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MEMORANDUM

TO: Wayne Houle, PE (MN)

FROM: Heather Kienitz, PE (MN)
Justin Anibas, EIT

DATE: March 1, 2019

RE: Johnson Parkway Test Closures Impact Study
SEH No. STPAU 148568

BACKGROUND & EXECUTIVE SUMMARY

The Johnson Parkway Trail was identified in the adopted Grand Round Design and Implementation Plan (2016). Initial technical screening work was completed for the proposed 2-mile long trail, including traffic operations analysis and 20% plans based upon the concept in the Plan document. Generally, the project includes construction of a 10 to 12 foot wide bituminous trail along the easterly side of Johnson Parkway from Burns Avenue to Phalen Boulevard.

In preparation for the implementation of the Johnson Parkway Trail, detailed traffic data collection and operations analysis have been conducted to inform the development of the final trail and street design.

Recommendations from the adopted Plan called for access restrictions along some of the cross streets between Bush Avenue and Wakefield Avenue. Based on this preliminary concept and subsequent work, the effects of the access restrictions on traffic operations and circulation were tested and analyzed by installing temporary closures, collecting “before and after” data, and conducting traffic operations analysis.

The following streets had access to Johnson Parkway closed on the east side under the test closure conditions:

- | | |
|---|---------------------|
| 1. Bush Avenue | 5. Fremont Avenue |
| 2. Reaney Avenue | 6. Conway Street |
| 3. Margaret Street (Permanently closed as part of a separate project in 2018) | 7. Euclid Street |
| 4. 5 th Street | 8. Wakefield Avenue |

In advance of the test closures, traffic counts were conducted at each of the east side legs (except Margaret Street) as well as at 5 intersections along Johnson Parkway, which are:

- | | |
|--|--|
| 1. Johnson Parkway at 7 th Street | 4. Johnson Parkway at 3 rd Street |
| 2. Johnson Parkway at Minnehaha Avenue | 5. Johnson Parkway at Wilson Avenue |
| 3. Johnson Parkway at 6 th Street | |

Figure 1 shows the project area, study intersections, and test closure locations.

Engineers | Architects | Planners | Scientists

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The traffic operations analysis was conducted for three scenarios: Existing, Test Closure and Mitigated Test Closure conditions. The results for each scenario are summarized below.

Existing Conditions

Operations analysis showed the following issues under existing conditions:

- Johnson Parkway at 3rd Street – The eastbound left turning movement operates at LOS F during the AM peak hour and LOS E during the PM peak hour. The long left-turn delays create increased delays for the other eastbound movements.
- Johnson Parkway – Many of the existing turn lanes on Johnson Parkway have maximum queues that extend beyond the current storage area. When this occurs, delays increase for other vehicles on Johnson Parkway. However, many of the approaches still operate acceptably (LOS D or better) despite maximum queues that extend beyond the available storage.

Test Closure – No Mitigation

Operations analysis showed the following issues under the test closure conditions with existing traffic signal phasing and only minor signal timing improvements:

- Johnson Parkway at Minnehaha Avenue – The southbound left turning movement operates at LOS F during the PM peak hour. The long delays cause the southbound left turn queue to extend beyond the provided storage, which increases delay for the other southbound movements.
- Johnson Parkway at 3rd Street – The eastbound left turning movement operates at LOS F during the PM peak hour. The long left turn delays create increased delays for the other eastbound movements.
- Johnson Parkway – Many of the existing turn lanes on Johnson Parkway have maximum queues that extend beyond the current storage area. When this occurs, delays increase for other vehicles on Johnson Parkway. However, many of the approaches still operate acceptably (LOS D or better) despite maximum queues that extend beyond the available storage.

Test Closure – Including Mitigation

The following mitigations should be implemented in conjunction with the 8 proposed access closures to provide acceptable traffic operations at the five study intersections along Johnson Parkway.

These mitigations will provide traffic operations that are similar or better than operations under the existing conditions.

- Johnson Parkway Intersections – Increase the cycle length for each intersection to 85 seconds during the PM peak hour.
- Johnson Parkway at Minnehaha Avenue – Add a leading protected southbound phase during the PM peak hour. This phase will allow some southbound left turns to clear under a protected phase while the other southbound movements also have a green light. This also aids in clearance of the southbound left turn queue that may extend beyond the available storage, blocking the other southbound movements.
- Johnson Parkway at 3rd Street –
 - Add a leading protected southbound phase during the PM peak hour. This phase aids in clearance of the southbound left turn queue that may be extend beyond the available storage, blocking the other southbound movements.
 - Add a leading protected eastbound phase during the PM peak hour. This phase aids in clearance of the eastbound left turns that block other eastbound movements under existing conditions.
- Johnson Parkway at 7th Street – Eliminate the existing leading protected eastbound phase during the AM peak hour unless there are unknown circumstances requiring its presence.

Overall Network Performance Comparison

Due to the change in volumes between the existing and test closure scenarios, a direct comparison of the total delay in the network cannot be made; a more accurate comparison is shown by the average delay per vehicle. The SimTraffic results show the average total delay per vehicle. This is the average cumulative delay for each vehicle that enters the network regardless of how many intersections a vehicle travels through. Therefore, some vehicles will have larger delays because they travel through several intersections (ex. a vehicle taking an eastbound left turn at 3rd Street, going northbound through 6th Street and Minnehaha Avenue, and then taking a northbound left turn onto 7th Street) while others will have very little delay because they only travel through one intersection (ex. a vehicle taking an eastbound right off of Wilson Avenue). **Table 1**, below, compares the average delay per vehicle for each vehicle entering the roadway network.

Table 1 – Access Counts Summary

Analysis Scenario	AM Peak Hour (sec/veh)	PM Peak Hour (sec/veh)
Existing Conditions	31.9	36.6
Test Closure Conditions – No Mitigations	29.0*	47.5
Test Closure Mitigated Conditions	30.1	42.7

*The benefits of the mitigations impact the lower volume side streets more positively while Johnson Parkway (with more vehicles) gets slightly worse thus the improvement in delay when averaging across the network is not significant.

Conway Street, 6th Street and Gotzian Street

It should be noted that additional analysis was completed for three areas of the Johnson Parkway Corridor based on comments received at the open house and other meetings. This included review of:

- Conway Street Access at Johnson Parkway
- 6th Street access during school dismissal of Harding High School
- The crash history of the intersection of 3rd Street at Gotzian Street

The findings of those analyses can be found in the Technical Memorandum *Conway Street/English Street Analysis and Other Open House Related Comments*, which was completed on February 20, 2019.

Additional Johnson Parkway Design Considerations

The following outlines additional design considerations for Johnson Parkway based on the analysis described above.

1. **Cross-Streets** – Consider striping the observed (but not officially striped) left-turn lanes on the cross street (east-west) approaches. While there are not left turn lanes present, it was observed there is sufficient width such that motorists typically drive around left-turning vehicles as they wait for a gap to make their turn. Formally marking a left turn lane would likely provide some benefit to traffic operations as currently not all vehicles drive around the waiting left turning vehicle.
2. **Minnehaha Avenue** – The preliminary designs for Johnson Parkway called for medians to be installed on Minnehaha Avenue on both sides of Johnson Parkway to provide only right-in/right-out movements at the frontage road intersections. The primary goal of this design was to reduce conflicts between vehicles on Minnehaha Avenue with vehicles turning on and off of the frontage roads.

Due to street width constraints the medians may eliminate the observed (but not officially striped) left-turn lanes which was assumed for the traffic operations analysis. Without the unofficial left turn lanes, the traffic operations at Minnehaha Avenue would be poor, as a single left turning motorist would block all through traffic, therefore it is recommended that the medians only be installed if a left turn lane with storage for one to two vehicles, would physically fit within the intersection approaches along with the medians.

3. **3rd Street** – Medians were initially part of preliminary design plans for the intersection of Johnson Parkway at 3rd Street; however, it was determined that there was not enough roadway width to accommodate a median and a westbound left turn lane at the intersection. As a result, the intersection plan calls for 3rd Street to be restriped to include a westbound left turn lane without a median.

Without a median, there would be no way to reduce the conflicts between vehicles on 3rd Street with vehicles turning on and off of the frontage road, so signs limiting the movements onto and off of the frontage road were considered. We think it would be difficult to sign and convey to motorists the turning movement restrictions due to the limited distance (40' between Johnson Parkway and the Frontage Road) for motorists originating from the Johnson Parkway side of the Frontage Road to see and react to the signs. We are uncertain the value they would offer for such movements. The sign would be visible to the movements originating from the east and frontage roads for a greater distance and perhaps better obeyed as a result. However, such static signs are likely to have violators. During peak periods, the queues blocking the Frontage Road may be more effective in discouraging the movement than the signs.

As part of the analysis of the closure of the Conway Street, the intersection of 3rd Street at the Frontage Road/English Street was observed with the test closures in place (video recordings were reviewed). It was observed that despite the increased traffic on English Street, vehicles still were able to enter 3rd Street safely without making dangerous or aggressive movements and the English Street demand volumes were low under test conditions. Therefore, it is reasonable to allow all movements to continue at the intersection. Further, it is likely that signs restricting turning movements would not be effective. If concerns arise the location should be monitored.

4. **Johnson Parkway** – Where opportunities exist, it would be beneficial to extend the turn lanes on Johnson Parkway that currently have maximum queues extending beyond the available storage; however, these queues do not appear to have a detrimental effect on the overall traffic operations at the intersections.

EXISTING CONDITIONS

Johnson Parkway is a two-lane north-south roadway with two-way frontage roads, generally running along each side within the study area (Bush Avenue to Wakefield Avenue). Johnson Parkway has a posted speed limit of 30 mph. All cross streets for Johnson Parkway are two-lane roadways with posted speed limits of 30 mph through the project area.

The attached **Figure 2** shows the existing geometry and intersection control for each of the five study intersections. During data collection, it was observed that if a couple vehicles on the east-west street (where there are no dedicated left turn lanes) were waiting to make left turns, the roadway was wide enough that through and right turning vehicles could drive by/around those waiting to take a left turn. As a result, a 50-foot left turn lane was added to all cross-street approaches.

The 7th Street, Minnehaha Avenue, and 3rd Street intersections with Johnson Parkway are signalized. Below are notes on the cycle length, phasing, and coordination at each of the existing signals:

- Johnson Parkway at 7th Street (cycle length = 75 seconds)
 - Actuated coordinated signal operating in coordination with the intersection of Johnson Parkway at Minnehaha Avenue
 - Has a leading protected eastbound phase
 - Permissive left turn phasing for all approaches except eastbound, which operates as protected/permissive with the leading protected eastbound phase

- Johnson Parkway at Minnehaha Avenue (cycle length = 75 seconds)
 - Pre-timed coordinated signal operating in coordination with the intersection of Johnson Parkway at 7th Street
 - Permissive left turn phasing for all approaches
- Johnson Parkway at 3rd Street (cycle length = 70 seconds)
 - Actuated uncoordinated signal (Note that the signal timing plan says N-S coordination but the cycle lengths aren't the same at the adjacent signals)
 - Permissive left turn phasing for all approaches

DATA COLLECTION

AM and PM peak hour (7-9 am, 4-6 pm) turning movement counts were collected at the five study intersections under both the existing conditions (all cross street accesses open except Margaret Street) and under the test-closure conditions (all eight proposed access closures in place). In addition, turning movement data was collected at the proposed closure locations before the closures were in place. These counts occurred during the same period as the existing conditions turning movement counts. The 48-hour tube counts were obtained along the frontage roads on both sides of Johnson Parkway and on 4th Street and Beech Street, which would maintain access to Johnson Parkway, to assist in understanding how traffic patterns may shift with the 8 proposed access closures. **Figure 3** shows the existing and test closure daily volumes for each tube count location.

The existing turning movement, access counts, and tube counts were collected in early November 2018. Traffic barriers (Type III Barricades) were then placed at the test closure locations for nearly three weeks to allow for users to develop and establish new travel patterns. The test-closure turning movement counts and tube counts were collected in early December 2018. **Figures 4 and 5** show a comparison between the existing and test-closure traffic volumes for the AM and PM peak hours, which were determined to be 7:15 to 8:15 am and 4:00 to 5:00 pm, respectively.

Table 2 shows the total trips in and out of the 7 accesses that are proposed to be closed as part of the trail project. Based on the access count, closing these accesses will displace a total of 253 trips during the AM peak hour and 267 trips during the PM peak hour. **Figure 6** shows the access counts under the existing conditions.

Table 2 – Access Counts Summary

Access Location	AM Peak Hour			PM Peak Hour		
	Into Access	Out of Access	Combined	Into Access	Out of Access	Combined
Bush Avenue	25	27	52	12	18	30
Reaney Avenue	24	28	52	21	32	53
5 th Street	13	16	29	19	11	30
Fremont Avenue	3	22	25	14	6	20
Conway Street	30	48	78	39	74	113
Euclid Street	4	10	14	11	9	20
Wakefield Avenue	0	3	3	1	0	1
Total	99	154	253	117	150	267

TRAFFIC PATTERN CHANGES (EXISTING VS. TEST CLOSURE CONDITIONS)

Based on the differences in the existing and test closure traffic volumes, some shifts in traffic pattern were noted between the existing and test closure conditions. While the existing volume of traffic at the test closure locations must reroute for access to and from the parkway, some of the minor changes in traffic volume observed and noted below may simply be the result of volume data obtained on two different days rather than the test closures alone. **Figure 7** shows the pre-test closure and test closure approach volumes for each study intersection as well as arrows indicating where traffic appears to have rerouted to from the test closure locations. These arrows are based on the comparison of the existing and test closure daily and peak hour traffic volumes.

- Johnson Parkway at 7th Street:
 - There is a slight increase (10%) in westbound through traffic and an increase of 18 southbound lefts during the AM peak hour.
 - During the PM peak hour, there are increases in northbound lefts and rights.

- Johnson Parkway at Minnehaha Avenue:
 - During the AM peak hour, there is an increase in traffic demands for the westbound approach as well as an increase in southbound left turns.
 - During the PM peak hour, there is an increase in traffic demands on Johnson Parkway.
- Johnson Parkway at 6th Street:
 - During the AM peak hour, there was an increase of 15 westbound vehicles, which is expected with the nearby access closure.
 - During the PM peak hour, there was an increase of 35 vehicles destined to the east leg of the intersection, which is expected with the nearby access closure.
- Johnson Parkway at 3rd Street:
 - During the AM peak hour, there was an increase of 88 westbound vehicles (17%), which indicates many of the trips that used the nearby accesses before the closures rerouted to use the signal at 3rd Street.
 - There was also an increase of 27 southbound left turning vehicles during the AM peak hour
 - During the PM peak hour, the traffic patterns at this intersection are similar to those seen in the AM with a 16% increase in westbound vehicles and a 13% increase in southbound left turning vehicles.
- Johnson Parkway at Wilson Avenue:
 - During the AM peak hour, there was an increase of 24 westbound vehicles and 15 southbound lefts, which are expected when nearby accesses are closed.
 - During the PM peak hour, there was a slight increase in northbound traffic on Johnson Parkway.

OPERATIONS ANALYSIS

Traffic operations analyses were conducted to determine the level of service (LOS), delay, and queueing information during AM and PM peak hour conditions for each traffic control scenario. Each scenario uses the existing intersection geometry.

LOS is a qualitative rating system used to describe the efficiency of traffic operations at an intersection. Six LOS values are defined, designated by letters A through F. LOS A represents the best operating conditions (no congestion), and LOS F represents the worst operating conditions (longest delays). For the study intersection, it was assumed that LOS D or better for all movements, approaches, and intersections represents acceptable operating conditions.

LOS for intersections is determined by the average control delay per vehicle. The range of control delay for each LOS is different for signalized and unsignalized intersections. The expectation is that a signalized intersection is designed to serve higher traffic volumes and will experience greater delays than an unsignalized intersection; with that, driver tolerance for delay is greater at a signal than a stop sign. Therefore, delay thresholds for each LOS category are lower for unsignalized intersections than for signalized intersections.

The traffic operations analyses were performed using Synchro/SimTraffic (version 9) software using an average of 10 simulation runs for each modeling result. Detailed SimTraffic result tables, that include delays for each movement and queueing information, are attached.

The following traffic control alternatives were analyzed as part of this study:

- Existing conditions – all accesses except Margaret Street open
- Test Closure conditions – all proposed access closures in effect
- Test Closure Mitigated conditions – all proposed access closures in effect with mitigations to address operational issues

Existing Conditions

Operations analysis showed the following issues under existing conditions:

- The eastbound left turning movement at the intersection of Johnson Parkway at 3rd Street operates at LOS F during the AM peak hour and LOS E during the PM peak hour. The long left turn delays create increased delays for the other eastbound movements.
- Many of the existing turn lanes on Johnson Parkway have maximum queues that extend beyond the current storage area. When this happens, it can increase delays for other vehicles on Johnson Parkway. However, many of the approaches still operate acceptably despite maximum queues that extend beyond the available storage.

Table 3 shows the AM and PM peak hour traffic operations under the existing conditions.

Table 3 – Existing Operations Results

Johnson Parkway at:	Approach	AM Peak Hour		PM Peak Hour	
		Approach (Delay / LOS)	Intersection (Delay / LOS)	Approach (Delay / LOS)	Intersection (Delay / LOS)
7 th Street	NB	18.5 / B	18.8 / B	13.0 / B	22.2 / C
	SB	22.4 / C		22.8 / C	
	EB	10.1 / B		26.8 / C	
	WB	18.4 / B		31.0 / C	
Minnehaha Avenue	NB	15.4 / B	15.9 / B	19.0 / B	20.0 / C
	SB	8.6 / A		23.2 / C	
	EB	13.8 / B		18.8 / B	
	WB	22.3 / C		18.1 / B	
6 th Street	NB	1.7 / A	2.7 / A	2.4 / A	3.8 / A
	SB	2.4 / A		3.7 / A	
	EB	7.7 / A		14.4 / B	
	WB	7.9 / A		11.6 / B	
3 rd Street	NB	9.3 / A	26.8 / C	10.6 / B	21.4 / C
	SB	13.3 / B		18.9 / B	
	EB	49.9 / D		34.1 / C	
	WB	34.1 / C		21.1 / C	
Wilson Avenue	NB	0.3 / A	2.3 / A	0.4 / A	3.4 / A
	SB	2.1 / A		3.2 / A	
	EB	5.9 / A		7.6 / A	
	WB	4.6 / A		6.9 / A	

TEST CLOSURE CONDITIONS

Operations analysis showed the following issues under the test closure conditions with existing traffic signal phasing and only minor signal timing improvements:

- The southbound left turning movement at the intersection of Johnson Parkway at Minnehaha Avenue operates at LOS F during the PM peak hour. The long delays cause the southbound left turn queue to extend beyond the provided storage, which increases delay for the other southbound movements.
- The eastbound left turning movement at the intersection of Johnson Parkway at 3rd Street operates at LOS F during the PM peak hour. The long left turn delays create increased delays for the other eastbound movements.
- Many of the existing turn lanes on Johnson Parkway have maximum queues that extend beyond the current storage area. When this happens, it can increase delays for other vehicles on Johnson Parkway. However, many of the approaches still operate acceptably despite maximum queues that extend beyond the available storage.

Table 4 shows the AM and PM peak hour traffic operations under the test-closure conditions.

Table 4 – Test Closure Operations Results

Johnson Parkway at:	Approach	AM Peak Hour		PM Peak Hour	
		Approach (Delay / LOS)	Intersection (Delay / LOS)	Approach (Delay / LOS)	Intersection (Delay / LOS)
7 th Street	NB	22.9 / C	21.1 / C	16.2 / B	22.8 / C
	SB	27.5 / C		22.7 / C	
	EB	9.4 / A		26.1 / C	
	WB	17.6 / B		31.5 / C	
Minnehaha Avenue	NB	18.1 / B	18 / B	20.9 / C	28.1 / C
	SB	15.0 / B		48.1 / D	
	EB	14.1 / B		18.0 / B	
	WB	21.2 / C		19.4 / B	
6 th Street	NB	1.8 / A	2.9 / A	2.7 / A	4.2 / A
	SB	2.6 / A		3.9 / A	
	EB	7.8 / A		13.4 / B	
	WB	8.4 / A		11.2 / B	
3 rd Street	NB	12.1 / B	17.0 / B	12.8 / B	33.5 / C
	SB	18.0 / B		37.3 / D	
	EB	16.7 / B		62.1 / E	
	WB	17.8 / B		19.7 / B	
Wilson Avenue	NB	0.3 / A	2.6 / A	0.5 / A	3.2 / A
	SB	2.5 / A		3.2 / A	
	EB	5.7 / A		7.8 / A	
	WB	4.9 / A		6.8 / A	

Test Closure Mitigated Conditions

The following mitigations should be implemented in conjunction with the 7 proposed access closures to provide acceptable traffic operations at the five study intersections along Johnson Parkway.

These mitigations will provide traffic operations that are similar or better than operations under the existing conditions without the need for roadway expansion or geometric changes.

- Johnson Parkway Intersections – Increase the cycle length for each intersection to 85 seconds during the PM peak hour.
- Add a leading protected southbound phase at the intersection of Johnson Parkway at Minnehaha Avenue during the PM peak hour. This phase will allow some southbound left turns to clear under a protected phase while the other southbound movements also have a green light. This also aids in clearance of the southbound left turns that may be extend beyond the available storage, blocking the other southbound movements.
- Add a leading protected southbound phase at the intersection of Johnson Parkway at 3rd Street during the PM peak hour. This phase aids in clearance of the southbound left turn that may extend beyond the available storage and block the other southbound movements.
- Add a leading protected eastbound phase at the intersection of Johnson Parkway at 3rd Street during the PM peak hour. This phase aids in clearance of the eastbound left turns that block other eastbound movements under existing conditions.
- Eliminate the existing leading protected eastbound phase at the intersection of Johnson Parkway at 7th Street unless there are unknown circumstances requiring its presence.

Table 5 shows the AM and PM peak hour traffic operations under the test-closure mitigated conditions.

Table 5 – Test Closure Mitigated Conditions Operations Results

Johnson Parkway at:	Approach	AM Peak Hour		PM Peak Hour	
		Approach (Delay / LOS)	Intersection (Delay / LOS)	Approach (Delay / LOS)	Intersection (Delay / LOS)
7 th Street	NB	12.7 / B	17.0 / B	12.7 / B	22.7 / C
	SB	18.5 / B		18.7 / B	
	EB	17.0 / B		32.6 / C	
	WB	19.5 / B		35.6 / D	
Minnehaha Avenue	NB	18.1 / B	18.9 / B	32.1 / C	24.2 / C
	SB	19.3 / B		12.9 / B	
	EB	13.3 / B		26.0 / C	
	WB	21.1 / C		26.6 / C	
6 th Street	NB	1.9 / A	3.2 / A	2.6 / A	4.1 / A
	SB	3.2 / A		3.7 / A	
	EB	7.6 / A		14.0 / B	
	WB	8.4 / A		12.0 / B	
3 rd Street	NB	12.0 / B	17.2 / B	22.5 / C	28.1 / C
	SB	19.0 / B		27.0 / C	
	EB	16.9 / B		22.0 / C	
	WB	17.7 / B		36.2 / D	
Wilson Avenue	NB	0.3 / A	2.6 / A	0.6 / A	3.0 / A
	SB	2.6 / A		2.7 / A	
	EB	5.7 / A		8.0 / A	
	WB	4.8 / A		6.7 / A	

COMPARISON OF EXISTING & TEST CLOSURE MITIGATED OPERATION

To reduce the impacts of the proposed access closures along Johnson Parkway, it is desirable that the operation of traffic with the closures (test-closure scenario) be similar or better than the existing operations without the need for roadway expansion or geometric changes.

Table 6 shows a comparison of the operational analysis results for the existing and test closure mitigated conditions. In the existing conditions, the eastbound left at 3rd Street operated at LOS F in the AM peak hour and PM peak hour, which is considered failing. However, in the test closure mitigated conditions all movements operated at LOS D or better and all intersections operated at LOS C or better. While some movements and approaches experienced some increase in delay, overall the intersections operate similarly or better than under the existing conditions.

Queuing Summary

In addition to average delay per vehicle and LOS, the operations modeling and simulation also recorded the length of vehicles queued during the analysis periods. The attached **Figures 8a through 12b** show the average and maximum through lane queues at each study intersection under both the existing and test closure mitigated (recommended) conditions. In general, queues at each intersection are similar or better than the existing queues. While some queues did get longer in the test closure mitigated conditions, the longer queues from some approaches did not have a detrimental effect on the operation of the approach nor the intersection.

Left turn lane queues were also analyzed at the three signalized intersections to determine the left turn lane lengths needed at each study intersection. In order to do this, each existing turn lane was given a storage length of approximately 400 feet to ensure that the through lane queue would not interfere with the left turning queue. The maximum queues were then used to determine the turn lane length needs. Turn lane lengths were also analyzed for Minnehaha Avenue because an ICE study will be completed for this intersection. It should be noted that while some of the turn lane lengths could be increased as described below, the existing turn lanes may have some vehicles spill out of the turn lanes but it does not have a detrimental effect on the operation of any of the study intersections.

1. Johnson Parkway at 7th Street

- Northbound: The existing turn lane with a length of approximately 60 feet could be increased to accommodate the maximum queue of 100 feet, however, the existing turn lane length does not cause any major traffic operations issues.
- Southbound: The southbound left turn lane length should be approximately 130 feet when the existing 3-lane section is converted to a 2-lane section to accommodate the maximum queue of 120 feet.
- Eastbound and Westbound: The current approach lane width should be maintained in order to allow through and right turning vehicles to sneak by left turning vehicles.

2. Johnson Parkway at Minnehaha Avenue

- Northbound: The existing turn lane with a length of approximately 75 feet could be increased to accommodate the maximum queue of approximately 90 feet, however, the existing turn lane length does not cause any major traffic operations issues.
- Southbound: The existing turn lane with a length of approximately 100 feet could be increased to accommodate the maximum queue of approximately 180 feet, however, the existing turn lane length does not cause any major traffic operations issues.
- Eastbound: A turn lane of approximately 80 feet would be adequate to accommodate the maximum queue of approximately 70 feet, however, a turn lane length of 50 feet (as was used for the observed unofficial turn lane) would not cause any major traffic operations issues.
- Westbound: A turn lane of approximately 120 feet would be adequate to accommodate the maximum queue of approximately 110 feet, however, a turn lane length of 50 feet (as was used for the observed unofficial turn lane) would not cause any major traffic operations issues.

3. Johnson Parkway at 3rd Street

- Northbound: The existing turn lane with a length of approximately 70 feet is adequate to store the maximum queue of approximately 50 feet.
- Southbound: The existing turn lane with a length of approximately 75 feet could be increased to accommodate the maximum queue of approximately 260 feet, however, the existing turn lane length does not cause any major traffic operations issues. It should be noted that the extension of this turn lane may be of particular importance due to the heavy demands for southbound left turning vehicles at this intersection (176 during the AM peak hour, 284 during the PM peak hour).
- Eastbound: A turn lane of approximately 130 feet would be adequate to accommodate the maximum queue of approximately 125 feet, however, a turn lane length of 50 feet (as was used for the observed unofficial turn lane) would not cause any major traffic operations issues.
- Westbound: A turn lane of approximately 70 feet would be adequate to accommodate the maximum queue of approximately 60 feet, however, a turn lane length of 50 feet (as was used for the observed unofficial turn lane) would not cause any major traffic operations issues.

Table 6 – Existing Conditions vs. Test Closure Mitigated Conditions

	Johnson Pkwy at:	Approach	Existing		Test Closure Mitigated		Difference	
			Approach (Delay / LOS)	Intersection (Delay / LOS)	Approach (Delay / LOS)	Intersection (Delay / LOS)	Approach (Delay)	Intersection (Delay)
AM Peak Hour	7 th Street	NB	18.5 / B	18.8 / B	12.7 / B	17.0 / B	-5.8	-1.8
		SB	22.4 / C		18.5 / B		-3.9	
		EB	10.1 / B		17.0 / B		6.9	
		WB	18.4 / B		19.5 / B		1.1	
	Minnehaha Avenue	NB	15.4 / B	15.9 / B	18.1 / B	18.9 / B	2.7	3.0
		SB	8.6 / A		19.3 / B		10.7	
		EB	13.8 / B		13.3 / B		-0.5	
		WB	22.3 / C		21.1 / C		-1.2	
	6 th Street	NB	1.7 / A	2.7 / A	1.9 / A	3.2 / A	0.2	0.5
		SB	2.4 / A		3.2 / A		0.8	
		EB	7.7 / A		7.6 / A		-0.1	
		WB	7.9 / A		8.4 / A		0.5	
	3 rd Street	NB	9.3 / A	26.8 / C	12.0 / B	17.2 / B	2.7	-9.6
		SB	13.3 / B		19.0 / B		5.7	
		EB	49.9 / D		16.9 / B		-33.0	
		WB	34.1 / C		17.7 / B		-16.4	
	Wilson Avenue	NB	0.3 / A	2.3 / A	0.3 / A	2.6 / A	0.0	0.3
		SB	2.1 / A		2.6 / A		0.5	
		EB	5.9 / A		5.7 / A		-0.2	
		WB	4.6 / A		4.8 / A		0.2	
PM Peak Hour	7 th Street	NB	13.0 / B	22.2 / C	12.7 / B	22.7 / C	-0.3	0.5
		SB	22.8 / C		18.7 / B		-4.1	
		EB	26.8 / C		32.6 / C		5.8	
		WB	31.0 / C		35.6 / D		4.6	
	Minnehaha Avenue	NB	19.0 / B	20.0 / C	32.1 / C	24.2 / C	13.1	4.2
		SB	23.2 / C		12.9 / B		-10.3	
		EB	18.8 / B		26.0 / C		7.2	
		WB	18.1 / B		26.6 / C		8.5	
	6 th Street	NB	2.4 / A	3.8 / A	2.6 / A	4.1 / A	0.2	0.3
		SB	3.7 / A		3.7 / A		0.0	
		EB	14.4 / B		14.0 / B		-0.4	
		WB	11.6 / B		12.0 / B		0.4	
	3 rd Street	NB	10.6 / B	21.4 / C	22.5 / C	28.1 / C	11.9	6.7
		SB	18.9 / B		27.0 / C		8.1	
		EB	34.1 / C		22.0 / C		-12.1	
		WB	21.1 / C		36.2 / D		15.1	
	Wilson Avenue	NB	0.4 / A	3.4 / A	0.6 / A	3.0 / A	0.2	-0.4
		SB	3.2 / A		2.7 / A		-0.5	
		EB	7.6 / A		8.0 / A		0.4	
		WB	6.9 / A		6.7 / A		-0.2	

Notes:

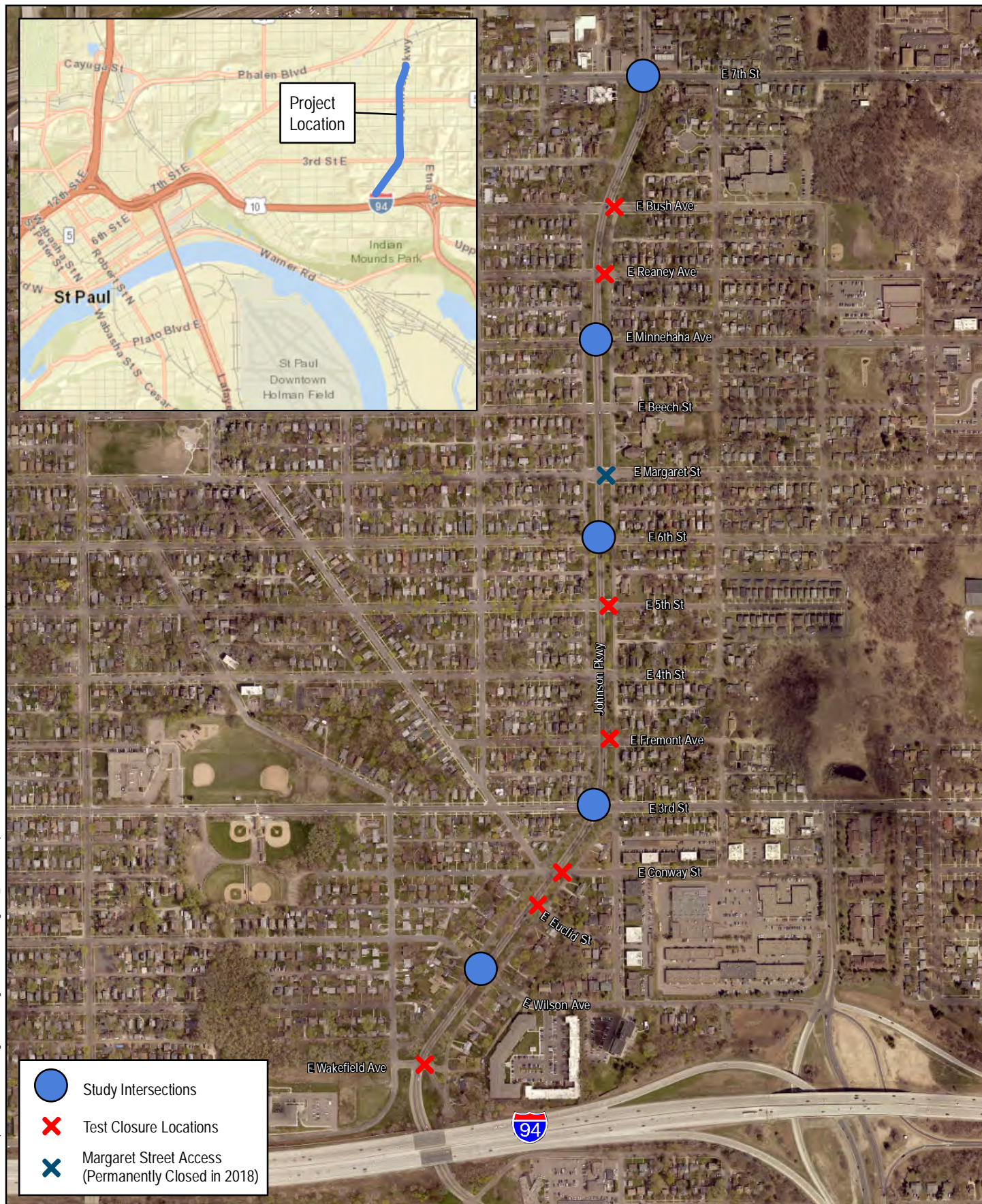
XX.X – Decrease in delay of 10 seconds or more

XX.X – Increase in delay of 10 seconds or more

Attachments:

Figure 1 – Project Location
Figure 2 – Intersection Control & Geometry
Figure 3 – Average Daily Traffic (ADT) Counts
Figure 4 – AM Peak Hour Traffic Volumes (Existing vs. Test Closure)
Figure 5 – PM Peak Hour Traffic Volumes (Existing vs. Test Closure)
Figure 6 – Pre-Test Closure Access Volumes
Figure 7 – Intersection Approach Volumes (Existing vs. Test Closure)
Tables A1 to A3 – Operational Analysis Results
Figures 8a & 8b – Queue Lengths - 7th St
Figures 9a & 9b – Queue Lengths - Minnehaha Ave
Figures 10a & 10b – Queue Lengths - 6th St
Figures 11a & 11b – Queue Lengths - 3rd St
Figures 12a & 12b – Queue Lengths - Wilson Ave

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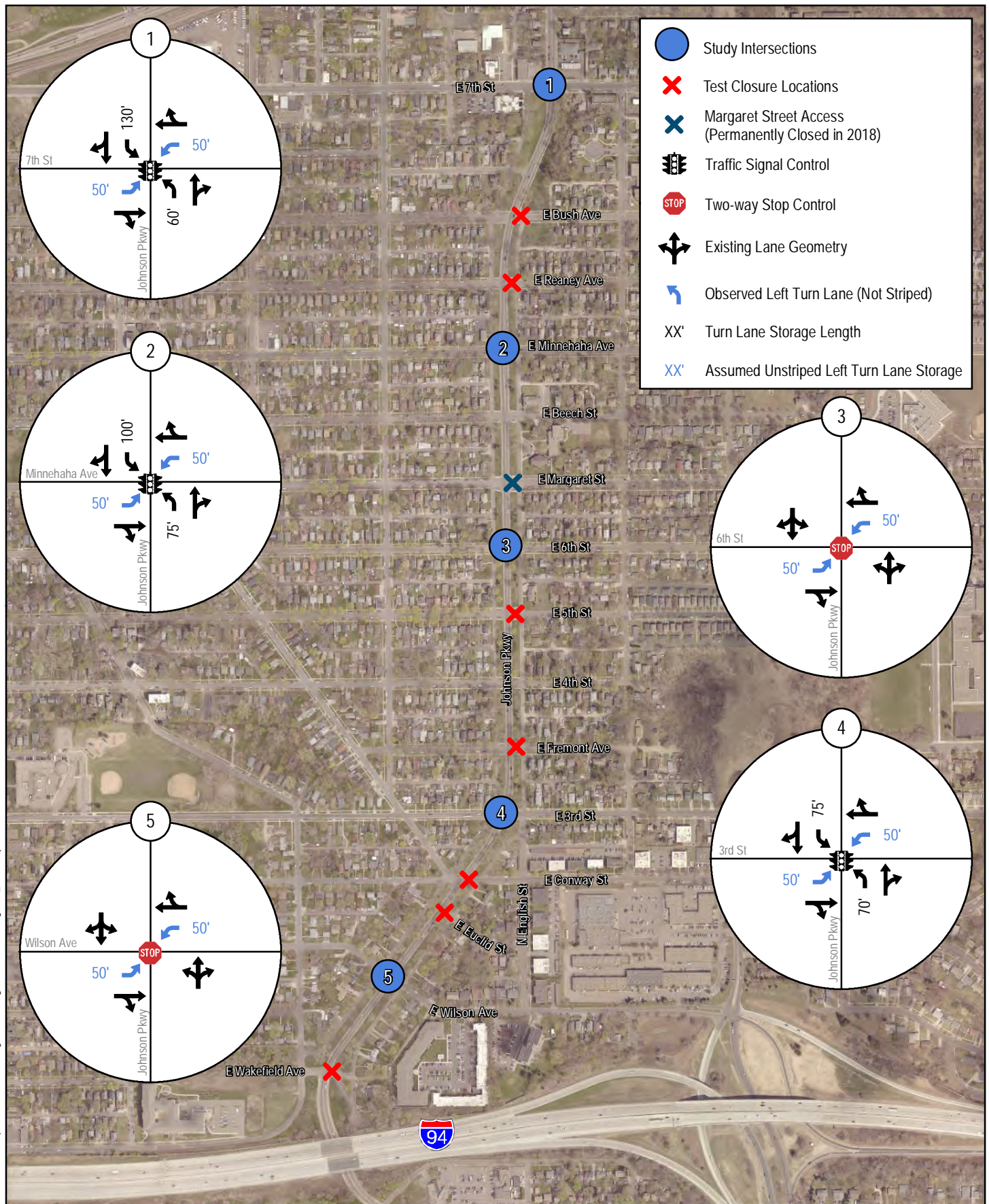
Project: STPAU 148568
Print Date: 1/17/2019

Map by: jdanibas
Projection: Ramsey Co. Coords.
Source: ESRI Online

PROJECT LOCATION
JOHNSON PARKWAY TRAIL PROJECT
St. Paul, Minnesota

Figure
1

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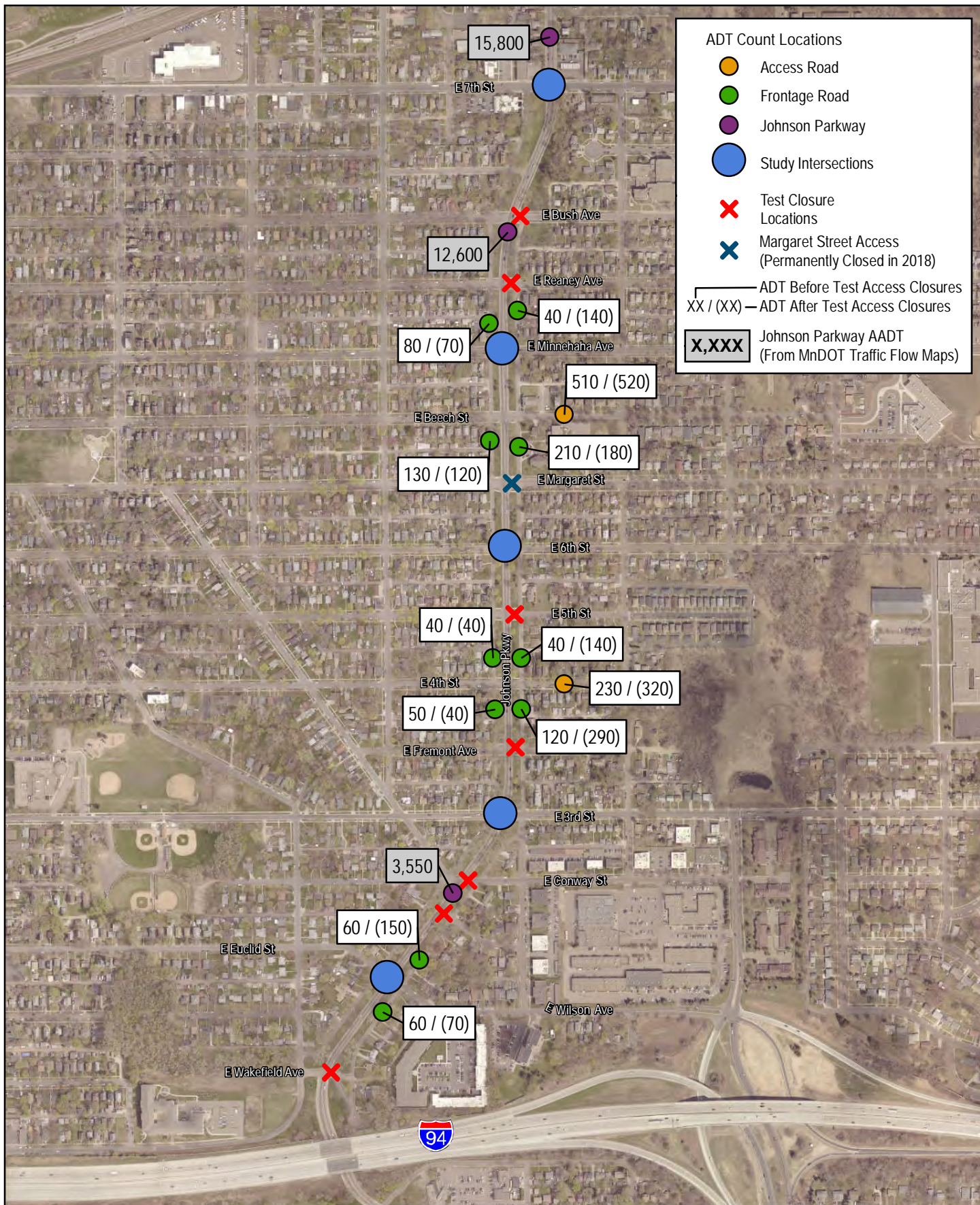
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INTERSECTION CONTROL & GEOMETRY JOHNSON PARKWAY TRAIL PROJECT St. Paul, Minnesota

Figure
2

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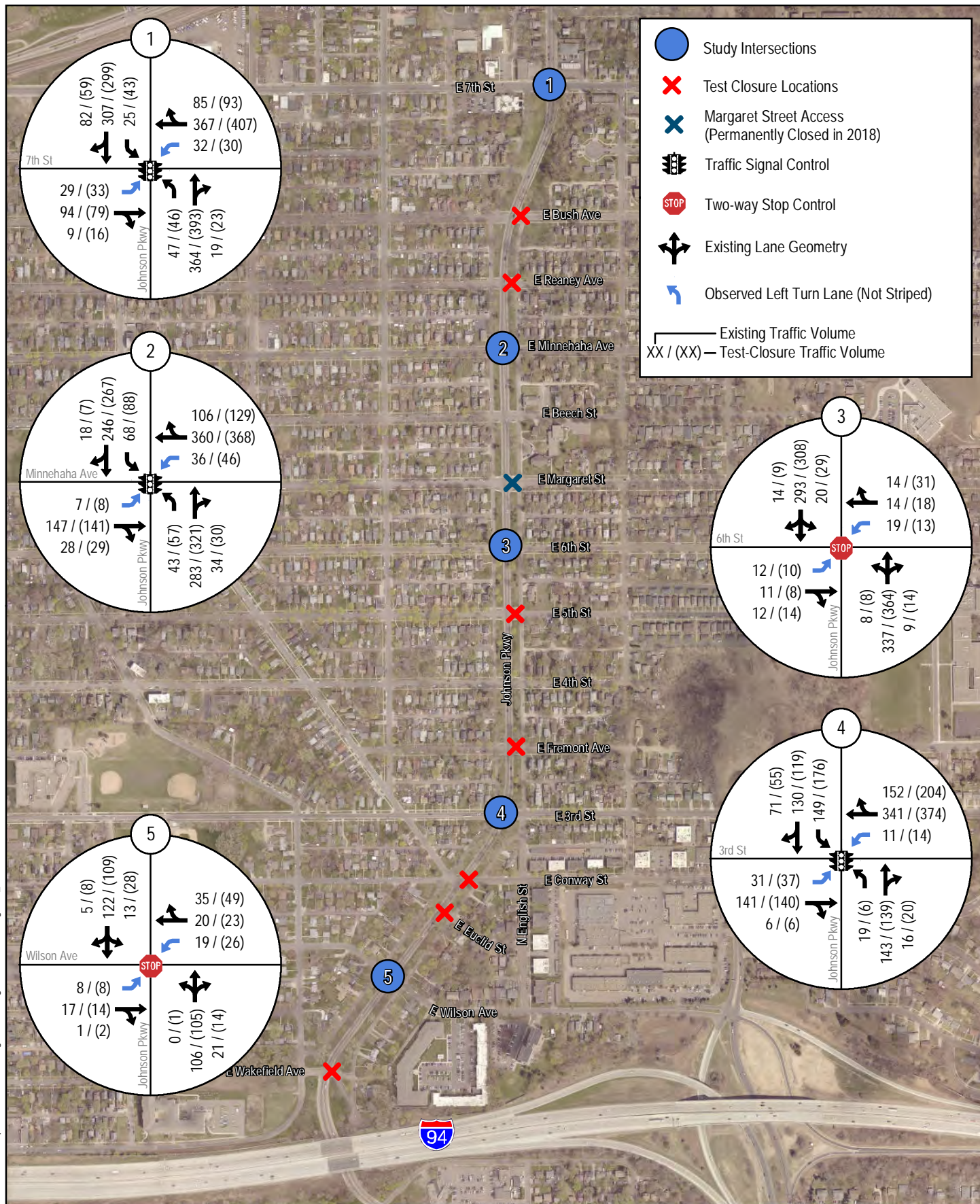
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Print Date: 1/17/2019

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Projection: Ramsey Co. Coords.
Source: ESRI Online

AVERAGE DAILY TRAFFIC (ADT) COUNTS JOHNSON PARKWAY TRAIL PROJECT St. Paul, Minnesota

Figure
3

This map is neither a legally recorded map nor a survey map and is not intended to be used as one. This map is a compilation of records, information, and data gathered from various sources listed on this map and is to be used for reference purposes only. SEH does not warrant that the Geographic Information System (GIS) Data used to prepare this map are error free, and SEH does not represent that the GIS Data can be used for navigational, tracking, or any other purpose requiring exacting measurement of distance or direction or precision in the depiction of geographic features. The user of this map acknowledges that SEH shall not be liable for any damages which arise out of the user's access or use of data provided.

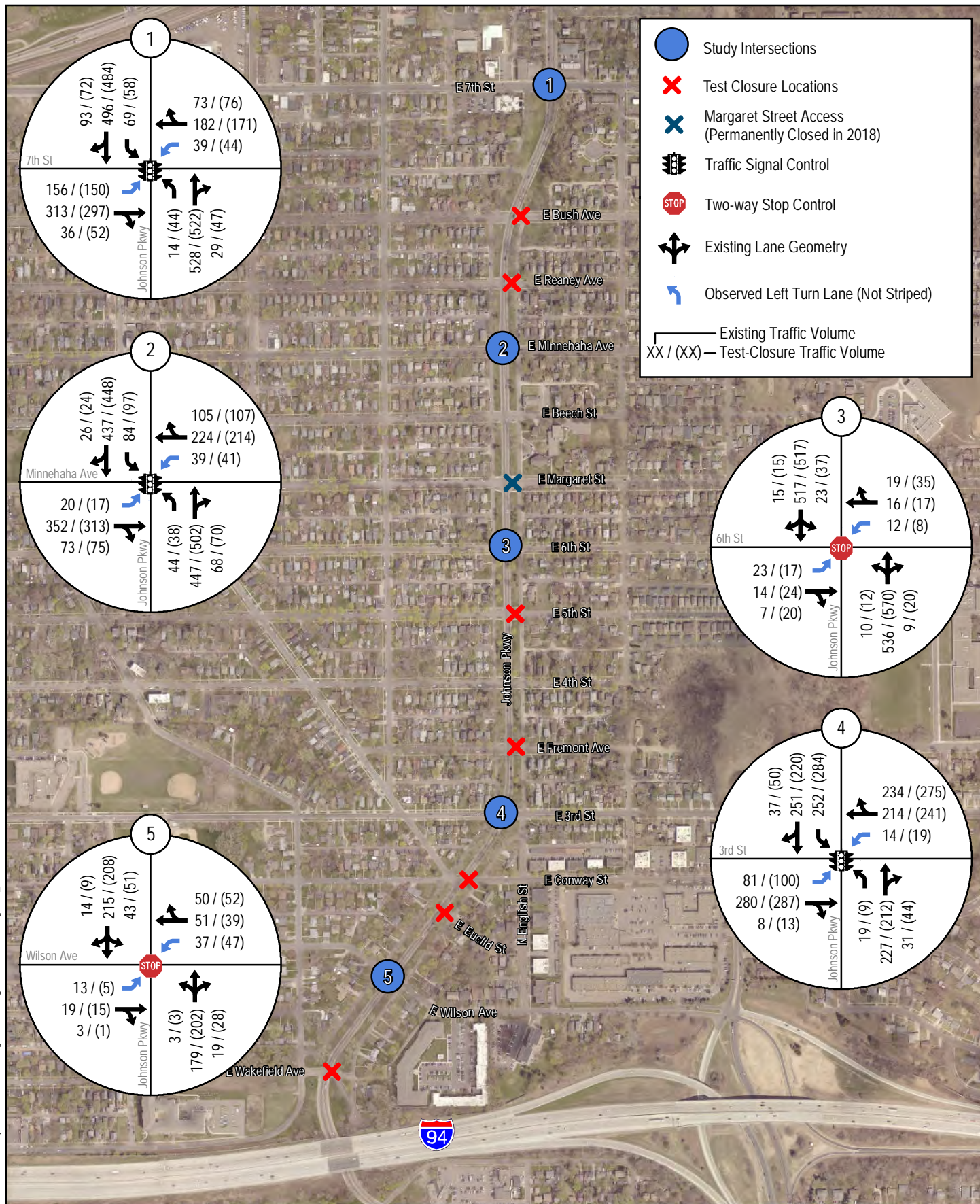


Project: STPAU 148568
Print Date: 1/17/2019

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Projection: Ramsey Co. Coords.
Source: ESRI Online

AM PEAK HOUR TRAFFIC VOLUMES JOHNSON PARKWAY TRAIL PROJECT St. Paul, Minnesota

Figure
4

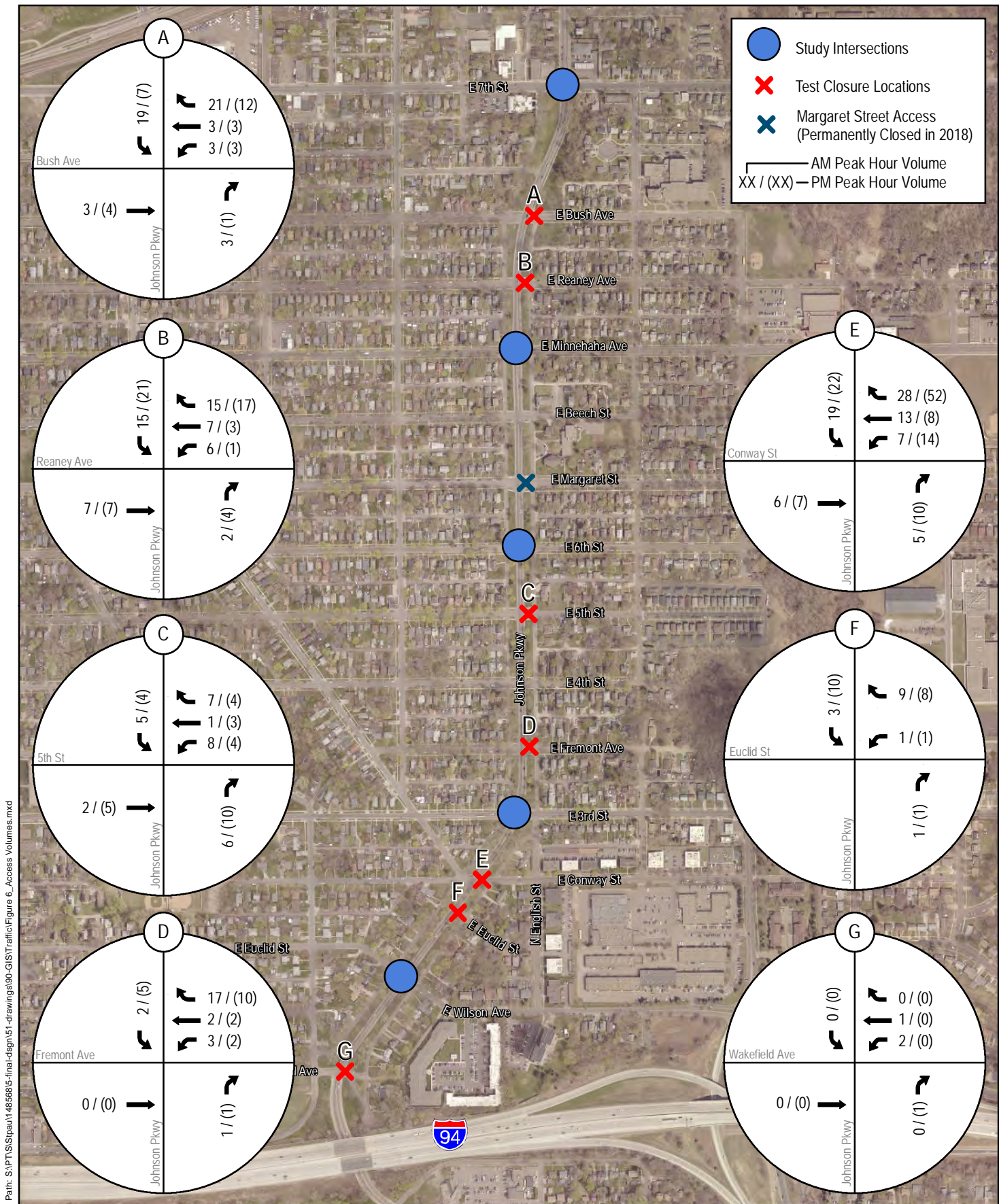


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Print Date: 1/17/2019

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Source: ESRI Online

PM PEAK HOUR TRAFFIC VOLUMES JOHNSON PARKWAY TRAIL PROJECT St. Paul, Minnesota

Figure
5



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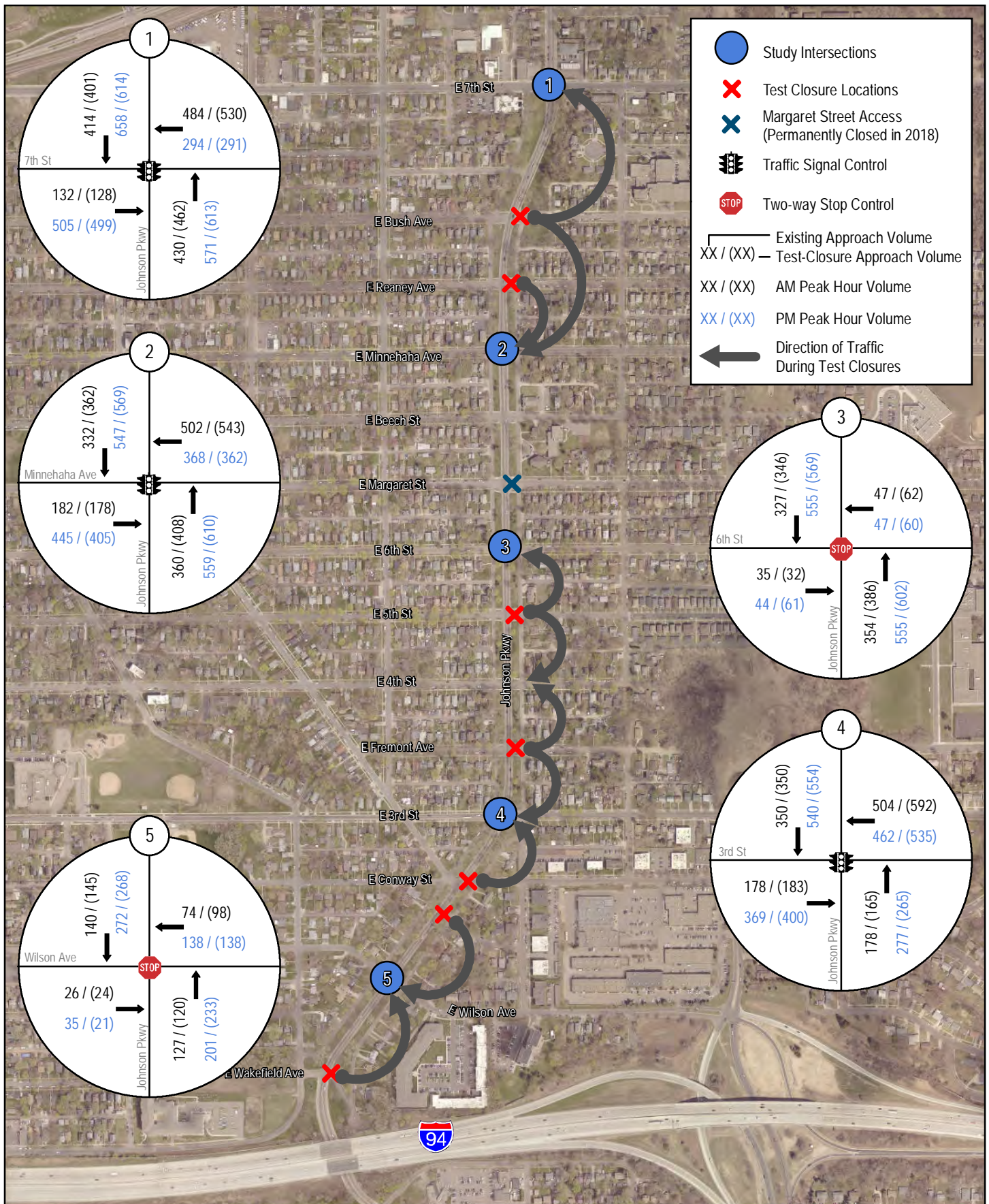
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Source: ESRI Online

PRE-TEST CLOSURE ACCESS VOLUMES JOHNSON PARKWAY TRAIL PROJECT St. Paul, Minnesota

Figure
6

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Project: STPAU 148568
Print Date: 1/17/2019

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Projection: Ramsey Co. Coords.
Source: ESRI Online

INTERSECTION APPROACH VOLUMES JOHNSON PARKWAY TRAIL PROJECT St. Paul, Minnesota

Figure
7

Table A1
Johnson Parkway Trail Project
Existing Conditions (2018)
AM & PM Peak Hours

AM & PM Peak Hours															Vehicle Queuing Information (feet)																
Intersection		Approach	Demand Volumes				Delay (s/veh)						LOS By Approach		LOS By Intersection		Left Turn Lane				Through Lane (s)						Right Turn Lane				
			L	T	R	Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Storage (feet) ³	Avg. Queue (feet) ¹	Max Queue (feet) ¹	% Block Thru ⁽²⁾ <--->	% Block Left ⁽²⁾ <---	Link Length (feet)	Avg. Queue (feet) ¹	Max Queue (feet) ¹	% Block Right ⁽²⁾ <---	% Block Thru ⁽²⁾ <---	Storage (feet) ³	Avg. Queue (feet) ¹	Max Queue (feet) ¹		
AM Peak Hour	Johnson Pkwy at 7th St (Signal)	NB	47	364	19	430	39.7	D	16.3	B	9.8	A	18.5	B	18.8	B	60	42	119		19 %	1292	120	261							
		SB	25	307	82	414	38.5	D	22.8	C	16.9	B	22.4	C			130	23	155		12 %	740	156	318							
		EB	29	94	9	132	15.1	B	9.2	A	5.0	A	10.1	B			50	19	69		6 %	1530	37	120							
		WB	32	367	85	484	19.4	B	19.0	B	15.3	B	18.4	B			50	16	72		35 %	1502	164	339							
	Johnson Pkwy at Minnehaha Ave (Signal)	NB	43	283	34	360	21.1	C	15.2	B	10.6	B	15.4	B	15.9	B	75	33	134		18 %	911	109	230							
		SB	68	246	18	332	14.2	B	7.4	A	6.2	A	8.6	A			100	33	95			1292	36	105							
		EB	7	147	28	182	43.9	D	13.7	B	8.1	A	13.8	B			50	7	61		15 %	1287	63	144							
		WB	36	360	106	502	28.1	C	22.9	C	18.6	B	22.3	C			50	22	74		39 %	1704	186	363							
	Johnson Pkwy at 6th St	NB	8	337	9	354	4.1	A	1.7	A	1.6	A	1.7	A	2.7	A						1243	3	48							
		SB	20	293	14	327	4.8	A	2.3	A	1.9	A	2.4	A								911	12	81							
		EB	12	11	12	35	9.0	A	10.0	B	4.3	A	7.7	A			50	10	34			1129	18	53							
		WB	19	14	14	47	10.3	B	9.3	A	4.5	A	7.9	A			50	16	61		1 %	1650	22	77							
	Johnson Pkwy at 3rd St (Signal)	NB	19	143	16	178	15.2	B	9.3	A	3.6	A	9.3	A	26.8	C	70	6	46		1 %	904	27	93							
		SB	149	130	71	350	16.8	B	11.7	B	9.1	A	13.3	B			75	61	111		4 %	1243	65	225							
		EB	31	141	6	178	124.7	F	34.6	C	39.4	D	49.9	D			50	28	72		15 %	1052	92	270							
		WB	11	341	152	504	41.7	D	36.4	D	28.1	C	34.1	C			50	11	65		46 %	1618	226	503							
Johnson Pkwy at Wilson Ave	NB		106	21	127			0.3	A	0.2	A	0.3	A	2.3	A																
	SB	13	122	5	140	4.0	A	1.9	A	1.6	A	2.1	A								904	2	29								
	EB	8	17	1	26	5.5	A	6.5	A	2.4	A	5.9	A			50	6	33			238	15	57								
	WB	19	20	35	74	5.5	A	6.6	A	3.0	A	4.6	A			50	14	37		1 %	266	30	73								
PM Peak Hour	Johnson Pkwy at 7th St (Signal)	NB	14	528	29	571	47.0	D	12.2	B	10.1	B	13.0	B	22.2	C	60	16	100		18 %	1292	99	253							
		SB	69	496	93	658	38.9	D	21.5	C	17.6	B	22.8	C			130	68	210		21 %	740	213	449							
		EB	156	313	36	505	30.5	C	25.6	C	21.9	C	26.8	C			50	61	75		36 %	1530	189	411							
		WB	39	182	73	294	35.9	D	32.9	C	23.8	C	31.0	C			50	30	74		46 %	1502	142	279							
	Johnson Pkwy at Minnehaha Ave (Signal)	NB	44	447	68	559	34.0	C	18.2	B	15.9	B	19.0	B	20.0	C	75	41	134		31 %	911	180	346							
		SB	84	437	26	547	46.7	D	19.1	B	18.4	B	23.2	C			100	67	124		10 %	1292	161	396							
		EB	20	352	73	445	27.1	C	19.0	B	15.3	B	18.8	B			50	16	72		36 %	1287	151	276							
		WB	39	224	105	368	32.5	C	17.6	B	13.4	B	18.1	B			50	32	74		29 %	1704	119	242							
	Johnson Pkwy at 6th St	NB	10	536	9	555	6.9	A	2.3	A	1.9	A	2.4	A	3.8	A						1243	8	101							
		SB	23	517	15	555	7.5	A	3.6	A	3.1	A	3.7	A								911	23	156							
		EB	23	14	7	44	17.8	C	13.1	B	6.3	A	14.4	B			50	17	58			1129	17	55							
		WB	12	16	19	47	16.4	C	14.0	B	6.1	A	11.6	B			50	11	40		1 %	1650	25	62							
	Johnson Pkwy at 3rd St (Signal)	NB	19	227	31	277	16.3	B	10.6	B	7.4	A	10.6	B	21.4	C	70	7	43		4 %	904	55	132							
		SB	252	251	37	540	24.4	C	14.9	B	11.6	B	18.9	B			75	88	112		9 %	1243	126	320							
		EB	81	280	8	369	61.5	E	26.9	C	30.7	C	34.1	C			50	47	75		30 %	1052	151	448							
		WB	14	214	234	462	30.9	C	24.5	C	17.5	B	21.1	C			50	11	65		40 %	1618	165	338							
Johnson Pkwy at Wilson Ave	NB	3	179	19	201	2.9	A	0.4	A	0.2	A	0.4	A	3.4	A						530	1	21								
	SB	43	215	14	272	5.0	A	2.9	A	2.4	A	3.2	A								904	13	84								
	EB	13	19	3	35	8.1	A	8.2	A	3.5	A	7.6	A			50	11	43			238	19	52								
	WB	37	51	50	138	7.6	A	8.8	A	4.3	A	6.9	A			50	24	64		3 %	266	43	86								

NOTES 1. If the reported queue is greater than zero (0), but less than ft, a minimum of ft is reported.
2. Block Percentage is proportion of analysis time (1 hour) the storage lane or through lane is blocked or blocking.
3. Multiple storage lanes of different length are averaged together to show the "Effective Storage Length" per lane.

Table A2
Project Description
Test-Closure Conditions (2018) - Signal Timing Improvements
AM & PM Peak Hours

AM & PM Peak Hours															Vehicle Queuing Information (feet)																
Intersection		Approach	Demand Volumes				Delay (s/veh)						LOS By Approach		LOS By Intersection		Left Turn Lane				Through Lane (s)						Right Turn Lane				
			L	T	R	Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Storage (feet) ³	Avg. Queue (feet) ¹	Max Queue (feet) ¹	% Block Thru ⁽²⁾ <---->	% Block Left ⁽²⁾ <----	Link Length (feet)	Avg. Queue (feet) ¹	Max Queue (feet) ¹	% Block Right ⁽²⁾ <---->	% Block Thru ⁽²⁾ <----	Storage (feet) ³	Avg. Queue (feet) ¹	Max Queue (feet) ¹		
AM Peak Hour	Johnson Pkwy at 7th St (Signal)	NB	46	393	23	462	41.7	D	21.2	C	16.1	B	22.9	C	21.1	C	60	42	119		25 %	1292	139	341							
		SB	43	299	59	401	53.0	D	25.6	C	18.8	B	27.5	C			130	44	184		14 %	740	157	338							
		EB	33	79	16	128	13.8	B	8.7	A	4.4	A	9.4	A			50	21	69		3 %	1530	29	112							
		WB	30	407	93	530	18.7	B	17.9	B	16.0	B	17.6	B			50	18	74		33 %	1502	172	348							
	Johnson Pkwy at Minnehaha Ave (Signal)	NB	57	321	30	408	25.2	C	17.2	B	12.5	B	18.1	B	18.0	B	75	46	133		21 %	911	123	246							
		SB	88	267	7	362	27.7	C	11.1	B	8.3	A	15.0	B			100	48	120		1 %	1292	61	283							
		EB	8	141	29	178	53.8	D	13.3	B	8.4	A	14.1	B			50	10	60		13 %	1287	64	158							
		WB	46	368	129	543	24.4	C	22.0	C	18.0	B	21.2	C			50	31	74		37 %	1704	190	430							
	Johnson Pkwy at 6th St	NB	8	364	14	386	4.9	A	1.8	A	1.6	A	1.8	A	2.9	A							1243	3	48						
		SB	29	308	9	346	5.3	A	2.4	A	1.7	A	2.6	A									911	13	90						
		EB	10	8	14	32	11.4	B	10.7	B	4.0	A	7.8	A			50	7	35		1 %	1129	17	64							
		WB	13	18	31	62	12.6	B	11.2	B	5.3	A	8.4	A			50	12	59		2 %	1650	32	84							
	Johnson Pkwy at 3rd St (Signal)	NB	6	139	20	165	17.2	B	12.8	B	5.5	A	12.1	B	17.0	B	70	2	24		2 %	904	34	114							
		SB	176	119	55	350	22.3	C	15.0	B	10.9	B	18.0	B			75	73	111		5 %	1243	74	219							
		EB	37	140	6	183	41.2	D	10.8	B	5.8	A	16.7	B			50	23	69		9 %	1052	50	130							
		WB	14	374	204	592	17.7	B	19.5	B	14.5	B	17.8	B			50	8	74		36 %	1618	182	353							
Johnson Pkwy at Wilson Ave	NB	1	105	14	120	3.3	A	0.3	A	0.1	A	0.3	A	2.6	A							530		6							
	SB	28	109	8	145	4.0	A	2.2	A	2.1	A	2.5	A									904	5	67							
	EB	8	14	2	24	5.4	A	6.6	A	2.4	A	5.7	A			50	6	30			238	15	54								
	WB	26	23	49	98	6.3	A	6.8	A	3.2	A	4.9	A			50	19	61		1 %	266	35	75								
PM Peak Hour	Johnson Pkwy at 7th St (Signal)	NB	44	522	47	613	36.2	D	14.9	B	12.0	B	16.2	B	22.8	C	60	35	111		17 %	1292	140	365							
		SB	58	484	72	614	50.2	D	20.2	C	16.7	B	22.7	C			130	64	198		18 %	740	198	420							
		EB	150	297	52	499	29.5	C	25.5	C	20.4	C	26.1	C			50	60	75		38 %	1530	189	374							
		WB	44	171	76	291	40.2	D	32.5	C	24.2	C	31.5	C			50	36	75		43 %	1502	136	261							
	Johnson Pkwy at Minnehaha Ave (Signal)	NB	38	502	70	610	33.8	C	20.4	C	17.6	B	20.9	C	28.1	C	75	39	134		35 %	911	201	400							
		SB	97	448	24	569	89.4	F	39.5	D	36.3	D	48.1	D			100	78	124		13 %	1292	258	850							
		EB	17	313	75	405	25.3	C	18.7	B	13.2	B	18.0	B			50	16	74		34 %	1287	140	270							
		WB	41	214	107	362	34.9	C	18.7	B	14.8	B	19.4	B			50	34	75		30 %	1704	123	256							
	Johnson Pkwy at 6th St	NB	12	570	20	602	6.3	A	2.6	A	2.2	A	2.7	A	4.2	A							1243	9	102						
		SB	37	517	15	569	7.2	A	3.7	A	2.7	A	3.9	A									911	30	166						
		EB	17	24	20	61	15.6	C	16.7	C	6.9	A	13.4	B			50	14	44		2 %	1129	27	69							
		WB	8	17	35	60	18.4	C	15.9	C	7.5	A	11.2	B			50	7	38		3 %	1650	33	86							
	Johnson Pkwy at 3rd St (Signal)	NB	9	212	44	265	18.5	B	13.4	B	8.4	A	12.8	B	33.5	C	70	5	48		6 %	904	59	162							
		SB	284	220	50	554	44.0	D	31.5	C	25.7	C	37.3	D			75	99	112		13 %	1243	212	608							
		EB	100	287	13	400	96.1	F	51.4	D	32.8	C	62.1	E			50	55	75		26 %	1052	226	688							
		WB	19	241	275	535	26.9	C	23.2	C	16.2	B	19.7	B			50	16	70		38 %	1618	177	377							
Johnson Pkwy at Wilson Ave	NB	3	202	28	233	2.6	A	0.5	A	0.3	A	0.5	A	3.2	A							530	1	23							
	SB	51	208	9	268	4.7	A	2.9	A	2.1	A	3.2	A									904	15	80							
	EB	5	15	1	21	7.0	A	8.2	A	3.7	A	7.8	A			50	4	30		1 %	238	17	62								
	WB	47	39	52	138	8.1	A	9.1	A	3.9	A	6.8	A			50	28	66		2 %	266	41	89								

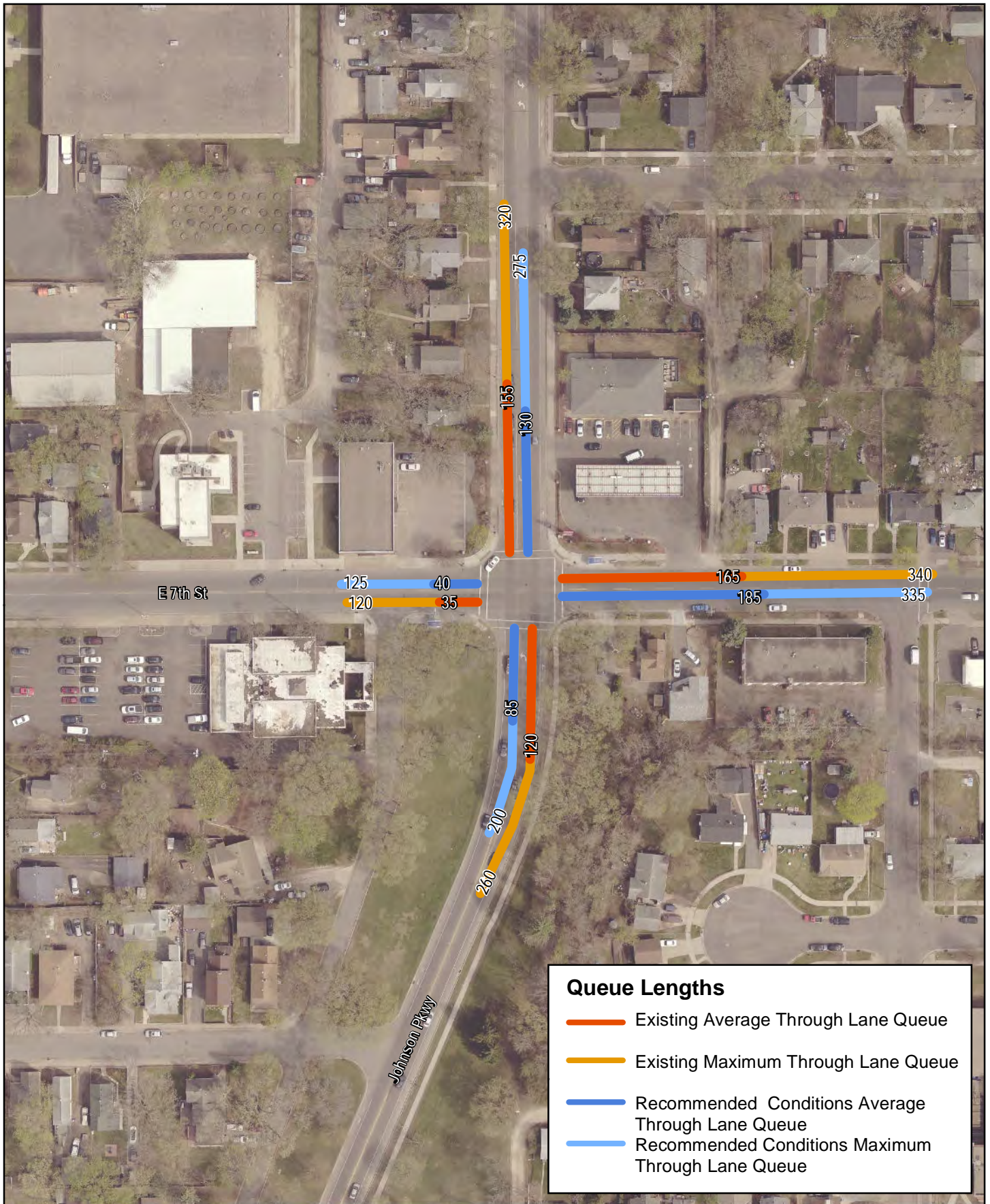
NOTES 1. If the reported queue is greater than zero (0), but less than ft, a minimum of ft is reported.
2. Block Percentage is proportion of analysis time (1 hour) the storage lane or through lane is blocked or blocking.
3. Multiple storage lanes of different length are averaged together to show the "Effective Storage Length" per lane.



Table A3
Project Description
Test-Closure Mitigated Conditions (2018) - Signal Timing Improvements and Added Protected Left Turn Phases
AM & PM Peak Hours

AM & PM Peak Hours															Vehicle Queuing Information (feet)																
Intersection		Approach	Demand Volumes				Delay (s/veh)						LOS By Approach		LOS By Intersection		Left Turn Lane				Through Lane (s)					Right Turn Lane					
			L	T	R	Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Storage (feet) ³	Avg. Queue (feet) ¹	Max Queue (feet) ¹	% Block Thru ⁽²⁾ <---->	% Block Left ⁽²⁾ <----	Link Length (feet)	Avg. Queue (feet) ¹	Max Queue (feet) ¹	% Block Right ⁽²⁾ <---->	% Block Thru ⁽²⁾ <----	Storage (feet) ³	Avg. Queue (feet) ¹	Max Queue (feet) ¹		
AM Peak Hour	Johnson Pkwy at 7th St (Signal)	NB	46	393	23	462	22.7	C	11.9	B	8.0	A	12.7	B	17.0	B	60	30	106		13 %	1292	83	199							
		SB	43	299	59	401	31.9	C	17.7	B	12.9	B	18.5	B			130	36	151		8 %	740	132	275							
		EB	33	79	16	128	34.1	C	12.1	B	6.9	A	17.0	B			50	25	72		5 %	1530	38	127							
		WB	30	407	93	530	20.8	C	20.1	C	16.5	B	19.5	B			50	18	74		37 %	1502	184	334							
	Johnson Pkwy at Minnehaha Ave (Signal)	NB	57	321	30	408	26.2	C	17.1	B	12.3	B	18.1	B	18.9	B	75	49	134		21 %	911	120	237							
		SB	88	267	7	362	33.5	C	14.9	B	11.1	B	19.3	B			100	56	124		3 %	1292	102	280							
		EB	8	141	29	178	50.7	D	12.7	B	7.5	A	13.3	B			50	9	60		13 %	1287	63	150							
		WB	46	368	129	543	25.1	C	22.0	C	17.4	B	21.1	C			50	29	74		36 %	1704	185	416							
	Johnson Pkwy at 6th St	NB	8	364	14	386	5.0	A	1.8	A	1.6	A	1.9	A	3.2	A						1243	3	53							
		SB	29	308	9	346	5.9	A	3.0	A	1.9	A	3.2	A								911	14	104							
		EB	10	8	14	32	10.1	B	10.9	B	4.3	A	7.6	A			50	7	37		1 %	1129	17	62							
		WB	13	18	31	62	12.1	B	11.5	B	5.3	A	8.4	A			50	11	60		2 %	1650	32	85							
	Johnson Pkwy at 3rd St (Signal)	NB	6	139	20	165	16.7	B	12.7	B	6.1	A	12.0	B	17.2	B	70	3	27		2 %	904	34	112							
		SB	176	119	55	350	23.1	C	16.2	B	12.0	B	19.0	B			75	72	112		6 %	1243	79	223							
		EB	37	140	6	183	41.4	D	11.0	B	6.4	A	16.9	B			50	23	72		9 %	1052	51	127							
		WB	14	374	204	592	17.9	B	19.2	B	14.6	B	17.7	B			50	8	74		36 %	1618	183	348							
Johnson Pkwy at Wilson Ave	NB	1	105	14	120	3.6	A	0.3	A	0.1	A	0.3	A	2.6	A						530		9								
	SB	28	109	8	145	4.1	A	2.3	A	1.9	A	2.6	A								904	4	44								
	EB	8	14	2	24	5.6	A	6.5	A	2.3	A	5.7	A			50	6	30			238	15	54								
	WB	26	23	49	98	6.2	A	6.8	A	3.2	A	4.8	A			50	19	62		1 %	266	35	75								
PM Peak Hour	Johnson Pkwy at 7th St (Signal)	NB	44	522	47	613	27.5	C	11.8	B	9.5	A	12.7	B	22.7	C	60	31	109		13 %	1292	98	284							
		SB	58	484	72	614	39.7	D	16.9	B	13.3	B	18.7	B			130	54	196		14 %	740	184	355							
		EB	150	297	52	499	38.3	D	30.8	C	26.7	C	32.6	C			50	62	75		42 %	1530	220	422							
		WB	44	171	76	291	43.2	D	36.9	D	28.0	C	35.6	D			50	37	75		47 %	1502	150	274							
	Johnson Pkwy at Minnehaha Ave (Signal)	NB	38	502	70	610	38.6	D	32.3	C	27.4	C	32.1	C	24.2	C	75	41	134		45 %	911	275	514							
		SB	97	448	24	569	26.5	C	10.1	B	7.7	A	12.9	B			100	57	121		3 %	1292	87	219							
		EB	17	313	75	405	41.6	D	26.3	C	20.9	C	26.0	C			50	18	69		45 %	1287	171	316							
		WB	41	214	107	362	51.0	D	25.7	C	19.1	B	26.6	C			50	39	75		38 %	1704	151	283							
	Johnson Pkwy at 6th St	NB	12	570	20	602	6.2	A	2.5	A	1.9	A	2.6	A	4.1	A						1243	10	92							
		SB	37	517	15	569	6.8	A	3.5	A	3.0	A	3.7	A								911	28	148							
		EB	17	24	20	61	17.6	C	15.9	C	7.9	A	14.0	B			50	14	46		2 %	1129	28	76							
		WB	8	17	35	60	20.7	C	16.5	C	8.1	A	12.0	B			50	7	37		3 %	1650	33	86							
	Johnson Pkwy at 3rd St (Signal)	NB	9	212	44	265	24.4	C	23.9	C	15.1	B	22.5	C	28.1	C	70	6	59		15 %	904	88	199							
		SB	284	220	50	554	32.8	C	22.2	C	16.3	B	27.0	C			75	89	112		10 %	1243	135	489							
		EB	100	287	13	400	32.9	C	18.6	B	11.6	B	22.0	C			50	47	75		29 %	1052	125	286							
		WB	19	241	275	535	42.1	D	41.4	D	31.3	C	36.2	D			50	15	74		52 %	1618	264	521							
Johnson Pkwy at Wilson Ave	NB	3	202	28	233	3.2	A	0.6	A	0.3	A	0.6	A	3.0	A						530	1	33								
	SB	51	208	9	268	4.3	A	2.4	A	1.6	A	2.7	A								904	12	81								
	EB	5	15	1	21	8.1	A	8.2	A	4.8	A	8.0	A			50	4	32			238	16	61								
	WB	47	39	52	138	8.1	A	8.9	A	4.0	A	6.7	A			50	28	65		2 %	266	40	82								

NOTES 1. If the reported queue is greater than zero (0), but less than ft, a minimum of ft is reported.
2. Block Percentage is proportion of analysis time (1 hour) the storage lane or through lane is blocked or blocking.
3. Multiple storage lanes of different length are averaged together to show the "Effective Storage Length" per lane.

Path: C:\Traffic Projects\Johnson Pkwy\GIS\Figure 8a to 12a_AM Queues.mxd



		Project: STPAU 148568 Print Date: 2/5/2019	<i>AM QUEUE LENGTHS - 7TH ST</i> JOHNSON PARKWAY TRAIL PROJECT St. Paul, Minnesota	Figure 8a
		Map by: jdanibas Projection: Ramsey Co. Coords. Source: ESRI Online		

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Path: C:\Traffic Projects\Johnson Pkwy\GIS\Figure 8b to 12b_PM Queues.mxd



Project: STPAU 148568
Print Date: 2/5/2019

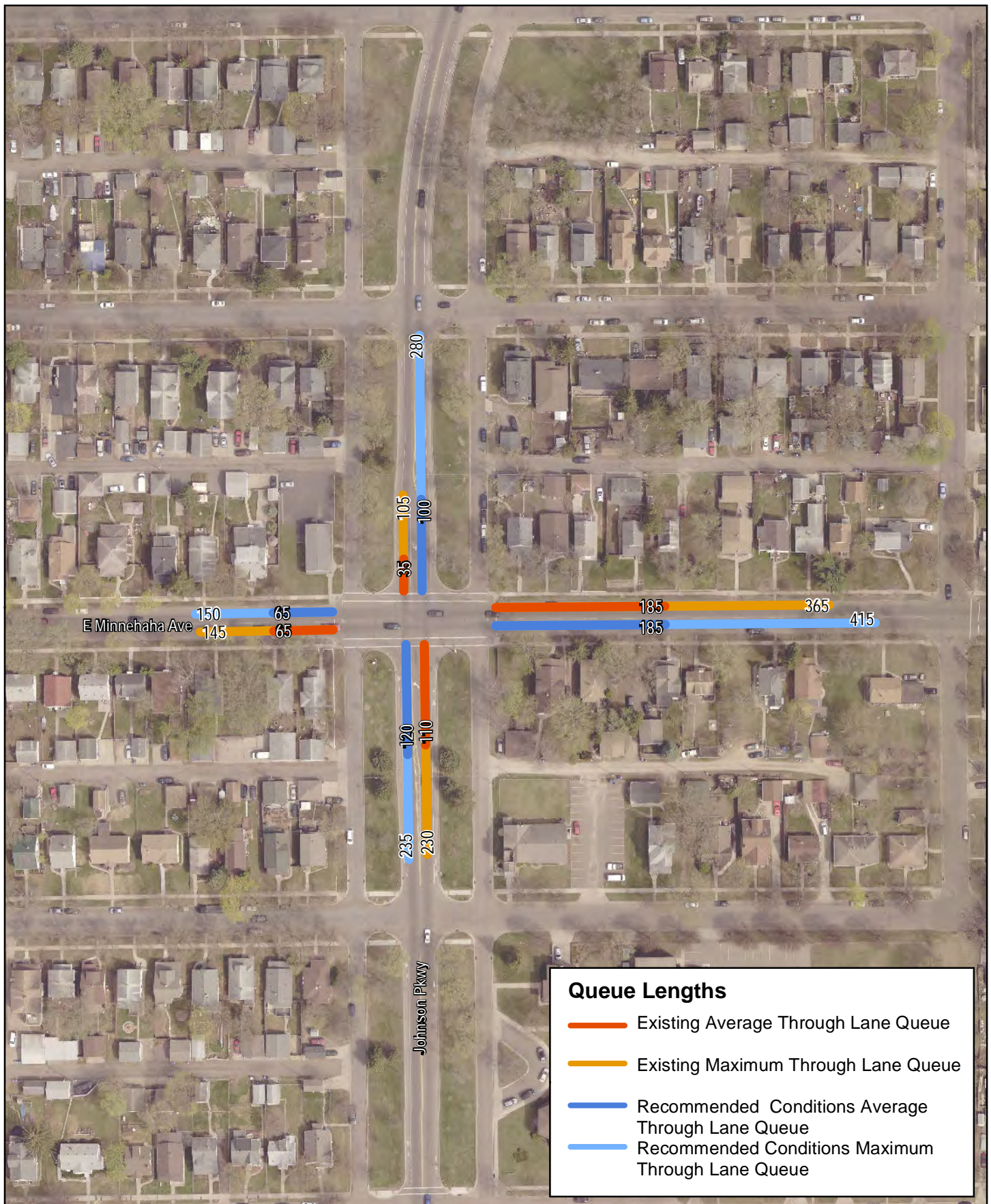
Map by: jdanibas
Projection: Ramsey Co. Coords.
Source: ESRI Online

PM QUEUE LENGTHS - 7TH ST
JOHNSON PARKWAY TRAIL PROJECT
St. Paul, Minnesota

Figure 8b

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Path: C:\Traffic Projects\Johnson Pkwy\GIS\Figure 8b to 12b_PN Queues.mxd



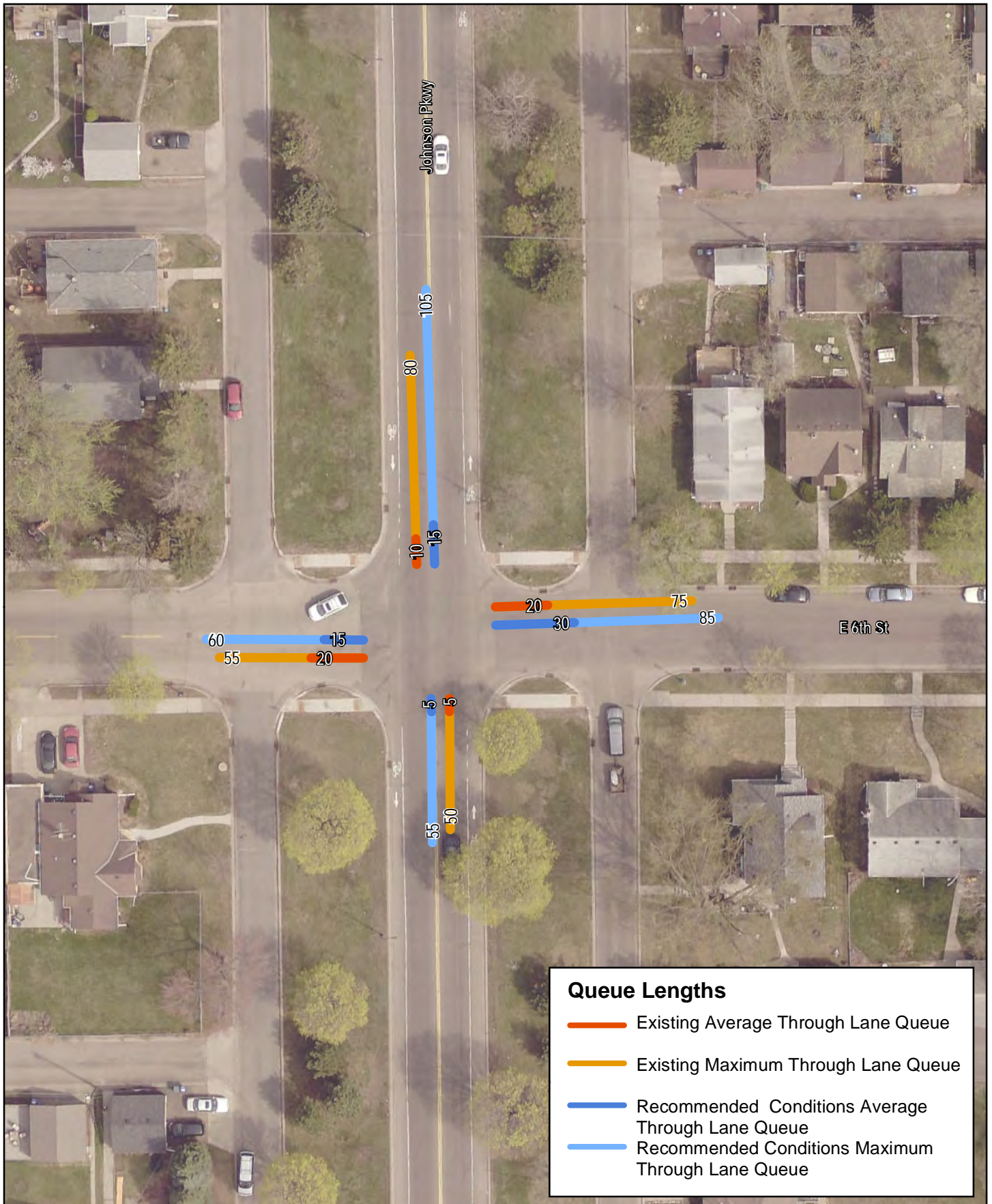
Project: STPAU 148568
Print Date: 2/5/2019



Map by: jdanibas
Projection: Ramsey Co. Coords.
Source: ESRI Online

PM QUEUE LENGTHS - MINNEHAHA AVE
JOHNSON PARKWAY TRAIL PROJECT
St. Paul, Minnesota

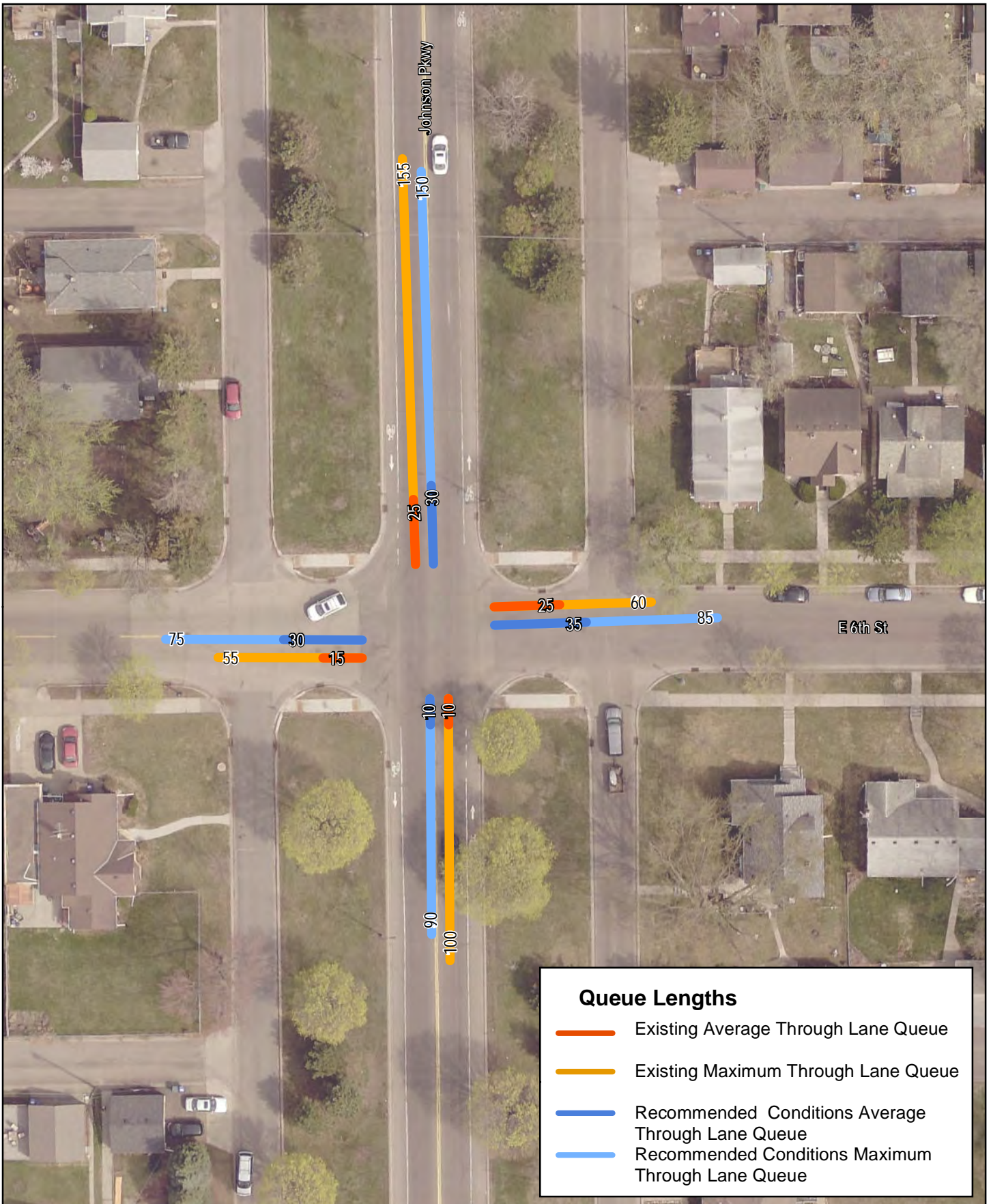
Figure 9b

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		<p>Project: STPAU 148568 Print Date: 2/5/2019</p> <p>Map by: jdanibas Projection: Ramsey Co. Coords. Source: ESRI Online</p>	<p><i>AM QUEUE LENGTHS - 6TH ST</i></p> <p>JOHNSON PARKWAY TRAIL PROJECT</p> <p>St. Paul, Minnesota</p>	<p>Figure 10a</p>
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Project: STPAU 148568
 Print Date: 2/5/2019
 Map by: jdanibas
 Projection: Ramsey Co. Coords.
 Source: ESRI Online

PM QUEUE LENGTHS - 6TH ST
JOHNSON PARKWAY TRAIL PROJECT
 St. Paul, Minnesota

Figure 10b

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Project: STPAU 148568
Print Date: 2/5/2019

Map by: jdanibas
Projection: Ramsey Co. Coords.
Source: ESRI Online

AM QUEUE LENGTHS - 3RD ST JOHNSON PARKWAY TRAIL PROJECT St. Paul, Minnesota

Figure
11a

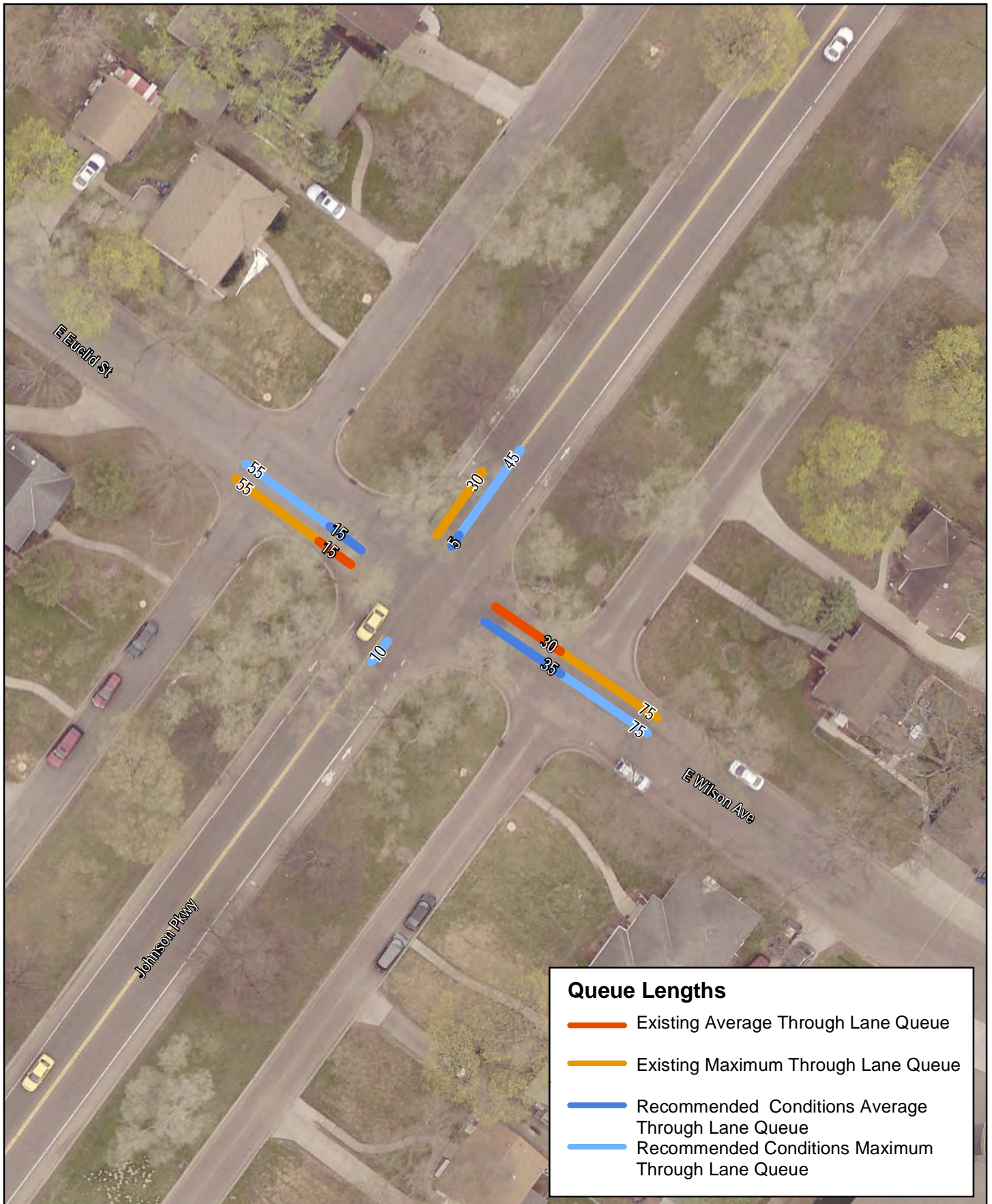


Project: STPAU 148568
Print Date: 2/5/2019

Map by: jdanibas
Projection: Ramsey Co. Coords.
Source: ESRI Online

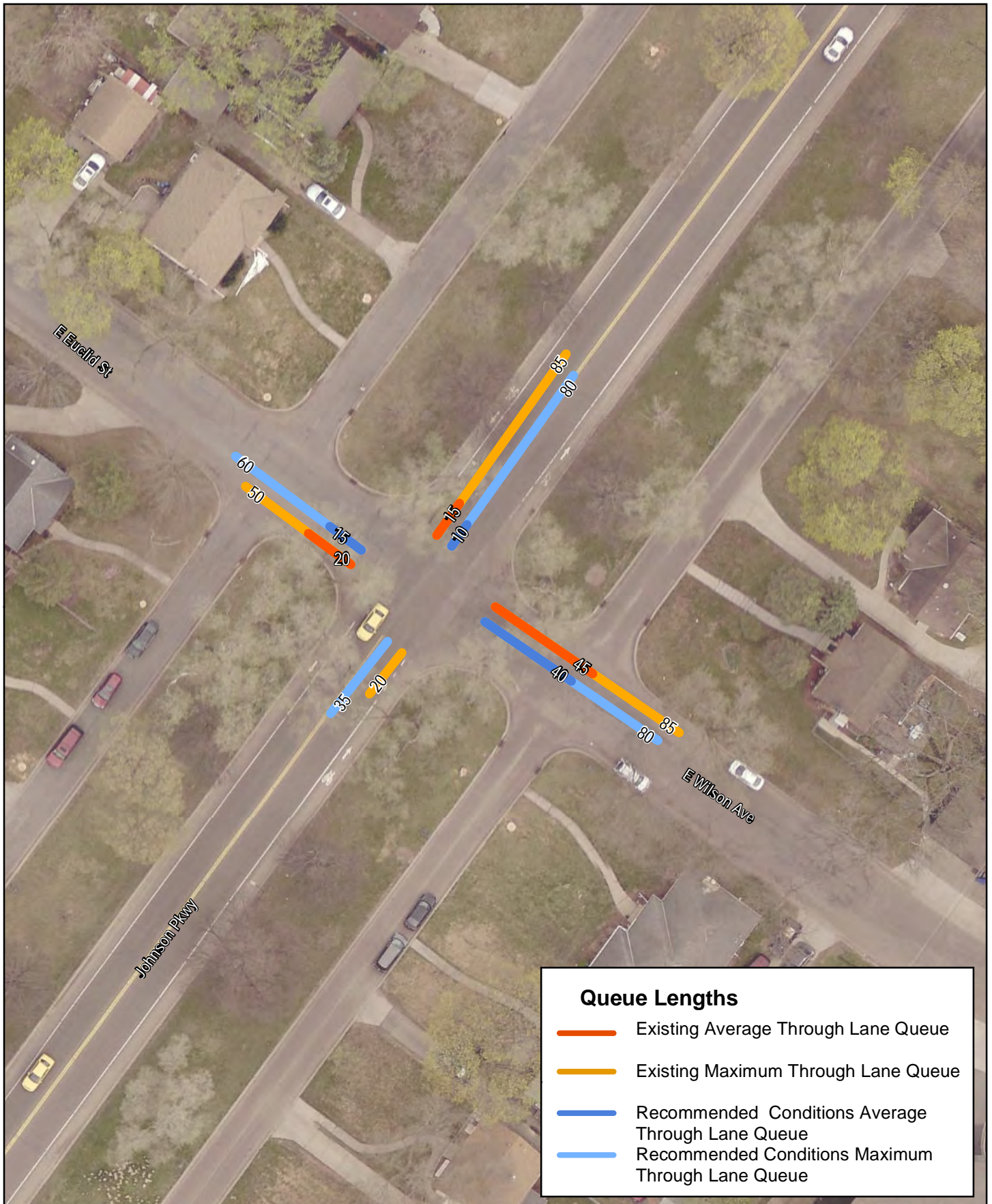
PM QUEUE LENGTHS - 3RD ST
JOHNSON PARKWAY TRAIL PROJECT
St. Paul, Minnesota



Figure 11b



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		Project: STPAU 148568 Print Date: 2/5/2019	<i>PM QUEUE LENGTHS - WILSON AVE</i> JOHNSON PARKWAY TRAIL PROJECT St. Paul, Minnesota	Figure 12b
		Map by: jdanibas Projection: Ramsey Co. Coords. Source: ESRI Online		

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MEMORANDUM

TO: Don Pflaum, PE
Engineer IV, City of Saint Paul

FROM: Heather Kienitz, PE (MN)
Justin Anibas, EIT

DATE: February 20, 2019

RE: Conway Street/English Street Analysis and Other Open House Related Comments
SEH No. STPAU 148568

This memo summarizes the findings and analysis related to the test closure of Conway Street and its effects on English Street as well as two other issues that were investigated based on comments received at the January 17, 2019 Public Open House. These included the school dismissal operations at the intersection of Johnson Parkway and 6th Street and crash analysis at the intersection of 3rd Street and Gotzian Street.

CONWAY STREET/ENGLISH STREET ANALYSIS

To better understand how traffic patterns change during the test closure at Conway Street, three figures were created. All three figures are attached.

- **Figure 1 – 13-hour Traffic Volumes (6AM to 7PM) – Existing vs. Test Closure:** This figure compares 13-hour total volumes (6AM to 7PM) for the existing and test closure conditions at 3 intersections.
 - Johnson Parkway and 3rd Street
 - Johnson Parkway and Conway Street
 - Johnson Parkway and the Frontage Road/English Street
- **Figure 2 – English Street Origin-Destination – Test Closure Conditions:** This figure shows the AM, PM, and 13-hour total volumes for the intersection of 3rd Street and the Frontage Road/English Street as well as origin-destination for all vehicles destined to or from English Street during the same time periods.
- **Figure 3 – English Street Origin-Destination – Existing vs. Test Closure:** This figure compares the 13-hour total volumes for the intersection of 3rd Street and the Frontage Road/English Street under existing and test closure conditions. It also shows the origin-destination for all vehicles destined to or from English Street during the same time periods.

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Based on our analysis of the traffic volumes and the observation of the intersection video, below are the answers to the questions raised during the February 11, 2019 Johnson Parkway Trail Design Meeting.

- *Provide specific volume data with closure and without closure*
 - See figures 1, 2 and 3
 - It should be noted that not all of the traffic that can no longer use Conway Street to access Johnson Parkway during the test closures rerouted to English Street. Based on the volume data it is estimated that 40% of traffic that previously used Conway Street moved to English Street
 - Based on the street network in the area, it is likely that vehicles rerouting from Conway Street but not using English Street would use routes such as Clarence Street and Etna Street to access 3rd Street/Johnson Parkway where it may be easier to gain access onto 3rd Street during peak periods.
- *How will the frontage road operate with the closure – how much increase in traffic will occur?*
 - The frontage road in this area will likely see very little increase in traffic as drivers will likely find other, non-frontage road routes to reach their destination
 - With the traffic demands on the frontage roads currently being very low, any increase in traffic would not be expected to have a detrimental effect on traffic operations.
- *How will the Frontage Road and 3rd Street operate with the closure at Conway Street?*
 - It was observed under both existing and test closure conditions that vehicles turning left from English Street onto westbound 3rd Street during the peak periods typically had to wait to find acceptable gaps in the westbound queue at the intersection of Johnson Parkway at 3rd Street; however, vehicles were still able to enter 3rd Street traffic safely without making aggressive or dangerous maneuvers.
 - It was also observed that the northbound English Street queues ranged from 2 to 3 vehicles at the longest during existing conditions and ranged from 3-4 vehicles at the longest during proposed conditions.
 - During off-peak periods, vehicles were able to turn from English Street onto westbound 3rd Street with minimal delay in most cases.
- *Is removing/restricting parking along the frontage roads recommended?*
 - Due to the width of the frontage roads, it would be useful to prohibit parking on the Johnson Parkway side of the Frontage Road and allow parking on the residence side.
 - Complete removal of parking on the frontage roads is not recommended as parked vehicles on the frontage road will provide some level of traffic calming and observed parking demand is relatively low.
 - Vehicles parked on the frontage road will not have any major effect on traffic operations because traffic demand is low.
 - Parking should be prohibited along the frontage road on the residence side within the sight distance triangle (approximately 30 feet) of each intersection and alleyway.
 - It may be beneficial to remove parking on English Street between 3rd Street and the Frontage Road, this would allow northbound vehicles the width to create an unofficial left turn/through lane and a right turn lane.

SCHOOL DISMISSAL COUNTS AT JOHNSON PARKWAY/6TH STREET

Comments from a citizen at the January 17, 2019 Open House indicated that 6th Street experiences long queues immediately after dismissal at nearby Harding High School. Based on this comment, we reviewed the traffic volume and queues at the intersection of 6th Street and Johnson Parkway during the dismissal period.

Harding High School dismisses at 2:00 PM, therefore, we reviewed the period between 1:45 and 2:25 PM under existing conditions (11/8/18) and for two days under the test closure conditions (12/4/18 & 12/5/18). The test closure conditions were observed for two days to remove any potential outliers from the comparison.

Based on the traffic counts and video observations, both test closure days had similar results with 12/4/18 experiencing slightly higher volumes on Johnson Parkway compared to 11/8/18 and 12/5/18. Traffic demand and queues were compared under existing and test closure conditions with the following findings (Figure 4 shows the traffic volume comparison and summarizes queueing).

- Queues on westbound 6th Street during the school dismissal period generally last from 2:08 to 2:15PM under both the existing and test closure conditions. And observed queues were generally the same under existing and test closure conditions.
- The queues on westbound 6th Street during the school dismissal do not experience unusually long delays and the queues are more likely due to the fact that many vehicles leave the school during a 10-minute span.
- Although the end of the queue could not always be observed in the video frame, it is unlikely that vehicles backed up as far as Clarence Street (approximately 550 feet) during the count periods based on the spot check of the intersection operation with the HCM reporting in Synchro software. This spot analysis showed LOS C (existing) and C (test closure) for the westbound approach using a peak hour factor of 0.6 for the westbound approach which represents the peaking from the school dismissal.
- Generally, the test closures did not change traffic patterns at the intersection as shown in Figure 4. Longer queues observed by the citizen on some days may be due to small changes in the traffic volume on Johnson Parkway.

CRASH ANALYSIS AT 3RD STREET/GOTZIAN STREET

A comment at the January 17, 2019 Open House suggested many crashes had occurred at the intersection of 3rd Street at Gotzian Street due to a possible sight distance issue when the Gotzian motorist looks toward the eastbound 3rd Street approach. The most recent 5 years of crash data available (2011-2015) was analyzed at the intersection with the following findings. Attached are tables summarizing the 2011-2015 crash analysis.

- There were 7 crashes between 2011 and 2015, one had a non-incapacitating injury, one had possible injuries, and the remaining 5 crashes involved property damage only.
- The crash rate for the intersection of 0.55 crashes per million entering vehicles (MEV) is slightly above the critical rate of 0.53 per MEV, which would indicate a crash problem. However, since volume counts are not available on Gotzian Street, an ADT of 500 was assumed, and should 1,000 be used as the ADT, the intersection would likely have a crash rate below the critical rate.
- All 7 crashes appear to have included an eastbound vehicle colliding with a vehicle coming from the minor approaches
 - 2 crashes involved northbound through vehicles
 - 1 crash involved a northbound left turning vehicle
 - 1 crash involved a northbound right turning vehicle
 - 3 crashes involved a southbound through vehicle
- The number of crashes all involving eastbound through vehicles may indicate a sight distance issue when looking at the eastbound approach from Gotzian Street which may also contribute to crashes at the intersection.

Further analysis of the intersection should include a field measurement of sight distance and the City could request crash data for this intersection from MnDOT for 2016-2018 (a more recent period than used in this brief review).

Attachments:

Figure 1 – 13-hour Traffic Volumes (6 am to 7 pm) – Existing vs. Test Closure

Figure 2 – English Street Origin-Destination – Test Closure Conditions

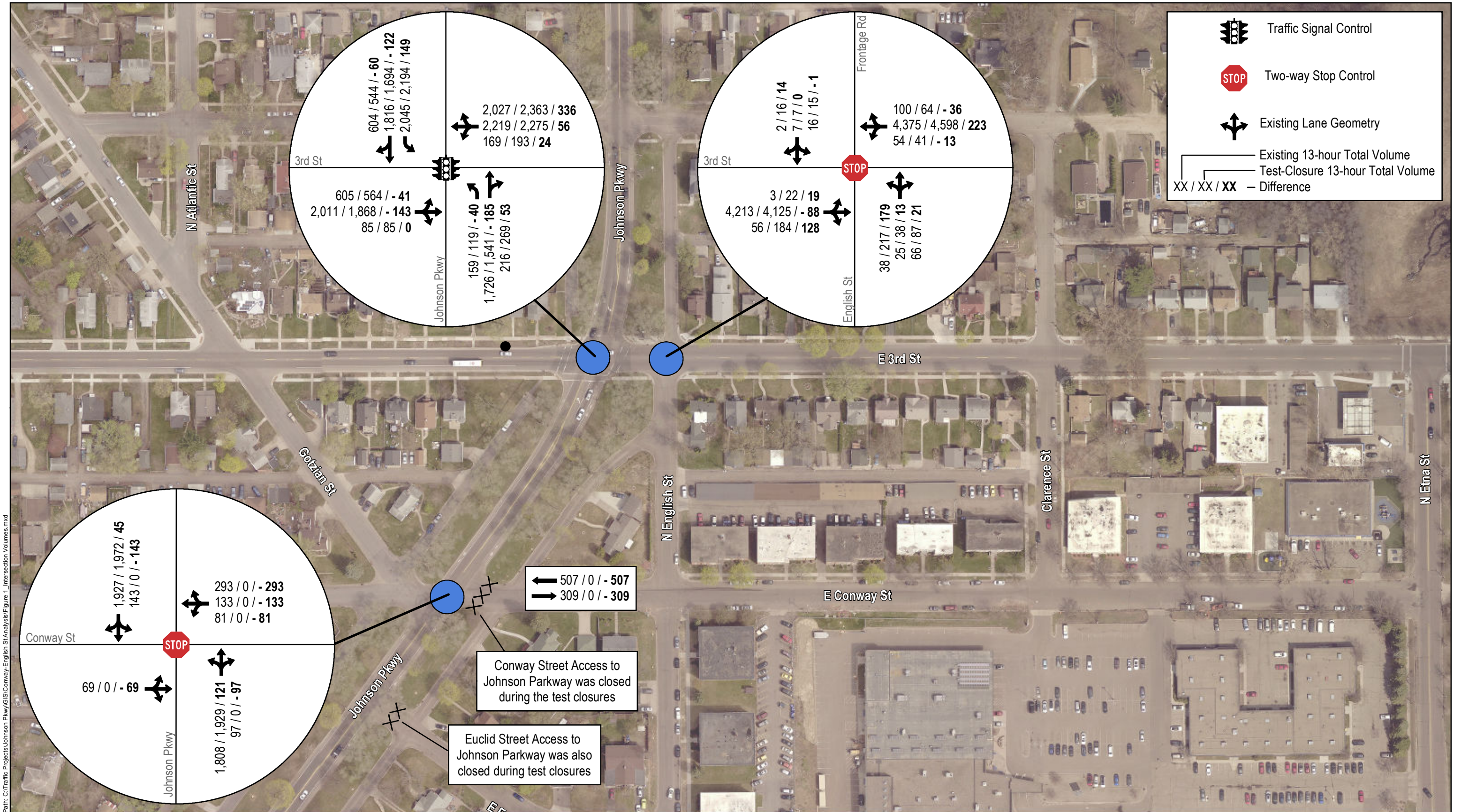
Figure 3 – English Street Origin-Destination – Existing vs. Test Closure

Figure 4 – School Dismissal Counts (1:45 to 2:45 pm) – Johnson Parkway at 6th Street

Table A1 – 3rd Street at Gotzian Street Crash Analysis

cc: Wayne Houle, PE – SEH

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Path: C:\Traffic Projects\Johnson Pkwy\GIS\Conway-English St Analysis\Figure 1_Intersection Volumes.mxd

		Project: STPAU 148568 Print Date: 2/20/2019	13-HOUR TRAFFIC VOLUMES (6AM to 7PM) - EXISTING VS. TEST CLOSURE Johnson Parkway Trail Project St. Paul, MN	Figure 1
		User Name: jdanibas Projection: Projection: NAD 1983 UTM Zone 15N Source: ESRI Online		

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Path: C:\Traffic Projects\Johnson Pkwy\GIS\Conway-English St Analysis\Figure 2 - Test Closure English St OD.mxd

		<p>Project: STPAU 148568 Print Date: 2/20/2019</p> <p>User Name: jdanibas Projection: Projection: NAD 1983 UTM Zone 15N Source:ESRI Online</p>	<p>ENGLISH STREET ORIGIN-DESTINATION - TEST CLOSURE CONDITIONS</p> <p>Johnson Parkway Trail Project St. Paul, MN</p>	<p>Figure 2</p>
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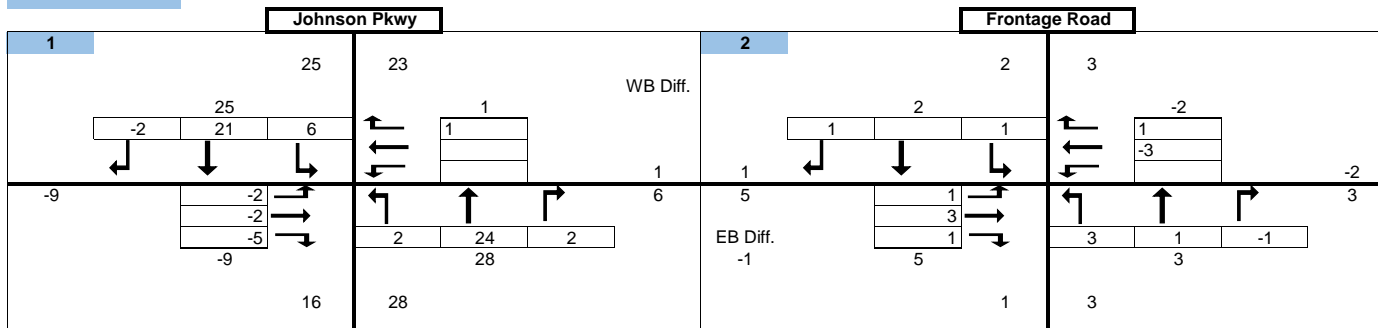
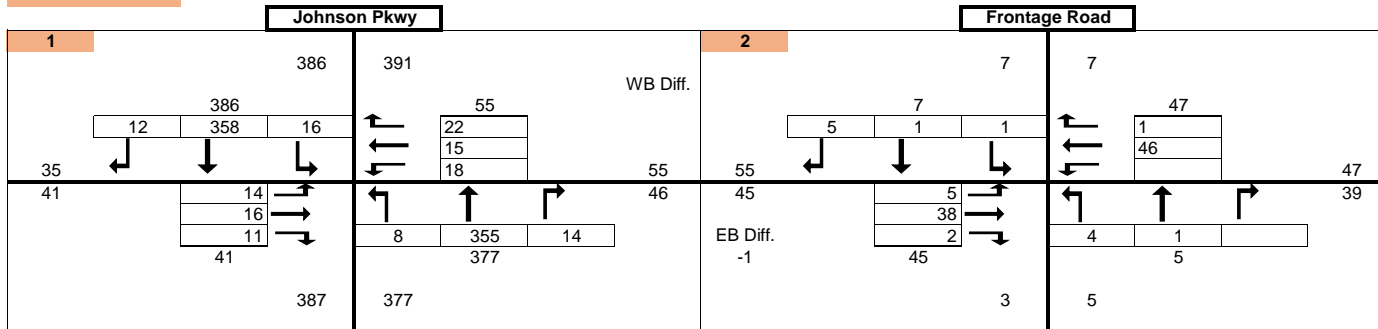
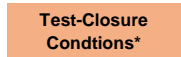
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Path: C:\Traffic Projects\Johnson Pkwy\GIS\Conway-English St Analysis\Figure 3. Comparison English St.OD.mxd

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Existing Conditions



- Queues generally last from about 2:08 to 2:15 pm during school dismissal both in existing and test-closure conditions.
- These queues do not seem to experience unusually long delays are more likely due to the fact that many vehicles leave the school during a 5-10 minute span

Table A1
3rd St at Gotzian St
2011 to 2015 Crash Data
MnDOT Crash Mapping Software Information

Study Intersections									INTERSECTION CRASH RATE INFORMATION			
									Crash Rate	Critical Rates	Critical Index	MnDOT Average
Intersection	Control Type	Entering ADT	Fatal	A	B	C	Property	Total	Crash Rate	Crash Rate	Critical Index	Crash Rate
3rd St at Gotzian St	Thru/Stop (U)	7,000	0	0	1	1	5	7	0.55	0.53	1.03	0.18
TOTAL			0	0	1	1	5	7				
			0%	0%	14%	14%	71%	100%				
									Critical Rate Exceeded	Critical Index ≥ 1	Average Rate Exceeded	

FATAL AND SEV A RATE INFORMATION		
FAR Rate	Critical Rates	MnDOT Average
FAR Rate	FAR Rate	FAR Rate
0.00	6.29	0.33
Critical FAR Rate Exceeded	Average FAR Rate Exceeded	

Study Intersections	Diagram - Crash Type									Pedestrian / Bicycle Crashes	
Intersection	Rear End	Left Turn	Right Angle	Right Turn	Side Swipe	Head On	Ran Off Road	Other	Total	Pedestrian Crashes	Bicycle Crashes
3rd St at Gotzian St	0	0	4	0	1	0	0	2	7	0	0
TOTAL	0	0	4	0	1	0	0	2	7	0	0
	0%	0%	57%	0%	14%	0%	0%	29%	100%		

NOTES:

Crash Rates - Number of crashes per million entering vehicles

FAR Rates - Number of Fatal and Severity A crashes per 100 million entering vehicles

Exceeding the Calculated Critical Rates indicated a sustained crash problem.

Control Type - Thru/Stop (U) - Urban

Control Type - Thru/Stop (R) - Rural

MnDOT Statewide Average Rates (2015 Data; 5-Year)*	
Intersection Type	Crash Rate
Urban Thru/Stop	0.18
Rural Thru/Stop	0.25
All Way Stop	0.35
Other	0.16