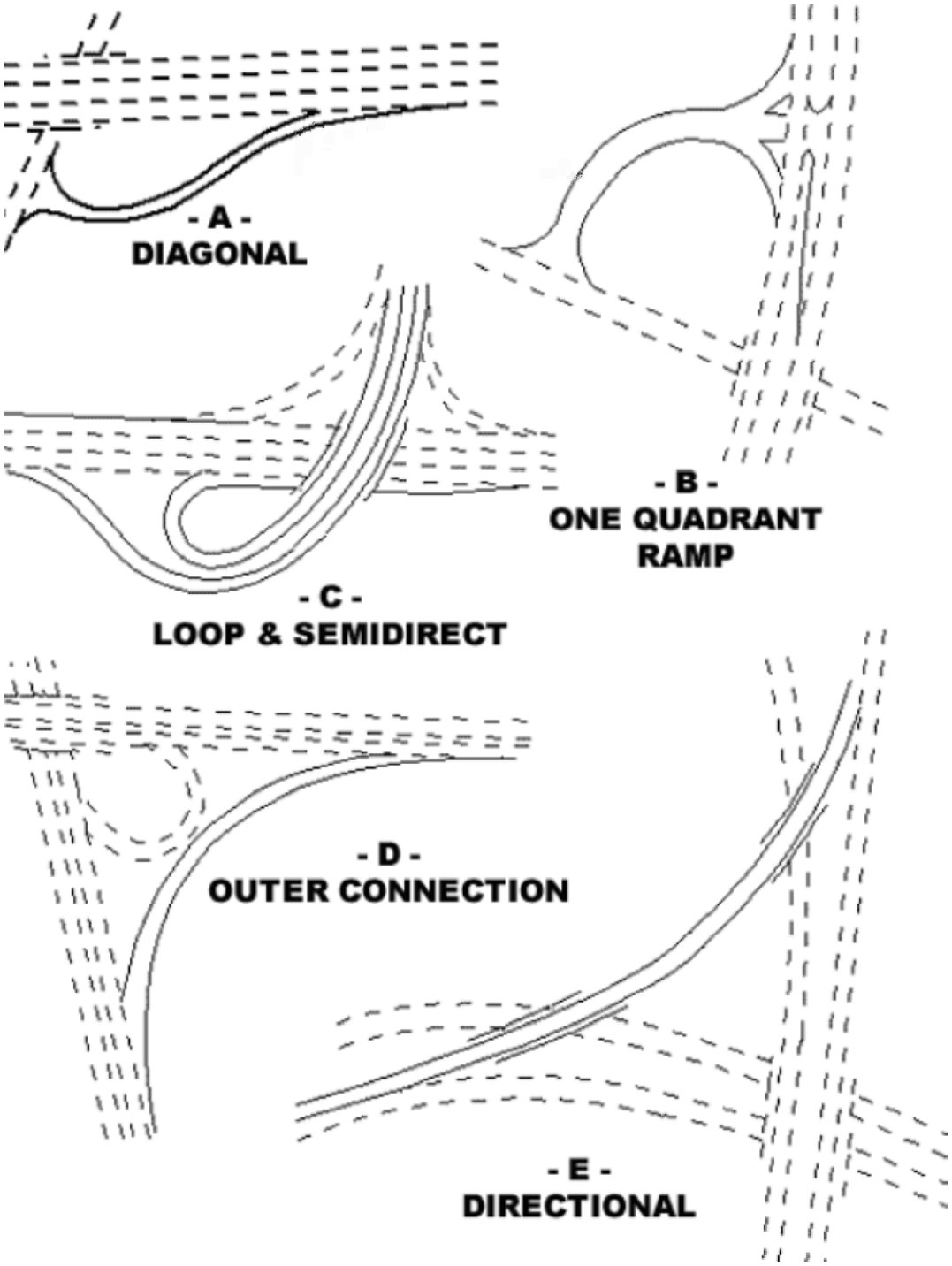
APPENDIX A

General Types of Freeway Ramps
American Association of State Highway and Transportation Officials


- A -
DIAGONAL
- B -
ONE QUADRANT
RAMP
- C -
LOOP & SEMIDIRECT
- D -
OUTER CONNECTION
- E -
DIRECTIONAL

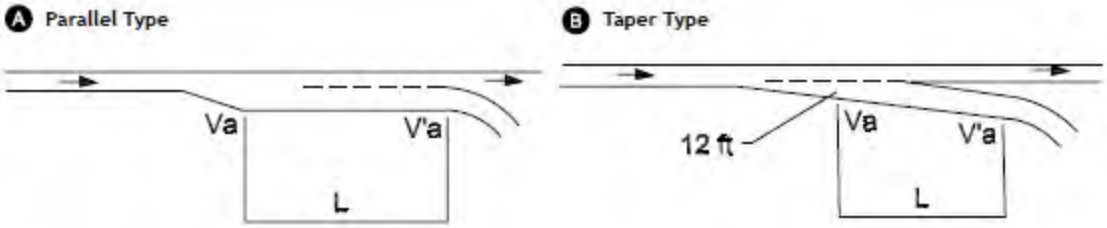
APPENDIX B

Deceleration Length Design Guidelines
MassDOT Project Development and Design Guide

Exhibit 7-13
Minimum Deceleration Lengths for Exit Terminals with Flat Grades of 2% or Less

		Deceleration Length L (ft) for Design Speed of Exit Curve V_N (mph)								
		Stop Condition	15	20	25	30	35	40	45	50
Highway Design Speed V (mph)	Highway Speed Reached, V_a (mph)	For Average Running Speed on Exit Curve V'_a (mph)								
		0	14	18	22	26	30	36	40	44
30	28	235	200	170	140	—	—	—	—	—
35	32	280	250	210	185	150	—	—	—	—
40	36	320	295	265	235	185	155	—	—	—
45	40	385	350	325	295	250	220	—	—	—
50	44	435	405	385	355	315	285	225	175	—
55	48	480	455	440	410	380	350	285	235	—
60	52	530	500	480	460	430	405	350	300	240
65	55	570	540	520	500	470	440	390	340	280
70	58	615	590	570	550	520	490	440	390	340
75	61	660	635	620	600	575	535	490	440	390

V = Design Speed of Highway (mph)
V_a = Average Running Speed of Highway (mph)
V_N = Design Speed of Exit Curve (mph)
V'_a = Average Running Speed of Exit Curve (mph)



Source: *A Policy on Geometric Design of Highways and Streets*, AASHTO, 2004. Chapter 10 Grade Separations and Interchanges

Notes for This Stdy:

Applicable to diverge locations at Exits 59 and 60 on I-95 northbound

Applicable to other diverge locations in the study area

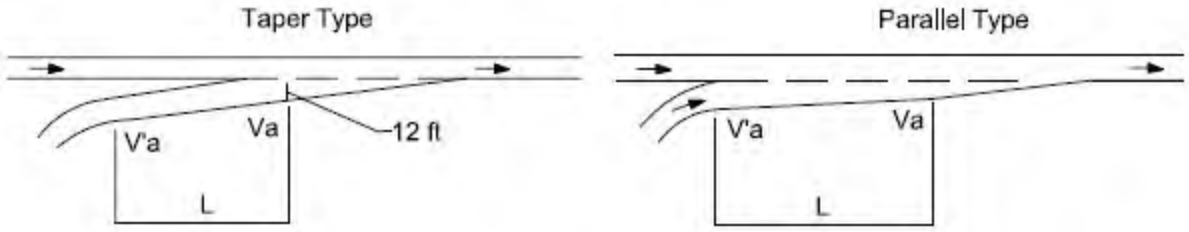
APPENDIX C

Acceleration Length Design Guidelines
MassDOT Project Development and Design Guide

Exhibit 7-14
Minimum Acceleration Lengths for Entrance Terminals with Flat Grades of 2% or Less

		Acceleration Length L (ft) for Entrance Curve Design Speed (mph)								
		Stop Condition	15	20	25	30	35	40	45	50
Highway Design Speed	Highway Speed Reached,	and Initial Speed V'a (mph)								
V (mph)	Va (mph)	0	14	18	22	26	30	36	40	44
30	28	180	140	—	—	—	—	—	—	—
35	32	280	220	160	—	—	—	—	—	—
40	36	360	300	270	210	120	—	—	—	—
45	40	560	490	440	380	280	160	—	—	—
50	44	720	660	610	550	450	350	130	—	—
55	48	960	900	810	780	670	550	320	150	—
60	52	1200	1140	1100	1020	910	800	550	420	180
65	55	1410	1350	1310	1220	1120	1000	770	600	370
70	58	1620	1560	1520	1420	1350	1230	1000	820	580
75	61	1790	1730	1630	1580	1510	1420	1160	1040	780

Note: Uniform 50:1 to 70:1 tapers are recommended where lengths of acceleration lanes exceed 1,300 feet.



Source: *A Policy on Geometric Design of Highways and Streets*, AASHTO, 2004. Chapter 10 Grade Separations and Interchanges

Notes for This Study:

Applicable to merge locations at Exits 59 and 61 on I-95 southbound

Applicable to other merge locations in the study area

APPENDIX D

Highway Capacity Analyses
2019 Weekday AM Peak Hour

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex57 Diverge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	600
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5150	500
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	5779	551
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.85	0.28

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1999.1	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	3600	Speed Index (DS)	0.489
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2143
Distance to Downstream Ramp (LDOWN), ft	1750	Off-Ramp Influence Area Speed (SR), mi/h	54.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.590	Outer Lanes Freeway Speed (SO), mi/h	67.7
Flow in Lanes 1 and 2 (v12), pc/h	3636	Ramp Junction Speed (S), mi/h	58.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	32.9
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	30.1

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex57 Basic Fwy - 2019 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.25
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.1
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4650	Heavy Vehicle Adjustment Factor (f_{HV})	0.948
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1739
Total Trucks, %	5.50	Capacity (c), pc/h/ln	2358
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2283
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.76
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	62.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	27.7
Total Ramp Density Adjustment	3.9	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex57 Merge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	650
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	4650	350
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	5218	385
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.82	0.20

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	868.8	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1750	Speed Index (MS)	0.589
Downstream Equilibrium Distance (LEQ), ft	3917.7	Flow Outer Lanes (vOA), pc/h/ln	1221
Distance to Downstream Ramp (LDOWN), ft	850	On-Ramp Influence Area Speed (SR), mi/h	51.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.766	Outer Lanes Freeway Speed (SO), mi/h	63.2
Flow in Lanes 1 and 2 (v12), pc/h	3997	Ramp Junction Speed (S), mi/h	53.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	4382	Average Density (D), pc/mi/ln	34.7
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	35.5

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex58 Diverge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	350
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5000	350
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	5611	385
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.82	0.20

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	2212.8	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	850	Speed Index (DS)	0.474
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2080
Distance to Downstream Ramp (LDOWN), ft	2300	Off-Ramp Influence Area Speed (SR), mi/h	54.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.602	Outer Lanes Freeway Speed (SO), mi/h	68.0
Flow in Lanes 1 and 2 (v12), pc/h	3531	Ramp Junction Speed (S), mi/h	58.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	31.8
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	31.5

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex58 Basic Fwy - 2019 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.25
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.1
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4650	Heavy Vehicle Adjustment Factor (f_{HV})	0.948
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1739
Total Trucks, %	5.50	Capacity (c), pc/h/ln	2358
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2283
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.76
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	62.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	27.7
Total Ramp Density Adjustment	3.9	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex58 Merge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	750
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	4650	800
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	5218	881
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.89	0.46

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1019.3	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2300	Speed Index (MS)	0.483
Downstream Equilibrium Distance (LEQ), ft	1421.9	Flow Outer Lanes (vOA), pc/h/ln	2098
Distance to Downstream Ramp (LDOWN), ft	1500	On-Ramp Influence Area Speed (SR), mi/h	55.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.598	Outer Lanes Freeway Speed (SO), mi/h	62.0
Flow in Lanes 1 and 2 (v12), pc/h	3120	Ramp Junction Speed (S), mi/h	57.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	4001	Average Density (D), pc/mi/ln	35.4
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	31.6

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex59 Diverge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	30.0
Segment Length (L) / Deceleration Length (LA),ft	1500	775
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5450	250
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	6116	275
Capacity (c), pc/h	6824	1839
Volume-to-Capacity Ratio (v/c)	0.90	0.15

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	4528.2	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1500	Speed Index (DS)	0.528
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2371
Distance to Downstream Ramp (LDOWN), ft	1125	Off-Ramp Influence Area Speed (SR), mi/h	54.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.594	Outer Lanes Freeway Speed (SO), mi/h	69.0
Flow in Lanes 1 and 2 (v12), pc/h	3745	Ramp Junction Speed (S), mi/h	59.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	34.5
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	29.5

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex59 Basic Fwy - 2019 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.16
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.4
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	5200	Heavy Vehicle Adjustment Factor (f_{HV})	0.948
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1945
Total Trucks, %	5.50	Capacity (c), pc/h/ln	2396
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2319
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.84
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	31.8
Total Ramp Density Adjustment	3.6	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	69.6		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex59 Merge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	650
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5200	200
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	5835	220
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.89	0.11

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	965.5	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1125	Speed Index (MS)	0.434
Downstream Equilibrium Distance (LEQ), ft	2712.3	Flow Outer Lanes (vOA), pc/h/ln	2357
Distance to Downstream Ramp (LDOWN), ft	4900	On-Ramp Influence Area Speed (SR), mi/h	57.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.596	Outer Lanes Freeway Speed (SO), mi/h	62.7
Flow in Lanes 1 and 2 (v12), pc/h	3478	Ramp Junction Speed (S), mi/h	59.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	3698	Average Density (D), pc/mi/ln	33.9
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	30.2

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex59-60 Basic Fwy - 2019 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	5400	Heavy Vehicle Adjustment Factor (f_{HV})	0.948
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2020
Total Trucks, %	5.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	59.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	33.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex60 Diverge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	30.0
Segment Length (L) / Deceleration Length (LA),ft	1500	200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5400	450
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	6060	496
Capacity (c), pc/h	6970	1839
Volume-to-Capacity Ratio (v/c)	0.87	0.27

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1250.6	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	4900	Speed Index (DS)	0.548
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2303
Distance to Downstream Ramp (LDOWN), ft	1200	Off-Ramp Influence Area Speed (SR), mi/h	54.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.586	Outer Lanes Freeway Speed (SO), mi/h	71.7
Flow in Lanes 1 and 2 (v12), pc/h	3757	Ramp Junction Speed (S), mi/h	60.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	33.6
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	34.8

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex60 Basic Fwy - 2019 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4950	Heavy Vehicle Adjustment Factor (f_{HV})	0.948
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1852
Total Trucks, %	5.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.80
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	29.3
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex60 Merge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	625
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5250	300
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	5891	330
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.89	0.17

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	989.9	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1200	Speed Index (MS)	0.518
Downstream Equilibrium Distance (LEQ), ft	3059.3	Flow Outer Lanes (vOA), pc/h/ln	2103
Distance to Downstream Ramp (LDOWN), ft	1500	On-Ramp Influence Area Speed (SR), mi/h	55.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.643	Outer Lanes Freeway Speed (SO), mi/h	64.2
Flow in Lanes 1 and 2 (v12), pc/h	3788	Ramp Junction Speed (S), mi/h	58.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	4118	Average Density (D), pc/mi/ln	35.6
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.6

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex61 Diverge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	450
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5250	500
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	2.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.976
Flow Rate (vi),pc/h	5891	545
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.85	0.28

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1962.4	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1500	Speed Index (DS)	0.489
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2203
Distance to Downstream Ramp (LDOWN), ft	1800	Off-Ramp Influence Area Speed (SR), mi/h	56.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.588	Outer Lanes Freeway Speed (SO), mi/h	72.1
Flow in Lanes 1 and 2 (v12), pc/h	3688	Ramp Junction Speed (S), mi/h	61.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	32.0
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	31.9

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex61 Basic Fwy - 2019 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4750	Heavy Vehicle Adjustment Factor (f_{HV})	0.948
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1777
Total Trucks, %	5.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.76
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	64.6
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	27.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex61 Merge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	4750	250
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	5330	275
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.80	0.14

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	802.6	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1800	Speed Index (MS)	0.407
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2175
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	58.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.592	Outer Lanes Freeway Speed (SO), mi/h	64.0
Flow in Lanes 1 and 2 (v12), pc/h	3155	Ramp Junction Speed (S), mi/h	60.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	3430	Average Density (D), pc/mi/ln	30.8
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	29.0

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex57 Merge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	600
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5350	450
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	5978	493
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.95	0.25

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1032.3	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1700	Speed Index (MS)	0.503
Downstream Equilibrium Distance (LEQ), ft	945.7	Flow Outer Lanes (vOA), pc/h/ln	2427
Distance to Downstream Ramp (LDOWN), ft	3600	On-Ramp Influence Area Speed (SR), mi/h	54.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.594	Outer Lanes Freeway Speed (SO), mi/h	60.5
Flow in Lanes 1 and 2 (v12), pc/h	3551	Ramp Junction Speed (S), mi/h	56.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	4044	Average Density (D), pc/mi/ln	38.0
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.1

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex57 Basic Fwy - 2019 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.25
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.1
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	5350	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1993
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2358
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2283
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	34.2
Total Ramp Density Adjustment	3.9	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.8		

HCS7 Freeway Diverge Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex57 Diverge - 2019 AM	Unit	United States Customary

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	600
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

	Freeway	Ramp
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

	Freeway	Ramp
Demand Volume (Vi)	5150	500
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	5779	551
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.85	0.28

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	1999.1	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	3600	Speed Index (DS)	0.489
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2143
Distance to Downstream Ramp (LDOWN), ft	1750	Off-Ramp Influence Area Speed (SR), mi/h	54.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.590	Outer Lanes Freeway Speed (SO), mi/h	67.7
Flow in Lanes 1 and 2 (v12), pc/h	3636	Ramp Junction Speed (S), mi/h	58.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	32.9
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	30.1

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex58 Merge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	550
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5150	600
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	5755	657
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.94	0.34

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	997.5	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2600	Speed Index (MS)	0.678
Downstream Equilibrium Distance (LEQ), ft	2602.0	Flow Outer Lanes (vOA), pc/h/ln	1796
Distance to Downstream Ramp (LDOWN), ft	825	On-Ramp Influence Area Speed (SR), mi/h	49.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.688	Outer Lanes Freeway Speed (SO), mi/h	61.1
Flow in Lanes 1 and 2 (v12), pc/h	3959	Ramp Junction Speed (S), mi/h	52.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	4616	Average Density (D), pc/mi/ln	40.8
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	37.8

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex58 Basic Fwy - 2019 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.25
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.1
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4650	Heavy Vehicle Adjustment Factor (f_{HV})	0.948
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1739
Total Trucks, %	5.50	Capacity (c), pc/h/ln	2358
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2283
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.76
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	62.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	27.7
Total Ramp Density Adjustment	3.9	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex58 Merge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	550
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5150	600
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	5755	657
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.94	0.34

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	997.5	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2600	Speed Index (MS)	0.678
Downstream Equilibrium Distance (LEQ), ft	2602.0	Flow Outer Lanes (vOA), pc/h/ln	1796
Distance to Downstream Ramp (LDOWN), ft	825	On-Ramp Influence Area Speed (SR), mi/h	49.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.688	Outer Lanes Freeway Speed (SO), mi/h	61.1
Flow in Lanes 1 and 2 (v12), pc/h	3959	Ramp Junction Speed (S), mi/h	52.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	4616	Average Density (D), pc/mi/ln	40.8
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	37.8

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Period 6:00-7:00
Project Description	I-95 SB Ex59 Diverge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	275
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5500	150
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6146	164
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.90	0.08

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1370.4	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	5600	Speed Index (DS)	0.454
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2399
Distance to Downstream Ramp (LDOWN), ft	1250	Off-Ramp Influence Area Speed (SR), mi/h	56.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.599	Outer Lanes Freeway Speed (SO), mi/h	68.9
Flow in Lanes 1 and 2 (v12), pc/h	3747	Ramp Junction Speed (S), mi/h	60.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	33.9
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	34.0

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex59 Basic Fwy - 2019 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.16
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.4
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	5350	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1993
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2360
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2284
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.3
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	34.2
Total Ramp Density Adjustment	3.6	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	66.0		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Period 6:00-7:00
Project Description	I-95 SB Ex59 Diverge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	275
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5500	150
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6146	164
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.90	0.08

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1370.4	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	5600	Speed Index (DS)	0.454
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2399
Distance to Downstream Ramp (LDOWN), ft	1250	Off-Ramp Influence Area Speed (SR), mi/h	56.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.599	Outer Lanes Freeway Speed (SO), mi/h	68.9
Flow in Lanes 1 and 2 (v12), pc/h	3747	Ramp Junction Speed (S), mi/h	60.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	33.9
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	34.0

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex59-60 Basic Fwy - 2019 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	5500	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2049
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.88
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	59.1
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	34.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex60 Merge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	625
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5250	300
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	5891	330
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.89	0.17

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	989.9	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1200	Speed Index (MS)	0.518
Downstream Equilibrium Distance (LEQ), ft	3059.3	Flow Outer Lanes (vOA), pc/h/ln	2103
Distance to Downstream Ramp (LDOWN), ft	1500	On-Ramp Influence Area Speed (SR), mi/h	55.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.643	Outer Lanes Freeway Speed (SO), mi/h	64.2
Flow in Lanes 1 and 2 (v12), pc/h	3788	Ramp Junction Speed (S), mi/h	58.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	4118	Average Density (D), pc/mi/ln	35.6
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.6

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex60 Basic Fwy - 2019 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	5250	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1956
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.84
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	32.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Period 6:00-7:00
Project Description	I-95 SB Ex60 Diverge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	575
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5650	400
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6314	438
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.91	0.23

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	2994.9	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1500	Speed Index (DS)	0.479
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2456
Distance to Downstream Ramp (LDOWN), ft	1925	Off-Ramp Influence Area Speed (SR), mi/h	56.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.582	Outer Lanes Freeway Speed (SO), mi/h	71.1
Flow in Lanes 1 and 2 (v12), pc/h	3858	Ramp Junction Speed (S), mi/h	61.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	34.2
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.3

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex61 Merge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	25.0
Segment Length (L) / Acceleration Length (LA),ft	1500	350
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5150	500
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	5755	548
Capacity (c), pc/h	6970	1839
Volume-to-Capacity Ratio (v/c)	0.90	0.30

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	377.9	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1125	Speed Index (MS)	0.550
Downstream Equilibrium Distance (LEQ), ft	2980.6	Flow Outer Lanes (vOA), pc/h/ln	2158
Distance to Downstream Ramp (LDOWN), ft	1500	On-Ramp Influence Area Speed (SR), mi/h	54.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.625	Outer Lanes Freeway Speed (SO), mi/h	64.0
Flow in Lanes 1 and 2 (v12), pc/h	3597	Ramp Junction Speed (S), mi/h	57.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	4145	Average Density (D), pc/mi/ln	36.5
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	35.4

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex61 Basic Fwy - 2019 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	5150	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1918
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.83
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.9
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	31.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Period 6:00-7:00
Project Description	I-95 SB Ex61 Diverge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	450
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5450	300
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6090	329
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.87	0.17

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.469
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2345
Distance to Downstream Ramp (LDOWN), ft	1125	Off-Ramp Influence Area Speed (SR), mi/h	56.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.593	Outer Lanes Freeway Speed (SO), mi/h	71.5
Flow in Lanes 1 and 2 (v12), pc/h	3745	Ramp Junction Speed (S), mi/h	61.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	32.8
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.4

APPENDIX E

Highway Capacity Analyses
2019 Weekday PM Peak Hour

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex57 Diverge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	600
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5850	500
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	6376	540
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.93	0.28

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	2445.6	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	3600	Speed Index (DS)	0.488
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2474
Distance to Downstream Ramp (LDOWN), ft	1750	Off-Ramp Influence Area Speed (SR), mi/h	54.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.576	Outer Lanes Freeway Speed (SO), mi/h	66.4
Flow in Lanes 1 and 2 (v12), pc/h	3902	Ramp Junction Speed (S), mi/h	58.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	36.4
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.4

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex57 Basic Fwy - 2019 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.25
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.1
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	5350	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1944
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2358
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2283
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.85
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	59.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	32.8
Total Ramp Density Adjustment	3.9	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex57 Merge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	650
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5350	550
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	5831	594
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.94	0.31

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1044.7	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1750	Speed Index (MS)	0.892
Downstream Equilibrium Distance (LEQ), ft	3917.7	Flow Outer Lanes (vOA), pc/h/ln	1364
Distance to Downstream Ramp (LDOWN), ft	850	On-Ramp Influence Area Speed (SR), mi/h	44.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.766	Outer Lanes Freeway Speed (SO), mi/h	62.7
Flow in Lanes 1 and 2 (v12), pc/h	4467	Ramp Junction Speed (S), mi/h	47.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	5061	Average Density (D), pc/mi/ln	45.1
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	40.7

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex58 Diverge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	350
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5900	550
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	6431	594
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.94	0.31

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	3417.7	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	850	Speed Index (DS)	0.493
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2498
Distance to Downstream Ramp (LDOWN), ft	2300	Off-Ramp Influence Area Speed (SR), mi/h	54.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.572	Outer Lanes Freeway Speed (SO), mi/h	66.3
Flow in Lanes 1 and 2 (v12), pc/h	3933	Ramp Junction Speed (S), mi/h	58.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	36.8
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	34.9

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex58 Basic Fwy - 2019 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.25
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.1
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	5250	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1907
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2358
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2283
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.84
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	59.9
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	31.8
Total Ramp Density Adjustment	3.9	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex58 Merge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	750
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5250	650
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	5722	702
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.94	0.36

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1088.9	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2300	Speed Index (MS)	0.582
Downstream Equilibrium Distance (LEQ), ft	2843.8	Flow Outer Lanes (vOA), pc/h/ln	2043
Distance to Downstream Ramp (LDOWN), ft	1500	On-Ramp Influence Area Speed (SR), mi/h	52.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.643	Outer Lanes Freeway Speed (SO), mi/h	62.2
Flow in Lanes 1 and 2 (v12), pc/h	3679	Ramp Junction Speed (S), mi/h	55.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	4381	Average Density (D), pc/mi/ln	38.6
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	34.7

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex59 Diverge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	30.0
Segment Length (L) / Deceleration Length (LA),ft	1500	775
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5900	500
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	6431	540
Capacity (c), pc/h	6824	1839
Volume-to-Capacity Ratio (v/c)	0.94	0.29

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	3945.9	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1500	Speed Index (DS)	0.552
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2510
Distance to Downstream Ramp (LDOWN), ft	1125	Off-Ramp Influence Area Speed (SR), mi/h	53.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.574	Outer Lanes Freeway Speed (SO), mi/h	68.5
Flow in Lanes 1 and 2 (v12), pc/h	3921	Ramp Junction Speed (S), mi/h	58.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	36.6
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	31.0

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex59 Basic Fwy - 2019 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.16
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.4
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	5400	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1962
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2396
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2319
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.85
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	60.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	32.3
Total Ramp Density Adjustment	3.6	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	69.6		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex59 Merge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	650
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5400	150
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	5886	162
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.89	0.08

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	964.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1125	Speed Index (MS)	0.430
Downstream Equilibrium Distance (LEQ), ft	1808.2	Flow Outer Lanes (vOA), pc/h/ln	2378
Distance to Downstream Ramp (LDOWN), ft	4900	On-Ramp Influence Area Speed (SR), mi/h	57.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.596	Outer Lanes Freeway Speed (SO), mi/h	62.6
Flow in Lanes 1 and 2 (v12), pc/h	3508	Ramp Junction Speed (S), mi/h	59.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	3670	Average Density (D), pc/mi/ln	33.9
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	30.0

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex59-60 Basic Fwy - 2019 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	5550	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2016
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	59.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	33.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex60 Diverge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	30.0
Segment Length (L) / Deceleration Length (LA),ft	1500	200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5550	300
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	6049	324
Capacity (c), pc/h	6970	1839
Volume-to-Capacity Ratio (v/c)	0.87	0.18

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	873.1	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	4900	Speed Index (DS)	0.533
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2324
Distance to Downstream Ramp (LDOWN), ft	1200	Off-Ramp Influence Area Speed (SR), mi/h	55.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.594	Outer Lanes Freeway Speed (SO), mi/h	71.6
Flow in Lanes 1 and 2 (v12), pc/h	3725	Ramp Junction Speed (S), mi/h	60.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	33.3
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	34.5

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex60 Basic Fwy - 2019 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	5250	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1907
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.82
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	62.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	30.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex60 Merge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	625
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5250	500
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	5722	540
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.90	0.28

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	998.7	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1200	Speed Index (MS)	0.559
Downstream Equilibrium Distance (LEQ), ft	3365.3	Flow Outer Lanes (vOA), pc/h/ln	1986
Distance to Downstream Ramp (LDOWN), ft	1500	On-Ramp Influence Area Speed (SR), mi/h	54.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.653	Outer Lanes Freeway Speed (SO), mi/h	64.7
Flow in Lanes 1 and 2 (v12), pc/h	3736	Ramp Junction Speed (S), mi/h	57.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	4276	Average Density (D), pc/mi/ln	36.5
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	34.7

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex61 Diverge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	450
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5750	550
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	6267	594
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.90	0.31

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	3175.9	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1500	Speed Index (DS)	0.493
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2405
Distance to Downstream Ramp (LDOWN), ft	1800	Off-Ramp Influence Area Speed (SR), mi/h	56.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.576	Outer Lanes Freeway Speed (SO), mi/h	71.3
Flow in Lanes 1 and 2 (v12), pc/h	3862	Ramp Junction Speed (S), mi/h	61.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	34.1
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.4

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex61 Basic Fwy - 2019 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	5200	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1889
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	62.5
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	30.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Merge Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex61 Merge - 2019 PM	Unit	United States Customary

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Demand Volume (Vi)	5200	450
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	5668	486
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.88	0.25

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	920.1	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1800	Speed Index (MS)	0.469
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2313
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	56.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.592	Outer Lanes Freeway Speed (SO), mi/h	63.4
Flow in Lanes 1 and 2 (v12), pc/h	3355	Ramp Junction Speed (S), mi/h	59.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	3841	Average Density (D), pc/mi/ln	34.7
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.1

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex57 Merge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	600
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	4900	550
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	5341	597
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.87	0.31

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	918.2	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1700	Speed Index (MS)	0.449
Downstream Equilibrium Distance (LEQ), ft	936.5	Flow Outer Lanes (vOA), pc/h/ln	2168
Distance to Downstream Ramp (LDOWN), ft	3600	On-Ramp Influence Area Speed (SR), mi/h	56.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.594	Outer Lanes Freeway Speed (SO), mi/h	61.8
Flow in Lanes 1 and 2 (v12), pc/h	3173	Ramp Junction Speed (S), mi/h	58.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	3770	Average Density (D), pc/mi/ln	34.1
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	30.9

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex57 Basic Fwy - 2019 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.25
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.1
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	5350	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1944
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2358
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2283
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.85
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	59.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	32.8
Total Ramp Density Adjustment	3.9	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.8		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex57 Diverge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	225
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5400	500
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	5886	543
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.86	0.28

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	2628.8	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	825	Speed Index (DS)	0.489
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2201
Distance to Downstream Ramp (LDOWN), ft	1700	Off-Ramp Influence Area Speed (SR), mi/h	54.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.588	Outer Lanes Freeway Speed (SO), mi/h	67.5
Flow in Lanes 1 and 2 (v12), pc/h	3685	Ramp Junction Speed (S), mi/h	58.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	33.5
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.9

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex58 Merge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	550
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5000	400
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	5450	434
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.86	0.22

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	884.5	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2600	Speed Index (MS)	0.591
Downstream Equilibrium Distance (LEQ), ft	3220.9	Flow Outer Lanes (vOA), pc/h/ln	1515
Distance to Downstream Ramp (LDOWN), ft	825	On-Ramp Influence Area Speed (SR), mi/h	51.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.722	Outer Lanes Freeway Speed (SO), mi/h	62.1
Flow in Lanes 1 and 2 (v12), pc/h	3935	Ramp Junction Speed (S), mi/h	54.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	4369	Average Density (D), pc/mi/ln	36.3
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	36.0

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex58 Basic Fwy - 2019 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.25
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.1
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	5000	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1817
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2358
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2283
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.80
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.5
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	29.5
Total Ramp Density Adjustment	3.9	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.8		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex58 Diverge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5650	650
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	6158	706
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.90	0.36

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	293.5	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2150	Speed Index (DS)	0.503
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2323
Distance to Downstream Ramp (LDOWN), ft	2600	Off-Ramp Influence Area Speed (SR), mi/h	53.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.574	Outer Lanes Freeway Speed (SO), mi/h	67.0
Flow in Lanes 1 and 2 (v12), pc/h	3835	Ramp Junction Speed (S), mi/h	58.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	35.3
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.7

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex59 Merge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	25.0
Segment Length (L) / Acceleration Length (LA),ft	1500	400
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5350	300
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	5831	326
Capacity (c), pc/h	6824	1839
Volume-to-Capacity Ratio (v/c)	0.90	0.18

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	368.8	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1250	Speed Index (MS)	0.521
Downstream Equilibrium Distance (LEQ), ft	4628.1	Flow Outer Lanes (vOA), pc/h/ln	2128
Distance to Downstream Ramp (LDOWN), ft	2150	On-Ramp Influence Area Speed (SR), mi/h	54.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.635	Outer Lanes Freeway Speed (SO), mi/h	61.9
Flow in Lanes 1 and 2 (v12), pc/h	3703	Ramp Junction Speed (S), mi/h	56.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	4029	Average Density (D), pc/mi/ln	36.1
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	34.3

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex59 Basic Fwy - 2019 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.16
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.4
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	5350	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1944
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2360
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2284
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.85
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	59.3
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	32.8
Total Ramp Density Adjustment	3.6	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	66.0		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex59 Diverge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	275
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5550	200
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	6049	217
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.89	0.11

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	3642.5	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	5600	Speed Index (DS)	0.459
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2339
Distance to Downstream Ramp (LDOWN), ft	1250	Off-Ramp Influence Area Speed (SR), mi/h	56.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.599	Outer Lanes Freeway Speed (SO), mi/h	69.2
Flow in Lanes 1 and 2 (v12), pc/h	3710	Ramp Junction Speed (S), mi/h	60.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	33.3
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.7

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex59-60 Basic Fwy - 2019 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	5550	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2016
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	59.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	33.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex60 Merge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	4950	600
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	5395	651
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.87	0.34

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	897.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1925	Speed Index (MS)	0.469
Downstream Equilibrium Distance (LEQ), ft	1330.6	Flow Outer Lanes (vOA), pc/h/ln	2201
Distance to Downstream Ramp (LDOWN), ft	5600	On-Ramp Influence Area Speed (SR), mi/h	56.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.592	Outer Lanes Freeway Speed (SO), mi/h	63.9
Flow in Lanes 1 and 2 (v12), pc/h	3194	Ramp Junction Speed (S), mi/h	59.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	3845	Average Density (D), pc/mi/ln	34.0
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.1

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex60 Basic Fwy - 2019 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4950	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1798
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.77
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	64.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	28.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex60 Diverge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	575
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5200	250
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	5668	271
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.81	0.14

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	2701.2	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1500	Speed Index (DS)	0.464
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2126
Distance to Downstream Ramp (LDOWN), ft	1925	Off-Ramp Influence Area Speed (SR), mi/h	57.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.606	Outer Lanes Freeway Speed (SO), mi/h	72.4
Flow in Lanes 1 and 2 (v12), pc/h	3542	Ramp Junction Speed (S), mi/h	61.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	30.5
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	29.5

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex61 Merge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	25.0
Segment Length (L) / Acceleration Length (LA),ft	1500	350
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	4750	450
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	5177	488
Capacity (c), pc/h	6970	1839
Volume-to-Capacity Ratio (v/c)	0.81	0.27

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	241.3	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1125	Speed Index (MS)	0.443
Downstream Equilibrium Distance (LEQ), ft	1844.8	Flow Outer Lanes (vOA), pc/h/ln	2092
Distance to Downstream Ramp (LDOWN), ft	1500	On-Ramp Influence Area Speed (SR), mi/h	57.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.596	Outer Lanes Freeway Speed (SO), mi/h	64.3
Flow in Lanes 1 and 2 (v12), pc/h	3085	Ramp Junction Speed (S), mi/h	59.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	3573	Average Density (D), pc/mi/ln	31.5
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	31.0

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex61 Basic Fwy - 2019 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4750	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1726
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.74
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	65.4
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	26.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2019
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex61 Diverge - 2019 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	450
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	5050	300
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	5504	326
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.79	0.17

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.469
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2035
Distance to Downstream Ramp (LDOWN), ft	1125	Off-Ramp Influence Area Speed (SR), mi/h	56.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.607	Outer Lanes Freeway Speed (SO), mi/h	72.8
Flow in Lanes 1 and 2 (v12), pc/h	3469	Ramp Junction Speed (S), mi/h	61.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	29.6
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	30.0

APPENDIX F

Intersection Capacity Analyses
Signalized Interchanges at I-95 Exits 57, 60, and 61
2021 Summer Weekday AM/PM Peak Hour

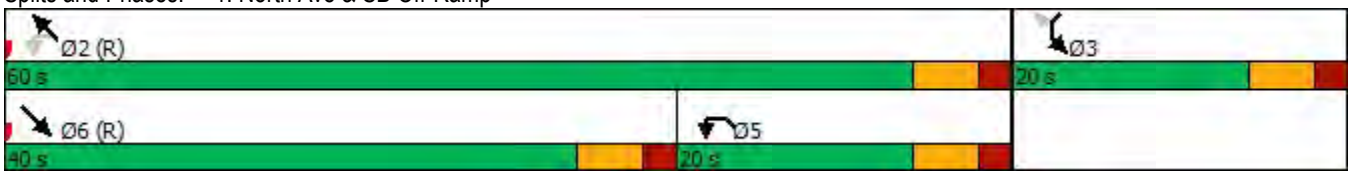
Intersection Capacity Analysis: I-95 Exit 57
1: North Ave & SB Off-Ramp

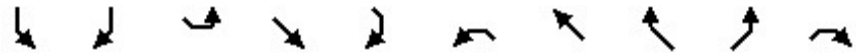
02/10/2022

Lane Group	NBL	NBR	SEL	SET	SER	NWL	NWT	NWR	SWL2	SWL	SWR
Lane Configurations											
Traffic Volume (vph)	0	0	0	739	275	245	554	0	93	0	322
Future Volume (vph)	0	0	0	739	275	245	554	0	93	0	322
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Right Turn on Red					Yes			Yes			Yes
Link Speed (mph)	30			30			30			30	
Link Distance (ft)	822			402			673			375	
Travel Time (s)	18.7			9.1			15.3			8.5	
Confl. Peds. (#/hr)					6	6					
Peak Hour Factor	0.92	0.92	0.92	0.94	0.94	0.90	0.90	0.92	0.93	0.92	0.93
Heavy Vehicles (%)	2%	2%	0%	2%	2%	2%	2%	0%	1%	2%	1%
Shared Lane Traffic (%)											
Turn Type				NA		pm+pt	NA		Prot		Perm
Protected Phases				6		5	2		3		
Permitted Phases						2					3
Detector Phase				6		5	2		3		3
Switch Phase											
Minimum Initial (s)				10.0		6.0	10.0		6.0		6.0
Minimum Split (s)				16.0		12.0	16.0		12.0		12.0
Total Split (s)				40.0		20.0	60.0		20.0		20.0
Total Split (%)				50.0%		25.0%	75.0%		25.0%		25.0%
Yellow Time (s)				4.0		4.0	4.0		4.0		4.0
All-Red Time (s)				2.0		2.0	2.0		2.0		2.0
Lost Time Adjust (s)				0.0			0.0		0.0		0.0
Total Lost Time (s)				6.0			6.0		6.0		6.0
Lead/Lag				Lead		Lag					
Lead-Lag Optimize?				Yes		Yes					
Recall Mode				C-Max		Max	C-Min		None		None
Act Effct Green (s)				38.1			58.1		9.9		9.9
Actuated g/C Ratio				0.48			0.73		0.12		0.12
v/c Ratio				0.65			0.55		0.45		0.69
Control Delay				17.5			6.7		38.3		11.5
Queue Delay				0.0			0.0		0.0		0.0
Total Delay				17.5			6.7		38.3		11.5
LOS				B			A		D		B
Approach Delay				17.5			6.7			17.5	
Approach LOS				B			A			B	

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 80			
Offset: 42 (53%), Referenced to phase 2:NWTL and 6:SET, Start of Green			
Natural Cycle: 55			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.69			
Intersection Signal Delay: 13.5		Intersection LOS: B	
Intersection Capacity Utilization 70.3%		ICU Level of Service C	
Analysis Period (min) 15			

Splits and Phases: 1: North Ave & SB Off-Ramp





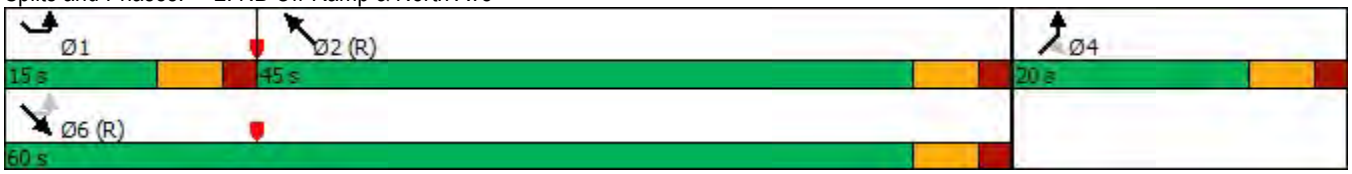
Lane Group	SBL	SBR	SEL	SET	SER	NWL	NWT	NWR	NEL	NER
Lane Configurations										
Traffic Volume (vph)	0	0	362	494	0	0	611	157	181	253
Future Volume (vph)	0	0	362	494	0	0	611	157	181	253
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0		0	0		0	0	200
Storage Lanes	0	0	0		0	0		0	2	1
Taper Length (ft)	25		25			25			25	
Right Turn on Red					Yes			Yes		Yes
Link Speed (mph)	30			30			30		30	
Link Distance (ft)	322			673			260		405	
Travel Time (s)	7.3			15.3			5.9		9.2	
Confl. Peds. (#/hr)									4	4
Peak Hour Factor	0.92	0.92	0.93	0.93	0.92	0.92	0.85	0.85	0.84	0.84
Parking (#/hr)				0						
Shared Lane Traffic (%)										
Turn Type			pm+pt	NA			NA		Prot	Perm
Protected Phases			1	6			2		4	
Permitted Phases			6							4
Detector Phase			1	6			2		4	4
Switch Phase										
Minimum Initial (s)			6.0	10.0			10.0		6.0	6.0
Minimum Split (s)			12.0	16.0			16.0		12.0	12.0
Total Split (s)			15.0	60.0			45.0		20.0	20.0
Total Split (%)			18.8%	75.0%			56.3%		25.0%	25.0%
Yellow Time (s)			4.0	4.0			4.0		4.0	4.0
All-Red Time (s)			2.0	2.0			2.0		2.0	2.0
Lost Time Adjust (s)				0.0			0.0		0.0	0.0
Total Lost Time (s)				6.0			6.0		6.0	6.0
Lead/Lag			Lead				Lag			
Lead-Lag Optimize?			Yes				Yes			
Recall Mode			None	C-Min			C-Min		Max	Max
Act Effct Green (s)				49.9			49.9		18.1	18.1
Actuated g/C Ratio				0.62			0.62		0.23	0.23
v/c Ratio				1.31dl			0.42		0.28	0.51
Control Delay				24.2			10.8		28.6	7.4
Queue Delay				0.0			0.9		0.0	0.0
Total Delay				24.2			11.7		28.6	7.4
LOS				C			B		C	A
Approach Delay				24.2			11.7		16.3	
Approach LOS				C			B		B	

Intersection Summary	
Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2:NWT and 6:SETL, Start of Green, Master Intersection	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.81	

Intersection Signal Delay: 17.6	Intersection LOS: B
Intersection Capacity Utilization 66.2%	ICU Level of Service C
Analysis Period (min) 15	

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

Splits and Phases: 2: NB Off-Ramp & North Ave

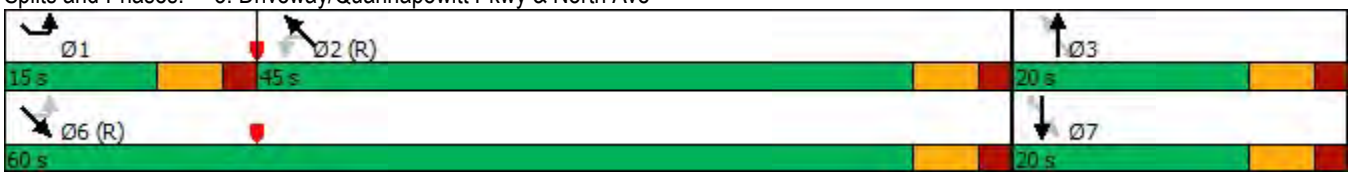


Lane Group	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	42	4	12	20	1	34	25	697	19	15	695	46
Future Volume (vph)	42	4	12	20	1	34	25	697	19	15	695	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		150	0		0	0		0	0		0
Storage Lanes	0		1	0		1	0		0	0		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		242			308			260			333	
Travel Time (s)		5.5			7.0			5.9			7.6	
Confl. Peds. (#/hr)	3					3	6		1	1		6
Peak Hour Factor	0.81	0.81	0.81	0.71	0.71	0.71	0.93	0.93	0.93	0.85	0.85	0.85
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	2%	2%	2%	3%	3%	3%
Shared Lane Traffic (%)												
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA		Perm	NA	
Protected Phases		3			7		1	6			2	
Permitted Phases	3		3	7		7	6			2		
Detector Phase	3	3	3	7	7	7	1	6		2	2	
Switch Phase												
Minimum Initial (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	10.0		10.0	10.0	
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	16.0		16.0	16.0	
Total Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	15.0	60.0		45.0	45.0	
Total Split (%)	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	18.8%	75.0%		56.3%	56.3%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0	0.0		0.0	0.0		0.0			0.0	
Total Lost Time (s)		6.0	6.0		6.0	6.0		6.0			6.0	
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?							Yes			Yes	Yes	
Recall Mode	None	None	None	None	None	None	None	C-Min		C-Min	C-Min	
Act Effct Green (s)		8.1	8.1		8.1	8.1		63.5			63.5	
Actuated g/C Ratio		0.10	0.10		0.10	0.10		0.79			0.79	
v/c Ratio		0.41	0.05		0.22	0.18		0.31			0.35	
Control Delay		42.0	0.4		36.1	1.5		4.7			3.7	
Queue Delay		0.0	0.0		0.0	0.0		0.4			0.0	
Total Delay		42.0	0.4		36.1	1.5		5.1			3.7	
LOS		D	A		D	A		A			A	
Approach Delay		33.3			14.5			5.1			3.7	
Approach LOS		C			B			A			A	

Intersection Summary	
Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2:NWTL and 6:SETL, Start of Green	
Natural Cycle: 45	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.41	

Intersection Signal Delay: 5.9	Intersection LOS: A
Intersection Capacity Utilization 57.3%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 3: Driveway/Quannapowitt Pkwy & North Ave



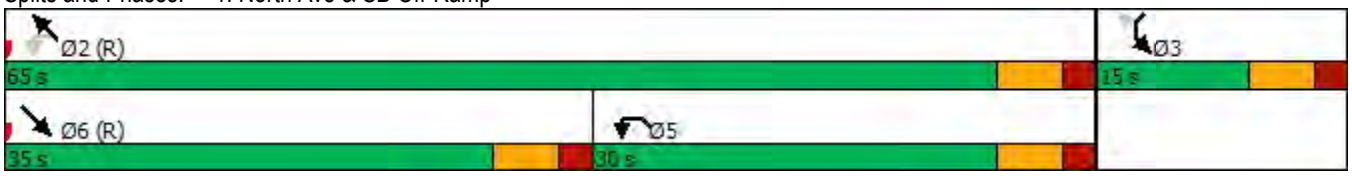
Intersection Capacity Analysis: I-95 Exit 57
1: North Ave & SB Off-Ramp

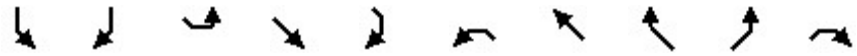
02/10/2022

Lane Group	NBL	NBR	SEL	SET	SER	NWL	NWT	NWR	SWL2	SWL	SWR
Lane Configurations											
Traffic Volume (vph)	0	0	0	426	226	229	489	0	135	0	396
Future Volume (vph)	0	0	0	426	226	229	489	0	135	0	396
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Right Turn on Red					Yes			Yes			Yes
Link Speed (mph)	30			30			30			30	
Link Distance (ft)	822			402			673			375	
Travel Time (s)	18.7			9.1			15.3			8.5	
Confl. Peds. (#/hr)					6	6					
Peak Hour Factor	0.92	0.92	0.92	0.93	0.93	0.94	0.94	0.92	0.86	0.92	0.86
Heavy Vehicles (%)	2%	2%	0%	5%	5%	4%	4%	0%	2%	2%	2%
Shared Lane Traffic (%)											
Turn Type				NA		pm+pt	NA		Prot		Perm
Protected Phases				6		5	2		3		
Permitted Phases						2					3
Detector Phase				6		5	2		3		3
Switch Phase											
Minimum Initial (s)				10.0		6.0	10.0		6.0		6.0
Minimum Split (s)				16.0		12.0	16.0		12.0		12.0
Total Split (s)				35.0		30.0	65.0		15.0		15.0
Total Split (%)				43.8%		37.5%	81.3%		18.8%		18.8%
Yellow Time (s)				4.0		4.0	4.0		4.0		4.0
All-Red Time (s)				2.0		2.0	2.0		2.0		2.0
Lost Time Adjust (s)				0.0			0.0		0.0		0.0
Total Lost Time (s)				6.0			6.0		6.0		6.0
Lead/Lag				Lead		Lag					
Lead-Lag Optimize?				Yes		Yes					
Recall Mode				C-Max		Max	C-Min		None		None
Act Effct Green (s)				29.1			59.1		8.9		8.9
Actuated g/C Ratio				0.36			0.74		0.11		0.11
v/c Ratio				0.56			0.40		0.80		0.81
Control Delay				18.1			5.2		64.4		17.2
Queue Delay				0.0			0.0		0.0		0.0
Total Delay				18.1			5.2		64.4		17.2
LOS				B			A		E		B
Approach Delay				18.1			5.2			29.2	
Approach LOS				B			A			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 80			
Offset: 42 (53%), Referenced to phase 2:NWTL and 6:SET, Start of Green			
Natural Cycle: 60			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.81			
Intersection Signal Delay: 16.7		Intersection LOS: B	
Intersection Capacity Utilization 60.2%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 1: North Ave & SB Off-Ramp



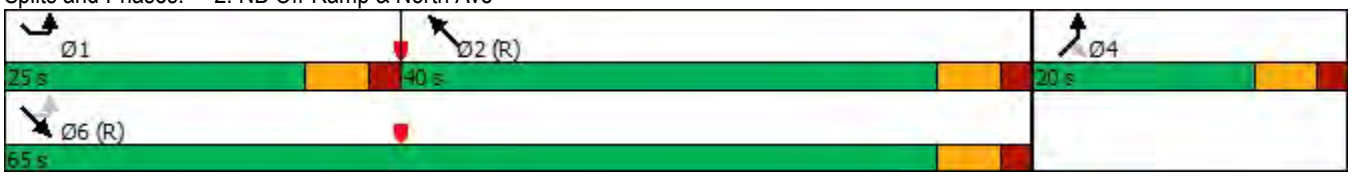


Lane Group	SBL	SBR	SEL	SET	SER	NWL	NWT	NWR	NEL	NER
Lane Configurations										
Traffic Volume (vph)	0	0	172	392	0	0	526	111	198	328
Future Volume (vph)	0	0	172	392	0	0	526	111	198	328
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0		0	0		0	0	200
Storage Lanes	0	0	0		0	0		0	2	1
Taper Length (ft)	25		25			25			25	
Right Turn on Red					Yes			Yes		Yes
Link Speed (mph)	30			30			30		30	
Link Distance (ft)	322			673			260		405	
Travel Time (s)	7.3			15.3			5.9		9.2	
Confl. Peds. (#/hr)									4	4
Peak Hour Factor	0.92	0.92	0.86	0.86	0.92	0.92	0.96	0.96	0.92	0.90
Heavy Vehicles (%)	2%	2%	3%	3%	2%	2%	3%	3%	2%	6%
Shared Lane Traffic (%)										
Turn Type			pm+pt	NA			NA		Prot	Perm
Protected Phases			1	6			2		4	
Permitted Phases			6							4
Detector Phase			1	6			2		4	4
Switch Phase										
Minimum Initial (s)			6.0	10.0			10.0		6.0	6.0
Minimum Split (s)			12.0	16.0			16.0		12.0	12.0
Total Split (s)			25.0	65.0			40.0		20.0	20.0
Total Split (%)			29.4%	76.5%			47.1%		23.5%	23.5%
Yellow Time (s)			4.0	4.0			4.0		4.0	4.0
All-Red Time (s)			2.0	2.0			2.0		2.0	2.0
Lost Time Adjust (s)				0.0			0.0		0.0	0.0
Total Lost Time (s)				6.0			6.0		6.0	6.0
Lead/Lag			Lead				Lag			
Lead-Lag Optimize?			Yes				Yes			
Recall Mode			None	C-Min			C-Min		Max	Max
Act Effct Green (s)				41.7			41.7		31.3	31.3
Actuated g/C Ratio				0.49			0.49		0.37	0.37
v/c Ratio				0.62			0.39		0.17	0.47
Control Delay				18.5			12.0		19.4	4.7
Queue Delay				0.0			0.6		0.0	0.0
Total Delay				18.5			12.5		19.4	4.7
LOS				B			B		B	A
Approach Delay				18.5			12.5		10.1	
Approach LOS				B			B		B	

Intersection Summary	
Area Type:	Other
Cycle Length: 85	
Actuated Cycle Length: 85	
Offset: 0 (0%), Referenced to phase 2:NWT and 6:SETL, Start of Green, Master Intersection	
Natural Cycle: 45	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.62	

Intersection Signal Delay: 13.9	Intersection LOS: B
Intersection Capacity Utilization 54.6%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 2: NB Off-Ramp & North Ave

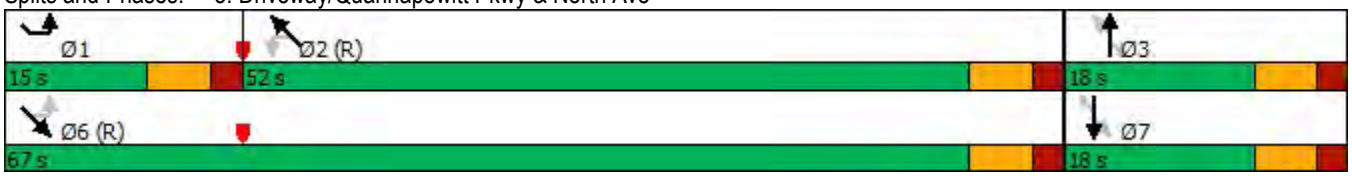


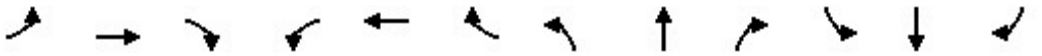
Lane Group	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	23	0	9	25	2	26	58	641	45	18	571	37
Future Volume (vph)	23	0	9	25	2	26	58	641	45	18	571	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		150	0		0	0		0	0		0
Storage Lanes	0		1	0		1	0		0	0		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		242			308			260			333	
Travel Time (s)		5.5			7.0			5.9			7.6	
Confl. Peds. (#/hr)	3					3	7					7
Peak Hour Factor	0.84	0.92	0.84	0.70	0.70	0.70	0.88	0.88	0.88	0.94	0.94	0.94
Heavy Vehicles (%)	5%	2%	5%	0%	0%	0%	4%	4%	4%	3%	3%	3%
Shared Lane Traffic (%)												
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA		Perm	NA	
Protected Phases		3			7		1	6			2	
Permitted Phases	3		3	7		7	6			2		
Detector Phase	3	3	3	7	7	7	1	6		2	2	
Switch Phase												
Minimum Initial (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	10.0		10.0	10.0	
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	16.0		16.0	16.0	
Total Split (s)	18.0	18.0	18.0	18.0	18.0	18.0	15.0	67.0		52.0	52.0	
Total Split (%)	21.2%	21.2%	21.2%	21.2%	21.2%	21.2%	17.6%	78.8%		61.2%	61.2%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0	0.0		0.0	0.0		0.0			0.0	
Total Lost Time (s)		6.0	6.0		6.0	6.0		6.0			6.0	
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?							Yes			Yes	Yes	
Recall Mode	None	None	None	None	None	None	None	C-Min		C-Min	C-Min	
Act Effct Green (s)		7.4	7.4		7.4	7.4		69.2			69.2	
Actuated g/C Ratio		0.09	0.09		0.09	0.09		0.81			0.81	
v/c Ratio		0.24	0.05		0.33	0.15		0.36			0.26	
Control Delay		40.6	0.3		43.4	1.3		2.7			2.8	
Queue Delay		0.0	0.0		0.0	0.0		0.2			0.0	
Total Delay		40.6	0.3		43.4	1.3		2.9			2.8	
LOS		D	A		D	A		A			A	
Approach Delay		28.9			22.9			2.9			2.8	
Approach LOS		C			C			A			A	

Intersection Summary	
Area Type:	Other
Cycle Length: 85	
Actuated Cycle Length: 85	
Offset: 0 (0%), Referenced to phase 2:NWTL and 6:SETL, Start of Green	
Natural Cycle: 40	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.36	

Intersection Signal Delay: 4.4	Intersection LOS: A
Intersection Capacity Utilization 61.5%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 3: Driveway/Quannapowitt Pkwy & North Ave



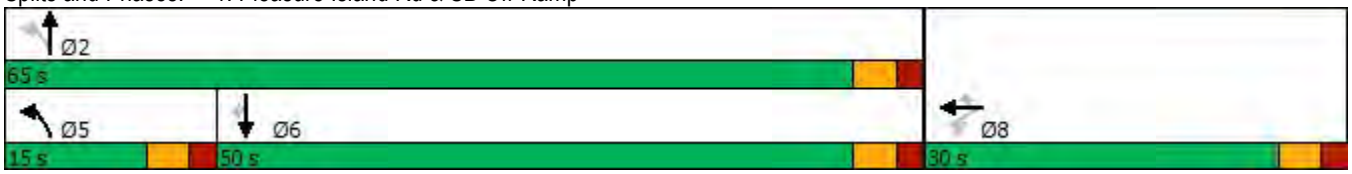


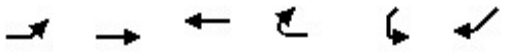
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	208	0	182	133	561	0	0	189	101
Future Volume (vph)	0	0	0	208	0	182	133	561	0	0	189	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		200	200		0	0		175
Storage Lanes	0		0	0		1	1		0	0		1
Taper Length (ft)	25			25			50			25		
Satd. Flow (prot)	0	0	0	0	1736	1583	1752	3505	0	0	3505	1568
Flt Permitted					0.950		0.412					
Satd. Flow (perm)	0	0	0	0	1736	1583	760	3505	0	0	3505	1568
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						188						126
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		795			527			668			287	
Travel Time (s)		18.1			12.0			15.2			6.5	
Peak Hour Factor	0.92	0.92	0.92	0.97	0.97	0.97	0.95	0.95	0.92	0.92	0.80	0.80
Heavy Vehicles (%)	2%	2%	2%	4%	4%	2%	3%	3%	2%	2%	3%	3%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	214	188	140	591	0	0	236	126
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases					8		5	2			6	
Permitted Phases				8		8	2					6
Detector Phase				8	8	8	5	2			6	6
Switch Phase												
Minimum Initial (s)				10.0	10.0	10.0	6.0	10.0			10.0	10.0
Minimum Split (s)				15.0	15.0	15.0	11.0	15.0			18.0	18.0
Total Split (s)				30.0	30.0	30.0	15.0	65.0			50.0	50.0
Total Split (%)				31.6%	31.6%	31.6%	15.8%	68.4%			52.6%	52.6%
Yellow Time (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
All-Red Time (s)				2.0	2.0	2.0	2.0	2.0			2.0	2.0
Lost Time Adjust (s)					0.0	0.0	0.0	0.0			0.0	0.0
Total Lost Time (s)					5.0	5.0	5.0	5.0			5.0	5.0
Lead/Lag							Lead				Lag	Lag
Lead-Lag Optimize?							Yes				Yes	Yes
Recall Mode				None	None	None	None	Min			Min	Min
Act Effct Green (s)					12.0	12.0	21.2	21.2			10.7	10.7
Actuated g/C Ratio					0.28	0.28	0.49	0.49			0.25	0.25
v/c Ratio					0.45	0.33	0.25	0.35			0.27	0.26
Control Delay					18.1	4.7	7.3	7.4			16.3	5.9
Queue Delay					0.0	0.0	0.0	0.0			0.0	0.0
Total Delay					18.1	4.7	7.3	7.4			16.3	5.9
LOS					B	A	A	A			B	A
Approach Delay					11.8			7.4			12.7	
Approach LOS					B			A			B	
Queue Length 50th (ft)					47	0	15	37			26	0
Queue Length 95th (ft)					102	36	44	78			50	25
Internal Link Dist (ft)		715			447			588			207	
Turn Bay Length (ft)						200	200					175
Base Capacity (vph)					1092	1066	606	3505			3358	1507

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn					0	0	0	0			0	0
Spillback Cap Reductn					0	0	0	0			0	0
Storage Cap Reductn					0	0	0	0			0	0
Reduced v/c Ratio					0.20	0.18	0.23	0.17			0.07	0.08

Intersection Summary			
Area Type:	Other		
Cycle Length: 95			
Actuated Cycle Length: 43.5			
Natural Cycle: 45			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.45			
Intersection Signal Delay: 9.9		Intersection LOS: A	
Intersection Capacity Utilization 39.7%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 1: Pleasure Island Rd & SB Off-Ramp





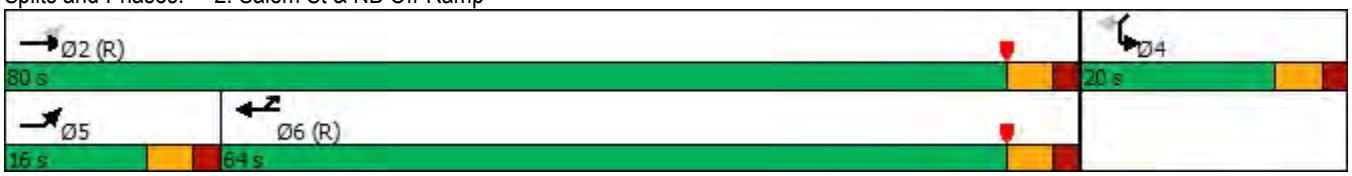
Lane Group	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Volume (vph)	115	236	294	204	482	27
Future Volume (vph)	115	236	294	204	482	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0			150	0	250
Storage Lanes	0			1	2	1
Taper Length (ft)	25				25	
Satd. Flow (prot)	0	3320	3252	1455	3400	1568
Flt Permitted		0.717			0.950	
Satd. Flow (perm)	0	2419	3252	1455	3400	1568
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				246		32
Link Speed (mph)		30	30		30	
Link Distance (ft)		346	296		281	
Travel Time (s)		7.9	6.7		6.4	
Peak Hour Factor	0.79	0.79	0.83	0.83	0.84	0.84
Heavy Vehicles (%)	7%	7%	11%	11%	3%	3%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	445	354	246	574	32
Turn Type	pm+pt	NA	NA	Prot	Prot	Perm
Protected Phases	5	2	6	6	4	
Permitted Phases	2					4
Detector Phase	5	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	5.0	10.0	10.0	10.0	7.0	7.0
Minimum Split (s)	10.5	15.5	15.5	15.5	12.5	12.5
Total Split (s)	16.0	80.0	64.0	64.0	20.0	20.0
Total Split (%)	16.0%	80.0%	64.0%	64.0%	20.0%	20.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		5.5	5.5	5.5	5.5	5.5
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?	Yes		Yes	Yes		
Recall Mode	None	C-Max	C-Max	C-Max	None	None
Act Effct Green (s)		74.5	74.5	74.5	14.5	14.5
Actuated g/C Ratio		0.74	0.74	0.74	0.14	0.14
v/c Ratio		0.25	0.15	0.21	1.16	0.13
Control Delay		4.4	4.4	2.4	133.4	14.5
Queue Delay		0.0	0.0	0.6	0.8	0.0
Total Delay		4.4	4.4	2.9	134.2	14.5
LOS		A	A	A	F	B
Approach Delay		4.4	3.8		127.9	
Approach LOS		A	A		F	
Queue Length 50th (ft)		38	40	15	~225	0
Queue Length 95th (ft)		46	m47	m28	#297	24
Internal Link Dist (ft)		266	216		201	
Turn Bay Length (ft)				150		250
Base Capacity (vph)		1802	2422	1146	493	254

Lane Group	EBL	EBT	WBT	WBR	SWL	SWR
Starvation Cap Reductn		0	0	570	0	0
Spillback Cap Reductn		96	0	0	45	0
Storage Cap Reductn		0	0	0	0	0
Reduced v/c Ratio		0.26	0.15	0.43	1.28	0.13

Intersection Summary			
Area Type:	Other		
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Yellow, Master Intersection			
Natural Cycle: 45			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.16			
Intersection Signal Delay: 49.5		Intersection LOS: D	
Intersection Capacity Utilization 45.7%		ICU Level of Service A	
Analysis Period (min) 15			

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Salem St & NB Off-Ramp



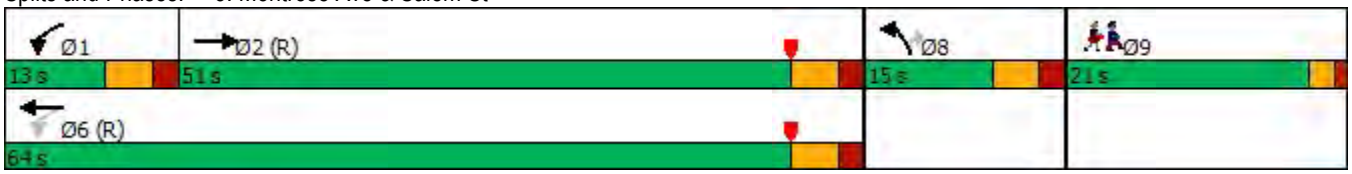
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø9
Lane Configurations							
Traffic Volume (vph)	645	81	168	362	135	160	
Future Volume (vph)	645	81	168	362	135	160	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Satd. Flow (prot)	3437	0	0	3229	1736	1553	
Flt Permitted				0.577	0.950		
Satd. Flow (perm)	3437	0	0	1893	1736	1553	
Right Turn on Red		Yes				Yes	
Satd. Flow (RTOR)	18					184	
Link Speed (mph)	30			30	30		
Link Distance (ft)	296			620	304		
Travel Time (s)	6.7			14.1	6.9		
Confl. Peds. (#/hr)		2	2				
Peak Hour Factor	0.84	0.84	0.90	0.90	0.87	0.87	
Heavy Vehicles (%)	3%	3%	10%	10%	4%	4%	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	864	0	0	589	155	184	
Turn Type	NA		pm+pt	NA	Prot	Perm	
Protected Phases	2		1	6	8		9
Permitted Phases			6			8	
Detector Phase	2		1	6	8	8	
Switch Phase							
Minimum Initial (s)	10.0		5.0	10.0	7.0	7.0	5.0
Minimum Split (s)	15.5		10.5	15.5	12.5	12.5	21.0
Total Split (s)	51.0		13.0	64.0	15.0	15.0	21.0
Total Split (%)	51.0%		13.0%	64.0%	15.0%	15.0%	21%
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5	2.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0	1.0
Lost Time Adjust (s)	0.0			0.0	0.0	0.0	
Total Lost Time (s)	5.5			5.5	5.5	5.5	
Lead/Lag	Lag		Lead				
Lead-Lag Optimize?	Yes		Yes				
Recall Mode	C-Max		None	C-Max	None	None	None
Act Effct Green (s)	79.5			79.5	9.5	9.5	
Actuated g/C Ratio	0.80			0.80	0.10	0.10	
v/c Ratio	0.32			0.39	0.95	0.59	
Control Delay	7.1			5.7	104.0	14.8	
Queue Delay	2.0			0.0	0.0	0.0	
Total Delay	9.1			5.7	104.0	14.8	
LOS	A			A	F	B	
Approach Delay	9.1			5.7	55.6		
Approach LOS	A			A	E		
Queue Length 50th (ft)	214			52	100	0	
Queue Length 95th (ft)	m203			113	#213	58	
Internal Link Dist (ft)	216			540	224		
Turn Bay Length (ft)							
Base Capacity (vph)	2736			1504	164	314	
Starvation Cap Reductn	1669			0	0	0	
Spillback Cap Reductn	0			0	0	0	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø9
Storage Cap Reductn	0			0	0	0	
Reduced v/c Ratio	0.81			0.39	0.95	0.59	

Intersection Summary			
Area Type:	Other		
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 99 (99%), Referenced to phase 2:EBT and 6:WBTL, Start of Yellow			
Natural Cycle: 70			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.95			
Intersection Signal Delay: 16.8		Intersection LOS: B	
Intersection Capacity Utilization 56.6%		ICU Level of Service B	
Analysis Period (min) 15			

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Montrose Ave & Salem St



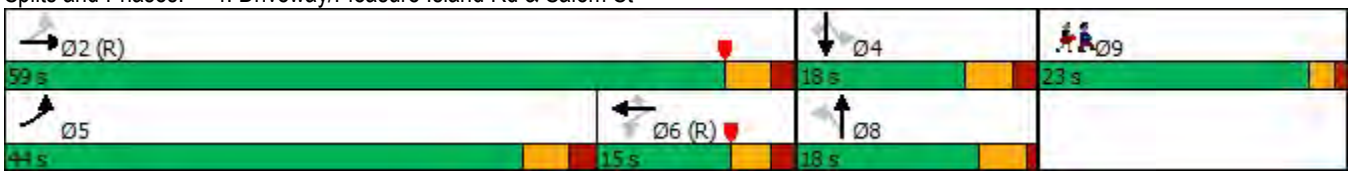
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	550	240	85	28	166	27	61	52	37	47	44	305
Future Volume (vph)	550	240	85	28	166	27	61	52	37	47	44	305
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	150		175	0		0	0		0
Storage Lanes	1		0	1		1	1		0	0		1
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1752	1762	0	1687	3374	1509	1805	1762	0	0	1764	1538
Flt Permitted	0.579			0.548			0.667				0.766	
Satd. Flow (perm)	1066	1762	0	961	3374	1473	1267	1762	0	0	1381	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		27				120		30				372
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		620			336			119			668	
Travel Time (s)		14.1			7.6			2.7			15.2	
Confl. Peds. (#/hr)	4		4	4		4			2	2		
Peak Hour Factor	0.91	0.91	0.91	0.92	0.92	0.92	0.94	0.94	0.94	0.82	0.82	0.82
Heavy Vehicles (%)	3%	3%	3%	7%	7%	7%	0%	0%	0%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	604	357	0	30	180	29	65	94	0	0	111	372
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6		6	8			4		4
Detector Phase	5	2		6	6	6	8	8		4	4	4
Switch Phase												
Minimum Initial (s)	8.0	10.0		10.0	10.0	10.0	8.0	8.0		8.0	8.0	8.0
Minimum Split (s)	13.5	15.5		15.0	15.0	15.0	12.5	12.5		13.5	13.5	13.5
Total Split (s)	44.0	59.0		15.0	15.0	15.0	18.0	18.0		18.0	18.0	18.0
Total Split (%)	44.0%	59.0%		15.0%	15.0%	15.0%	18.0%	18.0%		18.0%	18.0%	18.0%
Yellow Time (s)	3.5	3.5		3.0	3.0	3.0	3.5	3.5		3.5	3.5	3.5
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	1.0	1.0		2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0			0.0	0.0
Total Lost Time (s)	5.5	5.5		5.0	5.0	5.0	4.5	4.5			5.5	5.5
Lead/Lag	Lead			Lag	Lag	Lag						
Lead-Lag Optimize?	Yes			Yes	Yes	Yes						
Recall Mode	None	C-Max		C-Max	C-Max	C-Max	None	None		None	None	None
Act Effct Green (s)	77.7	77.7		53.9	53.9	53.9	12.3	12.3			11.3	11.3
Actuated g/C Ratio	0.78	0.78		0.54	0.54	0.54	0.12	0.12			0.11	0.11
v/c Ratio	0.63	0.26		0.06	0.10	0.03	0.42	0.39			0.71	0.74
Control Delay	11.7	1.5		14.5	13.1	0.1	48.5	32.7			67.3	14.2
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0			0.0	0.0
Total Delay	11.7	1.5		14.5	13.1	0.1	48.5	32.7			67.3	14.2
LOS	B	A		B	B	A	D	C			E	B
Approach Delay		7.9			11.7			39.2			26.4	
Approach LOS		A			B			D			C	
Queue Length 50th (ft)	147	19		9	28	0	38	37			68	0
Queue Length 95th (ft)	56	23		29	57	0	82	86			#117	54
Internal Link Dist (ft)		540			256			39			588	
Turn Bay Length (ft)				150		175						

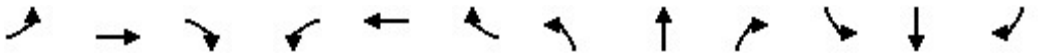
Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	23.0
Total Split (s)	23.0
Total Split (%)	23%
Yellow Time (s)	2.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	1091	1374		518	1819	849	171	263			172	517
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	0.55	0.26		0.06	0.10	0.03	0.38	0.36			0.65	0.72

Intersection Summary			
Area Type:	Other		
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 86 (86%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.74			
Intersection Signal Delay: 16.0		Intersection LOS: B	
Intersection Capacity Utilization 63.7%		ICU Level of Service B	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 4: Driveway/Pleasure Island Rd & Salem St



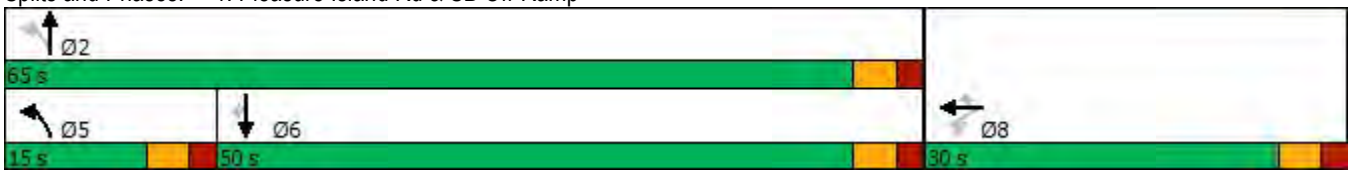


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	260	1	64	191	330	0	0	392	292
Future Volume (vph)	0	0	0	260	1	64	191	330	0	0	392	292
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		200	200		0	0		175
Storage Lanes	0		0	0		1	1		0	0		1
Taper Length (ft)	25			25			50			25		
Satd. Flow (prot)	0	0	0	0	1646	1468	1770	3539	0	0	3574	1599
Flt Permitted					0.953		0.328					
Satd. Flow (perm)	0	0	0	0	1646	1468	611	3539	0	0	3574	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						80						360
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		795			527			668			287	
Travel Time (s)		18.1			12.0			15.2			6.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.85	0.85	0.85	0.81	0.81	0.81
Heavy Vehicles (%)	2%	2%	2%	10%	10%	10%	2%	2%	2%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	284	70	225	388	0	0	484	360
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases					8		5	2			6	
Permitted Phases				8		8	2					6
Detector Phase				8	8	8	5	2			6	6
Switch Phase												
Minimum Initial (s)				10.0	10.0	10.0	6.0	10.0			10.0	10.0
Minimum Split (s)				15.0	15.0	15.0	11.0	15.0			18.0	18.0
Total Split (s)				30.0	30.0	30.0	15.0	65.0			50.0	50.0
Total Split (%)				31.6%	31.6%	31.6%	15.8%	68.4%			52.6%	52.6%
Yellow Time (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
All-Red Time (s)				2.0	2.0	2.0	2.0	2.0			2.0	2.0
Lost Time Adjust (s)					0.0	0.0	0.0	0.0			0.0	0.0
Total Lost Time (s)					5.0	5.0	5.0	5.0			5.0	5.0
Lead/Lag							Lead				Lag	Lag
Lead-Lag Optimize?							Yes				Yes	Yes
Recall Mode				None	None	None	None	Min			Min	Min
Act Effct Green (s)					15.3	15.3	30.9	30.9			16.0	16.0
Actuated g/C Ratio					0.27	0.27	0.55	0.55			0.28	0.28
v/c Ratio					0.64	0.15	0.42	0.20			0.48	0.51
Control Delay					26.2	5.0	10.0	7.3			18.9	5.1
Queue Delay					0.0	0.0	0.0	0.0			0.0	0.0
Total Delay					26.2	5.0	10.0	7.3			18.9	5.1
LOS					C	A	A	A			B	A
Approach Delay					22.0			8.3			13.1	
Approach LOS					C			A			B	
Queue Length 50th (ft)					84	0	34	30			68	0
Queue Length 95th (ft)					172	22	81	62			112	35
Internal Link Dist (ft)		715			447			588			207	
Turn Bay Length (ft)						200	200					175
Base Capacity (vph)					751	713	545	3404			2901	1365

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn					0	0	0	0			0	0
Spillback Cap Reductn					0	0	0	0			0	0
Storage Cap Reductn					0	0	0	0			0	0
Reduced v/c Ratio					0.38	0.10	0.41	0.11			0.17	0.26

Intersection Summary			
Area Type:	Other		
Cycle Length: 95			
Actuated Cycle Length: 56.5			
Natural Cycle: 45			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.64			
Intersection Signal Delay: 13.2		Intersection LOS: B	
Intersection Capacity Utilization 55.6%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 1: Pleasure Island Rd & SB Off-Ramp



Lane Group	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Volume (vph)	236	365	396	274	245	39
Future Volume (vph)	236	365	396	274	245	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0			150	0	250
Storage Lanes	0			1	2	1
Taper Length (ft)	25				25	
Satd. Flow (prot)	0	3472	3539	1583	3400	1568
Flt Permitted		0.654			0.950	
Satd. Flow (perm)	0	2315	3539	1583	3400	1568
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				297		45
Link Speed (mph)		30	30		30	
Link Distance (ft)		346	296		281	
Travel Time (s)		7.9	6.7		6.4	
Peak Hour Factor	0.95	0.95	0.88	0.88	0.87	0.87
Heavy Vehicles (%)	2%	2%	2%	2%	3%	3%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	632	450	311	282	45
Turn Type	pm+pt	NA	NA	Prot	Prot	Perm
Protected Phases	5	2	6	6	4	
Permitted Phases	2					4
Detector Phase	5	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	5.0	10.0	10.0	10.0	7.0	7.0
Minimum Split (s)	10.5	15.5	15.5	15.5	12.5	12.5
Total Split (s)	25.5	106.0	80.5	80.5	80.5	80.5
Total Split (%)	13.7%	56.8%	43.2%	43.2%	43.2%	43.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		5.5	5.5	5.5	5.5	5.5
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?	Yes		Yes	Yes		
Recall Mode	None	C-Max	C-Max	C-Max	None	None
Act Effct Green (s)		154.4	154.4	154.4	21.1	21.1
Actuated g/C Ratio		0.83	0.83	0.83	0.11	0.11
v/c Ratio		0.33	0.15	0.23	0.73	0.21
Control Delay		4.6	3.5	0.8	91.2	18.8
Queue Delay		0.0	1.3	2.1	0.0	0.0
Total Delay		4.6	4.8	3.0	91.2	18.8
LOS		A	A	A	F	B
Approach Delay		4.6	4.1		81.2	
Approach LOS		A	A		F	
Queue Length 50th (ft)		83	49	3	175	0
Queue Length 95th (ft)		123	72	20	215	39
Internal Link Dist (ft)		266	216		201	
Turn Bay Length (ft)				150		250
Base Capacity (vph)		1915	2929	1361	1367	657

Lane Group	EBL	EBT	WBT	WBR	SWL	SWR
Starvation Cap Reductn		0	2228	893	0	0
Spillback Cap Reductn		0	0	0	0	0
Storage Cap Reductn		0	0	0	0	0
Reduced v/c Ratio		0.33	0.64	0.66	0.21	0.07

Intersection Summary			
Area Type:	Other		
Cycle Length: 186.5			
Actuated Cycle Length: 186.5			
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Yellow, Master Intersection			
Natural Cycle: 40			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.73			
Intersection Signal Delay: 18.9		Intersection LOS: B	
Intersection Capacity Utilization 48.6%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: Salem St & NB Off-Ramp

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø9
Lane Configurations							
Traffic Volume (vph)	534	107	218	490	175	173	
Future Volume (vph)	534	107	218	490	175	173	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Satd. Flow (prot)	3401	0	0	3486	1787	1599	
Flt Permitted				0.615	0.950		
Satd. Flow (perm)	3401	0	0	2175	1787	1599	
Right Turn on Red		Yes				Yes	
Satd. Flow (RTOR)	22					228	
Link Speed (mph)	30			30	30		
Link Distance (ft)	296			620	304		
Travel Time (s)	6.7			14.1	6.9		
Confl. Peds. (#/hr)		8	8				
Peak Hour Factor	0.94	0.94	0.89	0.89	0.76	0.76	
Heavy Vehicles (%)	3%	3%	2%	2%	1%	1%	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	682	0	0	796	230	228	
Turn Type	NA		pm+pt	NA	Prot	Perm	
Protected Phases	2		1	6	8		9
Permitted Phases			6			8	
Detector Phase	2		1	6	8	8	
Switch Phase							
Minimum Initial (s)	10.0		5.0	10.0	7.0	7.0	5.0
Minimum Split (s)	15.5		10.5	15.5	12.5	12.5	21.0
Total Split (s)	85.5		25.5	112.0	25.5	25.5	21.0
Total Split (%)	53.9%		16.1%	70.7%	16.1%	16.1%	13%
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5	2.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0	1.0
Lost Time Adjust (s)	0.0			0.0	0.0	0.0	
Total Lost Time (s)	5.5			5.5	5.5	5.5	
Lead/Lag	Lag		Lead				
Lead-Lag Optimize?	Yes		Yes				
Recall Mode	C-Max		None	C-Max	None	None	None
Act Effct Green (s)	127.5			127.5	20.0	20.0	
Actuated g/C Ratio	0.80			0.80	0.13	0.13	
v/c Ratio	0.25			0.46	1.02	0.57	
Control Delay	3.9			5.7	131.8	13.1	
Queue Delay	2.0			0.5	0.0	0.0	
Total Delay	5.9			6.2	131.8	13.1	
LOS	A			A	F	B	
Approach Delay	5.9			6.2	72.7		
Approach LOS	A			A	E		
Queue Length 50th (ft)	74			114	~252	0	
Queue Length 95th (ft)	92			141	#327	33	
Internal Link Dist (ft)	216			540	224		
Turn Bay Length (ft)							
Base Capacity (vph)	2740			1749	225	400	
Starvation Cap Reductn	1860			483	0	0	
Spillback Cap Reductn	0			0	0	0	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø9
Storage Cap Reductn	0			0	0	0	
Reduced v/c Ratio	0.78			0.63	1.02	0.57	

Intersection Summary			
Area Type:	Other		
Cycle Length: 158.5			
Actuated Cycle Length: 158.5			
Offset: 99 (62%), Referenced to phase 2:EBT and 6:WBTL, Start of Yellow			
Natural Cycle: 80			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.02			
Intersection Signal Delay: 21.8		Intersection LOS: C	
Intersection Capacity Utilization 61.6%		ICU Level of Service B	
Analysis Period (min) 15			

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Montrose Ave & Salem St

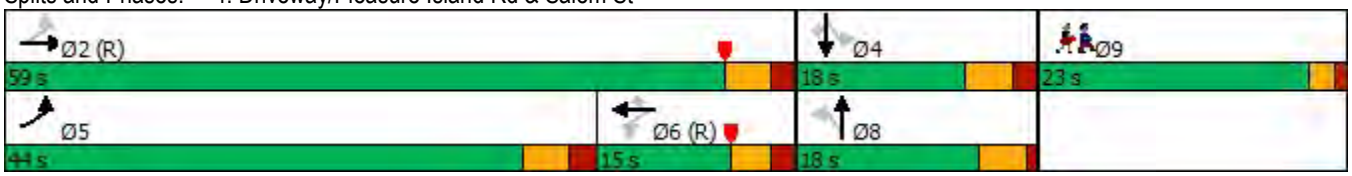
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	367	318	29	12	210	133	21	12	23	126	9	525
Future Volume (vph)	367	318	29	12	210	133	21	12	23	126	9	525
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	150		175	0		0	0		0
Storage Lanes	1		0	1		1	1		0	0		1
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1752	1818	0	1736	3471	1553	1770	1632	0	0	1712	1524
Flt Permitted	0.546			0.527			0.525				0.706	
Satd. Flow (perm)	1007	1818	0	932	3471	1553	978	1632	0	0	1239	1524
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7				156		31				603
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		620			336			119			668	
Travel Time (s)		14.1			7.6			2.7			15.2	
Confl. Peds. (#/hr)			11	11					6	6		
Peak Hour Factor	0.87	0.87	0.87	0.85	0.85	0.85	0.74	0.74	0.74	0.87	0.87	0.87
Heavy Vehicles (%)	3%	3%	3%	4%	4%	4%	2%	2%	2%	6%	6%	6%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	422	399	0	14	247	156	28	47	0	0	155	603
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6		6	8			4		4
Detector Phase	5	2		6	6	6	8	8		4	4	4
Switch Phase												
Minimum Initial (s)	8.0	10.0		10.0	10.0	10.0	8.0	8.0		8.0	8.0	8.0
Minimum Split (s)	13.5	15.5		15.0	15.0	15.0	12.5	12.5		13.5	13.5	13.5
Total Split (s)	44.0	59.0		15.0	15.0	15.0	18.0	18.0		18.0	18.0	18.0
Total Split (%)	44.0%	59.0%		15.0%	15.0%	15.0%	18.0%	18.0%		18.0%	18.0%	18.0%
Yellow Time (s)	3.5	3.5		3.0	3.0	3.0	3.5	3.5		3.5	3.5	3.5
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	1.0	1.0		2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0			0.0	0.0
Total Lost Time (s)	5.5	5.5		5.0	5.0	5.0	4.5	4.5			5.5	5.5
Lead/Lag	Lead			Lag	Lag	Lag						
Lead-Lag Optimize?	Yes			Yes	Yes	Yes						
Recall Mode	None	C-Max		C-Max	C-Max	C-Max	None	None		None	None	None
Act Effct Green (s)	76.5	76.5		58.1	58.1	58.1	13.5	13.5			12.5	12.5
Actuated g/C Ratio	0.76	0.76		0.58	0.58	0.58	0.14	0.14			0.12	0.12
v/c Ratio	0.49	0.29		0.03	0.12	0.16	0.21	0.19			1.01	0.84
Control Delay	5.7	4.1		10.5	10.2	2.3	43.0	21.4			120.1	15.6
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0			0.0	0.0
Total Delay	5.7	4.1		10.5	10.2	2.3	43.0	21.4			120.1	15.6
LOS	A	A		B	B	A	D	C			F	B
Approach Delay		4.9			7.2			29.5			36.9	
Approach LOS		A			A			C			D	
Queue Length 50th (ft)	68	61		4	34	0	16	9			~100	0
Queue Length 95th (ft)	96	87		13	56	24	35	31			#220	#136
Internal Link Dist (ft)		540			256			39			588	
Turn Bay Length (ft)				150		175						

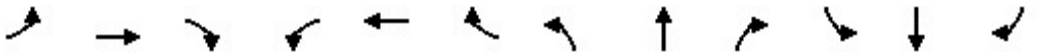
Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	23.0
Total Split (s)	23.0
Total Split (%)	23%
Yellow Time (s)	2.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	1057	1392		541	2016	967	132	247			154	718
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	0.40	0.29		0.03	0.12	0.16	0.21	0.19			1.01	0.84

Intersection Summary			
Area Type:	Other		
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 86 (86%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow			
Natural Cycle: 80			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.01			
Intersection Signal Delay: 18.0		Intersection LOS: B	
Intersection Capacity Utilization 60.0%		ICU Level of Service B	
Analysis Period (min) 15			
~ Volume exceeds capacity, queue is theoretically infinite.			
Queue shown is maximum after two cycles.			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 4: Driveway/Pleasure Island Rd & Salem St





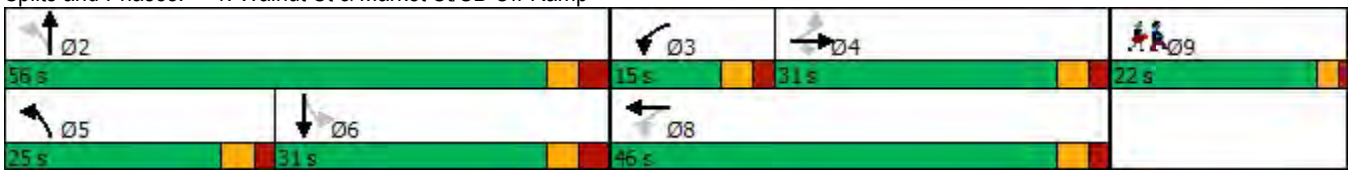
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	66	51	134	131	139	33	212	90	354	29	127	87
Future Volume (vph)	66	51	134	131	139	33	212	90	354	29	127	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		150	300		250	0		0
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1752	1845	1568	1770	1801	0	1752	1845	1568	1787	1766	0
Flt Permitted	0.621			0.490			0.405			0.696		
Satd. Flow (perm)	1142	1845	1568	913	1801	0	747	1845	1568	1309	1766	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			147		10				369		25	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		347			512			708			266	
Travel Time (s)		7.9			11.6			16.1			6.0	
Confl. Peds. (#/hr)	2					2						
Peak Hour Factor	0.91	0.91	0.91	0.78	0.78	0.78	0.96	0.96	0.96	0.98	0.98	0.98
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	3%	3%	3%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	73	56	147	168	220	0	221	94	369	30	219	0
Turn Type	Perm	NA	Perm	pm+pt	NA		pm+pt	NA	Free	Perm	NA	
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8			2		Free	6		
Detector Phase	4	4	4	3	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	6.0	6.0	6.0	6.0	6.0		6.0	10.0		10.0	10.0	
Minimum Split (s)	12.0	12.0	12.0	12.0	11.0		12.0	16.0		16.0	16.0	
Total Split (s)	31.0	31.0	31.0	15.0	46.0		25.0	56.0		31.0	31.0	
Total Split (%)	25.0%	25.0%	25.0%	12.1%	37.1%		20.2%	45.2%		25.0%	25.0%	
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	3.0		3.0	3.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	6.0		6.0	6.0	
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes			Yes			Yes	Yes	
Recall Mode	None	None	None	None	None		None	Min		Min	Min	
Act Effct Green (s)	10.4	10.4	10.4	24.8	24.8		34.5	33.5	69.6	13.9	13.9	
Actuated g/C Ratio	0.15	0.15	0.15	0.36	0.36		0.50	0.48	1.00	0.20	0.20	
v/c Ratio	0.43	0.20	0.41	0.38	0.34		0.38	0.11	0.24	0.11	0.59	
Control Delay	37.6	30.1	9.6	20.3	18.7		12.6	10.7	0.4	26.6	30.9	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	37.6	30.1	9.6	20.3	18.7		12.6	10.7	0.4	26.6	30.9	
LOS	D	C	A	C	B		B	B	A	C	C	
Approach Delay		21.2			19.4			5.7			30.4	
Approach LOS		C			B			A			C	
Queue Length 50th (ft)	29	21	0	49	63		51	21	0	11	75	
Queue Length 95th (ft)	77	59	49	96	118		104	50	0	36	165	
Internal Link Dist (ft)		267			432			628			186	
Turn Bay Length (ft)							300		250			

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	22.0
Total Split (s)	22.0
Total Split (%)	18%
Yellow Time (s)	2.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	440	711	694	452	1098		668	1367	1568	485	670	
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	0.17	0.08	0.21	0.37	0.20		0.33	0.07	0.24	0.06	0.33	

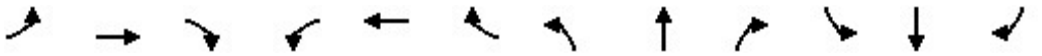
Intersection Summary			
Area Type:	Other		
Cycle Length: 124			
Actuated Cycle Length: 69.6			
Natural Cycle: 75			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.59			
Intersection Signal Delay: 15.6		Intersection LOS: B	
Intersection Capacity Utilization 55.6%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 1: Walnut St & Market St/SB Off-Ramp



Lane Group	Ø9
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	97	0	474	0	0	0	0	550	89	111	314	0
Future Volume (vph)	97	0	474	0	0	0	0	550	89	111	314	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		0	300		0
Storage Lanes	1		2	0		0	0		1	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1736	0	2733	0	0	0	0	1863	1583	1787	1881	0
Flt Permitted	0.950									0.343		
Satd. Flow (perm)	1736	0	2733	0	0	0	0	1863	1546	645	1881	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			494						124			
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		246			800			287			708	
Travel Time (s)		5.6			18.2			6.5			16.1	
Confl. Peds. (#/hr)									2	2		
Peak Hour Factor	0.96	0.96	0.96	0.92	0.92	0.92	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	2%	2%	2%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	101	0	494	0	0	0	0	573	93	116	327	0
Turn Type	Prot		Prot					NA	Perm	pm+pt	NA	
Protected Phases	4		4					2		1	6	
Permitted Phases									2	6		
Detector Phase	4		4					2	2	1	6	
Switch Phase												
Minimum Initial (s)	6.0		6.0					10.0	10.0	6.0	10.0	
Minimum Split (s)	12.0		12.0					16.0	16.0	12.0	16.0	
Total Split (s)	31.0		31.0					35.0	35.0	15.0	50.0	
Total Split (%)	32.0%		32.0%					36.1%	36.1%	15.5%	51.5%	
Yellow Time (s)	3.0		3.0					3.0	3.0	3.0	3.0	
All-Red Time (s)	3.0		3.0					3.0	3.0	2.0	3.0	
Lost Time Adjust (s)	0.0		0.0					0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.0		6.0					6.0	6.0	5.0	6.0	
Lead/Lag	Lag		Lag					Lag	Lag	Lead		
Lead-Lag Optimize?	Yes		Yes					Yes	Yes	Yes		
Recall Mode	None		None					C-Min	C-Min	None	C-Min	
Act Effct Green (s)	11.2		11.2					61.3	61.3	74.8	73.8	
Actuated g/C Ratio	0.12		0.12					0.63	0.63	0.77	0.76	
v/c Ratio	0.51		0.66					0.49	0.09	0.20	0.23	
Control Delay	48.4		8.1					12.2	1.1	4.0	4.2	
Queue Delay	0.0		0.0					7.9	0.0	0.0	0.0	
Total Delay	48.4		8.1					20.2	1.1	4.0	4.2	
LOS	D		A					C	A	A	A	
Approach Delay		15.0						17.5			4.1	
Approach LOS		B						B			A	
Queue Length 50th (ft)	60		0					167	0	14	47	
Queue Length 95th (ft)	106		47					315	13	34	93	
Internal Link Dist (ft)		166			720			207			628	
Turn Bay Length (ft)										300		

Lane Group	Ø3
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	3
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	7.0
Minimum Split (s)	16.0
Total Split (s)	16.0
Total Split (%)	16%
Yellow Time (s)	2.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	Yes
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	

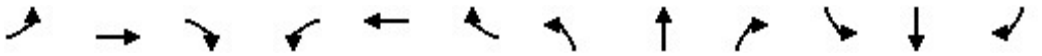
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	447		1071					1177	1022	616	1431	
Starvation Cap Reductn	0		0					556	0	0	0	
Spillback Cap Reductn	0		0					0	0	0	0	
Storage Cap Reductn	0		0					0	0	0	0	
Reduced v/c Ratio	0.23		0.46					0.92	0.09	0.19	0.23	

Intersection Summary			
Area Type:	Other		
Cycle Length: 97			
Actuated Cycle Length: 97			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green, Master Intersection			
Natural Cycle: 70			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.66			
Intersection Signal Delay: 13.1		Intersection LOS: B	
Intersection Capacity Utilization 53.0%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: Walnut St & NB Off-Ramp

Lane Group	Ø3
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary



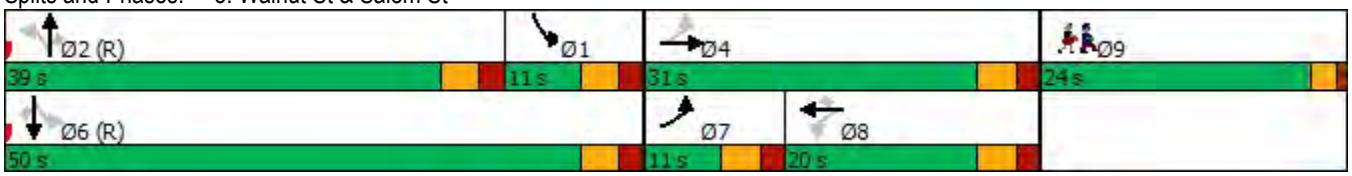
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	73	105	70	18	153	113	80	454	26	80	546	144
Future Volume (vph)	73	105	70	18	153	113	80	454	26	80	546	144
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		150	0		0
Storage Lanes	1		0	1		1	0		1	1		1
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1719	1701	0	1770	1863	1583	0	1868	1599	1752	3505	1568
Flt Permitted	0.315			0.638				0.832		0.343		
Satd. Flow (perm)	570	1701	0	1188	1863	1583	0	1565	1599	633	3505	1568
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		30				156			156			157
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		260			308			259			287	
Travel Time (s)		5.9			7.0			5.9			6.5	
Peak Hour Factor	0.92	0.92	0.92	0.90	0.90	0.90	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	5%	5%	5%	2%	2%	2%	1%	1%	1%	3%	3%	3%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	79	190	0	20	170	126	0	580	28	87	593	157
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		6
Detector Phase	7	4		8	8	8	2	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	6.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0	6.0	10.0	10.0
Minimum Split (s)	11.0	15.0		15.0	15.0	15.0	15.0	15.0	15.0	11.0	15.0	15.0
Total Split (s)	11.0	31.0		20.0	20.0	20.0	39.0	39.0	39.0	11.0	50.0	50.0
Total Split (%)	10.5%	29.5%		19.0%	19.0%	19.0%	37.1%	37.1%	37.1%	10.5%	47.6%	47.6%
Yellow Time (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	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
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead			Lag	Lag	Lag	Lead	Lead	Lead	Lag		
Lead-Lag Optimize?	Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Recall Mode	None	None		None	None	None	C-Max	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	22.3	22.3		13.5	13.5	13.5		63.9	63.9	72.7	72.7	72.7
Actuated g/C Ratio	0.21	0.21		0.13	0.13	0.13		0.61	0.61	0.69	0.69	0.69
v/c Ratio	0.42	0.49		0.13	0.71	0.37		0.61	0.03	0.17	0.24	0.14
Control Delay	39.4	33.9		41.8	60.5	6.9		18.4	0.0	8.0	6.9	1.4
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.7	0.5
Total Delay	39.4	33.9		41.8	60.5	6.9		18.4	0.0	8.0	7.6	1.9
LOS	D	C		D	E	A		B	A	A	A	A
Approach Delay		35.5			37.9			17.6			6.6	
Approach LOS		D			D			B			A	
Queue Length 50th (ft)	42	90		12	109	0		261	0	19	77	0
Queue Length 95th (ft)	83	158		35	181	33		391	0	36	103	21
Internal Link Dist (ft)		180			228			179			207	
Turn Bay Length (ft)									150			
Base Capacity (vph)	186	443		169	266	359		952	1034	502	2427	1134

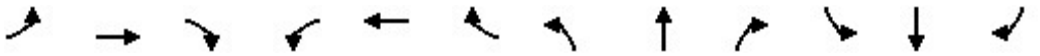
Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	24.0
Total Split (s)	24.0
Total Split (%)	23%
Yellow Time (s)	2.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn	0	0		0	0	0		0	0	0	1431	667
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	0.42	0.43		0.12	0.64	0.35		0.61	0.03	0.17	0.60	0.34

Intersection Summary			
Area Type:	Other		
Cycle Length: 105			
Actuated Cycle Length: 105			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 100			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.71			
Intersection Signal Delay: 18.6		Intersection LOS: B	
Intersection Capacity Utilization 78.2%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 3: Walnut St & Salem St





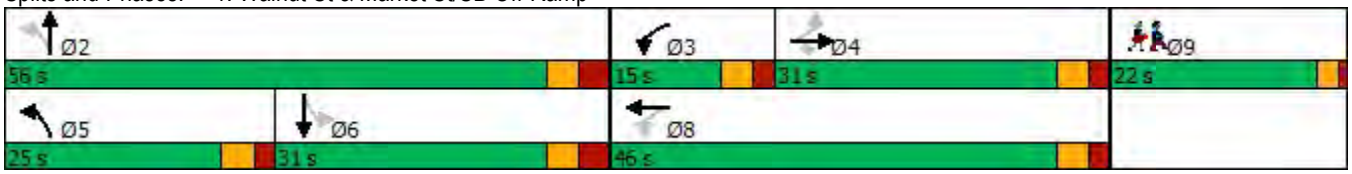
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	99	159	396	106	232	53	356	122	390	23	134	95
Future Volume (vph)	99	159	396	106	232	53	356	122	390	23	134	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		150	300		250	0		0
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1787	1881	1599	1770	1801	0	1787	1881	1599	1770	1747	0
Flt Permitted	0.583			0.438			0.295			0.677		
Satd. Flow (perm)	1088	1881	1599	816	1801	0	555	1881	1565	1256	1747	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			421		10				398		26	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		347			512			708			266	
Travel Time (s)		7.9			11.6			16.1			6.0	
Confl. Peds. (#/hr)	5					5			2	2		
Peak Hour Factor	0.94	0.94	0.94	0.99	0.99	0.99	0.98	0.98	0.98	0.76	0.76	0.76
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	1%	1%	1%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	105	169	421	107	288	0	363	124	398	30	301	0
Turn Type	Perm	NA	Perm	pm+pt	NA		pm+pt	NA	Free	Perm	NA	
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8			2		Free	6		
Detector Phase	4	4	4	3	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	6.0	6.0	6.0	6.0	6.0		6.0	10.0		10.0	10.0	
Minimum Split (s)	12.0	12.0	12.0	12.0	11.0		12.0	16.0		16.0	16.0	
Total Split (s)	31.0	31.0	31.0	15.0	46.0		25.0	56.0		31.0	31.0	
Total Split (%)	25.0%	25.0%	25.0%	12.1%	37.1%		20.2%	45.2%		25.0%	25.0%	
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	3.0		3.0	3.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	6.0		6.0	6.0	
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes			Yes			Yes	Yes	
Recall Mode	None	None	None	None	None		None	Min		Min	Min	
Act Effct Green (s)	16.5	16.5	16.5	27.1	27.1		46.0	44.9	83.5	19.4	19.4	
Actuated g/C Ratio	0.20	0.20	0.20	0.32	0.32		0.55	0.54	1.00	0.23	0.23	
v/c Ratio	0.49	0.46	0.64	0.29	0.49		0.60	0.12	0.25	0.10	0.71	
Control Delay	40.8	35.7	8.4	22.1	24.4		17.1	12.2	0.4	29.0	38.4	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	40.8	35.7	8.4	22.1	24.4		17.1	12.2	0.4	29.0	38.4	
LOS	D	D	A	C	C		B	B	A	C	D	
Approach Delay		19.9			23.8			8.9			37.6	
Approach LOS		B			C			A			D	
Queue Length 50th (ft)	52	83	0	40	115		107	32	0	13	137	
Queue Length 95th (ft)	108	151	77	80	197		212	75	0	33	204	
Internal Link Dist (ft)		267			432			628			186	
Turn Bay Length (ft)							300		250			

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	22.0
Total Split (s)	22.0
Total Split (%)	18%
Yellow Time (s)	2.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	352	609	802	383	924		612	1171	1565	391	562	
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	0.30	0.28	0.52	0.28	0.31		0.59	0.11	0.25	0.08	0.54	

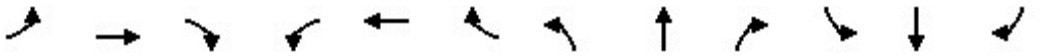
Intersection Summary			
Area Type:	Other		
Cycle Length: 124			
Actuated Cycle Length: 83.5			
Natural Cycle: 90			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.71			
Intersection Signal Delay: 18.9		Intersection LOS: B	
Intersection Capacity Utilization 71.1%		ICU Level of Service C	
Analysis Period (min) 15			

Splits and Phases: 1: Walnut St & Market St/SB Off-Ramp



Lane Group	Ø9
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary



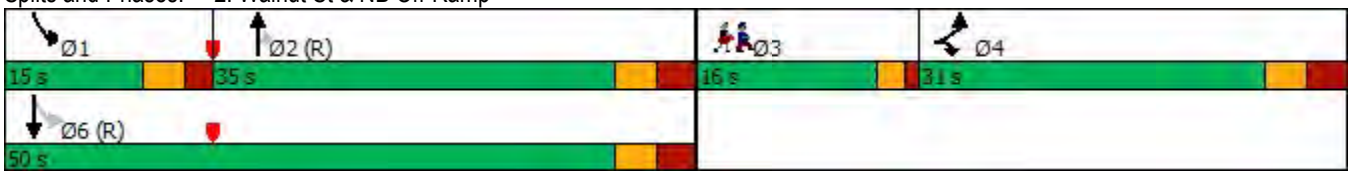
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	190	0	537	0	0	0	0	685	171	271	365	0
Future Volume (vph)	190	0	537	0	0	0	0	685	171	271	365	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		0	300		0
Storage Lanes	1		2	0		0	0		1	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1787	0	2814	0	0	0	0	1881	1599	1787	1881	0
Flt Permitted	0.950									0.117		
Satd. Flow (perm)	1787	0	2814	0	0	0	0	1881	1562	220	1881	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			548						146			
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		246			800			287			708	
Travel Time (s)		5.6			18.2			6.5			16.1	
Confl. Peds. (#/hr)									2	2		
Peak Hour Factor	0.98	0.98	0.98	0.92	0.92	0.92	0.99	0.99	0.99	0.90	0.90	0.90
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	194	0	548	0	0	0	0	692	173	301	406	0
Turn Type	Prot		Prot					NA	Perm	pm+pt	NA	
Protected Phases	4		4					2		1	6	
Permitted Phases									2	6		
Detector Phase	4		4					2	2	1	6	
Switch Phase												
Minimum Initial (s)	6.0		6.0					10.0	10.0	6.0	10.0	
Minimum Split (s)	12.0		12.0					16.0	16.0	12.0	16.0	
Total Split (s)	31.0		31.0					35.0	35.0	15.0	50.0	
Total Split (%)	32.0%		32.0%					36.1%	36.1%	15.5%	51.5%	
Yellow Time (s)	3.0		3.0					3.0	3.0	3.0	3.0	
All-Red Time (s)	3.0		3.0					3.0	3.0	2.0	3.0	
Lost Time Adjust (s)	0.0		0.0					0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.0		6.0					6.0	6.0	5.0	6.0	
Lead/Lag	Lag		Lag					Lag	Lag	Lead		
Lead-Lag Optimize?	Yes		Yes					Yes	Yes	Yes		
Recall Mode	None		None					C-Min	C-Min	None	C-Min	
Act Effct Green (s)	16.4		16.4					41.9	41.9	69.6	68.6	
Actuated g/C Ratio	0.17		0.17					0.43	0.43	0.72	0.71	
v/c Ratio	0.64		0.59					0.85	0.23	0.59	0.31	
Control Delay	46.6		5.6					38.0	5.9	19.5	6.7	
Queue Delay	0.0		0.0					50.8	0.5	0.0	0.0	
Total Delay	46.6		5.6					88.8	6.4	19.5	6.7	
LOS	D		A					F	A	B	A	
Approach Delay		16.4						72.3			12.2	
Approach LOS		B						E			B	
Queue Length 50th (ft)	112		0					363	9	88	82	
Queue Length 95th (ft)	171		44					#682	55	187	156	
Internal Link Dist (ft)		166			720			207			628	
Turn Bay Length (ft)										300		

Lane Group	Ø3
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	3
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	7.0
Minimum Split (s)	16.0
Total Split (s)	16.0
Total Split (%)	16%
Yellow Time (s)	2.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	Yes
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	460		1132					813	758	507	1329	
Starvation Cap Reductn	0		0					293	307	0	0	
Spillback Cap Reductn	0		0					0	0	0	0	
Storage Cap Reductn	0		0					0	0	0	0	
Reduced v/c Ratio	0.42		0.48					1.33	0.38	0.59	0.31	

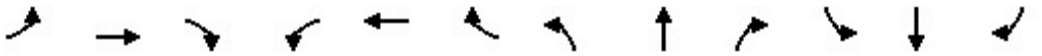
Intersection Summary			
Area Type:	Other		
Cycle Length: 97			
Actuated Cycle Length: 97			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green, Master Intersection			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.85			
Intersection Signal Delay: 36.0		Intersection LOS: D	
Intersection Capacity Utilization 74.1%		ICU Level of Service D	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 2: Walnut St & NB Off-Ramp



Lane Group	Ø3
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary



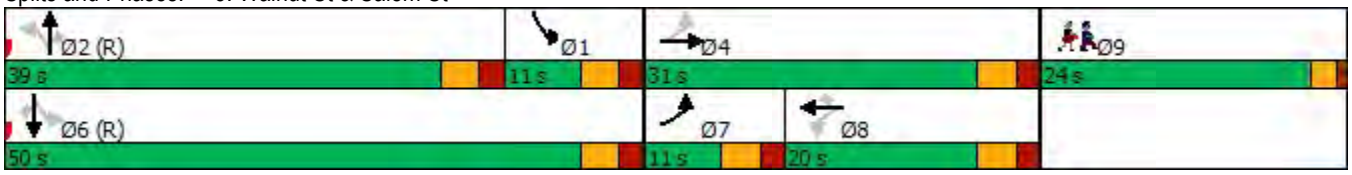
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	111	147	103	24	147	120	55	609	47	124	732	82
Future Volume (vph)	111	147	103	24	147	120	55	609	47	124	732	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		150	0		0
Storage Lanes	1		0	1		1	0		1	1		1
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1770	1737	0	1770	1863	1583	0	1855	1583	1787	3574	1599
Flt Permitted	0.349			0.586				0.871		0.254		
Satd. Flow (perm)	650	1737	0	1088	1863	1561	0	1622	1583	478	3574	1563
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		32				156			156			104
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		260			308			259			287	
Travel Time (s)		5.9			7.0			5.9			6.5	
Confl. Peds. (#/hr)	1		2	2		1	2					2
Peak Hour Factor	0.88	0.88	0.88	0.96	0.96	0.96	0.95	0.95	0.95	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	126	284	0	25	153	125	0	699	49	144	851	95
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		6
Detector Phase	7	4		8	8	8	2	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	6.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0	6.0	10.0	10.0
Minimum Split (s)	11.0	15.0		15.0	15.0	15.0	15.0	15.0	15.0	11.0	15.0	15.0
Total Split (s)	11.0	31.0		20.0	20.0	20.0	39.0	39.0	39.0	11.0	50.0	50.0
Total Split (%)	10.5%	29.5%		19.0%	19.0%	19.0%	37.1%	37.1%	37.1%	10.5%	47.6%	47.6%
Yellow Time (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	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
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead			Lag	Lag	Lag	Lead	Lead	Lead	Lag		
Lead-Lag Optimize?	Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Recall Mode	None	None		None	None	None	C-Max	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	24.1	24.1		13.1	13.1	13.1		59.9	59.9	70.9	70.9	70.9
Actuated g/C Ratio	0.23	0.23		0.12	0.12	0.12		0.57	0.57	0.68	0.68	0.68
v/c Ratio	0.59	0.67		0.19	0.66	0.38		0.76	0.05	0.36	0.35	0.09
Control Delay	45.7	40.8		43.6	57.4	6.8		24.2	0.1	12.0	8.0	1.3
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	1.9	0.0
Total Delay	45.7	40.8		43.6	57.4	6.8		24.2	0.1	12.0	9.9	1.3
LOS	D	D		D	E	A		C	A	B	A	A
Approach Delay		42.3			35.4			22.6			9.4	
Approach LOS		D			D			C			A	
Queue Length 50th (ft)	70	154		15	99	0		340	0	31	117	0
Queue Length 95th (ft)	118	234		41	165	33		521	0	53	146	13
Internal Link Dist (ft)		180			228			179			207	
Turn Bay Length (ft)									150			

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	24.0
Total Split (s)	24.0
Total Split (%)	23%
Yellow Time (s)	2.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	213	454		155	266	356		924	969	397	2412	1088
Starvation Cap Reductn	0	0		0	0	0		0	0	0	1355	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	0.59	0.63		0.16	0.58	0.35		0.76	0.05	0.36	0.81	0.09

Intersection Summary			
Area Type:	Other		
Cycle Length: 105			
Actuated Cycle Length: 105			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 120			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.76			
Intersection Signal Delay: 21.7		Intersection LOS: C	
Intersection Capacity Utilization 94.4%		ICU Level of Service F	
Analysis Period (min) 15			

Splits and Phases: 3: Walnut St & Salem St



APPENDIX G

Summary of Crash Data
I-95 Northbound at Exits 57 to 61

Table G-1
Summary of Crash Data 2015–17
I-95 Northbound at Exit 57

Statistics Period		2015	2016	2017	3-Yr. Total	Annual Avg.	Percentage
Total number of crashes		29	8	21	58	19.3	100%
Severity	Property damage only	20	7	16	43	14.3	74%
	Non-fatal injury	9	1	5	15	5.0	26%
	Fatality	0	0	0	0	0.0	0%
	Not reported/unknown	0	0	0	0	0.0	0%
Collision type	Single vehicle	4	1	3	8	2.7	14%
	Rear-end	16	6	14	36	12.0	62%
	Angle	4	0	2	6	2.0	10%
	Sideswipe, same direction	4	1	0	5	1.7	9%
	Sideswipe, opposite direction	0	0	0	0	0.0	0%
	Head-on	0	0	0	0	0.0	0%
	Rear-to-rear	0	0	0	0	0.0	0%
	Not reported/unknown	1	0	2	3	1.0	5%
Involved pedestrian(s)		0	0	0	0	0.0	0%
Involved cyclist(s)		0	0	0	0	0.0	0%
Occurred during weekday peak periods*		11	1	7	19	6.3	33%
Wet or icy pavement conditions		7	2	3	12	4.0	21%
Dark conditions (lit or unlit)		7	3	4	14	4.7	24%

* Peak periods are defined as 06:00–10:00 AM and 2:30–6:30 PM.

Table G-2
Summary of Crash Data 2015–17
I-95 Northbound at Exit 58

Statistics Period		2015	2016	2017	3-Yr. Total	Annual Avg.	Percentage
Total number of crashes		17	19	16	52	17.3	100%
Severity	Property damage only	10	11	11	32	10.7	62%
	Non-fatal injury	7	8	5	20	6.7	38%
	Fatality	0	0	0	0	0.0	0%
	Not reported/unknown	0	0	0	0	0.0	0%
Collision type	Single vehicle	1	8	5	14	4.7	27%
	Rear-end	14	7	8	29	9.7	56%
	Angle	0	2	2	4	1.3	8%
	Sideswipe, same direction	2	2	0	4	1.3	8%
	Sideswipe, opposite direction	0	0	0	0	0.0	0%
	Head-on	0	0	0	0	0.0	0%
	Rear-to-rear	0	0	0	0	0.0	0%
	Not reported/unknown	0	0	1	1	0.3	2%
Involved pedestrian(s)		0	0	0	0	0.0	0%
Involved cyclist(s)		0	0	0	0	0.0	0%
Occurred during weekday peak periods*		8	8	5	21	7.0	40%
Wet or icy pavement conditions		1	3	2	6	2.0	12%
Dark conditions (lit or unlit)		4	6	6	16	5.3	31%

* Peak periods are defined as 06:00–10:00 AM and 2:30–6:30 PM.

Table G-3
Summary of Crash Data 2015–17
I-95 Northbound at Exit 59

Statistics Period		2015	2016	2017	3-Yr. Total	Annual Avg.	Percentage
Total number of crashes		7	9	13	29	9.7	100%
Severity	Property damage only	3	9	10	22	7.3	76%
	Non-fatal injury	4	0	3	7	2.3	24%
	Fatality	0	0	0	0	0.0	0%
	Not reported/unknown	0	0	0	0	0.0	0%
Collision type	Single vehicle	4	2	3	9	3.0	31%
	Rear-end	2	5	7	14	4.7	48%
	Angle	0	0	0	0	0.0	0%
	Sideswipe, same direction	1	1	2	4	1.3	14%
	Sideswipe, opposite direction	0	0	1	1	0.3	3%
	Head-on	0	0	0	0	0.0	0%
	Rear-to-rear	0	0	0	0	0.0	0%
	Not reported/unknown	0	1	0	1	0.3	3%
Involved pedestrian(s)		0	0	0	0	0.0	0%
Involved cyclist(s)		0	0	0	0	0.0	0%
Occurred during weekday peak periods*		2	5	7	14	4.7	48%
Wet or icy pavement conditions		2	2	2	6	2.0	21%
Dark conditions (lit or unlit)		5	5	2	12	4.0	41%

* Peak periods are defined as 06:00–10:00 AM and 2:30–6:30 PM.

Table G-4
Summary of Crash Data 2015–17
I-95 Northbound at Exit 60

Statistics Period		2015	2016	2017	3-Yr. Total	Annual Avg.	Percentage
Total number of crashes		17	8	15	40	13.3	100%
Severity	Property damage only	8	7	11	26	8.7	65%
	Non-fatal injury	8	1	4	13	4.3	33%
	Fatality	1	0	0	1	0.3	3%
	Not reported/unknown	0	0	0	0	0.0	0%
Collision type	Single vehicle	5	4	1	10	3.3	25%
	Rear-end	9	1	11	21	7.0	53%
	Angle	1	0	0	1	0.3	3%
	Sideswipe, same direction	1	3	3	7	2.3	18%
	Sideswipe, opposite direction	0	0	0	0	0.0	0%
	Head-on	0	0	0	0	0.0	0%
	Rear-to-rear	1	0	0	1	0.3	3%
	Not reported/unknown	0	0	0	0	0.0	0%
Involved pedestrian(s)		0	0	0	0	0.0	0%
Involved cyclist(s)		0	0	0	0	0.0	0%
Occurred during weekday peak periods*		9	4	9	22	7.3	55%
Wet or icy pavement conditions		2	2	3	7	2.3	18%
Dark conditions (lit or unlit)		8	5	6	19	6.3	48%

* Peak periods are defined as 06:00–10:00 AM and 2:30–6:30 PM.

Table G-5
Summary of Crash Data 2015–17
I-95 Northbound at Exit 61

Statistics Period		2015	2016	2017	3-Yr. Total	Annual Avg.	Percentage
Total number of crashes		13	3	12	28	9.3	100%
Severity	Property damage only	11	3	9	23	7.7	82%
	Non-fatal injury	2	0	3	5	1.7	18%
	Fatality	0	0	0	0	0.0	0%
	Not reported/unknown	0	0	0	0	0.0	0%
Collision type	Single vehicle	4	0	1	5	1.7	18%
	Rear-end	6	3	10	19	6.3	68%
	Angle	1	0	0	1	0.3	4%
	Sideswipe, same direction	2	0	0	2	0.7	7%
	Sideswipe, opposite direction	0	0	1	1	0.3	4%
	Head-on	0	0	0	0	0.0	0%
	Rear-to-rear	0	0	0	0	0.0	0%
	Not reported/unknown	0	0	0	0	0.0	0%
Involved pedestrian(s)		0	0	0	0	0.0	0%
Involved cyclist(s)		0	0	0	0	0.0	0%
Occurred during weekday peak periods*		8	1	7	16	5.3	57%
Wet or icy pavement conditions		1	0	0	1	0.3	4%
Dark conditions (lit or unlit)		6	0	1	7	2.3	25%

* Peak periods are defined as 06:00–10:00 AM and 2:30–6:30 PM.

APPENDIX H

Summary of Crash Data
I-95 Southbound at Exits 57 to 61

Table H-1
Summary of Crash Data 2015–17
I-95 Southbound at Exit 57

Statistics Period		2015	2016	2017	3-Yr. Total	Annual Avg.	Percetage
Total number of crashes		22	14	23	59	19.7	100%
Severity	Property damage only	14	10	17	41	13.7	69%
	Non-fatal injury	8	4	6	18	6.0	31%
	Fatality	0	0	0	0	0.0	0%
	Not reported/unknown	0	0	0	0	0.0	0%
Collision type	Single vehicle	2	3	3	8	2.7	14%
	Rear-end	14	8	16	38	12.7	64%
	Angle	4	0	0	4	1.3	7%
	Sideswipe, same direction	1	3	4	8	2.7	14%
	Sideswipe, opposite direction	0	0	0	0	0.0	0%
	Head-on	1	0	0	1	0.3	2%
	Rear-to-rear	0	0	0	0	0.0	0%
	Not reported/unknown	0	0	0	0	0.0	0%
Involved pedestrian(s)		1	0	0	1	0.3	2%
Involved cyclist(s)		0	0	0	0	0.0	0%
Occurred during weekday peak periods*		11	6	6	23	7.7	39%
Wet or icy pavement conditions		2	1	7	10	3.3	17%
Dark conditions (lit or unlit)		7	3	3	13	4.3	22%

* Peak periods are defined as 6:00–10:00 AM and 2:30–6:30 PM.

Table H-2
Summary of Crash Data 2015–17
I-95 Southbound at Exit 58

Statistics Period		2015	2016	2017	3-Yr. Total	Annual Avg.	Percentage
Total number of crashes		9	15	15	39	13.0	100%
Severity	Property damage only	9	12	11	32	10.7	82%
	Non-fatal injury	0	3	4	7	2.3	18%
	Fatality	0	0	0	0	0.0	0%
	Not reported/unknown	0	0	0	0	0.0	0%
Collision type	Single vehicle	1	1	5	7	2.3	18%
	Rear-end	5	12	7	24	8.0	62%
	Angle	2	1	0	3	1.0	8%
	Sideswipe, same direction	1	1	3	5	1.7	13%
	Sideswipe, opposite direction	0	0	0	0	0.0	0%
	Head-on	0	0	0	0	0.0	0%
	Rear-to-rear	0	0	0	0	0.0	0%
	Not reported/unknown	0	0	0	0	0.0	0%
Involved pedestrian(s)		0	0	0	0	0.0	0%
Involved cyclist(s)		0	0	0	0	0.0	0%
Occurred during weekday peak periods*		3	8	8	19	6.3	49%
Wet or icy pavement conditions		2	1	1	4	1.3	10%
Dark conditions (lit or unlit)		3	3	4	10	3.3	26%

* Peak periods are defined as 06:00–10:00 AM and 2:30–6:30 PM.

Table H-3
Summary of Crash Data 2015–17
I-95 Southbound at Exit 59

Statistics Period		2015	2016	2017	3-Yr. Total	Annual Avg.	Percentage
Total number of crashes		14	20	12	46	15.3	100%
Severity	Property damage only	12	11	9	32	10.7	70%
	Non-fatal injury	2	9	3	14	4.7	30%
	Fatality	0	0	0	0	0.0	0%
	Not reported/unknown	0	0	0	0	0.0	0%
Collision type	Single vehicle	2	2	0	4	1.3	9%
	Rear-end	12	17	8	37	12.3	80%
	Angle	0	0	1	1	0.3	2%
	Sideswipe, same direction	0	1	2	3	1.0	7%
	Sideswipe, opposite direction	0	0	0	0	0.0	0%
	Head-on	0	0	0	0	0.0	0%
	Rear-to-rear	0	0	0	0	0.0	0%
	Not reported/unknown	0	0	1	1	0.3	2%
Involved pedestrian(s)		0	0	0	0	0.0	0%
Involved cyclist(s)		0	0	0	0	0.0	0%
Occurred during weekday peak periods*		8	10	5	23	7.7	50%
Wet or icy pavement conditions		2	1	3	6	2.0	13%
Dark conditions (lit or unlit)		3	5	2	10	3.3	22%

* Peak periods are defined as 06:00–10:00 AM and 2:30–6:30 PM.

Table H-4
Summary of Crash Data 2015–17
I-95 Southbound at Exit 60

Statistics Period		2015	2016	2017	3-Yr. Total	Annual Avg.	Percentage
Total number of crashes		17	15	19	51	17.0	100%
Severity	Property damage only	13	12	16	41	13.7	80%
	Non-fatal injury	4	3	3	10	3.3	20%
	Fatality	0	0	0	0	0.0	0%
	Not reported/unknown	0	0	0	0	0.0	0%
Collision type	Single vehicle	3	5	3	11	3.7	22%
	Rear-end	14	7	13	34	11.3	67%
	Angle	0	0	3	3	1.0	6%
	Sideswipe, same direction	0	3	0	3	1.0	6%
	Sideswipe, opposite direction	0	0	0	0	0.0	0%
	Head-on	0	0	0	0	0.0	0%
	Rear-to-rear	0	0	0	0	0.0	0%
	Not reported/unknown	0	0	0	0	0.0	0%
Involved pedestrian(s)		0	0	0	0	0.0	0%
Involved cyclist(s)		0	0	0	0	0.0	0%
Occurred during weekday peak periods*		7	11	10	28	9.3	55%
Wet or icy pavement conditions		3	2	2	7	2.3	14%
Dark conditions (lit or unlit)		5	2	5	12	4.0	24%

* Peak periods are defined as 06:00–10:00 AM and 2:30–6:30 PM.

Table H-5
Summary of Crash Data 2015–17
I-95 Southbound at Exit 61

Statistics Period		2015	2016	2017	3-Yr. Total	Annual Avg.	Percentage
Total number of crashes		23	14	25	62	20.7	100%
Severity	Property damage only	20	9	22	51	17.0	82%
	Non-fatal injury	3	5	3	11	3.7	18%
	Fatality	0	0	0	0	0.0	0%
	Not reported/unknown	0	0	0	0	0.0	0%
Collision type	Single vehicle	3	4	3	10	3.3	16%
	Rear-end	17	8	16	41	13.7	66%
	Angle	2	1	0	3	1.0	5%
	Sideswipe, same direction	1	1	5	7	2.3	11%
	Sideswipe, opposite direction	0	0	0	0	0.0	0%
	Head-on	0	0	0	0	0.0	0%
	Rear-to-rear	0	0	1	1	0.3	2%
	Not reported/unknown	0	0	0	0	0.0	0%
Involved pedestrian(s)		0	0	0	0	0.0	0%
Involved cyclist(s)		0	0	0	0	0.0	0%
Occurred during weekday peak periods*		10	4	12	26	8.7	42%
Wet or icy pavement conditions		4	1	6	11	3.7	18%
Dark conditions (lit or unlit)		9	4	5	18	6.0	29%

* Peak periods are defined as 06:00–10:00 AM and 2:30–6:30 PM.

APPENDIX I

Highway Capacity Analyses
AM Peak Hour: 2030 No-Build Scenario

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex57 Diverge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	600
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	5150	500
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	6183	589
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.91	0.30

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1923.1	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	3600	Speed Index (DS)	0.493
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2361
Distance to Downstream Ramp (LDOWN), ft	1750	Off-Ramp Influence Area Speed (SR), mi/h	54.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.578	Outer Lanes Freeway Speed (SO), mi/h	66.9
Flow in Lanes 1 and 2 (v12), pc/h	3822	Ramp Junction Speed (S), mi/h	58.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	35.3
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	31.7

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex57 Basic Fwy - 2030 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.25
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.1
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.070

Demand and Capacity

Demand Volume veh/h	4650	Heavy Vehicle Adjustment Factor (f_{HV})	0.948
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1861
Total Trucks, %	5.50	Capacity (c), pc/h/ln	2358
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2283
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.82
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	60.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	30.6
Total Ramp Density Adjustment	3.9	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex57 Merge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	650
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	4650	350
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	5584	412
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.88	0.21

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	952.9	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1750	Speed Index (MS)	0.701
Downstream Equilibrium Distance (LEQ), ft	3917.7	Flow Outer Lanes (vOA), pc/h/ln	1307
Distance to Downstream Ramp (LDOWN), ft	850	On-Ramp Influence Area Speed (SR), mi/h	49.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.766	Outer Lanes Freeway Speed (SO), mi/h	62.9
Flow in Lanes 1 and 2 (v12), pc/h	4277	Ramp Junction Speed (S), mi/h	51.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	4689	Average Density (D), pc/mi/ln	38.7
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	37.9

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex58 Diverge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	350
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	5000	350
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	6004	412
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.88	0.21

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	2125.8	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	850	Speed Index (DS)	0.477
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2287
Distance to Downstream Ramp (LDOWN), ft	2300	Off-Ramp Influence Area Speed (SR), mi/h	54.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.591	Outer Lanes Freeway Speed (SO), mi/h	67.2
Flow in Lanes 1 and 2 (v12), pc/h	3717	Ramp Junction Speed (S), mi/h	58.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	34.1
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.1

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex58 Basic Fwy - 2030 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.25
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.1
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.070

Demand and Capacity

Demand Volume veh/h	4650	Heavy Vehicle Adjustment Factor (f_{HV})	0.948
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1861
Total Trucks, %	5.50	Capacity (c), pc/h/ln	2358
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2283
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.82
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	60.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	30.6
Total Ramp Density Adjustment	3.9	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex58 Merge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	750
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	4650	800
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	5584	943
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.96	0.49

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1110.9	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2300	Speed Index (MS)	0.552
Downstream Equilibrium Distance (LEQ), ft	1449.9	Flow Outer Lanes (vOA), pc/h/ln	2245
Distance to Downstream Ramp (LDOWN), ft	1500	On-Ramp Influence Area Speed (SR), mi/h	53.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.598	Outer Lanes Freeway Speed (SO), mi/h	61.5
Flow in Lanes 1 and 2 (v12), pc/h	3339	Ramp Junction Speed (S), mi/h	56.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	4282	Average Density (D), pc/mi/ln	38.8
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.8

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex59 Diverge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	30.0
Segment Length (L) / Deceleration Length (LA),ft	1500	775
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	5450	250
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	6545	295
Capacity (c), pc/h	6824	1839
Volume-to-Capacity Ratio (v/c)	0.96	0.16

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	4338.4	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1500	Speed Index (DS)	0.530
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2606
Distance to Downstream Ramp (LDOWN), ft	1125	Off-Ramp Influence Area Speed (SR), mi/h	54.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.583	Outer Lanes Freeway Speed (SO), mi/h	68.1
Flow in Lanes 1 and 2 (v12), pc/h	3939	Ramp Junction Speed (S), mi/h	58.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	37.0
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	31.2

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex59 Basic Fwy - 2030 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.16
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.4
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.070

Demand and Capacity

Demand Volume veh/h	5200	Heavy Vehicle Adjustment Factor (f_{HV})	0.948
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2081
Total Trucks, %	5.50	Capacity (c), pc/h/ln	2396
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2319
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.90
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.1
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	35.8
Total Ramp Density Adjustment	3.6	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	69.6		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex59 Merge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	650
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	5200	200
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	6244	236
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.95	0.12

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1056.4	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1125	Speed Index (MS)	0.481
Downstream Equilibrium Distance (LEQ), ft	2712.3	Flow Outer Lanes (vOA), pc/h/ln	2523
Distance to Downstream Ramp (LDOWN), ft	4900	On-Ramp Influence Area Speed (SR), mi/h	56.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.596	Outer Lanes Freeway Speed (SO), mi/h	61.7
Flow in Lanes 1 and 2 (v12), pc/h	3721	Ramp Junction Speed (S), mi/h	58.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	3957	Average Density (D), pc/mi/ln	37.0
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.2

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex59-60 Basic Fwy - 2030 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.070

Demand and Capacity

Demand Volume veh/h	5400	Heavy Vehicle Adjustment Factor (f_{HV})	0.948
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2161
Total Trucks, %	5.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.93
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	56.3
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	38.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex60 Diverge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	30.0
Segment Length (L) / Deceleration Length (LA),ft	1500	200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	5400	450
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	6484	531
Capacity (c), pc/h	6970	1839
Volume-to-Capacity Ratio (v/c)	0.93	0.29

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1201.3	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	4900	Speed Index (DS)	0.551
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2542
Distance to Downstream Ramp (LDOWN), ft	1200	Off-Ramp Influence Area Speed (SR), mi/h	54.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.573	Outer Lanes Freeway Speed (SO), mi/h	70.8
Flow in Lanes 1 and 2 (v12), pc/h	3942	Ramp Junction Speed (S), mi/h	60.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	36.0
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	36.4

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex60 Basic Fwy - 2030 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.070

Demand and Capacity

Demand Volume veh/h	4950	Heavy Vehicle Adjustment Factor (f_{HV})	0.948
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1981
Total Trucks, %	5.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.85
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	60.6
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	32.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex60 Merge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	625
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	5250	300
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	6304	354
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.96	0.18

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1083.4	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1200	Speed Index (MS)	0.598
Downstream Equilibrium Distance (LEQ), ft	3059.3	Flow Outer Lanes (vOA), pc/h/ln	2251
Distance to Downstream Ramp (LDOWN), ft	1500	On-Ramp Influence Area Speed (SR), mi/h	53.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.643	Outer Lanes Freeway Speed (SO), mi/h	63.7
Flow in Lanes 1 and 2 (v12), pc/h	4053	Ramp Junction Speed (S), mi/h	56.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	4407	Average Density (D), pc/mi/ln	39.3
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	35.8

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex61 Diverge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	450
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	5250	500
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	2.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.976
Flow Rate (vi),pc/h	6304	583
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.90	0.30

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1886.8	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1500	Speed Index (DS)	0.492
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2426
Distance to Downstream Ramp (LDOWN), ft	1800	Off-Ramp Influence Area Speed (SR), mi/h	56.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.576	Outer Lanes Freeway Speed (SO), mi/h	71.2
Flow in Lanes 1 and 2 (v12), pc/h	3878	Ramp Junction Speed (S), mi/h	61.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	34.3
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.6

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex61 Basic Fwy - 2030 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.070

Demand and Capacity

Demand Volume veh/h	4750	Heavy Vehicle Adjustment Factor (f_{HV})	0.948
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1901
Total Trucks, %	5.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.82
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	62.3
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	30.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex61 Merge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	4750	250
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	5703	295
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.86	0.15

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	886.7	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1800	Speed Index (MS)	0.440
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2327
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	57.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.592	Outer Lanes Freeway Speed (SO), mi/h	63.3
Flow in Lanes 1 and 2 (v12), pc/h	3376	Ramp Junction Speed (S), mi/h	59.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	3671	Average Density (D), pc/mi/ln	33.4
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	30.9

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex57 Merge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	600
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5350	450
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6337	523
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	1.01	0.27

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1700	Speed Index (MS)	-
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2573
Distance to Downstream Ramp (LDOWN), ft	3600	On-Ramp Influence Area Speed (SR), mi/h	-
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.594	Outer Lanes Freeway Speed (SO), mi/h	-
Flow in Lanes 1 and 2 (v12), pc/h	3764	Ramp Junction Speed (S), mi/h	-
Flow Entering Ramp-Infl. Area (vR12), pc/h	4287	Average Density (D), pc/mi/ln	-
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	-

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex57 Basic Fwy - 2030 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.25
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.1
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.060

Demand and Capacity

Demand Volume veh/h	5350	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2112
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2358
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2283
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.93
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	55.4
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	38.1
Total Ramp Density Adjustment	3.9	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.8		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Period 6:00-7:00
Project Description	I-95 SB Ex57 Diverge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	225
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5750	400
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6811	465
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	1.00	0.24

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	3418.6	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	825	Speed Index (DS)	0.482
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2700
Distance to Downstream Ramp (LDOWN), ft	1700	Off-Ramp Influence Area Speed (SR), mi/h	54.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.568	Outer Lanes Freeway Speed (SO), mi/h	65.6
Flow in Lanes 1 and 2 (v12), pc/h	4111	Ramp Junction Speed (S), mi/h	58.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	38.9
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	37.6

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex59 Merge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	30.0
Segment Length (L) / Acceleration Length (LA),ft	1500	400
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5350	400
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6337	465
Capacity (c), pc/h	6824	1839
Volume-to-Capacity Ratio (v/c)	1.00	0.25

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	758.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	125	Speed Index (MS)	0.632
Downstream Equilibrium Distance (LEQ), ft	4314.0	Flow Outer Lanes (vOA), pc/h/ln	2351
Distance to Downstream Ramp (LDOWN), ft	2150	On-Ramp Influence Area Speed (SR), mi/h	51.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.629	Outer Lanes Freeway Speed (SO), mi/h	61.0
Flow in Lanes 1 and 2 (v12), pc/h	3986	Ramp Junction Speed (S), mi/h	54.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	4451	Average Density (D), pc/mi/ln	41.7
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	37.5

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex58 Basic Fwy - 2030 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.25
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.1
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.060

Demand and Capacity

Demand Volume veh/h	5150	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2033
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2358
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2283
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.89
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	57.3
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	35.5
Total Ramp Density Adjustment	3.9	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.8		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Period 6:00-7:00
Project Description	I-95 SB Ex58 Diverge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5750	600
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6811	697
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	1.00	0.36

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	2509.1	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2150	Speed Index (DS)	0.502
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2700
Distance to Downstream Ramp (LDOWN), ft	2600	Off-Ramp Influence Area Speed (SR), mi/h	53.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.558	Outer Lanes Freeway Speed (SO), mi/h	65.6
Flow in Lanes 1 and 2 (v12), pc/h	4111	Ramp Junction Speed (S), mi/h	58.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	39.1
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	35.1

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex59 Merge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	30.0
Segment Length (L) / Acceleration Length (LA),ft	1500	400
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5350	400
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6337	465
Capacity (c), pc/h	6824	1839
Volume-to-Capacity Ratio (v/c)	1.00	0.25

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	758.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	125	Speed Index (MS)	0.632
Downstream Equilibrium Distance (LEQ), ft	4314.0	Flow Outer Lanes (vOA), pc/h/ln	2351
Distance to Downstream Ramp (LDOWN), ft	2150	On-Ramp Influence Area Speed (SR), mi/h	51.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.629	Outer Lanes Freeway Speed (SO), mi/h	61.0
Flow in Lanes 1 and 2 (v12), pc/h	3986	Ramp Junction Speed (S), mi/h	54.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	4451	Average Density (D), pc/mi/ln	41.7
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	37.5

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex59 Basic Fwy - 2030 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.16
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.4
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.060

Demand and Capacity

Demand Volume veh/h	5350	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2112
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2360
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2284
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.92
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	55.5
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	38.1
Total Ramp Density Adjustment	3.6	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	66.0		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Period 6:00-7:00
Project Description	I-95 SB Ex59 Diverge - 2019 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	275
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5500	150
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6515	174
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.95	0.09

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1319.4	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	5600	Speed Index (DS)	0.455
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2606
Distance to Downstream Ramp (LDOWN), ft	1250	Off-Ramp Influence Area Speed (SR), mi/h	56.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.589	Outer Lanes Freeway Speed (SO), mi/h	68.1
Flow in Lanes 1 and 2 (v12), pc/h	3909	Ramp Junction Speed (S), mi/h	60.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	36.0
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	35.4

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex59-60 Basic Fwy - 2030 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.16
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.4
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.060

Demand and Capacity

Demand Volume veh/h	5500	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2172
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2396
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2319
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	55.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	38.9
Total Ramp Density Adjustment	3.6	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	69.6		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex60 Merge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5250	250
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6219	290
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.93	0.15

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	996.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1925	Speed Index (MS)	0.494
Downstream Equilibrium Distance (LEQ), ft	1007.7	Flow Outer Lanes (vOA), pc/h/ln	2537
Distance to Downstream Ramp (LDOWN), ft	5600	On-Ramp Influence Area Speed (SR), mi/h	56.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.592	Outer Lanes Freeway Speed (SO), mi/h	62.0
Flow in Lanes 1 and 2 (v12), pc/h	3682	Ramp Junction Speed (S), mi/h	58.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	3972	Average Density (D), pc/mi/ln	37.2
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.3

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex60 Basic Fwy - 2030 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.060

Demand and Capacity

Demand Volume veh/h	5250	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2073
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.89
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.5
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	35.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Period 6:00-7:00
Project Description	I-95 SB Ex60 Diverge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	575
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5650	400
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6693	465
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.96	0.24

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	2889.6	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1500	Speed Index (DS)	0.482
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2672
Distance to Downstream Ramp (LDOWN), ft	1925	Off-Ramp Influence Area Speed (SR), mi/h	56.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.571	Outer Lanes Freeway Speed (SO), mi/h	70.3
Flow in Lanes 1 and 2 (v12), pc/h	4021	Ramp Junction Speed (S), mi/h	61.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	36.4
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.7

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex61 Merge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	30.0
Segment Length (L) / Acceleration Length (LA),ft	1500	350
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5150	500
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6100	581
Capacity (c), pc/h	6970	1839
Volume-to-Capacity Ratio (v/c)	0.96	0.32

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	709.9	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1125	Speed Index (MS)	0.616
Downstream Equilibrium Distance (LEQ), ft	2980.6	Flow Outer Lanes (vOA), pc/h/ln	2288
Distance to Downstream Ramp (LDOWN), ft	1500	On-Ramp Influence Area Speed (SR), mi/h	52.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.625	Outer Lanes Freeway Speed (SO), mi/h	63.6
Flow in Lanes 1 and 2 (v12), pc/h	3812	Ramp Junction Speed (S), mi/h	56.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	4393	Average Density (D), pc/mi/ln	39.7
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	37.4

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex61 Basic Fwy - 2030 AM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.060

Demand and Capacity

Demand Volume veh/h	5150	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2033
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.88
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	59.4
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	34.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Period 6:00-7:00
Project Description	I-95 SB Ex61 Diverge - 2030 AM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	450
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5450	300
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6456	348
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.93	0.18

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.471
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2547
Distance to Downstream Ramp (LDOWN), ft	1125	Off-Ramp Influence Area Speed (SR), mi/h	56.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.583	Outer Lanes Freeway Speed (SO), mi/h	70.8
Flow in Lanes 1 and 2 (v12), pc/h	3909	Ramp Junction Speed (S), mi/h	61.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	34.9
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.8

APPENDIX J

Highway Capacity Analyses
PM Peak Hour: 2030 No-Build Scenario

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex57 Diverge - 2030 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	600
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5850	500
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	6759	572
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.99	0.30

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	2360.4	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	3600	Speed Index (DS)	0.491
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2691
Distance to Downstream Ramp (LDOWN), ft	1750	Off-Ramp Influence Area Speed (SR), mi/h	54.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.565	Outer Lanes Freeway Speed (SO), mi/h	65.6
Flow in Lanes 1 and 2 (v12), pc/h	4068	Ramp Junction Speed (S), mi/h	58.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	38.7
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.8

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex57 Basic Fwy - 2030 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.25
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.1
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.060

Demand and Capacity

Demand Volume veh/h	5350	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2060
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2358
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2283
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.90
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	56.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	36.3
Total Ramp Density Adjustment	3.9	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex57 Merge - 2030 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	650
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5350	550
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	6181	630
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	1.00	0.33

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1127.3	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1750	Speed Index (MS)	1.110
Downstream Equilibrium Distance (LEQ), ft	3917.7	Flow Outer Lanes (vOA), pc/h/ln	1446
Distance to Downstream Ramp (LDOWN), ft	850	On-Ramp Influence Area Speed (SR), mi/h	39.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.766	Outer Lanes Freeway Speed (SO), mi/h	62.4
Flow in Lanes 1 and 2 (v12), pc/h	4735	Ramp Junction Speed (S), mi/h	42.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	5365	Average Density (D), pc/mi/ln	53.2
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	43.0

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Period 5:00-6:00
Project Description	I-95 NB Ex58 Diverge - 2030 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	350
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5900	550
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	6817	630
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	1.00	0.33

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	3301.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	850	Speed Index (DS)	0.496
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2700
Distance to Downstream Ramp (LDOWN), ft	2300	Off-Ramp Influence Area Speed (SR), mi/h	54.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.561	Outer Lanes Freeway Speed (SO), mi/h	65.6
Flow in Lanes 1 and 2 (v12), pc/h	4117	Ramp Junction Speed (S), mi/h	58.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	39.1
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	36.5

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex58 Basic Fwy - 2030 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.25
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.1
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.060

Demand and Capacity

Demand Volume veh/h	5250	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2022
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2358
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2283
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.89
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	57.6
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	35.1
Total Ramp Density Adjustment	3.9	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex58 Merge - 2030 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	750
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5250	650
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	6066	744
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	1.00	0.38

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1171.5	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2300	Speed Index (MS)	0.675
Downstream Equilibrium Distance (LEQ), ft	2843.8	Flow Outer Lanes (vOA), pc/h/ln	2166
Distance to Downstream Ramp (LDOWN), ft	1500	On-Ramp Influence Area Speed (SR), mi/h	50.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.643	Outer Lanes Freeway Speed (SO), mi/h	61.8
Flow in Lanes 1 and 2 (v12), pc/h	3900	Ramp Junction Speed (S), mi/h	53.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	4644	Average Density (D), pc/mi/ln	42.4
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	36.7

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex59 Diverge - 2030 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	30.0
Segment Length (L) / Deceleration Length (LA),ft	1500	775
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5900	500
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	6817	572
Capacity (c), pc/h	6824	1839
Volume-to-Capacity Ratio (v/c)	1.00	0.31

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	3807.9	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1500	Speed Index (DS)	0.555
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2700
Distance to Downstream Ramp (LDOWN), ft	1125	Off-Ramp Influence Area Speed (SR), mi/h	53.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.563	Outer Lanes Freeway Speed (SO), mi/h	67.7
Flow in Lanes 1 and 2 (v12), pc/h	4117	Ramp Junction Speed (S), mi/h	58.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	39.0
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.7

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex59 Basic Fwy - 2030 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.16
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.4
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.060

Demand and Capacity

Demand Volume veh/h	5400	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2080
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2396
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2319
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.90
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.1
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	35.8
Total Ramp Density Adjustment	3.6	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	69.6		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex59 Merge - 2030 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	650
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5400	150
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	6239	172
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.94	0.09

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1041.7	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1125	Speed Index (MS)	0.467
Downstream Equilibrium Distance (LEQ), ft	1808.2	Flow Outer Lanes (vOA), pc/h/ln	2521
Distance to Downstream Ramp (LDOWN), ft	4900	On-Ramp Influence Area Speed (SR), mi/h	56.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.596	Outer Lanes Freeway Speed (SO), mi/h	61.7
Flow in Lanes 1 and 2 (v12), pc/h	3718	Ramp Junction Speed (S), mi/h	58.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	3890	Average Density (D), pc/mi/ln	36.5
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	31.7

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex59-60 Basic Fwy - 2030 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.060

Demand and Capacity

Demand Volume veh/h	5550	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2137
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.92
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	56.9
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	37.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex60 Diverge - 2030 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	30.0
Segment Length (L) / Deceleration Length (LA),ft	1500	200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5550	300
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	6412	343
Capacity (c), pc/h	6970	1839
Volume-to-Capacity Ratio (v/c)	0.92	0.19

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	841.8	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	4900	Speed Index (DS)	0.534
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2525
Distance to Downstream Ramp (LDOWN), ft	1200	Off-Ramp Influence Area Speed (SR), mi/h	55.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.584	Outer Lanes Freeway Speed (SO), mi/h	70.8
Flow in Lanes 1 and 2 (v12), pc/h	3887	Ramp Junction Speed (S), mi/h	60.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	35.4
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	35.9

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex60 Basic Fwy - 2030 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.060

Demand and Capacity

Demand Volume veh/h	5250	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2022
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	59.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	33.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex60 Merge - 2030 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	625
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5250	500
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	6066	572
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.95	0.30

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1079.1	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1200	Speed Index (MS)	0.641
Downstream Equilibrium Distance (LEQ), ft	3365.3	Flow Outer Lanes (vOA), pc/h/ln	2105
Distance to Downstream Ramp (LDOWN), ft	1500	On-Ramp Influence Area Speed (SR), mi/h	52.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.653	Outer Lanes Freeway Speed (SO), mi/h	64.2
Flow in Lanes 1 and 2 (v12), pc/h	3961	Ramp Junction Speed (S), mi/h	55.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	4533	Average Density (D), pc/mi/ln	39.9
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	36.7

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex61 Diverge - 2030 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	450
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5750	550
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	6643	630
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.95	0.33

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	3069.2	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1500	Speed Index (DS)	0.496
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2616
Distance to Downstream Ramp (LDOWN), ft	1800	Off-Ramp Influence Area Speed (SR), mi/h	56.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.565	Outer Lanes Freeway Speed (SO), mi/h	70.5
Flow in Lanes 1 and 2 (v12), pc/h	4027	Ramp Junction Speed (S), mi/h	61.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	36.3
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	34.8

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex61 Basic Fwy -2030 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.060

Demand and Capacity

Demand Volume veh/h	5200	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2003
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.86
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	60.1
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	33.3
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Merge Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex61 Merge - 2030 PM	Unit	United States Customary

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

	Freeway	Ramp
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity

	Freeway	Ramp
Demand Volume (Vi)	5200	450
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	6008	515
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.94	0.27

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	999.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1800	Speed Index (MS)	0.516
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2451
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	55.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.592	Outer Lanes Freeway Speed (SO), mi/h	62.6
Flow in Lanes 1 and 2 (v12), pc/h	3557	Ramp Junction Speed (S), mi/h	58.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	4072	Average Density (D), pc/mi/ln	37.5
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.9

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex57 Merge - 2030 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	600
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	4900	550
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	5715	638
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.93	0.33

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1007.1	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1700	Speed Index (MS)	0.500
Downstream Equilibrium Distance (LEQ), ft	936.5	Flow Outer Lanes (vOA), pc/h/ln	2320
Distance to Downstream Ramp (LDOWN), ft	3600	On-Ramp Influence Area Speed (SR), mi/h	54.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.594	Outer Lanes Freeway Speed (SO), mi/h	61.2
Flow in Lanes 1 and 2 (v12), pc/h	3395	Ramp Junction Speed (S), mi/h	57.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	4033	Average Density (D), pc/mi/ln	37.2
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.9

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex57 Basic Fwy - 2030 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.25
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.1
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.070

Demand and Capacity

Demand Volume veh/h	5350	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2080
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2358
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2283
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.91
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	56.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	37.0
Total Ramp Density Adjustment	3.9	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.8		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex57 Diverge - 2030 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	225
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	5400	500
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	6298	581
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.92	0.30

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	2527.9	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	825	Speed Index (DS)	0.492
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2424
Distance to Downstream Ramp (LDOWN), ft	1700	Off-Ramp Influence Area Speed (SR), mi/h	54.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.576	Outer Lanes Freeway Speed (SO), mi/h	66.6
Flow in Lanes 1 and 2 (v12), pc/h	3874	Ramp Junction Speed (S), mi/h	58.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	36.0
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	35.5

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex58 Merge - 2030 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	550
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	5000	400
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	5831	465
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.92	0.24

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	972.7	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2600	Speed Index (MS)	0.702
Downstream Equilibrium Distance (LEQ), ft	3220.9	Flow Outer Lanes (vOA), pc/h/ln	1621
Distance to Downstream Ramp (LDOWN), ft	825	On-Ramp Influence Area Speed (SR), mi/h	49.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.722	Outer Lanes Freeway Speed (SO), mi/h	61.8
Flow in Lanes 1 and 2 (v12), pc/h	4210	Ramp Junction Speed (S), mi/h	51.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	4675	Average Density (D), pc/mi/ln	40.5
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	38.4

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex58 Basic Fwy - 2030 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.25
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.1
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.070

Demand and Capacity

Demand Volume veh/h	5000	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1944
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2358
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2283
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.85
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	59.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	32.8
Total Ramp Density Adjustment	3.9	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.8		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex58 Diverge - 2030 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	5650	650
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	6590	756
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.97	0.39

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	282.6	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2150	Speed Index (DS)	0.508
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2567
Distance to Downstream Ramp (LDOWN), ft	2600	Off-Ramp Influence Area Speed (SR), mi/h	53.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.560	Outer Lanes Freeway Speed (SO), mi/h	66.1
Flow in Lanes 1 and 2 (v12), pc/h	4023	Ramp Junction Speed (S), mi/h	57.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	37.9
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	34.3

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex59 Merge - 2030 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	25.0
Segment Length (L) / Acceleration Length (LA),ft	1500	400
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	5350	300
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	6239	348
Capacity (c), pc/h	6824	1839
Volume-to-Capacity Ratio (v/c)	0.97	0.19

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	460.8	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1250	Speed Index (MS)	0.592
Downstream Equilibrium Distance (LEQ), ft	4628.1	Flow Outer Lanes (vOA), pc/h/ln	2277
Distance to Downstream Ramp (LDOWN), ft	2150	On-Ramp Influence Area Speed (SR), mi/h	52.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.635	Outer Lanes Freeway Speed (SO), mi/h	61.4
Flow in Lanes 1 and 2 (v12), pc/h	3962	Ramp Junction Speed (S), mi/h	55.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	4310	Average Density (D), pc/mi/ln	39.7
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	36.5

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex59 Basic Fwy - 2030 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.16
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.4
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.070

Demand and Capacity

Demand Volume veh/h	5350	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2080
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2360
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2284
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.91
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	56.3
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	36.9
Total Ramp Density Adjustment	3.6	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	66.0		

HCS7 Freeway Diverge Report

Project Information

Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex59 Diverge - 2030 PM	Unit	United States Customary

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	275
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity

Demand Volume (Vi)	5550	200
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	6472	232
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.95	0.12

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	3487.8	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	5600	Speed Index (DS)	0.461
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2571
Distance to Downstream Ramp (LDOWN), ft	1250	Off-Ramp Influence Area Speed (SR), mi/h	55.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.588	Outer Lanes Freeway Speed (SO), mi/h	68.2
Flow in Lanes 1 and 2 (v12), pc/h	3901	Ramp Junction Speed (S), mi/h	60.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	35.8
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	35.3

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex59-60 Basic Fwy - 2030 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.070

Demand and Capacity

Demand Volume veh/h	5550	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2157
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.93
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	56.4
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	38.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex60 Merge - 2030 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	4950	600
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	5773	697
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.93	0.36

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	987.7	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1925	Speed Index (MS)	0.526
Downstream Equilibrium Distance (LEQ), ft	1330.6	Flow Outer Lanes (vOA), pc/h/ln	2355
Distance to Downstream Ramp (LDOWN), ft	5600	On-Ramp Influence Area Speed (SR), mi/h	55.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.592	Outer Lanes Freeway Speed (SO), mi/h	63.1
Flow in Lanes 1 and 2 (v12), pc/h	3418	Ramp Junction Speed (S), mi/h	57.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	4115	Average Density (D), pc/mi/ln	37.2
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	34.2

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex60 Basic Fwy - 2030 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.070

Demand and Capacity

Demand Volume veh/h	4950	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1924
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.83
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	31.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex60 Diverge - 2030 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	575
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	5200	250
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	6065	291
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.87	0.15

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	2592.1	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1500	Speed Index (DS)	0.466
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2338
Distance to Downstream Ramp (LDOWN), ft	1925	Off-Ramp Influence Area Speed (SR), mi/h	57.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.595	Outer Lanes Freeway Speed (SO), mi/h	71.6
Flow in Lanes 1 and 2 (v12), pc/h	3727	Ramp Junction Speed (S), mi/h	61.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	32.7
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	31.1

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex61 Merge - 2030 PM	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	25.0
Segment Length (L) / Acceleration Length (LA),ft	1500	350
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	4750	450
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	5539	523
Capacity (c), pc/h	6970	1839
Volume-to-Capacity Ratio (v/c)	0.87	0.28

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	326.3	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1125	Speed Index (MS)	0.482
Downstream Equilibrium Distance (LEQ), ft	1844.8	Flow Outer Lanes (vOA), pc/h/ln	2238
Distance to Downstream Ramp (LDOWN), ft	1500	On-Ramp Influence Area Speed (SR), mi/h	56.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.596	Outer Lanes Freeway Speed (SO), mi/h	63.7
Flow in Lanes 1 and 2 (v12), pc/h	3301	Ramp Junction Speed (S), mi/h	59.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	3824	Average Density (D), pc/mi/ln	34.2
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.9

HCS7 Basic Freeway Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex61 Basic Fwy - 2030 PM	Unit	United States Customary

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	75.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	71.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.975
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.070

Demand and Capacity

Demand Volume veh/h	4750	Heavy Vehicle Adjustment Factor (f_{HV})	0.976
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1846
Total Trucks, %	2.50	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2323
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.79
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.3
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	29.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Diverge Report

Project Information

Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex61 Diverge - 2030 PM	Unit	United States Customary

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	450
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

	Freeway	Ramp
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity

	Freeway	Ramp
Demand Volume (Vi)	5050	300
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	5890	348
Capacity (c), pc/h	6970	1936
Volume-to-Capacity Ratio (v/c)	0.85	0.18

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.471
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2233
Distance to Downstream Ramp (LDOWN), ft	1125	Off-Ramp Influence Area Speed (SR), mi/h	56.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.597	Outer Lanes Freeway Speed (SO), mi/h	72.0
Flow in Lanes 1 and 2 (v12), pc/h	3657	Ramp Junction Speed (S), mi/h	61.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	31.8
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	31.7

APPENDIX K

Highway Capacity Analyses
AM Peak Hour: 2030 Proposed Improvements Scenario

HCS7 Freeway Weaving Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/21/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex57-58 Weaving - 2030 AM Proposed Scenario	Unit	United States Customary

Geometric Data

Number of Lanes (N), ln	4	Segment Type	Freeway
Segment Length (L_S), ft	1250	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.25	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.070

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	4650	315	35	315
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	5.50	3.50	3.50	3.50
Heavy Vehicle Adjustment Factor (f_{HV})	0.948	0.966	0.966	0.966
Flow Rate (v_i), pc/h	5583	371	41	371
Weaving Flow Rate (v_w), pc/h	742	Freeway Max Capacity (c_{IFL}), pc/h/ln		2358
Non-Weaving Flow Rate (v_{NW}), pc/h	5624	Density-Based Capacity (c_{IWL}), pc/h/ln		2170
Total Flow Rate (v), pc/h	6366	Demand Flow-Based Capacity (c_{IW}), pc/h		20513
Volume Ratio (VR)	0.117	Weaving Segment Capacity (c_W), veh/h		8248
Minimum Lane Change Rate (LC_{MIN}), lc/h	742	Adjusted Weaving Area Capacity, pc/h		8402
Maximum Weaving Length (L_{MAX}), ft	3705	Volume-to-Capacity Ratio (v/c)		0.76

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	879	Average Weaving Speed (S_W), mi/h	52.6
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1066	Average Non-Weaving Speed (S_{NW}), mi/h	52.8
Weaving Lane Change Rate (LC_W), lc/h	1110	Average Speed (S), mi/h	52.8
Weaving Lane Change Rate (LC_{All}), lc/h	2176	Density (D), pc/mi/ln	30.1
Weaving Intensity Factor (W)	0.350	Level of Service (LOS)	D

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex58 Merge - 2030 AM Proposed Scenario	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1050
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	4650	800
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	5584	943
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.96	0.49

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1244.1	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2300	Speed Index (MS)	0.546
Downstream Equilibrium Distance (LEQ), ft	1240.2	Flow Outer Lanes (vOA), pc/h/ln	2195
Distance to Downstream Ramp (LDOWN), ft	1500	On-Ramp Influence Area Speed (SR), mi/h	53.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.607	Outer Lanes Freeway Speed (SO), mi/h	61.7
Flow in Lanes 1 and 2 (v12), pc/h	3389	Ramp Junction Speed (S), mi/h	56.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	4332	Average Density (D), pc/mi/ln	38.8
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.3

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/24/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 NB Ex60 Diverge - 2030 AM Proposed Scenario	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	30.0
Segment Length (L) / Deceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5400	450
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.50	3.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.948	0.966
Flow Rate (vi),pc/h	6423	525
Capacity (c), pc/h	6970	1839
Volume-to-Capacity Ratio (v/c)	0.92	0.29

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1231.4	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	4900	Speed Index (DS)	0.551
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2507
Distance to Downstream Ramp (LDOWN), ft	1200	Off-Ramp Influence Area Speed (SR), mi/h	54.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.575	Outer Lanes Freeway Speed (SO), mi/h	70.9
Flow in Lanes 1 and 2 (v12), pc/h	3916	Ramp Junction Speed (S), mi/h	60.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	35.7
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.4

HCS7 Freeway Weaving Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex57-58 Weaving - 2030 AM Proposed Scenario	Unit	United States Customary

Geometric Data

Number of Lanes (N), ln	4	Segment Type	Freeway
Segment Length (L_S), ft	1250	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.25	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.060

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	4930	570	30	320
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	5.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.971	0.971	0.971
Flow Rate (v_i), pc/h	5840	662	35	372
Weaving Flow Rate (v_W), pc/h	1034	Freeway Max Capacity (c_{IFL}), pc/h/ln		2358
Non-Weaving Flow Rate (v_{NW}), pc/h	5875	Density-Based Capacity (c_{IWL}), pc/h/ln		2145
Total Flow Rate (v), pc/h	6909	Demand Flow-Based Capacity (c_{IW}), pc/h		16000
Volume Ratio (VR)	0.150	Weaving Segment Capacity (c_W), veh/h		8193
Minimum Lane Change Rate (LC_{MIN}), lc/h	1034	Adjusted Weaving Area Capacity, pc/h		8305
Maximum Weaving Length (L_{MAX}), ft	4031	Volume-to-Capacity Ratio (v/c)		0.83

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	918	Average Weaving Speed (S_W), mi/h	51.5
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1117	Average Non-Weaving Speed (S_{NW}), mi/h	50.1
Weaving Lane Change Rate (LC_W), lc/h	1402	Average Speed (S), mi/h	50.3
Weaving Lane Change Rate (LC_{All}), lc/h	2519	Density (D), pc/mi/ln	34.3
Weaving Intensity Factor (W)	0.393	Level of Service (LOS)	D

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Period 6:00-7:00
Project Description	I-95 SB Ex58 Diverge - 2030 AM Proposed Scenario	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	750
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5750	600
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6811	697
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	1.00	0.36

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	2509.1	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2150	Speed Index (DS)	0.502
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2700
Distance to Downstream Ramp (LDOWN), ft	2600	Off-Ramp Influence Area Speed (SR), mi/h	53.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.558	Outer Lanes Freeway Speed (SO), mi/h	65.6
Flow in Lanes 1 and 2 (v12), pc/h	4111	Ramp Junction Speed (S), mi/h	58.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	39.1
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.9

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex59 Merge - 2030 AM Proposed Scenario	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	30.0
Segment Length (L) / Acceleration Length (LA),ft	1500	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5350	400
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6337	465
Capacity (c), pc/h	6824	1839
Volume-to-Capacity Ratio (v/c)	1.00	0.25

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	935.6	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	125	Speed Index (MS)	0.609
Downstream Equilibrium Distance (LEQ), ft	3368.1	Flow Outer Lanes (vOA), pc/h/ln	2351
Distance to Downstream Ramp (LDOWN), ft	2150	On-Ramp Influence Area Speed (SR), mi/h	52.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.629	Outer Lanes Freeway Speed (SO), mi/h	61.0
Flow in Lanes 1 and 2 (v12), pc/h	3986	Ramp Junction Speed (S), mi/h	54.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	4451	Average Density (D), pc/mi/ln	41.3
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	35.0

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Period 6:00-7:00
Project Description	I-95 SB Ex59 Diverge - 2019 AM Proposed Scenario	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	450
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5500	150
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6515	174
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.95	0.09

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1319.4	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	5600	Speed Index (DS)	0.455
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2606
Distance to Downstream Ramp (LDOWN), ft	1250	Off-Ramp Influence Area Speed (SR), mi/h	56.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.589	Outer Lanes Freeway Speed (SO), mi/h	68.1
Flow in Lanes 1 and 2 (v12), pc/h	3909	Ramp Junction Speed (S), mi/h	60.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	36.0
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.8

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/21/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	AM Peak Hour 6:00-7:00
Project Description	I-95 SB Ex61 Merge - 2030 AM Proposed Scenario	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	30.0
Segment Length (L) / Acceleration Length (LA),ft	1500	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5150	500
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	5.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.971
Flow Rate (vi),pc/h	6100	581
Capacity (c), pc/h	6970	1839
Volume-to-Capacity Ratio (v/c)	0.96	0.32

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	909.7	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1125	Speed Index (MS)	0.590
Downstream Equilibrium Distance (LEQ), ft	2245.4	Flow Outer Lanes (vOA), pc/h/ln	2288
Distance to Downstream Ramp (LDOWN), ft	1500	On-Ramp Influence Area Speed (SR), mi/h	53.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.625	Outer Lanes Freeway Speed (SO), mi/h	63.6
Flow in Lanes 1 and 2 (v12), pc/h	3812	Ramp Junction Speed (S), mi/h	56.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	4393	Average Density (D), pc/mi/ln	39.3
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	34.5

APPENDIX L

Highway Capacity Analyses
PM Peak Hour: 2030 Proposed Improvements Scenario

HCS7 Freeway Weaving Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/21/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex57-58 Weaving - 2030 PM Proposed Scenario	Unit	United States Customary

Geometric Data

Number of Lanes (N), ln	4	Segment Type	Freeway
Segment Length (L_S), ft	1250	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.25	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.060

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	4730	520	30	620
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	2.50	1.50	1.50	1.50
Heavy Vehicle Adjustment Factor (f_{HV})	0.976	0.985	0.985	0.985
Flow Rate (v_i), pc/h	5465	595	34	710
Weaving Flow Rate (v_w), pc/h	1305	Freeway Max Capacity (c_{IFL}), pc/h/ln		2358
Non-Weaving Flow Rate (v_{NW}), pc/h	5499	Density-Based Capacity (c_{IWL}), pc/h/ln		2113
Total Flow Rate (v), pc/h	6804	Demand Flow-Based Capacity (c_{IW}), pc/h		12500
Volume Ratio (VR)	0.192	Weaving Segment Capacity (c_W), veh/h		8264
Minimum Lane Change Rate (LC_{MIN}), lc/h	1305	Adjusted Weaving Area Capacity, pc/h		8182
Maximum Weaving Length (L_{MAX}), ft	4455	Volume-to-Capacity Ratio (v/c)		0.83

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	859	Average Weaving Speed (S_W), mi/h	50.9
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1040	Average Non-Weaving Speed (S_{NW}), mi/h	48.2
Weaving Lane Change Rate (LC_W), lc/h	1673	Average Speed (S), mi/h	48.7
Weaving Lane Change Rate (LC_{All}), lc/h	2713	Density (D), pc/mi/ln	34.9
Weaving Intensity Factor (W)	0.417	Level of Service (LOS)	D

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex58 Merge - 2030 PM Proposed Scenario	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1050
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5250	650
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	6066	744
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	1.00	0.38

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1304.7	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2300	Speed Index (MS)	0.655
Downstream Equilibrium Distance (LEQ), ft	2432.5	Flow Outer Lanes (vOA), pc/h/ln	2166
Distance to Downstream Ramp (LDOWN), ft	1500	On-Ramp Influence Area Speed (SR), mi/h	50.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.643	Outer Lanes Freeway Speed (SO), mi/h	61.8
Flow in Lanes 1 and 2 (v12), pc/h	3900	Ramp Junction Speed (S), mi/h	53.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	4644	Average Density (D), pc/mi/ln	42.1
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	34.8

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 NB Ex60 Diverge - 2030 PM Proposed Scenario	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	30.0
Segment Length (L) / Deceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.060	1.060

Demand and Capacity		
Demand Volume (Vi)	5550	300
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	1.50
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.985
Flow Rate (vi),pc/h	6412	343
Capacity (c), pc/h	6970	1839
Volume-to-Capacity Ratio (v/c)	0.92	0.19

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	841.8	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	4900	Speed Index (DS)	0.534
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2525
Distance to Downstream Ramp (LDOWN), ft	1200	Off-Ramp Influence Area Speed (SR), mi/h	55.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.584	Outer Lanes Freeway Speed (SO), mi/h	70.8
Flow in Lanes 1 and 2 (v12), pc/h	3887	Ramp Junction Speed (S), mi/h	60.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	35.4
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.2

HCS7 Freeway Weaving Report

Project Information

Analyst	Chen-Yuan Wang	Date	1/24/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex57-58 Weaving - 2030 PM Proposed Scenario	Unit	United States Customary

Geometric Data

Number of Lanes (N), ln	4	Segment Type	Freeway
Segment Length (L_S), ft	1250	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.25	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.925
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.070

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	4530	360	40	460
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	2.50	2.50	2.00	2.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.976	0.976	0.980	0.980
Flow Rate (v_i), pc/h	5283	420	46	534
Weaving Flow Rate (v_w), pc/h	954	Freeway Max Capacity (c_{IFL}), pc/h/ln		2358
Non-Weaving Flow Rate (v_{NW}), pc/h	5329	Density-Based Capacity (c_{IWL}), pc/h/ln		2144
Total Flow Rate (v), pc/h	6283	Demand Flow-Based Capacity (c_{IW}), pc/h		15789
Volume Ratio (VR)	0.152	Weaving Segment Capacity (c_W), veh/h		8373
Minimum Lane Change Rate (LC_{MIN}), lc/h	954	Adjusted Weaving Area Capacity, pc/h		8301
Maximum Weaving Length (L_{MAX}), ft	4051	Volume-to-Capacity Ratio (v/c)		0.76

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	833	Average Weaving Speed (S_W), mi/h	52.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1005	Average Non-Weaving Speed (S_{NW}), mi/h	51.4
Weaving Lane Change Rate (LC_W), lc/h	1322	Average Speed (S), mi/h	51.5
Weaving Lane Change Rate (LC_{All}), lc/h	2327	Density (D), pc/mi/ln	30.5
Weaving Intensity Factor (W)	0.369	Level of Service (LOS)	D

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex58 Diverge - 2030 PM Proposed Scenario	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.1	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	750
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.925	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	5650	650
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	6590	756
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.97	0.39

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	1971.6	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2150	Speed Index (DS)	0.508
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2567
Distance to Downstream Ramp (LDOWN), ft	2600	Off-Ramp Influence Area Speed (SR), mi/h	53.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.560	Outer Lanes Freeway Speed (SO), mi/h	66.1
Flow in Lanes 1 and 2 (v12), pc/h	4023	Ramp Junction Speed (S), mi/h	57.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	37.9
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.1

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/18/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex59 Merge - 2030 PM Proposed Scenario	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	30.0
Segment Length (L) / Acceleration Length (LA),ft	1500	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	5350	300
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	6239	348
Capacity (c), pc/h	6824	1839
Volume-to-Capacity Ratio (v/c)	0.97	0.19

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	889.6	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	125	Speed Index (MS)	0.565
Downstream Equilibrium Distance (LEQ), ft	3613.3	Flow Outer Lanes (vOA), pc/h/ln	2277
Distance to Downstream Ramp (LDOWN), ft	2150	On-Ramp Influence Area Speed (SR), mi/h	53.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.635	Outer Lanes Freeway Speed (SO), mi/h	61.4
Flow in Lanes 1 and 2 (v12), pc/h	3962	Ramp Junction Speed (S), mi/h	55.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	4310	Average Density (D), pc/mi/ln	39.3
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	34.0

HCS7 Freeway Diverge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	8/10/2021
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex59 Diverge - 2019 PM Proposed Scenario	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.4	35.0
Segment Length (L) / Deceleration Length (LA),ft	1500	450
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.950	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	5550	200
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.971
Flow Rate (vi),pc/h	6472	234
Capacity (c), pc/h	6824	1936
Volume-to-Capacity Ratio (v/c)	0.95	0.12

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	3221.9	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	5600	Speed Index (DS)	0.461
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2576
Distance to Downstream Ramp (LDOWN), ft	1250	Off-Ramp Influence Area Speed (SR), mi/h	55.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.587	Outer Lanes Freeway Speed (SO), mi/h	68.2
Flow in Lanes 1 and 2 (v12), pc/h	3896	Ramp Junction Speed (S), mi/h	60.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	35.8
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.7

HCS7 Freeway Merge Report

Project Information			
Analyst	Chen-Yuan Wang	Date	1/21/2022
Agency	CTPS	Analysis Year	2030
Jurisdiction	MassDOT District 4	Time Period Analyzed	PM Peak Hour 5:00-6:00
Project Description	I-95 SB Ex61 Merge - 2030 PM Proposed Scenario	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	71.8	30.0
Segment Length (L) / Acceleration Length (LA),ft	1500	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	Mostly Familiar	Mostly Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.975	0.975
Final Capacity Adjustment Factor (CAF)	0.968	0.968
Demand Adjustment Factor (DAF)	1.070	1.070

Demand and Capacity		
Demand Volume (Vi)	4750	450
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	2.50	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.976	0.980
Flow Rate (vi),pc/h	5539	523
Capacity (c), pc/h	6970	1839
Volume-to-Capacity Ratio (v/c)	0.87	0.28

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	777.2	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	1125	Speed Index (MS)	0.463
Downstream Equilibrium Distance (LEQ), ft	1667.7	Flow Outer Lanes (vOA), pc/h/ln	2182
Distance to Downstream Ramp (LDOWN), ft	1500	On-Ramp Influence Area Speed (SR), mi/h	57.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.606	Outer Lanes Freeway Speed (SO), mi/h	63.9
Flow in Lanes 1 and 2 (v12), pc/h	3357	Ramp Junction Speed (S), mi/h	59.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	3880	Average Density (D), pc/mi/ln	34.1
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	30.6