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MEMORANDUM

Date: June 20, 2017

To: Brandon Anderson, P.E.
City Engineer – Apple Valley

From: Douglas Arnold, P.E.
Kimley-Horn and Associates, Inc.

Subject: Redevelopment Site – Cedar Avenue at 147th Street
Traffic Impact Study

Executive Summary

Launch Properties is proposing to redevelop an existing office building located on the southeast corner of Cedar Avenue and 147th Street in Apple Valley, MN. The existing building provides general office use. The redevelopment will include a +/- 9,000 square foot restaurant with a drive-through.

The proposed use is anticipated to generate 412 driveway trips during the Mid-Day peak hour and 198 driveway trips during the PM peak hour, which is based on information provided by the restaurant operator. Access is proposed to be located along 147th Street, with a right-in only driveway located 170 feet south of 147th Street and a full access driveway located 280 feet south of 147th Street. As part of the redevelopment, the property owner has offered to close the existing driveway access on 147th Street.

Based on discussion with City staff, a traffic impact analysis was performed to quantify operating conditions of adjacent intersections for Existing Conditions (2017), Build Conditions (2018), and Horizon Year Conditions (2030). The analysis focused on level of service and delay at the intersections of Cedar Avenue & 147th Street and 147th Street & Glazier Avenue during the weekday PM peak period, as well as vehicle queueing during the weekday Mid-Day and PM peak hours at Cedar Avenue & 147th Street and 147th Street & Glazier Avenue.

Following provides a summary of the recommended improvements for the 2018 Build-Out Year:

- The existing driveway connection of 147th Street should be abandoned.
- Restripe the northbound left-turn lane at 147th Street & Glazier Avenue to provide 240 feet of storage and a 50-foot taper.
- Restripe the westbound left-turn lane at Cedar Avenue & Glazier Avenue to provide 230 feet of storage and a 50-foot taper.

Following provides a summary of the recommended improvements for the 2030 Horizon Year:

- Convert the intersection of 147th Street SW & Glazier Avenue (South) to a ¾ access intersection, where the northbound left-turn movement is prohibited.
- Reconfigure the NB approach at 147th Street SW & Glazier Avenue (South) to provide only one approach lane (right-turn lane).
- Construct a roundabout at the intersection of 147th Street SW & Glazier Avenue (North).
- Construct a raised concrete median between Cedar Avenue and Glazier Avenue along 147th Street W.

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Introduction

Launch Properties is proposing to redevelop a site located on the southeast corner of the intersection of Cedar Avenue (CSAH 23) and 147th Street in Apple Valley, Dakota County, Minnesota. The site is +/- 2 acres and is currently occupied by an office building with multiple tenants. The site is planned to be redeveloped to accommodate a +/- 9,000-square foot restaurant with a drive-thru. As part of the development process, a traffic impact study has been requested by City staff to quantify any impacts the proposed redevelopment will have on the adjacent intersections.

Existing Conditions

The proposed redevelopment site has frontage on three public roadways; Cedar Avenue, 147th Street and Glazier Avenue, with driveways along 147th Street and Glazier Avenue. Following provides more information on the adjacent roadways:

- Cedar Avenue is a north-south divided highway with three lanes in each direction. At its intersection with 147th Street, left turn lanes are provided on all four approaches and right turn lanes are provided on three of the four approaches (excluding EB). The speed limit is 45 miles per hour.
- 147th Street is an east-west undivided roadway with two lanes in each direction and a posted speed limit of 30 miles per hour. At its intersection with Cedar Avenue, there are dedicated left-turn lanes in each direction, as well as a dedicated westbound right-turn lane.
- Glazier Avenue is a two lane north-south undivided roadway adjacent to the proposed site on the east side. At its intersection with 147th Street, dedicated lanes are provided for left-turn and right-turn movements.

The intersection of Cedar Avenue and 147th Street and the intersection of 147th Street and Glazier Avenue will be included as study intersections. Existing lane geometry and intersection control is provided in Exhibit 1 in Appendix 1.

Peak period turning movement counts were collected at the study intersections on Tuesday, February 21, 2017. Exhibit 2 in Appendix 1 provides a summary of the AM and PM peak hour turning movement counts. It should be noted that the traffic volumes reported for the Mid-Day peak hour at the intersection of Cedar Avenue & 147th Street are from counts performed in 2014.

Proposed Development

The proposed site will be a 9,000-square foot restaurant with a drive-thru. The concept plan calls for the closure of the current site full access driveway on 147th Street, with proposed access to the site provided by one right-in-right-out driveway and one full access driveway along Glazier Avenue spaced approximately 100 feet apart. The site is anticipated to be open for business in 2018.

Site Trip Generation

The proposed restaurant is a unique restaurant so the trip generation was based on trip data from existing restaurant locations. A traffic study completed by KLOA in 2014, reviewed four existing restaurant locations and based on the traffic at those locations summarized a trip generation for a

new restaurant. It is anticipated that the proposed restaurant will have approximately 80% of the traffic when compared to the trip generation provided in the traffic study due to the smaller restaurant size and a market assessment of the proposed restaurant. Trip generation for the proposed restaurant was adjusted to be 80% of the locations previously studied. The KLOA report can be found in Appendix 2.

A pass-by reduction was included in the trip generation. Pass-by traffic was assumed to be 50% and was assumed to be from Cedar Avenue. Table 1 shows the trip generation for the proposed site. In the Mid-Day peak hour, the site will generate 412 trips (206 in and 206 out) and in the PM peak hour it will generate 198 trips (99 in and 99 out). It should be noted that the site currently generates traffic; however, to provide a conservative estimate, the existing traffic was not reduced from the trip generation potential of the restaurant.

Table 1. Trip Generation

Land Use Description	ITE	Intensity / Units	Mid-Day Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Restaurant with Drive-Through	--	9,000 Square Feet	206	206	412	99	99	198
TOTAL EXTERNAL TRIPS			206	206	412	99	99	198
Peak Hour Pass-by (50%)			*102*	*102*	*204*	*50*	*50*	*100*
TOTAL NET NEW TRIPS			104	104	208	49	49	98

Trip Distribution and Assignment

The directional distribution was based on the current traffic patterns in the area, the location of the proposed site access, and the anticipated routes that will provide site users with the fastest and most convenient path to and from the site. The estimated trip distribution for the site-generated traffic is illustrated in Exhibit 3 in Appendix 1. All pass-by traffic is assumed to be from Cedar Avenue.

Site distribution is listed below:

- To/from the north on Cedar Avenue – 35%
- To/from the south on Cedar Avenue – 30%
- To/from the east on 147th Street – 10%
- To/from the west on 147th Street – 15%
- To/from the south on Glazier Avenue – 10%

In accordance with the estimated site trip generation and distribution, weekday Mid-Day and PM peak hour site traffic volumes were assigned to each of the study intersections. The resulting trip assignment is presented in Exhibit 4 in Appendix 1.

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Intersection Capacity Analysis

A capacity analysis was performed at the study intersections to quantify existing operating conditions, as well as future conditions without and with traffic from the proposed redevelopment. Since the proposed redevelopment will not be open during the AM peak hour, the focus of the future conditions analysis was on the weekday Mid-Day and PM peak hours.

Level of service (LOS) analysis was conducted for the Mid-Day and PM peak hours at both study intersections for existing conditions, Build-Out conditions and Horizon conditions. LOS is a quantitative measure used by traffic engineers to describe the operations of an intersection. It ranges from A to F, with A being the best and F being the worst level of operation. LOS A conditions are characterized by minimal vehicle delay and free-flow conditions, while LOS F is characterized by long vehicle delay – usually when demand exceeds available roadway capacity. Although LOS E is defined as at-capacity, LOS D is generally the minimum acceptable level of operation at an intersection. Each study intersection was analyzed based on the Highway Capacity Manual using Synchro/SimTraffic software.

Existing (2017) Analysis

A capacity analysis was performed to quantify existing operating conditions during the AM, Mid-Day, and PM peak hours at the study intersections. The analysis was based on signal timings provided by the Dakota County and the existing lane geometry. Synchro/SimTraffic was used to perform the capacity analysis. It should be noted that since the proposed development is not in operation during the AM peak hour, the capacity analysis is only provided for informational purposes and will not be performed for Build-Out or Horizon conditions.

Table 2, Table 3, and Table 4 provide a summary of the AM, PM, and Mid-Day peak hour analysis, respectively. Based on the analysis, all intersections are currently operating at an acceptable LOS during the study time periods. The SimTraffic reports are attached in Appendix 3.

Table 2. Existing Capacity Analysis Summary (AM Peak Hour)

Intersection	Approach / Movement	Left		Through		Right		Overall Intersection	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Cedar Avenue & 147th Street	EB	34.0	C	38.0	D	12.4	B	19.5	B
	WB	35.6	D	38.6	D	11.3	B		
	NB	51.0	D	20.6	C	6.0	A		
	SB	46.1	D	9.4	A	2.5	A		
147th Street & Glazier Avenue	EB			--	--	--	--	--	--
	WB	4.8	A	--	--				
	NB	8.7	A			2.7	A		
	SB								

(1) "--" = not applicable (2) Darkened boxes = movement not available

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Table 3. Existing Capacity Analysis Summary (PM Peak Hour)

Intersection	Approach / Movement	Left		Through		Right		Overall Intersection	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Cedar Avenue & 147th Street	EB	41.4	D	51.7	D	41.0	D	30.0	C
	WB	41.4	D	39.9	D	7.8	A		
	NB	65.1	E	27.0	C	6.4	A		
	SB	58.4	E	27.5	C	8.9	A		
147th Street & Glazier Avenue	EB			--	--	--	--	--	--
	WB	8.9	A	--	--				
	NB	19.0	C			3.4	A		
	SB								

(1) "--" = not applicable (2) Darkened boxes = movement not available

Table 4. Existing Capacity Analysis Summary (Mid-Day Peak Hour)

Intersection	Approach / Movement	Left		Through		Right		Overall Intersection	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Cedar Avenue & 147th Street	EB	41.3	D	49.3	D	33.8	C	26.4	C
	WB	41.9	D	47.8	D	6.8	A		
	NB	61.6	E	23.5	C	5.8	A		
	SB	55.7	E	16.8	B	3.4	A		
147th Street & Glazier Avenue	EB			--	--	--	--	--	--
	WB	5.8	A	--	--				
	NB	13.4	B			3.7	A		
	SB								

(1) "--" = not applicable (2) Darkened boxes = movement not available

Build-Out Background (2018) Analysis

The future conditions analysis was based on an expected opening year of 2018. Build-Out Background capacity analysis was performed at the study intersections to provide a basis of operations in the 2018 Build-Out year. Volumes used for the analysis are provided in Exhibit 5 in Appendix 1. Existing signal timings were used for this analysis.

Table 5 and Table 6 provide a summary of the capacity analysis for the PM and Mid-Day peak hours, respectively. Based on the analysis, the intersection of Cedar Avenue & 147th Street is anticipated to operate at LOS C during the PM and Mid-Day peak hours. The northbound left-turn movement at the intersection of 147th Street & Glazier Avenue is anticipated to operate at LOS C for the PM and Mid-Day peak hours. SimTraffic reports are provided in Appendix 3.

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Table 5. Build-Out Background Capacity Analysis Summary (PM Peak Hour)

Intersection	Approach / Movement	Left		Through		Right		Overall Intersection	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Cedar Avenue & 147th Street	EB	42.0	D	50.0	D	41.6	D	32.7	C
	WB	42.9	D	39.2	D	8.5	A		
	NB	65.9	E	28.6	C	6.3	A		
	SB	60.8	E	32.0	C	12.3	A		
147th Street & Glazier Avenue	EB			--	--	--	--	--	--
	WB	8.6	A	--	--				
	NB	21.4	C			4.1	A		
	SB								

(1) "--" = not applicable (2) Darkened boxes = movement not available

Table 6. Build-Out Background Capacity Analysis Summary (Mid-Day Peak Hour)

Intersection	Approach / Movement	Left		Through		Right		Overall Intersection	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Cedar Avenue & 147th Street	EB	42.6	D	50.1	D	34.1	D	26.7	C
	WB	40.8	D	49.6	D	7.2	A		
	NB	65.1	E	23.7	C	6.0	A		
	SB	59.0	E	16.5	C	3.8	A		
147th Street & Glazier Avenue	EB			--	--	--	--	--	--
	WB	5.8	A	--	--				
	NB	14.4	C			3.8	A		
	SB								

(1) "--" = not applicable (2) Darkened boxes = movement not available

Build-Out Total (2018) Analysis

Build-Out Total capacity analysis was performed at the study intersections to determine the operations once project traffic is added to the surrounding roadway network. Volumes used for the analysis are provided in Exhibit 6 in Appendix 1. Existing signal timings were used for this analysis.

Table 7 and Table 8 provide a summary of the capacity analysis for the PM and Mid-Day peak hours, respectively. Based on the analysis, the intersection of Cedar Avenue & 147th Street is anticipated to operate at LOS C during the PM and Mid-Day peak hours, similar to Build-Out Background conditions. The northbound left-turn movement at the intersection of 147th Street & Glazier Avenue is anticipated to operate at LOS D for the PM and Mid-Day peak hours. SimTraffic reports are provided in Appendix 3.

Table 7. Build-Out Total Capacity Analysis Summary (PM Peak Hour)

Intersection	Approach	Left		Through		Right		Overall Intersection	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Cedar Avenue & 147th Street	EB	40.4	D	53.0	D	44.4	D	34.3	C
	WB	46.2	D	37.8	D	8.3	A		
	NB	63.9	E	33.2	C	9.1	A		
	SB	64.1	E	32.3	C	11.6	B		
147th Street & Glazier Avenue	EB			--	--	--	--	--	--
	WB	8.3	A	--	--				
	NB	28.1	D			3.4	A		
	SB								

(1) "--" = not applicable (2) Darkened boxes = movement not available

Table 8. Build-Out Total Capacity Analysis Summary (Mid-Day Peak Hour)

Intersection	Approach	Left		Through		Right		Overall Intersection	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Cedar Avenue & 147th Street	EB	41.1	D	52.0	D	42.8	D	30.9	C
	WB	56.5	E	44.5	D	7.9	A		
	NB	65.9	E	30.8	C	10.4	B		
	SB	61.5	E	18.6	C	4.4	A		
147th Street & Glazier Avenue	EB			--	--	--	--	--	--
	WB	8.3	A	--	--				
	NB	33.2	D			3.2	A		
	SB								

(1) "--" = not applicable (2) Darkened boxes = movement not available

Horizon Background (2030) Analysis

Horizon Background capacity analysis was performed at the study intersections to provide a basis of operations in the 2030 horizon year. Volumes used for the analysis are provided in Exhibit 7 in Appendix 1. Existing signal timings were used for this analysis.

Table 9 and Table 10 provide a summary of the capacity analysis for the PM and Mid-Day peak hours, respectively. Based on the analysis, the intersection of Cedar Avenue & 147th Street is anticipated to operate at LOS E during the PM peak hour and LOS C during the Mid-Day peak hour. The northbound left-turn movement at the intersection of 147th Street & Glazier Avenue is anticipated to operate at LOS D for the PM peak hour and LOS C for the Mid-Day peak hour. SimTraffic reports are provided in Appendix 3.

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Table 9. Horizon Background Capacity Analysis Summary (PM Peak Hour)

Intersection	Approach	Left		Through		Right		Overall Intersection	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Cedar Avenue & 147th Street	EB	42.8	D	53.3	D	44.5	D	71.1	E
	WB	48.1	D	39.9	D	10.6	A		
	NB	65.4	E	33.0	C	8.0	A		
	SB	87.2	F	102.2	F	77.1	E		
147th Street & Glazier Avenue	EB			--	--	--	--	--	--
	WB	7.5	A	--	--				
	NB	25.4	D			3.3	A		
	SB								

(1) "--" = not applicable (2) Darkened boxes = movement not available

Table 10. Horizon Background Capacity Analysis Summary (Mid-Day Peak Hour)

Intersection	Approach	Left		Through		Right		Overall Intersection	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Cedar Avenue & 147th Street	EB	45.1	D	50.7	D	35.0	C	28.9	C
	WB	42.9	D	49.7	D	8.4	A		
	NB	65.7	E	27.2	C	8.1	A		
	SB	61.4	E	18.2	B	4.3	A		
147th Street & Glazier Avenue	EB			--	--	--	--	--	--
	WB	7.5	A	--	--				
	NB	18.2	C			3.4	A		
	SB								

(1) "--" = not applicable (2) Darkened boxes = movement not available

Horizon Total (2030) Analysis

Horizon Total capacity analysis was performed at the study intersections to determine the operations once project traffic is added to the surrounding roadway network. Volumes used for the analysis are provided in Exhibit 8 in Appendix 1. Existing signal timings were used for this analysis.

Table 11 and Table 12 provide a summary of the capacity analysis for the PM and Mid-Day peak hours, respectively. Based on the analysis, the intersection of Cedar Avenue & 147th Street is anticipated to continue to operate at LOS E during the PM peak hour and LOS C during the Mid-Day peak hour with the addition of project traffic. The northbound left-turn movement at the intersection of 147th Street & Glazier Avenue are anticipated to operate at LOS F for the PM and Mid-Day peak hours with the addition of project traffic. SimTraffic reports are provided in Appendix 3.

Table 11. Horizon Total Capacity Analysis Summary (PM Peak Hour)

Intersection	Approach	Left		Through		Right		Overall Intersection	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Cedar Avenue & 147th Street	EB	39.3	D	53.4	D	55.6	D	78.3	E
	WB	53.4	D	38.3	D	10.6	A		
	NB	66.9	E	38.7	C	15.1	A		
	SB	100.5	F	114.2	F	88.0	F		
147th Street & Glazier Avenue	EB			--	--	--	--	--	--
	WB	15.6	C	--	--				
	NB	63.0	F			3.8	A		
	SB								

(1) "--" = not applicable (2) Darkened boxes = movement not available

Table 12. Horizon Total Capacity Analysis Summary (Mid-Day Peak Hour)

Intersection	Approach	Left		Through		Right		Overall Intersection	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Cedar Avenue & 147th Street	EB	47.5	D	55.5	E	43.3	D	33.4	C
	WB	55.7	E	45.4	D	8.6	A		
	NB	69.6	E	34.6	C	12.7	A		
	SB	66.8	E	20.8	B	4.6	A		
147th Street & Glazier Avenue	EB			--	--	--	--	--	--
	WB	12.8	B	--	--				
	NB	56.4	F			3.6	A		
	SB								

(1) "--" = not applicable (2) Darkened boxes = movement not available

Horizon Total (2030) With Mitigation Analysis

Based on the Horizon Total (2030) capacity analysis, the northbound left-turn movement at the intersection of 147th Street & Glazier Avenue is anticipated to operate at LOS F for both Mid-Day and PM peak hours.

Through coordination with City staff, the following improvements along 147th Street have been identified to improve operating conditions as growth continue to occur in the area. The following improvements were considered:

- Convert the intersection of 147th Street SW & Glazier Avenue (South) to a ¾ access intersection, where the northbound left-turn movement is prohibited.
- Reconfigure the NB approach at 147th Street SW & Glazier Avenue (South) to provide only one approach lane (right-turn lane).

- Construct a roundabout at the intersection of 147th Street SW & Glazier Avenue (North). A concept layout of the roundabout is provided in Attachment 4.
- Construct a raised concrete median between Cedar Avenue and Glazier Avenue along 147th Street W.

A capacity analysis was performed to quantify the operating conditions of 147th Street with the inclusion of the recommended improvements. With the improvements, some turning movements would be prohibited. Traffic diversion was accounted for and is detailed below:

- The northbound left-turn movement at the intersection of 147th Street & Glazier Avenue (South) will now make a northbound right-turn movement then make an eastbound u-turn movement at the proposed roundabout at the intersection of 147th Street & Glazier Avenue (North).
- The eastbound left-turn movement into the retail development on the northeast corner of Cedar Avenue & 147th Street will now make an eastbound through movement at 147th Street & Glazier Avenue (South) and then an eastbound left-turn movement at the intersection of 147th Street & Glazier Avenue (North).
- The southbound left-turn movement out of the retail development on the northeast corner of Cedar Avenue & 147th Street will now make a southbound left-turn movement at the intersection of 147th Street & Glazier Avenue (North).

The capacity analysis was performed for Horizon Total (2030) conditions for the Mid-Day and PM peak hours. For the intersection of 147th Street & Glazier Avenue (South), SimTraffic was used to quantify delay and LOS. For the proposed roundabout at 147th Street & Glazier Avenue (North), both HCS 7 and SIDRA 7 were used to quantify delay and LOS. Volumes used for the analysis are provided in Exhibit 9 in Appendix 1.

Table 13 and Table 14 provide a summary of the capacity analysis for the PM and Mid-Day peak hours, respectively. Based on the analysis, the northbound approach at the intersection of 147th Street & Glazier Avenue improved to LOS A during the Mid-Day and PM peak hours for 2030 Build Total conditions. The proposed roundabout is anticipated to operate at LOS A during the Mid-Day and PM peak hours for 2030 Build Total conditions. Simulation reports are provided in Appendix 3.

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Table 13. Horizon Total (Mitigation) Capacity Analysis Summary (PM Peak Hour)

Intersection	Approach	Left		Through		Right		Overall Intersection	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
147th Street & Glazier Avenue (South)	EB			--	--	--	--	--	--
	WB	11.1	B	--	--				
	NB					7.4	A		
	SB								
147th Street & Glazier Avenue (North) HCS ANALYSIS	EB	5.8	A			6.3	A	6.6	A
	WB	6.8	A			7.3	A		
	NB			7.4	A				
	SB			7.8	A				
147th Street & Glazier Avenue (North) SIDRA ANALYSIS	EB	7.2	A			7.2	A	8.1	A
	WB	8.2	A			8.2	A		
	NB			10.9	B				
	SB			12.4	B				

(1) "--" = not applicable (2) Darkened boxes = movement not available
(2) HCS and SIDRA reports roundabout delay and LOS per lane.

Table 14. Horizon Total (Mitigation) Capacity Analysis Summary (Mid-Day Peak Hour)

Intersection	Approach	Left		Through		Right		Overall Intersection	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
147th Street & Glazier Avenue (South)	EB			--	--	--	--	--	--
	WB	9.8	A	--	--				
	NB					8.5	A		
	SB								
147th Street & Glazier Avenue (North) HCS ANALYSIS	EB	6.0	A			6.6	A	6.6	A
	WB	6.7	A			7.1	A		
	NB			7.1	A				
	SB			7.1	A				
147th Street & Glazier Avenue (North) SIDRA ANALYSIS	EB	7.3	A			7.3	A	7.9	A
	WB	8.0	A			8.0	A		
	NB			10.0	B				
	SB			11.1	B				

(3) "--" = not applicable (2) Darkened boxes = movement not available
(4) HCS reports roundabout delay and LOS per lane, rather than movement.

Capacity Analysis Summary

Based on the Build-Out analysis, the study intersections are anticipated to operate at an acceptable level of service. The northbound left-turn movement at 147th Street & Glazier Avenue is anticipated to operate at LOS D for both the PM and Mid-Day peak hours at the Build-Out of the development.

Based on the Horizon analysis, the intersection of Cedar Avenue & 147th Street is anticipated to operate at LOS E for both peak hours, while the northbound left-turn movement at 147th Street & Glazier Avenue is anticipated to operate at LOS F for both the PM and Mid-Day peak hours at the Build-Out of the development. Based on discussion with City staff, improvements along 147th Street have been discussed to alleviate some of the congestion as the corridor grows into the future. With the proposed roundabout at 147th Street & Glazier Avenue (North), and ¾ access at the intersection of 147th Street & Glazier Avenue (South), the intersections are anticipated to operate at an acceptable LOS through the 2030 Horizon Year.

Turn Lane Analysis

The traffic impact analysis also reviewed the anticipated queueing of vehicles for the westbound approach at the intersection of Cedar Avenue & 147th Street and the northbound left-turn movement at the intersection of 147th Street & Glazier Avenue during the Mid-Day and PM peak hours. Below is a summary of the analysis.

147th Street & Glazier Avenue – Northbound Left-Turn
The existing turn lane is approximately 190 feet in length, including 140 feet of storage and a 50-foot taper. Table 15 provides a summary of the average queue length and 95th percentile queue length for the Mid-Day and PM peak hours.

Based on the SimTraffic analysis, the 95th percentile queue is not anticipated to exceed the existing provided storage for Background conditions. Once project traffic is introduced, the provided storage will need to be increased. It is recommended that the provided storage be increased from 140 feet to 240 feet to serve the forecasted demand during Build-Out conditions. Based on the results from the Horizon analysis, the average queue is anticipated to be accommodated within the recommended additional storage. However, there may be a few instances where the 95th percentile queue exceeds the provided storage. With 147th Street +/- 36 feet in width, northbound through traffic will not be greatly impacted the few times that the spillback may occur.

Table 15. Turn Lane Queue Summary

Analysis Year	Mid-Day Peak Hour		PM Peak Hour	
	Average	95th	Average	95th
2018 Build-Out Background	49	88	63	114
2018 Build-Out Total	133	238	99	189

Cedar Avenue & 147th Street – Westbound Approach
The existing turn lane is approximately 230 feet in length, including 130 feet of storage and a 100-foot taper. Table 16 provides a summary of the average queue length and 95th percentile queue length for the Mid-Day and PM peak hours.

Based on the SimTraffic analysis, the 95th percentile queue is anticipated to exceed the existing provided storage for both Background and Total conditions for the westbound left-turn movement. It is recommended that the turn lane be extended to provide an additional 100 feet of storage. Because of the close proximity to Glazier Avenue, the existing 100-foot taper would likely need to be reduced to 50 feet. It should be noted that in all future year analyses, the westbound through movement is not anticipated to spill back through the intersection of 147th Street & Glazier Avenue.

Table 16. Turn Lane Queue Summary

Analysis Year	Mid-Day Peak Hour		PM Peak Hour	
	Average	95th	Average	95th
Westbound Left-Turn Movement				
2018 Build-Out Background	89	155	101	175
2018 Build-Out Total	148	234	132	209
2030 Horizon Background	92	166	121	207
2030 Horizon Total	150	229	145	231
Westbound Through Movement				
2018 Build-Out Background	92	153	87	161
2018 Build-Out Total	113	216	94	192
2030 Horizon Background	107	175	102	177
2030 Horizon Total	122	232	114	244

Conclusions and Recommendations

Launch Properties is proposing to redevelop an existing office building located on the southeast corner of Cedar Avenue and 147th Street in Apple Valley, MN. The existing building provides approximately 9,000 square feet of general office use. The redevelopment will include a +/- 9,000 square foot restaurant with a drive-through.

The proposed use is anticipated to generate 412 driveway trips during the Mid-Day peak hour and 198 driveway trips during the PM peak hour, which is based on information provided by the restaurant operator. Access is proposed to be located along 147th Street, with a right-in only driveway located 170 feet south of 147th Street and a full access driveway located 280 feet south of 147th Street. As part of the redevelopment, the property owner has offered to close the existing driveway access on 147th Street.

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Based on discussion with City staff, a traffic impact analysis was performed to quantify operating conditions of adjacent intersections for Existing Conditions (2017), Build Conditions (2018), and Horizon Year Conditions (2030). The analysis focused on level of service and delay at the intersections of Cedar Avenue & 147th Street and 147th Street & Glazier Avenue during the weekday PM peak period, as well as vehicle queueing during the weekday Mid-Day and PM peak hours at Cedar Avenue & 147th Street and 147th Street & Glazier Avenue.

Following provides a summary of recommended improvements for the 2018 Build-Out Year:

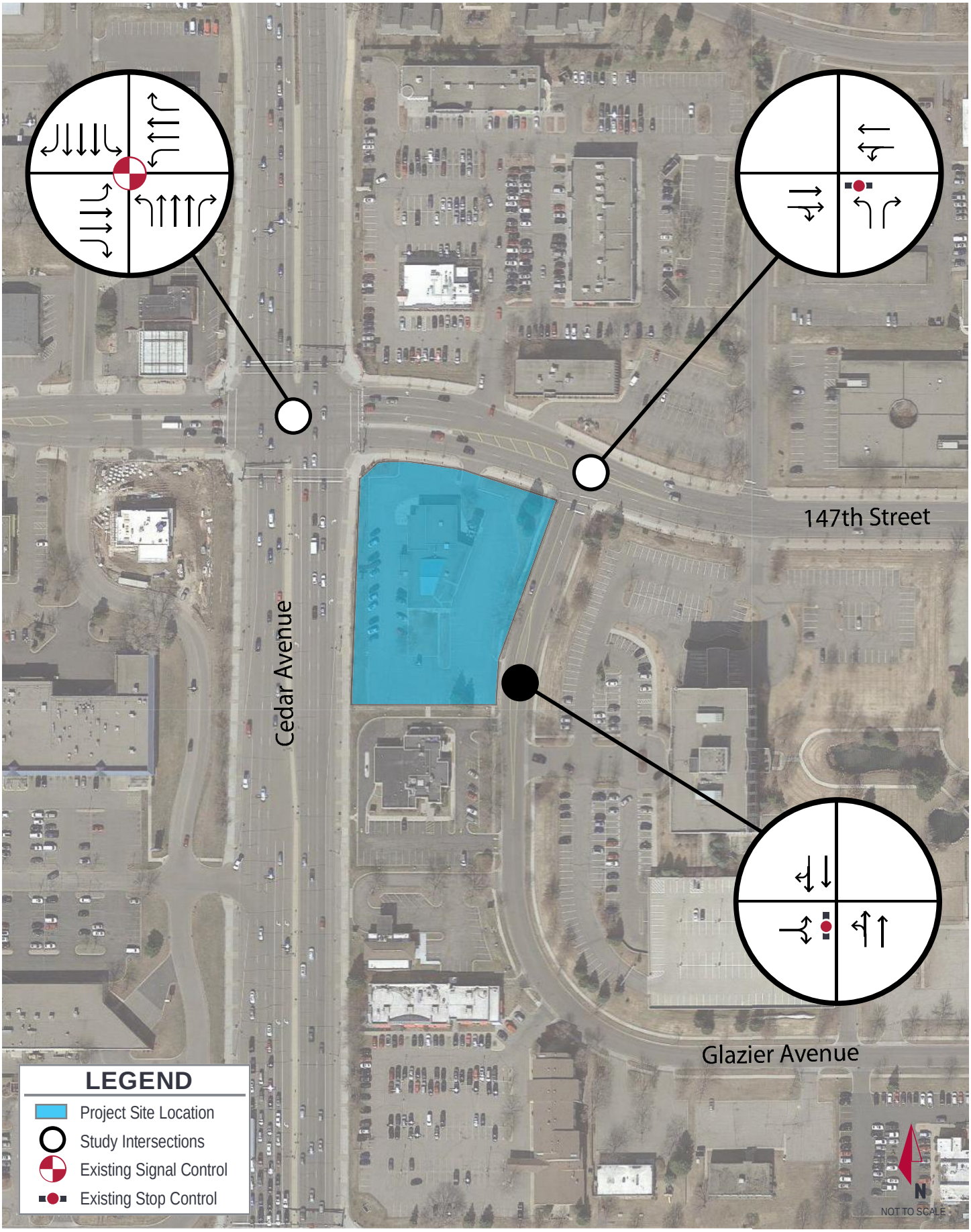
- The existing driveway connection of 147th Street should be abandoned.
- Restripe the northbound left-turn lane at 147th Street & Glazier Avenue to provide 240 feet of storage and a 50-foot taper.
- Restripe the westbound left-turn lane at Cedar Avenue & Glazier Avenue to provide 230 feet of storage and a 50-foot taper.

Following provides a summary of recommended improvements for the 2030 Horizon Year:

- Convert the intersection of 147th Street SW & Glazier Avenue (South) to a ¾ access intersection, where the northbound left-turn movement is prohibited.
- Reconfigure the NB approach at 147th Street SW & Glazier Avenue (South) to provide only one approach lane (right-turn lane).
- Construct a roundabout at the intersection of 147th Street SW & Glazier Avenue (North).
- Construct a raised concrete median between Cedar Avenue and Glazier Avenue along 147th Street W.

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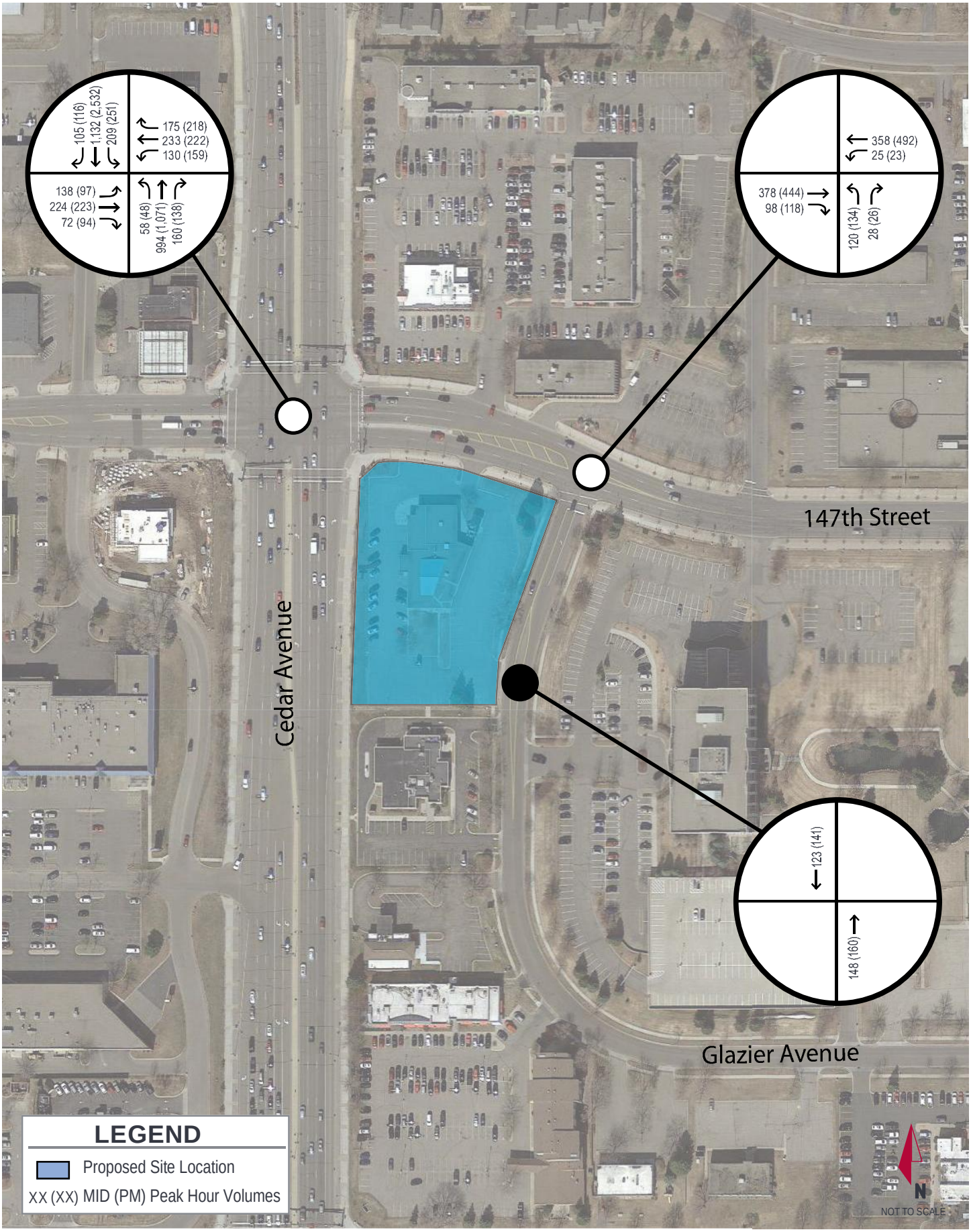
ATTACHMENT 1: EXHIBITS



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EXHIBIT 1

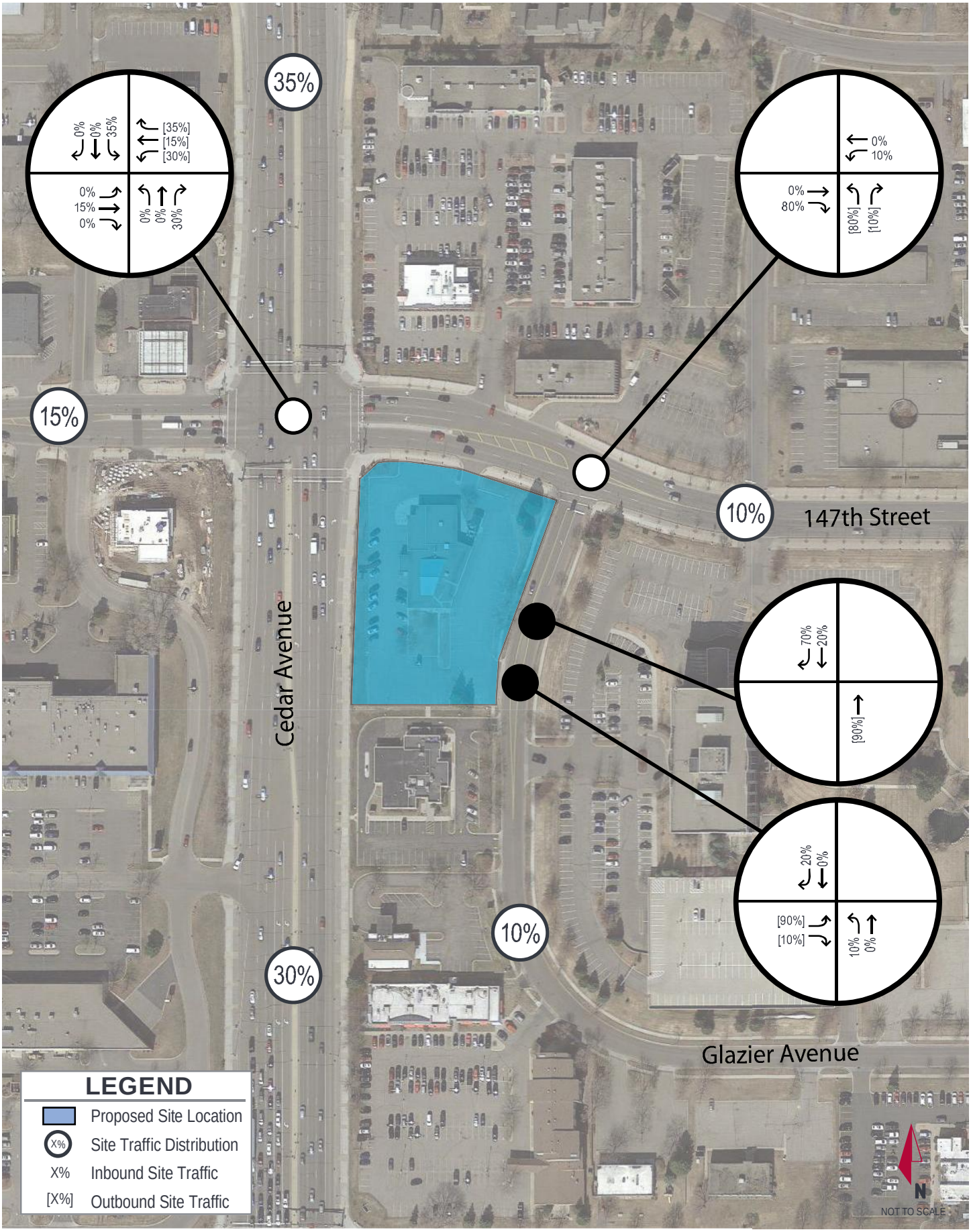
LANE GEOMETRY AND INTERSECTION CONTROL



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EXHIBIT 2

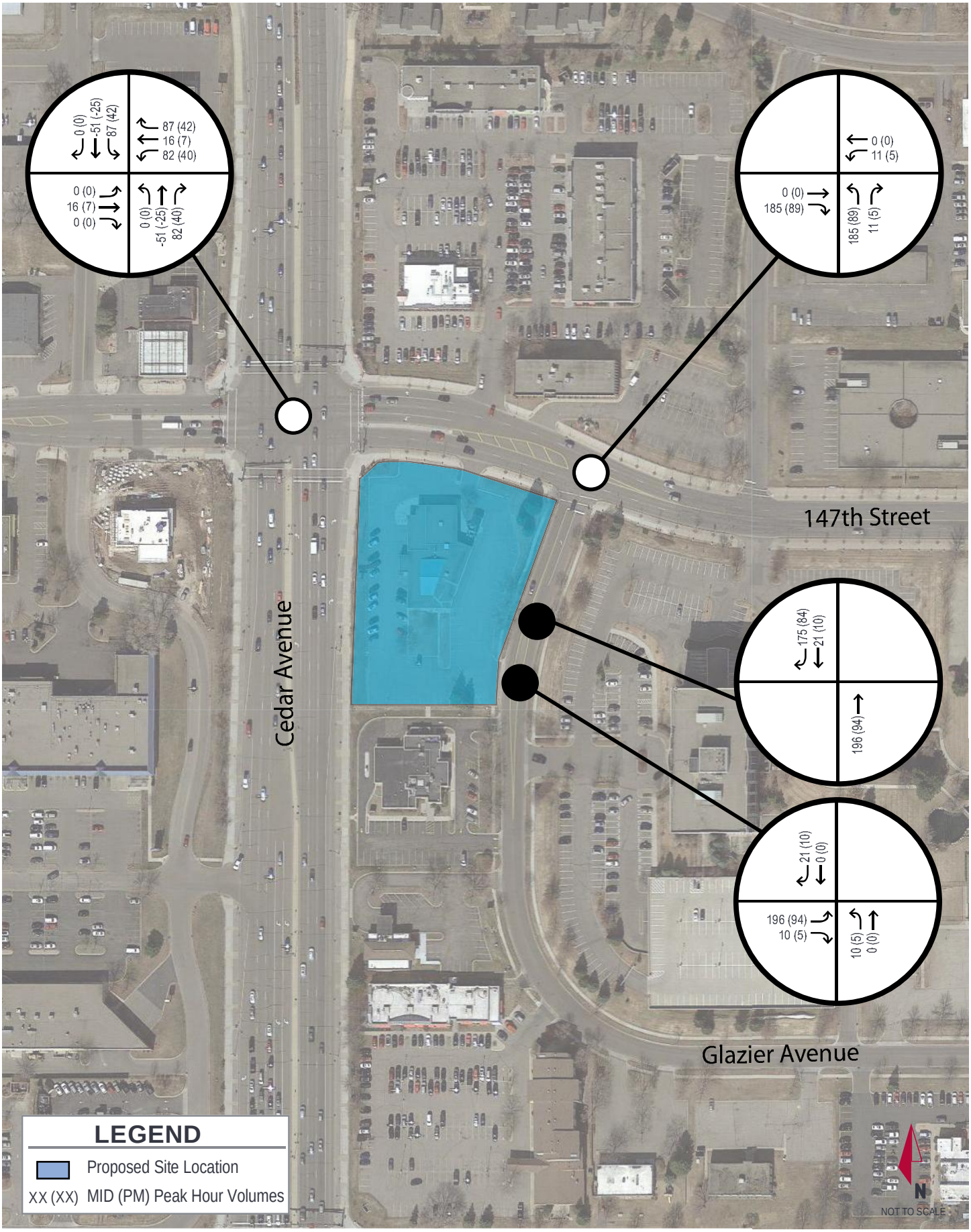
EXISTING TURNING MOVEMENT VOLUMES



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EXHIBIT 3

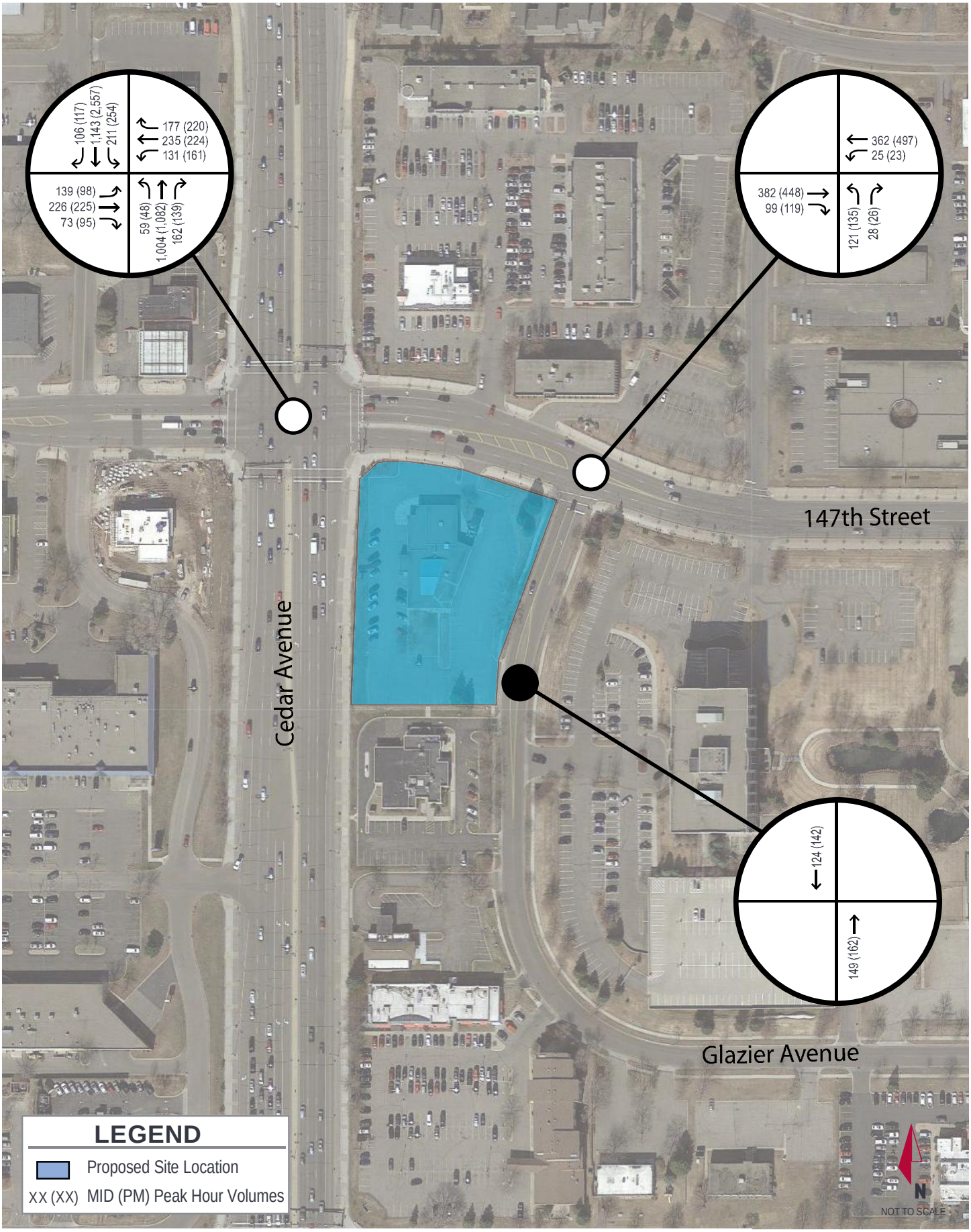
TRIP DISTRIBUTION



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EXHIBIT 4

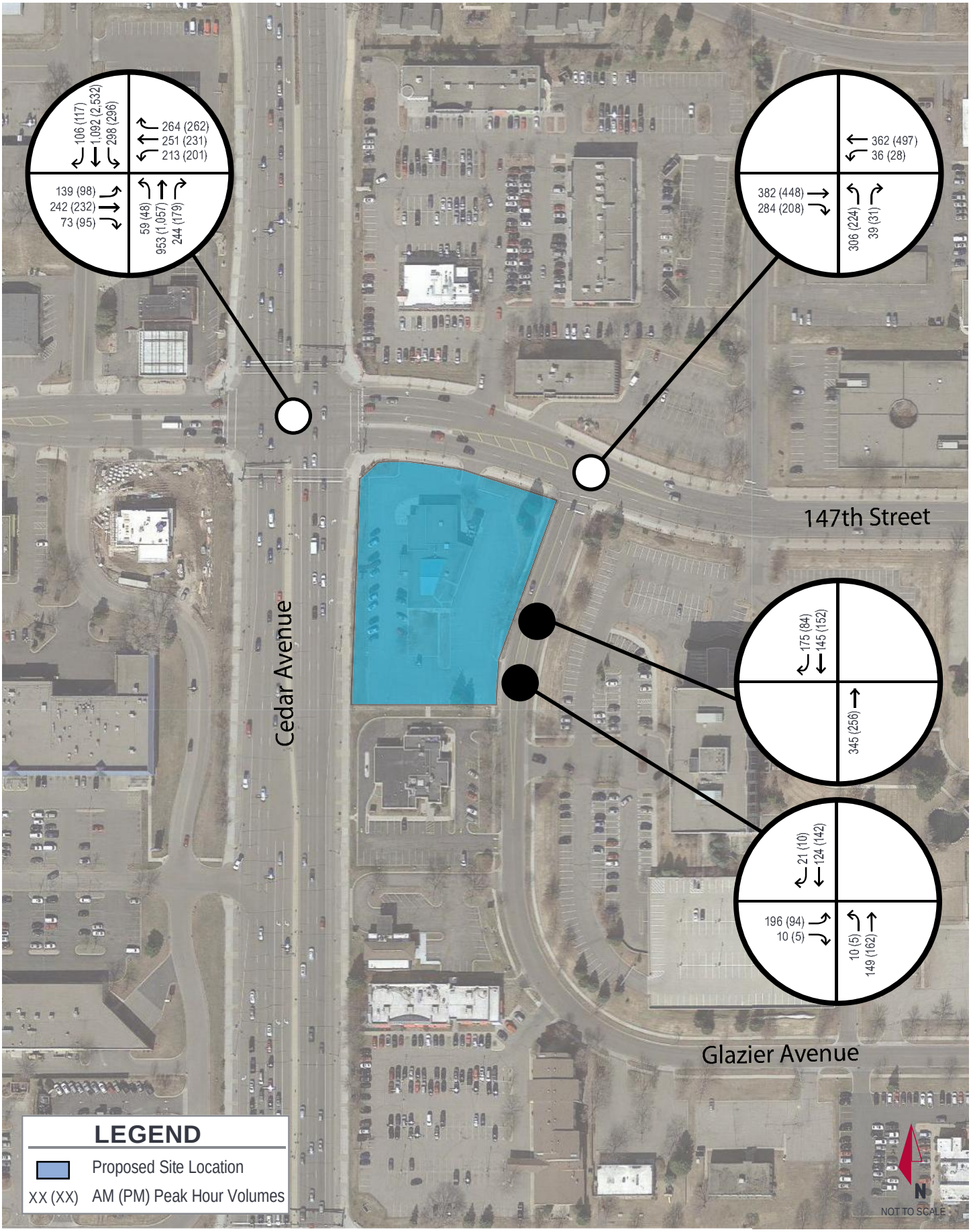
TRIP ASSIGNMENT



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EXHIBIT 5

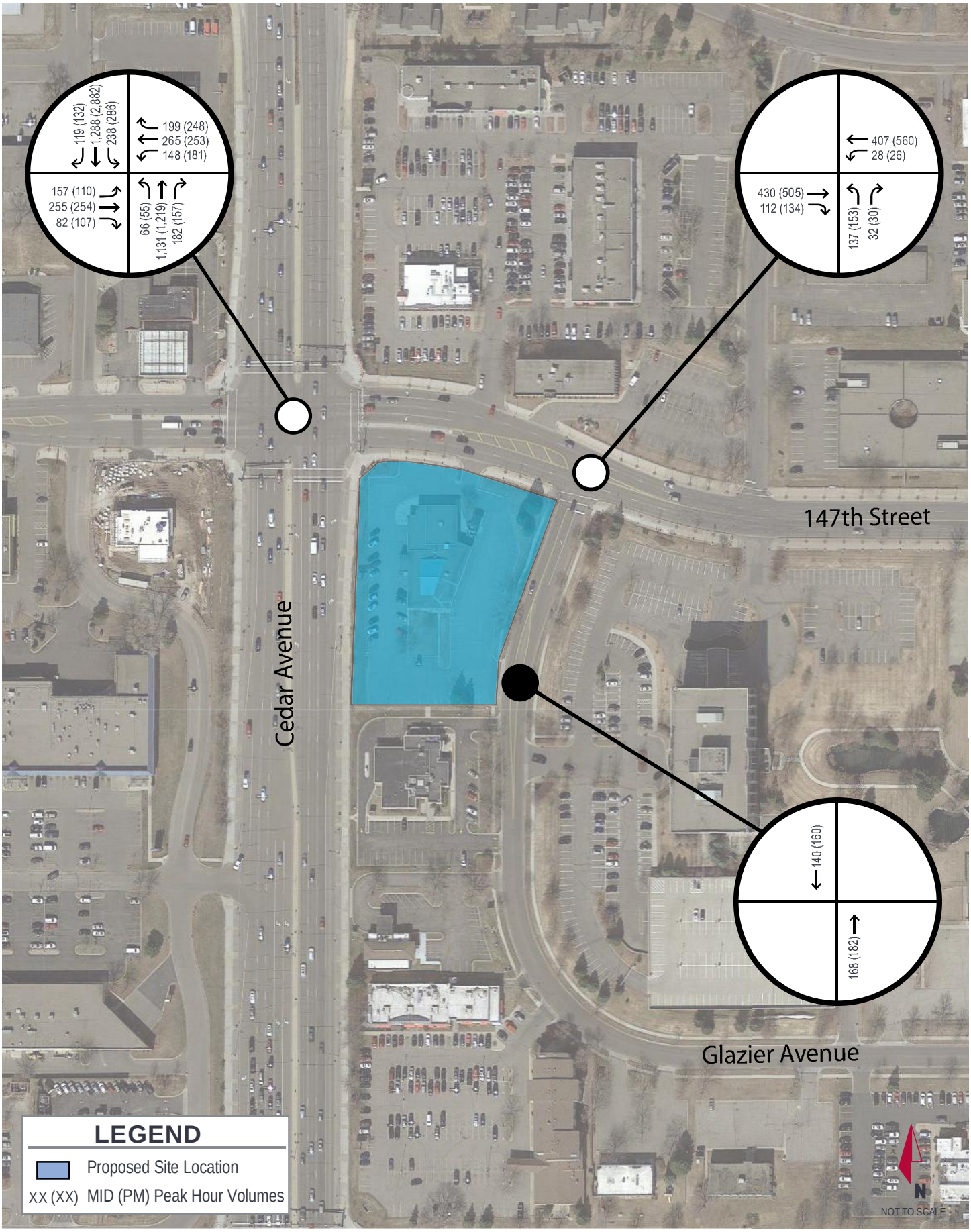
BUILD-OUT BACKGROUND TURNING MOVEMENT VOLUMES



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EXHIBIT 6

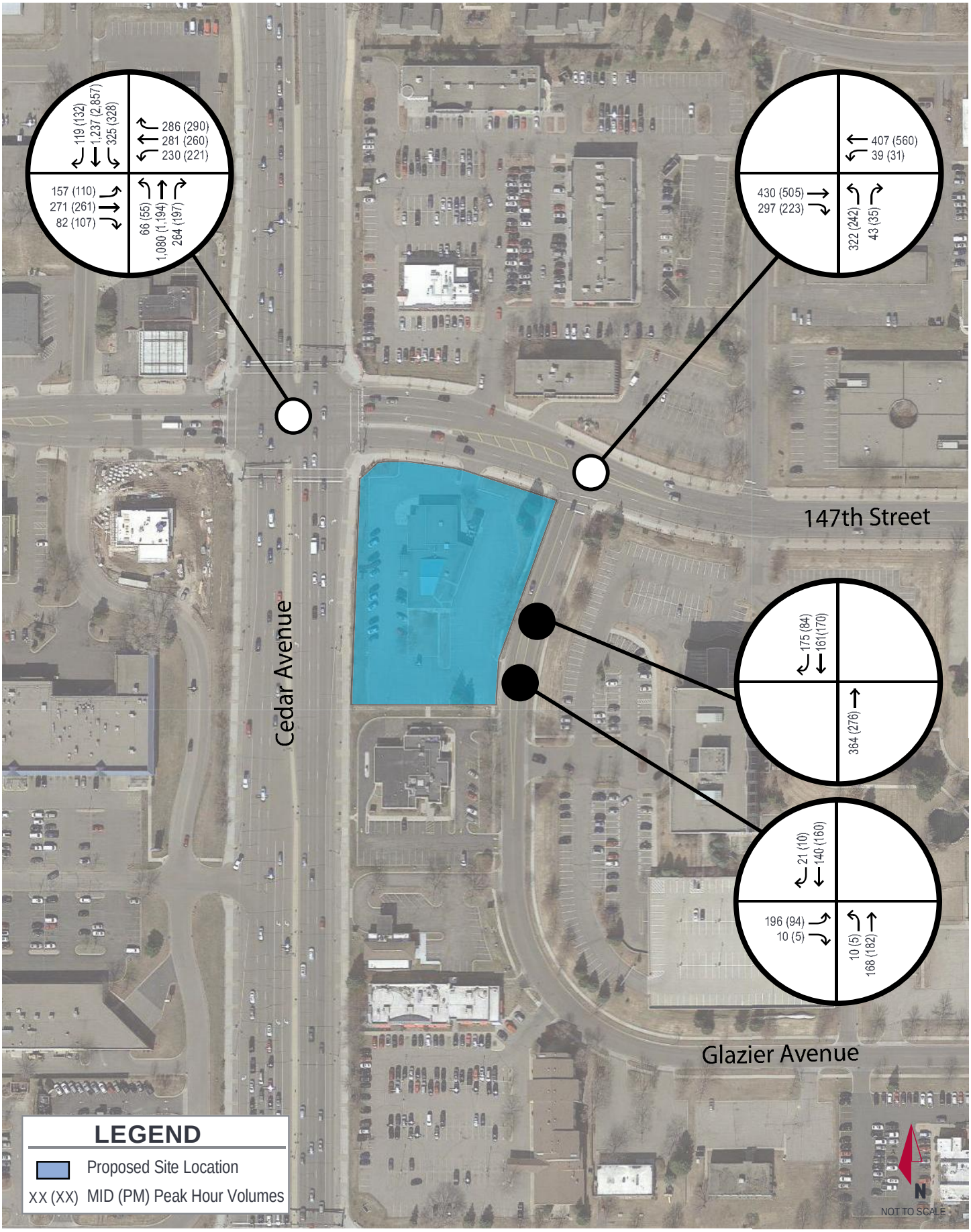
BUILD-OUT TOTAL TURNING MOVEMENT VOLUMES



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EXHIBIT 7

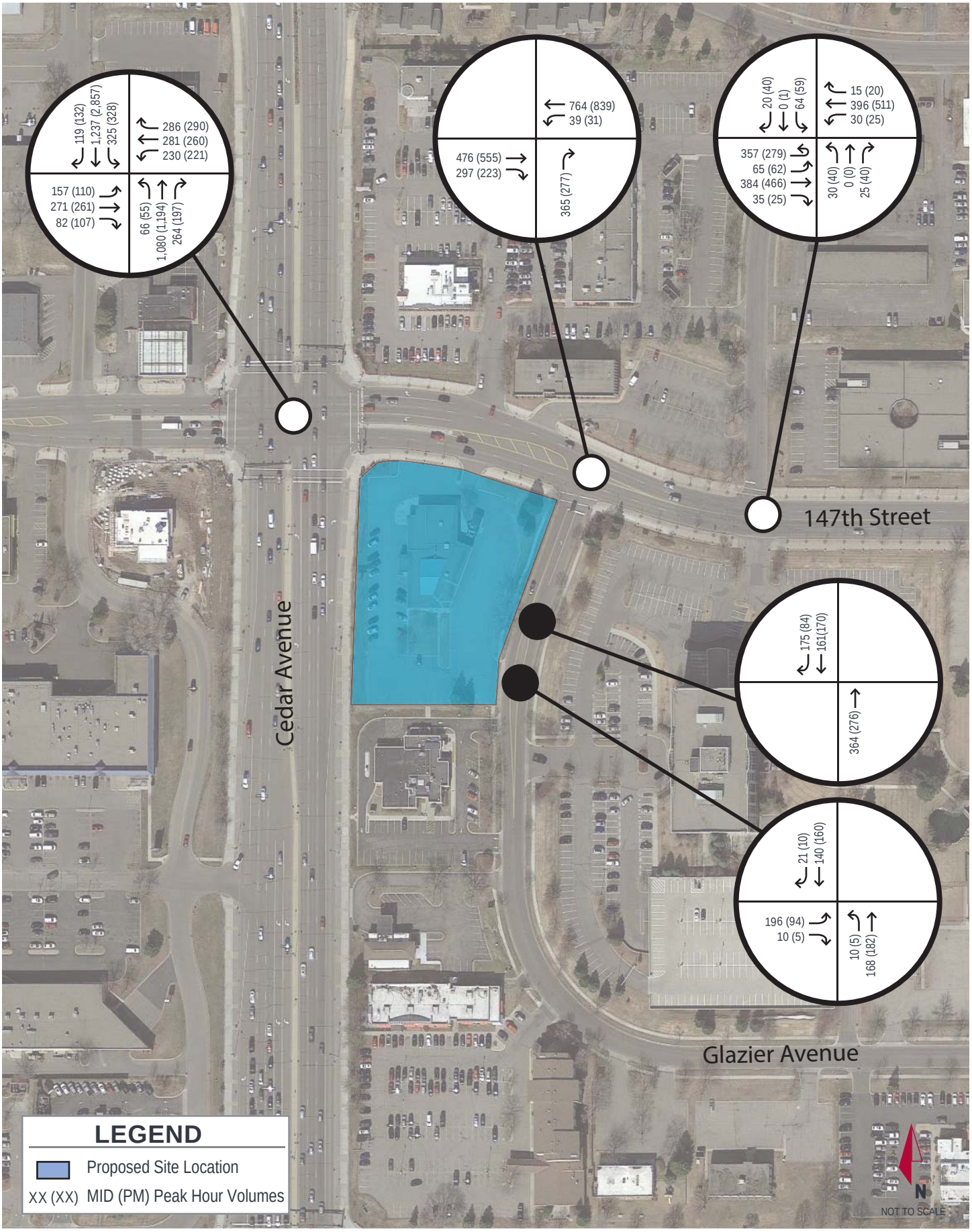
HORIZON BACKGROUND
TURNING MOVEMENT VOLUMES



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EXHIBIT 8

HORIZON TOTAL TURNING MOVEMENT VOLUMES



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EXHIBIT 9

HORIZON TOTAL WITH MITIGATION
TURNING MOVEMENT VOLUMES

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ATTACHMENT 2: TRIP GENERATION

Traffic Impact Study

for the

Proposed Portillo's Restaurant
Deerfield, Illinois



Prepared by:

Kenig, Lindgren, O'Hara, Aboona, Inc.

October 10, 2014

Introduction

This report summarizes the methodologies, results and findings of a traffic impact and parking analysis conducted by Kenig, Lindgren, O'Hara, Aboona, Inc. (KLOA, Inc.) for the proposed Portillo's restaurant to be located at 700 Lake-Cook Road in Deerfield, Illinois. The site is occupied by a vacant restaurant and is located in the northwest quadrant of the intersection of Lake-Cook Road and Deer Lake Road. **Figure 1** shows the location of the site in relation to the area roadway system.

The plans call for razing the existing building and for developing the site with a 10,507 square-foot (including a Mezzanine of approximately 1,546 square feet) Portillo's restaurant with a dual lane drive-through service. The Portillo's restaurant will be open Monday through Thursday from 10:30 A.M. to 10:30 P.M., Friday and Saturdays from 10:30 A.M. to 11:00 P.M. and on Sundays from 10:30 A.M. to 10:00 P.M. The restaurant will not be open for breakfast. Access to the site will continue to be provided via the three existing full ingress/egress access drives. **Figure 2** shows an aerial of the site and the adjacent land uses.

The following sections of this report present the following.

- Existing roadway conditions including traffic volumes for the weekday midday and evening peak hours
- A detailed description of the proposed development
- Vehicle trip generation for the proposed development
- Directional distribution of development-generated traffic
- Future transportation conditions including access to and from the development

Traffic Characteristics of the Proposed Portillo's Restaurant

To evaluate the impact of the proposed restaurant on the area roadway system, it was necessary to quantify the number of vehicle trips the restaurant will generate during the two respective peak hour periods and then determine the directions from which this traffic will approach and depart.

Proposed Site and Development Plan

The restaurant building will be located on the south side of the parcel and will provide a dual drive-through lane wrapping around the building in a counterclockwise direction. The dual lanes will provide stacking for approximately 20 vehicles (10 vehicles per lane) from the ordering board and approximately 20 vehicles (10 vehicles per lane) from the pick-up window for a total stacking of 40 vehicles. It should be noted that under the proposed plans and typical of many Portillo's restaurants, the pay window and the pick-up window will be separated to allow for a vehicle to stack in between thus enhancing the efficiency of the drive-through facility.

Access

The development will be served by three existing full ingress/egress access drives. A description of each access follows.

Full Access and Deer Lake Road - This access drive is located approximately 280 feet north of Lake-Cook Road. The access drive will be widened to provide one inbound lane and two outbound lanes striped for a shared left/through lane and an exclusive right-turn lane. Outbound movements will be under stop sign control.

Full Access and Estate Drive - This access drive is located approximately 220 feet west of Deer Lake Road and will provide one inbound lane and one outbound lane with outbound movements under stop sign control.

Full Access and 770 Lake Cook Road drive aisle - This access drive provides cross-access between the two land uses and will provide one inbound lane and one outbound lane with outbound movements under stop sign control.

Parking

The site is planned to provide a total of 124 parking spaces including five handicapped spaces. As proposed, 15 parking spaces will be located east of the restaurant building some of which could be utilized for drive-through customers that are waiting for their orders to be completed.

Directional Distribution of Site Development Traffic

The directional distribution of site-generated trips on the external roadway system is a function of several variables including the operational characteristics of the roadway system, and the ease with which drivers can travel over various sections of the roadway system, with the least amount of peak hour congestion. The directional distribution was estimated based on existing travel patterns as determined from the traffic counts.

Figure 4 shows the estimated directional distribution for the proposed restaurant.

Site Traffic Generation

The estimate of the traffic volumes that will be generated by the proposed Portillo's restaurant was based on transaction information provided by Portillo's at the following locations:

1. 806 West Dundee Road - Arlington Heights
2. 1020 South Randall Road - Elgin (Dual Drive Through)
3. 2306 East Lincoln Highway - New Lennox (Dual Drive Through)
4. 7195 Kingery Highway (IL 83) - Willowbrook

Transaction data for seven consecutive days separated between drive-through and dine in was reviewed. Based on a review of the data, the maximum number of transactions at the drive-through as well as inside the store occurred at the Arlington Heights location and as such that data was used to estimate the number of trips to be generated. Furthermore, KLOA, Inc. conducted traffic observations at the Arlington Heights location during the lunch time period that recorded the number of vehicles utilizing the drive-through lane as well as the number of customers that parked and went inside the restaurant. Based on the above, trip generation estimates were developed that took into account drive-through usage and walk-in traffic.

Table 1 shows the projected new trips to be generated by the proposed Portillo's restaurant.

Table 1
ESTIMATED PEAK HOUR TRAFFIC VOLUMES

		Midday		P.M.	
Land-Use	Size	In	Out	In	Out
Portillo's Restaurant	10,507 s.f.	258	258	124	124

It is important to note that due to the following, the traffic to be generated by the restaurant will not be all new traffic to the existing roadway system.

- Surveys conducted by the Institute of Transportation Engineers (ITE) have shown that a considerable number of trips made to drive-through restaurants are diverted from existing passing traffic. This is particularly true during the weekday morning and evening peak hours when traffic is diverted from the home-to-work and work-to-home trips. Such diverted trips are referred to as pass-by traffic. These surveys indicate that, on average, 60 percent of the peak hour trips generated by a drive-through restaurant are diverted from existing traffic on adjacent roadways.

- It is expected that the number of trips generated by the restaurant will be reduced due to the interaction (multipurpose trips) between the other uses in the immediate area (i.e., office buildings).

However, in order to provide a conservative analysis, the new traffic that will be generated by the Portillo's restaurant was not adjusted to reflect pass-by trips or interaction with other uses.

Site Traffic Assignment

The peak hour traffic volumes projected to be generated by the proposed restaurant (Table 1) were assigned to the access drives based on the directional distribution analysis (Figure 4) and are shown in **Figure 5**.

Deer Lake Road and Office Drive north of Estate Drive

The results of the capacity analyses indicate that the intersection is and will continue operating at acceptable levels of service with minimal increases in the delay experienced on the approaches under stop sign control. As such, no geometric or traffic control improvements are recommended at this intersection in conjunction with the proposed restaurant.

Estate Drive and Access Drive

This access drive is located approximately 220 feet west of Deer Lake Road and will provide full ingress/egress movements. Based on the results of the capacity analyses, the intersection will operate at acceptable levels of service with minimal queues (25 feet or less). As such, no geometric or traffic control improvements are recommended at this intersection in conjunction with the proposed restaurant.

Site Design

The site will provide 24 foot wide two-way drive aisles and 90 degree parking stalls. The drive aisle between the parking area and the building will be approximately 25 feet wide and will be striped to alert vehicles of pedestrians crossing to/from the restaurant. East-West crosswalks will be provided on the north side of the building providing pedestrian connectivity between the 770 Lake-Cook Road building , the proposed restaurant and the existing sidewalk along Deer Lake Road.

Parking

The proposed plans call for providing 124 off-street parking spaces. Based on a review of the Village of Deerfield Zoning Ordinance, the restaurant should provide a parking ratio of 1.0 parking space per 60 square feet of gross floor area (50 percent sit down) and 1.0 parking space per 120 square feet of gross floor area (50 percent carry out). Applying this, the restaurant will require 81 parking spaces for sit-down customers and 41 parking spaces for carry out customers for a total of 122 parking spaces. As such, the required number of parking spaces is two less than what is being proposed.

In order to determine the adequacy of the proposed number of parking spaces, KLOA, Inc. conducted a parking survey at the Arlington Heights restaurant on Tuesday October 7, 2014 from 11:30 A.M. to 1:30 P.M. The survey counted the number of vehicles parked in the parking field serving the restaurant as well as those that parked in the adjacent parking areas north of the restaurant. **Table 5** summarizes the parking demand of the Arlington Heights restaurant every 15 minutes.

Table 5
PORTILLOS RESTAURANT (ARLINGTON HEIGHTS) PARKING DEMAND

Time	Parking Demand
Tuesday, October 7, 2014	
11:30 A.M.	42
11:45 A.M.	58
12:00 Noon	88
12:15 P.M.	99
12:30 P.M.	100
12:45 P.M.	92
1:00 P.M.	76
1:15 P.M.	65
1:30 P.M.	56

As can be seen from the results of the parking survey, the peak parking demand occurred at 12:30 P.M. with 100 parked vehicles. Since the proposed Portillo's restaurant will be similar to the one in Arlington Heights, the proposed number of parking spaces will be adequate to accommodate the projected peak parking demand.

Proposed Drive-Through Operations

The Portillo's restaurant will provide dual drive-through lanes that will wrap around the west, south and east sides of the building with traffic traveling in a counterclockwise direction. The pick-up window will be located on the east side of the building while the ordering board will be located on the south side of the building. Traffic destined to the drive-through facility can enter the development from any of the three access drives therefore allowing site traffic to be distributed without potentially overloading a single access drive. The dual drive-through lanes will be narrowed to one lane past the pick-up window and will be under stop sign control at its intersection with the east-west main drive aisle.

Drive-Through Stacking Evaluation

Based on the site plan, the drive-through lanes have been designed to maximize vehicle storage without interfering with traffic circulation patterns within the parking lot area. The site plan indicates that 20 vehicles (10 vehicles per lane) can be stacked from the ordering window and approximately 20 (10 vehicles per lane) can be stacked from the pick-up window for a total stacking area of 40 vehicles.

In order to determine the adequacy of the proposed drive-through stacking, KLOA, Inc. observed the drive-through operations at the Portillo's restaurant in Arlington Heights which has a single drive-through lane with approximately 24 vehicles of stacking. Our observations were conducted on Tuesday September 16, 2014 from 11:30 A.M. to 1:00 P.M. and indicated that the average queue from the pick-up window was eight vehicles while the average queue from the ordering board was six vehicles. The highest observed queue was 10 vehicles from the pick-up window and 11 vehicles from the ordering for a total stacking of 21 vehicles occurring only once during the observation period. It should be noted that four employees were outside by the drive-through lane taking orders and two employees were outside by the pick-up window delivering customers their food. This system, which will be implemented at the proposed location, provides a very efficient way of operating the drive-through and speeds up the service time.

Given that the proposed restaurant will provide dual drive-through lanes with approximately 16 vehicle more stacking than the Arlington Heights restaurant, the proposed drive-through facility will be adequate in accommodating the drive-through demands.

Conclusion

Based on the proposed development plans and the preceding traffic impact study, the following conclusions and recommendations are made.

1. The Portillo's restaurant is not open during the weekday morning peak hour and typically peaks during the 12:00 to 1:00 P.M. lunch hour.

2. The traffic to be generated by the restaurant will not be all new traffic to the roadway system as a portion of the restaurant traffic will be (1) diverted from the existing traffic on the roadway system (pass-by trips) and (2) captured from the other uses within the immediate area (adjacent office buildings).

3. The existing access system will be maintained and will disperse traffic without overloading a specific intersections

4. The access drive off Deer Lake Road will be widened to provide one inbound lane and two outbound lanes striped for a combined left/through lane and an exclusive right-turn lane with outbound movements under stop sign control.

5. The volume of traffic to be generated by the proposed restaurant can be accommodated by the existing roadway system without significantly increasing the overall delays.

6. The results of the capacity analyses as well as the traffic simulations indicate that southbound queues on Deer Lake Road will not extend to the restaurant's access drive.

7. The outbound queues from the main access drive off Deer Lake Road will be minimal and will not have a negative impact on internal site circulation.

8. The proposed dual drive through lanes will maximize the amount of stacking provided (40 vehicles) which together with Portillo's typical operation of using employees to assist in taking and delivering orders will be adequate in accommodating the projected demand.

9. Outbound movements from the drive-through lane should be under stop sign control.

10. The proposed number of parking spaces will be adequate in accommodating the peak parking demand.

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ATTACHMENT 3: SIMTRAFFIC REPORTS

1: Cedar Avenue & 147th Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0
Denied Del/Veh (s)	1.8	0.1	0.1	0.3	0.0	0.2	1.6	0.2	1.6	2.4	0.1	2.0
Total Delay (hr)	0.5	1.0	0.1	0.5	0.9	0.2	0.5	10.9	0.3	2.3	2.2	0.0
Total Del/Veh (s)	34.0	38.0	12.4	35.6	38.6	11.3	51.0	20.6	6.0	46.1	9.4	2.5
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0

1: Cedar Avenue & 147th Street Performance by movement

Movement	All
Denied Delay (hr)	0.4
Denied Del/Veh (s)	0.4
Total Delay (hr)	19.3
Total Del/Veh (s)	19.5
Denied Entry Before	0
Denied Entry After	0

2: Glazier Avenue & 147th Street Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Total Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.2
Total Del/Veh (s)	1.2	1.1	4.8	0.2	8.7	2.7	1.2
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0

Total Network Performance

Denied Delay (hr)	0.4
Denied Del/Veh (s)	0.4
Total Delay (hr)	23.3
Total Del/Veh (s)	23.3
Denied Entry Before	0
Denied Entry After	0

Intersection: 1: Cedar Avenue & 147th Street

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	T	TR	L	T	T	R	L	T	T	T	R
Maximum Queue (ft)	84	74	100	88	71	61	65	128	340	328	308	122
Average Queue (ft)	31	29	31	34	36	15	24	30	232	217	174	41
95th Queue (ft)	67	60	70	73	67	41	51	88	319	310	278	87
Link Distance (ft)		2094	2094		309	309			1610	1610	1610	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	150			140			140	270				200
Storage Blk Time (%)									3		2	
Queuing Penalty (veh)									1		4	

Intersection: 1: Cedar Avenue & 147th Street

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	210	156	159	110	44
Average Queue (ft)	115	88	69	25	9
95th Queue (ft)	187	146	132	72	28
Link Distance (ft)		1688	1688	1688	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	750				215
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Glazier Avenue & 147th Street

Movement	EB	EB	WB	NB	NB
Directions Served	T	TR	LT	L	R
Maximum Queue (ft)	11	9	31	42	28
Average Queue (ft)	0	0	3	15	3
95th Queue (ft)	8	5	17	41	17
Link Distance (ft)	309	309	1309		242
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				150	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 5

1: Cedar Avenue & 147th Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.0
Denied Del/Veh (s)	1.9	0.1	0.2	0.0	0.0	0.0	2.2	0.1	2.2	1.5	0.3	1.4
Total Delay (hr)	1.1	3.4	1.1	1.8	2.7	0.5	0.8	8.0	0.3	4.3	19.2	0.3
Total Del/Veh (s)	41.4	51.7	41.0	41.4	39.9	7.8	65.1	27.0	6.4	58.4	27.5	8.9
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0

1: Cedar Avenue & 147th Street Performance by movement

Movement	All
Denied Delay (hr)	0.6
Denied Del/Veh (s)	0.4
Total Delay (hr)	43.5
Total Del/Veh (s)	30.0
Denied Entry Before	0
Denied Entry After	0

2: Glazier Avenue & 147th Street Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.2	0.2	0.0	0.0	0.1
Total Delay (hr)	0.2	0.1	0.0	0.1	0.7	0.0	1.2
Total Del/Veh (s)	1.6	1.7	8.9	1.0	19.0	3.4	3.3
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0

Total Network Performance

Denied Delay (hr)	0.6
Denied Del/Veh (s)	0.5
Total Delay (hr)	51.3
Total Del/Veh (s)	34.9
Denied Entry Before	0
Denied Entry After	0

Intersection: 1: Cedar Avenue & 147th Street

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	T	TR	L	T	T	R	L	T	T	T	R
Maximum Queue (ft)	164	249	256	163	175	156	157	111	313	295	260	100
Average Queue (ft)	67	102	128	97	80	71	49	44	214	194	136	40
95th Queue (ft)	138	193	214	164	142	127	103	88	293	275	237	74
Link Distance (ft)		2094	2094		309	309			1610	1610	1610	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	150			140			140	270				200
Storage Blk Time (%)	1	2		4	0	0	0		1		1	
Queuing Penalty (veh)	1	2		5	0	0	0		1		1	

Intersection: 1: Cedar Avenue & 147th Street

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	340	576	565	536	315
Average Queue (ft)	195	340	332	301	59
95th Queue (ft)	294	509	499	473	227
Link Distance (ft)		1688	1688	1688	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	750				215
Storage Blk Time (%)				15	
Queuing Penalty (veh)				17	

Intersection: 2: Glazier Avenue & 147th Street

Movement	EB	WB	NB	NB
Directions Served	TR	LT	L	R
Maximum Queue (ft)	18	94	121	55
Average Queue (ft)	1	15	56	19
95th Queue (ft)	8	61	99	45
Link Distance (ft)	309	1309		242
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			150	
Storage Blk Time (%)			0	
Queuing Penalty (veh)			0	

Network Summary

Network wide Queuing Penalty: 27

1: Cedar Avenue & 147th Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Denied Del/Veh (s)	1.8	0.1	0.2	0.4	0.0	0.5	2.2	0.1	2.2	2.0	0.2	1.9
Total Delay (hr)	1.5	3.2	0.7	1.5	3.2	0.3	1.0	6.7	0.3	3.4	5.4	0.1
Total Del/Veh (s)	41.3	49.3	33.8	41.9	47.8	6.8	61.6	23.5	5.8	55.7	16.8	3.4
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0

1: Cedar Avenue & 147th Street Performance by movement

Movement	All
Denied Delay (hr)	0.5
Denied Del/Veh (s)	0.5
Total Delay (hr)	27.3
Total Del/Veh (s)	26.4
Denied Entry Before	0
Denied Entry After	0

2: Glazier Avenue & 147th Street Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.1	0.0	0.1
Denied Del/Veh (s)	0.0	0.0	0.2	0.2	3.6	0.3	0.4
Total Delay (hr)	0.2	0.1	0.0	0.1	0.4	0.0	0.9
Total Del/Veh (s)	1.6	1.7	5.8	0.7	13.4	3.7	2.7
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0

Total Network Performance

Denied Delay (hr)	0.7
Denied Del/Veh (s)	0.6
Total Delay (hr)	31.3
Total Del/Veh (s)	29.6
Denied Entry Before	0
Denied Entry After	0

Intersection: 1: Cedar Avenue & 147th Street

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	T	TR	L	T	T	R	L	T	T	T	R
Maximum Queue (ft)	167	212	203	152	175	161	118	132	280	264	211	90
Average Queue (ft)	81	90	115	86	90	79	44	55	195	173	115	39
95th Queue (ft)	141	166	193	144	150	138	86	100	270	247	214	75
Link Distance (ft)		2094	2094		310	310			1611	1611	1611	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	150			140			140	270				200
Storage Blk Time (%)	1	1		2	1	1	0		0		0	
Queuing Penalty (veh)	1	1		2	1	1	0		0		0	

Intersection: 1: Cedar Avenue & 147th Street

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	276	247	258	212	51
Average Queue (ft)	158	159	144	96	18
95th Queue (ft)	251	232	221	193	41
Link Distance (ft)		1687	1687	1687	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	750				215
Storage Blk Time (%)				0	
Queuing Penalty (veh)				0	

Intersection: 2: Glazier Avenue & 147th Street

Movement	EB	EB	WB	NB	NB
Directions Served	T	TR	LT	L	R
Maximum Queue (ft)	4	15	65	102	62
Average Queue (ft)	0	1	10	48	22
95th Queue (ft)	3	8	43	81	51
Link Distance (ft)	310	310	1307		993
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				150	
Storage Blk Time (%)				0	
Queuing Penalty (veh)				0	

Network Summary

Network wide Queuing Penalty: 7

1: Cedar Avenue & 147th Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.0
Denied Del/Veh (s)	1.7	0.1	0.1	0.0	0.0	0.0	2.3	0.1	2.1	1.5	0.4	1.3
Total Delay (hr)	1.2	3.2	1.2	2.0	2.7	0.5	0.8	8.7	0.2	4.4	23.0	0.4
Total Del/Veh (s)	42.0	50.0	41.6	42.9	39.2	8.5	65.9	28.6	6.3	60.8	32.0	12.3
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	1	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0

1: Cedar Avenue & 147th Street Performance by movement

Movement	All
Denied Delay (hr)	0.6
Denied Del/Veh (s)	0.4
Total Delay (hr)	48.4
Total Del/Veh (s)	32.7
Denied Entry Before	1
Denied Entry After	0

2: Glazier Avenue & 147th Street Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.1	0.0	0.2
Denied Del/Veh (s)	0.0	0.0	0.2	0.2	3.5	0.5	0.4
Total Delay (hr)	0.2	0.1	0.1	0.1	0.8	0.0	1.3
Total Del/Veh (s)	1.7	1.8	8.6	1.0	21.4	4.1	3.6
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0

Total Network Performance

Denied Delay (hr)	0.8
Denied Del/Veh (s)	0.5
Total Delay (hr)	56.9
Total Del/Veh (s)	37.9
Denied Entry Before	1
Denied Entry After	0

Intersection: 1: Cedar Avenue & 147th Street

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	T	TR	L	T	T	R	L	T	T	T	R
Maximum Queue (ft)	149	216	260	203	206	138	132	134	333	329	268	73
Average Queue (ft)	70	92	132	101	87	71	53	46	217	198	146	34
95th Queue (ft)	133	165	212	175	161	124	99	95	300	284	247	64
Link Distance (ft)		2094	2094		312	312			1610	1610	1610	
Upstream Blk Time (%)					0							
Queuing Penalty (veh)					0							
Storage Bay Dist (ft)	150			130			140	270				200
Storage Blk Time (%)	1	1		7	1	0	0		2		1	
Queuing Penalty (veh)	1	1		8	2	1	0		1		2	

Intersection: 1: Cedar Avenue & 147th Street

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	450	632	621	595	315
Average Queue (ft)	204	382	376	351	81
95th Queue (ft)	347	595	588	573	279
Link Distance (ft)		1688	1688	1688	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	750				215
Storage Blk Time (%)		0		18	
Queuing Penalty (veh)		1		22	

Intersection: 2: Glazier Avenue & 147th Street

Movement	EB	EB	WB	NB	NB
Directions Served	T	TR	LT	L	R
Maximum Queue (ft)	11	13	96	141	66
Average Queue (ft)	0	0	17	63	19
95th Queue (ft)	8	6	66	114	51
Link Distance (ft)	312	312	1307		997
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				140	
Storage Blk Time (%)				1	
Queuing Penalty (veh)				0	

Network Summary

Network wide Queuing Penalty: 39

1: Cedar Avenue & 147th Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Denied Del/Veh (s)	1.8	0.1	0.2	0.4	0.0	0.4	2.3	0.1	2.2	2.0	0.2	2.0
Total Delay (hr)	1.8	3.2	0.7	1.5	3.2	0.4	1.0	6.7	0.3	3.4	5.3	0.1
Total Del/Veh (s)	42.6	50.1	34.1	40.8	49.6	7.2	65.1	23.7	6.0	59.0	16.5	3.8
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0

1: Cedar Avenue & 147th Street Performance by movement

Movement	All
Denied Delay (hr)	0.5
Denied Del/Veh (s)	0.5
Total Delay (hr)	27.6
Total Del/Veh (s)	26.7
Denied Entry Before	0
Denied Entry After	0

2: Glazier Avenue & 147th Street Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.1	0.0	0.1
Denied Del/Veh (s)	0.0	0.0	0.2	0.2	3.6	0.4	0.4
Total Delay (hr)	0.2	0.0	0.0	0.1	0.5	0.0	0.9
Total Del/Veh (s)	1.6	1.6	5.8	0.7	14.4	3.8	2.8
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0

Total Network Performance

Denied Delay (hr)	0.7
Denied Del/Veh (s)	0.6
Total Delay (hr)	31.5
Total Del/Veh (s)	29.8
Denied Entry Before	0
Denied Entry After	0

Intersection: 1: Cedar Avenue & 147th Street

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	T	TR	L	T	T	R	L	T	T	T	R
Maximum Queue (ft)	176	197	234	188	188	184	123	159	289	260	228	90
Average Queue (ft)	91	88	115	89	92	77	42	55	195	172	117	38
95th Queue (ft)	157	160	188	155	153	137	84	117	267	244	212	71
Link Distance (ft)		2094	2094		311	311			1610	1610	1610	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	150			130			140	270				200
Storage Blk Time (%)	2	1		5	2	1			0		0	
Queuing Penalty (veh)	2	2		5	3	1			0		1	

Intersection: 1: Cedar Avenue & 147th Street

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	294	257	244	195	56
Average Queue (ft)	157	157	146	92	18
95th Queue (ft)	253	229	219	180	41
Link Distance (ft)		1688	1688	1688	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	750				215
Storage Blk Time (%)				0	
Queuing Penalty (veh)				0	

Intersection: 2: Glazier Avenue & 147th Street

Movement	EB	EB	WB	NB	NB
Directions Served	T	TR	LT	L	R
Maximum Queue (ft)	9	18	75	115	64
Average Queue (ft)	0	1	14	49	22
95th Queue (ft)	7	9	53	88	52
Link Distance (ft)	311	311	1307		908
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				140	
Storage Blk Time (%)				0	
Queuing Penalty (veh)				0	

Network Summary

Network wide Queuing Penalty: 14

1: Cedar Avenue & 147th Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.0
Denied Del/Veh (s)	1.7	0.1	0.1	0.0	0.0	0.0	2.0	0.2	2.1	1.6	0.4	1.4
Total Delay (hr)	1.1	3.5	1.2	2.7	2.8	0.6	0.9	10.0	0.5	5.6	22.7	0.4
Total Del/Veh (s)	40.4	53.0	44.4	46.2	37.8	8.3	63.9	33.2	9.1	64.1	32.3	11.6
Vehicles Entered	101	231	91	212	265	257	49	1072	180	305	2505	114
Vehicles Exited	99	229	92	209	265	258	48	1068	179	308	2499	115
Hourly Exit Rate	99	229	92	209	265	258	48	1068	179	308	2499	115
Input Volume	98	232	95	201	266	262	48	1057	179	296	2532	117
% of Volume	101	99	97	104	100	99	100	101	100	104	99	98
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0

1: Cedar Avenue & 147th Street Performance by movement

Movement	All
Denied Delay (hr)	0.7
Denied Del/Veh (s)	0.5
Total Delay (hr)	52.0
Total Del/Veh (s)	34.3
Vehicles Entered	5382
Vehicles Exited	5369
Hourly Exit Rate	5369
Input Volume	5382
% of Volume	100
Denied Entry Before	0
Denied Entry After	0

2: Glazier Avenue & 147th Street Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.1
Total Delay (hr)	0.2	0.1	0.1	0.2	1.8	0.0	0.0	2.4
Total Del/Veh (s)	1.7	2.1	8.3	1.3	28.1	0.3	3.4	5.8
Vehicles Entered	503	214	29	503	227	3	33	1512
Vehicles Exited	503	214	28	503	227	3	34	1512
Hourly Exit Rate	503	214	28	503	227	3	34	1512
Input Volume	499	208	28	497	224	2	31	1488
% of Volume	101	103	101	101	101	171	111	102
Denied Entry Before	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0

Intersection: 1: Cedar Avenue & 147th Street

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	T	TR	L	T	T	R	L	T	T	T	R
Maximum Queue (ft)	150	200	239	227	285	211	128	158	368	359	308	159
Average Queue (ft)	66	93	136	132	94	79	54	52	236	219	170	52
95th Queue (ft)	123	166	215	209	192	155	101	126	333	316	270	107
Link Distance (ft)		2094	2094		312	312			1610	1610	1610	
Upstream Blk Time (%)					1	0						
Queuing Penalty (veh)					2	0						
Storage Bay Dist (ft)	150			130			140	270				200
Storage Blk Time (%)	0	2		14	1	0	0	0	4		3	
Queuing Penalty (veh)	0	2		16	3	1	0	0	2		5	

Intersection: 1: Cedar Avenue & 147th Street

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	440	659	659	627	315
Average Queue (ft)	246	388	377	354	67
95th Queue (ft)	399	595	579	559	244
Link Distance (ft)		1688	1688	1688	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	750				215
Storage Blk Time (%)		0		19	
Queuing Penalty (veh)		1		22	

Intersection: 2: Glazier Avenue & 147th Street

Movement	EB	WB	WB	NB	NB
Directions Served	TR	LT	T	L	R
Maximum Queue (ft)	18	111	32	176	39
Average Queue (ft)	2	22	1	95	20
95th Queue (ft)	14	75	24	167	44
Link Distance (ft)	312	1306	1306	114	114
Upstream Blk Time (%)				12	
Queuing Penalty (veh)				16	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

1: Cedar Avenue & 147th Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1
Denied Del/Veh (s)	1.8	0.1	0.2	0.3	0.0	0.3	2.2	0.2	2.2	2.1	0.2	1.9
Total Delay (hr)	1.5	3.6	0.9	3.5	3.3	0.6	1.2	8.2	0.8	5.1	5.8	0.1
Total Del/Veh (s)	41.1	52.0	42.8	56.5	44.5	7.9	65.9	30.8	10.4	61.5	18.6	4.4
Vehicles Entered	132	241	74	219	261	270	61	940	258	292	1105	111
Vehicles Exited	130	241	73	219	262	271	62	939	258	293	1102	112
Hourly Exit Rate	130	241	73	219	262	271	62	939	258	293	1102	112
Input Volume	139	242	73	213	251	264	59	953	244	298	1092	106
% of Volume	93	99	100	103	104	103	105	99	106	98	101	106
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0

1: Cedar Avenue & 147th Street Performance by movement

Movement	All
Denied Delay (hr)	0.7
Denied Del/Veh (s)	0.6
Total Delay (hr)	34.5
Total Del/Veh (s)	30.9
Vehicles Entered	3964
Vehicles Exited	3962
Hourly Exit Rate	3962
Input Volume	3935
% of Volume	101
Denied Entry Before	0
Denied Entry After	0

2: Glazier Avenue & 147th Street Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.1
Total Delay (hr)	0.2	0.2	0.1	0.1	2.8	0.0	0.0	3.5
Total Del/Veh (s)	1.6	2.2	8.3	1.2	33.2	0.6	3.2	8.0
Vehicles Entered	502	291	34	389	303	2	35	1556
Vehicles Exited	502	290	34	390	301	2	35	1554
Hourly Exit Rate	502	290	34	390	301	2	35	1554
Input Volume	501	284	36	362	306	1	39	1528
% of Volume	100	102	94	108	98	200	90	102
Denied Entry Before	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0

Intersection: 1: Cedar Avenue & 147th Street

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	T	TR	L	T	T	R	L	T	T	T	R
Maximum Queue (ft)	199	248	271	223	284	230	147	184	323	293	278	204
Average Queue (ft)	90	101	136	148	113	96	53	60	213	190	137	72
95th Queue (ft)	159	183	222	234	216	181	104	128	289	265	239	142
Link Distance (ft)		2094	2094		312	312			1610	1610	1610	
Upstream Blk Time (%)					0	0						
Queuing Penalty (veh)					1	0						
Storage Bay Dist (ft)	150			130			140	270				200
Storage Blk Time (%)	2	3		22	3	1	0		2		1	0
Queuing Penalty (veh)	2	4		28	6	2	0		1		2	0

Intersection: 1: Cedar Avenue & 147th Street

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	404	268	264	250	69
Average Queue (ft)	229	159	153	109	22
95th Queue (ft)	345	239	236	209	51
Link Distance (ft)		1688	1688	1688	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	750				215
Storage Blk Time (%)				0	
Queuing Penalty (veh)				0	

Intersection: 2: Glazier Avenue & 147th Street

Movement	EB	WB	WB	NB	NB
Directions Served	TR	LT	T	L	R
Maximum Queue (ft)	40	103	30	188	49
Average Queue (ft)	3	23	2	121	21
95th Queue (ft)	20	77	29	195	46
Link Distance (ft)	312	1306	1306	114	114
Upstream Blk Time (%)				29	
Queuing Penalty (veh)				52	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

1: Cedar Avenue & 147th Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	2.8	0.2
Denied Del/Veh (s)	1.7	0.1	0.1	0.0	0.0	0.0	2.0	0.2	2.0	4.3	3.5	4.9
Total Delay (hr)	1.4	4.0	1.3	2.5	3.3	0.7	1.0	11.3	0.3	6.9	82.9	2.8
Total Del/Veh (s)	42.8	53.3	44.5	48.1	39.9	10.6	65.4	33.0	8.0	87.2	102.2	77.1
Vehicles Entered	114	262	103	184	294	243	54	1214	155	273	2853	129
Vehicles Exited	115	266	103	185	295	242	53	1209	156	276	2782	125
Hourly Exit Rate	115	266	103	185	295	242	53	1209	156	276	2782	125
Input Volume	110	254	107	181	284	248	55	1219	157	286	2882	132
% of Volume	105	105	96	102	104	97	96	99	100	97	97	95
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	2	0
Denied Entry After	0	0	0	0	0	0	0	0	0	1	7	1

1: Cedar Avenue & 147th Street Performance by movement

Movement	All
Denied Delay (hr)	3.5
Denied Del/Veh (s)	2.1
Total Delay (hr)	118.5
Total Del/Veh (s)	71.1
Vehicles Entered	5878
Vehicles Exited	5807
Hourly Exit Rate	5807
Input Volume	5915
% of Volume	98
Denied Entry Before	2
Denied Entry After	9

2: Glazier Avenue & 147th Street Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.3	0.2	0.0	0.0	0.1
Total Delay (hr)	0.3	0.1	0.1	0.2	1.1	0.0	1.7
Total Del/Veh (s)	1.8	1.8	7.5	1.0	25.4	3.3	4.1
Vehicles Entered	566	132	25	565	156	29	1473
Vehicles Exited	564	132	25	565	156	29	1471
Hourly Exit Rate	564	132	25	565	156	29	1471
Input Volume	563	134	26	560	153	30	1466
% of Volume	100	98	97	101	102	97	100
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0

Total Network Performance

Denied Delay (hr)	3.5
Denied Del/Veh (s)	2.1
Total Delay (hr)	129.3
Total Del/Veh (s)	75.9
Vehicles Entered	5932
Vehicles Exited	5871
Hourly Exit Rate	5871
Input Volume	13606
% of Volume	43
Denied Entry Before	2
Denied Entry After	9

Intersection: 1: Cedar Avenue & 147th Street

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	T	TR	L	T	T	R	L	T	T	T	R
Maximum Queue (ft)	192	214	240	223	243	228	178	204	408	388	356	258
Average Queue (ft)	78	112	151	121	102	90	63	55	261	242	188	49
95th Queue (ft)	151	187	224	207	177	153	126	128	366	351	306	126
Link Distance (ft)		2094	2094		309	309			1610	1610	1610	
Upstream Blk Time (%)					0	0						
Queuing Penalty (veh)					0	0						
Storage Bay Dist (ft)	150			130			140	270				200
Storage Blk Time (%)	1	4		13	2	1	0	0	7		5	
Queuing Penalty (veh)	2	5		17	4	2	1	0	4		7	

Intersection: 1: Cedar Avenue & 147th Street

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	850	1719	1709	1674	315
Average Queue (ft)	575	1087	1056	1015	151
95th Queue (ft)	1096	1891	1824	1751	391
Link Distance (ft)		1688	1688	1688	
Upstream Blk Time (%)		8	4	5	
Queuing Penalty (veh)		0	0	0	
Storage Bay Dist (ft)	750				215
Storage Blk Time (%)		27		40	
Queuing Penalty (veh)		78		54	

Intersection: 2: Glazier Avenue & 147th Street

Movement	EB	EB	WB	NB	NB
Directions Served	T	TR	LT	L	R
Maximum Queue (ft)	20	9	100	170	133
Average Queue (ft)	1	1	16	73	22
95th Queue (ft)	10	7	61	132	66
Link Distance (ft)	309	309	1309		242
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				140	
Storage Blk Time (%)				2	0
Queuing Penalty (veh)				1	0

Network Summary

Network wide Queuing Penalty: 174

1: Cedar Avenue & 147th Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Denied Del/Veh (s)	1.9	0.1	0.2	0.4	0.0	0.4	2.0	0.2	2.0	2.0	0.2	1.8
Total Delay (hr)	1.9	3.7	0.8	1.8	3.7	0.5	1.3	8.6	0.4	4.2	6.6	0.1
Total Del/Veh (s)	45.1	50.7	35.0	42.9	49.7	8.4	65.7	27.2	8.1	61.4	18.2	4.3
Vehicles Entered	152	253	81	144	258	207	71	1126	195	244	1284	116
Vehicles Exited	151	256	80	145	262	207	70	1124	195	243	1280	116
Hourly Exit Rate	151	256	80	145	262	207	70	1124	195	243	1280	116
Input Volume	157	255	82	148	265	199	66	1131	182	238	1288	119
% of Volume	96	100	97	98	99	104	106	99	107	102	99	97
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0

1: Cedar Avenue & 147th Street Performance by movement

Movement	All
Denied Delay (hr)	0.6
Denied Del/Veh (s)	0.5
Total Delay (hr)	33.7
Total Del/Veh (s)	28.9
Vehicles Entered	4131
Vehicles Exited	4129
Hourly Exit Rate	4129
Input Volume	4130
% of Volume	100
Denied Entry Before	0
Denied Entry After	0

2: Glazier Avenue & 147th Street Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.3	0.2	0.0	0.0	0.1
Total Delay (hr)	0.3	0.1	0.1	0.1	0.7	0.0	1.2
Total Del/Veh (s)	1.6	1.9	7.5	0.9	18.2	3.4	3.4
Vehicles Entered	568	125	31	408	139	35	1306
Vehicles Exited	567	126	31	407	140	35	1306
Hourly Exit Rate	567	126	31	407	140	35	1306
Input Volume	564	112	28	407	137	32	1280
% of Volume	101	113	112	100	102	110	102
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0

Total Network Performance

Denied Delay (hr)	0.6
Denied Del/Veh (s)	0.5
Total Delay (hr)	38.7
Total Del/Veh (s)	32.4
Vehicles Entered	4196
Vehicles Exited	4188
Hourly Exit Rate	4188
Input Volume	9774
% of Volume	43
Denied Entry Before	0
Denied Entry After	0

Intersection: 1: Cedar Avenue & 147th Street

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	T	TR	L	T	T	R	L	T	T	T	R
Maximum Queue (ft)	204	191	223	209	209	188	164	165	323	311	256	116
Average Queue (ft)	101	102	131	92	107	95	50	65	220	200	147	49
95th Queue (ft)	175	174	205	166	175	156	106	128	306	286	248	90
Link Distance (ft)		2094	2094		309	309			1610	1610	1610	
Upstream Blk Time (%)					0							
Queuing Penalty (veh)					0							
Storage Bay Dist (ft)	150			130			140	270				200
Storage Blk Time (%)	4	2		5	4	2			2		2	
Queuing Penalty (veh)	5	4		7	6	4			1		3	

Intersection: 1: Cedar Avenue & 147th Street

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	358	262	276	219	56
Average Queue (ft)	193	179	172	129	20
95th Queue (ft)	306	246	246	216	45
Link Distance (ft)		1688	1688	1688	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	750				215
Storage Blk Time (%)				0	
Queuing Penalty (veh)				0	

Intersection: 2: Glazier Avenue & 147th Street

Movement	EB	WB	NB	NB
Directions Served	TR	LT	L	R
Maximum Queue (ft)	13	96	138	54
Average Queue (ft)	0	18	59	21
95th Queue (ft)	5	63	107	46
Link Distance (ft)	309	1309		242
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			140	
Storage Blk Time (%)			0	
Queuing Penalty (veh)			0	

Network Summary

Network wide Queuing Penalty: 30

1: Cedar Avenue & 147th Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	1.5	11.7	0.6
Denied Del/Veh (s)	1.8	0.1	0.2	0.0	0.0	0.0	2.0	0.2	2.0	16.2	14.7	15.4
Total Delay (hr)	1.3	3.9	1.7	3.3	3.1	0.9	0.9	12.8	0.9	9.4	91.3	3.2
Total Del/Veh (s)	39.3	53.4	55.6	53.4	38.3	10.6	66.9	38.7	15.1	100.5	114.2	88.0
Vehicles Entered	112	257	107	218	291	292	50	1180	205	329	2813	128
Vehicles Exited	113	259	105	219	292	293	49	1169	200	316	2737	123
Hourly Exit Rate	113	259	105	219	292	293	49	1169	200	316	2737	123
Input Volume	110	261	107	221	299	290	55	1194	197	328	2857	132
% of Volume	103	99	98	99	98	101	89	98	101	96	96	93
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	4	40	1

1: Cedar Avenue & 147th Street Performance by movement

Movement	All
Denied Delay (hr)	14.0
Denied Del/Veh (s)	8.4
Total Delay (hr)	132.8
Total Del/Veh (s)	78.3
Vehicles Entered	5982
Vehicles Exited	5875
Hourly Exit Rate	5875
Input Volume	6051
% of Volume	97
Denied Entry Before	0
Denied Entry After	45

2: Glazier Avenue & 147th Street Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Denied Del/Veh (s)	0.0	0.0	0.2	0.2	0.5	0.0	0.0	0.1
Total Delay (hr)	0.3	0.4	0.1	0.3	4.2	0.0	0.0	5.4
Total Del/Veh (s)	2.1	7.3	15.6	2.1	63.0	0.4	3.8	11.9
Vehicles Entered	560	216	27	565	235	2	31	1636
Vehicles Exited	556	213	28	562	233	2	31	1625
Hourly Exit Rate	556	213	28	562	233	2	31	1625
Input Volume	563	223	31	560	242	1	35	1655
% of Volume	99	96	91	100	96	160	89	98
Denied Entry Before	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0

Intersection: 1: Cedar Avenue & 147th Street

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	T	TR	L	T	T	R	L	T	T	T	R
Maximum Queue (ft)	204	273	300	225	304	197	178	193	422	428	398	290
Average Queue (ft)	78	124	165	145	114	89	70	53	277	255	203	72
95th Queue (ft)	158	230	266	231	244	174	137	124	383	362	305	169
Link Distance (ft)		2094	2094		312	312			1610	1610	1610	
Upstream Blk Time (%)					1	0						
Queuing Penalty (veh)					4	0						
Storage Bay Dist (ft)	150			130			140	270				200
Storage Blk Time (%)	1	4		20	2	1	1		10		5	2
Queuing Penalty (veh)	1	4		25	5	3	1		5		10	7

Intersection: 1: Cedar Avenue & 147th Street

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	850	1603	1587	1586	315
Average Queue (ft)	615	1172	1158	1125	162
95th Queue (ft)	1103	1940	1910	1873	403
Link Distance (ft)		1688	1688	1688	
Upstream Blk Time (%)		15	10	12	
Queuing Penalty (veh)		0	0	0	
Storage Bay Dist (ft)	750				215
Storage Blk Time (%)	0	31		43	
Queuing Penalty (veh)	3	102		57	

Intersection: 2: Glazier Avenue & 147th Street

Movement	EB	EB	WB	WB	NB	NB
Directions Served	T	TR	LT	T	L	R
Maximum Queue (ft)	39	97	190	107	193	45
Average Queue (ft)	2	12	30	5	140	20
95th Queue (ft)	25	100	105	53	217	45
Link Distance (ft)	312	312	1306	1306	114	114
Upstream Blk Time (%)		3			52	
Queuing Penalty (veh)		10			73	
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

1: Cedar Avenue & 147th Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.1	0.1
Denied Del/Veh (s)	1.8	0.1	0.1	0.4	0.0	0.4	2.0	0.2	2.1	1.9	0.2	1.8
Total Delay (hr)	2.2	4.3	0.9	3.5	3.5	0.7	1.2	10.4	1.0	6.1	7.2	0.2
Total Del/Veh (s)	47.5	55.5	43.3	55.7	45.4	8.6	69.6	34.6	12.7	66.8	20.8	4.6
Vehicles Entered	159	271	75	218	274	282	61	1061	289	319	1226	117
Vehicles Exited	159	270	76	218	274	281	60	1063	287	323	1223	118
Hourly Exit Rate	159	270	76	218	274	281	60	1063	287	323	1223	118
Input Volume	157	271	82	230	281	286	66	1080	264	325	1237	119
% of Volume	101	100	92	95	98	98	91	98	109	99	99	99
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0

1: Cedar Avenue & 147th Street Performance by movement

Movement	All
Denied Delay (hr)	0.7
Denied Del/Veh (s)	0.6
Total Delay (hr)	41.0
Total Del/Veh (s)	33.4
Vehicles Entered	4352
Vehicles Exited	4352
Hourly Exit Rate	4352
Input Volume	4397
% of Volume	99
Denied Entry Before	0
Denied Entry After	0

2: Glazier Avenue & 147th Street Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3
Denied Del/Veh (s)	0.0	0.0	0.2	0.2	3.7	0.0	0.0	0.7
Total Delay (hr)	0.3	0.2	0.2	0.2	4.9	0.0	0.0	5.8
Total Del/Veh (s)	1.7	2.4	12.8	2.1	56.4	0.4	3.6	12.5
Vehicles Entered	568	312	42	395	309	3	42	1671
Vehicles Exited	569	313	43	394	309	3	42	1673
Hourly Exit Rate	569	313	43	394	309	3	42	1673
Input Volume	562	297	39	407	322	2	43	1672
% of Volume	101	105	110	97	96	171	98	100
Denied Entry Before	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	1	0	0	1

Intersection: 1: Cedar Avenue & 147th Street

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	T	TR	L	T	T	R	L	T	T	T	R
Maximum Queue (ft)	242	243	284	229	291	210	169	216	372	347	277	186
Average Queue (ft)	110	118	152	150	122	101	62	64	248	224	171	76
95th Queue (ft)	190	205	228	229	232	170	131	139	338	315	270	132
Link Distance (ft)		2094	2094		312	312			1610	1610	1610	
Upstream Blk Time (%)					0	0						
Queuing Penalty (veh)					0	0						
Storage Bay Dist (ft)	150			130			140	270				200
Storage Blk Time (%)	5	4		23	4	2	0	0	5		3	0
Queuing Penalty (veh)	7	6		32	9	4	1	0	3		7	1

Intersection: 1: Cedar Avenue & 147th Street

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	479	280	287	250	63
Average Queue (ft)	271	182	177	141	20
95th Queue (ft)	443	267	263	239	46
Link Distance (ft)		1688	1688	1688	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	750				215
Storage Blk Time (%)				0	
Queuing Penalty (veh)				0	

Intersection: 2: Glazier Avenue & 147th Street

Movement	EB	WB	WB	NB	NB
Directions Served	TR	LT	T	L	R
Maximum Queue (ft)	56	144	29	190	50
Average Queue (ft)	5	39	1	156	22
95th Queue (ft)	29	105	21	219	49
Link Distance (ft)	312	1306	1306	114	114
Upstream Blk Time (%)				66	
Queuing Penalty (veh)				121	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

1: Cedar Avenue & 147th Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.1
Denied Del/Veh (s)	1.7	0.1	0.2	0.1	0.0	0.2	2.2	0.2	2.0	2.0	0.2	1.8
Total Delay (hr)	2.1	4.4	1.0	4.3	4.1	0.9	1.4	10.9	0.8	6.2	7.6	0.2
Total Del/Veh (s)	49.6	56.8	42.3	66.7	51.6	11.3	71.8	36.3	11.4	65.5	21.9	5.2
Vehicles Entered	147	276	80	230	283	279	70	1070	258	337	1235	130
Vehicles Exited	148	273	80	228	279	279	68	1070	255	335	1242	129
Hourly Exit Rate	148	273	80	228	279	279	68	1070	255	335	1242	129
Input Volume	157	271	82	230	281	286	66	1080	264	325	1237	119
% of Volume	94	101	97	99	99	98	103	99	97	103	100	108
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0

1: Cedar Avenue & 147th Street Performance by movement

Movement	All
Denied Delay (hr)	0.7
Denied Del/Veh (s)	0.5
Total Delay (hr)	44.0
Total Del/Veh (s)	35.5
Vehicles Entered	4395
Vehicles Exited	4386
Hourly Exit Rate	4386
Input Volume	4397
% of Volume	100
Denied Entry Before	0
Denied Entry After	0

2: Glazier Avenue & 147th Street Performance by movement

Movement	EBT	EBR	WBL	WBT	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	0.3	0.2	0.1	0.3	0.0	0.8	1.8
Total Del/Veh (s)	2.2	2.4	9.8	1.6	3.0	8.5	3.2
Vehicles Entered	570	294	35	771	1	351	2022
Vehicles Exited	571	294	35	771	1	351	2023
Hourly Exit Rate	571	294	35	771	1	351	2023
Input Volume	562	297	39	774	1	365	2038
% of Volume	102	99	90	100	100	96	99
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0

Total Zone Performance

Denied Delay (hr)	0.7
Denied Del/Veh (s)	0.7
Total Delay (hr)	45.9
Total Del/Veh (s)	922.3
Vehicles Entered	3646
Vehicles Exited	97
Hourly Exit Rate	97
Input Volume	6435
% of Volume	2
Denied Entry Before	0
Denied Entry After	0

Intersection: 1: Cedar Avenue & 147th Street

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	T	TR	L	T	T	R	L	T	T	T	R
Maximum Queue (ft)	228	272	270	287	299	232	190	205	391	364	296	198
Average Queue (ft)	108	126	150	178	122	115	77	69	250	229	178	71
95th Queue (ft)	188	224	246	277	244	192	154	139	343	318	276	136
Link Distance (ft)		2094	2094		317	317			1610	1610	1610	
Upstream Blk Time (%)				0	1	0						
Queuing Penalty (veh)				0	4	0						
Storage Bay Dist (ft)	150			200			140	270				200
Storage Blk Time (%)	4	6		14	0	5	1		5		3	
Queuing Penalty (veh)	5	10		20	1	14	1		3		7	

Intersection: 1: Cedar Avenue & 147th Street

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	462	312	290	260	70
Average Queue (ft)	275	195	187	150	24
95th Queue (ft)	424	273	264	242	54
Link Distance (ft)		1688	1688	1688	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	750				215
Storage Blk Time (%)				1	
Queuing Penalty (veh)				1	

Intersection: 2: Glazier Avenue & 147th Street

Movement	EB	WB	WB	NB
Directions Served	TR	LT	T	R
Maximum Queue (ft)	57	138	94	168
Average Queue (ft)	8	34	4	79
95th Queue (ft)	34	102	38	143
Link Distance (ft)	317	160	160	116
Upstream Blk Time (%)		0	0	4
Queuing Penalty (veh)		0	0	14
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Zone Summary

Zone wide Queuing Penalty: 80

1: Cedar Avenue & 147th Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	2.0	15.7	0.8
Denied Del/Veh (s)	1.8	0.1	0.2	0.0	0.0	0.0	1.9	0.2	2.0	21.5	19.8	21.5
Total Delay (hr)	1.3	4.4	1.5	3.9	3.7	1.1	1.0	13.0	0.5	8.8	89.2	3.2
Total Del/Veh (s)	41.3	56.6	46.5	60.3	37.2	13.2	69.1	37.8	9.7	94.5	111.8	87.1
Vehicles Entered	108	272	111	224	347	287	51	1209	192	329	2801	129
Vehicles Exited	109	273	112	225	347	287	50	1209	192	320	2737	126
Hourly Exit Rate	109	273	112	225	347	287	50	1209	192	320	2737	126
Input Volume	110	261	107	221	335	290	55	1191	197	328	2857	132
% of Volume	99	105	105	102	104	99	91	102	97	98	96	95
Denied Entry Before	0	0	0	0	0	0	0	0	0	1	1	0
Denied Entry After	0	0	0	0	0	0	0	0	0	5	51	2

1: Cedar Avenue & 147th Street Performance by movement

Movement	All
Denied Delay (hr)	18.8
Denied Del/Veh (s)	11.0
Total Delay (hr)	131.4
Total Del/Veh (s)	76.3
Vehicles Entered	6060
Vehicles Exited	5987
Hourly Exit Rate	5987
Input Volume	6084
% of Volume	98
Denied Entry Before	2
Denied Entry After	58

2: Glazier Avenue & 147th Street Performance by movement

Movement	EBT	EBR	WBL	WBT	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay (hr)	0.4	0.1	0.1	0.4	0.0	0.5	1.6
Total Del/Veh (s)	2.3	2.2	11.1	1.7		7.4	2.9
Vehicles Entered	558	231	30	864	0	261	1944
Vehicles Exited	560	230	29	863	0	261	1943
Hourly Exit Rate	560	230	29	863	0	261	1943
Input Volume	568	223	31	848	0	277	1947
% of Volume	99	103	94	102	0	94	100
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0

Total Zone Performance

Denied Delay (hr)	18.8
Denied Del/Veh (s)	12.8
Total Delay (hr)	132.9
Total Del/Veh (s)	1509.3
Vehicles Entered	5226
Vehicles Exited	100
Hourly Exit Rate	100
Input Volume	8031
% of Volume	1
Denied Entry Before	2
Denied Entry After	58

Intersection: 1: Cedar Avenue & 147th Street

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	T	TR	L	T	T	R	L	T	T	T	R
Maximum Queue (ft)	186	224	307	254	264	243	188	218	426	393	339	252
Average Queue (ft)	71	124	166	174	122	106	83	58	279	254	204	62
95th Queue (ft)	138	205	266	279	254	189	160	150	381	354	303	150
Link Distance (ft)		2094	2094		317	317			1610	1610	1610	
Upstream Blk Time (%)				0	1	0						
Queuing Penalty (veh)				0	4	0						
Storage Bay Dist (ft)	150			200			140	270				200
Storage Blk Time (%)	1	6		12	0	2	2	0	10		6	
Queuing Penalty (veh)	1	7		16	1	7	2	0	5		13	

Intersection: 1: Cedar Avenue & 147th Street

Movement	SB	SB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	850	1596	1594	1583	315
Average Queue (ft)	573	1132	1125	1096	147
95th Queue (ft)	1061	1904	1882	1857	386
Link Distance (ft)		1688	1688	1688	
Upstream Blk Time (%)		16	11	13	
Queuing Penalty (veh)		0	0	0	
Storage Bay Dist (ft)	750				215
Storage Blk Time (%)		27		44	
Queuing Penalty (veh)		90		58	

Intersection: 2: Glazier Avenue & 147th Street

Movement	EB	WB	WB	NB
Directions Served	TR	LT	T	R
Maximum Queue (ft)	41	143	98	149
Average Queue (ft)	2	32	4	67
95th Queue (ft)	18	103	45	116
Link Distance (ft)	317	160	160	116
Upstream Blk Time (%)		0	0	1
Queuing Penalty (veh)		1	1	3
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Zone Summary

Zone wide Queuing Penalty: 208

LANE SUMMARY

Site: 101 [147th & Glazier 2030 Mid Build]

174th Street & Glazier Avenue (North)
2030 Horizon Total with Mitigation (Mid-Day)
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: Private Driveway													
Lane 1[d]	60	2.0	445	0.135	100	10.0	LOS B	0.5	12.7	Full	1600	0.0	0.0
Approach	60	2.0		0.135		10.0	LOS B	0.5	12.7				
East: 147th Street W													
Lane 1	236	2.0	789	0.300	100	8.0	LOS A	1.8	46.1	Full	1600	0.0	0.0
Lane 2[d]	238	2.0	793	0.300	100	8.0	LOS A	1.8	46.2	Full	1600	0.0	0.0
Approach	474	2.0		0.300		8.0	LOS A	1.8	46.2				
North: Glazier Avenue (North)													
Lane 1[d]	91	2.0	447	0.204	100	11.1	LOS B	0.8	21.2	Full	1600	0.0	0.0
Approach	91	2.0		0.204		11.1	LOS B	0.8	21.2				
West: 147th Street W													
Lane 1[d]	454	2.0	1127	0.403	100	7.3	LOS A	2.9	74.8	Full	1600	0.0	0.0
Lane 2	451	2.0	1127	0.400	99[5]	7.3	LOS A	2.9	74.0	Full	1600	0.0	0.0
Approach	904	2.0		0.403		7.3	LOS A	2.9	74.8				
Intersection	1530	2.0		0.403		7.9	LOS A	2.9	74.8				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

5 Lane under-utilisation found by the program
d Dominant lane on roundabout approach

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LANE SUMMARY

Site: 101 [147th & Glazier 2030 PM Build]

174th Street & Glazier Avenue (North)
2030 Horizon Total with Mitigation
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: Private Driveway													
Lane 1[d]	87	2.0	449	0.194	100	10.9	LOS B	0.7	18.5	Full	1600	0.0	0.0
Approach	87	2.0		0.194		10.9	LOS B	0.7	18.5				
East: 147th Street W													
Lane 1	299	2.0	853	0.350	100	8.2	LOS A	2.2	55.5	Full	1600	0.0	0.0
Lane 2[d]	299	2.0	853	0.350	100	8.2	LOS A	2.2	55.5	Full	1600	0.0	0.0
Approach	598	2.0		0.350		8.2	LOS A	2.2	55.5				
North: Glazier Avenue (North)													
Lane 1[d]	108	2.0	430	0.250	100	12.4	LOS B	1.0	26.1	Full	1600	0.0	0.0
Approach	108	2.0		0.250		12.4	LOS B	1.0	26.1				
West: 147th Street W													
Lane 1	447	2.0	1139	0.393	100	7.2	LOS A	2.9	73.1	Full	1600	0.0	0.0
Lane 2[d]	447	2.0	1139	0.393	100	7.2	LOS A	2.9	73.1	Full	1600	0.0	0.0
Approach	895	2.0		0.393		7.2	LOS A	2.9	73.1				
Intersection	1687	2.0		0.393		8.1	LOS A	2.9	73.1				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

HCS7 Roundabouts Report

General Information

Analyst	DMA
Agency or Co.	Kimley-Horn
Date Performed	6/19/2017
Analysis Year	2030
Time Analyzed	MID Peak Hour
Project Description	Portillos Development

Site Information

Intersection	147th Street W & Glazier Avenue (North)
E/W Street Name	147th Street W
N/S Street Name	Glazier Avenue
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.93
Jurisdiction	Apple Valley, MN

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	2	0	0	0	2	0	0	0	1	0	0	0	1	0
Lane Assignment	LT		TR		LT		TR				LTR				LTR	
Volume (V), veh/h	357	65	408	35	0	30	396	15	0	30	0	25	0	64	0	20
Percent Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Flow Rate (v_{PCE}), pc/h	392	71	447	38	0	33	434	16	0	33	0	27	0	70	0	22
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)	4.5436	4.5436		4.5436	4.5436			4.3276			4.3276	
Follow-Up Headway (s)	2.5352	2.5352		2.5352	2.5352			2.5352			2.5352	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	446	502		227	256			60			92	
Entry Volume veh/h	437	493		223	251			59			90	
Circulating Flow (v_c), pc/h	103			496			980			892		
Exiting Flow (v_{ex}), pc/h	544			881			87			71		
Capacity (c_{pce}), pc/h	1293	1293		904	904			617			665	
Capacity (c), veh/h	1268	1268		886	886			605			652	
v/c Ratio (x)	0.34	0.39		0.25	0.28			0.10			0.14	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	6.0	6.6		6.7	7.1			7.1			7.1	
Lane LOS	A	A		A	A			A			A	
95% Queue, veh	1.6	1.9		1.0	1.2			0.3			0.5	
Approach Delay, s/veh	6.3			6.9			7.1			7.1		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	6.6						A					

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HCS7 Roundabouts Report

General Information

Analyst	DMA
Agency or Co.	Kimley-Horn
Date Performed	6/19/2017
Analysis Year	2030
Time Analyzed	PM Peak Hour
Project Description	Portillos Development

Site Information

Intersection	147th Street W & Glazier Avenue (North)
E/W Street Name	147th Street W
N/S Street Name	Glazier Avenue
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.93
Jurisdiction	Apple Valley, MN

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	2	0	0	0	2	0	0	0	1	0	0	0	1	0
Lane Assignment	LT		TR		LT		TR				LTR				LTR	
Volume (V), veh/h	279	62	466	25	0	25	511	20	0	40	0	40	0	59	1	40
Percent Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Flow Rate (v_{PCE}), pc/h	306	68	511	27	0	27	560	22	0	44	0	44	0	65	1	44
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)	4.5436	4.5436		4.5436	4.5436			4.3276			4.3276	
Follow-Up Headway (s)	2.5352	2.5352		2.5352	2.5352			2.5352			2.5352	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	429	483		286	323			88			110	
Entry Volume veh/h	420	474		281	316			86			108	
Circulating Flow (v_c), pc/h	93			418			950			937		
Exiting Flow (v_{ex}), pc/h	620			954			90			55		
Capacity (c_{pce}), pc/h	1305	1305		971	971			633			640	
Capacity (c), veh/h	1279	1279		952	952			621			628	
v/c Ratio (x)	0.33	0.37		0.29	0.33			0.14			0.17	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	5.8	6.3		6.8	7.3			7.4			7.8	
Lane LOS	A	A		A	A			A			A	
95% Queue, veh	1.4	1.7		1.2	1.5			0.5			0.6	
Approach Delay, s/veh	6.1			7.1			7.4			7.8		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	6.6						A					

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Kimley»Horn

ATTACHMENT 4: ROUNDABOUT LAYOUT

SITE LAYOUT

Site: 101 [147th & Glazier 2030 PM Build]

174th Street & Glazier Avenue (North)
2030 Horizon Total with Mitigation
Roundabout

