Traffic Analysis Technical Memorandum

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To: Kirsten Munz, City of Falls Church

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Project: South Washington Street – Corridor Improvements

Introduction:

The City of Falls Church plans to construct multi-modal improvements along the South Washington Street corridor to promote alternative modes of transportation including public transit, pedestrian and bicycle travel. Improvements proposed include an intermodal transit plaza and associated pedestrian, bicycle and transit-access improvements along South Washington Street from Rosemary Lane to Annandale Road (approximately 0.82 miles). This project is being funded by a $1,668,000 grant from the Federal Transit Administration (FTA) and $417,000 grant from the Northern Virginia Transportation Commission (NVTC). This technical memorandum serves to analyze the proposed improvements along South Washington Street in the City of Falls Church, and discusses the existing conditions, proposed improvements, and impacts to vehicular traffic of the proposed improvements, as well as the resulting benefits to transit, pedestrians, and bicyclists in the corridor.

Figure A: Project Map

Current Conditions along South Washington Street:

South Washington Street is classified by the Virginia Department of Transportation (VDOT) as an "Urban Principal Arterial" and carries approximately 25,000 vehicles per day through the City of Falls Church, as reported by VDOT's 2012 volume estimates. The study corridor extends from Annandale Road in the east to Rosemary Lane in the west and has a posted speed limit of 30 MPH. The corridor includes four signalized intersections located on South Washington Street at Marshall Street, South Washington Street at Hillwood Avenue, South Washington Street at Annandale Road, and Hillwood Avenue at Annandale Road.

Pedestrian volumes crossing South Washington Street and cyclists riding along South Washington Street are shown in Table 1, below. These volumes were collected at the named intersections below at the same time as vehicles counts were obtained, September 22, 2011. In total, there were 41 pedestrians and 11 bicyclists along South Washington Street at some point during the PM peak.

Table 1: South Washington Street Pedestrian and Bike Volumes

Cross Street	Pedestrians Crossing South Washington Street			Cyclists Riding on South Washington Street		
	AM Peak	Mid-Day Peak	PM Peak	AM Peak	Mid-Day Peak	PM Peak
Marshall Street	0	1	9	1	1	5
Greenway Boulevard	1	0	3	0	1	1
South Maple Avenue	5	1	9	0	0	0
Tinner Hill	0	1	2	1	1	1
Hillwood Avenue	0	3	8	2	6	2
Annandale Road	4	11	10	3	0	2

Along South Washington Street, there are unsignalized intersections at the following locations: Rosemary Lane, Jackson Street, Woodlawn Avenue, George Mason Road, Greenway Boulevard, Cameron Road, Summerfield Road, South Maple Avenue, and Tinner Hill. There are also a number of unsignalized access points for commercial driveways. To serve these intersections, there is currently a two-way left turn lane from Greenway Boulevard to South Maple Avenue as well as left turn lanes west of Greenway Boulevard. East of South Maple Avenue, there are no accommodations for turning movements (e.g. dedicated turn lanes) on South Washington Street.

Transit service along South Washington Street is provided by the Washington Metropolitan Area Transit Authority's (WMATA) "2A – Washington Boulevard-Dunn Loring Line". In total, there are thirteen bus stops located approximately every other block in either direction of South Washington Street which provide service to the two nearby Metro Stations (East Falls Church and West Falls Church) as well as other points of interest (i.e. Merrifield and Ballston).

Project Purpose and Proposed Improvements:

The purpose of this project is to support and encourage multi-modal transportation options in the City of Falls Church along South Washington Street by providing enhanced accommodations for transit users, cyclists, and pedestrians. These accommodations include safer pedestrian crossings as a result of modified curb lines and new signalized crossings. Cyclists will see new "sharrow" lanes (marked, combined vehicle and bicycle lanes) and transit users will experience

strategically relocated bus stops. The capstone of the entire project, which will benefit all users, is the intermodal transit plaza where pedestrians, cyclists, and transit users mix. Some of the improvements proposed in this plan fall outside of the City limits in Fairfax County. City staff is committed to coordination with Fairfax County, WMATA, and VDOT and has initiated the first steps to comply with their review requirements for the project.

The following improvements are planned for the corridor:

- Remove the channelized right turn lanes from the South Washington Street at Hillwood Avenue intersection (including the free-right from NB South Washington to EB Hillwood and the channelized right from WB Hillwood to NB South Washington) and modify the traffic signal and geometry as a result of the removals;
- Construct an intermodal transit plaza at the intersection of South Washington Street and Hillwood Avenue utilizing right of way gained from the channelized lane removals;
- Install a new traffic signal on South Washington Street at South Maple Avenue. The traffic signal at South Maple Avenue and South Washington Street will be funded with VDOT Revenue Sharing funds;
- Install high-visibility crosswalk and motorist warning signs at Greenway Boulevard to provide additional pedestrian access across South Washington Street;
- Provide "sharrow" lane markings along both directions of South Washington Street and along Hillwood Avenue;
- Relocate and/or consolidate bus stops and install bus shelters at high ridership locations, in consultation with WMATA; and
- Implement pedestrian safety improvements, including curb bump-outs, crosswalks and pedestrian signals.

Crash Analysis:

In the past 3 years (2010-2012) there were 79 crashes (as shown in Table 2) within the immediate area being affected by this project. Of the 79, thirty percent (30%) were rear end crashes, forty-four percent (44%) were angle crashes, six percent (6%) were head-on crashes, six percent (6%) were sideswipes, five percent (5%) were fixed object crashes, three percent (3%) were pedestrian crashes, one percent (1%) was bicycle crashes, and four percent (4%) were categorized as other. Sixty-two percent (62%) of all crashes resulted in at least one injury (either to a driver, passenger, cyclist, or pedestrian). Thirty-eight percent (38%) of the crashes resulted in property damage only. There were 95 injuries reported (either classified as a pedestrian or a non-pedestrian); of those injuries, 3 were pedestrians.

Year	Type of Crash								Injuries		Severity			Total
	Rear End	Angle	Head-On	Sideswipe	Fixed Object	Pedestrian	Bicyclist	Other	Pedestrian Injuries	Non-Pedestrian Injuries	Injury Crash	Property Damage Crash	Pedestrian Injury Crash	
2010	9	9	1	0	2	0	0	2	0	25	15	8	0	**23**
2011	5	15	3	3	1	2	0	1	3	28	13	15	2	**30**
2012	10	11	1	2	1	0	1	0	0	39	19	7	0	**26**
Total	24	35	5	5	4	2	1	3	3	92	47	30	2	**79**
Percentage	**30%**	**44%**	**6%**	**6%**	**5%**	**3%**	**1%**	**4%**	**3%**	**97%**	**59%**	**38%**	**3%**	

Table 2: Crash Data Table

There were eleven (11) crashes in the vicinity of the Tinner Hill/South Washington Street intersection (see Figure 2). Five (5) of those eleven (11) were angle crashes and the remaining six (6) were rear end crashes. Near the South Maple Avenue/South Washington Street intersection there were five (5) crashes during the study period (see Figure 2). Of those five (5), three (3) were angle crashes and two (2) were rear ends. Near the Greenway Boulevard/South Washington Street intersection there was one (1) rear end crash during the study period (see Figure 2). The two pedestrian crashes occurred at either end of the project limits; one at the intersection of Annandale Road and South Washington Street and the other at the intersection of Rosemary Lane and South Washington Street. The bicycle crash occurred at the intersection of Hillwood Avenue and Annandale Road.

With the proposed improvements, crashes may be reduced for all modes of transportation. For vehicles, angle crashes can be mitigated through the installation of traffic signals. As mentioned above, the location where a signal is proposed experienced 3 angle crashes during the most recent three-year period. With the addition of a traffic signal, the typically more severe angle crashes may be mitigated. However, it is noted that a traffic signal may increase the incidence of rear end crashes. Also, bicyclist crashes that occurred in the study area may be reduced through the addition of “sharrow” lane markings which provide more notice to motorists to be aware of bicyclists. As a result, the proposed improvements may improve the safety of the corridor and reduce crashes.

Figure 2: South Washington Street Crash History

Traffic Operations Analysis:

Traffic analyses have been conducted for the 2011 Existing conditions, 2015 "No-Build" conditions, 2035 "No-Build" conditions, 2015 "Build" conditions, and the 2035 "Build" conditions to identify current performance and anticipate the impacts that the proposed improvements will have on vehicular traffic operations along the corridor. Results of these analyses are presented in Appendices A and B, with A containing Synchro results and B containing SimTraffic results. It is understood that VDOT has particular interest in the vehicular traffic impacts northbound and southbound along the South Washington Street corridor, due to its status as a National Highway System (NHS) designated travel way. As a result, particular attention has been paid to the impacts of these improvements on vehicular traffic traveling along South Washington Street.

2011 Existing Conditions:

The Existing conditions along South Washington Street indicate a corridor dominated by vehicular traffic with few accommodations for other modes of transportation. The only crosswalks along the corridor are located at Marshall Street and at Hillwood Avenue, which are over 3,000 feet apart. This results in unsignalized pedestrian crossing activity. For example, during the PM peak there were 10 observed pedestrians crossing South Washington Street at South Maple Avenue. As a result, pedestrians crossing the street are regularly exposed to risk when motorists fail to yield to pedestrians. However, vehicular traffic through the corridor is well served along the corridor; all intersections perform at levels of service "C" or better. Similarly, arterial speeds through the corridor average 27.0 MPH NB and 32.2 MPH SB.

There is an existing channelized free-right turn movement along South Washington Street NB to Hillwood Avenue EB. This creates a pedestrian unfriendly environment at this intersection and was recommended for removal in a 2008 Corridor Study of South Washington Street.

From an access standpoint, the corridor includes commercial driveways and unsignalized residential streets (upwards of 30 and 15, respectively, within the 0.82 mile corridor). To serve these points, there is a two-way left turn lane between South Maple Avenue and Greenway Boulevard and west of Greenway Boulevard there are dedicated left-turn lanes. East of South Maple Avenue, there are no dedicated left turn lanes. At unsignalized intersections along South Washington Street, side streets experience delays (e.g. 31.2 seconds of delay for South Maple Avenue during the PM Peak) and queuing (e.g. SimTraffic results indicate that South Maple Avenue experiences an average queue of 398 feet during the PM peak). The existing conditions along South Washington Street are geared toward providing vehicular accommodations with distantly spaced pedestrian crossings and few accommodations for bicyclists.

2015 "No-Build" Conditions:

Vehicular traffic is projected to grow at 1% annually as determined using the Metropolitan Washington Council of Governments (MWCOG) traffic forecasting model. This growth rate is consistent with the other studies conducted in the surrounding area. Given this rate, vehicular traffic is projected to grow 4% by 2015. "No-Build" conditions include the installation of a traffic signal at the intersection of Tinner Hill and South Washington Street which is proposed by a private developer who is redeveloping the adjacent site (The Reserve at Tinner Hill).

Operationally, "No-Build" arterial speeds, as reported by SimTraffic, are anticipated to decrease by 0.4 MPH for NB traffic and 2.7 MPH for SB traffic, as shown in Table 3. Synchro results indicate that the intersection levels of service are anticipated to remain largely the same (all level of service "C" or better). However, side street delays are expected to

increase. For example, the South Maple Avenue approach to South Washington Street is expected to increase by 5.1 seconds (31.2 seconds in 2011 to 36.3 in 2015). Queuing is expected to increase as well. The average queue along South Maple Avenue approaching South Washington Street, as reported by SimTraffic, was 398 feet in the existing condition. In the 2015 "No-Build" condition the average queue is expected to grow to 514 feet. A queue of this length can cause large delays and cause blocking issues at driveways and parking lots along South Maple Avenue.

2035 "No-Build" Conditions:

The 2035 "No-Build" conditions were created by again applying a 1% growth rate, resulting in an additional 20% growth over 2015. The "No-Build" condition includes the developer-installed traffic signal at the intersection of Tinner Hill and South Washington Street.

Operationally, arterial speeds, as reported by SimTraffic, are anticipated to decrease by 8.1 MPH for NB traffic and 3.5 MPH for SB traffic (as compared to the 2015 "No-Build" model). This results in NB travel speeds of 19.3 MPH and SB travel speeds of 26.0 MPH, as shown in Table 3. Synchro results indicate that the intersection levels of service are anticipated to degrade with the worst levels of service being "E" at the intersection of Hillwood Avenue and Annandale Road during the PM peak and "D" at the intersection of Marshall Avenue and South Washington Street during the AM peak. Side street delays at unsignalized intersections are anticipated to increase. For example, the delay for the South Maple Avenue approach to South Washington Street is expected to increase from 36.3 seconds in the 2015 "No-Build" conditions to 61.5 seconds in the 2035 "No-Build" conditions. In 2015 "No-Build" an average queue of 512 feet was anticipated for South Maple Avenue approaching South Washington Street. In 2035 "No-Build" this queue is expected to increase, to 587 feet.

	NB South Washington St Arterial Speeds					SB South Washington St Arterial Speeds				
	2011 Existing Condition	**2015 "No-Build" Condition**	**2015 "Build" Condition**	**2035 "No-Build" Condition**	**2035 "Build" Condition**	**2011 Existing Condition**	**2015 "No-Build" Condition**	**2015 "Build" Condition**	**2035 "No-Build" Condition**	**2035 "Build" Condition**
AM	23.7	22.8	22.7	10.8	19.4	31.9	24.4	25.3	24.1	23.2
Mid-Day	31.1	30.7	25.8	28.9	25.6	33.9	33.2	25.7	31.8	24.6
PM	26.3	28.7	22.8	18.2	17.6	30.9	31.0	21.7	22.1	17.1
Average	**27.0**	**27.4**	**23.8**	**19.3**	**20.9**	**32.2**	**29.5**	**24.2**	**26.0**	**21.6**

Table 3: South Washington Street Arterial Speeds

2015 "Build" Conditions:

Using the 2015 "No-Build" volumes as the baseline, proposed improvements were modeled using Synchro. These improvements include the removal of both channelized right turns at Hillwood Avenue and the installation of a new traffic signal at South Maple Avenue.

At the intersection of South Washington Street and Hillwood Avenue the two channelized right turns are proposed to be removed. These lanes are located along the South Washington Street NB approach and the Hillwood Avenue WB approach. The South Washington Street NB is currently a free-right turn movement and permits high speed turning movements from South Washington Street NB to Hillwood Avenue EB. Removing this channelized lane will decrease

turning speed which is expected to improve pedestrian safety and access at this intersection. The removal of this free right is an improvement which has been previously recommended in the 2008 Corridor Study of South Washington Street, citing that it forces pedestrians to make a difficult crossing across a free-flow ramp. In order to accommodate the capstone of this project, the intermodal transit plaza, the space occupied by these channelized turns will be reallocated. Operationally, the travel time during the AM peak from South Maple Avenue to Hillwood Avenue is anticipated to increase from 44 seconds in the 2015 "No-Build" scenario to 47.9 seconds in the 2015 "Build" scenario. At the intersection, the South Washington Street NB approach to Hillwood Avenue EB is expected to experience an increase in delay from 8.2 seconds (with the free right-turn movement) to 13.0 seconds. The average queue along NB South Washington Street at Hillwood Avenue during the AM peak is expected to increase from 107 feet in "No-Build" conditions to 143 feet in "Build" conditions.

A new traffic signal is proposed to be installed at the intersection of South Maple Avenue and South Washington Street. This signal will benefit pedestrians and side street traffic. Pedestrian access and connectivity is improved across South Washington Street with the signalized crossing. Side street operational benefits are best shown in terms of queuing: the average queue along South Maple Avenue in 2015 is expected to decrease from 514 feet to 106 feet during the PM peak period. This expected decrease in queuing presents a lower possibility of traffic blocking driveways or parking lots along South Maple Avenue. With the new South Maple Avenue traffic signal, SB traffic on South Washington Street is expected to experience an additional 22.1 seconds of delay during the PM peak period. SB queuing is not anticipated to cause any intersection blocking issues upstream of the signal, with the average queue anticipated to be 297 feet and maximum queue anticipated to be 542 feet during the PM peak. NB Traffic is anticipated to experience 14.6 seconds of delay during the PM peak period. The average queue is expected to be 146 feet and maximum queue is anticipated to be 257 feet, neither of which presents an intersection blocking issue upstream of the signal, during the PM peak.

Corridor-wide, overall intersection levels of service are anticipated remain at levels of service "C" or better (same as 2015 "No-Build" condition). Corridor-wide arterial speeds are anticipated to be 23.8 MPH for NB traffic and 24.2 MPH for SB traffic, a decrease of 13% NB and 10% decrease in SB.

2035 "Build" Conditions:
Using the 2015 "Build" condition as a baseline, the volumes in this condition were grown at 1% annually to model 2035 conditions.

Comparing 2035 "No-Build" conditions to the 2035 "Build" conditions, the removal of the free-right at the intersection of Hillwood Avenue and South Washington Street is anticipated to cause 27.5 seconds of delay for NB traffic under "Build" conditions (as compared to 9.2 seconds, under "No-Build" conditions). The average queue along NB South Washington Street at Hillwood Avenue during the AM peak is expected to increase from 93 feet in "No-Build" conditions to 163 feet in "Build" conditions. Safety and access for pedestrians, as described above under **2015 "Build" Conditions**, is expected to improve with the proposed improvements at the Hillwood Avenue and South Washington Street intersection.

The proposed signal at South Maple Avenue is expected to have beneficial impacts to the side street traffic and pedestrians. The benefits to South Maple Avenue are best measured in terms of queuing: the average queue along South Maple Avenue in 2035 is expected to decrease significantly from 586 feet to 271 feet during the PM peak period.

As in the 2015 "Build" conditions, this expected decrease in queuing presents a lower possibility of traffic blocking driveways or parking lots along South Maple Avenue. South Washington Street SB traffic is expected to experience 25.5 seconds of delay at South Maple Avenue. This additional delay is not expected to cause queuing issues upstream of South Maple Avenue, with the maximum SB queue during the PM peak is expected to be 547 feet with an average queue of 345 feet. South Washington Street NB traffic is anticipated to experience 22.6 seconds of delay at South Maple Avenue during the PM peak period. South Washington Street NB queuing is not anticipated to cause queuing issues upstream of South Maple Avenue, with an average queue of 208 feet and a maximum queue of 284 feet, during the AM peak.

Corridor-wide, overall intersection levels of service are anticipated to remain at levels of service "E" or better (same as 2035 "No-Build" condition). Arterial speeds are anticipated to be approximately 20.9 MPH for NB traffic and 21.6 MPH for SB traffic, an increase of 8% NB and a decrease of 17% SB, respectively, as compared to 2035 "No-Build" conditions.

Signal Warrants Summary:

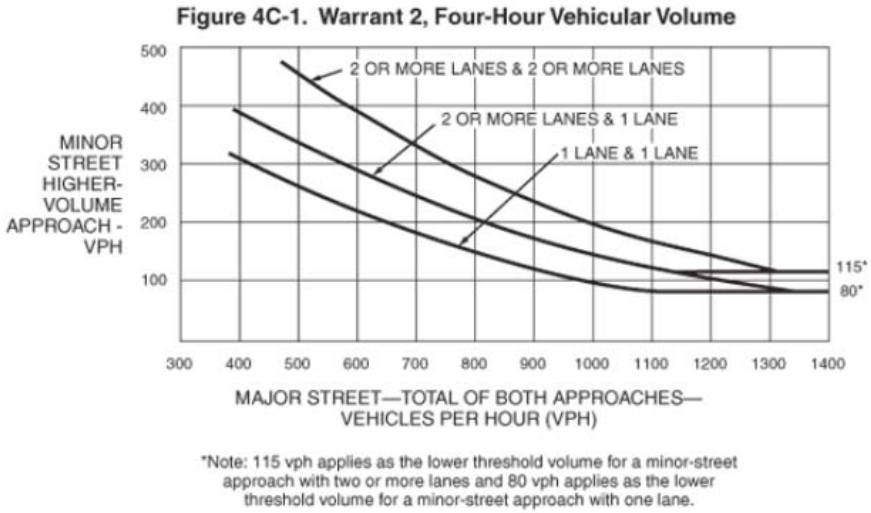
Signal warrants have been studied at South Maple Avenue and Greenway Boulevard to determine if a signal is appropriate based on operational and safety conditions.

South Washington Street at South Maple Avenue: Based on the turning movement count (TMC) conducted at this intersection on September 22, 2011 this signal is warranted. Refer to Appendix C for Warrant Analyses. The vehicular volume at this intersection (shown in Table C-1 of Appendix C) exceeds the volume thresholds in Condition B of Table 4C-1 of the 2009 MUTCD (shown below). For this intersection the volumes thresholds are 900 vehicles/hour on the major street, and 75 vehicles/hour on the higher volume minor street.

Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume

Condition A—Minimum Vehicular Volume									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	56%[d]	100%[a]	80%[b]	70%[c]	56%[d]
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112
Condition B—Interruption of Continuous Traffic									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	56%[d]	100%[a]	80%[b]	70%[c]	56%[d]
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

The South Washington Street at South Maple Avenue intersection exceeds these volumes for 10 hours of the observed day; therefore the signal meets the conditions of Warrant 1, Eight-Hour Vehicular Volume. This signal also exceeds the conditions of Warrant 2, Four-Hour Vehicular Volume as displayed on Table 4C-1 (shown left). As evidenced by the TMC shown in Table C-1 of Appendix C, the volumes observed exceed the volumes specified by Table 4C-1 for 11 of the 12 hours counted. The signal does meet condition B of Warrant 3, Peak Hour as well. The intersection does not meet any of the other five warrants. The intersection nearly meets Warrant 7, Crash experience however, only three of the requisite five crashes susceptible to correction by a traffic signal were reported.



Based on the first three warrants, Eight-Hour, Four-Hour Vehicular Volume, and Peak Hour Volume, outlined by the MUTCD, a signal is warranted at this location.

South Washington Street at Greenway Boulevard: Based on the TMC (provided in Table C-2 of Appendix C) at this intersection, crash analysis, and location study, a signal is not warranted at this location based on any of the 8 warrants laid out in the MUTCD. To reduce the distance between marked crosswalks along South Washington Street (1,500 feet between Marshall Street and South Washington Street), the City is proposing to install unsignalized, marked crosswalks with associated warning signs for motorists. Inclusion of crosswalks at Greenway Boulevard supports the City's goal of improving pedestrian safety and connectivity along the corridor.

In the future the City expects that pedestrian volume along this corridor will increase as a result of new developments along South Washington Street. With increased pedestrian activity along this corridor the City anticipates revisiting this area to consider signalized pedestrian treatments whether that be a full traffic signal or a high-intensity activated crosswalk (HAWK) beacon as countermeasures to improve pedestrian safety.

Access Management: Signal Spacing

Appendix F of the VDOT Road Design Manual states that for a Principal Arterial with a speed limit of 30 MPH the minimum spacing between signalized intersections is 1,050 feet. The proposed South Maple Avenue at South Washington Street signal will violate that spacing requirement as the signal will be approximately 800 feet from the developer-proposed signal at Tinner Hill. Similarly, the modified signal at Hillwood Avenue will be approximately 500 feet north of the signal at Tinner Hill, and approximately 600 feet south of the signal at Annandale Road. Although minimum spacing is not met, the following discussion illustrates that impacts of these improvements are not anticipated to create unacceptable delays or queues along South Washington Street.

South Washington Street at Maple Avenue

Synchro and SimTraffic analyses indicate that the installation of this signal will not adversely affect vehicular traffic travelling along South Washington Street, as shown in Table 4, below. SB South Washington Street is expected to experience the greatest delays, 25.5 seconds, during the PM Peak of the 2035 "Build" conditions. The max queue during the PM peak under the 2035 "Build" conditions is expected to be 547 feet, leaving more than 250 feet between the back of queue and the signal at Tinner Hill. Furthermore, the average queue along South Maple Avenue is expected to improve, decreasing from 586 feet in the 2035 "No-Build" conditions to 271 feet in the 2035 "Build" conditions.

South Washington Street is not anticipated to significantly deteriorate in terms of arterial speed or mainline levels of service as a result of this signal. Arterial Speeds, as reported by SimTraffic, approaching this intersection were simulated to be 20.2 MPH for NB and 26.6 MPH for SB in the 2035 "No-Build" conditions. With the addition of the signal at South Maple Avenue (and all other improvements) the arterial speed is simulated to be 17.9 MPH for NB traffic and 22.5 MPH for SB traffic.

		2011 Existing			2015 "No-Build"			2015 "Build"			2035 "No-Build"			2035 "Build"		
		AM	Mid-Day	PM	AM	Mid-Day	PM	AM	Mid-Day	PM	AM	Mid-Day	PM	AM	Mid-Day	PM
South Washington Street at South Maple Avenue	S. Wash. St. NB	A	A	C	C	B	A	B	B	B	D	B	D	B	B	C
	S. Wash. St. SB	A	A	A	A	A	A	C	C	C	A	A	A	C	C	C
	Cavalier Tr WB	F	C	F	F	C	F	B	B	B	F	F	F	B	B	B
	S. Maple Ave EB	C	C	D	C	C	D	A	A	C	F	C	F	A	A	F

Table 4: Levels of Service at South Maple Avenue
(Note: Overall intersection LOS not shown as it is not applicable to two-way stop controlled intersections, such as the "No-Build" or Existing Conditions. S. Wash St. NB/SB LOS represents left turn LOS in two-way stop controlled scenarios)

Evidenced by the above Synchro results, South Maple Avenue overall operations are anticipated to improve as a result of a new traffic signal. Furthermore, South Washington Street NB/SB traffic is not anticipated to experience unacceptable levels of service during the 2015 or 2035 "Build" conditions.

South Washington Street at Hillwood Avenue

Synchro and SimTraffic analyses indicate that the modification of this signal will not adversely affect vehicular traffic travelling along South Washington Street, as shown in Table 5, below. The greatest delays are expected to occur for the Hillwood Avenue approach during the AM peak. During this period, a delay of 53.5 seconds with a LOS "D" is expected. Similarly, the average and maximum queues are anticipated to be 130 feet and 341 feet, respectively.

South Washington Street traffic is not anticipated to deteriorate in terms of mainline levels of service as a result of this signal. With the modification to the signal at Hillwood Avenue levels of service are anticipated to remain largely the same. Under 2035 "No-Build" conditions, the average queue is anticipated to be 54 feet and 192 feet for NB and SB South Washington Street traffic, respectively. Under 2035 "Build" conditions, the average queue is anticipated to be 318 feet and 106 feet for NB and SB South Washington Street traffic, respectively. While the NB queue is expected to increase, it is not anticipated to block of the intersection upstream (Tinner Hill).

		2011 Existing			2015 "No-Build"			2015 "Build"			2035 "No-Build"			2035 "Build"		
		AM	Mid-Day	PM	AM	Mid-Day	PM	AM	Mid-Day	PM	AM	Mid-Day	PM	AM	Mid-Day	PM
South Washington Street at Hillwood Ave	S. Wash. St. NB	A	A	A	A	A	A	B	A	B	A	A	A	C	A	C
	S. Wash. St. SB	A	A	A	A	A	A	B	B	C	A	A	A	A	B	B
	Hillwood Ave WB	D	D	C	D	D	C	C	C	C	C	C	C	D	C	C
	Overall	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**C**	**B**	**B**	**B**	**C**	**B**	**C**

Table 5: Levels of Service at Hillwood Avenue

Evidenced by the above Synchro results and discussion, the modification to the signal at South Washington Street and Hillwood Avenue is not expected to cause any issues from a corridor-wide or signal spacing standpoint. South Washington Street NB and SB traffic is still expected to operate at acceptable levels of service and queuing is not expected to cause adjacent intersection blocking or poor operations.

Conclusion:

The goal of this project is to improve multi-modal transportation options along the South Washington Street corridor in the City of Falls Church. The addition of a new traffic signal at South Maple Avenue is anticipated to improve accessibility and safety for pedestrians and operations for side streets. With the additional signal and marked crosswalks average space between pedestrian crossings is cut from 3,300 feet down to 850 feet. The removal of channelized right turn lanes at the intersection of South Washington Street and Hillwood Avenue is not anticipated to have significant adverse impacts on NB traffic as reported by Synchro and SimTraffic. This project aims to create a reasonable balance between safety, for both vehicles and pedestrians, and vehicular flow. The proposed improvements help to redefine the corridor from a vehicle-dominated landscape with little accommodation for pedestrians or bicyclists into a multi-modal corridor for all users. Finally, as shown in the analysis, the proposed improvements achieve this balance without significantly disrupting vehicular flow through the corridor.

Appendix A: Synchro Results

Summary of Data Collection and Assumptions:

The City's consultant team of RK&K performed traffic analysis of the corridor for both existing conditions and future "No Build" and "Build" conditions. The future analysis reflects an anticipated 2015 opening year and a 2035 design year. The "Build" scenario models all of the proposed improvements including the removal of the channelized right turn and the installation of new traffic signals.

The RK&K team collected turning movement counts at the following locations on September 22, 2011 from 7:00AM to 7:00PM.:

- South Washington Street at Marshall Street (signalized)
- South Washington Street at Greenway Boulevard
- South Washington Street at Maple Avenue
- South Washington Street at Tinner Hill
- South Washington Street at Hillwood Avenue (signalized)
- South Washington Street at Annandale Road (signalized)
- Hillwood Avenue at Annandale Road

The system-wide peak hours were determined as follows:

- AM peak hour: 7:45 – 8:45 AM
- MD peak hour: 12:15 – 1:15 PM
- PM peak hour: 5:00 – 6:00 PM

The volumes along South Washington Street were balanced for the system-wide peak hours and placed into Synchro for analysis. Travel times were collected along the corridor as well to calibrate the models.

Table A-1 - Year 2011 Intersection Capacity Analysis: Synchro 8.0 was used to conduct capacity analyses at each of the key study intersections. Existing Synchro files, containing up-to-date signal timing information were provided by the City. These files were modified to include all study intersections. Table A-1 summarizes the existing year 2011 Synchro results. Measures of effectiveness including delay and level of service (LOS) reported from Synchro. As shown in Table A-1, all intersections perform at a level of service C or better.

Table A-2 – 2015 "No Build" Intersection Capacity Analysis: An assumed annual average growth rate of 1% was applied to the 2011 peak hour volumes to grow the volumes to the year 2015, which represents the build year for this analysis. A growth rate of 1 percent per year is consistent with other studies which have recently been completed in this area. The results of the Year 2015 Synchro analysis for the "No Build" conditions are presented in Table A-2. Based on the results, all the intersections perform at level of service C or better.

Table A-3 – 2035 "No Build" Intersection Capacity Analysis: An assumed annual average growth rate of 1% was applied to the 2011 peak hour volumes to grow the volumes to the year 2035, which represents the design year for this analysis. A growth rate of 1 percent per year is consistent with other studies which have recently been completed in this area. The results of the Year 2035 Synchro analysis for the "No Build" conditions are presented in Table A-3. Based on the results, all the intersections perform at level of service LOS E or better.

Table A-4 – 2015 "Build" Intersection Capacity Analysis: The 2015 "No Build" Synchro models were updated to reflect the proposed improvements identified above. The results of the Synchro analyses for the 2015 "Build" conditions are summarized in Table A-4. The results presented in this table indicate that all intersections would operate at level of service C or better with the proposed improvements in place. All cycle lengths, splits, and offsets have been optimized to achieve the best performance of the model within the context of the larger signal network.

Table A-5 – 2035 "Build" Intersection Capacity Analysis: The 2035 "No Build" Synchro models were updated to reflect the proposed improvements identified above. The results of the Synchro analyses for the 2035 "Build" conditions are summarized in Table A-5. The results presented in this table indicate that all intersections would operate at level of service E or better with the proposed improvements in place. All cycle lengths, splits, and offsets have been optimized to achieve the best performance of the model within the context of the larger signal network.

Table A-1: 2011 Existing Conditions Analysis - Synchro Results								
Intersection	**Approach**		**Synchro Results**					
			AM		**Mid-Day**		**PM**	
			Delay	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
Marshall St at South Washington St	S. Wash. St	NB	19.5	B	8.3	A	11.1	B
	S. Wash. St	SB	13.1	B	8.4	A	15.6	B
	Marshall St	WB	40.5	D	23.0	C	28.6	C
	Marshall St	EB	48.3	D	35.5	D	40.1	D
		Overall	**19.1**	**B**	**9.3**	**A**	**15.0**	**B**
Maple Ave at South Washington St*	S. Wash. St	NB-LT	3.1	A	1.6	A	16.6	C
	S. Wash. St	SB-LT	0.1	A	0.4	A	0.9	A
	Cavalier Tr	WB	500+	F	21.3	C	500+	F
	S. Maple Ave	EB	21.1	C	15.4	C	31.2	D
		Overall	-	-	-	-	-	-
Tinner Hill at South Washington St*	S. Wash. St	NB-LT	0.4	A	0.0	A	1.3	A
	S. Wash. St	SB-LT	0.1	A	0.1	A	0.3	A
	Tinner Hill	WB	92.5	F	24.5	C	50.6	F
	Tinner Hill	EB	59.6	F	31.2	D	51.6	F
		Overall	-	-	-	-	-	-
Hillwood Ave at South Washington St	S. Wash. St	NB	7.6	A	5.1	A	9.3	A
	S. Wash. St	SB	2.0	A	2.2	A	5.8	A
	Hillwood Ave	WB	35.9	D	36.8	D	32.9	C
		Overall	**11.9**	**B**	**10.9**	**B**	**14.8**	**B**
Annandale Rd at South Washington St	S. Wash. St	NB	12.8	B	11.0	B	12.9	B
	S. Wash. St	SB	12.3	B	9.9	A	14.5	B
	Annandale Rd	WB	29.9	C	33	C	20.9	C
	Annandale Rd	EB	32.2	C	21.1	C	38.5	D
		Overall	**18.8**	**B**	**15.6**	**B**	**19.5**	**B**
Hillwood Ave at Annandale Rd	Hillwood Ave	NB	33.4	C	17.9	B	31.4	C
	Hillwood Ave	SB	19.2	C	14.2	B	23.1	C
	Annandale Rd	WB	23.5	C	34.5	C	28.0	C
	Annandale Rd	EB	33.3	C	37.9	D	38.1	D
		Overall	**28.3**	**C**	**26.8**	**C**	**30.5**	**C**

*Denotes unsignalized intersection.

Table A-2: 2015 "No Build" Analysis - Synchro Results								
Intersection	**Approach**		**Synchro Results**					
			AM		**Mid-Day**		**PM**	
			Delay	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
Marshall St at South Washington St	S. Wash. St	NB	21.7	C	8.5	A	11.5	B
	S. Wash. St	SB	13.8	B	8.6	A	16.9	B
	Marshall St	WB	41.0	D	22.7	C	29.0	C
	Marshall St	EB	48.9	D	35.7	D	40.7	D
		Overall	**20.6**	**C**	**9.4**	**A**	**16.0**	**B**
Maple Ave at South Washington St*	S. Wash. St	NB-LT	18.2	C	11.1	B	17.8	A
	S. Wash. St	SB-LT	0.2	A	0.4	A	1.1	A
	Cavalier Tr	WB	500+	F	22.9	C	500+	F
	S. Maple Ave	EB	23.5	C	15.6	C	36.3	D
		Overall	**-**	**-**	**-**	**-**	**-**	**-**
Tinner Hill at South Washington St^	S. Wash. St	NB	1.9	A	1.6	A	2.2	A
	S. Wash. St	SB	0.9	A	1.1	A	1.5	A
	Tinner Hill	WB	30.6	C	31.6	C	24.8	C
	Tinner Hill	EB	29.5	C	36.4	D	24.8	C
		Overall	**1.9**	**A**	**2.2**	**A**	**2.3**	**A**
Hillwood Ave at South Washington St	S. Wash. St	NB	6.8	A	4.3	A	8.2	A
	S. Wash. St	SB	1.5	A	2.2	A	3.2	A
	Hillwood Ave	WB	33.4	D	38.3	D	31.1	C
		Overall	**10.8**	**B**	**11.0**	**B**	**12.8**	**B**
Annandale Rd at South Washington St	S. Wash. St	NB	12.1	B	9.3	A	11.2	B
	S. Wash. St	SB	12.9	B	10.1	B	16.4	B
	Annandale Rd	WB	45.0	D	30.9	C	37.9	D
	Annandale Rd	EB	32.3	C	33.4	C	41.7	D
		Overall	**22.3**	**C**	**17.3**	**B**	**23.1**	**C**
Hillwood Ave at Annandale Rd	Hillwood Ave	NB	27.6	C	16.9	B	27.0	C
	Hillwood Ave	SB	17.2	B	14.4	B	22.0	C
	Annandale Rd	WB	38.2	D	35.7	D	33.2	C
	Annandale Rd	EB	20.2	C	25.5	C	64.3	E
		Overall	**27.3**	**C**	**23.6**	**C**	**38.2**	**D**

*Denotes unsignalized intersection.
^ Tinner Hill Signal is planned for construction by private developer

Table A-3: 2035 "No Build" Analysis - Synchro Results								
			Synchro Results					
			AM		Mid-Day		PM	
Intersection	**Approach**		**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
Marshall St at South Washington St	S. Wash. St	NB	58.3	E	9.6	A	14.3	B
	S. Wash. St	SB	18.3	B	9.7	A	32.2	C
	Marshall St	WB	44.4	D	22.5	C	32.2	C
	Marshall St	EB	54.5	D	36.4	D	44.7	D
		Overall	**42.0**	**D**	**10.5**	**B**	**25.6**	**C**
Maple Ave at South Washington St*	S. Wash. St	NB-LT	34.4	D	12.6	B	29.6	D
	S. Wash. St	SB-LT	0.4	A	0.6	A	2.1	A
	Cavalier Tr	WB	500+	F	62.5	F	500+	F
	S. Maple Ave	EB	500+	F	18.2	C	61.5	F
		Overall	**-**	**-**	**-**	**-**	**-**	**-**
Tinner Hill at South Washington St^	S. Wash. St	NB	3.4	A	1.8	A	3.7	A
	S. Wash. St	SB	1.3	A	1.3	A	2.6	A
	Tinner Hill	WB	29.3	C	31.0	C	27.5	C
	Tinner Hill	EB	29.5	C	37.2	D	24.9	C
		Overall	**2.9**	**A**	**2.5**	**A**	**3.6**	**A**
Hillwood Ave at South Washington St	S. Wash. St	NB	8.3	A	5.4	A	9.2	A
	S. Wash. St	SB	1.9	A	2.7	A	3.7	A
	Hillwood Ave	WB	30.4	C	34.6	C	25.2	C
		Overall	**10.9**	**B**	**10.8**	**B**	**11.5**	**B**
Annandale Rd at South Washington St	S. Wash. St	NB	15.9	B	10.3	B	12.3	B
	S. Wash. St	SB	18.9	B	12.2	B	35.9	D
	Annandale Rd	WB	54.4	D	39.8	D	44.3	D
	Annandale Rd	EB	33.0	C	35.1	D	61.1	E
		Overall	**27.8**	**C**	**20.5**	**C**	**36.4**	**C**
Hillwood Ave at Annandale Rd	Hillwood Ave	NB	41.9	D	20.6	C	41.2	D
	Hillwood Ave	SB	19.6	B	17.0	B	39.6	D
	Annandale Rd	WB	51.0	D	35.5	D	39.6	D
	Annandale Rd	EB	31.9	C	25.3	C	64.3	E
		Overall	**37.9**	**D**	**24.9**	**C**	**47.5**	**D**

*Denotes unsignalized intersection.
^ Tinner Hill Signal is planned for construction by private developer

Table A-4: 2015 "Build" Analysis (With Proposed Improvements) - Synchro Results								
			Synchro Results					
			AM		Mid-Day		PM	
Intersection	**Approach**		**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
Marshall St at South Wash. St	S. Wash. St	NB	19.5	B	8.6	A	10.8	B
	S. Wash. St	SB	12.7	B	8.7	A	15.6	B
	Marshall St	WB	42.3	D	22.3	C	29.7	C
	Marshall St	EB	50.3	D	35.2	D	41.8	D
		Overall	**19.2**	**B**	**9.5**	**A**	**15.0**	**B**
Maple Ave at South Wash. St*	S. Wash. St	NB	17.7	B	16.7	B	14.6	B
	S. Wash. St	SB	24.5	C	21.4	C	23.2	C
	Cavalier Tr	WB	17.8	B	13.6	B	13.3	B
	S. Maple Ave	EB	8.1	A	4.9	A	28.9	C
		Overall	**19.7**	**B**	**17.7**	**B**	**20.1**	**C**
Tinner Hill at South Wash. St*	S. Wash. St	NB	1.1	A	0.4	A	1.6	A
	S. Wash. St	SB	1.0	A	1.7	A	2.0	A
	Tinner Hill	WB	30.6	C	31.6	C	24.8	C
	Tinner Hill	EB	29.5	C	36.4	D	24.8	C
		Overall	**1.4**	**A**	**2.0**	**A**	**2.3**	**A**
Hillwood Ave at South Wash. St	S. Wash. St	NB	10.8	B	2.4	A	13.0	B
	S. Wash. St	SB	11.2	B	11.2	B	27.4	C
	Hillwood Ave	WB	42.8	C	30.4	C	33.9	C
		Overall	**16.6**	**B**	**11.1**	**B**	**23.3**	**C**
Annandale Rd at South Wash. St	S. Wash. St	NB	9.2	C	9.6	A	19.6	B
	S. Wash. St	SB	12.7	B	9.9	A	13.5	B
	Annandale Rd	WB	13.1	B	18.9	B	17.5	B
	Annandale Rd	EB	32.0	C	33.5	C	40.7	D
		Overall	**14.0**	**B**	**14.8**	**B**	**20.6**	**C**
Hillwood Ave at Annandale Rd	Hillwood Ave	NB	16.7	D	8.5	A	16.0	B
	Hillwood Ave	SB	20.7	B	15.1	B	23.6	C
	Annandale Rd	WB	40.1	D	35.5	D	34.5	C
	Annandale Rd	EB	26.3	C	29.9	C	33.2	C
		Overall	**27.0**	**C**	**23.3**	**C**	**26.9**	**C**

*Denotes newly signalized intersection (currently unsignalized)

Table A-5: 2035 "Build" Analysis (With Proposed Improvements) - Synchro Results								
			Synchro Results					
			AM		Mid-Day		PM	
Intersection	**Approach**		**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
Marshall St at South Wash. St	S. Wash. St	NB	47.5	D	9.6	A	13.2	B
	S. Wash. St	SB	16.7	B	9.7	A	27.0	C
	Marshall St	WB	45.8	D	22.5	C	32.7	C
	Marshall St	EB	56.8	E	36.4	D	45.7	D
		Overall	**35.8**	**D**	**10.5**	**B**	**22.3**	**C**
Maple Ave at South Wash. St*	S. Wash. St	NB	17.9	B	12.9	B	22.6	C
	S. Wash. St	SB	25.5	C	22.9	C	25.5	C
	Cavalier Tr	WB	19.2	B	16.9	B	15.3	B
	S. Maple Ave	EB	9.7	A	6.4	A	83.0	F
		Overall	**20.2**	**C**	**16.7**	**B**	**29.6**	**C**
Tinner Hill at South Wash. St*	S. Wash. St	NB	1.9	A	1.0	A	3.9	A
	S. Wash. St	SB	2.0	A	1.8	A	2.8	A
	Tinner Hill	WB	29.3	C	31.0	C	27.5	C
	Tinner Hill	EB	29.5	C	37.2	D	24.9	C
		Overall	**2.3**	**A**	**2.4**	**A**	**3.7**	**A**
Hillwood Ave at South Wash. St	S. Wash. St	NB	29.8	C	5.7	A	27.5	C
	S. Wash. St	SB	9.9	A	13.3	B	18.9	B
	Hillwood Ave	WB	53.5	D	33.5	C	34.9	C
		Overall	**28.2**	**C**	**13.9**	**B**	**26.2**	**C**
Annandale Rd at South Wash. St	S. Wash. St	NB	9.3	A	10.9	B	15.0	B
	S. Wash. St	SB	18.5	B	11.7	B	23.5	C
	Annandale Rd	WB	29.6	C	20.2	C	34.4	C
	Annandale Rd	EB	32.5	C	35.1	D	74.6	E
		Overall	**19.6**	**B**	**16.4**	**B**	**32.7**	**C**
Hillwood Ave at Annandale Rd	Hillwood Ave	NB	16.0	B	9.4	A	60.1	E
	Hillwood Ave	SB	39.5	D	17.3	B	41.1	D
	Annandale Rd	WB	70.3	E	36.1	D	49.9	D
	Annandale Rd	EB	36.0	D	32.7	C	71.7	E
		Overall	**42.6**	**D**	**24.9**	**C**	**56.5**	**E**

*Denotes newly signalized intersection (currently unsignalized)

Appendix B: SimTraffic Results

Table B-1 - Year 2011 SimTraffic Queuing Results: SimTraffic was used to analyze queuing at each intersection during each of the peak hours. Five simulations lasting one hour each were conducted for each peak period. Average and maximum queues are reported in table B-1.

Table B-2 - Year 2015 "No Build" SimTraffic Queuing Results: SimTraffic was used to analyze queuing at each intersection during each of the peak hours. Five simulations lasting one hour each were conducted for each peak period. An annual growth rate of 1% was applied to the 2011 volumes in order to create the 2015 "No Build" simulations. Table B-2 contains the average and maximum queues reported by SimTraffic.

Table B-3 - Year 2035 "No Build" SimTraffic Queuing Results: SimTraffic was used to analyze queuing at each intersection during each of the peak hours. Five simulations lasting one hour each were conducted for each peak period. An annual growth rate of 1% was applied to the 2011 volumes in order to create the 2035 "No Build" simulations. Table B-3 contains the average and maximum queues reported by SimTraffic.

Table B-4 - Year 2015 "Build" SimTraffic Queuing Results: SimTraffic was used to analyze queuing at each intersection during each of the peak hours. Five simulations lasting one hour each were conducted for each peak period. An annual growth rate of 1% was applied to the 2011 volumes and proposed changes implemented to model the 2015 Build simulation. Table B-4 contains the average and maximum queues reported by SimTraffic.

Table B-5 - Year 2035 "Build" SimTraffic Queuing Results: SimTraffic was used to analyze queuing at each intersection during each of the peak hours. Five simulations lasting one hour each were conducted for each peak period. An annual growth rate of 1% was applied to the 2011 volumes and proposed changes implemented to model the 2035 Build simulation. Table B-5 contains the average and maximum queues reported by SimTraffic.

Table B-6 and B-7 – South Washington Street Travel Times: Field travel times and SimTraffic results from the existing, 2015 "No Build", 2035 "No Build, 2015 "Build", and 2035 "Build" simulations were used to create this table. These tables are separated by direction (NB/SB) and display travel times for each segment of the corridor as well as the corridor-wide average speed.

Table B-1: 2011 Existing Conditions Queuing Analysis - SimTraffic Results								
Intersection	**Approach**		**SimTraffic Results**					
			AM		**Mid-Day**		**PM**	
			Avg. Queue	**Max. Queue**	**Avg. Queue**	**Max. Queue**	**Avg. Queue**	**Max. Queue**
Marshall St at South Wash. St	S. Wash. St	NB	274	355	110	225	168	309
	S. Wash. St	SB	152	246	105	208	191	258
	Marshall St	WB	71	163	22	77	44	119
	Marshall St	EB	46	131	32	95	58	123
Maple Ave at South Wash. St*	S. Wash. St	NB-LT	99	115	49	110	70	112
	S. Wash. St	SB-LT	7	83	13	86	26	225
	Cavalier Tr	WB	156	284	15	50	73	207
	S. Maple Ave	EB	271	518	38	137	398	635
Tinner Hill at South Wash. St*	S. Wash. St	NB-LT	10	97	0	6	22	103
	S. Wash. St	SB-LT	4	87	2	47	5	78
	Tinner Hill	WB	10	52	11	40	5	35
	Tinner Hill	EB	20	82	25	79	22	78
Hillwood Ave at South Wash. St	S. Wash. St	NB	91	167	52	138	51	77
	S. Wash. St	SB	78	233	70	205	86	245
	Hillwood Ave	WB	77	125	69	120	109	139
Annandale Rd at South Wash. St	S. Wash. St	NB	144	291	87	180	88	196
	S. Wash. St	SB	113	221	90	239	266	320
	Annandale Rd	WB	171	248	112	235	100	218
	Annandale Rd	EB	48	135	80	188	290	479
Hillwood Ave at Annandale Rd	Hillwood Ave	NB	185	226	104	213	177	223
	Hillwood Ave	SB	107	226	62	133	130	267
	Annandale Rd	WB	297	551	192	357	154	329
	Annandale Rd	EB	111	221	165	246	226	249

*Denotes unsignalized intersection.

Table B-2: 2015 "No Build" Queuing Analysis - SimTraffic Results								
Intersection	**Approach**		**SimTraffic Results**					
			AM		**Mid-Day**		**PM**	
			Avg. Queue	**Max. Queue**	**Avg. Queue**	**Max. Queue**	**Avg. Queue**	**Max. Queue**
Marshall St at South Wash. St	S. Wash. St	NB	282	344	118	256	164	311
	S. Wash. St	SB	152	248	109	209	194	260
	Marshall St	WB	73	172	24	65	45	108
	Marshall St	EB	42	119	29	90	55	130
Maple Ave at South Wash. St*	S. Wash. St	NB-LT	99	115	50	109	68	114
	S. Wash. St	SB-LT	16	117	12	81	26	165
	Cavalier Tr	WB	159	267	19	50	37	143
	S. Maple Ave	EB	211	428	65	250	514	644
Tinner Hill at South Wash. St^	S. Wash. St	NB	54	189	33	122	37	161
	S. Wash. St	SB	28	138	29	110	39	178
	Tinner Hill	WB	4	34	8	35	4	35
	Tinner Hill	EB	13	51	25	73	19	63
Hillwood Ave at South Wash. St	S. Wash. St	NB	107	180	58	139	52	85
	S. Wash. St	SB	90	294	65	184	54	177
	Hillwood Ave	WB	81	132	73	121	104	144
Annandale Rd at South Wash. St	S. Wash. St	NB	153	310	79	227	78	180
	S. Wash. St	SB	121	233	97	259	282	325
	Annandale Rd	WB	176	253	122	249	113	230
	Annandale Rd	EB	54	169	87	202	290	507
Hillwood Ave at Annandale Rd	Hillwood Ave	NB	189	226	122	218	173	222
	Hillwood Ave	SB	135	264	59	135	154	280
	Annandale Rd	WB	296	525	205	384	163	348
	Annandale Rd	EB	112	230	171	245	225	250

*Denotes unsignalized intersection.
^ Tinner Hill Signal is planned for construction by private developer

Table B-3: 2035 "No Build" Queuing Analysis - SimTraffic Results								
Intersection	**Approach**		**SimTraffic Results**					
			AM		**Mid-Day**		**PM**	
			Avg. Queue	**Max. Queue**	**Avg. Queue**	**Max. Queue**	**Avg. Queue**	**Max. Queue**
Marshall St at South Wash. St	S. Wash. St	NB	322	357	149	292	248	338
	S. Wash. St	SB	181	254	135	235	232	270
	Marshall St	WB	86	183	26	69	55	111
	Marshall St	EB	60	176	45	109	83	189
Maple Ave at South Wash. St*	S. Wash. St	NB-LT	112	115	67	114	91	115
	S. Wash. St	SB-LT	66	390	28	143	93	367
	Cavalier Tr	WB	247	296	35	101	89	201
	S. Maple Ave	EB	302	525	144	473	586	637
Tinner Hill at South Wash. St^	S. Wash. St	NB	63	244	47	154	67	215
	S. Wash. St	SB	34	193	43	166	67	235
	Tinner Hill	WB	5	35	13	47	7	35
	Tinner Hill	EB	13	54	27	90	18	61
Hillwood Ave at South Wash. St	S. Wash. St	NB	93	173	68	156	54	98
	S. Wash. St	SB	78	263	71	238	192	335
	Hillwood Ave	WB	77	136	89	129	102	144
Annandale Rd at South Wash. St	S. Wash. St	NB	137	293	100	221	182	316
	S. Wash. St	SB	168	303	134	299	301	324
	Annandale Rd	WB	207	257	149	243	133	245
	Annandale Rd	EB	81	225	137	318	524	558
Hillwood Ave at Annandale Rd	Hillwood Ave	NB	200	225	147	220	195	225
	Hillwood Ave	SB	244	296	92	210	240	307
	Annandale Rd	WB	438	578	231	434	186	396
	Annandale Rd	EB	139	242	187	249	230	250

*Denotes unsignalized intersection.
^ Tinner Hill Signal is planned for construction by private developer

Table B-4: 2015 "Build" Queuing Analysis - SimTraffic Results								
Intersection	**Approach**		**SimTraffic Results**					
			AM		**Mid-Day**		**PM**	
			Avg. Queue	**Max. Queue**	**Avg. Queue**	**Max. Queue**	**Avg. Queue**	**Max. Queue**
Marshall St at South Wash. St	S. Wash. St	NB	282	342	133	290	192	319
	S. Wash. St	SB	155	250	116	237	194	254
	Marshall St	WB	73	181	24	74	47	125
	Marshall St	EB	44	126	31	78	57	126
Maple Ave at South Wash. St*	S. Wash. St	NB	198	272	149	234	146	257
	S. Wash. St	SB	188	381	180	364	297	542
	Cavalier Tr	WB	19	75	7	33	12	54
	S. Maple Ave	EB	27	100	37	112	106	231
Tinner Hill at South Wash. St*	S. Wash. St	NB	55	268	32	178	45	231
	S. Wash. St	SB	25	150	32	130	63	269
	Tinner Hill	WB	4	30	12	48	6	39
	Tinner Hill	EB	13	53	24	65	17	71
Hillwood Ave at South Wash. St	S. Wash. St	NB	143	190	86	281	194	396
	S. Wash. St	SB	50	170	33	160	90	228
	Hillwood Ave	WB	108	218	97	173	136	241
Annandale Rd at South Wash. St	S. Wash. St	NB	123	281	82	173	135	256
	S. Wash. St	SB	122	226	94	250	214	314
	Annandale Rd	WB	167	260	125	257	124	226
	Annandale Rd	EB	58	171	81	218	458	553
Hillwood Ave at Annandale Rd	Hillwood Ave	NB	206	420	98	286	154	383
	Hillwood Ave	SB	128	265	68	181	205	310
	Annandale Rd	WB	301	530	204	422	170	320
	Annandale Rd	EB	110	237	159	248	224	253

*Denotes newly signalized intersection (currently unsignalized)

Table B-5: 2035 "Build" Queuing Analysis - SimTraffic Results								
Intersection	**Approach**		**SimTraffic Results**					
			AM		**Mid-Day**		**PM**	
			Avg. Queue	**Max. Queue**	**Avg. Queue**	**Max. Queue**	**Avg. Queue**	**Max. Queue**
Marshall St at South Wash. St	S. Wash. St	NB	320	352	163	309	237	331
	S. Wash. St	SB	163	254	147	247	238	271
	Marshall St	WB	92	216	28	71	55	138
	Marshall St	EB	57	188	38	106	67	146
Maple Ave at South Wash. St*	S. Wash. St	NB	208	284	161	263	163	268
	S. Wash. St	SB	257	511	218	409	345	547
	Cavalier Tr	WB	26	82	14	54	20	72
	S. Maple Ave	EB	39	123	64	174	271	573
Tinner Hill at South Wash. St*	S. Wash. St	NB	72	258	47	251	97	263
	S. Wash. St	SB	32	191	59	177	99	322
	Tinner Hill	WB	5	33	15	49	7	51
	Tinner Hill	EB	12	51	30	87	17	58
Hillwood Ave at South Wash. St	S. Wash. St	NB	163	197	129	345	318	428
	S. Wash. St	SB	42	173	42	180	106	261
	Hillwood Ave	WB	130	341	109	214	123	340
Annandale Rd at South Wash. St	S. Wash. St	NB	177	351	92	214	199	352
	S. Wash. St	SB	160	300	112	293	286	324
	Annandale Rd	WB	185	271	157	259	166	256
	Annandale Rd	EB	77	214	110	267	516	560
Hillwood Ave at Annandale Rd	Hillwood Ave	NB	259	427	139	339	262	428
	Hillwood Ave	SB	236	296	94	248	265	325
	Annandale Rd	WB	540	586	221	384	199	353
	Annandale Rd	EB	153	247	164	250	242	253

*Denotes newly signalized intersection (currently unsignalized)

Table B-6: NB S Washington St Travel Times

	AM						MD						PM					
	Field	2011 No-Build	2015 No-Build	2035 No-Build	2015 Build	2035 Build	Field	2011 No-Build	2015 No-Build	2035 No-Build	2015 Build	2035 Build	Field	2011 No-Build	2015 No-Build	2035 No-Build	2015 Build	2035 Build
Marshall St																		
George Mason Rd		11.3	11.8	23.2	11	12.5		7.6	7.7	8	7.7	8		7.9	7.8	14.7	7.8	8.3
Greenway Blvd	38.9	8.8	9.4	47.6	7.7	8.8	28.3	6.4	6.4	6.6	6.3	6.5	34	6.8	6.5	14	6.5	7.4
Cameron Rd		10.9	10.8	47	8.3	10.4		6.6	6.7	6.8	6.7	6.9		8.2	6.8	16.9	6.9	8.6
Summerfield Rd		12.8	12.4	32.8	11.6	13.6		6.6	6.6	7.1	7.4	8.4		10.1	7.2	16.5	7.8	10.6
S Maple Ave		11.4	10.2	46	17.5	19.4		6.5	6.5	7	20.8	18.2		12.2	6.9	11.3	15.8	16.1
Tinner Hill Rd	43.1	21.7	23.7	26.3	26.2	26.9	37.8	18	19.2	20.1	14.6	23.3	53.7	18.7	19.8	22.2	23.8	30.4
Hillwood Ave		18.5	20.3	20.3	21.7	26.5		15.6	16	17.8	24.4	18.5		19.9	22	23.6	23.5	35.9
Annandale Rd	40.9	29.4	30.8	30.2	26	34	12.2	27.7	27	28.7	26.4	25.6	18.6	28.4	26	42.8	37.6	50
Total	**122.9**	**124.8**	**129.4**	**273.4**	**130**	**152.1**	**78.3**	**95**	**96.1**	**102.1**	**114.3**	**115.4**	**106.3**	**112.2**	**103**	**162**	**129.7**	**167.3**
Average Speed (MPH)	**24.0**	**23.7**	**22.8**	**10.8**	**22.7**	**19.4**	**37.7**	**31.1**	**30.7**	**28.9**	**25.8**	**25.6**	**27.8**	**26.3**	**28.7**	**18.2**	**22.8**	**17.6**

Table B-7: SB S Washington St Travel Times

	AM						MD						PM					
	Field	2011 No-Build	2015 No-Build	2035 No-Build	2015 Build	2035 Build	Field	2011 No-Build	2015 No-Build	2035 No-Build	2015 Build	2035 Build	Field	2011 No-Build	2015 No-Build	2035 No-Build	2015 Build	2035 Build
Annandale Rd																		
Hillwood Ave	23.6	18.2	25.1	19.6	19.8	19	27.7	17.2	17.4	17.9	17.8	18.7	23.6	16.6	14.7	30.5	23.1	28.3
Tinner Hill Rd	26.6	13.4	19.3	24.6	12.7	13.5	25	13.1	14.1	14.8	12	12.9	26.6	13.4	14.2	16.4	14.2	17.6
S Maple Ave		17	31.8	27	35.8	42.9		16.9	17.4	18.3	40.6	42.5		18.4	18.2	24.4	45.7	50.3
Summerfield Rd		7.3	7.5	8.2	9.6	10.1		7.2	7.2	7.5	9.4	9.6		7.7	7.6	8.8	10	10.5
Cameron Rd		6.5	6.5	7	6.9	7.1		6.4	6.4	6.5	6.7	6.8		6.6	6.6	7.8	7.1	8.8
Greenway Blvd	54.1	6.8	6.8	7.7	7.3	7.5	40.3	6.6	6.6	6.7	6.9	7	54.1	7	7.1	9.9	7.7	13
George Mason Rd		7	7.1	8.7	7.9	8.8		6.5	6.6	6.9	7	7.4		8	8.5	12.4	9.6	17.4
Marshall St		16.4	16.9	19.5	16.9	18.1		13.2	13.2	14.2	14.3	15.1		17.8	18.3	23.1	18.7	26.8
Total	**104.3**	**92.6**	**121**	**122.3**	**116.9**	**127**	**93**	**87.1**	**88.9**	**92.8**	**114.7**	**120**	**104.3**	**95.5**	**95.2**	**133.3**	**136.1**	**172.7**
Average Speed (MPH)	**28.3**	**31.9**	**24.4**	**24.1**	**25.3**	**23.2**	**31.7**	**33.9**	**33.2**	**31.8**	**25.7**	**24.6**	**28.3**	**30.9**	**31.0**	**22.1**	**21.7**	**17.1**

Appendix C: Warrants Exhibits

Table C-1 – South Washington Street at South Maple Avenue 12-Hour TMC: Turning movement count for the intersection of South Washington Street at South Maple Avenue/Cavalier Trail. Data was collected September 22, 2011.

Table C-2 – South Washington Street at Greenway Boulevard 12-Hour TMC: Turning movement count for the intersection of South Washington Street at Greenway Boulevard. Data was collected September 22, 2011.

Figures C-3 & C-4 – South Washington Street Warrants Reports: Warrants results as reported by HCS 2010 for the two intersections which are being signalized as part of this project.

Table C-1: 12 Hour TMC for South Washington Street at Cavalier Tr/S Maple Ave

	Cavalier Trail WB					South Maple Avenue EB					South Washington Street NB					South Washington Street SB				
	Left	Thru	Right	U-Turn	**Total**	Left	Thru	Right	U-Turn	**Total**	Left	Thru	Right	U-Turn	**Total**	Left	Thru	Right	U-Turn	**Total**
7:00	3	5	26	0	**34**	4	0	68	0	**72**	264	1425	3	0	**1692**	4	397	3	0	**404**
8:00	5	4	20	0	**29**	1	0	107	0	**108**	251	1237	0	0	**1488**	2	680	4	0	**686**
9:00	3	3	9	0	**15**	1	0	63	0	**64**	190	1083	2	0	**1275**	5	521	5	0	**531**
10:00	4	4	12	0	**20**	2	2	80	0	**84**	127	761	0	0	**888**	4	466	2	0	**472**
11:00	5	3	15	0	**23**	0	4	119	0	**123**	100	692	7	0	**799**	13	552	7	0	**572**
12:00	2	3	11	0	**16**	2	1	141	0	**144**	117	757	8	0	**882**	15	675	6	0	**696**
13:00	5	1	8	0	**14**	2	2	134	0	**138**	115	757	4	0	**876**	12	651	0	0	**663**
14:00	5	1	9	0	**15**	2	2	130	1	**135**	96	862	5	0	**963**	7	718	2	0	**727**
15:00	2	0	18	0	**20**	2	1	186	0	**189**	98	1019	1	0	**1118**	5	1017	6	0	**1028**
16:00	2	2	10	0	**14**	4	3	196	0	**203**	110	918	1	0	**1029**	15	1328	3	0	**1346**
17:00	4	2	18	0	**24**	2	0	241	0	**243**	128	997	7	0	**1132**	13	1390	7	0	**1410**
18:00	0	0	10	0	**10**	5	0	215	0	**220**	123	899	8	0	**1030**	21	1162	8	0	**1191**

Table C-2: 12 Hour TMC for South Washington Street at Greenway Boulevard

	Greenway Boulevard WB					Greenway Boulevard EB					South Washington Street NB					South Washington Street SB				
	Left	Thru	Right	U-Turn	**Total**	Left	Thru	Right	U-Turn	**Total**	Left	Thru	Right	U-Turn	**Total**	Left	Thru	Right	U-Turn	**Total**
7:00	5	0	12	0	**17**	18	0	11	0	**29**	14	1655	1	0	**1670**	3	462	17	0	**482**
8:00	7	0	16	0	**23**	15	1	12	0	**28**	20	1439	3	0	**1462**	6	769	24	0	**799**
9:00	2	0	10	0	**12**	20	2	7	0	**29**	8	1271	3	2	**1284**	8	580	12	0	**600**
10:00	4	0	7	0	**11**	12	2	2	1	**17**	7	856	3	0	**866**	5	561	9	1	**576**
11:00	9	0	10	0	**19**	9	2	5	0	**16**	1	823	7	1	**832**	8	663	7	0	**678**
12:00	7	0	14	0	**21**	14	1	12	1	**28**	12	897	4	0	**913**	7	801	12	0	**820**
13:00	3	0	9	0	**12**	10	0	14	0	**24**	12	868	3	2	**885**	10	803	9	0	**822**
14:00	2	0	12	0	**14**	11	0	12	0	**23**	7	839	5	0	**851**	6	846	13	1	**866**
15:00	7	2	14	0	**23**	8	0	21	0	**29**	5	878	4	0	**887**	14	1182	23	0	**1219**
16:00	7	0	7	0	**14**	10	0	17	0	**27**	10	984	8	0	**1002**	9	1493	17	0	**1519**
17:00	3	0	15	0	**18**	16	2	18	0	**36**	11	1118	7	0	**1136**	13	1595	23	2	**1633**
18:00	3	0	12	0	**15**	13	0	14	0	**27**	12	989	13	0	**1014**	14	1328	22	0	**1364**

Greenway Boulevard
HCS+: MUTCD Signal Warrants Release 5.5

Analyst: ASM
Agency:
Date: 10/7/2013
Project ID:
EW Street: Greenway Boulevard

Intersection: S. Wash. St. at Greenway Blvd
Jurisdiction: City of Falls Church
Units: U.S. Customary
Analysis Year:
NS Street: South Washington Street

General Information

Major St. Speed (mph): 30
Nearest Signal (ft): 0
Crashes per Yr: 0

Population: Not less than 10000
Coordinated Signal System: Y

School Crossing

Students in Highest Hour: 0
Adequate Gaps in Period: 0
Minutes in Period: 0

Roadway Network

Two Major Routes: 0
Weekend Count: 0
5-yr Growth Factor: 0

Geometry and Traffic

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	2	0	0	2	0	0	1	0	0	1	0
LaneUsage		LTR			LTR			LTR			LTR	

Results

Warrant 1: Eight-Hour Vehicular Volume [ ]
1 A. Minimum Vehicular Volumes [ ]
1 B. Interruption of Continuous Traffic [ ]
1 80% Vehicular --and-- Interruption Volumes [ ]

Warrant 2: Four-Hour Vehicular Volume
2 A. Four-Hour Vehicular Volumes [ ]

Warrant 3: Peak Hour [ ]
3 A. Peak-Hour Conditions [ ]
3 B. Peak-Hour Vehicular Volume Hours Met [ ]

Warrant 4: Pedestrian Volume [ ]
4 A. Pedestrian Volumes [ ]
4 B. Gaps Same Period [ ]

Warrant 5: School Crossing [ ]
5 A. Student Volumes [ ]
5 B. Gaps Same Period [ ]

Warrant 6: Coordinated Signal System
6 Degree of Platooning [ ]

Warrant 7: Crash Experience [ ]
7 A. Adequate trials of alternatives [ ]
7 B. Reported crashes [ ]
7 80% Volumes for Warrants 1A, 1B --or-- 4 [ ]

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Figur-3

Greenway Boulevard

Warrant 8: Roadway Network [ ]
8 A. Weekday Volume [ ]
8 B. Weekend Volume [ ]

Summary

Hours	Major Volume	Minor Volume	Total Volume	Delay (Veh-hr)	1A 100%	1A 80%	1B 100%	1B 80%	2 100%	3A 100%	3B 100%
07-08	2152	29	2198	0.0	No	No	No	No	No	No	No
08-09	2261	28	2312	0.0	No	No	No	No	No	No	No
09-10	1882	29	1923	0.0	No	No	No	No	No	No	No
10-11	1441	16	1468	0.0	No	No	No	No	No	No	No
11-12	1509	19	1544	0.0	No	No	No	No	No	No	No
12-13	1733	27	1781	0.0	No	No	No	No	No	No	No
13-14	1705	24	1741	0.0	No	No	No	No	No	No	No
14-15	1716	23	1753	0.0	No	No	No	No	No	No	No
15-16	2106	29	2158	0.0	No	No	No	No	No	No	No
16-17	2521	27	2562	0.0	No	No	No	No	No	No	No
17-18	2767	35	2820	0.0	No	No	No	No	No	No	No
18-19	2378	27	2420	0.0	No	No	No	No	No	No	No
Total	24171	313	24680		0	0	0	0	0	0	0

Traffic Volumes (vph)

Northbound			Southbound			Westbound			Eastbound		
L	T	R	L	T	R	L	T	R	L	T	R
14	1655	1	3	462	17	5	0	12	18	0	11
20	1439	3	6	769	24	7	0	16	15	1	12
8	1271	3	8	580	12	2	0	10	20	2	7
7	856	3	5	561	9	4	0	7	12	2	2
1	823	7	8	663	7	9	0	10	9	2	5
12	897	4	7	801	12	7	0	14	14	1	12
12	868	3	10	803	9	3	0	9	10	0	14
7	839	5	6	846	13	2	0	12	11	0	12
5	878	4	14	1182	23	7	2	14	8	0	21
10	984	8	9	1493	17	7	0	7	10	0	17
11	1118	7	13	1595	23	3	0	15	15	2	18
12	989	13	14	1328	22	3	0	12	13	0	14

Pedestrian Volumes and Gaps (Per Hour)

Volume	Gap	Volume	Gap	Volume	Gap	Volume	Gap
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

Delay	sec/veh	veh-hrs	sec/veh	veh-hrs	sec/veh	veh-hrs	sec/veh	veh-hrs
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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Figure C-3

Greenway Boulevard

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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Figure C-3

South Maple Ave
HCS+: MUTCD Signal Warrants Release 5.5

Analyst: ASM
Intersection: S. Wash. St at S. Maple Ave.

Agency:
Jurisdiction: City of Falls Church
Date: 10/7/2013
Units: U.S. Customary
Project ID:
Analysis Year:
EW Street: South Maple Avenue
NS Street: South Washington Street

General Information

Major St. Speed (mph): 30
Population: Not less than 10000
Nearest Signal (ft): 0
Coordinated Signal System: Y
Crashes per Yr: 0

School Crossing

Students in Highest Hour: 0
Adequate Gaps in Period: 0
Minutes in Period: 0

Roadway Network

Two Major Routes: 0
Weekend Count: 0
5-yr Growth Factor: 0

Geometry and Traffic

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	0	0	1	0	0	2	0	0	2	0
LaneUsage		LTR			LTR			LTR			LTR	

Results

Warrant 1: Eight-Hour Vehicular Volume [X]
1 A. Minimum Vehicular Volumes [ ]
1 B. Interruption of Continuous Traffic [X]
1 80% Vehicular --and-- Interruption Volumes [X]

Warrant 2: Four-Hour Vehicular Volume
2 A. Four-Hour Vehicular Volumes [X]

Warrant 3: Peak Hour [X]
3 A. Peak-Hour Conditions [ ]
3 B. Peak-Hour Vehicular Volume Hours Met [X]

Warrant 4: Pedestrian Volume [ ]
4 A. Pedestrian Volumes [ ]
4 B. Gaps Same Period [ ]

Warrant 5: School Crossing [ ]
5 A. Student Volumes [ ]
5 B. Gaps Same Period [ ]

Warrant 6: Coordinated Signal System
6 Degree of Platooning [X]

Warrant 7: Crash Experience [ ]
7 A. Adequate trials of alternatives [ ]
7 B. Reported crashes [ ]

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Figure C-4

South Maple Ave

7 80% Volumes for Warrants 1A, 1B --or-- 4 [X]

Warrant 8: Roadway Network [ ]
8 A. Weekday Volume [ ]
8 B. Weekend Volume [ ]

Summary

Hours	Major Volume	Minor Volume	Total Volume	Delay (Veh-hr)	1A 100%	1A 80%	1B 100%	1B 80%	2 100%	3A 100%	3B 100%
07-08	2096	72	2202	0.0	No	No	No	Yes	No	No	No
08-09	2174	108	2311	0.0	No	No	Yes	Yes	Yes	No	Yes
09-10	1806	64	1885	0.0	No	No	No	Yes	No	No	No
10-11	1360	84	1464	0.0	No	No	Yes	Yes	Yes	No	No
11-12	1371	123	1517	0.0	No	Yes	Yes	Yes	Yes	No	No
12-13	1578	144	1738	0.0	No	Yes	Yes	Yes	Yes	No	Yes
13-14	1539	138	1691	0.0	No	Yes	Yes	Yes	Yes	No	Yes
14-15	1690	134	1839	0.0	No	Yes	Yes	Yes	Yes	No	Yes
15-16	2146	189	2355	0.0	Yes	Yes	Yes	Yes	Yes	No	Yes
16-17	2375	203	2592	0.0	Yes	Yes	Yes	Yes	Yes	No	Yes
17-18	2542	243	2809	0.0	Yes	Yes	Yes	Yes	Yes	No	Yes
18-19	2221	220	2451	0.0	Yes	Yes	Yes	Yes	Yes	No	Yes
Total	22898	1722	24854		4	8	10	12	10	0	8

Traffic Volumes (vph)

Eastbound			Westbound			Northbound			Southbound		
L	T	R	L	T	R	L	T	R	L	T	R
4	0	68	3	5	26	264	1425	3	4	397	3
1	0	107	5	4	20	251	1237	0	2	680	4
1	0	63	3	3	9	190	1083	2	5	521	5
2	2	80	4	4	12	127	761	0	4	466	2
0	4	119	5	3	15	100	692	7	13	552	7
2	1	141	2	3	11	117	757	8	15	675	6
2	2	134	5	1	8	115	757	4	12	651	0
2	2	130	5	1	9	96	862	5	7	718	2
2	1	186	2	0	18	98	1019	1	5	1017	6
4	3	196	2	2	10	110	918	1	15	1328	3
2	0	241	4	2	18	128	997	7	13	1390	7
5	0	215	0	0	10	123	899	8	21	1162	8

Pedestrian Volumes and Gaps (Per Hour)

Volume	Gap	Volume	Gap	Volume	Gap	Volume	Gap
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

Delay	sec/veh	veh-hrs	sec/veh	veh-hrs	sec/veh	veh-hrs	sec/veh	veh-hrs
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Page 2

Figure C-4

South Maple Ave

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Page 3

Figure C-4

CITY OF FALLS CHURCH
S. WASHINGTON STREET TRANSPORTATION IMPROVEMENTS
2011 PEAK HOUR TURNING MOVEMENT VOLUMES - UNBALANCED

System Peak Hours

AM PEAK: 7:45 AM - 8:45 AM

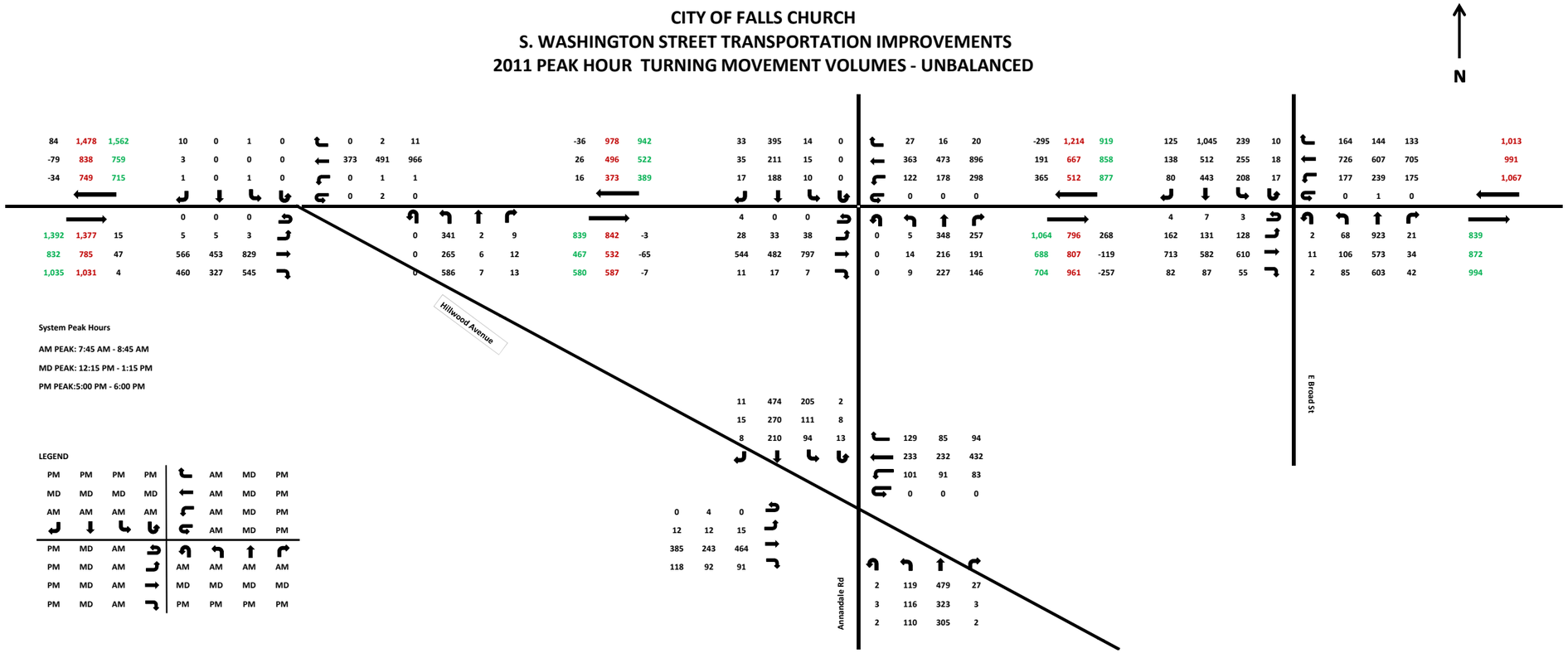
MD PEAK: 12:15 PM - 1:15 PM

PM PEAK:5:00 PM - 6:00 PM

LEGEND

PM	PM	PM	PM		AM	MD	PM
MD	MD	MD	MD		AM	MD	PM
AM	AM	AM	AM		AM	MD	PM
					AM	MD	PM
PM	MD	AM					
PM	MD	AM		AM	AM	AM	AM
PM	MD	AM		MD	MD	MD	MD
PM	MD	AM		PM	PM	PM	PM

CITY OF FALLS CHURCH
S. WASHINGTON STREET TRANSPORTATION IMPROVEMENTS
2011 PEAK HOUR TURNING MOVEMENT VOLUMES - UNBALANCED



System Peak Hours

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LEGEND

PM	PM	PM	PM		AM	MD	PM
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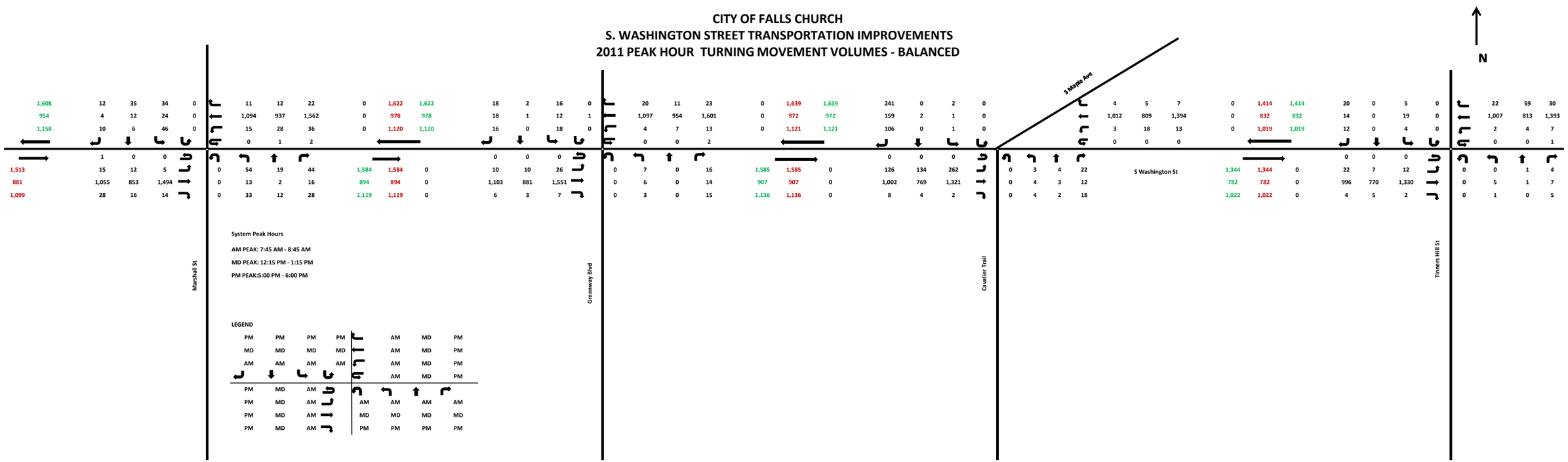
AM	AM	AM	AM		AM	MD	PM
					AM	MD	PM
PM	MD	AM					
PM	MD	AM		AM	AM	AM	AM
PM	MD	AM		MD	MD	MD	MD
PM	MD	AM		PM	PM	PM	PM

CITY OF FALLS CHURCH
S. WASHINGTON STREET TRANSPORTATION IMPROVEMENTS
2011 PEAK HOUR TURNING MOVEMENT VOLUMES - BALANCED



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LEGEND

PM	PM	PM	PM		AM	MD	PM
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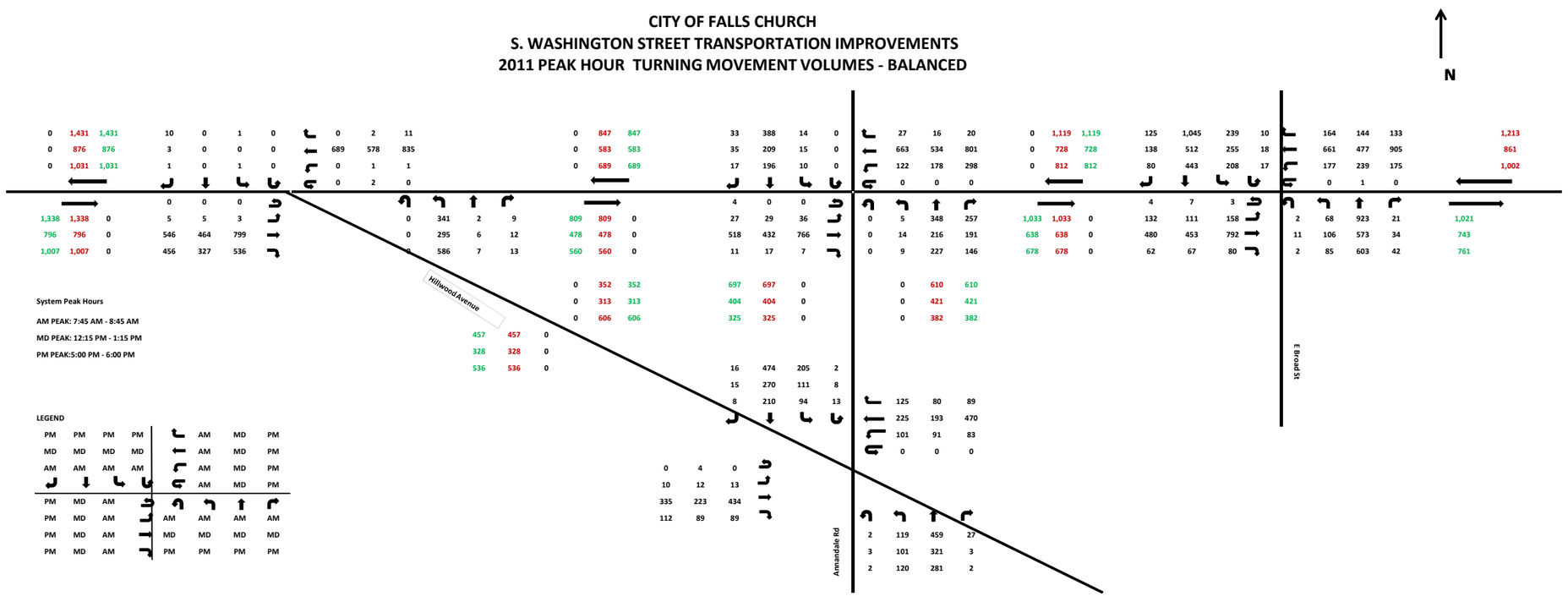
AM	AM	AM	AM		AM	MD	PM
					AM	MD	PM
PM	MD	AM					
PM	MD	AM		AM	AM	AM	AM
PM	MD	AM		MD	MD	MD	MD
PM	MD	AM		PM	PM	PM	PM

CITY OF FALLS CHURCH
S. WASHINGTON STREET TRANSPORTATION IMPROVEMENTS
2011 PEAK HOUR TURNING MOVEMENT VOLUMES - BALANCED



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LEGEND

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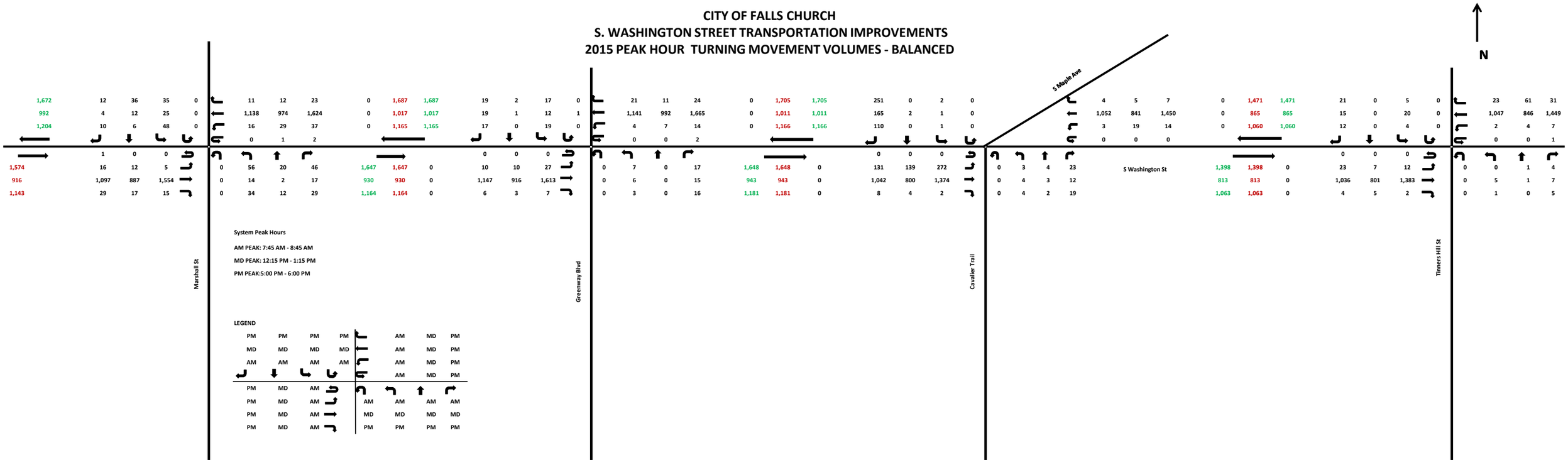
MD	MD	MD	MD		AM	MD	PM
AM	AM	AM	AM		AM	MD	PM
					AM	MD	PM
PM	MD	AM					
PM	MD	AM		AM	AM	AM	AM
PM	MD	AM		MD	MD	MD	MD
PM	MD	AM		PM	PM	PM	PM

CITY OF FALLS CHURCH
S. WASHINGTON STREET TRANSPORTATION IMPROVEMENTS
2015 PEAK HOUR TURNING MOVEMENT VOLUMES - BALANCED



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LEGEND

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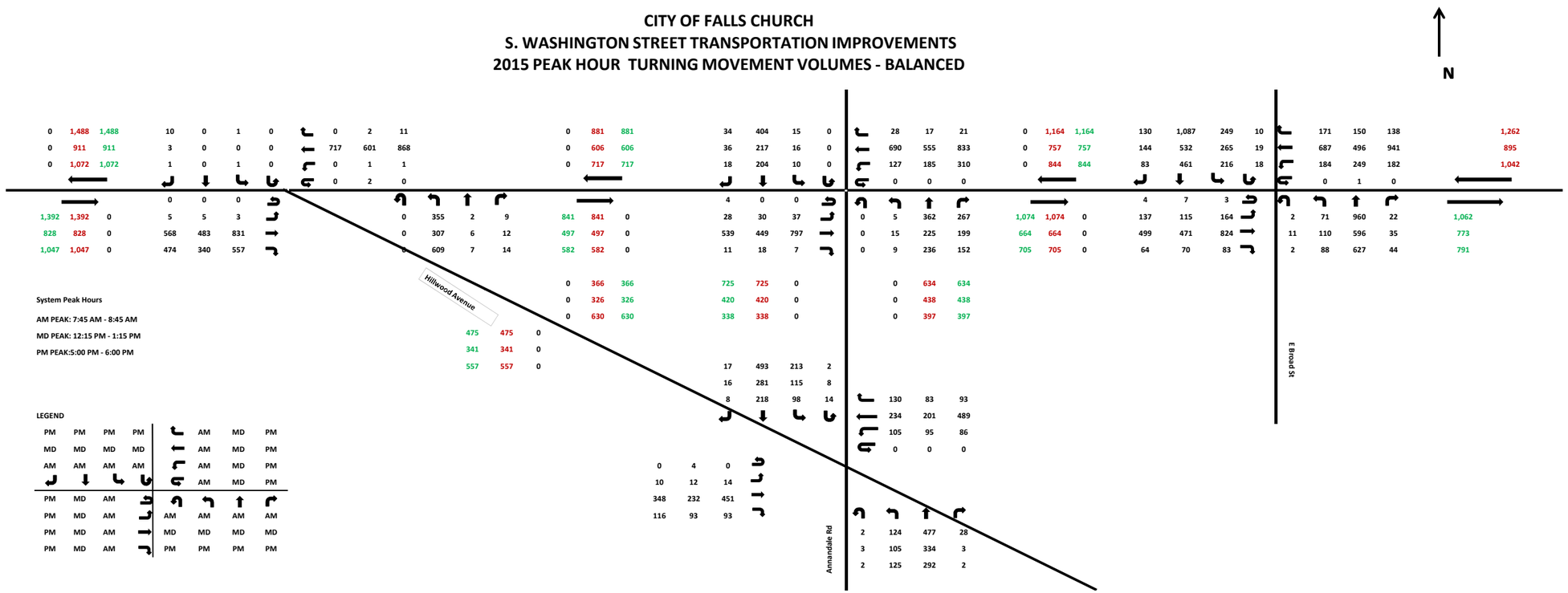
MD	MD	MD	MD		AM	MD	PM
AM	AM	AM	AM		AM	MD	PM
					AM	MD	PM
PM	MD	AM					
PM	MD	AM		AM	AM	AM	AM
PM	MD	AM		MD	MD	MD	MD
PM	MD	AM		PM	PM	PM	PM

CITY OF FALLS CHURCH
S. WASHINGTON STREET TRANSPORTATION IMPROVEMENTS
2015 PEAK HOUR TURNING MOVEMENT VOLUMES - BALANCED



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LEGEND

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MD	MD	MD	MD		AM	MD	PM
AM	AM	AM	AM		AM	MD	PM
					AM	MD	PM
PM	MD	AM					
PM	MD	AM		AM	AM	AM	AM
PM	MD	AM		MD	MD	MD	MD
PM	MD	AM		PM	PM	PM	PM

CITY OF FALLS CHURCH
S. WASHINGTON STREET TRANSPORTATION IMPROVEMENTS
2035 PEAK HOUR TURNING MOVEMENT VOLUMES - BALANCED

N

Marshall St

1,994	15	43	42	0	14	15	27	0	2,011	2,011	22	2	20	0	25	14	29	0	2,032	2,032	299	0	2	0	5	6	9	0	1,753	1,753	25	0	6	0	27	73	37
1,183	5	15	30	0	1,357	1,162	1,937	0	1,213	1,213	22	1	15	1	1,360	1,183	1,985	0	1,205	1,205	197	2	1	0	1,255	1,003	1,729	0	1,032	1,032	17	0	24	0	1,249	1,008	1,727
1,436	12	7	57	0	19	35	45	0	1,389	1,389	20	0	22	0	5	9	16	0	1,390	1,390	131	0	1	0	4	22	16	0	1,264	1,264	15	0	5	0	2	5	9
					0	1	2								0	0	2								0	0	0								0	0	1
	1	0	0								0	0	0								0	0	0								0	0	0					
1,876	19	15	6		0	67	24	55	1,964	1,964	0	12	12	32	0	9	0	20	1,965	1,965	0	156	166	325		0	4	5	27			1,667	1,667	0	27	9	15		0	0	1	5
1,092	1,308	1,058	1,853		0	16	2	20	1,109	1,109	0	1,368	1,092	1,923	0	7	0	17	1,125	1,125	0	1,242	954	1,638		0	5	4	15			970	970	0	1,235	955	1,649		0	6	1	9
1,363	35	20	17		0	41	15	35	1,388	1,388	0	7	4	9	0	4	0	19	1,409	1,409	0	10	5	2		0	5	2	22			1,267	1,267	0	5	6	2		0	1	0	6

Greenway Blvd

Cavalier Trail

S Washington St

S Maple Ave

Tinners Hill St

System Peak Hours

AM PEAK: 7:45 AM - 8:45 AM

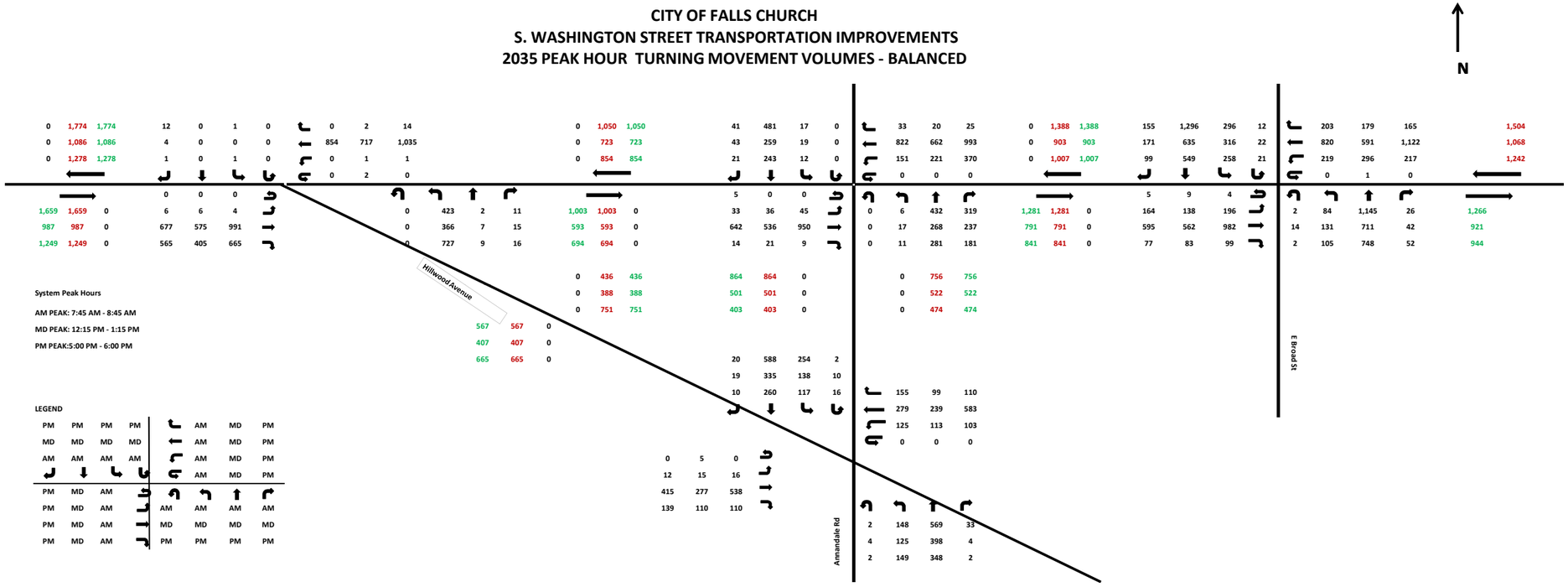
MD PEAK: 12:15 PM - 1:15 PM

PM PEAK:5:00 PM - 6:00 PM

LEGEND

PM	PM	PM	PM		AM	MD	PM
MD	MD	MD	MD		AM	MD	PM
AM	AM	AM	AM		AM	MD	PM
					AM	MD	PM
PM	MD	AM					
PM	MD	AM		AM	AM	AM	AM
PM	MD	AM		MD	MD	MD	MD
PM	MD	AM		PM	PM	PM	PM

CITY OF FALLS CHURCH
S. WASHINGTON STREET TRANSPORTATION IMPROVEMENTS
2035 PEAK HOUR TURNING MOVEMENT VOLUMES - BALANCED



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PM	MD	AM					
PM	MD	AM		AM	AM	AM	AM
PM	MD	AM		MD	MD	MD	MD
PM	MD	AM		PM	PM	PM	PM