

Before and After-Implementation Studies of Advanced Signal Control Technologies in Florida

APPENDIX G: Summary of Data Collection at 66th St, Pinellas County, FL

Submitted to:

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EXECUTIVE SUMMARY

The objective of this research is to evaluate traffic operations at several arterial corridors in Florida, before and after the implementation of proposed Adaptive Signal Control Technologies (ASCT), document the advantages and disadvantages of different ASCT approaches and implementations, and provide recommendations for state-wide implementation of ASCT.

This appendix summarizes the before and after field data collected along the 66th Street, Pinellas County corridor from Ulmerton Road to 54th Avenue. This corridor has a different type of configuration compared to the other arterial corridors analyzed in this project, in that the InSync adaptive signal control system has been implemented along a side street rather than along the mainline arterial. The system has been implemented along 66th Street (which runs North-South), while the mainline arterials are Ulmerton Road and Park Boulevard (which run East-West). These two arterials carry high levels of commuter traffic to Tampa via I-275 and to Clearwater via SR-19. The intersections of these arterials with the 66th Street are considered as the two critical intersections in the analysis of this corridor.

The InSync adaptive signal control system was implemented along this corridor in April 24, 2017. Two data collection methods were used to collect the desired information. Floating car runs were conducted with the UFTI instrumented vehicle to collect vehicle travel times during three time periods – AM Peak (7-9AM), Off Peak (1-3 PM) and PM Peak (4-6PM.) In addition, turning movement counts and queue lengths were collected at the two critical intersections (Ulmerton Road and Park Boulevard). Based on these, five performance measures were obtained for the before and after study periods: Link/Route Travel Time, Delay at Intersections, Queue Length (at critical intersections), Queue to Lane Storage Ratio (at critical intersections), and Passenger Car Equivalent (PCE) flows (at critical intersections). For each performance measure, a comparison between the before and after data is conducted and presented in this appendix.

The following were observed:

- The InSync resulted in an overall decrease in travel time in both directions (20.3% for the SB, and 10.5% for the NB) and during all time periods studied. Conditions improved more significantly for the SB direction. This corridor has the highest percentage decrease in travel time among all the corridors studied in this project so far.
- During the before study, the intersection delay for the two critical intersections – Ulmerton Rd and Park Boulevard – were the highest compared to all other intersections along the corridor, particularly for the SB. After the InSync installation there was an overall decrease in delay in both directions, especially for the SB.
- The average queue length at Ulmerton Road decreased for all approaches and time periods except for the WB through movements during PM peak and Off peak. The Park Boulevard intersection average queue length decreased for the NB and SB approaches, but the EB and WB approaches had longer queues during the Off and PM peak periods.

- As expected, the traffic volumes at both the critical intersections are higher for the EB and WB directions during both before and after studies. The PM peak has higher volumes than the AM and Off peak periods.

CORRIDOR INFORMATION

Figure G-1 provides a schematic of the 66th Street, Pinellas County Corridor (North-South). Table G-1 lists the intersections along the corridor. The adjacent land use is mostly industrial and commercial with restaurants, hotels, gas stations, drug stores, automotive service shops and banks. Commuting and recreational traffic coming mainly from Tampa towards St. Pete Beach is carried by I-275, toward the NE of this corridor. This traffic crosses the corridor through two intersections (Ulmerton Rd and Park Blvd) which were selected by the County as the critical intersections for this corridor. These two roadways are actually the mainline arterials, while the study corridor (66th St) is a side street. Ulmerton Road mainly carries traffic to and from Clearwater and Tampa, whereas Park Boulevard carries traffic mainly to and from Tampa, feeding I-275. For the analysis of the two critical intersections detailed turning movement and queue counts were collected. Figure G-2 provides the lane configuration of these two critical intersections.

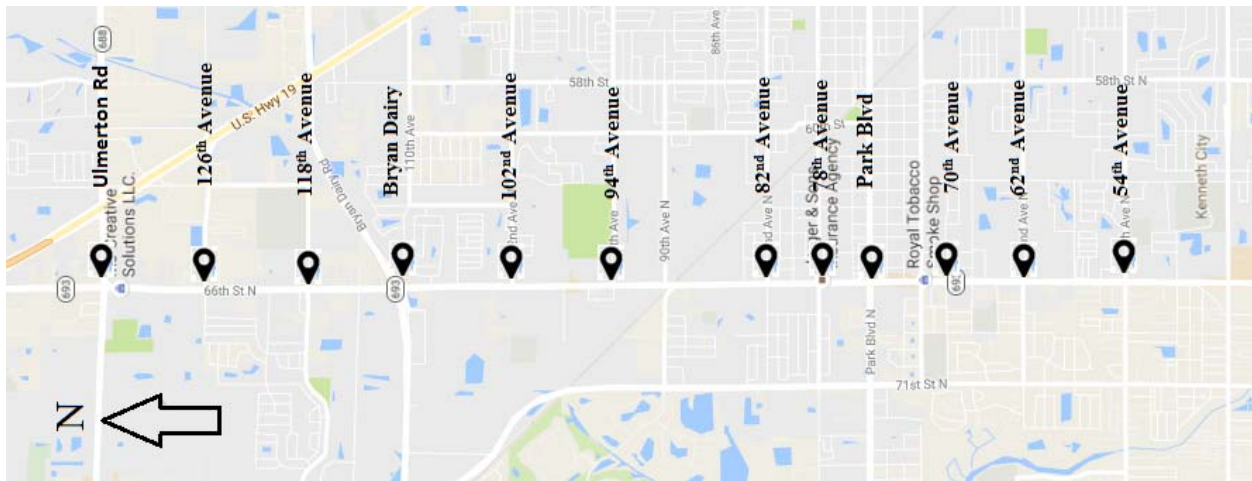
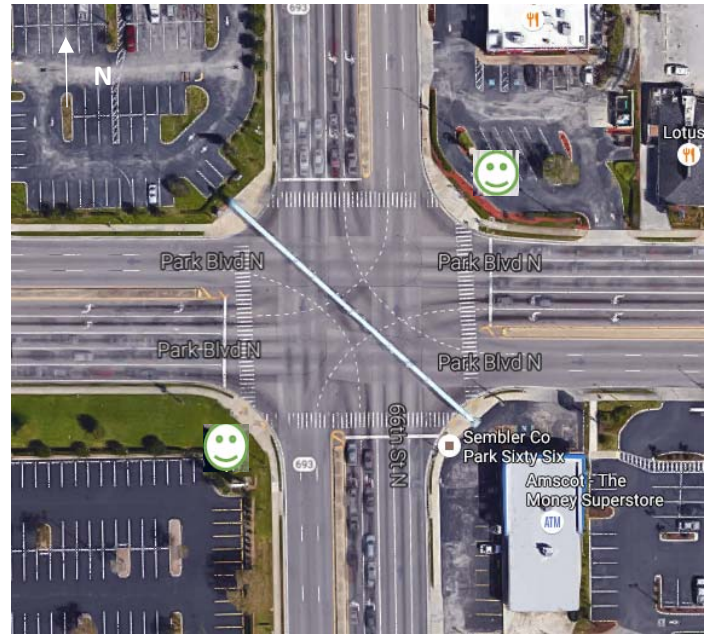
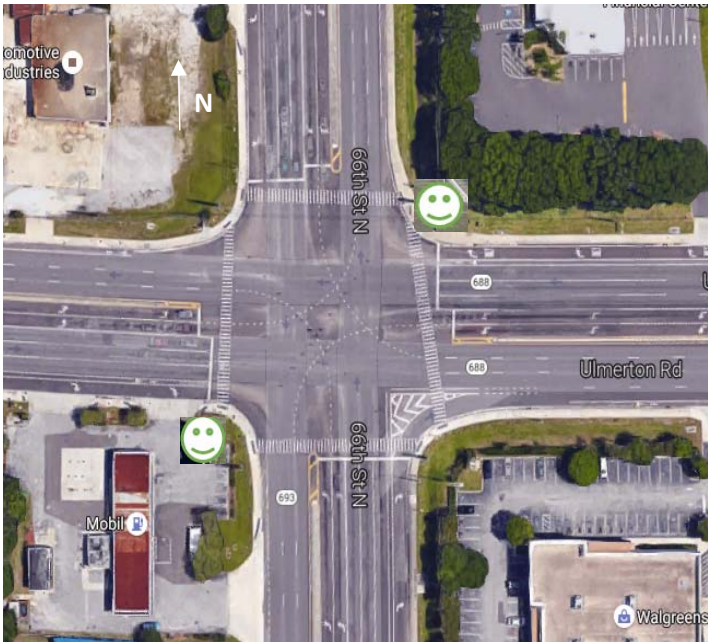
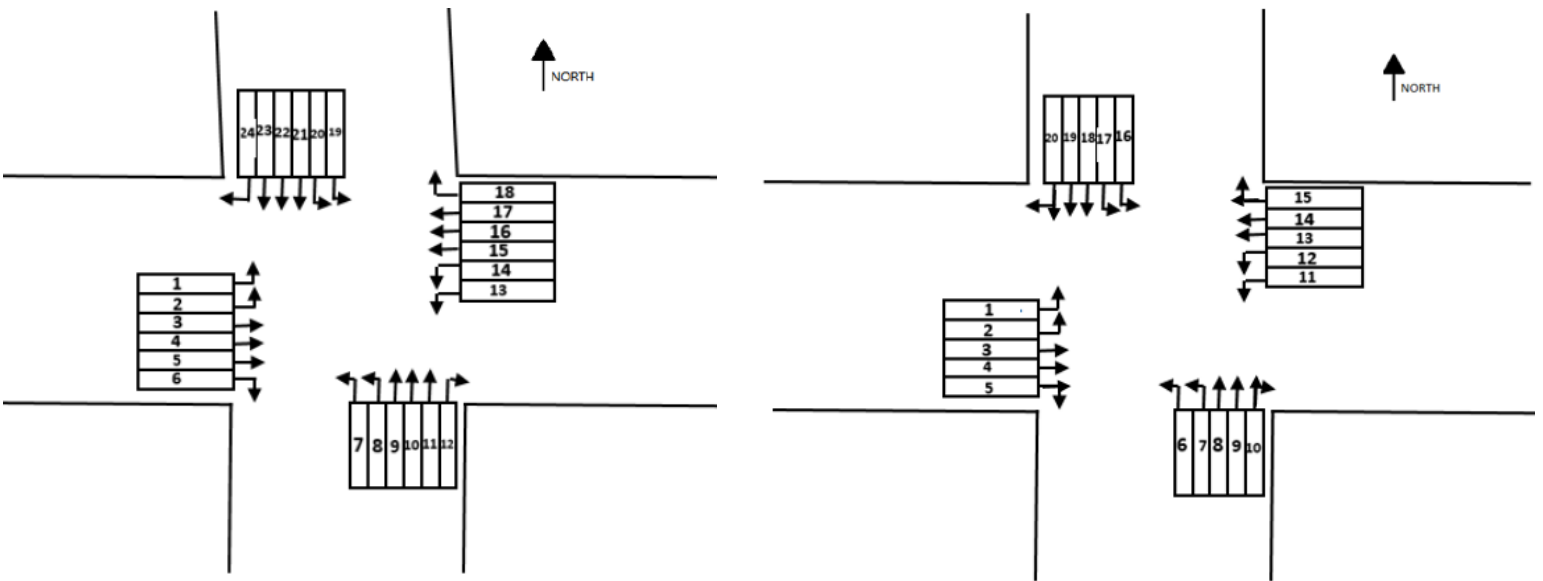


Figure G-1 Schematic of 66th Street, Pinellas County Corridor

Table G-1 List of Intersections along SR 693 (66th Street) Corridor

	Intersection	No. of Unsignalized Intersections	Distance
1	Ulmerton Rd	-	-
2	126 th Avenue	1	0.5 Miles
3	118 th Avenue	3	0.5 Miles
4	Bryan Dairy	1	0.45 Miles
5	102 nd Avenue	0	0.55 Miles
6	94 th Avenue	4	0.5 Miles
7	82 nd Avenue	5	0.75 Miles
8	78 th Avenue	1	0.25 Miles
9	Park Blvd	0	0.25 Miles
10	70 th Avenue	2	0.25 Miles
11	62 nd Avenue	5	0.5 Miles
12	54 th Avenue	4	0.5 Miles



(a) SR 693 (66th Street) and SR 688 (Ulmerton Rd)

(b) SR 693 (66th Street) and SR 694 (Park Boulevard)

Figure G-2 Lane Configuration Schematic and Overview Aerial Photo of Critical Intersections

PERFORMANCE MEASURES

Five performance measures are evaluated: Link/Route Travel Time, Delay at Intersections, Number of Stops, Queue Length (critical intersections), Queue-to-Lane Storage Ratio (critical intersections), and PCE Flows (critical intersections). For each performance measure, a comparison between the before and after data is conducted and the results of the differences (“after data” – “before data”) are presented.

1. Route Travel Time

The average travel time (min) along the route was measured through a floating car study. During the before data collection we collected data for a total of 8 runs for each time period. During the after data collection we were able to perform during the first day a total of 10 runs for each time period, and during the second day 11 runs for the AM peak, 9 for the OFF peak and 9 for the PM peak. Tables G-1.1 and G-1.2 provide the route travel time for the before and after data. The travel time comparison is presented in Table G-1.3.

1.1. Before Study (Nov. 9 & Nov. 10, 2016)

Table G-1.1 Route Travel Time (min)

Route TT (min)	AM Peak	Off Peak	PM Peak	Average
66th Street, SB	12.94	14.37	14.84	14.05
66th Street, NB	13.88	13.06	14.43	13.78

1.2. After Study (May 16 & May 17, 2017)

Table G-1.2 Route Travel Time (min)

Route TT (min)	AM	Off Peak	PM	Average
66th Street, SB	10.57	11.49	11.53	11.20
66th Street, NB	11.82	11.96	13.22	12.33

1.3. Comparison of Before and After Travel Times

Table G-1.3 Change in Percentage of Route Travel Time (After – Before-no rain)

Route TT (min)	AM	Off Peak	PM	Average
66th Street, SB	-2.37 (-18.3%)	-2.88 (-20%)	-3.31 (-22.3%)	-2.85 (-20.3%)
66th Street, NB	-2.06 (-14.8%)	-1.1 (-8.4%)	-1.21 (-8.4%)	-1.45 (-10.5%)

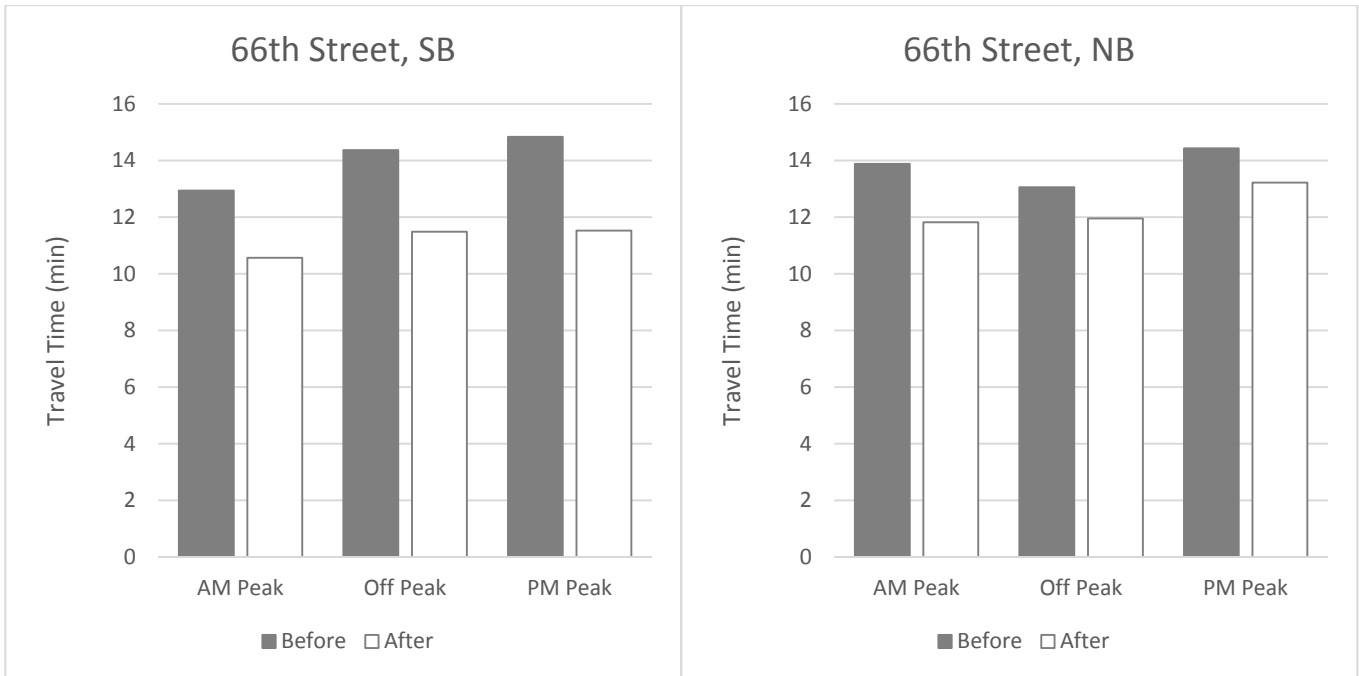


Figure G-1.1 Travel Times along 66th Street, Pinellas County

1.4. Discussion

The following can be concluded from the comparison of travel times:

- Overall, there was a reduction in travel time for both directions (20.3% for the SB, and 10.5% for the NB) and during all time periods. The reduction is generally higher for the SB direction. This corridor has the highest percentage decrease in travel time among all the corridors evaluated to-date for this project. This may be because this corridor is not a main arterial, and thus may not have had optimal signal timings.
- The greatest reduction in travel time occurs during the PM peak for the SB direction (22.3% or 3.31 min.)
- The relationship of travel times between the three study periods is similar for the before and after data collection, i.e., the travel time for the PM peak period is the highest for both the SB and NB directions along the 66th Street. In the SB, the Off Peak travel time is higher than the AM Peak for both the before and after studies. In the NB, the Off Peak is less than the AM Peak and the PM Peak for the before, and nearly the same for the after study.

2. Delay

Delay (sec) at each intersection along the corridor was also obtained using the floating car measurements.

2.1. Before Study (Nov. 9 & Nov. 10, 2016)

Table G-2.1 Delay (s) for each Intersection Through Movement Along the SB Direction

Delay at Intersections (sec)	AM Peak	Off Peak	PM Peak
Ulmerton Rd	121.13	112.00	150.00
126 th Avenue	0.00	16.21	0.00
118 th Avenue	0.00	0.00	0.00
Bryan Dairy	9.50	35.92	0.00
102 nd Avenue	2.75	27.29	0.00
94 th Avenue	1.63	6.58	0.88
82 nd Avenue	3.75	11.79	2.38
78 th Avenue	26.63	0.00	12.75
Park Blvd	86.75	102.92	112.75
70 th Avenue	7.38	1.50	0.00
62 nd Avenue	14.63	6.79	15.88
54 th Avenue	45.25	47.00	58.38

Figure G-2.1 shows the delay at each intersection for the through movement in the SB in graphical view. The intersection delay for the two critical intersections (Ulmerton Rd and Park Blvd.) is the highest during all study time periods (AM Peak, Off Peak and PM Peak), particularly for the SB. At other intersections, the delay is significantly less.

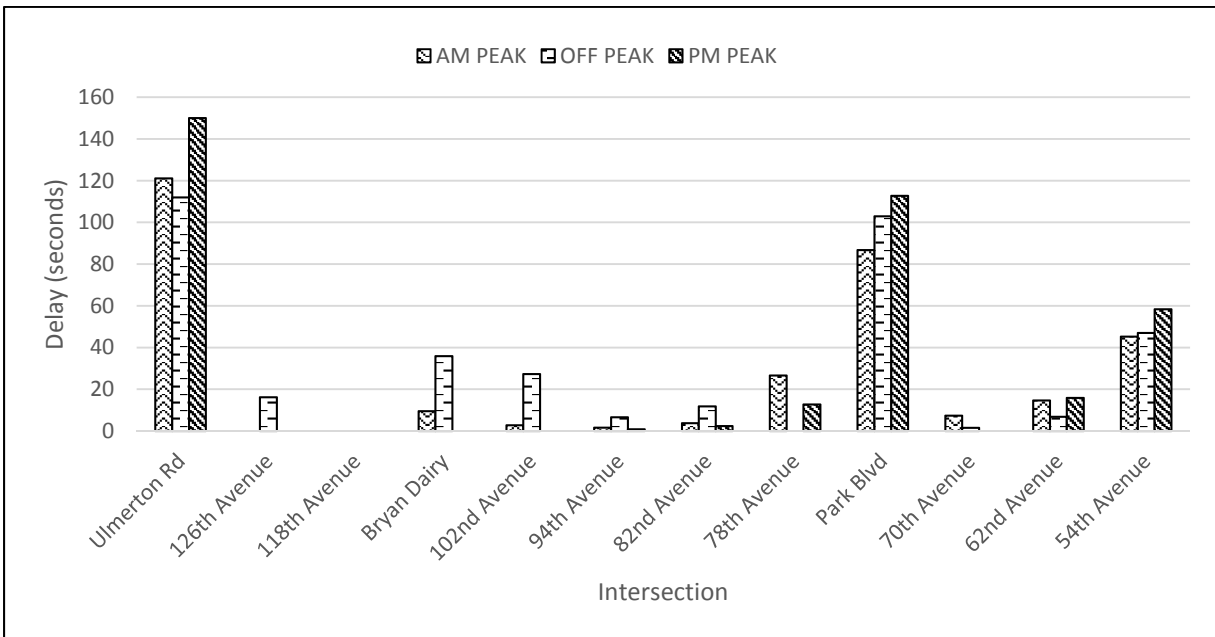


Figure G-2.1 Delay (s) for each Intersection Through Movement Along the SB Direction-Before Study

Table G-2.2 and Figure G-2.2 show the delays obtained by intersection for the NB. Figure G-2.2 shows the delay at each intersection for the through movement in the NB direction. The intersection delay in the NB direction is highest at Park Blvd during all study time periods (AM Peak, Off Peak and PM Peak). Delay at Ulmerton Rd is highest during the PM Peak period. The Off-Peak delays are higher than the PM Peak delays at six different intersections.

Table G-2.2 Delay (s) for each Intersection Through Movement Along the NB Direction – Before Study

Delay at Intersections (sec)	AM Peak	Off Peak	PM Peak
Ulmerton Rd	31.25	35.63	69.00
126 th Avenue	35.88	13.00	2.13
118 th Avenue	14.00	15.88	36.80
Bryan Dairy	39.00	32.38	20.25
102 nd Avenue	23.75	23.75	20.50
94 th Avenue	2.63	12.13	0.00
82 nd Avenue	12.00	25.13	31.38
78 th Avenue	13.88	14.13	0.00
Park Blvd	88.50	67.13	70.63
70 th Avenue	3.38	8.38	5.63
62 nd Avenue	18.00	14.88	23.00
54 th Avenue	20.25	35.25	52.38

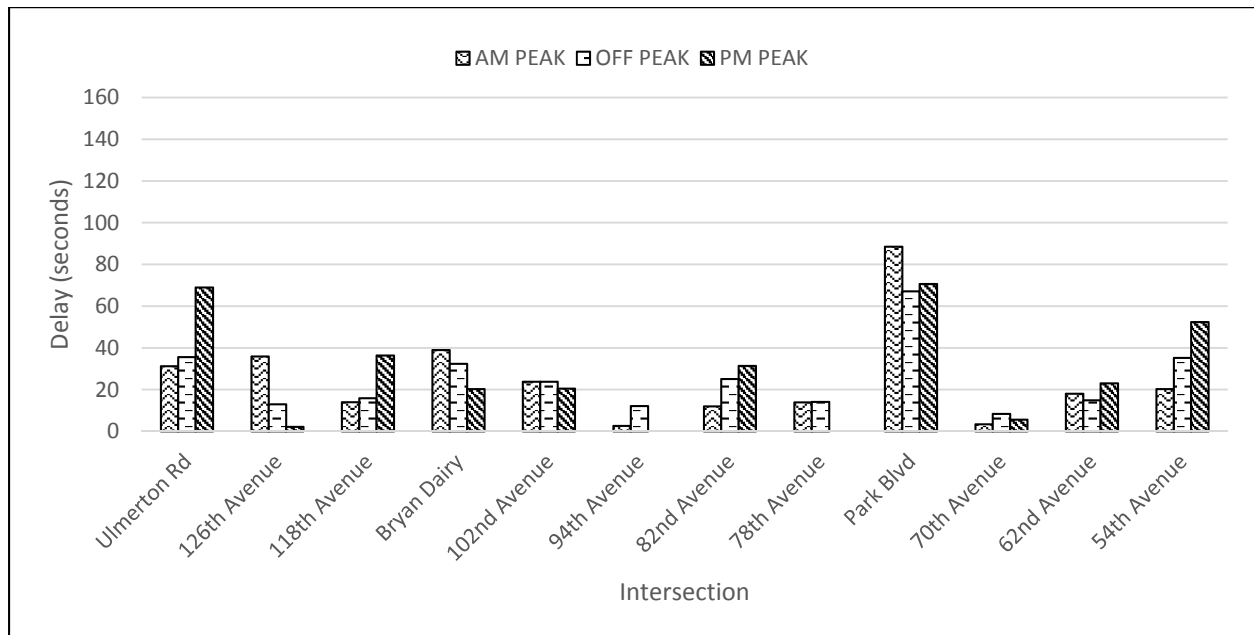


Figure G-2.2 Delay (s) for each Intersection Through Movement Along the NB Direction – Before Study

2.2. After Study (May 16 & May 17, 2017)

Table G-2.3 and Figure G-2.3 summarize the delay data for the after study in the SB direction. Again, the data shows that the highest intersection delay is reached at the two critical intersections. At other intersections, the delay is significantly less. The intersection with 118th Avenue remained with zero delay for all the runs conducted by floating car. Also, during the AM and PM peak periods some intersections had zero or very low delay for all runs.

Table G-2.3 Delay (s) for each Intersection Through Movement Along the SB Direction –After Study

Delay at Intersections (sec)	AM Peak	Off Peak	PM Peak
Ulmerton Rd	81.91	57.00	42.44
126 th Avenue	0.09	2.22	0.00
118 th Avenue	0.00	0.00	0.00
Bryan Dairy	0.00	21.56	0.00
102 nd Avenue	10.00	21.44	21.33
94 th Avenue	2.09	3.00	0.67
82 nd Avenue	0.00	7.56	10.00
78 th Avenue	2.45	6.78	7.33
Park Blvd	35.82	36.78	65.78
70 th Avenue	0.27	8.44	5.56
62 nd Avenue	0.00	3.78	6.33
54 th Avenue	0.00	11.67	17.56

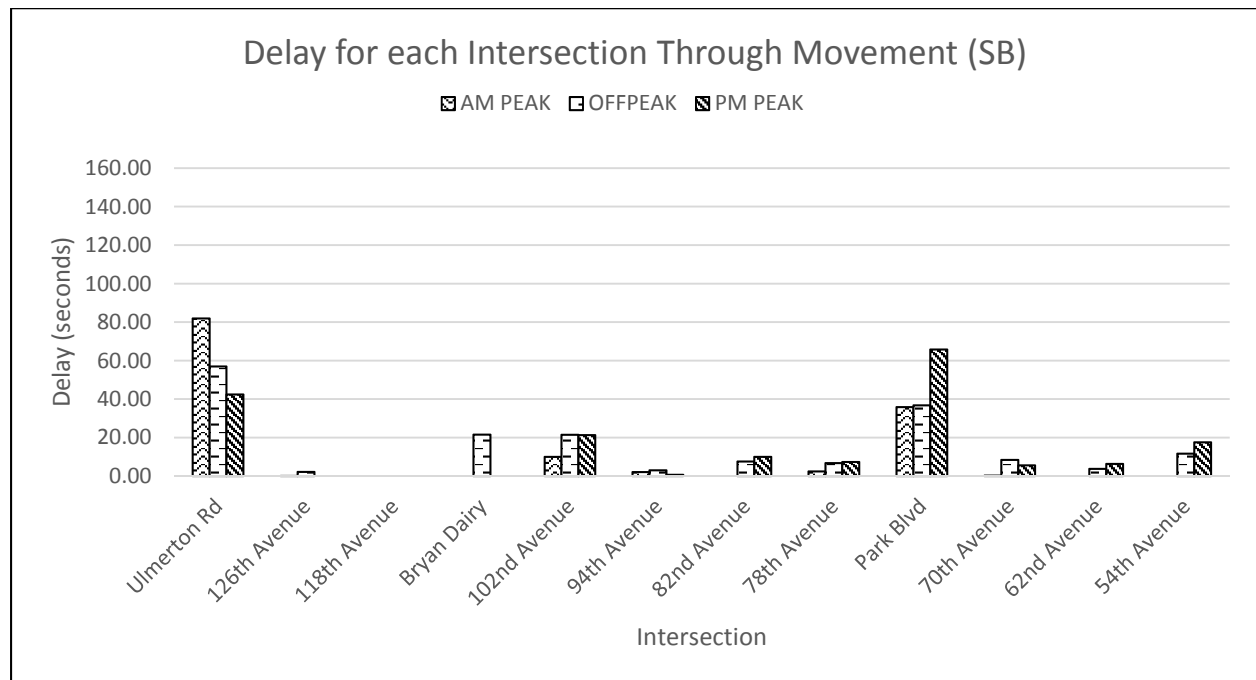


Figure G-2.3 Delay (sec) for each Intersection Through Movement Along the SB Direction – After Study

Table G-2.4 and Figure G-2.4 provide the delay data for the NB direction. As shown, the highest delay is reached at the intersections of Ulmerton Rd and 54th Avenue (approximately 1 minute of delay during the Off-peak and PM peak). Some intersections show zero or very low delay.

Table G-2.4 Delay (s) for each Intersection Through Movement Along the NB Direction– After Study

Delay at Intersections (sec)	AM Peak	Off Peak	PM Peak
Ulmerton Rd	35.40	73.44	51.67
126 th Avenue	0.00	3.11	2.00
118 th Avenue	20.00	1.56	0.67
Bryan Dairy	29.70	14.67	50.89
102 nd Avenue	19.00	21.78	29.22
94 th Avenue	1.60	0.00	0.00
82 nd Avenue	7.20	0.00	0.00
78 th Avenue	0.00	0.00	0.00
Park Blvd	16.30	14.22	0.89
70 th Avenue	15.80	1.78	15.67
62 nd Avenue	8.70	0.78	12.11
54 th Avenue	25.80	62.89	64.00

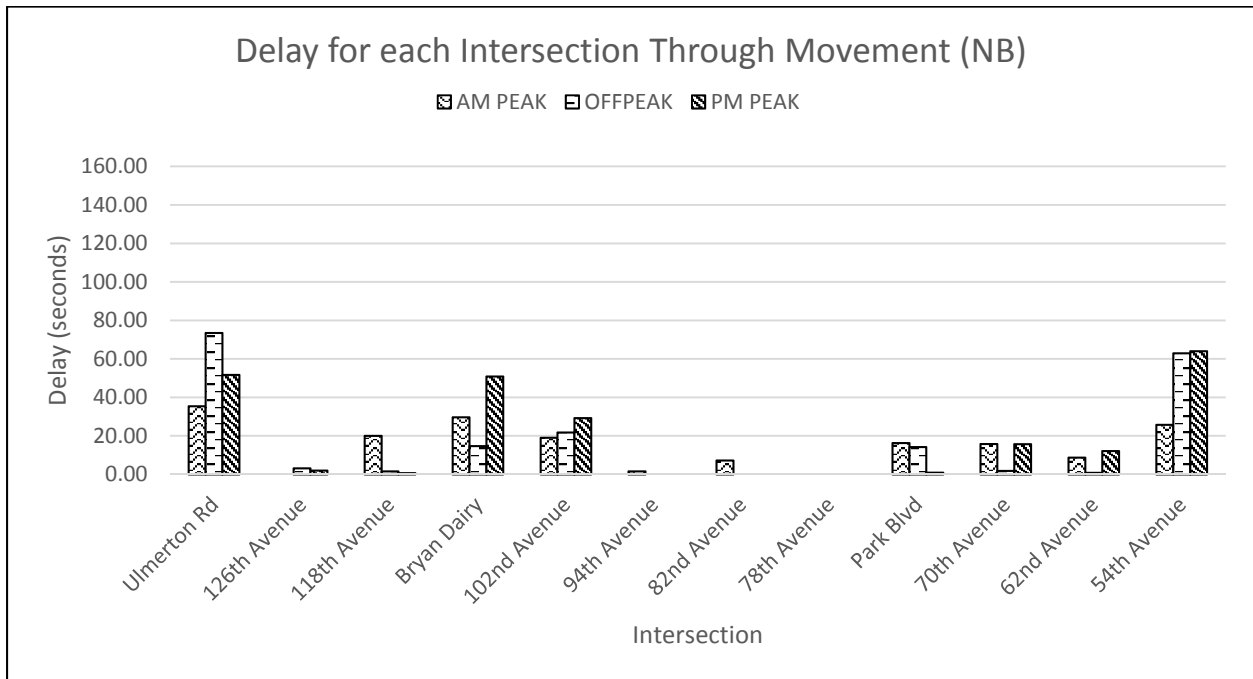


Figure J-2.4 Delay (sec) for each Intersection Through Movement Along the NB Direction – After Study

2.3. Comparisons of Before and After Intersection Delay Times

The differences in delay between the before and after studies are shown in Table G-2.5 and Table G-2.6. The tables are color-coded as follows: green shows significant improvement, yellow shows modest change (either improvement or deterioration), and red shows significant deterioration in delay. Several gradations of each color are used to represent different variations within each classification.

Table G-2.5 Difference in Delay (sec) for each Intersection Through Movement Along the SB Direction

Delay at Intersections (sec)	AM Peak	Off Peak	PM Peak
Ulmerton Rd	-39.22	-55.00	-107.56
126th Avenue	0.09	-13.99	0.00
118th Avenue	0.00	0.00	0.00
Bryan Dairy	-9.50	-14.36	0.00
102nd Avenue	7.25	-5.85	21.33
94th Avenue	0.46	-3.58	-0.21
82nd Avenue	-3.75	-4.23	7.62
78th Avenue	-24.18	6.78	-5.42
Park Blvd	-50.93	-66.14	-46.97
70th Avenue	-7.11	6.94	5.56
62nd Avenue	-14.63	-3.01	-9.55
54th Avenue	-45.25	-35.33	-40.82
Average	-15.56	-15.65	-14.67

Table G-2.6 Difference in Delay (sec) for each Intersection Through Movement Along the NB Direction

Delay at Intersections (sec)	AM Peak	Off Peak	PM Peak
Ulmerton Rd	4.15	37.81	-17.33
126th Avenue	-35.88	-9.89	-0.13
118th Avenue	6.00	-14.32	-36.13
Bryan Dairy	-9.30	-17.71	30.64
102nd Avenue	-4.75	-1.97	8.72
94th Avenue	-1.03	-12.13	0.00
82nd Avenue	-4.80	-25.13	-31.38
78th Avenue	-13.88	-14.13	0.00
Park Blvd	-72.20	-52.91	-69.74
70th Avenue	12.42	-6.60	10.04
62nd Avenue	-9.30	-14.10	-10.89
54th Avenue	5.55	27.64	11.62
Average	-10.25	-8.62	-8.72

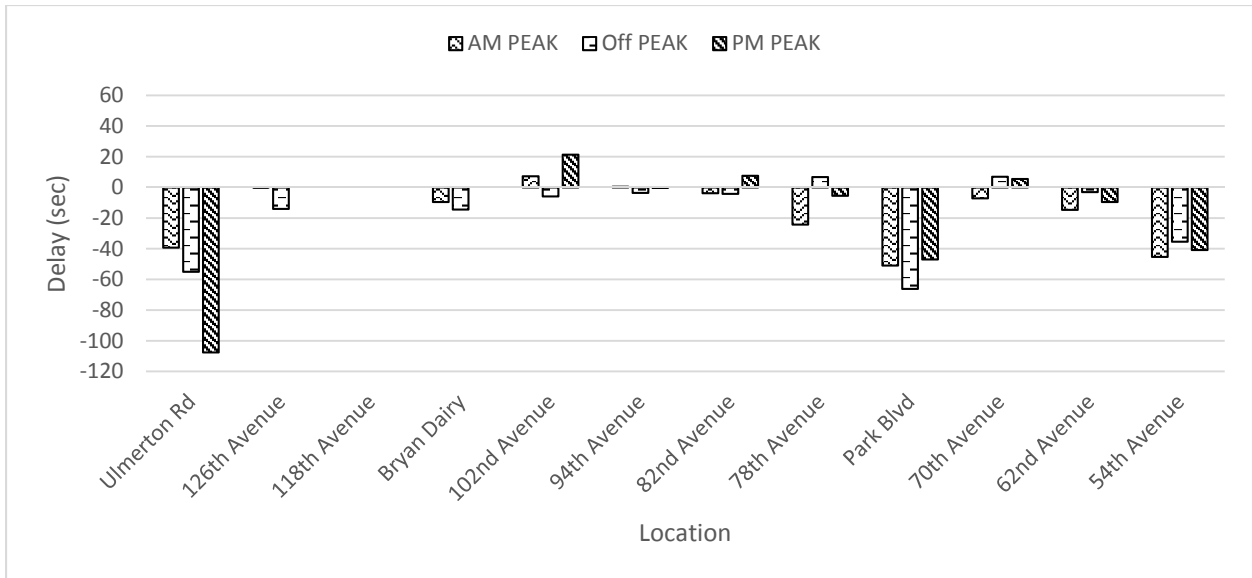


Figure G-2.5 Difference in Delay (sec) for each Intersection Through Movement Along the SB Direction

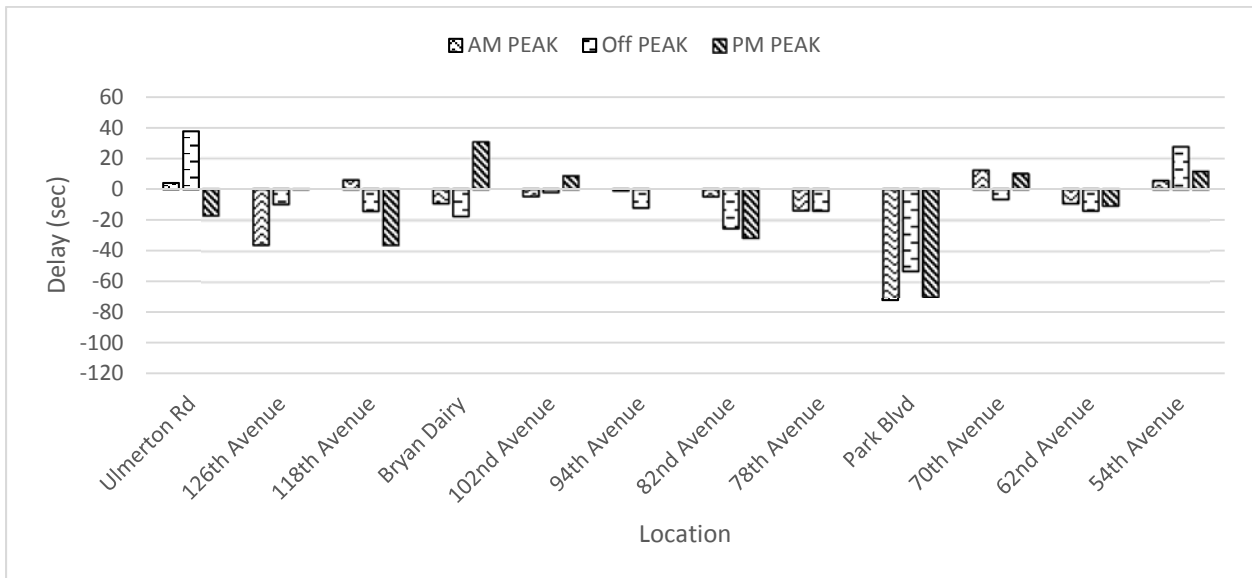


Figure G-2.6 Difference in Delay (sec) for each Intersection Through Movement Along the NB Direction

2.4. Discussion

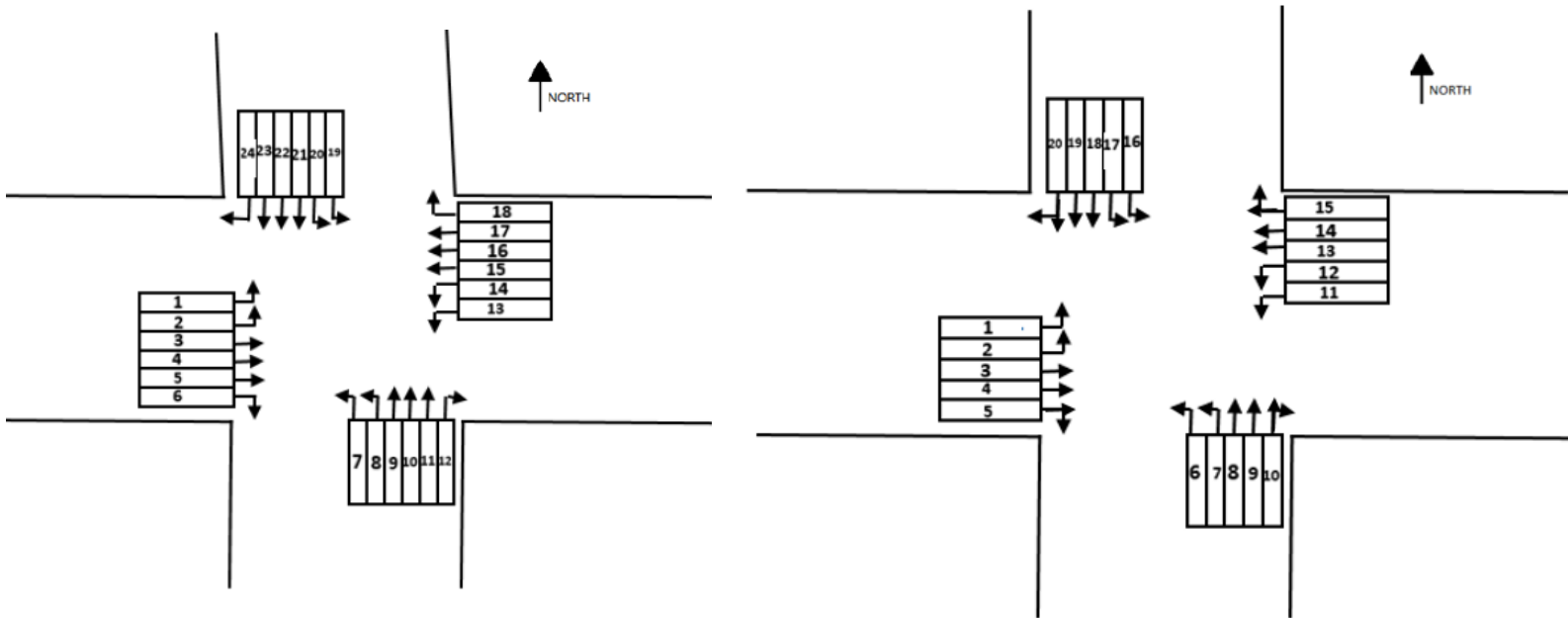
The following can be concluded from the comparison of delays:

- The data show that after installation of the InSync system there was an overall decrease in delay in both directions.
- One of the critical intersections, Park Boulevard, had a reduction in delay during all three time periods in both directions. The most significant delay reduction was 107.56 seconds and was observed at the other critical intersection, Ulmerton Road, during the PM peak in the SB direction.
- An increase in delay was observed for some intersections. In the SB direction, the maximum increase was 21.3 seconds and was observed at the 102nd Avenue intersection during the PM peak. In the NB direction, four intersections show a significant increase in delay (mostly during the PM peak).

3. Queue Length

Queue length (number of vehicles/lane) is presented by movement and by time period. This measure is used to evaluate oversaturated conditions at the critical intersections along the study corridors. Note that the queue length reported here is the observed maximum number of vehicles queued during each cycle, and does not represent the total number of vehicles that may have stopped during the cycle. During some time periods, because of cycle failure, vehicles need to stop multiple times before passing through the intersection.

Figure G-3.1 presents the schematic of the lane configurations at the two critical intersections. The queue length is reported for each of these lanes.



(a) SR 693 (66th Street) and SR 688 (Ulmerton Rd)

(b) SR 693 (66th Street) and SR 694 (Park Blvd)

Figure G-3.1 Lane Configuration of Critical Intersections

3.1. Before Study (Nov. 9 & Nov.10, 2016)

Table G-3.1 Average Queue Length by Lane (#vehs/lane) at 66th Street & Ulmerton Rd – Before Study.

Time Period	Time Segment (15 min)	EB					NB					WB					SB								
		Left		Through		Right	Left		Through		Right	Left		Through		Right	Left		Through		Right				
Lane Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
AM Peak	1	22	22	22	22	22	0	4	5	7	8	7	0	5	5	11	10	9	0	3	7	15	17	8	2
	2	22	22	22	22	22	0	6	6	13	13	13	0	6	6	9	8	8	0	3	7	14	11	11	3
	3	22	22	22	22	22	0	4	6	16	15	14	0	7	7	8	9	8	1	3	5	20	18	17	2
	4	22	22	22	22	22	0	6	6	13	13	13	0	5	7	9	10	11	0	2	3	13	12	10	2
	Average	22	22	22	22	22	0	5	6	12	12	11	0	6	6	9	9	9	0	3	5	15	14	12	2
Off Peak	1	15	15	16	15	15	0	5	4	10	10	8	0	5	6	9	11	10	0	2	5	11	6	9	6
	2	15	15	18	18	18	0	8	9	11	10	10	3	7	7	6	5	6	2	0	2	13	11	9	6
	3	11	10	14	13	12	0	7	7	13	12	10	0	5	6	5	6	8	2	3	4	16	9	9	4
	4	7	7	18	19	19	0	7	8	17	17	16	0	5	6	8	7	6	0	2	3	14	7	6	6
	Average	12	12	16	16	16	0	7	7	12	12	11	1	5	6	7	7	7	1	2	3	13	8	8	5
PM Peak	1	9	10	14	15	16	4	7	9	16	16	16	5	7	7	8	8	8	1	2	3	8	7	7	2
	2	10	10	19	19	20	4	9	10	14	14	13	5	5	6	9	12	8	2	1	3	7	6	7	4
	3	11	10	14	12	13	5	10	10	18	17	17	4	8	7	12	11	12	1	2	1	18	14	11	5
	4	8	8	8	9	7	4	8	10	15	15	15	4	4	6	9	9	10	1	1	3	12	9	10	4
	Average	10	10	14	14	14	4	8	10	16	16	15	5	6	6	9	10	9	1	1	3	11	9	8	4

Table G-3.2 Average Queue Length (#vehs/lane) at 66th Street & Ulmerton Rd – Before Study.

Time Period	EB			NB			WB			SB		
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
AM Peak	22	22	0	5	12	0	6	9	0	4	14	2
Off Peak	12	16	0	7	12	1	6	7	1	3	10	5
PM Peak	10	14	4	9	15	5	6	10	1	2	9	4

Table G-3.3 Average Queue Length by Lane (#vehs/lane) at 66th Street & Park Blvd – Before Study.

Time Period	Time Segment	EB					NB					WB					SB				
		Left		Through		T/R	Left		Through		T/R	Left		Through		T/R	Left		Through		T/R
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
AM Peak	1	2	4	15	17	14	5	6	19	20	0	5	5	10	10	9	5	7	11	12	12
	2	2	4	17	18	17	6	9	19	19	0	13	15	16	7	10	3	7	18	19	20
	3	4	6	21	21	20	12	14	20	20	0	5	8	12	11	10	6	14	20	20	20
	4	4	4	16	16	16	5	6	15	17	1	5	7	10	8	9	6	10	17	18	16
	Average	3	4	17	18	17	7	9	18	19	0	7	9	12	9	10	5	9	16	17	17
Off Peak	1	4	5	6	7	11	6	8	17	14	18	6	7	11	12	4	7	8	18	18	16
	2	3	5	7	7	14	8	15	12	9	16	6	7	7	8	3	10	10	18	18	19
	3	4	5	7	9	15	9	15	18	14	19	6	6	9	10	2	10	11	20	20	20
	4	4	5	7	8	14	9	19	20	18	19	7	8	10	10	5	8	7	20	20	20
	Average	4	5	7	8	13	8	14	16	14	18	6	7	9	10	3	9	9	19	19	19
PM Peak	1	7	10	12	12	13	6	13	13	13	13	5	10	18	19	20	9	16	20	20	20
	2	7	10	8	8	8	7	13	19	19	19	5	5	15	16	18	8	9	19	20	19
	3	6	9	10	10	9	6	10	16	15	13	3	6	17	17	20	7	9	20	20	20
	4	6	8	10	10	11	8	12	10	10	10	5	5	16	17	18	7	8	18	20	19
	Average	6	9	10	10	10	7	12	14	14	14	4	6	16	17	19	7	10	19	20	20

Table G-3.4 Average Queue Length (#vehs/lane) at 66th Street & Park Blvd – Before Study.

Time Period	EB			NB			WB			SB		
	Left	Through	T/R	Left	Through	T/R	Left	Through	T/R	Left	Through	T/R
AM Peak	4	18	17	8	18	0	8	10	10	7	17	17
Off Peak	4	7	13	11	15	18	7	9	3	9	19	19
PM Peak	8	10	10	9	14	14	5	17	19	9	20	20

As shown above, the longest queues were observed for the 66th Street and Ulmerton Rd intersection, for the EB left and through movements, with queues reaching 22 vehicles.

For the 66th Street and Park Blvd. intersection, the longest queue observed was 21 vehicles for the EB through movement. Also, long queues were observed in the other approaches, with up to 20 vehicles during certain periods, mostly for the through and right movements.

3.2. After Study (May 16 & May 17, 2017)

Tables G-3.5 to G-3.8 show the average queue length by lane and by movement for both critical intersections from the after study.

Table G-3.5 Average Queue Length by Lane (#vehs/lane) at 66th Street & Ulmerton Rd – After Study

Time Period	Time Segment (15 min)	EB					NB					WB					SB								
		Left		Through			Right	Left		Through			Right	Left		Through			Right						
Lane Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
AM Peak	1	8	8	19	19	19	1	6	5	10	10	8	1	4	4	4	4	4	4	4	4	4	4	4	4
	2	8	7	18	18	17	1	4	6	15	14	12	2	6	6	6	6	6	6	6	6	6	6	6	6
	3	7	6	14	15	15	3	5	6	12	11	10	2	4	4	4	4	4	4	4	4	4	4	4	4
	4	7	7	15	15	16	3	4	6	11	11	8	2	4	4	4	4	4	4	4	4	4	4	4	4
	Average	7	7	17	17	17	2	5	6	12	11	9	2	4	4	4	4	4	4	4	4	4	4	4	4
Off Peak	1	5	5	8	9	10	2	6	5	5	5	3	1	6	7	13	14	14	3	3	3	11	10	10	3
	2	5	6	7	7	9	1	4	5	3	3	1	1	7	6	15	16	15	3	1	2	13	10	9	2
	3	7	8	10	10	11	3	6	7	7	5	5	1	4	4	16	16	16	3	2	3	11	10	10	4
	4	7	8	13	12	12	3	7	8	13	9	8	1	3	4	11	11	12	2	2	4	7	7	7	3
	Average	6	7	9	10	10	2	6	6	7	5	4	1	5	5	14	14	14	3	2	3	10	9	9	3
PM Peak	1	11	10	14	14	14	3	13	12	14	14	12	1	3	4	7	8	8	1	2	3	7	7	8	5
	2	11	13	16	17	18	3	7	9	17	15	13	1	5	6	12	13	13	3	1	2	14	13	13	5
	3	8	7	14	13	17	4	9	9	12	12	10	1	5	5	23	23	23	3	1	1	16	17	15	6
	4	7	7	10	10	13	2	7	10	11	11	9	1	5	5	10	11	12	1	1	2	15	12	11	5
	Average	9	9	13	14	16	3	9	10	14	13	11	1	4	5	13	14	14	2	1	2	13	12	12	5

Table G-3.6 Average Queue Length (#vehs/lane) at 66th Street & Ulmerton Rd – After Study.

Time Period	EB			NB			WB			SB		
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
AM Peak	7	17	2	5	11	2	4	4	4	4	4	4
Off Peak	6	10	2	6	5	1	5	14	3	2	9	3
PM Peak	9	14	3	10	12	1	5	13	2	2	12	5

Table G-3.7 Average Queue Length by Lane (#vehs/lane) at 66th Street & Park Blvd – After Study.

Time Period	Time Segment	EB					NB					WB					SB				
		Left		Through		T/R	Left		Through		T/R	Left		Through		T/R	Left		Through		T/R
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
AM Peak	1	3	3	13	13	12	3	6	10	9	9	7	8	9	9	8	5	5	6	6	7
	2	2	4	17	17	17	7	8	11	12	10	9	10	13	13	14	6	8	8	8	8
	3	4	7	15	15	17	7	9	8	8	6	5	8	10	10	9	6	6	8	8	7
	4	3	5	15	16	18	4	6	8	8	8	5	8	14	15	15	5	5	11	11	12
	Average	3	5	15	15	16	5	7	9	9	8	6	8	11	11	11	5	6	8	8	8
Off Peak	1	5	5	15	15	20	7	8	4	3	4	8	7	16	17	15	8	9	11	11	7
	2	4	4	12	12	16	6	7	5	6	8	7	7	15	14	12	5	6	9	10	8
	3	4	5	20	20	20	8	11	9	9	9	7	6	13	13	11	5	7	9	9	8
	4	4	6	15	16	20	8	10	6	5	6	5	6	19	20	19	6	7	9	8	10
	Average	4	5	16	16	19	7	9	6	6	7	7	6	16	16	14	6	7	9	9	8
PM Peak	1	3	4	18	17	20	7	8	7	9	10	6	9	19	18	17	9	9	9	9	8
	2	4	6	14	15	19	8	14	7	6	5	8	9	16	15	13	8	9	8	8	7
	3	4	4	20	20	20	7	9	6	5	4	8	10	17	18	14	10	10	15	15	15
	4	5	10	9	6	12	6	8	6	5	7	7	8	12	12	9	11	11	14	14	13
	Average	4	6	15	14	18	7	10	6	6	6	7	9	16	16	13	9	10	12	11	11

Table G-3.8 Average Queue Length (#vehs/lane) at 66th Street & Park Blvd – After Study.

Time Period	EB			NB			WB			SB		
	Left	Through	T/R	Left	Through	T/R	Left	Through	T/R	Left	Through	T/R
AM Peak	4	15	16	6	9	8	7	11	11	6	8	8
Off Peak	4	16	19	8	6	7	7	16	14	7	9	8
PM Peak	5	15	18	8	6	6	8	16	13	10	11	11

For the after study, at the 66th Street and Ulmerton Rd intersection the longest queues observed were at the EB through movement during the AM peak, with 19 vehicles. For the 66th Street and Park Blvd. intersection, the longest queue observed was of 20 vehicles during the Off peak and the PM peak for the through-right shared lane.

3.3. Comparison of Before and After Queue Lengths for Critical Intersections

The differences in queue length between the before and after measurements are shown in Table G-3.9 to Table G-3.12. The tables are color-coded as follows: green shows significant improvement, yellow shows modest change (either improvement or deterioration), and red shows significant deterioration in delay. Several gradations of each color are used to represent different variations within each classification.

Table G-3.9 Difference in Avg. Queue Length by Lane (#vehs/lane) at 66th Street & Ulmerton Rd

Time Period	EB						NB						WB						SB						Avg.
	Left		Through			Right	Left		Through			Right	Left		Through			Right	Left		Through			Right	
Lane Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
AM Peak	-14.73	-15.05	-5.41	-5.16	-5.43	1.94	-0.09	0.03	-0.24	-0.71	-2.06	1.53	-1.46	-1.61	-0.25	-0.25	-1.44	-0.19	-0.25	-1.61	-1.79	-2.61	0.39	-2.06	-2.44
Off Peak	-5.65	-4.60	-6.97	-6.67	-5.76	2.18	-0.78	-0.88	-5.58	-6.64	-6.69	0.10	-0.09	-1.04	6.89	7.28	6.90	1.71	0.01	-0.10	-2.84	0.99	0.68	-2.43	-1.25
PM Peak	-0.28	-0.54	-0.23	-0.04	1.64	-0.88	0.98	0.28	-1.83	-2.75	-4.45	-3.46	-1.49	-1.46	3.74	3.63	4.53	0.75	-0.09	-0.34	1.74	3.40	3.54	1.75	0.34

Table G-3.10 Difference in Avg. Queue Length (#vehs/lane) at 66th Street & Ulmerton Rd

Time Period	EB			NB			WB			SB		
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
AM Peak	-14.89	-5.33	1.94	-0.03	-1.00	1.53	-1.54	-0.65	-0.19	-0.93	-1.34	-2.06
Off Peak	-5.13	-6.47	2.18	-0.83	-6.30	0.10	-0.56	7.02	1.71	-0.04	-0.39	-2.43
PM Peak	-0.41	0.46	-0.88	0.63	-3.01	-3.46	-1.48	3.96	0.75	-0.21	2.89	1.75

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Table G-3.11 Difference in Avg. Queue Length by Lane (#vehs/lane) at 66th Street & Park Blvd

Time Period	EB					NB					WB					SB					Average
	Left		Through	Right		Left		Through	Right		Left		Through	Right		Left		Through	Right		
Lane Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
AM Peak	0.09	0.25	-2.54	-2.69	-0.43	-1.69	-1.50	-9.25	-9.44	7.81	-0.54	-0.19	-0.49	2.65	1.58	0.31	-3.31	-7.94	-8.81	-8.56	-2.23
Off Peak	0.13	0.06	8.75	8.00	5.75	-0.69	-5.29	-10.67	-8.13	-11.19	0.38	-0.63	6.56	6.13	10.56	-2.75	-1.75	-9.38	-9.63	-10.44	-1.21
PM Peak	-2.34	-3.44	5.30	4.44	7.81	0.13	-2.06	-8.00	-8.06	-7.50	2.61	2.34	-0.64	-1.39	-5.66	2.06	-0.38	-7.63	-8.56	-8.63	-1.98

Table G-3.12 Difference in Average Queue Length (#vehs/lane) at 66th Street & Park Blvd

Time Period	EB			NB			WB			SB		
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
AM Peak	0.17	-2.61	-0.43	-1.59	-9.34	7.81	-0.36	1.08	1.58	-1.50	-8.38	-8.56
Off Peak	0.09	8.38	5.75	-2.99	-9.40	-11.19	-0.13	6.34	10.56	-2.25	-9.50	-10.44
PM Peak	-2.89	4.87	7.81	-0.97	-8.03	-7.50	2.48	-1.01	-5.66	0.84	-8.09	-8.63

3.4. Discussion

The following can be concluded from the comparison of queue lengths:

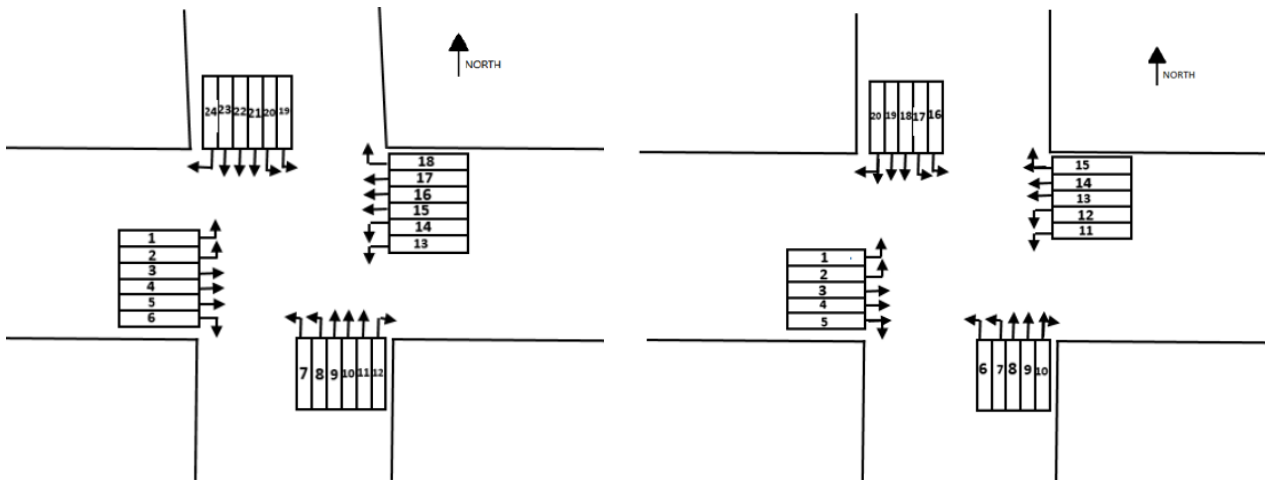
- The average queue length mostly improved for all approaches at the Ulmerton Rd intersection, especially for the EB approach where the reduction reaches almost 15 vehicles per lane. Through lanes on the WB approach have an increase in average queue length of 7 vehicles/lane. This is consistent with other implementations of InSync, where queues along the coordinated arterial are reduced while the queues on the side streets increase.
- The 66th Street and Park Blvd intersection average queue length mostly improved for the main approaches (NB and SB). The greatest improvement is of 11 vehicles/lane and it occurs for the NB through movement. However, there is an increase in queue lengths for both the EB and WB approaches (maximum increase is 11 vehicles for the WB approach.)
- On average, at the Ulmerton Rd intersection, the queue length decreased for the AM peak and Off peak periods (2.06 and 2.43 veh/lane, respectively) and increased for the PM peak (1.75 veh/lane). At the Park Blvd intersection, the average queue length decreased during all time periods (reductions of 8.56, 10.44 and 8.63 veh/lane during the AM, Off and PM peak, respectively.)

4. Queue to Lane Storage Ratio

In addition to queue length, it is important to assess any impact to adjacent lanes or to upstream facilities. The queue to link/lane ratio is used to establish the likelihood of spillback, which is presented in this section by movement and by time period.

The following assumptions are used:

- The storage capacity is estimated as the maximum number of vehicles in the lane.
- The queue to link/lane storage ratio is estimated as 1 if the observer reported “spillback”, and as 0.8 if reported as the maximum number of vehicles visible to the observer.
- Queue to lane storage ratios over 80% are highlighted in yellow, as they represent conditions with a high probability for spillback.



(a) SR 693 (66th Street) and SR 688 (Ulmerton Rd) (b) SR 693 (66th Street) and SR 694 (Park Boulevard)

Figure G-4 Lane Configuration of Critical Intersections

4.1. Before Study (Nov. 9 & Nov.10, 2016)

Table G-4.1 Average Queue Storage Ratio by Lane and by Period at 66th Street & Ulmerton Rd – Before Study.

Time period	Time segment	EB						NB						WB						SB					
		Left		Through		Right		Left		Through		Right		Left		Through		Right		Left		Through		Right	
Lane Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
AM PEAK	1	1.00	1.00	1.00	1.00	1.00	0.00	0.35	0.40	0.32	0.34	0.31	0.00	0.44	0.50	0.58	0.61	0.44	0.00	0.75	0.81	0.60	0.71	0.44	0.10
	2	1.00	1.00	1.00	1.00	1.00	0.00	0.48	0.46	0.59	0.58	0.57	0.00	0.48	0.63	0.47	0.50	0.38	0.06	0.63	0.81	0.56	0.45	0.63	0.17
	3	1.00	1.00	1.00	1.00	1.00	0.00	0.31	0.48	0.69	0.67	0.61	0.00	0.54	0.70	0.42	0.55	0.38	0.13	0.63	0.59	0.84	0.76	0.94	0.13
	4	1.00	1.00	1.00	1.00	1.00	0.00	0.48	0.46	0.59	0.58	0.57	0.00	0.42	0.70	0.51	0.63	0.52	0.00	0.50	0.31	0.55	0.48	0.57	0.15
	Average	1.00	1.00	1.00	1.00	1.00	0.00	0.41	0.45	0.55	0.54	0.51	0.00	0.47	0.63	0.50	0.57	0.43	0.05	0.63	0.63	0.64	0.60	0.65	0.14
OFF PEAK	1	0.66	0.66	0.73	0.69	0.67	0.00	0.38	0.33	0.43	0.47	0.38	0.00	0.38	0.58	0.47	0.69	0.46	0.00	0.56	0.56	0.44	0.26	0.47	0.38
	2	0.66	0.67	0.82	0.82	0.83	0.00	0.65	0.71	0.49	0.44	0.43	0.25	0.54	0.68	0.31	0.28	0.27	0.38	0.06	0.19	0.53	0.45	0.51	0.42
	3	0.48	0.45	0.61	0.60	0.56	0.00	0.56	0.54	0.58	0.52	0.43	0.00	0.40	0.60	0.28	0.38	0.36	0.50	0.69	0.44	0.68	0.36	0.50	0.23
	4	0.23	0.24	0.63	0.64	0.65	0.00	0.44	0.46	0.59	0.59	0.57	0.00	0.42	0.58	0.44	0.42	0.27	0.00	0.56	0.38	0.56	0.28	0.35	0.37
	Average	0.51	0.51	0.70	0.69	0.68	0.00	0.51	0.51	0.52	0.51	0.45	0.06	0.43	0.61	0.38	0.44	0.34	0.22	0.47	0.39	0.55	0.34	0.46	0.35
PM PEAK	1	0.41	0.44	0.61	0.66	0.70	0.42	0.56	0.65	0.73	0.72	0.73	0.40	0.56	0.70	0.43	0.50	0.39	0.31	0.56	0.38	0.32	0.27	0.38	0.10
	2	0.45	0.47	0.80	0.81	0.64	0.53	0.75	0.88	0.63	0.63	0.55	0.42	0.44	0.55	0.47	0.72	0.38	0.50	0.31	0.38	0.30	0.25	0.36	0.27
	3	0.51	0.47	0.59	0.51	0.55	0.53	0.79	0.79	0.81	0.78	0.78	0.35	0.59	0.59	0.55	0.63	0.43	0.25	0.34	0.16	0.82	0.69	0.65	0.33
	4	0.35	0.38	0.36	0.40	0.33	0.42	0.63	0.75	0.67	0.68	0.67	0.35	0.33	0.63	0.50	0.58	0.46	0.13	0.19	0.41	0.49	0.38	0.53	0.28
	Average	0.43	0.44	0.59	0.59	0.55	0.47	0.68	0.77	0.71	0.70	0.68	0.38	0.48	0.62	0.49	0.61	0.42	0.30	0.35	0.33	0.48	0.40	0.48	0.24

Table G-4.2 Number of Cycles with Spillback at 66th Street & Ulmerton Rd – Before Study.

Time period	Time segment	# cycles in 15 min	EB					NB					WB					SB								
			Left		Through			Right	Left		Through			Right	Left		Through			Right						
Lane Number			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
AM PEAK	1	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0
	2	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0
	3	4	4	4	4	4	4	0	0	0	1	1	1	0	0	1	0	0	0	0	0	0	1	0	3	0
	4	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Average		4	4	4	4	4	0	0	0	0.25	0.25	0.25	0	0	0.25	0	0	0	0	0.5	1	0.25	0	0.75	0
OFF PEAK	1	4	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	4	1	1	2	2	2	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	1
	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
	4	4	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0
	Average		0.8	0.8	1	1.3	1	0	0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0	0	0	0.3	0.5	0	0	0	0.3
PM PEAK	1	4	0	0	1	1	1	1	0	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	4	0	0	3	3	2	0	1	0	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0
	3	4	0	0	1	1	1	0	0	0	3	3	3	0	0	0	0	0	0	0	0	0	1	1	0	0
	4	4	0	0	0	0	0	0	0	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	Average		0	0	1.25	1.25	1	0.25	0.25	0	2	2	2	0	0	0	0	0.25	0	0	0	0	0	0.25	0.25	0

Table G-4.3 Average Queue Storage Ratio by Lane and by Period at 66th Street & Park Blvd – Before Study.

Time period	Time segment	EB					NB					WB					SB				
		Left		Through		T/R	Left		Through		T/R	Left		Through		T/R	Left		Through		T/R
Lane Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
AM PEAK	1	0.25	0.31	0.68	0.77	0.63	0.38	0.28	0.95	0.98	0.00	0.35	0.28	0.51	0.48	0.45	0.40	0.33	0.54	0.61	0.58
	2	0.22	0.29	0.78	0.81	0.76	0.48	0.40	0.94	0.93	0.00	0.87	0.83	0.79	0.33	0.51	0.21	0.35	0.89	0.93	0.98
	3	0.47	0.48	0.93	0.95	0.91	0.94	0.61	1.00	1.00	0.00	0.30	0.43	0.60	0.55	0.51	0.46	0.68	1.00	1.00	1.00
	4	0.53	0.35	0.74	0.73	0.70	0.35	0.28	0.75	0.83	0.06	0.32	0.38	0.48	0.40	0.44	0.46	0.49	0.84	0.89	0.81
	Average	0.37	0.36	0.78	0.82	0.75	0.54	0.39	0.91	0.93	0.02	0.46	0.48	0.59	0.44	0.48	0.38	0.46	0.82	0.86	0.84
OFF PEAK	1	0.44	0.42	0.28	0.33	0.49	0.46	0.36	0.85	0.70	0.90	0.42	0.38	0.53	0.58	0.21	0.54	0.39	0.88	0.90	0.79
	2	0.41	0.42	0.32	0.30	0.63	0.60	0.69	0.58	0.44	0.78	0.42	0.38	0.36	0.39	0.14	0.77	0.49	0.88	0.89	0.93
	3	0.50	0.38	0.30	0.42	0.66	0.69	0.69	0.89	0.71	0.95	0.38	0.35	0.45	0.49	0.10	0.77	0.56	1.00	1.00	1.00
	4	0.53	0.40	0.33	0.36	0.63	0.67	0.84	0.98	0.91	0.95	0.47	0.44	0.48	0.48	0.24	0.62	0.36	1.00	1.00	1.00
	Average	0.47	0.40	0.31	0.35	0.60	0.61	0.65	0.82	0.69	0.89	0.42	0.39	0.45	0.48	0.17	0.67	0.45	0.94	0.95	0.93
PM PEAK	1	0.84	0.85	0.55	0.55	0.57	0.46	0.58	0.65	0.65	0.65	0.32	0.53	0.89	0.93	0.98	0.67	0.79	1.00	1.00	1.00
	2	0.88	0.79	0.35	0.35	0.35	0.50	0.57	0.94	0.94	0.94	0.32	0.28	0.74	0.79	0.91	0.58	0.43	0.94	1.00	0.96
	3	0.78	0.77	0.45	0.43	0.40	0.48	0.44	0.78	0.76	0.65	0.22	0.33	0.85	0.85	1.00	0.50	0.45	1.00	1.00	1.00
	4	0.72	0.65	0.45	0.47	0.49	0.58	0.53	0.49	0.51	0.51	0.33	0.29	0.81	0.86	0.88	0.52	0.38	0.90	0.98	0.94
	Average	0.80	0.77	0.45	0.45	0.45	0.50	0.53	0.71	0.72	0.69	0.30	0.36	0.82	0.86	0.94	0.57	0.51	0.96	0.99	0.98

Table G-4.4 Number of Cycles with Spillback at 66th Street & Park Blvd – Before Study.

Time period	Time segment	# cycles in 15 min	EB					NB					WB					SB				
			Left		Through		T/R	Left		Through		T/R	Left		Through		T/R	Left		Through	T/R	
Lane Number			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
AM PEAK	1	4	0	0	1	1	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
	2	4	0	0	0	0	0	0	0	3	3	0	1	1	10	0	0	0	0	2	2	3
	3	4	1	0	3	3	3	3	0	4	4	0	0	0	0	0	0	0	2	4	4	4
	4	4	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	2	2	1
	Average			0.25	0.00	1.00	1.00	1.00	0.75	0.00	3.00	2.25	0.00	0.25	0.25	2.50	0.00	0.00	0.00	0.50	2.00	2.00
OFF PEAK	1	4	0	0	0	0	0	0	0	2	2	2	0	0	0	0	0	0	0	3	3	1
	2	4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	3	3
	3	4	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	4	4	4
	4	4	1	0	0	0	0	0	0	3	2	2	0	0	0	0	0	0	0	4	4	4
	Average			0.30	0.00	0.00	0.00	0.00	0.00	0.30	1.50	1.00	1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.50	3.50
PM PEAK	1	4	1	2	0	0	0	0	0	0	0	0	0	0	2	2	2	0	0	4	4	4
	2	4	0	0	0	0	0	0	0	3	3	3	0	0	1	2	2	0	0	3	3	3
	3	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	4	4
	4	4	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	3	3	3
	Average			0.50	0.75	0.00	0.00	0.00	0.00	0.00	0.75	0.75	0.75	0.00	0.00	1.00	1.75	2.00	0.00	0.00	3.50	3.50

4.2. After Study (May 16 & May 17, 2017)

Table G-4.5 Average Queue Storage Ratio by Lane and by Period at 66th Street & Ulmerton Rd – After Study

Time Period	EB						NB						WB						SB						
	Left		Through			Right	Left		Through			Right	Left		Through			Right	Left		Through			Right	
Lane Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
AM Peak	1	0.36	0.35	0.86	0.88	0.86	0.13	0.50	0.40	0.49	0.48	0.40	0.08	0.30	0.34	0.43	0.53	0.28	0.00	0.45	0.30	0.55	0.58	0.73	0.00
	2	0.35	0.31	0.84	0.84	0.76	0.07	0.33	0.44	0.74	0.70	0.60	0.17	0.48	0.54	0.46	0.48	0.34	0.00	0.69	0.47	0.61	0.58	0.81	0.00
	3	0.31	0.28	0.65	0.67	0.68	0.36	0.40	0.48	0.61	0.55	0.48	0.13	0.31	0.58	0.54	0.63	0.39	0.00	0.55	0.55	0.52	0.42	0.53	0.00
	4	0.30	0.32	0.67	0.67	0.70	0.31	0.37	0.49	0.55	0.54	0.40	0.13	0.29	0.43	0.50	0.59	0.44	0.00	0.56	0.41	0.58	0.39	0.60	0.00
	Average	0.33	0.32	0.75	0.77	0.75	0.22	0.40	0.45	0.60	0.57	0.47	0.13	0.35	0.47	0.48	0.55	0.36	0.00	0.56	0.43	0.57	0.49	0.67	0.00
Off Peak	1	0.22	0.25	0.35	0.39	0.46	0.22	0.50	0.35	0.23	0.23	0.13	0.05	0.53	0.66	0.71	0.85	0.65	0.65	0.63	0.41	0.46	0.40	0.57	0.22
	2	0.23	0.28	0.31	0.33	0.39	0.06	0.37	0.42	0.16	0.14	0.06	0.05	0.56	0.63	0.85	1.00	0.73	0.81	0.31	0.28	0.52	0.42	0.49	0.10
	3	0.31	0.36	0.45	0.47	0.48	0.33	0.46	0.54	0.34	0.25	0.23	0.08	0.33	0.35	0.86	1.00	0.75	0.63	0.50	0.38	0.45	0.41	0.53	0.25
	4	0.32	0.37	0.61	0.56	0.55	0.36	0.58	0.62	0.64	0.46	0.41	0.10	0.27	0.38	0.61	0.70	0.56	0.50	0.45	0.45	0.31	0.30	0.40	0.19
	Average	0.27	0.32	0.43	0.44	0.47	0.24	0.48	0.48	0.34	0.27	0.21	0.07	0.43	0.50	0.76	0.90	0.67	0.65	0.47	0.38	0.43	0.38	0.50	0.19
PM Peak	1	0.52	0.45	0.62	0.63	0.65	0.36	1.00	0.90	0.71	0.68	0.58	0.06	0.25	0.36	0.40	0.50	0.36	0.15	0.56	0.41	0.30	0.29	0.43	0.33
	2	0.48	0.58	0.73	0.77	0.83	0.31	0.62	0.66	0.86	0.75	0.66	0.12	0.42	0.60	0.67	0.78	0.63	0.69	0.25	0.28	0.57	0.55	0.72	0.35
	3	0.35	0.32	0.62	0.61	0.77	0.49	0.77	0.71	0.61	0.59	0.51	0.10	0.40	0.48	1.00	1.00	1.00	0.85	0.19	0.16	0.66	0.70	0.85	0.42
	4	0.33	0.30	0.47	0.47	0.57	0.27	0.60	0.77	0.56	0.54	0.43	0.08	0.40	0.50	0.53	0.69	0.56	0.25	0.35	0.28	0.61	0.52	0.63	0.32
	Average	0.42	0.41	0.61	0.62	0.71	0.35	0.76	0.76	0.69	0.64	0.54	0.09	0.37	0.49	0.72	0.85	0.66	0.48	0.34	0.28	0.53	0.51	0.66	0.35

Table G-4.6 Number of Cycles with Spillback at 66th Street & Ulmerton Rd – After Study

Time Period	Time Segment	# Cycles in 15 mins	EB					NB						WB				SB								
			Left		Through			Right	Left		Through			Right	Left		Through		Right	Left		Through			Right	
Lane Number			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
AM Peak	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
	3	5	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Average			0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0.25	0	0	0.5	0	0	0	0.5
Off Peak	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	2	0	0	0	0	0	0
	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	2	0	0	0	0	0	0	0
	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	1	1	0	0	0	0	0	0
	4	5	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Average			0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	1	1.25	0.5	1.25	0.75	0	0	0	0
PM Peak	1	5	0	0	0	0	0	0	3	2	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	2	5	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0
	3	5	0	0	0	0	0	1	1	0	0	0	0	0	0	5	5	5	3	0	0	0	0	2	0	
	4	5	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Average			0	0	0	0	0	0.25	1	0.75	0.75	0.25	0	0	0	0	1.25	1.75	1.25	1	0	0	0	0	0.75

Table G-4.7 Average Queue Storage Ratio by Lane and by Period at 66th Street & Park Blvd – After Study

Time Period	EB					NB					WB					SB					
	Left		Through	Right		Left		Through	Right		Left		Through	Right		Left		Through	Right		
Lane Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
AM Peak	1	0.38	0.23	0.58	0.60	0.56	0.25	0.28	0.48	0.46	0.43	0.45	0.43	0.34	0.43	0.39	0.35	0.25	0.31	0.31	0.33
	2	0.28	0.33	0.75	0.78	0.76	0.52	0.36	0.54	0.61	0.51	0.60	0.54	0.45	0.65	0.68	0.44	0.41	0.41	0.41	0.39
	3	0.44	0.54	0.66	0.67	0.78	0.56	0.40	0.40	0.39	0.30	0.31	0.44	0.23	0.48	0.44	0.48	0.29	0.41	0.40	0.36
	4	0.43	0.42	0.68	0.72	0.82	0.31	0.26	0.38	0.38	0.39	0.33	0.46	0.25	0.73	0.73	0.37	0.23	0.54	0.54	0.58
	Average	0.38	0.38	0.67	0.69	0.73	0.41	0.33	0.45	0.46	0.41	0.42	0.47	0.32	0.57	0.56	0.41	0.29	0.42	0.42	0.41
Off Peak	1	0.56	0.40	0.67	0.69	0.91	0.52	0.35	0.18	0.14	0.19	0.52	0.39	0.39	0.83	0.74	0.60	0.45	0.55	0.53	0.36
	2	0.47	0.33	0.56	0.56	0.74	0.46	0.33	0.27	0.30	0.40	0.48	0.38	0.36	0.71	0.58	0.40	0.31	0.45	0.49	0.40
	3	0.44	0.44	0.91	0.91	0.90	0.63	0.50	0.43	0.45	0.46	0.43	0.32	0.33	0.64	0.56	0.40	0.35	0.45	0.45	0.39
	4	0.47	0.46	0.68	0.70	0.90	0.60	0.44	0.29	0.25	0.29	0.35	0.32	0.26	0.98	0.93	0.44	0.34	0.43	0.40	0.48
	Average	0.48	0.41	0.70	0.72	0.86	0.55	0.41	0.29	0.28	0.33	0.45	0.35	0.33	0.79	0.70	0.46	0.36	0.47	0.47	0.41
PM Peak	1	0.43	0.33	0.83	0.77	0.91	0.52	0.38	0.35	0.45	0.48	0.41	0.48	0.31	0.91	0.83	0.65	0.44	0.46	0.43	0.40
	2	0.53	0.46	0.63	0.66	0.86	0.60	0.65	0.35	0.31	0.23	0.50	0.49	0.38	0.76	0.66	0.63	0.46	0.40	0.39	0.36
	3	0.53	0.33	0.91	0.91	0.91	0.52	0.39	0.28	0.23	0.20	0.53	0.56	0.40	0.88	0.70	0.79	0.50	0.75	0.75	0.75
	4	0.56	0.79	0.41	0.26	0.55	0.42	0.34	0.28	0.26	0.35	0.43	0.43	0.33	0.60	0.44	0.83	0.56	0.70	0.70	0.66
	Average	0.51	0.48	0.69	0.65	0.81	0.51	0.44	0.31	0.31	0.31	0.47	0.49	0.79	0.79	0.66	0.73	0.49	0.58	0.57	0.54

Table G-4.8 Number of Cycles with Spillback at 66th Street & Park Blvd – After Study

Time Period	Time Segment	# Cycles in 15 mins	EB					NB					WB					SB				
			Left		Through		Right	Left		Through		Right	Left		Through		Right	Left		Through		Right
Lane Number			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
AM Peak	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	4	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0
	Average			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.00	0.00	0.00	0.00
Off Peak	1	4	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0
	2	4	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0
	3	4	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0
	4	4	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	0	0	0	0	0
	Average			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	1.50	1.50	0.00	0.00	0.00	0.00
PM Peak	1	5	0	0	0	0	0	0	0	0	0	0	0	0	4	3	2	0	0	0	0	0
	2	5	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
	3	4	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	1	0	0	0	0
	4	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	Average			0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.75	1.50	0.75	0.50	0.00	0.00	0.00

4.3. Comparisons of Before and After Queue Storage Ratios

The differences in Queue Storage Ratio between before and after measurements are shown in Table J-4.9 and J-4.10. The tables are color-coded as follows: green shows significant improvement, yellow shows modest change (either improvement or deterioration), and red shows significant deterioration in delay. Several gradations of each color are used to represent different variations within each classification.

Table G-4.9 Difference in Avg. Queue Storage Ratios at 66th Street & Ulmerton Rd

Time Period	EB						NB						WB						SB						Avg.
	Left		Through			Right	Left		Through			Right	Left		Through			Right	Left		Through			Right	
Lane Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
AM Peak	-0.67	-0.68	-0.25	-0.23	-0.25	0.22	-0.01	0.00	-0.01	-0.04	-0.10	0.13	-0.12	-0.16	-0.01	-0.02	-0.07	-0.05	-0.06	-0.20	-0.07	-0.11	0.02	-0.14	-0.12
Off Peak	-0.26	-0.21	-0.32	-0.30	-0.26	0.24	-0.06	-0.07	-0.28	-0.33	-0.33	0.01	-0.01	-0.10	0.38	0.45	0.33	0.43	0.00	-0.01	-0.12	0.04	0.04	-0.16	-0.04
PM Peak	-0.01	-0.02	-0.01	0.00	0.07	-0.10	0.08	0.02	-0.09	-0.14	-0.22	-0.29	-0.12	-0.15	0.21	0.23	0.22	0.19	-0.02	-0.04	0.07	0.14	0.20	0.12	0.01

Table G-4.10 Difference in Avg. Queue Storage Ratios at 66th Street & Park Blvd

Time Period	EB					NB					WB					SB					Avg
	Left		Through		Right	Left		Through		Right	Left		Through		Right	Left		Through		Right	
Lane Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
AM Peak	0.10	-0.15	0.12	0.14	0.73	-0.05	0.10	0.22	0.16	0.32	0.47	-0.33	-0.13	-0.11	-0.15	-0.31	0.41	0.01	-0.02	-0.64	0.04
Off Peak	0.20	-0.06	0.19	0.18	0.71	0.01	-0.11	0.07	0.10	0.32	0.16	0.01	0.46	0.18	0.03	-0.11	0.39	0.14	0.11	-0.36	0.13
PM Peak	0.23	0.01	0.18	0.11	0.72	0.04	-0.09	0.10	0.08	0.34	0.21	0.19	0.46	0.30	0.39	0.04	-0.14	0.22	0.00	-0.59	0.14

4.4. Discussion

The following are concluded from the comparison of queue storage ratios:

- Overall, the queue storage ratios have improved for the two critical intersections.
- The queue storage ratios for the EB left at Ulmerton Road significantly improved, particularly for the AM peak. However, the WB through and right movements have an increase in the queue storage ratios, especially for the Off-peak period.
- The Park Boulevard intersection shows moderate changes during all periods from all approaches, but there is a significant improvement on queue storage ratios for the SB right movement during all periods, and a deterioration for the EB right during all periods.
- There is reduction in the number of cycles with spillback at both critical intersections, particularly for Ulmerton Road at the EB approach and, for Park Boulevard at the main approaches (NB and SB) throughout the day. Since the Insync adaptive system does not use traditional cycle lengths, the approaches with spillbacks or longer queues could be served on multiple occasions.

5. Equivalent PCE Flows

Traffic flows were counted manually and converted to equivalent PCE flows (pce/hour) by considering the percentage of heavy vehicles. It was assumed that the PCE for trucks is 2.

5.1. Truck Percentage Observations Before Study (Nov. 9 & Nov. 10, 2016)

Table G-5.1 Truck Percentages at 66th Street & Ulmerton Rd – Before Study.

Period	Interval	EB			NB			WB			SB			Ave.
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak	1	7.02%	3.87%	1.79%	4.41%	5.00%	6.56%	7.69%	5.53%	18.18%	0.00%	0.43%	5.83%	5.53%
	2	2.50%	3.28%	3.03%	8.62%	3.35%	1.89%	0.00%	4.14%	0.00%	0.00%	1.23%	3.85%	2.66%
	3	5.19%	5.96%	1.67%	12.00%	6.06%	2.63%	2.33%	6.37%	11.11%	0.00%	2.13%	0.00%	4.62%
	4	0.00%	5.64%	13.04%	2.90%	4.91%	0.00%	4.35%	4.86%	6.25%	5.13%	0.99%	2.88%	4.25%
	Average	3.68%	4.69%	4.88%	6.98%	4.83%	2.77%	3.59%	5.23%	8.89%	1.28%	1.19%	3.14%	4.26%
Off Peak	1	1.49%	8.31%	1.72%	4.48%	2.03%	7.69%	6.25%	5.74%	3.85%	5.26%	3.60%	4.05%	4.54%
	2	9.09%	8.75%	1.79%	1.30%	2.82%	0.00%	1.72%	7.25%	5.26%	0.00%	1.95%	3.75%	3.64%
	3	7.32%	9.47%	5.71%	7.02%	3.87%	8.33%	0.00%	5.13%	0.00%	5.00%	3.42%	2.99%	4.85%
	4	2.70%	6.82%	3.85%	3.33%	3.39%	10.42%	3.45%	4.70%	5.88%	4.00%	3.05%	8.47%	5.01%
	Average	5.15%	8.34%	3.27%	4.03%	3.03%	6.61%	2.86%	5.71%	3.75%	3.57%	3.00%	4.82%	4.51%
PM Peak	1	0.94%	3.57%	1.41%	4.35%	2.22%	5.56%	1.92%	2.67%	0.00%	0.00%	0.00%	4.65%	2.27%
	2	1.64%	2.47%	1.28%	1.19%	1.22%	0.00%	2.94%	1.70%	0.00%	0.00%	1.12%	4.21%	1.48%
	3	0.00%	2.18%	0.00%	0.00%	0.40%	2.27%	4.41%	2.11%	0.00%	0.00%	1.97%	0.00%	1.11%
	4	0.84%	2.58%	0.00%	3.03%	0.98%	0.00%	2.08%	1.61%	2.33%	0.00%	1.63%	0.00%	1.26%
	Average	0.86%	2.70%	0.67%	2.14%	1.21%	1.96%	2.84%	2.02%	0.58%	0.00%	1.18%	2.22%	1.53%

Table G-5.2 Truck Percentages at 66th Street & Park Blvd – Before Study.

Period	Interval	EB			NB			WB			SB			Ave.
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak	1	0.00%	1.78%	8.11%	0.00%	0.93%	0.00%	2.50%	6.22%	4.00%	3.64%	0.00%	2.70%	2.49%
	2	0.00%	2.58%	6.98%	0.00%	1.09%	3.85%	3.92%	3.21%	6.25%	2.82%	4.93%	5.13%	3.40%
	3	2.17%	1.16%	7.14%	2.44%	1.78%	1.75%	2.04%	3.77%	2.63%	4.29%	3.05%	3.23%	2.95%
	4	7.14%	1.09%	7.02%	0.00%	3.30%	6.25%	1.85%	6.85%	2.78%	2.74%	2.67%	6.67%	4.03%
	Average	2.33%	1.65%	7.31%	0.61%	1.77%	2.96%	2.58%	5.01%	3.91%	3.37%	2.66%	4.43%	3.22%
Off Peak	1	1.75%	2.76%	4.17%	0.00%	3.55%	2.78%	1.59%	2.73%	2.63%	2.86%	0.00%	0.00%	2.07%
	2	1.75%	5.41%	0.00%	1.69%	2.70%	13.04%	0.00%	1.03%	2.63%	3.57%	2.29%	2.00%	3.01%
	3	3.92%	1.35%	1.82%	0.00%	0.00%	4.65%	0.00%	3.10%	1.61%	0.00%	0.00%	0.00%	1.37%
	4	2.33%	5.26%	0.00%	3.41%	2.13%	4.00%	4.92%	0.78%	6.67%	1.65%	3.21%	0.00%	2.86%
	Average	2.44%	3.69%	1.50%	1.28%	2.10%	6.12%	1.63%	1.91%	3.39%	2.02%	1.37%	0.50%	2.33%
PM Peak	1	1.69%	3.63%	0.00%	1.18%	2.42%	4.65%	0.00%	1.53%	16.13%	0.00%	2.33%	0.00%	2.80%
	2	1.69%	3.33%	0.00%	1.56%	0.53%	0.00%	1.37%	1.11%	3.85%	4.00%	0.92%	0.00%	1.53%
	3	0.00%	1.58%	1.43%	0.00%	1.38%	2.13%	0.00%	0.68%	2.44%	0.00%	0.43%	0.00%	0.84%
	4	0.00%	1.86%	1.35%	3.30%	1.86%	4.88%	0.00%	0.23%	4.88%	0.00%	1.16%	0.00%	1.63%
	Average	0.85%	2.60%	0.69%	1.51%	1.55%	2.92%	0.34%	0.89%	6.82%	1.00%	1.21%	0.00%	1.70%

5.2. PCE Flow Rates Before Study (Nov. 9 & Nov. 10, 2016)

Table G-5.3 PCE Flow Rates (pce/15 min and pce/hour) at 66th Street & Ulmerton Rd – Before Study.

Time Period (15 min)		EB			NB			WB			SB		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
AM Peak	1	61	403	57	71	168	65	42	267	13	38	234	109
	2	82	409	68	63	216	54	67	352	8	37	247	108
	3	81	391	61	28	210	39	44	217	10	15	144	66
	4	125	356	78	71	171	64	48	259	17	41	204	107
	Flow Rate	349	1559	264	233	765	222	201	1095	48	131	829	390
Off Peak	1	68	352	59	70	151	42	51	221	27	20	144	77
	2	60	323	57	78	146	33	59	281	20	23	157	83
	3	88	370	74	61	161	39	53	287	30	21	151	69
	4	76	407	54	62	183	53	30	334	18	26	169	64
	Flow Rate	292	1452	244	271	641	167	193	1123	95	90	621	293
PM Peak	1	107	319	72	72	230	57	53	385	25	30	173	90
	2	124	374	79	85	248	52	70	419	38	20	181	99
	3	105	375	68	91	251	90	71	532	25	21	207	55
	4	120	278	46	102	207	62	49	378	44	24	187	61
	Flow Rate	456	1346	265	350	936	261	243	1714	132	95	748	305

Table G-5.4 PCE Flow Rates (pce/15 min and pce/hour) at 66th Street & Park Blvd – Before Study

Time Period (15 min)		EB			NB			WB			SB		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
AM Peak	1	41	400	40	62	218	38	41	222	26	57	177	38
	2	33	437	46	71	278	54	53	257	34	73	319	41
	3	47	350	45	42	229	58	50	220	39	73	270	32
	4	45	371	61	64	282	51	55	234	37	75	308	16
	Flow Rate	166	1558	192	239	1007	201	199	933	136	278	1074	127
Off Peak	1	58	298	75	75	175	37	64	263	39	72	184	28
	2	58	312	58	60	190	52	26	293	39	87	179	51
	3	53	301	56	62	182	45	44	333	63	101	188	36
	4	44	200	68	91	240	26	64	389	32	123	225	31
	Flow Rate	213	1111	257	288	787	160	198	1278	173	383	776	146
PM Peak	1	60	343	79	86	212	45	71	398	36	69	220	27
	2	60	372	75	65	190	39	74	454	27	104	220	42
	3	74	385	71	69	220	48	79	447	42	83	235	34
	4	57	383	75	94	219	43	93	434	43	54	261	18
	Flow Rate	251	1483	300	314	841	175	317	1733	148	310	936	121

The traffic volumes at the Ulmerton Rd. intersection are generally higher for the EB and WB approaches (Table G-5.3). The same trend is observed for the Park Blvd intersection (Table G-5.4). This occurs because the major arterial is Park Blvd, which connects to I-275 and SR-92, while 66th Street could be considered the minor street.

5.3. Truck Percentage Observations After Study (May 16 & May 17, 2017)

Table G-5.5 Truck Percentages at 66th Street & Ulmerton Rd – After Study

Period	Interval	EB			NB			WB			SB			Ave.
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak	1	1.79%	0.68%	2.27%	0.00%	1.76%	2.94%	13.79%	8.59%	0.00%	0.00%	2.09%	8.86%	3.56%
	2	0.00%	2.82%	1.41%	2.60%	4.37%	10.00%	10.17%	6.21%	0.00%	8.00%	2.80%	13.33%	5.14%
	3	0.00%	1.37%	1.54%	2.27%	9.66%	10.64%	7.69%	9.48%	10.00%	8.00%	3.85%	0.00%	5.37%
	4	0.00%	1.32%	1.61%	4.00%	11.72%	23.40%	4.65%	10.00%	6.67%	7.69%	3.91%	5.68%	6.72%
	Avg	0.45%	1.55%	1.71%	2.22%	6.88%	11.75%	9.08%	8.57%	4.17%	5.92%	3.16%	6.97%	5.20%
Off Peak	1	0.00%	3.15%	4.05%	0.00%	1.85%	0.00%	3.41%	4.33%	0.00%	3.13%	2.05%	5.08%	2.26%
	2	0.63%	2.24%	3.49%	1.20%	1.37%	4.55%	4.35%	5.99%	6.67%	3.57%	3.80%	8.82%	3.89%
	3	0.96%	2.73%	0.00%	0.00%	0.61%	5.41%	2.17%	3.64%	0.00%	2.86%	1.93%	9.43%	2.48%
	4	0.00%	2.55%	3.13%	0.00%	1.46%	3.45%	3.13%	4.12%	25.00%	0.00%	0.96%	17.78%	5.13%
	Avg	0.40%	2.67%	2.67%	0.30%	1.32%	3.35%	3.26%	4.52%	7.92%	2.39%	2.19%	10.28%	3.44%
PM Peak	1	0.71%	1.79%	0.00%	0.00%	1.29%	0.00%	20.00%	2.81%	5.26%	4.76%	5.75%	13.33%	4.64%
	2	0.00%	0.00%	0.00%	0.00%	3.45%	2.63%	0.00%	0.00%	0.00%	0.00%	1.98%	5.48%	1.13%
	3	0.00%	0.00%	0.00%	1.27%	0.00%	0.00%	3.39%	3.28%	2.17%	5.26%	4.48%	4.17%	2.00%
	4	0.00%	0.00%	0.00%	0.00%	4.94%	0.00%	0.00%	2.01%	0.00%	0.00%	1.98%	6.14%	1.26%
	Avg	0.18%	0.45%	0.00%	0.32%	2.42%	0.66%	5.85%	2.03%	1.86%	2.51%	3.55%	7.28%	2.26%

Table G-5.6 Truck Percentages at 66th Street & Park Blvd – After Study.

Period	Interval	EB			NB			WB			SB			Ave.
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak	1	0.00%	1.52%	2.27%	1.89%	0.94%	3.57%	9.80%	8.59%	0.00%	10.81%	7.55%	5.56%	4.38%
	2	0.00%	0.60%	0.00%	0.00%	1.13%	0.00%	6.00%	6.21%	0.00%	4.44%	5.49%	10.00%	2.82%
	3	0.00%	1.24%	1.39%	2.56%	0.33%	1.22%	8.11%	9.48%	10.00%	7.84%	3.91%	0.00%	3.84%
	4	0.00%	0.36%	5.93%	4.00%	0.00%	2.94%	7.41%	10.00%	6.67%	3.39%	4.72%	11.76%	4.77%
	Avg	0.00%	0.93%	2.40%	2.11%	0.60%	1.93%	7.83%	8.57%	4.17%	6.62%	5.42%	6.83%	3.95%
Off Peak	1	0.00%	0.92%	3.45%	0.87%	1.63%	1.18%	13.33%	2.53%	6.67%	7.55%	6.64%	4.88%	4.14%
	2	24.92%	2.70%	1.17%	0.87%	0.55%	1.17%	1.79%	2.02%	9.38%	8.70%	4.75%	8.33%	5.53%
	3	0.00%	0.93%	0.00%	0.00%	0.55%	0.00%	5.80%	2.69%	5.45%	4.62%	2.38%	1.75%	2.01%
	4	0.00%	0.84%	1.08%	0.00%	0.00%	0.00%	0.00%	2.51%	2.08%	9.59%	2.47%	0.00%	1.55%
	Avg	6.23%	1.35%	1.42%	0.43%	0.68%	0.59%	5.23%	2.44%	5.89%	7.61%	4.06%	3.74%	3.31%
PM Peak	1	2.60%	0.45%	0.00%	0.00%	0.32%	2.44%	6.38%	2.61%	11.11%	9.23%	1.22%	3.85%	3.35%
	2	0.00%	0.00%	0.00%	0.00%	0.58%	0.79%	0.00%	0.00%	0.00%	12.70%	2.54%	3.64%	1.69%
	3	0.00%	0.58%	0.00%	0.00%	0.00%	1.92%	8.22%	4.89%	0.00%	5.08%	3.72%	7.14%	2.63%
	4	0.00%	0.00%	0.00%	3.03%	0.80%	1.49%	2.99%	1.81%	0.00%	4.11%	5.74%	0.00%	1.66%
	Avg	0.65%	0.26%	0.00%	0.76%	0.43%	1.66%	4.40%	2.33%	2.78%	7.78%	3.30%	3.66%	2.33%

5.4. PCE Flow Rates After Study (May 16 & May 17, 2017)

Table G-5.7 PCE Flow Rates (pce/15 min and pce/hour) at 66th Street & Ulmerton Rd – After Study.

Time Period		EB			NB			WB			SB		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
AM Peak	1	57	296	45	47	173	35	33	215	9	19	195	86
	2	64	328	72	79	191	33	65	325	9	27	220	102
	3	48	222	66	45	227	52	42	231	22	27	162	75
	4	97	308	63	26	143	58	45	242	16	28	186	93
	Flow Rate	266	1154	246	197	734	178	185	1013	56	101	763	356
Off Peak	1	60	262	77	49	110	16	91	289	19	33	149	62
	2	160	501	89	84	371	115	48	301	16	29	191	37
	3	105	263	16	36	166	78	47	313	14	36	211	58
	4	113	241	33	34	209	60	33	354	10	51	211	53
	Flow Rate	438	1267	215	203	856	269	219	1257	59	149	762	210
PM Peak	1	142	397	67	80	157	46	42	366	20	44	184	51
	2	111	375	149	65	150	39	47	402	28	16	206	77
	3	46	392	117	80	169	37	61	504	47	20	303	100
	4	84	188	45	57	85	47	69	709	51	38	257	121
	Flow Rate	383	1352	378	282	561	169	219	1981	146	118	950	349

Table G-5.8 PCE Flow Rates (pce/15 min and pce/hour) at 66th Street & Park Blvd – After Study

Time Period		EB			NB			WB			SB		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
AM Peak	1	30	200	45	54	214	29	56	215	9	41	171	38
	2	97	334	64	20	268	74	53	325	9	47	288	44
	3	83	245	73	40	301	83	40	231	22	55	239	33
	4	72	277	125	26	132	35	58	242	16	61	244	38
	Flow Rate	282	1056	307	140	915	221	207	1013	56	204	942	153
Off Peak	1	6	219	90	116	187	86	68	445	48	114	305	43
	2	10	228	86	117	184	86	57	405	35	75	397	39
	3	6	218	84	114	182	84	73	382	58	68	431	58
	4	7	239	94	125	198	92	44	327	49	80	374	59
	Flow Rate	29	904	354	471	751	348	242	1559	190	337	1507	199
PM Peak	1	79	224	68	68	314	126	50	275	30	71	249	27
	2	67	191	55	16	346	127	69	334	38	71	242	57
	3	123	345	112	60	308	106	79	322	19	62	307	60
	4	96	191	51	34	376	68	69	338	25	76	258	40
	Flow Rate	365	951	286	178	1344	427	267	1269	112	280	1056	184

5.5. Comparisons of Before and After Flows

The differences in traffic flow between the before and after measurements are shown in Table G-5.9 and Table G-5.10. The tables are color-coded as follows: green shows significant decrease, yellow shows modest change (either improvement or deterioration), and red shows significant deterioration in delay. Several gradations of each color are used to represent different variations within each classification.

Table G-5.9 Difference in Traffic Flow Rate (pce/hr) at 66th Street & Ulmerton Rd

Period	EB			NB			WB			SB		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
AM Peak	-83	-405	-18	-36	-31	-44	-16	-82	8	-30	-66	-34
Off Peak	146	-185	-29	-68	215	102	26	134	-36	59	141	-83
PM Peak	-73	6	113	-68	-375	-92	-24	267	14	23	202	44

Table G-5.10 Difference in Traffic Flow Rate (pce/hr) at 66th Street & Park Blvd

Period	EB			NB			WB			SB		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
AM Peak	116	-502	115	-99	-92	20	8	80	-80	-74	-132	26
Off Peak	-184	-207	97	183	-36	188	44	281	17	-46	731	53
PM Peak	114	-532	-14	-136	503	252	-50	-464	-36	-30	120	63

5.6. Discussion

The following are concluded from the comparison of traffic flows:

- At Ulmerton Rd, volumes during the after study were found to be lower during the AM peak for all the approaches, which may be due to seasonal variation. During the Off-peak, the volumes are higher on all approaches with the exception of the EB approach. During the PM peak the volumes decrease for the NB and increase for the other approaches.
- At Park Boulevard, the EB through movement has a reduction in volumes across all time periods, while the WB has a reduction during the PM peak. The NB has a significant increase in volume during the PM peak and the SB during the Off peak. This might be due to the prioritization of North-South movements by the adaptive system.

6. Consideration of Traffic Flows Jointly with Queue Length

The differences in “Traffic Flow” and “Queue Length” between before and after measurements are shown in Table J-6.1 and Table J-6.3. The tables are color-coded as follows: green indicates that “Queue” decreases and “Traffic Flow” increases, red indicates “Queue” increases and “Traffic Flow” decreases, no color indicates “Traffic Flow” and “Queue” increase or decrease at the same time. Generally, green indicates improvement despite an increase in flow.

Table G-6.1 Differences in Traffic Flow (TF) and Queue Length (Q) at 66th Street & Ulmerton Rd

Time Period	EB						NB						WB						SB					
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		Left		Thru		Right	
	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q
AM Peak	-83	-14.89	-405	-5.33	-18	1.94	-36	-0.03	-31	-1.00	-44	1.53	-16	-1.54	-82	-0.65	8	-0.19	-30	-0.93	-66	-1.34	-34	-2.06
Mid-Day	146	-5.13	-185	-6.47	-29	2.18	-68	-0.83	215	-6.30	102	0.10	26	-0.56	134	7.02	-36	1.71	59	-0.04	141	-0.39	-83	-2.43
PM Peak	-73	-0.41	6	0.46	113	-0.88	-68	0.63	-375	-3.01	-92	-3.46	-24	-1.48	267	3.96	14	0.75	23	-0.21	202	2.89	44	1.75

Table G-6.2 Difference (%) in Traffic Flow (TF) and Queue Length (Q) at 66th Street & Ulmerton Rd

Time Period	EB						NB						WB						SB					
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		Left		Thru		Right	
	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q
AM Peak	-36%	-68%	-53%	-24%	-8%	N/A	-27%	-1%	-4%	-8%	-11%	N/A	-5%	-26%	-5%	-7%	3%	N/A	-15%	-23%	-6%	-10%	-71%	-103%
Mid-Day	54%	-43%	-29%	-40%	-17%	N/A	-76%	-12%	35%	-53%	35%	10%	9%	-9%	9%	100%	-15%	171%	31%	-1%	13%	-4%	-87%	-49%
PM Peak	-21%	-4%	1%	3%	43%	-22%	-72%	7%	-50%	-20%	-30%	-69%	-5%	-25%	20%	40%	5%	75%	9%	-11%	12%	32%	33%	44%

Table G-6.3 Differences in Traffic Flow (TF) and Queue Length (Q) at 66th Street & Park Blvd

Time Period	EB						NB						WB						SB					
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		Left		Thru		Right	
	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q
AM Peak	116	0.17	-502	-2.61	115	-0.43	-99	-1.59	-92	-9.34	20	7.81	8	-0.36	80	1.08	-80	1.58	-74	-1.50	-132	-8.38	26	-8.56
Off-peak	-184	0.09	-207	8.38	97	5.75	183	-2.99	-36	-9.40	188	-11.19	44	-0.13	281	6.34	17	10.56	-46	-2.25	731	-9.50	53	-10.44
PM Peak	114	-2.89	-532	4.87	-14	7.81	-136	-0.97	503	-8.03	252	-7.50	-50	2.48	-464	-1.01	-36	-5.66	-30	0.84	120	-8.09	63	-8.63

Table G-6.4 Difference (%) in Traffic Flow (TF) and Queue Length (Q) at 66th Street & Park Blvd

Time Period	EB						NB						WB						SB					
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		Left		Thru		Right	
	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q	TF	Q
AM Peak	49%	4%	-50%	-17%	57%	-7%	-36%	-20%	-9%	-78%	16%	N/A	5%	-5%	5%	12%	-42%	53%	-37%	-21%	-14%	-56%	19%	-143%
Off-peak	-64%	2%	-26%	105%	61%	115%	48%	-27%	-5%	-67%	129%	-186%	21%	-2%	25%	91%	7%	1056%	-23%	-25%	57%	-56%	31%	-209%
PM Peak	36%	-36%	-63%	54%	-8%	195%	-44%	-11%	54%	-62%	208%	-188%	-20%	50%	-31%	-7%	-12%	-81%	-9%	9%	7%	-45%	43%	-216%

6.1. Discussion

The following can be concluded from the comparison of traffic flows jointly with queue length:

- At Ulmerton Rd, all approaches, except a few right turn movements, showed either a moderate improvement or remained as before.
- At Park Blvd. conditions either improved or remained the same for all approaches except for the EB. The SB during Off peak and the NB during PM peak showed the highest percentage improvements. This can be due to the adaptive system prioritizing the North-South direction.

7. Conclusions Regarding Operational Performance Measures

Based on the field data collection and the comparison of operational performance measures we conclude the following:

- Based on the comparison of each performance measure, it can be concluded that quality of service for the corridor and the critical intersections has improved after installation of InSync. Travel time was reduced for both directions, during all time periods. The highest improvement is reached during the PM peak in the SB direction with a decrease in travel time of 3.31 min (22.3%). The average improvement in the SB direction is 2.85 min (20.3%) and in the NB 1.45 min (10.5%).
- The average delay is generally reduced at all intersections in the corridor. Park Blvd., which had high delays in the before study, has the highest reduction in delay during all time periods and in both directions.
- Queue lengths have improved for most of the movements, especially for the AM peak. However, the WB through movement during the Off Peak and PM peak has longer queues, mainly due to the commuting traffic (coming back from Tampa via I-275.)
- The queue storage ratios for the EB at the Ulmerton Road intersection significantly improved for all periods. However, there was deterioration on the WB during Off peak and PM peak. The Park Boulevard intersection improved for all approaches and time periods.
- The number of cycles with spillback has improved for all approaches at both critical intersections.
- Except for a few right turns and the EB at Park Blvd., there was significant improvement in traffic flow and queue conditions. Approaches on Ulmerton Rd either remained the same or showed moderate improvements.