

McDonough & Rea Associates, Inc.

Traffic and Transportation Consulting

Kevin P. McDonough (1953-1994)
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December 21, 2021

Lawrence Township Planning Board
P.O. Box 6006
Lawrenceville, New Jersey 08648

Re: Spruce Street Apartments
Lot 39 in Block 701
Lawrence Township, Mercer County
MRA File No. 21-239

Dear Board Members:

McDonough & Rea Associates (MRA) has been asked to provide a *Traffic Impact Study* for plans to construct 129 apartments on the noted property. The property is located on the east side of Spruce Street, generally behind the existing *Boys & Girls Club* building as shown on *Figure 1*, a *Site Location Map* in the *Appendix*.

Plans prepared by Hopewell Valley Engineering (HVE) show a single point of access to Spruce Street which will be designed to be a right-in/right-out only driveway.

SCOPE OF STUDY

In order to prepare a thorough *Traffic Impact Analysis* for the project, MRA conducted the following tasks:

1. Made field visits to the site to establish existing roadway and traffic conditions in the area.
2. Conducted peak hour traffic counts at the following locations:
 - Spruce Street at Tiffany Woods Court/Capital Plaza
 - Spruce Street at Arctic Parkway
3. Prepared estimates of traffic to be generated by the 129 apartments based upon Institute of Transportation Engineers (ITE) data.
4. Distributed site generated traffic north and south along Spruce Street in accordance with anticipated origins and destinations of site generated traffic.

Please reply to:

- 1431 Lakewood Road, Suite C, Manasquan, NJ 08736 • (732) 528-7076 • Fax (732) 528-6673
- 105 Elm Street, Lower Level, Westfield, NJ 07090 • (908) 789-7180 • Fax (908) 789-7181



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5. Prepared estimates of future traffic volume demand for the 2026 design year including background traffic growth from the New Jersey Department of Transportation's (NJDOT) *Background Traffic Growth Rate* data for the area.
6. Conducted level of service capacity analyses for the site driveway to Spruce Street and the intersection of Spruce Street at Tiffany Woods Court/Capital Plaza and Spruce Street/Arctic Parkway in accordance with the latest *Highway Capacity Manual* procedures.
7. Reviewed the *Site Plan* with respect to conformance with New Jersey *Residential Site Improvement Standards (RSIS)*.

The following report sets forth the data base accumulated and the conclusions reached with respect to the Spruce Street apartments.

EXISTING CONDITIONS

Spruce Street in the vicinity of the site is a 4-lane (2 lanes in each direction) north/south roadway under the jurisdiction of Mercer County. It has a generally level and straight alignment in the area and a posted speed limit of 40 MPH.

Tiffany Woods Court intersects Spruce Street from the east at an unsignalized intersection under stop control. The west leg of the intersection is a driveway serving the *Capital Plaza* shopping center; however, this is a secondary driveway to the center.

The intersection of Spruce Street at Arctic Parkway is a signalized intersection with a leading left turn arrow for northbound Spruce Street traffic turning left onto Arctic Parkway. The 4th leg of the intersection, opposite Arctic Parkway, is currently inactive but will likely be developed in the future.

EXISTING TRAFFIC VOLUMES

Traffic volume data was collected by MRA through the conduct of manual turning movement counts at the following intersection:

- Spruce Street at Tiffany Woods Court/Capital Plaza
- Spruce Street at Arctic Parkway

The traffic counts were conducted in October of 2021 during weekdays when schools were in session. *Figure 2* in the *Appendix* illustrates existing peak hour traffic flow in the area.



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TRIP GENERATION/DISTRIBUTION

Estimates of traffic to be generated by the 129 apartments were made after reviewing the 10th Edition of the ITE *Trip Generation Manual*. Land Use Code 221, *Multi-Family Housing-Mid-Rise* was utilized for the trip generation analysis. Based on the ITE data, *Table I* illustrates the anticipated peak hour traffic generation from the 129 apartments.

**TABLE II
TRIP GENERATION
129 MID-RISE MULTI-FAMILY UNITS**

AM PSH			PM PSH		
IN	OUT	TOTAL	IN	OUT	TOTAL
12	34	46	35	22	57

With respect to the distribution of site generated traffic, since the site driveway to Spruce Street will only be a right-in/right-out driveway, left turns onto and off Spruce Street will be prohibited. All entering traffic must approach from the south on Spruce Street in order to enter the apartments. *Figure 3* in the *Appendix* illustrates anticipated site generated traffic volumes during the morning and afternoon peak hours.

ANALYSIS OF FUTURE TRAFFIC

A design year of 2026 was assumed for analysis. The NJDOT’s *Background Traffic Growth Rate* data for the area was consulted with a finding that background traffic growth is expected to occur at 1.0 percent per year along Spruce Street. *Figure 4* in the *Appendix* illustrates design year 2026 *no-build* traffic volumes.

Site generated and distributed traffic volumes were then surcharged onto no-build volumes and are shown on *Figure 5* in the *Appendix*.

Traffic engineers calculate levels of service of unsignalized and signalized intersections which relate to the quality of traffic flow. Level of service is a measure of average control delay. Average control delay is the time lost due to deceleration and the amount of time from when a vehicle is stopped for a traffic control device (or at the end of the queue) to when the vehicle departs the intersection. Delay is a relative quantity of driver discomfort, frustration, fuel consumption, and loss in travel time.



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Levels of service range from “A” to “F,” with “A” being the highest, or best attainable level of service. Level of service “E” with average control delays of not more than 50 seconds per vehicle at an unsignalized intersection or 80 seconds per vehicle at a signalized intersection indicates near to or at capacity conditions and is generally considered the limit of acceptable level of service and delay.

Full definitions of levels of service for unsignalized and signalized intersections as well as level of service summaries are included in the *Appendix*. The intersections studied by this report were analyzed according to the procedures set forth in the *Highway Capacity Manual 2010*, using the *McTrans Highway Capacity Software (HCS7)*, release 7.9.5.

SPRUCE STREET/ARCTIC PARKWAY

At the signalized off-site intersection of Spruce Street/Arctic Parkway findings were that the intersection currently operates at level of service “A” for existing conditions during the AM peak street hour. For the 2026 design year it will continue to operate at level of service “A” for the *no-build* and *build* condition for the AM peak street hour.

During the PM peak street hour, findings were that the intersection currently operates at level of service “B”. It will continue to operate at level of service “B” for the 2026 design year for both the *no-build* and *build* condition.

Therefore, the off-site signalized intersection of Spruce Street/Arctic Parkway will operate well within accepted traffic engineering parameters.

SPRUCE STREET/TIFFANY WOODS COURT/CAPITAL PLAZA

At this unsignalized 4-way intersection, findings were that traffic entering Spruce Street from either Tiffany Woods Court or the Capital Plaza driveway does so at level of service “C” during the AM peak street hour for the existing condition. For the 2026 design year, findings were that all movements would operate at level of service “D” or better for both the *no-build* and *build* condition.

For the PM peak street hour, findings were that movements entering Spruce Street from the 2 side streets do so at level of service “D” during the PM peak street hour. For the 2026 design year, all movements will operate at level of service “E” or better for both the *no-build* and *build* condition.



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Based on the foregoing, there will be no change in the level of service at this location for either the AM peak street hour or PM peak street hour with the Spruce Street apartments traffic added to the intersection. Therefore, this development will not have a significant impact on this location.

The Applicant has met with the Mercer County Planning Board to discuss the project and access to Spruce Street which is under Mercer County jurisdiction. The Applicant has been advised that there is a potential future traffic signal planned for Spruce Street/Tiffany Woods Drive and, as a result, has prepared a plan that shows how access to Tiffany Woods Drive and the future traffic signal can be accomplished.

SITE DRIVEWAY TO SPRUCE STREET

For the site driveway to Spruce Street, findings were that it will operate at level of service "B" for both the AM peak street hour and PM peak street hour for the 2026 design year. Therefore, this intersection will operate within accepted traffic engineering parameters. Again, all movements at this location are assumed to be right-in/right-out movements only.

SITE PLAN & PARKING

The *Site Plan*, prepared by HVE, shows a divided boulevard serving as access to the 129 units. Based on New Jersey *RSIS*, a multi-family development is allowed to operate on a single point of access if the total 24 hour daily traffic volume is less than 1,000 vehicles per day. Based on ITE data, the 129 units will generate approximately 702 daily trips (total of ins and outs); therefore, this threshold is met.

Parking is also provided in accordance with New Jersey *RSIS* and is well distributed throughout the site around the 4 residential buildings and the clubhouse/recreation area.

CONCLUSIONS

It is concluded, based on the analysis set forth in this report, that plans to construct 129 residential apartments on the noted property can be approved and operate compatibly with existing and future traffic conditions in the area. For the 2026 design year, the site access to Spruce Street, which will be a right-in/right-out only access, will operate at level of service "B" for both the AM and PM peak street hours. The off-site intersections of Spruce Street/Arctic Parkway (signalized) and Spruce Street/Tiffany Woods Court/Capital Plaza (unsignalized) will not be significantly impacted by this proposal and will also continue to operate within acceptable traffic engineering parameters.



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The *Site Plan* itself has been properly designed with respect to availability and accessibility of the parking supply, conformance to New Jersey *RSIS* and proper traffic engineering principles.

A representative from MRA will be in attendance at an upcoming Lawrence Township Planning Board meeting to provide expert testimony and to answer any questions Board members, Board experts or the public may have.

Very truly yours,

John H. Rea, PE
Principal

Scott T. Kennel
Sr. Associate

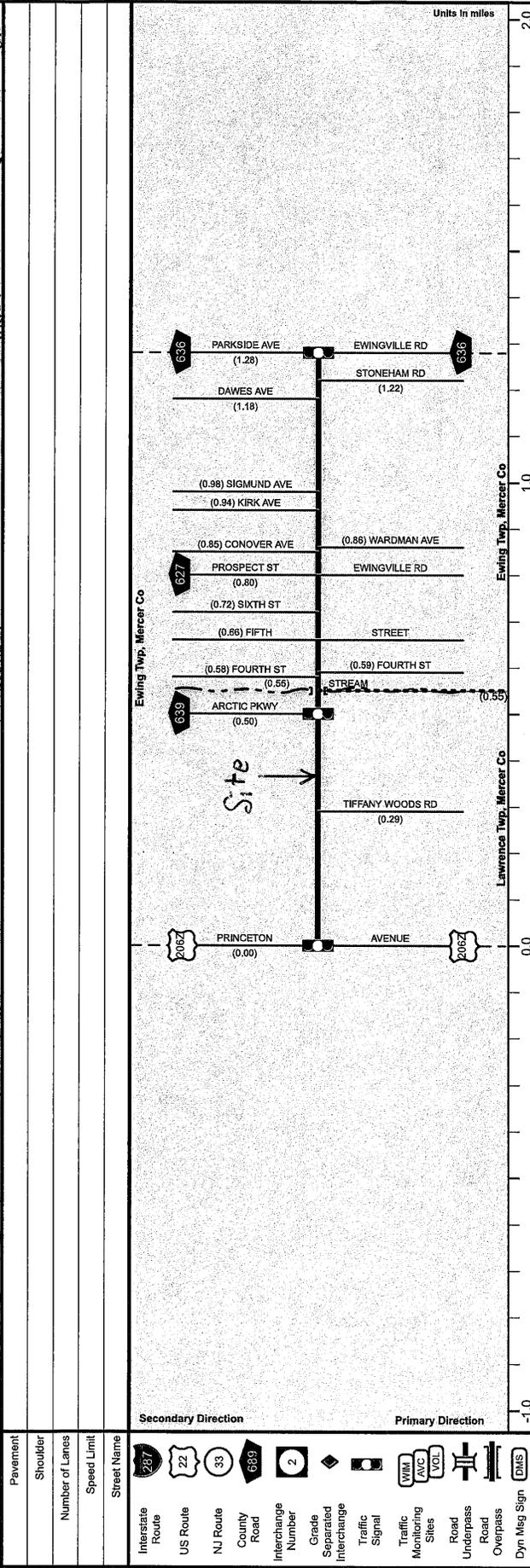
cc: Joe Kline
Russell M. Smith, PE
Dino Spadaccini, Esq.
Dante Germano

APPENDIX

SITE LOCATION MAP

Mile Posts: 0.000 - 1.280

MERCER COUNTY 613 (South to North)

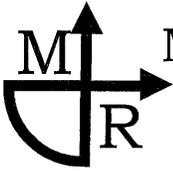


Street Name	Jurisdiction	Functional Class	Federal Aid - NHS Sy	Control Section	Speed Limit	Number of Lanes	Med. Type	Med. Width	Pavement	Shoulder	Traffic Volume	Traffic Sta. ID	Structure No.	Enlarged Views
PRINCETON AVENUE	County	Urban Minor Arterial		STP	99	4	None				48			
TIFFANY WOODS RD	County	STP			35	2					32			
ARCTIC PKWY	County	STP												
PROSPECT ST	County	STP												
CONOVER AVE	County	STP												
KIRK AVE	County	STP												
SIGMUND AVE	County	STP												
DAWES AVE	County	STP												
STONEHAM RD	County	STP												
EWINGVILLE RD	County	STP												

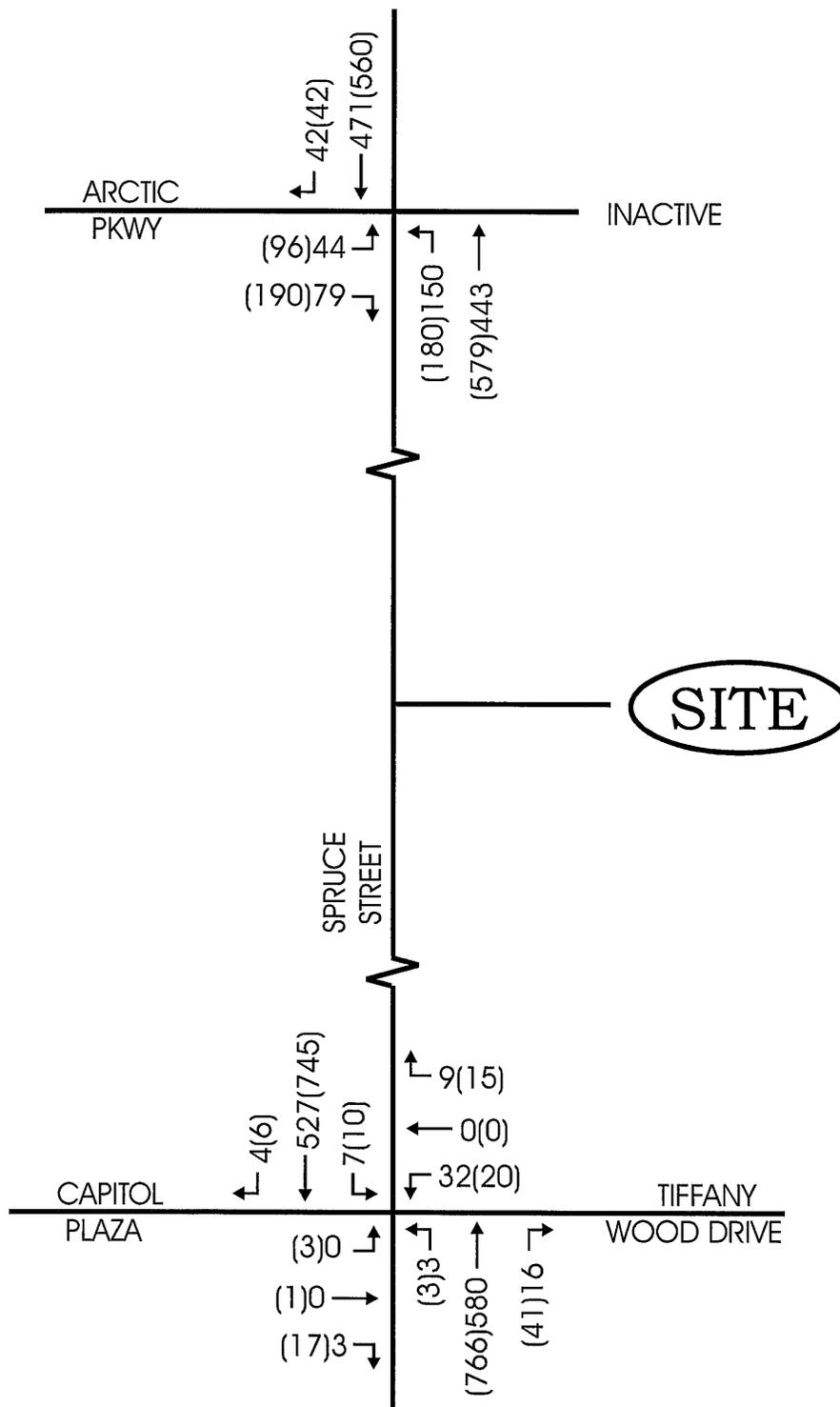
Date last inventoried: May 2011

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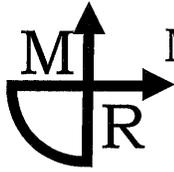
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SUBJECT: SPRUCE STREET APARTMENTS - LAWRENCE TOWNSHIP
EXISTING AM PSH(PM PSH) RAW TRAFFIC VOLUMES

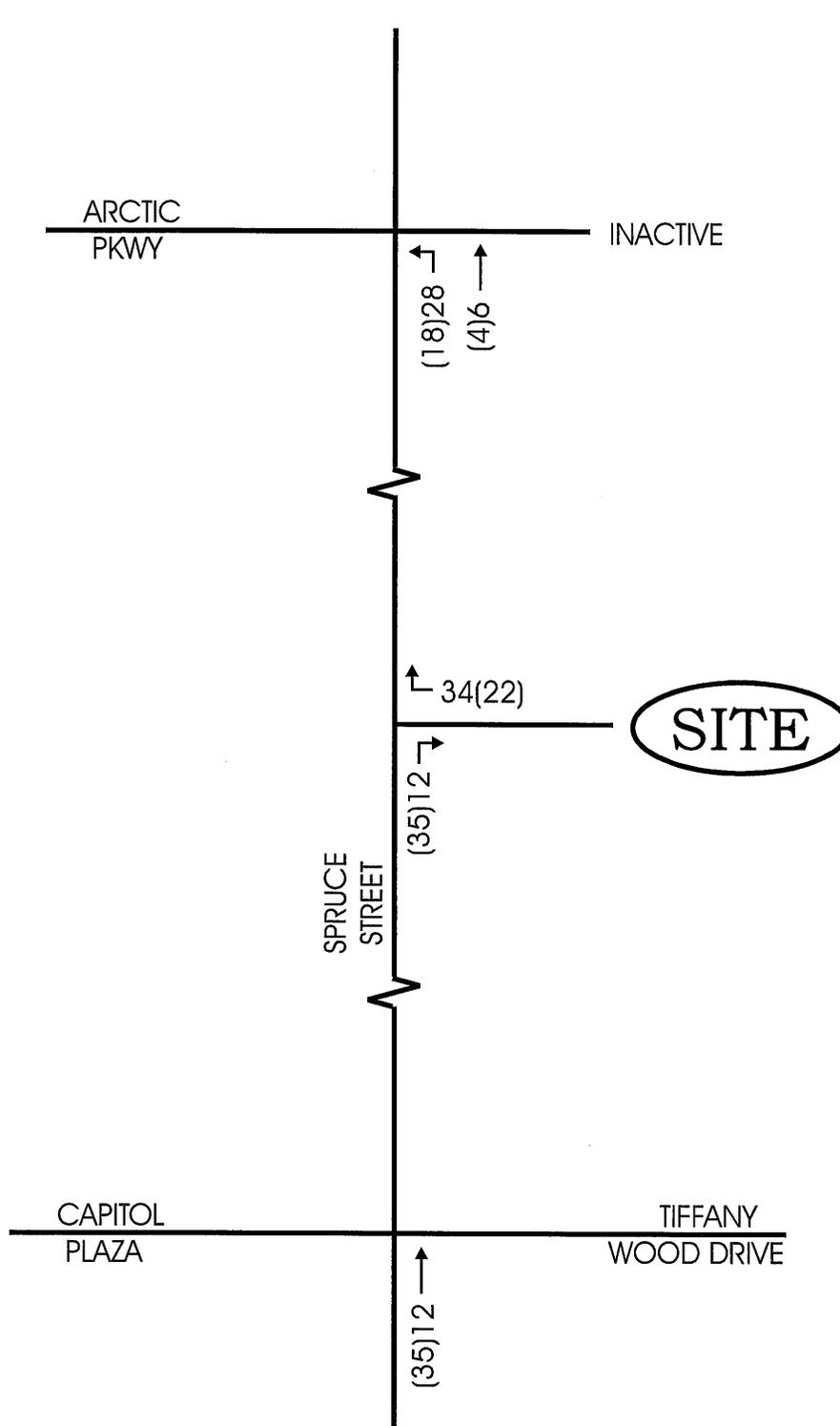


LEGEND: ← AM PSH(PM PSH)

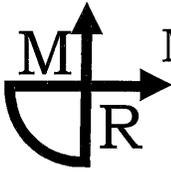


SUBJECT:

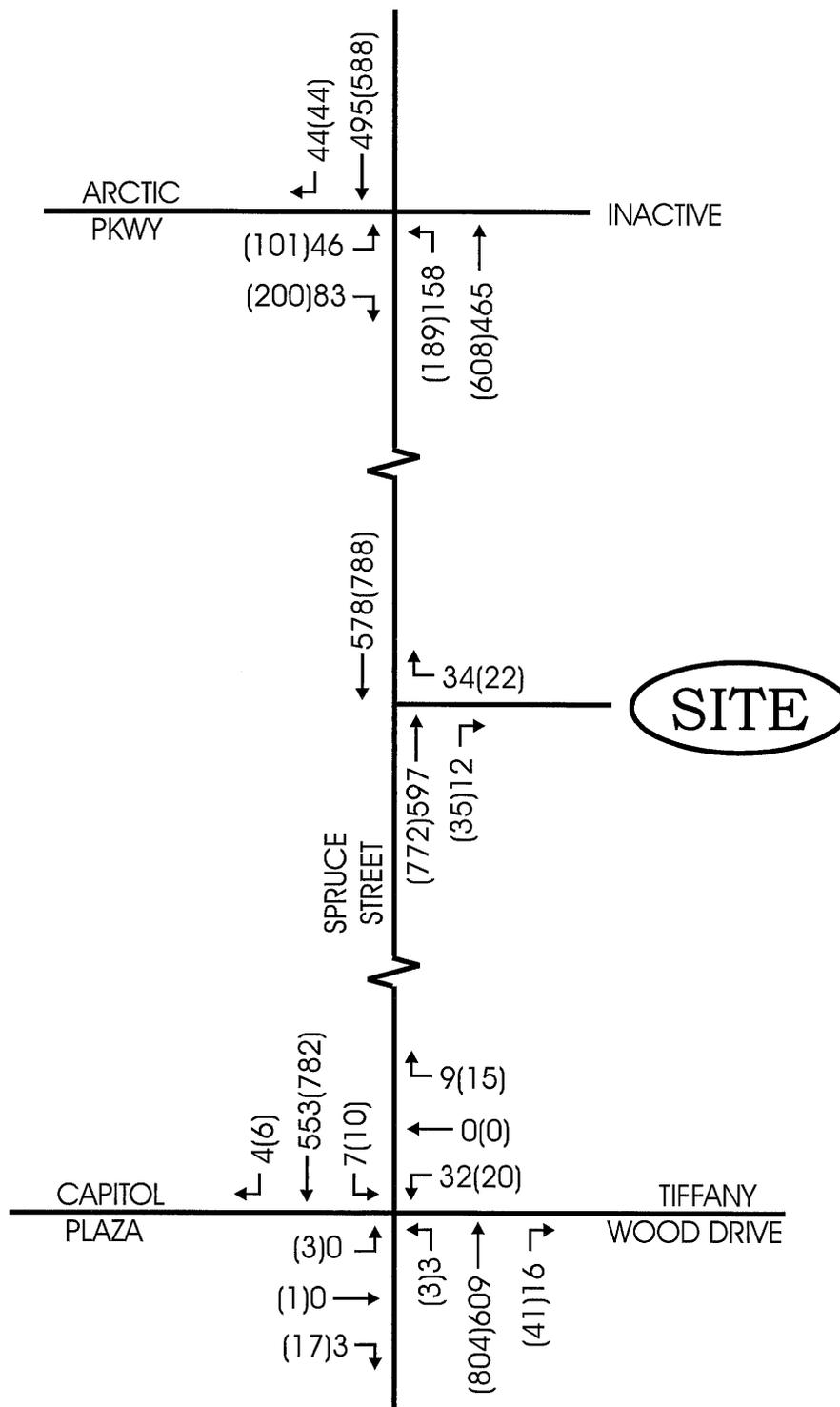
SPRUCE STREET APARTMENTS - LAWRENCE TOWNSHIP
SITE GENERATED TRAFFIC VOLUMES



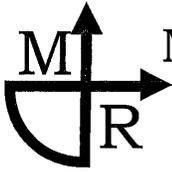
LEGEND: ← AM PSH(PM PSH)



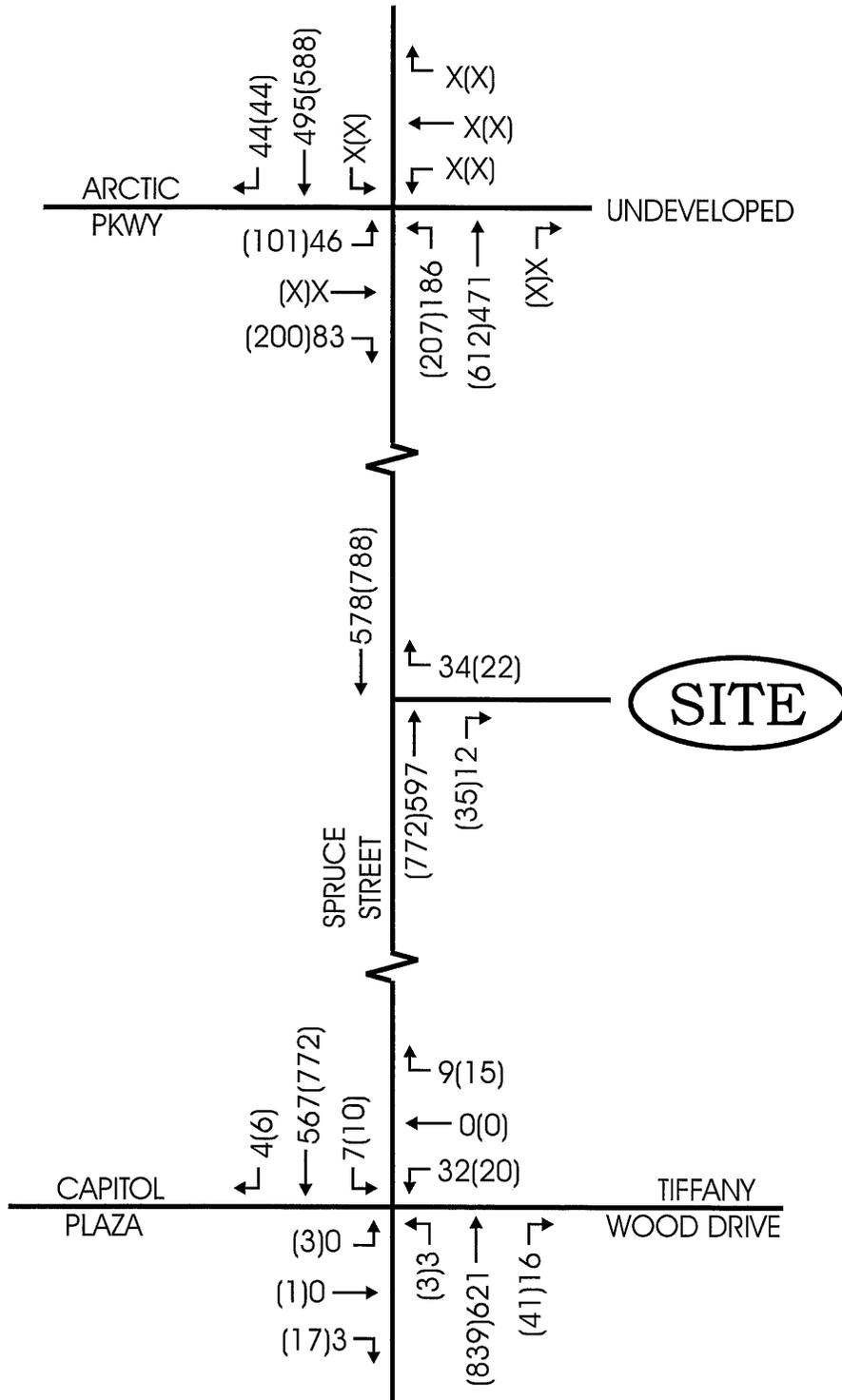
SUBJECT: SPRUCE STREET APARTMENTS - LAWRENCE TOWNSHIP
DESIGN YEAR 2026 NO - BUILD TRAFFIC VOLUMES



LEGEND: ← AM PSH(PM PSH)



SUBJECT: SPRUCE STREET APARTMENTS - LAWRENCE TOWNSHIP
DESIGN YEAR 2026 BUILD TRAFFIC VOLUMES

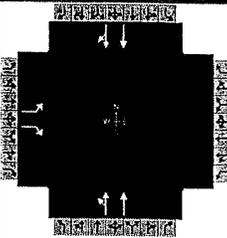


**LEVEL OF SERVICE
FOR
SIGNALIZED INTERSECTIONS¹**

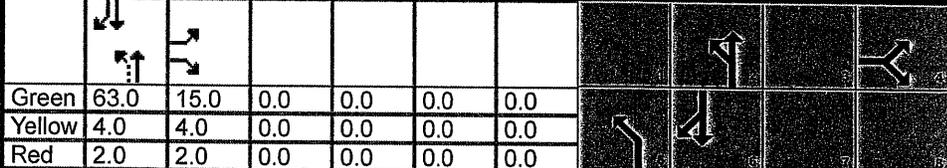
<u>Level of Service</u>	<u>Description</u>	<u>Control (Signal) Delay Per Vehicle (Seconds)</u>
A	Very short delay, good progression; most vehicles do not stop at intersection.	≤ 10.0
B	Generally good progression and/or short cycle length; more vehicles stop at intersection than at Level of Service "A."	> 10.0 and ≤ 20.0
C	Fair progression and/or longer cycle length; significant number of vehicles stop at intersection, though many still pass through without stopping.	> 20.0 and ≤ 35.0
D	Congestion becomes noticeable; longer delays from unfavorable progression, long cycle lengths, or high volume/capacity ratios; many vehicles stop at intersection.	> 35.0 and ≤ 55.0
E	Considered to be the <u>limit of acceptable delay</u> ; indicative of poor progression, long cycle lengths, or high volume/capacity ratios; frequent individual cycles failures.	> 55.0 and ≤ 80.0
F	Often an indication of over-saturation (i.e., arrival flow exceeds capacity); also caused by poor progression and long cycles lengths; capacity is not necessarily exceeded under this level of service.	> 80.0

¹ Transportation Research Board, Highway Capacity Manual 2010, National Research Council, Washington, DC, 2010.

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information		
Agency	MRA			Duration, h	0.250	
Analyst	STK	Analysis Date		Area Type	Other	
Jurisdiction		Time Period	AM	PHF	0.90	
Urban Street	SPRUCE ST	Analysis Year	2021 EXIST	Analysis Period	1> 7:00	
Intersection	ARTIC PARKWAY	File Name	21-239AE-1.xus			
Project Description	21-239AE-1					

Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	44		79				150	443			471	42

Signal Information												
Cycle, s	90.0	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	No	Simult. Gap E/W	On									
Force Mode	Fixed	Simult. Gap N/S	On									
Green	63.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

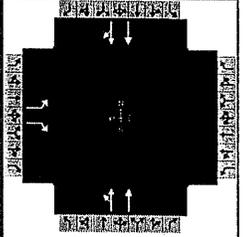
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			0.0	14.2		8.3
Phase Duration, s		21.0			0.0	69.0		69.0
Change Period, (Y+R _c), s		6.0			3.0	6.0		6.0
Max Allow Headway (MAH), s		2.9			0.0	0.0		0.0
Queue Clearance Time (g _s), s		4.1						
Green Extension Time (g _e), s		0.1			0.0	0.0		0.0
Phase Call Probability		1.00						
Max Out Probability		0.00						

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14				5	2		6		16
Adjusted Flow Rate (v), veh/h	49		32				272	387		276		272
Adjusted Saturation Flow Rate (s), veh/h/ln	1781		1585				1008	1702		1870		1841
Queue Service Time (g _s), s	2.1		1.6				4.8	7.9		6.9		4.7
Cycle Queue Clearance Time (g _c), s	2.1		1.6				4.8	7.9		6.9		4.7
Green Ratio (g/C)	0.17		0.17				0.70	0.70		0.70		0.70
Capacity (c), veh/h	297		264				770	1192		1309		1288
Volume-to-Capacity Ratio (X)	0.165		0.122				0.353	0.324		0.211		0.211
Back of Queue (Q), ft/ln (85 th percentile)	45.7		30.1				94.4	98.9		68.1		67.3
Back of Queue (Q), veh/ln (85 th percentile)	1.8		1.2				3.7	3.9		2.7		2.6
Queue Storage Ratio (RQ) (85 th percentile)	0.00		0.00				0.00	0.00		0.00		0.00
Uniform Delay (d ₁), s/veh	32.1		31.9				6.9	5.2		4.8		4.8
Incremental Delay (d ₂), s/veh	1.2		0.9				1.3	0.7		0.4		0.4
Initial Queue Delay (d ₃), s/veh	0.0		0.0				0.0	0.0		0.0		0.0
Control Delay (d), s/veh	33.3		32.8				8.1	6.0		5.1		5.1
Level of Service (LOS)	C		C				A	A		A		A
Approach Delay, s/veh / LOS	33.1		C	0.0			6.9	A		5.1		A
Intersection Delay, s/veh / LOS	7.8						A					

Multimodal Results	EB	WB	NB	SB
Pedestrian LOS Score / LOS				
Bicycle LOS Score / LOS				

HCS7 Signalized Intersection Results Summary

General Information					Intersection Information		
Agency	MRA			Duration, h	0.250		
Analyst	STK	Analysis Date		Area Type	Other		
Jurisdiction		Time Period	AM	PHF	0.90		
Urban Street	SPRUCE ST	Analysis Year	2026 NO-BUILD	Analysis Period	1> 7:00		
Intersection	ARTIC PARKWAY	File Name	21-239ANB-1.xus				
Project Description	21-239ANB-1						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	46		83				158	465			495	44

Signal Information				Signal Phases														
Cycle, s	90.0	Reference Phase	2	Green	63.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Offset, s	0	Reference Point	End	Yellow	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap EW	On	Red	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On															

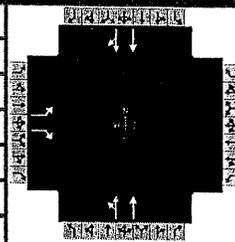
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			0.0	14.2		8.3
Phase Duration, s		21.0			0.0	69.0		69.0
Change Period, (Y+R _c), s		6.0			3.0	6.0		6.0
Max Allow Headway (MAH), s		2.9			0.0	0.0		0.0
Queue Clearance Time (g _s), s		4.2						
Green Extension Time (g _e), s		0.1			0.0	0.0		0.0
Phase Call Probability		1.00						
Max Out Probability		0.00						

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Assigned Movement	7		14				5	2		6	16	
Adjusted Flow Rate (v), veh/h	51		37				280	412		290	286	
Adjusted Saturation Flow Rate (s), veh/h/ln	1781		1585				970	1702		1870	1840	
Queue Service Time (g _s), s	2.2		1.8				4.9	8.6		7.4	5.0	
Cycle Queue Clearance Time (g _c), s	2.2		1.8				4.9	8.6		7.4	5.0	
Green Ratio (g/C)	0.17		0.17				0.70	0.70		0.70	0.70	
Capacity (c), veh/h	297		264				744	1192		1309	1288	
Volume-to-Capacity Ratio (X)	0.172		0.139				0.377	0.346		0.222	0.222	
Back of Queue (Q), ft/ln (85 th percentile)	47.9		34.5				100.6	105.8		72.1	71.3	
Back of Queue (Q), veh/ln (85 th percentile)	1.9		1.4				4.0	4.2		2.8	2.8	
Queue Storage Ratio (RQ) (85 th percentile)	0.00		0.00				0.00	0.00		0.00	0.00	
Uniform Delay (d ₁), s/veh	32.2		32.0				7.3	5.3		4.8	4.8	
Incremental Delay (d ₂), s/veh	1.3		1.1				1.5	0.8		0.4	0.4	
Initial Queue Delay (d ₃), s/veh	0.0		0.0				0.0	0.0		0.0	0.0	
Control Delay (d), s/veh	33.4		33.1				8.7	6.1		5.2	5.2	
Level of Service (LOS)	C		C				A	A		A	A	
Approach Delay, s/veh / LOS	33.3		C	0.0			7.2	A		5.2	A	
Intersection Delay, s/veh / LOS	8.0						A					

Multimodal Results	EB	WB	NB	SB
Pedestrian LOS Score / LOS				
Bicycle LOS Score / LOS				

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	MRA			Duration, h	0.250		
Analyst	STK	Analysis Date		Area Type	Other		
Jurisdiction		Time Period	AM	PHF	0.90		
Urban Street	SPRUCE ST		Analysis Year	2026 BUILD	Analysis Period	1> 7:00	
Intersection	ARTIC PARKWAY		File Name	21-239AFB-1.xus			
Project Description	21-239AFB-1						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	46		83				186	471			495	44

Signal Information				Signal Phases								
Cycle, s	90.0	Reference Phase	2	↓	↘					↑	↙	↗
Offset, s	0	Reference Point	End	Green	63.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0

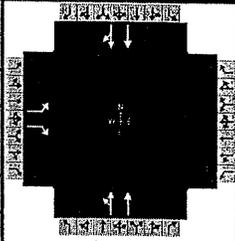
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			0.0	14.2		8.3
Phase Duration, s		21.0			0.0	69.0		69.0
Change Period, (Y+Rc), s		6.0			3.0	6.0		6.0
Max Allow Headway (MAH), s		2.9			0.0	0.0		0.0
Queue Clearance Time (gs), s		4.2						
Green Extension Time (ge), s		0.1			0.0	0.0		0.0
Phase Call Probability		1.00						
Max Out Probability		0.00						

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (v), veh/h	51		37				286	444			290	286
Adjusted Saturation Flow Rate (s), veh/h/ln	1781		1585				898	1702			1870	1840
Queue Service Time (gs), s	2.2		1.8				5.0	9.5			7.4	5.0
Cycle Queue Clearance Time (gc), s	2.2		1.8				8.0	9.5			7.4	5.0
Green Ratio (g/C)	0.17		0.17				0.70	0.70			0.70	0.70
Capacity (c), veh/h	297		264				697	1192			1309	1288
Volume-to-Capacity Ratio (X)	0.172		0.139				0.410	0.373			0.222	0.222
Back of Queue (Q), ft/ln (85 th percentile)	47.9		34.5				107.7	115.4			72.1	71.3
Back of Queue (Q), veh/ln (85 th percentile)	1.9		1.4				4.2	4.5			2.8	2.8
Queue Storage Ratio (RQ) (85 th percentile)	0.00		0.00				0.00	0.00			0.00	0.00
Uniform Delay (d1), s/veh	32.2		32.0				8.0	5.5			4.8	4.8
Incremental Delay (d2), s/veh	1.3		1.1				1.8	0.9			0.4	0.4
Initial Queue Delay (d3), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (d), s/veh	33.4		33.1				9.8	6.4			5.2	5.2
Level of Service (LOS)	C		C				A	A			A	A
Approach Delay, s/veh / LOS	33.3	C	0.0				7.7	A		5.2	A	
Intersection Delay, s/veh / LOS	8.3						A					

Multimodal Results	EB	WB	NB	SB
Pedestrian LOS Score / LOS				
Bicycle LOS Score / LOS				

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	MRA			Duration, h	0.250		
Analyst	STK	Analysis Date		Area Type	Other		
Jurisdiction		Time Period	PM	PHF	0.90		
Urban Street	SPRUCE ST	Analysis Year	2021 EXIST	Analysis Period	1> 7:00		
Intersection	ARTIC PARKWAY	File Name	21-239PE-1.xus				
Project Description	21-239PE-1						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	96		190				180	579			560	42

Signal Information				Signal Timing (s)								Signal Phases							
Cycle, s	90.0	Reference Phase	2	Green	63.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Offset, s	0	Reference Point	End	Yellow	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Uncoordinated	No	Simult. Gap E/W	On	Red	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Force Mode	Fixed	Simult. Gap N/S	On																

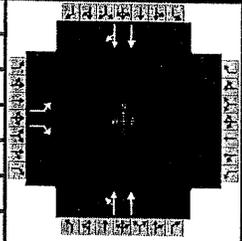
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			0.0	14.2		8.3
Phase Duration, s		21.0			0.0	69.0		69.0
Change Period, (Y+R _c), s		6.0			3.0	6.0		6.0
Max Allow Headway (MAH), s		2.9			0.0	0.0		0.0
Queue Clearance Time (g _s), s		10.2						
Green Extension Time (g _e), s		0.2			0.0	0.0		0.0
Phase Call Probability		1.00						
Max Out Probability		0.17						

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (v), veh/h	107		156				331	513			325	321
Adjusted Saturation Flow Rate (s), veh/h/ln	1781		1585				923	1702			1870	1845
Queue Service Time (g _s), s	4.8		8.2				5.0	11.6			8.4	5.7
Cycle Queue Clearance Time (g _c), s	4.8		8.2				9.5	11.6			8.4	5.7
Green Ratio (g/C)	0.17		0.17				0.70	0.70			0.70	0.70
Capacity (c), veh/h	297		264				710	1192			1309	1292
Volume-to-Capacity Ratio (X)	0.359		0.589				0.466	0.430			0.248	0.249
Back of Queue (Q), ft/ln (85 th percentile)	98.9		147.2				127.4	135.4			81.2	80.8
Back of Queue (Q), veh/ln (85 th percentile)	3.9		5.8				5.0	5.3			3.2	3.2
Queue Storage Ratio (RQ) (85 th percentile)	0.00		0.00				0.00	0.00			0.00	0.00
Uniform Delay (d ₁), s/veh	33.2		34.7				8.3	5.8			4.9	4.9
Incremental Delay (d ₂), s/veh	3.4		9.3				2.2	1.1			0.5	0.5
Initial Queue Delay (d ₃), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (d), s/veh	36.6		43.9				10.5	6.9			5.4	5.4
Level of Service (LOS)	D		D				B	A			A	A
Approach Delay, s/veh / LOS	41.0		D	0.0			8.3	A		5.4		A
Intersection Delay, s/veh / LOS	12.1						B					

Multimodal Results	EB	WB	NB	SB
Pedestrian LOS Score / LOS				
Bicycle LOS Score / LOS				

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	MRA			Duration, h	0.250		
Analyst	STK	Analysis Date		Area Type	Other		
Jurisdiction		Time Period	PM	PHF	0.90		
Urban Street	SPRUCE ST		Analysis Year	2026 NO-BUILD	Analysis Period	1> 7:00	
Intersection	ARTIC PARKWAY		File Name	21-239PNB-1.xus			
Project Description	21-239PNB-1						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	101		200				189	608			588	44

Signal Information												
Cycle, s	90.0	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	No	Simult. Gap E/W	On	Green	63.0	15.0	0.0	0.0	0.0	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	0.0	0.0	0.0	0.0		
				Red	2.0	2.0	0.0	0.0	0.0	0.0		

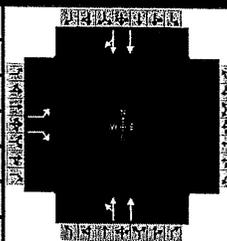
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			0.0	14.2		8.3
Phase Duration, s		21.0			0.0	69.0		69.0
Change Period, (Y+R _c), s		6.0			3.0	6.0		6.0
Max Allow Headway (MAH), s		2.9			0.0	0.0		0.0
Queue Clearance Time (g _s), s		10.8						
Green Extension Time (g _e), s		0.2			0.0	0.0		0.0
Phase Call Probability		1.00						
Max Out Probability		0.32						

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (v), veh/h	112		167				340	545			342	338
Adjusted Saturation Flow Rate (s), veh/h/ln	1781		1585				883	1702			1870	1844
Queue Service Time (g _s), s	5.0		8.8				5.0	12.7			9.0	6.1
Cycle Queue Clearance Time (g _c), s	5.0		8.8				10.4	12.7			9.0	6.1
Green Ratio (g/C)	0.17		0.17				0.70	0.70			0.70	0.70
Capacity (c), veh/h	297		264				683	1192			1309	1291
Volume-to-Capacity Ratio (X)	0.378		0.631				0.498	0.458			0.261	0.262
Back of Queue (Q), ft/ln (85 th percentile)	103.5		158.9				137.2	146			85.6	84.8
Back of Queue (Q), veh/ln (85 th percentile)	4.1		6.3				5.4	5.7			3.4	3.3
Queue Storage Ratio (RQ) (85 th percentile)	0.00		0.00				0.00	0.00			0.00	0.00
Uniform Delay (d ₁), s/veh	33.4		34.9				8.9	6.0			5.0	5.0
Incremental Delay (d ₂), s/veh	3.6		10.9				2.6	1.3			0.5	0.5
Initial Queue Delay (d ₃), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (d), s/veh	37.0		45.8				11.5	7.2			5.4	5.5
Level of Service (LOS)	D		D				B	A			A	A
Approach Delay, s/veh / LOS	42.3		D	0.0			8.9	A		5.4		A
Intersection Delay, s/veh / LOS	12.7						B					

Multimodal Results	EB	WB	NB	SB
Pedestrian LOS Score / LOS				
Bicycle LOS Score / LOS				

HCS7 Signalized Intersection Results Summary

General Information					Intersection Information		
Agency	MRA			Duration, h	0.250		
Analyst	STK	Analysis Date			Area Type	Other	
Jurisdiction		Time Period	PM	PHF	0.90		
Urban Street	SPRUCE ST	Analysis Year	2026 BUILD	Analysis Period	1> 7:00		
Intersection	ARTIC PARKWAY	File Name	21-239PFB-1.xus				
Project Description	21-239PFB-1						



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	101		200				207	612			588	44

Signal Information												
Cycle, s	90.0	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	No	Simult. Gap E/W	On									
Force Mode	Fixed	Simult. Gap N/S	On									
Green	63.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			0.0	14.2		8.3
Phase Duration, s		21.0			0.0	69.0		69.0
Change Period, (Y+R _c), s		6.0			3.0	6.0		6.0
Max Allow Headway (MAH), s		2.9			0.0	0.0		0.0
Queue Clearance Time (g _s), s		10.8						
Green Extension Time (g _e), s		0.2			0.0	0.0		0.0
Phase Call Probability		1.00						
Max Out Probability		0.32						

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (v), veh/h	112		167				342	568			342	338
Adjusted Saturation Flow Rate (s), veh/h/ln	1781		1585				841	1702			1870	1844
Queue Service Time (g _s), s	5.0		8.8				5.0	13.5			9.0	6.1
Cycle Queue Clearance Time (g _c), s	5.0		8.8				11.3	13.5			9.0	6.1
Green Ratio (g/C)	0.17		0.17				0.70	0.70			0.70	0.70
Capacity (c), veh/h	297		264				656	1192			1309	1291
Volume-to-Capacity Ratio (X)	0.378		0.631				0.522	0.477			0.261	0.262
Back of Queue (Q), ft/ln (85 th percentile)	103.5		158.9				143.8	154.5			85.6	84.8
Back of Queue (Q), veh/ln (85 th percentile)	4.1		6.3				5.7	6.1			3.4	3.3
Queue Storage Ratio (RQ) (85 th percentile)	0.00		0.00				0.00	0.00			0.00	0.00
Uniform Delay (d ₁), s/veh	33.4		34.9				9.5	6.1			5.0	5.0
Incremental Delay (d ₂), s/veh	3.6		10.9				3.0	1.4			0.5	0.5
Initial Queue Delay (d ₃), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (d), s/veh	37.0		45.8				12.5	7.4			5.4	5.5
Level of Service (LOS)	D		D				B	A			A	A
Approach Delay, s/veh / LOS	42.3		D		0.0		9.3	A		5.4		A
Intersection Delay, s/veh / LOS	12.8						B					

Multimodal Results	EB	WB	NB	SB
Pedestrian LOS Score / LOS				
Bicycle LOS Score / LOS				

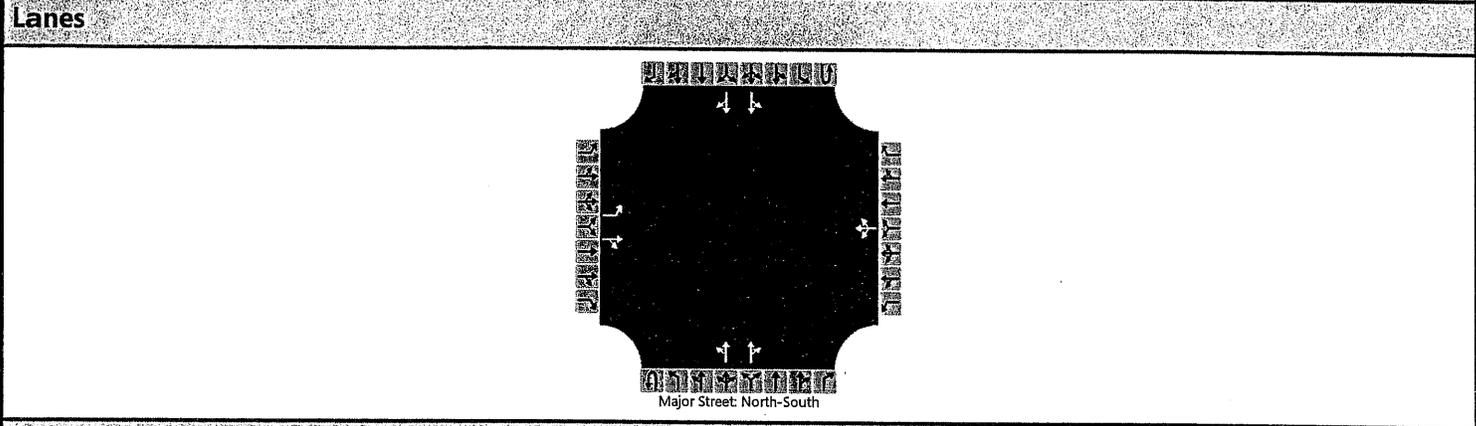
**LEVEL OF SERVICE CRITERIA
FOR
TWO-WAY STOP-CONTROLLED INTERSECTIONS¹**

<u>Level of Service</u>	<u>Average Control Delay</u>
A	≤ 10.0 Seconds Per Vehicle
B	> 10.0 and ≤ 15.0 Seconds Per Vehicle
C	> 15.0 and ≤ 25.0 Seconds Per Vehicle
D	> 25.0 and ≤ 35.0 Seconds Per Vehicle
E	> 35.0 and ≤ 50.0 Seconds Per Vehicle
F	> 50.0 Seconds Per Vehicle

¹ Transportation Research Board, Highway Capacity Manual 2010, National Research Council, Washington, DC, 2010.

HCS7 Two-Way Stop-Control Report

General Information				Site Information			
Analyst	STK			Intersection	SPRUCE & CAPITAL/TIFFANY		
Agency/Co.	MRA			Jurisdiction			
Date Performed	10/28/2021			East/West Street	CAPITAL-TIFFANY		
Analysis Year	2021			North/South Street	SPRUCE		
Time Analyzed	AM			Peak Hour Factor	0.90		
Intersection Orientation	North-South			Analysis Time Period (hrs)	0.25		
Project Description	21-239AE-2 EXIST						



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement																
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	1	0	0	0	2	0	0	0	2	0
Configuration		L		TR			LTR			LT		TR		LT		TR
Volume (veh/h)		0	0	3		32	0	9		3	580	16		7	527	4
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.56	6.56	6.96		7.56	6.56	6.96		4.16				4.16		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.53	4.03	3.33		3.53	4.03	3.33		2.23				2.23		

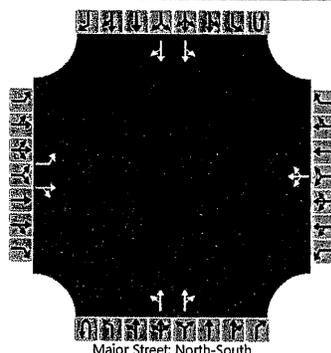
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		0		3			46			3				8		
Capacity, c (veh/h)		213		698			239			975				916		
v/c Ratio		0.00		0.00			0.19			0.00				0.01		
95% Queue Length, Q ₉₅ (veh)		0.0		0.0			0.7			0.0				0.0		
Control Delay (s/veh)		21.9		10.2			23.5			8.7				9.0		
Level of Service (LOS)		C		B			C			A				A		
Approach Delay (s/veh)	10.2				23.5				0.1				0.2			
Approach LOS	B				C				A				A			

HCS7 Two-Way Stop-Control Report

General Information				Site Information			
Analyst	STK			Intersection	SPRUCE & CAPITAL/TIFFANY		
Agency/Co.	MRA			Jurisdiction			
Date Performed	10/28/2021			East/West Street	CAPITAL-TIFFANY		
Analysis Year	2026			North/South Street	SPRUCE		
Time Analyzed	AM			Peak Hour Factor	0.90		
Intersection Orientation	North-South			Analysis Time Period (hrs)	0.25		
Project Description	21-239ANB-2 NO-BUILD						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound				
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	
Movement																	
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6	
Number of Lanes		1	1	0		0	1	0	0	0	2	0	0	0	2	0	
Configuration		L		TR			LTR			LT		TR		LT		TR	
Volume (veh/h)		0	0	3		32	0	9		3	609	16		7	553	4	
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3			
Proportion Time Blocked																	
Percent Grade (%)	0				0												
Right Turn Channelized																	
Median Type Storage	Undivided																

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1			
Critical Headway (sec)		7.56	6.56	6.96		7.56	6.56	6.96		4.16				4.16			
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2			
Follow-Up Headway (sec)		3.53	4.03	3.33		3.53	4.03	3.33		2.23				2.23			

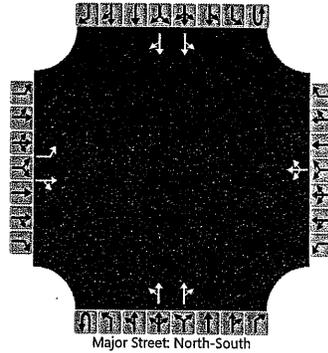
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		0		3		46				3				8			
Capacity, c (veh/h)		198		683		222				951				890			
v/c Ratio		0.00		0.00		0.21				0.00				0.01			
95% Queue Length, Q ₉₅ (veh)		0.0		0.0		0.7				0.0				0.0			
Control Delay (s/veh)		23.2		10.3		25.4				8.8				9.1			
Level of Service (LOS)		C		B		D				A				A			
Approach Delay (s/veh)		10.3				25.4				0.1				0.2			
Approach LOS		B				D											

HCS7 Two-Way Stop-Control Report

General Information				Site Information			
Analyst	STK			Intersection	SPRUCE & CAPITAL/TIFFANY		
Agency/Co.	MRA			Jurisdiction			
Date Performed	10/28/2021			East/West Street	CAPITAL-TIFFANY		
Analysis Year	2026			North/South Street	SPRUCE		
Time Analyzed	AM			Peak Hour Factor	0.90		
Intersection Orientation	North-South			Analysis Time Period (hrs)	0.25		
Project Description	21-239AFB-2 BUILD						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement																
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	1	0	0	0	2	0	0	0	2	0
Configuration		L		TR			LTR			LT		TR		LT		TR
Volume (veh/h)		0	0	3		32	0	9		3	621	16		7	567	4
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.56	6.56	6.96		7.56	6.56	6.96		4.16				4.16		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.53	4.03	3.33		3.53	4.03	3.33		2.23				2.23		

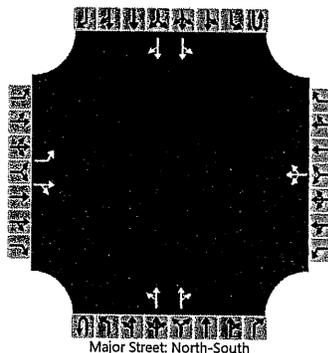
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		0		3			46			3				8		
Capacity, c (veh/h)		190		676			215			938				880		
v/c Ratio		0.00		0.00			0.21			0.00				0.01		
95% Queue Length, Q ₉₅ (veh)		0.0		0.0			0.8			0.0				0.0		
Control Delay (s/veh)		23.9		10.4			26.3			8.9				9.1		
Level of Service (LOS)		C		B			D			A				A		
Approach Delay (s/veh)	10.4				26.3				0.1				0.2			
Approach LOS	B				D											

HCS7 Two-Way Stop-Control Report

General Information				Site Information			
Analyst	STK			Intersection	SPRUCE & CAPITAL/TIFFANY		
Agency/Co.	MRA			Jurisdiction			
Date Performed	10/28/2021			East/West Street	CAPITAL-TIFFANY		
Analysis Year	2021			North/South Street	SPRUCE		
Time Analyzed	PM			Peak Hour Factor	0.90		
Intersection Orientation	North-South			Analysis Time Period (hrs)	0.25		
Project Description	21-239PE-2 EXIST						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound				
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	
Movement																	
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6	
Number of Lanes		1	1	0		0	1	0	0	0	2	0	0	0	2	0	
Configuration		L		TR			LTR			LT		TR		LT		TR	
Volume (veh/h)		3	1	17		20	0	15		3	766	41		10	745	6	
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3			
Proportion Time Blocked																	
Percent Grade (%)		0				0											
Right Turn Channelized																	
Median Type Storage		Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1			
Critical Headway (sec)		7.56	6.56	6.96		7.56	6.56	6.96		4.16				4.16			
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2			
Follow-Up Headway (sec)		3.53	4.03	3.33		3.53	4.03	3.33		2.23				2.23			

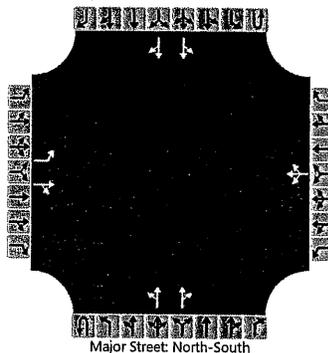
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		3		20				39					3				11
Capacity, c (veh/h)		114		432				163					788				747
v/c Ratio		0.03		0.05				0.24					0.00				0.01
95% Queue Length, Q ₉₅ (veh)		0.1		0.1				0.9					0.0				0.0
Control Delay (s/veh)		37.6		13.7				33.9					9.6				9.9
Level of Service (LOS)		E		B				D					A				A
Approach Delay (s/veh)		17.2				33.9				0.1				0.3			
Approach LOS		C				D											

HCS7 Two-Way Stop-Control Report

General Information				Site Information			
Analyst	STK	Intersection	SPRUCE & CAPITAL/TIFFANY				
Agency/Co.	MRA	Jurisdiction					
Date Performed	10/28/2021	East/West Street	CAPITAL-TIFFANY				
Analysis Year	2026	North/South Street	SPRUCE				
Time Analyzed	PM	Peak Hour Factor	0.90				
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25				
Project Description	21-239PNB-2 NO-BUILD						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound				
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	
Movement																	
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6	
Number of Lanes		1	1	0		0	1	0	0	0	2	0	0	0	2	0	
Configuration		L		TR			LTR			LT		TR		LT		TR	
Volume (veh/h)		3	1	17		20	0	15		3	804	41		10	782	6	
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3			
Proportion Time Blocked																	
Percent Grade (%)		0				0											
Right Turn Channelized																	
Median Type Storage		Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.56	6.56	6.96		7.56	6.56	6.96		4.16				4.16		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.53	4.03	3.33		3.53	4.03	3.33		2.23				2.23		

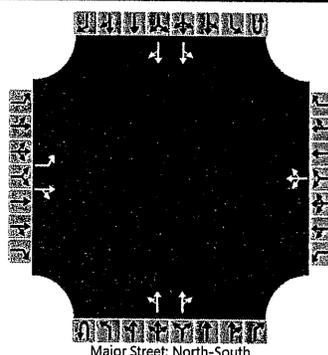
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		3		20			39			3				11			
Capacity, c (veh/h)		102		407			147			760				719			
v/c Ratio		0.03		0.05			0.26			0.00				0.02			
95% Queue Length, Q ₉₅ (veh)		0.1		0.2			1.0			0.0				0.0			
Control Delay (s/veh)		41.5		14.3			38.1			9.8				10.1			
Level of Service (LOS)		E		B			E			A				B			
Approach Delay (s/veh)		18.2				38.1				0.1				0.3			
Approach LOS		C				E											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	STK	Intersection	SPRUCE & CAPITAL/TIFFANY
Agency/Co	MRA	Jurisdiction	
Date Performed	10/28/2021	East/West Street	CAPITAL-TIFFANY
Analysis Year	2026	North/South Street	SPRUCE
Time Analyzed	PM	Peak Hour Factor	0.90
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	21-239PFB-2 BUILD		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement																
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	1	0		0	2	0		0	2	0
Configuration		L		TR			LTR			LT		TR		LT		TR
Volume (veh/h)		3	1	17		20	0	15		3	839	41		10	782	6
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.56	6.56	6.96		7.56	6.56	6.96		4.16				4.16		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.53	4.03	3.33		3.53	4.03	3.33		2.23				2.23		

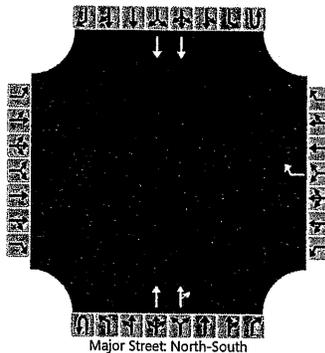
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		3		20			39			3				11		
Capacity, c (veh/h)		98		399			138			760				695		
v/c Ratio		0.03		0.05			0.28			0.00				0.02		
95% Queue Length, Q ₉₅ (veh)		0.1		0.2			1.1			0.0				0.0		
Control Delay (s/veh)		42.9		14.5			41.1			9.8				10.3		
Level of Service (LOS)		E		B			E			A				B		
Approach Delay (s/veh)	18.5				41.1				0.1				0.3			
Approach LOS	C				E				A				B			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	STK	Intersection	SPRUCE & SITE ACCESS
Agency/Co	MRA	Jurisdiction	
Date Performed	10/28/2021	East/West Street	SITE ACCESS
Analysis Year	2026	North/South Street	SPRUCE
Time Analyzed	AM	Peak Hour Factor	0.90
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	21-239AFB-3 BUILD		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement																
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	0	0	0	2	0
Configuration								R			T	TR			T	
Volume (veh/h)								34			597	12				578
Percent Heavy Vehicles (%)								3								
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized					No											
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)								6.9								
Critical Headway (sec)								6.96								
Base Follow-Up Headway (sec)								3.3								
Follow-Up Headway (sec)								3.33								

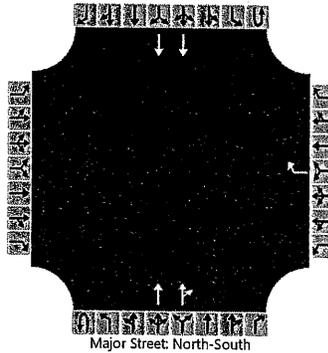
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								38								
Capacity, c (veh/h)								655								
v/c Ratio								0.06								
95% Queue Length, Q ₉₅ (veh)								0.2								
Control Delay (s/veh)								10.8								
Level of Service (LOS)								B								
Approach Delay (s/veh)					10.8											
Approach LOS					B											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	STK	Intersection	SPRUCE & SITE ACCESS
Agency/Co.	MRA	Jurisdiction	
Date Performed	10/28/2021	East/West Street	SITE ACCESS
Analysis Year	2026	North/South Street	SPRUCE
Time Analyzed	PM	Peak Hour Factor	0.90
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	21-239PFB-3 BUILD		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement																
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	0	0	0	2	0
Configuration								R			T	TR			T	
Volume (veh/h)								22			772	35				788
Percent Heavy Vehicles (%)								3								
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized					No											
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)								6.9								
Critical Headway (sec)								6.96								
Base Follow-Up Headway (sec)								3.3								
Follow-Up Headway (sec)								3.33								

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								24								
Capacity, c (veh/h)								555								
v/c Ratio								0.04								
95% Queue Length, Q ₉₅ (veh)								0.1								
Control Delay (s/veh)								11.8								
Level of Service (LOS)								B								
Approach Delay (s/veh)					11.8											
Approach LOS					B											

McDonough & Rea Associates
 1431 Lakewood Road Suite C
 Manasquan NJ 08736
 (732) 528-7076

File Name : 21239 arctic & spruce am1
 Site Code : 00021239
 Start Date : 10/7/2021
 Page No : 1

SPRUCE STREET AVTS
 ARCTIC PARKWAY & SPRUCE STREET
 LAWRENCE TOWNSHIP, MERCER COUNTY
 MRA JOB 21-239 THURSDAY AM COUNT

Groups Printed- CARS - TRUCKS - SCHOOL BUS

Start Time	Spruce Street (CR 613) Southbound				Spruce Street (CR 613) Northbound				Arctic Parkway (CR 639) Eastbound			
	Thru	Right	App. Total	Int. Total	Left	Thru	App. Total	Int. Total	Left	Right	App. Total	Int. Total
06:30 AM	59	5	64	109	22	87	109	189	9	7	16	16
06:45 AM	72	4	76	121	21	100	121	213	5	11	16	213
Total	131	9	140	230	43	187	230	402	14	18	32	402
07:00 AM	92	8	100	104	22	82	104	229	9	16	25	229
07:15 AM	99	9	108	153	38	115	153	284	9	14	23	284
07:30 AM	95	5	100	128	33	95	128	263	16	19	35	263
07:45 AM	114	17	131	170	37	133	170	329	9	19	28	329
Total	400	39	439	555	130	425	555	1105	43	68	111	1105
08:00 AM	121	6	127	146	40	106	146	294	5	16	21	294
08:15 AM	101	7	108	142	27	115	142	276	11	15	26	276
08:30 AM	125	18	143	134	34	100	134	310	13	20	33	310
08:45 AM	124	11	135	171	49	122	171	349	15	28	43	349
Total	471	42	513	593	150	443	593	1229	44	79	123	1229
Grand Total	1002	90	1092	1378	323	1055	1378	2736	101	165	266	2736
Approch %	91.8	8.2	39.9	50.4	23.4	76.6	50.4	9.7	38.0	62.0	9.7	9.7
Total %	36.6	3.3	39.9	50.4	11.8	38.6	50.4	9.7	3.7	6.0	9.7	9.7

Start Time	Spruce Street (CR 613) Southbound				Spruce Street (CR 613) Northbound				Arctic Parkway (CR 639) Eastbound			
	Thru	Right	App. Total	Int. Total	Left	Thru	App. Total	Int. Total	Left	Right	App. Total	Int. Total
08:30 AM to 08:45 AM - Peak 1 of 1	471	42	513	593	150	443	593	1229	44	79	123	1229
Intersection Volume	471	42	513	593	150	443	593	1229	44	79	123	1229
Percent	91.8	8.2	39.9	50.4	23.4	76.6	50.4	9.7	35.8	64.2	43	349
08:45 Volume	124	11	135	171	49	122	171	349	15	28	43	349
Peak Factor								0.880				0.880
High Int. Volume	125	18	143	171	49	122	171	349	15	28	43	349
Peak Factor			0.897	0.867			0.867	0.715				0.715

**SPRUCE STREET APTS
ARCTIC PARKWAY & SPRUCE STREET
LAWRENCE TOWNSHIP, MERCER COUNTY
MRA JOB 21-239 WEDNESDAY PM COUNT**

**McDonough & Rea Associates
1431 Lakewood Road Suite C
Manasquan NJ 08736
(732) 528-7076**

**File Name : 21239 arctic & spruce pm1
Site Code : 00021239
Start Date : 10/6/2021
Page No : 1**

Groups Printed- CARS - TRUCKS - SCHOOL BUS

Start Time	Spruce Street (CR 613) Southbound			Spruce Street (CR 613) Northbound			Arctic Parkway (CR 639) Eastbound			Int. Total
	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	
03:30 PM	128	17	145	55	131	186	14	49	63	394
03:45 PM	123	6	129	49	147	196	21	47	68	393
Total	251	23	274	104	278	382	35	96	131	787
04:00 PM	150	7	157	37	139	176	27	50	77	410
04:15 PM	118	13	131	43	153	196	19	55	74	401
04:30 PM	169	16	185	51	140	191	29	38	67	443
04:45 PM	133	15	148	47	145	192	17	34	51	391
Total	570	51	621	178	577	755	92	177	269	1645
05:00 PM	148	12	160	46	133	179	15	41	56	395
05:15 PM	123	13	136	47	155	202	21	36	57	395
05:30 PM	127	10	137	44	148	192	21	36	57	386
05:45 PM	110	6	116	50	141	191	12	33	45	352
Total	508	41	549	187	577	764	69	146	215	1528
Grand Total	1329	115	1444	469	1432	1901	196	419	615	3960
Approch %	92.0	8.0	14.44	24.7	75.3	48.0	31.9	68.1	15.5	
Total %	33.6	2.9	36.5	11.8	36.2	48.0	4.9	10.6		

Start Time	Spruce Street (CR 613) Southbound			Spruce Street (CR 613) Northbound			Arctic Parkway (CR 639) Eastbound			Int. Total
	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	
03:30 PM to 05:45 PM - Peak 1 of 1										
Intersection	03:45 PM									
Volume	560	42	602	180	579	759	96	190	286	1647
Percent	93.0	7.0	185	23.7	76.3	191	33.6	66.4	67	443
04:30 Volume	169	16	185	51	140	191	29	38	67	0.929
Peak Factor										
High Int. Volume	04:30 PM	16	185	03:45 PM	49	196	04:00 PM	27	77	
Peak Factor			0.814		147	0.968		50	0.929	

