TECHNICAL APPENDIX ADDITION

(LOS CALCULATION AT THORPE AND MEADOWLANE IMP)

APRIL 14, 2022

YEAR 2021

LEVEL OF SERVICE CALCULATIONS

AM & PM EXISTING CONDITIONS

(J-TURN AT THORPE & SR 195)

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↱			↱		↑↑	↱		↑↑	↱
Traffic Vol, veh/h	0	0	165	0	0	41	0	1557	147	0	546	64
Future Vol, veh/h	0	0	165	0	0	41	0	1557	147	0	546	64
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	Free
Storage Length	-	-	0	-	-	0	-	-	25	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	85	85	85	85	85	85	85	85	85	85	85	85
Heavy Vehicles, %	0	0	3	0	0	5	0	2	2	0	12	12
Mvmt Flow	0	0	194	0	0	48	0	1832	173	0	642	75

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	-	-	321	-	-	-	-	0	0	-	-	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.96	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.33	-	-	-	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	0	672	0	0	0	0	-	-	0	-	0
Stage 1	0	0	-	0	0	0	0	-	-	0	-	0
Stage 2	0	0	-	0	0	0	0	-	-	0	-	0
Platoon blocked, %								-	-		-	
Mov Cap-1 Maneuver	-	-	672	-	-	-	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	12.5	0	0	0
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	WBLn1	SBT
Capacity (veh/h)	-	-	672	-	-
HCM Lane V/C Ratio	-	-	0.289	-	-
HCM Control Delay (s)	-	-	12.5	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	1.2	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	60	60	1538	550	0
Future Vol, veh/h	0	60	60	1538	550	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	600	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	5	5	2	12	0
Mvmt Flow	0	65	65	1672	598	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	-	598	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.2	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.25	-	-	-
Pot Cap-1 Maneuver	0	0	954	-	-	0
Stage 1	0	0	-	-	-	0
Stage 2	0	0	-	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	-	954	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	0.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT
Capacity (veh/h)	954	-	-	-
HCM Lane V/C Ratio	0.068	-	-	-
HCM Control Delay (s)	9.1	-	0	-
HCM Lane LOS	A	-	A	-
HCM 95th %tile Q(veh)	0.2	-	-	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2021 AM Existing
Jurisdiction	WSDOT	Time Analyzed	AM
Project Description	19-2318 Marshall Creek - Thorpe N MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
Segment Length (L) / Acceleration Length (LA),ft	1500	900
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

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

Demand and Capacity		
Demand Volume (Vi)	550	60
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	12.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.893	0.952
Flow Rate (vi),pc/h	669	69
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.16	0.03

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.257
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	669	Ramp Junction Speed (S), mi/h	43.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	738	Average Density (D), pc/mi/ln	8.5
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	5.6

Intersection	
Int Delay, s/veh	1.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	124	1580	0	124	587
Future Vol, veh/h	0	124	1580	0	124	587
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	-	-	600	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	3	2	0	3	12
Mvmt Flow	0	135	1717	0	135	638

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	-	0	-	1717	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	4.16	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	2.23	-
Pot Cap-1 Maneuver	0	0	-	0	361	-
Stage 1	0	0	-	0	-	-
Stage 2	0	0	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	-	-	-	-	361	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	3.6
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	361	-
HCM Lane V/C Ratio	-	-	0.373	-
HCM Control Delay (s)	-	0	20.8	-
HCM Lane LOS	-	A	C	-
HCM 95th %tile Q(veh)	-	-	1.7	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2021 AM Existing
Jurisdiction	WSDOT	Time Analyzed	AM
Project Description	19-2318 Marshall Creek - Thorpe S. MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
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	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	1580	124
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	2.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.980	0.971
Flow Rate (vi),pc/h	1752	139
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.42	0.07

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.307
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	1752	Ramp Junction Speed (S), mi/h	43.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	1891	Average Density (D), pc/mi/ln	21.9
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	17.1

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	96	0	0	69	0	699	107	0	1400	136
Future Vol, veh/h	0	0	96	0	0	69	0	699	107	0	1400	136
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	Free
Storage Length	-	-	0	-	-	0	-	-	25	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2	2	4	4	2	2	2
Mvmt Flow	0	0	103	0	0	74	0	752	115	0	1505	146

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	-	-	753	-	-	-	-	0	0	-	-	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.94	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.32	-	-	-	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	0	352	0	0	0	0	-	-	0	-	0
Stage 1	0	0	-	0	0	0	0	-	-	0	-	0
Stage 2	0	0	-	0	0	0	0	-	-	0	-	0
Platoon blocked, %								-	-		-	
Mov Cap-1 Maneuver	-	-	352	-	-	-	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	19.4	0	0	0
HCM LOS	C	A		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	WBLn1	SBT
Capacity (veh/h)	-	-	352	-	-
HCM Lane V/C Ratio	-	-	0.293	-	-
HCM Control Delay (s)	-	-	19.4	0	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	1.2	-	-

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	106	106	661	1430	0
Future Vol, veh/h	0	106	106	661	1430	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	600	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	4	2	2
Mvmt Flow	0	115	115	718	1554	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	-	1554	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.14	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.22	-	-	-
Pot Cap-1 Maneuver	0	0	422	-	-	0
Stage 1	0	0	-	-	-	0
Stage 2	0	0	-	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	-	422	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	2.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT
Capacity (veh/h)	422	-	-	-
HCM Lane V/C Ratio	0.273	-	-	-
HCM Control Delay (s)	16.7	-	0	-
HCM Lane LOS	C	-	A	-
HCM 95th %tile Q(veh)	1.1	-	-	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2021 PM Existing
Jurisdiction	WSDOT	Time Analyzed	PM
Project Description	19-2318 Marshall Creek - Thorpe N MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
Segment Length (L) / Acceleration Length (LA),ft	1500	900
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

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

Demand and Capacity		
Demand Volume (Vi)	1430	106
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	2.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.980	0.980
Flow Rate (vi),pc/h	1586	118
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.38	0.06

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.270
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	1586	Ramp Junction Speed (S), mi/h	43.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	1704	Average Density (D), pc/mi/ln	19.7
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	13.1

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	81	724	0	81	1415
Future Vol, veh/h	0	81	724	0	81	1415
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	-	-	600	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	2	4	0	2	2
Mvmt Flow	0	88	787	0	88	1538

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	-	0	-	787	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	4.14	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	2.22	-
Pot Cap-1 Maneuver	0	0	-	0	828	-
Stage 1	0	0	-	0	-	-
Stage 2	0	0	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	-	-	-	-	828	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	0.5
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	828	-
HCM Lane V/C Ratio	-	-	0.106	-
HCM Control Delay (s)	-	0	9.9	-
HCM Lane LOS	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0.4	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2021 PM Existing
Jurisdiction	WSDOT	Time Analyzed	PM
Project Description	19-2318 Marshall Creek - Thorpe S. MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
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	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	724	81
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	4.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.962	0.980
Flow Rate (vi),pc/h	818	90
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.20	0.05

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.291
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	818	Ramp Junction Speed (S), mi/h	43.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	908	Average Density (D), pc/mi/ln	10.5
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	9.5

YEAR 2026

LEVEL OF SERVICE CALCULATIONS

AM & PM WITH BACKGROUND GROWTH RATE

(J-TURN AT THORPE & SR 195 AND MEADOWLANE IMP)

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	173	0	0	43	0	1636	155	0	574	67
Future Vol, veh/h	0	0	173	0	0	43	0	1636	155	0	574	67
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	Free
Storage Length	-	-	0	-	-	0	-	-	25	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	85	85	85	85	85	85	85	85	85	85	85	85
Heavy Vehicles, %	0	0	3	0	0	5	0	2	2	0	12	12
Mvmt Flow	0	0	204	0	0	51	0	1925	182	0	675	79

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	-	-	338	-	-	-	-	0	0	-	-	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.96	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.33	-	-	-	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	0	655	0	0	0	0	-	-	0	-	0
Stage 1	0	0	-	0	0	0	0	-	-	0	-	0
Stage 2	0	0	-	0	0	0	0	-	-	0	-	0
Platoon blocked, %								-	-		-	
Mov Cap-1 Maneuver	-	-	655	-	-	-	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13	0	0	0
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	WBLn1	SBT
Capacity (veh/h)	-	-	655	-	-
HCM Lane V/C Ratio	-	-	0.311	-	-
HCM Control Delay (s)	-	-	13	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	1.3	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	63	63	1617	578	0
Future Vol, veh/h	0	63	63	1617	578	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	600	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	5	5	2	12	0
Mvmt Flow	0	68	68	1758	628	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	-	628	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.2	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.25	-	-	-
Pot Cap-1 Maneuver	0	0	930	-	-	0
Stage 1	0	0	-	-	-	0
Stage 2	0	0	-	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	-	930	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	0.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT
Capacity (veh/h)	930	-	-	-
HCM Lane V/C Ratio	0.074	-	-	-
HCM Control Delay (s)	9.2	-	0	-
HCM Lane LOS	A	-	A	-
HCM 95th %tile Q(veh)	0.2	-	-	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2026 AM w BK GR
Jurisdiction	WSDOT	Time Analyzed	AM
Project Description	19-2318 Marshall Creek - Thorpe N MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
Segment Length (L) / Acceleration Length (LA),ft	1500	900
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

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

Demand and Capacity		
Demand Volume (Vi)	578	63
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	12.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.893	0.952
Flow Rate (vi),pc/h	704	72
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.17	0.04

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.257
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	704	Ramp Junction Speed (S), mi/h	43.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	776	Average Density (D), pc/mi/ln	9.0
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	5.9

Intersection	
Int Delay, s/veh	1.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	130	1661	0	130	617
Future Vol, veh/h	0	130	1661	0	130	617
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	-	-	600	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	3	2	0	3	12
Mvmt Flow	0	141	1805	0	141	671

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	-	0	-	1805	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	4.16	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	2.23	-
Pot Cap-1 Maneuver	0	0	-	0	333	-
Stage 1	0	0	-	0	-	-
Stage 2	0	0	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	-	-	-	-	333	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	4.1
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	333	-
HCM Lane V/C Ratio	-	-	0.424	-
HCM Control Delay (s)	-	0	23.5	-
HCM Lane LOS	-	A	C	-
HCM 95th %tile Q(veh)	-	-	2	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2026 AM w BK GR
Jurisdiction	WSDOT	Time Analyzed	AM
Project Description	19-2318 Marshall Creek - Thorpe S. MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
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	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	1661	130
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	2.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.980	0.971
Flow Rate (vi),pc/h	1842	146
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.44	0.07

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.309
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	1842	Ramp Junction Speed (S), mi/h	43.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	1988	Average Density (D), pc/mi/ln	23.1
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	17.9

Intersection	
Int Delay, s/veh	0.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	19	1144	4	12	594
Future Vol, veh/h	0	19	1144	4	12	594
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	-	0	-	25	200	-
Veh in Median Storage, #	1	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	17	17	2	2	9	9
Mvmt Flow	0	21	1243	4	13	646

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	622	0	0	1247	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	7.24	-	-	4.28	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.47	-	-	2.29	-
Pot Cap-1 Maneuver	0	395	-	-	517	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	395	-	-	517	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	14.6	0	0.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	395	517	-
HCM Lane V/C Ratio	-	-	0.052	0.025	-
HCM Control Delay (s)	-	-	14.6	12.1	-
HCM Lane LOS	-	-	B	B	-
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	93	93	1071	515	0
Future Vol, veh/h	0	93	93	1071	515	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	250	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	9	9
Mvmt Flow	0	101	101	1164	560	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	-	560	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.14	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.22	-	-	-
Pot Cap-1 Maneuver	0	0	1007	-	-	0
Stage 1	0	0	-	-	-	0
Stage 2	0	0	-	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	-	1007	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	0.7	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT
Capacity (veh/h)	1007	-	-	-
HCM Lane V/C Ratio	0.1	-	-	-
HCM Control Delay (s)	9	-	0	-
HCM Lane LOS	A	-	A	-
HCM 95th %tile Q(veh)	0.3	-	-	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2026 AM w BK GR
Jurisdiction	WSDOT	Time Analyzed	AM
Project Description	19-2318 Marshall Creek - Meadowlane N MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
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	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	515	93
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	9.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.917	0.980
Flow Rate (vi),pc/h	610	103
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.16	0.05

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.289
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	610	Ramp Junction Speed (S), mi/h	43.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	713	Average Density (D), pc/mi/ln	8.3
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	7.9

Intersection	
Int Delay, s/veh	5.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	197	100	0	0	495	0
Future Vol, veh/h	197	100	0	0	495	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	-	-	-
Veh in Median Storage, #	2	-	-	16979	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	3	3	2	2	9	9
Mvmt Flow	214	109	0	0	538	0

Major/Minor	Minor2			Major2	
Conflicting Flow All	538	269		-	0
Stage 1	538	-		-	-
Stage 2	0	-		-	-
Critical Hdwy	6.86	6.96		-	-
Critical Hdwy Stg 1	5.86	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	3.53	3.33		-	-
Pot Cap-1 Maneuver	471	726		-	0
Stage 1	547	-		-	0
Stage 2	-	-		-	0
Platoon blocked, %				-	
Mov Cap-1 Maneuver	471	726		-	-
Mov Cap-2 Maneuver	517	-		-	-
Stage 1	547	-		-	-
Stage 2	-	-		-	-

Approach	EB	SB
HCM Control Delay, s	14.8	0
HCM LOS	B	

Minor Lane/Major Mvmt	EBLn1	EBLn2	SBT
Capacity (veh/h)	517	726	-
HCM Lane V/C Ratio	0.414	0.15	-
HCM Control Delay (s)	16.8	10.8	-
HCM Lane LOS	C	B	-
HCM 95th %tile Q(veh)	2	0.5	-

Intersection	
Int Delay, s/veh	7.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	459	417	91	204	303
Future Vol, veh/h	0	459	417	91	204	303
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	25	350	-
Veh in Median Storage, #	1	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	2	9	9
Mvmt Flow	0	534	485	106	237	352

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	243	0	0	591	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	4.28	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	2.29	-
Pot Cap-1 Maneuver	0	758	-	-	934	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	758	-	-	934	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	20.2	0	4.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	758	934	-
HCM Lane V/C Ratio	-	-	0.704	0.254	-
HCM Control Delay (s)	-	-	20.2	10.2	-
HCM Lane LOS	-	-	C	B	-
HCM 95th %tile Q(veh)	-	-	5.9	1	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	101	0	0	73	0	734	113	0	1472	143
Future Vol, veh/h	0	0	101	0	0	73	0	734	113	0	1472	143
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	Free
Storage Length	-	-	0	-	-	0	-	-	25	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2	2	4	4	2	2	2
Mvmt Flow	0	0	109	0	0	78	0	789	122	0	1583	154

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	-	-	792	-	-	-	-	0	0	-	-	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.94	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.32	-	-	-	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	0	332	0	0	0	0	-	-	0	-	0
Stage 1	0	0	-	0	0	0	0	-	-	0	-	0
Stage 2	0	0	-	0	0	0	0	-	-	0	-	0
Platoon blocked, %								-	-		-	
Mov Cap-1 Maneuver	-	-	332	-	-	-	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	21	0	0	0
HCM LOS	C	A		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	WBLn1	SBT
Capacity (veh/h)	-	-	332	-	-
HCM Lane V/C Ratio	-	-	0.327	-	-
HCM Control Delay (s)	-	-	21	0	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	1.4	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	112	112	695	1503	0
Future Vol, veh/h	0	112	112	695	1503	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	600	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	4	2	2
Mvmt Flow	0	122	122	755	1634	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	-	1634	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.14	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.22	-	-	-
Pot Cap-1 Maneuver	0	0	393	-	-	0
Stage 1	0	0	-	-	-	0
Stage 2	0	0	-	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	-	393	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	2.5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT
Capacity (veh/h)	393	-	-	-
HCM Lane V/C Ratio	0.31	-	-	-
HCM Control Delay (s)	18.2	-	0	-
HCM Lane LOS	C	-	A	-
HCM 95th %tile Q(veh)	1.3	-	-	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2026 PM w BK GR
Jurisdiction	WSDOT	Time Analyzed	PM
Project Description	19-2318 Marshall Creek - Thorpe N MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
Segment Length (L) / Acceleration Length (LA),ft	1500	900
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

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

Demand and Capacity		
Demand Volume (Vi)	1503	112
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	2.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.980	0.980
Flow Rate (vi),pc/h	1667	124
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.40	0.06

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.272
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	1667	Ramp Junction Speed (S), mi/h	43.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	1791	Average Density (D), pc/mi/ln	20.7
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	13.8

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	86	761	0	86	1487
Future Vol, veh/h	0	86	761	0	86	1487
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	-	-	600	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	2	4	0	2	2
Mvmt Flow	0	93	827	0	93	1616

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	-	0	-	827	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	4.14	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	2.22	-
Pot Cap-1 Maneuver	0	0	-	0	800	-
Stage 1	0	0	-	0	-	-
Stage 2	0	0	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	-	-	-	-	800	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	0.6
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	800	-
HCM Lane V/C Ratio	-	-	0.117	-
HCM Control Delay (s)	-	0	10.1	-
HCM Lane LOS	-	A	B	-
HCM 95th %tile Q(veh)	-	-	0.4	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2026 PM w BK GR
Jurisdiction	WSDOT	Time Analyzed	PM
Project Description	19-2318 Marshall Creek - Thorpe S. MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
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	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	761	86
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	4.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.962	0.980
Flow Rate (vi),pc/h	860	95
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.21	0.05

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.291
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	860	Ramp Junction Speed (S), mi/h	43.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	955	Average Density (D), pc/mi/ln	11.1
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	9.8

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	29	758	4	21	1219
Future Vol, veh/h	0	29	758	4	21	1219
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	-	0	-	25	200	-
Veh in Median Storage, #	1	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	17	17	2	2	9	9
Mvmt Flow	0	32	824	4	23	1325

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	412	0	0	828	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	7.24	-	-	4.28	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.47	-	-	2.29	-
Pot Cap-1 Maneuver	0	549	-	-	756	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	549	-	-	756	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12	0	0.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	549	756	-
HCM Lane V/C Ratio	-	-	0.057	0.03	-
HCM Control Delay (s)	-	-	12	9.9	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	204	204	584	1035	0
Future Vol, veh/h	0	204	204	584	1035	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	250	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	5	5	2	2
Mvmt Flow	0	222	222	635	1125	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	-	1125	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.2	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.25	-	-	-
Pot Cap-1 Maneuver	0	0	600	-	-	0
Stage 1	0	0	-	-	-	0
Stage 2	0	0	-	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	-	600	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	3.7	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT
Capacity (veh/h)	600	-	-	-
HCM Lane V/C Ratio	0.37	-	-	-
HCM Control Delay (s)	14.5	-	0	-
HCM Lane LOS	B	-	A	-
HCM 95th %tile Q(veh)	1.7	-	-	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2026 PM w BK GR
Jurisdiction	WSDOT	Time Analyzed	PM
Project Description	19-2318 Marshall Creek - Meadowlane N MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
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	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	1035	204
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	2.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.980	0.952
Flow Rate (vi),pc/h	1148	233
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.31	0.12

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.297
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	1148	Ramp Junction Speed (S), mi/h	43.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	1381	Average Density (D), pc/mi/ln	16.0
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	13.1

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	56	57	0	0	953	0
Future Vol, veh/h	56	57	0	0	953	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	-	-	-
Veh in Median Storage, #	2	-	-	16979	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	3	3	2	2	9	9
Mvmt Flow	61	62	0	0	1036	0

Major/Minor	Minor2			Major2	
Conflicting Flow All	1036	518		-	0
Stage 1	1036	-		-	-
Stage 2	0	-		-	-
Critical Hdwy	6.86	6.96		-	-
Critical Hdwy Stg 1	5.86	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	3.53	3.33		-	-
Pot Cap-1 Maneuver	226	500		-	0
Stage 1	301	-		-	0
Stage 2	-	-		-	0
Platoon blocked, %				-	
Mov Cap-1 Maneuver	226	500		-	-
Mov Cap-2 Maneuver	276	-		-	-
Stage 1	301	-		-	-
Stage 2	-	-		-	-

Approach	EB	SB
HCM Control Delay, s	17.4	0
HCM LOS	C	

Minor Lane/Major Mvmt	EBLn1	EBLn2	SBT
Capacity (veh/h)	276	500	-
HCM Lane V/C Ratio	0.221	0.124	-
HCM Control Delay (s)	21.7	13.2	-
HCM Lane LOS	C	B	-
HCM 95th %tile Q(veh)	0.8	0.4	-

Intersection	
Int Delay, s/veh	5.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	390	241	57	425	529
Future Vol, veh/h	0	390	241	57	425	529
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	25	350	-
Veh in Median Storage, #	1	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	5	5	2	2
Mvmt Flow	0	402	248	59	438	545

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	124	0	0	307	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	4.14	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	0	904	-	-	1250	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	904	-	-	1250	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.1	0	4.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	904	1250	-
HCM Lane V/C Ratio	-	-	0.445	0.351	-
HCM Control Delay (s)	-	-	12.1	9.4	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	2.3	1.6	-

YEAR 2026

LEVEL OF SERVICE CALCULATIONS

AM & PM WITH BACKGROUND PROJECTS

(J-TURN AT THORPE & SR 195 AND MEADOWLANE IMP)

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	175	0	0	47	0	1767	168	0	624	71
Future Vol, veh/h	0	0	175	0	0	47	0	1767	168	0	624	71
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	Free
Storage Length	-	-	0	-	-	0	-	-	25	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	85	85	85	85	85	85	85	85	85	85	85	85
Heavy Vehicles, %	0	0	3	0	0	5	0	2	2	0	12	12
Mvmt Flow	0	0	206	0	0	55	0	2079	198	0	734	84

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	-	-	367	-	-	-	-	0	0	-	-	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.96	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.33	-	-	-	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	0	627	0	0	0	0	-	-	0	-	0
Stage 1	0	0	-	0	0	0	0	-	-	0	-	0
Stage 2	0	0	-	0	0	0	0	-	-	0	-	0
Platoon blocked, %								-	-		-	
Mov Cap-1 Maneuver	-	-	627	-	-	-	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13.5	0	0	0
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	WBLn1	SBT
Capacity (veh/h)	-	-	627	-	-
HCM Lane V/C Ratio	-	-	0.328	-	-
HCM Control Delay (s)	-	-	13.5	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	1.4	-	-

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	71	71	1744	624	0
Future Vol, veh/h	0	71	71	1744	624	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	600	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	5	5	2	12	0
Mvmt Flow	0	77	77	1896	678	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	-	678	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.2	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.25	-	-	-
Pot Cap-1 Maneuver	0	0	890	-	-	0
Stage 1	0	0	-	-	-	0
Stage 2	0	0	-	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	-	890	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	0.4	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT
Capacity (veh/h)	890	-	-	-
HCM Lane V/C Ratio	0.087	-	-	-
HCM Control Delay (s)	9.4	-	0	-
HCM Lane LOS	A	-	A	-
HCM 95th %tile Q(veh)	0.3	-	-	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2026 AM w BK Proj.
Jurisdiction	WSDOT	Time Analyzed	AM
Project Description	19-2318 Marshall Creek - Thorpe N MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
Segment Length (L) / Acceleration Length (LA),ft	1500	900
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

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

Demand and Capacity		
Demand Volume (Vi)	624	71
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	12.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.893	0.952
Flow Rate (vi),pc/h	760	81
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.19	0.04

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.258
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	760	Ramp Junction Speed (S), mi/h	43.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	841	Average Density (D), pc/mi/ln	9.7
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	6.4

Intersection	
Int Delay, s/veh	1.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	130	1805	0	130	669
Future Vol, veh/h	0	130	1805	0	130	669
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	-	-	600	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	3	2	0	3	12
Mvmt Flow	0	141	1962	0	141	727

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	-	0	-	1962	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	4.16	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	2.23	-
Pot Cap-1 Maneuver	0	0	-	0	289	-
Stage 1	0	0	-	0	-	-
Stage 2	0	0	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	-	-	-	-	289	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	4.7
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	289	-
HCM Lane V/C Ratio	-	-	0.489	-
HCM Control Delay (s)	-	0	28.8	-
HCM Lane LOS	-	A	D	-
HCM 95th %tile Q(veh)	-	-	2.5	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2026 AM w BK Proj.
Jurisdiction	WSDOT	Time Analyzed	AM
Project Description	19-2318 Marshall Creek - Thorpe S. MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
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	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	1805	130
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	2.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.980	0.971
Flow Rate (vi),pc/h	2002	146
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.48	0.07

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.314
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	2002	Ramp Junction Speed (S), mi/h	43.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	2148	Average Density (D), pc/mi/ln	24.9
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	19.1

Intersection	
Int Delay, s/veh	0.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	19	1260	4	12	644
Future Vol, veh/h	0	19	1260	4	12	644
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	-	0	-	25	200	-
Veh in Median Storage, #	1	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	17	17	2	2	9	9
Mvmt Flow	0	21	1370	4	13	700

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	685	0	0	1374	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	7.24	-	-	4.28	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.47	-	-	2.29	-
Pot Cap-1 Maneuver	0	357	-	-	460	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	357	-	-	460	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.7	0	0.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	357	460	-
HCM Lane V/C Ratio	-	-	0.058	0.028	-
HCM Control Delay (s)	-	-	15.7	13.1	-
HCM Lane LOS	-	-	C	B	-
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	105	105	1175	553	0
Future Vol, veh/h	0	105	105	1175	553	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	250	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	9	9
Mvmt Flow	0	114	114	1277	601	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	-	601	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.14	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.22	-	-	-
Pot Cap-1 Maneuver	0	0	972	-	-	0
Stage 1	0	0	-	-	-	0
Stage 2	0	0	-	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	-	972	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	0.8	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT
Capacity (veh/h)	972	-	-	-
HCM Lane V/C Ratio	0.117	-	-	-
HCM Control Delay (s)	9.2	-	0	-
HCM Lane LOS	A	-	A	-
HCM 95th %tile Q(veh)	0.4	-	-	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2026 AM w BK Proj.
Jurisdiction	WSDOT	Time Analyzed	AM
Project Description	19-2318 Marshall Creek - Meadowlane N MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
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	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	553	105
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	9.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.917	0.980
Flow Rate (vi),pc/h	655	116
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.17	0.06

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.289
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	655	Ramp Junction Speed (S), mi/h	43.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	771	Average Density (D), pc/mi/ln	8.9
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	8.4

Intersection	
Int Delay, s/veh	6.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	238	124	0	0	523	0
Future Vol, veh/h	238	124	0	0	523	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	-	-	-
Veh in Median Storage, #	2	-	-	16979	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	3	3	2	2	9	9
Mvmt Flow	259	135	0	0	568	0

Major/Minor	Minor2			Major2	
Conflicting Flow All	568	284		-	0
Stage 1	568	-		-	-
Stage 2	0	-		-	-
Critical Hdwy	6.86	6.96		-	-
Critical Hdwy Stg 1	5.86	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	3.53	3.33		-	-
Pot Cap-1 Maneuver	451	710		-	0
Stage 1	528	-		-	0
Stage 2	-	-		-	0
Platoon blocked, %				-	
Mov Cap-1 Maneuver	451	710		-	-
Mov Cap-2 Maneuver	499	-		-	-
Stage 1	528	-		-	-
Stage 2	-	-		-	-

Approach	EB	SB
HCM Control Delay, s	16.8	0
HCM LOS	C	

Minor Lane/Major Mvmt	EBLn1	EBLn2	SBT
Capacity (veh/h)	499	710	-
HCM Lane V/C Ratio	0.518	0.19	-
HCM Control Delay (s)	19.7	11.3	-
HCM Lane LOS	C	B	-
HCM 95th %tile Q(veh)	2.9	0.7	-

Intersection	
Int Delay, s/veh	8.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	469	482	102	218	341
Future Vol, veh/h	0	469	482	102	218	341
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	25	350	-
Veh in Median Storage, #	1	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	2	9	9
Mvmt Flow	0	545	560	119	253	397

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	280	0	0	679	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	4.28	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	2.29	-
Pot Cap-1 Maneuver	0	717	-	-	864	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	717	-	-	864	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	24.1	0	4.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	717	864	-
HCM Lane V/C Ratio	-	-	0.761	0.293	-
HCM Control Delay (s)	-	-	24.1	10.9	-
HCM Lane LOS	-	-	C	B	-
HCM 95th %tile Q(veh)	-	-	7.1	1.2	-

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↱			↱		↑↑	↱		↑↑	↱
Traffic Vol, veh/h	0	0	106	0	0	90	0	826	123	0	1638	145
Future Vol, veh/h	0	0	106	0	0	90	0	826	123	0	1638	145
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	Free
Storage Length	-	-	0	-	-	0	-	-	25	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2	2	4	4	2	2	2
Mvmt Flow	0	0	114	0	0	97	0	888	132	0	1761	156

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	-	-	881	-	-	-	-	0	0	-	-	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.94	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.32	-	-	-	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	0	290	0	0	0	0	-	-	0	-	0
Stage 1	0	0	-	0	0	0	0	-	-	0	-	0
Stage 2	0	0	-	0	0	0	0	-	-	0	-	0
Platoon blocked, %								-	-		-	
Mov Cap-1 Maneuver	-	-	290	-	-	-	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	25.2	0	0	0
HCM LOS	D	A		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	WBLn1	SBT
Capacity (veh/h)	-	-	290	-	-
HCM Lane V/C Ratio	-	-	0.393	-	-
HCM Control Delay (s)	-	-	25.2	0	-
HCM Lane LOS	-	-	D	A	-
HCM 95th %tile Q(veh)	-	-	1.8	-	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	131	131	785	1652	0
Future Vol, veh/h	0	131	131	785	1652	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	600	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	4	2	2
Mvmt Flow	0	142	142	853	1796	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	-	1796	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.14	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.22	-	-	-
Pot Cap-1 Maneuver	0	0	340	-	-	0
Stage 1	0	0	-	-	-	0
Stage 2	0	0	-	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	-	340	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	3.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT
Capacity (veh/h)	340	-	-	-
HCM Lane V/C Ratio	0.419	-	-	-
HCM Control Delay (s)	23	-	0	-
HCM Lane LOS	C	-	A	-
HCM 95th %tile Q(veh)	2	-	-	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2026 PM w BK Proj.
Jurisdiction	WSDOT	Time Analyzed	PM
Project Description	19-2318 Marshall Creek - Thorpe N MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
Segment Length (L) / Acceleration Length (LA),ft	1500	900
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

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

Demand and Capacity		
Demand Volume (Vi)	1652	131
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	2.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.980	0.980
Flow Rate (vi),pc/h	1832	145
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.44	0.07

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.277
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	1832	Ramp Junction Speed (S), mi/h	43.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	1977	Average Density (D), pc/mi/ln	22.9
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	15.3

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	86	863	0	86	1658
Future Vol, veh/h	0	86	863	0	86	1658
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	-	-	600	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	2	4	0	2	2
Mvmt Flow	0	93	938	0	93	1802

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	-	0	-	938	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	4.14	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	2.22	-
Pot Cap-1 Maneuver	0	0	-	0	726	-
Stage 1	0	0	-	0	-	-
Stage 2	0	0	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	-	-	-	-	726	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	0.5
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	726	-
HCM Lane V/C Ratio	-	-	0.129	-
HCM Control Delay (s)	-	0	10.7	-
HCM Lane LOS	-	A	B	-
HCM 95th %tile Q(veh)	-	-	0.4	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2026 PM w BK Proj.
Jurisdiction	WSDOT	Time Analyzed	PM
Project Description	19-2318 Marshall Creek - Thorpe S. MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
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	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	863	86
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	4.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.962	0.980
Flow Rate (vi),pc/h	975	95
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.24	0.05

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.292
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	975	Ramp Junction Speed (S), mi/h	43.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	1070	Average Density (D), pc/mi/ln	12.4
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	10.7

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	29	869	4	21	1376
Future Vol, veh/h	0	29	869	4	21	1376
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	-	0	-	25	200	-
Veh in Median Storage, #	1	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	17	17	2	2	9	9
Mvmt Flow	0	32	945	4	23	1496

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	473	0	0	949	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	7.24	-	-	4.28	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.47	-	-	2.29	-
Pot Cap-1 Maneuver	0	499	-	-	678	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	499	-	-	678	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.7	0	0.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	499	678	-
HCM Lane V/C Ratio	-	-	0.063	0.034	-
HCM Control Delay (s)	-	-	12.7	10.5	-
HCM Lane LOS	-	-	B	B	-
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	243	243	656	1153	0
Future Vol, veh/h	0	243	243	656	1153	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	250	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	5	5	2	2
Mvmt Flow	0	264	264	713	1253	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	-	1253	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.2	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.25	-	-	-
Pot Cap-1 Maneuver	0	0	535	-	-	0
Stage 1	0	0	-	-	-	0
Stage 2	0	0	-	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	-	535	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	4.9	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT
Capacity (veh/h)	535	-	-	-
HCM Lane V/C Ratio	0.494	-	-	-
HCM Control Delay (s)	18.1	-	0	-
HCM Lane LOS	C	-	A	-
HCM 95th %tile Q(veh)	2.7	-	-	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2026 PM w BK Proj.
Jurisdiction	WSDOT	Time Analyzed	PM
Project Description	19-2318 Marshall Creek - Meadowlane N MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
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	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	1153	243
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	2.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.980	0.952
Flow Rate (vi),pc/h	1279	277
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.35	0.14

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.299
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	1279	Ramp Junction Speed (S), mi/h	43.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	1556	Average Density (D), pc/mi/ln	18.1
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	14.4

Intersection	
Int Delay, s/veh	2.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	81	74	0	0	1038	0
Future Vol, veh/h	81	74	0	0	1038	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	-	-	-
Veh in Median Storage, #	2	-	-	16979	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	3	3	2	2	9	9
Mvmt Flow	88	80	0	0	1128	0

Major/Minor	Minor2			Major2	
Conflicting Flow All	1128	564		-	0
Stage 1	1128	-		-	-
Stage 2	0	-		-	-
Critical Hdwy	6.86	6.96		-	-
Critical Hdwy Stg 1	5.86	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	3.53	3.33		-	-
Pot Cap-1 Maneuver	196	466		-	0
Stage 1	269	-		-	0
Stage 2	-	-		-	0
Platoon blocked, %				-	
Mov Cap-1 Maneuver	196	466		-	-
Mov Cap-2 Maneuver	243	-		-	-
Stage 1	269	-		-	-
Stage 2	-	-		-	-

Approach	EB	SB
HCM Control Delay, s	21.5	0
HCM LOS	C	

Minor Lane/Major Mvmt	EBLn1	EBLn2	SBT
Capacity (veh/h)	243	466	-
HCM Lane V/C Ratio	0.362	0.173	-
HCM Control Delay (s)	28	14.3	-
HCM Lane LOS	D	B	-
HCM 95th %tile Q(veh)	1.6	0.6	-

Intersection	
Int Delay, s/veh	5.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	419	298	64	436	620
Future Vol, veh/h	0	419	298	64	436	620
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	25	350	-
Veh in Median Storage, #	1	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	5	5	2	2
Mvmt Flow	0	432	307	66	449	639

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	154	0	0	373	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	4.14	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	0	864	-	-	1182	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	864	-	-	1182	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.3	0	4.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	864	1182	-
HCM Lane V/C Ratio	-	-	0.5	0.38	-
HCM Control Delay (s)	-	-	13.3	9.9	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	2.8	1.8	-

YEAR 2026

LEVEL OF SERVICE CALCULATIONS

AM & PM WITH BACKGROUND PROJECTS AND PROJECT

(J-TURN AT THORPE & SR 195 AND MEADOWLANE IMP)

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↱			↱		↑↑	↱		↑↑	↱
Traffic Vol, veh/h	0	0	182	0	0	50	0	1896	177	0	663	92
Future Vol, veh/h	0	0	182	0	0	50	0	1896	177	0	663	92
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	Free
Storage Length	-	-	0	-	-	0	-	-	25	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	85	85	85	85	85	85	85	85	85	85	85	85
Heavy Vehicles, %	0	0	3	0	0	5	0	2	2	0	12	12
Mvmt Flow	0	0	214	0	0	59	0	2231	208	0	780	108

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	-	-	390	-	-	-	-	0	0	-	-	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.96	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.33	-	-	-	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	0	606	0	0	0	0	-	-	0	-	0
Stage 1	0	0	-	0	0	0	0	-	-	0	-	0
Stage 2	0	0	-	0	0	0	0	-	-	0	-	0
Platoon blocked, %								-	-		-	
Mov Cap-1 Maneuver	-	-	606	-	-	-	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	14.2	0	0	0
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	WBLn1	SBT
Capacity (veh/h)	-	-	606	-	-
HCM Lane V/C Ratio	-	-	0.353	-	-
HCM Control Delay (s)	-	-	14.2	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	1.6	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	95	95	1852	660	0
Future Vol, veh/h	0	95	95	1852	660	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	600	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	5	5	2	12	0
Mvmt Flow	0	103	103	2013	717	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	-	717	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.2	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.25	-	-	-
Pot Cap-1 Maneuver	0	0	860	-	-	0
Stage 1	0	0	-	-	-	0
Stage 2	0	0	-	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	-	860	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	0.5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT
Capacity (veh/h)	860	-	-	-
HCM Lane V/C Ratio	0.12	-	-	-
HCM Control Delay (s)	9.8	-	0	-
HCM Lane LOS	A	-	A	-
HCM 95th %tile Q(veh)	0.4	-	-	-

HCS7 Freeway Merge Report

Project Information

Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2026 AM w Proj.
Jurisdiction	WSDOT	Time Analyzed	AM
Project Description	19-2318 Marshall Creek - Thorpe N MUT	Units	U.S. Customary

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
Segment Length (L) / Acceleration Length (LA),ft	1500	900
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	660	95
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	12.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.893	0.952
Flow Rate (vi),pc/h	803	108
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.20	0.05

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.259
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	803	Ramp Junction Speed (S), mi/h	43.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	911	Average Density (D), pc/mi/ln	10.5
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	7.0

Intersection	
Int Delay, s/veh	1.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	130	1943	0	130	715
Future Vol, veh/h	0	130	1943	0	130	715
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	-	-	600	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	3	2	0	3	12
Mvmt Flow	0	141	2112	0	141	777

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	-	0	-	2112	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	4.16	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	2.23	-
Pot Cap-1 Maneuver	0	0	-	0	252	-
Stage 1	0	0	-	0	-	-
Stage 2	0	0	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	-	-	-	-	252	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	5.6
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	252	-
HCM Lane V/C Ratio	-	-	0.561	-
HCM Control Delay (s)	-	0	36.1	-
HCM Lane LOS	-	A	E	-
HCM 95th %tile Q(veh)	-	-	3.1	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2026 AM w Proj.
Jurisdiction	WSDOT	Time Analyzed	AM
Project Description	19-2318 Marshall Creek - Thorpe S. MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
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	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	1943	130
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	2.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.980	0.971
Flow Rate (vi),pc/h	2155	146
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.51	0.07

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.320
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	2155	Ramp Junction Speed (S), mi/h	43.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	2301	Average Density (D), pc/mi/ln	26.7
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	20.3

Intersection	
Int Delay, s/veh	0.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	19	1272	4	12	671
Future Vol, veh/h	0	19	1272	4	12	671
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	-	0	-	25	200	-
Veh in Median Storage, #	1	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	17	17	2	2	9	9
Mvmt Flow	0	21	1383	4	13	729

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	692	0	0	1387	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	7.24	-	-	4.28	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.47	-	-	2.29	-
Pot Cap-1 Maneuver	0	353	-	-	455	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	353	-	-	455	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.8	0	0.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	353	455	-
HCM Lane V/C Ratio	-	-	0.059	0.029	-
HCM Control Delay (s)	-	-	15.8	13.1	-
HCM Lane LOS	-	-	C	B	-
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	109	109	1183	576	0
Future Vol, veh/h	0	109	109	1183	576	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	-	0	250	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	9	9
Mvmt Flow	0	118	118	1286	626	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	-	626	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.14	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.22	-	-	-
Pot Cap-1 Maneuver	0	0	952	-	-	0
Stage 1	0	0	-	-	-	0
Stage 2	0	0	-	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	-	952	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	0.8	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT
Capacity (veh/h)	952	-	-	-
HCM Lane V/C Ratio	0.124	-	-	-
HCM Control Delay (s)	9.3	-	0	-
HCM Lane LOS	A	-	A	-
HCM 95th %tile Q(veh)	0.4	-	-	-

HCS7 Freeway Merge Report

Project Information			
Analyst	Whipple Consulting Engineers	Date	03/05/2021
Agency	WSDOT	Analysis Year	2026 AM w Proj.
Jurisdiction	WSDOT	Time Analyzed	AM
Project Description	19-2318 Marshall Creek - Meadowlane N MUT	Units	U.S. Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	43.6	40.0
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	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	576	109
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	9.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.917	0.980
Flow Rate (vi),pc/h	683	121
Capacity (c), pc/h	4500	2000
Volume-to-Capacity Ratio (v/c)	0.18	0.06

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.290
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 1 and 2 (v12), pc/h	683	Ramp Junction Speed (S), mi/h	43.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	804	Average Density (D), pc/mi/ln	9.3
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	8.6