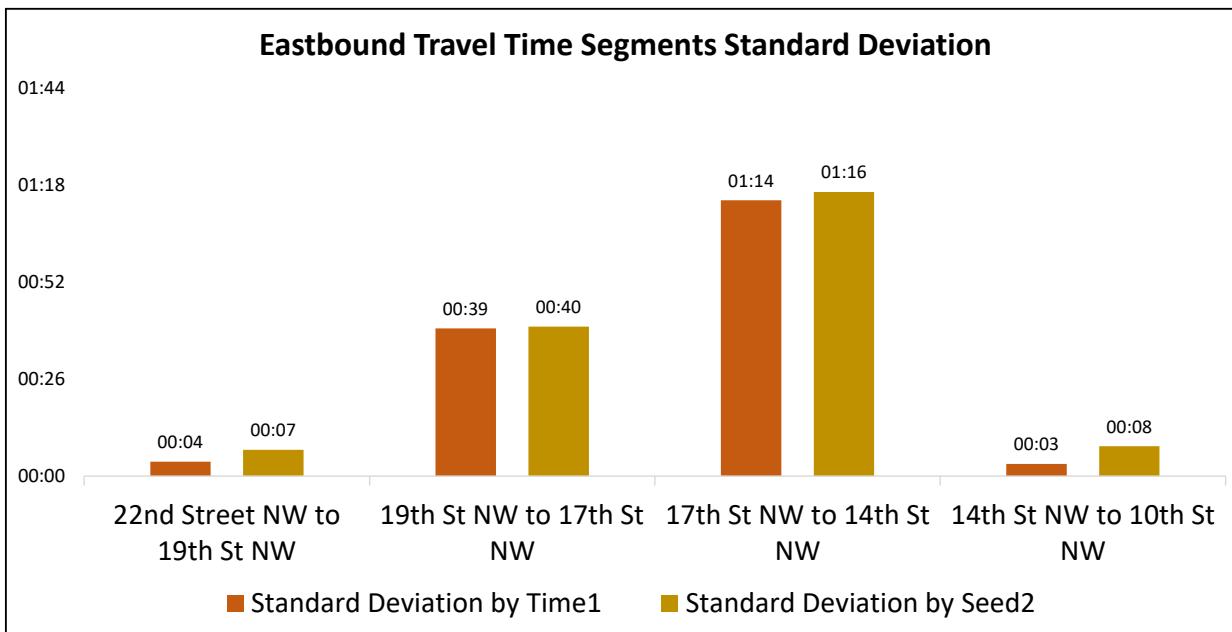
Travel Time | Segment-by-Segment Passenger Cars

PM Peak Period: 4:15PM-6:15PM

*Travel time results collected throughout the 2-hour peak period at 15-minute intervals.

¹Standard deviation by time is standard deviation of the average travel time for all simulation runs in each 15-minute time segment, representing how the average travel time changes throughout the peak period.

²Standard deviation by seed is the average standard deviation of travel times for each 15-minute time segment in the peak period, representing the consistency of travel time throughout the peak period.

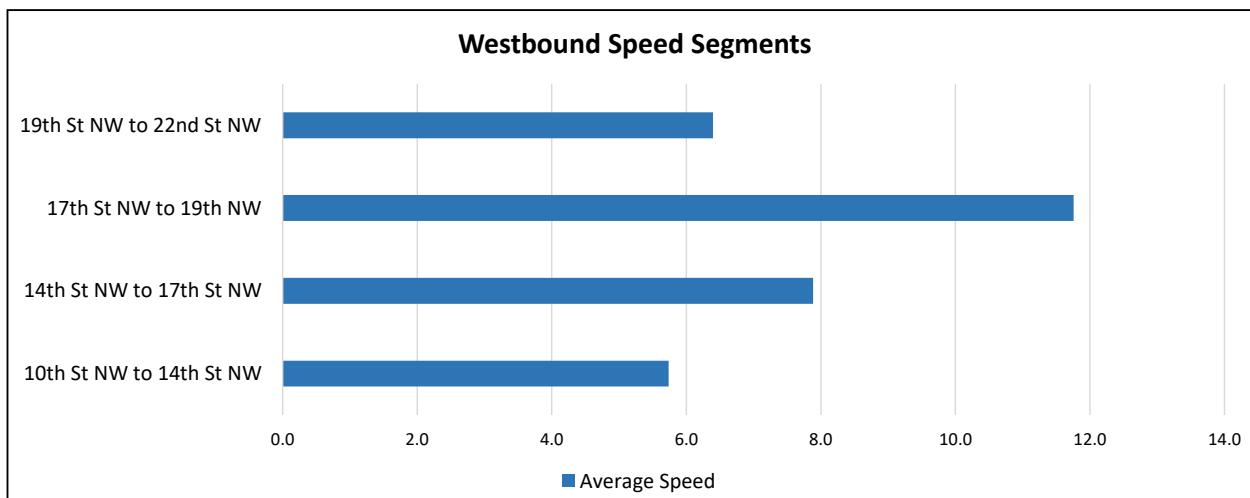
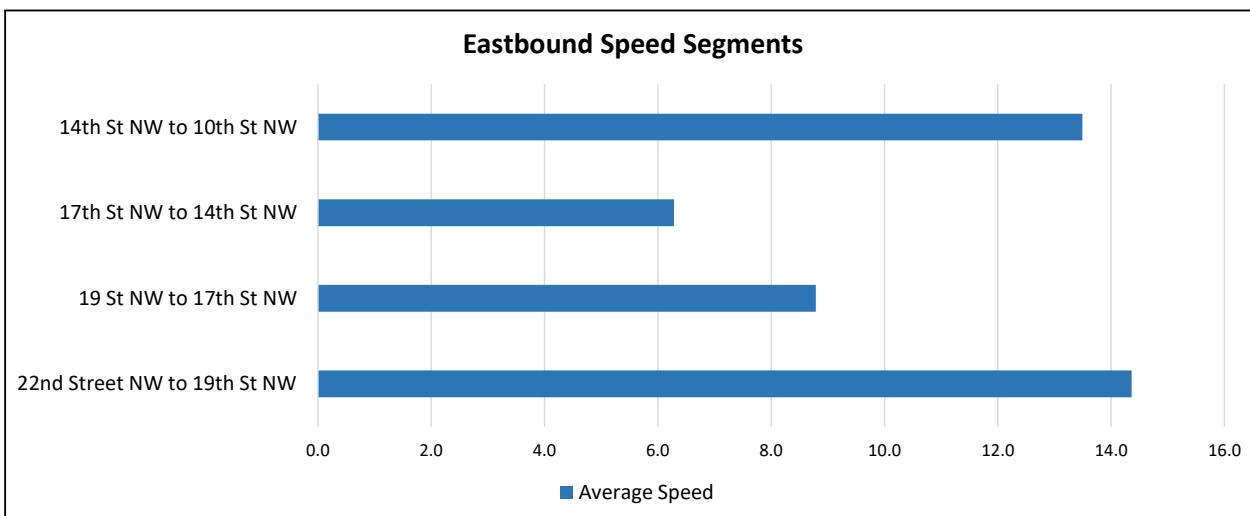


Speed | Segment-by-Segment Passenger Cars

PM Peak Period: 4:15PM-6:15PM

Passenger Vehicle Segment-by-Segment Average Speed Comparison			
Segment ID	Route	Vehicle Count	Average Speed
			MPH
1	22nd Street NW to 19th St NW	395	14.4
2	19 St NW to 17th St NW	710	8.8
3	17th St NW to 14th St NW	649	6.3
4	14th St NW to 10th St NW	706	13.5
Average Eastbound		2460	10.7
5	10th St NW to 14th St NW	524	5.7
6	14th St NW to 17th St NW	703	7.9
7	17th St NW to 19th NW	1321	11.8
8	19th St NW to 22nd St NW	1283	6.4
Average Westbound		3831	7.9

*Results show the average from 10 simulation runs.

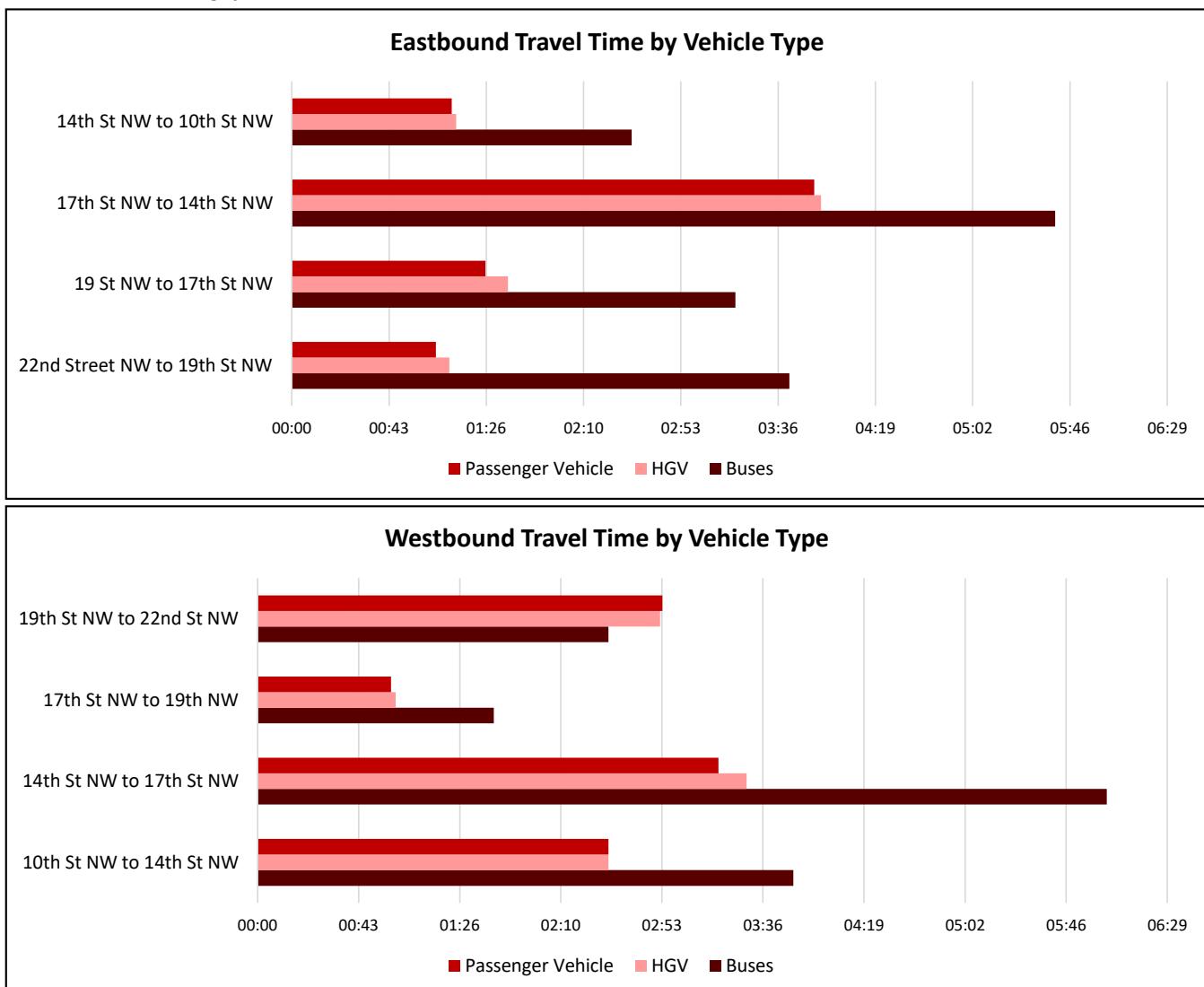


Travel Time | Comparison by Vehicle Type

PM Peak Period: 4:15PM-6:15PM

Travel Time by Vehicle Type				
Segment ID	Route	Passenger Vehicle	HGV	Buses
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:04	01:10	03:41
2	19 St NW to 17th St NW	01:26	01:36	03:17
3	17th St NW to 14th St NW	03:52	03:55	05:39
4	14th St NW to 10th St NW	01:11	01:13	02:31
Total	Total Eastbound	07:33	07:54	15:08
5	10th St NW to 14th St NW	02:30	02:30	03:49
6	14th St NW to 17th St NW	03:17	03:29	06:03
7	17th St NW to 19th NW	00:57	00:59	01:41
8	19th St NW to 22nd St NW	02:53	02:52	02:30
Total	Total Westbound	09:37	09:50	14:03

*Results show the average from 10 simulation runs.

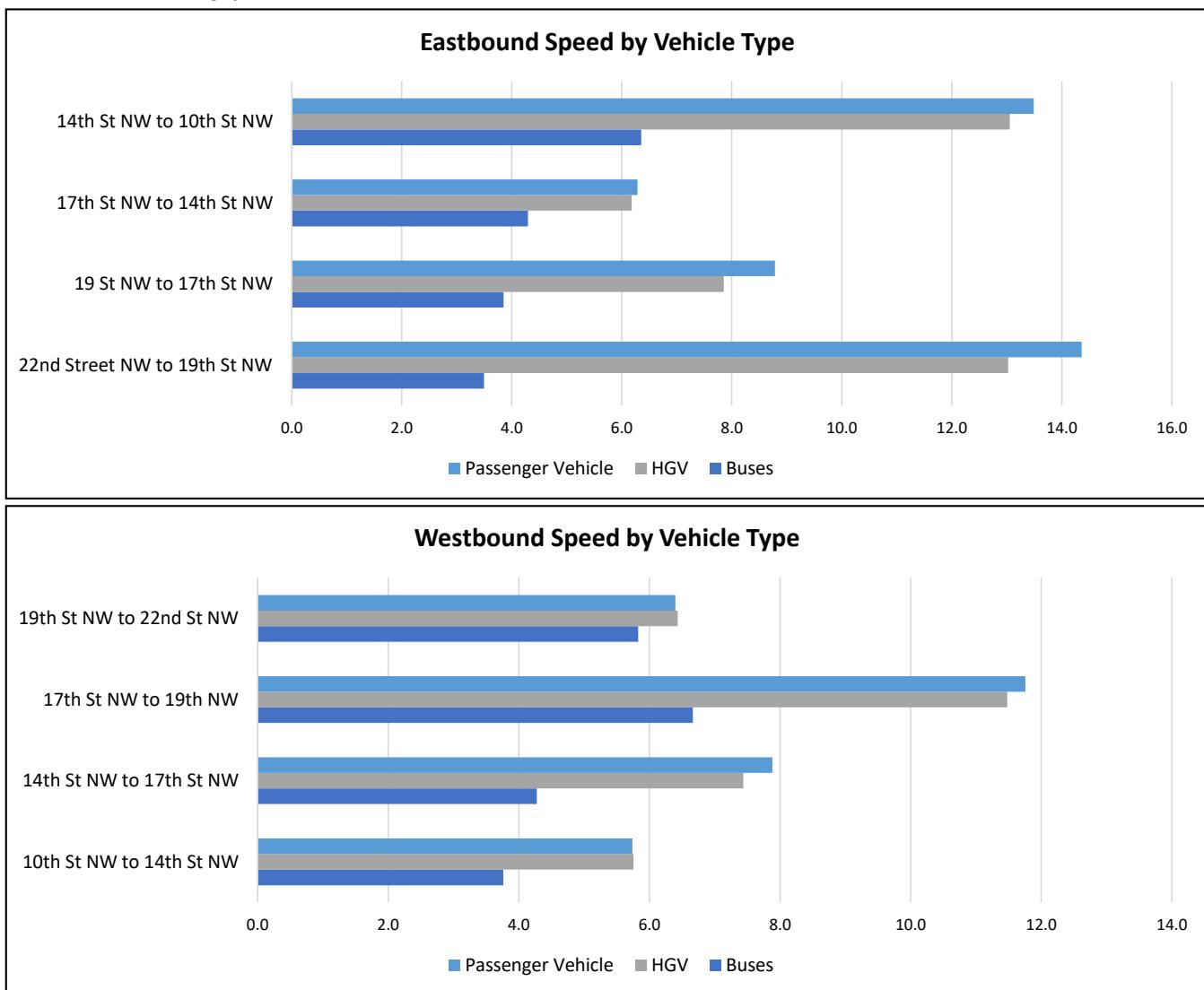


Speed | Comparison by Vehicle Type

PM Peak Period: 4:15PM-6:15PM

Speed by Vehicle Type				
Segment ID	Route	Passenger Vehicle	HGV	Buses
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	14.4	13.0	3.5
2	19 St NW to 17th St NW	8.8	7.9	3.9
3	17th St NW to 14th St NW	6.3	6.2	4.3
4	14th St NW to 10th St NW	13.5	13.1	6.4
Average Eastbound		10.7	10.0	4.5
5	10th St NW to 14th St NW	5.7	5.8	3.8
6	14th St NW to 17th St NW	7.9	7.4	4.3
7	17th St NW to 19th NW	11.8	11.5	6.7
8	19th St NW to 22nd St NW	6.4	6.4	5.8
Average Westbound		7.9	7.8	5.1

*Results show the average from 10 simulation runs.



Travel Time | Comparison by Vehicle Type

PM Peak Period: 4:15PM-6:15PM

Number of Vehicles Represented in Travel Time/Speed by Vehicle Type				
Segment ID	Route	Passenger Vehicle	HGV	Buses
		Vehicle Count	Vehicle Count	Vehicle Count
1	22nd Street NW to 19th St NW	395	19	41
2	19 St NW to 17th St NW	710	38	82
3	17th St NW to 14th St NW	649	38	82
4	14th St NW to 10th St NW	706	41	75
Total	Total Eastbound	2460	136	280
5	10th St NW to 14th St NW	524	28	12
6	14th St NW to 17th St NW	703	38	37
7	17th St NW to 19th NW	1321	66	49
8	19th St NW to 22nd St NW	1283	67	4
Total	Total Westbound	3831	199	102

*Total number of vehicles counted in Travel Time runs through the 2-hour peak period.

GEH of Vehicular Throughput

PM Peak Hour: 4:45PM-5:45PM

GEH Criteria	Value	Percent	Target	Target Met
Total Network Volume with GEH < 4	GEH: 2.6	N/A	4	Yes
Total Network Volume %Difference from Balanced Counts	N/A	-1.4%	5%	Yes
85% of individual links below GEH < 5	103 of 103	100%	85%	Yes

Total K Street NW Volume	Sum of balanced counts	Sum of all link flows	Percent Difference	GEH
	36,918	36,411	-1.4%	2.6

* Bus volume during peak period added to "Sum of balanced counts"

Intersection Approaches	Number of Approaches	Number of Segments with GEH < 5	Number of Segments with GEH >5	Percent Compliance
	103	103	0	100%

The GEH statistic is computed using the following formula:

E = Vissim estimated throughput
V = balanced field count:

$$\text{GEH} = \sqrt{\frac{(E-V)^2}{(E+V)/2}}$$

Sample Size Determination Tool, Version 2.0



<p>Step 1: Input number of MOEs (max is 12). Clear out old data.</p> <p>Step 2: Select type of MOEs</p> <p>Step 3: Insert simulation results from four random seeds for selected MOEs</p>		<p>User Inputs</p> <p>Constants</p> <p>Outputs</p> <p>Sample Size (N) = Number of Model Runs $\text{Sample Mean (X}_s\text{)} = (1/N) (X_1 + X_2 + X_3 \dots + X_N)$ $\text{Sample Standard Deviation (S}_s\text{)} = \sqrt{[(\sum(X-X_s)^2)/(N-1)]}$ $\text{Sampling Error} = t (S_s/\sqrt{N})$ $\text{Confidence Level} = X_s \pm t (S_s/\sqrt{N})$ $\% \text{ of Sample Mean (E)} = \% \text{ Tolerance} * X_s$ $\text{Sample Size Needed} = [(t^2 * (S_s)^2) / (E^2)]$</p> <p>The "t" statistic is the hypothesized number of standard deviations away from the mean corresponding to the required confidence level and sample size in a t-distribution.</p>								
<p>Inputs</p> <p>Confidence Interval: <input type="button" value="95%"/></p> <p>Tolerance Error: <input type="button" value="10%"/></p> <p>Number of MOEs: <input type="button" value="10"/></p>		<p>Output</p> <p>Number of Required Runs: 10</p> <p>*Minimum number of required runs = 10</p>								
Location (optional)	EB K Street	WB K Street	EB (17th/18th)	WB (17th/18th)	EB (13th/14th)	WB (13th/14th)	EB (17th/18th)	WB (17th/18th)	EB (13th/14th)	WB (13th/14th)
Runs (Seeds)	Travel Time	Travel Time	Volume	Volume	Volume	Volume	Speed	Speed	Speed	Speed
1	327	446	1690	1869	1536	1317	19.3	18.5	24.2	18.8
2	317	459	1619	1882	1482	1365	18.2	19.8	24.4	20.8
3	314	467	1553	1912	1502	1361	17.8	20.3	24.6	20.3
4	292	450	1576	1854	1387	1399	17.6	20.3	24.4	23.2
*Results from four random seeds										
Statistics										
X_s =	312.4	455.4	1609.5	1879.3	1476.8	1360.5	18.2	19.7	24.4	20.8
S_s =	15.0	9.2	60.2	24.6	63.9	33.6	0.8	0.8	0.2	1.8
E =	31.2	45.5	161.0	187.9	147.7	136.1	1.8	2.0	2.4	2.1
t =	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18
Sampling Error =	23.82	14.58	95.85	39.22	101.60	53.53	1.23	1.34	0.27	2.88
95% Interval Lower =	288.5	440.8	1513.7	1840.0	1375.1	1307.0	17.0	18.4	24.1	17.9
95% Interval Upper =	336.2	470.0	1705.3	1918.5	1578.4	1414.0	19.4	21.1	24.7	23.7
% of Sample Mean =	7.63%	3.20%	5.96%	2.09%	6.88%	3.93%	6.72%	6.77%	1.12%	13.85%
Sample Size Needed =	4	4	4	4	4	4	4	4	4	8

Intersection Queue Lengths

PM Peak Hour: 4:45PM-5:45PM

Intersection		Approach	Storage (ft)	Max Queue Observed (ft)	Vissim Average Queue (ft)	Vissim Max Queue (ft)	Vissim Max Queue			Vissim Average Queue			Is Max Observed Queue between Average and Max Vissim Queue?
							Queue Difference	% Queue Difference (ft)	% Queue Difference wrt Storage Space ¹	Queue Difference	% Queue Difference (ft)	% Queue Difference wrt Storage Space ¹	
1	K Street NW and 22nd Street NW												
2	K Street NW and 21st Street NW	EB	490	343	14	133	-210	-61%	-43%	-329	-96%	-67%	False
		WB	410	246	157	480	234	95%	57%	-89	-36%	-22%	True
		SB	--	--	221	452	--	--	--	--	--	--	--
3	K Street NW and 20th Street NW	EB	410	164	71	329	165	101%	40%	-93	-57%	-23%	True
		WB	320	320	33	218	-102	-32%	-32%	-287	-90%	-90%	False
	K Street NW and 19th Street NW	EB	320	192	83	336	144	75%	45%	-109	-57%	-34%	True
4	K Street NW and 18th Street NW	WB	410	410	45	281	-129	-31%	-31%	-365	-89%	-89%	False
		EB	410	123	52	263	140	114%	34%	-71	-58%	-17%	True
		WB	520	520	83	315	-205	-39%	-39%	-437	-84%	-84%	False
6	K Street NW and Connecticut Avenue	EB	520	520	124	462	-58	-11%	-11%	-396	-76%	-76%	False
		WB	145	124	48	254	130	105%	89%	-76	-62%	-53%	True
		NB	310	155	64	279	124	80%	40%	-91	-59%	-29%	True
		SB	315	284	221	455	171	60%	54%	-63	-22%	-20%	True
7	K Street NW and 17th Street NW (east)	EB	145	102	80	306	204	200%	141%	-22	-21%	-15%	True
		WB	460	368	86	384	16	4%	3%	-282	-77%	-61%	True
		NB	315	158	17	110	-48	-30%	-15%	-141	-90%	-45%	False
		SB	--	--	45	190	--	--	--	--	--	--	--
8	K Street NW and 16th Street NW	EB	460	276	90	507	231	84%	50%	-186	-67%	-40%	True
		WB	450	225	41	192	-33	-14%	-7%	-184	-82%	-41%	False
		NB	300	270	45	203	-67	-25%	-22%	-225	-83%	-75%	False
		SB	305	305	28	223	-82	-27%	-27%	-277	-91%	-91%	False
9	K Street NW and 15th Street NW (west)	EB	450	450	229	564	114	25%	25%	-221	-49%	-49%	True
		WB	160	160	144	348	188	118%	118%	-16	-10%	-10%	True
		SB	330	165	113	365	200	121%	61%	-52	-31%	-16%	True
10	K Street NW and Vermont Avenue	EB	160	160	107	294	134	84%	84%	-53	-33%	-33%	True
		WB	360	324	161	488	164	50%	45%	-163	-50%	-45%	True
		NB	295	148	32	217	69	46%	23%	-116	-78%	-39%	True
		SB	--	--	178	391	--	--	--	--	--	--	--
11	K Street NW and 14th Street NW	EB	360	360	120	380	20	6%	6%	-240	-67%	-67%	True
		WB	530	265	178	504	239	90%	45%	-87	-33%	-16%	True
		NB	300	300	44	229	-71	-24%	-24%	-256	-85%	-85%	False
		SB	315	221	100	330	109	49%	34%	-121	-55%	-38%	True
12	K Street NW and 13th Street NW	EB	530	265	71	299	34	13%	6%	-194	-73%	-37%	True
		WB	330	198	68	276	78	39%	24%	-130	-66%	-39%	True
		SB	315	221	68	250	29	13%	9%	-153	-69%	-49%	True
13	K Street NW and 12th Street NW	EB	330	99	29	326	227	229%	69%	-70	-70%	-21%	True
		WB	200	200	29	221	21	10%	10%	-171	-85%	-85%	True
14	K Street NW and 11th Street NW	EB	200	200	18	199	-1	-1%	-1%	-182	-91%	-91%	False
		WB	190	95	54	183	88	93%	46%	-41	-43%	-22%	True
		NB	--	--	50	264	--	--	--	--	--	--	--
		SB	--	--	40	219	--	--	--	--	--	--	--
15	K Street NW and 10th Street NW	EB	190	190	32	217	27	14%	14%	-158	-83%	-83%	True
		WB	480	96	9	102	6	6%	1%	-87	-91%	-18%	True
		SB	270	243	42	212	-31	-13%	-11%	-201	-83%	-74%	False
16	K Street NW and 9th Street NW	EB	480	144	74	324	180	125%	37%	-70	-49%	-15%	True

¹ Percent difference with respect to storage space

Intersection Queue Lengths - Service Lanes

PM Peak Hour: 4:45PM-5:45PM

Intersection	Approach	Storage (ft)	Max Queue Observed (ft)	Vissim Average Queue (ft)	Vissim Max Queue (ft)	Vissim Max Queue			Vissim Average Queue			Is Max Observed Queue between Average and Max Vissim Queue?	
						Queue Difference	% Queue Difference (ft)	% Queue Difference wrt Storage Space ¹	Queue Difference	% Queue Difference (ft)	% Queue Difference wrt Storage Space ¹		
1	K Street NW and 22nd Street NW	EB	40	16	7	146	130	814%	326%	-9	-55%	-22%	True
		WB	530	265	46	165	-100	-38%	-19%	-219	-83%	-41%	False
2	K Street NW and 21st Street NW	EB	490	294	56	339	45	15%	9%	-238	-81%	-49%	True
		WB	410	123	16	162	39	32%	10%	-107	-87%	-26%	True
3	K Street NW and 20th Street NW	EB	410	123	8	119	-4	-4%	-1%	-115	-94%	-28%	False
		WB	320	320	9	146	-174	-54%	-54%	-311	-97%	-97%	False
4	K Street NW and 19th Street NW	EB	320	128	58	272	144	112%	45%	-70	-54%	-22%	True
		WB	410	123	6	104	-20	-16%	-5%	-117	-95%	-28%	False
5	K Street NW and 18th Street NW	EB	410	41	3	52	11	26%	3%	-38	-94%	-9%	True
		WB	520	156	5	95	-61	-39%	-12%	-151	-97%	-29%	False
6	K Street NW and Connecticut Avenue	EB	520	520	130	408	-112	-22%	-22%	-390	-75%	-75%	False
		WB	145	145	89	281	136	94%	94%	-56	-38%	-38%	True
7	K Street NW and 17th Street NW (east)	WB	460	368	25	217	-151	-41%	-33%	-343	-93%	-75%	False
8	K Street NW and 16th Street NW	EB	460	23	1	43	20	87%	4%	-22	-97%	-5%	True
		WB	450	180	21	179	-1	-1%	0%	-159	-88%	-35%	False
9	K Street NW and 15th Street NW (west)	EB	450	45	0	33	-12	-26%	-3%	-45	-99%	-10%	False
		WB	160	160	20	185	25	16%	16%	-140	-87%	-87%	True
10	K Street NW and Vermont Avenue	WB	360	144	12	131	-13	-9%	-3%	-132	-92%	-37%	False
11	K Street NW and 14th Street NW	EB	360	180	19	181	1	1%	0%	-161	-90%	-45%	True
		WB	530	106	26	185	79	74%	15%	-80	-75%	-15%	True
12	K Street NW and 13th Street NW	WB	330	33	16	188	155	469%	47%	-17	-51%	-5%	True
13	K Street NW and 12th Street NW	EB	330	0	0	14	14	--	4%	0	--	0%	False

¹ Percent difference with respect to storage space

Network Gridlock Check

Inputs

Confidence Interval:	95%
Tolerance Error:	10%

Runs (Seeds)

1
2
3
4
5
6
7
8
9
10

<u>Runs (Seeds)</u>	<u>Ave Delay PVs</u>	<u>Latend Demand</u>	<u>Ave Speed PVs</u>	<u>Ave Delay Stop PVs</u>	<u>Total Delay PVs</u>	<u>PVs Active @ End of Simulation</u>	<u>Total PVs Arrived</u>
1	92.87	136	8.5	67.7	4.1	1024	43164
2	86.40	127	8.9	62.6	3.8	999	43037
3	90.82	115	8.7	66.0	4.0	997	43011
4	91.42	88	8.6	67.2	4.0	1190	42973
5	88.00	210	8.8	64.1	3.9	1166	42793
6	81.91	37	9.2	58.9	3.6	994	43294
7	87.92	120	8.8	63.5	3.9	914	43153
8	77.14	33	9.6	55.6	3.4	876	43202
9	91.02	154	8.7	66.3	4.0	955	43245
10	98.15	68	8.2	72.4	4.4	1088	43402

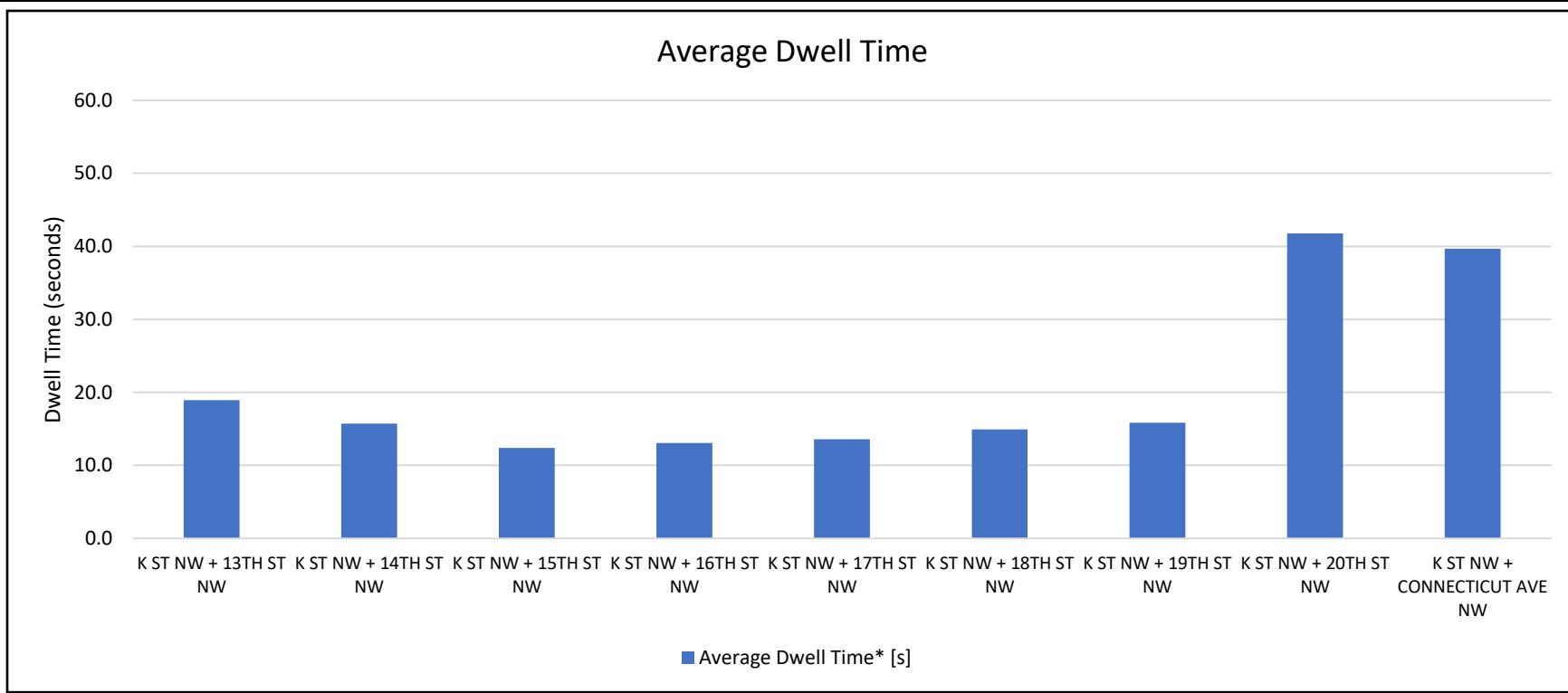
Statistics

X _s =	88.6	108.8	8.8	64.4	3.9	1020.3	43127.4
S _s =	5.9	54.3	0.4	4.7	0.3	101.5	177.0
E =	8.9	10.9	0.9	6.4	0.4	102.0	4312.7
t =	3.18	3.18	3.18	3.18	3.18	3.18	3.18

Sampling Error =	9.34	86.37	0.61	7.54	0.42	161.49	281.63
95% Interval Lower =	79.2	22.4	8.2	56.9	3.5	858.8	42845.8
95% Interval Upper =	97.9	195.2	9.4	72.0	4.3	1181.8	43409.0
% of Sample Mean =	10.54%	79.39%	6.93%	11.70%	10.82%	15.83%	0.65%

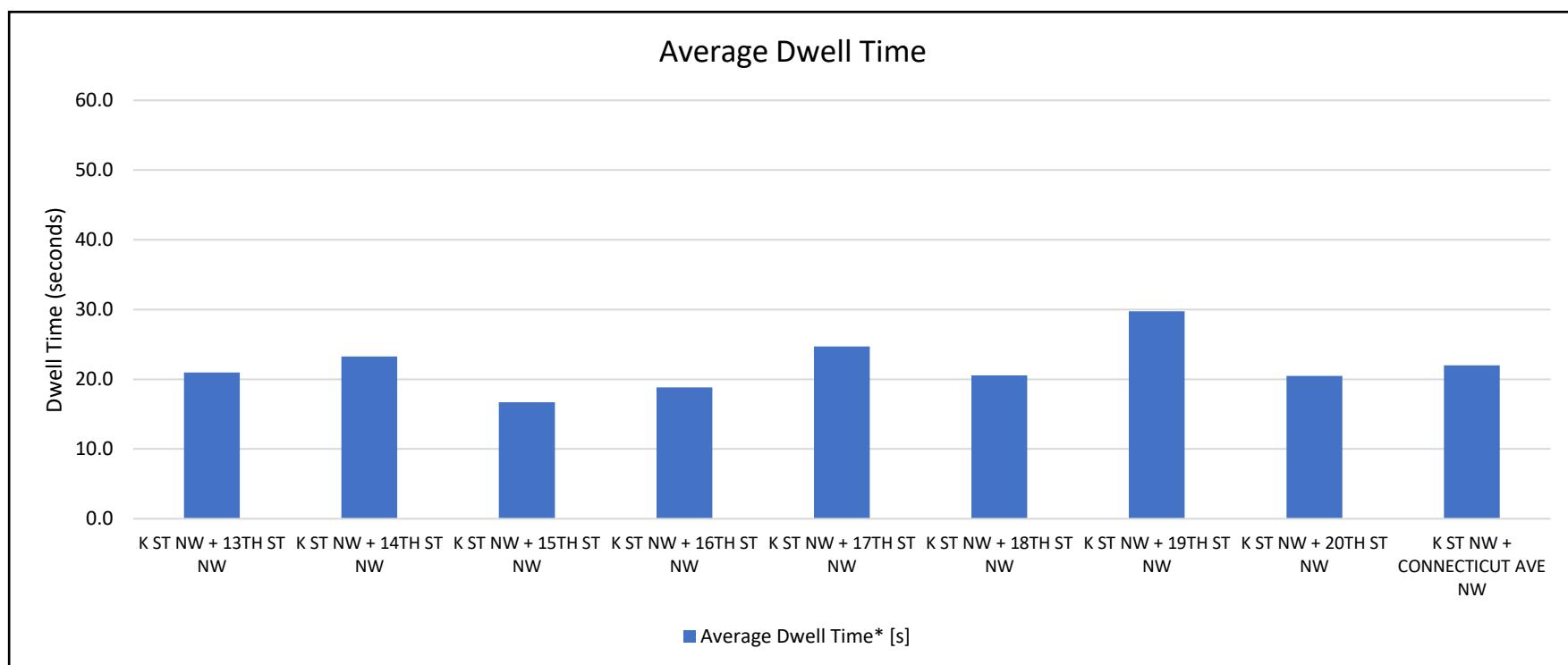
Attachment C: WMATA Bus Dwell Times

WMATA Dwell Time AM, Eastbound				
Stop Locations	Average Dwell Time* [s]	Stdev Dwell Time [s]	95th Percentile Dwell Time [s]	Sample Size
K ST NW + 13TH ST NW	18.9	23.4	60.8	546
K ST NW + 14TH ST NW	15.7	15.6	52.7	284
K ST NW + 15TH ST NW	12.4	19.7	38.6	213
K ST NW + 16TH ST NW	13.1	12.9	40.0	200
K ST NW + 17TH ST NW	13.6	12.1	40.1	418
K ST NW + 18TH ST NW	14.9	21.4	36.2	260
K ST NW + 19TH ST NW	15.8	17.2	50.1	119
K ST NW + 20TH ST NW	41.8	105.6	202.6	55
K ST NW + CONNECTICUT AVE NW	39.7	36.4	89.0	233
Average	20.7	29.4	67.8	259



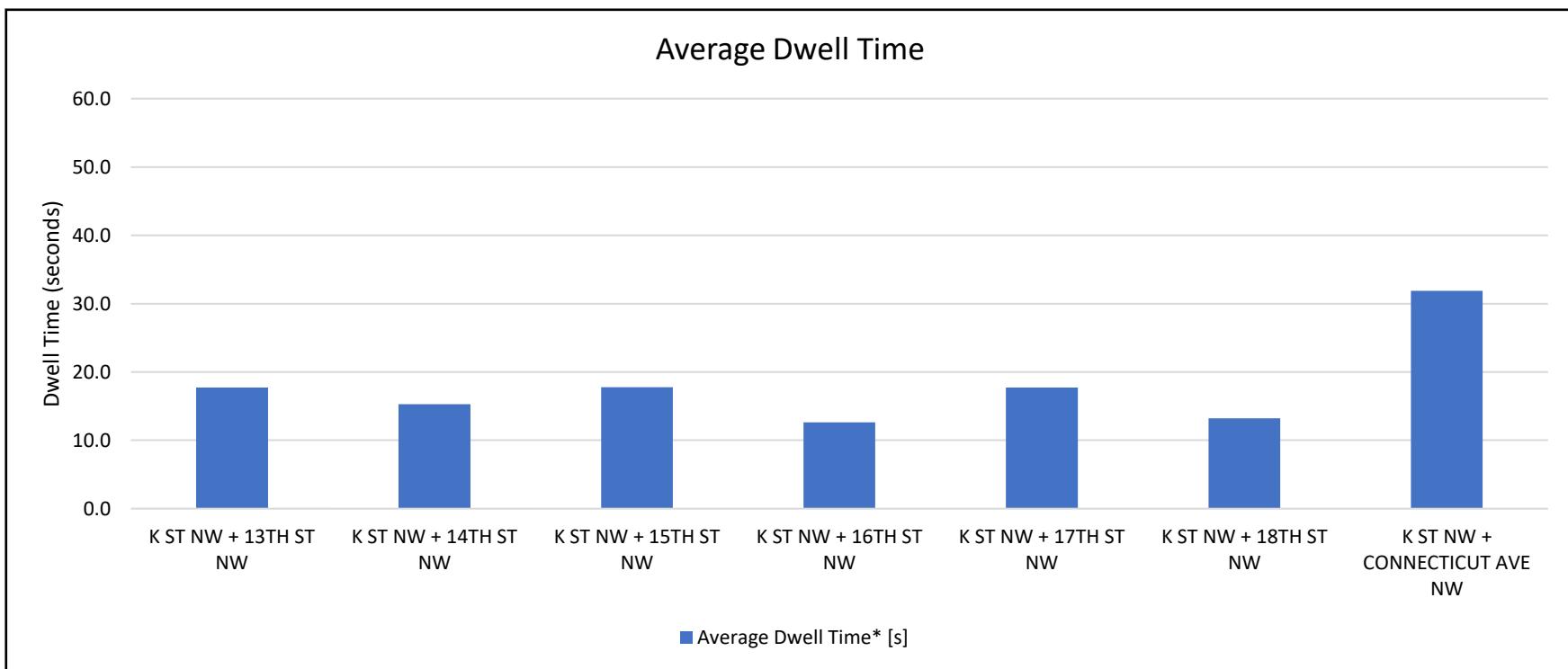
*Average of recorded dwell times for stops greater than 5 seconds with more than 0 passengers boarding or alighting.

WMATA Dwell Time PM, Eastbound				
Stop Locations	Average Dwell Time* [s]	Stdev Dwell Time [s]	95th Percentile Dwell Time [s]	Sample Size
K ST NW + 13TH ST NW	21.0	25.3	252.0	576
K ST NW + 14TH ST NW	23.3	22.9	182.0	414
K ST NW + 15TH ST NW	16.7	23.2	175.0	123
K ST NW + 16TH ST NW	18.9	22.2	199.0	242
K ST NW + 17TH ST NW	24.7	23.3	158.0	482
K ST NW + 18TH ST NW	20.6	33.2	255.0	147
K ST NW + 19TH ST NW	29.7	53.2	433.0	107
K ST NW + 20TH ST NW	20.5	36.7	381.0	98
K ST NW + CONNECTICUT AVE NW	22.0	20.8	103.0	88
Average	21.9	29.0	237.6	253



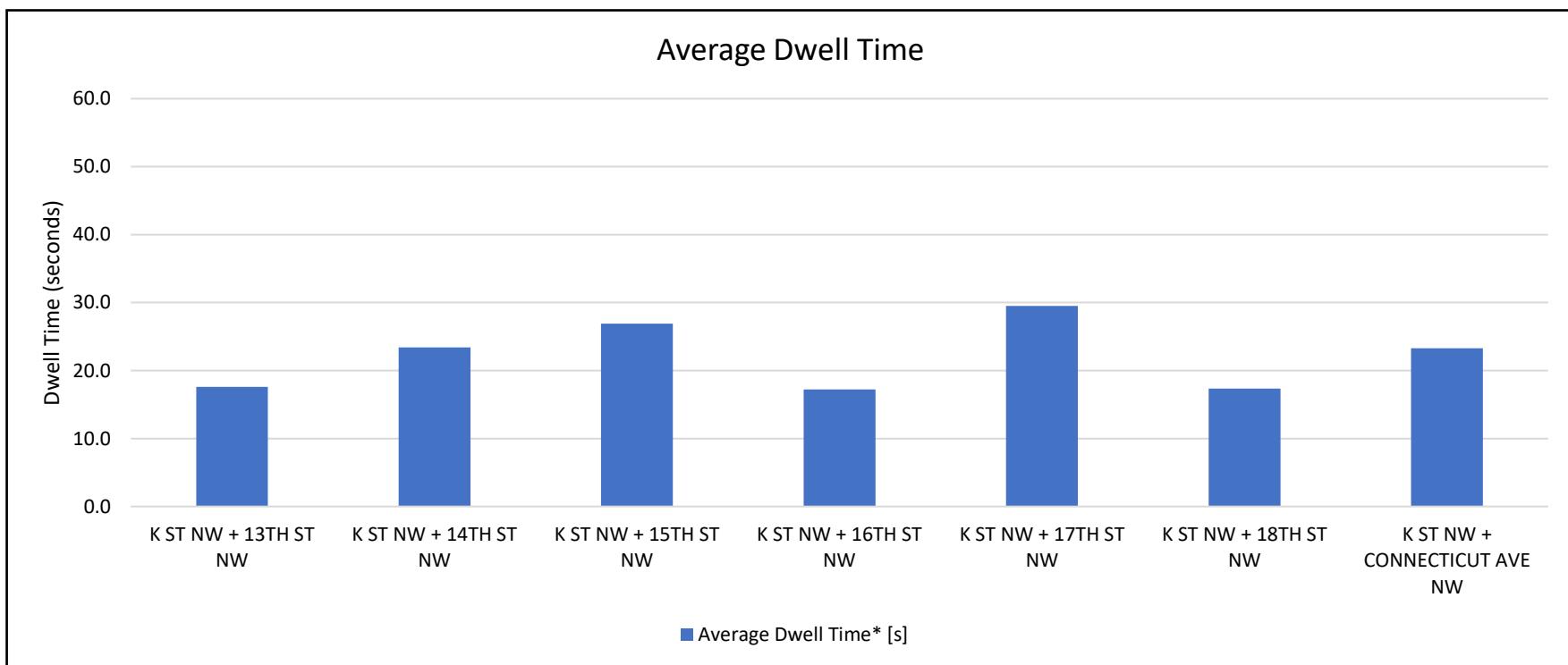
*Average of recorded dwell times for stops greater than 5 seconds with more than 0 passengers boarding or alighting.

WMATA Dwell Time AM, Westbound				
Stop Locations	Average Dwell Time* [s]	Stdev Dwell Time [s]	95th Percentile Dwell Time [s]	Sample Size
K ST NW + 13TH ST NW	17.7	18.7	215.0	574
K ST NW + 14TH ST NW	15.3	13.9	112.0	281
K ST NW + 15TH ST NW	17.8	33.3	242.0	121
K ST NW + 16TH ST NW	12.6	11.6	88.0	190
K ST NW + 17TH ST NW	17.7	19.7	101.0	46
K ST NW + 18TH ST NW	13.2	16.1	168.0	251
K ST NW + 19TH ST NW	--	--	--	--
K ST NW + 20TH ST NW	--	--	--	--
K ST NW + CONNECTICUT AVE NW	31.9	31.4	403.0	396
Average	17.4	19.6	175.4	240



*Average of recorded dwell times for stops greater than 5 seconds with more than 0 passengers boarding or alighting.

WMATA Dwell Time PM, Westbound				
Stop Locations	Average Dwell Time* [s]	Stdev Dwell Time [s]	95th Percentile Dwell Time [s]	Sample Size
K ST NW + 13TH ST NW	17.6	23.2	252.0	397
K ST NW + 14TH ST NW	23.4	26.9	187.0	355
K ST NW + 15TH ST NW	26.9	52.5	324.0	176
K ST NW + 16TH ST NW	17.2	21.9	238.0	257
K ST NW + 17TH ST NW	29.5	25.6	158.0	167
K ST NW + 18TH ST NW	17.4	16.2	119.0	260
K ST NW + 19TH ST NW	--	--	--	--
K ST NW + 20TH ST NW	--	--	--	--
K ST NW + CONNECTICUT AVE NW	23.3	18.4	103.0	381
Average	22.1	30.1	217.3	254



*Average of recorded dwell times for stops greater than 5 seconds with more than 0 passengers boarding or alighting.

Attachment C:

2025 Build Volumes

Observations

MWCOG model shows little to no growth in study area and on K Street NW in 2025 compared to 2019 (No Build TDM run migrating changes to the MWCOG model from calibrated 2019 conditions).

The proposed Build Alternatives have minor impacts on the study area volumes denoted with cut lines 1 through 4. Larger fluctuations in link volume are seen along K Street NW (see **Table 1** and **Figure 1**). Link-by-link average annual growth rates (AAGR) are provided in **Figure 3**.

Forecasting Recommendation

The MWCOG model does not provide sufficient resolution to clearly define changes in travel patterns along K Street NW.

In order to provide a conservative forecast and produce a future model that is comparable with Existing Conditions, it is recommended to use the same volumes from Existing Conditions and adjust traffic flow through the network by replacing restricted movements with plausible alternative routes (see **Figure 2**).

Table 1 Average Annual Growth Rate at Cutline Locations from MWCOG

Cutline/ Segment	Description	2025 24-Hr Modeled Volume - AAGR		2025 AM Modeled Volume - AAGR		2025 PM Modeled Volume - AAGR	
		No Build	Build	No Build	Build	No Build	Build
#1	P St NW to I-66/Theodore Roosevelt Bridge	-0.1%	-0.1%	-0.3%	-0.2%	-0.1%	-0.2%
#2	Rock Creek Pkwy to N Capitol St	-0.2%	-0.2%	-0.6%	-0.6%	-0.4%	-0.5%
#3	New York Ave NW to Constitution Ave NW	0.0%	0.1%	-0.2%	-0.3%	-0.8%	-0.8%
#4	23rd St NW to Louisiana Ave NW	-0.2%	-0.1%	-0.5%	-0.6%	-0.5%	-0.4%
#5	K St NW (West of 21st St NW)	-0.1%	-0.7%	0.0%	0.6%	0.5%	0.0%
#6	K St NW (West of 16th St NW)	0.1%	0.7%	0.0%	0.0%	0.2%	-0.2%
#7	K St NW (West of 11th St NW)	0.5%	-1.4%	0.3%	-1.1%	0.5%	-1.1%

Figure 1 Cutline Locations

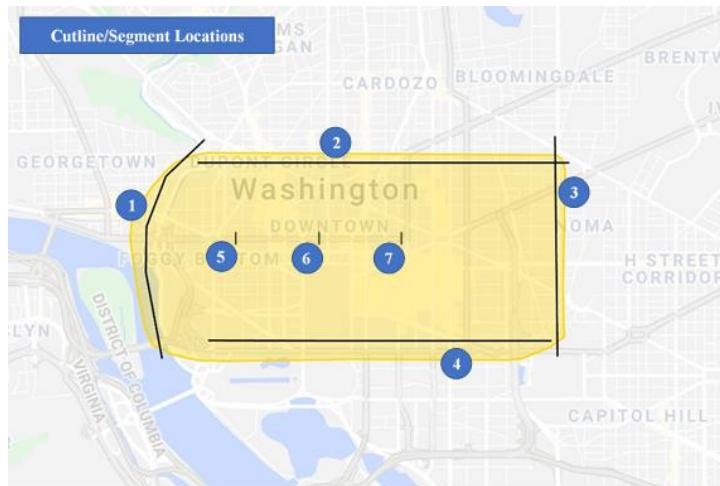
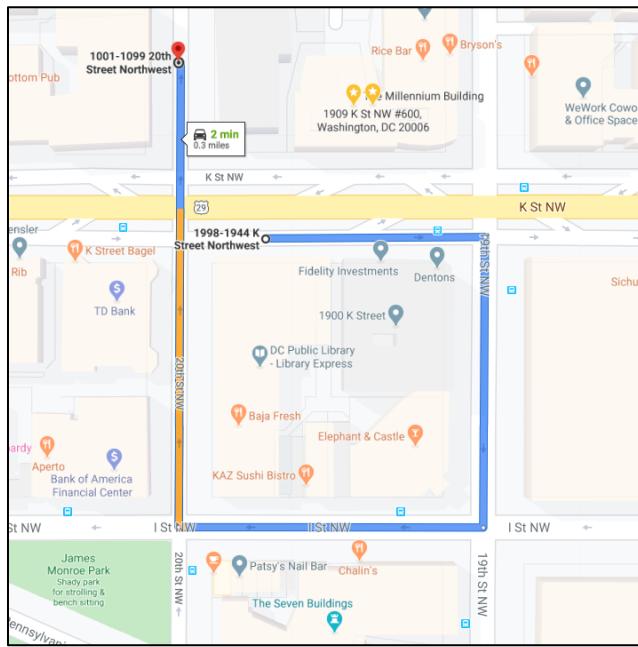


Figure 2 Example re-routing for existing EBL at K Street NW and 20th Street NW



Build Alternatives

The MWCOG model was adjusted for both Build scenarios; however, the model is limited in how it represents turning lanes and through lanes. Therefore, minimal differences exist between the two build scenarios. This supports the development of a single Build Forecast as determined in the Scope of Work.

Alternative 1 – Two Through Lanes

Two through lanes along K Street NW at most major intersections (eastbound and westbound) with right-turn pockets at select locations.

Alternative 2 – One Through Lane

One through lane and one right-turn lane along K Street NW at most major intersections (eastbound and westbound).

K Street NW Traffic Analysis

2025 Routing Assumptions for Alternative 1 and 2

Turn Restrictions

Restricted Movement	From	To	Alternative Movement	Path
EBL	K St NW	20 th St NW	EBR (x3)	19 th St NW to I St NW to 20 th St NW
		18 th St NW		17 th St NW (west) to I St NW to 18 th St NW
		Connecticut Ave NW		16 th St NW to I St NW to 17 th St NW (west)
		17 th St NW		16 th St NW to I St NW to 17 th St NW (east)
		16 th St NW		15 th St NW (west) to I St NW to 16 th St NW
		15 th St NW (west)		14 th St NW to I St NW to 15 th St NW (west)
		Vermont Ave NW		13 th St NW to I St NW to 15 th St NW (east) ¹
		14 th St NW		14 th St NW to I St NW to 15th St NW (east)
		13 th St NW		11 th St NW to I St NW to 12 th St NW
		12 th St NW		
EBR		17 th St NW (east)	EBR	16th St NW ¹
WBL		13 th St NW	WBR (x3)	14 th St NW to L St NW to 13 th St NW
		14 th St NW		Vermont Ave NW to L St NW to 14 th St NW
		15 th St NW (west)		16 th St NW to L St NW to 15 th St NW (west)
		16 th St NW		17 th St NW (east) to L St NW to 16 th St NW
		17 th St NW (east)		Connecticut Ave NW to L St NW to 17 th St NW (east)
		17 th St NW (west)		18th St NW to L St NW to Connecticut Ave NW
		19 th St NW		20 th St NW to L St NW to 19 th St NW
		21 st St NW	WBU, EBR	22 nd St NW (U-turn slip lane) to 21 st St NW

¹ Based on model performance, these rerouting paths were updated.

Proposed 2025 Volumes

Peak Period	AM Peak Hour																
Peak Hour	8:30 AM - 9:30 AM																
Intersection No.	Intersection Name	EBU	EBL	EBT	EBR	NBU	NBL	NBT	NBR	WBU	WBL	WBT	WBR	SBU	SBL	SBT	SBR
1	K Street NW and 22nd Street NW	0	49	301	0	0	58	205	66	94	0	101	144	0	0	0	0
2	K Street NW and 21st Street NW	0	0	836	167	0	0	0	0	0	0	614	0	0	62	357	175
3	K Street NW and 20th Street NW	0	0	883	0	0	80	806	92	0	0	485	207	0	0	0	0
4	K Street NW and 19th Street NW	0	0	788	191	0	0	0	0	0	0	603	0	0	57	415	82
5	K Street NW and 18th Street NW	0	0	710	0	0	66	793	93	0	0	650	140	0	0	0	0
6	K Street NW and Connecticut Avenue	0	0	608	97	0	0	711	54	0	0	814	136	0	6	479	144
7	K Street NW and 17th Street NW (east)	0	0	668	0	0	7	40	14	0	0	829	46	0	42	182	114
8	K Street NW and 16th Street NW	0	0	515	144	0	3	311	24	0	0	627	179	0	67	453	129
9	K Street NW and 15th Street NW (west)	0	0	598	36	0	30	439	16	0	0	993	186	0	5	105	38
10	K Street NW and Vermont Avenue	0	0	619	0	0	172	244	73	0	0	925	66	0	36	0	75
11	K Street NW and 14th Street NW	0	0	484	194	0	208	620	50	0	0	716	115	0	31	569	66
12	K Street NW and 13th Street NW	0	0	372	193	0	173	384	34	0	0	534	105	0	20	863	101
13	K Street NW and 12th Street NW	0	0	428	0	0	255	664	80	0	0	372	46	0	0	0	0
14	K Street NW and 11th Street NW	0	72	178	192	0	101	214	47	0	39	197	21	0	13	435	105
15	K Street NW and 10th Street NW	0	0	99	133	0	0	0	0	0	9	103	0	0	24	260	164
16	K Street NW and 9th Street NW	0	0	0	65	0	0	0	0	0	0	0	0	0	0	941	124
Study Intersections Adjacent to K Street NW																	
17	L Street NW and 21st Street NW	0	0	784	145	0	0	0	0	0	0	0	0	0	177	449	0
18	Pennsylvania Avenue NW and 21st Street NW	0	0	722	114	0	0	0	0	0	123	274	0	0	105	391	28
19	L Street NW and Connecticut Avenue	0	88	725	63	0	0	667	180	0	0	0	0	0	0	566	0
20	I Street NW and 17th Street NW (west)	0	0	0	0	0	135	630	0	0	368	781	135	0	0	479	97
21	L Street NW and 16th Street NW	0	159	542	49	0	0	327	163	0	0	0	0	0	245	600	0
22	I Street NW and 16th Street NW	0	0	0	0	0	69	187	0	0	19	902	151	0	0	291	306
23	L Street NW and 15th Street NW (west)	0	159	578	84	0	0	555	70	0	0	0	0	0	41	64	0
24	L Street NW and 14th Street NW	0	36	514	70	0	0	504	231	0	0	0	0	0	111	596	0
25	I Street NW and 14th Street NW	0	0	0	0	0	311	824	0	0	88	776	54	0	0	622	141
Driveway Entrances and Exits																	
101	2100 Block of K Street NW	0	0	337	124	0	0	0	0	0	0	262	0	0	0	0	77
102	2000 Block of K Street NW	0	0	883	15	0	0	0	0	0	0	565	0	0	0	0	49
103	1900 Block of K Street NW	0	0	975	0	0	0	0	4	0	0	685	0	0	0	0	7
104	1800 Block of K Street NW	0	0	710	135	0	0	0	0	0	0	603	113	0	0	0	0
105	1700 Block of K Street NW	0	0	705	98	0	0	0	0	0	0	778	180	0	0	0	12
106	1600 Block of K Street NW	0	0	659	65	0	0	0	0	0	0	759	0	0	0	0	116
107	1500 Block of K Street NW	0	0	606	0	0	0	0	28	0	0	806	255	0	0	0	0
108	1400 Block of K Street NW (west of Vermont)	0	0	619	0	0	0	0	0	0	0	1172	0	0	0	0	7
109	1400 Block of K Street NW (east of Vermont)	0	0	678	50	0	0	0	0	0	0	990	0	0	0	0	1
110	1300 Block of K Street NW	0	0	565	0	0	0	0	0	0	0	808	0	0	0	0	23
111	1200 Block of K Street NW	0	0	417	9	0	0	0	11	0	0	627	0	0	0	0	12
112	1100 Block of K Street NW	0	0	442	66	0	0	0	0	0	0	403	0	0	0	0	15
113	1000 Block of K Street NW	0	0	232	6	0	0	0	0	0	0	257	10	0	0	0	0
114	900 Block of K Street NW	0	0	65	58	0	0	0	0	0	0	112	12	0	0	0	0
115	1500 Block of L Street NW	0	0	821	129	0	0	0	0	0	0	0	0	0	0	0	0

Proposed 2025 Volumes

Peak Period	AM Peak Hour										
Peak Hour	8:30 AM - 9:30 AM										
Intersection No.	Intersection Name	NB Approach	SB Approach	EB Approach	WB Approach	NB Departure	SB Departure	EB Departure	WB Departure	Total Approach	Total Depart
1	K Street NW and 22nd Street NW	329	0	350	339	398	0	461	159	1018	1018
2	K Street NW and 21st Street NW	0	594	1003	614	0	524	898	789	2211	2211
3	K Street NW and 20th Street NW	978	0	883	692	1013	0	975	565	2553	2553
4	K Street NW and 19th Street NW	0	554	979	603	0	606	845	685	2136	2136
5	K Street NW and 18th Street NW	952	0	710	790	933	0	803	716	2452	2452
6	K Street NW and Connecticut Avenue	765	629	705	950	847	576	668	958	3049	3049
7	K Street NW and 17th Street NW (east)	61	338	668	875	86	182	724	950	1942	1942
8	K Street NW and 16th Street NW	338	649	659	806	490	597	606	759	2452	2452
9	K Street NW and 15th Street NW (west)	485	148	634	1179	625	141	619	1061	2446	2446
10	K Street NW and Vermont Avenue	489	111	619	991	310	0	728	1172	2210	2210
11	K Street NW and 14th Street NW	878	666	678	831	735	763	565	990	3053	3053
12	K Street NW and 13th Street NW	591	984	565	639	489	1056	426	808	2779	2779
13	K Street NW and 12th Street NW	999	0	428	418	710	0	508	627	1845	1845
14	K Street NW and 11th Street NW	362	553	442	257	307	666	238	403	1614	1614
15	K Street NW and 10th Street NW	0	448	232	112	0	402	123	267	792	792
16	K Street NW and 9th Street NW	0	1065	65	0	0	1006	0	124	1130	1130
Study Intersections Adjacent to K Street NW											
17	L Street NW and 21st Street NW	0	626	929	0	0	594	961	0	1555	1555
18	Pennsylvania Avenue NW and 21st Street NW	0	524	836	397	0	628	827	302	1757	1757
19	L Street NW and Connecticut Avenue	847	566	876	0	755	629	905	0	2289	2289
20	I Street NW and 17th Street NW (west)	765	576	0	1284	765	847	0	1013	2625	2625
21	L Street NW and 16th Street NW	490	845	750	0	486	649	950	0	2085	2085
22	I Street NW and 16th Street NW	256	597	0	1072	338	310	0	1277	1925	1925
23	L Street NW and 15th Street NW (west)	625	105	821	0	714	148	689	0	1551	1551
24	L Street NW and 14th Street NW	735	707	620	0	540	666	856	0	2062	2062
25	I Street NW and 14th Street NW	1135	763	0	918	878	710	0	1228	2816	2816
Driveway Entrances and Exits											
101	2100 Block of K Street NW	0	77	461	262	0	124	337	339	800	800
102	2000 Block of K Street NW	0	49	898	565	0	15	883	614	1512	1512
103	1900 Block of K Street NW	4	7	975	685	0	0	979	692	1671	1671
104	1800 Block of K Street NW	0	0	845	716	113	135	710	603	1561	1561
105	1700 Block of K Street NW	0	12	803	958	180	98	705	790	1773	1773
106	1600 Block of K Street NW	0	116	724	759	0	65	659	875	1599	1599
107	1500 Block of K Street NW	28	0	606	1061	255	0	634	806	1695	1695
108	1400 Block of K Street NW (west of Vermont)	0	7	619	1172	0	0	619	1179	1798	1798
109	1400 Block of K Street NW (east of Vermont)	0	1	728	990	0	50	678	991	1719	1719
110	1300 Block of K Street NW	0	23	565	808	0	0	565	831	1396	1396
111	1200 Block of K Street NW	11	12	426	627	0	9	428	639	1076	1076
112	1100 Block of K Street NW	0	15	508	403	0	66	442	418	926	926
113	1000 Block of K Street NW	0	0	238	267	10	6	232	257	505	505
114	900 Block of K Street NW	0	0	123	124	12	58	65	112	247	247
115	1500 Block of L Street NW	0	0	950	0	0	129	821	0	950	950

Turning Movement Delta

Proposed 2025 Traffic Volume – 2019 Existing Volume

Peak Period	AM Peak Hour	Typical Re-Routing Pattern shown for EB and WB. Please reference Table 1 on Page 1 for full re-routing summary.															
Peak Hour	8:30 AM - 9:30 AM	EB #1					EB #2			EB #3			WB #1				
Intersection No.	Intersection Name	EBU	EBL	EBT	EBR	NBU	NBL	NBT	NBR	WBU	WBL	WBT	WBR	SBU	SBL	SBT	SBR
1	K Street NW and 22nd Street NW	0	0	0	0	0	0	0	0	27	0	0	0	0	0	0	0
2	K Street NW and 21st Street NW	0	0	0	27	0	0	0	0	0	-27	27	0	0	0	0	0
3	K Street NW and 20th Street NW	0	-14	14	0	0	0	14	0	0	0	0	32	0	0	0	0
4	K Street NW and 19th Street NW	0	0	0	14	0	0	0	0	0	-32	32	0	0	0	32	0
5	K Street NW and 18th Street NW	0	-5	5	0	0	0	5	0	0	0	0	1	0	0	0	0
6	K Street NW and Connecticut Avenue	0	-1	1	5	0	0	1	0	0	-1	1	1	0	0	1	0
7	K Street NW and 17th Street NW (east)	0	-2	102	-99	0	0	2	0	0	-1	1	0	0	0	1	0
8	K Street NW and 16th Street NW	0	-3	3	102	0	0	3	0	0	0	0	28	0	0	0	0
9	K Street NW and 15th Street NW (west)	0	-75	75	3	0	0	75	0	0	-28	28	0	0	0	28	0
10	K Street NW and Vermont Avenue	0	-45	120	0	0	0	45	0	0	0	0	2	0	0	0	0
11	K Street NW and 14th Street NW	0	-3	48	75	0	0	3	0	0	-2	2	9	0	0	2	0
12	K Street NW and 13th Street NW	0	0	0	48	0	0	0	0	0	-9	9	0	0	0	9	0
13	K Street NW and 12th Street NW	0	-90	90	0	0	0	90	0	0	0	0	0	0	0	0	0
14	K Street NW and 11th Street NW	0	0	0	90	0	0	0	0	0	0	0	0	0	0	0	0
15	K Street NW and 10th Street NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	K Street NW and 9th Street NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Study Intersections Adjacent to K Street NW																	
17	L Street NW and 21st Street NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	Pennsylvania Avenue NW and 21st Street NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	L Street NW and Connecticut Avenue	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
20	I Street NW and 17th Street NW (west)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	5
21	L Street NW and 16th Street NW	0	0	0	0	0	0	0	28	0	0	0	0	0	0	0	0
22	I Street NW and 16th Street NW	0	0	0	0	0	0	0	0	0	0	0	3	0	0	99	3
23	L Street NW and 15th Street NW (west)	0	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0
24	L Street NW and 14th Street NW	0	0	0	2	0	0	0	9	0	0	0	0	0	0	0	0
25	I Street NW and 14th Street NW	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	75
Driveway Entrances and Exits																	
101	2100 Block of K Street NW	0	0	27	0	0	0	0	0	0	0	27	0	0	0	0	0
102	2000 Block of K Street NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103	1900 Block of K Street NW	0	0	14	0	0	0	0	0	0	0	32	0	0	0	0	0
104	1800 Block of K Street NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	1700 Block of K Street NW	0	0	5	0	0	0	0	0	0	0	1	0	0	0	0	0
106	1600 Block of K Street NW	0	0	102	0	0	0	0	0	0	0	0	0	0	0	0	0
107	1500 Block of K Street NW	0	0	3	0	0	0	0	0	0	0	28	0	0	0	0	0
108	1400 Block of K Street NW (west of Vermont)	0	0	75	0	0	0	0	0	0	0	0	0	0	0	0	0
109	1400 Block of K Street NW (east of Vermont)	0	0	120	0	0	0	0	0	0	0	2	0	0	0	0	0
110	1300 Block of K Street NW	0	0	48	0	0	0	0	0	0	0	9	0	0	0	0	0
111	1200 Block of K Street NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
112	1100 Block of K Street NW	0	0	90	0	0	0	0	0	0	0	0	0	0	0	0	0
113	1000 Block of K Street NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
114	900 Block of K Street NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115	1500 Block of L Street NW	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0

Proposed 2025 Volumes

Peak Period	PM Peak Hour																
Peak Hour	4:45 PM - 5:45 PM																
Intersection No.	Intersection Name	EBU	EBL	EBT	EBR	NBU	NBL	NBT	NBR	WBU	WBL	WBT	WBR	SBU	SBL	SBT	SBR
1	K Street NW and 22nd Street NW	0	21	107	0	0	122	247	32	76	0	179	92	0	0	0	0
2	K Street NW and 21st Street NW	0	0	385	111	0	0	0	0	0	0	1264	0	0	96	516	245
3	K Street NW and 20th Street NW	0	0	466	0	0	133	403	121	0	0	920	200	0	0	0	0
4	K Street NW and 19th Street NW	0	0	475	197	0	0	0	0	0	0	971	0	0	60	701	138
5	K Street NW and 18th Street NW	0	0	525	0	0	132	487	107	0	0	822	123	0	0	0	0
6	K Street NW and Connecticut Avenue	0	0	729	142	0	2	590	56	0	0	931	190	0	12	740	155
7	K Street NW and 17th Street NW (east)	0	0	797	0	0	37	122	24	0	0	965	71	0	41	169	119
8	K Street NW and 16th Street NW	0	0	620	112	0	8	286	42	0	0	740	208	0	115	332	105
9	K Street NW and 15th Street NW (west)	0	0	806	41	0	48	311	16	0	0	911	161	0	8	198	88
10	K Street NW and Vermont Avenue	0	0	830	0	0	92	219	52	0	0	895	66	0	80	0	90
11	K Street NW and 14th Street NW	0	0	752	216	0	125	569	39	0	0	792	69	0	28	632	53
12	K Street NW and 13th Street NW	0	0	640	179	0	188	473	17	0	0	539	48	0	26	553	116
13	K Street NW and 12th Street NW	0	0	670	0	0	201	763	76	0	0	369	49	0	0	0	0
14	K Street NW and 11th Street NW	0	67	342	296	0	152	239	51	0	13	192	20	0	34	437	67
15	K Street NW and 10th Street NW	0	0	180	264	0	0	0	0	0	37	95	0	0	32	302	111
16	K Street NW and 9th Street NW	0	0	0	182	0	0	0	0	0	0	0	0	0	0	781	83
Study Intersections Adjacent to K Street NW																	
17	L Street NW and 21st Street NW	0	0	492	165	0	0	0	0	0	0	0	0	0	188	692	0
18	Pennsylvania Avenue NW and 21st Street NW	0	0	554	100	0	0	0	0	0	267	558	0	0	142	394	91
19	L Street NW and Connecticut Avenue	0	151	788	157	0	0	689	91	0	0	0	0	0	0	750	0
20	I Street NW and 17th Street NW (west)	0	0	0	0	0	58	533	0	0	442	592	115	0	0	803	79
21	L Street NW and 16th Street NW	0	214	662	92	0	0	377	117	0	0	0	0	0	103	460	0
22	I Street NW and 16th Street NW	0	0	0	0	0	32	175	0	0	77	733	161	0	0	238	207
23	L Street NW and 15th Street NW (west)	0	225	735	142	0	0	432	40	0	0	0	0	0	59	152	0
24	L Street NW and 14th Street NW	0	71	725	168	0	0	518	120	0	0	0	0	0	77	545	0
25	I Street NW and 14th Street NW	0	0	0	0	0	254	687	0	0	128	607	46	0	0	785	63
Driveway Entrances and Exits																	
101	2100 Block of K Street NW	0	0	215	0	0	0	0	23	0	0	305	0	0	0	0	42
102	2000 Block of K Street NW	0	0	466	15	0	0	0	0	0	0	1053	0	0	0	0	211
103	1900 Block of K Street NW	0	0	587	0	0	0	0	85	0	0	1109	0	0	0	0	11
104	1800 Block of K Street NW	0	0	510	25	0	0	0	15	0	0	901	53	0	0	0	70
105	1700 Block of K Street NW	0	0	632	0	0	0	0	239	0	0	945	143	0	0	0	0
106	1600 Block of K Street NW	0	0	732	130	0	0	0	0	0	0	853	0	0	0	0	183
107	1500 Block of K Street NW	0	0	765	12	0	0	0	82	0	0	948	99	0	0	0	0
108	1400 Block of K Street NW (west of Vermont)	0	0	830	0	0	0	0	0	0	0	1072	5	0	0	0	0
109	1400 Block of K Street NW (east of Vermont)	0	0	899	63	0	0	0	69	0	0	961	9	0	0	0	0
110	1300 Block of K Street NW	0	0	819	0	0	0	0	0	0	0	843	0	0	0	0	18
111	1200 Block of K Street NW	0	0	667	16	0	0	0	3	0	0	570	0	0	0	0	17
112	1100 Block of K Street NW	0	0	705	41	0	0	0	0	0	0	411	0	0	0	0	7
113	1000 Block of K Street NW	0	0	427	0	0	0	0	17	0	0	206	0	0	0	0	19
114	900 Block of K Street NW	0	0	182	30	0	0	0	0	0	0	83	0	0	0	0	49
115	1500 Block of L Street NW	0	0	882	0	0	0	0	220	0	0	0	0	0	0	0	0

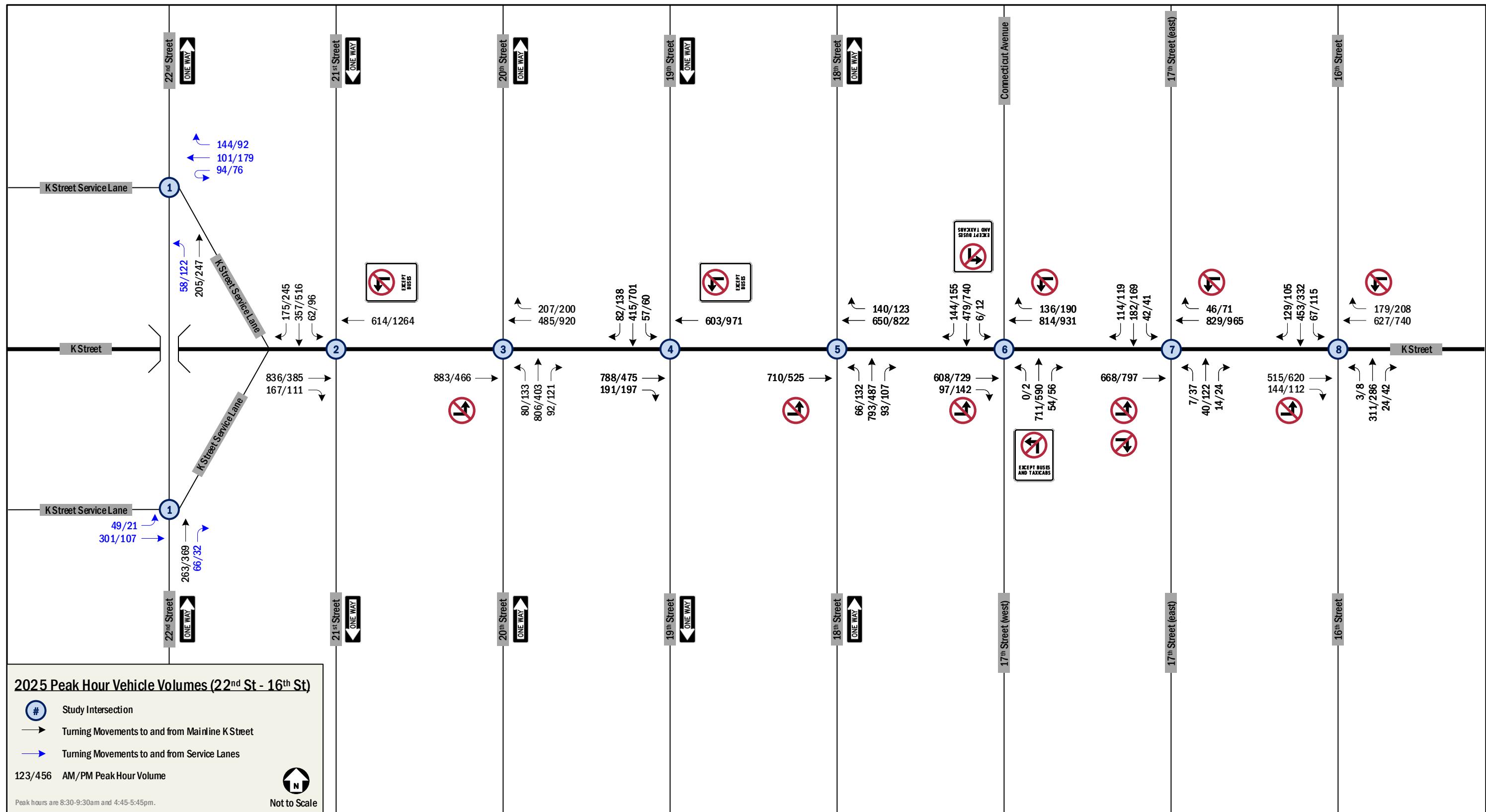
Proposed 2025 Volumes

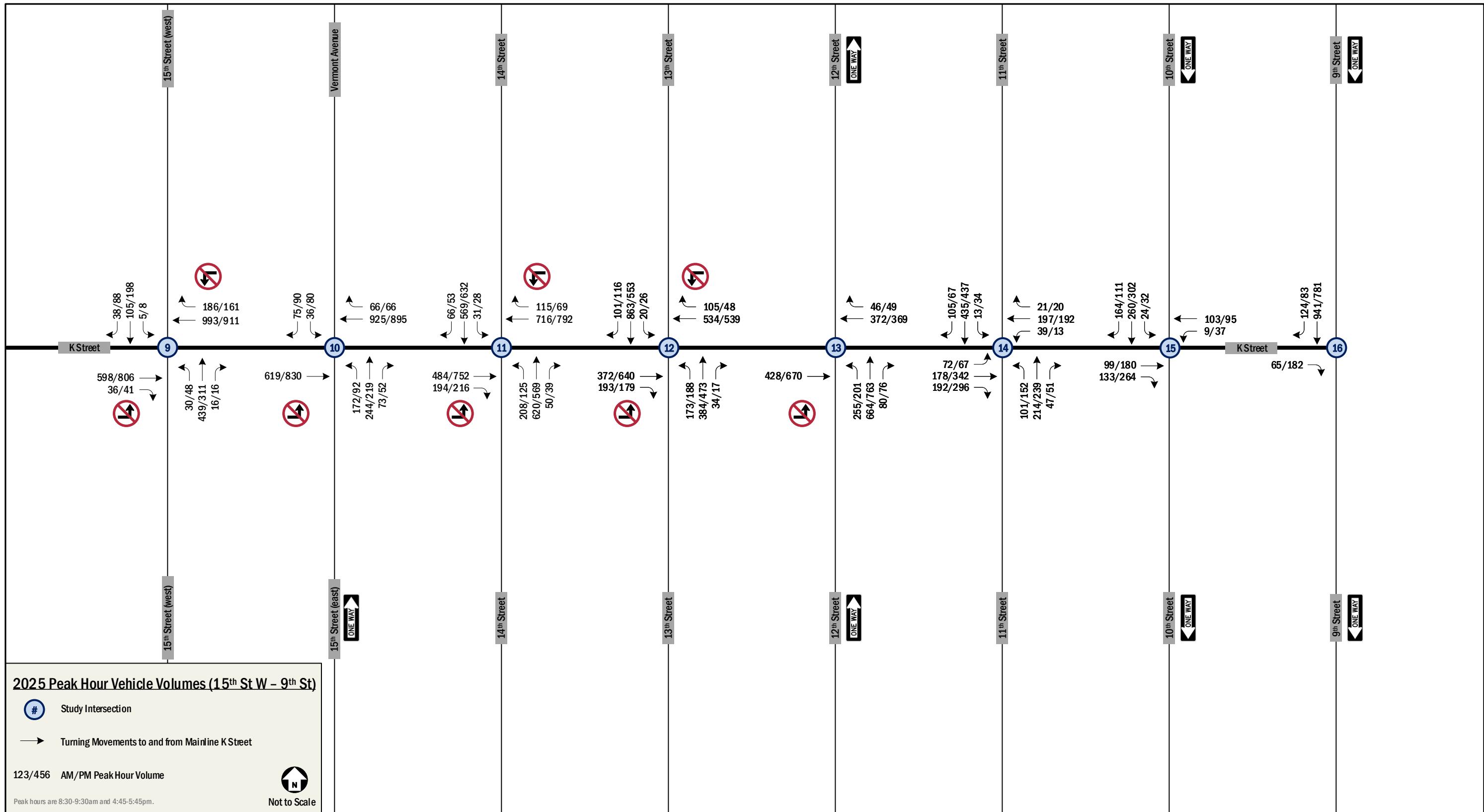
Peak Period	PM Peak Hour										
Peak Hour	4:45 PM - 5:45 PM										
Intersection No.	Intersection Name	NB Approach	SB Approach	EB Approach	WB Approach	NB Departure	SB Departure	EB Departure	WB Departure	Total Approach	Total Depart
1	K Street NW and 22nd Street NW	401	0	128	347	360	0	215	301	876	876
2	K Street NW and 21st Street NW	0	857	496	1264	0	627	481	1509	2617	2617
3	K Street NW and 20th Street NW	657	0	466	1120	603	0	587	1053	2243	2243
4	K Street NW and 19th Street NW	0	899	672	971	0	898	535	1109	2542	2542
5	K Street NW and 18th Street NW	726	0	525	945	610	0	632	954	2196	2196
6	K Street NW and Connecticut Avenue	648	907	871	1121	780	882	797	1088	3547	3547
7	K Street NW and 17th Street NW (east)	183	329	797	1036	193	169	862	1121	2345	2345
8	K Street NW and 16th Street NW	336	552	732	948	494	444	777	853	2568	2568
9	K Street NW and 15th Street NW (west)	375	294	847	1072	472	239	830	1047	2588	2588
10	K Street NW and Vermont Avenue	363	170	830	961	285	0	962	1077	2324	2324
11	K Street NW and 14th Street NW	733	713	968	861	638	848	819	970	3275	3275
12	K Street NW and 13th Street NW	678	695	819	587	521	732	683	843	2779	2779
13	K Street NW and 12th Street NW	1040	0	670	418	812	0	746	570	2128	2128
14	K Street NW and 11th Street NW	442	538	705	225	326	746	427	411	1910	1910
15	K Street NW and 10th Street NW	0	445	444	132	0	603	212	206	1021	1021
16	K Street NW and 9th Street NW	0	864	182	0	0	963	0	83	1046	1046
Study Intersections Adjacent to K Street NW											
17	L Street NW and 21st Street NW	0	880	657	0	0	857	680	0	1537	1537
18	Pennsylvania Avenue NW and 21st Street NW	0	627	654	825	0	761	696	649	2106	2106
19	L Street NW and Connecticut Avenue	780	750	1096	0	840	907	879	0	2626	2626
20	I Street NW and 17th Street NW (west)	591	882	0	1149	648	1245	0	729	2622	2622
21	L Street NW and 16th Street NW	494	563	968	0	591	552	882	0	2025	2025
22	I Street NW and 16th Street NW	207	445	0	971	336	315	0	972	1623	1623
23	L Street NW and 15th Street NW (west)	472	211	1102	0	657	294	834	0	1785	1785
24	L Street NW and 14th Street NW	638	622	964	0	589	713	922	0	2224	2224
25	I Street NW and 14th Street NW	941	848	0	781	733	913	0	924	2570	2570
Driveway Entrances and Exits											
101	2100 Block of K Street NW	23	42	215	305	0	0	238	347	585	585
102	2000 Block of K Street NW	0	211	481	1053	0	15	466	1264	1745	1745
103	1900 Block of K Street NW	85	11	587	1109	0	0	672	1120	1792	1792
104	1800 Block of K Street NW	15	70	535	954	53	25	525	971	1574	1574
105	1700 Block of K Street NW	239	0	632	1088	143	0	871	945	1959	1959
106	1600 Block of K Street NW	0	183	862	853	0	130	732	1036	1898	1898
107	1500 Block of K Street NW	82	0	777	1047	99	12	847	948	1906	1906
108	1400 Block of K Street NW (west of Vermont)	0	0	830	1077	5	0	830	1072	1907	1907
109	1400 Block of K Street NW (east of Vermont)	69	0	962	970	9	63	968	961	2001	2001
110	1300 Block of K Street NW	0	18	819	843	0	0	819	861	1680	1680
111	1200 Block of K Street NW	3	17	683	570	0	16	670	587	1273	1273
112	1100 Block of K Street NW	0	7	746	411	0	41	705	418	1164	1164
113	1000 Block of K Street NW	17	19	427	206	0	0	444	225	669	669
114	900 Block of K Street NW	0	49	212	83	0	30	182	132	344	344
115	1500 Block of L Street NW	220	0	882	0	0	0	1102	0	1102	1102

Turning Movement Delta

Proposed 2025 Traffic Volume – 2019 Existing Volume

Peak Period	PM Peak Hour	Typical Re-Routing Pattern shown for EB and WB. Please reference Table 1 on Page 1 for full re-routing summary.																			
Peak Hour	4:45 PM - 5:45 PM	EB #1				EB #2				EB #3				WB #1				WB #2			
Intersection No.	Intersection Name	EBU	EBL	EBT	EBR	NBU	NBL	NBT	NBR	WBU	WBL	WBT	WBR	SBU	SBL	SBT	SBR				
1	K Street NW and 22nd Street NW	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	
2	K Street NW and 21st Street NW	0	0	0	5	0	0	0	0	0	-5	5	0	0	0	0	0	0	0	0	
3	K Street NW and 20th Street NW	0	-18	18	0	0	0	18	0	0	0	0	18	0	0	0	0	0	0	0	
4	K Street NW and 19th Street NW	0	0	0	18	0	0	0	0	0	-18	18	0	0	0	0	18	0	0	0	
5	K Street NW and 18th Street NW	0	-1	1	0	0	0	1	0	0	0	0	28	0	0	0	0	0	0	0	
6	K Street NW and Connecticut Avenue	0	-1	1	1	0	0	1	0	0	-28	28	0	0	0	0	28	0	0	0	
7	K Street NW and 17th Street NW (east)	0	-2	75	-72	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	
8	K Street NW and 16th Street NW	0	-6	6	75	0	0	6	0	0	-1	1	50	0	0	0	1	0	0	0	
9	K Street NW and 15th Street NW (west)	0	-1	1	6	0	0	1	0	0	-50	50	0	0	0	0	50	0	0	0	
10	K Street NW and Vermont Avenue	0	-84	85	0	0	0	84	0	0	0	0	3	0	0	0	0	0	0	0	
11	K Street NW and 14th Street NW	0	-4	88	1	0	0	4	0	0	-3	3	1	0	0	0	3	0	0	0	
12	K Street NW and 13th Street NW	0	-15	15	88	0	0	0	0	0	-1	1	0	0	0	0	1	0	0	0	
13	K Street NW and 12th Street NW	0	-142	157	0	0	0	157	0	0	0	0	0	0	0	0	0	0	0	0	
14	K Street NW and 11th Street NW	0	0	0	157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15	K Street NW and 10th Street NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
16	K Street NW and 9th Street NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Study Intersections Adjacent to K Street NW																					
17	L Street NW and 21st Street NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
18	Pennsylvania Avenue NW and 21st Street NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
19	L Street NW and Connecticut Avenue	0	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
20	I Street NW and 17th Street NW (west)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
21	L Street NW and 16th Street NW	0	0	0	1	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	
22	I Street NW and 16th Street NW	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	73	0	3		
23	L Street NW and 15th Street NW (west)	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
24	L Street NW and 14th Street NW	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
25	I Street NW and 14th Street NW	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	1	0	
Driveway Entrances and Exits																					
101	2100 Block of K Street NW	0	0	5	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	
102	2000 Block of K Street NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
103	1900 Block of K Street NW	0	0	18	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	
104	1800 Block of K Street NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
105	1700 Block of K Street NW	0	0	1	0	0	0	0	0	0	0	0	28	0	0	0	0	0	0	0	
106	1600 Block of K Street NW	0	0	75	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
107	1500 Block of K Street NW	0	0	6	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	
108	1400 Block of K Street NW (west of Vermont)	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
109	1400 Block of K Street NW (east of Vermont)	0	0	85	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	
110	1300 Block of K Street NW	0	0	88	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
111	1200 Block of K Street NW	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
112	1100 Block of K Street NW	0	0	157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
113	1000 Block of K Street NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
114	900 Block of K Street NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
115	1500 Block of L Street NW	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	





Attachment D-1:

Alternative 1 Vissim Results Summary – AM Peak

AM Alternative 1 (Two Through Lanes) Model Loading Summary

AM Peak Hour: 8:30AM-9:30AM

AM Peak Period: 8:00AM-10:00AM

Item	Basis	Criteria	Value	Target	Criteria Met
Simulated Vehicular Throughput (Individual Links)	All Segments and Approaches	Within \pm 100 vph for < 700 vph		85%	Yes
		Within \pm 15% for \geq 700 vph to < 2,700 vph			
		Within \pm 400 vph for \geq 2,700 vph			
		GEH < 5 for individual link flows	100%	85%	Yes
Simulated Vehicular Throughput (Network Wide)	Total Volume throughout Network on K Street Corridor	GEH < 4 for total network volume	0.8	4.0	Yes
		Within 5% of total network volume	0.4%	5%	Yes
Required Sample Size			10		

*Findings Represent Results from 10 Simulation Runs

Intersection Volume Loading

AM Peak Hour: 8:30AM-9:30AM

85% of All Intersection Approaches within the following Volume Criteria		Number of Approaches		Passing Approaches		Percent	Target	Target Met
Within \pm 100 vph for < 700 vph	51	84	51	84	100%	85%	Yes	Yes
Within \pm 15% for \geq 700 vph to < 2,700 vph	33		33					
Within \pm 400 vph for \geq 2,700 vph	0		0					

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)	
1	K Street NW and 22nd Street NW	NB	LT - SL	58	329	58	-8	0%
			TH	205		209		
			RT - SL	66		54		
		EB	TH	666	666	665	-1	0%
			TH	527		525		
		WB	LT	49	350	45	-24	-8%
			TH	301		281		
		EB Service Lane	UT	94	339	92	19	-7%
			TH	101		130		
			RT	144		136		
		Intersection		2,211	2,195		-16	-1%
2	K Street NW and 21st Street NW	SB	LT	62	594	62	-2	0%
			TH	357		358		
			RT	175		172		
		EB	TH	666	666	671	5	1%
			TH	352		356		
		WB	TH - SL	262	614	262	4	0%
			TH - ML	170		151		
		EB Service Lane	RT	167		152		
			Intersection		2,211	2,184	-27	-1%
3	K Street NW and 20th Street NW	NB	LT	80	978	78	8	-3%
			TH	806		819		
			RT	92		89		
		EB	TH	883	883	866	-17	-2%
			TH	485		490		
		WB	RT	207	692	209	7	1%
			Intersection		2,553	2,551	-2	0%
		SB	LT	57	554	59	6	4%
			TH	415		421		
			RT	82		80		
			TH	788		774		
			RT	191		178		
4	K Street NW and 19th Street NW	EB	TH	603	979	613	-27	-3%
			RT	191		178		
		WB	Intersection		2,136	2,125	-11	-1%
			TH	603	613	10	2%	
		NB	LT	66	952	69	22	5%
			TH	793		812		
			RT	93		93		
			TH	710		697		
			TH	650		659		
5	K Street NW and 18th Street NW	EB	RT	140	790	141	10	1%
			Intersection		2,452	2,471	19	1%
			TH	711	744			
			RT	54	57			
			LT	6	6			
		WB	TH	479	950	519	46	8%
			RT	144		150		
			TH	608		602		
			RT	97		88		
			TH	814		809		
6	K Street NW and Connecticut Avenue	SB	RT	136	705	143	-15	-2%
			Intersection		3,049	3,118	69	2%
			TH	711	744			
			RT	54	57			
			LT	6	6			
		EB	TH	479	519			
			RT	144	150			
			TH	608	602			
			RT	97	88			
			TH	814	809			

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)
7	K Street NW and 17th Street NW (east)	NB	LT	7	61	0	0%
			TH	40		1	3%
			RT	14		-1	-7%
			LT	42		0	0%
		SB	TH	182	338	1	1%
			RT	114		0	0%
			TH	668		-2	0%
		EB	TH	829	668	3	0%
			RT	46		0	0%
		WB	Intersection		1,942	2	0%
		Intersection		1,944			
8	K Street NW and 16th Street NW	NB	LT	3	338	1	33%
			TH	311		6	2%
			RT	24		0	0%
			LT	67		2	3%
		SB	TH	453	649	30	7%
			RT	129		-4	-3%
			TH	515		-4	-1%
		EB	RT	144	659	-4	-3%
			TH	627		6	1%
		WB	RT	179	806	3	0%
		Intersection		2,452		-3	-2%
		Intersection		2,482		30	1%
9	K Street NW and 15th Street NW (west)	NB	LT	30	485	4	13%
			TH	439		2	0%
			RT	16		0	0%
			LT	5		-1	-20%
		SB	TH	105	148	0	0%
			RT	38		-4	-11%
			TH	598		-10	-2%
		EB	RT	36	634	1	3%
			TH	993		-3	0%
		WB	RT	186	1,179	-3	-2%
		Intersection		2,446		-14	-1%
		Intersection		2,432			
10	K Street NW and Vermont Avenue	NB	LT	172	489	4	2%
			TH	244		0	0%
			RT	73		3	4%
			LT	36		-1	-3%
		SB	RT	75	111	-2	-3%
			TH	619		-11	-2%
			TH	925		-7	-1%
		EB	RT	66	991	-4	-6%
			Intersection			-18	-1%
		Intersection		2,210			
11	K Street NW and 14th Street NW	NB	LT	208	878	3	1%
			TH	620		34	5%
			RT	50		1	2%
			LT	31		-1	-3%
		SB	TH	569	666	20	4%
			RT	66		-3	-5%
			TH	484		-16	-3%
		EB	RT	194	678	5	3%
			TH	716		-7	-1%
		WB	RT	115	831	-9	-8%
		Intersection		3,053		27	1%
		Intersection		3,080			
12	K Street NW and 13th Street NW	NB	LT	173	591	-7	-4%
			TH	384		7	2%
			RT	34		2	6%
			LT	20		3	15%
		SB	TH	863	984	24	3%
			RT	101		-4	-4%
			TH	372		-16	-4%
		EB	RT	193	565	-1	-1%
			TH	534		4	1%
		WB	RT	105	639	2	2%
		Intersection		2,779		14	1%
		Intersection		2,793			

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)	
13	K Street NW and 12th Street NW	NB	LT	255	999	261	6	2%
			TH	664		665		
			RT	80		80		
		EB	TH	428	428	420	-8	-2%
			TH	372		368		
			RT	46		47		
		Intersection		1,845	1,841		-4	0%
		SB	LT	101	362	123	22	22%
			TH	214		216		
			RT	47		44		
			LT	13	553	12	-3	-6%
			TH	435		435		
			RT	105		120		
14	K Street NW and 11th Street NW	EB	LT	72	442	70	-2	-3%
			TH	178		182		
			RT	192		206		
		WB	LT	39	257	42	3	8%
			TH	197		198		
			RT	21		22		
		Intersection		1,614	1,670		56	3%
		SB	LT	24	448	24	0	0%
			TH	260		257		
			RT	164		164		
			TH	99	232	100	1	1%
			RT	133		133		
15	K Street NW and 10th Street NW	EB	LT	9	112	10	1	11%
			TH	103		107		
		Intersection		792	795		3	0%
		WB	LT	9	112	10	4	4%
			TH	103		107		
			Intersection		795		3	0%
16	K Street NW and 9th Street NW	SB	TH	941	1,065	960	19	2%
			RT	124		127		
			RT	65		67		
		Intersection		1,130	1,154		24	2%
17	L Street NW and 21st Street NW	SB	LT	177	626	172	-5	-3%
			TH	449		451		
			TH	784		790		
			RT	145		139		
		Intersection		1,555	1,552		-3	0%
18	Pennsylvania Avenue NW and 21st Street NW	SB	LT	105	524	102	-3	-3%
			TH	391		389		
			RT	28		30		
			TH	722		719		
		EB	RT	114		109	-3	0%
			LT	123	397	128		
		WB	TH	274		281	-5	-4%
			Intersection		1,757			
		Intersection		1,757	1,758		1	0%
19	L Street NW and Connecticut Avenue	NB	TH	667	847	703	36	5%
			RT	180		182		
		SB	TH	566	566	573	2	1%
			TH	566		573		
		EB	LT	88	876	86	-2	-2%
			TH	725		748		
			RT	63		101		
		Intersection		2,289	2,393		104	5%
20	I Street NW and 17th Street NW (west)	NB	LT	135	765	140	5	4%
			TH	630		657		
			TH	479		504		
			RT	97		94		
		SB	LT	368	576	367	-1	4%
			TH	781		789		
			RT	135		143		
			Intersection		2,625		69	3%
			Intersection		2,694		69	3%

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)
21	L Street NW and 16th Street NW	NB	TH	327	490	324	-3
			RT	163		164	
			LT	245		260	
			TH	600		625	
		EB	LT	159	845	153	-6
			TH	542		534	
			RT	49		51	
		Intersection		2,085	2,111		26
							1%
		SB	LT	69	256	68	-1
			TH	187		178	
			TH	291		295	
			RT	306		322	
22	I Street NW and 16th Street NW	WB	LT	19	1,072	17	-2
			TH	902		922	
			RT	151		163	
			Intersection		1,965		40
							2%
		NB	TH	555	625	557	2
			RT	70		68	
			LT	41		42	
			TH	64		58	
		EB	LT	159	821	156	-3
			TH	578		585	
			RT	84		85	
		Intersection		1,551	1,551		0
							0%
23	L Street NW and 15th Street NW (west)	SB	TH	504	735	520	16
			RT	231		234	
			LT	111		113	
			TH	596		614	
		EB	LT	36	620	36	0
			TH	514		513	
			RT	70		63	
		Intersection		2,062	2,093		31
							2%
24	L Street NW and 14th Street NW	NB	LT	311	1,135	315	4
			TH	824		839	
			TH	622		635	
			RT	141		144	
		EB	LT	88	918	90	2
			TH	776		808	
			RT	54		65	
		Intersection		2,816	2,896		80
							3%
25	I Street NW and 14th Street NW	SB	LT	19	763	1,154	19
			TH	15			
			TH	13			
			RT	3			
		WB	LT	2	963		45
			TH	32			
			RT	11			
		Intersection		2,816	2,896		80
							3%

*Results show the average from 10 simulation runs.

Intersection Delay and Estimated LOS

AM Peak Hour: 8:30AM-9:30AM

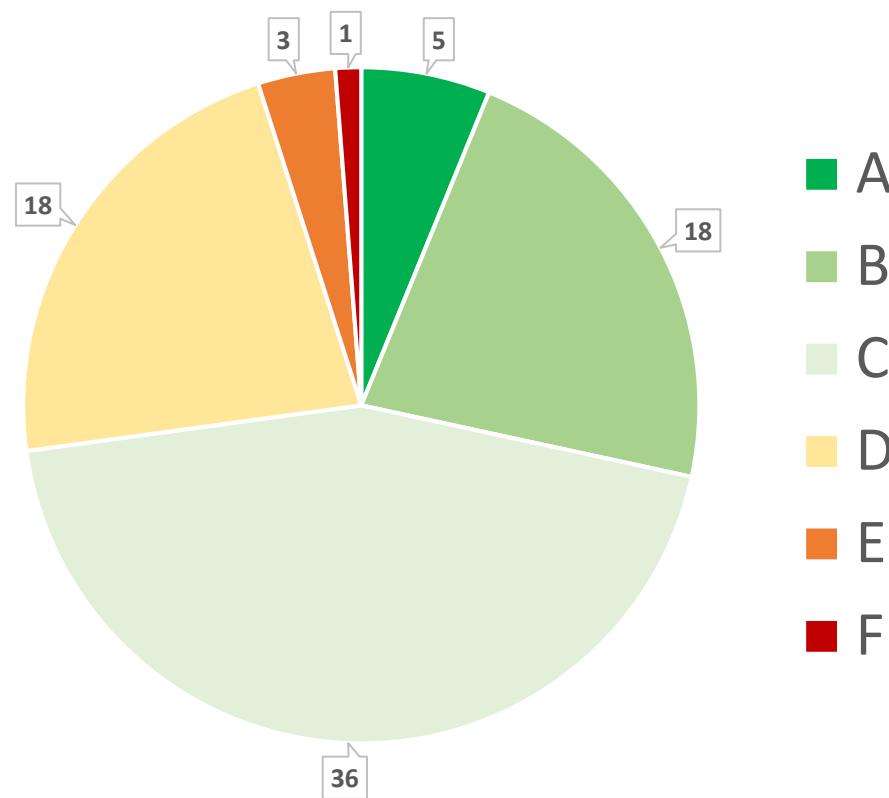
#	Intersection	Approach	Average Delay (sec/veh)	Approach LOS	Intersection Delay	Intersection LOS
1	K Street NW and 22nd Street NW	NB	42.7	D	18.9	B
		SB	-	-		
		EB Service Lane	35.0	C		
		WB Service Lane	45.5	D		
2	K Street NW and 21st Street NW	NB	-	-	33.1	C
		SB	23.8	C		
		EB	29.6	C		
		WB	25.6	C		
3	K Street NW and 20th Street NW	NB	36.3	D	30.9	C
		SB	-	-		
		EB	23.5	C		
		WB	32.7	C		
4	K Street NW and 19th Street NW	NB	-	-	26.5	C
		SB	32.0	C		
		EB	28.3	C		
		WB	18.6	B		
5	K Street NW and 18th Street NW	NB	27.1	C	23.8	C
		SB	-	-		
		EB	8.3	A		
		WB	33.2	C		
6	K Street NW and Connecticut Avenue	NB	27.6	C	20.0	C
		SB	31.5	C		
		EB	13.8	B		
		WB	10.0	B		
7	K Street NW and 17th Street NW (east)	NB	31.7	C	27.4	C
		SB	25.0	C		
		EB	17.2	B		
		WB	35.7	D		
8	K Street NW and 16th Street NW	NB	41.6	D	31.8	C
		SB	19.8	B		
		EB	33.6	C		
		WB	36.3	D		
9	K Street NW and 15th Street NW (west)	NB	34.3	C	17.1	B
		SB	36.7	D		
		EB	5.5	A		
		WB	13.7	B		
10	K Street NW and Vermont Avenue	NB	42.2	D	24.9	C
		SB	47.1	D		
		EB	11.4	B		
		WB	22.1	C		
11	K Street NW and 14th Street NW	NB	37.1	D	52.9	D
		SB	57.0	E		
		EB	48.0	D		
		WB	71.1	E		
12	K Street NW and 13th Street NW	NB	19.0	B	23.7	C
		SB	34.3	C		
		EB	13.7	B		
		WB	20.0	B		

#	Intersection	Approach	Average Delay (sec/veh)	Approach LOS	Intersection Delay	Intersection LOS
13	K Street NW and 12th Street NW	NB	92.0	F	58.2	E
		SB	-	-		
		EB	9.2	A		
		WB	25.9	C		
14	K Street NW and 11th Street NW	NB	20.5	C	24.3	C
		SB	26.3	C		
		EB	13.7	B		
		WB	44.2	D		
15	K Street NW and 10th Street NW	NB	-	-	19.5	B
		SB	18.5	B		
		EB	20.0	C		
		WB	22.1	C		
16	K Street NW and 9th Street NW	NB	-	-	7.6	A
		SB	5.3	A		
		EB	45.7	D		
		WB	-	-		
17	L Street NW and 21st Street NW	NB	-	-	21.2	C
		SB	23.0	C		
		EB	20.0	B		
		WB	-	-		
18	Pennsylvania Avenue NW and 21st Street NW	NB	-	-	29.4	C
		SB	26.7	C		
		EB	27.4	C		
		WB	36.9	D		
19	L Street NW and Connecticut Avenue	NB	53.9	D	34.2	C
		SB	23.5	C		
		EB	22.1	C		
		WB	-	-		
20	I Street NW and 17th Street NW (west)	NB	21.4	C	27.3	C
		SB	36.8	D		
		EB	-	-		
		WB	26.5	C		
21	L Street NW and 16th Street NW	NB	7.9	A	22.0	C
		SB	26.1	C		
		EB	26.5	C		
		WB	-	-		
22	I Street NW and 16th Street NW	NB	14.6	B	31.4	C
		SB	44.3	D		
		EB	-	-		
		WB	27.9	C		
23	L Street NW and 15th Street NW (west)	NB	12.9	B	15.2	B
		SB	21.2	C		
		EB	16.3	B		
		WB	-	-		
24	L Street NW and 14th Street NW	NB	14.0	B	19.5	B
		SB	16.4	B		
		EB	30.1	C		
		WB	-	-		
25	I Street NW and 14th Street NW	NB	25.0	C	41.9	D
		SB	66.1	E		
		EB	-	-		
		WB	42.6	D		

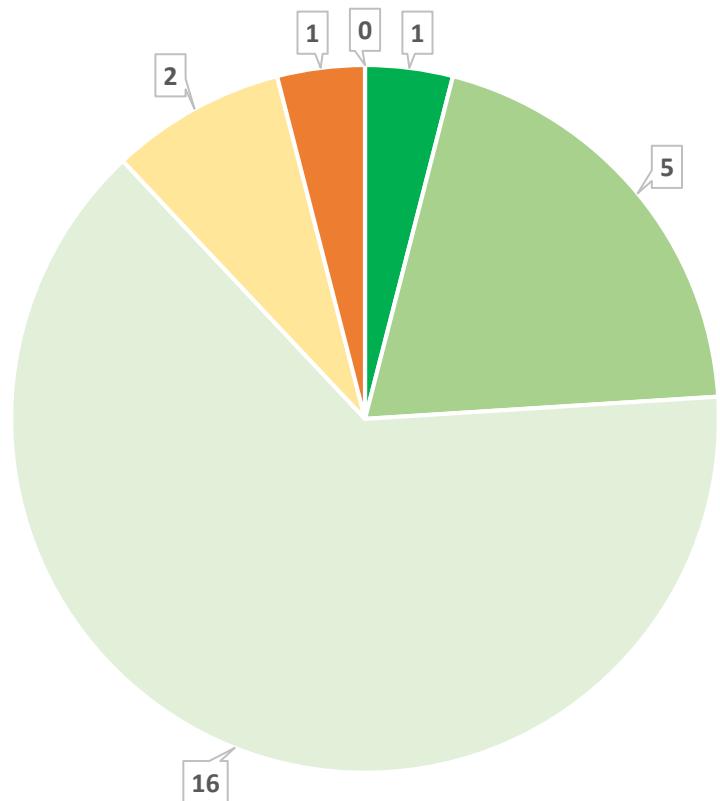
Intersection Delay and Estimated LOS

AM Peak Hour: 8:30AM-9:30AM

Approach LOS Summary



Intersection LOS Summary



Approach LOS	A	B	C	D	E	F	Intersection LOS	A	B	C	D	E	F
Approach LOS	5	18	36	18	3	1	Intersection LOS	1	5	16	2	1	0

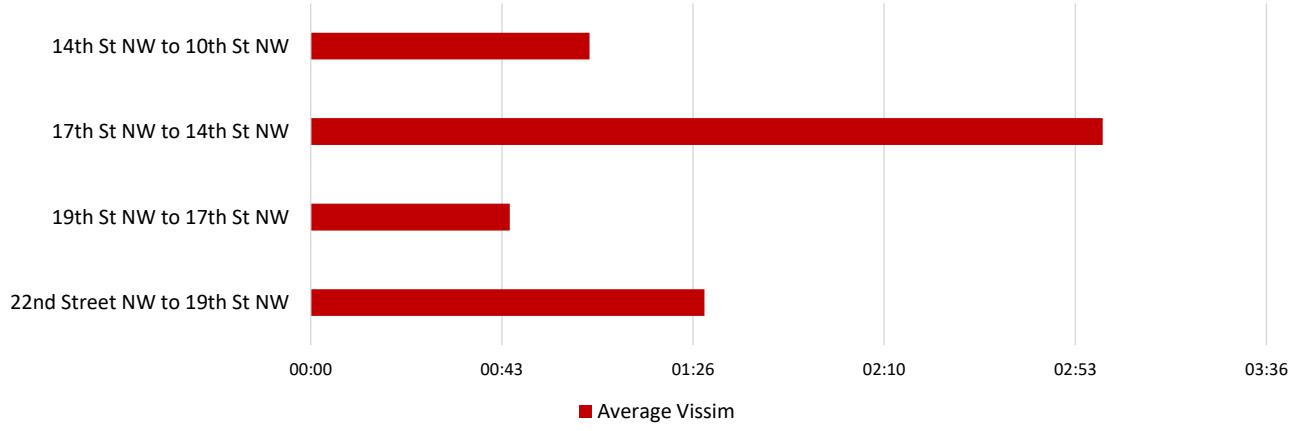
Travel Time | Segment-by-Segment Passenger Cars

AM Peak Period: 8:00AM-10:00AM

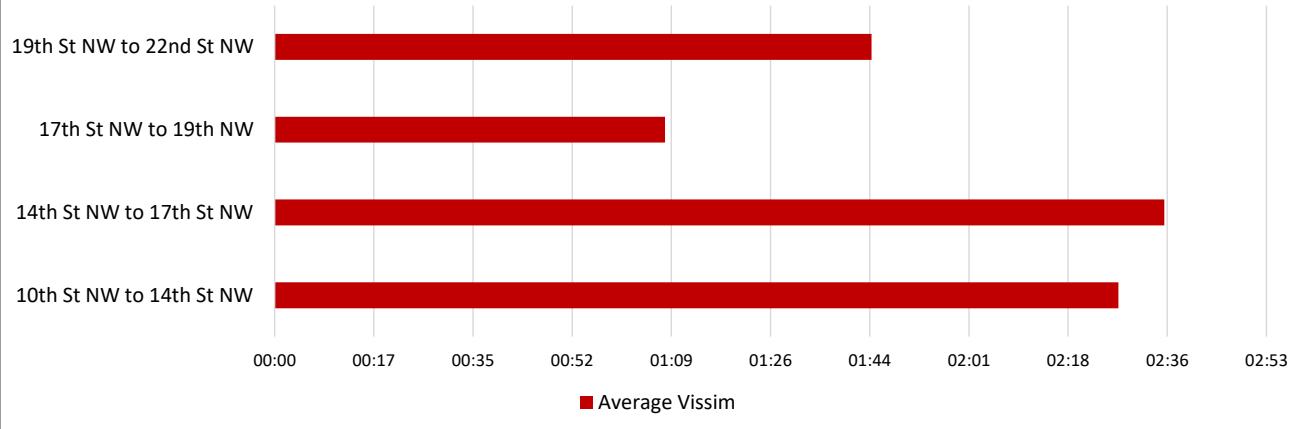
Passenger Vehicle Segment-by-Segment Travel Time Comparison					
Segment ID	Route	Vehicle Count	Average Vissim	Standard Deviation by Time ¹	Standard Deviation by Seed ²
		(MM:SS)	(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	1089	01:29	00:24	00:16
2	19th St NW to 17th St NW	985	00:45	00:03	00:05
3	17th St NW to 14th St NW	468	02:59	00:11	00:22
4	14th St NW to 10th St NW	485	01:03	00:02	00:05
Total	Total Eastbound	3027	06:16	00:39	00:48
5	10th St NW to 14th St NW	572	02:27	00:06	00:16
6	14th St NW to 17th St NW	505	02:35	00:08	00:17
7	17th St NW to 19th NW	1006	01:08	00:05	00:10
8	19th St NW to 22nd St NW	461	01:44	00:07	00:16
Total	Total Westbound	2544	07:54	00:26	00:59

*Results show the average from 10 simulation runs.

Eastbound Travel Time Segments



Westbound Travel Time Segments



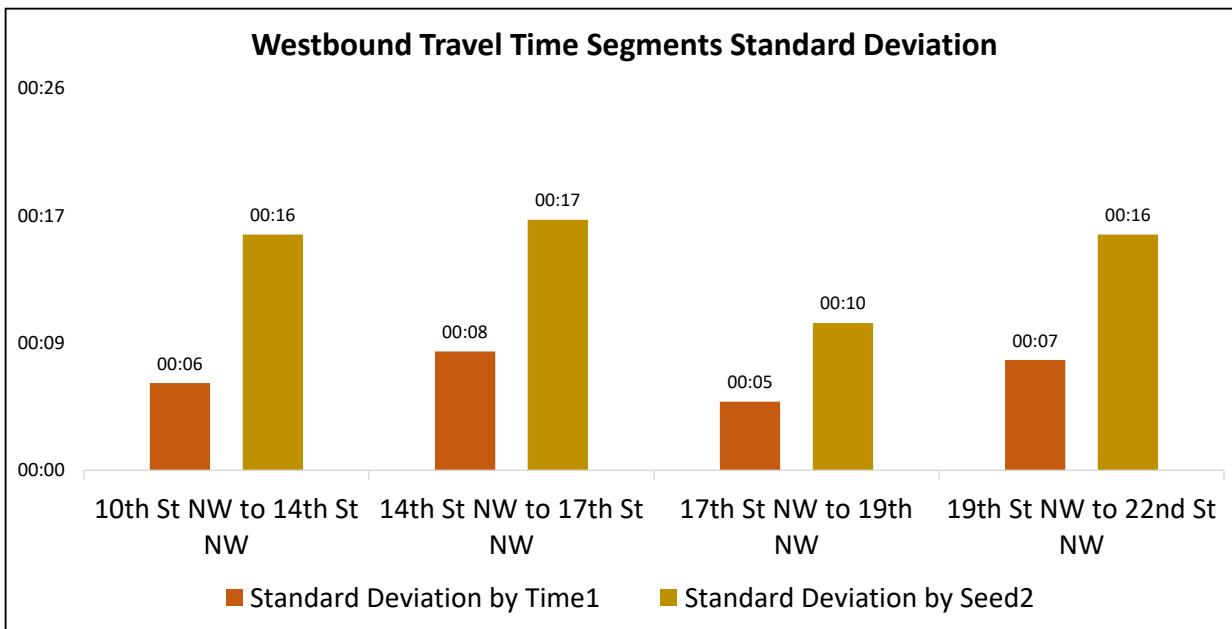
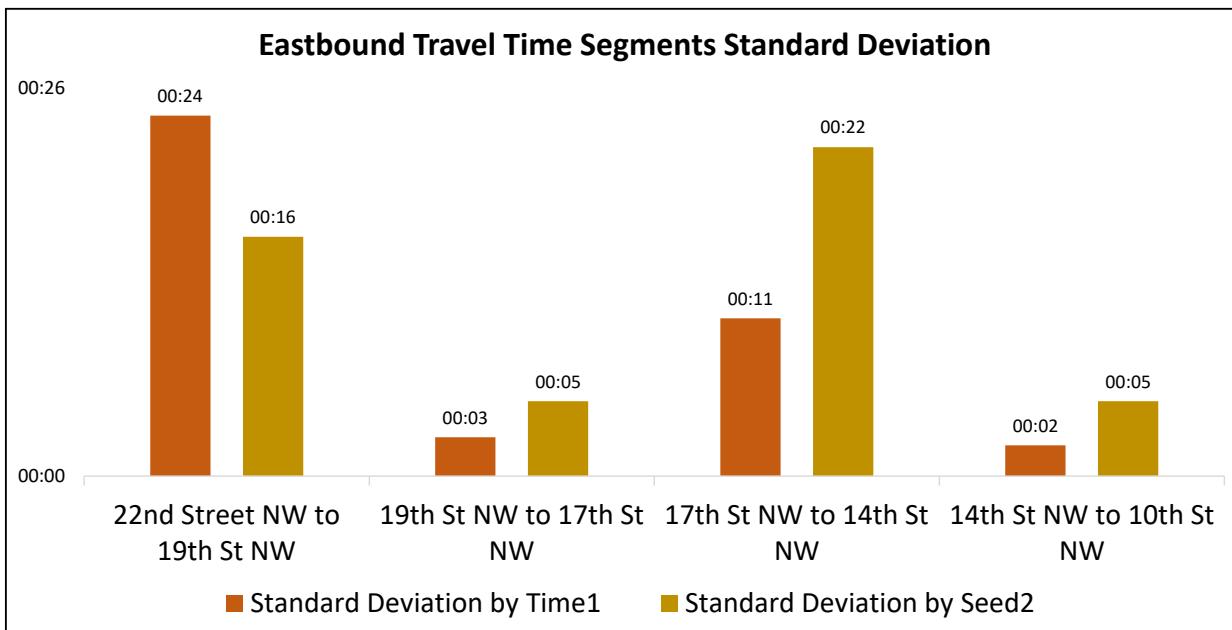
Travel Time | Segment-by-Segment Passenger Cars

AM Peak Period: 8:00AM-10:00AM

*Travel time results collected throughout the 2-hour peak period at 15-minute intervals.

¹Standard deviation by time is standard deviation of the average travel time for all simulation runs in each 15-minute time segment, representing how the average travel time changes throughout the peak period.

²Standard deviation by seed is the average standard deviation of travel times for each 15-minute time segment in the peak period, representing the consistency of travel time throughout the peak period.

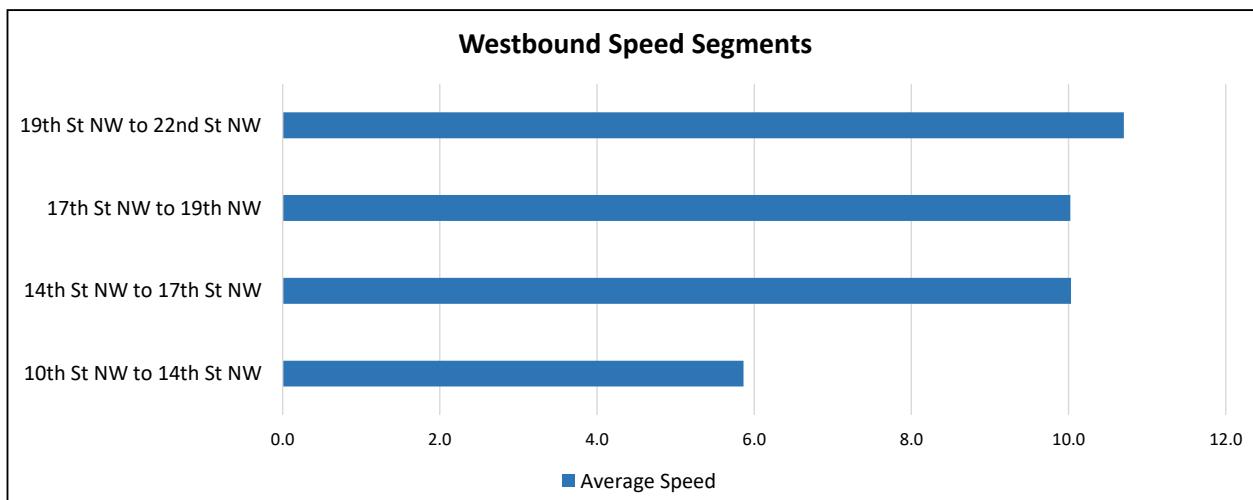
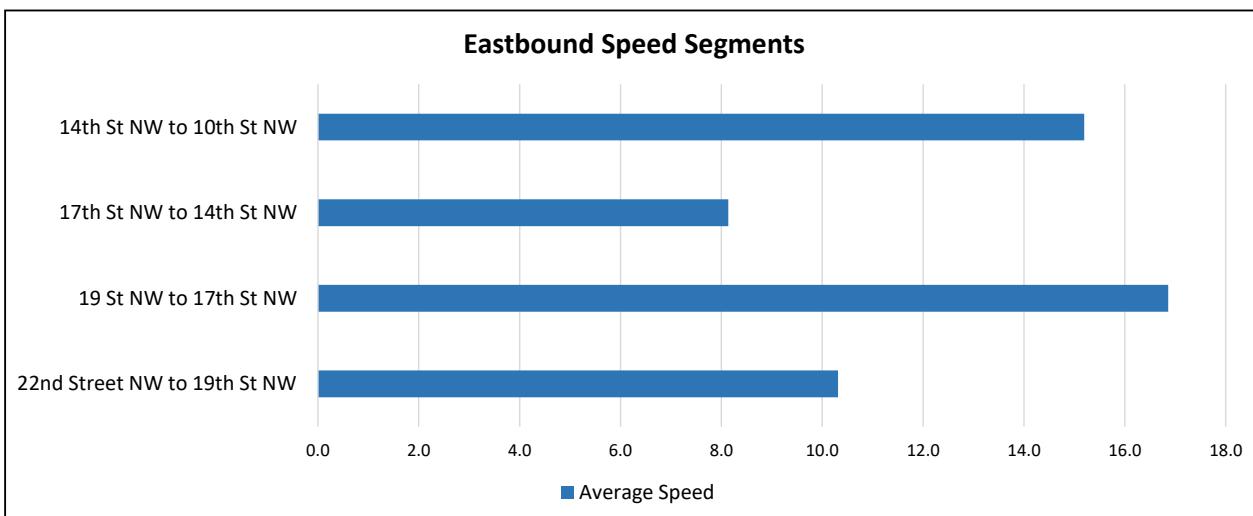


Speed | Segment-by-Segment Passenger Cars

AM Peak Period: 8:00AM-10:00AM

Passenger Vehicle Segment-by-Segment Average Speed Comparison			
Segment ID	Route	Vehicle Count	Average Speed
			MPH
1	22nd Street NW to 19th St NW	1089	10.3
2	19 St NW to 17th St NW	985	16.9
3	17th St NW to 14th St NW	468	8.1
4	14th St NW to 10th St NW	485	15.2
Average Eastbound		3027	12.6
5	10th St NW to 14th St NW	572	5.9
6	14th St NW to 17th St NW	505	10.0
7	17th St NW to 19th NW	1006	10.0
8	19th St NW to 22nd St NW	461	10.7
Average Westbound		2544	9.2

*Results show the average from 10 simulation runs.

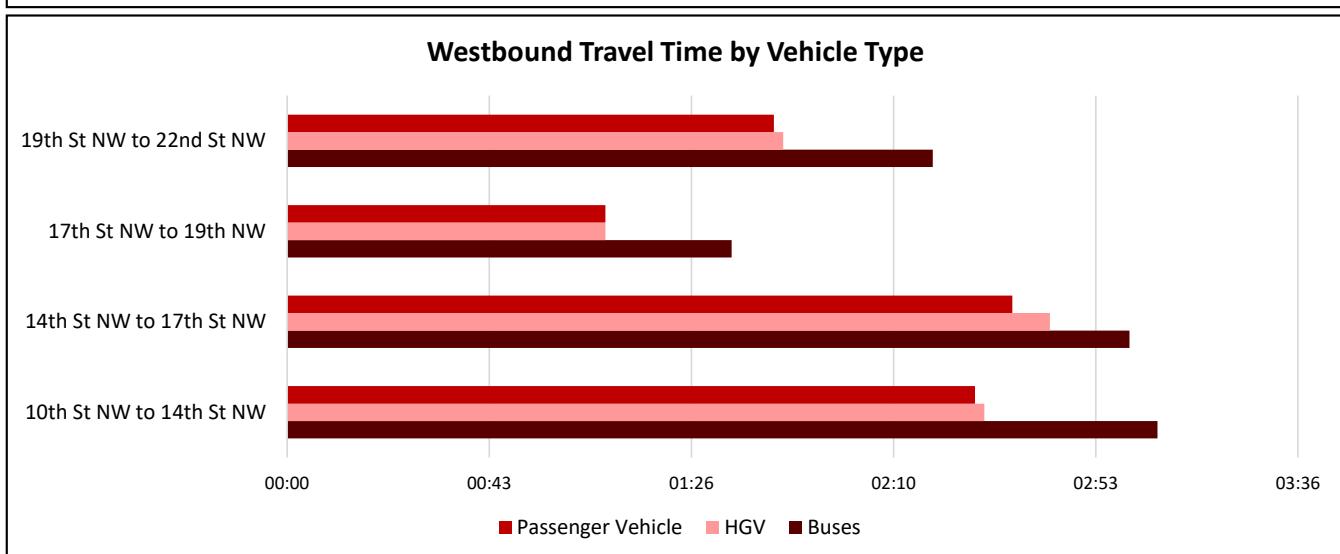
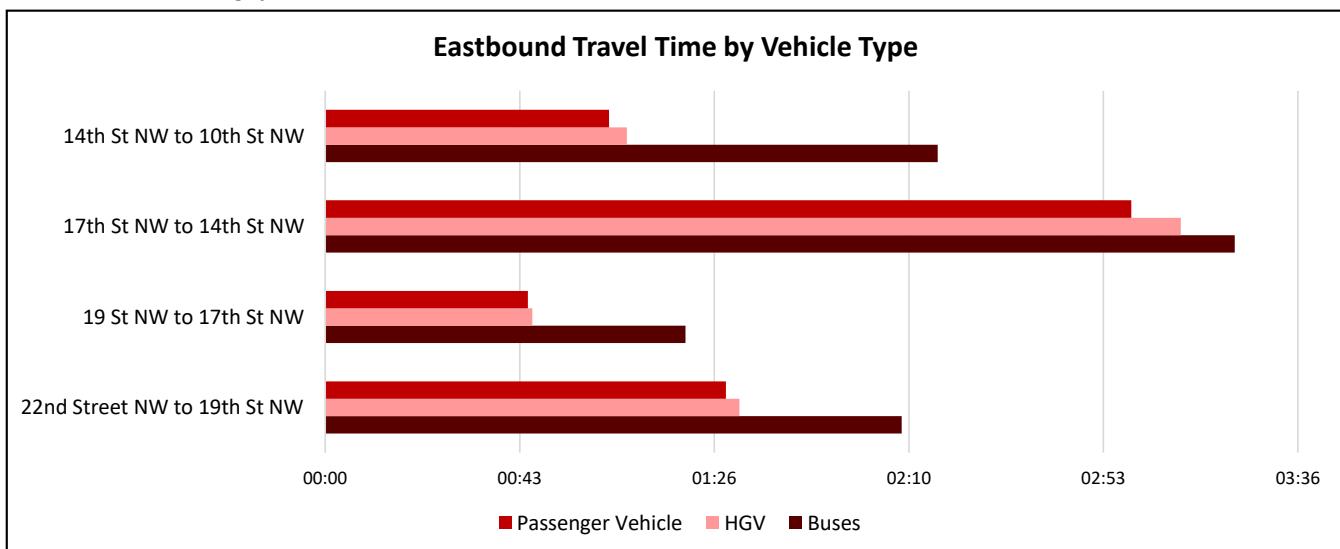


Travel Time | Comparison by Vehicle Type

AM Peak Period: 8:00AM-10:00AM

Segment ID	Route	Travel Time by Vehicle Type		
		Passenger Vehicle (MM:SS)	HGV (MM:SS)	Buses (MM:SS)
1	22nd Street NW to 19th St NW	01:29	01:32	02:08
2	19 St NW to 17th St NW	00:45	00:46	01:20
3	17th St NW to 14th St NW	02:59	03:10	03:22
4	14th St NW to 10th St NW	01:03	01:07	02:16
Total	Total Eastbound	06:16	06:35	09:06
5	10th St NW to 14th St NW	02:27	02:29	03:06
6	14th St NW to 17th St NW	02:35	02:43	03:00
7	17th St NW to 19th NW	01:08	01:08	01:35
8	19th St NW to 22nd St NW	01:44	01:46	02:18
Total	Total Westbound	07:54	08:06	09:59

*Results show the average from 10 simulation runs.

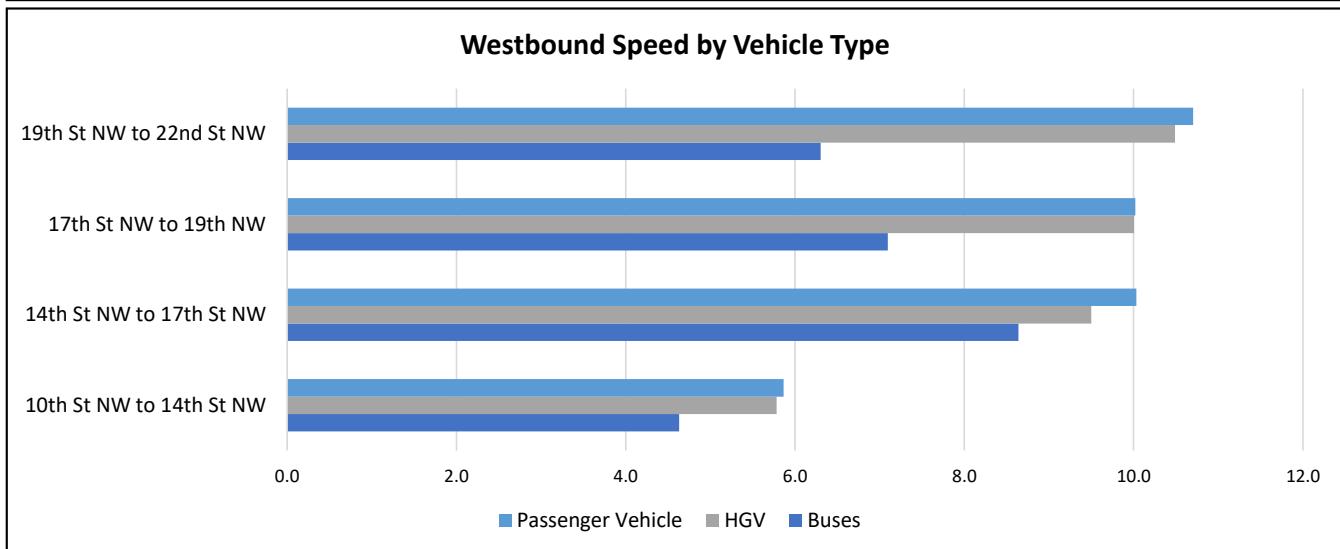
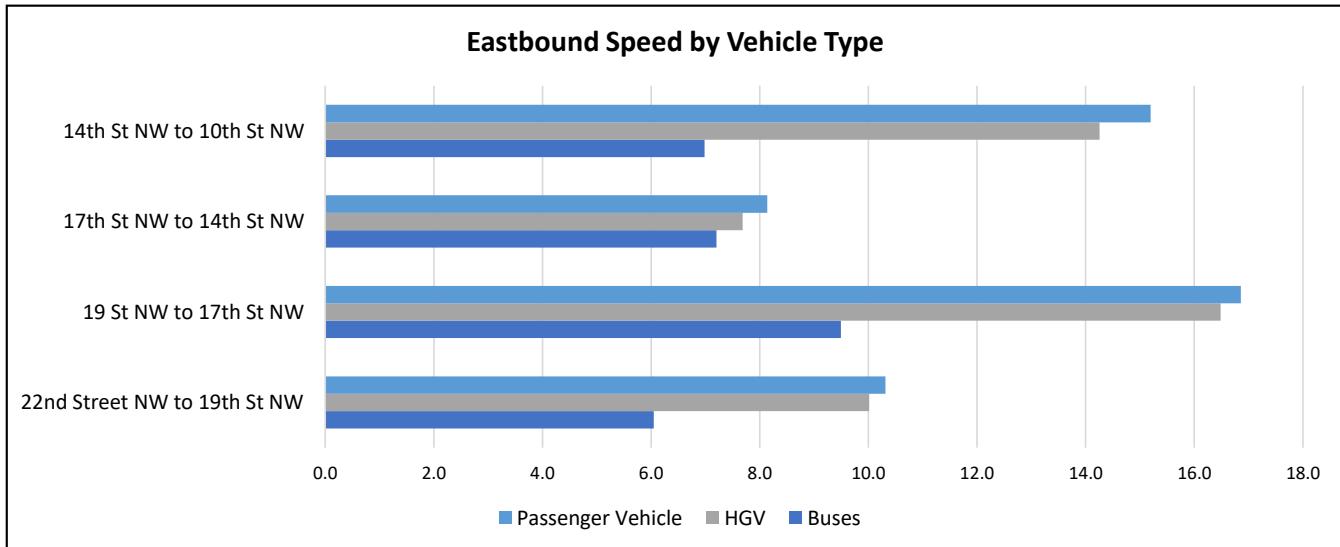


Speed | Comparison by Vehicle Type

AM Peak Period: 8:00AM-10:00AM

Segment ID	Route	Travel Time by Vehicle Type		
		Passenger Vehicle (MM:SS)	HGV (MM:SS)	Buses (MM:SS)
1	22nd Street NW to 19th St NW	10.3	10.0	6.0
2	19 St NW to 17th St NW	16.9	16.5	9.5
3	17th St NW to 14th St NW	8.1	7.7	7.2
4	14th St NW to 10th St NW	15.2	14.3	7.0
Average Eastbound		12.6	12.1	7.4
5	10th St NW to 14th St NW	5.9	5.8	4.6
6	14th St NW to 17th St NW	10.0	9.5	8.6
7	17th St NW to 19th NW	10.0	10.0	7.1
8	19th St NW to 22nd St NW	10.7	10.5	6.3
Average Westbound		9.2	8.9	6.7

*Results show the average from 10 simulation runs.



Travel Time | Comparison by Vehicle Type

AM Peak Period: 8:00AM-10:00AM

Number of Vehicles Represented in Travel Time by Vehicle Type				
Segment ID	Route	Passenger Vehicle	HGV	Buses
		Vehicle Count	Vehicle Count	Vehicle Count
1	22nd Street NW to 19th St NW	1089	57	27
2	19 St NW to 17th St NW	985	53	58
3	17th St NW to 14th St NW	468	26	76
4	14th St NW to 10th St NW	485	25	48
Total	Total Eastbound	3027	161	209
5	10th St NW to 14th St NW	572	33	56
6	14th St NW to 17th St NW	505	24	130
7	17th St NW to 19th NW	1006	56	81
8	19th St NW to 22nd St NW	461	24	49
Total	Total Westbound	2544	137	316

*Total number of vehicles counted in Travel Time runs through the 2-hour peak period.

GEH of Vehicular Throughput

AM Peak Hour: 8:30AM-9:30AM

GEH Criteria	Value	Percent	Target	Target Met
Total Network Volume with GEH < 4	GEH: 0.8	N/A	4	Yes
Total Network Volume %Difference from Balanced Counts	N/A	0.44%	5%	Yes
85% of individual links below GEH < 5	84 of 84	100%	85%	Yes

Total K Street NW Volume	Sum of balanced counts	Sum of all link flows	Percent Difference	GEH
	34,875	35,027	0.4%	0.8

* Bus volume during peak period added to "Sum of balanced counts"

Intersection Approaches	Number of Approaches	Number of Segments with GEH < 5	Number of Segments with GEH >5	Percent Compliance
	84	84	0	100%

The GEH statistic is computed using the following formula:

E = Vissim estimated throughput

V = balanced field count:

$$\text{GEH} = \sqrt{\frac{(E-V)^2}{(E+V)/2}}$$

Sample Size Determination Tool, Version 2.0



<p>Step 1: Input number of MOEs (max is 12). Clear out old data.</p> <p>Step 2: Select type of MOEs</p> <p>Step 3: Insert simulation results from four random seeds for selected MOEs</p>		<p>User Inputs</p> <p>Constants</p> <p>Outputs</p> <p>Sample Size (N) = Number of Model Runs Sample Mean (X_s) = $(1/N)(X_1 + X_2 + X_3 \dots + X_N)$ Sample Standard Deviation (S_s) = $\sqrt{[(\sum(X-X_s)^2)/(N-1)]}$ Sampling Error = $t(S_s/\sqrt{N})$ Confidence Level = $X_s \pm t(S_s/\sqrt{N})$ % of Sample Mean (E) = % Tolerance * X_s Sample Size Needed = $[(t)^2 * (S_s)^2] / (E)^2$</p> <p><i>The "t" statistic is the hypothesized number of standard deviations away from the mean corresponding to the required confidence level and sample size in a t-distribution.</i></p>								
<p>Inputs</p> <p>Confidence Interval: 95%</p> <p>Tolerance Error: 10%</p> <p>Number of MOEs: 10</p>		<p>Output</p> <p>Number of Required Runs: 10</p> <p>*Minimum number of required runs = 10</p>								
Location (optional)	EB K Street	WB K Street	EB (17th/18th)	WB (17th/18th)	EB (13th/14th)	WB (13th/14th)	EB (17th/18th)	WB (17th/18th)	EB (13th/14th)	WB (13th/14th)
Runs (Seeds)	Travel Time	Travel Time	Volume	Volume	Volume	Volume	Speed	Speed	Speed	Speed
100	352	315	614	1934	1090	1654	19.1	18.3	24.6	18.8
120	349	303	573	1892	1074	1639	20.0	18.4	24.6	19.5
140	341	306	594	1900	1102	1752	20.1	17.8	24.5	18.1
160	354	306	628	1836	1107	1627	19.6	18.0	24.3	20.1
*Results from four random seeds										
Statistics										
$X_s =$	349.1	307.3	602.3	1890.5	1093.3	1668.0	19.7	18.1	24.5	19.1
$S_s =$	5.9	5.1	24.0	40.6	14.7	57.1	0.5	0.3	0.1	0.9
$E =$	34.9	30.7	60.2	189.1	109.3	166.8	2.0	1.8	2.4	1.9
$t =$	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18
Sampling Error =	9.39	8.06	38.15	64.67	23.36	90.83	0.74	0.47	0.22	1.36
95% Interval Lower =	339.7	299.3	564.1	1825.8	1069.9	1577.2	19.0	17.6	24.3	17.8
95% Interval Upper =	358.5	315.4	640.4	1955.2	1116.6	1758.8	20.4	18.6	24.7	20.5
% of Sample Mean =	2.69%	2.62%	6.34%	3.42%	2.14%	5.45%	3.74%	2.60%	0.90%	7.11%
Sample Size Needed =	4	4	4	4	4	4	4	4	4	4

Network Gridlock Check

Inputs

Confidence Interval:	95%
Tolerance Error:	10%

Runs (Seeds)

100
110
120
130
140
150
160
170
180
190

<u>Runs (Seeds)</u>	<u>Ave Delay PVs</u>	<u>Latend Demand</u>	<u>Ave Speed PVs</u>	<u>Ave Delay Stop PVs</u>	<u>Total Delay PVs</u>	<u>PVs Active @ End of Simulation</u>	<u>Total PVs Arrived</u>
100	67.53	0	10.6	48.9	3.0	735	43524
110	67.08	298	10.6	49.7	2.9	778	43192
120	60.83	0	11.2	43.5	2.7	592	43494
130	61.92	0	11.1	44.5	2.7	650	43594
140	65.57	0	10.8	47.4	2.9	660	43282
150	65.58	0	10.8	47.3	2.9	743	43399
160	61.48	0	11.2	44.1	2.7	678	43470
170	65.24	0	10.8	46.9	2.9	720	43527
180	63.47	80	11.0	46.5	2.8	642	43310
190	62.09	40	11.1	44.5	2.8	680	43677

Statistics

X _s =	64.1	41.8	10.9	46.3	2.8	687.8	43446.9
S _s =	2.4	93.9	0.2	2.1	0.1	55.9	150.1
E =	6.4	4.2	1.1	4.6	0.3	68.8	4344.7
t =	3.18	3.18	3.18	3.18	3.18	3.18	3.18

Sampling Error =	3.86	149.39	0.37	3.36	0.17	88.88	238.92
95% Interval Lower =	60.2	-107.6	10.5	43.0	2.7	598.9	43208.0
95% Interval Upper =	67.9	191.2	11.3	49.7	3.0	776.7	43685.8
% of Sample Mean =	6.03%	357.40%	3.37%	7.25%	5.95%	12.92%	0.55%

Attachment D-2:

Alternative 1 Vissim Results Summary – PM Peak

PM Alternative 1 (Two Through Lanes) Model Loading Summary

PM Peak Hour: 4:45PM-5:45PM

PM Peak Period: 4:15PM-6:15PM

Item	Basis	Criteria	Value	Target	Criteria Met
Simulated Vehicular Throughput (Individual Links)	All Segments and Approaches	Within \pm 100 vph for < 700 vph		85%	Yes
		Within \pm 15% for \geq 700 vph to < 2,700 vph			
		Within \pm 400 vph for \geq 2,700 vph			
		GEH < 5 for individual link flows	100%	85%	Yes
Simulated Vehicular Throughput (Network Wide)	Total Volume throughout Network on K Street Corridor	GEH < 4 for total network volume	1.3	4.0	Yes
		Within 5% of total network volume	-0.7%	5%	Yes
Required Sample Size			10		

*Findings Represent Results from 10 Simulation Runs

Intersection Volume Loading

PM Peak Hour: 4:45PM-5:45PM

85% of All Intersection Approaches within the following Volume Criteria		Number of Approaches		Passing Approaches		Percent	Target	Target Met
Within \pm 100 vph for < 700 vph	43	84	43	84	100%	85%	Yes	
Within \pm 15% for \geq 700 vph to < 2,700 vph	41		41					
Within \pm 400 vph for \geq 2,700 vph	0		0					

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)	
1	K Street NW and 22nd Street NW	NB	LT - SL	122	401	121	-1	-1%
			TH	247		236		
			RT - SL	32		30		
		EB	TH	258	258	253	-5	-2%
			WB	1,204	1,204	1,115	-89	-7%
		EB Service Lane	LT	21	128	21	0	0%
			TH	107		147		
		WB Service Lane	UT	76	347	71	40	31%
			TH	179		180		
			RT	92		83		
		Intersection		2,338	2,257		-81	-3%
2	K Street NW and 21st Street NW	SB	LT	96	857	96	0	0%
			TH	516		504		
			RT	245		236		
		EB	TH	258	258	252	-6	-2%
			TH	959		871		
		WB	TH - SL	305	1,264	271	-34	-10%
			TH - ML	127		139		
		EB Service Lane	RT	111		108	-3	4%
			Intersection		2,617	2,477	-140	
3	K Street NW and 20th Street NW	NB	LT	133	657	132	-1	-1%
			TH	403		402		
			RT	121		134		
		EB	TH	466	466	479	13	2%
			TH	920		860		
		WB	RT	200	1,120	204	4	-5%
			Intersection		2,243	2,211	-32	
		SB	LT	60	899	61	1	2%
			TH	701		708		
			RT	138		140		
			TH	475		496		
			RT	197		191		
4	K Street NW and 19th Street NW	EB	Intersection		2,542	2,516	-26	-1%
			LT	60	672	61	10	1%
			TH	701		708		
			RT	138		140		
			TH	475		496		
		WB	RT	197		191	15	2%
			TH	971		920		
			Intersection		2,542	2,516	-26	
			LT	60	672	61	10	1%
			TH	701		708		
5	K Street NW and 18th Street NW	NB	Intersection		2,196	2,181	-15	-1%
			LT	132	726	131	14	2%
			TH	487		502		
			RT	107		107		
			TH	525		549		
		EB	TH	822	945	775	24	5%
			RT	123		117		
			Intersection		2,196	2,181	-15	
			LT	132	131			
			TH	487	502			
6	K Street NW and Connecticut Avenue	SB	Intersection		3,547	3,463	-84	-2%
			TH	590	648	623	38	6%
			RT	56		61		
			LT	12		10		
			TH	740		673		
		EB	RT	155	871	124	7	1%
			TH	729		749		
			RT	142		129		
			TH	931	1,121	905	-29	-3%
			RT	190		187		

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)	
7	K Street NW and 17th Street NW (east)	NB	LT	37	183	38	2	3% 2% -8% -5%
			TH	122		125		
			RT	24		22		
			LT	41		39		
		SB	TH	169	329	168	-4	-1% -1% -1%
			RT	119		118		
			TH	797		825		
		EB	TH	965	1,036	938	28	4% 4%
			RT	71		73		
		Intersection		2,345	2,346	1	0%	
8	K Street NW and 16th Street NW	NB	LT	8	336	9	12	13% 4% 0% -2%
			TH	286		297		
			RT	42		42		
			LT	115		113		
		SB	TH	332	552	342	5	3% -3% 5%
			RT	105		102		
			TH	620		648		
		EB	RT	112	732	115	31	3% 4%
			TH	740		727		
		WB		208	948	210	-11	-2% -1%
		Intersection		2,568		2,605		
9	K Street NW and 15th Street NW (west)	NB	LT	48	375	46	4	-4% 2% -6% 25%
			TH	311		318		
			RT	16		15		
			LT	8		10		
		SB	TH	198	294	196	-6	-1% -7% 3%
			RT	88		82		
			TH	806		832		
		EB	RT	41	847	39	24	-5% 3%
			TH	911		904		
		WB		161	1,072	157	-11	-1% -2%
		Intersection		2,588		2,599		
10	K Street NW and Vermont Avenue	NB	LT	92	363	90	2	-2% 2% -2% -2%
			TH	219		224		
			RT	52		51		
			LT	80		78		
		SB	RT	90	170	89	-3	-3% -1% 2%
			TH	830		849		
			TH	895		880		
		EB	RT	66	961	62	19	-2% -6%
			TH	792		769		
		WB		69	861	65	-19	-3% -6%
		Intersection		2,324		2,323		
11	K Street NW and 14th Street NW	NB	LT	125	733	125	40	0% 7% 3% -7%
			TH	569		608		
			RT	39		40		
			LT	28		26		
		SB	TH	632	713	622	-17	-2% -9% 0%
			RT	53		48		
			TH	752		754		
		EB	RT	216	968	216	2	0% 0%
			TH	792		769		
		WB		69	861	65	-27	-3% -6%
		Intersection		3,275		3,273		
12	K Street NW and 13th Street NW	NB	LT	188	678	185	11	-2% 3% 0% -8%
			TH	473		487		
			RT	17		17		
			LT	26		24		
		SB	TH	553	695	567	9	3% -3% 3%
			RT	116		113		
			TH	640		656		
		EB	RT	179	819	177	14	-1% 10%
			TH	539		540		
		WB		48	587	53	6	0% 10%
		Intersection		2,779		2,819		

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)	
13	K Street NW and 12th Street NW	NB	LT	201	1,040	201	-14	0%
			TH	763		751		-2%
			RT	76		74		-3%
		EB	TH	670	670	687	17	3%
			TH	369		370		0%
			RT	49		50		2%
		Intersection		2,128	2,133		5	0%
		SB	LT	152	442	168	12	11%
			TH	239		239		0%
			RT	51		47		-8%
			LT	34	538	32	-5	-6%
			TH	437		425		-3%
			RT	67		76		13%
14	K Street NW and 11th Street NW	EB	LT	67	705	70	38	4%
			TH	342		336		-2%
			RT	296		337		14%
		WB	LT	13	225	14	-4	8%
			TH	192		188		-2%
			RT	20		19		-5%
		Intersection		1,910	1,951		41	2%
		SB	LT	32	445	33	-12	3%
			TH	302		293		-3%
			RT	111		107		-4%
			TH	180	444	175	-11	-3%
			RT	264		258		-2%
15	K Street NW and 10th Street NW	EB	LT	37	132	39	2	5%
			TH	95		95		0%
		Intersection		1,021	1,000		-21	-2%
		WB	TH	781	864	798	16	2%
			RT	83		82		-1%
			RT	182		177		-3%
16	K Street NW and 9th Street NW	Intersection		1,046	1,057		11	1%
		SB	LT	188	880	187	-2	-1%
			TH	692		691		0%
			TH	492	657	488		-1%
			RT	165		154		-7%
17	L Street NW and 21st Street NW	Intersection		1,537	1,520		-17	-1%
		SB	LT	142	627	138	-14	-3%
			TH	394		388		-2%
			RT	91		87		-4%
		EB	TH	554	654	562	9	1%
			RT	100		101		1%
18	Pennsylvania Avenue NW and 21st Street NW	WB	LT	267	825	262	16	-2%
			TH	558		579		4%
			Intersection		2,106	2,117	11	1%
		SB	TH	689	780	720	29	4%
			RT	91		89		-2%
19	L Street NW and Connecticut Avenue	EB	TH	750	750	713	-37	-5%
			LT	151		147		-3%
			TH	788		787		0%
		NB	RT	157	1,096	141	-21	-10%
			Intersection		2,626	2,597		-1%
20	I Street NW and 17th Street NW (west)	SB	LT	58	591	59	23	2%
			TH	533		555		4%
			TH	803		713		-11%
			RT	79		63		-20%
		WB	LT	442	1,149	433	-8	-2%
			TH	592		579		-2%
			RT	115		129		12%
			Intersection		2,622	2,531	-91	-3%

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)			
21	L Street NW and 16th Street NW	NB	TH	377	494	379	2	0	1%	0%
			RT	117		115	-2		-2%	
			LT	103	563	112	9		9%	2%
			TH	460		462	2		0%	
		EB	LT	214	968	221	7	-2	3%	0%
			TH	662		649	-13		-2%	
			RT	92		96	4		4%	
		Intersection		2,025	2,034		9	0%		
		NB	LT	32	207	33	1	-6	3%	-3%
			TH	175		168	-7		-4%	
		SB	TH	238	445	239	1		0%	
			RT	207		217	10		5%	
22	I Street NW and 16th Street NW	WB	LT	77	971	78	1	32	1%	3%
			TH	733		745	12		2%	
			RT	161		180	19		12%	
			Intersection		1,623	1,660		37	2%	
		NB	TH	432	472	425	-7	-1	-2%	0%
			RT	40		46	6		15%	
		SB	LT	59	211	59	0		0%	
			TH	152		145	-7		-5%	
		EB	LT	225	1,102	222	-3	15	-1%	1%
			TH	735		749	14		2%	
			RT	142		146	4		3%	
			Intersection		1,785	1,792		7	0%	
23	L Street NW and 15th Street NW (west)	NB	TH	518	638	536	18	19	3%	3%
			RT	120		121	1		1%	
		SB	LT	77	622	77	0		0%	
			TH	545		552	7		1%	
		EB	LT	71	964	67	-4	-10	-6%	-1%
			TH	725		724	-1		0%	
			RT	168		163	-5		-3%	
			Intersection		2,224	2,240		16	1%	
		NB	LT	254	941	256	2	26	1%	3%
			TH	687		711	24		3%	
			TH	785	848	739	-46		-6%	
			RT	63		59	-4		-6%	
		WB	LT	128	781	131	3	46	2%	6%
			TH	607		636	29		5%	
			RT	46		60	14		30%	
		Intersection		2,570	2,592		22	1%		

*Results show the average from 10 simulation runs.

Intersection Delay and Estimated LOS

PM Peak Hour: 4:45PM-5:45PM

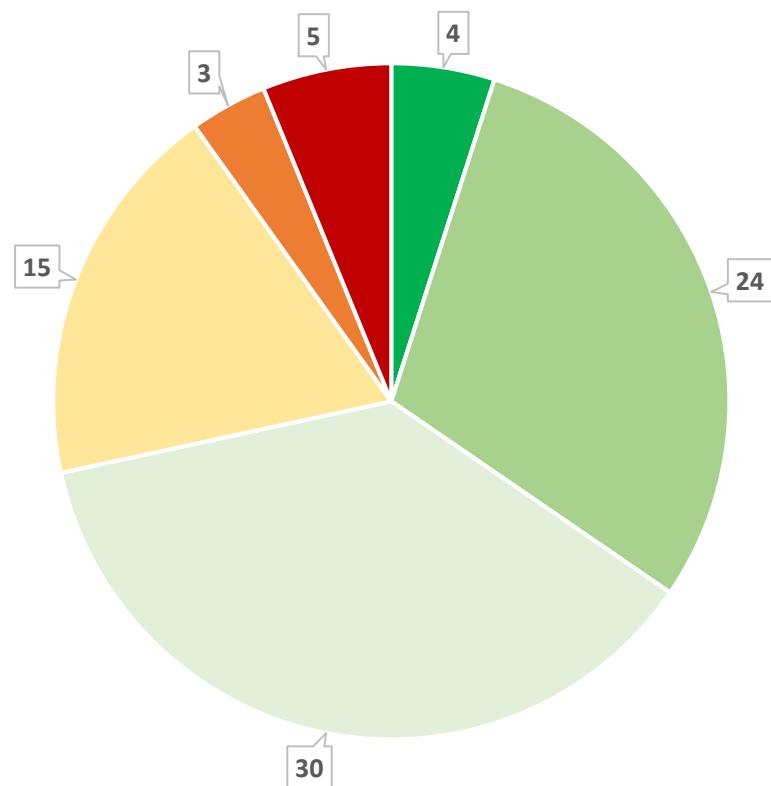
#	Intersection	Approach	Average Delay (sec/veh)	Approach LOS	Intersection Delay	Intersection LOS
1	K Street NW and 22nd Street NW	NB	29.2	C	29.4	C
		SB	-	-		
		EB Service Lane	10.6	B		
		WB Service Lane	33.5	C		
2	K Street NW and 21st Street NW	NB	-	-	48.7	D
		SB	40.0	D		
		EB	26.2	C		
		WB	58.2	E		
3	K Street NW and 20th Street NW	NB	40.5	D	26.2	C
		SB	-	-		
		EB	6.8	A		
		WB	25.9	C		
4	K Street NW and 19th Street NW	NB	-	-	26.5	C
		SB	30.4	C		
		EB	29.8	C		
		WB	20.2	C		
5	K Street NW and 18th Street NW	NB	32.8	C	21.9	C
		SB	-	-		
		EB	15.7	B		
		WB	16.6	B		
6	K Street NW and Connecticut Avenue	NB	15.8	B	42.6	D
		SB	108.9	F		
		EB	35.8	D		
		WB	16.0	B		
7	K Street NW and 17th Street NW (east)	NB	32.6	C	15.4	B
		SB	25.5	C		
		EB	4.2	A		
		WB	18.2	B		
8	K Street NW and 16th Street NW	NB	35.4	D	17.4	B
		SB	13.0	B		
		EB	13.3	B		
		WB	16.8	B		
9	K Street NW and 15th Street NW (west)	NB	30.3	C	20.4	C
		SB	38.6	D		
		EB	17.3	B		
		WB	14.4	B		
10	K Street NW and Vermont Avenue	NB	35.6	D	21.5	C
		SB	53.5	D		
		EB	13.2	B		
		WB	17.9	B		
11	K Street NW and 14th Street NW	NB	32.4	C	41.7	D
		SB	76.4	E		
		EB	40.5	D		
		WB	22.9	C		
12	K Street NW and 13th Street NW	NB	21.3	C	24.3	C
		SB	37.4	D		
		EB	23.0	C		
		WB	14.3	B		

#	Intersection	Approach	Average Delay (sec/veh)	Approach LOS	Intersection Delay	Intersection LOS
13	K Street NW and 12th Street NW	NB	43.3	D	28.6	C
		SB	-	-		
		EB	11.7	B		
		WB	20.1	C		
14	K Street NW and 11th Street NW	NB	31.9	C	23.3	C
		SB	31.4	C		
		EB	14.1	B		
		WB	17.2	B		
15	K Street NW and 10th Street NW	NB	-	-	17.5	B
		SB	26.7	C		
		EB	8.5	A		
		WB	16.5	B		
16	K Street NW and 9th Street NW	NB	-	-	13.6	B
		SB	4.9	A		
		EB	56.8	E		
		WB	-	-		
17	L Street NW and 21st Street NW	NB	-	-	25.5	C
		SB	25.3	C		
		EB	25.7	C		
		WB	-	-		
18	Pennsylvania Avenue NW and 21st Street NW	NB	-	-	103.2	F
		SB	21.3	C		
		EB	35.6	D		
		WB	216.1	F		
19	L Street NW and Connecticut Avenue	NB	10.5	B	64.5	E
		SB	152.2	F		
		EB	47.1	D		
		WB	-	-		
20	I Street NW and 17th Street NW (west)	NB	23.2	C	62.8	E
		SB	112.5	F		
		EB	-	-		
		WB	50.3	D		
21	L Street NW and 16th Street NW	NB	14.3	B	20.4	C
		SB	23.7	C		
		EB	21.6	C		
		WB	-	-		
22	I Street NW and 16th Street NW	NB	18.2	B	27.1	C
		SB	40.3	D		
		EB	-	-		
		WB	22.9	C		
23	L Street NW and 15th Street NW (west)	NB	12.7	B	14.2	B
		SB	31.5	C		
		EB	11.7	B		
		WB	-	-		
24	L Street NW and 14th Street NW	NB	19.8	B	25.0	C
		SB	25.9	C		
		EB	27.9	C		
		WB	-	-		
25	I Street NW and 14th Street NW	NB	21.2	C	48.2	D
		SB	91.1	F		
		EB	-	-		
		WB	38.6	D		

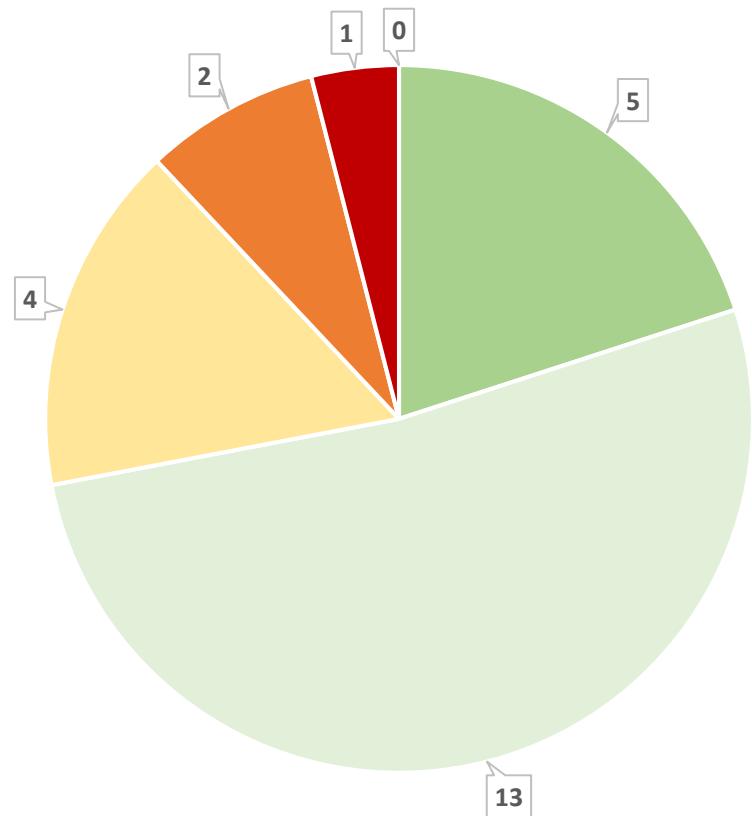
Intersection Delay and Estimated LOS

PM Peak Hour: 4:45PM-5:45PM

Approach LOS Summary



Intersection LOS Summary



Approach LOS	A	B	C	D	E	F	Intersection LOS	A	B	C	D	E	F
	4	24	30	15	3	5		0	5	13	4	2	1

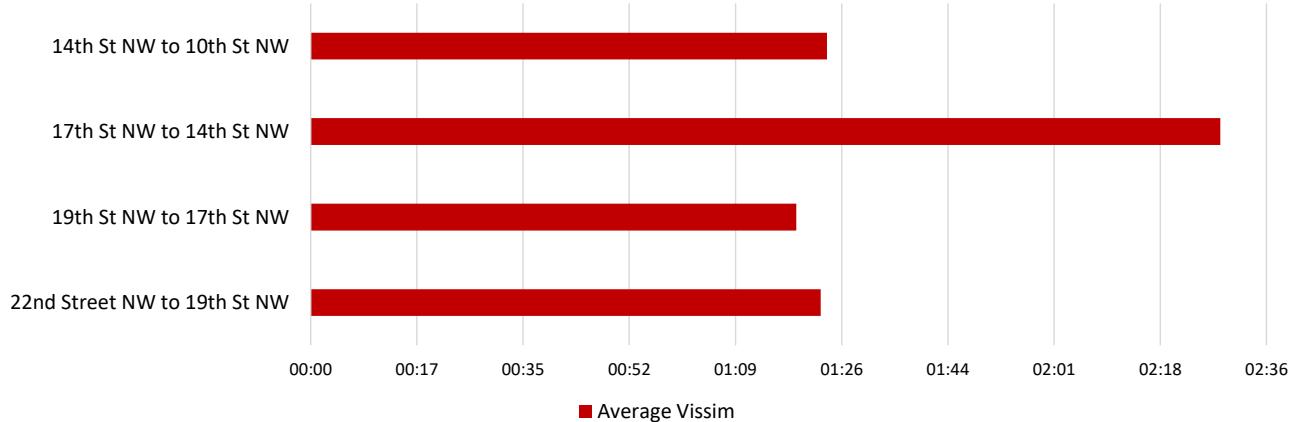
Travel Time | Segment-by-Segment Passenger Cars

PM Peak Period: 4:15PM-6:15PM

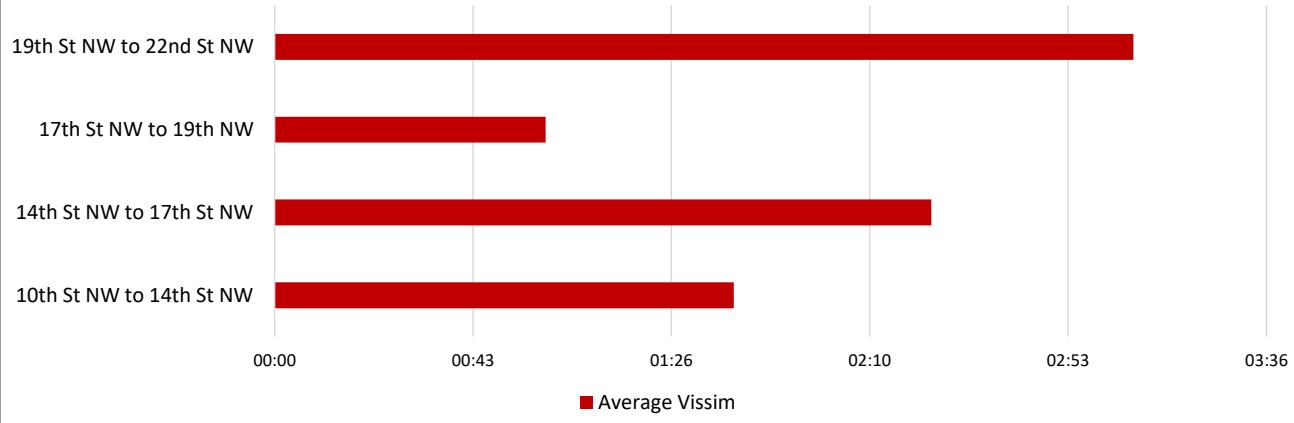
Passenger Vehicle Segment-by-Segment Travel Time Comparison					
Segment ID	Route	Vehicle Count	Average Vissim	Standard Deviation by Time ¹	Standard Deviation by Seed ²
		(MM:SS)	(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	513	01:23	00:04	00:12
2	19th St NW to 17th St NW	884	01:19	00:15	00:15
3	17th St NW to 14th St NW	682	02:28	00:09	00:20
4	14th St NW to 10th St NW	998	01:24	00:05	00:09
Total	Total Eastbound	3077	06:34	00:32	00:56
5	10th St NW to 14th St NW	609	01:40	00:05	00:03
6	14th St NW to 17th St NW	615	02:23	00:06	00:05
7	17th St NW to 19th NW	1350	00:59	00:12	00:21
8	19th St NW to 22nd St NW	1058	03:07	00:22	00:20
Total	Total Westbound	3632	08:09	00:45	00:49

*Results show the average from 10 simulation runs.

Eastbound Travel Time Segments



Westbound Travel Time Segments



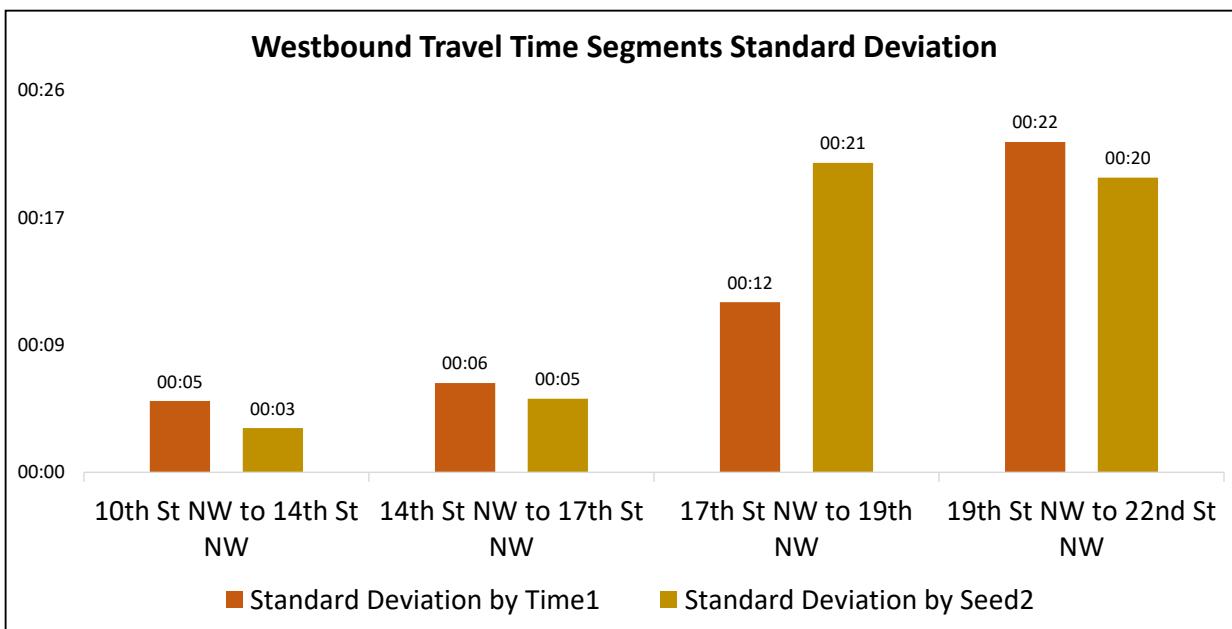
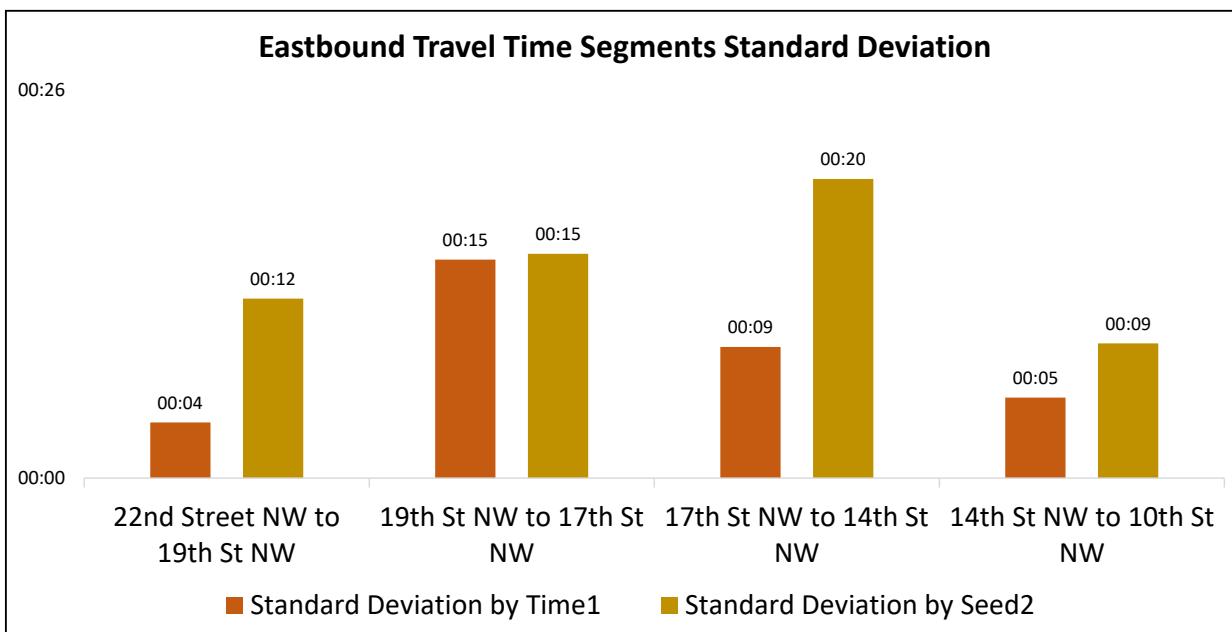
Travel Time | Segment-by-Segment Passenger Cars

PM Peak Period: 4:15PM-6:15PM

*Travel time results collected throughout the 2-hour peak period at 15-minute intervals.

¹Standard deviation by time is standard deviation of the average travel time for all simulation runs in each 15-minute time segment, representing how the average travel time changes throughout the peak period.

²Standard deviation by seed is the average standard deviation of travel times for each 15-minute time segment in the peak period, representing the consistency of travel time throughout the peak period.

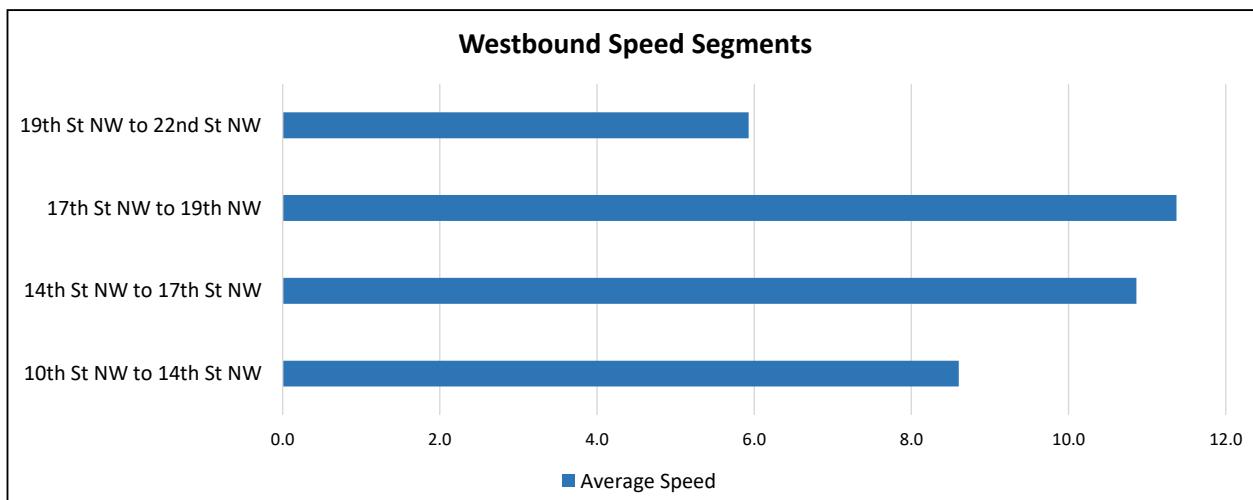
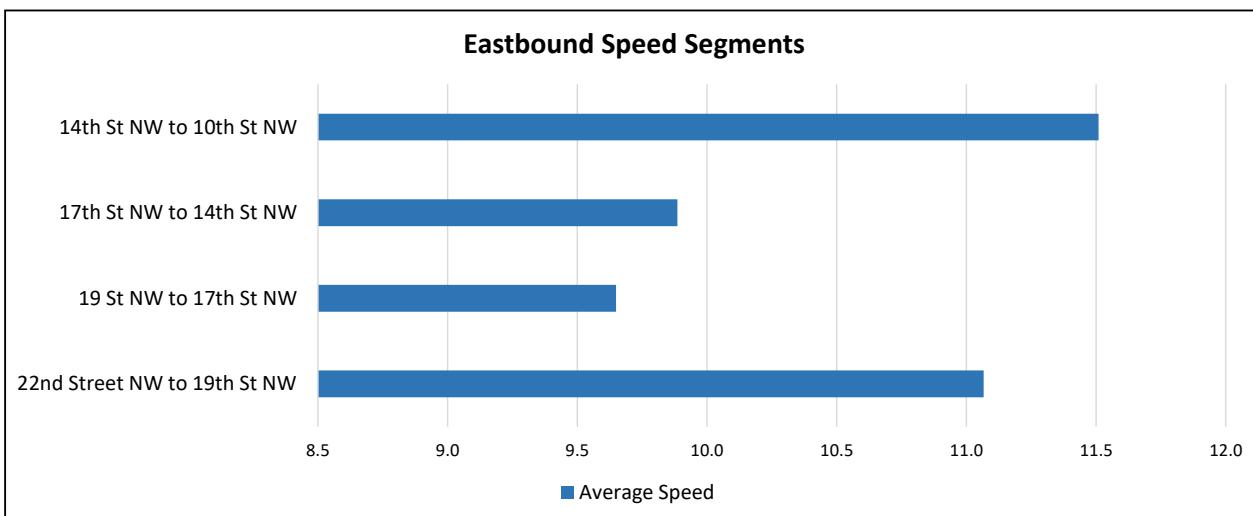


Speed | Segment-by-Segment Passenger Cars

PM Peak Period: 4:15PM-6:15PM

Passenger Vehicle Segment-by-Segment Average Speed Comparison			
Segment ID	Route	Vehicle Count	Average Speed
			MPH
1	22nd Street NW to 19th St NW	513	11.1
2	19 St NW to 17th St NW	884	9.6
3	17th St NW to 14th St NW	682	9.9
4	14th St NW to 10th St NW	998	11.5
Average Eastbound		3077	10.5
5	10th St NW to 14th St NW	609	8.6
6	14th St NW to 17th St NW	615	10.9
7	17th St NW to 19th NW	1350	11.4
8	19th St NW to 22nd St NW	1058	5.9
Average Westbound		3632	9.2

*Results show the average from 10 simulation runs.

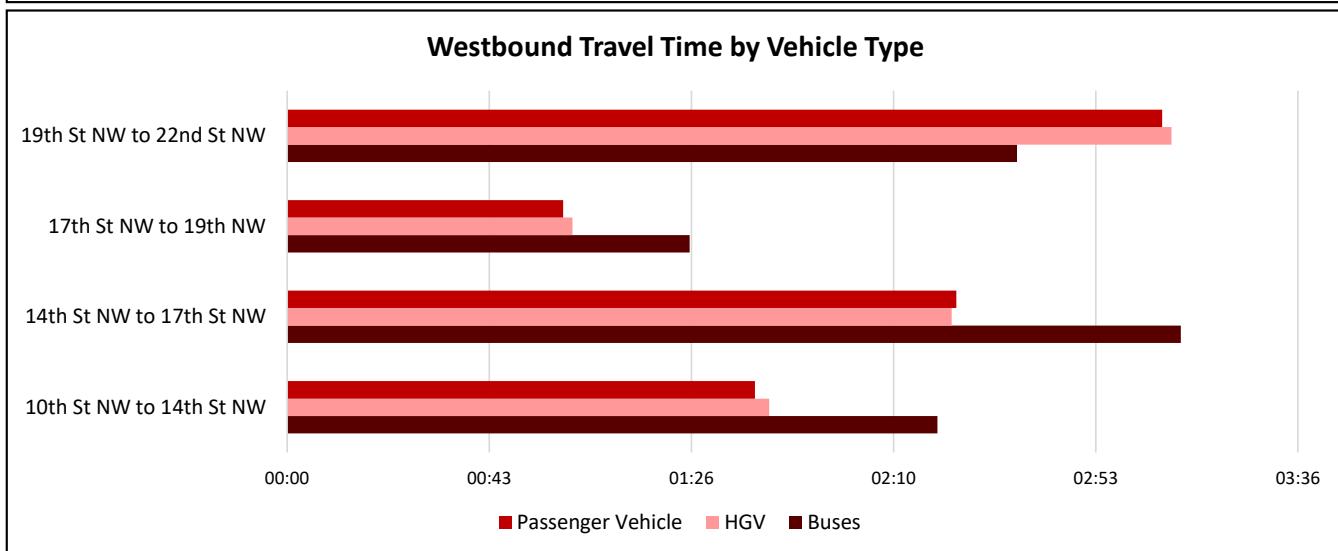
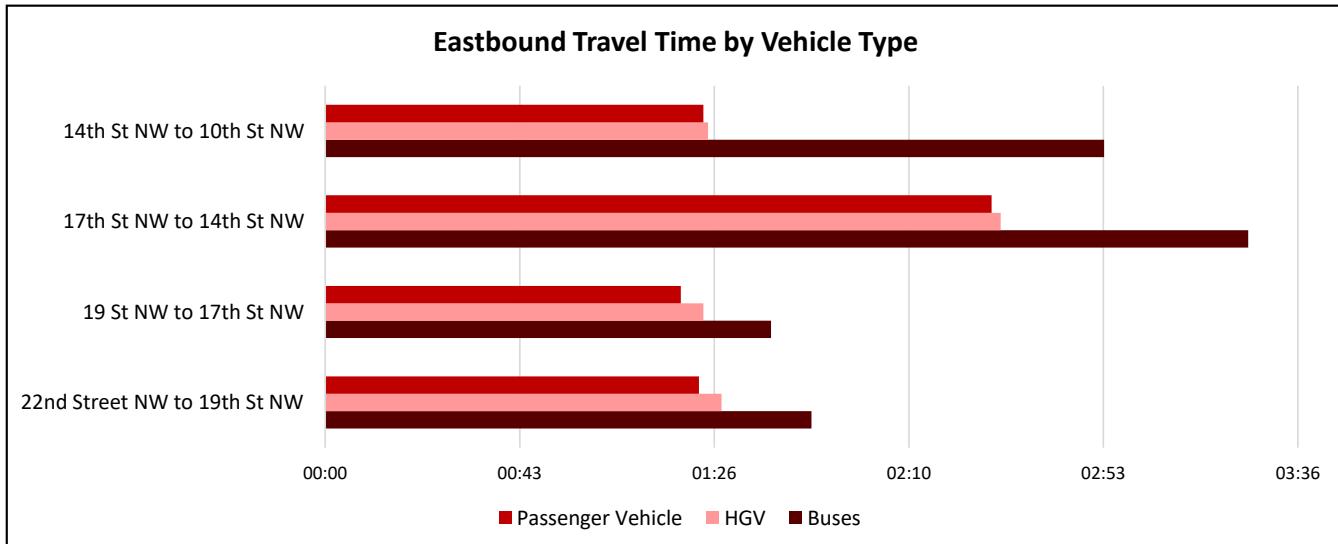


Travel Time | Comparison by Vehicle Type

PM Peak Period: 4:15PM-6:15PM

Segment ID	Route	Travel Time by Vehicle Type		
		Passenger Vehicle (MM:SS)	HGV (MM:SS)	Buses (MM:SS)
1	22nd Street NW to 19th St NW	01:23	01:28	01:48
2	19 St NW to 17th St NW	01:19	01:24	01:39
3	17th St NW to 14th St NW	02:28	02:30	03:25
4	14th St NW to 10th St NW	01:24	01:25	02:53
Total	Total Eastbound	06:34	06:47	09:45
5	10th St NW to 14th St NW	01:40	01:43	02:19
6	14th St NW to 17th St NW	02:23	02:22	03:11
7	17th St NW to 19th NW	00:59	01:01	01:26
8	19th St NW to 22nd St NW	03:07	03:09	02:36
Total	Total Westbound	08:09	08:15	09:32

*Results show the average from 10 simulation runs.

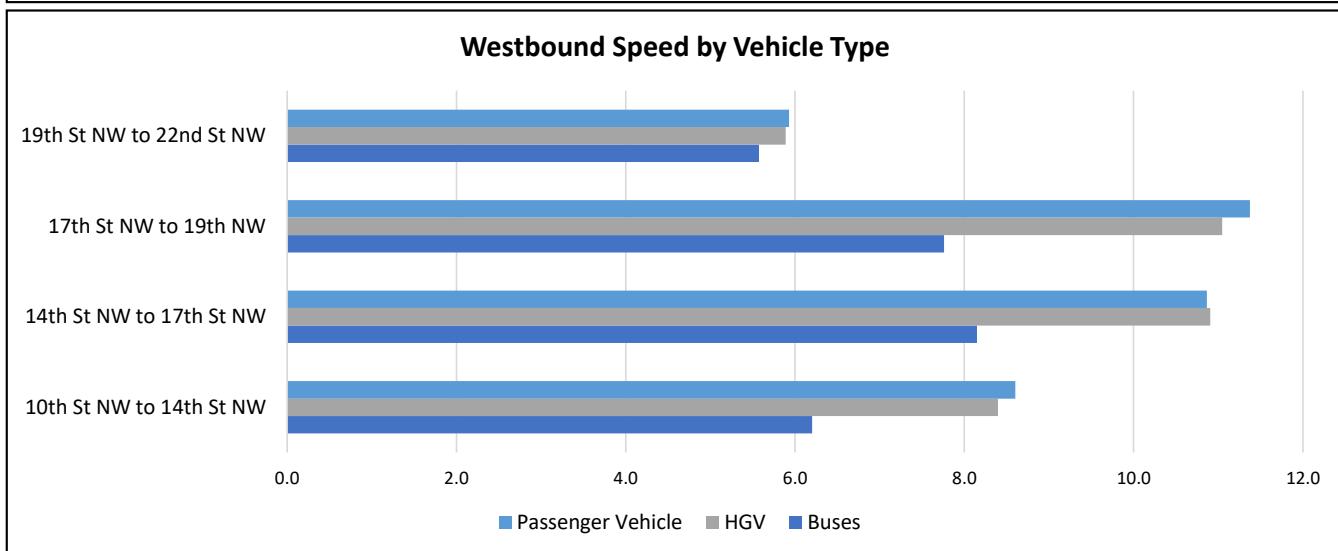
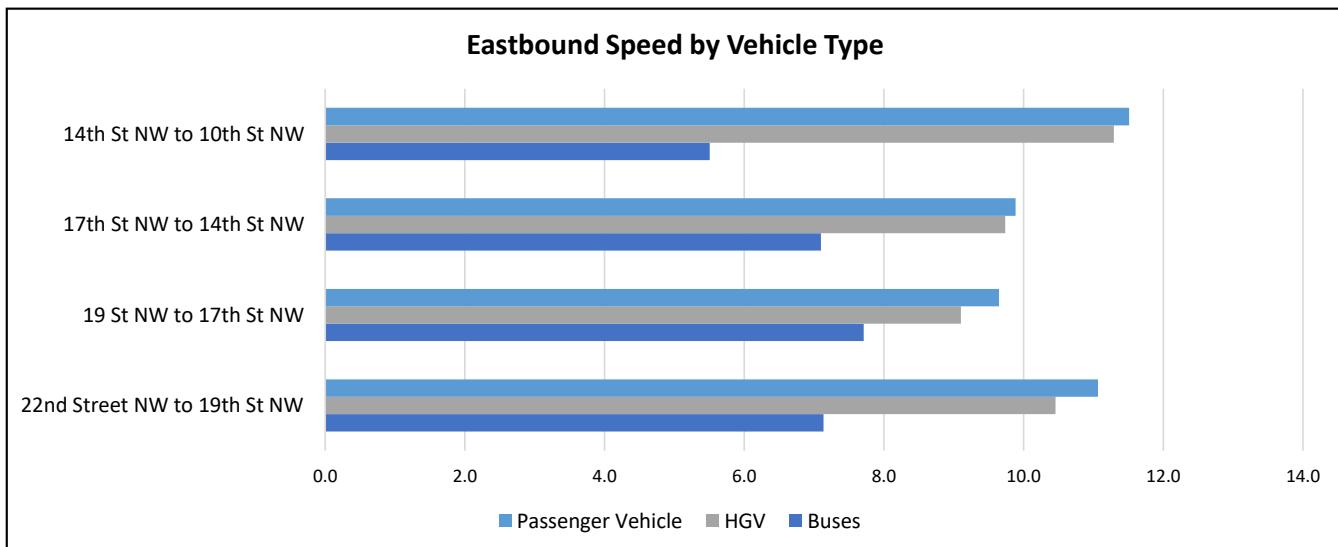


Speed | Comparison by Vehicle Type

PM Peak Period: 4:15PM-6:15PM

Segment ID	Route	Travel Time by Vehicle Type		
		Passenger Vehicle (MM:SS)	HGV (MM:SS)	Buses (MM:SS)
1	22nd Street NW to 19th St NW	11.1	10.5	7.1
2	19 St NW to 17th St NW	9.6	9.1	7.7
3	17th St NW to 14th St NW	9.9	9.7	7.1
4	14th St NW to 10th St NW	11.5	11.3	5.5
Average Eastbound		10.5	10.1	6.9
5	10th St NW to 14th St NW	8.6	8.4	6.2
6	14th St NW to 17th St NW	10.9	10.9	8.1
7	17th St NW to 19th NW	11.4	11.0	7.8
8	19th St NW to 22nd St NW	5.9	5.9	5.6
Average Westbound		9.2	9.1	6.9

*Results show the average from 10 simulation runs.



Travel Time | Comparison by Vehicle Type

PM Peak Period: 4:15PM-6:15PM

Segment ID	Route	Number of Vehicles Represented in Travel Time by Vehicle Type		
		Passenger Vehicle Vehicle Count	HGV Vehicle Count	Buses Vehicle Count
1	22nd Street NW to 19th St NW	513	28	41
2	19 St NW to 17th St NW	884	47	70
3	17th St NW to 14th St NW	682	37	111
4	14th St NW to 10th St NW	998	51	46
Total	Total Eastbound	3077	163	268
5	10th St NW to 14th St NW	609	34	44
6	14th St NW to 17th St NW	615	33	73
7	17th St NW to 19th NW	1350	71	58
8	19th St NW to 22nd St NW	1058	49	28
Total	Total Westbound	3632	187	203

*Total number of vehicles counted in Travel Time runs through the 2-hour peak period.

GEH of Vehicular Throughput

PM Peak Hour: 4:45PM-5:45PM

GEH Criteria	Value	Percent	Target	Target Met
Total Network Volume with GEH < 4	GEH: 1.3	N/A	4	Yes
Total Network Volume %Difference from Balanced Counts	N/A	-0.68%	5%	Yes
85% of individual links below GEH < 5	84 of 84	100%	85%	Yes

Total K Street NW Volume	Sum of balanced counts	Sum of all link flows	Percent Difference	GEH
	37,467	37,211	-0.7%	1.3

* Bus volume during peak period added to "Sum of balanced counts"

Intersection Approaches	Number of Approaches	Number of Segments with GEH < 5	Number of Segments with GEH >5	Percent Compliance
	84	84	0	100%

The GEH statistic is computed using the following formula:

E = Vissim estimated throughput

V = balanced field count:

$$\text{GEH} = \sqrt{\frac{(E-V)^2}{(E+V)/2}}$$

Sample Size Determination Tool, Version 2.0



<p>Step 1: Input number of MOEs (max is 12). Clear out old data.</p> <p>Step 2: Select type of MOEs</p> <p>Step 3: Insert simulation results from four random seeds for selected MOEs</p>		<p>User Inputs</p> <p>Constants</p> <p>Outputs</p> <p>Sample Size (N) = Number of Model Runs $\text{Sample Mean (X}_s\text{)} = (\text{1}/\text{N}) (\text{X}_1 + \text{X}_2 + \text{X}_3 \dots + \text{X}_N)$ $\text{Sample Standard Deviation (S}_s\text{)} = \sqrt{[(\sum(\text{X}-\text{X}_s)^2)/(\text{N}-1)]}$ $\text{Sampling Error} = t (S_s/\sqrt{N})$ $\text{Confidence Level} = X_s \pm t (S_s/\sqrt{N})$ $\% \text{ of Sample Mean (E)} = \% \text{ Tolerance} * X_s \text{ Sample Size Needed} = [(t^2 * (S_s)^2) / (E)^2]$</p> <p><i>The "t" statistic is the hypothesized number of standard deviations away from the mean corresponding to the required confidence level and sample size in a t-distribution.</i></p>								
Inputs Confidence Interval: 95% Tolerance Error: 10% Number of MOEs: 10		Output Number of Required Runs: 10								
		*Minimum number of required runs = 10								
Location (optional)	EB K Street	WB K Street	EB (17th/18th)	WB (17th/18th)	EB (13th/14th)	WB (13th/14th)	EB (17th/18th)	WB (17th/18th)	EB (13th/14th)	WB (13th/14th)
Runs (Seeds)	Travel Time	Travel Time	Volume	Volume	Volume	Volume	Speed	Speed	Speed	Speed
100	387	438	806	2158	1679	1642	20.6	18.9	24.0	24.1
120	384	428	730	2133	1683	1640	20.6	19.1	23.8	24.0
140	367	425	810	2109	1731	1676	20.4	19.2	23.7	24.2
160	373	429	827	2108	1715	1662	20.6	19.5	23.8	24.1
<i>*Results from four random seeds</i>										
Statistics										
X_s =	377.8	430.1	793.3	2127.0	1702.0	1655.0	20.5	19.2	23.8	24.1
S_s =	9.0	5.8	43.1	23.7	25.2	17.2	0.1	0.2	0.1	0.1
E =	37.8	43.0	79.3	212.7	170.2	165.5	2.1	1.9	2.4	2.4
t =	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18
Sampling Error =	14.33	9.21	68.64	37.68	40.04	27.31	0.13	0.36	0.19	0.14
95% Interval Lower =	363.5	420.9	724.6	2089.3	1662.0	1627.7	20.4	18.8	23.6	24.0
95% Interval Upper =	392.1	439.3	861.9	2164.7	1742.0	1682.3	20.7	19.5	24.0	24.3
% of Sample Mean =	3.79%	2.14%	8.65%	1.77%	2.35%	1.65%	0.63%	1.90%	0.79%	0.60%
Sample Size Needed =	4	4	4	4	4	4	4	4	4	4

Network Gridlock Check

Inputs

Confidence Interval:	95%
Tolerance Error:	10%

Runs (Seeds)	Ave Delay PVs	Latend Demand	Ave Speed PVs	Ave Delay Stop PVs	Total Delay PVs	PVs Active @ End of Simulation	Total PVs Arrived
100	77.07	121	9.7	54.7	3.5	752	44139
110	76.25	87	9.7	54.4	3.4	884	43756
120	81.85	109	9.3	58.8	3.6	823	43763
130	84.31	252	9.2	61.0	3.8	892	43663
140	74.93	55	9.8	53.6	3.3	864	43728
150	77.16	90	9.6	55.1	3.5	801	43974
160	74.39	43	9.9	53.0	3.3	769	44121
170	77.85	79	9.6	55.7	3.5	837	43944
180	81.33	186	9.4	58.4	3.6	813	43903
190	79.65	173	9.5	57.0	3.6	789	44201

Statistics

X _s =	78.5	119.5	9.6	56.2	3.5	822.4	43919.2
S _s =	3.2	65.4	0.2	2.6	0.1	47.2	190.2
E =	7.8	12.0	1.0	5.6	0.4	82.2	4391.9
t =	3.18	3.18	3.18	3.18	3.18	3.18	3.18

Sampling Error =	5.12	104.12	0.36	4.10	0.22	75.11	302.64
95% Interval Lower =	73.4	15.4	9.2	52.1	3.3	747.3	43616.6
95% Interval Upper =	83.6	223.6	9.9	60.3	3.7	897.5	44221.8
% of Sample Mean =	6.53%	87.13%	3.78%	7.29%	6.35%	9.13%	0.69%

Attachment E:

Alternative 2 Vissim Results Summary – PM Peak

PM Alternative 1 (Two Through Lanes) Model Loading Summary

PM Peak Hour: 4:45PM-5:45PM

PM Peak Period: 4:15PM-6:15PM

Item	Basis	Criteria	Value	Target	Criteria Met
Simulated Vehicular Throughput (Individual Links)	All Segments and Approaches	Within \pm 100 vph for < 700 vph		85%	No
		Within \pm 15% for \geq 700 vph to < 2,700 vph			
		Within \pm 400 vph for \geq 2,700 vph			
		GEH < 5 for individual link flows	75%	85%	No
Simulated Vehicular Throughput (Network Wide)	Total Volume throughout Network on K Street Corridor	GEH < 4 for total network volume	31.0	4.0	No
		Within 5% of total network volume	-15.4%	5%	No
Required Sample Size			10		

*Findings Represent Results from 10 Simulation Runs

Intersection Volume Loading

PM Peak Hour: 4:45PM-5:45PM

85% of All Intersection Approaches within the following Volume Criteria		Number of Approaches		Passing Approaches		Percent	Target	Target Met
Within \pm 100 vph for < 700 vph	43	84	39	64	76%	85%	No	
Within \pm 15% for \geq 700 vph to < 2,700 vph	41		25					
Within \pm 400 vph for \geq 2,700 vph	0		0					

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)	
1	K Street NW and 22nd Street NW	NB	LT - SL	122	401	121	-1	-1%
			TH	247		236		
			RT - SL	32		30		
		EB	TH	258	258	253	-5	-2%
			WB	1,204	1,204	1,070	-134	-11%
		EB Service Lane	LT	21	128	21	0	0%
			TH	107		152		
		WB Service Lane	UT	76	347	67	-9	-12%
			TH	179		168		
			RT	92		78		
		Intersection		2,338	2,196		-142	-6%
2	K Street NW and 21st Street NW	SB	LT	96	857	96	0	0%
			TH	516		505		
			RT	245		238		
		EB	TH	258	258	255	-3	-1%
			TH	959		814		
		WB	TH - SL	305	1,264	253	-52	-17%
			TH - ML	127		132		
		EB Service Lane	RT	111		102	5	4%
			Intersection		2,617	2,395		
		Intersection		2,617	2,395		-222	-8%
3	K Street NW and 20th Street NW	NB	LT	133	657	126	-7	-5%
			TH	403		380		
			RT	121		119		
		EB	TH	466	466	463	-3	-1%
			TH	920		762		
		WB	RT	200	1,120	181	-19	-10%
			Intersection		2,243	2,031		
		Intersection		2,243	2,031		-212	-9%
		SB	LT	60	899	60	0	0%
			TH	701		708		
			RT	138		140		
			TH	475		460	-15	-3%
			RT	197		181		
4	K Street NW and 19th Street NW	EB	Intersection		2,542	2,332	-210	-8%
			LT	60	899	908	9	1%
			TH	701		708		
			RT	138		140		
			TH	475		460		
		WB	RT	197	971	181	-16	-8%
			TH	971		783		
			Intersection		2,542	2,332		
			TH	971	783			
			Intersection		2,542	2,332	-210	-8%
5	K Street NW and 18th Street NW	NB	LT	132	726	131	-1	-1%
			TH	487		502		
			RT	107		98		
			TH	525	525	498	15	3%
			TH	822		640		
		EB	RT	123	945	99	-9	-8%
			Intersection		2,196	1,968		
			TH	525	498			
			TH	822	640			
			RT	123	99			
6	K Street NW and Connecticut Avenue	SB	Intersection		3,547	2,998	-549	-15%
			TH	590	648	619	29	5%
			RT	56		60		
			LT	12		10		
			TH	740		718		
		EB	RT	155	871	139	-22	-3%
			TH	729		500		
			RT	142		90		
			TH	931	1,121	711	-220	-24%
			RT	190		149		
		Intersection		3,547	2,998		-549	-15%

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)
7	K Street NW and 17th Street NW (east)	NB	LT	37	183	38	3%
			TH	122		125	
			RT	24		23	
			LT	41		40	
		SB	TH	169	329	168	-4%
			RT	119		117	
			TH	797		571	
		EB	TH	965	1,036	707	-28%
			RT	71		56	
		Intersection		2,345	1,845		-500
							-21%
8	K Street NW and 16th Street NW	NB	LT	8	336	9	13%
			TH	286		301	
			RT	42		43	
			LT	115		114	
		SB	TH	332	552	343	5%
			RT	105		102	
			TH	620		459	
		EB	RT	112	732	79	-1%
			TH	740		483	
		WB	RT	208	948	141	-27%
			Intersection		2,568		-34%
					2,074		-494
							-19%
9	K Street NW and 15th Street NW (west)	NB	LT	48	375	43	-10%
			TH	311		318	
			RT	16		15	
			LT	8		1	
		SB	TH	198	294	196	2%
			RT	88		83	
			TH	806		651	
		EB	RT	41	847	32	-6%
			TH	911		568	
		WB	RT	161	1,072	101	25%
			Intersection		2,588		-19%
					2,017		-571
							-22%
10	K Street NW and Vermont Avenue	NB	LT	92	363	86	-7%
			TH	219		224	
			RT	52		52	
			LT	80		49	
		SB	RT	90	170	51	2%
			TH	830		675	
			TH	895		529	
		EB	RT	66	961	37	-6%
			Intersection		2,324		-155
					1,703		-44%
							-41%
							-19%
							-19%
11	K Street NW and 14th Street NW	NB	LT	125	733	122	-39%
			TH	569		610	
			RT	39		40	
			LT	28		27	
		SB	TH	632	713	632	0%
			RT	53		34	
			TH	752		620	
		EB	RT	216	968	182	-36%
			TH	792		417	
		WB	RT	69	861	35	-19%
			Intersection		3,275		-166
					2,719		-47%
							-48%
							-17%
12	K Street NW and 13th Street NW	NB	LT	188	678	29	-85%
			TH	473		393	
			RT	17		14	
			LT	26		25	
		SB	TH	553	695	546	-17%
			RT	116		33	
			TH	640		549	
		EB	RT	179	819	149	-18%
			TH	539		386	
		WB	RT	48	587	38	-4%
			Intersection		2,779		-121
					2,162		-14%
							-17%
							-15%
							-28%
							-28%
							-21%
							-22%

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)
13	K Street NW and 12th Street NW	NB	LT	201	1,040	151	-50
			TH	763		689	
			RT	76		67	
		EB	TH	670	670	578	-92
			TH	369		260	
			RT	49		33	
		Intersection		2,128	1,778		-350
						-16%	
		SB	LT	152	442	97	-55
			TH	239		220	
			RT	51		44	
			LT	34	538	32	-7
			TH	437		423	
			RT	67		72	
14	K Street NW and 11th Street NW	EB	LT	67	705	60	-7
			TH	342		288	
			RT	296		301	
		WB	LT	13	225	0	-13
			TH	192		0	
			RT	20		15	
		Intersection		1,910	1,552		-358
						-19%	
		WB	LT	32	445	33	1
			TH	302		292	
			RT	111		72	
			TH	180	444	154	-10
			RT	264		227	
15	K Street NW and 10th Street NW	SB	LT	37	132	37	-10
			TH	95		85	
			Intersection		1,021	900	-121
		EB	TH	781	864	798	-121
			RT	83		82	
			RT	182		159	
		Intersection		1,046	1,039		-7
16	K Street NW and 9th Street NW	SB	TH	188	880	187	-1
			TH	692		691	
			TH	492	657	488	
		EB	RT	165		154	-1
			Intersection		1,537	1,520	-17
17	L Street NW and 21st Street NW	SB	LT	188	880	187	-1
			TH	692		691	
			TH	492		488	
			RT	165		154	
		EB	Intersection		1,537	1,520	-17
			LT	142	627	136	-2
			TH	394		390	
			RT	91		81	
			TH	554	654	562	-10
			RT	100		101	
		WB	LT	267	825	263	-1
			TH	558		579	
			Intersection		2,106	2,112	6
							0%
18	Pennsylvania Avenue NW and 21st Street NW	SB	TH	689	780	687	-2
			RT	91		84	
			TH	750	750	738	-7
			TH	750		738	
		EB	LT	151	1,096	144	-12
			TH	788		794	
			RT	157		162	
			Intersection		2,626	2,609	-17
19	L Street NW and Connecticut Avenue	NB	TH	689	780	687	-9
			RT	91		84	
			TH	750		738	
		EB	LT	151	1,096	144	-12
			TH	788		794	
			RT	157		162	
			Intersection		2,626	2,609	-17
							-1%
		WB	LT	58	591	59	-23
			TH	533		555	
			TH	803		719	
			RT	79	882	65	-98
			LT	442		411	
			TH	592		566	
20	I Street NW and 17th Street NW (west)	SB	RT	115	1,149	126	-46
			Intersection		2,622	2,501	-121
							-5%

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)		
21	L Street NW and 16th Street NW	NB	TH	377	494	332	-45	-12%	
			RT	117		100			
			LT	103	563	111			
			TH	460		458			
		EB	LT	214	968	221	7	3%	
			TH	662		655			
			RT	92		97			
		Intersection		2,025	1,974		-51	-3%	
		NB	LT	32	207	33	1	3%	
			TH	175		168			
		SB	TH	238	445	220	-7		
			RT	207		202			
22	I Street NW and 16th Street NW	WB	LT	77	971	78	1	1%	
			TH	733		745			
			RT	161		181			
			Intersection		1,623	1,627	4	0%	
		NB	TH	432	472	378	-54	-13%	
			RT	40		42			
			LT	59	211	60	1		
			TH	152		145			
		EB	LT	225	1,102	216	-9	-4%	
			TH	735		731			
			RT	142		141			
		Intersection		1,785	1,713		-72	-4%	
23	L Street NW and 15th Street NW (west)	NB	TH	518	638	519	1	0%	
			RT	120		117			
			LT	77	622	78	-3		
			TH	545		559			
		EB	LT	71	964	65	1	1%	
			TH	725		693			
			RT	168		156			
		Intersection		2,224	2,187		-37	-2%	
		NB	LT	254	941	254	0	3%	
			TH	687		714			
			TH	785	848	738	27		
			RT	63		59			
25	I Street NW and 14th Street NW	WB	LT	128	781	131	-47	-6%	
			TH	607		635			
			RT	46		56			
		Intersection		2,570	2,587		17	1%	
		NB	LT	254	941	254	0	0%	
			TH	687		714			
			TH	785	848	738	27		
			RT	63		59			
		SB	LT	128	781	131	-4	-6%	
			TH	607		635			
			RT	46		56			

*Results show the average from 10 simulation runs.

Intersection Delay and Estimated LOS

PM Peak Hour: 4:45PM-5:45PM

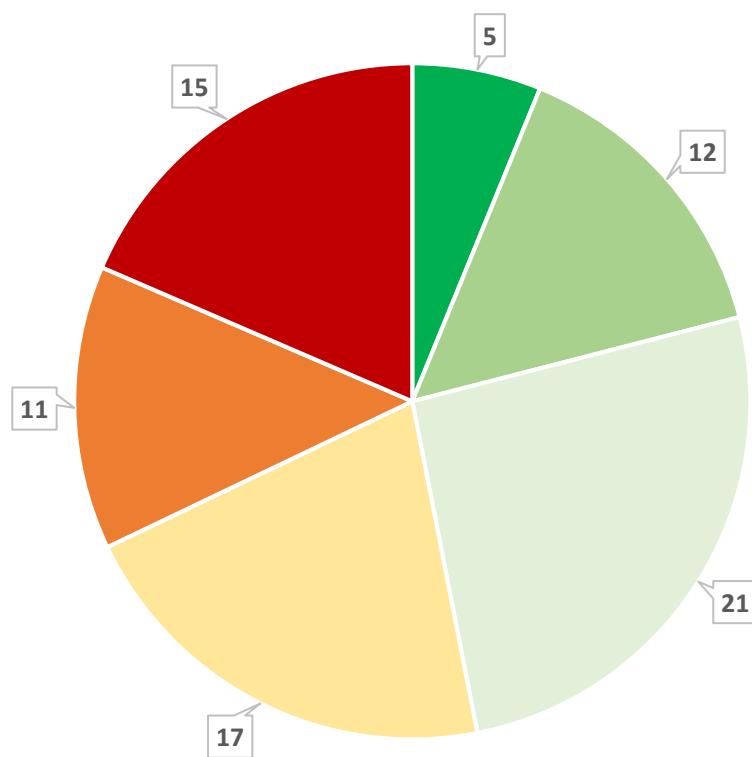
#	Intersection	Approach	Average Delay (sec/veh)	Approach LOS	Intersection Delay	Intersection LOS
1	K Street NW and 22nd Street NW	NB	29.4	C	26.0	C
		SB	-	-		
		EB Service Lane	11.8	B		
		WB Service Lane	34.9	C		
2	K Street NW and 21st Street NW	NB	-	-	39.6	D
		SB	36.1	D		
		EB	28.7	C		
		WB	39.1	D		
3	K Street NW and 20th Street NW	NB	71.0	E	35.4	D
		SB	-	-		
		EB	40.3	D		
		WB	9.5	A		
4	K Street NW and 19th Street NW	NB	-	-	45.6	D
		SB	31.4	C		
		EB	69.2	E		
		WB	42.8	D		
5	K Street NW and 18th Street NW	NB	58.4	E	70.5	E
		SB	-	-		
		EB	153.2	F		
		WB	26.6	C		
6	K Street NW and Connecticut Avenue	NB	23.0	C	75.5	E
		SB	83.7	F		
		EB	212.3	F		
		WB	14.9	B		
7	K Street NW and 17th Street NW (east)	NB	40.1	D	33.2	C
		SB	35.1	D		
		EB	21.3	C		
		WB	39.7	D		
8	K Street NW and 16th Street NW	NB	35.2	D	42.5	D
		SB	17.0	B		
		EB	72.4	E		
		WB	43.8	D		
9	K Street NW and 15th Street NW (west)	NB	45.3	D	41.9	D
		SB	43.4	D		
		EB	56.2	E		
		WB	24.6	C		
10	K Street NW and Vermont Avenue	NB	71.5	E	77.1	E
		SB	538.0	F		
		EB	13.8	B		
		WB	74.7	E		
11	K Street NW and 14th Street NW	NB	35.7	D	60.0	E
		SB	72.2	E		
		EB	21.3	C		
		WB	151.7	F		
12	K Street NW and 13th Street NW	NB	191.6	F	119.3	F
		SB	198.3	F		
		EB	21.7	C		
		WB	93.2	F		

#	Intersection	Approach	Average Delay (sec/veh)	Approach LOS	Intersection Delay	Intersection LOS
13	K Street NW and 12th Street NW	NB	147.2	F	91.7	F
		SB	-	-		
		EB	9.7	A		
		WB	81.7	F		
14	K Street NW and 11th Street NW	NB	164.3	F	61.9	E
		SB	55.2	E		
		EB	11.5	B		
		WB	12.8	B		
15	K Street NW and 10th Street NW	NB	-	-	54.9	D
		SB	68.8	E		
		EB	8.5	A		
		WB	154.7	F		
16	K Street NW and 9th Street NW	NB	-	-	12.5	B
		SB	4.9	A		
		EB	54.2	D		
		WB	-	-		
17	L Street NW and 21st Street NW	NB	-	-	25.3	C
		SB	25.1	C		
		EB	25.6	C		
		WB	-	-		
18	Pennsylvania Avenue NW and 21st Street NW	NB	-	-	105.4	F
		SB	22.8	C		
		EB	35.7	D		
		WB	220.0	F		
19	L Street NW and Connecticut Avenue	NB	13.3	B	44.1	D
		SB	102.8	F		
		EB	26.3	C		
		WB	-	-		
20	I Street NW and 17th Street NW (west)	NB	22.8	C	65.5	E
		SB	106.4	F		
		EB	-	-		
		WB	60.1	E		
21	L Street NW and 16th Street NW	NB	14.6	B	20.9	C
		SB	24.2	C		
		EB	21.8	C		
		WB	-	-		
22	I Street NW and 16th Street NW	NB	18.5	B	20.4	C
		SB	16.2	B		
		EB	-	-		
		WB	22.5	C		
23	L Street NW and 15th Street NW (west)	NB	7.8	A	12.8	B
		SB	32.4	C		
		EB	11.1	B		
		WB	-	-		
24	L Street NW and 14th Street NW	NB	10.2	B	26.7	C
		SB	28.2	C		
		EB	37.2	D		
		WB	-	-		
25	I Street NW and 14th Street NW	NB	23.2	C	37.6	D
		SB	54.8	D		
		EB	-	-		
		WB	37.7	D		

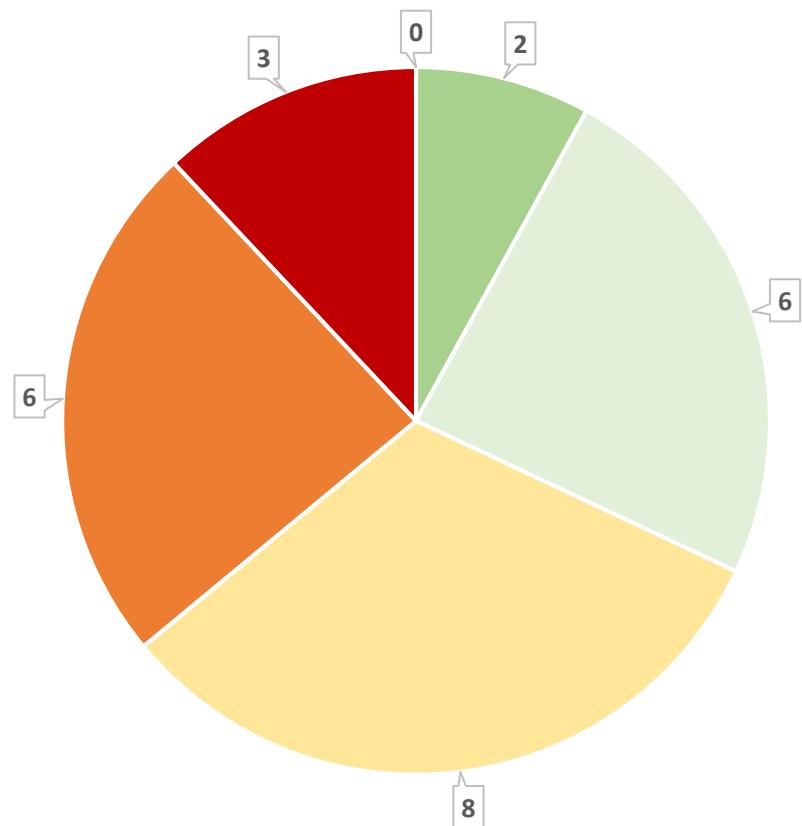
Intersection Delay and Estimated LOS

PM Peak Hour: 4:45PM-5:45PM

Approach LOS Summary



Intersection LOS Summary



Approach LOS	A	B	C	D	E	F	Intersection LOS	A	B	C	D	E	F
Approach LOS	5	12	21	17	11	15	Intersection LOS	0	2	6	8	6	3

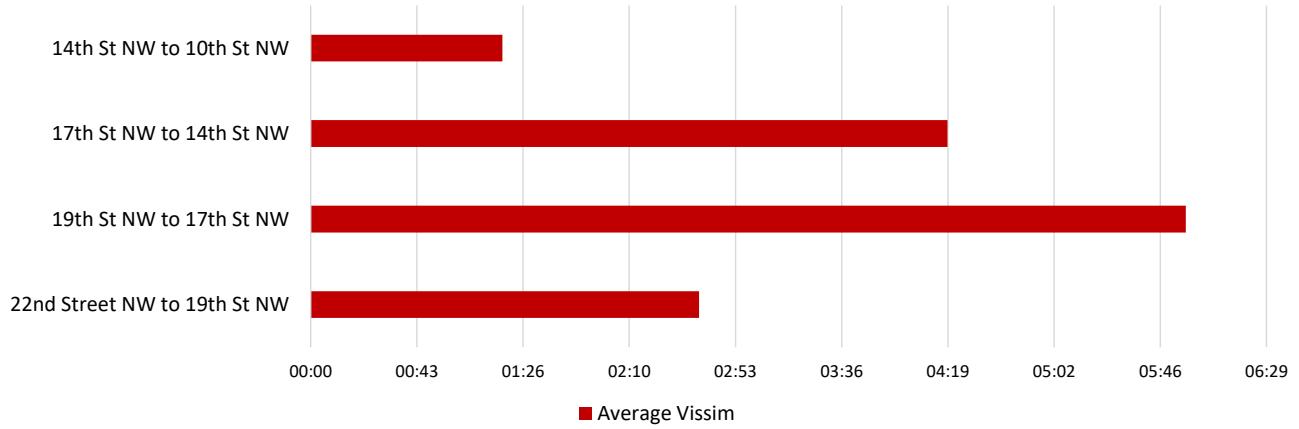
Travel Time | Segment-by-Segment Passenger Cars

PM Peak Period: 4:15PM-6:15PM

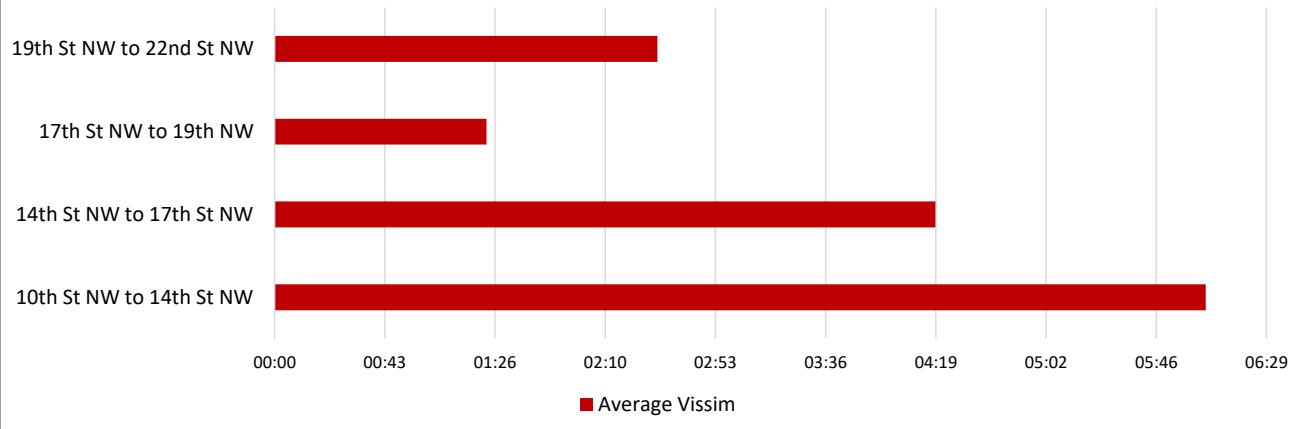
Passenger Vehicle Segment-by-Segment Travel Time Comparison					
Segment ID	Route	Vehicle Count	Average Vissim	Standard Deviation by Time ¹	Standard Deviation by Seed ²
		(MM:SS)	(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	496	02:38	01:19	01:29
2	19th St NW to 17th St NW	826	05:56	01:03	01:27
3	17th St NW to 14th St NW	467	04:19	00:19	00:46
4	14th St NW to 10th St NW	821	01:18	00:13	00:15
Total	Total Eastbound	2610	14:11	02:54	03:57
5	10th St NW to 14th St NW	461	06:05	02:25	02:43
6	14th St NW to 17th St NW	355	04:19	01:01	01:27
7	17th St NW to 19th NW	1131	01:23	00:19	00:20
8	19th St NW to 22nd St NW	922	02:30	00:05	00:08
Total	Total Westbound	2869	14:17	03:49	04:38

*Results show the average from 10 simulation runs.

Eastbound Travel Time Segments



Westbound Travel Time Segments



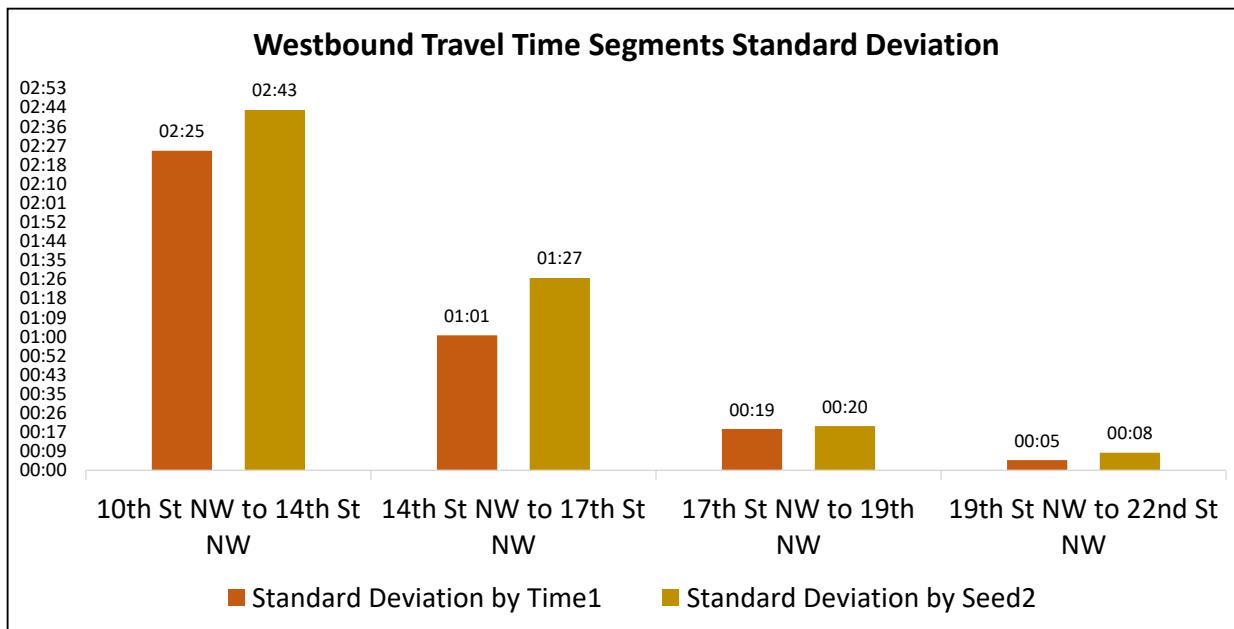
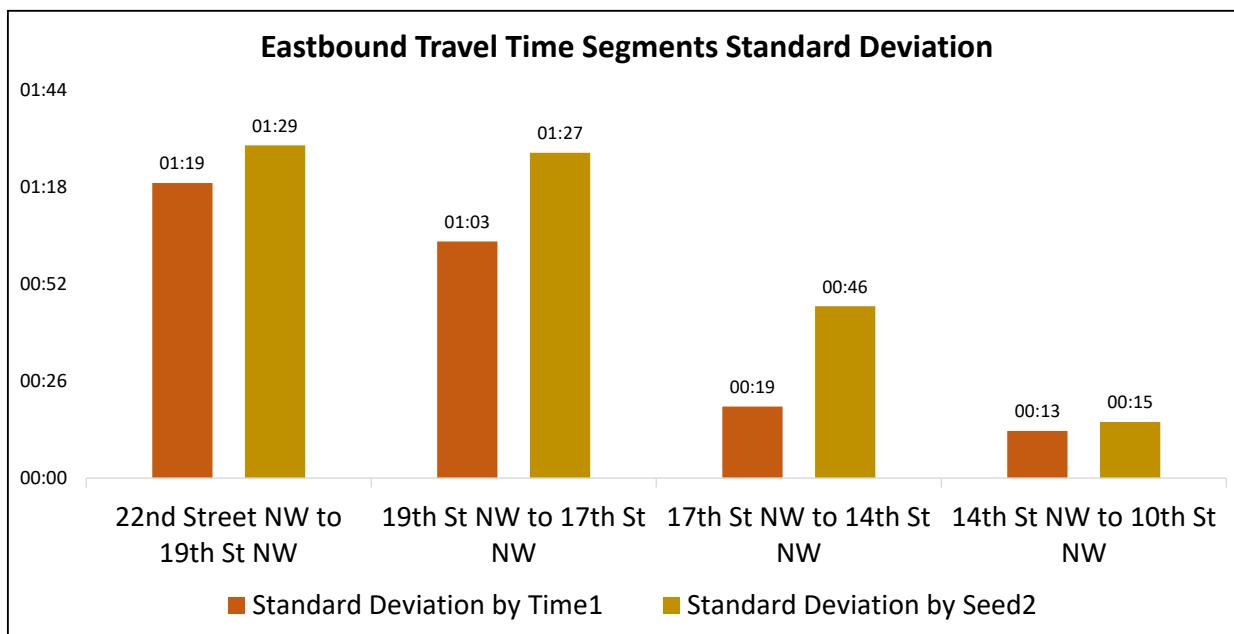
Travel Time | Segment-by-Segment Passenger Cars

PM Peak Period: 4:15PM-6:15PM

*Travel time results collected throughout the 2-hour peak period at 15-minute intervals.

¹Standard deviation by time is standard deviation of the average travel time for all simulation runs in each 15-minute time segment, representing how the average travel time changes throughout the peak period.

²Standard deviation by seed is the average standard deviation of travel times for each 15-minute time segment in the peak period, representing the consistency of travel time throughout the peak period.

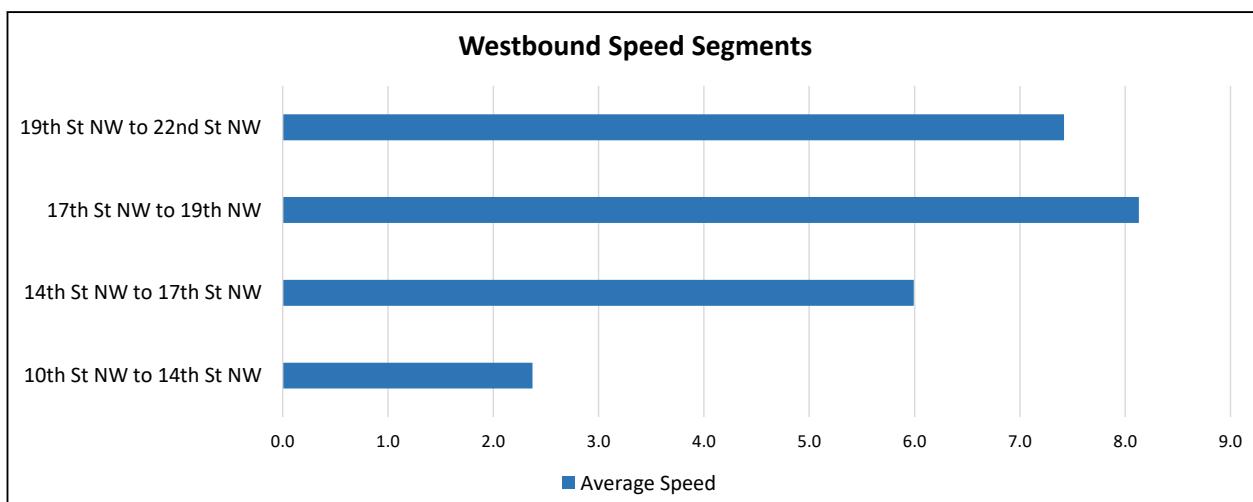
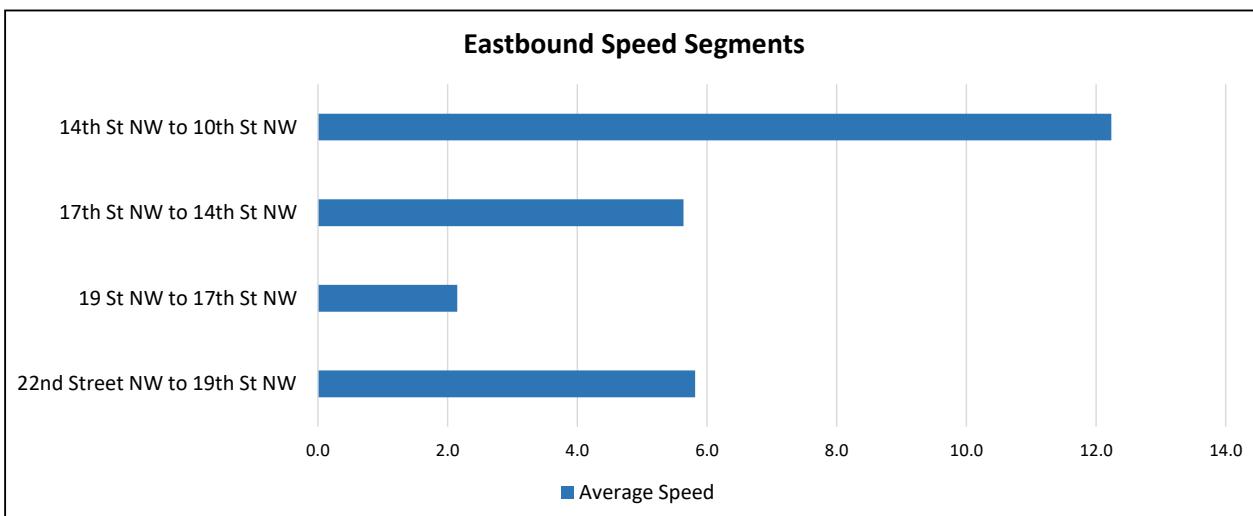


Speed | Segment-by-Segment Passenger Cars

PM Peak Period: 4:15PM-6:15PM

Passenger Vehicle Segment-by-Segment Average Speed Comparison			
Segment ID	Route	Vehicle Count	Average Speed
			MPH
1	22nd Street NW to 19th St NW	496	5.8
2	19 St NW to 17th St NW	826	2.1
3	17th St NW to 14th St NW	467	5.6
4	14th St NW to 10th St NW	821	12.2
Average Eastbound		2610	6.5
5	10th St NW to 14th St NW	461	2.4
6	14th St NW to 17th St NW	355	6.0
7	17th St NW to 19th NW	1131	8.1
8	19th St NW to 22nd St NW	922	7.4
Average Westbound		2869	6.0

*Results show the average from 10 simulation runs.

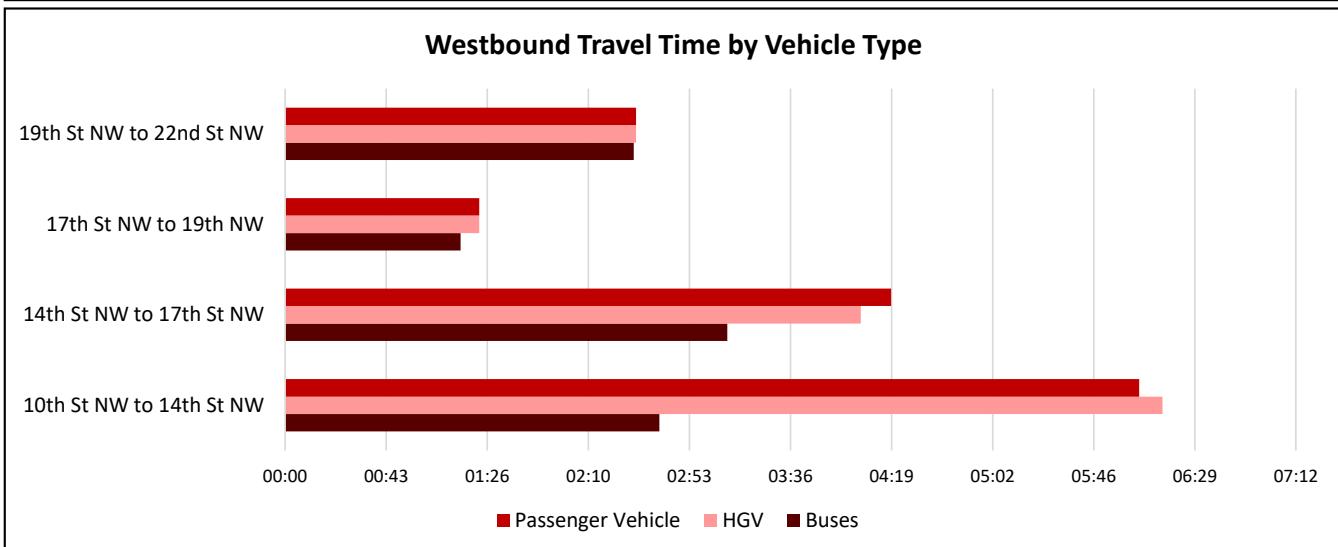
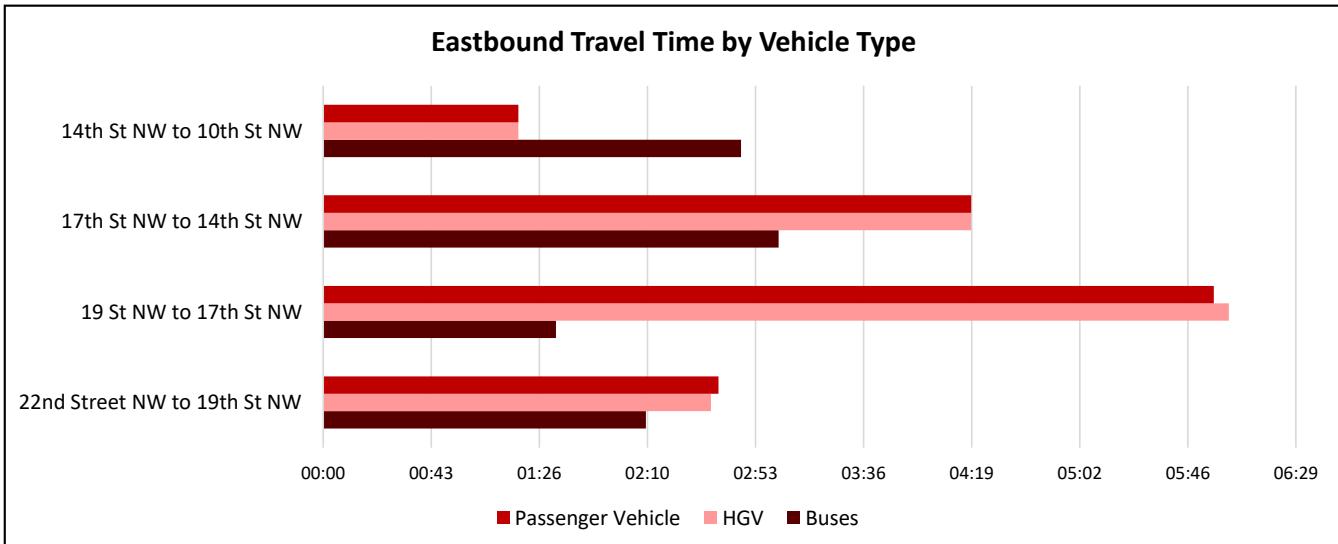


Travel Time | Comparison by Vehicle Type

PM Peak Period: 4:15PM-6:15PM

Segment ID	Route	Travel Time by Vehicle Type		
		Passenger Vehicle (MM:SS)	HGV (MM:SS)	Buses (MM:SS)
1	22nd Street NW to 19th St NW	02:38	02:35	02:09
2	19 St NW to 17th St NW	05:56	06:02	01:33
3	17th St NW to 14th St NW	04:19	04:19	03:02
4	14th St NW to 10th St NW	01:18	01:18	02:47
Total	Total Eastbound	14:11	14:14	09:31
5	10th St NW to 14th St NW	06:05	06:15	02:40
6	14th St NW to 17th St NW	04:19	04:06	03:09
7	17th St NW to 19th NW	01:23	01:23	01:15
8	19th St NW to 22nd St NW	02:30	02:30	02:29
Total	Total Westbound	14:17	14:14	09:33

*Results show the average from 10 simulation runs.

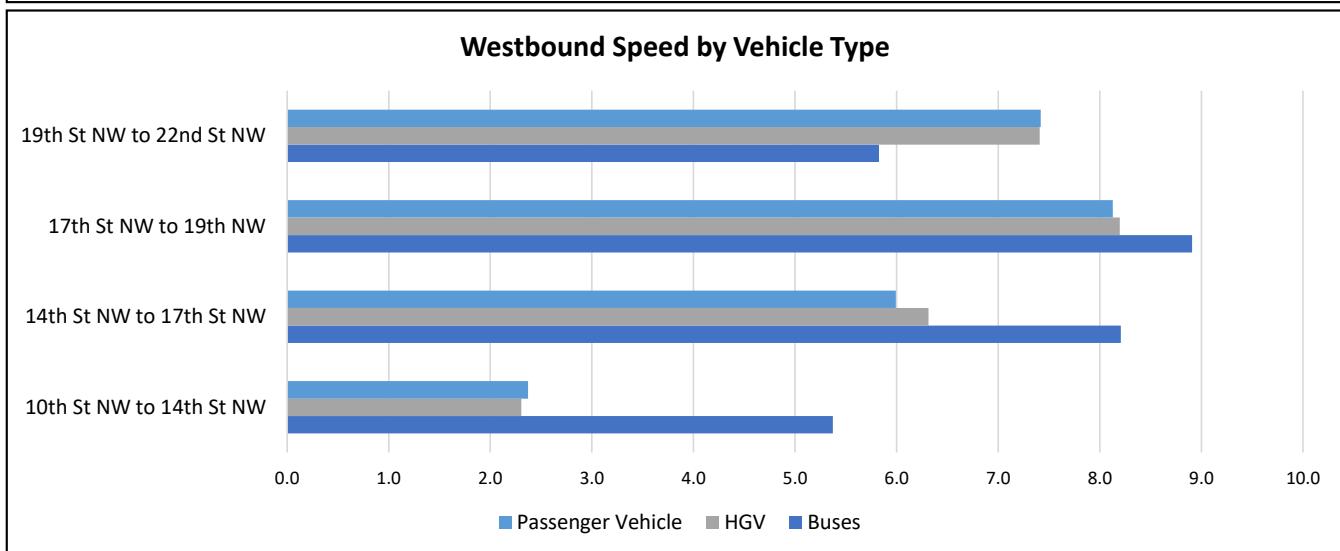
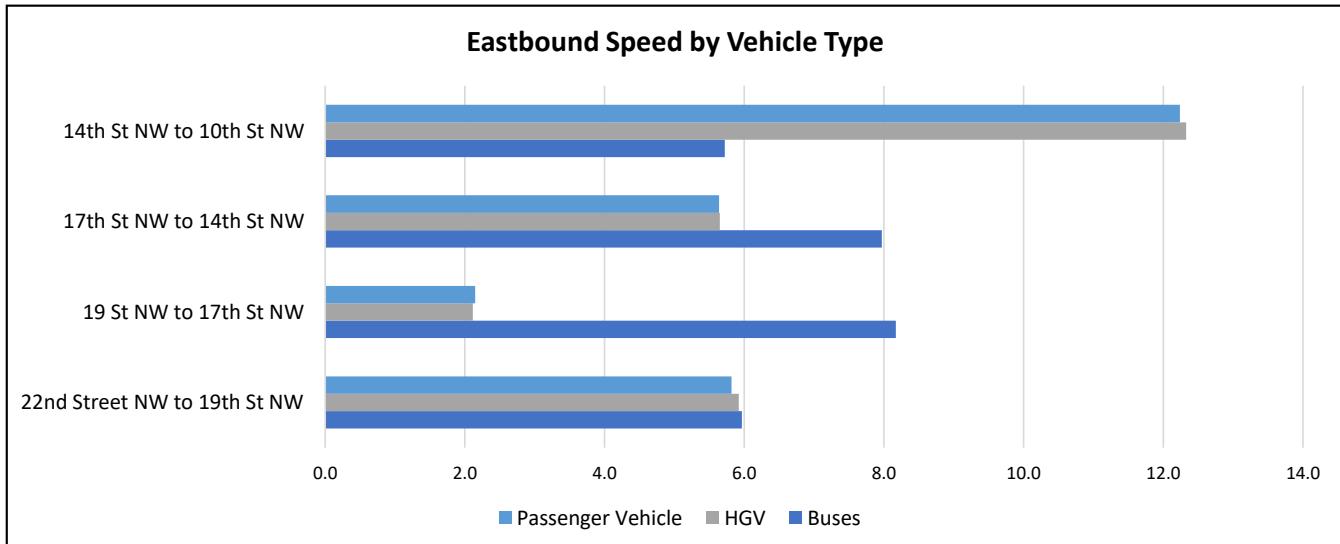


Speed | Comparison by Vehicle Type

PM Peak Period: 4:15PM-6:15PM

Segment ID	Route	Travel Time by Vehicle Type		
		Passenger Vehicle (MM:SS)	HGV (MM:SS)	Buses (MM:SS)
1	22nd Street NW to 19th St NW	5.8	5.9	6.0
2	19 St NW to 17th St NW	2.1	2.1	8.2
3	17th St NW to 14th St NW	5.6	5.6	8.0
4	14th St NW to 10th St NW	12.2	12.3	5.7
Average Eastbound		6.5	6.5	7.0
5	10th St NW to 14th St NW	2.4	2.3	5.4
6	14th St NW to 17th St NW	6.0	6.3	8.2
7	17th St NW to 19th NW	8.1	8.2	8.9
8	19th St NW to 22nd St NW	7.4	7.4	5.8
Average Westbound		6.0	6.1	7.1

*Results show the average from 10 simulation runs.



Travel Time | Comparison by Vehicle Type

PM Peak Period: 4:15PM-6:15PM

Number of Vehicles Represented in Travel Time by Vehicle Type				
Segment ID	Route	Passenger Vehicle	HGV	Buses
		Vehicle Count	Vehicle Count	Vehicle Count
1	22nd Street NW to 19th St NW	496	27	54
2	19 St NW to 17th St NW	826	43	112
3	17th St NW to 14th St NW	467	26	110
4	14th St NW to 10th St NW	821	43	74
Total	Total Eastbound	2610	139	350
5	10th St NW to 14th St NW	461	26	37
6	14th St NW to 17th St NW	355	20	41
7	17th St NW to 19th NW	1131	62	43
8	19th St NW to 22nd St NW	922	51	22
Total	Total Westbound	2869	159	143

*Total number of vehicles counted in Travel Time runs through the 2-hour peak period.

GEH of Vehicular Throughput

PM Peak Hour: 4:45PM-5:45PM

GEH Criteria	Value	Percent	Target	Target Met
Total Network Volume with GEH < 4	GEH: 31.0	N/A	4	No
Total Network Volume %Difference from Balanced Counts	N/A	-15.37%	5%	No
85% of individual links below GEH < 5	63 of 84	75%	85%	No

Total K Street NW Volume	Sum of balanced counts	Sum of all link flows	Percent Difference	GEH
	37,467	31,709	-15.4%	31.0

* Bus volume during peak period added to "Sum of balanced counts"

Intersection Approaches	Number of Approaches	Number of Segments with GEH < 5	Number of Segments with GEH >5	Percent Compliance
	84	63	21	75%

The GEH statistic is computed using the following formula:

E = Vissim estimated throughput

V = balanced field count:

$$GEH = \sqrt{\frac{(E-V)^2}{(E+V)/2}}$$

Sample Size Determination Tool, Version 2.0



<p>Step 1: Input number of MOEs (max is 12). Clear out old data.</p> <p>Step 2: Select type of MOEs</p> <p>Step 3: Insert simulation results from four random seeds for selected MOEs</p>		<p>User Inputs</p> <p>Constants</p> <p>Outputs</p> <p>Sample Size (N) = Number of Model Runs Sample Mean (X_s) = $(1/N)(X_1 + X_2 + X_3 \dots + X_N)$ Sample Standard Deviation (S_s) = $\sqrt{[(\sum(X-X_s)^2)/(N-1)]}$ Sampling Error = $t(S_s/\sqrt{N})$ Confidence Level = $X_s \pm t(S_s/\sqrt{N})$ % of Sample Mean (E) = % Tolerance * X_s Sample Size Needed = $[(t^2 * (S_s)^2) / (E^2)]$</p> <p><i>The "t" statistic is the hypothesized number of standard deviations away from the mean corresponding to the required confidence level and sample size in a t-distribution.</i></p>								
<p>Inputs</p> <p>Confidence Interval: 95%</p> <p>Tolerance Error: 10%</p> <p>Number of MOEs: 10</p>		<p>Output</p> <p>Number of Required Runs: 10</p> <p>*Minimum number of required runs = 10</p>								
Location (optional)	EB K Street	WB K Street	EB (17th/18th)	WB (17th/18th)	EB (13th/14th)	WB (13th/14th)	EB (17th/18th)	WB (17th/18th)	EB (13th/14th)	WB (13th/14th)
Runs (Seeds)	Travel Time	Travel Time	Volume	Volume	Volume	Volume	Speed	Speed	Speed	Speed
100	321	331	1188	1688	1390	890	17.4	18.0	21.2	15.2
120	330	323	1138	1769	1431	1000	16.9	19.5	21.3	16.9
140	311	340	1162	1812	1434	1120	17.4	19.5	21.0	16.6
160	304	311	1159	1786	1408	1085	17.0	19.6	21.3	17.3
<i>*Results from four random seeds</i>										
Statistics										
X_s =	316.6	326.3	1161.8	1763.8	1415.8	1023.8	17.2	19.1	21.2	16.5
S_s =	11.2	12.2	20.5	53.5	20.7	102.4	0.3	0.8	0.2	0.9
E =	31.7	32.6	116.2	176.4	141.6	102.4	1.7	1.9	2.1	1.6
t =	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18
Sampling Error =	17.89	19.47	32.62	85.14	32.98	162.97	0.43	1.22	0.26	1.46
95% Interval Lower =	298.7	306.8	1129.1	1678.6	1382.8	860.8	16.7	17.9	21.0	15.0
95% Interval Upper =	334.5	345.7	1194.4	1848.9	1448.7	1186.7	17.6	20.4	21.5	17.9
% of Sample Mean =	5.65%	5.97%	2.81%	4.83%	2.33%	15.92%	2.48%	6.39%	1.22%	8.89%
Sample Size Needed =	4	4	4	4	4	10	4	4	4	4

Network Gridlock Check

Inputs

Confidence Interval:	95%
Tolerance Error:	10%

Runs (Seeds)	Ave Delay PVs	Latend Demand	Ave Speed PVs	Ave Delay Stop PVs	Total Delay PVs	PVs Active @ End of Simulation	Total PVs Arrived
100	151.17	1235	6.2	116.8	6.7	1585	42423
110	145.46	1266	6.4	112.5	6.4	1612	42089
120	139.19	835	6.7	107.1	6.1	1538	42456
130	157.70	1384	6.0	124.0	6.9	1763	41782
140	130.86	906	7.0	99.9	5.7	1447	42446
150	133.84	854	6.8	102.6	5.9	1418	42847
160	140.28	922	6.6	107.4	6.2	1463	42758
170	120.19	882	7.4	91.1	5.3	1357	42749
180	135.91	842	6.8	103.9	6.0	1326	42888
190	149.23	980	6.3	115.5	6.6	1486	42895

Statistics

X _s =	140.4	1010.6	6.6	108.1	6.2	1499.5	42533.3
S _s =	11.0	204.1	0.4	9.5	0.5	130.0	371.1
E =	14.0	101.1	0.7	10.8	0.6	150.0	4253.3
t =	3.18	3.18	3.18	3.18	3.18	3.18	3.18

Sampling Error =	17.46	324.83	0.65	15.08	0.75	206.93	590.56
95% Interval Lower =	122.9	685.8	6.0	93.0	5.4	1292.6	41942.7
95% Interval Upper =	157.8	1335.4	7.3	123.2	6.9	1706.4	43123.9
% of Sample Mean =	12.43%	32.14%	9.83%	13.95%	12.09%	13.80%	1.39%

Attachment F-1:

Hybrid Alternative Vissim Results Summary – AM Peak

AM Alternative 3 (Hybrid) Model Loading Summary

AM Peak Hour: 8:30AM-9:30AM

AM Peak Period: 8:00AM-10:00AM

Item	Basis	Criteria	Value	Target	Criteria Met
Simulated Vehicular Throughput (Individual Links)	All Segments and Approaches	Within \pm 100 vph for < 700 vph		85%	Yes
		Within \pm 15% for \geq 700 vph to < 2,700 vph			
		Within \pm 400 vph for \geq 2,700 vph			
		GEH < 5 for individual link flows	100%	85%	Yes
Simulated Vehicular Throughput (Network Wide)	Total Volume throughout Network on K Street Corridor	GEH < 4 for total network volume	2.1	4.0	Yes
		Within 5% of total network volume	1.1%	5%	Yes
Required Sample Size			10		

*Findings Represent Results from 10 Simulation Runs

Intersection Volume Loading

AM Peak Hour: 8:30AM-9:30AM

85% of All Intersection Approaches within the following Volume Criteria		Number of Approaches		Passing Approaches		Percent	Target	Target Met
Within \pm 100 vph for < 700 vph	51	84	51	84	100%	85%	Yes	Yes
Within \pm 15% for \geq 700 vph to < 2,700 vph	33		33					
Within \pm 400 vph for \geq 2,700 vph	0		0					

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)	
1	K Street NW and 22nd Street NW	NB	LT - SL	58	329	58	-4	0% 2% -12%
			TH	205		209		
			RT - SL	66		58		
		EB	TH	666	665	665	-1	0% 0%
			TH	527	529	529	2	0% 0%
		WB	LT	49	350	47	-8	-4% -2%
			TH	301		295		
		EB Service Lane	UT	94	339	94	-6	0% 15% -3%
			TH	101		116		
			RT	144		140		
		Intersection		2,211	2,211		0	0%
2	K Street NW and 21st Street NW	SB	LT	62	594	62	-3	0% 0% -1%
			TH	357		357		
			RT	175		172		
		EB	TH	666	666	669	3	0% 0%
			TH	352		358		
		WB	TH - SL	262	614	264	8	1% 1%
			TH - ML	170		163		
		EB Service Lane	RT	167		162	-12	-4% -3%
			Intersection	2,211	2,207		-4	0%
3	K Street NW and 20th Street NW	NB	LT	80	978	78	-2	-3% 2% 1%
			TH	806		821		
			RT	92		89		
		EB	TH	883	883	877	-6	-3% -1%
			TH	485		490		
		WB	RT	207	692	213	11	1% 2%
			Intersection	2,553	2,568		15	1%
4	K Street NW and 19th Street NW	SB	LT	57	554	59	6	4% 1% 1%
			TH	415		421		
			RT	82		80		
		EB	TH	788	979	780	-15	-2% -1% -4%
			RT	191		184		
		WB	TH	603	603	619	16	3% 3%
			Intersection	2,136	2,143		7	0%
5	K Street NW and 18th Street NW	NB	LT	66	952	70	23	6% 2% 2%
			TH	793		812		
			RT	93		93		
		EB	TH	710	710	704	-6	0% -1% 2%
			TH	650		663		
		WB	RT	140	790	142	15	1% 2%
			Intersection	2,452	2,484		32	1%
6	K Street NW and Connecticut Avenue	NB	TH	711	765	743	37	5% 9% 5%
			RT	54		59		
			LT	6		6		
		SB	TH	479	629	522	50	0% 9% 8%
			RT	144		151		
		EB	TH	608	705	608	-8	0% 5% -8%
			RT	97		89		
		WB	TH	814	950	813	3	0% 3%
			RT	136		140		
		Intersection		3,049	3,131		82	3%

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)
7	K Street NW and 17th Street NW (east)	NB	LT	7	61	0	0%
			TH	40		1	3%
			RT	14		-2	-14%
			LT	42		0	0%
		SB	TH	182	338	1	1%
			RT	114		0	0%
			TH	668		8	1%
		EB	TH	829	668	5	1%
			RT	46		0	0%
		WB	Intersection		1,942	13	1%
			Vissim Throughput (vph)		1,955		
		Difference (vph)		Difference (%)			
8	K Street NW and 16th Street NW	NB	LT	3	338	1	33%
			TH	311		7	2%
			RT	24		0	0%
			LT	67		2	3%
		SB	TH	453	649	30	7%
			RT	129		-4	-3%
			TH	515		5	1%
		EB	RT	144	659	-1	-1%
			TH	627		11	2%
		WB	RT	179	806	-2	-1%
			Intersection		2,452	9	1%
		Vissim Throughput (vph)		Difference (vph)		Difference (%)	
9	K Street NW and 15th Street NW (west)	NB	LT	30	485	3	10%
			TH	439		1	0%
			RT	16		0	0%
			LT	5		-1	-20%
		SB	TH	105	148	0	0%
			RT	38		-4	-11%
			TH	598		-3	-1%
		EB	RT	36	634	1	3%
			TH	993		9	1%
		WB	RT	186	1,179	-3	-2%
			Intersection		2,446	6	1%
		Vissim Throughput (vph)		Difference (vph)		Difference (%)	
10	K Street NW and Vermont Avenue	NB	LT	172	489	3	2%
			TH	244		-1	0%
			RT	73		3	4%
			LT	36		-2	-6%
		SB	RT	75	111	-2	-3%
			TH	619		-3	0%
			TH	925		7	1%
		EB	RT	66	991	-2	-3%
			Intersection		2,210	5	1%
		Vissim Throughput (vph)		Difference (vph)		Difference (%)	
11	K Street NW and 14th Street NW	NB	LT	208	878	3	1%
			TH	620		5	4%
			RT	50		0	0%
			LT	31		-1	-3%
		SB	TH	569	666	17	3%
			RT	66		-4	-6%
			TH	484		-14	-3%
		EB	RT	194	678	6	3%
			TH	716		-1	0%
		WB	RT	115	831	-7	-6%
			Intersection		3,053	8	-1%
		Vissim Throughput (vph)		Difference (vph)		Difference (%)	
12	K Street NW and 13th Street NW	NB	LT	173	591	-5	-3%
			TH	384		8	2%
			RT	34		2	6%
			LT	20		3	15%
		SB	TH	863	984	27	3%
			RT	101		-3	-3%
			TH	372		-16	-4%
		EB	RT	193	565	1	1%
			TH	534		8	1%
		WB	RT	105	639	2	2%
			Intersection		2,779	10	1%
		Vissim Throughput (vph)		Difference (vph)		Difference (%)	

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)			
13	K Street NW and 12th Street NW	NB	LT	255	999	280	25	10%	5%	
			TH	664		682				
			RT	80		83				
		EB	TH	428	428	419	-9	-2%	-2%	
			TH	372		364				
			RT	46		46				
		Intersection		1,845	1,874		29	2%		
		SB	LT	101	362	127	26	26%	7%	
			TH	214		216				
			RT	47		44				
			LT	13	553	12	-3	-6%	3%	
			TH	435		435				
			RT	105		120				
14	K Street NW and 11th Street NW	EB	LT	72	442	71	-1	-1%	9%	
			TH	178		183				
			RT	192		228				
		WB	LT	39	257	40	1	3%	-2%	
			TH	197		190				
			RT	21		21				
		Intersection		1,614	1,687		73	5%		
		SB	LT	24	448	24	0	0%	-1%	
			TH	260		257				
			RT	164		161				
			TH	99	232	101	2	2%	1%	
			RT	133		133				
15	K Street NW and 10th Street NW	WB	LT	9	112	10	1	11%	4%	
			TH	103		107				
		Intersection		792	793		1	0%		
		SB	TH	941	1,065	960	19	2%	2%	
			RT	124		127				
			RT	65		67				
		Intersection		1,130	1,154		24	2%		
16	K Street NW and 9th Street NW	EB	LT	177	626	172	-5	-3%	0%	
			TH	449		451				
			TH	784		790				
			RT	145		139				
		Intersection		1,555	1,552		-3	0%		
		SB	LT	105	524	104	15	-1%	3%	
			TH	391		410				
			RT	28		25				
17	L Street NW and 21st Street NW		TH	722		719	828	0	0%	
			RT	114		109				
	Intersection		1,757	1,776		19	1%			
	EB	LT	123	397	128	12	4%	3%		
		TH	274		281					
		LT	105		104					
		TH	391		410					
		RT	28		25					
		TH	722		719					
18	Pennsylvania Avenue NW and 21st Street NW	WB	RT		114	109	-8	-4%	-1%	
			LT		123	128				
			TH		274	281				
			LT		105	104				
			TH		391	410				
		Intersection		1,757	1,776		19	1%		
		SB	TH	566	524	573	7	1%	1%	
			RT	88		85				
			TH	725		737				
			RT	63		105				
			LT	105		104				
19	L Street NW and Connecticut Avenue	Intersection		2,289	2,383		94	4%		
		NB	TH	667	847	701	36	5%	4%	
			RT	180		182				
			TH	566		573				
		EB	LT	88		85	51	-3%	6%	
			TH	725		737				
			RT	63		105				
			LT	88		85				
			TH	725		737				
			RT	63		105				
20	I Street NW and 17th Street NW (west)	Intersection		2,625	2,702		77	3%		
		SB	LT	135	765	140	32	4%	4%	
			TH	630		657				
			TH	479		508				
		WB	RT	97		95				
			LT	368	1,284	368	18	0%	1%	
			TH	781		791				
			RT	135		143				
			LT	368		368				
			TH	781		791				
		Intersection		2,625	2,702		77	3%		

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)
21	L Street NW and 16th Street NW	NB	TH	327	490	325	-2
			RT	163		488	
			LT	245		15	-1%
			TH	600		25	0%
		SB	LT	159	845	-6	6%
			TH	542		-9	
			RT	49		1	
		Intersection		2,085	2,109		24
							1%
		WB	LT	69	256	68	-4%
			TH	187		178	
			TH	291		296	
			RT	306		321	
22	I Street NW and 16th Street NW	NB	LT	19	597	17	-10
			TH	902		922	
			RT	151		164	
			Intersection		1,925		41
		SB	LT	19	17	-11%	
			TH	902	20		
			RT	151	13		
							3%
		WB	Intersection		1,966		2%
23	L Street NW and 15th Street NW (west)	NB	TH	555	625	558	-1%
			RT	70		69	
			LT	41		42	
			TH	64		58	
		EB	LT	159	821	156	-2%
			TH	578		584	
			RT	84		85	
		Intersection		1,551	1,552		1
		SB					0%
24	L Street NW and 14th Street NW	NB	TH	504	735	521	3%
			RT	231		233	
			LT	111		113	
			TH	596		614	
		EB	LT	36	620	36	0%
			TH	514		511	
			RT	70		63	
		Intersection		2,062	2,091		29
		SB					1%
25	I Street NW and 14th Street NW	NB	LT	311	1,135	314	1%
			TH	824		839	
			TH	622		642	
			RT	141		147	
		WB	LT	88	763	90	2%
			TH	776		805	
			RT	54		65	
		Intersection		2,816	2,902		86
		SB					3%

*Results show the average from 10 simulation runs.

Intersection Delay and Estimated LOS

AM Peak Hour: 8:30AM-9:30AM

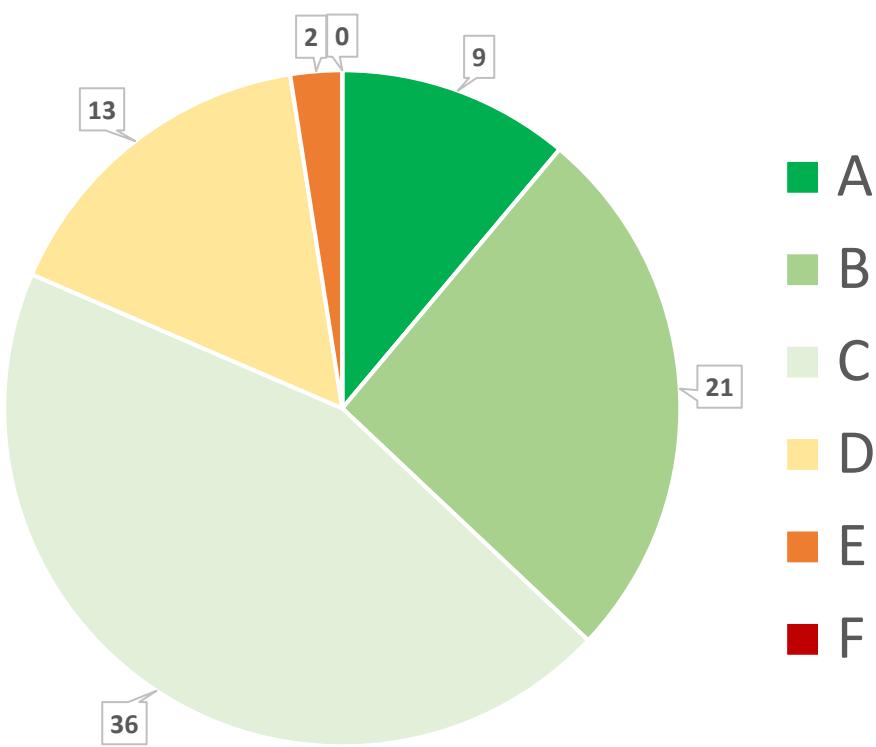
#	Intersection	Approach	Average Delay (sec/veh)	Approach LOS	Intersection Delay	Intersection LOS
1	K Street NW and 22nd Street NW	NB	40.8	D	12.7	B
		SB	-	-		
		EB Service Lane	6.5	A		
		WB Service Lane	35.7	D		
2	K Street NW and 21st Street NW	NB	-	-	23.5	C
		SB	21.6	C		
		EB	21.5	C		
		WB	24.7	C		
3	K Street NW and 20th Street NW	NB	33.8	C	19.7	B
		SB	-	-		
		EB	6.9	A		
		WB	15.6	B		
4	K Street NW and 19th Street NW	NB	-	-	13.9	B
		SB	30.3	C		
		EB	6.1	A		
		WB	11.3	B		
5	K Street NW and 18th Street NW	NB	29.0	C	23.2	C
		SB	-	-		
		EB	10.6	B		
		WB	27.1	C		
6	K Street NW and Connecticut Avenue	NB	22.9	C	16.2	B
		SB	28.9	C		
		EB	12.7	B		
		WB	4.2	A		
7	K Street NW and 17th Street NW (east)	NB	30.4	C	10.0	B
		SB	22.9	C		
		EB	7.5	A		
		WB	5.6	A		
8	K Street NW and 16th Street NW	NB	42.2	D	23.9	C
		SB	18.3	B		
		EB	28.1	C		
		WB	17.4	B		
9	K Street NW and 15th Street NW (west)	NB	33.0	C	17.4	B
		SB	31.9	C		
		EB	11.9	B		
		WB	12.2	B		
10	K Street NW and Vermont Avenue	NB	35.9	D	29.9	C
		SB	48.9	D		
		EB	10.5	B		
		WB	36.9	D		
11	K Street NW and 14th Street NW	NB	31.5	C	25.7	C
		SB	30.5	C		
		EB	18.2	B		
		WB	21.4	C		
12	K Street NW and 13th Street NW	NB	17.7	B	27.1	C
		SB	34.9	C		
		EB	23.3	C		
		WB	26.7	C		

#	Intersection	Approach	Average Delay (sec/veh)	Approach LOS	Intersection Delay	Intersection LOS
13	K Street NW and 12th Street NW	NB	37.9	D	31.6	C
		SB	-	-		
		EB	34.6	C		
		WB	12.6	B		
14	K Street NW and 11th Street NW	NB	17.2	B	26.4	C
		SB	23.3	C		
		EB	17.9	B		
		WB	64.4	E		
15	K Street NW and 10th Street NW	NB	-	-	19.1	B
		SB	19.5	B		
		EB	15.2	B		
		WB	25.3	C		
16	K Street NW and 9th Street NW	NB	-	-	8.5	A
		SB	5.4	A		
		EB	58.6	E		
		WB	-	-		
17	L Street NW and 21st Street NW	NB	-	-	21.1	C
		SB	23.2	C		
		EB	19.7	B		
		WB	-	-		
18	Pennsylvania Avenue NW and 21st Street NW	NB	-	-	30.4	C
		SB	30.6	C		
		EB	27.0	C		
		WB	37.0	D		
19	L Street NW and Connecticut Avenue	NB	53.6	D	34.0	C
		SB	23.6	C		
		EB	21.8	C		
		WB	-	-		
20	I Street NW and 17th Street NW (west)	NB	21.3	C	26.5	C
		SB	36.0	D		
		EB	-	-		
		WB	25.4	C		
21	L Street NW and 16th Street NW	NB	8.3	A	20.7	C
		SB	23.6	C		
		EB	25.5	C		
		WB	-	-		
22	I Street NW and 16th Street NW	NB	14.6	B	31.7	C
		SB	45.6	D		
		EB	-	-		
		WB	27.7	C		
23	L Street NW and 15th Street NW (west)	NB	8.9	A	13.4	B
		SB	20.8	C		
		EB	15.9	B		
		WB	-	-		
24	L Street NW and 14th Street NW	NB	19.2	B	20.2	C
		SB	13.0	B		
		EB	30.1	C		
		WB	-	-		
25	I Street NW and 14th Street NW	NB	27.1	C	34.0	C
		SB	39.3	D		
		EB	-	-		
		WB	38.0	D		

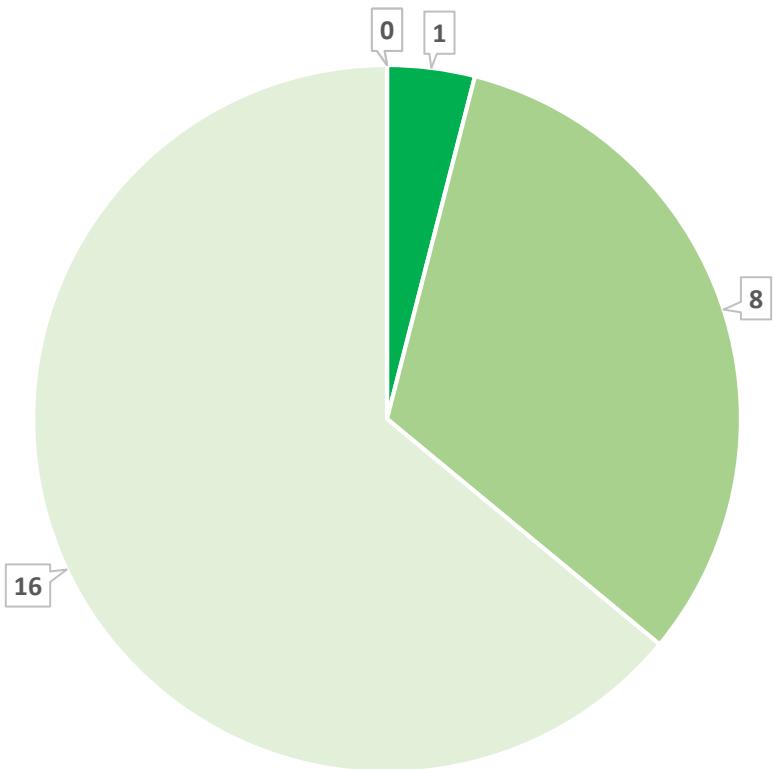
Intersection Delay and Estimated LOS

AM Peak Hour: 8:30AM-9:30AM

Approach LOS Summary



Intersection LOS Summary



Approach LOS	A	B	C	D	E	F	Intersection LOS	A	B	C	D	E	F
Approach LOS	9	21	36	13	2	0	Intersection LOS	1	8	16	0	0	0

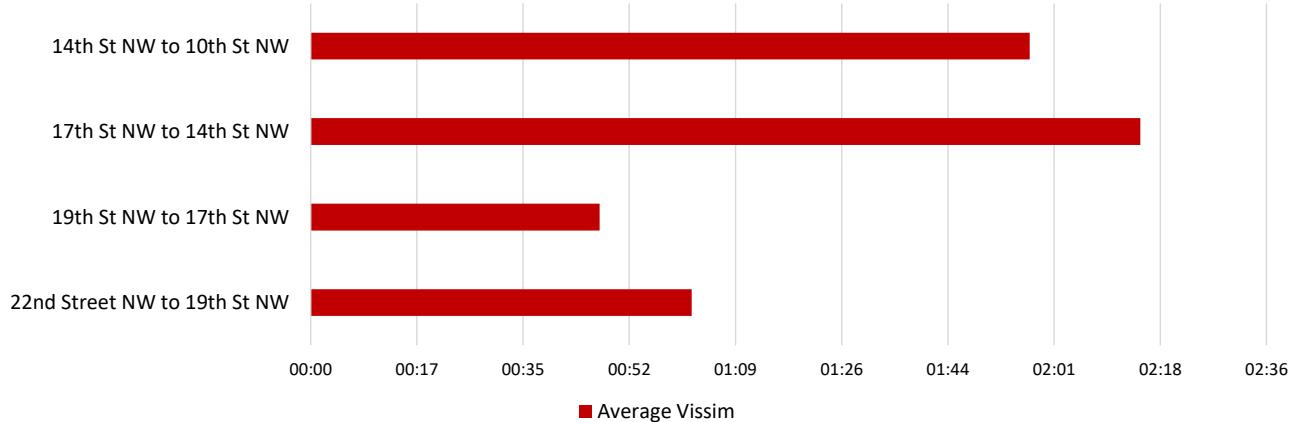
Travel Time | Segment-by-Segment Passenger Cars

AM Peak Period: 8:00AM-10:00AM

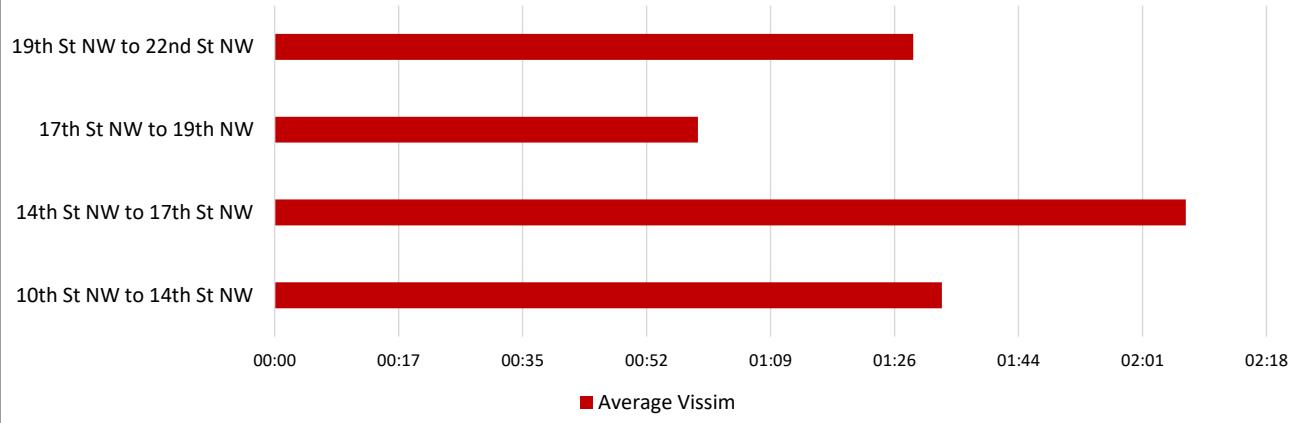
Passenger Vehicle Segment-by-Segment Travel Time Comparison					
Segment ID	Route	Vehicle Count	Average Vissim	Standard Deviation by Time ¹	Standard Deviation by Seed ²
		(MM:SS)	(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	1087	01:02	00:03	00:02
2	19th St NW to 17th St NW	989	00:47	00:03	00:05
3	17th St NW to 14th St NW	468	02:15	00:08	00:10
4	14th St NW to 10th St NW	485	01:57	00:05	00:15
Total	Total Eastbound	3029	06:01	00:18	00:32
5	10th St NW to 14th St NW	575	01:33	00:03	00:06
6	14th St NW to 17th St NW	505	02:07	00:03	00:05
7	17th St NW to 19th NW	1012	00:59	00:00	00:02
8	19th St NW to 22nd St NW	457	01:29	00:01	00:03
Total	Total Westbound	2549	06:08	00:08	00:16

*Results show the average from 10 simulation runs.

Eastbound Travel Time Segments



Westbound Travel Time Segments



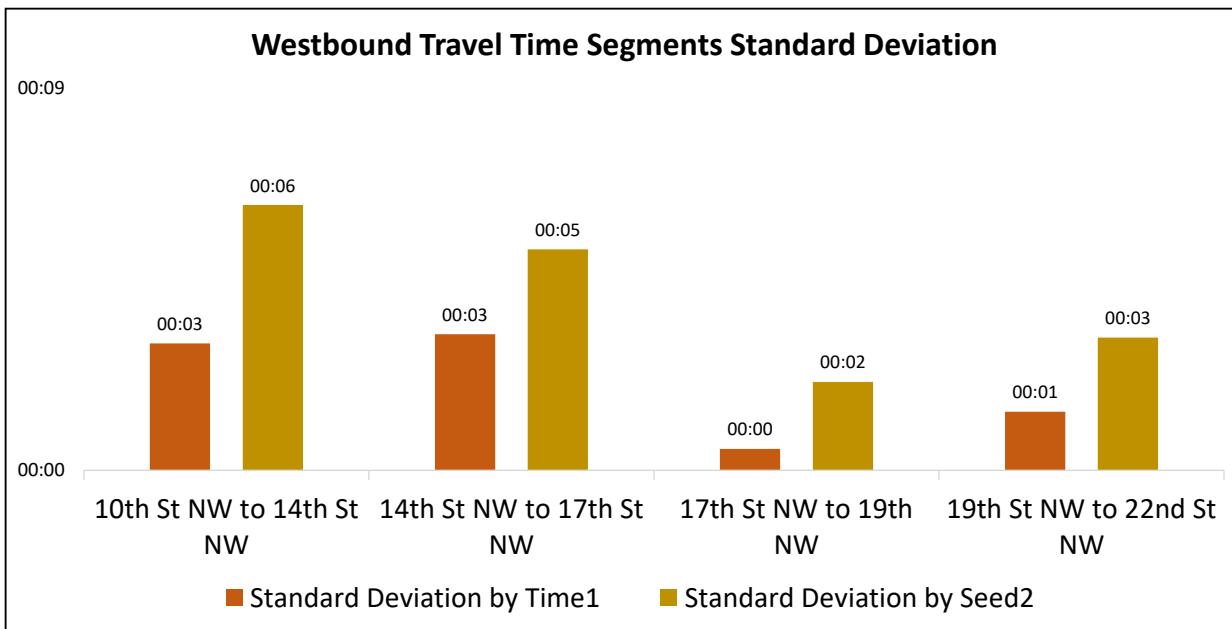
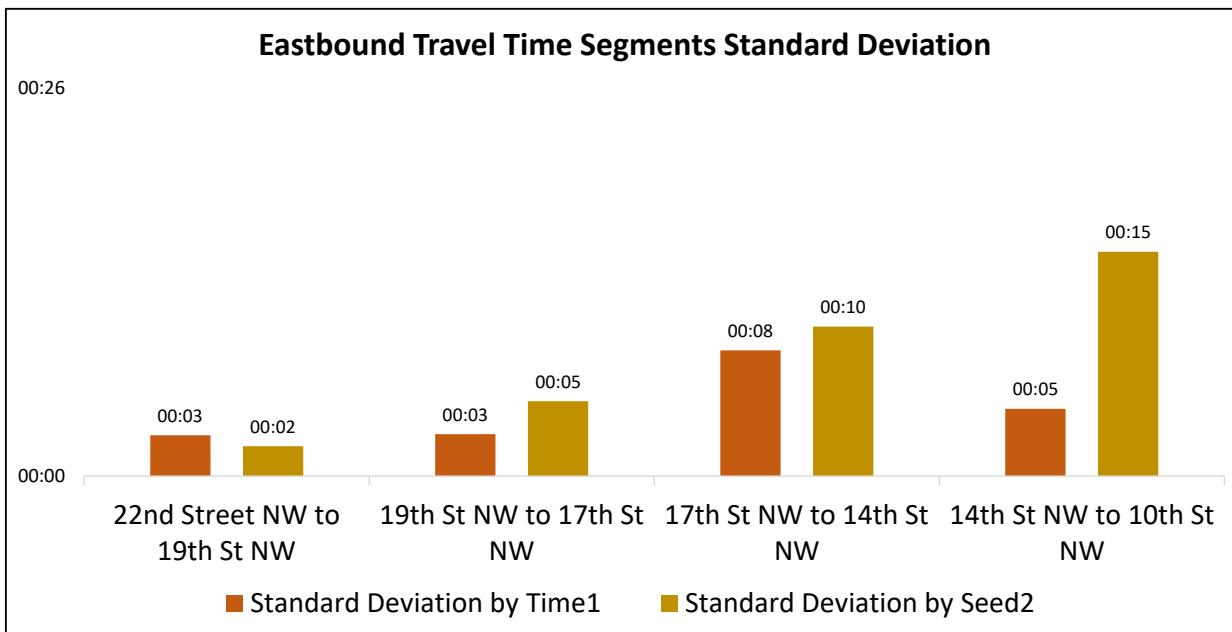
Travel Time | Segment-by-Segment Passenger Cars

AM Peak Period: 8:00AM-10:00AM

*Travel time results collected throughout the 2-hour peak period at 15-minute intervals.

¹Standard deviation by time is standard deviation of the average travel time for all simulation runs in each 15-minute time segment, representing how the average travel time changes throughout the peak period.

²Standard deviation by seed is the average standard deviation of travel times for each 15-minute time segment in the peak period, representing the consistency of travel time throughout the peak period.

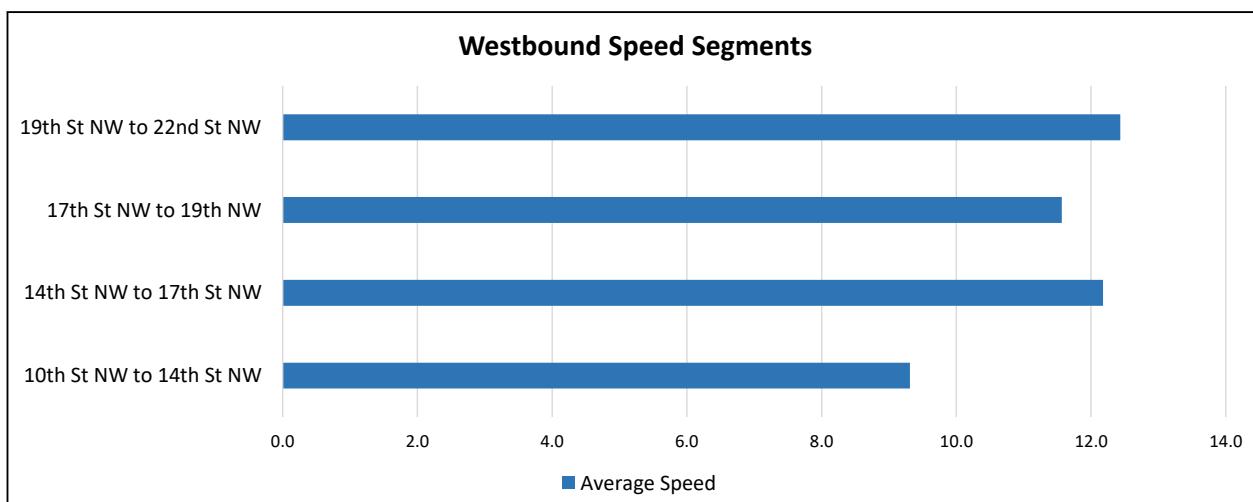
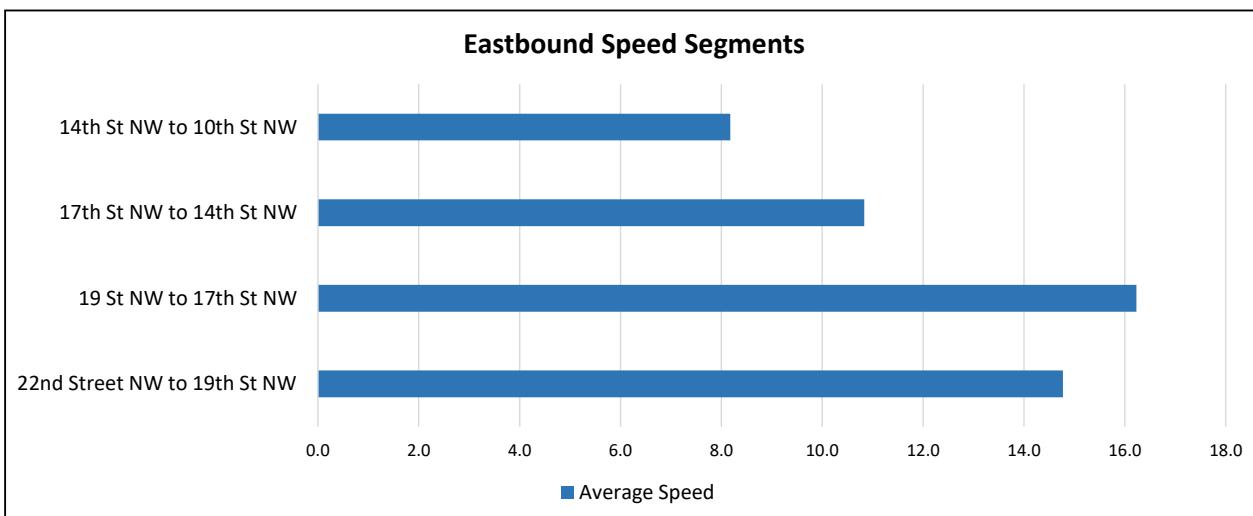


Speed | Segment-by-Segment Passenger Cars

AM Peak Period: 8:00AM-10:00AM

Passenger Vehicle Segment-by-Segment Average Speed Comparison			
Segment ID	Route	Vehicle Count	Average Speed
			MPH
1	22nd Street NW to 19th St NW	1087	14.8
2	19 St NW to 17th St NW	989	16.2
3	17th St NW to 14th St NW	468	10.8
4	14th St NW to 10th St NW	485	8.2
Average Eastbound		3029	12.5
5	10th St NW to 14th St NW	575	9.3
6	14th St NW to 17th St NW	505	12.2
7	17th St NW to 19th NW	1012	11.6
8	19th St NW to 22nd St NW	457	12.4
Average Westbound		2549	11.4

*Results show the average from 10 simulation runs.

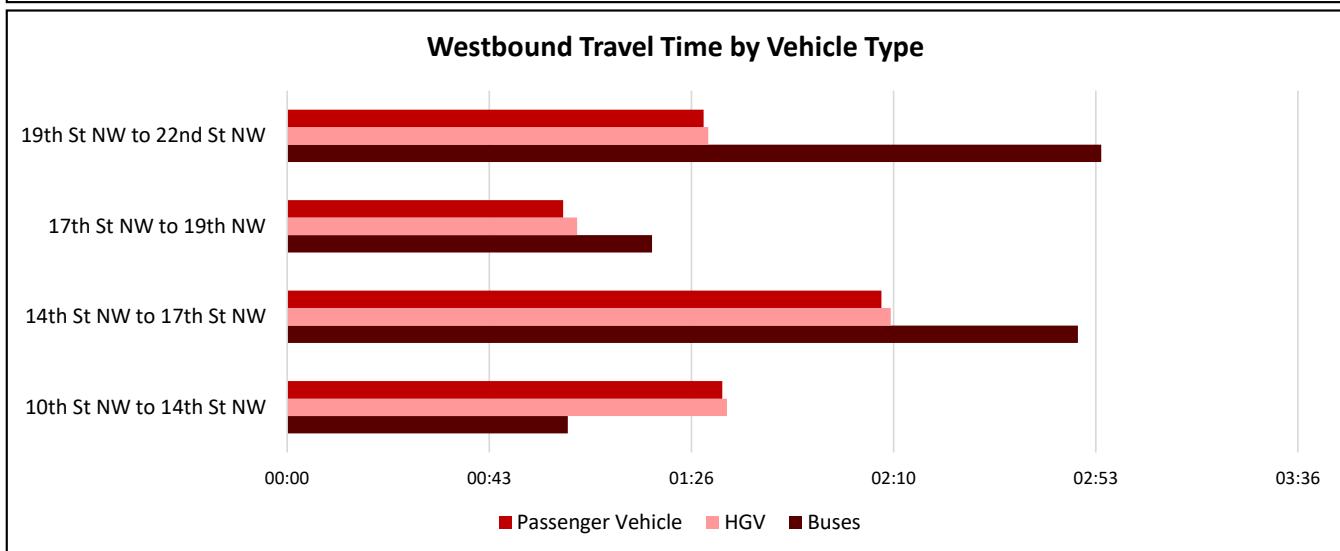
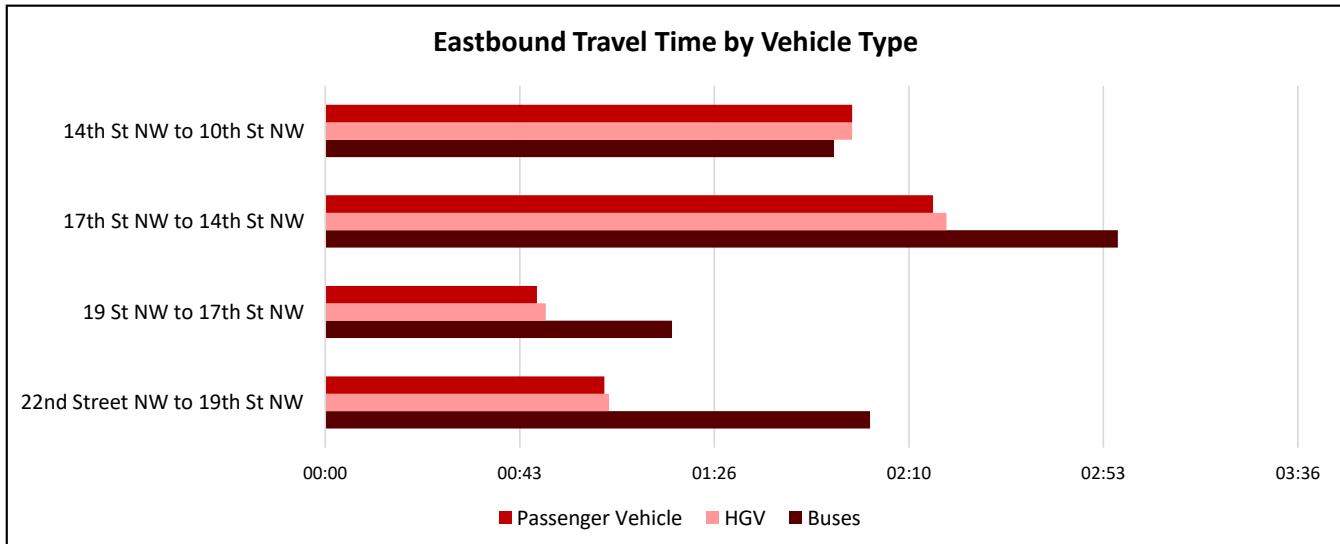


Travel Time | Comparison by Vehicle Type

AM Peak Period: 8:00AM-10:00AM

Segment ID	Route	Travel Time by Vehicle Type		
		Passenger Vehicle (MM:SS)	HGV (MM:SS)	Buses (MM:SS)
1	22nd Street NW to 19th St NW	01:02	01:03	02:01
2	19 St NW to 17th St NW	00:47	00:49	01:17
3	17th St NW to 14th St NW	02:15	02:18	02:56
4	14th St NW to 10th St NW	01:57	01:57	01:53
Total	Total Eastbound	06:01	06:07	08:07
5	10th St NW to 14th St NW	01:33	01:34	01:00
6	14th St NW to 17th St NW	02:07	02:09	02:49
7	17th St NW to 19th NW	00:59	01:02	01:18
8	19th St NW to 22nd St NW	01:29	01:30	02:54
Total	Total Westbound	06:08	06:15	08:01

*Results show the average from 10 simulation runs.

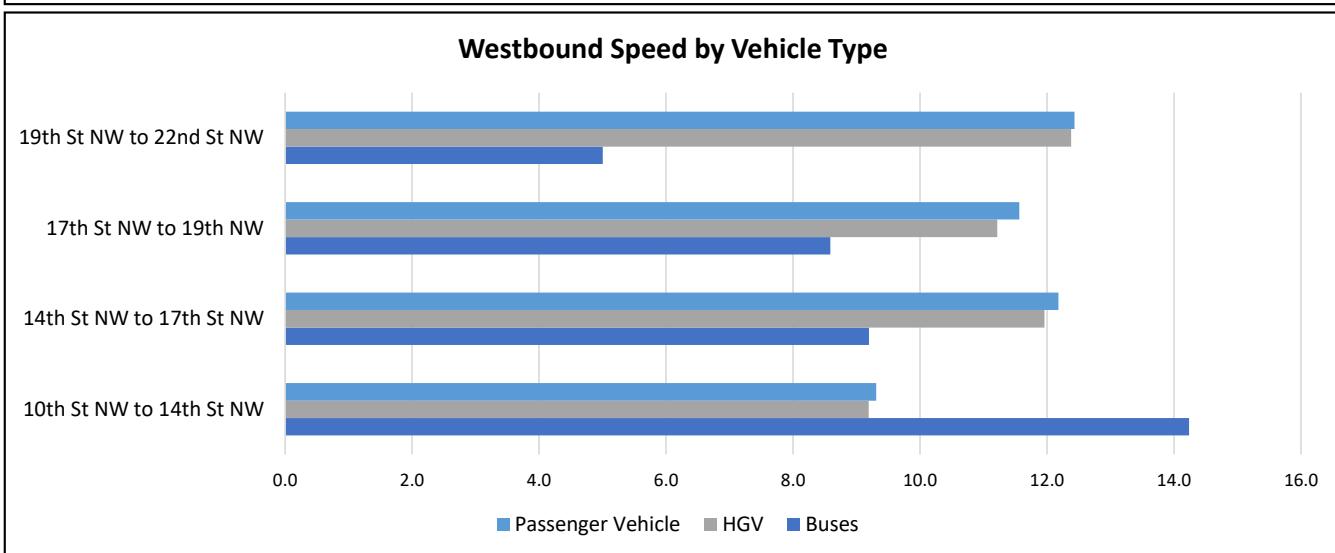
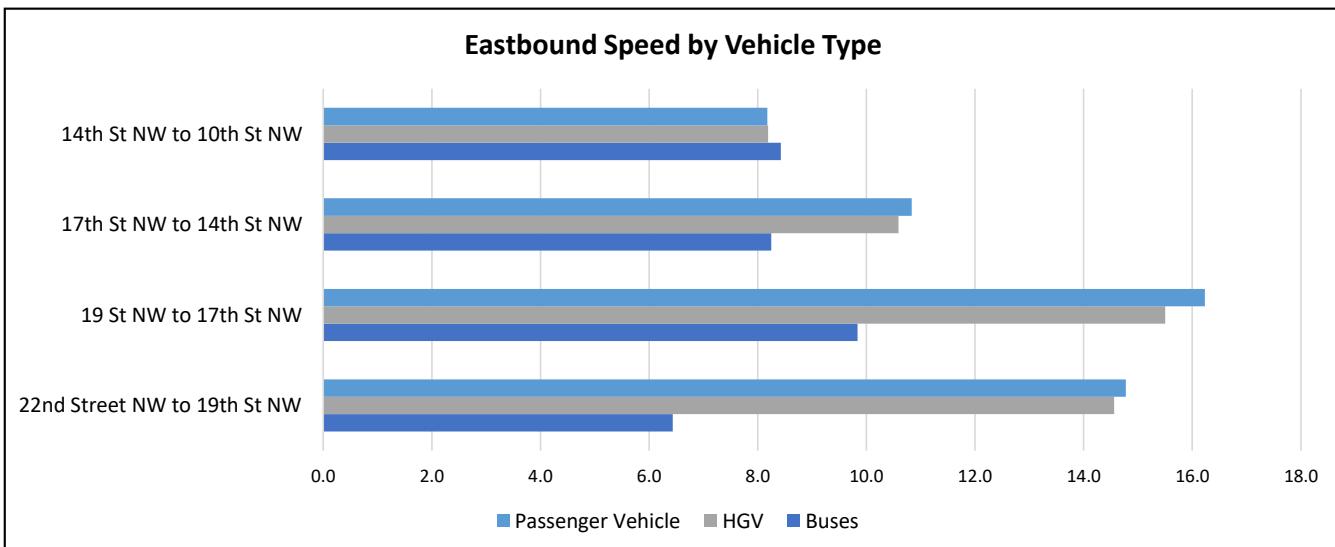


Speed | Comparison by Vehicle Type

AM Peak Period: 8:00AM-10:00AM

Segment ID	Route	Travel Time by Vehicle Type		
		Passenger Vehicle (MM:SS)	HGV (MM:SS)	Buses (MM:SS)
1	22nd Street NW to 19th St NW	14.8	14.6	6.4
2	19 St NW to 17th St NW	16.2	15.5	9.8
3	17th St NW to 14th St NW	10.8	10.6	8.2
4	14th St NW to 10th St NW	8.2	8.2	8.4
Average Eastbound		12.5	12.2	8.2
5	10th St NW to 14th St NW	9.3	9.2	14.2
6	14th St NW to 17th St NW	12.2	12.0	9.2
7	17th St NW to 19th NW	11.6	11.2	8.6
8	19th St NW to 22nd St NW	12.4	12.4	5.0
Average Westbound		11.4	11.2	9.3

*Results show the average from 10 simulation runs.



Travel Time | Comparison by Vehicle Type

AM Peak Period: 8:00AM-10:00AM

Number of Vehicles Represented in Travel Time by Vehicle Type				
Segment ID	Route	Passenger Vehicle	HGV	Buses
		Vehicle Count	Vehicle Count	Vehicle Count
1	22nd Street NW to 19th St NW	1087	58	42
2	19 St NW to 17th St NW	989	55	99
3	17th St NW to 14th St NW	468	25	102
4	14th St NW to 10th St NW	485	25	80
Total	Total Eastbound	3029	163	323
5	10th St NW to 14th St NW	575	31	65
6	14th St NW to 17th St NW	505	27	107
7	17th St NW to 19th NW	1012	55	109
8	19th St NW to 22nd St NW	457	25	66
Total	Total Westbound	2549	138	347

*Total number of vehicles counted in Travel Time runs through the 2-hour peak period.

GEH of Vehicular Throughput

AM Peak Hour: 8:30AM-9:30AM

GEH Criteria	Value	Percent	Target	Target Met
Total Network Volume with GEH < 4	GEH: 2.1	N/A	4	Yes
Total Network Volume %Difference from Balanced Counts	N/A	1.11%	5%	Yes
85% of individual links below GEH < 5	84 of 84	100%	85%	Yes

Total K Street NW Volume	Sum of balanced counts	Sum of all link flows	Percent Difference	GEH
	34,875	35,261	1.1%	2.1

* Bus volume during peak period added to "Sum of balanced counts"

Intersection Approaches	Number of Approaches	Number of Segments with GEH < 5	Number of Segments with GEH >5	Percent Compliance
	84	84	0	100%

The GEH statistic is computed using the following formula:

E = Vissim estimated throughput

V = balanced field count:

$$\text{GEH} = \sqrt{\frac{(E-V)^2}{(E+V)/2}}$$

Sample Size Determination Tool, Version 2.0



<p>Step 1: Input number of MOEs (max is 12). Clear out old data.</p> <p>Step 2: Select type of MOEs</p> <p>Step 3: Insert simulation results from four random seeds for selected MOEs</p>		<p>User Inputs</p> <p>Constants</p> <p>Outputs</p> <p>Sample Size (N) = Number of Model Runs Sample Mean (X_s) = (1/N) (X₁ + X₂ + X₃ ... + X_N) Sample Standard Deviation (S_s) = $\sqrt{[(\sum(X-X_s)^2)/(N-1)]}$ Sampling Error = t (S_s/VN) Confidence Level = X_s ± t (S_s/VN) % of Sample Mean (E) = % Tolerance * X_s Sample Size Needed = [(t)² * (S_s)²] / (E)²</p> <p><i>The "t" statistic is the hypothesized number of standard deviations away from the mean corresponding to the required confidence level and sample size in a t-distribution.</i></p>								
<p>Inputs</p> <p>Confidence Interval: 95%</p> <p>Tolerance Error: 10%</p> <p>Number of MOEs: 10</p>		<p>Output</p> <p>Number of Required Runs: 10</p> <p>*Minimum number of required runs = 10</p>								
Location (optional)	EB K Street	WB K Street	EB (17th/18th)	WB (17th/18th)	EB (13th/14th)	WB (13th/14th)	EB (17th/18th)	WB (17th/18th)	EB (13th/14th)	WB (13th/14th)
Runs (Seeds)	Travel Time	Travel Time	Volume	Volume	Volume	Volume	Speed	Speed	Speed	Speed
100	356	312	1259	1942	1101	1670	21.3	22.0	24.3	24.4
120	359	304	1186	1902	1065	1647	21.3	22.3	24.4	24.3
140	341	307	1222	1905	1111	1764	21.2	22.2	23.7	23.4
160	348	305	1258	1839	1100	1649	20.4	22.6	24.4	23.5
*Results from four random seeds										
Statistics										
X _s =	350.9	307.1	1231.3	1897.0	1094.3	1682.5	21.1	22.3	24.2	23.9
S _s =	8.1	3.4	34.7	42.7	20.1	55.3	0.5	0.3	0.3	0.5
E =	35.1	30.7	123.1	189.7	109.4	168.3	2.1	2.2	2.4	2.4
t =	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18
Sampling Error =	12.95	5.47	55.26	68.00	32.02	88.03	0.74	0.45	0.54	0.85
95% Interval Lower =	337.9	301.7	1176.0	1829.0	1062.2	1594.5	20.3	21.8	23.7	23.0
95% Interval Upper =	363.8	312.6	1286.5	1965.0	1126.3	1770.5	21.8	22.7	24.8	24.7
% of Sample Mean =	3.69%	1.78%	4.49%	3.58%	2.93%	5.23%	3.50%	2.02%	2.24%	3.55%
Sample Size Needed =	4	4	4	4	4	4	4	4	4	4

Network Gridlock Check

Inputs

Confidence Interval:	95%
Tolerance Error:	10%

Runs (Seeds)

100
110
120
130
140
150
160
170
180
190

<u>Runs (Seeds)</u>	<u>Ave Delay PVs</u>	<u>Latend Demand</u>	<u>Ave Speed PVs</u>	<u>Ave Delay Stop PVs</u>	<u>Total Delay PVs</u>	<u>PVs Active @ End of Simulation</u>	<u>Total PVs Arrived</u>
100	53.41	0	12.1	38.6	2.4	654	43579
110	54.19	36	11.9	39.0	2.4	713	43448
120	52.23	0	12.2	37.7	2.3	576	43479
130	54.94	0	11.9	39.8	2.4	659	43560
140	55.01	0	11.9	39.7	2.4	622	43315
150	53.69	0	12.0	38.9	2.4	690	43383
160	53.46	0	12.0	38.7	2.4	621	43500
170	52.18	0	12.2	37.8	2.3	626	43589
180	53.49	0	12.0	38.7	2.4	571	43436
190	53.43	0	12.0	38.7	2.4	683	43657

Statistics

X _s =	53.6	3.6	12.0	38.8	2.4	641.5	43494.6
S _s =	1.0	11.4	0.1	0.7	0.0	47.1	104.0
E =	5.4	0.4	1.2	3.9	0.2	64.2	4349.5
t =	3.18	3.18	3.18	3.18	3.18	3.18	3.18

Sampling Error =	1.51	18.11	0.17	1.08	0.07	74.92	165.43
95% Interval Lower =	52.1	-14.5	11.8	37.7	2.3	566.6	43329.2
95% Interval Upper =	55.1	21.7	12.2	39.8	2.4	716.4	43660.0
% of Sample Mean =	2.82%	503.19%	1.45%	2.79%	2.77%	11.68%	0.38%

Attachment F-2:

Hybrid Alternative Vissim Results Summary – PM Peak

PM Alternative 3 (Hybrid) Model Loading Summary

PM Peak Hour: 4:45PM-5:45PM

PM Peak Period: 4:15PM-6:15PM

Item	Basis	Criteria	Value	Target	Criteria Met
Simulated Vehicular Throughput (Individual Links)	All Segments and Approaches	Within \pm 100 vph for < 700 vph		85%	Yes
		Within \pm 15% for \geq 700 vph to < 2,700 vph			
		Within \pm 400 vph for \geq 2,700 vph			
		GEH < 5 for individual link flows	100%	85%	Yes
Simulated Vehicular Throughput (Network Wide)	Total Volume throughout Network on K Street Corridor	GEH < 4 for total network volume	0.8	4.0	Yes
		Within 5% of total network volume	-0.4%	5%	Yes
Required Sample Size			10		

*Findings Represent Results from 10 Simulation Runs

Intersection Volume Loading

PM Peak Hour: 4:45PM-5:45PM

85% of All Intersection Approaches within the following Volume Criteria		Number of Approaches		Passing Approaches		Percent	Target	Target Met
Within \pm 100 vph for < 700 vph	43	84	43	84	84	100%	85%	Yes
Within \pm 15% for \geq 700 vph to < 2,700 vph	41		41					
Within \pm 400 vph for \geq 2,700 vph	0		0					

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)		
1	K Street NW and 22nd Street NW	NB	LT - SL	122	401	121	-1		
			TH	247		236			
			RT - SL	32		30			
		EB	TH	258	258	253	-5		
			WB	1,204	1,204	1,143	-61		
		EB Service Lane	LT	21	128	21	0		
			TH	107		127			
		WB Service Lane	UT	76	347	74	-2		
			TH	179		194			
			RT	92		88			
		Intersection		2,338	2,287		-51		
2	K Street NW and 21st Street NW	SB	LT	96	857	97	1		
			TH	516		505			
			RT	245		231			
		EB	TH	258	258	251	-7		
			TH	959		906			
		WB	TH - SL	305	1,264	284	-21		
			TH - ML	127		140			
		EB Service Lane	RT	111	238	108	-3		
			Intersection			248			
3	K Street NW and 20th Street NW	NB	LT	133	657	131	-2		
			TH	403		397			
			RT	121		134			
		EB	TH	466	466	485	19		
			TH	920		895			
		WB	RT	200	1,120	209	9		
			Intersection			2,251			
		SB	LT	133	657	131	-2		
			TH	403		397			
			RT	121		134			
4	K Street NW and 19th Street NW		TH	466		485			
			TH	920		895			
	EB	RT	200	209					
		Intersection				2,251			
	WB	LT	60	899	61	1			
		TH	701		701				
		RT	138		139				
		TH	475	672	506	31			
		RT	197		195				
5		K Street NW and 18th Street NW			Intersection			957	
					TH		971	957	
	NB	LT	132	726	130	-2			
		TH	487		501				
		RT	107		108				
	EB	TH	525	525	558	33			
		TH	822		802				
	WB	RT	123	945	119	-4			
		Intersection			921				
6	K Street NW and Connecticut Avenue	NB	LT	132	648	614	24		
			TH	590		56			
			RT	56		10			
			LT	12		2			
			TH	740		729			
		SB	RT	155	907	138	-11		
			TH	729		756			
			RT	142		129			
		EB	TH	931	871	914	27		
			RT	190		189			
		Intersection		3,547	3,537		-10		
							0%		

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)
7	K Street NW and 17th Street NW (east)	NB	LT	37	183	38	3%
			TH	122		125	
			RT	24		23	
			LT	41		40	
		SB	TH	169	329	168	-2%
			RT	119		118	
			TH	797		824	
		EB	TH	965	1,036	939	-3%
			RT	71		73	
		Intersection		2,345	2,348	3	0%
8	K Street NW and 16th Street NW	NB	LT	8	336	9	13%
			TH	286		293	
			RT	42		42	
			LT	115		113	
		SB	TH	332	552	340	-2%
			RT	105		102	
			TH	620		647	
		EB	RT	112	732	113	4%
			TH	740		730	
		WB		208	948	211	-1%
		Intersection		2,568		2,600	
						32	1%
9	K Street NW and 15th Street NW (west)	NB	LT	48	375	46	-4%
			TH	311		319	
			RT	16		15	
			LT	8		10	
		SB	TH	198	294	197	-6%
			RT	88		82	
			TH	806		802	
		EB	RT	41	847	38	25%
			TH	911		909	
		WB		161	1,072	157	-1%
		Intersection		2,588		2,575	
						-13	-1%
10	K Street NW and Vermont Avenue	NB	LT	92	363	90	-2%
			TH	219		224	
			RT	52		52	
			LT	80		79	
		SB	RT	90	170	89	0%
			TH	830		817	
			TH	895		886	
		EB	RT	66	961	63	-1%
			RT	66		63	
		Intersection		2,324		2,300	
						-24	-1%
11	K Street NW and 14th Street NW	NB	LT	125	733	125	0%
			TH	569		604	
			RT	39		40	
			LT	28		26	
		SB	TH	632	713	633	6%
			RT	53		49	
			TH	752		726	
		EB	RT	216	968	205	-3%
			TH	792		788	
		WB		69	861	67	-4%
		Intersection		3,275		3,263	
						-12	0%
12	K Street NW and 13th Street NW	NB	LT	188	678	185	-2%
			TH	473		490	
			RT	17		17	
			LT	26		0	
		SB	TH	553	695	573	4%
			RT	116		113	
			TH	640		613	
		EB	RT	179	819	171	0%
			TH	539		534	
		WB		48	587	52	-4%
		Intersection		2,779		2,773	
						-6	0%

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)	
13	K Street NW and 12th Street NW	NB	LT	201	1,040	205	4	2%
			TH	763		766		
			RT	76		75		
		EB	TH	670	670	649	-21	-1%
			TH	369		368		
			RT	49		49		
		Intersection		2,128	2,112		-16	-1%
		SB	LT	152	442	167	15	10%
			TH	239		239		
			RT	51		47		
			LT	34	538	32	-4	-8%
			TH	437		424		
			RT	67		76		
14	K Street NW and 11th Street NW	EB	LT	67	705	67	0	0%
			TH	342		322		
			RT	296		333		
		WB	LT	13	225	14	1	8%
			TH	192		188		
			RT	20		19		
		Intersection		1,910	1,928		18	1%
		SB	LT	32	445	33	1	3%
			TH	302		298		
			RT	111		108		
			TH	180	444	170	-10	-6%
			RT	264		249		
15	K Street NW and 10th Street NW	EB	LT	37	132	39	2	5%
			TH	95		95		
		Intersection		1,021	992		-29	-3%
		WB	TH	781	864	798	17	2%
			RT	83		82		
			RT	182		171		
16	K Street NW and 9th Street NW	Intersection		1,046	1,051		5	0%
		SB	LT	188	880	188	0	0%
			TH	692		691		
			TH	492	657	488	-1	0%
17	L Street NW and 21st Street NW		RT	165		154		
	Intersection		1,537	1,521		-16	-1%	
	EB	LT	142	627	138	-4	-3%	
		TH	394		394			
		RT	91		81			
		TH	554	654	562	8	1%	
		RT	100		101			
18	Pennsylvania Avenue NW and 21st Street NW	WB	LT	267	825	263	-4	-1%
			TH	558		580		
			Intersection		2,106	2,119		
		SB	TH	689	780	712	23	3%
			RT	91		87		
			TH	750	750	739	-4	-4%
			LT	151		146		
19	L Street NW and Connecticut Avenue	EB	TH	788	1,096	796	8	1%
			RT	157		178		
			Intersection		2,626	2,658		
		NB	LT	58	591	59	1	2%
			TH	533		554		
			TH	803		766		
20	I Street NW and 17th Street NW (west)	SB	RT	79	882	68	22	4%
			LT	442		403		
			TH	592		552		
			RT	115		122		
		Intersection		2,622	2,524		-98	-4%

#	Intersection	Approach	Movement	Balanced Count (vph)	Vissim Throughput (vph)	Difference (vph)	Difference (%)		
21	L Street NW and 16th Street NW	NB	TH	377	494	379	2	1%	0%
			RT	117		116	-1		
			LT	103	563	112	9	-1%	2%
			TH	460		462	2		
		EB	LT	214	968	220	6	3%	0%
			TH	662		648	-14		
			RT	92		96	4		
		Intersection		2,025	2,033		8	0%	
22	I Street NW and 16th Street NW	NB	LT	32	207	33	1	-6	-3%
			TH	175		168	-7		
			TH	238	445	238	0	10	2%
			RT	207		217	10		
		WB	LT	77	971	78	1	33	3%
			TH	733		745	12		
			RT	161		181	20		
		Intersection		1,623	1,660		37	2%	
23	L Street NW and 15th Street NW (west)	NB	TH	432	472	426	-6	0	0%
			RT	40		46	6		
			LT	59	211	59	0	-7	-3%
			TH	152		145	-7		
		EB	LT	225	1,102	222	-3	14	1%
			TH	735		749	14		
			RT	142		145	3		
		Intersection		1,785	1,792		7	0%	
24	L Street NW and 14th Street NW	NB	TH	518	638	539	21	22	3%
			RT	120		121	1		
			LT	77	622	77	0	11	2%
			TH	545		556	11		
		EB	LT	71	964	68	-3	-4	0%
			TH	725		725	0		
			RT	168		167	-1		
		Intersection		2,224	2,253		29	1%	
25	I Street NW and 14th Street NW	NB	LT	254	941	257	3	27	3%
			TH	687		711	24		
			TH	785	848	770	-15	-16	-2%
			RT	63		62	-1		
		WB	LT	128	781	131	3	47	6%
			TH	607		637	30		
			RT	46		60	14		
		Intersection		2,570	2,628		58	2%	

*Results show the average from 10 simulation runs.

Intersection Delay and Estimated LOS

PM Peak Hour: 4:45PM-5:45PM

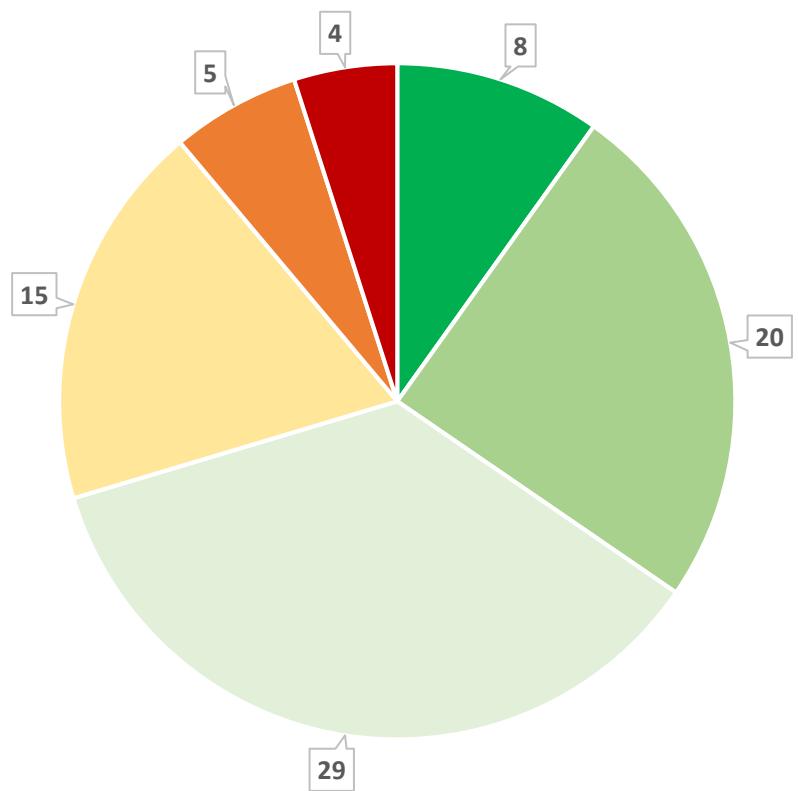
#	Intersection	Approach	Average Delay (sec/veh)	Approach LOS	Intersection Delay	Intersection LOS
1	K Street NW and 22nd Street NW	NB	29.1	C	32.2	C
		SB	-	-		
		EB Service Lane	10.6	B		
		WB Service Lane	47.4	D		
2	K Street NW and 21st Street NW	NB	-	-	42.3	D
		SB	48.8	D		
		EB	19.6	B		
		WB	44.8	D		
3	K Street NW and 20th Street NW	NB	36.4	D	19.9	B
		SB	-	-		
		EB	9.8	A		
		WB	14.5	B		
4	K Street NW and 19th Street NW	NB	-	-	16.9	B
		SB	33.0	C		
		EB	5.4	A		
		WB	10.3	B		
5	K Street NW and 18th Street NW	NB	28.1	C	18.0	B
		SB	-	-		
		EB	7.3	A		
		WB	16.4	B		
6	K Street NW and Connecticut Avenue	NB	31.4	C	35.6	D
		SB	68.8	E		
		EB	41.7	D		
		WB	6.8	A		
7	K Street NW and 17th Street NW (east)	NB	35.8	D	16.6	B
		SB	26.2	C		
		EB	9.8	A		
		WB	15.6	B		
8	K Street NW and 16th Street NW	NB	38.3	D	19.2	B
		SB	12.5	B		
		EB	22.4	C		
		WB	13.5	B		
9	K Street NW and 15th Street NW (west)	NB	29.6	C	33.2	C
		SB	36.5	D		
		EB	59.7	E		
		WB	12.6	B		
10	K Street NW and Vermont Avenue	NB	34.3	C	26.2	C
		SB	49.3	D		
		EB	29.6	C		
		WB	16.0	B		
11	K Street NW and 14th Street NW	NB	27.6	C	35.0	D
		SB	23.4	C		
		EB	65.2	E		
		WB	18.4	B		
12	K Street NW and 13th Street NW	NB	22.8	C	52.8	D
		SB	42.7	D		
		EB	117.6	F		
		WB	13.5	B		

#	Intersection	Approach	Average Delay (sec/veh)	Approach LOS	Intersection Delay	Intersection LOS
13	K Street NW and 12th Street NW	NB	39.7	D	29.2	C
		SB	-	-		
		EB	24.7	C		
		WB	10.2	B		
14	K Street NW and 11th Street NW	NB	38.7	D	24.7	C
		SB	36.2	D		
		EB	6.8	A		
		WB	26.7	C		
15	K Street NW and 10th Street NW	NB	-	-	16.4	B
		SB	25.1	C		
		EB	7.0	A		
		WB	17.3	B		
16	K Street NW and 9th Street NW	NB	-	-	13.1	B
		SB	4.9	A		
		EB	55.2	E		
		WB	-	-		
17	L Street NW and 21st Street NW	NB	-	-	27.5	C
		SB	28.6	C		
		EB	26.0	C		
		WB	-	-		
18	Pennsylvania Avenue NW and 21st Street NW	NB	-	-	101.6	F
		SB	27.7	C		
		EB	34.9	C		
		WB	207.8	F		
19	L Street NW and Connecticut Avenue	NB	20.5	C	39.8	D
		SB	88.3	F		
		EB	21.7	C		
		WB	-	-		
20	I Street NW and 17th Street NW (west)	NB	25.8	C	71.0	E
		SB	103.5	F		
		EB	-	-		
		WB	71.6	E		
21	L Street NW and 16th Street NW	NB	13.8	B	19.9	B
		SB	23.9	C		
		EB	20.6	C		
		WB	-	-		
22	I Street NW and 16th Street NW	NB	18.1	B	26.6	C
		SB	39.1	D		
		EB	-	-		
		WB	22.7	C		
23	L Street NW and 15th Street NW (west)	NB	12.5	B	13.8	B
		SB	30.8	C		
		EB	11.3	B		
		WB	-	-		
24	L Street NW and 14th Street NW	NB	14.6	B	19.0	B
		SB	19.6	B		
		EB	21.7	C		
		WB	-	-		
25	I Street NW and 14th Street NW	NB	21.7	C	30.9	C
		SB	34.5	C		
		EB	-	-		
		WB	38.0	D		

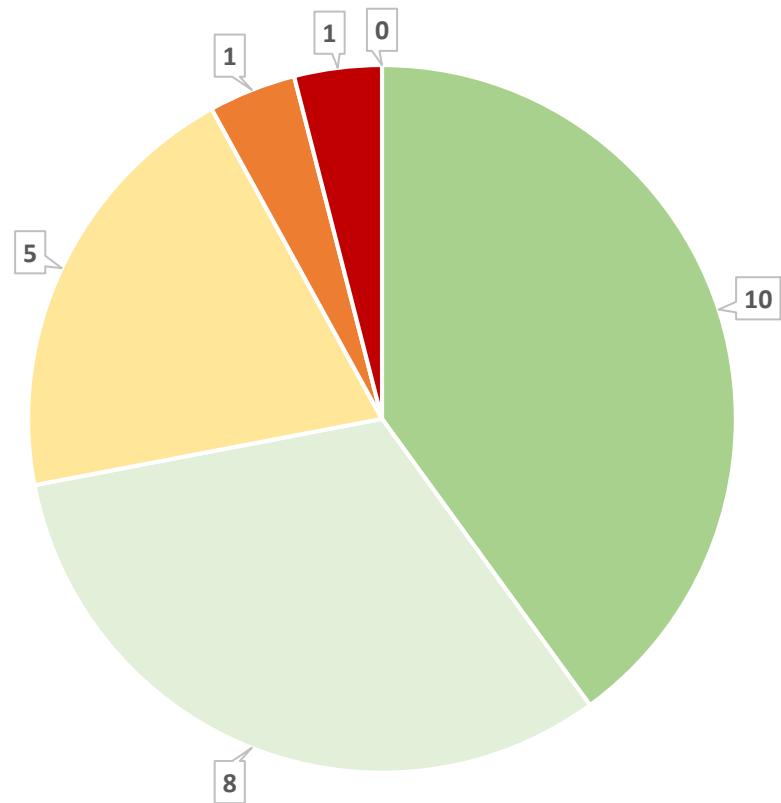
Intersection Delay and Estimated LOS

PM Peak Hour: 4:45PM-5:45PM

Approach LOS Summary



Intersection LOS Summary



Approach LOS	A	B	C	D	E	F	Intersection LOS	A	B	C	D	E	F
Approach LOS	8	20	29	15	5	4	Intersection LOS	0	10	8	5	1	1

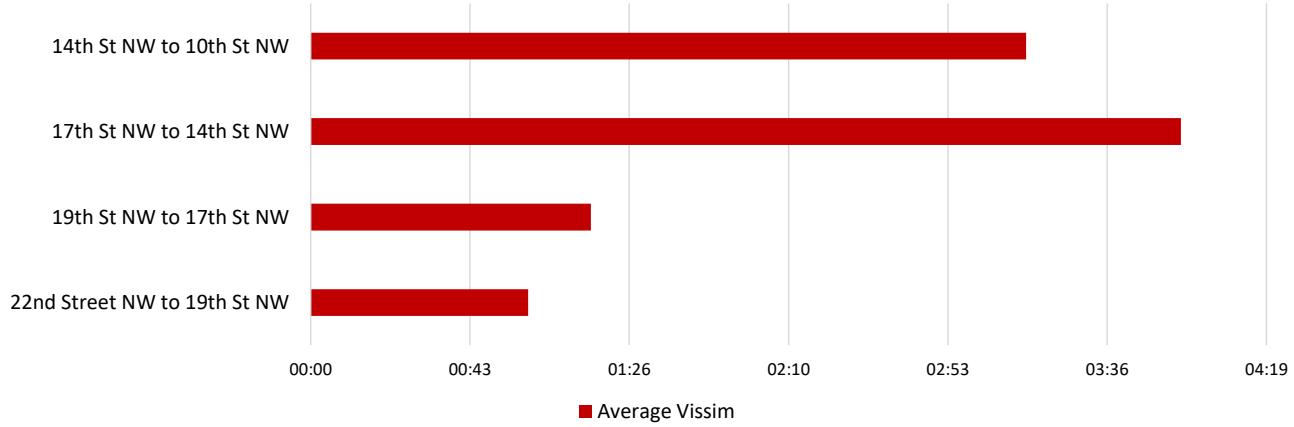
Travel Time | Segment-by-Segment Passenger Cars

PM Peak Period: 4:15PM-6:15PM

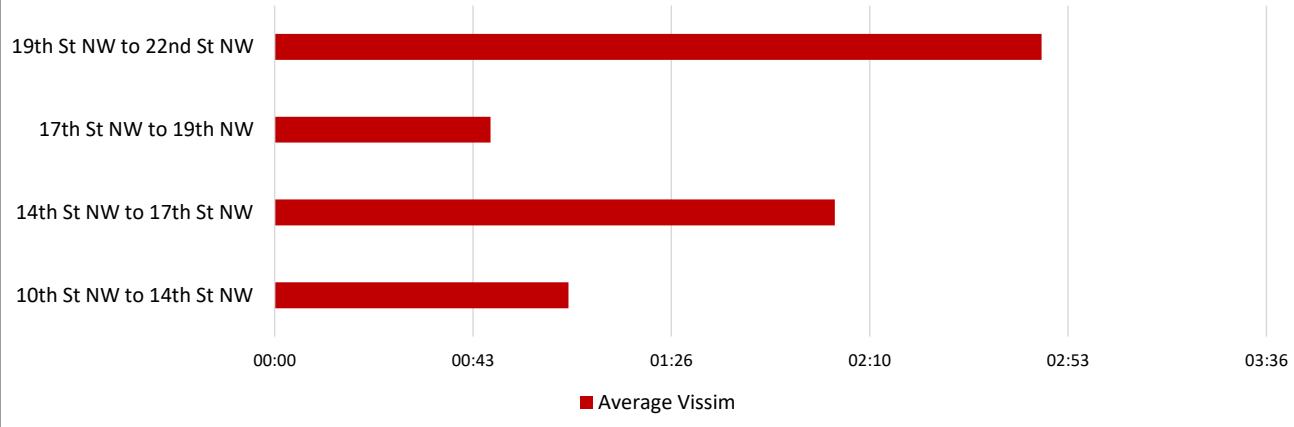
Passenger Vehicle Segment-by-Segment Travel Time Comparison					
Segment ID	Route	Vehicle Count	Average Vissim	Standard Deviation by Time ¹	Standard Deviation by Seed ²
		(MM:SS)	(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	509	00:59	00:01	00:03
2	19th St NW to 17th St NW	878	01:16	00:20	00:23
3	17th St NW to 14th St NW	659	03:56	00:59	01:11
4	14th St NW to 10th St NW	946	03:14	00:10	00:26
Total	Total Eastbound	2992	09:25	01:31	02:03
5	10th St NW to 14th St NW	605	01:04	00:01	00:03
6	14th St NW to 17th St NW	601	02:02	00:03	00:03
7	17th St NW to 19th NW	1351	00:47	00:02	00:02
8	19th St NW to 22nd St NW	1065	02:47	00:14	00:13
Total	Total Westbound	3622	06:40	00:21	00:21

*Results show the average from 10 simulation runs.

Eastbound Travel Time Segments



Westbound Travel Time Segments



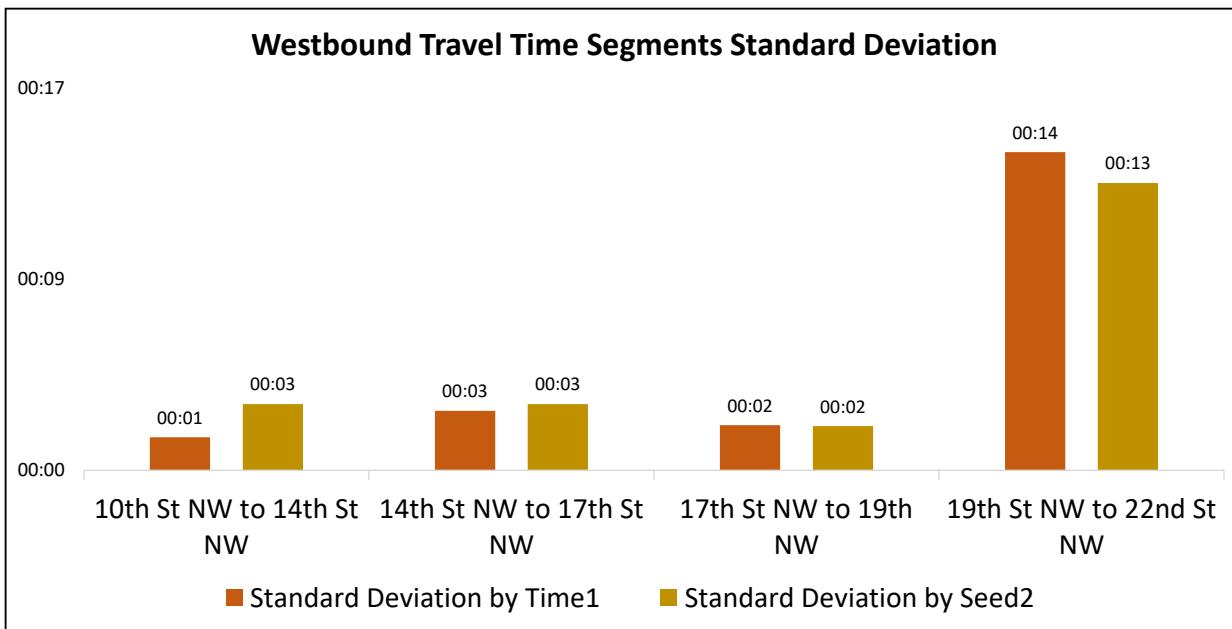
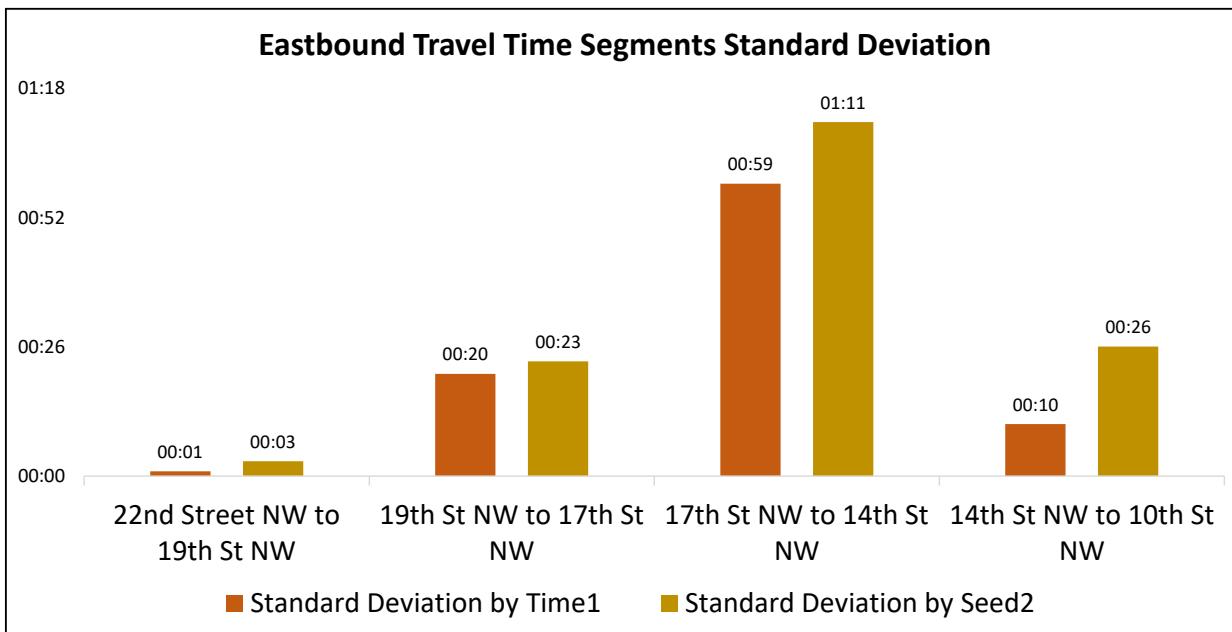
Travel Time | Segment-by-Segment Passenger Cars

PM Peak Period: 4:15PM-6:15PM

*Travel time results collected throughout the 2-hour peak period at 15-minute intervals.

¹Standard deviation by time is standard deviation of the average travel time for all simulation runs in each 15-minute time segment, representing how the average travel time changes throughout the peak period.

²Standard deviation by seed is the average standard deviation of travel times for each 15-minute time segment in the peak period, representing the consistency of travel time throughout the peak period.

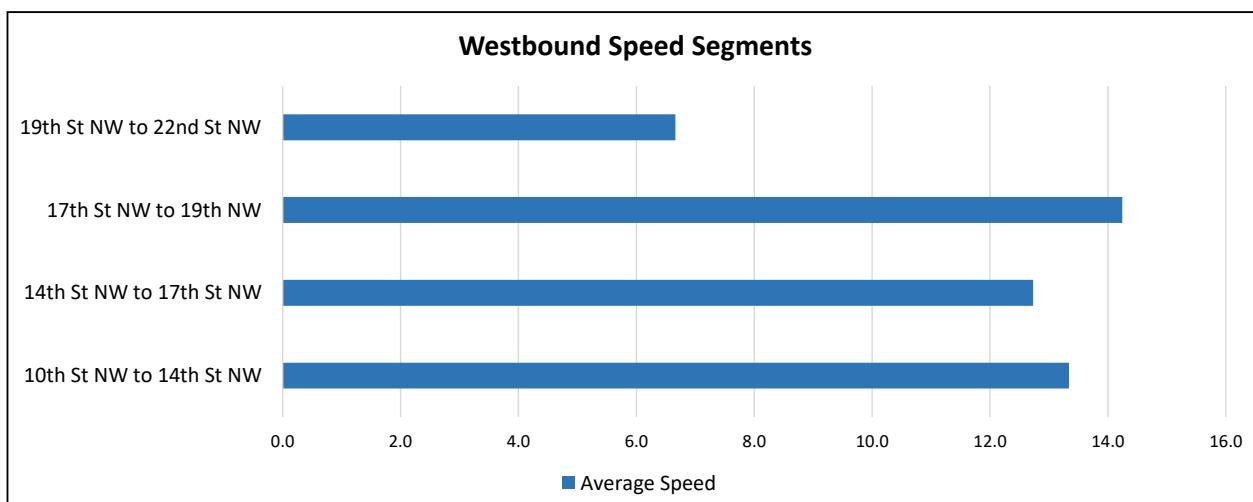
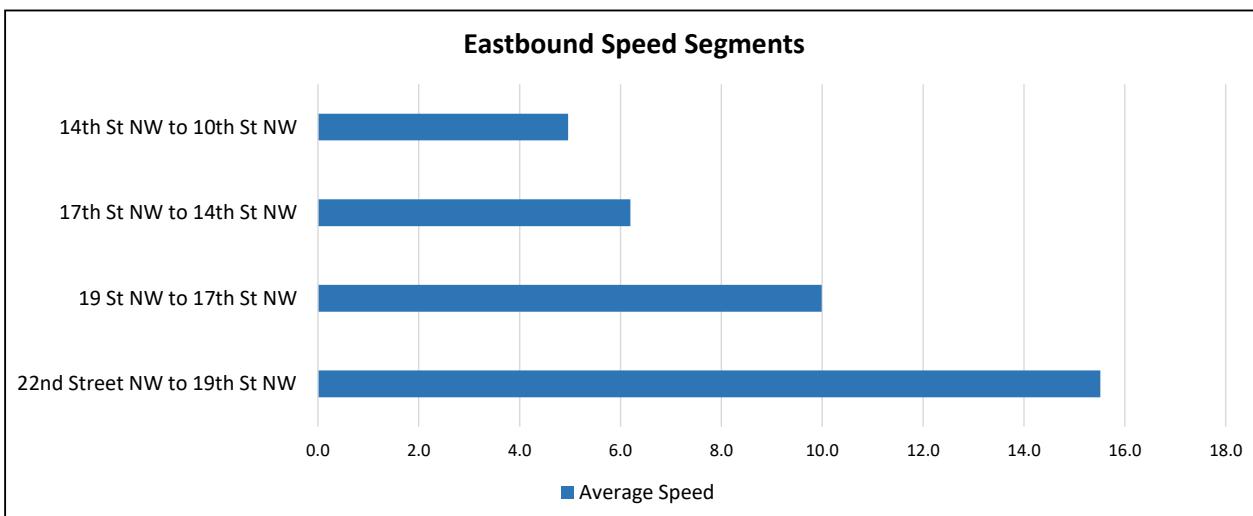


Speed | Segment-by-Segment Passenger Cars

PM Peak Period: 4:15PM-6:15PM

Passenger Vehicle Segment-by-Segment Average Speed Comparison			
Segment ID	Route	Vehicle Count	Average Speed
			MPH
1	22nd Street NW to 19th St NW	509	15.5
2	19 St NW to 17th St NW	878	10.0
3	17th St NW to 14th St NW	659	6.2
4	14th St NW to 10th St NW	946	5.0
Average Eastbound		2992	9.2
5	10th St NW to 14th St NW	605	13.3
6	14th St NW to 17th St NW	601	12.7
7	17th St NW to 19th NW	1351	14.2
8	19th St NW to 22nd St NW	1065	6.7
Average Westbound		3622	11.7

*Results show the average from 10 simulation runs.

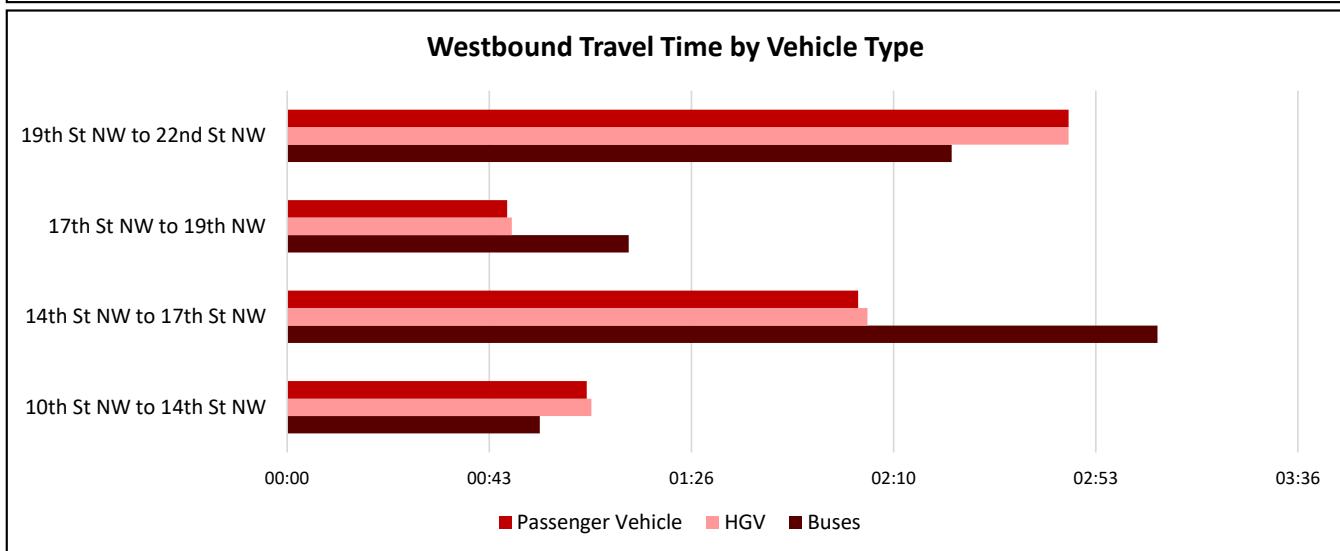
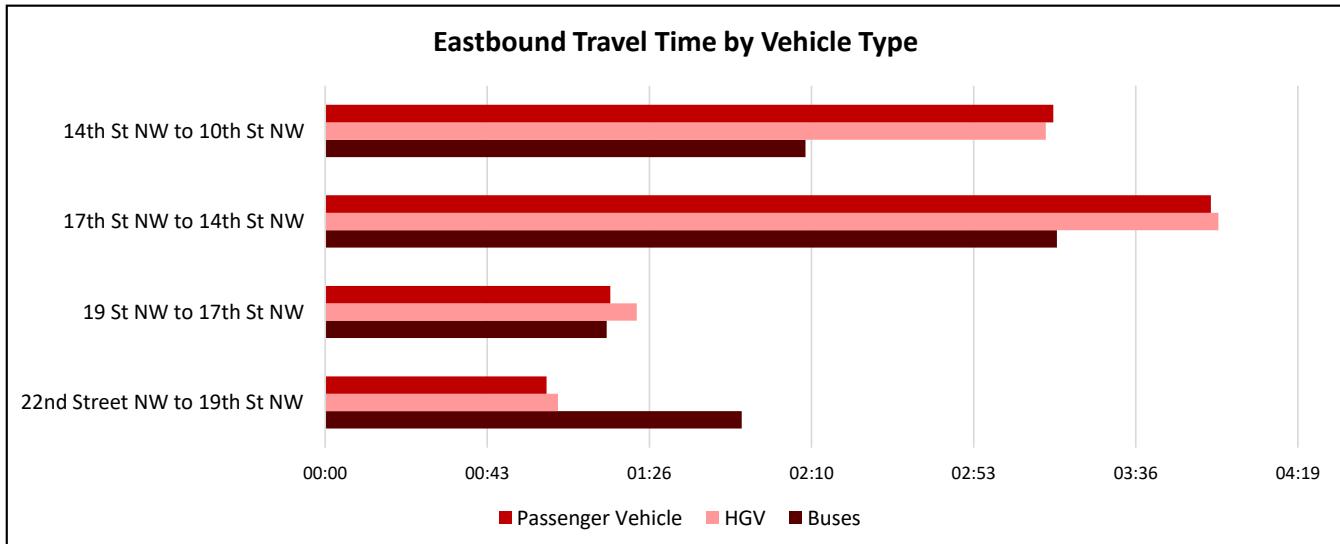


Travel Time | Comparison by Vehicle Type

PM Peak Period: 4:15PM-6:15PM

Segment ID	Route	Travel Time by Vehicle Type		
		Passenger Vehicle (MM:SS)	HGV (MM:SS)	Buses (MM:SS)
1	22nd Street NW to 19th St NW	00:59	01:02	01:51
2	19 St NW to 17th St NW	01:16	01:23	01:15
3	17th St NW to 14th St NW	03:56	03:58	03:15
4	14th St NW to 10th St NW	03:14	03:12	02:08
Total	Total Eastbound	09:25	09:35	08:29
5	10th St NW to 14th St NW	01:04	01:05	00:54
6	14th St NW to 17th St NW	02:02	02:04	03:06
7	17th St NW to 19th NW	00:47	00:48	01:13
8	19th St NW to 22nd St NW	02:47	02:47	02:22
Total	Total Westbound	06:40	06:44	07:35

*Results show the average from 10 simulation runs.

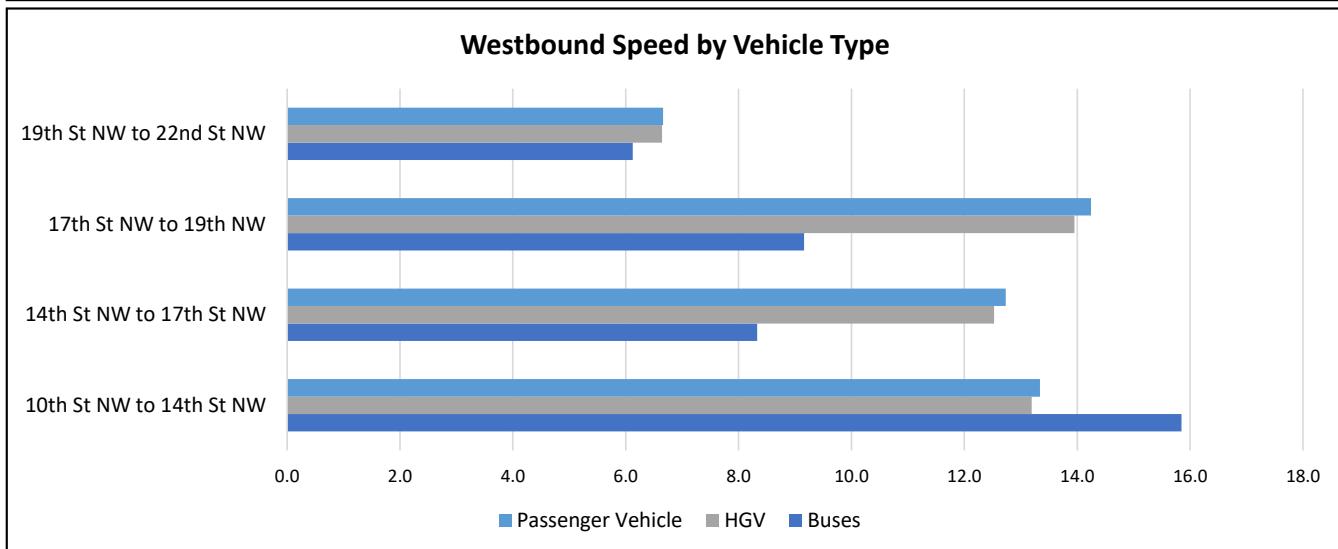
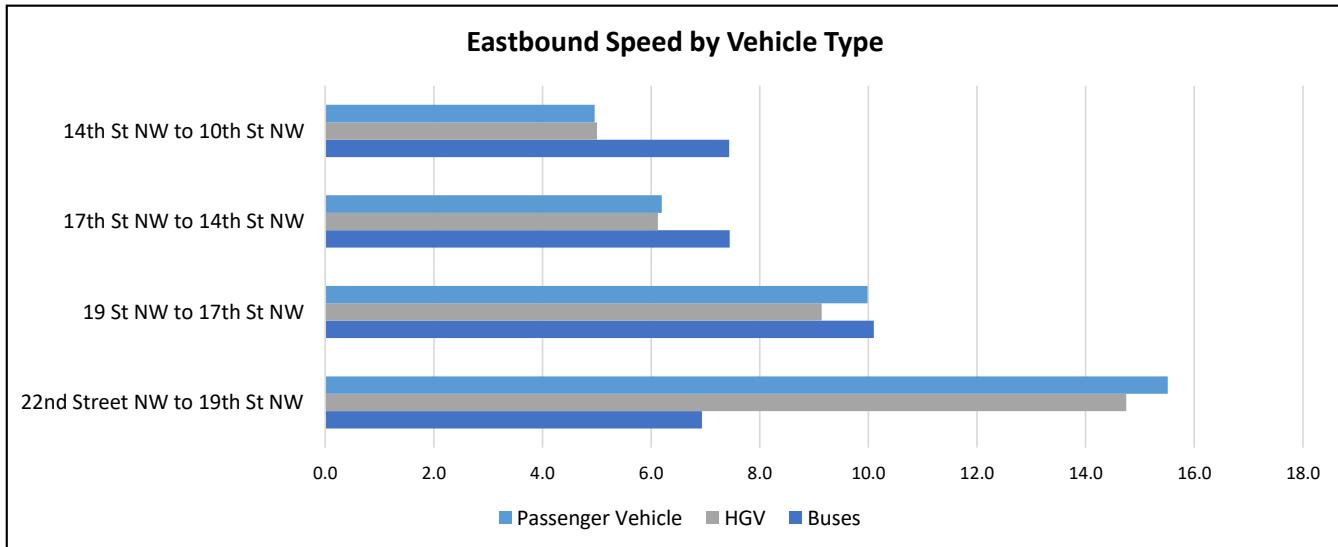


Speed | Comparison by Vehicle Type

PM Peak Period: 4:15PM-6:15PM

Segment ID	Route	Travel Time by Vehicle Type		
		Passenger Vehicle (MM:SS)	HGV (MM:SS)	Buses (MM:SS)
1	22nd Street NW to 19th St NW	15.5	14.7	6.9
2	19 St NW to 17th St NW	10.0	9.1	10.1
3	17th St NW to 14th St NW	6.2	6.1	7.4
4	14th St NW to 10th St NW	5.0	5.0	7.4
Average Eastbound		9.2	8.8	8.0
5	10th St NW to 14th St NW	13.3	13.2	15.8
6	14th St NW to 17th St NW	12.7	12.5	8.3
7	17th St NW to 19th NW	14.2	14.0	9.2
8	19th St NW to 22nd St NW	6.7	6.6	6.1
Average Westbound		11.7	11.6	9.9

*Results show the average from 10 simulation runs.



Travel Time | Comparison by Vehicle Type

PM Peak Period: 4:15PM-6:15PM

Number of Vehicles Represented in Travel Time by Vehicle Type				
Segment ID	Route	Passenger Vehicle	HGV	Buses
		Vehicle Count	Vehicle Count	Vehicle Count
1	22nd Street NW to 19th St NW	509	26	53
2	19 St NW to 17th St NW	878	46	109
3	17th St NW to 14th St NW	659	36	111
4	14th St NW to 10th St NW	946	51	69
Total	Total Eastbound	2992	159	342
5	10th St NW to 14th St NW	605	33	43
6	14th St NW to 17th St NW	601	34	73
7	17th St NW to 19th NW	1351	80	72
8	19th St NW to 22nd St NW	1065	61	45
Total	Total Westbound	3622	208	233

*Total number of vehicles counted in Travel Time runs through the 2-hour peak period.

GEH of Vehicular Throughput

PM Peak Hour: 4:45PM-5:45PM

GEH Criteria	Value	Percent	Target	Target Met
Total Network Volume with GEH < 4	GEH: 0.8	N/A	4	Yes
Total Network Volume %Difference from Balanced Counts	N/A	-0.40%	5%	Yes
85% of individual links below GEH < 5	84 of 84	100%	85%	Yes

Total K Street NW Volume	Sum of balanced counts	Sum of all link flows	Percent Difference	GEH
	37,467	37,316	-0.4%	0.8

* Bus volume during peak period added to "Sum of balanced counts"

Intersection Approaches	Number of Approaches	Number of Segments with GEH < 5	Number of Segments with GEH >5	Percent Compliance
	84	84	0	100%

The GEH statistic is computed using the following formula:

E = Vissim estimated throughput
V = balanced field count:

$$\text{GEH} = \sqrt{\frac{(E-V)^2}{(E+V)/2}}$$

Sample Size Determination Tool, Version 2.0



<p>Step 1: Input number of MOEs (max is 12). Clear out old data.</p> <p>Step 2: Select type of MOEs</p> <p>Step 3: Insert simulation results from four random seeds for selected MOEs</p>		<p>User Inputs</p> <p>Constants</p> <p>Outputs</p> <p>Sample Size (N) = Number of Model Runs Sample Mean (X_s) = (1/N) (X₁ + X₂ + X₃ ... + X_N) Sample Standard Deviation (S_s) = $\sqrt{[(\sum(X-X_s)^2)/(N-1)]}$ Sampling Error = t (S_s/VN) Confidence Level = X_s ± t (S_s/VN) % of Sample Mean (E) = % Tolerance * X_s Sample Size Needed = [(t)² * (S_s)²] / (E)²</p> <p><i>The "t" statistic is the hypothesized number of standard deviations away from the mean corresponding to the required confidence level and sample size in a t-distribution.</i></p>								
<p>Inputs</p> <p>Confidence Interval: 95%</p> <p>Tolerance Error: 10%</p> <p>Number of MOEs: 10</p>		<p>Output</p> <p>Number of Required Runs: 10</p> <p>*Minimum number of required runs = 10</p>								
Location (optional)	EB K Street	WB K Street	EB (17th/18th)	WB (17th/18th)	EB (13th/14th)	WB (13th/14th)	EB (17th/18th)	WB (17th/18th)	EB (13th/14th)	WB (13th/14th)
Runs (Seeds)	Travel Time	Travel Time	Volume	Volume	Volume	Volume	Speed	Speed	Speed	Speed
100	377	440	1703	2171	1596	1651	19.9	20.3	10.2	23.8
120	371	433	1494	2137	1608	1647	19.9	21.0	9.5	23.8
140	355	427	1592	2100	1576	1685	19.4	21.0	9.3	23.6
160	362	438	1639	2103	1571	1665	20.0	20.9	9.9	23.7
<i>*Results from four random seeds</i>										
Statistics										
X _s =	366.2	434.6	1607.0	2127.8	1587.8	1662.0	19.8	20.8	9.7	23.7
S _s =	9.9	5.8	88.0	33.4	17.3	17.2	0.3	0.4	0.4	0.1
E =	36.6	43.5	160.7	212.8	158.8	166.2	2.0	2.1	1.0	2.4
t =	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18
Sampling Error =	15.73	9.16	140.03	53.08	27.51	27.31	0.45	0.58	0.67	0.15
95% Interval Lower =	350.4	425.4	1467.0	2074.7	1560.2	1634.7	19.3	20.2	9.0	23.6
95% Interval Upper =	381.9	443.7	1747.0	2180.8	1615.3	1689.3	20.2	21.4	10.4	23.9
% of Sample Mean =	4.30%	2.11%	8.71%	2.49%	1.73%	1.64%	2.27%	2.81%	6.94%	0.62%
Sample Size Needed =	4	4	4	4	4	4	4	4	4	4

Network Gridlock Check

Inputs

Confidence Interval:	95%
Tolerance Error:	10%

Runs (Seeds)
100
110
120
130
140
150
160
170
180
190

	Ave Delay PVs	Latend Demand	Ave Speed PVs	Ave Delay Stop PVs	Total Delay PVs	PVs Active @ End of Simulation	Total PVs Arrived
	74.75	89	9.8	52.4	3.4	731	44218
	73.71	119	9.9	52.0	3.3	847	43794
	78.37	85	9.6	55.5	3.5	779	43848
	74.83	203	9.8	52.9	3.3	792	43824
	77.53	147	9.6	54.9	3.5	871	43658
	72.80	72	10.0	51.3	3.3	791	44030
	77.14	164	9.6	54.5	3.5	775	44030
	72.85	82	10.0	51.3	3.3	817	43974
	75.62	33	9.8	53.5	3.4	690	44177
	74.71	28	9.8	52.6	3.4	758	44409

Statistics

X _s =	75.2	102.2	9.8	53.1	3.4	785.1	43996.2
S _s =	1.9	56.1	0.1	1.5	0.1	52.9	226.6
E =	7.5	10.2	1.0	5.3	0.3	78.5	4399.6
t =	3.18	3.18	3.18	3.18	3.18	3.18	3.18

Sampling Error =	3.07	89.31	0.23	2.36	0.13	84.12	360.50
95% Interval Lower =	72.2	12.9	9.6	50.7	3.2	701.0	43635.7
95% Interval Upper =	78.3	191.5	10.0	55.4	3.5	869.2	44356.7
% of Sample Mean =	4.08%	87.39%	2.35%	4.44%	3.90%	10.72%	0.82%

Attachment G-1:

Vissim Results Comparison – AM Peak

Intersection Throughput Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* Throughput differences greater than 10% from existing are shown with bold text and color.

* **Green** represents an increase greater than 10%. **Orange** represents a decrease greater than 10%. **Red** represents removed movements.

* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing		Alternative 1		Hybrid Alternative	
1	K Street NW and 22nd Street NW	NB	LT - SL	3	268	58	321	58	325
			TH	197		209		209	
			RT - SL	68		54		58	
		EB	TH	666	666	665	665	665	665
			WB	TH	523	525	525	529	529
		EB Service Lane	LT	50	355	45	326	47	342
			TH	305		281		295	
		WB Service Lane	UT	68	321	92	358	94	350
			TH	110		130		116	
			RT	143		136		140	
		Intersection		2,133	2,195		2,211		
2	K Street NW and 21st Street NW	SB	LT - SL	21	605	0	592	0	591
			LT	52		62		62	
			TH	359		358		357	
			RT	72		172		172	
			RT - SL	101		0		0	
		EB	TH	625	669	671	671	669	669
			TH - SL	38		0		0	
			RT	6		0		0	
		WB	LT	31	507	0	618	0	622
			TH	448		356		358	
			TH - SL	28		262		264	
		EB Service Lane	TH - ML	22	314	151	303	163	325
			TH	158		0		0	
			RT	134		152		162	
		WB Service Lane	TH - ML	4	121	0	0	0	0
			TH	117		0		0	
		Intersection		2,216	2,184		2,207		

Intersection Throughput Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* Throughput differences greater than 10% from existing are shown with bold text and color.

* **Green** represents an increase greater than 10%. **Orange** represents a decrease greater than 10%. **Red** represents removed movements.

* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing		Alternative 1		Hybrid Alternative	
3	K Street NW and 20th Street NW	NB	LT - SL	22	982	0	986	0	988
			LT	57		78		78	
			TH	807		819		821	
			RT	46		89		89	
			RT - SL	50		0		0	
		EB	LT	13	780	0	866	0	877
			TH	753		866		877	
			TH - SL	14		0		0	
		WB	TH	459	470	490	699	490	703
			TH - SL	2		0		0	
			RT	9		209		213	
		EB Service Lane	TH - ML	7	121	0	0	0	0
			TH	114		0		0	
		WB Service Lane	TH - ML	3	219	0	0	0	0
			TH	37		0		0	
			RT	179		0		0	
		Intersection		2,572		2,551		2,568	
4	K Street NW and 19th Street NW	SB	LT - SL	14	529	0	560	0	560
			LT	45		59		59	
			TH	390		421		421	
			RT	26		80		80	
			RT - SL	54		0		0	
		EB	TH	755	770	774	952	780	964
			TH - SL	7		0		0	
			RT	8		178		184	
		WB	LT	49	587	0	613	0	619
			TH	524		613		619	
			TH - SL	14		0		0	
		EB Service Lane	TH - ML	5	211	0	0	0	0
			TH	41		0		0	
			RT	165		0		0	
		WB Service Lane	TH	61	61	0	0	0	0
		Intersection		2,158		2,125		2,143	

Intersection Throughput Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* Throughput differences greater than 10% from existing are shown with bold text and color.

* **Green** represents an increase greater than 10%. **Orange** represents a decrease greater than 10%. **Red** represents removed movements.

* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing		Alternative 1		Hybrid Alternative	
5	K Street NW and 18th Street NW	NB	LT - SL	9	990	0	974	0	975
			LT	60		69		70	
			TH	807		812		812	
			RT	66		93		93	
			RT - SL	48		0		0	
		EB	LT	4	683	0	697	0	704
			TH	669		697		704	
			TH - SL	10		0		0	
		WB	TH	660	667	659	800	663	805
			TH - SL	5		0		0	
			RT	2		141		142	
		EB Service Lane	TH - ML	3	45	0	0	0	0
			TH	42		0		0	
		WB Service Lane	TH	28	161	0	0	0	0
			RT	133		0		0	
		Intersection		2,546		2,471		2,484	
6	K Street NW and Connecticut Avenue	NB	TH	739	802	744	801	743	802
			RT	63		57		59	
		SB	LT - SL	11	644	0	669	0	673
			TH	489		519		522	
			RT	30		150		151	
			RT - SL	114		0		0	
		EB	LT	1	637	0	690	0	697
			TH	633		602		608	
			TH - SL	3		0		0	
			RT	0		88		89	
		WB	LT	2	864	0	952	0	953
			TH	781		809		813	
			TH - SL	77		0		0	
			RT	4		143		140	
		EB Service Lane	TH - ML	3	94	0	0	0	0
			RT	91		0		0	
		WB Service Lane	RT	143	143	0	0	0	0
		Intersection		3,184		3,112		3,125	

Intersection Throughput Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* Throughput differences greater than 10% from existing are shown with bold text and color.

* **Green** represents an increase greater than 10%. **Orange** represents a decrease greater than 10%. **Red** represents removed movements.

* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing	Alternative 1	Hybrid Alternative	
7	K Street NW and 17th Street NW (east)	NB	LT - SL	2	58	0	60
			LT	4		7	
			TH	39		41	
			RT	6		13	
			RT - SL	7		0	
		SB	LT - SL	5	338	0	339
			LT	37		42	
			TH	182		183	
			RT	68		114	
			RT - SL	46		0	
		EB	LT	1	700	0	676
			TH	559		666	
			TH - SL	29		0	
			RT	111		0	
		WB	LT	1	810	0	880
			TH	782		832	
			TH - SL	27		0	
			RT	0		46	
		WB Service Lane	TH - ML	8	118	0	0
			TH	66		0	
			RT	44		0	
Intersection			2,024		1,944	1,955	

Intersection Throughput Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* Throughput differences greater than 10% from existing are shown with bold text and color.

* **Green** represents an increase greater than 10%. **Orange** represents a decrease greater than 10%. **Red** represents removed movements.

* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing	Alternative 1	Hybrid Alternative	
8	K Street NW and 16th Street NW	NB	LT - SL	2	337	0	346
			LT	2		4	
			TH	309		317	
			RT	15		24	
			RT - SL	9		0	
		SB	LT	87	698	69	677
			TH	472		483	
			RT	87		125	
			RT - SL	52		0	
		EB	LT	4	521	0	663
			TH	511		511	
			TH - SL	4		0	
			RT	2		140	
		WB	TH	606	632	633	815
			TH - SL	21		0	
			RT	5		176	
		EB Service Lane	TH - ML	1	55	0	0
			TH	13		0	
			RT	41		0	
		WB Service Lane	TH - ML	1	200	0	0
			TH	41		0	
			RT	158		0	
Intersection				2,443	2,482	2,501	

Intersection Throughput Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* Throughput differences greater than 10% from existing are shown with bold text and color.

* **Green** represents an increase greater than 10%. **Orange** represents a decrease greater than 10%. **Red** represents removed movements.

* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing	Alternative 1	Hybrid Alternative	
9	K Street NW and 15th Street NW (west)	NB	LT - SL	9	418	0	489
			LT	24		34	
			TH	368		441	
			RT	17		16	
		SB	LT	4	119	4	143
			TH	78		105	
			RT	16		34	
			RT - SL	21		0	
		EB	LT	70	623	0	632
			TH	553		588	
			TH - SL	0		0	
			RT	0		37	
		WB	LT	25	987	0	1,185
			TH	935		990	
			TH - SL	22		0	
			RT	5		183	
		EB Service Lane	TH - ML	4	35	0	0
			RT	31		0	
		WB Service Lane	TH	59	239	0	0
			RT	180		0	
Intersection			2,421	2,432		2,449	

Intersection Throughput Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* Throughput differences greater than 10% from existing are shown with bold text and color.

* **Green** represents an increase greater than 10%. **Orange** represents a decrease greater than 10%. **Red** represents removed movements.

* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing		Alternative 1		Hybrid Alternative	
10	K Street NW and Vermont Avenue	NB	LT - SL	57	453	0	496	0	494
			LT	123		176		175	
			TH	200		244		243	
			RT	31		76		76	
			RT - SL	42		0		0	
		SB	LT - SL	11	106	0	108	0	107
			LT	25		35		34	
			RT	46		73		73	
			RT - SL	24		0		0	
		EB	LT	42	576	0	608	0	616
			TH	486		608		616	
			TH - SL	48		0		0	
		WB	TH	804	844	918	980	932	996
			TH - SL	39		0		0	
			RT	1		62		64	
		WB Service Lane	TH - ML	11	184	0	0	0	0
			TH	112		0		0	
			RT	61		0		0	
Intersection				2,163		2,192		2,213	

Intersection Throughput Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* Throughput differences greater than 10% from existing are shown with bold text and color.

* **Green** represents an increase greater than 10%. **Orange** represents a decrease greater than 10%. **Red** represents removed movements.

* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing	Alternative 1	Hybrid Alternative	
11	K Street NW and 14th Street NW	NB	LT - SL	61	928	0	914
			LT	162		211	
			TH	653		654	
			RT	52		51	
		SB	LT	30	670	30	678
			TH	579		589	
			RT	37		63	
			RT - SL	24		0	
		EB	LT	3	492	0	670
			TH	452		468	
			RT	37		199	
		WB	LT	1	679	0	823
			TH	645		709	
			TH - SL	28		0	
			RT	5		106	
		EB Service Lane	TH - ML	4	102	0	0
			RT	98		0	
		WB Service Lane	TH	73	174	0	0
			RT	101		0	
Intersection			3,045	3,080		3,085	

Intersection Throughput Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* Throughput differences greater than 10% from existing are shown with bold text and color.

* **Green** represents an increase greater than 10%. **Orange** represents a decrease greater than 10%. **Red** represents removed movements.

* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing		Alternative 1		Hybrid Alternative	
12	K Street NW and 13th Street NW	NB	LT - SL	26	605	0	593	0	596
			LT	151		166		168	
			TH	395		391		392	
			RT	32		36		36	
			RT - SL	1		0		0	
		SB	LT	23	999	23	1,007	23	1,011
			TH	877		887		890	
			RT	62		97		98	
			RT - SL	37		0		0	
		EB	TH	366	529	356	548	356	550
			RT	163		192		194	
		WB	LT	11	517	0	645	0	649
			TH	481		538		542	
			TH - SL	19		0		0	
			RT	6		107		107	
		WB Service Lane	TH - ML	4	151	0	0	0	0
			TH	48		0		0	
			RT	99		0		0	
		Intersection		2,801		2,793		2,806	
13	K Street NW and 12th Street NW	NB	LT - SL	67	954	0	1,006	0	1,045
			LT	217		261		280	
			TH	592		665		682	
			RT	78		80		83	
		EB	LT	88	416	0	420	0	419
			TH	328		420		419	
		WB	TH	318	423	368	415	364	410
			TH - SL	59		0		0	
			RT	46		47		46	
		EB Service Lane	TH - ML	9	9	0	0	0	0
		Intersection		1,802		1,841		1,874	

Intersection Throughput Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

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* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing		Alternative 1		Hybrid Alternative	
14	K Street NW and 11th Street NW	NB	LT	109	370	123	383	127	387
			TH	217		216		216	
			RT	44		44		44	
		SB	LT	11	552	12	567	12	567
			TH	433		435		435	
			RT	108		120		120	
		EB	LT	73	352	70	458	71	482
			TH	177		182		183	
			RT	102		206		228	
		WB	LT	40	255	42	262	40	251
			TH	193		198		190	
			RT	22		22		21	
Intersection				1,529		1,670		1,687	
15	K Street NW and 10th Street NW	SB	LT	26	443	24	445	24	442
			TH	255		257		257	
			RT	162		164		161	
		EB	TH	99	230	100	233	101	234
			RT	131		133		133	
		WB	LT	9	115	10	117	10	117
			TH	106		107		107	
		Intersection				788		795	
		SB	TH	958	1,085	960	1,087	960	1,087
			RT	127		127		127	
16	K Street NW and 9th Street NW	EB	RT	66	66	67	67	67	67
		Intersection				1,151		1,154	
								1,154	
17	L Street NW and 21st Street NW	SB	LT	173	629	172	623	172	623
			TH	456		451		451	
		EB	TH	786	923	790	929	790	929
			RT	137		139		139	
		Intersection				1,552		1,552	

Intersection Throughput Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

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* **Green** represents an increase greater than 10%. **Orange** represents a decrease greater than 10%. **Red** represents removed movements.

* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing		Alternative 1		Hybrid Alternative	
18	Pennsylvania Avenue NW and 21st Street NW	SB	LT	109	531	102	521	104	539
			TH	391		389		410	
			RT	31		30		25	
		EB	TH	702	814	719	828	719	828
			RT	112		109		109	
		WB	LT	130	410	128	409	128	409
			TH	280		281		281	
		Intersection		1,755	1,758		1,776		
		NB	TH	701	882	703	885	701	883
			RT	181		182		182	
19	L Street NW and Connecticut Avenue	SB	TH	577	577	573	573	573	573
			LT	85	875	86	935	85	927
		EB	TH	726		748		737	
			RT	64		101		105	
		Intersection		2,334	2,393		2,383		
		NB	LT	142	799	140	797	140	797
			TH	657		657		657	
20	I Street NW and 17th Street NW (west)	SB	TH	490	583	504	598	508	603
			RT	93		94		95	
		WB	LT	362	1,289	367	1,299	368	1,302
			TH	781		789		791	
			RT	146		143		143	
		Intersection		2,671	2,694		2,702		
		NB	TH	335	472	324	488	325	488
			RT	137		164		163	
21	L Street NW and 16th Street NW	SB	LT	240	881	260	885	260	885
			TH	641		625		625	
		EB	LT	153	734	153	738	153	736
			TH	530		534		533	
			RT	51		51		50	
		Intersection		2,087	2,111		2,109		

Intersection Throughput Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

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* **Green** represents an increase greater than 10%. **Orange** represents a decrease greater than 10%. **Red** represents removed movements.

* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing		Alternative 1		Hybrid Alternative	
22	I Street NW and 16th Street NW	NB	LT	67	247	68	246	68	246
			TH	180		178		178	
		SB	TH	203	511	295	617	296	617
			RT	308		322		321	
		WB	LT	23	1,115	17	1,102	17	1,103
			TH	941		922		922	
			RT	151		163		164	
		Intersection		1,873		1,965		1,966	
		NB	TH	561	630	557	625	558	627
			RT	69		68		69	
23	L Street NW and 15th Street NW (west)	SB	LT	43	102	42	100	42	100
			TH	59		58		58	
		EB	LT	157	783	156	826	156	825
			TH	568		585		584	
			RT	58		85		85	
			Intersection		1,515		1,551		1,552
		NB	TH	524	752	520	754	521	754
			RT	228		234		233	
		SB	LT	112	724	113	727	113	727
			TH	612		614		614	
24	L Street NW and 14th Street NW	EB	LT	36	616	36	612	36	610
			TH	518		513		511	
			RT	62		63		63	
			Intersection		2,092		2,093		2,091
		NB	LT	314	1,154	315	1,154	314	1,153
			TH	840		839		839	
		SB	TH	643	709	635	779	642	789
			RT	66		144		147	
		WB	LT	90	973	90	963	90	960
			TH	808		808		805	
			RT	75		65		65	
			Intersection		2,836		2,896		2,902

Intersection Delay Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* Coloring represents estimated intersection level of service (LOS). **Green** represents LOS A-C, **Yellow** represents LOS D, **Orange** represents LOS E, **Red** represents LOS F.

#	Intersection	Approach	Existing		Alternative 1		Hybrid Alternative	
			Average Delay (sec/veh)	Intersection Delay	Average Delay (sec/veh)	Intersection Delay	Average Delay (sec/veh)	Intersection Delay
1	K Street NW and 22nd Street NW	NB	38.7	8.7	42.7	18.9	40.8	12.7
		SB	-		-		-	
		EB	6.2		35.0		6.5	
		WB	18.0		45.5		35.7	
2	K Street NW and 21st Street NW	NB	-	20.5	-	33.1	-	23.5
		SB	28.5		23.8		21.6	
		EB	17.3		29.6		21.5	
		WB	10.9		25.6		24.7	
		EB Service Lane	31.3		74.2		28.8	
3	K Street NW and 20th Street NW	NB	32.1	25.7	36.3	30.9	33.8	19.7
		SB	-		-		-	
		EB	15.1		23.5		6.9	
		WB	24.8		32.7		15.6	
4	K Street NW and 19th Street NW	NB	-	27.3	-	26.5	-	13.9
		SB	31.5		32.0		30.3	
		EB	18.3		28.3		6.1	
		WB	18.8		18.6		11.3	
5	K Street NW and 18th Street NW	NB	35.2	24.8	27.1	23.8	29.0	23.2
		SB	-		-		-	
		EB	14.9		8.3		10.6	
		WB	21.3		33.2		27.1	
6	K Street NW and Connecticut Avenue	NB	37.5	35.0	27.6	20.0	22.9	16.2
		SB	20.2		31.5		28.9	
		EB	62.1		13.8		12.7	
		WB	16.6		10.0		4.2	
7	K Street NW and 17th Street NW (east)	NB	27.9	29.0	31.7	27.4	30.4	10.0
		SB	47.4		25.0		22.9	
		EB	28.6		17.2		7.5	
		WB	23.8		35.7		5.6	
8	K Street NW and 16th Street NW	NB	36.5	29.9	41.6	31.8	42.2	23.9
		SB	26.9		19.8		18.3	
		EB	39.9		33.6		28.1	
		WB	26.0		36.3		17.4	
9	K Street NW and 15th Street NW (west)	NB	28.8	38.2	34.3	17.1	33.0	17.4
		SB	33.0		36.7		31.9	
		EB	81.3		5.5		11.9	
		WB	19.6		13.7		12.2	

Intersection Delay Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* Coloring represents estimated intersection level of service (LOS). **Green** represents LOS A-C, **Yellow** represents LOS D, **Orange** represents LOS E, **Red** represents LOS F.

#	Intersection	Approach	Existing		Alternative 1		Hybrid Alternative	
			Average Delay (sec/veh)	Intersection Delay	Average Delay (sec/veh)	Intersection Delay	Average Delay (sec/veh)	Intersection Delay
10	K Street NW and Vermont Avenue	NB	54.0	36.3	42.2	24.9	35.9	29.9
		SB	60.3		47.1		48.9	
		EB	16.7		11.4		10.5	
		WB	36.8		22.1		36.9	
11	K Street NW and 14th Street NW	NB	34.1	52.4	37.1	52.9	31.5	25.7
		SB	73.5		57.0		30.5	
		EB	40.5		48.0		18.2	
		WB	76.5		71.1		21.4	
12	K Street NW and 13th Street NW	NB	17.0	24.5	19.0	23.7	17.7	27.1
		SB	28.9		34.3		34.9	
		EB	22.1		13.7		23.3	
		WB	29.5		20.0		26.7	
13	K Street NW and 12th Street NW	NB	59.1	38.8	92.0	58.2	37.9	31.6
		SB	-		-		-	
		EB	13.9		9.2		34.6	
		WB	17.9		25.9		12.6	
14	K Street NW and 11th Street NW	NB	17.3	20.4	20.5	24.3	17.2	26.4
		SB	22.9		26.3		23.3	
		EB	12.0		13.7		17.9	
		WB	31.1		44.2		64.4	
15	K Street NW and 10th Street NW	NB	-	20.6	-	19.5	-	19.1
		SB	17.8		18.5		19.5	
		EB	24.5		20.0		15.2	
		WB	23.5		22.1		25.3	
16	K Street NW and 9th Street NW	NB	-	8.2	-	7.6	-	8.5
		SB	5.3		5.3		5.4	
		EB	56.5		45.7		58.6	
		WB	-		-		-	
17	L Street NW and 21st Street NW	NB	-	21.2	-	21.2	-	21.1
		SB	23.8		23.0		23.2	
		EB	19.4		20.0		19.7	
		WB	-		-		-	
18	Pennsylvania Avenue NW and 21st Street NW	NB	-	27.5	-	29.4	-	30.4
		SB	20.8		26.7		30.6	
		EB	28.7		27.4		27.0	
		WB	33.7		36.9		37.0	

Intersection Delay Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* Coloring represents estimated intersection level of service (LOS). **Green** represents LOS A-C, **Yellow** represents LOS D, **Orange** represents LOS E, **Red** represents LOS F.

#	Intersection	Approach	Existing		Alternative 1		Hybrid Alternative	
			Average Delay (sec/veh)	Intersection Delay	Average Delay (sec/veh)	Intersection Delay	Average Delay (sec/veh)	Intersection Delay
19	L Street NW and Connecticut Avenue	NB	42.2	30.0	53.9	34.2	53.6	34.0
		SB	24.1		23.5		23.6	
		EB	21.5		22.1		21.8	
		WB	-		-		-	
20	I Street NW and 17th Street NW (west)	NB	21.2	28.6	21.4	27.3	21.3	26.5
		SB	16.3		36.8		36.0	
		EB	-		-		-	
		WB	38.8		26.5		25.4	
21	L Street NW and 16th Street NW	NB	6.8	21.2	7.9	22.0	8.3	20.7
		SB	24.3		26.1		23.6	
		EB	26.7		26.5		25.5	
		WB	-		-		-	
22	I Street NW and 16th Street NW	NB	14.3	28.4	14.6	31.4	14.6	31.7
		SB	37.7		44.3		45.6	
		EB	-		-		-	
		WB	27.2		27.9		27.7	
23	L Street NW and 15th Street NW (west)	NB	9.6	13.1	12.9	15.2	8.9	13.4
		SB	23.8		21.2		20.8	
		EB	14.6		16.3		15.9	
		WB	-		-		-	
24	L Street NW and 14th Street NW	NB	12.3	20.6	14.0	19.5	19.2	20.2
		SB	22.2		16.4		13.0	
		EB	29.1		30.1		30.1	
		WB	-		-		-	
25	I Street NW and 14th Street NW	NB	27.7	40.4	25.0	41.9	27.1	34.0
		SB	58.7		66.1		39.3	
		EB	-		-		-	
		WB	42.2		42.6		38.0	

Intersection LOS Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* Coloring represents estimated intersection level of service (LOS). **Green** represents LOS A-C, **Yellow** represents LOS D, **Orange** represents LOS E, **Red** represents LOS F.

* Estimated LOS derived from Vissim simulation results reporting average vehicle delay. Simulated LOS is not equivalent to Highway Capacity Manual definitions.

#	Intersection	Approach	Existing		Alternative 1		Hybrid Alternative	
			Approach LOS	Intersection LOS	Approach LOS	Intersection LOS	Approach LOS	Intersection LOS
1	K Street NW and 22nd Street NW	NB	D	A	D	B	D	B
		SB	-		-		-	
		EB	A		C		A	
		WB	B		D		D	
2	K Street NW and 21st Street NW	NB	-	C	-	C	-	C
		SB	C		C		C	
		EB	B		C		C	
		WB	B		C		C	
		EB Service Lane	C		E		C	
3	K Street NW and 20th Street NW	NB	C	C	D	C	C	B
		SB	-		-		-	
		EB	B		C		A	
		WB	C		C		B	
4	K Street NW and 19th Street NW	NB	-	C	-	C	-	B
		SB	C		C		C	
		EB	B		C		A	
		WB	B		B		B	
5	K Street NW and 18th Street NW	NB	D	C	C	C	C	C
		SB	-		-		-	
		EB	B		A		B	
		WB	C		C		C	
6	K Street NW and Connecticut Avenue	NB	D	D	C	C	C	B
		SB	C		C		C	
		EB	E		B		B	
		WB	B		B		A	
7	K Street NW and 17th Street NW (east)	NB	C	C	C	C	C	B
		SB	D		C		C	
		EB	C		B		A	
		WB	C		D		A	
8	K Street NW and 16th Street NW	NB	D	C	D	C	D	C
		SB	C		B		B	
		EB	D		C		C	
		WB	C		D		B	
9	K Street NW and 15th Street NW (west)	NB	C	D	C	B	C	B
		SB	C		D		C	
		EB	F		A		B	
		WB	B		B		B	

Intersection LOS Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* Coloring represents estimated intersection level of service (LOS). **Green** represents LOS A-C, **Yellow** represents LOS D, **Orange** represents LOS E, **Red** represents LOS F.

* Estimated LOS derived from Vissim simulation results reporting average vehicle delay. Simulated LOS is not equivalent to Highway Capacity Manual definitions.

#	Intersection	Approach	Existing		Alternative 1		Hybrid Alternative	
			Approach LOS	Intersection LOS	Approach LOS	Intersection LOS	Approach LOS	Intersection LOS
10	K Street NW and Vermont Avenue	NB	D	D	D	C	D	C
		SB	E		D		D	
		EB	B		B		B	
		WB	D		C		D	
11	K Street NW and 14th Street NW	NB	C	D	D	D	C	C
		SB	E		E		C	
		EB	D		D		B	
		WB	E		E		C	
12	K Street NW and 13th Street NW	NB	B	C	B	C	B	C
		SB	C		C		C	
		EB	C		B		C	
		WB	C		B		C	
13	K Street NW and 12th Street NW	NB	E	D	F	E	D	C
		SB	-		-		-	
		EB	B		A		C	
		WB	B		C		B	
14	K Street NW and 11th Street NW	NB	B	C	C	C	B	C
		SB	C		C		C	
		EB	B		B		B	
		WB	C		D		E	
15	K Street NW and 10th Street NW	NB	-	C	-	B	-	B
		SB	B		B		B	
		EB	C		C		B	
		WB	C		C		C	
16	K Street NW and 9th Street NW	NB	-	A	-	A	-	A
		SB	A		A		A	
		EB	E		D		E	
		WB	-		-		-	
17	L Street NW and 21st Street NW	NB	-	C	-	C	-	C
		SB	C		C		C	
		EB	B		B		B	
		WB	-		-		-	
18	Pennsylvania Avenue NW and 21st Street NW	NB	-	C	-	C	-	C
		SB	C		C		C	
		EB	C		C		C	
		WB	C		D		D	

Intersection LOS Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* Coloring represents estimated intersection level of service (LOS). **Green** represents LOS A-C, **Yellow** represents LOS D, **Orange** represents LOS E, **Red** represents LOS F.

* Estimated LOS derived from Vissim simulation results reporting average vehicle delay. Simulated LOS is not equivalent to Highway Capacity Manual definitions.

#	Intersection	Approach	Existing		Alternative 1		Hybrid Alternative	
			Approach LOS	Intersection LOS	Approach LOS	Intersection LOS	Approach LOS	Intersection LOS
19	L Street NW and Connecticut Avenue	NB	D	C	D	C	D	C
		SB	C		C		C	
		EB	C		C		C	
		WB	-		-		-	
20	I Street NW and 17th Street NW (west)	NB	C	C	C	C	C	C
		SB	B		D		D	
		EB	-		-		-	
		WB	D		C		C	
21	L Street NW and 16th Street NW	NB	A	C	A	C	A	C
		SB	C		C		C	
		EB	C		C		C	
		WB	-		-		-	
22	I Street NW and 16th Street NW	NB	B	C	B	C	B	C
		SB	D		D		D	
		EB	-		-		-	
		WB	C		C		C	
23	L Street NW and 15th Street NW (west)	NB	A	B	B	B	A	B
		SB	C		C		C	
		EB	B		B		B	
		WB	-		-		-	
24	L Street NW and 14th Street NW	NB	B	C	B	B	B	C
		SB	C		B		B	
		EB	C		C		C	
		WB	-		-		-	
25	I Street NW and 14th Street NW	NB	C	D	C	D	C	C
		SB	E		E		D	
		EB	-		-		-	
		WB	D		D		D	

Travel Time | Comparison by Vehicle Type

AM Peak Period (8:00 AM - 10:00 AM)

Passenger Vehicle Travel Time by Scenario				
Segment ID	Route	Existing	Alternative 1	Hybrid Alternative
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:13	01:29	01:02
2	19th St NW to 17th St NW (west)	01:22	00:45	00:47
3	17th St NW (west) to 14th St NW	03:24	02:59	02:15
4	14th St NW to 10th St NW	01:09	01:03	01:57
Total	Total Eastbound	07:08	06:16	06:01
5	10th St NW to 14th St NW	02:18	02:27	01:33
6	14th St NW to 17th St NW (west)	02:46	02:35	02:07
7	17th St NW (west) to 19th NW	00:55	01:08	00:59
8	19th St NW to 22nd St NW	01:22	01:44	01:29
Total	Total Westbound	07:21	07:54	06:08

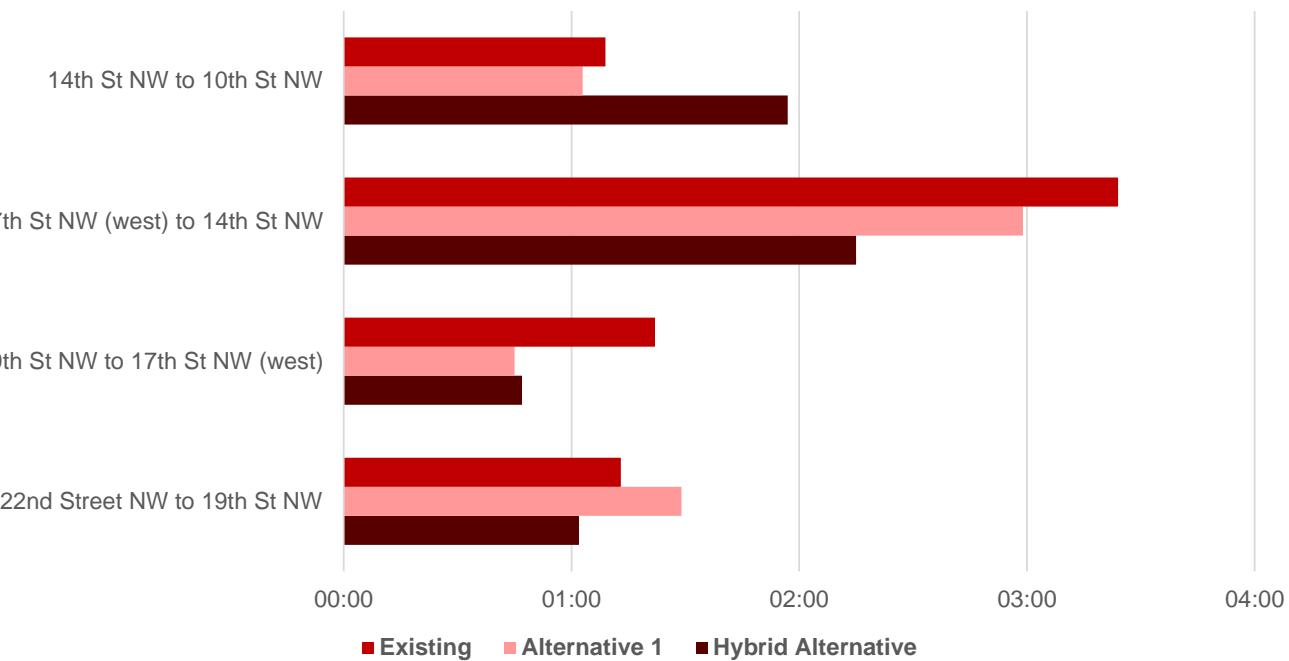
Heavy Goods Vehicle (HGV) Travel Time by Scenario				
Segment ID	Route	Existing	Alternative 1	Hybrid Alternative
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:18	01:32	01:03
2	19th St NW to 17th St NW (west)	01:29	00:46	00:49
3	17th St NW (west) to 14th St NW	03:39	03:10	02:18
4	14th St NW to 10th St NW	01:13	01:07	01:57
Total	Total Eastbound	07:39	06:35	06:07
5	10th St NW to 14th St NW	02:23	02:29	01:34
6	14th St NW to 17th St NW (west)	02:50	02:43	02:09
7	17th St NW (west) to 19th NW	00:57	01:08	01:02
8	19th St NW to 22nd St NW	01:27	01:46	01:30
Total	Total Westbound	07:37	08:06	06:15

Bus Travel Time by Scenario (Includes Dwell Time)				
Segment ID	Route	Existing	Alternative 1	Hybrid Alternative
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	02:58	02:08	02:01
2	19th St NW to 17th St NW (west)	03:02	01:20	01:17
3	17th St NW (west) to 14th St NW	04:53	03:22	02:56
4	14th St NW to 10th St NW	02:03	02:16	01:53
Total	Total Eastbound	12:56	09:06	08:07
5	10th St NW to 14th St NW	03:02	03:06	01:00
6	14th St NW to 17th St NW (west)	05:39	03:00	02:49
7	17th St NW (west) to 19th NW	01:55	01:35	01:18
8	19th St NW to 22nd St NW	01:55	02:18	02:54
Total	Total Westbound	12:31	09:59	08:01

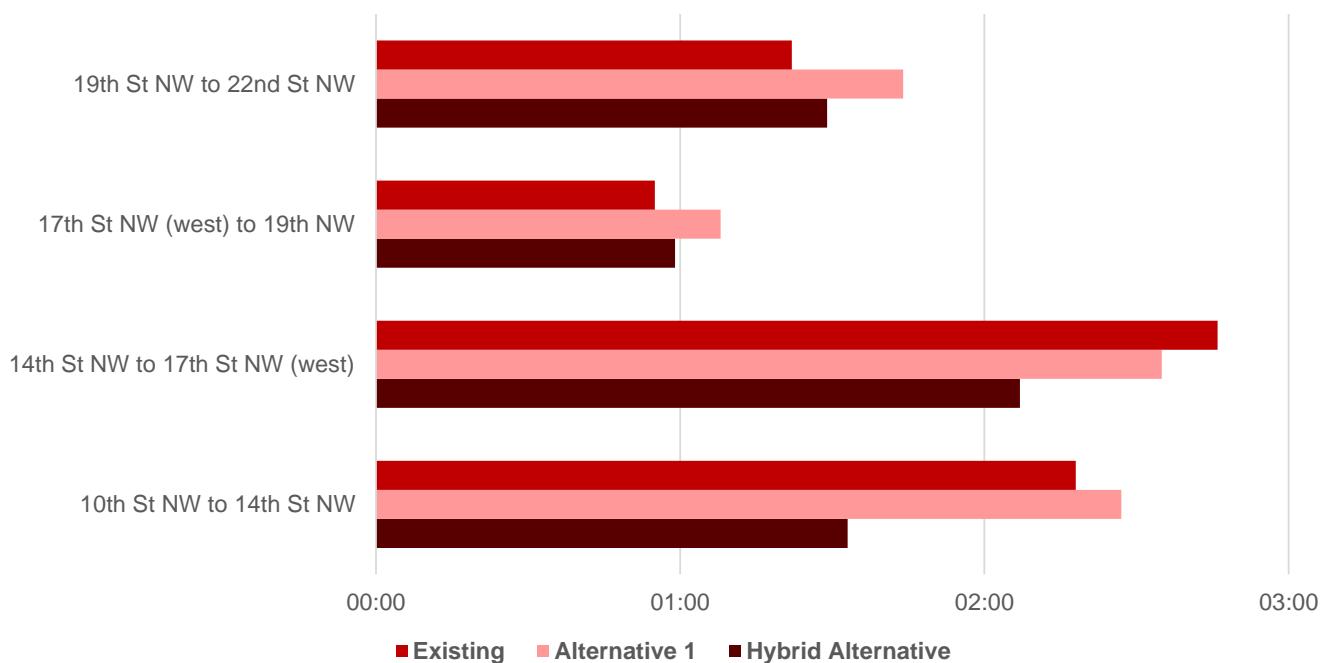
Travel Time | Comparison by Vehicle Type

AM Peak Period (8:00 AM - 10:00 AM)

Eastbound Travel Time [min] by Scenario - Passenger Vehicle



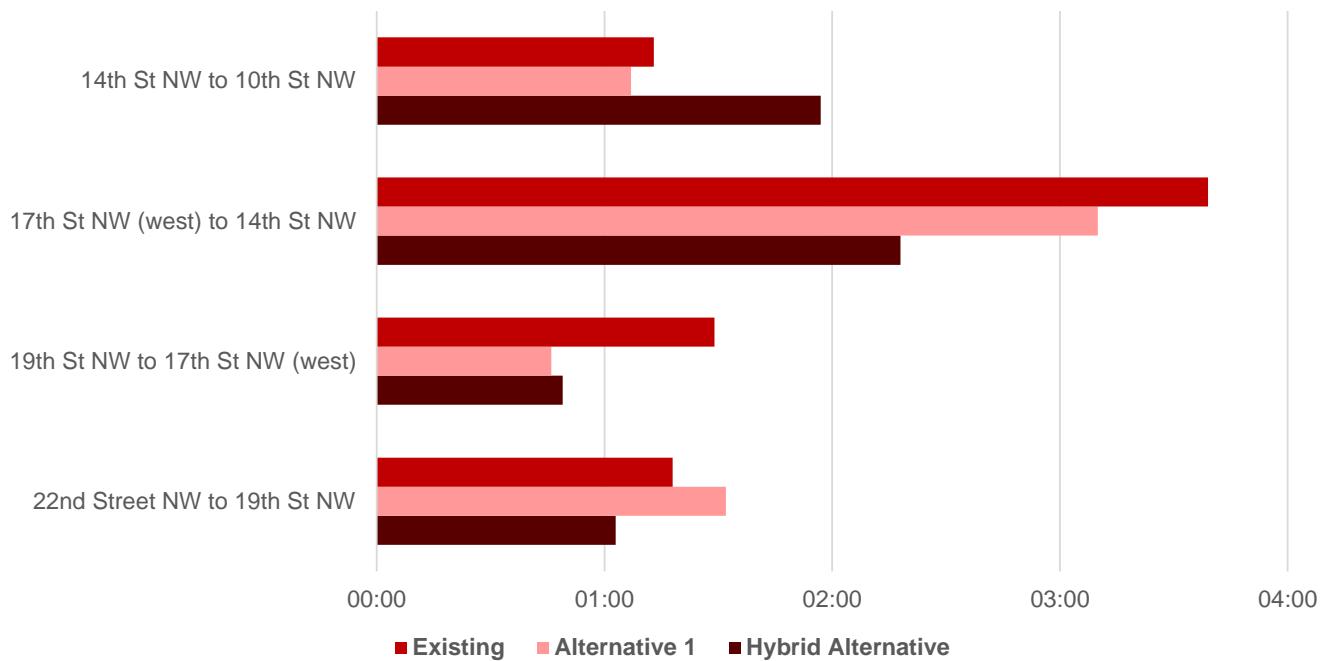
Westbound Travel Time [min] by Scenario - Passenger Vehicle



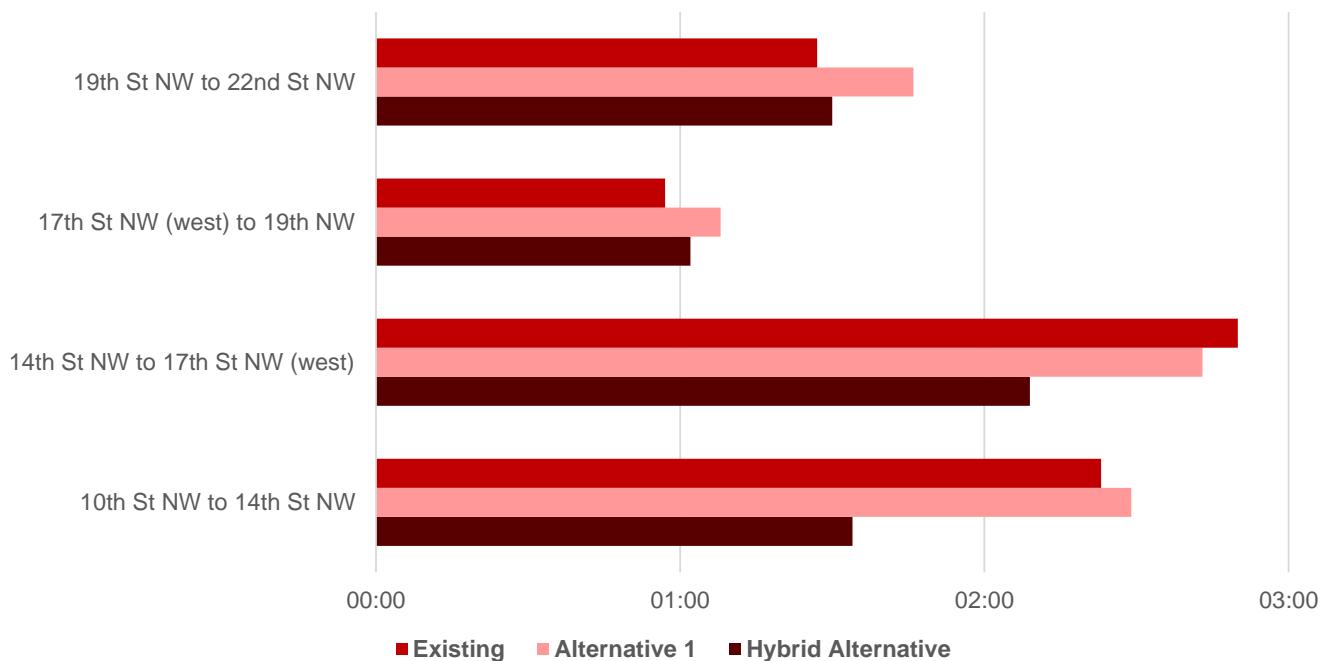
Travel Time | Comparison by Vehicle Type

AM Peak Period (8:00 AM - 10:00 AM)

Eastbound Travel Time [min] by Scenario - HGV



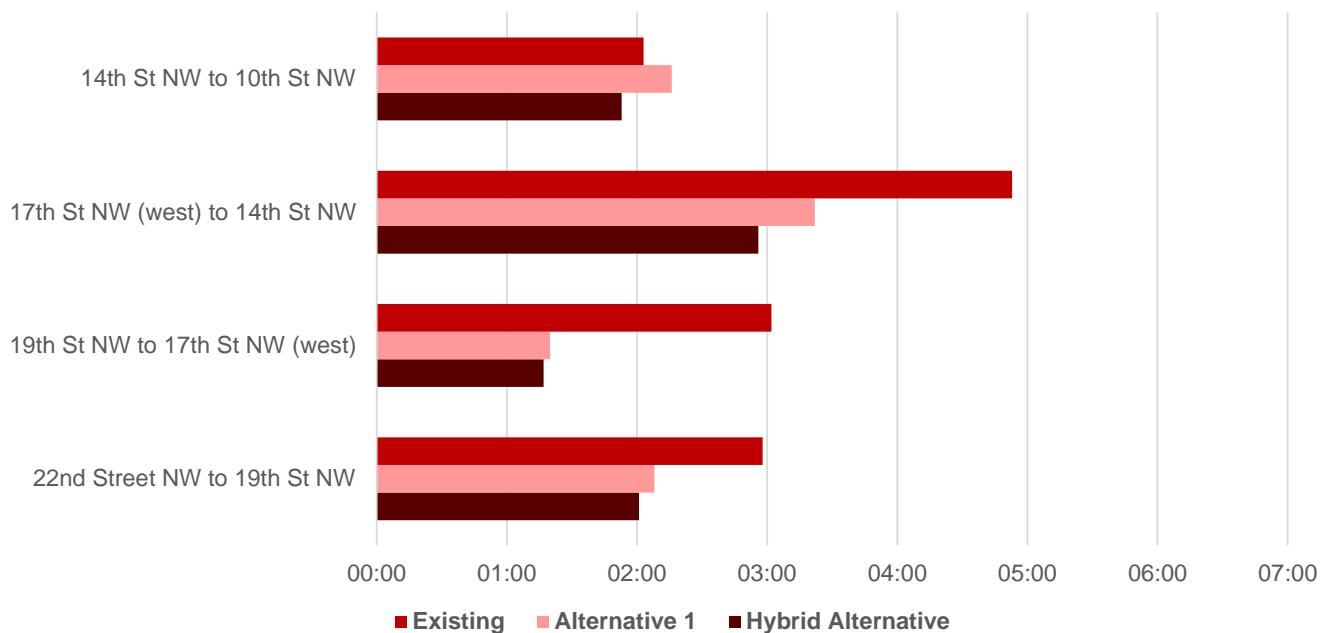
Westbound Travel Time [min] by Scenario - HGV



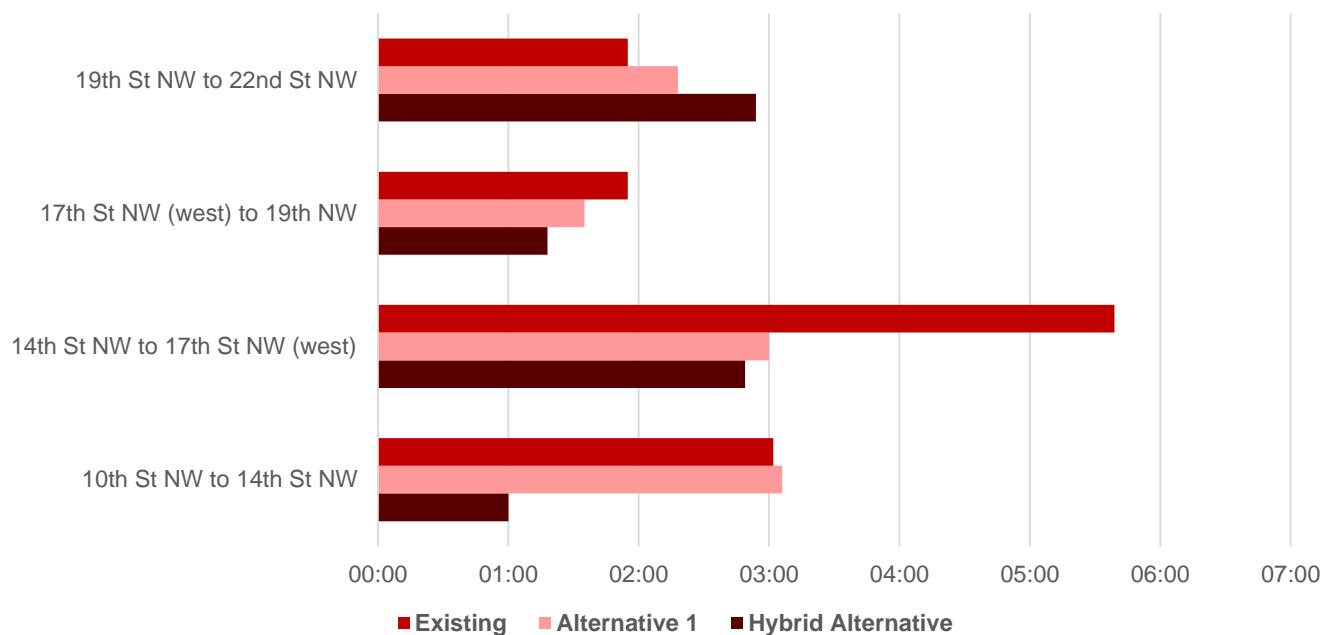
Travel Time | Comparison by Vehicle Type

AM Peak Period (8:00 AM - 10:00 AM)

Eastbound Travel Time [min] by Scenario - Bus (Includes Dwell Time)



Westbound Travel Time [min] by Scenario - Bus (Includes Dwell Time)



Speed | Comparison by Vehicle Type

AM Peak Period (8:00 AM - 10:00 AM)

* Average travel speed approximated from reported travel time measurements. Estimate includes intersection delay.

Passenger Vehicle Speed by Scenario				
Segment ID	Route	Existing	Alternative 1	Hybrid Alternative
		mph	mph	mph
1	22nd Street NW to 19th St NW	12.5	10.3	14.8
2	19th St NW to 17th St NW (west)	9.2	16.9	16.2
3	17th St NW (west) to 14th St NW	7.1	8.1	10.8
4	14th St NW to 10th St NW	13.8	15.2	8.2
Total	Total Eastbound	10.7	12.6	12.5
5	10th St NW to 14th St NW	6.2	5.9	9.3
6	14th St NW to 17th St NW (west)	9.4	10.0	12.2
7	17th St NW (west) to 19th NW	12.1	10.0	11.6
8	19th St NW to 22nd St NW	13.5	10.7	12.4
Total	Total Westbound	10.3	9.2	11.4

Heavy Goods Vehicle (HGV) Speed by Scenario				
Segment ID	Route	Existing	Alternative 1	Hybrid Alternative
		mph	mph	mph
1	22nd Street NW to 19th St NW	11.7	10.0	14.6
2	19th St NW to 17th St NW (west)	8.5	16.5	15.5
3	17th St NW (west) to 14th St NW	6.6	7.7	10.6
4	14th St NW to 10th St NW	13.1	14.3	8.2
Total	Total Eastbound	10.0	12.1	12.2
5	10th St NW to 14th St NW	6.0	5.8	9.2
6	14th St NW to 17th St NW (west)	9.1	9.5	12.0
7	17th St NW (west) to 19th NW	11.8	10.0	11.2
8	19th St NW to 22nd St NW	12.7	10.5	12.4
Total	Total Westbound	9.9	8.9	11.2

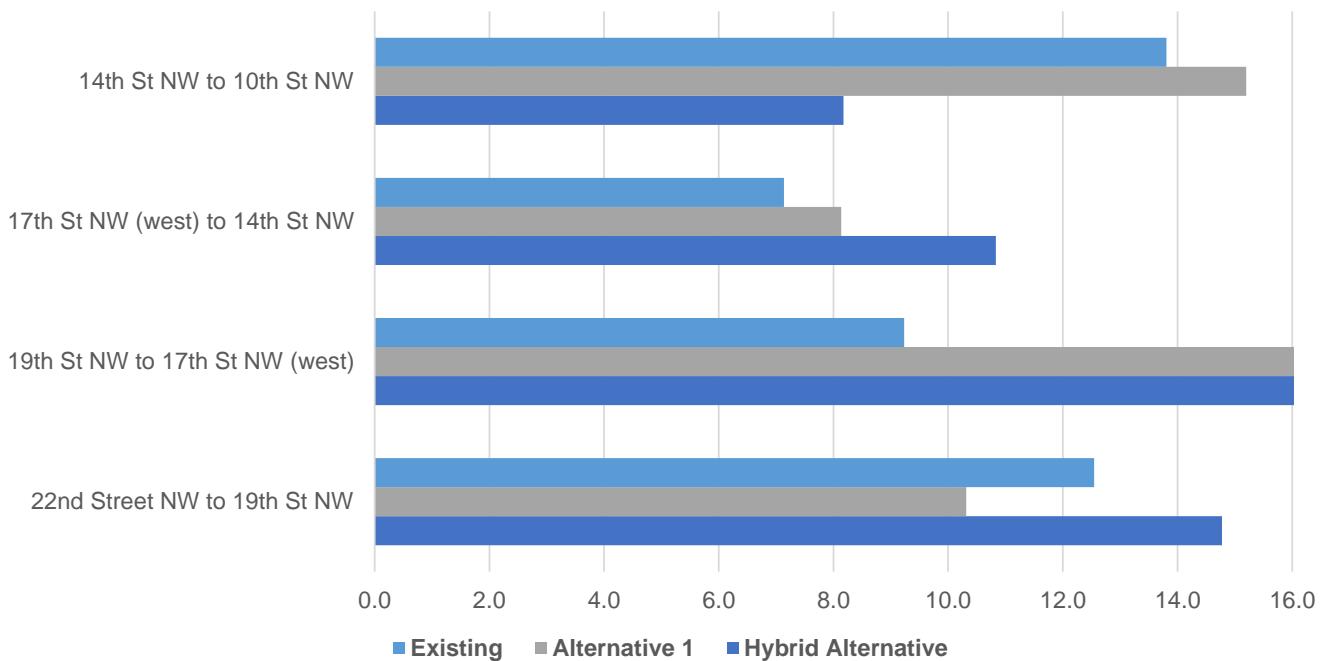
Bus Speed by Scenario (Speed Estimate Includes Dwell Time)				
Segment ID	Route	Existing	Alternative 1	Hybrid Alternative
		mph	mph	mph
1	22nd Street NW to 19th St NW	4.4	6.0	6.4
2	19th St NW to 17th St NW (west)	4.2	9.5	9.8
3	17th St NW (west) to 14th St NW	5.0	7.2	8.2
4	14th St NW to 10th St NW	7.8	7.0	8.4
Total	Total Eastbound	5.3	7.4	8.2
5	10th St NW to 14th St NW	4.7	4.6	14.2
6	14th St NW to 17th St NW (west)	4.6	8.6	9.2
7	17th St NW (west) to 19th NW	5.8	7.1	8.6
8	19th St NW to 22nd St NW	7.6	6.3	5.0
Total	Total Westbound	5.7	6.7	9.3

Speed | Comparison by Vehicle Type

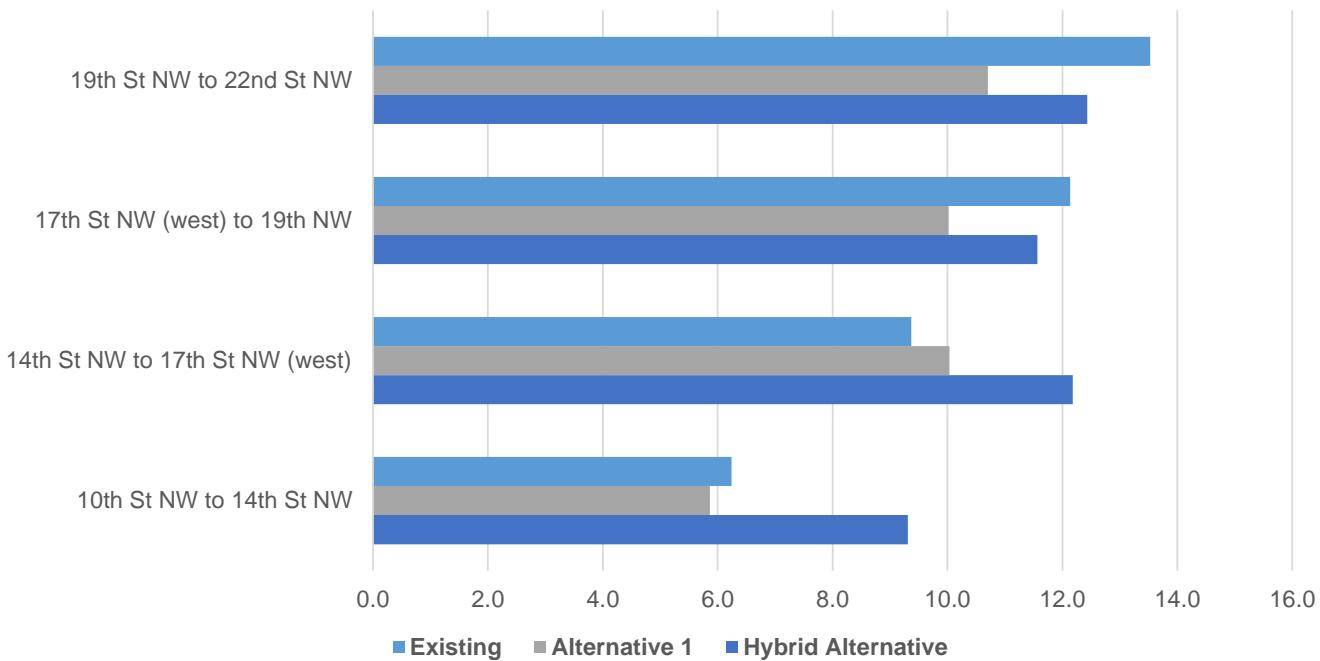
AM Peak Period (8:00 AM - 10:00 AM)

* Average travel speed approximated from reported travel time measurements. Estimate includes intersection delay.

Eastbound Speed [mph] by Scenario - Passenger Vehicle



Westbound Speed [mph] by Scenario - Passenger Vehicle

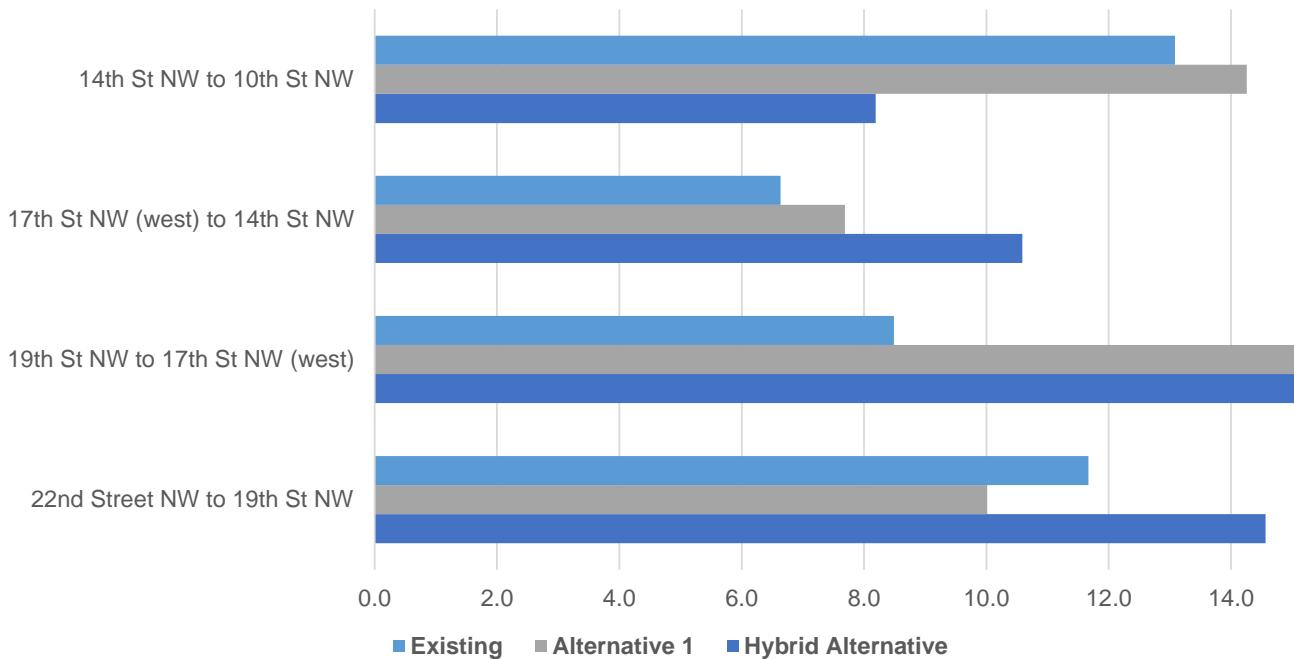


Speed | Comparison by Vehicle Type

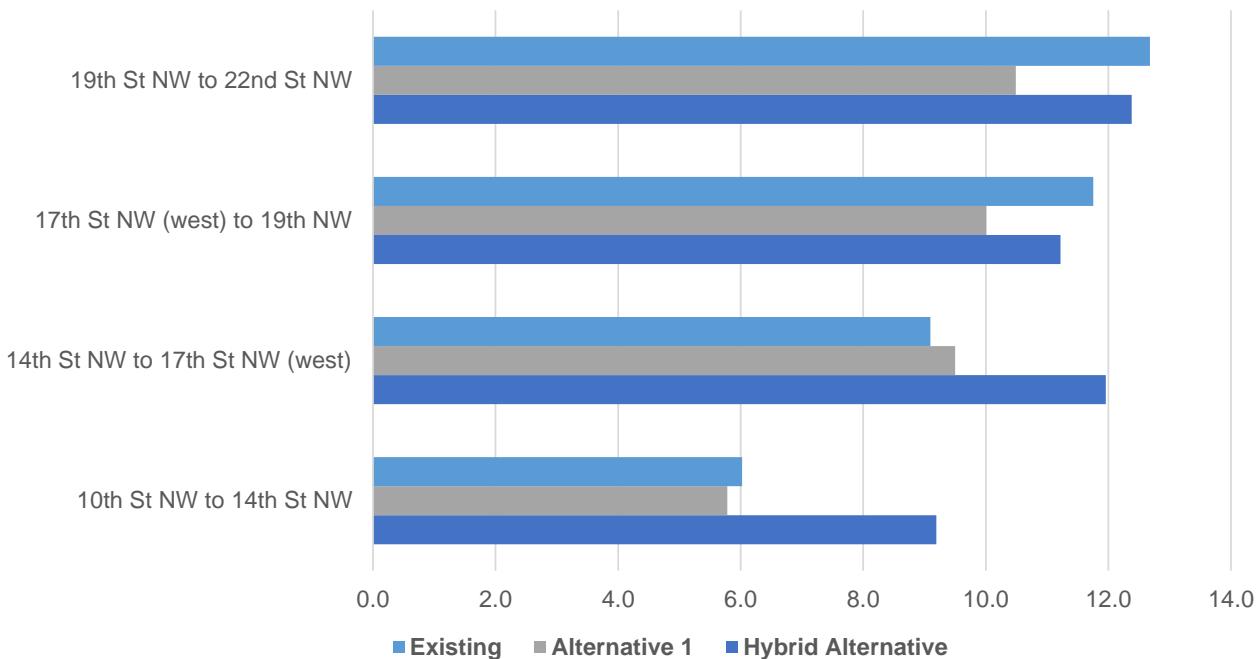
AM Peak Period (8:00 AM - 10:00 AM)

* Average travel speed approximated from reported travel time measurements. Estimate includes intersection delay.

Eastbound Speed [mph] by Scenario - HGV



Westbound Speed [mph] by Scenario - HGV



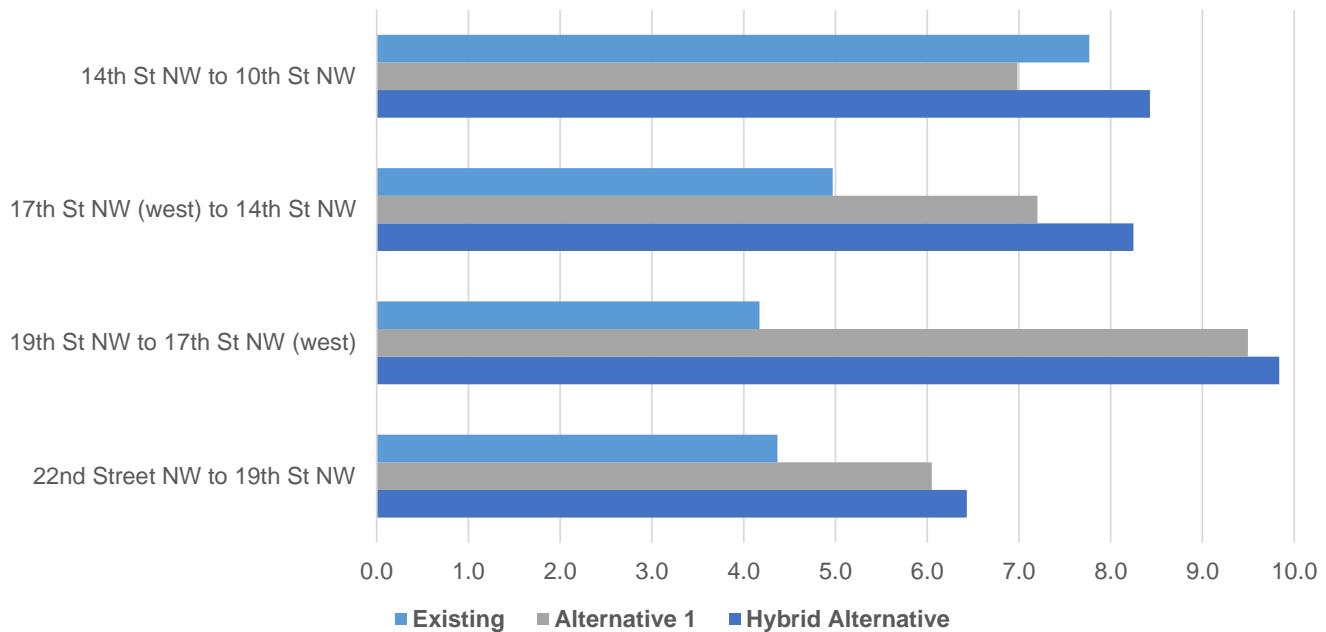
Speed | Comparison by Vehicle Type

AM Peak Period (8:00 AM - 10:00 AM)

* Average travel speed approximated from reported travel time measurements. Estimate includes intersection delay.

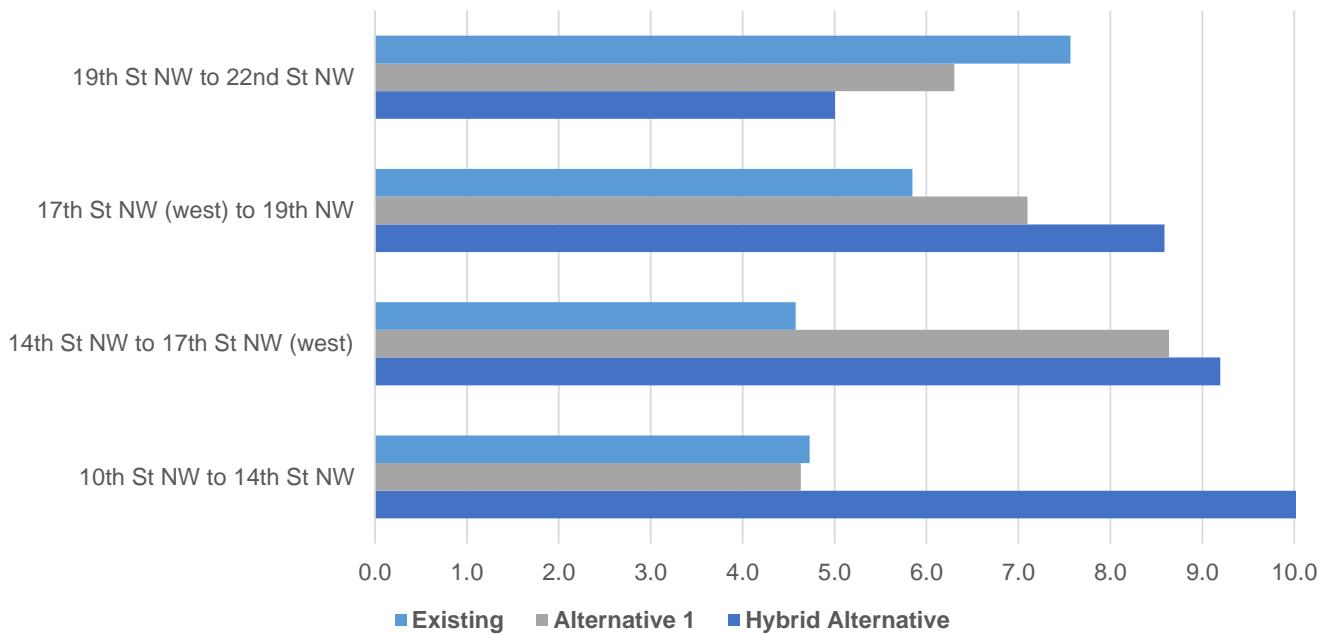
Eastbound Speed [mph] by Scenario - Bus

(Speed Estimate Includes Dwell Time)



Westbound Speed [mph] by Scenario - Bus

(Speed Estimate Includes Dwell Time)



Intersection Queue Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* **Red** represents a queue increase greater than 20%. **Green** represents a queue decrease greater than 20%.

Intersection		Approach	Existing		Alternative 1		Hybrid Alternative	
			Vissim Average Queue (ft)	Vissim Max Queue (ft)	Vissim Average Queue (ft)	Vissim Max Queue (ft)	Vissim Average Queue (ft)	Vissim Max Queue (ft)
1	K Street NW and 22nd Street NW							
2	K Street NW and 21st Street NW	EB	38	260	66	365	47	303
		WB	17	133	57	264	56	267
		SB	82	315	44	233	41	204
3	K Street NW and 20th Street NW	EB	74	408	77	479	15	171
		WB	56	295	88	345	39	237
4	K Street NW and 19th Street NW	EB	90	357	104	416	17	269
		WB	50	266	39	183	22	141
5	K Street NW and 18th Street NW	EB	44	323	18	169	23	163
		WB	109	416	110	351	93	371
6	K Street NW and Connecticut Avenue	EB	183	544	30	218	35	476
		WB	90	268	46	295	13	203
		NB	117	330	66	295	54	278
		SB	44	252	66	273	60	264
7	K Street NW and 17th Street NW (east)	EB	119	324	45	243	31	243
		WB	73	375	139	450	19	174
		NB	5	56	6	60	6	67
		SB	67	241	30	156	29	153
8	K Street NW and 16th Street NW	EB	87	334	78	355	61	239
		WB	58	241	103	327	44	187
		NB	43	202	54	240	55	224
		SB	74	272	40	183	39	184

Intersection Queue Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* **Red** represents a queue increase greater than 20%. **Green** represents a queue decrease greater than 20%.

Intersection		Approach	Existing		Alternative 1		Hybrid Alternative	
			Vissim Average Queue (ft)	Vissim Max Queue (ft)	Vissim Average Queue (ft)	Vissim Max Queue (ft)	Vissim Average Queue (ft)	Vissim Max Queue (ft)
9	K Street NW and 15th Street NW (west)	EB	212	534	10	87	24	138
		WB	118	317	80	290	71	305
		SB	10	114	17	169	14	147
10	K Street NW and Vermont Avenue	EB	34	174	22	127	21	111
		WB	141	477	69	339	129	410
		NB	70	279	72	450	54	375
		SB	18	118	17	125	18	126
11	K Street NW and 14th Street NW	EB	96	327	145	388	55	281
		WB	203	530	244	536	80	343
		NB	67	337	65	320	61	289
		SB	128	364	99	332	57	253
12	K Street NW and 13th Street NW	EB	72	284	41	262	85	347
		WB	84	357	63	291	79	295
		SB	74	311	87	316	88	314
13	K Street NW and 12th Street NW	EB	21	136	14	88	88	422
		WB	28	165	92	343	37	329
14	K Street NW and 11th Street NW	EB	13	168	28	203	54	330
		WB	60	278	76	262	104	315
		NB	22	161	25	163	22	153
		SB	28	204	30	210	29	184
15	K Street NW and 10th Street NW	EB	28	217	20	183	16	184
		WB	14	120	14	119	15	119
		SB	30	197	31	196	35	219
16	K Street NW and 9th Street NW	EB	23	112	26	140	34	143

Attachment G-2:

Vissim Results Comparison – PM Peak

Intersection Throughput Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

* Throughput differences greater than 10% from existing are shown with bold text and color.

* Green represents an increase greater than 10%. Orange represents a decrease greater than 10%. Red represents removed movements.

* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing		Alternative 1		Alternative 2		Hybrid Alternative	
1	K Street NW and 22nd Street NW	NB	LT - SL	11	269	121	387	121	387	121	387
			TH	226		236		236		236	
			RT - SL	32		30		30		30	
		EB	TH	255	255	253	253	253	253	253	253
		WB	TH	1,162	1,162	1,115	1,115	1,070	1,070	1,143	1,143
		EB Service Lane	LT	21	150	21	168	21	173	21	148
			TH	129		147		152		127	
		WB Service Lane	UT	71	341	71	334	67	313	74	356
			TH	181		180		168		194	
			RT	89		83		78		88	
		Intersection		2,177		2,257		2,196		2,287	
2	K Street NW and 21st Street NW	SB	LT - SL	31	829	0	836	0	839	0	833
			LT	68		96		96		97	
			TH	499		504		505		505	
			RT	191		236		238		231	
			RT - SL	40		0		0		0	
		EB	TH	251	251	252	252	255	255	251	251
			TH - SL	0		0		0		0	
			RT	0		0		0		0	
		WB	LT	10	1,018	0	1,142	0	1,067	0	1,190
			TH	967		871		814		906	
			TH - SL	41		271		253		284	
		EB Service Lane	TH - ML	46	251	139	247	132	234	140	248
			TH	96		0		0		0	
			RT	109		108		102		108	
		WB Service Lane	TH - ML	2	216	0	0	0	0	0	0
			TH	214		0		0		0	
		Intersection		2,565		2,477		2,395		2,522	

Intersection Throughput Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

* Throughput differences greater than 10% from existing are shown with bold text and color.

* Green represents an increase greater than 10%. Orange represents a decrease greater than 10%. Red represents removed movements.

* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing	Alternative 1	Alternative 2	Hybrid Alternative
3	K Street NW and 20th Street NW	NB	LT - SL	9	666	0	662
			LT	125		132	
			TH	391		402	
			RT	83		134	
			RT - SL	58		0	
		EB	LT	17	408	0	485
			TH	387		479	
			TH - SL	4		0	
		WB	TH	842	851	860	1,104
			TH - SL	4		0	
			RT	5		204	
		EB Service Lane	TH - ML	3	71	0	0
			TH	68		0	
		WB Service Lane	TH - ML	1	219	0	0
			TH	43		0	
			RT	175		0	
Intersection			2,215	2,211	2,031	2,251	
4	K Street NW and 19th Street NW	SB	LT - SL	7	892	0	901
			LT	54		61	
			TH	691		708	
			RT	76		140	
			RT - SL	64		0	
		EB	TH	466	474	496	701
			TH - SL	5		0	
			RT	3		191	
		WB	LT	32	851	0	957
			TH	791		920	
			TH - SL	28		0	
		EB Service Lane	TH - ML	0	219	0	0
			TH	37		0	
			RT	182		0	
		WB Service Lane	TH	100	100	0	0
Intersection			2,536	2,516	2,332	2,559	

Intersection Throughput Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

* Throughput differences greater than 10% from existing are shown with bold text and color.

* Green represents an increase greater than 10%. Orange represents a decrease greater than 10%. Red represents removed movements.

* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing		Alternative 1		Alternative 2		Hybrid Alternative	
5	K Street NW and 18th Street NW	NB	LT - SL	1	750	0	740	0	731	0	739
			LT	135		131		131		130	
			TH	501		502		502		501	
			RT	75		107		98		108	
			RT - SL	38		0		0		0	
		EB	LT	1	504	0	549	0	498	0	558
			TH	496		549		498		558	
			TH - SL	7		0		0		0	
		WB	TH	786	788	775	892	640	739	802	921
			TH - SL	1		0		0		0	
			RT	1		117		99		119	
		EB Service Lane	TH - ML	3	47	0	0	0	0	0	0
			TH	44		0		0		0	
		WB Service Lane	TH	10	101	0	0	0	0	0	0
			RT	91		0		0		0	
Intersection				2,190		2,181		1,968		2,218	
6	K Street NW and Connecticut Avenue	NB	TH	621	682	623	684	619	679	614	670
			RT	61		61		60		56	
		SB	LT - SL	12	793	0	797	0	857	0	867
			TH	645		673		718		729	
			RT	62		124		139		138	
			RT - SL	74		0		0		0	
		EB	LT	1	743	0	878	0	590	0	885
			TH	742		749		500		756	
			TH - SL	0		0		0		0	
			RT	0		129		90		129	
		WB	LT	26	915	0	1,092	0	860	0	1,103
			TH	794		905		711		914	
			TH - SL	93		0		0		0	
			RT	2		187		149		189	
		EB Service Lane	TH - ML	0	120	0	0	0	0	0	0
			RT	120		0		0		0	
		WB Service Lane	RT	186	186	0	0	0	0	0	0
Intersection				3,439		3,451		2,986		3,525	

Intersection Throughput Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

* Throughput differences greater than 10% from existing are shown with bold text and color.

* Green represents an increase greater than 10%. Orange represents a decrease greater than 10%. Red represents removed movements.

* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing		Alternative 1		Alternative 2		Hybrid Alternative	
7	K Street NW and 17th Street NW (east)	NB	LT - SL	9	185	0	185	0	186	0	186
			LT	31		38		38		38	
			TH	122		125		125		125	
			RT	10		22		23		23	
			RT - SL	13		0		0		0	
		SB	LT - SL	3	326	0	325	0	325	0	326
			LT	38		39		40		40	
			TH	168		168		168		168	
			RT	85		118		117		118	
			RT - SL	32		0		0		0	
		EB	LT	2	815	0	825	0	571	0	824
			TH	722		825		571		824	
			TH - SL	16		0		0		0	
			RT	75		0		0		0	
		WB	LT	0	831	0	1,011	0	763	0	1,012
			TH	794		938		707		939	
			TH - SL	37		0		0		0	
			RT	0		73		56		73	
		WB Service Lane	TH - ML	2	181	0	0	0	0	0	0
			TH	108		0		0		0	
			RT	71		0		0		0	
Intersection				2,338		2,346		1,845	2,348		

Intersection Throughput Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

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* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing	Alternative 1	Alternative 2	Hybrid Alternative
8	K Street NW and 16th Street NW	NB	LT - SL	0	320	0	344
			LT	9		9	
			TH	269		297	
			RT	24		42	
			RT - SL	18		0	
		SB	LT	118	558	113	555
			TH	340		342	
			RT	65		102	
			RT - SL	35		0	
		EB	LT	9	632	0	760
			TH	619		648	
			TH - SL	4		0	
			RT	0		115	
		WB	TH	606	659	727	941
			TH - SL	53		0	
			RT	0		210	
		EB Service Lane	TH - ML	3	42	0	0
			TH	3		0	
			RT	36		0	
		WB Service Lane	TH - ML	2	240	0	0
			TH	73		0	
			RT	165		0	
Intersection			2,451	2,605	2,074	2,600	

Intersection Throughput Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

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* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing	Alternative 1	Alternative 2	Hybrid Alternative	
9	K Street NW and 15th Street NW (west)	NB	LT - SL	7	380	0	380	0
			LT	43		46		46
			TH	309		318		319
			RT	21		15		15
		SB	LT	11	288	10	289	10
			TH	176		196		197
			RT	73		82		82
			RT - SL	28		0		0
		EB	LT	1	812	0	840	0
			TH	811		832		802
			TH - SL	0		0		0
			RT	0		39		38
		WB	LT	46	874	0	1,066	0
			TH	749		904		909
			TH - SL	66		0		0
			RT	13		157		157
		EB Service Lane	TH - ML	0	18	0	0	0
			RT	18		0		0
		WB Service Lane	TH	32	187	0	0	0
			RT	155		0		0
Intersection				2,559		2,599	2,017	2,575

Intersection Throughput Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

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* Removal of the Service Lanes in the Build Alternatives causes the approach demand for the service lanes to shift to the mainline, which accounts for some volume shifts.

#	Intersection	Approach	Movement	Existing		Alternative 1		Alternative 2		Hybrid Alternative	
10	K Street NW and Vermont Avenue	NB	LT - SL	21	280	0	365	0	362	0	366
			LT	71		90		86		90	
			TH	136		224		224		224	
			RT	28		51		52		52	
			RT - SL	24		0		0		0	
		SB	LT - SL	30	141	0	167	0	100	0	168
			LT	41		78		49		79	
			RT	48		89		51		89	
			RT - SL	22		0		0		0	
		EB	LT	77	839	0	849	0	675	0	817
			TH	689		849		675		817	
			TH - SL	73		0		0		0	
		WB	TH	758	791	880	942	529	566	886	949
			TH - SL	33		0		0		0	
			RT	0		62		37		63	
		WB Service Lane	TH - ML	1	173	0	0	0	0	0	0
			TH	111		0		0		0	
			RT	61		0		0		0	
Intersection				2,224		2,323		1,703		2,300	

Intersection Throughput Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

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#	Intersection	Approach	Movement	Existing		Alternative 1		Alternative 2		Hybrid Alternative	
11	K Street NW and 14th Street NW	NB	LT - SL	28	778	0	773	0	772	0	769
			LT	111		125		122		125	
			TH	598		608		610		604	
			RT	41		40		40		40	
		SB	LT	27	702	26	696	27	693	26	708
			TH	626		622		632		633	
			RT	21		48		34		49	
			RT - SL	28		0		0		0	
		EB	LT	4	695	0	970	0	802	0	931
			TH	671		754		620		726	
			RT	20		216		182		205	
		WB	LT	4	679	0	834	0	452	0	855
			TH	662		769		417		788	
			TH - SL	11		0		0		0	
			RT	2		65		35		67	
		EB Service Lane	TH - ML	6	204	0	0	0	0	0	0
			RT	198		0		0		0	
		WB Service Lane	TH	115	179	0	0	0	0	0	0
			RT	64		0		0		0	
Intersection				3,237		3,273		2,719		3,263	

Intersection Throughput Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

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#	Intersection	Approach	Movement	Existing		Alternative 1		Alternative 2		Hybrid Alternative	
12	K Street NW and 13th Street NW	NB	LT - SL	18	702	0	689	0	436	0	692
			LT	181		185		29		185	
			TH	485		487		393		490	
			RT	15		17		14		17	
			RT - SL	3		0		0		0	
		SB	LT	25	705	24	704	25	604	25	711
			TH	568		567		546		573	
			RT	71		113		33		113	
			RT - SL	41		0		0		0	
		EB	TH	621	725	656	833	549	698	613	784
			RT	104		177		149		171	
		WB	LT	1	495	0	593	0	424	0	586
			TH	473		540		386		534	
			TH - SL	19		0		0		0	
			RT	2		53		38		52	
		WB Service Lane	TH - ML	4	102	0	0	0	0	0	0
			TH	51		0		0		0	
			RT	47		0		0		0	
		Intersection		2,729		2,819		2,162		2,773	
13	K Street NW and 12th Street NW	NB	LT - SL	40	866	0	1,026	0	907	0	1,046
			LT	163		201		151		205	
			TH	593		751		689		766	
			RT	70		74		67		75	
		EB	LT	133	650	0	687	0	578	0	649
			TH	517		687		578		649	
		WB	TH	320	426	370	420	260	293	368	417
			TH - SL	57		0		0		0	
			RT	49		50		33		49	
		EB Service Lane	TH - ML	2	2	0	0	0	0	0	0
		Intersection		1,944		2,133		1,778		2,112	

Intersection Throughput Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

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#	Intersection	Approach	Movement	Existing		Alternative 1		Alternative 2		Hybrid Alternative	
14	K Street NW and 11th Street NW	NB	LT	157	443	168	454	97	361	167	453
			TH	238		239		220		239	
			RT	48		47		44		47	
		SB	LT	32	530	32	533	32	527	32	532
			TH	427		425		423		424	
			RT	71		76		72		76	
		EB	LT	61	549	70	743	60	649	67	722
			TH	324		336		288		322	
			RT	164		337		301		333	
		WB	LT	13	223	14	221	0	15	14	221
			TH	190		188		0		188	
			RT	20		19		15		19	
Intersection				1,745		1,951		1,552		1,928	
15	K Street NW and 10th Street NW	SB	LT	33	436	33	433	33	397	33	439
			TH	293		293		292		298	
			RT	110		107		72		108	
		EB	TH	168	421	175	433	154	381	170	419
			RT	253		258		227		249	
		WB	LT	36	130	39	134	37	122	39	134
			TH	94		95		85		95	
Intersection				987		1,000		900		992	
16	K Street NW and 9th Street NW	SB	TH	804	884	798	880	798	880	798	880
			RT	80		82		82		82	
		EB	RT	173	173	177	177	159	159	171	171
		Intersection		1,057		1,057		1,039		1,051	
17	L Street NW and 21st Street NW	SB	LT	192	878	187	878	187	878	188	879
			TH	686		691		691		691	
		EB	TH	483	639	488	642	488	642	488	642
			RT	156		154		154		154	
		Intersection		1,517		1,520		1,520		1,521	

Intersection Throughput Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

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#	Intersection	Approach	Movement	Existing		Alternative 1		Alternative 2		Hybrid Alternative	
18	Pennsylvania Avenue NW and 21st Street NW	SB	LT	139	614	138	613	136	607	138	613
			TH	386		388		390		394	
			RT	89		87		81		81	
		EB	TH	563	662	562	663	562	663	562	663
			RT	99		101		101		101	
		WB	LT	264	839	262	841	263	842	263	843
			TH	575		579		579		580	
		Intersection		2,115		2,117		2,112		2,119	
		NB	TH	723	812	720	809	687	771	712	799
			RT	89		89		84		87	
19	L Street NW and Connecticut Avenue	SB	TH	695	695	713	713	738	738	739	739
		EB	LT	146	1,051	147	1,075	144	1,100	146	1,120
			TH	779		787		794		796	
			RT	126		141		162		178	
		Intersection		2,558		2,597		2,609		2,658	
		NB	LT	59	617	59	614	59	614	59	613
			TH	558		555		555		554	
20	I Street NW and 17th Street NW (west)	SB	TH	724	793	713	776	719	784	766	834
			RT	69		63		65		68	
		WB	LT	443	1,171	433	1,141	411	1,103	403	1,077
			TH	594		579		566		552	
			RT	134		129		126		122	
		Intersection		2,581		2,531		2,501		2,524	
		NB	TH	371	437	379	494	332	432	379	495
			RT	66		115		100		116	
21	L Street NW and 16th Street NW	SB	LT	103	573	112	574	111	569	112	574
			TH	470		462		458		462	
		EB	LT	215	964	221	966	221	973	220	964
			TH	657		649		655		648	
			RT	92		96		97		96	
		Intersection		1,974		2,034		1,974		2,033	

Intersection Throughput Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

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#	Intersection	Approach	Movement	Existing		Alternative 1		Alternative 2		Hybrid Alternative	
22	I Street NW and 16th Street NW	NB	LT	32	201	33	201	33	201	33	201
			TH	169		168		168		168	
		SB	TH	167	377	239	456	220	422	238	455
			RT	210		217		202		217	
		WB	LT	80	1,000	78	1,003	78	1,004	78	1,004
			TH	765		745		745		745	
			RT	155		180		181		181	
		Intersection		1,578		1,660		1,627		1,660	
		NB	TH	434	474	425	471	378	420	426	472
			RT	40		46		42		46	
23	L Street NW and 15th Street NW (west)	SB	LT	58	192	59	204	60	205	59	204
			TH	134		145		145		145	
		EB	LT	173	1,057	222	1,117	216	1,088	222	1,116
			TH	719		749		731		749	
			RT	165		146		141		145	
		Intersection		1,723		1,792		1,713		1,792	
		NB	TH	538	657	536	657	519	636	539	660
			RT	119		121		117		121	
24	L Street NW and 14th Street NW	SB	LT	78	630	77	629	78	637	77	633
			TH	552		552		559		556	
		EB	LT	68	950	67	954	65	914	68	960
			TH	724		724		693		725	
			RT	158		163		156		167	
		Intersection		2,237		2,240		2,187		2,253	
		NB	LT	256	964	256	967	254	968	257	968
			TH	708		711		714		711	
25	I Street NW and 14th Street NW	SB	TH	754	814	739	798	738	797	770	832
			RT	60		59		59		62	
		WB	LT	127	832	131	827	131	822	131	828
			TH	633		636		635		637	
			RT	72		60		56		60	
		Intersection		2,610		2,592		2,587		2,628	

Intersection Delay Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

* Coloring represents estimated intersection level of service (LOS). **Green** represents LOS A-C, **Yellow** represents LOS D, **Orange** represents LOS E, **Red** represents LOS F.

#	Intersection	Approach	Existing		Alternative 1		Alternative 2		Hybrid Alternative	
			Average Delay (sec/veh)	Intersection Delay						
1	K Street NW and 22nd Street NW	NB	29.2	32.8	29.2	29.4	29.4	26.0	29.1	32.2
		SB	-		-		-		-	
		EB	10.2		10.6		11.8		10.6	
		WB	34.2		33.5		34.9		47.4	
2	K Street NW and 21st Street NW	NB	-	43.7	-	48.7	-	39.6	-	42.3
		SB	59.6		40.0		36.1		48.8	
		EB	15.8		26.2		28.7		19.6	
		WB	44.7		58.2		39.1		44.8	
		EB Service Lane	36.8		57.1		31.3		31.3	
3	K Street NW and 20th Street NW	NB	37.3	20.0	40.5	26.2	71.0	35.4	36.4	19.9
		SB	-		-		-		-	
		EB	13.9		6.8		40.3		9.8	
		WB	12.0		25.9		9.5		14.5	
4	K Street NW and 19th Street NW	NB	-	25.2	-	26.5	-	45.6	-	16.9
		SB	33.7		30.4		31.4		33.0	
		EB	15.4		29.8		69.2		5.4	
		WB	14.7		20.2		42.8		10.3	
5	K Street NW and 18th Street NW	NB	28.6	21.0	32.8	21.9	58.4	70.5	28.1	18.0
		SB	-		-		-		-	
		EB	15.7		15.7		153.2		7.3	
		WB	18.9		16.6		26.6		16.4	
6	K Street NW and Connecticut Avenue	NB	21.5	45.7	15.8	42.6	23.0	75.5	31.4	35.6
		SB	97.6		108.9		83.7		68.8	
		EB	33.9		35.8		212.3		41.7	
		WB	11.8		16.0		14.9		6.8	
7	K Street NW and 17th Street NW (east)	NB	31.6	26.5	32.6	15.4	40.1	33.2	35.8	16.6
		SB	38.1		25.5		35.1		26.2	
		EB	17.8		4.2		21.3		9.8	
		WB	30.9		18.2		39.7		15.6	
8	K Street NW and 16th Street NW	NB	40.8	25.4	35.4	17.4	35.2	42.5	38.3	19.2
		SB	14.7		13.0		17.0		12.5	
		EB	35.2		13.3		72.4		22.4	
		WB	19.2		16.8		43.8		13.5	
9	K Street NW and 15th Street NW (west)	NB	28.5	45.5	30.3	20.4	45.3	41.9	29.6	33.2
		SB	93.4		38.6		43.4		36.5	
		EB	60.8		17.3		56.2		59.7	
		WB	30.2		14.4		24.6		12.6	

Intersection Delay Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

* Coloring represents estimated intersection level of service (LOS). **Green** represents LOS A-C, **Yellow** represents LOS D, **Orange** represents LOS E, **Red** represents LOS F.

#	Intersection	Approach	Existing		Alternative 1		Alternative 2		Hybrid Alternative	
			Average Delay (sec/veh)	Intersection Delay						
10	K Street NW and Vermont Avenue	NB	44.8	50.0	35.6	21.5	71.5	77.1	34.3	26.2
		SB	201.6		53.5		538.0		49.3	
		EB	34.1		13.2		13.8		29.6	
		WB	49.0		17.9		74.7		16.0	
11	K Street NW and 14th Street NW	NB	25.4	43.5	32.4	41.7	35.7	60.0	27.6	35.0
		SB	52.6		76.4		72.2		23.4	
		EB	38.1		40.5		21.3		65.2	
		WB	70.7		22.9		151.7		18.4	
12	K Street NW and 13th Street NW	NB	22.5	25.1	21.3	24.3	191.6	119.3	22.8	52.8
		SB	35.9		37.4		198.3		42.7	
		EB	18.2		23.0		21.7		117.6	
		WB	24.5		14.3		93.2		13.5	
13	K Street NW and 12th Street NW	NB	55.4	32.8	43.3	28.6	147.2	91.7	39.7	29.2
		SB	-		-		-		-	
		EB	12.1		11.7		9.7		24.7	
		WB	18.2		20.1		81.7		10.2	
14	K Street NW and 11th Street NW	NB	28.7	20.9	31.9	23.3	164.3	61.9	38.7	24.7
		SB	30.4		31.4		55.2		36.2	
		EB	9.2		14.1		11.5		6.8	
		WB	11.5		17.2		12.8		26.7	
15	K Street NW and 10th Street NW	NB	-	21.4	-	17.5	-	54.9	-	16.4
		SB	26.9		26.7		68.8		25.1	
		EB	16.7		8.5		8.5		7.0	
		WB	18.3		16.5		154.7		17.3	
16	K Street NW and 9th Street NW	NB	-	13.5	-	13.6	-	12.5	-	13.1
		SB	5.0		4.9		4.9		4.9	
		EB	56.7		56.8		54.2		55.2	
		WB	-		-		-		-	
17	L Street NW and 21st Street NW	NB	-	31.8	-	25.5	-	25.3	-	27.5
		SB	32.4		25.3		25.1		28.6	
		EB	30.9		25.7		25.6		26.0	
		WB	-		-		-		-	
18	Pennsylvania Avenue NW and 21st Street NW	NB	-	92.3	-	103.2	-	105.4	-	101.6
		SB	16.7		21.3		22.8		27.7	
		EB	46.9		35.6		35.7		34.9	
		WB	183.4		216.1		220.0		207.8	

Intersection Delay Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

* Coloring represents estimated intersection level of service (LOS). **Green** represents LOS A-C, **Yellow** represents LOS D, **Orange** represents LOS E, **Red** represents LOS F.

#	Intersection	Approach	Existing		Alternative 1		Alternative 2		Hybrid Alternative	
			Average Delay (sec/veh)	Intersection Delay						
19	L Street NW and Connecticut Avenue	NB	20.5	45.0	10.5	64.5	13.3	44.1	20.5	39.8
		SB	104.9		152.2		102.8		88.3	
		EB	24.4		47.1		26.3		21.7	
		WB	-		-		-		-	
20	I Street NW and 17th Street NW (west)	NB	26.5	66.9	23.2	62.8	22.8	65.5	25.8	71.0
		SB	135.4		112.5		106.4		103.5	
		EB	-		-		-		-	
		WB	41.8		50.3		60.1		71.6	
21	L Street NW and 16th Street NW	NB	11.4	20.5	14.3	20.4	14.6	20.9	13.8	19.9
		SB	25.4		23.7		24.2		23.9	
		EB	21.7		21.6		21.8		20.6	
		WB	-		-		-		-	
22	I Street NW and 16th Street NW	NB	17.9	26.0	18.2	27.1	18.5	20.4	18.1	26.6
		SB	38.8		40.3		16.2		39.1	
		EB	-		-		-		-	
		WB	22.8		22.9		22.5		22.7	
23	L Street NW and 15th Street NW (west)	NB	16.4	18.9	12.7	14.2	7.8	12.8	12.5	13.8
		SB	70.0		31.5		32.4		30.8	
		EB	10.7		11.7		11.1		11.3	
		WB	-		-		-		-	
24	L Street NW and 14th Street NW	NB	12.7	20.5	19.8	25.0	10.2	26.7	14.6	19.0
		SB	23.2		25.9		28.2		19.6	
		EB	24.0		27.9		37.2		21.7	
		WB	-		-		-		-	
25	I Street NW and 14th Street NW	NB	21.3	45.4	21.2	48.2	23.2	37.6	21.7	30.9
		SB	80.5		91.1		54.8		34.5	
		EB	-		-		-		-	
		WB	39.0		38.6		37.7		38.0	

Intersection LOS Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

* Coloring represents estimated intersection level of service (LOS). **Green** represents LOS A-C, **Yellow** represents LOS D, **Orange** represents LOS E, **Red** represents LOS F.

* Estimated LOS derived from Vissim simulation results reporting average vehicle delay. Simulated LOS is not equivalent to Highway Capacity Manual definitions.

#	Intersection	Approach	Existing		Alternative 1		Alternative 2		Hybrid Alternative	
			Approach LOS	Intersection LOS	Approach LOS	Intersection LOS	Approach LOS	Intersection LOS	Approach LOS	Intersection LOS
1	K Street NW and 22nd Street NW	NB	C	C	C	C	C	C	C	C
		SB	-		-		-		-	
		EB	B		B		B		B	
		WB	C		C		C		D	
2	K Street NW and 21st Street NW	NB	-	D	-	D	-	D	-	D
		SB	E		D		D		D	
		EB	B		C		C		B	
		WB	D		E		D		D	
		EB Service Lane	D		E		C		C	
3	K Street NW and 20th Street NW	NB	D	C	D	C	E	D	D	B
		SB	-		-		-		-	
		EB	B		A		D		A	
		WB	B		C		A		B	
4	K Street NW and 19th Street NW	NB	-	C	-	C	-	D	-	B
		SB	C		C		C		C	
		EB	B		C		E		A	
		WB	B		C		D		B	
5	K Street NW and 18th Street NW	NB	C	C	C	C	E	E	C	B
		SB	-		-		-		-	
		EB	B		B		F		A	
		WB	B		B		C		B	
6	K Street NW and Connecticut Avenue	NB	C	D	B	D	C	E	C	D
		SB	F		F		F		E	
		EB	C		D		F		D	
		WB	B		B		B		A	
7	K Street NW and 17th Street NW (east)	NB	C	C	C	B	D	C	D	B
		SB	D		C		D		C	
		EB	B		A		C		A	
		WB	C		B		D		B	
8	K Street NW and 16th Street NW	NB	D	C	D	B	D	D	D	B
		SB	B		B		B		B	
		EB	D		B		E		C	
		WB	B		B		D		B	
9	K Street NW and 15th Street NW (west)	NB	C	D	C	C	D	D	C	C
		SB	F		D		D		D	
		EB	E		B		E		E	
		WB	C		B		C		B	

Intersection LOS Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

* Coloring represents estimated intersection level of service (LOS). **Green** represents LOS A-C, **Yellow** represents LOS D, **Orange** represents LOS E, **Red** represents LOS F.

* Estimated LOS derived from Vissim simulation results reporting average vehicle delay. Simulated LOS is not equivalent to Highway Capacity Manual definitions.

#	Intersection	Approach	Existing		Alternative 1		Alternative 2		Hybrid Alternative	
			Approach LOS	Intersection LOS	Approach LOS	Intersection LOS	Approach LOS	Intersection LOS	Approach LOS	Intersection LOS
10	K Street NW and Vermont Avenue	NB	D	D	D	C	E	E	C	C
		SB	F		D		F		D	
		EB	C		B		B		C	
		WB	D		B		E		B	
11	K Street NW and 14th Street NW	NB	C	D	C	D	D	E	C	D
		SB	D		E		E		C	
		EB	D		D		C		E	
		WB	E		C		F		B	
12	K Street NW and 13th Street NW	NB	C	C	C	C	F	F	C	D
		SB	D		D		F		D	
		EB	B		C		C		F	
		WB	C		B		F		B	
13	K Street NW and 12th Street NW	NB	E	C	D	C	F	F	D	C
		SB	-		-		-		-	
		EB	B		B		A		C	
		WB	B		C		F		B	
14	K Street NW and 11th Street NW	NB	C	C	C	C	F	E	D	C
		SB	C		C		E		D	
		EB	A		B		B		A	
		WB	B		B		B		C	
15	K Street NW and 10th Street NW	NB	-	C	-	B	-	D	-	B
		SB	C		C		E		C	
		EB	B		A		A		A	
		WB	B		B		F		B	
16	K Street NW and 9th Street NW	NB	-	B	-	B	-	B	-	B
		SB	A		A		A		A	
		EB	E		E		D		E	
		WB	-		-		-		-	
17	L Street NW and 21st Street NW	NB	-	C	-	C	-	C	-	C
		SB	C		C		C		C	
		EB	C		C		C		C	
		WB	-		-		-		-	
18	Pennsylvania Avenue NW and 21st Street NW	NB	-	F	-	F	-	F	-	F
		SB	B		C		C		C	
		EB	D		D		D		C	
		WB	F		F		F		F	

Intersection LOS Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

* Coloring represents estimated intersection level of service (LOS). **Green** represents LOS A-C, **Yellow** represents LOS D, **Orange** represents LOS E, **Red** represents LOS F.

* Estimated LOS derived from Vissim simulation results reporting average vehicle delay. Simulated LOS is not equivalent to Highway Capacity Manual definitions.

#	Intersection	Approach	Existing		Alternative 1		Alternative 2		Hybrid Alternative	
			Approach LOS	Intersection LOS	Approach LOS	Intersection LOS	Approach LOS	Intersection LOS	Approach LOS	Intersection LOS
19	L Street NW and Connecticut Avenue	NB	C	D	B	E	B	D	C	D
		SB	F		F		F		F	
		EB	C		D		C		C	
		WB	-		-		-		-	
20	I Street NW and 17th Street NW (west)	NB	C	E	C	E	C	E	C	E
		SB	F		F		F		F	
		EB	-		-		-		-	
		WB	D		D		E		E	
21	L Street NW and 16th Street NW	NB	B	C	B	C	B	C	B	B
		SB	C		C		C		C	
		EB	C		C		C		C	
		WB	-		-		-		-	
22	I Street NW and 16th Street NW	NB	B	C	B	C	B	C	B	C
		SB	D		D		B		D	
		EB	-		-		-		-	
		WB	C		C		C		C	
23	L Street NW and 15th Street NW (west)	NB	B	B	B	B	A	B	B	B
		SB	E		C		C		C	
		EB	B		B		B		B	
		WB	-		-		-		-	
24	L Street NW and 14th Street NW	NB	B	C	B	C	B	C	B	B
		SB	C		C		C		B	
		EB	C		C		D		C	
		WB	-		-		-		-	
25	I Street NW and 14th Street NW	NB	C	D	C	D	C	D	C	C
		SB	F		F		D		C	
		EB	-		-		-		-	
		WB	D		D		D		D	

Travel Time | Comparison by Vehicle Type

PM Peak Hour (4:45 PM - 5:45 PM)

Passenger Vehicle Travel Time by Scenario					
Segment ID	Route	Existing	Alternative 1	Alternative 2	Hybrid Alternative
		(MM:SS)	(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:04	01:23	02:38	00:59
2	19th St NW to 17th St NW (west)	01:26	01:19	05:56	01:16
3	17th St NW (west) to 14th St NW	03:52	02:28	04:19	03:56
4	14th St NW to 10th St NW	01:11	01:24	01:18	03:14
Total	Total Eastbound	07:33	06:34	14:11	09:25
5	10th St NW to 14th St NW	02:30	01:40	06:05	01:04
6	14th St NW to 17th St NW (west)	03:17	02:23	04:19	02:02
7	17th St NW (west) to 19th NW	00:57	00:59	01:23	00:47
8	19th St NW to 22nd St NW	02:53	03:07	02:30	02:47
Total	Total Westbound	09:37	08:09	14:17	06:40

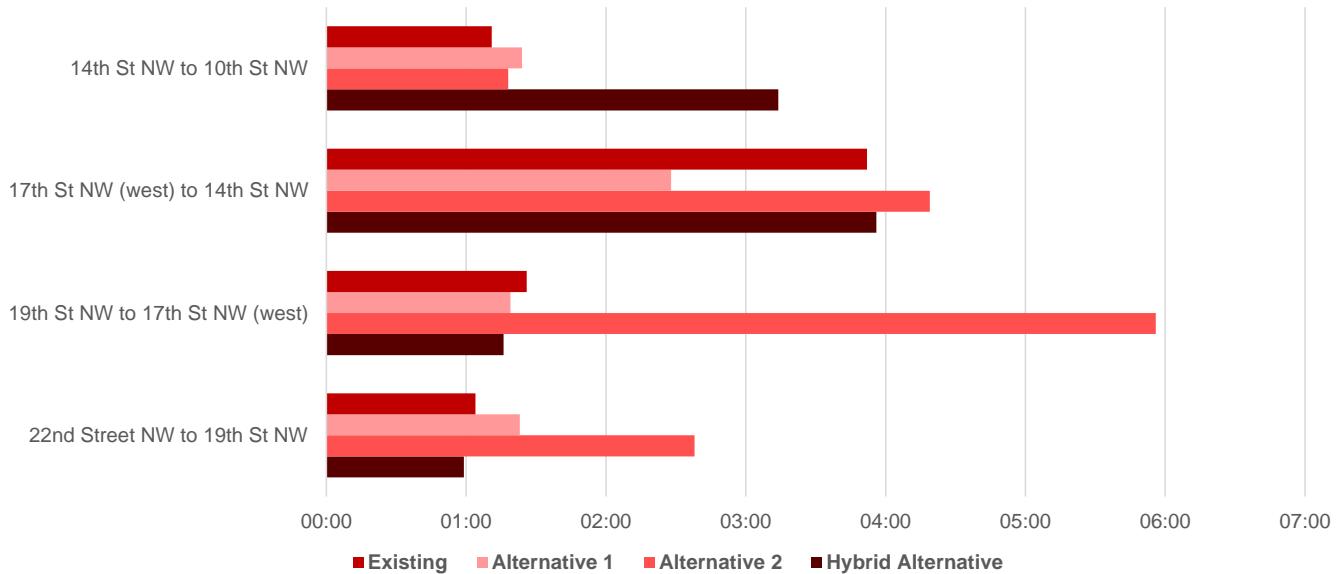
Heavy Goods Vehicle (HGV) Travel Time by Scenario					
Segment ID	Route	Existing	Alternative 1	Alternative 2	Hybrid Alternative
		(MM:SS)	(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:10	01:28	02:35	01:02
2	19th St NW to 17th St NW (west)	01:36	01:24	06:02	01:23
3	17th St NW (west) to 14th St NW	03:55	02:30	04:19	03:58
4	14th St NW to 10th St NW	01:13	01:25	01:18	03:12
Total	Total Eastbound	07:54	06:47	14:14	09:35
5	10th St NW to 14th St NW	02:30	01:43	06:15	01:05
6	14th St NW to 17th St NW (west)	03:29	02:22	04:06	02:04
7	17th St NW (west) to 19th NW	00:59	01:01	01:23	00:48
8	19th St NW to 22nd St NW	02:52	03:09	02:30	02:47
Total	Total Westbound	09:50	08:15	14:14	06:44

Bus Travel Time by Scenario (Includes Dwell Time)					
Segment ID	Route	Existing	Alternative 1	Alternative 2	Hybrid Alternative
		(MM:SS)	(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	03:41	01:48	02:09	01:51
2	19th St NW to 17th St NW (west)	03:17	01:39	01:33	01:15
3	17th St NW (west) to 14th St NW	05:39	03:25	03:02	03:15
4	14th St NW to 10th St NW	02:31	02:53	02:47	02:08
Total	Total Eastbound	15:08	09:45	09:31	08:29
5	10th St NW to 14th St NW	03:49	02:19	02:40	00:54
6	14th St NW to 17th St NW (west)	06:03	03:11	03:09	03:06
7	17th St NW (west) to 19th NW	01:41	01:26	01:15	01:13
8	19th St NW to 22nd St NW	02:30	02:36	02:29	02:22
Total	Total Westbound	14:03	09:32	09:33	07:35

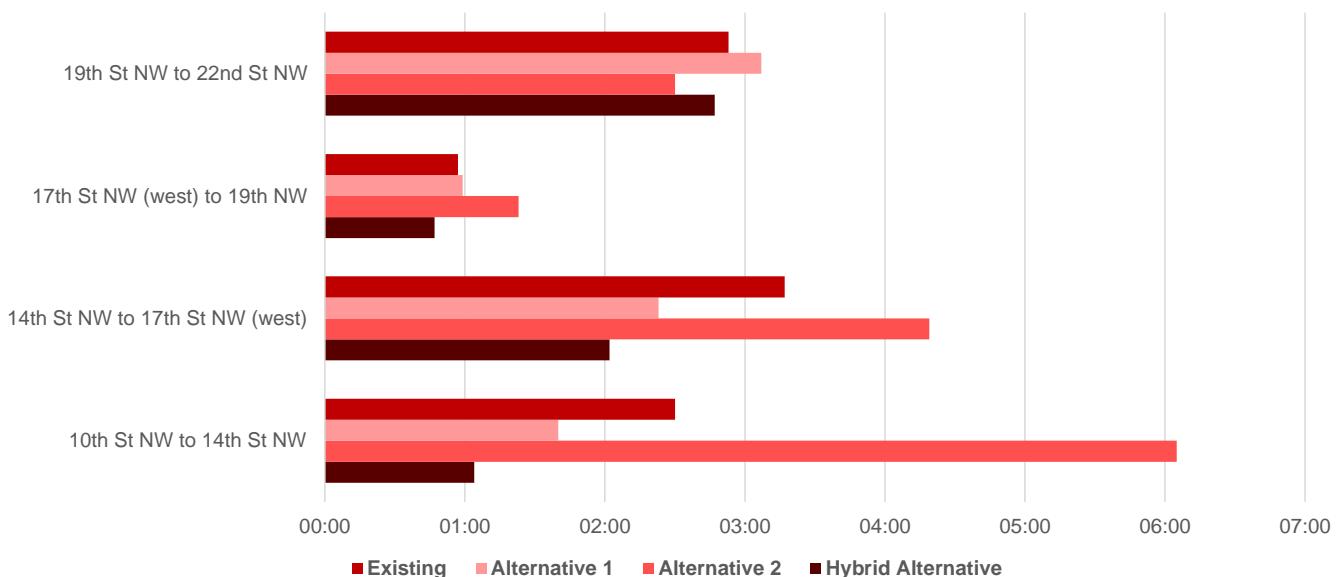
Travel Time | Comparison by Vehicle Type

PM Peak Hour (4:45 PM - 5:45 PM)

Eastbound Travel Time [min] by Scenario - Passenger Vehicle



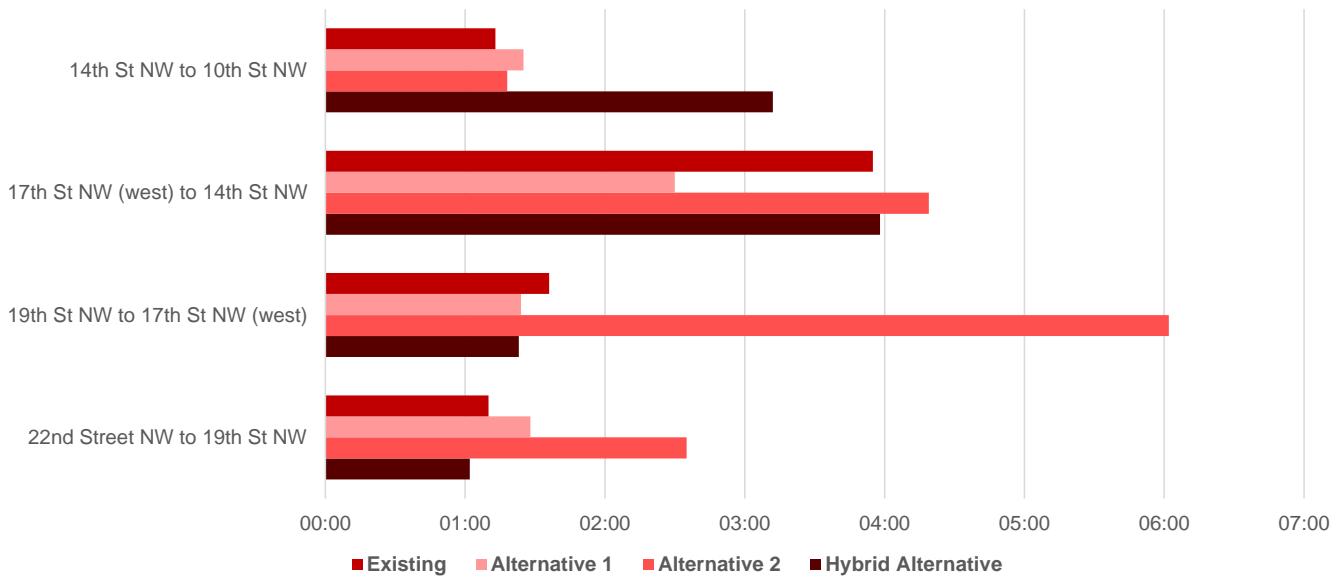
Westbound Travel Time [min] by Scenario - Passenger Vehicle



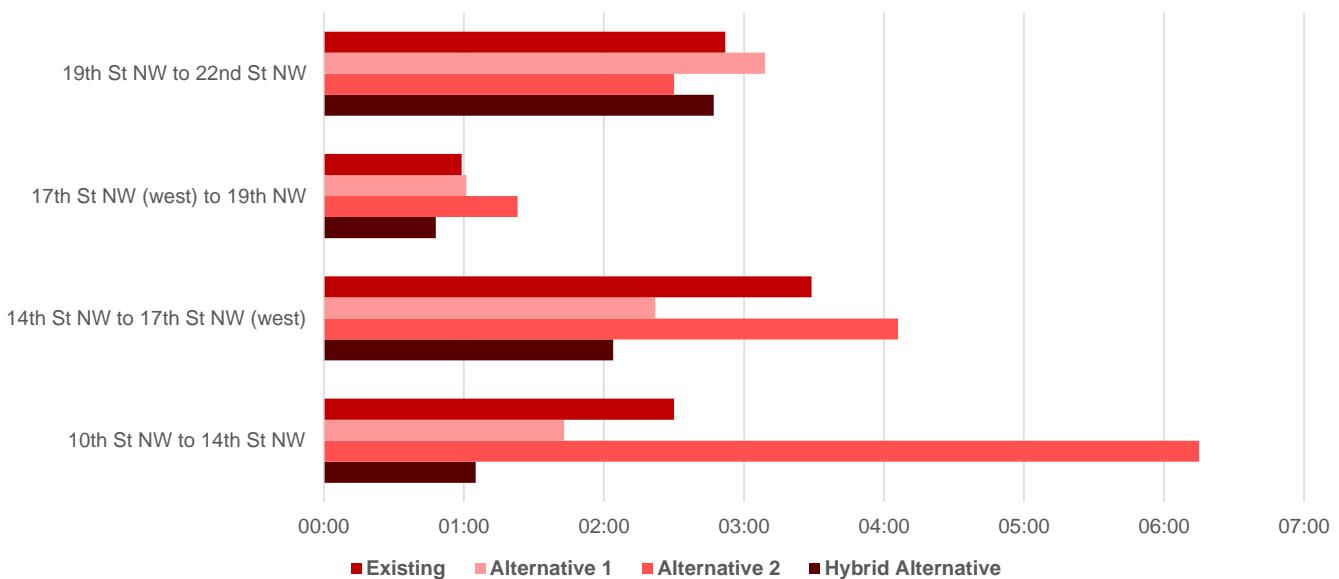
Travel Time | Comparison by Vehicle Type

PM Peak Hour (4:45 PM - 5:45 PM)

Eastbound Travel Time [min] by Scenario - HGV



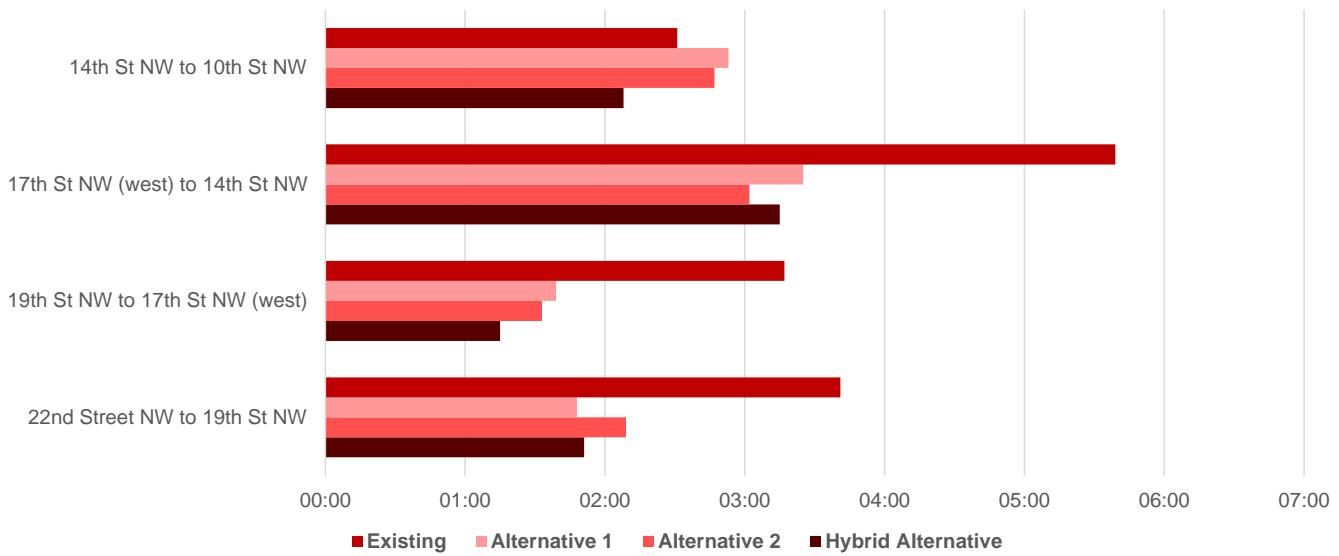
Westbound Travel Time [min] by Scenario - HGV



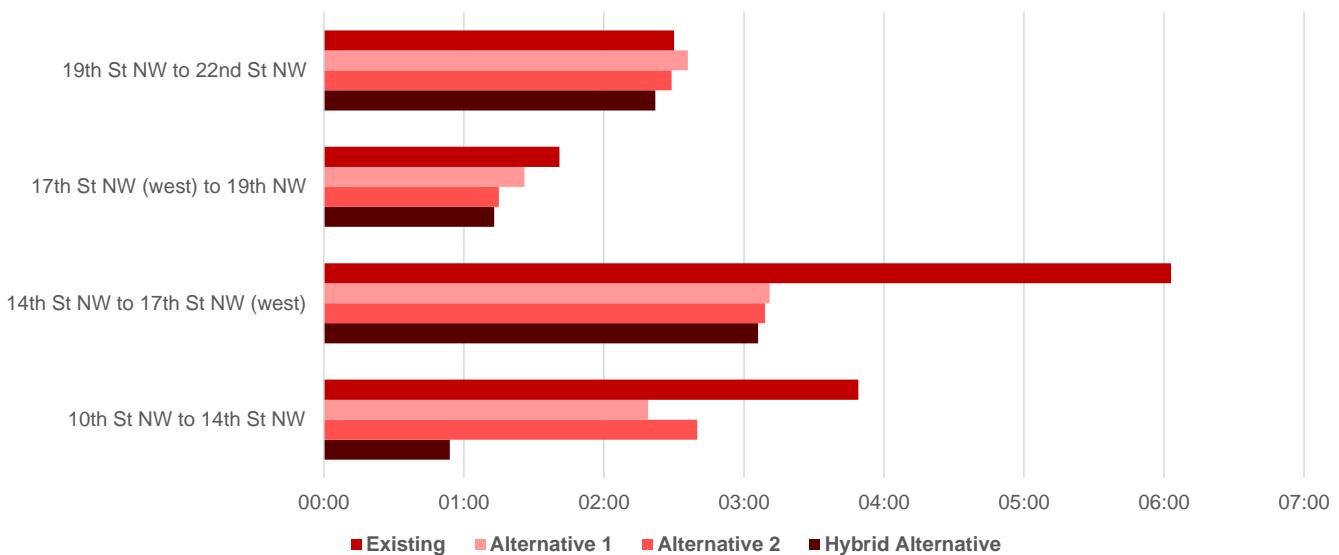
Travel Time | Comparison by Vehicle Type

PM Peak Hour (4:45 PM - 5:45 PM)

Eastbound Travel Time [min] by Scenario - Bus (Includes Dwell Time)



Westbound Travel Time [min] by Scenario - Bus (Includes Dwell Time)



Speed | Comparison by Vehicle Type

PM Peak Hour (4:45 PM - 5:45 PM)

* Average travel speed approximated from reported travel time measurements. Estimate includes intersection delay.

Passenger Vehicle Speed by Scenario					
Segment ID	Route	Existing	Alternative 1	Alternative 2	Hybrid Alternative
		mph	mph	mph	mph
1	22nd Street NW to 19th St NW	14.4	11.1	5.8	15.5
2	19th St NW to 17th St NW (west)	8.8	9.6	2.1	10.0
3	17th St NW (west) to 14th St NW	6.3	9.9	5.6	6.2
4	14th St NW to 10th St NW	13.5	11.5	12.2	5.0
Total	Total Eastbound	10.7	10.5	6.5	9.2
5	10th St NW to 14th St NW	5.7	8.6	2.4	13.3
6	14th St NW to 17th St NW (west)	7.9	10.9	6.0	12.7
7	17th St NW (west) to 19th NW	11.8	11.4	8.1	14.2
8	19th St NW to 22nd St NW	6.4	5.9	7.4	6.7
Total	Total Westbound	7.9	9.2	6.0	11.7

Heavy Goods Vehicle (HGV) Speed by Scenario					
Segment ID	Route	Existing	Alternative 1	Alternative 2	Hybrid Alternative
		mph	mph	mph	mph
1	22nd Street NW to 19th St NW	13.0	10.5	5.9	14.7
2	19th St NW to 17th St NW (west)	7.9	9.1	2.1	9.1
3	17th St NW (west) to 14th St NW	6.2	9.7	5.6	6.1
4	14th St NW to 10th St NW	13.1	11.3	12.3	5.0
Total	Total Eastbound	10.0	10.1	6.5	8.8
5	10th St NW to 14th St NW	5.8	8.4	2.3	13.2
6	14th St NW to 17th St NW (west)	7.4	10.9	6.3	12.5
7	17th St NW (west) to 19th NW	11.5	11.0	8.2	14.0
8	19th St NW to 22nd St NW	6.4	5.9	7.4	6.6
Total	Total Westbound	7.8	9.1	6.1	11.6

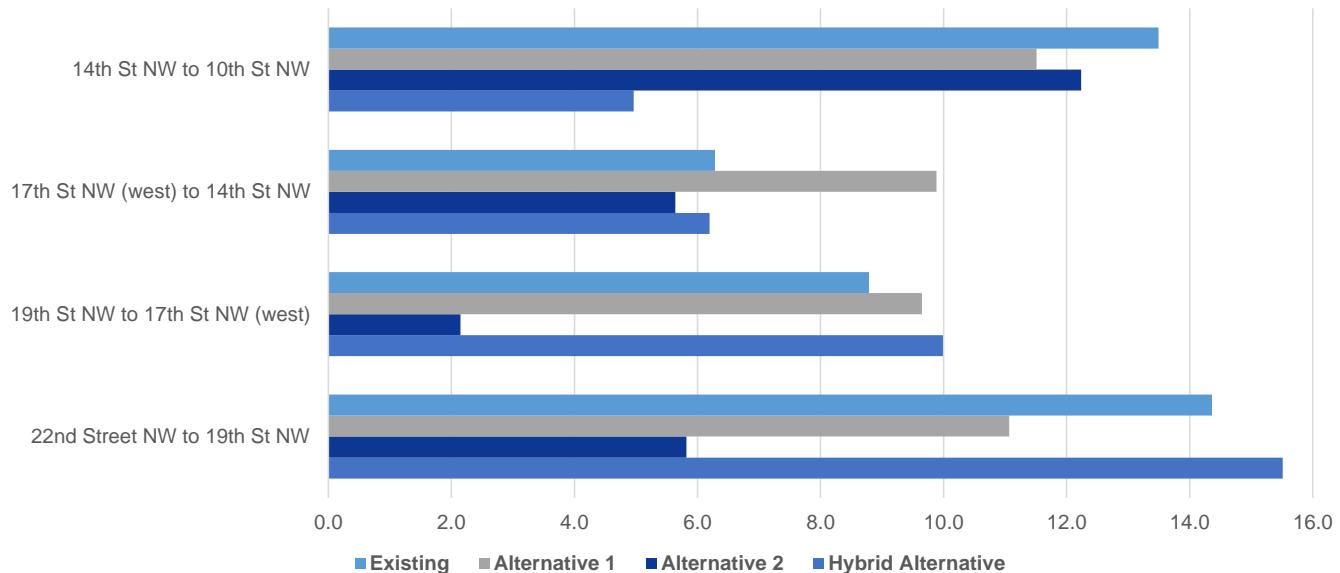
Bus Speed by Scenario (Speed Estimate Includes Dwell Time)					
Segment ID	Route	Existing	Alternative 1	Alternative 2	Hybrid Alternative
		mph	mph	mph	mph
1	22nd Street NW to 19th St NW	3.5	7.1	6.0	6.9
2	19th St NW to 17th St NW (west)	3.9	7.7	8.2	10.1
3	17th St NW (west) to 14th St NW	4.3	7.1	8.0	7.4
4	14th St NW to 10th St NW	6.4	5.5	5.7	7.4
Total	Total Eastbound	4.5	6.9	7.0	8.0
5	10th St NW to 14th St NW	3.8	6.2	5.4	15.8
6	14th St NW to 17th St NW (west)	4.3	8.1	8.2	8.3
7	17th St NW (west) to 19th NW	6.7	7.8	8.9	9.2
8	19th St NW to 22nd St NW	5.8	5.6	5.8	6.1
Total	Total Westbound	5.1	6.9	7.1	9.9

Speed | Comparison by Vehicle Type

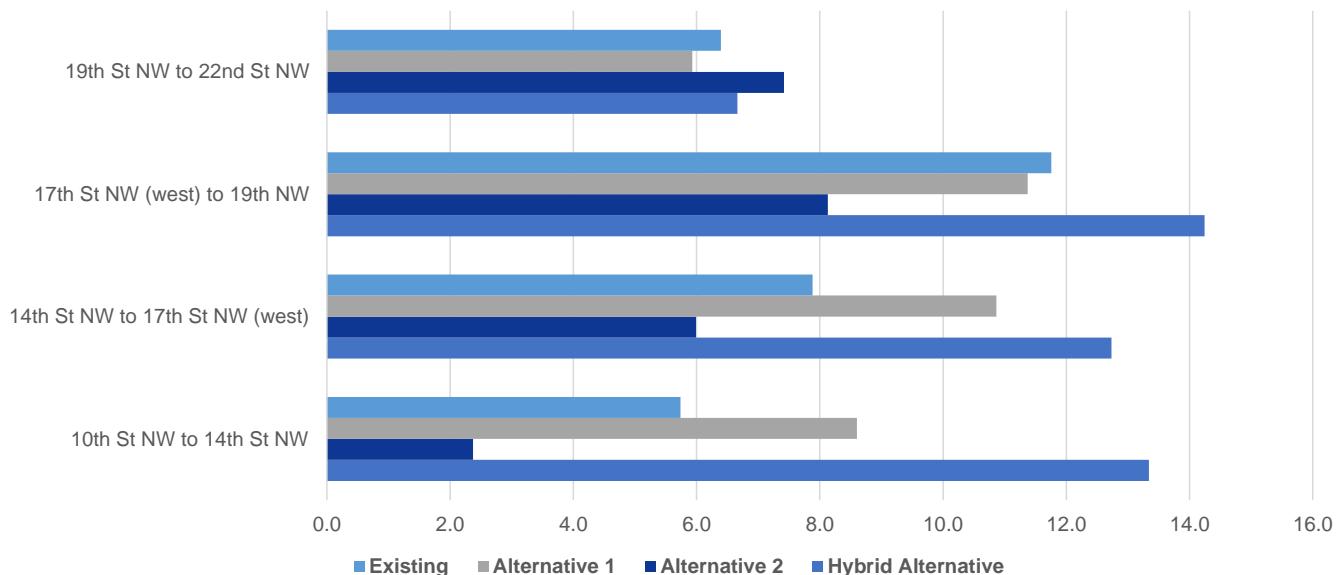
PM Peak Hour (4:45 PM - 5:45 PM)

* Average travel speed approximated from reported travel time measurements. Estimate includes intersection delay.

Eastbound Speed [mph] by Scenario - Passenger Vehicle



Westbound Speed [mph] by Scenario - Passenger Vehicle

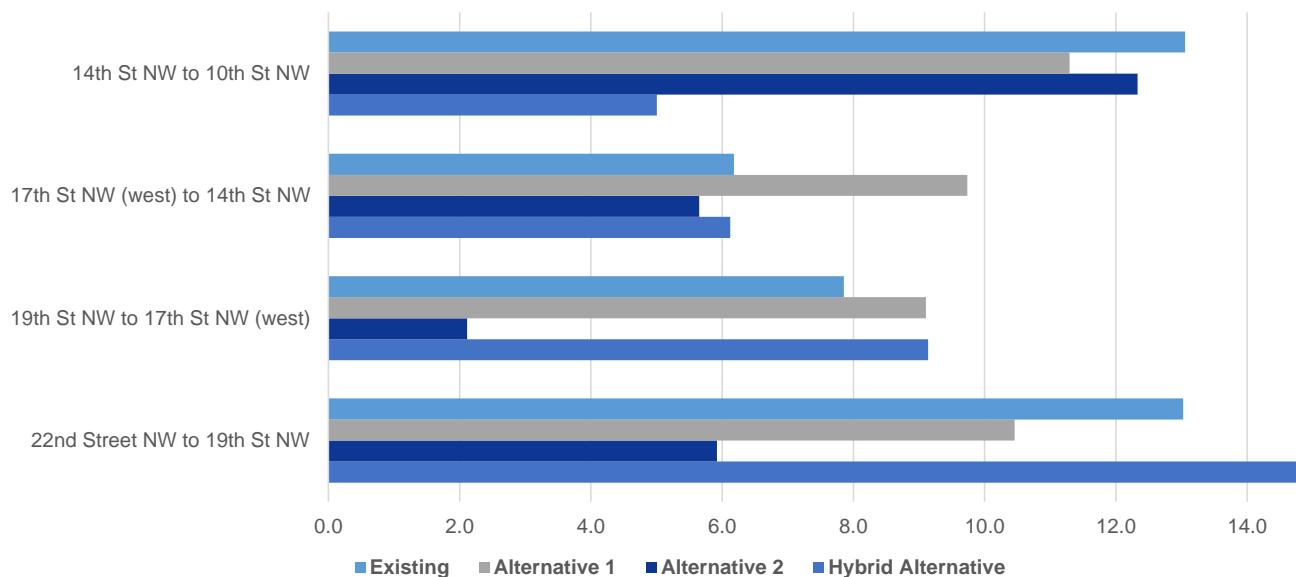


Speed | Comparison by Vehicle Type

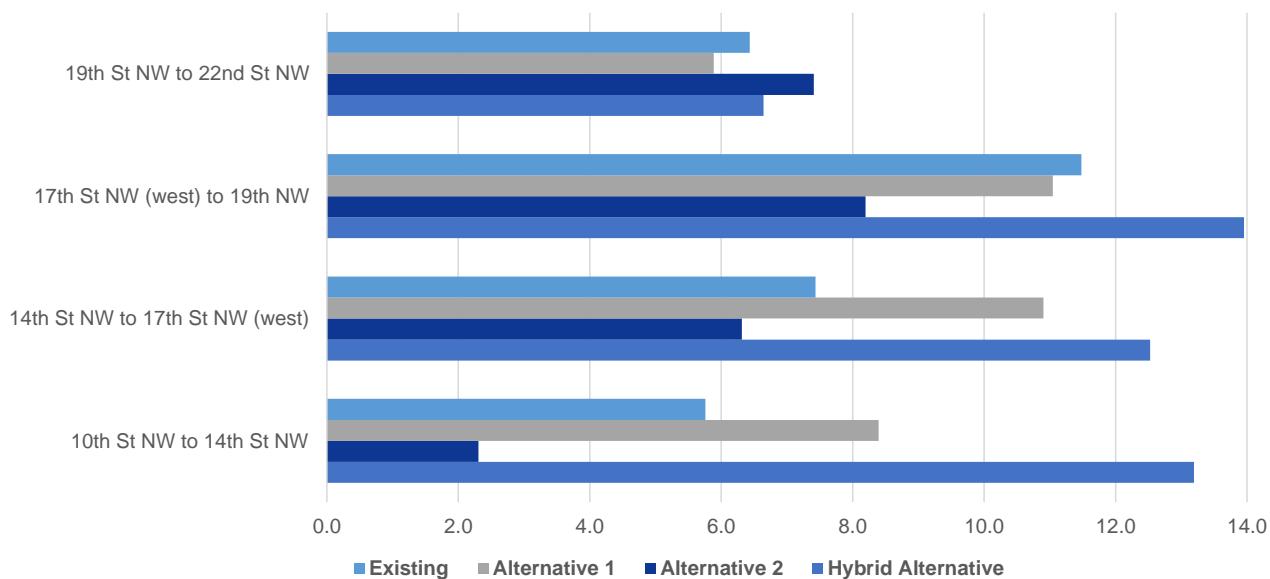
PM Peak Hour (4:45 PM - 5:45 PM)

* Average travel speed approximated from reported travel time measurements. Estimate includes intersection delay.

Eastbound Speed [mph] by Scenario - HGV



Westbound Speed [mph] by Scenario - HGV



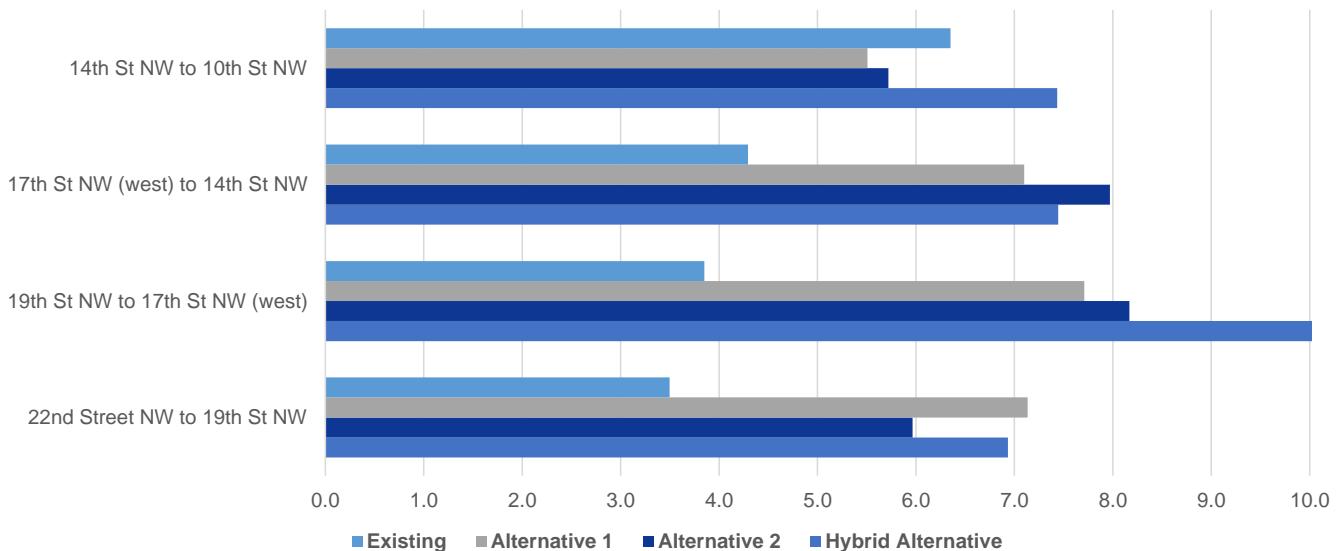
Speed | Comparison by Vehicle Type

PM Peak Hour (4:45 PM - 5:45 PM)

* Average travel speed approximated from reported travel time measurements. Estimate includes intersection delay.

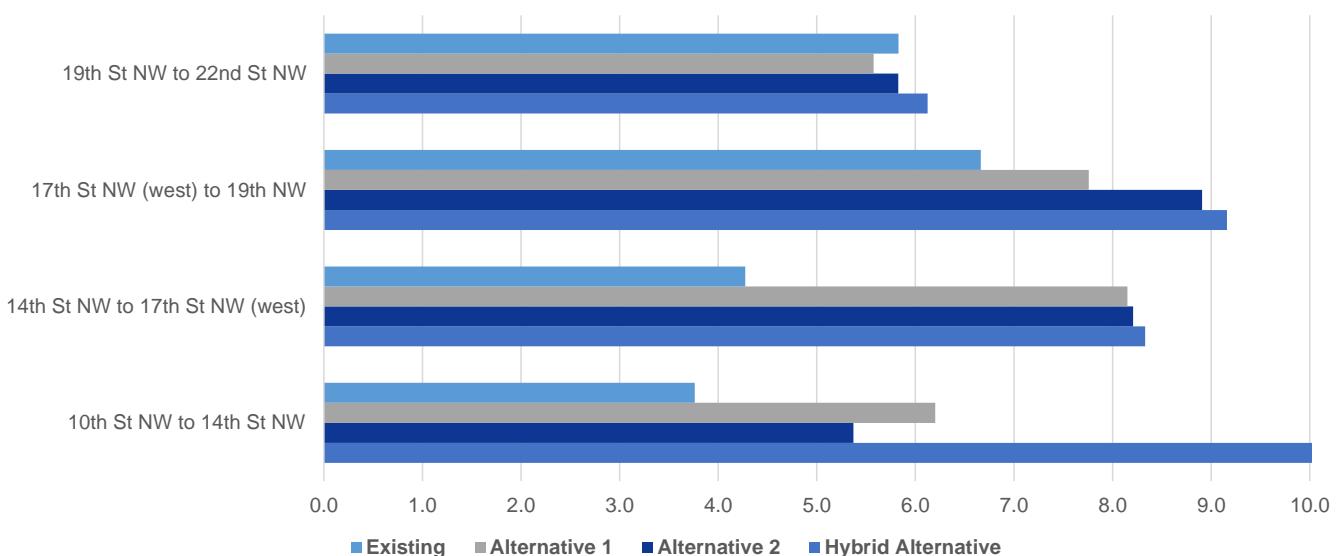
Eastbound Speed [mph] by Scenario - Bus

(Speed Estimate Includes Dwell Time)



Westbound Speed [mph] by Scenario - Bus

(Speed Estimate Includes Dwell Time)



Intersection Queue Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

* Red represents a queue increase greater than 20%. Green represents a queue decrease greater than 20%.

Intersection		Approach	Existing		Alternative 1		Alternative 2		Hybrid Alternative	
			Vissim Average Queue (ft)	Vissim Max Queue (ft)	Vissim Average Queue (ft)	Vissim Max Queue (ft)	Vissim Average Queue (ft)	Vissim Max Queue (ft)	Vissim Average Queue (ft)	Vissim Max Queue (ft)
1	K Street NW and 22nd Street NW									
2	K Street NW and 21st Street NW	EB	14	133	22	144	22	134	16	127
		WB	157	480	272	504	230	444	205	471
		SB	221	452	104	355	92	358	129	400
3	K Street NW and 20th Street NW	EB	71	329	12	123	65	334	15	160
		WB	33	218	105	413	47	384	54	393
4	K Street NW and 19th Street NW	EB	83	336	80	299	153	428	16	173
		WB	45	281	65	330	280	534	30	186
5	K Street NW and 18th Street NW	EB	52	263	31	156	289	555	14	106
		WB	83	315	58	272	141	627	61	381
6	K Street NW and Connecticut Avenue	EB	124	462	123	466	547	653	179	500
		WB	48	254	87	327	87	313	42	273
		NB	64	279	32	200	53	272	66	303
		SB	221	455	243	419	196	432	181	426
7	K Street NW and 17th Street NW (east)	EB	80	306	12	200	86	275	74	277
		WB	86	384	75	295	212	561	63	274
		NB	17	110	17	107	22	124	20	116
		SB	45	190	27	149	36	168	30	156
8	K Street NW and 16th Street NW	EB	90	507	33	199	287	580	61	334
		WB	41	192	51	290	172	522	42	251
		NB	45	203	47	222	47	235	52	231
		SB	28	223	21	132	27	165	20	164
9	K Street NW and 15th Street NW (west)	EB	229	564	49	224	277	609	186	488
		WB	144	348	72	279	155	289	64	291
		SB	113	365	38	255	39	263	33	211
10	K Street NW and Vermont Avenue	EB	107	294	39	210	56	266	85	279
		WB	161	488	53	393	265	475	45	195
		NB	32	217	47	309	92	273	44	304
		SB	178	391	24	148	347	397	21	143

Intersection Queue Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

* Red represents a queue increase greater than 20%. Green represents a queue decrease greater than 20%.

Intersection	Approach	Existing		Alternative 1		Alternative 2		Hybrid Alternative	
		Vissim Average Queue (ft)	Vissim Max Queue (ft)	Vissim Average Queue (ft)	Vissim Max Queue (ft)	Vissim Average Queue (ft)	Vissim Max Queue (ft)	Vissim Average Queue (ft)	Vissim Max Queue (ft)
11	K Street NW and 14th Street NW	EB	120	380	181	500	120	473	279
		WB	178	504	82	371	526	676	70
		NB	44	229	47	254	71	290	49
		SB	100	330	134	368	156	402	50
12	K Street NW and 13th Street NW	EB	71	299	81	405	119	650	481
		WB	68	276	41	210	257	449	39
		SB	68	250	71	245	1615	1930	83
13	K Street NW and 12th Street NW	EB	29	326	27	240	31	418	103
		WB	29	221	71	336	154	291	29
14	K Street NW and 11th Street NW	EB	18	199	48	278	31	268	20
		WB	54	183	26	185	168	314	41
		NB	50	264	58	253	803	1712	72
		SB	40	219	41	252	110	387	49
15	K Street NW and 10th Street NW	EB	32	217	12	149	10	141	11
		WB	9	102	10	107	98	294	9
		SB	42	212	41	213	311	975	37
16	K Street NW and 9th Street NW	EB	74	324	74	296	65	259	71
									236

Attachment H:

Sensitivity Analysis Eastbound Lane Drop Location

Alternative 3 (Hybrid) | Sensitivity Analysis of EB Lane Drop Location (13th Street vs. 12th Street)

AM Peak Hour (8:30 AM - 9:30 AM) | PM Peak Hour (4:45 PM - 5:45 PM)
AM Peak Period (8:00 AM - 10:00 AM) | PM Peak Period (4:15 PM - 6:15 PM)
AM Analysis Period (7:30 AM - 10:00 AM) | PM Analysis Period (3:45 PM - 6:15 PM)

This attachment provides a summary of K Street NW network performance as modeled in Vissim for the calibrated Existing Conditions model and two versions of the Alternative 3 Build model design. The purpose of this sensitivity analysis was to evaluate a potential countermeasure to improve the adverse impact of the design on eastbound general-purpose traffic. The current design includes two lane drops in the eastbound direction: (1) approaching Connecticut Avenue NW and (2) approaching 13th Street NW. The lane drop at 13th Street NW was found to increase travel times during the PM peak period for eastbound traffic.

The Kimley-Horn team investigated the impact of maintaining two through-lanes eastbound at 13th Street NW and introducing a lane drop on the 1200 Block to maintain one eastbound through-lane entering the 1100 Block. **This analysis shows that moving the lane-drop further downstream provides modest improvements to eastbound vehicular traffic.**

In the attached results, the model labeled "**EB Lane Drop at 13th Street**" represents the initial design configuration, where one through-lane continues eastbound at 13th Street NW. This lane configuration was intended to provide flexible curb space use along the 1200 Block of K Street NW. However, analysis results show that the lane drop at 13th Street NW is the primary bottleneck for eastbound vehicular delay. Therefore, the model labeled "**EB Lane Drop at 12th Street**" represents a design alternative in which two through-lanes are maintained eastbound through 13th Street NW and the lane drop occurs in the 1200 block, effectively moving the lane drop further downstream. A summary of findings from this analysis in the AM and PM peak periods is provided below.

- (1) **AM Peak Period** | Overall eastbound travel time improvement of 9 seconds as compared to the "EB Lane Drop at 13th Street" model.
- (2) **PM Peak Period** | Overall eastbound travel time improvement of 27 seconds as compared to the "EB Lane Drop at 13th Street" model.

The factors influencing the improvement of the lane drop on the 1200 block as compared to the 1300 block are described below:

- (1) The demand volume along the 1300 block is higher than the demand volume along the 1200 block; therefore, there are fewer vehicles maneuvering the lane drop conditions.
- (2) The lane drop at the 13th Street NW approach introduced additional lane change friction from right-turning vehicles. This conflict does not exist at the 12th Street NW approach.
- (3) There is a longer green band for eastbound vehicles at 12th Street NW as compared to 13th Street NW; therefore, the added capacity provided on the 1200 block enables more storage space for vehicles coming from 13th Street NW and more time for the queues to dissipate after eastbound through traffic at 13th Street NW is stopped.

These findings suggest reconfiguration of the eastbound lane drop at 12th Street NW may provide modest improvements to eastbound travel. The trade-off for this vehicular travel time improvement is the loss of curb space in the eastbound direction on the 1200 block.

Travel Time | Comparison by Vehicle Type

AM Peak Period (8:00 AM - 10:00 AM)

Passenger Vehicle Travel Time by Scenario				
Segment ID	Route	Existing	EB Lane Drop at 13th Street	EB Lane Drop at 12th Street
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:13	01:08	01:08
2	19th St NW to 17th St NW (west)	01:22	00:48	00:49
3	17th St NW (west) to 14th St NW	03:24	02:13	02:13
4	14th St NW to 11th St NW	01:09	02:10	02:00
Total	Total Eastbound	07:08	06:19	06:10
5	11th St NW to 14th St NW	02:18	01:34	01:34
6	14th St NW to 17th St NW (west)	02:46	02:07	02:07
7	17th St NW (west) to 19th NW	00:55	00:59	00:58
8	19th St NW to 22nd St NW	01:22	01:34	01:34
Total	Total Westbound	07:21	06:14	06:13

Heavy Goods Vehicle (HGV) Travel Time by Scenario				
Segment ID	Route	Existing	EB Lane Drop at 13th Street	EB Lane Drop at 12th Street
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:18	01:08	01:08
2	19th St NW to 17th St NW (west)	01:29	00:50	00:51
3	17th St NW (west) to 14th St NW	03:39	02:14	02:17
4	14th St NW to 11th St NW	01:13	02:12	02:01
Total	Total Eastbound	07:39	06:24	06:17
5	11th St NW to 14th St NW	02:23	01:36	01:37
6	14th St NW to 17th St NW (west)	02:50	02:09	02:08
7	17th St NW (west) to 19th NW	00:57	00:58	01:00
8	19th St NW to 22nd St NW	01:27	01:38	01:34
Total	Total Westbound	07:37	06:21	06:19

Bus Travel Time by Scenario (Includes Dwell Time)				
Segment ID	Route	Existing	EB Lane Drop at 13th Street	EB Lane Drop at 12th Street
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	02:58	02:06	02:06
2	19th St NW to 17th St NW (west)	03:02	01:20	01:20
3	17th St NW (west) to 14th St NW	04:53	02:59	02:59
4	14th St NW to 11th St NW	02:03	02:20	02:18
Total	Total Eastbound	12:56	08:45	08:43
5	11th St NW to 14th St NW	03:02	01:57	01:57
6	14th St NW to 17th St NW (west)	05:39	02:45	02:45
7	17th St NW (west) to 19th NW	01:55	01:15	01:15
8	19th St NW to 22nd St NW	01:55	02:18	02:18
Total	Total Westbound	12:31	08:15	08:15

Travel Time | Comparison by Vehicle Type

PM Peak Period (4:15 PM - 6:15 PM)

Passenger Vehicle Travel Time by Scenario				
Segment ID	Route	Existing	EB Lane Drop at 13th Street	EB Lane Drop at 12th Street
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:04	01:04	01:04
2	19th St NW to 17th St NW (west)	01:26	01:09	01:13
3	17th St NW (west) to 14th St NW	03:52	03:35	02:45
4	14th St NW to 11th St NW	01:11	03:07	03:26
Total	Total Eastbound	07:33	08:55	08:28
5	11th St NW to 14th St NW	02:30	01:04	01:05
6	14th St NW to 17th St NW (west)	03:17	02:02	02:02
7	17th St NW (west) to 19th NW	00:57	00:48	00:48
8	19th St NW to 22nd St NW	02:53	03:07	03:06
Total	Total Westbound	09:37	07:01	07:01

Heavy Goods Vehicle (HGV) Travel Time by Scenario				
Segment ID	Route	Existing	EB Lane Drop at 13th Street	EB Lane Drop at 12th Street
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:10	01:07	01:07
2	19th St NW to 17th St NW (west)	01:36	01:12	01:16
3	17th St NW (west) to 14th St NW	03:55	03:37	02:46
4	14th St NW to 11th St NW	01:13	03:05	03:33
Total	Total Eastbound	07:54	09:01	08:42
5	11th St NW to 14th St NW	02:30	01:06	01:06
6	14th St NW to 17th St NW (west)	03:29	02:02	02:05
7	17th St NW (west) to 19th NW	00:59	00:47	00:48
8	19th St NW to 22nd St NW	02:52	03:08	03:06
Total	Total Westbound	09:50	07:03	07:05

Bus Travel Time by Scenario (Includes Dwell Time)				
Segment ID	Route	Existing	EB Lane Drop at 13th Street	EB Lane Drop at 12th Street
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	03:41	01:47	01:46
2	19th St NW to 17th St NW (west)	03:17	01:15	01:15
3	17th St NW (west) to 14th St NW	05:39	03:16	03:17
4	14th St NW to 11th St NW	02:31	02:34	02:36
Total	Total Eastbound	15:08	08:52	08:54
5	11th St NW to 14th St NW	03:49	01:41	01:41
6	14th St NW to 17th St NW (west)	06:03	03:03	03:03
7	17th St NW (west) to 19th NW	01:41	01:17	01:17
8	19th St NW to 22nd St NW	02:30	02:10	02:10
Total	Total Westbound	14:03	08:11	08:11

Attachment I:

Sensitivity Analysis of Four Transit Stops

Alternative 3 (Hybrid) | Sensitivity Analysis of Four Transit Stops

AM Peak Hour (8:30 AM - 9:30 AM) | PM Peak Hour (4:45 PM - 5:45 PM)

AM Peak Period (8:00 AM - 10:00 AM) | PM Peak Period (4:15 PM - 6:15 PM)

AM Analysis Period (7:30 AM - 10:00 AM) | PM Analysis Period (3:45 PM - 6:15 PM)

This attachment provides a summary of K Street NW network performance as modeled in Vissim for the calibrated Existing Conditions model and two versions of the Alternative 3 Build model design. The purpose of this sensitivity analysis is to evaluate the impact of eliminating the transit stop on the 1200 block of K Street NW.

The Kimley-Horn Team investigated the impact of eliminating the transit stop on the 1200 block of K Street NW. **This analysis shows that eliminating the transit stop provides improvements in transit travel time, eastbound and westbound.**

In the attached results, the model labeled "**Five Transit Stops**" represents the initial design configuration, where there are five transit stops along the K Street Transitway. In the model labeled "**Four Transit Stops**," the stop on the 1200 block was eliminated to evaluate the impact on corridor travel time. A summary of findings from this analysis in the AM and PM peak periods are provided below. Results were consistent among AM and PM peak periods.

- (1) **Eastbound Travel Time** | Overall eastbound transit travel time was reduced by approximately 20 seconds under the Four Stop scenario. This results in a total transit travel time improvement over existing conditions of 35% in the AM peak and 44% in the PM peak.
- (2) **Westbound Travel Time** | Overall westbound transit travel time was reduced by approximately 50 seconds under the Four Stop scenario. This results in a total transit time improvement over existing conditions of 41% in the AM peak and 48% in the PM peak.

These travel time improvements can be attributed to the removal of bus dwell time and resulting signal progression benefits as a result of eliminating the stop. Westbound travel time improvements are more significant because the removal of the 1200 block stop improves the probability that a bus will not be delayed at 13th Street NW. Conversely, in the eastbound direction, travel time improvements are less significant due to incurred delay at 12th Street NW.

These findings suggest that removing the stop on the 1200 block of the K Street Transitway will provide improvements to transit travel times in the eastbound and westbound directions.

Travel Time | Comparison by Vehicle Type

AM Peak Period (8:00 AM - 10:00 AM)

Passenger Vehicle Travel Time by Scenario				
Segment ID	Route	Existing	Five Transit Stops	Four Transit Stops
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:13	01:08	01:08
2	19th St NW to 17th St NW (west)	01:22	00:48	00:48
3	17th St NW (west) to 14th St NW	03:24	02:13	02:12
4	14th St NW to 11th St NW	01:09	02:10	02:06
Total	Total Eastbound	07:08	06:19	06:14
5	11th St NW to 14th St NW	02:18	01:34	01:33
6	14th St NW to 17th St NW (west)	02:46	02:07	02:07
7	17th St NW (west) to 19th NW	00:55	00:59	00:58
8	19th St NW to 22nd St NW	01:22	01:34	01:34
Total	Total Westbound	07:21	06:14	06:12

Heavy Goods Vehicle (HGV) Travel Time by Scenario				
Segment ID	Route	Existing	Five Transit Stops	Four Transit Stops
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:18	01:08	01:09
2	19th St NW to 17th St NW (west)	01:29	00:50	00:51
3	17th St NW (west) to 14th St NW	03:39	02:14	02:17
4	14th St NW to 11th St NW	01:13	02:12	02:10
Total	Total Eastbound	07:39	06:24	06:27
5	11th St NW to 14th St NW	02:23	01:36	01:32
6	14th St NW to 17th St NW (west)	02:50	02:09	02:09
7	17th St NW (west) to 19th NW	00:57	00:58	00:59
8	19th St NW to 22nd St NW	01:27	01:38	01:33
Total	Total Westbound	07:37	06:21	06:13

Bus Travel Time by Scenario (Includes Dwell Time)				
Segment ID	Route	Existing	Five Transit Stops	Four Transit Stops
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	02:58	02:06	02:05
2	19th St NW to 17th St NW (west)	03:02	01:20	01:18
3	17th St NW (west) to 14th St NW	04:53	02:59	02:56
4	14th St NW to 11th St NW	02:03	02:20	02:03
Total	Total Eastbound	12:56	08:45	08:22
5	11th St NW to 14th St NW	03:02	01:57	01:01
6	14th St NW to 17th St NW (west)	05:39	02:45	02:48
7	17th St NW (west) to 19th NW	01:55	01:15	01:18
8	19th St NW to 22nd St NW	01:55	02:18	02:19
Total	Total Westbound	12:31	08:15	07:26

Travel Time | Comparison by Vehicle Type

PM Peak Period (4:15 PM - 6:15 PM)

Passenger Vehicle Travel Time by Scenario				
Segment ID	Route	Existing	Five Transit Stops	Four Transit Stops
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:04	01:04	01:05
2	19th St NW to 17th St NW (west)	01:26	01:09	01:09
3	17th St NW (west) to 14th St NW	03:52	03:35	03:44
4	14th St NW to 11th St NW	01:11	03:07	03:12
Total	Total Eastbound	07:33	08:55	09:10
5	11th St NW to 14th St NW	02:30	01:04	01:04
6	14th St NW to 17th St NW (west)	03:17	02:02	02:02
7	17th St NW (west) to 19th NW	00:57	00:48	00:47
8	19th St NW to 22nd St NW	02:53	03:07	03:04
Total	Total Westbound	09:37	07:01	06:57

Heavy Goods Vehicle (HGV) Travel Time by Scenario				
Segment ID	Route	Existing	Five Transit Stops	Four Transit Stops
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:10	01:07	01:07
2	19th St NW to 17th St NW (west)	01:36	01:12	01:12
3	17th St NW (west) to 14th St NW	03:55	03:37	03:47
4	14th St NW to 11th St NW	01:13	03:05	03:09
Total	Total Eastbound	07:54	09:01	09:15
5	11th St NW to 14th St NW	02:30	01:06	01:04
6	14th St NW to 17th St NW (west)	03:29	02:02	02:03
7	17th St NW (west) to 19th NW	00:59	00:47	00:49
8	19th St NW to 22nd St NW	02:52	03:08	03:04
Total	Total Westbound	09:50	07:03	07:00

Bus Travel Time by Scenario (Includes Dwell Time)				
Segment ID	Route	Existing	Five Transit Stops	Four Transit Stops
		(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	03:41	01:47	01:46
2	19th St NW to 17th St NW (west)	03:17	01:15	01:16
3	17th St NW (west) to 14th St NW	05:39	03:16	03:16
4	14th St NW to 11th St NW	02:31	02:34	02:13
Total	Total Eastbound	15:08	08:52	08:31
5	11th St NW to 14th St NW	03:49	01:41	00:54
6	14th St NW to 17th St NW (west)	06:03	03:03	03:06
7	17th St NW (west) to 19th NW	01:41	01:17	01:13
8	19th St NW to 22nd St NW	02:30	02:10	02:08
Total	Total Westbound	14:03	08:11	07:21

Attachment J:

Sensitivity Analysis of 21st Street Reconfiguration

Alternative 3 (Hybrid) | Sensitivity Analysis of 21st Street Reconfiguration (Option 2)

AM Peak Hour (8:30 AM - 9:30 AM) | PM Peak Hour (4:45 PM - 5:45 PM)

AM Peak Period (8:00 AM - 10:00 AM) | PM Peak Period (4:15 PM - 6:15 PM)

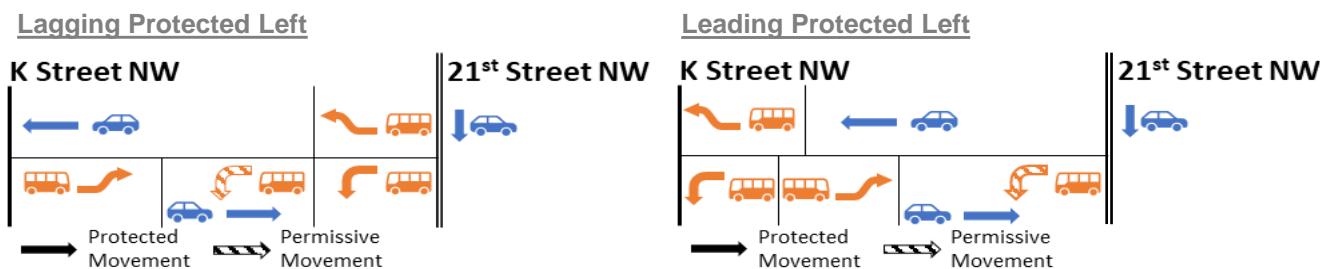
AM Analysis Period (7:30 AM - 10:00 AM) | PM Analysis Period (3:45 PM - 6:15 PM)

This attachment provides a summary of K Street NW network performance as modeled in Vissim for Alternative 3, the 21st Street Reconfiguration Alternative, and the 21st Street Reconfiguration with Alternate Phasing. The purpose of this sensitivity analysis is to evaluate the impact of reconfiguring the geometry and operations of the transitway entrance at 21st Street NW.

The Kimley-Horn team investigated the impact of shifting the EB transitway entry lane from the median side to curb side of the service lanes, west of 21st Street NW. A permissive WBL transit phase was added at 21st Street NW. Additionally, the phase sequence was modified in an additional sensitivity analysis.

This analysis shows that shifting the transit lane and adding the WBL permissive transit phase provides modest improvements to westbound transit times. Beyond this, modifying the phase sequence did not provide additional transit travel time benefits.

The model labeled "**Baseline**" represents design Alternative 3, where the transitway entry lane is on the median side and the westbound transit phase operates protected only left-turn phasing. Therefore, the model labeled "**Option 2, Lagging Protected Left**" represents the alternative with the curb side eastbound transitway entry lane and a leading permissive WBL transit phase followed by a lagging protected WBL transit phase at 21st Street NW for transit. Additionally, the model labeled "**Option 2, Leading Protected Left**" represents an alternative with the same geometry as "**Option 2, Lagging Protected Left**," but with the protected WBL transit phase occurring before the permissive WBL phase at 21st Street NW. Lastly, a third sensitivity test was performed at 21st Street NW to evaluate a permissive only WBL transit phase, labeled "**Option 2, Permissive Left Only**".



A summary of findings from this analysis in the AM and PM peak periods are provided below.

Baseline to Option 2, Lagging Protected Left findings:

- (1) **AM Peak Period** | WBL transit travel times were reduced by 12 seconds.
- (2) **PM Peak Period** | WBL transit travel times were reduced by 18 seconds.

- *Aside from the improvements in the WBL travel times, there were no reductions in EB transit travel times between 22nd and 19th Streets NW. Additionally, there were no changes for vehicle times.*

Baseline to Option 2, Leading Protected Left findings:

- (1) **AM Peak Period** | WBL transit travel times were reduced by 11 seconds; however, WBT travel times were increased by 36 seconds.
- (2) **PM Peak Period** | WBL transit travel times were reduced by 7 seconds; however, WBT travel times were increased by 9 seconds.

Alternative 3 (Hybrid) | Sensitivity Analysis of 21st Street Reconfiguration (Option 2)

AM Peak Hour (8:30 AM - 9:30 AM) | PM Peak Hour (4:45 PM - 5:45 PM)

AM Peak Period (8:00 AM - 10:00 AM) | PM Peak Period (4:15 PM - 6:15 PM)

AM Analysis Period (7:30 AM - 10:00 AM) | PM Analysis Period (3:45 PM - 6:15 PM)

Option 2, Lagging Protected Left to Option 2, Permissive Left Only findings:

(1) **AM Peak Period** | Eastbound GP travel times were reduced by 7 seconds between 22nd Street NW to 19th Street NW; however, WBL transit travel times were increased by 44 seconds.

(2) **PM Peak Period** | Eastbound GP travel times were reduced by 4 seconds between 22nd Street NW to 19th Street NW; however, WBL transit travel times were increased by 14 seconds.

- Modest improvements to eastbound vehicle travel time were observed in the AM and PM peak periods; however, WBL transit travel times increased by 14 to 44 seconds.

As described above, reconfiguring the 21st Street NW intersection and operating a leading permissive WBL transit phase provides modest improvements to WBL transit travel time. Operating a leading protected WBL transit phase further reduces WBL transit travel time, but increases overall transit travel time between 19th Street NW and 22nd Street NW. Lastly, operating a permissive only WBL transit phase marginally decreases eastbound GP travel time, but greatly increases WBL transit travel time in the AM peak period. Therefore, the recommended configuration is **Option 2, Lagging Protected Left**. However, these results show that the travel time differences are not significant, indicating there can be operational flexibility once the transitway is implemented. Additional considerations for signal design may include equipment upgrades that would allow for conditional service based on transit vehicle detection.

Travel Time | Comparison by Vehicle Type

AM Peak Period (8:00 AM - 10:00 AM)

Passenger Vehicle Travel Time by Scenario					
Segment ID	Route	Baseline	Option 2, Lagging Protected Left	Option 2, Leading Protected Left	Option 2, Permissive Left Only
		(MM:SS)	(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:08	01:07	01:02	01:00
2	19th St NW to 17th St NW (west)	00:48	00:49	00:46	00:45
3	17th St NW (west) to 14th St NW	02:13	02:12	02:12	02:10
4	14th St NW to 11th St NW	02:10	02:07	02:11	02:08
Total	Total Eastbound	06:19	06:15	06:11	06:03
5	11th St NW to 14th St NW	01:34	01:34	01:34	01:33
6	14th St NW to 17th St NW (west)	02:07	02:07	02:07	02:08
7	17th St NW (west) to 19th NW	00:59	00:58	00:59	00:59
8	19th St NW to 22nd St NW	01:34	01:35	01:29	01:41
Total	Total Westbound	06:14	06:14	06:09	06:21

Heavy Goods Vehicle (HGV) Travel Time by Scenario					
Segment ID	Route	Baseline	Option 2, Lagging Protected Left	Option 2, Leading Protected Left	Option 2, Permissive Left Only
		(MM:SS)	(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:08	01:07	01:03	01:01
2	19th St NW to 17th St NW (west)	00:50	00:52	00:47	00:46
3	17th St NW (west) to 14th St NW	02:14	02:13	02:14	02:19
4	14th St NW to 11th St NW	02:12	02:06	02:11	02:14
Total	Total Eastbound	06:24	06:18	06:15	06:20
5	11th St NW to 14th St NW	01:36	01:33	01:38	01:32
6	14th St NW to 17th St NW (west)	02:09	02:07	02:10	02:11
7	17th St NW (west) to 19th NW	00:58	00:59	01:00	01:00
8	19th St NW to 22nd St NW	01:38	01:38	01:29	01:42
Total	Total Westbound	06:21	06:17	06:17	06:25

Bus Travel Time by Scenario (Includes Dwell Time)					
Segment ID	Route	Baseline	Option 2, Lagging Protected Left	Option 2, Leading Protected Left	Option 2, Permissive Left Only
		(MM:SS)	(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	02:06	02:07	02:01	01:57
2	19th St NW to 17th St NW (west)	01:20	01:20	01:20	01:20
3	17th St NW (west) to 14th St NW	02:59	02:59	03:00	03:00
4	14th St NW to 11th St NW	02:20	02:19	02:22	02:19
Total	Total Eastbound	08:45	08:45	08:43	08:36
5	11th St NW to 14th St NW	01:57	01:57	01:57	01:57
6	14th St NW to 17th St NW (west)	02:45	02:46	02:45	02:46
7	17th St NW (west) to 19th NW	01:15	01:15	01:15	01:15
8	19th St NW to 22nd St NW	02:18	02:18	02:54	02:12
32	19th St NW to 21st St NW (WBL @ 21st)*	02:12	02:00	01:49	02:44
Total	Total Westbound	08:15	08:16	08:51	08:10

* Travel time segment added for sensitivity analysis to identify the impact to westbound left-turning buses at 21st Street NW. This segment is not included in the total westbound travel time calculation.

Travel Time | Comparison by Vehicle Type

PM Peak Period (4:15 PM - 6:15 PM)

Passenger Vehicle Travel Time by Scenario					
Segment ID	Route	Baseline	Option 2, Lagging Protected Left	Option 2, Leading Protected Left	Option 2, Permissive Left Only
		(MM:SS)	(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:04	01:03	00:59	00:59
2	19th St NW to 17th St NW (west)	01:09	01:13	01:12	01:12
3	17th St NW (west) to 14th St NW	03:35	03:44	03:41	03:44
4	14th St NW to 11th St NW	03:07	03:09	03:06	03:09
Total	Total Eastbound	08:55	09:09	08:58	09:04
5	11th St NW to 14th St NW	01:04	01:04	01:05	01:04
6	14th St NW to 17th St NW (west)	02:02	02:02	02:02	02:01
7	17th St NW (west) to 19th NW	00:48	00:48	00:47	00:47
8	19th St NW to 22nd St NW	03:07	03:09	02:47	03:04
Total	Total Westbound	07:01	07:03	06:41	06:56

Heavy Goods Vehicle (HGV) Travel Time by Scenario					
Segment ID	Route	Baseline	Option 2, Lagging Protected Left	Option 2, Leading Protected Left	Option 2, Permissive Left Only
		(MM:SS)	(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:07	01:06	01:02	01:03
2	19th St NW to 17th St NW (west)	01:12	01:19	01:19	01:17
3	17th St NW (west) to 14th St NW	03:37	03:47	03:45	03:48
4	14th St NW to 11th St NW	03:05	03:10	03:02	03:11
Total	Total Eastbound	09:01	09:22	09:08	09:19
5	11th St NW to 14th St NW	01:06	01:06	01:06	01:06
6	14th St NW to 17th St NW (west)	02:02	02:03	02:02	02:06
7	17th St NW (west) to 19th NW	00:47	00:47	00:47	00:47
8	19th St NW to 22nd St NW	03:08	03:11	02:48	03:04
Total	Total Westbound	07:03	07:07	06:43	07:03

Bus Travel Time by Scenario (Includes Dwell Time)					
Segment ID	Route	Baseline	Option 2, Lagging Protected Left	Option 2, Leading Protected Left	Option 2, Permissive Left Only
		(MM:SS)	(MM:SS)	(MM:SS)	(MM:SS)
1	22nd Street NW to 19th St NW	01:47	01:47	01:51	01:55
2	19th St NW to 17th St NW (west)	01:15	01:15	01:15	01:15
3	17th St NW (west) to 14th St NW	03:16	03:16	03:16	03:16
4	14th St NW to 11th St NW	02:34	02:34	02:35	02:33
Total	Total Eastbound	08:52	08:52	08:57	08:59
5	11th St NW to 14th St NW	01:41	01:41	01:41	01:41
6	14th St NW to 17th St NW (west)	03:03	03:03	03:03	03:03
7	17th St NW (west) to 19th NW	01:17	01:17	01:17	01:17
8	19th St NW to 22nd St NW	02:10	02:10	02:19	02:00
32	19th St NW to 21st St NW (WBL @ 21st)*	02:01	01:43	01:36	01:57
Total	Total Westbound	08:11	08:11	08:20	08:01

* Travel time segment added for sensitivity analysis to identify the impact to westbound left-turning buses at 21st Street NW. This segment is not included in the total westbound travel time calculation.

Intersection Delay Comparison

AM Peak Hour (8:30 AM - 9:30 AM)

* Coloring represents estimated intersection level of service (LOS). **Green** represents LOS A-C, **Yellow** represents LOS D, **Orange** represents LOS E, **Red** represents LOS F.

#	Intersection	Approach	Baseline		Option 2, Lagging Protected Left		Option 2, Leading Protected Left		Option 2, Permissive Left Only	
			Average Delay (sec/veh)	Intersection Delay	Average Delay (sec/veh)	Intersection Delay	Average Delay (sec/veh)	Intersection Delay	Average Delay (sec/veh)	Intersection Delay
2	K Street NW and 21st Street NW	NB	-	27.5	-	26.8	-	23.2	-	25.2
		SB	18.3		17.6		21.1		21.9	
		EB	28.0		26.1		21.7		20.2	
		WB	27.8		29.5		23.9		33.3	
		EB Service Lane	42.5		39.4		29.0		33.7	

Intersection Delay Comparison

PM Peak Hour (4:45 PM - 5:45 PM)

* Coloring represents estimated intersection level of service (LOS). **Green** represents LOS A-C, **Yellow** represents LOS D, **Orange** represents LOS E, **Red** represents LOS F.

#	Intersection	Approach	Baseline		Option 2, Lagging Protected Left		Option 2, Leading Protected Left		Option 2, Permissive Left Only	
			Average Delay (sec/veh)	Intersection Delay	Average Delay (sec/veh)	Intersection Delay	Average Delay (sec/veh)	Intersection Delay	Average Delay (sec/veh)	Intersection Delay
2	K Street NW and 21st Street NW	NB	-	45.1	-	46.8	-	41.5	-	49.5
		SB	26.1		23.9		46.3		45.8	
		EB	26.5		25.7		19.6		18.9	
		WB	65.8		70.5		44.8		63.2	
		EB Service Lane	33.6		38.7		31.9		52.7	