APPENDIX E

HCS Capacity Software Output

APPENDIX E

HCS Capacity Software Output - No-Build Alternative - 2023

HCS7 Two-Way Stop-Control Report

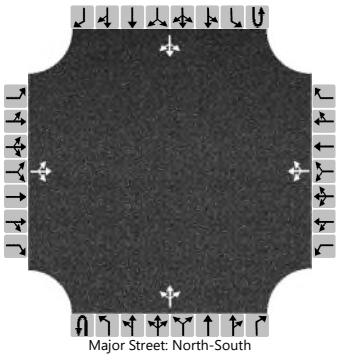
General Information

Analyst	QAi
Agency/Co.	Arcadis
Date Performed	3/13/2023
Analysis Year	2023
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Middletown Road
Jurisdiction	District 8
East/West Street	Middeltown Road
North/South Street	US 42
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		78	12	3		19	13	6		4	158	4		0	323	135
Percent Heavy Vehicles (%)		13	13	13		0	0	0		5				5		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.23	6.63	6.33		7.10	6.50	6.20		4.15				4.15		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.62	4.12	3.42		3.50	4.00	3.30		2.25				2.25		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			101				41			4				0		
Capacity, c (veh/h)			379				422			1051				1382		
v/c Ratio			0.27				0.10			0.00				0.00		
95% Queue Length, Q_{95} (veh)			1.1				0.3			0.0				0.0		
Control Delay (s/veh)			17.9				14.5			8.4				7.6		
Level of Service (LOS)			C				B			A				A		
Approach Delay (s/veh)		17.9				14.5				0.2				0.0		
Approach LOS		C				B										

HCS7 Two-Way Stop-Control Report

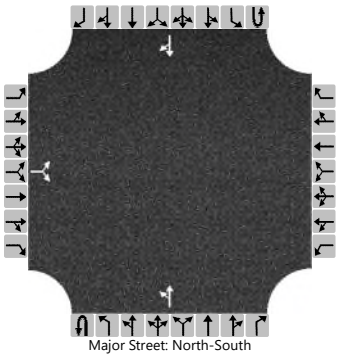
General Information

Analyst	QAi
Agency/Co.	Arcadis
Date Performed	3/13/2023
Analysis Year	2023
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Township Line
Jurisdiction	District 8
East/West Street	Township Line Road
North/South Street	US 42
Peak Hour Factor	0.93
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		2		173						123	163				344	0
Percent Heavy Vehicles (%)		10		10						6						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.50		6.30						4.16						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.59		3.39						2.25						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			188							132						
Capacity, c (veh/h)			649							1167						
v/c Ratio			0.29							0.11						
95% Queue Length, Q_{95} (veh)			1.2							0.4						
Control Delay (s/veh)			12.8							8.5						
Level of Service (LOS)			B							A						
Approach Delay (s/veh)		12.8								4.3						
Approach LOS		B														

HCS7 Two-Way Stop-Control Report

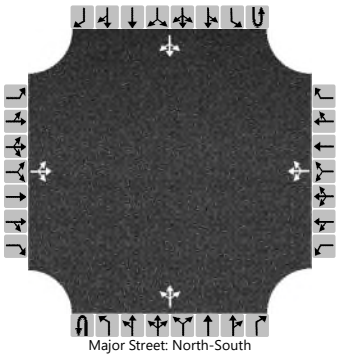
General Information

Analyst	QAi
Agency/Co.	Arcadis
Date Performed	3/13/2023
Analysis Year	2023
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Middletown Road
Jurisdiction	District 8
East/West Street	Middeltown Road
North/South Street	US 42
Peak Hour Factor	0.93
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		122	15	10		17	17	5		9	366	28		11	354	95
Percent Heavy Vehicles (%)		3	3	3		10	10	10		2				2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.13	6.53	6.23		7.20	6.60	6.30		4.12				4.12		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.53	4.03	3.33		3.59	4.09	3.39		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			158				42			10				12		
Capacity, c (veh/h)			253				262			1080				1136		
v/c Ratio			0.63				0.16			0.01				0.01		
95% Queue Length, Q_{95} (veh)			3.8				0.6			0.0				0.0		
Control Delay (s/veh)			40.4				21.4			8.4				8.2		
Level of Service (LOS)			E				C			A				A		
Approach Delay (s/veh)	40.4				21.4				0.3				0.3			
Approach LOS	E				C											

HCS7 Two-Way Stop-Control Report

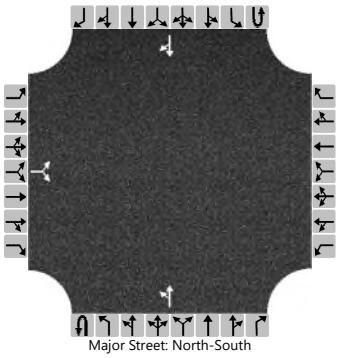
General Information

Analyst	QAi
Agency/Co.	Arcadis
Date Performed	3/13/2023
Analysis Year	2023
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Township Line
Jurisdiction	District 8
East/West Street	Township Line Road
North/South Street	US 42
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		2		153						205	401				376	5
Percent Heavy Vehicles (%)		1		1						1						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.41		6.21						4.11						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.51		3.31						2.21						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			172							228						
Capacity, c (veh/h)			604							1141						
v/c Ratio			0.29							0.20						
95% Queue Length, Q_{95} (veh)			1.2							0.7						
Control Delay (s/veh)			13.3							8.9						
Level of Service (LOS)			B							A						
Approach Delay (s/veh)		13.3								4.6						
Approach LOS		B														

APPENDIX E

HCS Capacity Software Output - No-Build Alternative - 2048

HCS7 Two-Way Stop-Control Report

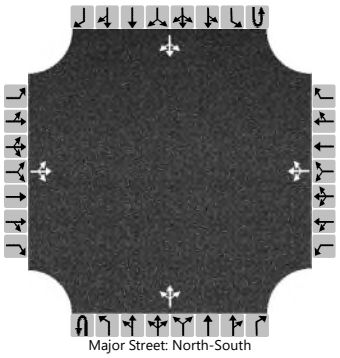
General Information

Analyst	QAi
Agency/Co.	Arcadis
Date Performed	3/13/2023
Analysis Year	2048
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Middletown Road
Jurisdiction	District 8
East/West Street	Middeltown Road
North/South Street	US 42
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		100	20	10		30	20	10		10	200	10		0	410	170
Percent Heavy Vehicles (%)		13	13	13		0	0	0		5				5		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.23	6.63	6.33		7.10	6.50	6.20		4.15				4.15		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.62	4.12	3.42		3.50	4.00	3.30		2.25				2.25		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			141				65			11				0		
Capacity, c (veh/h)			284				317			938				1322		
v/c Ratio			0.50				0.21			0.01				0.00		
95% Queue Length, Q_{95} (veh)			2.6				0.8			0.0				0.0		
Control Delay (s/veh)			29.6				19.2			8.9				7.7		
Level of Service (LOS)			D				C			A				A		
Approach Delay (s/veh)	29.6				19.2				0.5				0.0			
Approach LOS	D				C											

HCS7 Two-Way Stop-Control Report

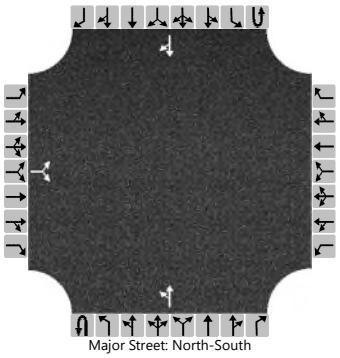
General Information

Analyst	QAi
Agency/Co.	Arcadis
Date Performed	3/13/2023
Analysis Year	2048
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Township Line
Jurisdiction	District 8
East/West Street	Township Line Road
North/South Street	US 42
Peak Hour Factor	0.93
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		10		220						160	210				440	0
Percent Heavy Vehicles (%)		10		10						6						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.50		6.30						4.16						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.59		3.39						2.25						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			247							172						
Capacity, c (veh/h)			532							1068						
v/c Ratio			0.47							0.16						
95% Queue Length, Q_{95} (veh)			2.4							0.6						
Control Delay (s/veh)			17.5							9.0						
Level of Service (LOS)			C							A						
Approach Delay (s/veh)		17.5								4.8						
Approach LOS		C														

HCS7 Two-Way Stop-Control Report

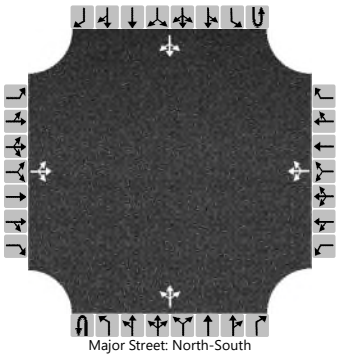
General Information

Analyst	QAi
Agency/Co.	Arcadis
Date Performed	3/13/2023
Analysis Year	2048
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Middletown Road
Jurisdiction	District 8
East/West Street	Middeltown Road
North/South Street	US 42
Peak Hour Factor	0.93
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		160	20	20		30	30	10		20	460	40		20	450	120
Percent Heavy Vehicles (%)		3	3	3		10	10	10		2				2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.13	6.53	6.23		7.20	6.60	6.30		4.12				4.12		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.53	4.03	3.33		3.59	4.09	3.39		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			215				75			22				22		
Capacity, c (veh/h)			149				166			966				1031		
v/c Ratio			1.45				0.45			0.02				0.02		
95% Queue Length, Q_{95} (veh)			14.1				2.1			0.1				0.1		
Control Delay (s/veh)			291.1				43.7			8.8				8.6		
Level of Service (LOS)			F				E			A				A		
Approach Delay (s/veh)	291.1				43.7				0.6				0.6			
Approach LOS	F				E											

HCS7 Two-Way Stop-Control Report

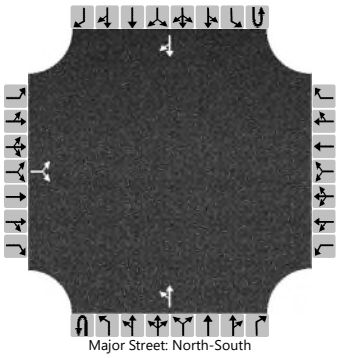
General Information

Analyst	QAi
Agency/Co.	Arcadis
Date Performed	3/13/2023
Analysis Year	2048
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Township Line
Jurisdiction	District 8
East/West Street	Township Line Road
North/South Street	US 42
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		10		200						260	510				480	10
Percent Heavy Vehicles (%)		1		1						1						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.41		6.21						4.11						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.51		3.31						2.21						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			233							289						
Capacity, c (veh/h)			395							1030						
v/c Ratio			0.59							0.28						
95% Queue Length, Q_{95} (veh)			3.7							1.2						
Control Delay (s/veh)			26.4							9.9						
Level of Service (LOS)			D							A						
Approach Delay (s/veh)		26.4								6.0						
Approach LOS		D														

APPENDIX E

HCS Capacity Software Output - Northbound Left Turn Lane at Township Line Road

HCS7 Two-Way Stop-Control Report

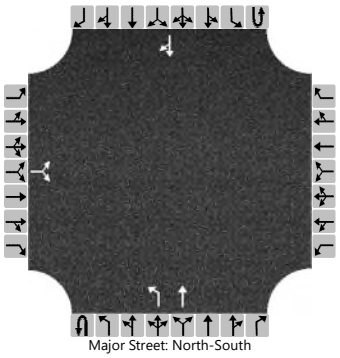
General Information

Analyst	QAi
Agency/Co.	Arcadis
Date Performed	3/13/2023
Analysis Year	2048
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Township Line
Jurisdiction	District 8
East/West Street	Township Line Road
North/South Street	US 42
Peak Hour Factor	0.93
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LR							L	T					TR
Volume (veh/h)		10		220						160	210				440	0
Percent Heavy Vehicles (%)		10		10						6						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.50		6.30						4.16						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.59		3.39						2.25						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			247							172						
Capacity, c (veh/h)			533							1068						
v/c Ratio			0.46							0.16						
95% Queue Length, Q_{95} (veh)			2.4							0.6						
Control Delay (s/veh)			17.4							9.0						
Level of Service (LOS)			C							A						
Approach Delay (s/veh)		17.4								3.9						
Approach LOS		C														

HCS7 Two-Way Stop-Control Report

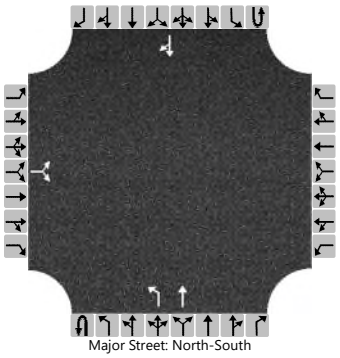
General Information

Analyst	QAi
Agency/Co.	Arcadis
Date Performed	3/13/2023
Analysis Year	2048
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Township Line
Jurisdiction	District 8
East/West Street	Township Line Road
North/South Street	US 42
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LR							L	T					TR
Volume (veh/h)		10		200						260	510				480	10
Percent Heavy Vehicles (%)		1		1						1						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.41		6.21						4.11						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.51		3.31						2.21						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			233							289						
Capacity, c (veh/h)			419							1030						
v/c Ratio			0.56							0.28						
95% Queue Length, Q_{95} (veh)			3.3							1.2						
Control Delay (s/veh)			23.8							9.9						
Level of Service (LOS)			C							A						
Approach Delay (s/veh)		23.8								3.3						
Approach LOS		C														

APPENDIX E

HCS Capacity Software Output - Build Alternative - Roundabout at Middletown Road and Right Out Only at Township Line Road

HCS7 Roundabouts Report

General Information

Analyst	QAi
Agency or Co.	Arcadis
Date Performed	6/12/2023
Analysis Year	2048
Time Analyzed	Build AM Peak
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Middletown Road
E/W Street Name	Middeltown Road
N/S Street Name	US 42
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.92
Jurisdiction	District 8

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	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	110	20	10	0	30	20	10	0	170	190	10	0	0	410	170
Percent Heavy Vehicles, %	13	13	13	13	0	0	0	0	5	5	5	5	5	5	5	5
Flow Rate (v_{PCE}), pc/h	0	135	25	12	0	33	22	11	0	194	217	11	0	0	468	194
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
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)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

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		172			66			422			662	
Entry Volume, veh/h		152			66			402			630	
Circulating Flow (v_c), pc/h	501			546			160			249		
Exiting Flow (v_{ex}), pc/h	36			410			363			513		
Capacity (c_{pce}), pc/h		828			791			1172			1070	
Capacity (c), veh/h		733			791			1116			1020	
v/c Ratio (x)		0.21			0.08			0.36			0.62	

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		7.2			5.4			6.8			12.2	
Lane LOS		A			A			A			B	
95% Queue, veh		0.8			0.3			1.7			4.5	
Approach Delay, s/veh	7.2			5.4			6.8			12.2		
Approach LOS	A			A			A			B		
Intersection Delay, s/veh | LOS	9.5						A					

HCS7 Roundabouts Report

General Information

Analyst	QAi
Agency or Co.	Arcadis
Date Performed	6/12/2023
Analysis Year	2048
Time Analyzed	Build PM Peak
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Middletown Road
E/W Street Name	Middeltown Road
N/S Street Name	US 42
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.93
Jurisdiction	District 8

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	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	170	20	20	0	30	30	10	0	280	450	40	0	20	440	130
Percent Heavy Vehicles, %	3	3	3	3	0	10	10	10	2	2	2	2	2	2	2	2
Flow Rate (v_{PCE}), pc/h	0	188	22	22	0	35	35	12	0	307	494	44	0	22	483	143
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
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)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

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		232			82			845			648	
Entry Volume, veh/h		225			75			828			635	
Circulating Flow (v_c), pc/h	540			989			232			377		
Exiting Flow (v_{ex}), pc/h	88			485			694			540		
Capacity (c_{pce}), pc/h		796			503			1089			939	
Capacity (c), veh/h		772			457			1068			921	
v/c Ratio (x)		0.29			0.16			0.78			0.69	

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		8.0			10.2			17.8			15.6	
Lane LOS		A			B			C			C	
95% Queue, veh		1.2			0.6			8.2			5.7	
Approach Delay, s/veh	8.0			10.2			17.8			15.6		
Approach LOS	A			B			C			C		
Intersection Delay, s/veh | LOS	15.4						C					

HCS7 Two-Way Stop-Control Report

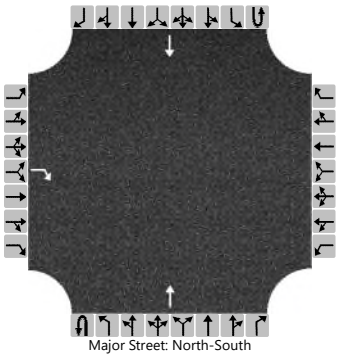
General Information

Analyst	QAi
Agency/Co.	Arcadis
Date Performed	3/13/2023
Analysis Year	2048
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Township Line
Jurisdiction	District 8
East/West Street	Township Line Road
North/South Street	US 42
Peak Hour Factor	0.93
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	0	0	0	1	0	0	0	1	0
Configuration				R							T				T	
Volume (veh/h)				220							370				440	
Percent Heavy Vehicles (%)				10												
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No															
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)				6.2												
Critical Headway (sec)				6.30												
Base Follow-Up Headway (sec)				3.3												
Follow-Up Headway (sec)				3.39												

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				237												
Capacity, c (veh/h)				575												
v/c Ratio				0.41												
95% Queue Length, Q_{95} (veh)				2.0												
Control Delay (s/veh)				15.6												
Level of Service (LOS)				C												
Approach Delay (s/veh)	15.6															
Approach LOS	C															

HCS7 Two-Way Stop-Control Report

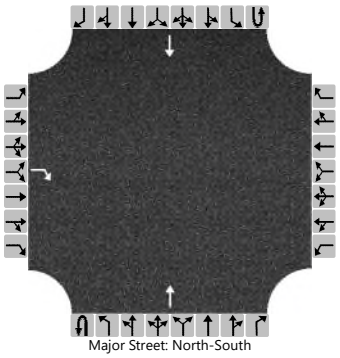
General Information

Analyst	QAi
Agency/Co.	Arcadis
Date Performed	3/13/2023
Analysis Year	2048
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Township Line
Jurisdiction	District 8
East/West Street	Township Line Road
North/South Street	US 42
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	0	0	0	1	0	0	0	1	0
Configuration				R							T				T	
Volume (veh/h)				200							770				480	
Percent Heavy Vehicles (%)				1												
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No															
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)				6.2												
Critical Headway (sec)				6.21												
Base Follow-Up Headway (sec)				3.3												
Follow-Up Headway (sec)				3.31												

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				222												
Capacity, c (veh/h)				548												
v/c Ratio				0.41												
95% Queue Length, Q_{95} (veh)				2.0												
Control Delay (s/veh)				16.0												
Level of Service (LOS)				C												
Approach Delay (s/veh)	16.0															
Approach LOS	C															

APPENDIX E

HCS Capacity Software Output - Build Alternative - Close West Leg of Middletown Road and Roundabout at Township Line Road

HCS7 Two-Way Stop-Control Report

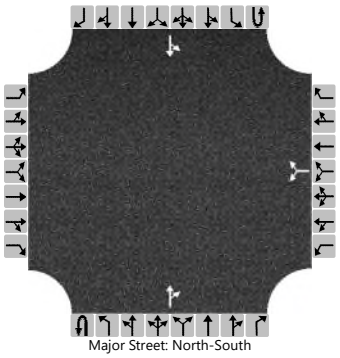
General Information

Analyst	QAi
Agency/Co.	Arcadis
Date Performed	3/13/2023
Analysis Year	2048
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Middletown Road
Jurisdiction	District 8
East/West Street	Middeltown Road
North/South Street	US 42
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume (veh/h)						50		10			300	30		0	580	
Percent Heavy Vehicles (%)						0		0						5		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.40		6.20						4.15		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.50		3.30						2.25		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							65							0		
Capacity, c (veh/h)							313							1184		
v/c Ratio							0.21							0.00		
95% Queue Length, Q_{95} (veh)							0.8							0.0		
Control Delay (s/veh)							19.5							8.0		
Level of Service (LOS)							C							A		
Approach Delay (s/veh)						19.5								0.0		
Approach LOS						C										

HCS7 Two-Way Stop-Control Report

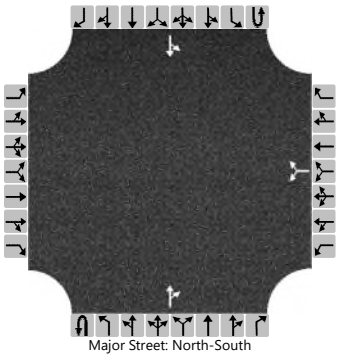
General Information

Analyst	QAi
Agency/Co.	Arcadis
Date Performed	3/13/2023
Analysis Year	2048
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Middletown Road
Jurisdiction	District 8
East/West Street	Middeltown Road
North/South Street	US 42
Peak Hour Factor	0.93
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume (veh/h)						60		10			620	60		20	570	
Percent Heavy Vehicles (%)						10		10						2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.50		6.30						4.12		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.59		3.39						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							75							22		
Capacity, c (veh/h)							168							873		
v/c Ratio							0.45							0.02		
95% Queue Length, Q_{95} (veh)							2.1							0.1		
Control Delay (s/veh)							42.8							9.2		
Level of Service (LOS)							E							A		
Approach Delay (s/veh)						42.8								0.7		
Approach LOS						E										

HCS7 Roundabouts Report

General Information

Analyst	QAi
Agency or Co.	Arcadis
Date Performed	6/12/2023
Analysis Year	2048
Time Analyzed	Build AM Peak
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Township Line
E/W Street Name	Township Line Road
N/S Street Name	US 42
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.93
Jurisdiction	District 8

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	1	0	0	0	0	0	0	0	1	0	0	0	1	0
Lane Assignment			LR								LT				TR	
Volume (V), veh/h	0	130		230					0	170	200		0		440	190
Percent Heavy Vehicles, %	13	13		13					6	6	6		6		6	6
Flow Rate (v_{PCE}), pc/h	0	158		279					0	194	228		0		502	217
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1								1				1			
Pedestrians Crossing, p/h	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)		4.9763						4.9763			4.9763	
Follow-Up Headway (s)		2.6087						2.6087			2.6087	

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		437						422			719	
Entry Volume, veh/h		387						398			678	
Circulating Flow (v_c), pc/h	502			580			158			194		
Exiting Flow (v_{ex}), pc/h	0			411			386			781		
Capacity (c_{pce}), pc/h		827						1175			1132	
Capacity (c), veh/h		732						1108			1068	
v/c Ratio (x)		0.53						0.36			0.64	

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		12.9						6.9			12.2	
Lane LOS		B						A			B	
95% Queue, veh		3.1						1.7			4.8	
Approach Delay, s/veh	12.9						6.9			12.2		
Approach LOS	B						A			B		
Intersection Delay, s/veh | LOS	10.9						B					

HCS7 Roundabouts Report

General Information

Analyst	QAi
Agency or Co.	Arcadis
Date Performed	6/12/2023
Analysis Year	2048
Time Analyzed	Build PM Peak
Project Description	Safety Studies - 2023

Site Information

Intersection	US 42 at Township Line
E/W Street Name	Township Line Road
N/S Street Name	US 42
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.90
Jurisdiction	District 8

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	1	0	0	0	0	0	0	0	1	0	0	0	1	0
Lane Assignment			LR								LT				TR	
Volume (V), veh/h	0	190		220					0	280	490		0		480	160
Percent Heavy Vehicles, %	1	3		3					1	1	1		1		1	1
Flow Rate (v_{PCE}), pc/h	0	217		252					0	314	550		0		539	180
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1								1				1			
Pedestrians Crossing, p/h	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)		4.9763						4.9763			4.9763	
Follow-Up Headway (s)		2.6087						2.6087			2.6087	

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		469						864			719	
Entry Volume, veh/h		455						855			712	
Circulating Flow (v_c), pc/h	539			1081			217			314		
Exiting Flow (v_{ex}), pc/h	0			494			767			791		
Capacity (c_{pce}), pc/h		796						1106			1002	
Capacity (c), veh/h		773						1095			992	
v/c Ratio (x)		0.59						0.78			0.72	

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		14.0						17.8			15.9	
Lane LOS		B						C			C	
95% Queue, veh		3.9						8.4			6.4	
Approach Delay, s/veh	14.0						17.8			15.9		
Approach LOS	B						C			C		
Intersection Delay, s/veh | LOS	16.3						C					