

Government of the District of Columbia

Department of Transportation



Traffic Engineering and Signals Division

EXECUTIVE SUMMARY

A traffic analysis was conducted to evaluate the proposed Streatery implementations in Georgetown, including at the critical intersection of **Wisconsin Avenue and M Street, NW**. As part of the response to the COVID-19 pandemic, numerous Streatery locations have been proposed and implemented throughout the District to provide expanded sidewalks for pedestrians and opportunities for restaurants with outdoor seating to comply with social distancing requirements.

This memo provides a summary of the traffic analysis impacts to the corridor, identifies any problematic intersections, and presents a list of possible mitigations for adverse impacts at affected intersections. Based on the analysis, TESD recommends **1) minor modifications to the proposed Streatery design approaching 34th Street NW to mitigate potential backups into Georgetown, and 2) more significant modifications to the proposed Streatery design at Wisconsin Avenue and M Street, NW to maintain exclusive right-turn bays**, allowing the existing phasing to remain in place in order to safely accommodate high volumes of pedestrians and vehicles at this intersection. No changes are recommended to any of the other intersections in the study area. The following sections summarize our preliminary findings and specific recommendations.

BACKGROUND

The proposed Streateries are to be implemented on Wisconsin Avenue NW and M Street NW in the heart of Georgetown. These streets are surrounded by retail and commercial land uses that generate high pedestrian volumes. The lack of Metro access also contributes to high vehicle volumes. Wisconsin Avenue NW is a 5-lane, principal arterial carrying an AADT of 28,000 to the north of M Street NW and 8,000 to the south of M Street NW. M Street NW is a 6-lane, principal arterial carrying an AADT of 22,000 throughout the study area. These AADT values are taken from the 2018 OpenDC Dataset, the most recent year of available data. Existing vehicular and pedestrian AM, PM, and weekend peak hour volumes for the intersection of these two principal arterials are contained in **Figure 1** and **Figure 2**, respectively.

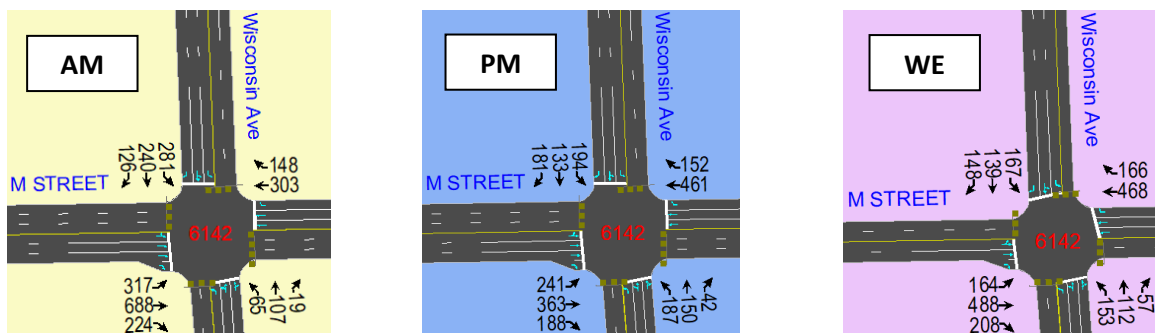


Figure 1 - Existing AM, PM, and Weekend Peak Hour Volumes at M Street and Wisconsin Avenue, NW

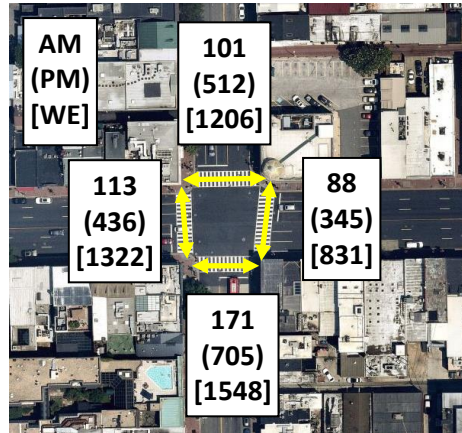


Figure 2 - Existing AM, PM, and Weekend Peak Hour Pedestrian Volumes at M Street and Wisconsin Avenue, NW

The proposed Streatery design for Georgetown has been developed by the Georgetown BID to provide opportunities for local businesses to comply with social distancing requirements during the COVID-19 pandemic. Streateries have been proposed along both M Street NW and Wisconsin Avenue NW as part of this effort, as shown in **Figure 3**. Implementation of Streateries requires the conversion of vehicular travel lanes to expanded sidewalks and/or dining spaces. At certain locations, this can also involve relocation of bus stops into the adjacent travel lane. Where Streateries are proposed at intersections, temporary corner bump-outs are typically installed. A typical proposed Streatery design is shown in **Figure 4**.

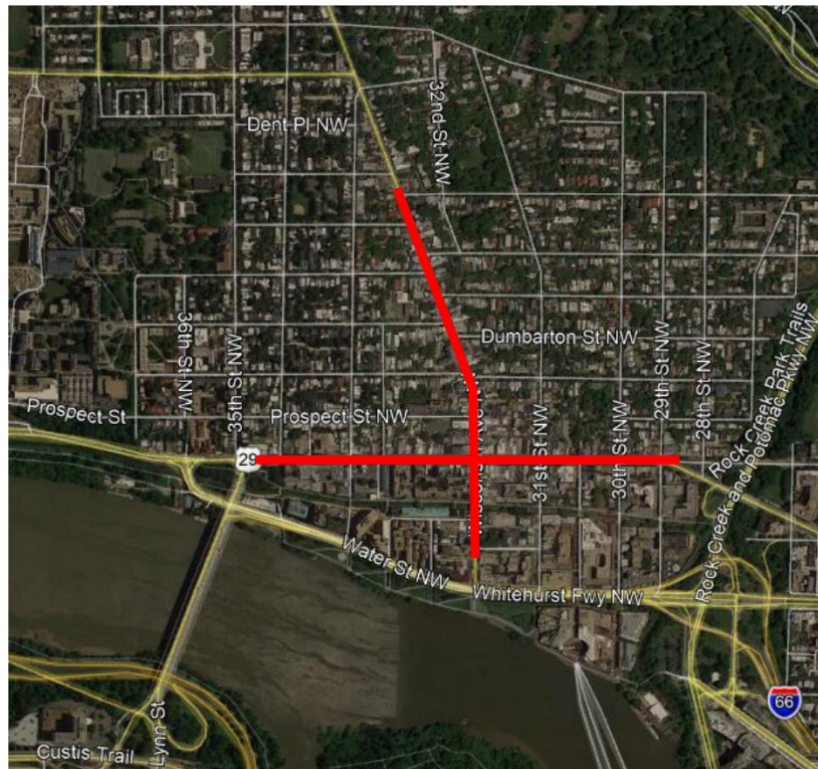


Figure 3 - Proposed Georgetown Streatery Limits

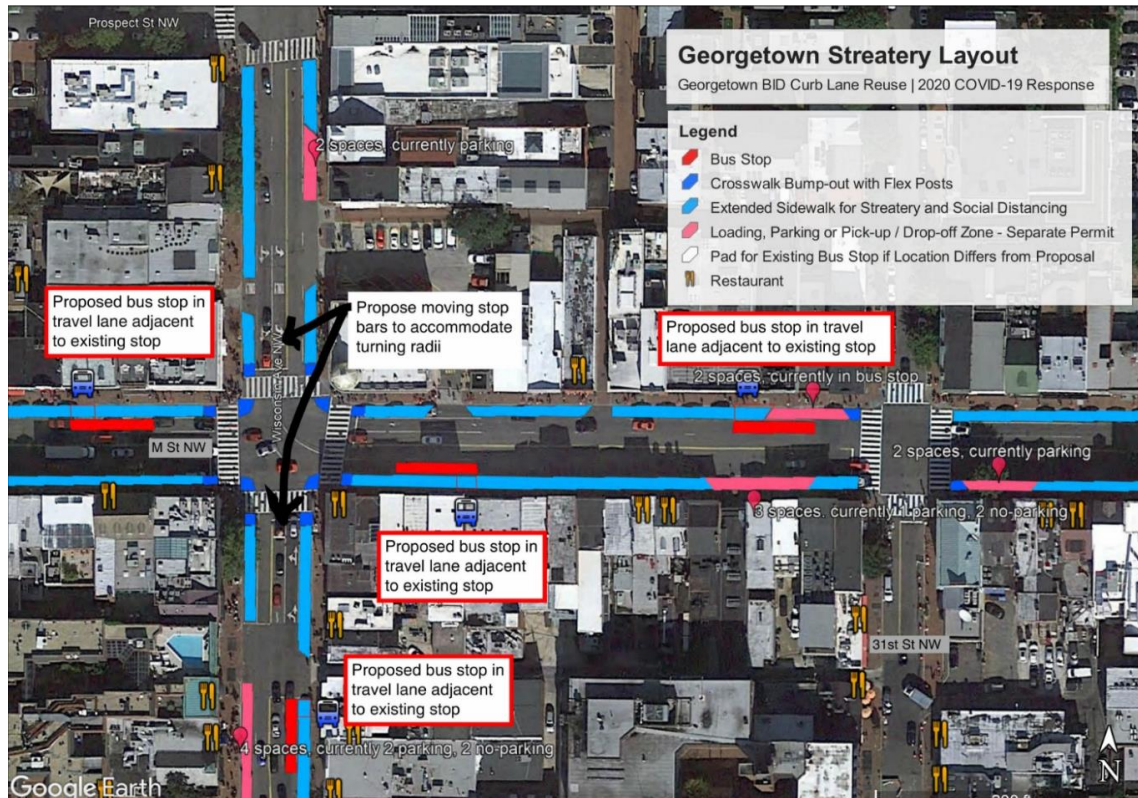


Figure 4 - Proposed Streatery Design for Wisconsin Avenue and M Street, NW

Due to the existing operational constraints in Georgetown, TESD is evaluating the proposed Streatery design for operational and safety considerations that would necessitate changes to the proposed design at any signalized intersections within the study area. The following section summarizes the traffic operations analysis performed for the study intersections.

CORRIDOR-WIDE TRAFFIC ANALYSIS

Capacity analyses were performed for the study intersections under existing and alternative conditions for AM, PM, and Weekend peak hours. A summary of the scenarios analyzed is included below:

1. Baseline: This scenario includes the existing geometry, signal phasing and timings, and traffic volumes collected in 2019 as part of the Citywide Signal Optimization program.
2. Alternative 1: This scenario includes the modified geometric conditions proposed for the Streatery condition. All signal timings and phasing remained consistent from Baseline, except at the intersection of Wisconsin Avenue and M Street, NW. Here, the existing split phased operation is retained; however, the right-turn overlaps are removed to correspond to the elimination of right-turn only lanes.

Table 1 provides a summary of the results of the capacity analysis performed using Synchro 10 and Highway Capacity Manual (HCM) methodology. The delay, volume-to-capacity ratio, and Level of Service (LOS) are shown for each intersection in the study area.

Table 1 - Summary of Capacity Analysis for Georgetown Streateries

Scenario	Intersection	Synchro 10 (HCM2000) Results								
		Delay (sec/veh)			v/c Ratio			Level of Service		
		AM	PM	Sat	AM	PM	Sat	AM	PM	Sat
Baseline: Existing Geometry; Existing Signal Timings/Phasing	Key Bridge and M St, NW	29.6	36.3	26.4	0.95	0.98	0.76	C	D	C
	34th St and M St, NW	19.7	22.8	17.0	0.67	0.63	0.57	B	C	B
	33rd St and M St, NW	9.4	12.3	18.4	0.52	0.54	0.72	A	B	B
	Potomac St and M St, NW	7.9	15.0	14.8	0.45	0.46	0.51	A	B	B
	Wisconsin Ave and M St, NW	30.0	22.8	26.8	0.72	0.55	0.67	C	C	C
	31st St and M St, NW	6.2	10.1	11.1	0.36	0.37	0.51	A	B	B
	Thomas Jefferson St and M St, NW	6.8	9.4	9.4	0.41	0.43	0.41	A	A	A
	30th St and M St, NW	6.4	10.9	12.9	0.51	0.54	0.63	A	B	B
	29th St and M St, NW	7.2	10.8	9.2	0.49	0.44	0.60	A	B	A
	Wisconsin Ave and Prospect St, NW	8.0	9.2	14.8	0.29	0.35	0.58	A	A	B
	Wisconsin Ave and N St, NW	9.4	15.2	16.8	0.46	0.64	0.61	A	B	B
	Wisconsin Ave and Dumbarton St, NW	4.5	2.0	2.7	0.35	0.42	0.44	A	A	A
	Wisconsin Ave and O St, NW	8.2	7.4	10.9	0.36	0.38	0.50	A	A	B
Alternative 1: Streatery Geometry; Modified Signal Timings/Phasing	Key Bridge and M St, NW	29.6	36.2	26.5	0.95	0.98	0.76	C	D	C
	34th St and M St, NW	19.6	25.8	17.4	0.67	0.69	0.57	B	C	B
	33rd St and M St, NW	20.1	16.0	17.8	0.79	0.68	0.72	C	B	B
	Potomac St and M St, NW	8.6	18.5	14.3	0.61	0.60	0.51	A	B	B
	Wisconsin Ave and M St, NW	170.1	88.1	85.9	1.36	1.17	1.13	F	F	F
	31st St and M St, NW	7.7	10.7	10.7	0.49	0.46	0.51	A	B	B

Scenario	Intersection	Synchro 10 (HCM2000) Results								
		Delay (sec/veh)			v/c Ratio			Level of Service		
		AM	PM	Sat	AM	PM	Sat	AM	PM	Sat
	Thomas Jefferson St and M St, NW	7.1	10.2	9.7	0.54	0.52	0.41	A	B	A
	30th St and M St, NW	8.9	14.7	13.0	0.67	0.70	0.63	A	C	B
	29th St and M St, NW	7.5	11.3	9.2	0.50	0.47	0.60	A	B	A
	Wisconsin Ave and Prospect St, NW	11.6	15.5	19.0	0.50	0.57	0.58	B	B	B
	Wisconsin Ave and N St, NW	15.1	36.5	15.0	0.73	1.01	0.61	B	D	B
	Wisconsin Ave and Dumbarton St, NW	6.3	6.9	3.0	0.64	0.75	0.48	A	A	A
	Wisconsin Ave and O St, NW	11.8	13.9	10.9	0.63	0.69	0.50	B	B	B

The analysis results presented in **Table 1** indicate that the proposed lane reduction would have low to moderate impact for 12 out of the 13 signalized intersections in the study area. However, although the results do not indicate significant degradation, the impact of friction, queue spillback, bus blockages, and other factors in Georgetown may contribute to challenging traffic operations that are not necessarily reflected in the modeling. For example, due to the reduction to two travel lanes, it is possible that bus blockages could result in a total loss of throughput at one intersection: 33rd Street and M Street, NW. A bus stopped at the nearside bus stop in the outer travel lane at the same time as left turning vehicle is waiting for a gap in the inner travel lane would temporarily restrict the through capacity. However, given the extremely low turning volumes at this intersection (1 vph in the AM Peak and 5 vph in the PM peak), no mitigations are recommended at the present time as a complete blockage would be unlikely. In the event of frequent blockages at project open, a peak period left turn restriction could be implemented for westbound M Street NW at 33rd Street NW.

Additionally, spillback from the capacity constrained intersection of Key Bridge and M Street, NW could impact operations at 34th Street and M Street, NW due to the westbound lane shift through 34th Street NW. Given the lane reduction from three to two lanes approaching 34th Street NW, if the westbound left turn lanes at Key Bridge are queued back through 34th Street NW in the proposed condition they will block westbound access to the only available through lane. This will starve they Key Bridge intersection of any westbound throughput. A recommended mitigation is to simply remove the proposed sidewalk expansion from the bank alley to 34th Street NW, thereby allowing westbound through vehicles to bypass the left turning vehicles that will likely spillback from Key Bridge during the PM peak.

In contrast to moderate impacts to 12 of 13 locations along M Street, the reduction in curb lane capacity at the intersection of Wisconsin Avenue and M Street, NW will result in severe degradation to traffic operations due to the complexity of the signal operation involving protected only turning movements that will no longer be feasible with the removal of the curb lanes for each direction. An in-depth traffic analysis was performed for this intersection to identify feasible mitigations in order to accommodate the proposed Streateries while maintaining safe and adequate traffic operations. Additionally, field observations and fine tuning should be performed if the corridor-wide Streateries are to be implemented, and possible mitigations may require increasing signal cycle lengths in order to maintain traffic flow.

IN-DEPTH TRAFFIC ANALYSIS: WISCONSIN AVENUE AND M STREET, NW

Separate capacity analyses were performed for the intersection of Wisconsin Avenue and M Street, NW under existing and three alternative conditions, all of which include the Streatery design as proposed by Georgetown BID with no geometric modifications. The study intersection is a pretimed signal with a cycle length of 120 seconds during the AM, PM, and Weekend peak hours.

Modification of the signal phasing is required during the three alternative scenarios to remove the right-turn overlaps and protected-only right turn phases. Due to the throughput volumes on each approach it is infeasible to stripe the remaining lanes a single through and single right-only lane; therefore, the exclusive right turn lanes are dropped and right turning vehicles must share a travel lane with through vehicles. As protected-only turns and overlaps cannot operate in travel lane shared between a turning movement and non-turning movement, these phases must be removed. A summary of the scenarios analyzed is included below:

1. Baseline: This scenario includes the existing geometry, signal phasing and timings, and traffic volumes collected in 2019 as part of the Citywide Signal Optimization program.
2. Alternative 1: This scenario includes the modified geometric conditions proposed for the Streatery condition. The existing split phased operation is retained; however, the right-turn overlaps are removed to correspond to the elimination of right-turn only lanes.
3. Alternative 2: This scenario includes the modified geometric conditions proposed for the Streatery condition. The signal phasing is changed to operate both northbound and southbound movements concurrently. Right turn overlaps are not included given the elimination of right-turn only lanes.
4. Alternative 3: This scenario includes the modified geometric conditions proposed for the Streatery condition. The signal phasing is changed to operate both northbound and southbound movements concurrently, along with leading left turns for both these movements. Right turn overlaps are not included given the elimination of right-turn only lanes.

Table 2 provides a summary of the results of the capacity analysis performed using Synchro 10 and Highway Capacity Manual (HCM) methodology. The delay, volume-to-capacity ratio, Level of Service (LOS), and 95th-percentile queue lengths in feet are shown for each approach and the overall intersection.

Table 2 - Summary of Capacity Analysis for Wisconsin Avenue and M Street, NW (Proposed Streatery)

Scenario	Approach	Synchro 10 (HCM2000) Results											
		Delay (sec/veh)			v/c Ratio			Level of Service			95th-% Queues		
		AM	PM	Sat	AM	PM	Sat	AM	PM	Sat	AM	PM	Sat
Baseline: Existing Geometry; Existing Split Phasing	Overall	30.0	22.8	24.8	0.72	0.55	0.64	C	C	C			
	Eastbound	16.0	6.2	23.3				B	A	C			
	EBL/T/R	19.1	6.7	28.1	0.69	0.40	0.72	B	A	C	205	31	154
	Westbound	35.7	28.9	29.4				D	C	C			
	WBT	23.2	14.2	29.2	0.37	0.45	0.54	C	B	C	127	67	185
	WBR	61.3	73.4	38.2	0.62	0.74	0.03	E	E	D	207	#240	m11
	Northbound	8.5	20.6	10.5				A	C	B			
	NBL	9.3	22.5	11.3	0.29	0.57	0.42	A	C	B	9	m42	m23
	NBL/T/R	8.2	19.7	10.1	0.32	0.61	0.49	A	B	B	9	m42	21
	Southbound	58.6	42.6	33.0				E	D	C			
	SBL	70.4	56.7	31.6	0.94	0.69	0.48	E	E	C	#404	#229	m171
	SBL/T	72.5	55.8	31.2	0.96	0.68	0.48	E	E	C	#429	#222	m175
SBR	5.6	18.0	36.3	0.13	0.45	0.16	A	B	D	5	84	m62	
Alternative 1: Streatery Geometry; Existing Split Phasing	Overall	167.4	86.8	70.3	1.36	1.16	1.10	F	F	E			
	Eastbound	220.7	36.3	81.8				F	D	F			
	EBL/T/R	220.7	36.3	81.8	1.44	0.96	1.06	F	D	F	#655	#393	#264
	Westbound	27.5	18.7	29.6				C	B	C			
	WBT/R	27.5	18.7	29.6	0.62	0.70	0.56	C	B	C	190	188	187
	Northbound	19.9	47.8	27.8				B	D	C			
	NBL	9.0	26.7	12.6	0.27	0.73	0.51	A	C	B	9	m54	m28
	NBL/T/R	24.8	64.6	39.1	0.63	1.00	0.83	C	E	D	61	m#246	#249
	Southbound	207.0	276.8	121.5				F	F	F			
	SBL	70.4	60.9	31.6	0.94	0.75	0.48	E	E	C	#404	#261	m171
SBL/T/R	294.4	389.8	166.0	1.55	1.72	1.23	F	F	F	#706	#594	#487	
Alternative 2: Streatery Geometry; Concurrent N/S Phasing	Overall	72.8	35.6	27.7	1.22	1.04	0.96	E	D	C			
	Eastbound	92.4	36.3	22.2				F	D	C			
	EBL/T/R	92.4	36.3	22.2	1.16	0.96	0.89	F	D	C	#785	#406	#342
	Westbound	12.1	17.7	14.9				B	B	B			
	WBT/R	12.1	17.7	14.9	0.46	0.68	0.41	B	B	B	113	141	148
	Northbound	18.3	50.3	41.0				B	D	D			
	NBL	38.0	95.2	77.5	0.65	1.06	0.97	D	F	E	#127	#328	#264
	NBT/R	8.1	6.7	7.8	0.33	0.41	0.43	A	A	A	26	17	32
Southbound	93.8	45.1	42.4				F	D	D				
SBL	147.0	54.7	59.0	1.20	0.81	0.85	F	D	E	#468	#283	m#258	

Scenario	Approach	Synchro 10 (HCM2000) Results											
		Delay (sec/veh)			v/c Ratio			Level of Service			95th-% Queues		
		AM	PM	Sat	AM	PM	Sat	AM	PM	Sat	AM	PM	Sat
	SBT/R	53.0	39.2	32.7	0.93	0.70	0.71	D	D	C	#477	290	#46
Alternative 3: Streatery Geometry; Concurrent N/S Phasing with N/S LT Phases	Overall	85.1	43.1	32.3	1.23	0.99	0.92	F	D	C			
	Eastbound	98.5	27.3	18.6				F	C	B			
	EBL/T/R	98.5	27.3	18.6	1.18	0.91	0.87	F	C	B	#792	#371	#215
	Westbound	12.5	16.1	16.2				B	B	B			
	WBT/R	12.5	16.1	16.2	0.47	0.66	0.40	B	B	B	135	90	161
	Northbound	41.2	54.7	37.6				D	D	D			
	NBL	71.0	87.1	57.3	0.57	0.94	0.76	E	F	E	#80	#225	#161
	NBT/R	25.8	23.2	19.7	0.57	0.66	0.61	C	C	B	168	235	200
	Southbound	123.0	91.5	71.2				F	F	E			
	SBL	84.2	46.1	36.4	1.03	0.70	0.65	F	D	D	#438	#161	m#178
SBT/R	152.8	119.5	91.4	1.22	1.07	1.00	F	F	F	#573	#441	#352	

The in-depth capacity analysis demonstrates that implementing the Streatery geometry without making adjustments to the signal operation will result in significant impacts to vehicular operations. In **Alternative 1**, LOS during AM and PM peak hours is reduced from a C to an F. Significant queuing increases are expected for all four approaches that will impact upstream intersections, and many movements begin to operate over capacity.

Implementing concurrent phasing for Wisconsin Avenue NW in **Alternative 2** results in some mitigation to the impacts to the northbound and southbound movements. LOS during AM and PM peak hours improve from F in each for **Alternative 1** to E and D, respectively. In general, northbound and southbound queues are reduced over those in **Alternative 1** to be comparable to queues in the existing condition. However, queues for the northbound and southbound left turns are significantly increased as a result of the phasing change. These left turn movements are now no longer completely protected, but conflict with the opposing vehicular movement and crosswalk. This presents operational challenges for the northbound and southbound left turn movements compared with the existing condition, as well as introduces conflicts that are not present in the existing conditions. Additionally, the phasing adjustment does not mitigate impacts to eastbound and westbound M Street NW approaches.

To provide some mitigation for the impacts to northbound and southbound left turn operations, **Alternative 3** was developed which includes a protected-permissive phase for both the northbound and southbound left turn movements. While this phase improves the operations for the left turn movements and reduces queues, it has adverse impacts on the opposing through movements. As a result, overall intersection delay and LOS worsens in **Alternative 3** compared with **Alternative 2**. Additionally, while it will help to reduce left-turn conflicts with opposing through vehicles and pedestrians at the beginning of the cycle, it still introduces a permissive conflict with both movements that is not present today.

MODIFIED STREATERY DESIGN

In order to balance the District’s goals to provide expanded walking and dining spaces for pedestrians during the ongoing COVID-19 pandemic with the need to provide safe and efficient transportation for users of all modes at the intersection of Wisconsin Avenue and M Street, NW, a modified Streatery design concept is proposed that would maintain the existing signal operation with right-turn overlaps. This would be accomplished by ending the Streatery zones in advance of the intersection on the existing approaches with right-turn overlaps (i.e. eastbound, westbound, and southbound), thus providing exclusive right-turn bays. These modifications would require changes to or the elimination of bump-outs on three of four corners. This alternative still maintains a significant amount of curb space designated for the proposed Streatery at Wisconsin Avenue and M Street, NW and has a minimal impact on the total amount of Streatery space proposed in Georgetown. A concept showing proposed modifications to the Streatery design is shown in **Figure 5** with modifications shown in orange.

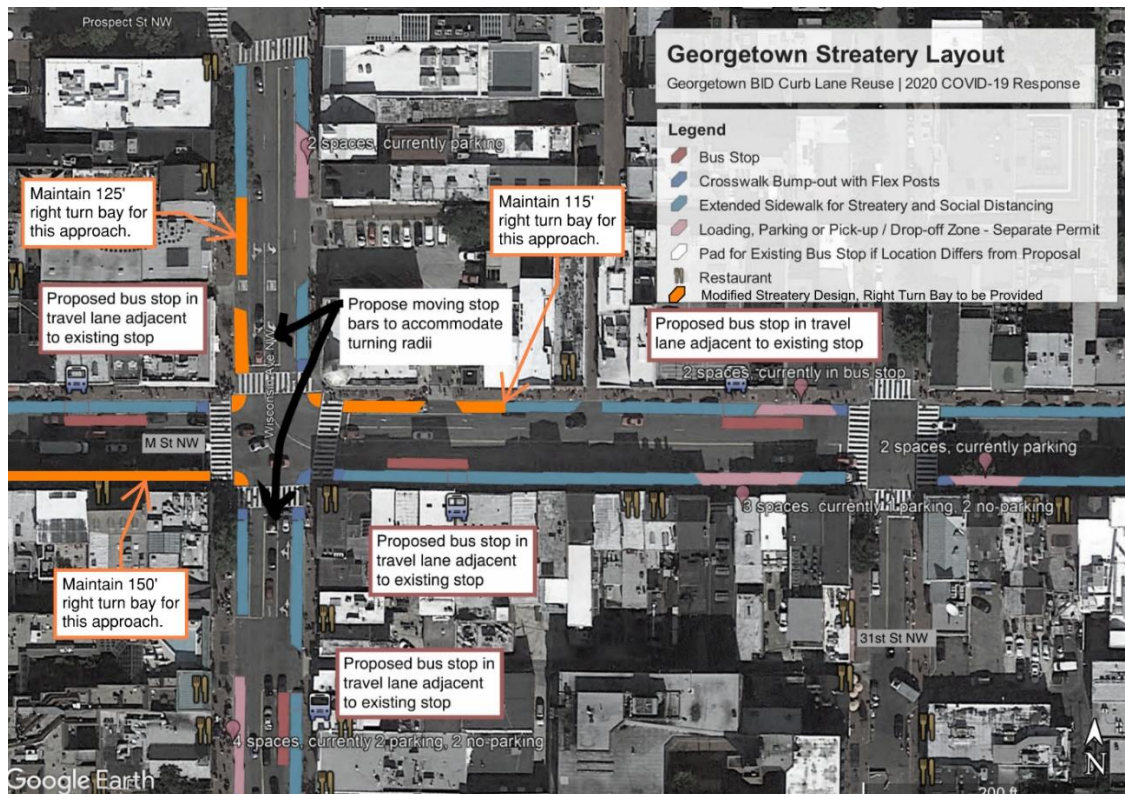


Figure 5 - Modified Streatery Concept at Wisconsin Avenue and M Street, NW



Traffic operations analyses for the existing and two alternative scenarios are presented in **Table 3**.

Table 3 - Summary of Capacity Analysis for Wisconsin Avenue and M Street, NW (Modified Streatery)

Scenario	Approach	Synchro 10 (HCM2000) Results											
		Delay (sec/veh)			v/c Ratio			Level of Service			95th-% Queues		
		AM	PM	Sat	AM	PM	Sat	AM	PM	Sat	AM	PM	Sat
Baseline: Existing Geometry; Existing Split Phasing	Overall	30.0	22.8	24.8	0.72	0.55	0.64	C	C	C			
	Eastbound	16.0	6.2	23.3				B	A	C			
	<i>EBL/T/R</i>	19.1	6.7	28.1	0.69	0.40	0.72	B	A	C	205	31	154
	Westbound	35.7	28.9	29.4				D	C	C			
	<i>WBT</i>	23.2	14.2	29.2	0.37	0.45	0.54	C	B	C	127	67	185
	<i>WBR</i>	61.3	73.4	38.2	0.62	0.74	0.03	E	E	D	207	#240	m11
	Northbound	8.5	20.6	10.5				A	C	B			
	<i>NBL</i>	9.3	22.5	11.3	0.29	0.57	0.42	A	C	B	9	m42	m23
	<i>NBL/T/R</i>	8.2	19.7	10.1	0.32	0.61	0.49	A	B	B	9	m42	21
	Southbound	58.6	42.6	33.0				E	D	C			
	<i>SBL</i>	70.4	56.7	31.6	0.94	0.69	0.48	E	E	C	#404	#229	m171
	<i>SBL/T</i>	72.5	55.8	31.2	0.96	0.68	0.48	E	E	C	#429	#222	m175
<i>SBR</i>	5.6	18.0	36.3	0.13	0.45	0.16	A	B	D	5	84	m62	
Alternative 1: Streatery Geometry; Existing Split Phasing	Overall	167.4	86.8	70.3	1.36	1.16	1.10	F	F	E			
	Eastbound	220.7	36.3	81.8				F	D	F			
	<i>EBL/T/R</i>	220.7	36.3	81.8	1.44	0.96	1.06	F	D	F	#655	#393	#264
	Westbound	27.5	18.7	29.6				C	B	C			
	<i>WBT/R</i>	27.5	18.7	29.6	0.62	0.70	0.56	C	B	C	190	188	187
	Northbound	19.9	47.8	27.8				B	D	C			
	<i>NBL</i>	9.0	26.7	12.6	0.27	0.73	0.51	A	C	B	9	m54	m28
	<i>NBL/T/R</i>	24.8	64.6	39.1	0.63	1.00	0.83	C	E	D	61	m#246	#249
	Southbound	207.0	276.8	121.5				F	F	F			
<i>SBL</i>	70.4	60.9	31.6	0.94	0.75	0.48	E	E	C	#404	#261	m171	
<i>SBL/T/R</i>	294.4	389.8	166.0	1.55	1.72	1.23	F	F	F	#706	#594	#487	
Modified Streatery Concept - Existing Phasing	Overall	46.0	28.4	29.2	0.98	0.76	0.75	D	C	C			
	Eastbound	47.2	9.6	23.3				D	A	C			
	<i>EBL/T</i>	57.2	11.1	28.1	1.04	0.63	0.72	E	B	C	#572	145	154
	<i>EBR</i>	2.5	4.8	8.4	0.33	0.31	0.39	A	A	A	6	34	34
	Westbound	35.7	28.9	35.4				D	C	D			
	<i>WBT</i>	23.2	14.2	29.2	0.37	0.45	0.54	C	B	C	127	67	185
	<i>WBR</i>	61.3	73.4	52.7	0.62	0.74	0.61	E	E	D	207	#240	211
	Northbound	19.9	47.8	27.8				B	D	C			
<i>NBL</i>	9.0	26.7	12.6	0.27	0.73	0.51	A	C	B	9	m54	m28	



Scenario	Approach	Synchro 10 (HCM2000) Results											
		Delay (sec/veh)			v/c Ratio			Level of Service			95th-% Queues		
		AM	PM	Sat	AM	PM	Sat	AM	PM	Sat	AM	PM	Sat
	<i>NBL/T/R</i>	24.8	64.6	39.1	0.63	1.00	0.83	C	E	D	61	m#246	#249
	Southbound	58.6	42.6	33.0				E	D	C			
	<i>SBL</i>	70.4	56.7	31.6	0.94	0.69	0.48	E	E	C	#404	#229	m171
	<i>SBL/T</i>	72.5	55.8	21.2	0.96	0.68	0.48	E	E	C	#429	#222	m175
	<i>SBR</i>	5.3	18.0	36.3	0.14	0.45	0.16	A	B	D	6	84	m63

While still increasing delays and queues for each approach, especially for eastbound M Street NW, the **Modified Streatery Design Alternative** mitigates the impacts of lane reductions and improves the LOS over the original Streatery concept to achieve passing grades. In fact, overall LOS is unchanged in the PM and weekend peak hours and only degrades by one letter grade in the AM peak hour.

This **Modified Streatery Design Alternative** improves upon the original Streatery concept at Wisconsin Avenue and M Street, NW in several aspects, including the following:

1. Right-turn overlaps are maintained through the provision of exclusive right-turn bays. This maintains acceptable operations for the on average 150-220 vph turning right on each of the westbound, eastbound, and southbound approaches during peak hours at the study intersection. Maintenance of the overlaps also provides dedicated protected green time for right turning vehicles, reducing the time that right turns are conflicting with pedestrians.
2. Similarly, the protected-only westbound right turn is maintained in this alternative through the provision of an exclusive right-turn bay. This provides a significant safety benefit given the extremely high pedestrian volumes in the north crosswalk.
3. Existing split phasing is retained, which maintains time-separation of the northbound and southbound left turns from the west and east crosswalks, respectively. This provides a significant safety benefit given the extremely high pedestrian volumes at the study intersection.
4. The provision of exclusive right-turn bays provides a safety and operational benefit for the affected approaches. Right turning vehicles are given a designated place to wait while yielding to pedestrians, reducing the chances that vehicles will fail to yield for pedestrians or encroach on the crosswalk to move out of the way of through vehicles. This also reduces blockages to through vehicles, which will become more critical given the reduction in lane capacity associated with the Streatery design.

Recommended exclusive right turn bay lengths were calculated based on the peak hour right turn demand to avoid spillback into the through travel lanes (which could result in undesirable weaving behaviors). These lengths are presented in **Table 4**.

Table 4 - Turn Bay Length Calculations for Modified Streatery Design

Approach	AM Peak Hour Volume (vph)	PM Peak Hour Volume (vph)	WE Peak Hour Volume (vph)	Recommended Turn Bay Length (ft)
EBR	224	188	208	150
WBR	148	152	166	115
SBR	126	181	148	125

CONCLUSION AND RECOMMENDATIONS

As presented in the corridor-wide traffic analysis, moderate impacts to traffic operations are expected at 12 of 13 signalized intersections within the study area. The following observations and recommendations are made for these 12 intersections:

- Infrequent blockages of westbound M Street NW may occur at 33rd Street NW due to the combined effect of bus blockages and permissive left turns.
 - Due to the extremely low volumes of left turning traffic, no mitigation is recommended for this location at the present time.
 - In the event of adverse impacts following project open the westbound left turn may need to be restricted during peak periods
- Heavy outbound volumes of PM traffic typically spill back from the intersection of Key Bridge and M Street, NW, which with the proposed expanded sidewalks at 34th Street NW may result in a complete loss of westbound throughput.
 - It is recommended that the proposed sidewalk expansion be removed along the north side of M Street NW from the bank alley to 34th Street NW.
 - This change will allow westbound through vehicles to bypass left turning vehicles, thereby reducing the impacts of spillback from Key Bridge in the Georgetown roadway network.
- In addition to the above concerns, impacts from the proposed lane reductions may be more significant than indicated due to friction, queue spillback, and other complexities that are present in Georgetown.
 - Field observations and fine-tuning are recommended if the Streateries are to be implemented corridor-wide, as well as strict enforcement of illegal stopping, loading, and unloading behaviors to maximize throughput of the available traffic lanes.

The results of the traffic operations analysis also indicate several concerns with the Streatery design at Wisconsin Avenue and M Street, NW as proposed. First, if implemented as shown, the Streatery will require the removal of existing right turn overlaps and protected phasing, leading to safety and operational concerns. Second, the reduction in lane capacity and subsequent integration of the through movement and right turn movements into a single traffic stream will result in an unacceptable degradation of traffic operations. Third, signal phasing changes to improve operations will result in the introduction of new conflicts between turning vehicles and pedestrians.

To mitigate these concerns, **it is recommended that the proposed Streatery design be modified to end the designated Streatery spaces in advance of the intersection of Wisconsin Avenue and M Street, NW on three approaches in order to maintain the exclusive right turn bays provided in the existing condition.** This will address each of the above concerns by allowing the existing right turn overlaps and protected right turn phases to remain in place, allowing the existing split phasing to remain in place, and preventing a degradation of traffic operations by more than a single letter grade for each peak. Recommended turn bay lengths are provided in **Table 4**. This modified design will not impact proposed Streateries at any other signalized intersection within the proposed area, providing more than adequate space for the proposed Georgetown Streateries while maintaining safe and efficient operation of the critical Wisconsin Avenue and M Street, NW intersection.