INNER LOOP SCOPING REPORT
ATTACHMENTS

A. Go/No Go Traffic Assessment
B. Safety Considerations, Accident History and Analysis
C. I-490 Ramp Evaluation and Analysis
D. Main Street Alternatives
E. Minimum Lane Requirements
F. Hazardous Waste
G. Endangered Species
H. Probable Cost and Benefit/Cost Assessment
I. Memorandum of Understanding - Draft

C. I-490 Ramp Evaluation and Analysis

Memo

Stantec

To:	Jim Hofmann Jr Rochester (2250) NY Office	From:	Bill Holthoff Rochester (2250) NY Office
File:	New I-490 Ramp	Date:	August 25, 2009 Revised March 2010

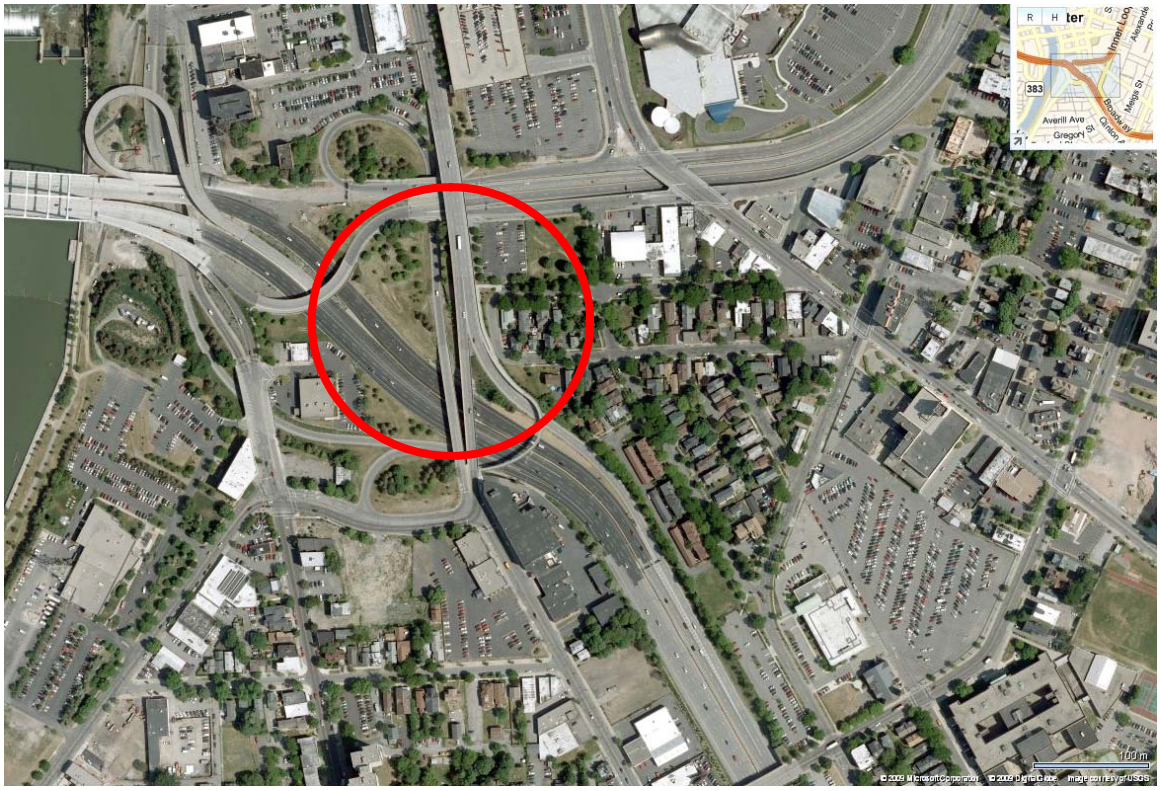
Reference: New I-490 Westbound Off Ramp to the Inner Loop

Introduction

Currently the interchange between I-490 and the Rochester Inner Loop is a partial interchange. An exit ramp for westbound I-490 traffic to reach the Inner Loop to travel eastbound is missing. This memo explores the possibility of up-grading the I-490 interchange with the Inner Loop to a fully directional interchange.

Figure 1 show the general area where this new ramp would be constructed

Figure 1
Location Map



Reference: New I-490 Westbound Off Ramp to the Inner Loop

Figure 2 presents a general concept of this new ramp and it relationship to other streets and expressway ramps in the area.

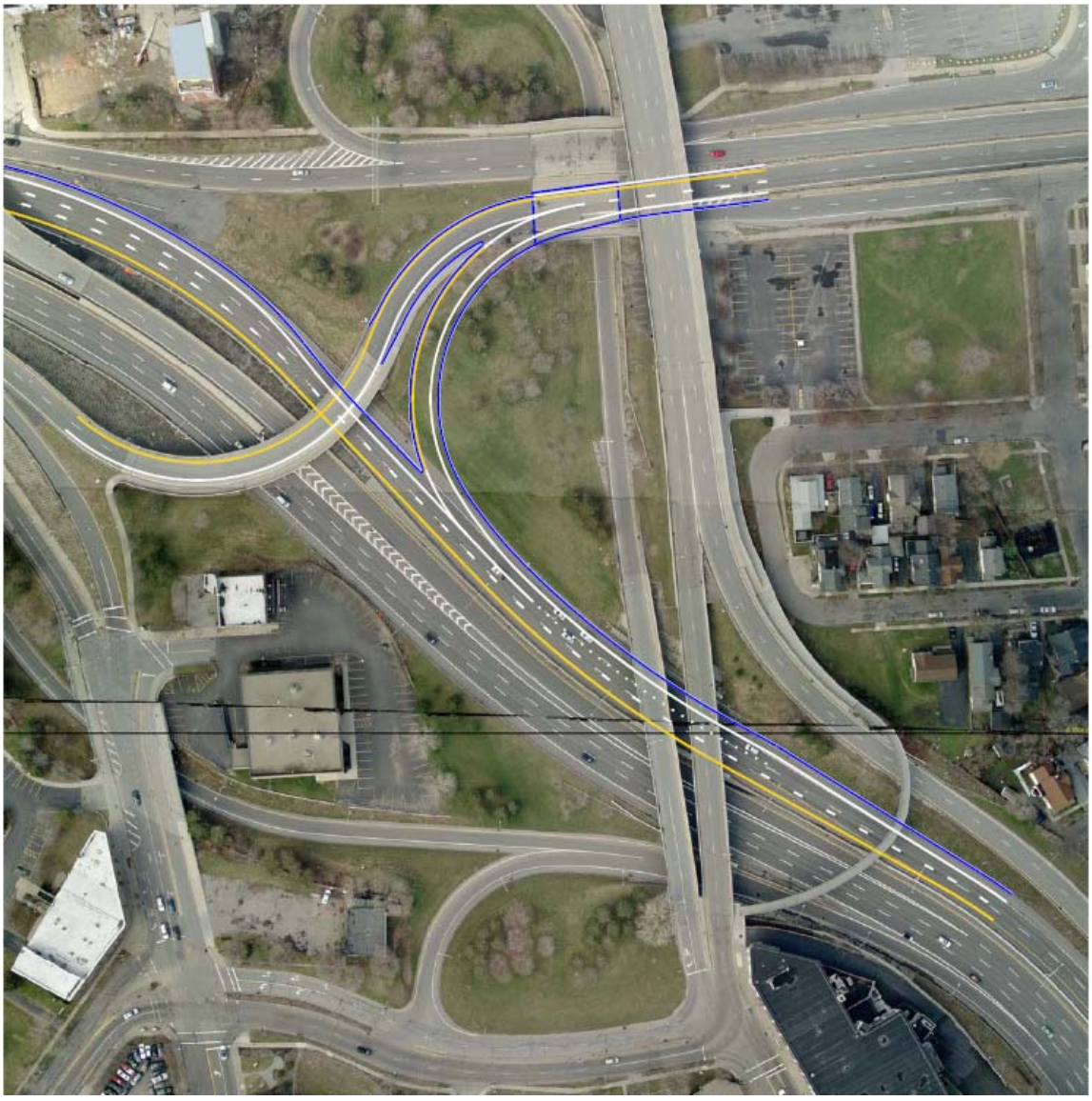
Figure 2
General Ramp Concept

The Ramp

Figure 3 shows a detail concept of the possible new off-ramp. A new westbound off-ramp would require that that the existing I-490 westbound off-ramp to the Inner Loop be

reduced from two lanes to one lane. It would also modify westbound I-490 so that the addition of a third mainline lane would not be added until after the new off-ramp diverges from the mainline lanes.

Figure 3
Concept Ramp Layout



Reference: New I-490 Westbound Off Ramp to the Inner Loop

The ramp, according to AASHTO, would be classified as a directional ramp and therefore was compared to the design standards for a loop ramp from NYSDOT Highway Design Manual to determine any Non-Standard and Non-Conforming Features.

Non-Standard Features:

Design Speed: The ramp would have a design speed of 15, 20, or 25 mph depending on the super-elevation that can be achieved, the standard is 25 mph. It should be noted however, that I-490 in this section has a posted speed limit of 40 mph;

Grade: Will most likely not be an issue, but cannot be rule it out without doing a more detailed design. Based on maps from the I-490 project, the grade would be around 4.5%, the standard is a maximum grade of 7%.

Non-Conforming Features:

Super-elevation Transition: This is an issue with the Inner Loop bridge that goes over the Inner Loop ramp to South Clinton Avenue. Normally a ramp would start to transition out of Super-elevation in this area, but because of the bridge, it would hold a constant cross slope, and forces the transition further out into the tangent section.

Other Features

Exit Ramp Spacing between the new westbound I-490 off-ramp and the existing I-490 off-ramp to South Clinton Avenue, was reviewed. The minimum exit spacing according to AASHTO should be a minimum of 1000 feet between two (2) exit ramps with no entrance ramps between the exit ramps. The spacing between the new ramp and the exiting ramp is approximately 1005 feet so most likely this new ramp will conform to this standard.

Inner Loop Interchange with Monroe Avenue/Chestnut Street: The new ramp would require this interchange be removed and replaced with an at-grade, traffic signal controlled intersection. There is not enough distance between the merge point of the two off-ramps to the Inner Loop and the Howell Street exit ramp from the Inner Loop to allow traffic to merge and weave to reach this ramp or to remain on the Inner Loop.

Reference: New I-490 Westbound Off Ramp to the Inner Loop

Traffic and Traffic Operations

An analysis was undertaken to determine the possible diversion of I-490 westbound traffic to that might use this new ramp in the year 2035 and it's impacts on traffic operations in the year 2035 analyzed. This analysis found the following:

1. The new off-ramp is estimated to divert between 300 to possibly 450 vehicles during the morning peak travel hour and 300 to 400 vehicles during the evening peak travel hour in the year 2035. Traffic diverted to this ramp would be from both the I-490 westbound off-ramps to Goodman Street and to South Clinton Avenue. This information is documented in the 1/13/09 "Raising the Eastern Portion of the Inner Loop, Go/No Go" memo from Stantec to the City of Rochester:

2. Analysis of this traffic on a raised Inner Loop found that it would not have a notable impact. All intersections were found to continue to operate at LOS "C" with no turning movement below LOS of "D". Documentation of this analysis presented in the Memo identified under 1.

3. Analysis of traffic diverted on I-490 also found no notable traffic impact, This analysis is documented in the attached KLD Associates, Inc. memo to Stantec.

4. The diverted traffic from the existing two off-ramps at Goodman Street and South Clinton Avenue would be expected to improve traffic operations at the intersections of these off-ramps and along adjacent intersections and roadway sections.

Operational Issues

1. Some traffic will have to weave and merge in approximately 700 feet to enter the appropriate travel lane on the approach to Monroe/Chestnut Street from where the new off-ramp meets the exiting I-490 eastbound off-ramp to the Inner Loop. These movements can be reduced by making the eastbound approach to Monroe/Chestnut Street a separate left turn, through and through/right turn lane;

2. I-490 eastbound off-ramp will need to be reduced from two (2) lanes to one (1). With less than 700 vehicles using this ramp in 2035, however, a single lane ramp will provide enough capacity to easily accommodate this volume of traffic;

3. The new off-ramp deceleration lane will be starting at or near the same point as the I-490 mainline section is widening out from two (2) travel lanes to three (3) travel lanes. With limited westbound approach sight distance cause by a horizontal curve and three bridges over I-490, drivers may become confuses as to the correct lane travel in. This can be address however, by re-striping I-490 so that the third travel lane does not begin until after the new off-ramp. This re-

striping will not impact vehicle capacity since the upstream section only provides two travel lanes;

4. This westbound limited approach sight distance also poses a challenge as how to sign this section in order to direct drivers into the correct lane.

Costs

It is estimated that to design and construct this ramp, including construction inspection would cost $2.3 million in 2010 dollars. These costs do not include modification to the Inner Loop Interchange with Monroe Avenue/Chestnut Street or the approach to it.

Benefits

There are a number of benefits to providing a more direct route to this section of the City. These include:

- More direct access to this section of the Rochester CBD would promote further economic development;
- Reduction in traffic along the heavy used South Clinton Avenue where drivers must traverse other CBD streets to reach their destination in this section of the CBD;
- Reduction of traffic on Broadway Street that would assist in economic development along Broadway Street by allowing it to be converted two way traffic operations;
- Reduction in traffic on the southern section of South Union Street.

Environmental Impact

Few if any environmental impacts would be expected to occur, land required to construct the ramp is already occupied by the current highway system. The only identified possible impact is severing one of the current pedestrian connections (sidewalk) between the Monroe/Inner Loop area to the South Wedge. This impact however, is expected to minor, since an alternative connection between these two areas is provided by the pedestrian bridge over I-490 just west of the South Clinton Avenue off-ramp.

Reference: New I-490 Westbound Off Ramp to the Inner Loop

Conclusion

Based on the initial analysis it appears that adding the final leg of the partial I-490 interchange with the Inner Loop may be feasible. This will depend on whether the sub-standard design speed and horizontal curvature for this ramp are acceptable to both the New York State Department of Transportation and the Federal Highway Administration. It is also dependent on the Inner Loop at Monroe Avenue/Chestnut Street being raised to grade to form an at-grade intersection. Adding this ramp will have little notable impact on traffic operations with the Inner Loop or on I-490 and would reduce traffic at the I-490 westbound off-ramp to Goodman Street and South Clinton Avenue.

Next Steps

1. Submit this information to NYSDOT and FHWA for their review, comment, and a Go/No Go decision for the possibility of adding this ramp. This would occur with the understanding that further analysis would be required to justify adding this new ramp and identification of any environmental impacts and concerns at some point in the future;

2. Given it is Go decision, then preliminary engineering of the ramp will need to be undertaken with the engineering associated with raising Inner Loop between Monroe Avenue/Chestnut Street in order not to preclude adding this new ramp at some point in the future;

3. Finally, the need for, benefits of and any possible environmental impact of adding this ramp will need to be documented, along with identification of funds to construct this ramp, once the Inner Loop is raised.

STANTEC CONSULTING SERVICES INC.

William C. Holthoff
Principal
bill.holthoff@stantec.com

Attachment

KLD ASSOCIATES, INC.

Memorandum

To: **William C. Holthoff, Stantec**
From: **KLD Associates, Inc.**
Date: **July 8, 2009**
Subject: **Rochester Inner Loop Analysis using VISSIM Simulation**

This memorandum describes the analysis of the proposed off-ramp from I-490 onto the Inner Loop as shown in Figure 1 using the simulation model VISSIM.

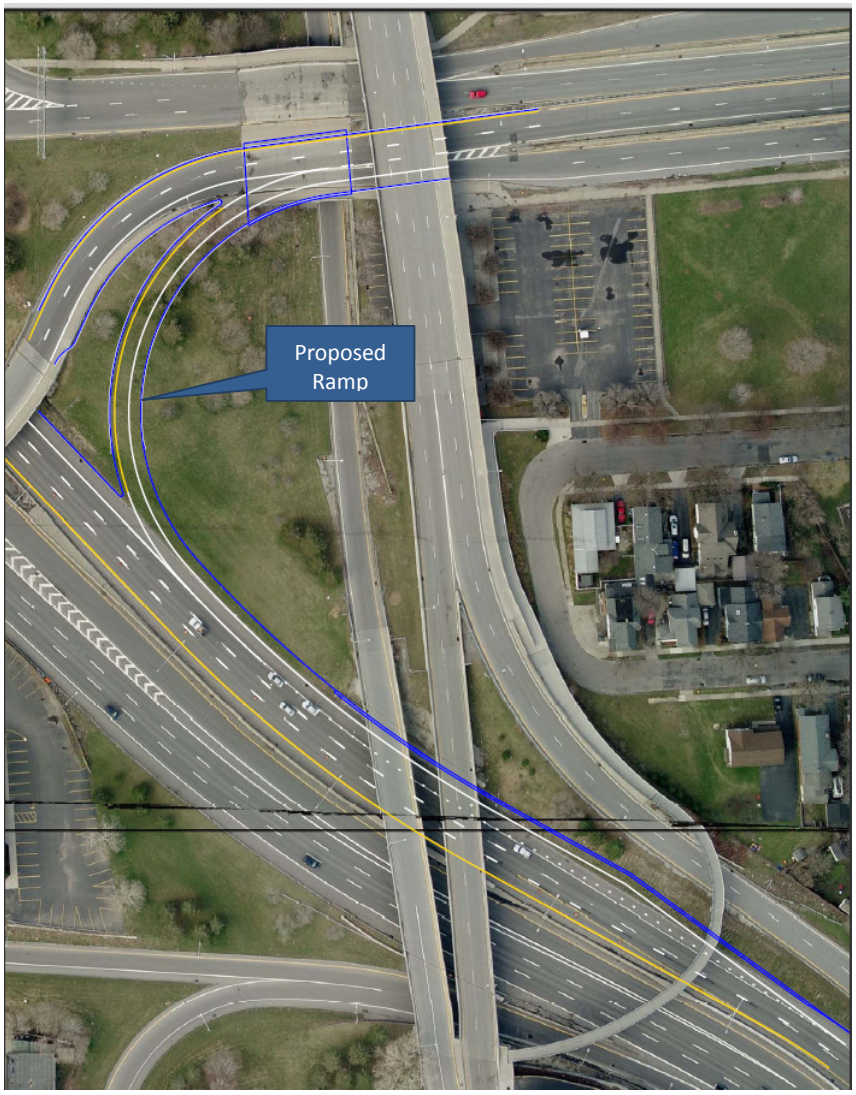


Figure 1- Proposed Off-ramp

The proposed ramp shown in Figure 1 will connect I-490 westbound and the Inner Loop just after the off-ramp at Clinton Avenue. To evaluate the traffic impact due to the new ramp, a VISSIM simulation analysis was performed reflecting expected traffic operations during both AM and PM peak hours in 2035. The study area is shown in Figure 2 and was defined along I-490 between the South Ave off-ramp eastbound and Clinton Ave off-ramp westbound inclusive. The analysis also included the Inner Loop ramp, the proposed ramp, and the intersection at Inner Loop and Monroe Avenue. The simulation input data, as provided by Stantec is included in Appendix A.

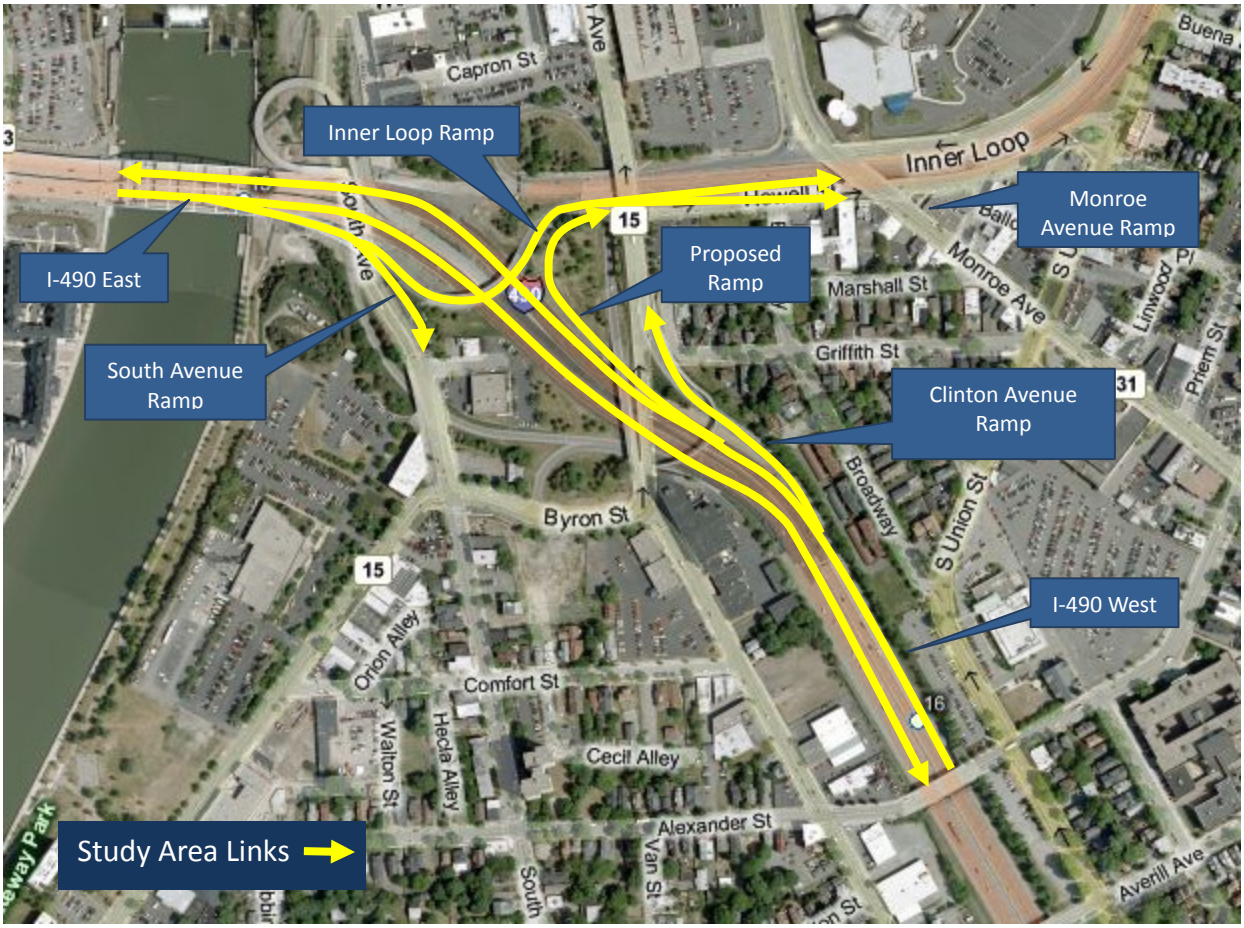


Figure 2- Study Area

Each model represented a three hour period: pre-peak, peak hour and post-peak hour. Traffic volumes during the pre-peak and post-peak hours were assumed to be 70 percent and 50 percent of the peak hour volumes respectively.

Two geometric designs were analyzed for the intersection at Inner Loop and Monroe Avenue using the simulation model.

The first design shown in Figure 3 includes one lane for the merge of Inner Loop ramp and proposed ramp traffic. The roadway subsequently widens to add a one lane left-turn and one lane right-turn bay approaching Monroe Avenue. Traffic from the proposed ramp would yield to traffic from the Inner Loop in this design.

The second design is a variation of the first with two-lanes immediately downstream of the merge, with a left-turn bay at the stop-line, as shown in Figure 4.

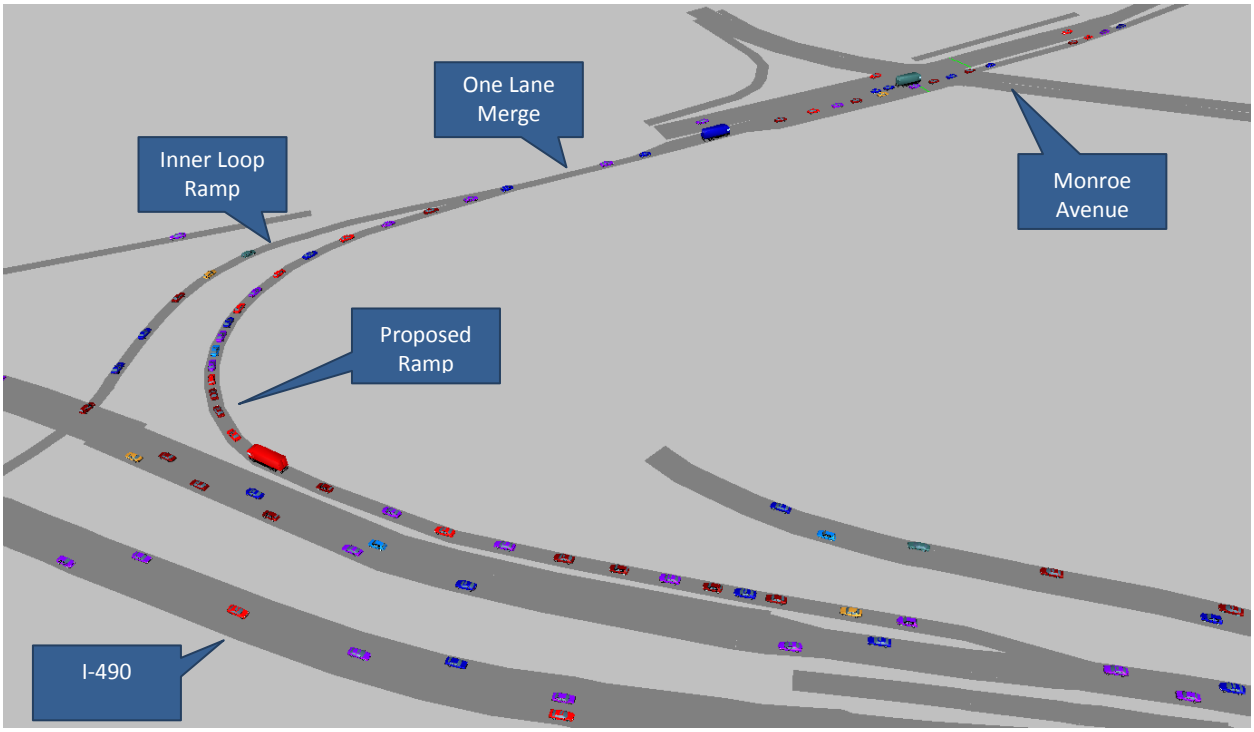


Figure 3 - Snapshot of 2035 AM Peak Hour for Design 1 Showing Maximum Queuing Condition

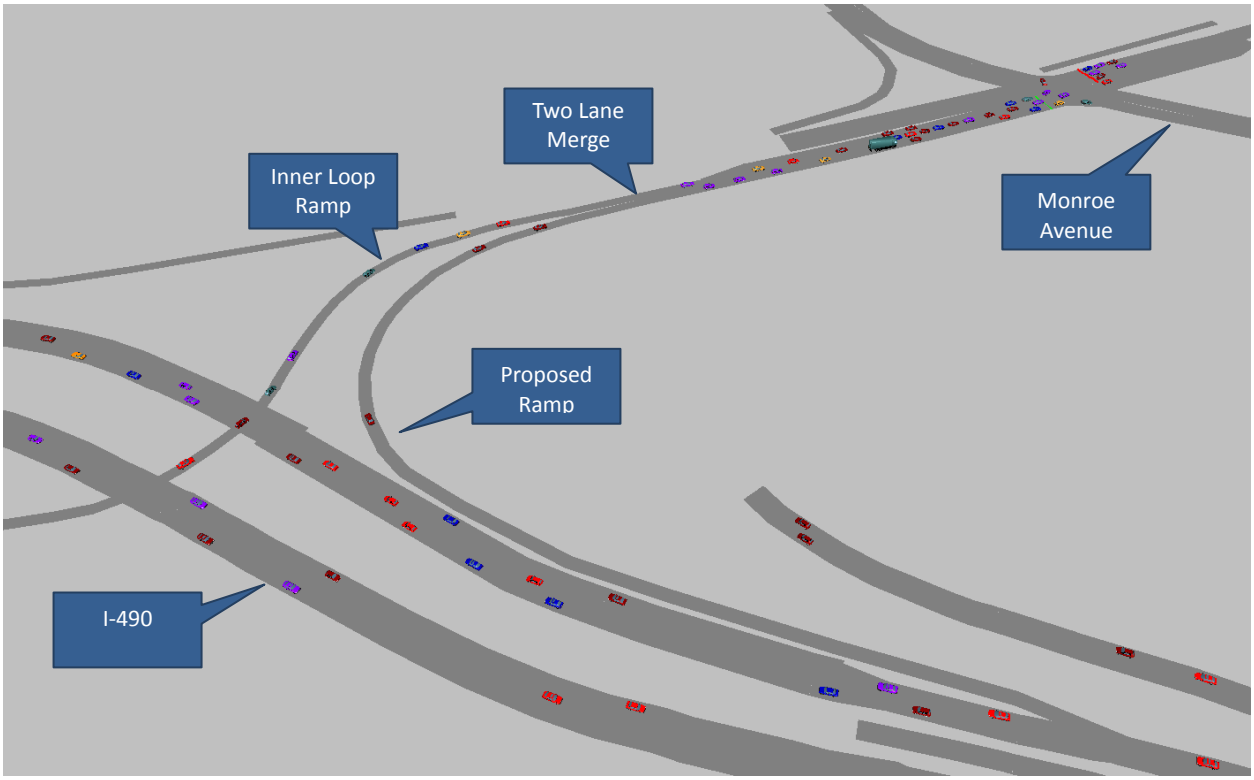


Figure 4 - Snapshot of 2035 AM Peak Hour for Design 2 Showing Maximum Queuing Condition

The queuing as predicted by the simulation analysis is shown in Table 1.

Table 1 – Predicted Queues

Measure	2035 AM		2035 PM	
	Design 1	Design 2	Design 1	Design 2
Average Queue Length (ft)	**704**	97	63	55
Maximum Queue Length (ft)	**1509**	407	428	294

Figure 5 shows how this queue length is measured.

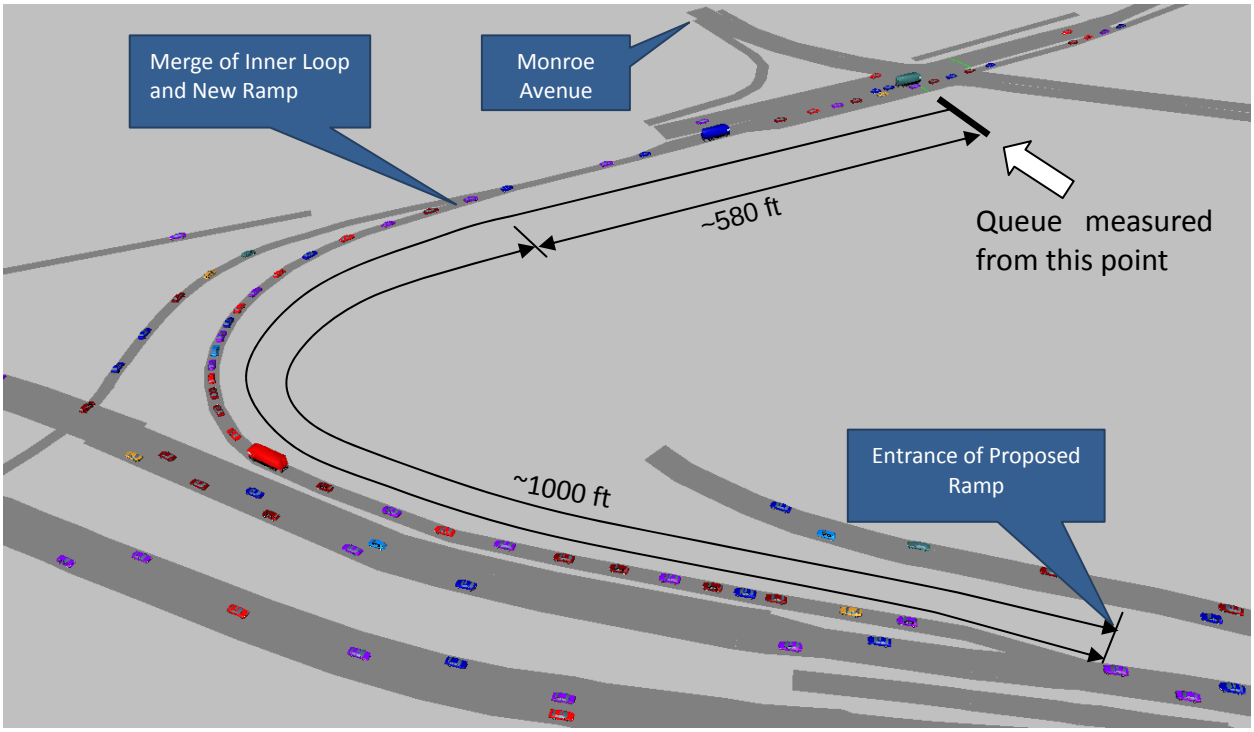


Figure 5- Queue Measurement

Design 1 will result in a maximum queue of approximately 1500 ft extending back along the proposed ramp during the 2035 AM peak hour. This condition will last for approximately 5 minutes. During this time, traffic on both the Inner Loop ramp and proposed ramp will experience delays of about 3 minutes per vehicle to travel approximately 0.3 miles. ***In comparison, Design 2 will not cause any significant queuing at all.*** Snapshots of the maximum queue conditions for both designs during the 2035 AM peak hour are shown in Figure 3 and Figure 4.

Predicted queues are shorter during the PM peak hour than the AM peak hour for 2035 volumes. As shown in Table 1 these queues do not cause any spillback onto the mainline during the PM peak.

In summary, a 2-lane roadway section downstream of the merge between the proposed ramp and the Inner loop ramp offers lower queues and delays during the AM peak hour and is recommended.

APPENDIX A

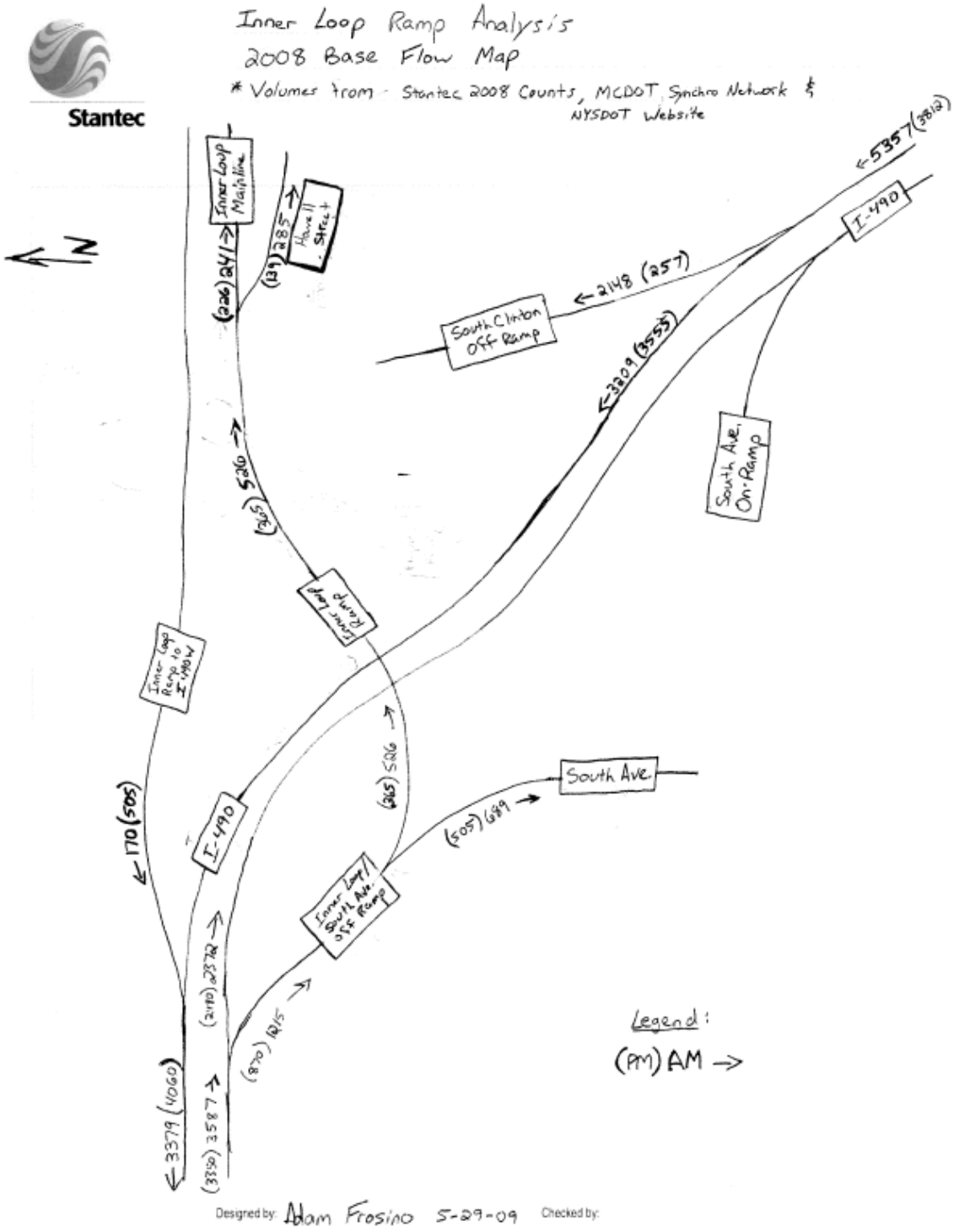
SIMULATION INPUT DATA

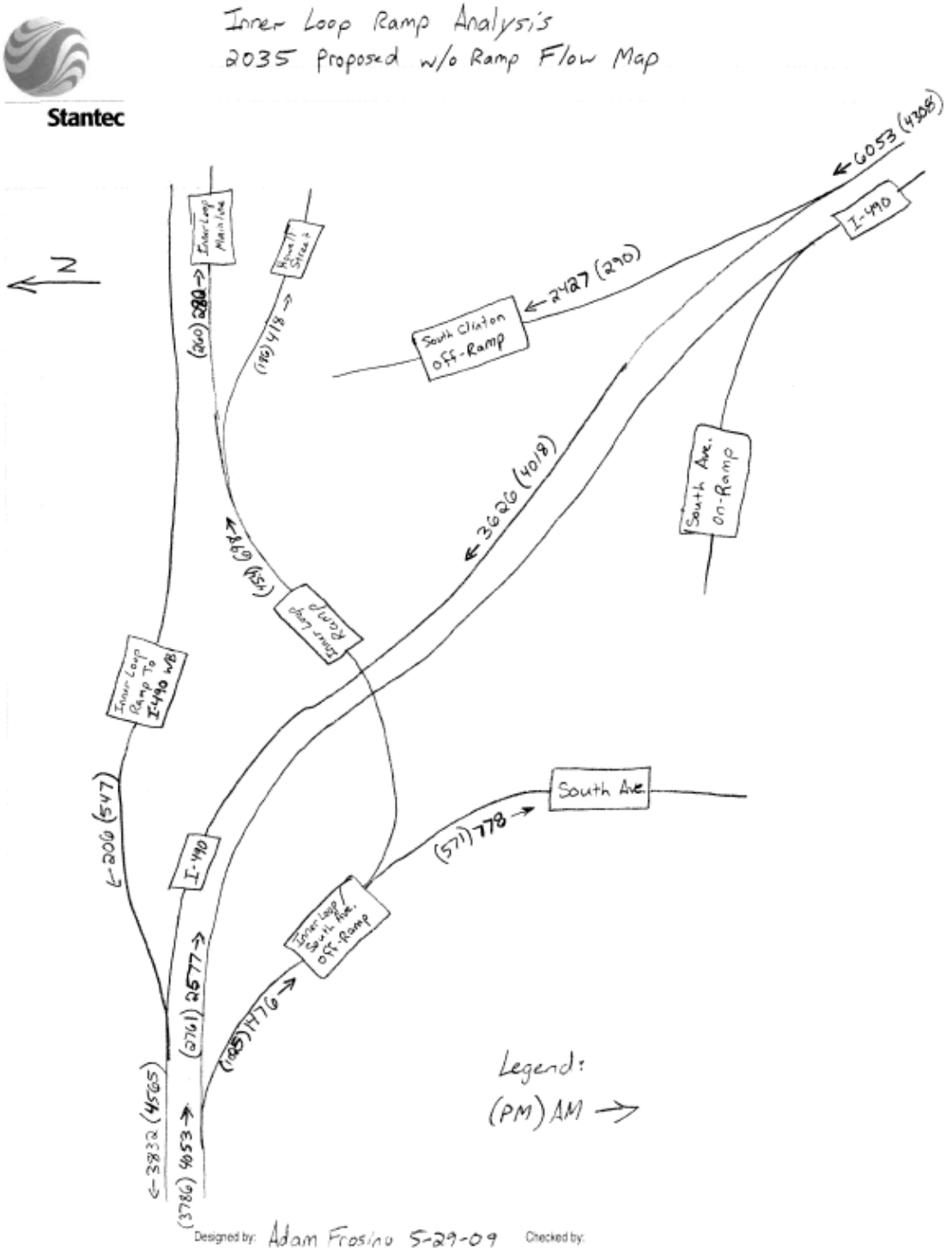
VISSIM Simulation Ramp Analysis Data

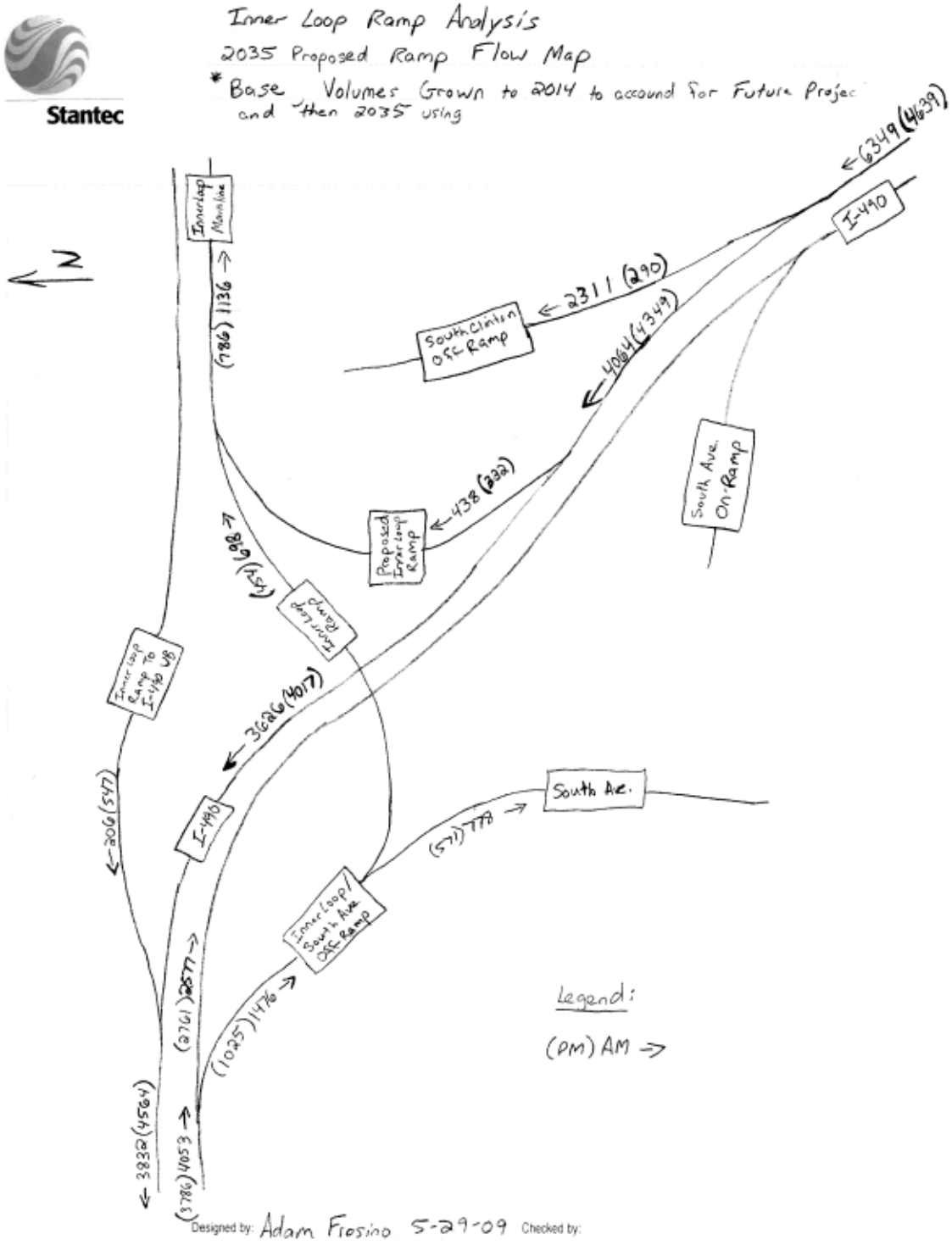
		Base Volumes		2035 Volumes No Ramp		2035 Volumes With Ramp		PHF		Truck %			Speed Limit/ Design Speed	Suggested Speed	# Lanes	Lane Designation
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	Source				
Location A	I-490 EB (Bridge)	3587	3350	4053	3786	4053	3786	0.95	0.95	5%	5%	Sept. 2002 NYSDOT Tube Count	40	-	4	ML
	I-490 WB (Bridge)	3379	4060	3832	4565	3832	4564	0.95	0.95	5%	5%	Calculated	40	-	3	ML
	I-490 EB	2372	2480	2577	2761	2577	2761	0.95	0.95	5%	5%	Combination	40	-	3	ML
	IL to I-490 WB Ramp	170	505	206	547	206	547	0.82	0.86	2%	8%	2008 Count	40	-	3	Ramp
	South Ave/IL Off-Ramp	1215	870	1476	1025	1476	1025	0.95	0.92	2%	2%	Calculated	40	30	1	Ramp
Location B	South Ave Ramp	689	505	778	571	778	571	0.95	0.95	2%	2%	MCDOT Synchro Network	40	30	1	Ramp
	Inner Loop Ramp	526	365	698	454	698	454	0.96	0.86	6%	2%	2008 Counted	40	20	2	Ramp
Location C	I-490 WB Mainline	3209	3555	3626	4018	4064	4349	0.95	0.95	5%	5%	Calculated	40	-	3	ML
	Proposed Ramp	0	0	0	0	438	332	0.9	0.9	6%	2%	Projected	25 - 15 *	20 - 10 *	1	Ramp
	I-490 WB Mainline	3209	3555	3626	4018	3626	4017	0.95	0.95	5%	5%	Calculated	40	-	3	ML
Location D	Proposed Ramp	0	0	0	0	438	332	0.9	0.9	6%	2%	Projected	20	15	1	Ramp
	Inner Loop Ramp	526	365	698	446	698	454	0.96	0.86	6%	2%	2008 Counted	40	20	2	Ramp
	IL to Howell	285	139	408	185	0	0	0.8	0.8	6%	1%	2008 Counted	40	-	1	Ramp
New Location	I-490 WB Mailine	5357	3812	6053	4308	6375	4639	0.95	0.95	5%	5%	May 2007 NYSDOT Tube count	40	-	2	ML
	Clinton Ave Ramp	2148	257	2427	290	2311	290	0.9	0.9	2%	2%	MCDOT Synchro Network	40	30	2	Ramp

* = Super Elevation range from 3.7% to 5.8%

= Default/Assumed Vaules no Supporting Data

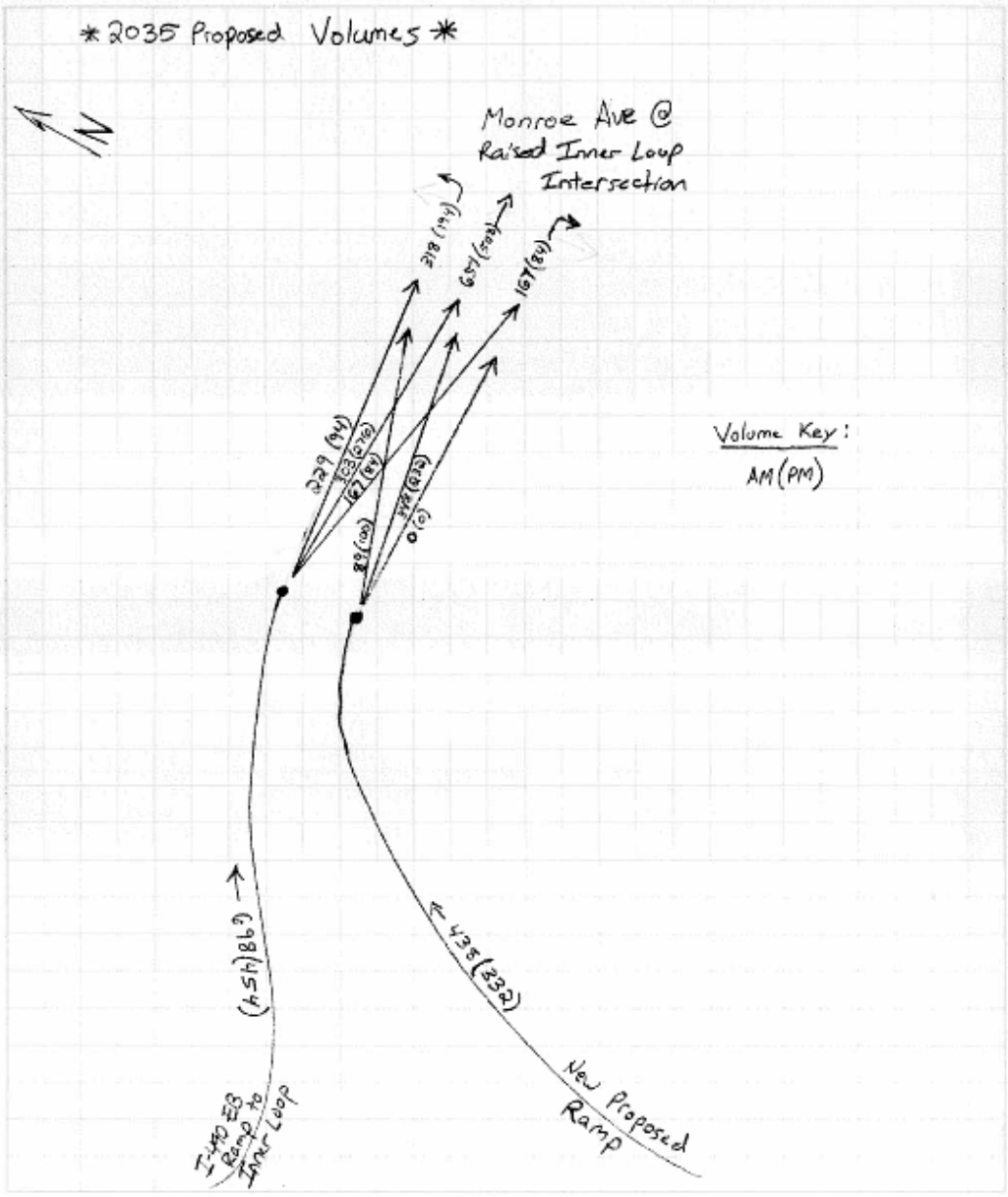

Inner Loop Ramp Analysis
2008 Base Flow Map
* Volumes from Stantec 2008 Counts, MCDOT Synchro Network & NYSDOT Website
Stantec
N
Inner Loop Mainline
Howell Street
(226) 241
(13) 285
South Clinton Off Ramp
2148 (257)
5357 (3812)
I-490
3809 (3555)
South Ave. On-Ramp
(365) 5246
Inner Loop Ramp
Inner Loop Ramp to I-490W
170 (505)
I-490
(365) 5246
South Ave
(505) 689
Inner Loop/ Scott Ave. Off Ramp
(870) 1015
(2410) 2872
3379 (4060)
(3350) 3587
Legend:
(PM) AM →
Designed by: Adam Frosino 5-29-09
Checked by:


Inner Loop Ramp Analysis
2035 Proposed w/o Ramp Flow Map
Stantec
N
Inner Loop Mainline
Broadway Street
(200) 280
(186) 418
South Clinton Off-Ramp
2427 (270)
6053 (4388)
I-490
3626 (4018)
South Ave. On-Ramp
(454) 699
Inner Loop Ramp
Inner Loop Ramp To I-490 WB
206 (547)
I-490
South Ave
(571) 778
Inner Loop South Ave. Off-Ramp
(185) 476
(276) 2677
3832 (4565)
(378) 4053
Legend:
(PM) AM
Designed by: Adam Frosino 5-29-09
Checked by:


Inner Loop Ramp Analysis
2035 Proposed Ramp Flow Map
* Base Volumes Grown to 2014 to account for Future Projec
and then 2035 using
Stantec
N
Inner Loop Mainline
(786) 1136 →
South Clinton Off-Ramp
← 2311 (290)
← 6349 (4639)
I-490
← 4064 (4349)
South Ave. On-Ramp
Proposed Inner Loop Ramp
← 438 (332)
(54) 98 →
Inner Loop Ramp
Inner Loop Ramp to I-490 WB
← 3626 (4017)
← 206 (547)
I-490
South Ave.
(571) 778 →
Inner Loop/ South Ave Off-Ramp
(2761) 2577 →
(1025) 1476 →
← 3832 (4564)
(3786) 4053 →
Legend:
(PM) AM →
Designed by: Adam Frosino 5-29-09 Checked by:

Stantec

Inner Loop Project
Proposed I-490 WB Ramp Analysis
Weave Movement Diagram



Designed by: Adam Frosino 6-9-09 Checked by:

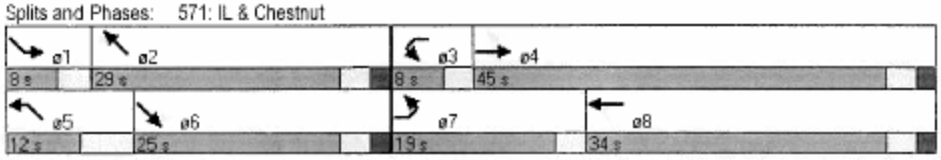
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	274	561	144	87	236	57	48	228	253	145	315	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	300		200	250		0	200		100
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (ft)	25		25	25		25	25		25	70		70
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850		0.971				0.850			
Flt Protected	0.950			0.950				0.991		0.950		
Satd. Flow (prot)	1770	1863	1583	1770	3437	0	0	3507	1583	1770	1863	0
Flt Permitted	0.427			0.159				0.809		0.380		
Satd. Flow (perm)	795	1863	1583	296	3437	0	0	2863	1583	708	1863	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			186		34				326			
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		827			978			783			621	
Travel Time (s)		18.8			22.2			17.8			14.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Growth Factor	116%	116%	116%	116%	116%	116%	116%	116%	116%	116%	116%	116%
Adj. Flow (vph)	353	723	186	112	304	73	62	294	326	187	406	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	353	723	186	112	377	0	0	356	326	187	407	0
Turn Type	pm+pt		Perm	pm+pt			pm+pt		Free	pm+pt		
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases	4		4	8			6		Free	2		
Detector Phase	7	4	4	3	8		1	6		5	2	
Switch Phase												
Minimum Initial (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Split (s)	8.0	25.0	25.0	8.0	27.0		8.0	25.0		8.0	25.0	
Total Split (s)	19.0	45.0	45.0	8.0	34.0	0.0	8.0	25.0	0.0	12.0	29.0	0.0
Total Split (%)	21.1%	50.0%	50.0%	8.9%	37.8%	0.0%	8.9%	27.8%	0.0%	13.3%	32.2%	0.0%
Maximum Green (s)	16.0	40.0	40.0	5.0	29.0		5.0	20.0		7.0	24.0	
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		5.0	3.0	
All-Red Time (s)	0.0	2.0	2.0	0.0	2.0		0.0	2.0		0.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	5.0	5.0	3.0	5.0	4.0	3.0	5.0	4.0	5.0	5.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?							Yes				Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None		None	Max		None	Max	
Walk Time (s)		5.0	5.0		5.0			5.0			5.0	
Flash Dont Walk (s)		15.0	15.0		15.0			15.0			15.0	
Pedestrian Calls (#/hr)		0	0		0			0			0	
Act Effct Green (s)	43.8	35.7	35.7	31.5	24.4			20.3	84.4	32.5	32.5	
Actuated g/C Ratio	0.52	0.42	0.42	0.37	0.29			0.24	1.00	0.39	0.39	
v/c Ratio	0.61	0.92	0.24	0.56	0.37			0.52	0.21	0.52	0.57	
Control Delay	16.6	41.3	3.3	23.2	22.2			32.7	0.3	26.2	26.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	
Total Delay	16.6	41.3	3.3	23.2	22.2			32.7	0.3	26.2	26.2	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
LOS	B	D	A	C	C			C	A	C	C	
Approach Delay		28.8			22.4			17.2			26.2	
Approach LOS		C			C			B			C	
90th %ile Green (s)	16.0	40.0	40.0	5.0	29.0		0.0	20.0		7.0	32.0	
90th %ile Term Code	Max	Max	Max	Max	Hold		Skip	MaxR		Max	Hold	
70th %ile Green (s)	16.0	40.0	40.0	5.0	29.0		0.0	20.0		7.0	32.0	
70th %ile Term Code	Max	Max	Max	Max	Hold		Skip	MaxR		Max	Hold	
50th %ile Green (s)	15.4	40.0	40.0	5.0	29.6		0.0	20.0		7.0	32.0	
50th %ile Term Code	Gap	Max	Max	Max	Hold		Skip	MaxR		Max	Hold	
30th %ile Green (s)	13.3	35.9	35.9	5.0	27.6		0.0	20.0		7.0	32.0	
30th %ile Term Code	Gap	Gap	Gap	Max	Hold		Skip	MaxR		Max	Hold	
10th %ile Green (s)	11.0	24.1	24.1	0.0	10.1		0.0	20.0		7.0	32.0	
10th %ile Term Code	Gap	Gap	Gap	Skip	Hold		Skip	MaxR		Max	Hold	
Queue Length 50th (ft)	104	361	0	28	75			95	0	76	188	
Queue Length 95th (ft)	161	#584	36	53	114			140	0	128	286	
Internal Link Dist (ft)		747			898			703			541	
Turn Bay Length (ft)	300			300						200		
Base Capacity (vph)	600	896	858	199	1225			688	1583	361	716	
Starvation Cap Reductn	0	0	0	0	0			0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0			0	0	0	0	
Storage Cap Reductn	0	0	0	0	0			0	0	0	0	
Reduced v/c Ratio	0.59	0.81	0.22	0.56	0.31			0.52	0.21	0.52	0.57	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 84.4
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 24.7 — Intersection LOS: C
Intersection Capacity Utilization 83.9% — ICU Level of Service E
Analysis Period (min) 15
90th %ile Actuated Cycle: 90
70th %ile Actuated Cycle: 90
50th %ile Actuated Cycle: 90
30th %ile Actuated Cycle: 85.9
10th %ile Actuated Cycle: 66.1
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 571: IL & Chestnut



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	167	438	72	132	553	18	227	207	13	66	467	1108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	330		250	250		0	450		0	150		0
Storage Lanes	1		1	1		1	1		1	1		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	*1.00	1.00
Frt			0.850		0.995			0.991				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1863	1583	1770	3522	0	1770	1846	0	1770	3725	1583
Flt Permitted	0.185			0.172			0.228			0.318		
Satd. Flow (perm)	345	1863	1583	320	3522	0	425	1846	0	592	3725	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			88		4			3				398
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		559			602			751			690	
Travel Time (s)		12.7			13.7			17.1			15.7	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	116%	116%	116%	116%	116%	116%	116%	116%	116%	116%	116%	116%
Adj. Flow (vph)	204	535	88	161	675	22	277	253	16	81	570	1353
Shared Lane Traffic (%)												
Lane Group Flow (vph)	204	535	88	161	697	0	277	269	0	81	570	1353
Turn Type	pm+pt		Perm	pm+pt			pm+pt			pm+pt		Free
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases	4		4	8			6			2		Free
Detector Phase	7	4	4	3	8		1	6		5	2	
Switch Phase												
Minimum Initial (s)	3.0	3.0	3.0	3.0	6.0		7.0	7.0		3.0	7.0	
Minimum Split (s)	8.0	20.0	20.0	8.0	11.0		18.0	20.0		8.0	20.0	
Total Split (s)	16.0	44.0	44.0	12.0	40.0	0.0	20.0	34.0	0.0	10.0	24.0	0.0
Total Split (%)	16.0%	44.0%	44.0%	12.0%	40.0%	0.0%	20.0%	34.0%	0.0%	10.0%	24.0%	0.0%
Maximum Green (s)	11.0	39.0	39.0	7.0	35.0		17.0	29.0		5.0	19.0	
Yellow Time (s)	5.0	3.0	3.0	5.0	3.0		3.0	3.0		5.0	3.0	
All-Red Time (s)	0.0	2.0	2.0	0.0	2.0		0.0	2.0		0.0	2.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-2.0	-2.0	-1.0	-2.0	-2.0	-1.0	-1.0	-2.0	-1.0
Total Lost Time (s)	4.0	4.0	4.0	3.0	3.0	3.0	1.0	3.0	3.0	4.0	3.0	3.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lag	Lead		Lag	Lead	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes				Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		2.0	2.0		3.0	2.0	
Recall Mode	None	None	None	None	None		C-Max	None		None	Max	
Walk Time (s)		5.0	5.0				5.0	5.0			5.0	
Flash Dont Walk (s)		10.0	10.0				10.0	10.0			10.0	
Pedestrian Calls (#/hr)		0	0				0	0			0	
Act Effct Green (s)	46.1	34.5	34.5	40.9	31.9		48.5	31.1		33.5	21.0	100.0
Actuated g/C Ratio	0.46	0.34	0.34	0.41	0.32		0.48	0.31		0.34	0.21	1.00
v/c Ratio	0.63	0.83	0.15	0.61	0.62		0.52	0.47		0.23	0.73	0.85
Control Delay	24.4	41.7	4.9	25.4	30.8		31.3	33.5		17.6	37.5	15.3
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	24.4	41.7	4.9	25.4	30.8		31.3	33.5		17.6	37.5	15.3

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	C	D	A	C	C		C	C		B	D	B
Approach Delay		33.5			29.8			32.4			21.7	
Approach LOS		C			C			C			C	
90th %ile Green (s)	11.0	39.0	39.0	7.0	35.0		17.0	25.6		8.4	19.0	
90th %ile Term Code	Max	Max	Max	Max	Hold		Coord	Coord		Hold	MaxR	
70th %ile Green (s)	11.0	38.1	38.1	7.0	34.1		17.9	22.2		12.7	19.0	
70th %ile Term Code	Max	Gap	Gap	Max	Hold		Coord	Coord		Hold	MaxR	
50th %ile Green (s)	11.0	34.9	34.9	7.0	30.9		21.1	21.8		16.3	19.0	
50th %ile Term Code	Max	Gap	Gap	Max	Hold		Coord	Coord		Hold	MaxR	
30th %ile Green (s)	11.0	30.5	30.5	7.0	26.5		25.5	22.9		19.6	19.0	
30th %ile Term Code	Max	Gap	Gap	Max	Hold		Coord	Coord		Hold	MaxR	
10th %ile Green (s)	8.9	24.9	24.9	7.0	23.0		31.1	53.1		0.0	19.0	
10th %ile Term Code	Gap	Gap	Gap	Max	Hold		Coord	Coord		Skip	MaxR	
Queue Length 50th (ft)	74	303	0	56	192		107	152		20	126	607
Queue Length 95th (ft)	110	408	30	86	236		181	225		m38	201	808
Internal Link Dist (ft)		479			522			671			610	
Turn Bay Length (ft)	330		250	250			450			150		
Base Capacity (vph)	331	745	686	262	1306		536	663		357	782	1583
Starvation Cap Reductn	0	0	0	0	0		0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	0
Reduced v/c Ratio	0.62	0.72	0.13	0.61	0.53		0.52	0.41		0.23	0.73	0.85

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 1:NBL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 27.0 Intersection LOS: C
Intersection Capacity Utilization 78.1% ICU Level of Service D
Analysis Period (min) 15
* User Entered Value
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2472: IL & Monroe