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M E M O R A N D U M

DATE: July 26, 2019

TO: Neil Kopper, PE, City of Bloomington

FROM: Gannon Grimmer, PE, American Structurepoint

CC: Patrick O'Connor, PE, PTOE, American Structurepoint

RE: Dunn Street Lane Reduction

Introduction

American Structurepoint, Inc. conducted a traffic analysis for Dunn Street in Bloomington, IN. An evaluation was completed to determine the feasibility of modifying Dunn Street (one-way southbound) from a two-lane roadway to a one-lane roadway in order to add on-street parking. The lane reduction would begin at 10th Street and end at 6th Street, and two (2) southbound lanes would remain south of 6th Street through Kirkwood Avenue. The purpose of this memorandum is to document the traffic analysis and findings.

Study Area

Dunn Street, from 10th Street to 6th Street, currently operates as a one-way roadway consisting of two (2) travel lanes in the southbound direction with on-street parking allowed on only a single side of the road. There is no posted speed limit on Dunn Street; however, the operating speed is generally between 25-30 mph based upon speed data collected south of 10th Street.

The traffic analysis consists of three (3) study intersections along Dunn Street, as listed below in **Table 1**. Each intersection operates as stop-controlled. The intersection locations and traffic control types are also shown on **Figure 1**.

Table 1 – Study Intersections

No.	Intersection Name	Traffic Control Type
1	Dunn Street & 10th Street	One-Way Stop Control
2	Dunn Street & 7th Street	All-Way Stop Control
3	Dunn Street & 6th Street	All-Way Stop Control

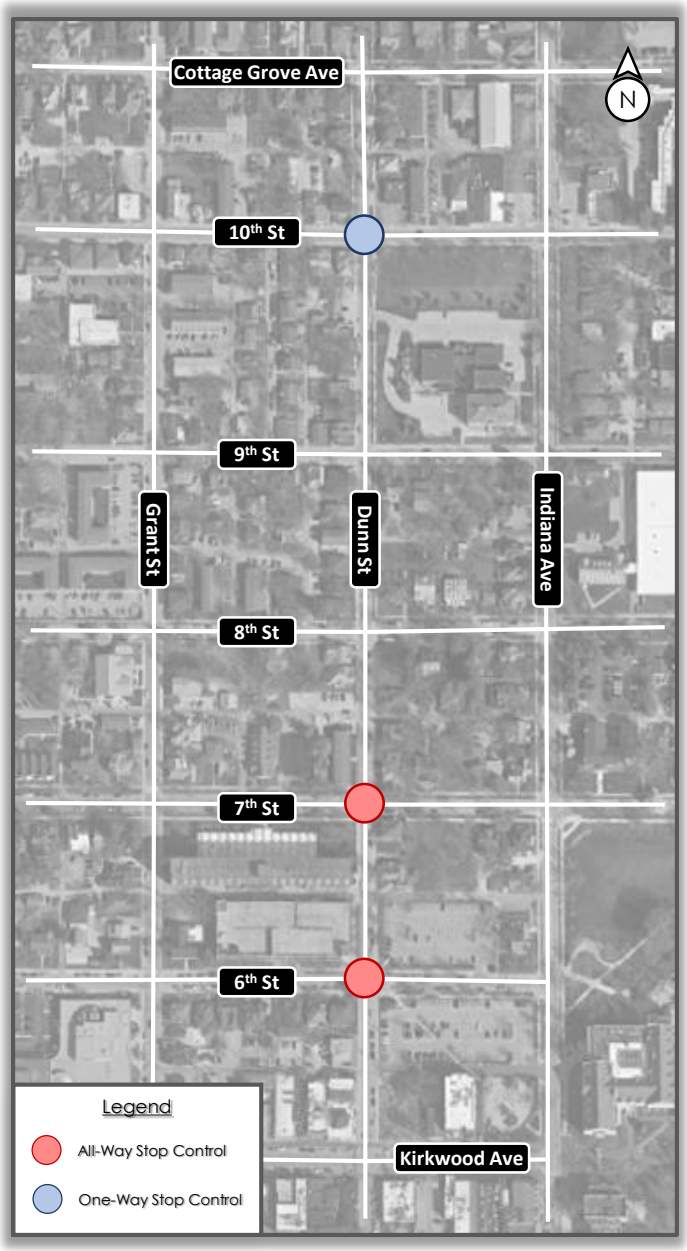

Figure 1 – Study Area

Traffic Data

Traffic volumes for this analysis were obtained through various measures. For the intersection of Dunn Street & 6th Street, peak hour turning movement counts (7:00 AM – 9:00 AM, and 4:00 PM – 6:00 PM) were collected by the City of Bloomington. For the intersection of Dunn Street & 7th Street, peak hour counts for the same time periods were obtained from the *7th Street Protected Bike Lane Project* prepared by American Structurepoint in February 2019. Turning movement counts at the intersection of Dunn Street & 10th Street were estimated based on tube count data that was collected by the City on Dunn Street between 10th Street and 9th Street. All traffic data was collected on a typical weekday during 2019 while schools were in session. The 2019 traffic volumes are provided in **Table 2** and **Table 3** for the AM and PM peak hour, respectively.

Table 2 – AM Peak Hour (8:00 – 9:00 AM) Traffic Volumes

ID	Intersection	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	PHF
1	Dunn Street & 10th Street	5	10	5		50	55	55	50		0.78
2	Dunn Street & 7th Street	4	115	15		72	15	35	53		0.78
3	Dunn Street & 6th Street	18	115			13	23				0.87
--	Dunn Street (10th St to 9th St)		120								--

Table 3 – PM Peak Hour (5:00 – 6:00 PM) Traffic Volumes

ID	Intersection	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	PHF
1	Dunn Street & 10th Street	5	10	5		100	150	150	100		0.88
2	Dunn Street & 7th Street	8	262	25		103	10	124	167		0.88
3	Dunn Street & 6th Street	11	459			48	154				0.80
--	Dunn Street (10th St to 9th St)		311								--

Capacity Analysis

A capacity analysis has been performed for the study intersections based on the scenarios listed in **Table 4**. The analysis was performed using Synchro (Version 9.2), which utilizes the methodology outlined in the *Highway Capacity Manual*.

Table 4 – Study Scenarios

Scenario	Description
1	Existing Configuration (2-lane SB)
2	Proposed Configuration (1-lane SB)

The standard parameter used to evaluate traffic operating conditions is referred to as the level of service. There are six LOS (A through F) which relate to driving conditions. LOS for signalized intersections is defined in terms of control delay per vehicle, which is a direct correlation to driver discomfort, frustration, fuel consumption, and lost travel time. **Table 5** provides the LOS criteria for intersections as defined in the *Highway Capacity Manual*.

The operating conditions of intersections are generally considered to be acceptable if found to operate at LOS D or better for the overall intersection, with no approach operating worse than LOS E. The 95th percentile queue lengths were also evaluated to determine if queuing has an adverse impact on upstream intersection, i.e. spillback queuing into an adjacent major intersection.

Table 5 – LOS Thresholds: Unsignalized Intersections

LOS	Control Delay per Vehicle (seconds)
A	≤ 10
B	> 10 and ≤ 15
C	> 15 and ≤ 25
D	> 25 and ≤ 35
E	> 35 and ≤ 50
F	> 50

The capacity analysis results are summarized in **Table 6** and **Table 7** for the AM and PM peak hours, respectively. The Synchro analysis output is provided in **Attachment A**.

Table 6 – Capacity Analysis Results: 2019 AM Peak Hour

ID	Intersection	Approach	Scenario 1 Existing (2-lane SB)			Scenario 2 Proposed (1-lane SB)		
			Delay (sec/veh)	LOS	95th % Queue Length (ft)	Delay (sec/veh)	LOS	95th % Queue Length (ft)
1	Dunn St & 10th St	SB	9.7	A	25	Same as Scenario 1		
		EB	0.0	A	0			
		WB*	7.6	A	25			
		Overall	***9.7***	***A***	--			
2	Dunn St & 7th St	SB	8.4	A	25	8.5	A	25
		EB	8.4	A	25	8.4	A	25
		WB	8.5	A	25	8.5	A	25
		Overall	***8.4***	***A***	--	***8.5***	***A***	--
3	Dunn St & 6th St	SB	7.9	A	25	7.8	A	25
		EB	7.1	A	25	7.0	A	25
		Overall	***7.7***	***A***	--	***7.6***	***A***	--

*Left-turn movement delay of free-flow approach
**Reflects delay of stop-controlled approach

Table 7 – Capacity Analysis Results: 2019 PM Peak Hour

ID	Intersection	Approach	Scenario 1 Existing (2-lane SB)			Scenario 2 Proposed (1-lane SB)		
			Delay (sec/veh)	LOS	95th % Queue Length (ft)	Delay (sec/veh)	LOS	95th % Queue Length (ft)
1	Dunn St & 10th St	SB	12.0	B	25	Same as Scenario 1		
		EB	0.0	A	0			
		WB*	8.2	A	25			
		Overall	***12.0***	***B***	--			
2	Dunn St & 7th St	SB	10.4	B	25	12.4	B	75
		EB	9.5	A	25	9.6	A	25
		WB	12.3	B	50	12.4	B	50
		Overall	***11.0***	***B***	--	***11.9***	***B***	--
3	Dunn St & 6th St	SB	12.5	B	75	19.3	C	175
		EB	10.1	B	50	10.4	B	50
		Overall	***11.8***	***B***	--	***16.6***	***C***	--

*Left-turn movement delay of free-flow approach
**Reflects delay of stop-controlled approach

Findings

Based on a review of the traffic data and capacity analysis results, the findings were determined as follows:

Scenario 1 – Dunn Street 2-lane Southbound: All study intersections currently operate at an acceptable LOS during the AM and PM peak hours with the existing two-lane roadway configuration on southbound Dunn Street.

According to field observations from City staff at the intersection of Dunn Street & 6th Street, drivers during the PM peak hour were regularly observed to be using both southbound travel lanes at the same time. In some instances, there were multiple vehicles queued in each lane. The capacity analysis supports this observation, as the 95th percentile queue length for the southbound approach of 75 feet equates to approximately three (3) vehicles queued in each travel lane.

Scenario 2 – Dunn Street 1-lane Southbound: With the lane reduction of Dunn Street to a one-lane roadway, all study intersections are expected to operate at an acceptable LOS during the AM and PM peak hours. The 95th percentile queue length results indicate that no impacts to upstream intersections are anticipated to occur with the new configuration.

At the intersection of Dunn Street & 6th Street, the 95th percentile queue length for the southbound approach is anticipated to be 175 feet during the PM peak hour which is approximately seven (7) vehicles. The distance between 6th Street and 7th Street is 300 feet; therefore, no impacts are expected to occur with the upstream intersection.

The use of both southbound travel lanes with the current configuration is likely due to having the option to choose the next available lane, and not out of necessity to maximize throughput from a capacity standpoint. Although queuing is expected to be slightly longer during the PM peak hour as a one-lane roadway, Dunn Street is anticipated to continue to operate at an acceptable LOS without any significant impacts to corridor operations.

Attachment A

[Synchro Output]

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	50	55	55	50	0	0	0	0	5	10	5
Future Vol, veh/h	0	50	55	55	50	0	0	0	0	5	10	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	78	78	78	78	78	78	78	78	78	78	78	78
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	0	64	71	71	64	0	0	0	0	6	13	6

Major/Minor	Major1			Major2			Minor2		
Conflicting Flow All	-	0	0	135	0	0	306	341	64
Stage 1	-	-	-	-	-	-	206	206	-
Stage 2	-	-	-	-	-	-	100	135	-
Critical Hdwy	-	-	-	4.1	-	-	6.4	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	5.4	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.4	5.5	-
Follow-up Hdwy	-	-	-	2.2	-	-	3.5	4	3.3
Pot Cap-1 Maneuver	0	-	-	1462	-	-	690	584	1006
Stage 1	0	-	-	-	-	-	833	735	-
Stage 2	0	-	-	-	-	-	929	789	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	-	-	-	1462	-	-	656	0	1006
Mov Cap-2 Maneuver	-	-	-	-	-	-	656	0	-
Stage 1	-	-	-	-	-	-	833	0	-
Stage 2	-	-	-	-	-	-	883	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	4	9.7
HCM LOS			A

Minor Lane/Major Mvmt	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	1462	-	-	794
HCM Lane V/C Ratio	-	-	0.048	-	-	0.032
HCM Control Delay (s)	-	-	7.6	0	-	9.7
HCM Lane LOS	-	-	A	A	-	A
HCM 95th %tile Q(veh)	-	-	0.2	-	-	0.1

Intersection	
Intersection Delay, s/veh	8.4
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	72	15	35	53	0	0	0	0	4	115	15
Future Vol, veh/h	0	72	15	35	53	0	0	0	0	4	115	15
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Heavy Vehicles, %	0	16	0	9	13	0	0	0	0	0	3	0
Mvmt Flow	0	92	19	45	68	0	0	0	0	5	147	19
Number of Lanes	0	1	0	0	1	0	0	0	0	0	2	0

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	2	1
HCM Control Delay	8.4	8.5	8.4
HCM LOS	A	A	A

Lane	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	0%	40%	7%	0%
Vol Thru, %	83%	60%	93%	79%
Vol Right, %	17%	0%	0%	21%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	87	88	62	73
LT Vol	0	35	4	0
Through Vol	72	53	58	58
RT Vol	15	0	0	15
Lane Flow Rate	112	113	79	93
Geometry Grp	2	2	7	7
Degree of Util (X)	0.143	0.147	0.111	0.128
Departure Headway (Hd)	4.626	4.688	5.067	4.94
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	776	767	709	727
Service Time	2.645	2.705	2.787	2.661
HCM Lane V/C Ratio	0.144	0.147	0.111	0.128
HCM Control Delay	8.4	8.5	8.4	8.4
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.5	0.5	0.4	0.4

Intersection	
Intersection Delay, s/veh	7.7
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	13	23	0	0	0	0	0	0	18	115	0
Future Vol, veh/h	0	13	23	0	0	0	0	0	0	18	115	0
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles, %	0	0	3	0	0	0	0	0	0	0	2	0
Mvmt Flow	0	15	26	0	0	0	0	0	0	21	132	0
Number of Lanes	0	1	0	0	0	0	0	0	0	0	2	0

Approach	EB	SB
Opposing Approach		
Opposing Lanes	0	0
Conflicting Approach Left	SB	
Conflicting Lanes Left	2	0
Conflicting Approach Right		EB
Conflicting Lanes Right	0	1
HCM Control Delay	7.1	7.9
HCM LOS	A	A

Lane	EBLn1	SBLn1	SBLn2
Vol Left, %	0%	32%	0%
Vol Thru, %	36%	68%	100%
Vol Right, %	64%	0%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	36	56	77
LT Vol	0	18	0
Through Vol	13	38	77
RT Vol	23	0	0
Lane Flow Rate	41	65	88
Geometry Grp	2	7	7
Degree of Util (X)	0.045	0.085	0.113
Departure Headway (Hd)	3.881	4.733	4.607
Convergence, Y/N	Yes	Yes	Yes
Cap	928	759	780
Service Time	1.881	2.449	2.323
HCM Lane V/C Ratio	0.044	0.086	0.113
HCM Control Delay	7.1	7.9	7.9
HCM Lane LOS	A	A	A
HCM 95th-tile Q	0.1	0.3	0.4

Intersection	
Int Delay, s/veh	2.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	100	150	150	100	0	0	0	0	5	10	5
Future Vol, veh/h	0	100	150	150	100	0	0	0	0	5	10	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	0	114	170	170	114	0	0	0	0	6	11	6

Major/Minor	Major1			Major2			Minor2		
Conflicting Flow All	-	0	0	284	0	0	653	738	114
Stage 1	-	-	-	-	-	-	454	454	-
Stage 2	-	-	-	-	-	-	199	284	-
Critical Hdwy	-	-	-	4.1	-	-	6.4	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	5.4	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.4	5.5	-
Follow-up Hdwy	-	-	-	2.2	-	-	3.5	4	3.3
Pot Cap-1 Maneuver	0	-	-	1290	-	-	435	348	944
Stage 1	0	-	-	-	-	-	644	573	-
Stage 2	0	-	-	-	-	-	839	680	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	-	-	-	1290	-	-	374	0	944
Mov Cap-2 Maneuver	-	-	-	-	-	-	374	0	-
Stage 1	-	-	-	-	-	-	644	0	-
Stage 2	-	-	-	-	-	-	721	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	4.9	12
HCM LOS			B

Minor Lane/Major Mvmt	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	1290	-	-	536
HCM Lane V/C Ratio	-	-	0.132	-	-	0.042
HCM Control Delay (s)	-	-	8.2	0	-	12
HCM Lane LOS	-	-	A	A	-	B
HCM 95th %tile Q(veh)	-	-	0.5	-	-	0.1

Intersection	
Intersection Delay, s/veh	11
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	103	10	124	167	0	0	0	0	8	262	25
Future Vol, veh/h	0	103	10	124	167	0	0	0	0	8	262	25
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	0	5	0	1	6	0	0	0	0	0	0	4
Mvmt Flow	0	117	11	141	190	0	0	0	0	9	298	28
Number of Lanes	0	1	0	0	1	0	0	0	0	0	2	0

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	2	1
HCM Control Delay	9.5	12.3	10.4
HCM LOS	A	B	B

Lane	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	0%	43%	6%	0%
Vol Thru, %	91%	57%	94%	84%
Vol Right, %	9%	0%	0%	16%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	113	291	139	156
LT Vol	0	124	8	0
Through Vol	103	167	131	131
RT Vol	10	0	0	25
Lane Flow Rate	128	331	158	177
Geometry Grp	2	2	7	7
Degree of Util (X)	0.186	0.46	0.248	0.271
Departure Headway (Hd)	5.204	5.01	5.649	5.507
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	683	714	630	645
Service Time	3.289	3.076	3.438	3.296
HCM Lane V/C Ratio	0.187	0.464	0.251	0.274
HCM Control Delay	9.5	12.3	10.3	10.4
HCM Lane LOS	A	B	B	B
HCM 95th-tile Q	0.7	2.4	1	1.1

Intersection	
Intersection Delay, s/veh	11.8
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	48	154	0	0	0	0	0	0	11	459	0
Future Vol, veh/h	0	48	154	0	0	0	0	0	0	11	459	0
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	1	0
Mvmt Flow	0	60	193	0	0	0	0	0	0	14	574	0
Number of Lanes	0	1	0	0	0	0	0	0	0	0	2	0

Approach	EB	SB
Opposing Approach		
Opposing Lanes	0	0
Conflicting Approach Left	SB	
Conflicting Lanes Left	2	0
Conflicting Approach Right		EB
Conflicting Lanes Right	0	1
HCM Control Delay	10.1	12.5
HCM LOS	B	B

Lane	EBLn1	SBLn1	SBLn2
Vol Left, %	0%	7%	0%
Vol Thru, %	24%	93%	100%
Vol Right, %	76%	0%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	202	164	306
LT Vol	0	11	0
Through Vol	48	153	306
RT Vol	154	0	0
Lane Flow Rate	252	205	382
Geometry Grp	2	7	7
Degree of Util (X)	0.331	0.292	0.544
Departure Headway (Hd)	4.721	5.135	5.118
Convergence, Y/N	Yes	Yes	Yes
Cap	760	697	704
Service Time	2.753	2.888	2.871
HCM Lane V/C Ratio	0.332	0.294	0.543
HCM Control Delay	10.1	10	13.9
HCM Lane LOS	B	A	B
HCM 95th-tile Q	1.5	1.2	3.3

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	50	55	55	50	0	0	0	0	5	10	5
Future Vol, veh/h	0	50	55	55	50	0	0	0	0	5	10	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	78	78	78	78	78	78	78	78	78	78	78	78
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	0	64	71	71	64	0	0	0	0	6	13	6

Major/Minor	Major1			Major2			Minor2		
Conflicting Flow All	-	0	0	135	0	0	306	341	64
Stage 1	-	-	-	-	-	-	206	206	-
Stage 2	-	-	-	-	-	-	100	135	-
Critical Hdwy	-	-	-	4.1	-	-	6.4	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	5.4	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.4	5.5	-
Follow-up Hdwy	-	-	-	2.2	-	-	3.5	4	3.3
Pot Cap-1 Maneuver	0	-	-	1462	-	-	690	584	1006
Stage 1	0	-	-	-	-	-	833	735	-
Stage 2	0	-	-	-	-	-	929	789	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	-	-	-	1462	-	-	656	0	1006
Mov Cap-2 Maneuver	-	-	-	-	-	-	656	0	-
Stage 1	-	-	-	-	-	-	833	0	-
Stage 2	-	-	-	-	-	-	883	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	4	9.7
HCM LOS			A

Minor Lane/Major Mvmt	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	1462	-	-	794
HCM Lane V/C Ratio	-	-	0.048	-	-	0.032
HCM Control Delay (s)	-	-	7.6	0	-	9.7
HCM Lane LOS	-	-	A	A	-	A
HCM 95th %tile Q(veh)	-	-	0.2	-	-	0.1

Intersection	
Intersection Delay, s/veh	8.5
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	72	15	35	53	0	0	0	0	4	115	15
Future Vol, veh/h	0	72	15	35	53	0	0	0	0	4	115	15
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Heavy Vehicles, %	0	16	0	9	13	0	0	0	0	0	3	0
Mvmt Flow	0	92	19	45	68	0	0	0	0	5	147	19
Number of Lanes	0	1	0	0	1	0	0	0	0	0	1	0

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	1	1
HCM Control Delay	8.4	8.5	8.5
HCM LOS	A	A	A

Lane	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	40%	3%
Vol Thru, %	83%	60%	86%
Vol Right, %	17%	0%	11%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	87	88	134
LT Vol	0	35	4
Through Vol	72	53	115
RT Vol	15	0	15
Lane Flow Rate	112	113	172
Geometry Grp	1	1	1
Degree of Util (X)	0.142	0.146	0.209
Departure Headway (Hd)	4.596	4.657	4.372
Convergence, Y/N	Yes	Yes	Yes
Cap	782	772	823
Service Time	2.616	2.677	2.387
HCM Lane V/C Ratio	0.143	0.146	0.209
HCM Control Delay	8.4	8.5	8.5
HCM Lane LOS	A	A	A
HCM 95th-tile Q	0.5	0.5	0.8

Intersection	
Intersection Delay, s/veh	7.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	13	23	0	0	0	0	0	0	18	115	0
Future Vol, veh/h	0	13	23	0	0	0	0	0	0	18	115	0
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles, %	0	0	3	0	0	0	0	0	0	0	2	0
Mvmt Flow	0	15	26	0	0	0	0	0	0	21	132	0
Number of Lanes	0	1	0	0	0	0	0	0	0	0	1	0

Approach	EB	SB
Opposing Approach		
Opposing Lanes	0	0
Conflicting Approach Left	SB	
Conflicting Lanes Left	1	0
Conflicting Approach Right		EB
Conflicting Lanes Right	0	1
HCM Control Delay	7	7.8
HCM LOS	A	A

Lane	EBLn1	SBLn1
Vol Left, %	0%	14%
Vol Thru, %	36%	86%
Vol Right, %	64%	0%
Sign Control	Stop	Stop
Traffic Vol by Lane	36	133
LT Vol	0	18
Through Vol	13	115
RT Vol	23	0
Lane Flow Rate	41	153
Geometry Grp	1	1
Degree of Util (X)	0.043	0.17
Departure Headway (Hd)	3.783	4
Convergence, Y/N	Yes	Yes
Cap	936	899
Service Time	1.85	2.012
HCM Lane V/C Ratio	0.044	0.17
HCM Control Delay	7	7.8
HCM Lane LOS	A	A
HCM 95th-tile Q	0.1	0.6

Intersection	
Int Delay, s/veh	2.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	100	150	150	100	0	0	0	0	5	10	5
Future Vol, veh/h	0	100	150	150	100	0	0	0	0	5	10	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	0	114	170	170	114	0	0	0	0	6	11	6

Major/Minor	Major1			Major2			Minor2		
Conflicting Flow All	-	0	0	284	0	0	653	738	114
Stage 1	-	-	-	-	-	-	454	454	-
Stage 2	-	-	-	-	-	-	199	284	-
Critical Hdwy	-	-	-	4.1	-	-	6.4	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	5.4	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.4	5.5	-
Follow-up Hdwy	-	-	-	2.2	-	-	3.5	4	3.3
Pot Cap-1 Maneuver	0	-	-	1290	-	-	435	348	944
Stage 1	0	-	-	-	-	-	644	573	-
Stage 2	0	-	-	-	-	-	839	680	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	-	-	-	1290	-	-	374	0	944
Mov Cap-2 Maneuver	-	-	-	-	-	-	374	0	-
Stage 1	-	-	-	-	-	-	644	0	-
Stage 2	-	-	-	-	-	-	721	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	4.9	12
HCM LOS			B

Minor Lane/Major Mvmt	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	1290	-	-	536
HCM Lane V/C Ratio	-	-	0.132	-	-	0.042
HCM Control Delay (s)	-	-	8.2	0	-	12
HCM Lane LOS	-	-	A	A	-	B
HCM 95th %tile Q(veh)	-	-	0.5	-	-	0.1

Intersection	
Intersection Delay, s/veh	11.9
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	103	10	124	167	0	0	0	0	8	262	25
Future Vol, veh/h	0	103	10	124	167	0	0	0	0	8	262	25
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	0	5	0	1	6	0	0	0	0	0	0	4
Mvmt Flow	0	117	11	141	190	0	0	0	0	9	298	28
Number of Lanes	0	1	0	0	1	0	0	0	0	0	1	0

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	1	1
HCM Control Delay	9.6	12.4	12.4
HCM LOS	A	B	B

Lane	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	43%	3%
Vol Thru, %	91%	57%	89%
Vol Right, %	9%	0%	8%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	113	291	295
LT Vol	0	124	8
Through Vol	103	167	262
RT Vol	10	0	25
Lane Flow Rate	128	331	335
Geometry Grp	1	1	1
Degree of Util (X)	0.19	0.462	0.464
Departure Headway (Hd)	5.324	5.027	4.981
Convergence, Y/N	Yes	Yes	Yes
Cap	678	708	714
Service Time	3.324	3.114	3.068
HCM Lane V/C Ratio	0.189	0.468	0.469
HCM Control Delay	9.6	12.4	12.4
HCM Lane LOS	A	B	B
HCM 95th-tile Q	0.7	2.4	2.5

Intersection	
Intersection Delay, s/veh	16.6
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	48	154	0	0	0	0	0	0	11	459	0
Future Vol, veh/h	0	48	154	0	0	0	0	0	0	11	459	0
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	1	0
Mvmt Flow	0	60	193	0	0	0	0	0	0	14	574	0
Number of Lanes	0	1	0	0	0	0	0	0	0	0	1	0

Approach	EB	SB
Opposing Approach		
Opposing Lanes	0	0
Conflicting Approach Left	SB	
Conflicting Lanes Left	1	0
Conflicting Approach Right		EB
Conflicting Lanes Right	0	1
HCM Control Delay	10.4	19.3
HCM LOS	B	C

Lane	EBLn1	SBLn1
Vol Left, %	0%	2%
Vol Thru, %	24%	98%
Vol Right, %	76%	0%
Sign Control	Stop	Stop
Traffic Vol by Lane	202	470
LT Vol	0	11
Through Vol	48	459
RT Vol	154	0
Lane Flow Rate	252	588
Geometry Grp	1	1
Degree of Util (X)	0.339	0.738
Departure Headway (Hd)	4.83	4.52
Convergence, Y/N	Yes	Yes
Cap	740	799
Service Time	2.887	2.571
HCM Lane V/C Ratio	0.341	0.736
HCM Control Delay	10.4	19.3
HCM Lane LOS	B	C
HCM 95th-tile Q	1.5	6.7