2018 Traffic Conditions Technical Memorandum

I-229 Benson Road Interchange Modification Study

Sioux Falls, South Dakota

May 16, 2018

City of Sioux Falls
SOUTH DAKOTA

South Dakota DOT
Connecting South Dakota and the Nation

This memorandum provides the results of operations analysis for the year 2018 traffic conditions in the project study area (Figure 1). The analysis was prepared using the procedures and inputs specified in the approved Methods and Assumptions document for this study. Analysis output documents are provided in the appendix to this memorandum.

1.0 Traffic Volume Development

Traffic counts on the Interstate roadway segments were gathered by SDDOT in 2017. Traffic counts on the arterial street system were available in City of Sioux Falls and HDR files. Count data were assembled and balanced to produce a representation of peak hour traffic flows through the study area. Peak hour traffic volumes are shown in Figures 2, 3 and 6.

2.0 Traffic Operations

Level of service on Interstate 229 was calculated for mainline, ramp merge-diverge, and weave areas for peak hours under 2018 conditions. The level of service results are shown in Figure 6. Note that several Interstate mainline segments were analyzed both as regular mainline segments and weaving segments. If it was determined that the segment satisfied the conditions for weaving, the weaving level of service was reported and indicated by an asterisk (*) next to the level of service result.

Intersection turning volumes and level of service for peak hours under 2018 conditions are shown in Figures 2 and 3. Multimodal levels of service for the Benson Road and Rice Street arterial corridors are shown in Figures 4 and 5.

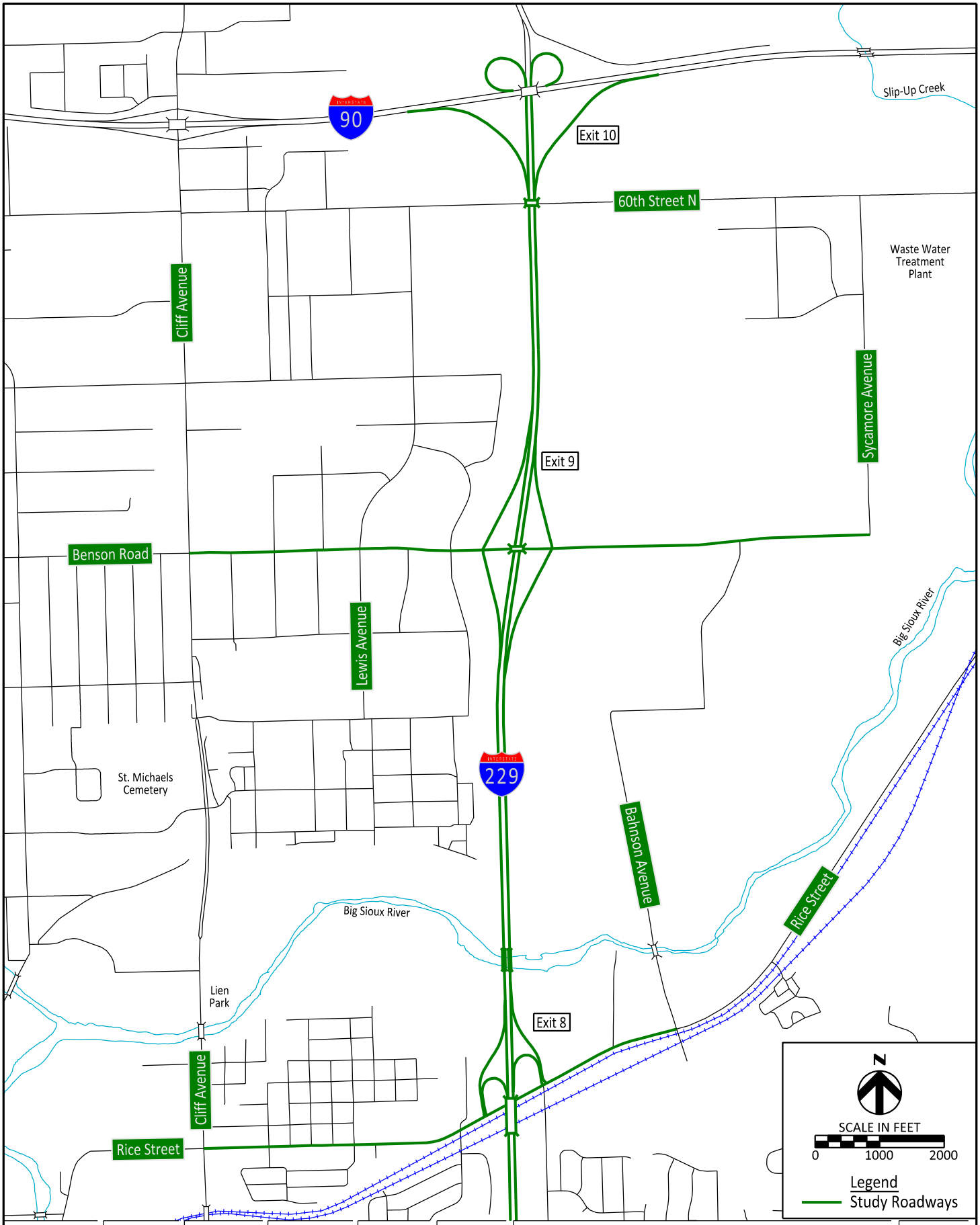
The 2018 conditions analysis shows that all Interstate facilities within the study area operate at an acceptable level of service (Figure 6).

The arterial street system experiences peak hour congestion at the following locations:

- Benson Road/Potsdam Avenue
- Benson Road/I-229 Southbound
- Benson Road/I-229 Northbound
- Rice Street/I-229 SB
- Rice Street/I-229 NB

Certain movements experienced low levels of service or queues that exceeded the length of the available storage during particular peak hours. The southbound left turn at Rice Street/Cliff Avenue is an example of this characteristic, with the left turn queue extending through the Bennett Street/Cliff Avenue intersection at times.

Multimodal level of service varies widely throughout the Benson Road and Rice Street corridors. The lowest levels of service are related to locations with the absence of specific facilities for pedestrians and bicyclists in these corridors.

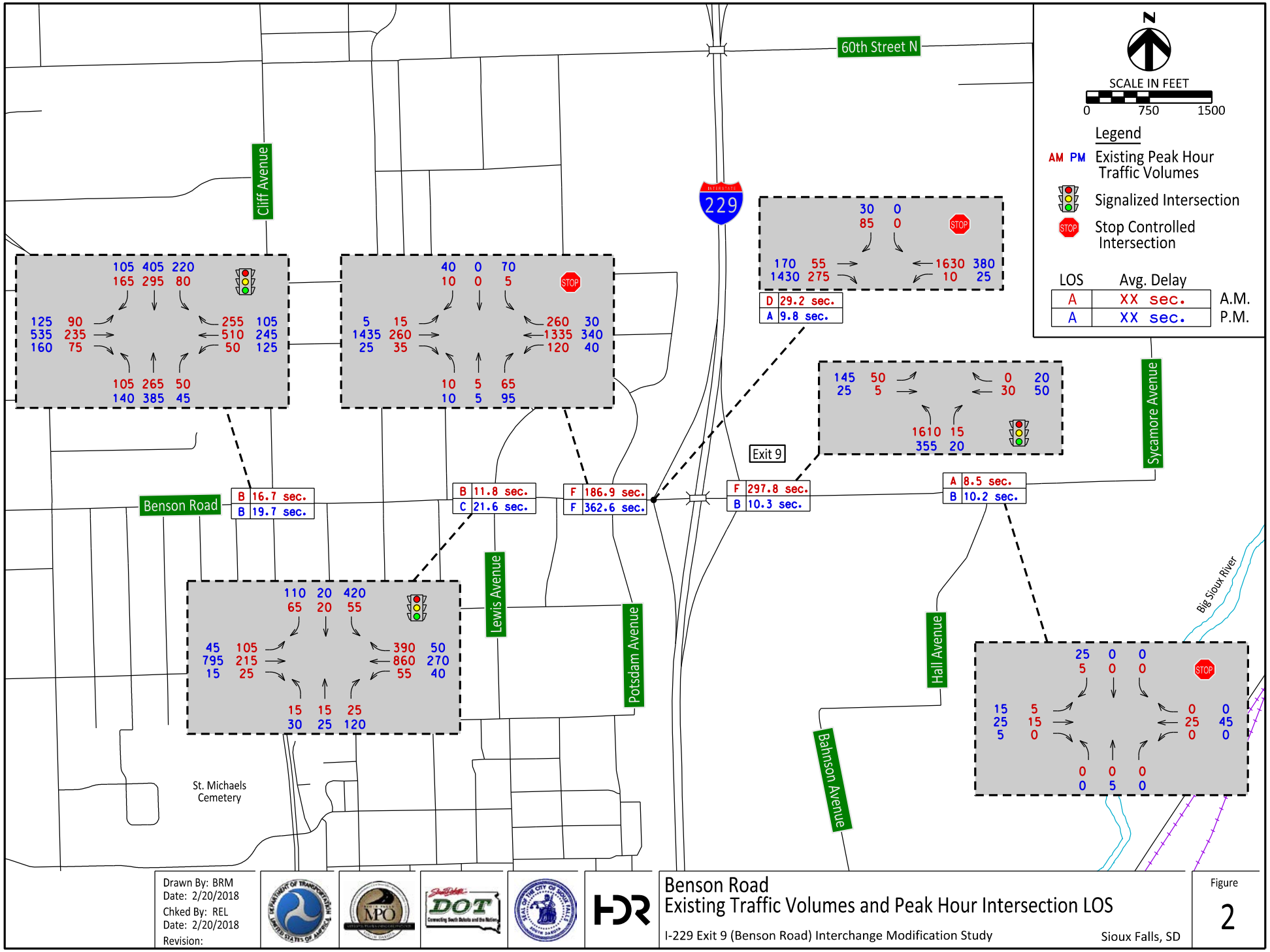


Drawn By: BRM
Date: 1/30/2018
Chked By: REL
Date: 1/30/2018
Revision:

Study Area

I-229 Exit 9 (Benson Road) Interchange Modification Study
Sioux Falls, SD

Figure 1



Drawn By: BRM
Date: 2/20/2018
Chked By: REL
Date: 2/20/2018
Revision:

Benson Road
Existing Traffic Volumes and Peak Hour Intersection LOS

I-229 Exit 9 (Benson Road) Interchange Modification Study

Sioux Falls, SD

Figure 2

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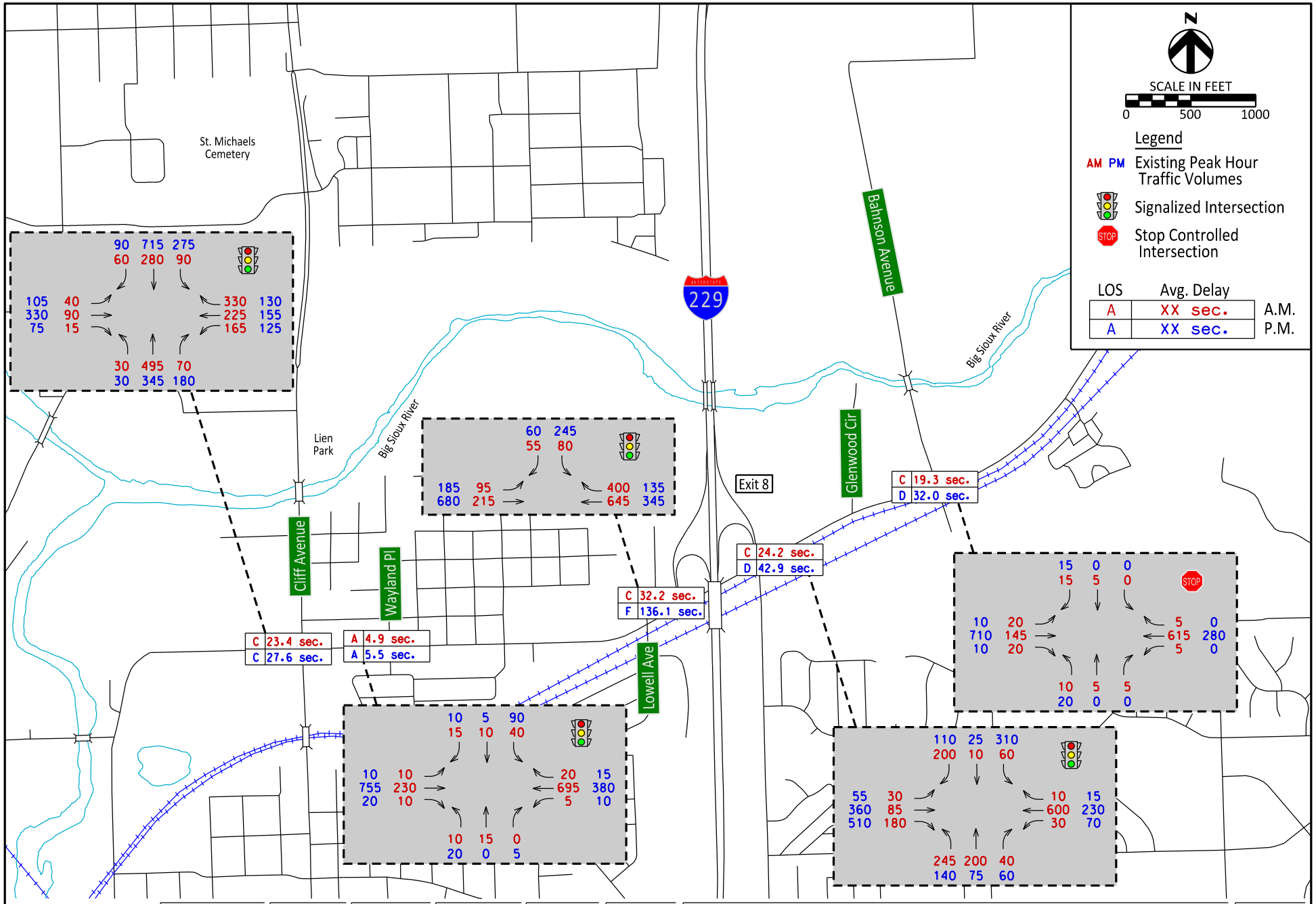

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Date: 2/20/2018
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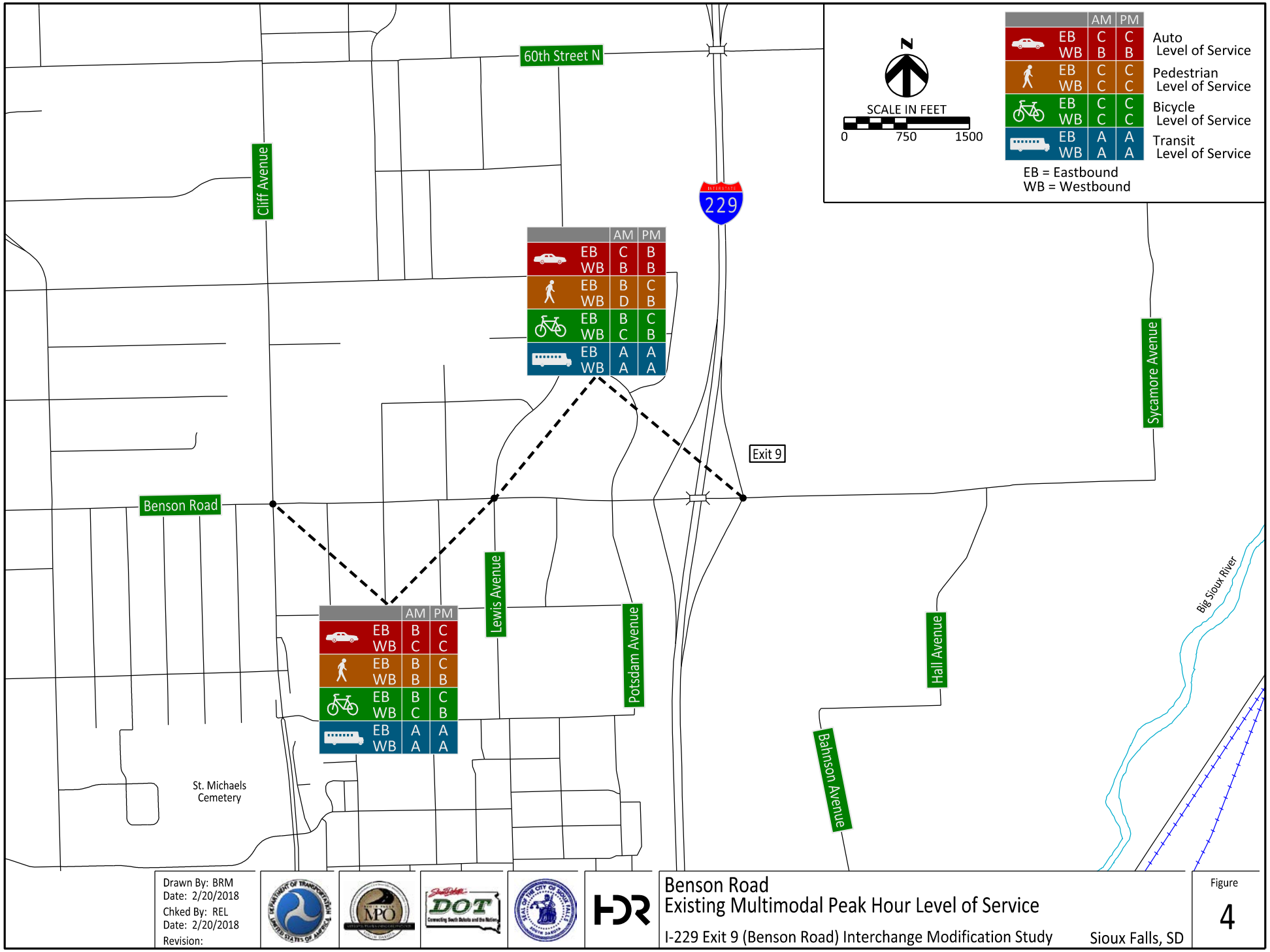
Date: 2/20/2018
Revision:

Rice Street
Existing Traffic Volumes and Peak Hour Intersection LOS

I-229 Exit 9 (Benson Road) Interchange Modification Study Sioux Falls, SD

Figure 3



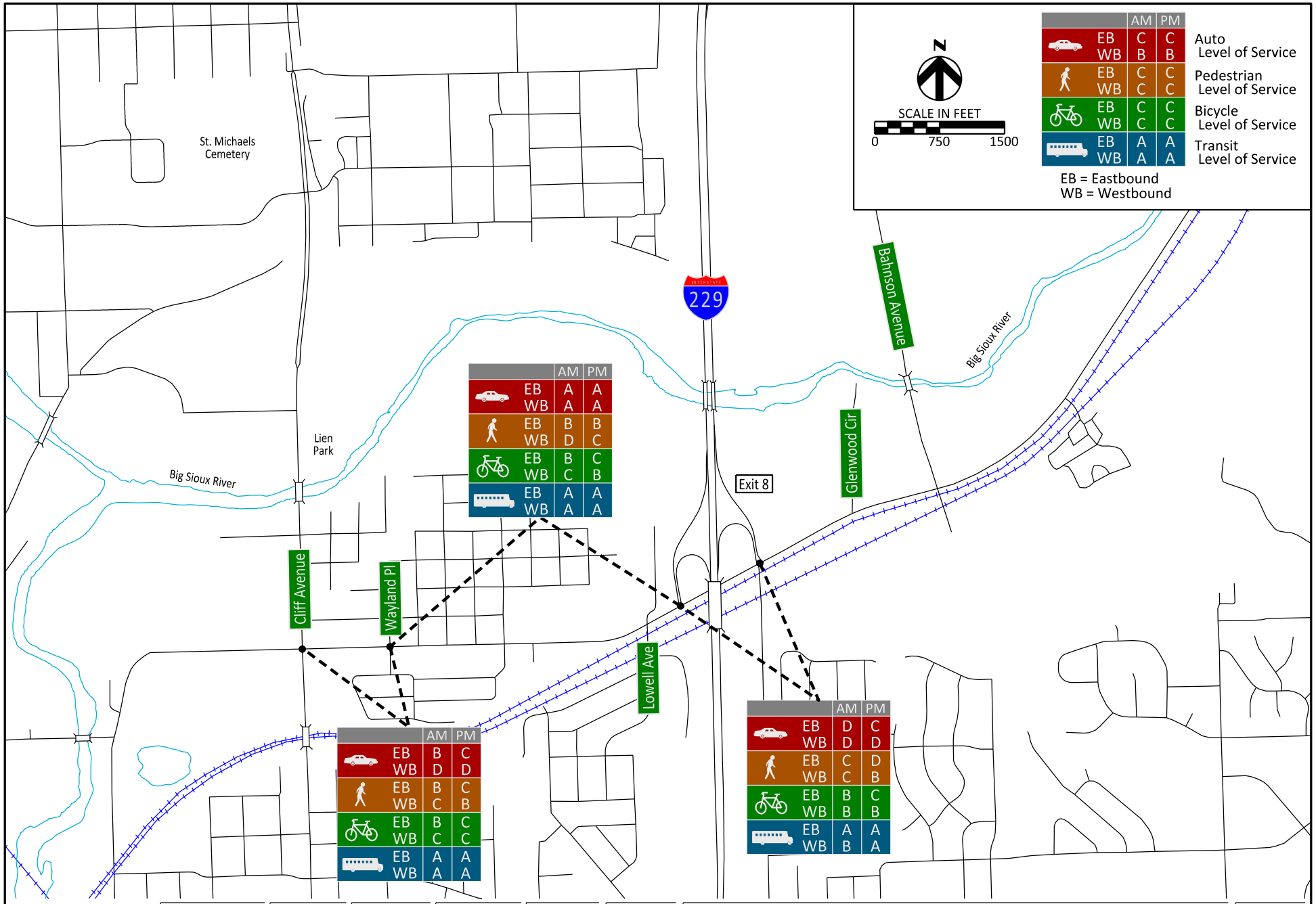
Drawn By: BRM
Date: 2/20/2018
Chked By: REL
Date: 2/20/2018
Revision:

Benson Road
Existing Multimodal Peak Hour Level of Service

I-229 Exit 9 (Benson Road) Interchange Modification Study

Sioux Falls, SD

Figure 4



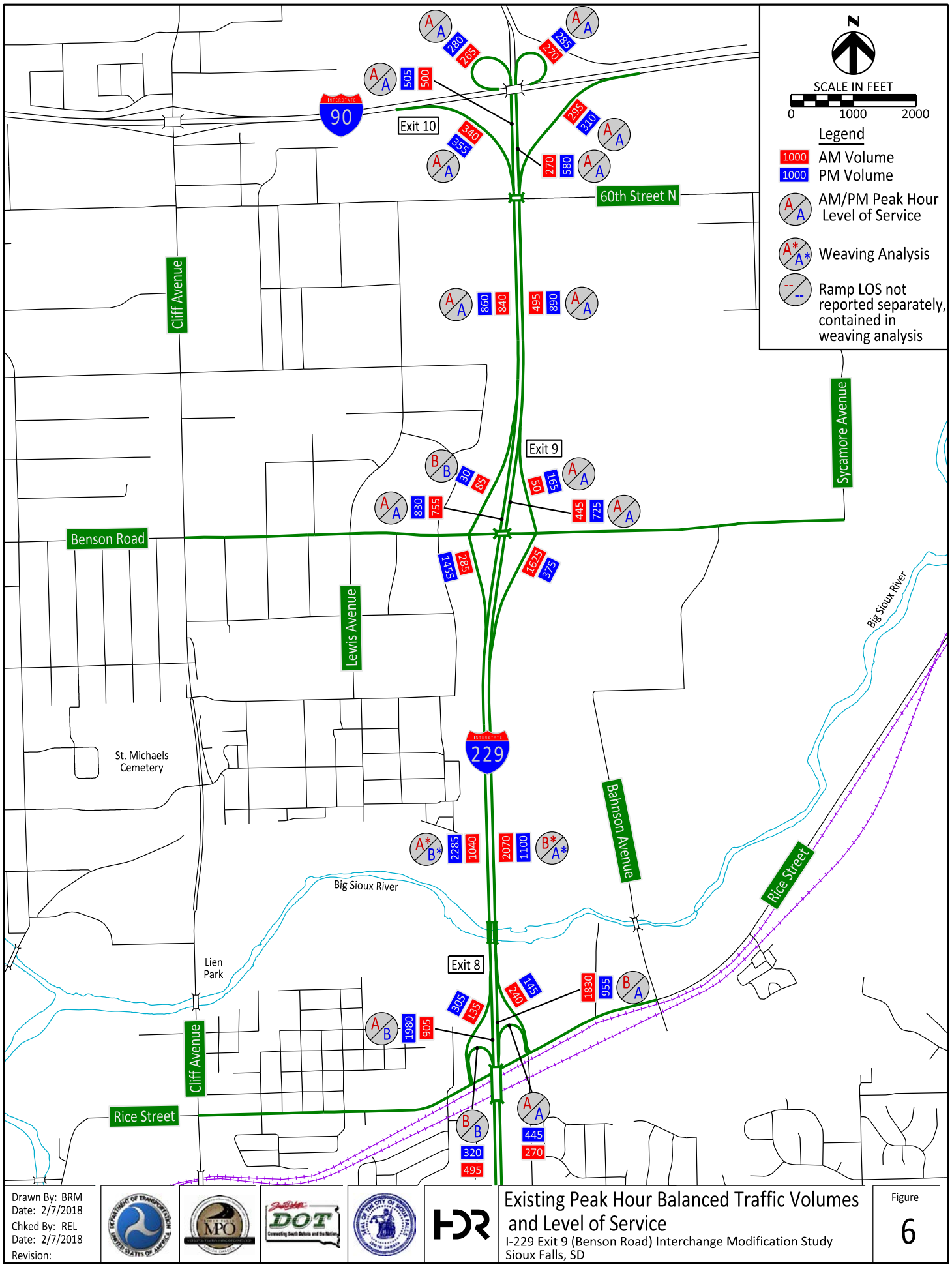
Drawn By: BRM
Date: 2/20/2018
Chked By: REL
Date: 2/20/2018
Revision:

Rice Street
Existing Multimodal Peak Hour Level of Service

I-229 Exit 9 (Benson Road) Interchange Modification Study

Sioux Falls, SD

Figure 5



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PLOTTING DATE: 05-16-2018

Drawn By: BRM
Date: 2/7/2018
Chked By: REL
Date: 2/7/2018
Revision:

Existing Peak Hour Balanced Traffic Volumes and Level of Service

I-229 Exit 9 (Benson Road) Interchange Modification Study
Sioux Falls, SD

Figure 6

APPENDIX

I. Freeway Analysis – Mainline
II. Freeway Analysis – Ramps
III. Freeway Analysis – Weaving
IV. Arterial Analysis

I. Freeway Analysis – Mainline

HCS7 Basic Freeway Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	AM PEAK
Project Description	I-229/BENSON ROAD IMJR		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	500	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.82	Flow Rate (V_p), pc/h/ln	336
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.15
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	5.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

HCS7 Basic Freeway Report

Project Information

Analyst	RL	Date	2/26/2018
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Jurisdiction	SDDOT	Time Period Analyzed	AM PEAK
Project Description	I-229/BENSON ROAD IMJR		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	840	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.82	Flow Rate (V_p), pc/h/ln	564
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.25
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	8.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

HCS7 Basic Freeway Report

Project Information

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Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	755	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.82	Flow Rate (V_p), pc/h/ln	506
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.22
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	7.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

HCS7 Basic Freeway Report

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Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	1040	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor	0.82	Flow Rate (V_p), pc/h/ln	452
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.20
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	6.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

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Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	905	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor	0.82	Flow Rate (V_p), pc/h/ln	590
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.26
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	8.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

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Project Description	I-229/BENSON ROAD IMJR		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	1830	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor	0.92	Flow Rate (V_p), pc/h/ln	1064
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.46
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	15.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

HCS7 Basic Freeway Report

Project Information

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Jurisdiction	SDDOT	Time Period Analyzed	AM PEAK
Project Description	I-229/BENSON ROAD IMJR		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	2070	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor	0.92	Flow Rate (V_p), pc/h/ln	802
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.35
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	11.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

HCS7 Basic Freeway Report

Project Information

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Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	AM PEAK
Project Description	I-229/BENSON ROAD IMJR		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	445	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.92	Flow Rate (V_p), pc/h/ln	266
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.12
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	4.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

HCS7 Basic Freeway Report

Project Information

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Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	AM PEAK
Project Description	I-229/BENSON ROAD IMJR		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	495	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.92	Flow Rate (V_p), pc/h/ln	197
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.09
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	2.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

HCS7 Basic Freeway Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	AM PEAK
Project Description	I-229/BENSON ROAD IMJR		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	270	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.92	Flow Rate (V_p), pc/h/ln	162
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.07
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	2.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

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Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	505	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	316
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.14
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	4.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

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Agency	HDR	Analysis Year	2018
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Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	860	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	538
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.23
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	8.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

HCS7 Basic Freeway Report

Project Information

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Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	PM PEAK
Project Description	I-229/BENSON ROAD IMJR		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	830	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	519
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.23
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	7.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

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Project Information

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Project Description	I-229/BENSON ROAD IMJR		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	2285	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	926
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.40
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	13.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

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Project Information

Analyst	RL	Date	2/26/2018
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Project Description	I-229/BENSON ROAD IMJR		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	1980	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	1203
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.52
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	17.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

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Project Information

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Project Description	I-229/BENSON ROAD IMJR		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	955	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor	0.92	Flow Rate (V_p), pc/h/ln	555
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.24
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	8.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

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Project Information

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Project Description	I-229/BENSON ROAD IMJR		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	1100	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor	0.92	Flow Rate (V_p), pc/h/ln	426
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.19
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	6.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

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Project Information

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Project Description	I-229/BENSON ROAD IMJR		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	725	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.92	Flow Rate (V_p), pc/h/ln	434
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.19
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	6.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

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Project Information

Analyst	RL	Date	2/26/2018
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Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	890	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.92	Flow Rate (V_p), pc/h/ln	355
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.15
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	5.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

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Project Information

Analyst	RL	Date	2/26/2018
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Project Description	I-229/BENSON ROAD IMJR		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	69.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	69.0
Right-Side Lateral Clearance, ft	-		

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	580	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.92	Flow Rate (V_p), pc/h/ln	347
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2373
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2297
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.15
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	5.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.3		

II. Freeway Analysis – Ramps

HCS7 Freeway Merge Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	AM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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 (V_i), veh/h	500	340
Peak Hour Factor (PHF)	0.82	0.82
Total Trucks, %	10.00	10.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.909
Flow Rate (v_i), pc/h	671	456
Capacity (c), pc/h	4550	2033
Volume-to-Capacity Ratio (v/c)	0.25	0.22

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	4.7
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.201
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	62.2
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	671	Ramp Junction Speed (S), mi/h	62.2
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	1127	Average Density (D), pc/mi/ln	9.1
Level of Service (LOS)	A		

HCS7 Freeway Diverge Report

Project Information

Analyst	RL	Date	2/26/2018
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Jurisdiction	SDDOT	Time Period Analyzed	AM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Deceleration Length (L_D), ft	3620	280
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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)	1.000	1.000

Demand and Capacity

	Freeway	Ramp
Demand Volume (V_i), veh/h	840	85
Peak Hour Factor (PHF)	0.82	0.82
Total Trucks, %	10.00	10.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.909
Flow Rate (v_i), pc/h	1127	114
Capacity (c), pc/h	4550	2033
Volume-to-Capacity Ratio (v/c)	0.25	0.06

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	11.4
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.323
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	59.1
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	1127	Ramp Junction Speed (S), mi/h	59.1
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	9.5
Level of Service (LOS)	B		

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Project Information

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Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	3655	1500
Terrain Type	Rolling	Rolling
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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 (V_i), veh/h	755	285
Peak Hour Factor (PHF)	0.82	0.82
Total Trucks, %	20.00	10.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.714	0.833
Flow Rate (v_i), pc/h	1290	417
Capacity (c), pc/h	4550	2033
Volume-to-Capacity Ratio (v/c)	0.38	0.21

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	9.3
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.211
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	62.0
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	1290	Ramp Junction Speed (S), mi/h	62.0
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	1707	Average Density (D), pc/mi/ln	13.8
Level of Service (LOS)	A		

HCS7 Freeway Diverge Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	AM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Deceleration Length (L_D), ft	5705	1500
Terrain Type	Rolling	Rolling
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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)	1.000	1.000

Demand and Capacity

	Freeway	Ramp
Demand Volume (V_i), veh/h	1040	134
Peak Hour Factor (PHF)	0.82	0.82
Total Trucks, %	7.00	7.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.877	0.877
Flow Rate (v_i), pc/h	1446	186
Capacity (c), pc/h	6824	2033
Volume-to-Capacity Ratio (v/c)	0.21	0.09

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	0.1
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.329
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	359
Distance to Downstream Ramp (L_{DOWN}), ft	1080	Off-Ramp Influence Area Speed (S_R), mi/h	59.0
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.715	Outer Lanes Freeway Speed (S_O), mi/h	73.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	1087	Ramp Junction Speed (S), mi/h	62.1
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	7.8
Level of Service (LOS)	A		

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Project Information

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Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	35.0
Segment Length (L) / Acceleration Length (L_A), ft	1080	1500
Terrain Type	Level	Rolling
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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)	1.000	1.000

Demand and Capacity

	Freeway	Ramp
Demand Volume (V_i), veh/h	905	495
Peak Hour Factor (PHF)	0.82	0.82
Total Trucks, %	7.00	7.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.877
Flow Rate (v_i), pc/h	1180	688
Capacity (c), pc/h	4550	1936
Volume-to-Capacity Ratio (v/c)	0.41	0.36

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	10.4
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.244
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	61.1
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	1180	Ramp Junction Speed (S), mi/h	61.1
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	1868	Average Density (D), pc/mi/ln	15.3
Level of Service (LOS)	B		

HCS7 Freeway Diverge Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	AM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Deceleration Length (L_D), ft	5500	1500
Terrain Type	Level	Rolling
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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)	1.000	1.000

Demand and Capacity

	Freeway	Ramp
Demand Volume (V_i), veh/h	2100	270
Peak Hour Factor (PHF)	0.82	0.82
Total Trucks, %	7.00	10.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.833
Flow Rate (v_i), pc/h	2739	395
Capacity (c), pc/h	6824	2033
Volume-to-Capacity Ratio (v/c)	0.40	0.19

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	7.7
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.348
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	766
Distance to Downstream Ramp (L_{DOWN}), ft	1000	Off-Ramp Influence Area Speed (S_R), mi/h	58.5
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.673	Outer Lanes Freeway Speed (S_O), mi/h	73.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	1973	Ramp Junction Speed (S), mi/h	62.1
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	14.7
Level of Service (LOS)	A		

HCS7 Freeway Merge Report

Project Information

Analyst	RL	Date	2/26/2018
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Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1000	1500
Terrain Type	Level	Rolling
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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)	1.000	1.000

Demand and Capacity

	Freeway	Ramp
Demand Volume (V_i), veh/h	1830	240
Peak Hour Factor (PHF)	0.82	0.82
Total Trucks, %	7.00	7.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.877
Flow Rate (v_i), pc/h	2387	334
Capacity (c), pc/h	4550	2033
Volume-to-Capacity Ratio (v/c)	0.60	0.16

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	17.2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.249
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	61.0
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	2387	Ramp Junction Speed (S), mi/h	61.0
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2721	Average Density (D), pc/mi/ln	22.3
Level of Service (LOS)	B		

HCS7 Freeway Diverge Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
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Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	2
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Deceleration Length (L_D), ft	5195	1500
Terrain Type	Level	Rolling
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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 (V_i), veh/h	2070	1625
Peak Hour Factor (PHF)	0.82	0.82
Total Trucks, %	7.00	7.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.877
Flow Rate (v_i), pc/h	2700	2260
Capacity (c), pc/h	6824	4066
Volume-to-Capacity Ratio (v/c)	0.40	0.56

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	11.9
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.516
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	242
Distance to Downstream Ramp (L_{DOWN}), ft	3445	Off-Ramp Influence Area Speed (S_R), mi/h	54.2
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.450	Outer Lanes Freeway Speed (S_O), mi/h	73.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	2458	Ramp Junction Speed (S), mi/h	55.5
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	16.2
Level of Service (LOS)	B		

HCS7 Freeway Merge Report

Project Information

Analyst	RL	Date	2/26/2018
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Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	3445	1050
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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 (V_i), veh/h	445	50
Peak Hour Factor (PHF)	0.82	0.82
Total Trucks, %	10.00	10.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.909
Flow Rate (v_i), pc/h	597	67
Capacity (c), pc/h	4550	2033
Volume-to-Capacity Ratio (v/c)	0.15	0.03

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	4.1
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.236
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	61.3
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	597	Ramp Junction Speed (S), mi/h	61.3
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	664	Average Density (D), pc/mi/ln	5.4
Level of Service (LOS)	A		

HCS7 Freeway Diverge Report

Project Information

Analyst	RL	Date	2/26/2018
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Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Deceleration Length (L_D), ft	4075	550
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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)	1.000	1.000

Demand and Capacity

	Freeway	Ramp
Demand Volume (V_i), veh/h	495	295
Peak Hour Factor (PHF)	0.82	0.82
Total Trucks, %	10.00	10.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.909
Flow Rate (v_i), pc/h	664	396
Capacity (c), pc/h	4550	2033
Volume-to-Capacity Ratio (v/c)	0.15	0.19

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	5.0
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.348
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	10000	Off-Ramp Influence Area Speed (S_R), mi/h	58.5
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	664	Ramp Junction Speed (S), mi/h	58.5
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	5.7
Level of Service (LOS)	A		

HCS7 Freeway Diverge Report

Project Information

Analyst	RL	Date	2/26/2018
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Jurisdiction	SDDOT	Time Period Analyzed	AM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	35.0
Segment Length (L) / Deceleration Length (L_D), ft	1885	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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 (V_i), veh/h	270	270
Peak Hour Factor (PHF)	0.82	0.82
Total Trucks, %	10.00	10.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.909
Flow Rate (v_i), pc/h	362	362
Capacity (c), pc/h	4550	1936
Volume-to-Capacity Ratio (v/c)	0.08	0.19

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	0.0
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.472
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	55.4
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	362	Ramp Junction Speed (S), mi/h	55.4
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	3.3
Level of Service (LOS)	A		

HCS7 Freeway Merge Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	AM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	35.0
Segment Length (L) / Acceleration Length (L_A), ft	1750	250
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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 (V_i), veh/h	235	265
Peak Hour Factor (PHF)	0.82	0.82
Total Trucks, %	2.00	10.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.980	0.909
Flow Rate (v_i), pc/h	292	356
Capacity (c), pc/h	4550	1936
Volume-to-Capacity Ratio (v/c)	0.14	0.18

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	8.9
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.311
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	59.4
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	292	Ramp Junction Speed (S), mi/h	59.4
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	648	Average Density (D), pc/mi/ln	5.5
Level of Service (LOS)	A		

HCS7 Freeway Merge Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	HDR	Time Period Analyzed	PM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	35.0
Segment Length (L) / Acceleration Length (L_A), ft	1750	250
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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 (V_i), veh/h	225	280
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	2.00	10.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.980	0.909
Flow Rate (v_i), pc/h	250	335
Capacity (c), pc/h	4550	1936
Volume-to-Capacity Ratio (v/c)	0.13	0.17

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	8.4
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.311
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	59.4
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	250	Ramp Junction Speed (S), mi/h	59.4
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	585	Average Density (D), pc/mi/ln	4.9
Level of Service (LOS)	A		

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Project Information

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Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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)	1.000	1.000

Demand and Capacity

	Freeway	Ramp
Demand Volume (V_i), veh/h	505	355
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	10.00	10.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.909
Flow Rate (v_i), pc/h	604	424
Capacity (c), pc/h	4550	2033
Volume-to-Capacity Ratio (v/c)	0.23	0.21

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	4.0
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.200
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	62.2
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	604	Ramp Junction Speed (S), mi/h	62.2
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	1028	Average Density (D), pc/mi/ln	8.3
Level of Service (LOS)	A		

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Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Deceleration Length (L_D), ft	3620	280
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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 (V_i), veh/h	860	30
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	10.00	10.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.909
Flow Rate (v_i), pc/h	1028	36
Capacity (c), pc/h	4550	2033
Volume-to-Capacity Ratio (v/c)	0.23	0.02

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	10.6
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.316
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	59.3
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	1028	Ramp Junction Speed (S), mi/h	59.3
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	8.7
Level of Service (LOS)	B		

HCS7 Freeway Merge Report

Project Information

Analyst	RL	Date	2/26/2018
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Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	3655	1500
Terrain Type	Rolling	Rolling
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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 (V_i), veh/h	830	1455
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	20.00	10.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.714	0.833
Flow Rate (v_i), pc/h	1264	1899
Capacity (c), pc/h	4550	2033
Volume-to-Capacity Ratio (v/c)	0.70	0.93

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	19.9
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.282
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	60.2
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	1264	Ramp Junction Speed (S), mi/h	60.2
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3163	Average Density (D), pc/mi/ln	26.3
Level of Service (LOS)	B		

HCS7 Freeway Diverge Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	PM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Deceleration Length (L_D), ft	5705	1500
Terrain Type	Level	Rolling
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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)	1.000	1.000

Demand and Capacity

	Freeway	Ramp
Demand Volume (V_i), veh/h	2285	305
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	7.00	10.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.833
Flow Rate (v_i), pc/h	2656	398
Capacity (c), pc/h	6824	2033
Volume-to-Capacity Ratio (v/c)	0.39	0.20

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	7.3
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.348
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	734
Distance to Downstream Ramp (L_{DOWN}), ft	1080	Off-Ramp Influence Area Speed (S_R), mi/h	58.5
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.675	Outer Lanes Freeway Speed (S_O), mi/h	73.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	1922	Ramp Junction Speed (S), mi/h	62.1
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	14.3
Level of Service (LOS)	A		

HCS7 Freeway Merge Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	PM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	35.0
Segment Length (L) / Acceleration Length (L_A), ft	1080	1500
Terrain Type	Level	Rolling
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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)	1.000	1.000

Demand and Capacity

	Freeway	Ramp
Demand Volume (V_i), veh/h	1980	320
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	7.00	7.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.877
Flow Rate (v_i), pc/h	2302	397
Capacity (c), pc/h	4550	1936
Volume-to-Capacity Ratio (v/c)	0.59	0.21

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	17.0
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.277
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	60.3
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	2302	Ramp Junction Speed (S), mi/h	60.3
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2699	Average Density (D), pc/mi/ln	22.4
Level of Service (LOS)	B		

HCS7 Freeway Diverge Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	PM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Deceleration Length (L_D), ft	5500	1500
Terrain Type	Level	Rolling
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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)	1.000	1.000

Demand and Capacity

	Freeway	Ramp
Demand Volume (V_i), veh/h	1400	445
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	7.00	10.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.833
Flow Rate (v_i), pc/h	1628	581
Capacity (c), pc/h	6824	2033
Volume-to-Capacity Ratio (v/c)	0.24	0.29

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	2.0
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.365
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	321
Distance to Downstream Ramp (L_{DOWN}), ft	1000	Off-Ramp Influence Area Speed (S_R), mi/h	58.1
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.693	Outer Lanes Freeway Speed (S_O), mi/h	73.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	1307	Ramp Junction Speed (S), mi/h	60.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	9.0
Level of Service (LOS)	A		

HCS7 Freeway Merge Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	PM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1000	1500
Terrain Type	Level	Rolling
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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)	1.000	1.000

Demand and Capacity

	Freeway	Ramp
Demand Volume (V_i), veh/h	955	145
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	7.00	7.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.877
Flow Rate (v_i), pc/h	1110	180
Capacity (c), pc/h	4550	2033
Volume-to-Capacity Ratio (v/c)	0.28	0.09

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	6.1
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.203
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	62.2
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	1110	Ramp Junction Speed (S), mi/h	62.2
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	1290	Average Density (D), pc/mi/ln	10.4
Level of Service (LOS)	A		

HCS7 Freeway Diverge Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	PM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	2
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Deceleration Length (L_D), ft	5195	1500
Terrain Type	Level	Rolling
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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 (V_i), veh/h	1100	375
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	7.00	7.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.877
Flow Rate (v_i), pc/h	1279	465
Capacity (c), pc/h	6824	4066
Volume-to-Capacity Ratio (v/c)	0.19	0.11

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	0.0
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.354
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	448
Distance to Downstream Ramp (L_{DOWN}), ft	3445	Off-Ramp Influence Area Speed (S_R), mi/h	58.3
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.450	Outer Lanes Freeway Speed (S_O), mi/h	73.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	831	Ramp Junction Speed (S), mi/h	62.9
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	6.8
Level of Service (LOS)	A		

HCS7 Freeway Merge Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	PM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	3445	1050
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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 (V_i), veh/h	725	165
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	10.00	10.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.909
Flow Rate (v_i), pc/h	867	197
Capacity (c), pc/h	4550	2033
Volume-to-Capacity Ratio (v/c)	0.23	0.10

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	7.2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.240
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	61.2
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	867	Ramp Junction Speed (S), mi/h	61.2
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	1064	Average Density (D), pc/mi/ln	8.7
Level of Service (LOS)	A		

HCS7 Freeway Diverge Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	PM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	45.0
Segment Length (L) / Deceleration Length (L_D), ft	4075	550
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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 (V_i), veh/h	890	310
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	10.00	10.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.909
Flow Rate (v_i), pc/h	1064	371
Capacity (c), pc/h	4550	2033
Volume-to-Capacity Ratio (v/c)	0.23	0.18

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	8.5
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.346
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	10000	Off-Ramp Influence Area Speed (S_R), mi/h	58.5
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	1064	Ramp Junction Speed (S), mi/h	58.5
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	9.1
Level of Service (LOS)	A		

HCS7 Freeway Diverge Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	PM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	2	1
Free-Flow Speed (FFS), mi/h	69.0	35.0
Segment Length (L) / Deceleration Length (L_D), ft	1885	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

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)	1.000	1.000

Demand and Capacity

	Freeway	Ramp
Demand Volume (V_i), veh/h	580	285
Peak Hour Factor (PHF)	0.92	0.92
Total Trucks, %	10.00	10.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.909
Flow Rate (v_i), pc/h	694	341
Capacity (c), pc/h	4550	1936
Volume-to-Capacity Ratio (v/c)	0.15	0.18

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	0.0
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.470
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	55.4
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	-
Flow in Lanes 1 and 2 (v_{12}), pc/h	694	Ramp Junction Speed (S), mi/h	55.4
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	6.3
Level of Service (LOS)	A		

III. Freeway Analysis – Weaving

HCS7 Freeway Weaving Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	AM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Short Length (L_S), ft	5705	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	0.66	Cross Weaving Managed Lane	No

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

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	630	275	10	125
Peak Hour Factor (PHF)	0.82	0.82	0.82	0.82
Total Trucks, %	7.00	7.00	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.877	0.877	0.877
Flow Rate (v_i), pc/h	822	382	14	174

Weaving Flow Rate (v_w), pc/h	556	Freeway Max Capacity (c_{IFL}), pc/h/ln	2373
Non-Weaving Flow Rate (v_{NW}), pc/h	836	Density-Based Capacity (c_{IWL}), pc/h/ln	2299
Total Flow Rate (v), pc/h	1392	Demand Flow-Based Capacity (c_{IW}), pc/h	6015
Volume Ratio (VR)	0.399	Weaving Segment Capacity (c_W), veh/h	5624
Minimum Lane Change Rate (LC_{MIN}), lc/h	556	Adjusted Weaving Area Capacity, pc/h	5975
Maximum Weaving Length (L_{MAX}), ft	6670	Volume-to-Capacity Ratio (v/c)	0.23

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	315	Average Weaving Speed (S_W), mi/h	61.3
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1875	Average Non-Weaving Speed (S_{NW}), mi/h	61.1
Weaving Lane Change Rate (LC_W), lc/h	943	Average Speed (S), mi/h	61.2
Total Lane Change Rate (LC_{All}), lc/h	2818	Density (D), pc/mi/ln	7.6
Weaving Intensity Factor (W)	0.130	Level of Service (LOS)	A

HCS7 Freeway Weaving Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	AM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Highway/CD Roadway
Short Length (L_S), ft	5195	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	0.66	Cross Weaving Managed Lane	No

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

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	305	140	100	1525
Peak Hour Factor (PHF)	0.92	0.92	0.92	0.92
Total Trucks, %	7.00	7.00	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.877	0.877	0.877
Flow Rate (v_i), pc/h	355	174	124	1890

Weaving Flow Rate (v_w), pc/h	2064	Freeway Max Capacity (c_{IFL}), pc/h/ln	2373
Non-Weaving Flow Rate (v_{NW}), pc/h	479	Density-Based Capacity (c_{IWL}), pc/h/ln	1876
Total Flow Rate (v), pc/h	2543	Demand Flow-Based Capacity (c_{IW}), pc/h	2956
Volume Ratio (VR)	0.812	Weaving Segment Capacity (c_W), veh/h	2764
Minimum Lane Change Rate (LC_{MIN}), lc/h	2064	Adjusted Weaving Area Capacity, pc/h	3024
Maximum Weaving Length (L_{MAX}), ft	11695	Volume-to-Capacity Ratio (v/c)	0.84

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	164	Average Weaving Speed (S_W), mi/h	58.9
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1796	Average Non-Weaving Speed (S_{NW}), mi/h	48.4
Weaving Lane Change Rate (LC_W), lc/h	2432	Average Speed (S), mi/h	56.6
Total Lane Change Rate (LC_{All}), lc/h	4228	Density (D), pc/mi/ln	15.0
Weaving Intensity Factor (W)	0.192	Level of Service (LOS)	B

HCS7 Freeway Weaving Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	PM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Short Length (L_S), ft	5705	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	0.66	Cross Weaving Managed Lane	No

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

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	555	1425	30	275
Peak Hour Factor (PHF)	0.92	0.92	0.92	0.92
Total Trucks, %	7.00	7.00	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.877	0.877	0.877
Flow Rate (v_i), pc/h	645	1766	37	341

Weaving Flow Rate (v_w), pc/h	2107	Freeway Max Capacity (c_{IFL}), pc/h/ln	2373
Non-Weaving Flow Rate (v_{NW}), pc/h	682	Density-Based Capacity (c_{IWL}), pc/h/ln	1971
Total Flow Rate (v), pc/h	2789	Demand Flow-Based Capacity (c_{IW}), pc/h	3179
Volume Ratio (VR)	0.755	Weaving Segment Capacity (c_W), veh/h	2972
Minimum Lane Change Rate (LC_{MIN}), lc/h	2107	Adjusted Weaving Area Capacity, pc/h	3231
Maximum Weaving Length (L_{MAX}), ft	10956	Volume-to-Capacity Ratio (v/c)	0.86

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	257	Average Weaving Speed (S_W), mi/h	59.2
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1841	Average Non-Weaving Speed (S_{NW}), mi/h	47.7
Weaving Lane Change Rate (LC_W), lc/h	2494	Average Speed (S), mi/h	55.9
Total Lane Change Rate (LC_{All}), lc/h	4335	Density (D), pc/mi/ln	16.6
Weaving Intensity Factor (W)	0.182	Level of Service (LOS)	B

HCS7 Freeway Weaving Report

Project Information

Analyst	RL	Date	2/26/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	SDDOT	Time Period Analyzed	PM PEAK
Project Description	I-229/BENSON IMJR		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Short Length (L_S), ft	5195	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	0.66	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	Mostly Unfamiliar	Final Speed Adjustment Factor (SAF)	0.913
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.898
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	640	85	60	315
Peak Hour Factor (PHF)	0.92	0.92	0.92	0.92
Total Trucks, %	7.00	7.00	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.877	0.877	0.877
Flow Rate (v_i), pc/h	744	105	74	390

Weaving Flow Rate (v_w), pc/h	495	Freeway Max Capacity (c_{IFL}), pc/h/ln	2330
Non-Weaving Flow Rate (v_{NW}), pc/h	818	Density-Based Capacity (c_{IWL}), pc/h/ln	2236
Total Flow Rate (v), pc/h	1313	Demand Flow-Based Capacity (c_{IW}), pc/h	6366
Volume Ratio (VR)	0.377	Weaving Segment Capacity (c_W), veh/h	5952
Minimum Lane Change Rate (LC_{MIN}), lc/h	495	Adjusted Weaving Area Capacity, pc/h	5870
Maximum Weaving Length (L_{MAX}), ft	6424	Volume-to-Capacity Ratio (v/c)	0.22

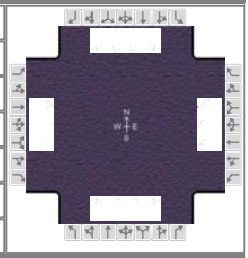
Speed and Density

Non-Weaving Vehicle Index (I_{NW})	280	Average Weaving Speed (S_W), mi/h	57.3
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1871	Average Non-Weaving Speed (S_{NW}), mi/h	57.3
Weaving Lane Change Rate (LC_W), lc/h	863	Average Speed (S), mi/h	57.3
Total Lane Change Rate (LC_{All}), lc/h	2734	Density (D), pc/mi/ln	7.6
Weaving Intensity Factor (W)	0.136	Level of Service (LOS)	A

IV. Arterial Analysis

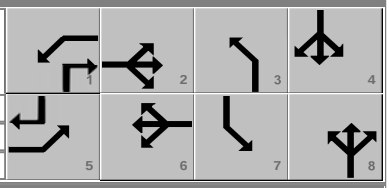
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	RL	Analysis Date	Jan 23, 2018	Area Type	Other
Jurisdiction	CITY OF SIOUX FALLS	Time Period	AM PEAK	PHF	0.80
Urban Street	BENSON ROAD	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	CLIFF AVENUE	File Name	BENSON AM.xus		
Project Description	I-229/BENSON IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	90	235	75	50	510	255	105	265	50	80	295	165

Signal Information												
Cycle, s	57.9	Reference Phase	2									
Offset, s	0	Reference Point	Begin									
Uncoordinated	Yes	Simult. Gap E/W	On	Green	1.7	2.4	15.0	3.7	1.1	15.0		
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	3.0	0.0	3.5	3.0	0.0	3.5		
				Red	1.0	0.0	2.0	1.0	0.0	2.0		



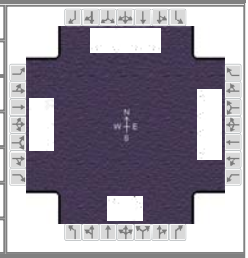
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	4.0	1.1	4.0	1.1	3.0	1.1	3.0
Phase Duration, s	8.1	22.9	5.7	20.5	8.8	21.6	7.7	20.5
Change Period, ($Y+R_c$), s	4.0	5.5	4.0	5.5	4.0	5.5	4.0	5.5
Max Allow Headway (*MAH*), s	5.1	1.0	5.1	1.0	5.1	1.0	5.1	1.0
Queue Clearance Time (g_s), s	4.8	6.8	2.9	8.8	5.3	6.7	4.5	7.4
Green Extension Time (g_e), s	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Phase Call Probability	0.84	1.00	0.42	1.00	0.88	1.00	0.80	1.00
Max Out Probability	1.00	0.00	0.93	0.00	1.00	0.00	1.00	0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	113	178	172	34	232	218	131	331	38	100	369	125
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1647	1730	1634	1647	1730	1592	1647	1647	1466	1647	1647	1466
Queue Service Time (g_s), s	2.8	4.6	4.8	0.9	6.6	6.8	3.3	4.7	1.1	2.5	5.4	3.6
Cycle Queue Clearance Time (g_c), s	2.8	4.6	4.8	0.9	6.6	6.8	3.3	4.7	1.1	2.5	5.4	3.6
Green Ratio (*g/C*)	0.34	0.30	0.30	0.29	0.26	0.26	0.34	0.28	0.31	0.32	0.26	0.33
Capacity (*c*), veh/h	372	521	492	358	448	413	424	914	449	396	853	484
Volume-to-Capacity Ratio (*X*)	0.303	0.341	0.349	0.094	0.517	0.529	0.309	0.363	0.083	0.253	0.432	0.258
Back of Queue (*Q*), ft/ln (95 th percentile)	44.2	74.3	69.3	13.7	108.8	99.3	51.3	72	14.2	39.7	83.9	47.9
Back of Queue (*Q*), veh/ln (95 th percentile)	1.7	2.9	2.8	0.5	4.2	4.0	2.0	2.8	0.5	1.5	3.2	1.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.23	0.00	0.00	0.10	0.00	0.00	0.17	0.00	0.06	0.11	0.00	0.15
Uniform Delay (d_1), s/veh	14.1	15.8	15.8	15.1	18.3	18.4	13.9	16.8	14.3	14.4	17.9	14.2
Incremental Delay (d_2), s/veh	0.6	0.1	0.2	0.1	0.3	0.3	0.6	0.1	0.0	0.5	0.1	0.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	14.8	15.9	16.0	15.3	18.6	18.7	14.5	16.9	14.3	14.9	18.0	14.3
Level of Service (LOS)	B	B	B	B	B	B	B	B	B	B	B	B
Approach Delay, s/veh / LOS	15.6	B		18.4	B		16.1	B		16.7	B	
Intersection Delay, s/veh / LOS	16.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.71	C	2.86	C	2.83	C	2.73	C
Bicycle LOS Score / LOS	2.64	C	3.00	C	2.80	C	2.88	C

HCS7 Signalized Intersection Results Summary

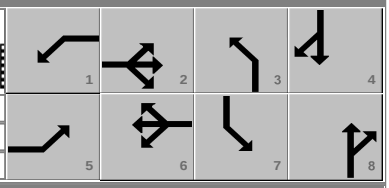
General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	RL	Analysis Date	Jan 23, 2018	Area Type	Other
Jurisdiction	CITY OF SIOUX FALLS	Time Period	AM PEAK	PHF	0.80
Urban Street	BENSON ROAD	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	LEWIS AVENUE	File Name	BENSON AM.xus		
Project Description	I-229/BENSON IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	105	215	25	55	860	390	15	15	25	55	20	65

Signal Information			
Cycle, s	45.7	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	1.5	2.1	15.0	0.8	1.5	3.2						
Yellow	3.9	0.0	3.9	3.6	0.0	3.6						
Red	1.0	0.0	2.2	1.0	0.0	2.2						



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	4.0	1.1	3.0	2.0	4.0	2.0	3.0
Phase Duration, s	8.6	23.2	6.4	21.1	5.4	9.0	6.9	10.5
Change Period, ($Y+R_c$), s	4.9	6.1	4.9	6.1	4.6	5.8	4.6	5.8
Max Allow Headway (*MAH*), s	5.1	1.0	5.1	1.0	5.1	1.2	5.1	1.2
Queue Clearance Time (g_s), s	4.3	4.6	2.7	8.9	2.5	3.0	3.0	3.4
Green Extension Time (g_e), s	0.2	0.1	0.0	0.1	0.0	0.0	0.1	0.0
Phase Call Probability	0.81	1.00	0.39	1.00	0.21	0.81	0.58	0.90
Max Out Probability	1.00	0.00	0.27	0.00	0.18	0.00	0.43	0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	131	145	143	38	602	164	19	38		69	25	50
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1647	1730	1690	1647	1647		1647	1587		1600	1730	1466
Queue Service Time (g_s), s	2.3	2.6	2.6	0.7	6.9		0.5	1.0		1.0	0.6	1.4
Cycle Queue Clearance Time (g_c), s	2.3	2.6	2.6	0.7	6.9		0.5	1.0		1.0	0.6	1.4
Green Ratio (*g/C*)	0.41	0.38	0.38	0.36	0.33		0.02	0.07		0.05	0.10	0.10
Capacity (*c*), veh/h	433	649	634	506	1082		31	113		163	179	152
Volume-to-Capacity Ratio (*X*)	0.303	0.223	0.225	0.076	0.556		0.613	0.332		0.421	0.140	0.329
Back of Queue (*Q*), ft/ln (95 th percentile)	30.3	34.5	32.8	8.8	67.2		18.3	16.5		17.3	10.1	20.9
Back of Queue (*Q*), veh/ln (95 th percentile)	1.2	1.3	1.3	0.3	2.6		0.7	0.6		0.7	0.4	0.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.15	0.00	0.00	0.13	0.00		0.46	0.00		0.06	0.00	0.00
Uniform Delay (d_1), s/veh	9.3	9.7	9.7	9.6	12.6		22.2	20.2		21.0	18.6	19.0
Incremental Delay (d_2), s/veh	0.5	0.1	0.1	0.0	0.0		25.0	0.6		2.4	0.1	0.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Control Delay (*d*), s/veh	9.8	9.8	9.8	9.6	12.6	0.0	47.3	20.8		23.5	18.7	19.5
Level of Service (LOS)	A	A	A	A	B	A	D	C		C	B	B
Approach Delay, s/veh / LOS	9.8	A		9.9	A		29.6	C		21.3	C	
Intersection Delay, s/veh / LOS	11.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.99	B	2.58	C	3.09	C	2.71	C
Bicycle LOS Score / LOS	2.61	C	3.45	C	2.02	B	2.32	B

HCS7 Two-Way Stop-Control Report

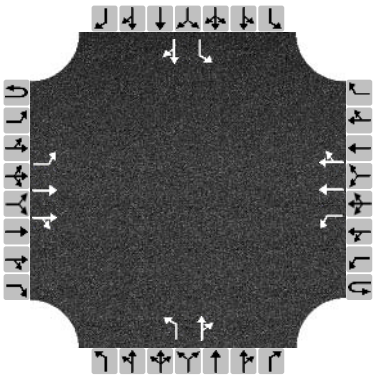
General Information

Analyst	RL
Agency/Co.	HDR
Date Performed	1/23/2018
Analysis Year	2018
Time Analyzed	AM PEAK
Intersection Orientation	East-West
Project Description	I-229/BENSON IMJR

Site Information

Intersection	BENSON/POTSDAM
Jurisdiction	CITY OF SIOUX FALLS
East/West Street	BENSON ROAD
North/South Street	POTSDAM AVENUE
Peak Hour Factor	0.81
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	1	2	0		1	1	0		1	1	0
Configuration		L	T	TR		L	T	TR		L		TR		L		TR
Volume, V (veh/h)		15	260	35		120	1335	260		10	5	65		5	0	10
Percent Heavy Vehicles (%)		5				5				5	5	5		5	5	5
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.5	6.5	6.9		7.5	6.5	6.9
Critical Headway (sec)		4.20				4.20				7.60	6.60	7.00		7.60	6.60	7.00
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.25				2.25				3.55	4.05	3.35		3.55	4.05	3.35

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		19				148				12		86		6		12
Capacity, c (veh/h)		280				1170				67		195		11		242
v/c Ratio		0.07				0.13				0.19		0.44		0.55		0.05
95% Queue Length, Q_{95} (veh)		0.2				0.4				0.6		2.1		1.2		0.2
Control Delay (s/veh)		18.8				8.5				70.8		37.5		519.3		20.7
Level of Service, LOS		C				A				F		E		F		C
Approach Delay (s/veh)		0.9				0.6				41.7				186.9		
Approach LOS										E				F		

HCS7 Two-Way Stop-Control Report

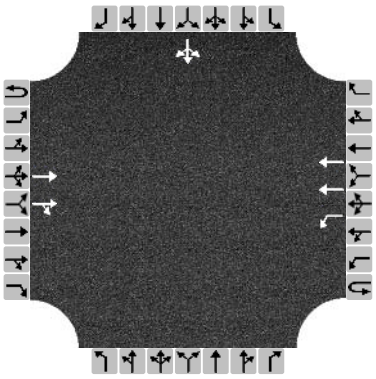
General Information

Analyst	RL
Agency/Co.	HDR
Date Performed	1/23/2018
Analysis Year	2018
Time Analyzed	AM PEAK
Intersection Orientation	East-West
Project Description	I-229/BENSON IMJR

Site Information

Intersection	BENSON/I-229 SB
Jurisdiction	CITY OF SIOUX FALLS
East/West Street	BENSON ROAD
North/South Street	I-229 SB
Peak Hour Factor	0.84
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	1	2	0		0	0	0		0	1	0
Configuration			T	TR		L	T								LTR	
Volume, V (veh/h)			55	275		10	1630							0	0	85
Percent Heavy Vehicles (%)						5								5	5	5
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized			No				No				No				No	
Median Type/Storage							Undivided									

Critical and Follow-up Headways

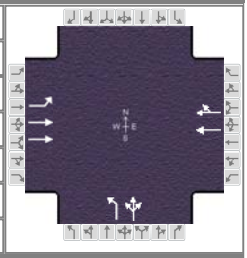
Base Critical Headway (sec)						4.1								7.5	6.5	6.9
Critical Headway (sec)						4.20								6.90	6.60	7.00
Base Follow-Up Headway (sec)						2.2								3.5	4.0	3.3
Follow-Up Headway (sec)						2.25								3.55	4.05	3.35

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						12									101	
Capacity, c (veh/h)						1141									248	
v/c Ratio						0.01									0.41	
95% Queue Length, Q_{95} (veh)						0.0									1.9	
Control Delay (s/veh)						8.2									29.2	
Level of Service, LOS						A									D	
Approach Delay (s/veh)						0.0								29.2		
Approach LOS														D		

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	RL	Analysis Date	Jan 23, 2018	Area Type	Other
Jurisdiction	CITY OF SIOUX FALLS	Time Period	AM PEAK	PHF	0.81
Urban Street	BENSON ROAD	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	BENSON AM.xus		
Project Description	I-229/BENSON IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	50	5			30	0	1610	0	15			

Signal Information			
Cycle, s	65.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

								1	2	3	4
Green	7.0	47.0	0.0	0.0	0.0	0.0					
Yellow	3.5	3.5	0.0	0.0	0.0	0.0					
Red	2.0	2.0	0.0	0.0	0.0	0.0	5	6	7	8	

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		6.0		8.0		10.0		
Phase Duration, s		12.5		12.5		52.5		
Change Period, ($Y+R_c$), s		5.5		5.5		5.5		
Max Allow Headway (*MAH*), s		5.1		5.1		5.0		
Queue Clearance Time (g_s), s		5.4		2.7		49.0		
Green Extension Time (g_e), s		0.2		0.3		0.0		
Phase Call Probability		1.00		1.00		1.00		
Max Out Probability		0.15		0.02		1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16	3	8	18			
Adjusted Flow Rate (*v*), veh/h	59	6			37	0	1988	12				
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1338	1539			1619	0	1647	1371				
Queue Service Time (g_s), s	2.7	0.1			0.7	0.0	47.0	0.2				
Cycle Queue Clearance Time (g_c), s	3.4	0.1			0.7	0.0	47.0	0.2				
Green Ratio (*g/C*)	0.11	0.11			0.11		0.72	0.72				
Capacity (*c*), veh/h	241	332			349		1191	992				
Volume-to-Capacity Ratio (*X*)	0.246	0.018			0.106	0.000	1.669	0.012				
Back of Queue (*Q*), ft/ln (95 th percentile)	39.9	1.8			11.6	0	4471.5	0.9				
Back of Queue (*Q*), veh/ln (95 th percentile)	1.5	0.1			0.4	0.0	172.0	0.0				
Queue Storage Ratio (*RQ*) (95 th percentile)	0.40	0.00			0.00	0.00	0.00	0.00				
Uniform Delay (d_1), s/veh	27.7	25.9			26.2		9.0	2.5				
Incremental Delay (d_2), s/veh	0.7	0.0			0.2	0.0	304.6	0.0				
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0	0.0	0.0	0.0				
Control Delay (*d*), s/veh	28.4	26.0			26.4		313.6	2.5				
Level of Service (LOS)	C	C			C		F	A				
Approach Delay, s/veh / LOS	28.2	C		26.4	C		311.7	F		0.0		
Intersection Delay, s/veh / LOS	297.8						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.18	C	1.43	A	2.16	B	2.88	C
Bicycle LOS Score / LOS	2.53	C	2.51	C	5.47	E		

HCS7 Two-Way Stop-Control Report

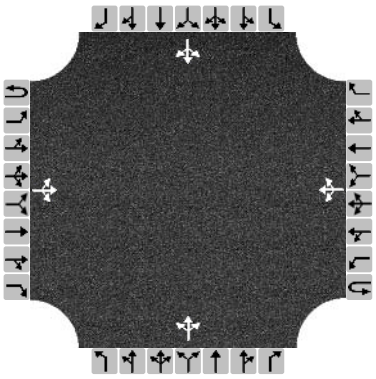
General Information

Analyst	RL
Agency/Co.	HDR
Date Performed	1/23/2018
Analysis Year	2018
Time Analyzed	AM PEAK
Intersection Orientation	East-West
Project Description	I-229/BENSON IMJR

Site Information

Intersection	BENSON/HALL
Jurisdiction	CITY OF SIOUX FALLS
East/West Street	BENSON ROAD
North/South Street	HALL AVENUE
Peak Hour Factor	0.66
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		5	15	0		0	25	0		0	0	0		0	0	5
Percent Heavy Vehicles (%)		5				5				5	5	5		5	5	5
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.15				4.15				7.15	6.55	6.25		7.15	6.55	6.25
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		8				0					0				8	
Capacity, c (veh/h)		1557				1576					0				1027	
v/c Ratio		0.00				0.00									0.01	
95% Queue Length, Q_{95} (veh)		0.0				0.0									0.0	
Control Delay (s/veh)		7.3				7.3					5.0				8.5	
Level of Service, LOS		A				A					A				A	
Approach Delay (s/veh)		1.9				0.0				5.0				8.5		
Approach LOS										A				A		

HCS7 Streets Text Report

File Name:	BENSON AM.xus
Analyst:	RL
Agency/Co.:	HDR
Analysis Date:	Jan 23, 2018
Time Period:	AM PEAK
Jurisdiction:	CITY OF SIOUX FALLS
Analysis Year:	2018
Project Description:	I-229/BENSON IMJR
Urban Street:	BENSON ROAD
Analysis Period:	1> 7:00

Input

URBAN STREET PARAMETERS

Number of Intersections	3
Number of Segments	2
Analysis period duration, h	0.25
System cycle length, s	65
Urban street forward direction	EB
Sneakers per cycle, veh	2
Saturation flow rate, veh/h/ln	1900
Stored vehicle lane length, ft	25
Detected vehicle length, ft	17
Queue length percent	95
Critical merge gap, s	3.7
Stop threshold speed, mph	5
Acceleration rate, ft/s/s	3.5
Decel. rate (signal), ft/s/s	4
Minimum headway in a platoon, s/veh	1.5
Maximum headway in a platoon, s/veh	3.6
Number of iterations	15
Length of left-turn bay (access pt.), ft	250
Decel. rate (access pt.), ft/s/s	6.7
Right-turn speed (access pt.), ft/s	20
Critical gap from major left (access pt.), s	4.1
Follow-up time from major left (access pt.), s	2.2
Right-turn equivalency factor (access pt.)	2.2
Stored heavy vehicle lane length, ft	45
Proportion of peds who push button	0.51
Critical gap for permissive left-turn, s	4.5
Follow-up time for permissive left-turn, s	2.5
Calibration factor for platoon dispersion	0.14
Average ratio of speed limit to free-flow speed	0.9

BASIC SEGMENT INFORMATION

Seg	Spd Lmt		TH Lanes		Seg Len		IntWid		LenRM		PctCurb		Other Dly	
Num	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
1	40	40	2	2	2645	2645	50	50	0	0	70	70	0	0
2	40	40	2	2	2955	2955	50	50	0	0	70	70	0	0

ORIGIN-DESTINATION SEED PROPORTIONS - Forward Direction

	Cross LT	Major TH	Cross RT	MidEntry
Downstream Left	0.02	0.1	0.05	0.02
Downstream Thru	0.91	0.78	0.92	0.97
Downstream Right	0.05	0.1	0.02	0.01
Mid-segment Exit	0.02	0.02	0.01	0

ORIGIN-DESTINATION SEED PROPORTIONS - Reverse Direction

	Cross LT	Major TH	Cross RT	MidEntry
Downstream Left	0.02	0.1	0.05	0.02
Downstream Thru	0.91	0.78	0.92	0.97
Downstream Right	0.05	0.1	0.02	0.01
Mid-segment Exit	0.02	0.02	0.01	0

ACCESS POINT DATA

SEGMENT 1

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Movement	1	2	3	4	5	6	7	8	9	10	11	12
1: Volume, veh/h	0	345	20	0	815	125	0	0	0	0	0	0
1: Lanes	1	2	0	1	2	0	0	1	0	0	1	0
1: Location, ft	1320											
1: Peak Hour Factor	1											

Number of access points: 1

SEGMENT 2

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Movement	1	2	3	4	5	6	7	8	9	10	11	12
1: Volume, veh/h	0	295	0	0	1305	50	0	0	0	15	0	0
1: Lanes	1	2	0	0	2	0	0	0	0	1	0	1
1: Location, ft	700											
1: Peak Hour Factor	1											
2: Volume, veh/h	15	260	35	120	1335	260	10	5	65	5	0	10
2: Lanes	1	2	0	1	2	0	1	1	0	0	1	0
2: Location, ft	1420											
2: Peak Hour Factor	1											
3: Volume, veh/h	0	55	275	10	1630	0	0	0	0	0	0	85
3: Lanes	0	2	0	1	2	0	0	0	0	0	1	0
3: Location, ft	1910											
3: Peak Hour Factor	1											

Number of access points: 3

Global Output

SEGMENT DATA

Seg.No.	Movement	EB LT 5	EB TH 2	EB RT 12	WB LT 1	WB TH 6	WB RT 16
1	Bay/Lane Spillback Time, h	999	999	999	999	999	999
1	ShrdLane Spillback Time, h	999			999		
1	Base Free-Flow Speed, mph		44.07			44.07	
1	Running Time, s		43			43.31	
1	Running Speed, mph		41.94			41.64	
1	Through Delay, s/veh		9.79			18.66	
1	Travel Speed, mph		34.16			29.1	
1	Stop Rate, stops/veh		0.51			0.65	
1	Spatial Stop Rate, stops/mi		1.01			1.31	
1	Through vol/cap ratio		0.22			0.52	
1	Percent of Base FFS		77.52			66.03	
1	Level of Service		B			C	
1	Automobile Perception Score		2.29			2.34	
2	Bay/Lane Spillback Time, h	999	999	999	999	999	999
2	ShrdLane Spillback Time, h	999			999		999
2	Base Free-Flow Speed, mph		44.07			44.07	
2	Running Time, s		47.59			48.82	
2	Running Speed, mph		42.34			41.27	
2	Through Delay, s/veh		25.96			12.61	
2	Travel Speed, mph		27.4			32.8	
2	Stop Rate, stops/veh		0.73			0.61	
2	Spatial Stop Rate, stops/mi		1.31			1.08	
2	Through vol/cap ratio		0.02			0.56	
2	Percent of Base FFS		62.16			74.42	
2	Level of Service		C			B	
2	Automobile Perception Score		2.39			2.41	

Facility Travel Time, s	126.33	123.4
Facility Travel Speed, mph	30.22	30.94
Facility Spatial Stop Rate, stops/mi	1.17	1.19
Facility Base Free Flow Speed, mph	44.07	44.07
Facility Percent Base Free Flow Speed	68.58	70.21
Facility Level of Service	B	B
Facility Automobile Perception Score	2.34	2.37
Facility Pedestrian Space	Infinity	Infinity
Facility Pedestrian Travel Speed	4.29	4.28
Facility Pedestrian LOS Score	2.57	3.18
Facility Pedestrian LOS	C	C
Facility Bicycle Travel Speed	13.76	13.13
Facility Bicycle LOS Score	2.55	2.9
Facility Bicycle LOS	C	C
Facility Transit Travel Speed	34.17	29.12
Facility Transit LOS Score	0.86	0.92
Facility Transit LOS	A	A

SPILLBACK TIME, h 999

Multimodal Results

1	Average Pedestrian Space, ft2/p	Infinity	Infinity
1	Pedestrian Travel Speed, ft/s	4.22	4.22
1	Ped LOS Score for Intersection	1.99	2.86
1	Cross-section Adjustment Factor	-4.74	-4.74
1	Volume Adjustment Factor	0.52	0.8
1	Speed Adjustment Factor	0.7	0.69
1	Ped LOS Score for Link	2.53	2.8
1	Ped Link LOS	C	C
1	Roadway Crossing Difficulty Factor	0.93	0.84
1	Ped LOS Score for Segment	2.63	2.65
1	Ped Segment LOS	B	B
1	Bicycle Travel Speed	13.42	13.82
1	Bicycle LOS Score for Intersection	2.61	3
1	Cross-section Adjustment Factor	-1.28	-1.28
1	Volume Adjustment Factor	2.05	2.27
1	Speed Adjustment Factor	0.85	0.85
1	Pavement Adjustment Factor	0.58	0.58
1	Bicycle LOS Score for Link	2.96	3.17
1	Bicycle Link LOS	C	C
1	Number of access point approaches	0	0
1	Segment Length, ft	2645	2645
1	Unsignalized Conflicts Factor	-0.7	-0.7
1	Bicycle LOS Score for Segment	2.59	2.76
1	Bicycle Segment LOS	B	C
1	Transit Running Speed, mi/h	41.94	41.64
1	g/C Ratio	0.38	0.26
1	Transit Running Time, s	43	43.31
1	Delay at Intersection, s/veh	9.78	18.63
1	Transit Travel Speed, mi/h	34.17	29.12
1	Transit Wait-Ride Score	3.83	3.62
1	Ped LOS Score for Link	2.53	2.8
1	Transit LOS Score for Segment	0.64	1
1	Transit Segment LOS	A	A
2	Average Pedestrian Space, ft2/p	Infinity	Infinity
2	Pedestrian Travel Speed, ft/s	4.34	4.33
2	Ped LOS Score for Intersection	3.18	2.58
2	Cross-section Adjustment Factor	-4.74	-4.74
2	Volume Adjustment Factor	0.42	1.4
2	Speed Adjustment Factor	0.72	0.68
2	Ped LOS Score for Link	2.44	3.39
2	Ped Link LOS	B	C
2	Roadway Crossing Difficulty Factor	0.89	1.1
2	Ped LOS Score for Segment	2.51	3.66
2	Ped Segment LOS	B	D
2	Bicycle Travel Speed	14.07	12.58
2	Bicycle LOS Score for Intersection	2.53	3.45
2	Cross-section Adjustment Factor	-1.28	-1.28
2	Volume Adjustment Factor	1.94	2.55
2	Speed Adjustment Factor	0.85	0.84
2	Pavement Adjustment Factor	0.58	0.58
2	Bicycle LOS Score for Link	2.85	3.45
2	Bicycle Link LOS	C	C
2	Number of access point approaches	0	0
2	Segment Length, ft	2955	2955
2	Unsignalized Conflicts Factor	-0.7	-0.7
2	Bicycle LOS Score for Segment	2.51	3.03
2	Bicycle Segment LOS	B	C
2	Transit Running Speed, mi/h	42.34	41.27
2	g/C Ratio	0.11	0.33
2	Transit Running Time, s	47.59	48.82
2	Delay at Intersection, s/veh	25.96	12.61
2	Transit Travel Speed, mi/h	27.4	32.8
2	Transit Wait-Ride Score	3.54	3.77
2	Ped LOS Score for Link	2.44	3.39
2	Transit LOS Score for Segment	1.06	0.85
2	Transit Segment LOS	A	A

ACCESS POINT DATA

SEGMENT 1

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Movement	1	2	3	4	5	6	7	8	9	10	11	12
1: Volume, veh/h	0	431	25	0	608	93.3	0	0	0	0	0	0
1: Lanes	1	2	0	1	2	0	0	1	0	0	1	0
1: Prop blocked												
1: Thru veh delay		0.02			0.05							
1: Prob inside blk		0			0							
1: Dist to upstream signal	1320											

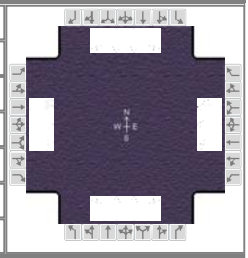
SEGMENT 2

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Movement	1	2	3	4	5	6	7	8	9	10	11	12
1: Volume, veh/h	0	369	0	0	997	38.2	0	0	0	15	0	0
1: Lanes	1	2	0	0	2	0	0	0	0	1	0	1
1: Prop blocked												
1: Thru veh delay		0			0.03							
1: Prob inside blk		0			0							
1: Dist to upstream signal	700											
2: Volume, veh/h	18.6	322	43.3	91.3	1016	198	10	5	65	5	0	10
2: Lanes	1	2	0	1	2	0	1	1	0	0	1	0
2: Prop blocked												
2: Thru veh delay		0.03			0.1							
2: Prob inside blk		0			0							
2: Dist to upstream signal	1420											
3: Volume, veh/h	0	65.3	327	7.48	1220	0	0	0	0	0	0	85
3: Lanes	0	2	0	1	2	0	0	0	0	0	1	0
3: Prop blocked												
3: Thru veh delay		0			0							
3: Prob inside blk		0			0							
3: Dist to upstream signal	1910											

This Urban Streets text report was created in HCS7 Streets Version 7.4 on January 29, 2018 at 02:08:07

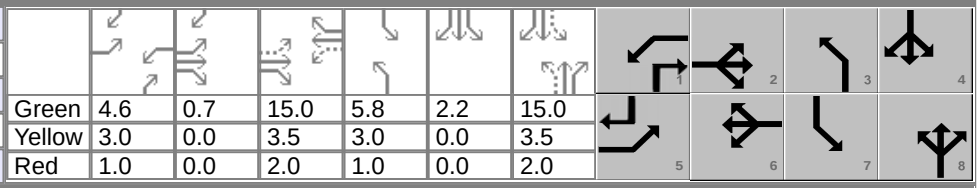
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	RL	Analysis Date	Jan 29, 2018	Area Type	Other
Jurisdiction	CITY OF SIOUX FALLS	Time Period	PM PEAK	PHF	0.93
Urban Street	BENSON ROAD	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	CLIFF AVENUE	File Name	BENSON PM.xus		
Project Description	I-229/BENSON IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	125	535	160	125	245	105	140	385	45	220	405	105

Signal Information			
Cycle, s	62.3	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.6	0.7	15.0	5.8	2.2	15.0						
Yellow	3.0	0.0	3.5	3.0	0.0	3.5						
Red	1.0	0.0	2.0	1.0	0.0	2.0						

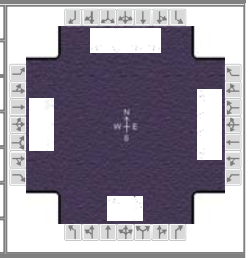
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	4.0	1.1	4.0	1.1	3.0	1.1	3.0
Phase Duration, s	9.3	21.2	8.6	20.5	9.8	20.5	12.0	22.7
Change Period, ($Y+R_c$), s	4.0	5.5	4.0	5.5	4.0	5.5	4.0	5.5
Max Allow Headway (*MAH*), s	5.1	1.0	5.1	1.0	5.1	1.0	5.1	1.0
Queue Clearance Time (g_s), s	5.7	13.8	5.2	6.5	6.2	8.8	8.6	8.9
Green Extension Time (g_e), s	0.1	0.0	0.1	0.0	0.1	0.1	0.0	0.1
Phase Call Probability	0.90	1.00	0.86	1.00	0.93	1.00	0.98	1.00
Max Out Probability	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	134	347	330	114	144	139	151	414	27	237	435	70
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1647	1730	1639	1647	1730	1606	1647	1647	1466	1647	1647	1466
Queue Service Time (g_s), s	3.7	11.7	11.8	3.2	4.3	4.5	4.2	6.8	0.8	6.6	6.9	2.0
Cycle Queue Clearance Time (g_c), s	3.7	11.7	11.8	3.2	4.3	4.5	4.2	6.8	0.8	6.6	6.9	2.0
Green Ratio (*g/C*)	0.33	0.25	0.25	0.31	0.24	0.24	0.33	0.24	0.31	0.37	0.28	0.36
Capacity (*c*), veh/h	436	436	413	260	417	387	394	793	460	452	909	529
Volume-to-Capacity Ratio (*X*)	0.308	0.795	0.799	0.440	0.347	0.359	0.382	0.522	0.058	0.523	0.479	0.132
Back of Queue (*Q*), ft/ln (95 th percentile)	60	200.8	186.1	54	73.1	68	67.5	109.4	11	105.5	108.6	26.7
Back of Queue (*Q*), veh/ln (95 th percentile)	2.3	7.7	7.4	2.1	2.8	2.7	2.6	4.2	0.4	4.1	4.2	1.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.31	0.00	0.00	0.39	0.00	0.00	0.22	0.00	0.05	0.29	0.00	0.08
Uniform Delay (d_1), s/veh	15.6	21.8	21.8	17.3	19.6	19.6	15.6	20.5	14.9	14.8	18.8	13.4
Incremental Delay (d_2), s/veh	0.6	1.3	1.4	1.6	0.2	0.2	0.9	0.2	0.0	1.5	0.1	0.0
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	16.2	23.0	23.2	18.9	19.7	19.8	16.5	20.7	14.9	16.3	19.0	13.4
Level of Service (LOS)	B	C	C	B	B	B	B	C	B	B	B	B
Approach Delay, s/veh / LOS	22.0	C		19.5	B		19.4	B		17.6	B	
Intersection Delay, s/veh / LOS	19.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.81	C	2.85	C	2.78	C	2.80	C
Bicycle LOS Score / LOS	2.93	C	2.65	C	2.87	C	3.00	C

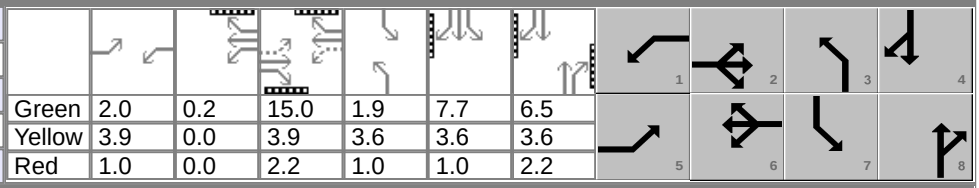
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	RL	Analysis Date	Jan 29, 2018	Area Type	Other
Jurisdiction	CITY OF SIOUX FALLS	Time Period	PM PEAK	PHF	0.79
Urban Street	BENSON ROAD	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	LEWIS AVENUE	File Name	BENSON PM.xus		
Project Description	I-229/BENSON IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	45	795	15	40	270	50	30	25	120	420	20	110

Signal Information			
Cycle, s	59.3	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	2.0	0.2	15.0	1.9	7.7	6.5
Yellow	3.9	0.0	3.9	3.6	3.6	3.6
Red	1.0	0.0	2.2	1.0	1.0	2.2

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	4.0	1.1	3.0	2.0	4.0	2.0	3.0
Phase Duration, s	6.9	21.1	7.1	21.3	6.5	12.3	18.7	24.6
Change Period, ($Y+R_c$), s	4.9	6.1	4.9	6.1	4.6	5.8	4.6	5.8
Max Allow Headway (*MAH*), s	5.1	1.0	5.1	1.0	5.1	1.3	5.1	1.3
Queue Clearance Time (g_s), s	3.1	14.6	3.3	6.9	3.4	6.5	11.0	4.4
Green Extension Time (g_e), s	0.1	0.1	0.1	0.1	0.1	0.0	3.1	0.0
Phase Call Probability	0.51	1.00	0.55	1.00	0.47	0.99	1.00	1.00
Max Out Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	43	383	381	49	331	37	38	120		532	25	82
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1647	1730	1722	1647	1647		1647	1527		1600	1730	1466
Queue Service Time (g_s), s	1.1	12.6	12.6	1.3	4.9		1.4	4.5		9.0	0.6	2.4
Cycle Queue Clearance Time (g_c), s	1.1	12.6	12.6	1.3	4.9		1.4	4.5		9.0	0.6	2.4
Green Ratio (*g/C*)	0.29	0.25	0.25	0.29	0.26		0.03	0.11		0.24	0.32	0.32
Capacity (*c*), veh/h	322	438	436	211	845		52	168		764	548	464
Volume-to-Capacity Ratio (*X*)	0.133	0.874	0.874	0.232	0.392		0.729	0.718		0.696	0.046	0.177
Back of Queue (*Q*), ft/ln (95 th percentile)	17.9	193.3	185.3	21.3	77.1		39.6	75.3		148.8	9.9	33.5
Back of Queue (*Q*), veh/ln (95 th percentile)	0.7	7.4	7.4	0.8	3.0		1.5	2.9		5.7	0.4	1.3
Queue Storage Ratio (*RQ*) (95 th percentile)	0.09	0.00	0.00	0.30	0.00		0.99	0.00		0.55	0.00	0.00
Uniform Delay (d_1), s/veh	15.9	21.2	21.2	16.8	18.2		28.5	25.5		20.6	14.1	14.7
Incremental Delay (d_2), s/veh	0.2	1.5	1.5	0.6	0.1		24.0	2.1		1.6	0.0	0.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Control Delay (*d*), s/veh	16.0	22.7	22.7	17.4	18.3	0.0	52.4	27.7		22.3	14.1	14.7
Level of Service (LOS)	B	C	C	B	B	A	D	C		C	B	B
Approach Delay, s/veh / LOS	22.4	C		16.6	B		33.6	C		21.0	C	
Intersection Delay, s/veh / LOS	21.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.11	B	2.62	C	3.05	C	2.69	C
Bicycle LOS Score / LOS	3.15	C	2.62	C	2.19	B	3.13	C

HCS7 Two-Way Stop-Control Report

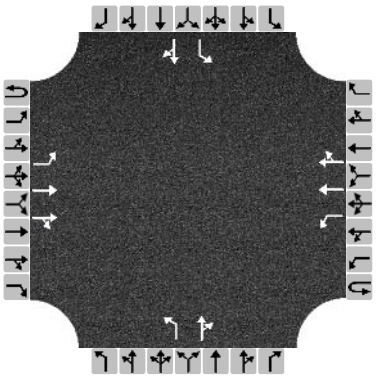
General Information

Analyst	RL
Agency/Co.	HDR
Date Performed	1/29/2018
Analysis Year	2018
Time Analyzed	PM PEAK
Intersection Orientation	East-West
Project Description	I-229/BENSON IMJR

Site Information

Intersection	BENSON/POTSDAM
Jurisdiction	CITY OF SIOUX FALLS
East/West Street	BENSON ROAD
North/South Street	POTSDAM AVENUE
Peak Hour Factor	0.84
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	1	2	0		1	1	0		1	1	0
Configuration		L	T	TR		L	T	TR		L		TR		L		TR
Volume, V (veh/h)		5	1435	25		40	340	30		10	5	95		70	0	40
Percent Heavy Vehicles (%)		5				5				5	5	5		5	5	5
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.5	6.5	6.9		7.5	6.5	6.9
Critical Headway (sec)		4.20				4.20				7.60	6.60	7.00		7.60	6.60	7.00
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.25				2.25				3.55	4.05	3.35		3.55	4.05	3.35

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		6				48				12		119		83		48
Capacity, c (veh/h)		1095				345				27		208		47		775
v/c Ratio		0.01				0.14				0.44		0.57		1.79		0.06
95% Queue Length, Q_{95} (veh)		0.0				0.5				1.4		3.1		8.3		0.2
Control Delay (s/veh)		8.3				17.1				219.5		43.2		564.1		9.9
Level of Service, LOS		A				C				F		E		F		A
Approach Delay (s/veh)		0.0				1.7				59.2				362.6		
Approach LOS										F				F		

HCS7 Two-Way Stop-Control Report

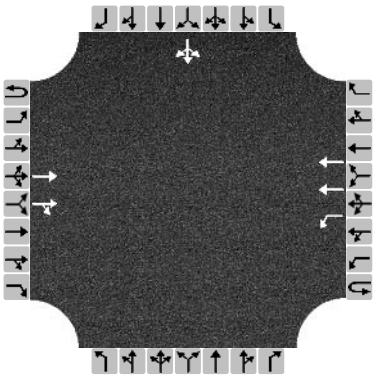
General Information

Analyst	RL
Agency/Co.	HDR
Date Performed	1/29/2018
Analysis Year	2018
Time Analyzed	PM PEAK
Intersection Orientation	East-West
Project Description	I-229/BENSON IMJR

Site Information

Intersection	BENSON/I-229 SB
Jurisdiction	CITY OF SIOUX FALLS
East/West Street	BENSON ROAD
North/South Street	I-229 SB
Peak Hour Factor	0.88
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	1	2	0		0	0	0		0	1	0
Configuration			T	TR		L	T								LTR	
Volume, V (veh/h)			170	1430		25	380							0	0	30
Percent Heavy Vehicles (%)						5								5	5	5
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized			No				No				No				No	
Median Type/Storage							Undivided									

Critical and Follow-up Headways

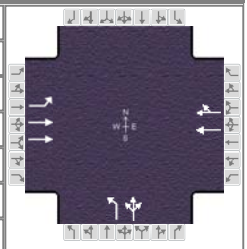
Base Critical Headway (sec)						4.1								7.5	6.5	6.9
Critical Headway (sec)						4.20								6.90	6.60	7.00
Base Follow-Up Headway (sec)						2.2								3.5	4.0	3.3
Follow-Up Headway (sec)						2.25								3.55	4.05	3.35

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						28									34	
Capacity, c (veh/h)						321									780	
v/c Ratio						0.09									0.04	
95% Queue Length, Q_{95} (veh)						0.3									0.1	
Control Delay (s/veh)						17.3									9.8	
Level of Service, LOS						C									A	
Approach Delay (s/veh)						1.1								9.8		
Approach LOS														A		

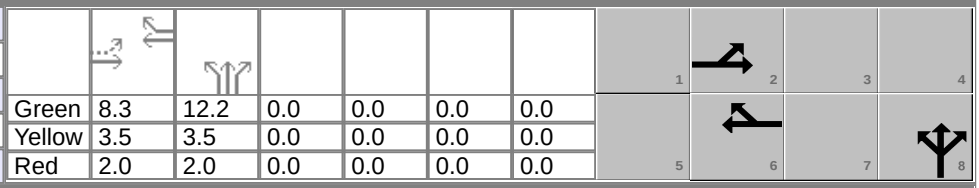
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	RL	Analysis Date	Jan 29, 2018	Area Type	Other
Jurisdiction	CITY OF SIOUX FALLS	Time Period	PM PEAK	PHF	0.78
Urban Street	BENSON ROAD	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	BENSON PM.xus		
Project Description	I-229/BENSON IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	145	25			50	20	355	0	20			

Signal Information			
Cycle, s	31.5	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	8.3	12.2	0.0	0.0	0.0	0.0						
Yellow	3.5	3.5	0.0	0.0	0.0	0.0						
Red	2.0	2.0	0.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		6.0		8.0		10.0		
Phase Duration, s		13.8		13.8		17.7		
Change Period, ($Y+R_c$), s		5.5		5.5		5.5		
Max Allow Headway (*MAH*), s		5.2		5.2		5.0		
Queue Clearance Time (g_s), s		7.5		4.0		9.4		
Green Extension Time (g_e), s		0.8		1.0		3.1		
Phase Call Probability		1.00		1.00		0.98		
Max Out Probability		0.22		0.05		0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16	3	8	18			
Adjusted Flow Rate (*v*), veh/h	154	27			39	38	455	13				
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1291	1540			1619	1527	1647	1371				
Queue Service Time (g_s), s	3.4	0.2			2.0	0.6	7.4	0.2				
Cycle Queue Clearance Time (g_c), s	5.5	0.2			2.0	0.6	7.4	0.2				
Green Ratio (*g/C*)	0.26	0.26			0.26	0.26	0.39	0.39				
Capacity (*c*), veh/h	486	813			428	403	637	530				
Volume-to-Capacity Ratio (*X*)	0.317	0.033			0.090	0.095	0.714	0.024				
Back of Queue (*Q*), ft/ln (95 th percentile)	31.8	2			6.4	6.1	71	1.3				
Back of Queue (*Q*), veh/ln (95 th percentile)	1.2	0.1			0.2	0.2	2.7	0.0				
Queue Storage Ratio (*RQ*) (95 th percentile)	0.32	0.00			0.00	0.00	0.00	0.00				
Uniform Delay (d_1), s/veh	11.5	8.6			8.7	8.8	8.2	6.0				
Incremental Delay (d_2), s/veh	0.3	0.0			0.1	0.1	2.1	0.0				
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0	0.0	0.0	0.0				
Control Delay (*d*), s/veh	11.7	8.6			8.9	8.9	10.3	6.0				
Level of Service (LOS)	B	A			A	A	B	A				
Approach Delay, s/veh / LOS	11.3	B		8.9	A		10.2	B		0.0		
Intersection Delay, s/veh / LOS	10.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.02	B	1.42	A	2.17	B	2.54	C
Bicycle LOS Score / LOS	2.66	C	2.54	C	2.94	C		

HCS7 Two-Way Stop-Control Report

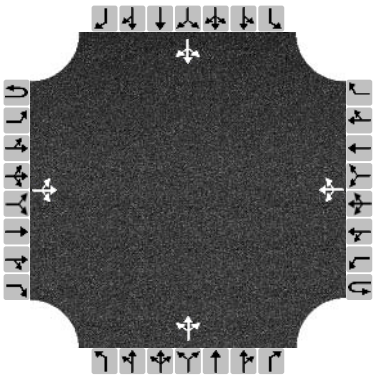
General Information

Analyst	RL
Agency/Co.	HDR
Date Performed	1/29/2018
Analysis Year	2018
Time Analyzed	PM PEAK
Intersection Orientation	East-West
Project Description	I-229/BENSON IMJR

Site Information

Intersection	BENSON/HALL
Jurisdiction	CITY OF SIOUX FALLS
East/West Street	BENSON ROAD
North/South Street	HALL AVENUE
Peak Hour Factor	0.60
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		15	25	5		0	45	0		0	5	0		0	0	25
Percent Heavy Vehicles (%)		5				5				5	5	5		5	5	5
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.15				4.15				7.15	6.55	6.25		7.15	6.55	6.25
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		25				0					8				42	
Capacity, c (veh/h)		1509				1541					705				980	
v/c Ratio		0.02				0.00					0.01				0.04	
95% Queue Length, Q_{95} (veh)		0.1				0.0					0.0				0.1	
Control Delay (s/veh)		7.4				7.3					10.2				8.8	
Level of Service, LOS		A				A					B				A	
Approach Delay (s/veh)	2.6				0.0				10.2				8.8			
Approach LOS									B				A			

HCS7 Streets Text Report

File Name:	BENSON PM.xus
Analyst:	RL
Agency/Co.:	HDR
Analysis Date:	Jan 29, 2018
Time Period:	PM PEAK
Jurisdiction:	CITY OF SIOUX FALLS
Analysis Year:	2018
Project Description:	I-229/BENSON IMJR
Urban Street:	BENSON ROAD
Analysis Period:	1> 7:00

Input

URBAN STREET PARAMETERS

Number of Intersections	3
Number of Segments	2
Analysis period duration, h	0.25
System cycle length, s	65
Urban street forward direction	EB
Sneakers per cycle, veh	2
Saturation flow rate, veh/h/ln	1900
Stored vehicle lane length, ft	25
Detected vehicle length, ft	17
Queue length percent	95
Critical merge gap, s	3.7
Stop threshold speed, mph	5
Acceleration rate, ft/s/s	3.5
Decel. rate (signal), ft/s/s	4
Minimum headway in a platoon, s/veh	1.5
Maximum headway in a platoon, s/veh	3.6
Number of iterations	15
Length of left-turn bay (access pt.), ft	250
Decel. rate (access pt.), ft/s/s	6.7
Right-turn speed (access pt.), ft/s	20
Critical gap from major left (access pt.), s	4.1
Follow-up time from major left (access pt.), s	2.2
Right-turn equivalency factor (access pt.)	2.2
Stored heavy vehicle lane length, ft	45
Proportion of peds who push button	0.51
Critical gap for permissive left-turn, s	4.5
Follow-up time for permissive left-turn, s	2.5
Calibration factor for platoon dispersion	0.14
Average ratio of speed limit to free-flow speed	0.9

BASIC SEGMENT INFORMATION

Seg	Spd Lmt		TH Lanes		Seg Len		IntWid		LenRM		PctCurb		Other Dly	
Num	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
1	40	40	2	2	2610	2610	50	50	0	0	70	70	0	0
2	40	40	2	2	2990	2990	50	50	0	0	70	70	0	0

ORIGIN-DESTINATION SEED PROPORTIONS - Forward Direction

	Cross LT	Major TH	Cross RT	MidEntry
Downstream Left	0.02	0.1	0.05	0.02
Downstream Thru	0.91	0.78	0.92	0.97
Downstream Right	0.05	0.1	0.02	0.01
Mid-segment Exit	0.02	0.02	0.01	0

ORIGIN-DESTINATION SEED PROPORTIONS - Reverse Direction

	Cross LT	Major TH	Cross RT	MidEntry
Downstream Left	0.02	0.1	0.05	0.02
Downstream Thru	0.91	0.78	0.92	0.97
Downstream Right	0.05	0.1	0.02	0.01
Mid-segment Exit	0.02	0.02	0.01	0

ACCESS POINT DATA

SEGMENT 1

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Movement	1	2	3	4	5	6	7	8	9	10	11	12
1: Volume, veh/h	0	345	20	0	815	125	0	0	0	0	0	0
1: Lanes	1	2	0	1	2	0	0	1	0	0	1	0
1: Location, ft	1320											
1: Peak Hour Factor	1											

Number of access points: 1

SEGMENT 2

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Movement	1	2	3	4	5	6	7	8	9	10	11	12
1: Volume, veh/h	0	1335	0	0	360	30	0	0	0	130	0	0
1: Lanes	1	2	0	0	2	0	0	0	0	1	0	1
1: Location, ft	700											
1: Peak Hour Factor	1											
2: Volume, veh/h	5	1435	25	40	340	30	10	5	95	70	0	40
2: Lanes	1	2	0	1	2	0	1	1	0	0	1	0
2: Location, ft	1410											
2: Peak Hour Factor	1											
3: Volume, veh/h	0	170	1430	25	380	0	0	0	0	0	0	30
3: Lanes	0	2	0	1	2	0	0	0	0	0	1	0
3: Location, ft	1920											
3: Peak Hour Factor	1											

Number of access points: 3

Global Output

SEGMENT DATA

Seg.No.	Movement	EB LT 5	EB TH 2	EB RT 12	WB LT 1	WB TH 6	WB RT 16
1	Bay/Lane Spillback Time, h	999	999	999	999	999	999
1	ShrdLane Spillback Time, h	999			999		
1	Base Free-Flow Speed, mph		44.07			44.07	
1	Running Time, s		42.94			42.55	
1	Running Speed, mph		41.44			41.82	
1	Through Delay, s/veh		22.71			19.78	
1	Travel Speed, mph		27.11			28.55	
1	Stop Rate, stops/veh		0.75			0.64	
1	Spatial Stop Rate, stops/mi		1.51			1.29	
1	Through vol/cap ratio		0.87			0.35	
1	Percent of Base FFS		61.5			64.78	
1	Level of Service		C			C	
1	Automobile Perception Score		2.37			2.33	
2	Bay/Lane Spillback Time, h	999	999	999	999	999	999
2	ShrdLane Spillback Time, h	999			999		999
2	Base Free-Flow Speed, mph		44.07			44.07	
2	Running Time, s		49.57			48.32	
2	Running Speed, mph		41.13			42.19	
2	Through Delay, s/veh		8.62			18.31	
2	Travel Speed, mph		35.04			30.6	
2	Stop Rate, stops/veh		0.59			0.63	
2	Spatial Stop Rate, stops/mi		1.04			1.11	
2	Through vol/cap ratio		0.03			0.39	
2	Percent of Base FFS		79.5			69.42	
2	Level of Service		B			B	
2	Automobile Perception Score		2.35			2.41	

Facility Travel Time, s	123.84	128.96
Facility Travel Speed, mph	30.83	29.61
Facility Spatial Stop Rate, stops/mi	1.26	1.19
Facility Base Free Flow Speed, mph	44.07	44.07
Facility Percent Base Free Flow Speed	69.96	67.18
Facility Level of Service	B	B
Facility Automobile Perception Score	2.36	2.37
Facility Pedestrian Space	Infinity	Infinity
Facility Pedestrian Travel Speed	4.25	4.25
Facility Pedestrian LOS Score	3.11	2.57
Facility Pedestrian LOS	C	C
Facility Bicycle Travel Speed	13.24	13.66
Facility Bicycle LOS Score	2.93	2.63
Facility Bicycle LOS	C	C
Facility Transit Travel Speed	27.11	28.57
Facility Transit LOS Score	0.94	0.93
Facility Transit LOS	A	A

SPILLBACK TIME, h 999

Multimodal Results

1	Average Pedestrian Space, ft2/p	Infinity	Infinity
1	Pedestrian Travel Speed, ft/s	4.21	4.21
1	Ped LOS Score for Intersection	2.11	2.85
1	Cross-section Adjustment Factor	-4.74	-4.74
1	Volume Adjustment Factor	0.98	0.58
1	Speed Adjustment Factor	0.69	0.7
1	Ped LOS Score for Link	2.97	2.59
1	Ped Link LOS	C	C
1	Roadway Crossing Difficulty Factor	0.94	0.8
1	Ped LOS Score for Segment	2.95	2.46
1	Ped Segment LOS	C	B
1	Bicycle Travel Speed	13.08	13.18
1	Bicycle LOS Score for Intersection	3.15	2.65
1	Cross-section Adjustment Factor	-1.28	-1.28
1	Volume Adjustment Factor	2.37	2.1
1	Speed Adjustment Factor	0.84	0.85
1	Pavement Adjustment Factor	0.58	0.58
1	Bicycle LOS Score for Link	3.27	3.01
1	Bicycle Link LOS	C	C
1	Number of access point approaches	0	0
1	Segment Length, ft	2610	2610
1	Unsignalized Conflicts Factor	-0.7	-0.7
1	Bicycle LOS Score for Segment	2.86	2.64
1	Bicycle Segment LOS	C	B
1	Transit Running Speed, mi/h	41.44	41.82
1	g/C Ratio	0.25	0.24
1	Transit Running Time, s	42.94	42.55
1	Delay at Intersection, s/veh	22.7	19.75
1	Transit Travel Speed, mi/h	27.11	28.57
1	Transit Wait-Ride Score	3.52	3.59
1	Ped LOS Score for Link	2.97	2.59
1	Transit LOS Score for Segment	1.16	1
1	Transit Segment LOS	A	A
2	Average Pedestrian Space, ft2/p	Infinity	Infinity
2	Pedestrian Travel Speed, ft/s	4.3	4.3
2	Ped LOS Score for Intersection	2.02	2.62
2	Cross-section Adjustment Factor	-4.74	-4.74
2	Volume Adjustment Factor	1.64	0.59
2	Speed Adjustment Factor	0.68	0.71
2	Ped LOS Score for Link	3.62	2.61
2	Ped Link LOS	D	C
2	Roadway Crossing Difficulty Factor	0.88	0.92
2	Ped LOS Score for Segment	3.25	2.67
2	Ped Segment LOS	C	B
2	Bicycle Travel Speed	13.37	14.11
2	Bicycle LOS Score for Intersection	2.66	2.62
2	Cross-section Adjustment Factor	-1.28	-1.28
2	Volume Adjustment Factor	2.63	2.12
2	Speed Adjustment Factor	0.84	0.85
2	Pavement Adjustment Factor	0.58	0.58
2	Bicycle LOS Score for Link	3.53	3.02
2	Bicycle Link LOS	D	C
2	Number of access point approaches	0	0
2	Segment Length, ft	2990	2990
2	Unsignalized Conflicts Factor	-0.7	-0.7
2	Bicycle LOS Score for Segment	2.98	2.63
2	Bicycle Segment LOS	C	B
2	Transit Running Speed, mi/h	41.13	42.19
2	g/C Ratio	0.26	0.26
2	Transit Running Time, s	49.57	48.32
2	Delay at Intersection, s/veh	8.62	18.31
2	Transit Travel Speed, mi/h	35.04	30.6
2	Transit Wait-Ride Score	3.86	3.68
2	Ped LOS Score for Link	3.62	2.61
2	Transit LOS Score for Segment	0.75	0.87
2	Transit Segment LOS	A	A

ACCESS POINT DATA

SEGMENT 1

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Movement	1	2	3	4	5	6	7	8	9	10	11	12
1: Volume, veh/h	0	813	47.1	0	441	67.6	0	0	0	0	0	0
1: Lanes	1	2	0	1	2	0	0	1	0	0	1	0
1: Prop blocked												
1: Thru veh delay		0.04			0.04							
1: Prob inside blk		0			0							
1: Dist to upstream signal	1320											

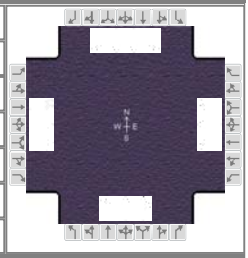
SEGMENT 2

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Movement	1	2	3	4	5	6	7	8	9	10	11	12
1: Volume, veh/h	0	1438	0	0	441	36.8	0	0	0	130	0	0
1: Lanes	1	2	0	0	2	0	0	0	0	1	0	1
1: Prop blocked												
1: Thru veh delay		0			0.03							
1: Prob inside blk		0			0							
1: Dist to upstream signal	700											
2: Volume, veh/h	5.35	1536	26.8	50.4	428	37.8	10	5	95	70	0	40
2: Lanes	1	2	0	1	2	0	1	1	0	0	1	0
2: Prop blocked												
2: Thru veh delay		0.03			0.03							
2: Prob inside blk		0			0							
2: Dist to upstream signal	1410											
3: Volume, veh/h	0	181	1520	32	486	0	0	0	0	0	0	30
3: Lanes	0	2	0	1	2	0	0	0	0	0	1	0
3: Prop blocked												
3: Thru veh delay		0			0							
3: Prob inside blk		0			0							
3: Dist to upstream signal	1920											

This Urban Streets text report was created in HCS7 Streets Version 7.4 on January 29, 2018 at 02:16:54

HCS7 Signalized Intersection Results Summary

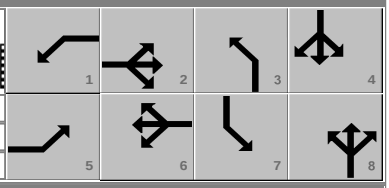
General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	RL	Analysis Date	Jan 29, 2018	Area Type	Other
Jurisdiction	CITY OF SIOUX FALLS	Time Period	AM	PHF	0.91
Urban Street	RICE STREET	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	CLIFF AVENUE	File Name	RICE AM.xus		
Project Description	I-229/BENSON IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	40	90	15	165	225	330	30	495	70	90	280	60

Signal Information			
Cycle, s	87.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	2.6	2.3	36.0	2.2	1.8	19.2						
Yellow	3.5	3.5	3.5	3.5	0.0	3.5						
Red	0.5	0.5	2.0	0.5	0.0	2.0						



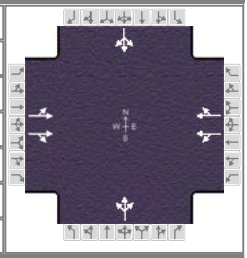
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	3.0
Phase Duration, s	6.6	41.5	12.9	47.7	6.2	24.7	8.0	26.5
Change Period, ($Y+R_c$), s	4.0	5.5	4.0	5.5	4.0	5.5	4.0	5.5
Max Allow Headway (*MAH*), s	4.1	0.0	4.1	0.0	4.1	4.1	4.1	4.1
Queue Clearance Time (g_s), s	3.4		8.6		3.3	16.1	6.0	8.8
Green Extension Time (g_e), s	0.0	0.0	0.3	0.0	0.0	3.0	0.0	3.6
Phase Call Probability	0.65		1.00		0.55	1.00	0.91	1.00
Max Out Probability	0.00		0.67		1.00	0.15	1.00	0.02

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	44	55	55	225	307	273	33	297	291	99	308	38
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1594	1674	1615	1594	1674	1418	1647	1730	1684	1647	1647	
Queue Service Time (g_s), s	1.4	1.7	1.8	6.6	10.0	10.7	1.3	14.1	14.1	4.0	6.8	
Cycle Queue Clearance Time (g_c), s	1.4	1.7	1.8	6.6	10.0	10.7	1.3	14.1	14.1	4.0	6.8	
Green Ratio (*g/C*)	0.44	0.41	0.41	0.54	0.49	0.49	0.25	0.22	0.22	0.27	0.24	
Capacity (*c*), veh/h	482	692	668	722	812	688	271	381	371	205	794	
Volume-to-Capacity Ratio (*X*)	0.091	0.080	0.082	0.312	0.378	0.396	0.122	0.780	0.784	0.482	0.388	
Back of Queue (*Q*), ft/ln (95 th percentile)	23	32.5	30.2	103.2	178	164.6	24.5	263.3	249.7	76.4	122.6	
Back of Queue (*Q*), veh/ln (95 th percentile)	0.9	1.2	1.2	3.9	6.6	6.1	0.9	10.1	10.0	2.9	4.7	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.23	0.00	0.00	0.65	0.00	0.00	0.22	0.00	0.00	0.51	0.00	
Uniform Delay (d_1), s/veh	14.1	15.5	15.5	10.9	14.1	14.3	25.6	31.9	32.0	26.5	27.6	
Incremental Delay (d_2), s/veh	0.1	0.2	0.2	0.2	1.1	1.4	0.2	4.1	4.3	1.8	0.3	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	14.1	15.7	15.7	11.1	15.2	15.7	25.8	36.0	36.3	28.2	28.0	0.0
Level of Service (LOS)	B	B	B	B	B	B	C	D	D	C	C	A
Approach Delay, s/veh / LOS	15.3	B		14.2	B		35.6	D		25.6	C	
Intersection Delay, s/veh / LOS	23.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.62	C	2.77	C	2.75	C	2.35	B
Bicycle LOS Score / LOS	2.08	B	3.33	C	2.78	C	2.63	C

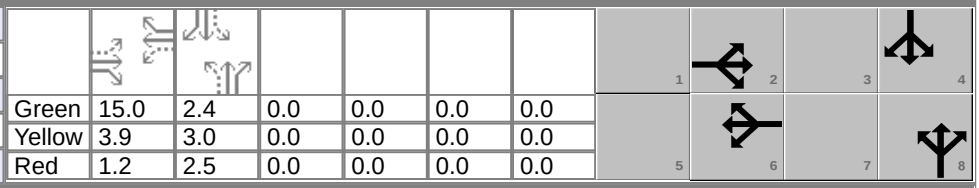
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	RL	Analysis Date	Jan 29, 2018	Area Type	Other
Jurisdiction	CITY OF SIOUX FALLS	Time Period	AM	PHF	0.70
Urban Street	RICE STREET	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	WAYLAND AVE	File Name	RICE AM.xus		
Project Description	I-229/BENSON IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	10	230	10	5	695	20	10	15	0	40	10	15

Signal Information			
Cycle, s	28.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	15.0	2.4	0.0	0.0	0.0	0.0						
Yellow	3.9	3.0	0.0	0.0	0.0	0.0						
Red	1.2	2.5	0.0	0.0	0.0	0.0						

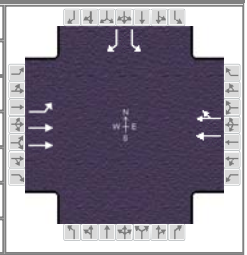
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		8.0		8.0
Phase Duration, s		20.1		20.1		7.9		7.9
Change Period, ($Y+R_c$), s		5.1		5.1		5.5		5.5
Max Allow Headway (*MAH*), s		1.3		1.3		4.2		4.2
Queue Clearance Time (g_s), s		3.2		7.4		2.6		3.6
Green Extension Time (g_e), s		0.1		0.1		0.3		0.3
Phase Call Probability		1.00		1.00		0.61		0.61
Max Out Probability		0.00		0.00		0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	140		128	489		442		36			86	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1612		1511	1671		1515		1592			1470	
Queue Service Time (g_s), s	0.0		1.2	0.0		5.4		0.0			1.0	
Cycle Queue Clearance Time (g_c), s	1.2		1.2	5.4		5.4		0.6			1.6	
Green Ratio (*g/C*)	0.53		0.53	0.53		0.53		0.09			0.09	
Capacity (*c*), veh/h	1000		808	1024		810		319			342	
Volume-to-Capacity Ratio (*X*)	0.140		0.158	0.478		0.546		0.112			0.250	
Back of Queue (*Q*), ft/ln (95 th percentile)	3.8		3.5	17.1		16		8.1			20.2	
Back of Queue (*Q*), veh/ln (95 th percentile)	0.2		0.1	0.7		0.6		0.3			0.8	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00		0.00	0.00		0.00		0.00			0.00	
Uniform Delay (d_1), s/veh	3.3		3.3	4.3		4.3		12.0			12.4	
Incremental Delay (d_2), s/veh	0.0		0.0	0.1		0.2		0.2			0.4	
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0		0.0		0.0			0.0	
Control Delay (*d*), s/veh	3.3		3.3	4.4		4.4		12.1			12.8	
Level of Service (LOS)	A		A	A		A		B			B	
Approach Delay, s/veh / LOS	3.3	A		4.4	A		12.1	B		12.8	B	
Intersection Delay, s/veh / LOS	4.9						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.69	B	1.73	B	2.50	C	2.48	B
Bicycle LOS Score / LOS	2.46	B	3.01	C	2.72	C	2.80	C

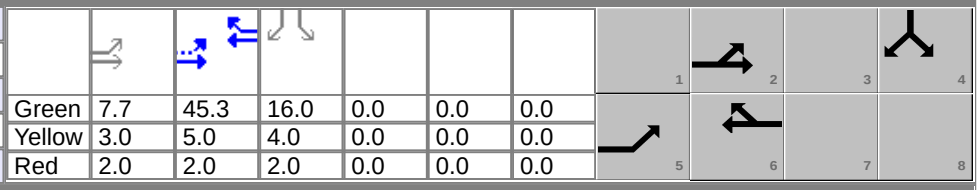
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	RL	Analysis Date	Jan 29, 2018	Area Type	Other
Jurisdiction	CITY OF SIOUX FALLS	Time Period	AM	PHF	0.86
Urban Street	RICE STREET	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	RICE AM.xus		
Project Description	I-229/BENSON IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	95	215			645	400				80		55

Signal Information			
Cycle, s	87.0	Reference Phase	2
Offset, s	75	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	7.7	45.3	16.0	0.0	0.0	0.0
Yellow	3.0	5.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0

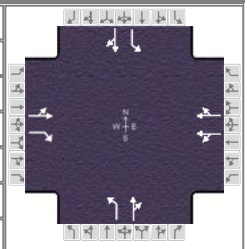
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	12.7	65.0		52.3				22.0
Change Period, ($Y+R_c$), s	5.0	7.0		7.0				6.0
Max Allow Headway (*MAH*), s	4.1	0.0		0.0				4.2
Queue Clearance Time (g_s), s	8.3							18.0
Green Extension Time (g_e), s	0.0	0.0		0.0				0.0
Phase Call Probability	0.92							0.98
Max Out Probability	1.00							1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	106	240			622	567				93		64
Adjusted Saturation Flow Rate (*s*), veh/h/ln	645	1623			1806	1627				377		1436
Queue Service Time (g_s), s	6.3	2.3			18.3	24.6				16.0		3.3
Cycle Queue Clearance Time (g_c), s	6.3	2.3			18.3	24.6				16.0		3.3
Green Ratio (*g/C*)	0.63	0.67			0.52	0.52				0.18		0.18
Capacity (*c*), veh/h	183	2164			940	847				69		264
Volume-to-Capacity Ratio (*X*)	0.581	0.111			0.662	0.669				1.341		0.242
Back of Queue (*Q*), ft/ln (95 th percentile)	91.8	30.2			351.3	364.3				463.2		51.5
Back of Queue (*Q*), veh/ln (95 th percentile)	2.2	1.2			14.1	14.6				10.3		2.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay (d_1), s/veh	15.7	5.2			16.7	19.6				35.5		30.3
Incremental Delay (d_2), s/veh	3.5	0.1			2.8	3.3				223.6		0.5
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	19.3	5.3			19.6	22.8				259.1		30.8
Level of Service (LOS)	B	A			B	C				F		C
Approach Delay, s/veh / LOS	9.6	A		21.1	C		0.0			166.1	F	
Intersection Delay, s/veh / LOS	32.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.66	A	1.89	B	2.37	B	2.31	B
Bicycle LOS Score / LOS	0.78	A	1.34	A				F

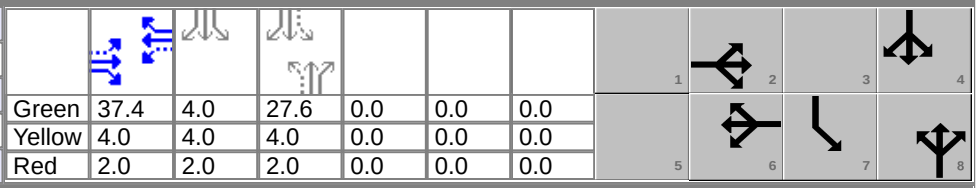
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	RL	Analysis Date	Jan 29, 2018	Area Type	Other
Jurisdiction	CITY OF SIOUX FALLS	Time Period	AM	PHF	0.76
Urban Street	RICE STREET	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	RICE AM.xus		
Project Description	I-229/BENSON IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30	85	180	30	600	10	245	200	40	60	10	200

Signal Information			
Cycle, s	87.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	37.4	4.0	27.6	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8	7	4
Case Number		7.0		8.0		6.3	1.0	4.0
Phase Duration, s		43.4		43.4		33.6	10.0	43.6
Change Period, ($Y+R_c$), s		6.0		6.0		6.0	6.0	6.0
Max Allow Headway (*MAH*), s		0.0		0.0		6.4	6.0	6.4
Queue Clearance Time (g_s), s						24.2	4.8	9.1
Green Extension Time (g_e), s		0.0		0.0		3.4	0.0	8.2
Phase Call Probability						1.00	0.85	1.00
Max Out Probability						0.95	1.00	0.07

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h		111	106	435		400	322	296		79	171	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		839	1341	1641		1484	1185	1638		1594	1367	
Queue Service Time (g_s), s		1.0	4.7	0.0		18.3	22.2	13.1		2.8	7.1	
Cycle Queue Clearance Time (g_c), s		19.3	4.7	17.6		18.3	22.2	13.1		2.8	7.1	
Green Ratio (*g/C*)		0.43	0.43	0.43		0.43	0.32	0.32		0.39	0.43	
Capacity (*c*), veh/h		413	576	751		638	459	520		327	591	
Volume-to-Capacity Ratio (*X*)		0.269	0.184	0.580		0.627	0.703	0.570		0.242	0.290	
Back of Queue (*Q*), ft/ln (95 th percentile)		81.9	71.9	282.3		273	285.3	233.3		48.6	100.3	
Back of Queue (*Q*), veh/ln (95 th percentile)		3.1	2.7	11.3		10.9	11.0	9.0		1.8	3.7	
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00		0.00	1.90	0.00		0.49	0.00	
Uniform Delay (d_1), s/veh		19.0	17.3	19.1		19.2	27.9	24.7		18.7	16.0	
Incremental Delay (d_2), s/veh		1.4	0.6	3.3		4.6	5.4	2.1		0.8	0.6	
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh		20.4	17.9	22.4		23.8	33.3	26.9		19.5	16.6	
Level of Service (LOS)		C	B	C		C	C	C		B	B	
Approach Delay, s/veh / LOS	19.2	B		23.1	C		30.2	C		17.5	B	
Intersection Delay, s/veh / LOS	24.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.26	B	2.37	B	2.36	B	3.03	C
Bicycle LOS Score / LOS	2.81	C	1.30	A	3.16	C	2.58	C

HCS7 Two-Way Stop-Control Report

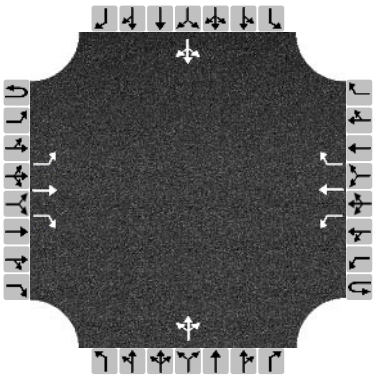
General Information

Analyst	RL
Agency/Co.	HDR
Date Performed	1/29/2018
Analysis Year	2018
Time Analyzed	AM PEAK
Intersection Orientation	East-West
Project Description	I-229/BENSON IMJR

Site Information

Intersection	BAHNSON AVENUE
Jurisdiction	CITY OF SIOUX FALLS
East/West Street	RICE STREET
North/South Street	BAHNSON AVENUE
Peak Hour Factor	0.85
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	1	0	1	1	1		0	1	0		0	1	0
Configuration		L	T	R		L	T	R			LTR				LTR	
Volume, V (veh/h)		20	145	20		5	615	5		10	5	5		0	5	15
Percent Heavy Vehicles (%)		3				3				3	3	3		3	3	3
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.13				4.13				7.13	6.53	6.23		7.13	6.53	6.23
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.23				2.23				3.53	4.03	3.33		3.53	4.03	3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		24				6					24				24	
Capacity, c (veh/h)		869				1372					275				357	
v/c Ratio		0.03				0.00					0.09				0.07	
95% Queue Length, Q_{95} (veh)		0.1				0.0					0.3				0.2	
Control Delay (s/veh)		9.3				7.6					19.3				15.8	
Level of Service, LOS		A				A					C				C	
Approach Delay (s/veh)		1.0				0.1					19.3				15.8	
Approach LOS											C				C	

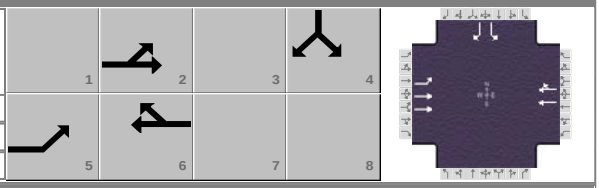
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	HDR			Interchange Type	Parclo AB-2Q
Analyst	RL	Analysis Date	Jan 29, 2018	Segment Distance, ft	1020
Jurisdiction	CITY OF SIOUX FALLS	Duration, h	0.25	Freeway Direction	North-South
Intersection	I-229 SB	PHF	0.86	Arterial Direction	East-West
File Name	RICE AM.xus				
Project Description	I-229/BENSON IMJR				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h	95	215			645	400				80		55
Intersection Two Demand (*v*), veh/h	30	85	180	30	600	10	245	200	40	60	10	200

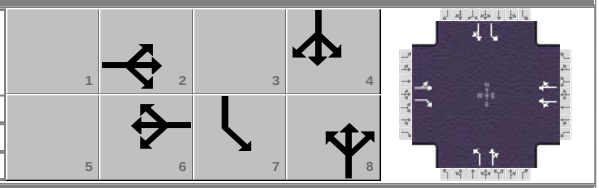
Signal One Information	
Cycle, s	87.0
Offset, s	75
Uncoordinated	No
Force Mode	Fixed

Green	7.7	45.3	16.0	0.0	0.0	0.0
Yellow	3.0	5.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



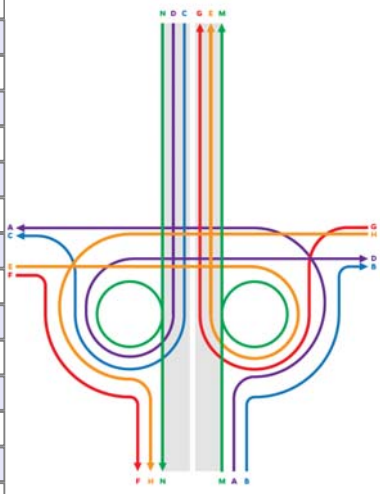
Signal Two Information	
Cycle, s	87.0
Offset, s	75
Uncoordinated	No
Force Mode	Fixed

Green	37.4	4.0	27.6	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	122	52.9	0.0	52.9	No	Yes	F
B	33	26.9	0.0	26.9	No	No	B
C	0	0.0	5.0	5.0	No	No	A
D	0	0.0	5.0	5.0	No	No	A
E	106	23.2	5.0	28.2	No	No	B
F	0	5.3	0.0	5.3	No	No	A
G	39	22.4	5.0	27.4	No	No	B
H	0	0.0	0.0	0.0	No	No	A
I	282	5.3	0.0	5.3	No	No	A
J	544	19.6	0.0	19.6	No	No	B
K	-	-	0.0	-	-	-	-
L	-	-	0.0	-	-	-	-
M	200	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	19.3	5.3			19.6	22.8				259.1		30.8
Level of Service (LOS)	B	A			B	C				F		C
Approach Delay, s/veh / LOS	9.6	A		21.1	C		0.0			166.1	F	
Intersection Delay, s/veh / LOS	32.2						C					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		20.4	17.9	22.4		23.8	33.3	26.9		19.5	16.6	
Level of Service (LOS)		C	B	C		C	C	C		B	B	
Approach Delay, s/veh / LOS	19.2	B		23.1	C		30.2	C		17.5	B	
Intersection Delay, s/veh / LOS	24.2						C					

HCS7 Streets Text Report

File Name:	RICE AM.xus
Analyst:	RL
Agency/Co.:	HDR
Analysis Date:	Jan 29, 2018
Time Period:	AM
Jurisdiction:	CITY OF SIOUX FALLS
Analysis Year:	2018
Project Description:	I-229/BENSON IMJR
Urban Street:	RICE STREET
Analysis Period:	1> 7:00

Input

URBAN STREET PARAMETERS

Number of Intersections	4
Number of Segments	3
Analysis period duration, h	0.25
System cycle length, s	87
Urban street forward direction	EB
Sneakers per cycle, veh	2
Saturation flow rate, veh/h/ln	1900
Stored vehicle lane length, ft	25
Detected vehicle length, ft	17
Queue length percent	95
Critical merge gap, s	3.7
Stop threshold speed, mph	5
Acceleration rate, ft/s/s	3.5
Decel. rate (signal), ft/s/s	4
Minimum headway in a platoon, s/veh	1.5
Maximum headway in a platoon, s/veh	3.6
Number of iterations	15
Length of left-turn bay (access pt.), ft	250
Decel. rate (access pt.), ft/s/s	6.7
Right-turn speed (access pt.), ft/s	20
Critical gap from major left (access pt.), s	4.1
Follow-up time from major left (access pt.), s	2.2
Right-turn equivalency factor (access pt.)	2.2
Stored heavy vehicle lane length, ft	45
Proportion of peds who push button	0.51
Critical gap for permissive left-turn, s	4.5
Follow-up time for permissive left-turn, s	2.5
Calibration factor for platoon dispersion	0.14
Average ratio of speed limit to free-flow speed	0.9

BASIC SEGMENT INFORMATION

Seg	Spd Lmt		TH Lanes		Seg Len		IntWid		LenRM		PctCurb		Other Dly	
Num	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
1	35	35	2	1	1020	1020	50	50	0	0	70	70	0	0
2	35	35	2	2	3460	3460	50	50	0	0	70	70	0	0
3	35	35	1	2	1020	1020	50	50	0	0	70	70	0	0

ORIGIN-DESTINATION SEED PROPORTIONS - Forward Direction

	Cross LT	Major TH	Cross RT	MidEntry
Downstream Left	0.02	0.1	0.05	0.02
Downstream Thru	0.91	0.78	0.92	0.97
Downstream Right	0.05	0.1	0.02	0.01
Mid-segment Exit	0.02	0.02	0.01	0

ORIGIN-DESTINATION SEED PROPORTIONS - Reverse Direction

	Cross LT	Major TH	Cross RT	MidEntry
Downstream Left	0.02	0.1	0.05	0.02
Downstream Thru	0.91	0.78	0.92	0.97
Downstream Right	0.05	0.1	0.02	0.01
Mid-segment Exit	0.02	0.02	0.01	0

ACCESS POINT DATA

SEGMENT 1

Number of access points: 0

SEGMENT 2

	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB

Movement	LT 1	TH 2	RT 3	LT 4	TH 5	RT 6	LT 7	TH 8	RT 9	LT 10	TH 11	RT 12
1: Volume, veh/h	0	255	15	15	685	0	35	0	55	0	0	0
1: Lanes	0	2	0	1	2	0	0	1	0	0	0	0
1: Location, ft	3030											
1: Peak Hour Factor	1											

Number of access points: 1

SEGMENT 3

Number of access points: 0

Global Output

SEGMENT DATA

Seg.No.	Movement	EB LT 5	EB TH 2	EB RT 12	WB LT 1	WB TH 6	WB RT 16
1	Bay/Lane Spillback Time, h	999	999	999	999	999	999
1	ShrdLane Spillback Time, h				999		
1	Base Free-Flow Speed, mph		41.72			41.72	
1	Running Time, s		19.87			20.94	
1	Running Speed, mph		35			33.21	
1	Through Delay, s/veh		3.34			15.22	
1	Travel Speed, mph		29.96			19.23	
1	Stop Rate, stops/veh		0.41			0.51	
1	Spatial Stop Rate, stops/mi		2.14			2.62	
1	Through vol/cap ratio		0.15			0.38	
1	Percent of Base FFS		71.82			46.1	
1	Level of Service		B			D	
1	Automobile Perception Score		2.7			2.78	
2	Bay/Lane Spillback Time, h	999	999	999	999	999	999
2	ShrdLane Spillback Time, h						
2	Base Free-Flow Speed, mph		41.72			41.72	
2	Running Time, s		58.04			59.03	
2	Running Speed, mph		40.65			39.97	
2	Through Delay, s/veh		5.32			4.41	
2	Travel Speed, mph		37.23			37.19	
2	Stop Rate, stops/veh		0.23			0.42	
2	Spatial Stop Rate, stops/mi		0.35			0.65	
2	Through vol/cap ratio		0.11			0.51	
2	Percent of Base FFS		89.24			89.13	
2	Level of Service		A			A	
2	Automobile Perception Score		2.29			2.34	
3	Bay/Lane Spillback Time, h	999	999	999	999	999	999
3	ShrdLane Spillback Time, h						
3	Base Free-Flow Speed, mph		41.72			41.72	
3	Running Time, s		20.05			20.53	
3	Running Speed, mph		34.68			33.88	
3	Through Delay, s/veh		20.43			20.5	
3	Travel Speed, mph		17.18			16.95	
3	Stop Rate, stops/veh		0.65			0.66	
3	Spatial Stop Rate, stops/mi		3.35			3.44	
3	Through vol/cap ratio		0.27			0.66	
3	Percent of Base FFS		41.17			40.63	
3	Level of Service		D			D	
3	Automobile Perception Score		2.91			2.93	

Facility Travel Time, s	127.05	140.62
Facility Travel Speed, mph	29.51	26.67
Facility Spatial Stop Rate, stops/mi	1.24	1.53
Facility Base Free Flow Speed, mph	41.72	41.72
Facility Percent Base Free Flow Speed	70.74	63.92
Facility Level of Service	B	C
Facility Automobile Perception Score	2.46	2.51
Facility Pedestrian Space	Infinity	Infinity
Facility Pedestrian Travel Speed	4.24	4.22
Facility Pedestrian LOS Score	2.46	3.36
Facility Pedestrian LOS	C	C
Facility Bicycle Travel Speed	13.74	13.53
Facility Bicycle LOS Score	2.45	2.86
Facility Bicycle LOS	C	C
Facility Transit Travel Speed	35	19.23

Facility Transit LOS Score		0.48	0.99
Facility Transit LOS		A	A
SPILLBACK TIME, h		999	

Multimodal Results

1	Average Pedestrian Space, ft2/p	Infinity	Infinity
1	Pedestrian Travel Speed, ft/s	3.85	3.85
1	Ped LOS Score for Intersection	1.69	2.77
1	Cross-section Adjustment Factor	-4.74	-4.74
1	Volume Adjustment Factor	0.31	2.16
1	Speed Adjustment Factor	0.49	0.44
1	Ped LOS Score for Link	2.11	3.9
1	Ped Link LOS	B	D
1	Roadway Crossing Difficulty Factor	1.06	0.8
1	Ped LOS Score for Segment	2.51	3.18
1	Ped Segment LOS	B	C
1	Bicycle Travel Speed	11.34	14.08
1	Bicycle LOS Score for Intersection	2.46	3.33
1	Cross-section Adjustment Factor	-1.28	-1.28
1	Volume Adjustment Factor	1.79	2.77
1	Speed Adjustment Factor	0.76	0.74
1	Pavement Adjustment Factor	0.58	0.58
1	Bicycle LOS Score for Link	2.61	3.57
1	Bicycle Link LOS	C	D
1	Number of access point approaches	0	0
1	Segment Length, ft	1020	1020
1	Unsignalized Conflicts Factor	-0.7	-0.7
1	Bicycle LOS Score for Segment	2.42	3.04
1	Bicycle Segment LOS	B	C
1	Transit Running Speed, mi/h	35	33.21
1	g/C Ratio	0.53	0.49
1	Transit Running Time, s	19.87	20.94
1	Delay at Intersection, s/veh	0	15.22
1	Transit Travel Speed, mi/h	35	19.23
1	Transit Wait-Ride Score	3.86	3.09
1	Ped LOS Score for Link	2.11	3.9
1	Transit LOS Score for Segment	0.53	1.96
1	Transit Segment LOS	A	A
2	Average Pedestrian Space, ft2/p	Infinity	Infinity
2	Pedestrian Travel Speed, ft/s	4.34	4.34
2	Ped LOS Score for Intersection	0.66	1.73
2	Cross-section Adjustment Factor	-4.74	-4.74
2	Volume Adjustment Factor	0.35	1.06
2	Speed Adjustment Factor	0.66	0.64
2	Ped LOS Score for Link	2.32	3
2	Ped Link LOS	B	C
2	Roadway Crossing Difficulty Factor	0.8	1.2
2	Ped LOS Score for Segment	2.26	3.56
2	Ped Segment LOS	B	D
2	Bicycle Travel Speed	14.72	14.1
2	Bicycle LOS Score for Intersection	0.78	3.01
2	Cross-section Adjustment Factor	-1.28	-1.28
2	Volume Adjustment Factor	1.85	2.41
2	Speed Adjustment Factor	0.84	0.83
2	Pavement Adjustment Factor	0.58	0.58
2	Bicycle LOS Score for Link	2.74	3.3
2	Bicycle Link LOS	C	C
2	Number of access point approaches	0	0
2	Segment Length, ft	3460	3460
2	Unsignalized Conflicts Factor	-0.7	-0.7
2	Bicycle LOS Score for Segment	2.39	2.84
2	Bicycle Segment LOS	B	C
2	Transit Running Speed, mi/h	40.65	39.97
2	g/C Ratio	0.67	0.53
2	Transit Running Time, s	58.04	59.03
2	Delay at Intersection, s/veh	5.32	0
2	Transit Travel Speed, mi/h	37.23	39.97
2	Transit Wait-Ride Score	3.94	4.04
2	Ped LOS Score for Link	2.32	3
2	Transit LOS Score for Segment	0.43	0.4
2	Transit Segment LOS	A	A
3	Average Pedestrian Space, ft2/p	Infinity	Infinity

3	Pedestrian Travel Speed, ft/s	4.31	4.22
3	Ped LOS Score for Intersection	2.26	1.89
3	Cross-section Adjustment Factor	-4.74	-4.74
3	Volume Adjustment Factor	0.7	1.56
3	Speed Adjustment Factor	0.48	0.46
3	Ped LOS Score for Link	2.49	3.33
3	Ped Link LOS	B	C
3	Roadway Crossing Difficulty Factor	1.2	0.8
3	Ped LOS Score for Segment	3.1	2.85
3	Ped Segment LOS	C	C
3	Bicycle Travel Speed	13.58	11.49
3	Bicycle LOS Score for Intersection	2.81	1.34
3	Cross-section Adjustment Factor	-1.28	-1.28
3	Volume Adjustment Factor	2.2	2.61
3	Speed Adjustment Factor	0.76	0.75
3	Pavement Adjustment Factor	0.58	0.58
3	Bicycle LOS Score for Link	3.02	3.41
3	Bicycle Link LOS	C	C
3	Number of access point approaches	0	0
3	Segment Length, ft	1020	1020
3	Unsignalized Conflicts Factor	-0.7	-0.7
3	Bicycle LOS Score for Segment	2.65	2.73
3	Bicycle Segment LOS	B	B
3	Transit Running Speed, mi/h	34.68	33.88
3	g/C Ratio	0.43	0.52
3	Transit Running Time, s	20.05	20.53
3	Delay at Intersection, s/veh	0	19.59
3	Transit Travel Speed, mi/h	34.68	17.34
3	Transit Wait-Ride Score	3.85	2.96
3	Ped LOS Score for Link	2.49	3.33
3	Transit LOS Score for Segment	0.6	2.06
3	Transit Segment LOS	A	B

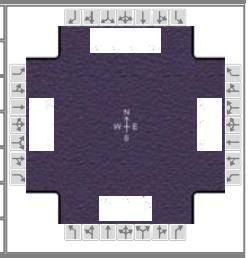
ACCESS POINT DATA

SEGMENT 2

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Movement	1	2	3	4	5	6	7	8	9	10	11	12
1: Volume, veh/h	0	291	17.1	19.9	911	0	35	0	55	0	0	0
1: Lanes	0	2	0	1	2	0	0	1	0	0	0	0
1: Prop blocked												
1: Thru veh delay		0.01			0							
1: Prob inside blk		0			0							
1: Dist to upstream signal	3030											

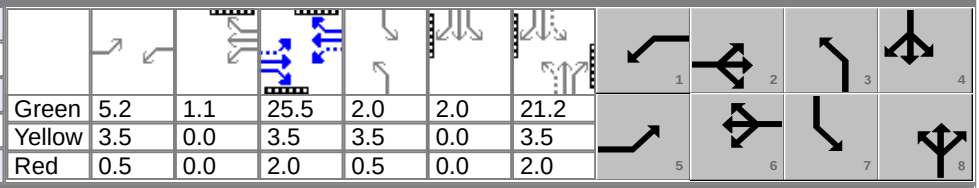
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	RL	Analysis Date	Jan 29, 2018	Area Type	Other
Jurisdiction	CITY OF SIOUX FALLS	Time Period	PM	PHF	0.91
Urban Street	RICE STREET	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	CLIFF AVENUE	File Name	RICE PM.xus		
Project Description	I-229/BENSON IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	105	330	75	125	155	130	30	345	180	275	715	90

Signal Information			
Cycle, s	76.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.2	1.1	25.5	2.0	2.0	21.2
Yellow	3.5	0.0	3.5	3.5	0.0	3.5
Red	0.5	0.0	2.0	0.5	0.0	2.0

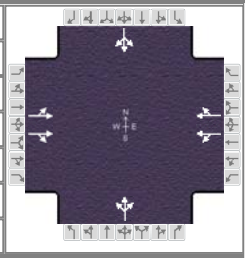
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	3.0
Phase Duration, s	9.2	31.0	10.3	32.1	6.0	26.7	8.0	28.7
Change Period, ($Y+R_c$), s	4.0	5.5	4.0	5.5	4.0	5.5	4.0	5.5
Max Allow Headway (*MAH*), s	4.1	0.0	4.1	0.0	4.1	4.1	4.1	4.1
Queue Clearance Time (g_s), s	5.5		6.5		3.1	11.8	6.0	18.5
Green Extension Time (g_e), s	0.1	0.0	0.2	0.0	0.0	5.4	0.0	4.7
Phase Call Probability	0.91		0.95		0.50	1.00	1.00	1.00
Max Out Probability	0.23		0.56		1.00	0.17	1.00	0.33

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	115	209	203	146	181	93	33	258	242	302	786	71
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1594	1674	1603	1594	1674	1418	1647	1730	1587	1647	1647	
Queue Service Time (g_s), s	3.5	7.2	7.3	4.5	6.0	3.5	1.1	9.6	9.8	4.0	16.5	
Cycle Queue Clearance Time (g_c), s	3.5	7.2	7.3	4.5	6.0	3.5	1.1	9.6	9.8	4.0	16.5	
Green Ratio (*g/C*)	0.40	0.34	0.34	0.42	0.35	0.35	0.31	0.28	0.28	0.33	0.31	
Capacity (*c*), veh/h	482	561	538	447	586	497	179	483	443	313	1005	
Volume-to-Capacity Ratio (*X*)	0.239	0.373	0.378	0.326	0.308	0.188	0.184	0.535	0.546	0.967	0.781	
Back of Queue (*Q*), ft/ln (95 th percentile)	58.4	140.3	128	73.2	114.1	56.3	19.2	177.7	161.1	303.4	270	
Back of Queue (*Q*), veh/ln (95 th percentile)	2.2	5.2	5.1	2.7	4.3	2.1	0.7	6.8	6.4	11.7	10.4	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.58	0.00	0.00	0.46	0.00	0.00	0.17	0.00	0.00	2.02	0.00	
Uniform Delay (d_1), s/veh	14.9	19.2	19.2	14.6	18.0	17.2	20.6	23.2	23.3	28.9	24.1	
Incremental Delay (d_2), s/veh	0.3	1.9	2.0	0.4	1.3	0.8	0.5	0.9	1.0	41.9	2.3	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	15.2	21.1	21.2	15.0	19.3	18.0	21.1	24.1	24.4	70.7	26.4	0.0
Level of Service (LOS)	B	C	C	B	B	B	C	C	C	E	C	A
Approach Delay, s/veh / LOS	19.9	B		17.5	B		24.0	C		36.3	D	
Intersection Delay, s/veh / LOS	27.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.75	C	2.86	C	2.76	C	2.40	B
Bicycle LOS Score / LOS	2.39	B	2.92	C	2.70	C	3.22	C

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	RL	Analysis Date	Jan 29, 2018	Area Type	Other
Jurisdiction	CITY OF SIOUX FALLS	Time Period	PM	PHF	0.76
Urban Street	RICE STREET	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	WAYLAND AVE	File Name	RICE PM.xus		
Project Description	I-229/BENSON IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	10	755	20	10	380	15	20	0	5	90	5	10

Signal Information			
Cycle, s	29.3	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	15.0	3.7	0.0	0.0	0.0	0.0	5	6	7	8
Yellow	3.9	3.0	0.0	0.0	0.0	0.0				
Red	1.2	2.5	0.0	0.0	0.0	0.0				

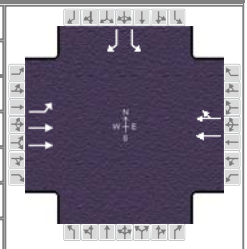
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		8.0		8.0
Phase Duration, s		20.1		20.1		9.2		9.2
Change Period, ($Y+R_c$), s		5.1		5.1		5.5		5.5
Max Allow Headway (*MAH*), s		1.3		1.3		4.2		4.2
Queue Clearance Time (g_s), s		7.2		4.4		2.5		4.6
Green Extension Time (g_e), s		0.2		0.2		0.4		0.4
Phase Call Probability		1.00		1.00		0.74		0.74
Max Out Probability		0.00		0.00		0.00		0.01

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	445		404	240		219		33			132	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1664		1516	1638		1509		1482			1430	
Queue Service Time (g_s), s	0.0		5.2	0.0		2.4		0.0			2.1	
Cycle Queue Clearance Time (g_c), s	5.2		5.2	2.4		2.4		0.5			2.6	
Green Ratio (*g/C*)	0.51		0.51	0.51		0.51		0.12			0.12	
Capacity (*c*), veh/h	979		777	969		774		407			412	
Volume-to-Capacity Ratio (*X*)	0.455		0.520	0.247		0.283		0.081			0.319	
Back of Queue (*Q*), ft/ln (95 th percentile)	24.5		22.7	11.3		10.5		7.3			31.9	
Back of Queue (*Q*), veh/ln (95 th percentile)	1.0		0.9	0.5		0.4		0.3			1.3	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00		0.00	0.00		0.00		0.00			0.00	
Uniform Delay (d_1), s/veh	4.7		4.7	4.1		4.1		11.4			12.3	
Incremental Delay (d_2), s/veh	0.1		0.1	0.0		0.1		0.1			0.4	
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0		0.0		0.0			0.0	
Control Delay (*d*), s/veh	4.8		4.9	4.1		4.1		11.5			12.8	
Level of Service (LOS)	A		A	A		A		B			B	
Approach Delay, s/veh / LOS	4.9	A		4.1	A		11.5	B		12.8	B	
Intersection Delay, s/veh / LOS	5.5						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.67	B	1.72	B	2.57	C	2.53	C
Bicycle LOS Score / LOS	3.01	C	2.61	C	2.72	C	2.88	C

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	RL	Analysis Date	Jan 29, 2018	Area Type	Other
Jurisdiction	CITY OF SIOUX FALLS	Time Period	PM	PHF	0.91
Urban Street	RICE STREET	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	RICE PM.xus		
Project Description	I-229/BENSON IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	185	680			345	135				245		60

Signal Information			
Cycle, s	76.0	Reference Phase	2
Offset, s	65	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	15.0	23.0	20.0	0.0	0.0	0.0	5	6	7	8
Yellow	3.0	5.0	4.0	0.0	0.0	0.0				
Red	2.0	2.0	2.0	0.0	0.0	0.0				

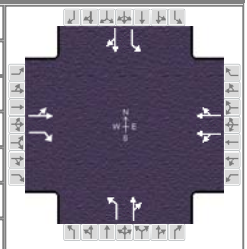
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	20.0	50.0		30.0				26.0
Change Period, ($Y+R_c$), s	5.0	7.0		7.0				6.0
Max Allow Headway (*MAH*), s	4.1	0.0		0.0				4.2
Queue Clearance Time (g_s), s	17.0							22.0
Green Extension Time (g_e), s	0.0	0.0		0.0				0.0
Phase Call Probability	0.99							1.00
Max Out Probability	1.00							1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	207	759			259	246				269		66
Adjusted Saturation Flow Rate (*s*), veh/h/ln	645	1662			1725	1611				377		1435
Queue Service Time (g_s), s	15.0	9.8			8.1	7.8				20.0		2.7
Cycle Queue Clearance Time (g_c), s	15.0	9.8			8.1	7.8				20.0		2.7
Green Ratio (*g/C*)	0.53	0.57			0.30	0.30				0.26		0.26
Capacity (*c*), veh/h	289	1881			522	487				99		378
Volume-to-Capacity Ratio (*X*)	0.715	0.404			0.496	0.504				2.713		0.175
Back of Queue (*Q*), ft/ln (95 th percentile)	195.8	140.4			136.8	125.9				1873.7		39.7
Back of Queue (*Q*), veh/ln (95 th percentile)	4.8	5.6			5.5	5.0				41.6		1.6
Queue Storage Ratio (*RQ*) (95 th percentile)	2.45	0.00			0.00	0.00				18.74		0.00
Uniform Delay (d_1), s/veh	15.6	9.3			16.2	15.4				28.0		21.6
Incremental Delay (d_2), s/veh	7.1	0.6			3.2	3.5				798.4		0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	22.7	9.8			19.4	18.9				826.4		21.8
Level of Service (LOS)	C	A			B	B				F		C
Approach Delay, s/veh / LOS	12.6	B		19.1	B		0.0			668.2	F	
Intersection Delay, s/veh / LOS	136.1						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.68	A	1.91	B	2.22	B	2.31	B
Bicycle LOS Score / LOS	1.27	A	0.87	A				F

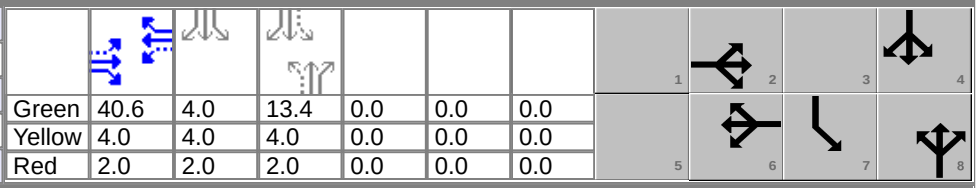
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	RL	Analysis Date	Jan 29, 2018	Area Type	Other
Jurisdiction	CITY OF SIOUX FALLS	Time Period	PM	PHF	0.85
Urban Street	RICE STREET	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	RICE PM.xus		
Project Description	I-229/BENSON IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	55	360	510	70	230	15	140	75	60	310	25	110

Signal Information			
Cycle, s	76.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	40.6	4.0	13.4	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	2.0	2.0	2.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8	7	4
Case Number		7.0		8.0		6.3	1.0	4.0
Phase Duration, s		46.6		46.6		19.4	10.0	29.4
Change Period, ($Y+R_c$), s		6.0		6.0		6.0	6.0	6.0
Max Allow Headway (*MAH*), s		0.0		0.0		6.3	6.0	6.3
Queue Clearance Time (g_s), s						11.4	6.0	6.3
Green Extension Time (g_e), s		0.0		0.0		2.0	0.0	3.3
Phase Call Probability						1.00	1.00	1.00
Max Out Probability						0.60	1.00	0.02

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h		356	261	181		184	165	129		365	106	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1569	1360	1290		1432	1257	1548		1594	1398	
Queue Service Time (g_s), s		0.0	3.9	0.0		5.2	9.4	5.7		4.0	4.3	
Cycle Queue Clearance Time (g_c), s		5.5	3.9	5.0		5.2	9.4	5.7		4.0	4.3	
Green Ratio (*g/C*)		0.53	0.53	0.53		0.53	0.18	0.18		0.26	0.31	
Capacity (*c*), veh/h		892	726	758		765	317	273		299	431	
Volume-to-Capacity Ratio (*X*)		0.399	0.360	0.239		0.240	0.520	0.474		1.219	0.246	
Back of Queue (*Q*), ft/ln (95 th percentile)		53.2	32.9	69.5		70.9	140.1	105.4		569	64.6	
Back of Queue (*Q*), veh/ln (95 th percentile)		2.0	1.2	2.8		2.8	5.4	4.1		21.2	2.4	
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00		0.00	0.93	0.00		5.69	0.00	
Uniform Delay (d_1), s/veh		4.9	3.7	9.4		9.4	29.7	28.1		31.6	19.7	
Incremental Delay (d_2), s/veh		0.1	0.1	0.7		0.7	2.8	2.7		124.8	0.6	
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh		5.0	3.8	10.1		10.1	32.5	30.8		156.4	20.3	
Level of Service (LOS)		A	A	B		B	C	C		F	C	
Approach Delay, s/veh / LOS	4.5	A		10.1	B		31.8	C		125.8	F	
Intersection Delay, s/veh / LOS	42.9						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.28	B	2.32	B	2.42	B	3.20	C
Bicycle LOS Score / LOS	3.72	D	0.91	A	2.63	C	2.95	C

HCS7 Two-Way Stop-Control Report

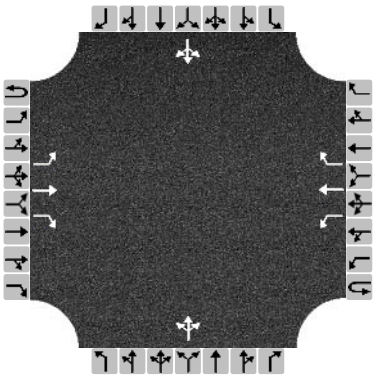
General Information

Analyst	RL
Agency/Co.	HDR
Date Performed	1/29/2018
Analysis Year	2018
Time Analyzed	PM PEAK
Intersection Orientation	East-West
Project Description	I-229/BENSON IMJR

Site Information

Intersection	BAHNSON AVENUE
Jurisdiction	CITY OF SIOUX FALLS
East/West Street	RICE STREET
North/South Street	BAHNSON AVENUE
Peak Hour Factor	0.85
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	1	0	1	1	1		0	1	0		0	1	0
Configuration		L	T	R		L	T	R			LTR				LTR	
Volume, V (veh/h)		10	710	10		0	280	0		20	0	0		0	0	15
Percent Heavy Vehicles (%)		3				3				3	3	3		3	3	3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.13				4.13				7.13	6.53	6.23		7.13	6.53	6.23
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.23				2.23				3.53	4.03	3.33		3.53	4.03	3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		12				0					24				18	
Capacity, c (veh/h)		1224				785					157				710	
v/c Ratio		0.01				0.00					0.15				0.02	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.5				0.1	
Control Delay (s/veh)		8.0				9.6					32.0				10.2	
Level of Service, LOS		A				A					D				B	
Approach Delay (s/veh)	0.1				0.0				32.0				10.2			
Approach LOS									D				B			

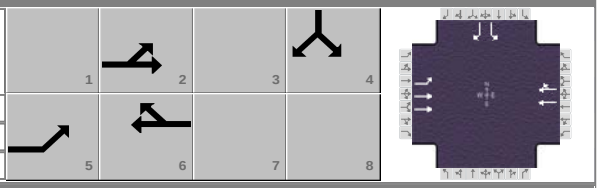
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	HDR			Interchange Type	Parclo AB-2Q
Analyst	RL	Analysis Date	Jan 29, 2018	Segment Distance, ft	1020
Jurisdiction	CITY OF SIOUX FALLS	Duration, h	0.25	Freeway Direction	North-South
Intersection	I-229 SB	PHF	0.91	Arterial Direction	East-West
File Name	RICE PM.xus				
Project Description	I-229/BENSON IMJR				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h	185	680			345	135				245		60
Intersection Two Demand (*v*), veh/h	55	360	510	70	230	15	140	75	60	310	25	110

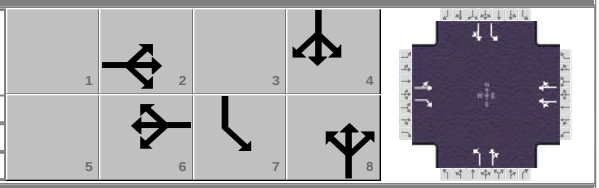
Signal One Information	
Cycle, s	76.0
Offset, s	65
Uncoordinated	No
Force Mode	Fixed

Green	15.0	23.0	20.0	0.0	0.0	0.0
Yellow	3.0	5.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



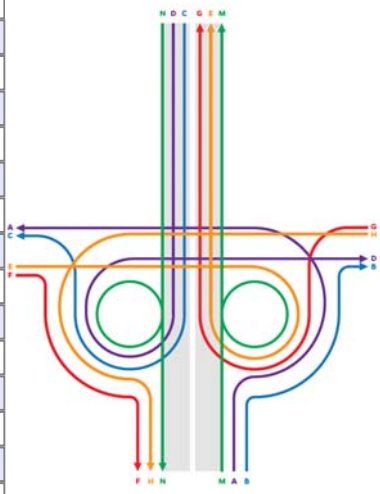
Signal Two Information	
Cycle, s	76.0
Offset, s	65
Uncoordinated	No
Force Mode	Fixed

Green	40.6	4.0	13.4	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	90	51.8	0.0	51.8	No	No	C
B	41	30.8	0.0	30.8	No	No	C
C	0	0.0	5.0	5.0	No	No	A
D	0	0.0	5.0	5.0	No	No	A
E	261	13.6	5.0	18.6	No	No	A
F	0	9.8	0.0	9.8	No	No	A
G	82	10.1	5.0	15.1	No	No	A
H	0	0.0	0.0	0.0	No	No	A
I	384	9.8	0.0	9.8	No	No	A
J	245	19.4	0.0	19.4	No	No	B
K	-	-	0.0	-	-	-	-
L	-	-	0.0	-	-	-	-
M	75	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	22.7	9.8			19.4	18.9				826.4		21.8
Level of Service (LOS)	C	A			B	B				F		C
Approach Delay, s/veh / LOS	12.6	B		19.1	B		0.0			668.2	F	
Intersection Delay, s/veh / LOS	136.1						F					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		5.0	3.8	10.1		10.1	32.5	30.8		156.4	20.3	
Level of Service (LOS)		A	A	B		B	C	C		F	C	
Approach Delay, s/veh / LOS	4.5	A		10.1	B		31.8	C		125.8	F	
Intersection Delay, s/veh / LOS	42.9						D					

HCS7 Streets Text Report

File Name:	RICE PM.xus
Analyst:	RL
Agency/Co.:	HDR
Analysis Date:	Jan 29, 2018
Time Period:	PM
Jurisdiction:	CITY OF SIOUX FALLS
Analysis Year:	2018
Project Description:	I-229/BENSON IMJR
Urban Street:	RICE STREET
Analysis Period:	1> 7:00

Input

URBAN STREET PARAMETERS

Number of Intersections	4
Number of Segments	3
Analysis period duration, h	0.25
System cycle length, s	76
Urban street forward direction	EB
Sneakers per cycle, veh	2
Saturation flow rate, veh/h/ln	1900
Stored vehicle lane length, ft	25
Detected vehicle length, ft	17
Queue length percent	95
Critical merge gap, s	3.7
Stop threshold speed, mph	5
Acceleration rate, ft/s/s	3.5
Decel. rate (signal), ft/s/s	4
Minimum headway in a platoon, s/veh	1.5
Maximum headway in a platoon, s/veh	3.6
Number of iterations	15
Length of left-turn bay (access pt.), ft	250
Decel. rate (access pt.), ft/s/s	6.7
Right-turn speed (access pt.), ft/s	20
Critical gap from major left (access pt.), s	4.1
Follow-up time from major left (access pt.), s	2.2
Right-turn equivalency factor (access pt.)	2.2
Stored heavy vehicle lane length, ft	45
Proportion of peds who push button	0.51
Critical gap for permissive left-turn, s	4.5
Follow-up time for permissive left-turn, s	2.5
Calibration factor for platoon dispersion	0.14
Average ratio of speed limit to free-flow speed	0.9

BASIC SEGMENT INFORMATION

Seg	Spd Lmt		TH Lanes		Seg Len		IntWid		LenRM		PctCurb		Other Dly	
Num	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
1	35	35	2	1	1020	1020	50	50	0	0	70	70	0	0
2	35	35	2	2	3460	3460	50	50	0	0	70	70	0	0
3	35	35	1	2	1020	1020	50	50	0	0	70	70	0	0

ORIGIN-DESTINATION SEED PROPORTIONS - Forward Direction

	Cross LT	Major TH	Cross RT	MidEntry
Downstream Left	0.02	0.1	0.05	0.02
Downstream Thru	0.91	0.78	0.92	0.97
Downstream Right	0.05	0.1	0.02	0.01
Mid-segment Exit	0.02	0.02	0.01	0

ORIGIN-DESTINATION SEED PROPORTIONS - Reverse Direction

	Cross LT	Major TH	Cross RT	MidEntry
Downstream Left	0.02	0.1	0.05	0.02
Downstream Thru	0.91	0.78	0.92	0.97
Downstream Right	0.05	0.1	0.02	0.01
Mid-segment Exit	0.02	0.02	0.01	0

ACCESS POINT DATA

SEGMENT 1

Number of access points: 0

SEGMENT 2

	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB

Movement	LT 1	TH 2	RT 3	LT 4	TH 5	RT 6	LT 7	TH 8	RT 9	LT 10	TH 11	RT 12
1: Volume, veh/h	0	835	15	60	345	0	60	0	30	0	0	0
1: Lanes	0	2	0	1	2	0	0	1	0	0	0	0
1: Location, ft	3030											
1: Peak Hour Factor	1											

Number of access points: 1

SEGMENT 3

Number of access points: 0

Global Output

SEGMENT DATA

Seg.No.	Movement	EB LT 5	EB TH 2	EB RT 12	WB LT 1	WB TH 6	WB RT 16
1	Bay/Lane Spillback Time, h	999	999	999	999	999	999
1	ShrdLane Spillback Time, h				999		
1	Base Free-Flow Speed, mph		41.72			41.72	
1	Running Time, s		20.19			20.25	
1	Running Speed, mph		34.44			34.35	
1	Through Delay, s/veh		4.85			19.32	
1	Travel Speed, mph		27.77			17.58	
1	Stop Rate, stops/veh		0.44			0.62	
1	Spatial Stop Rate, stops/mi		2.26			3.21	
1	Through vol/cap ratio		0.49			0.31	
1	Percent of Base FFS		66.56			42.14	
1	Level of Service		C			D	
1	Automobile Perception Score		2.72			2.89	
2	Bay/Lane Spillback Time, h	999	999	999	999	999	999
2	ShrdLane Spillback Time, h	999					
2	Base Free-Flow Speed, mph		41.72			41.72	
2	Running Time, s		59.08			58.28	
2	Running Speed, mph		39.93			40.48	
2	Through Delay, s/veh		9.85			4.11	
2	Travel Speed, mph		34.23			37.81	
2	Stop Rate, stops/veh		0.39			0.43	
2	Spatial Stop Rate, stops/mi		0.59			0.66	
2	Through vol/cap ratio		0.4			0.26	
2	Percent of Base FFS		82.04			90.63	
2	Level of Service		A			A	
2	Automobile Perception Score		2.33			2.34	
3	Bay/Lane Spillback Time, h	999	999	999	999	999	999
3	ShrdLane Spillback Time, h						
3	Base Free-Flow Speed, mph		41.72			41.72	
3	Running Time, s		20.79			20.02	
3	Running Speed, mph		33.45			34.74	
3	Through Delay, s/veh		4.98			19.19	
3	Travel Speed, mph		26.99			17.74	
3	Stop Rate, stops/veh		0.19			0.55	
3	Spatial Stop Rate, stops/mi		0.97			2.85	
3	Through vol/cap ratio		0.4			0.5	
3	Percent of Base FFS		64.69			42.52	
3	Level of Service		C			D	
3	Automobile Perception Score		2.5			2.82	

Facility Travel Time, s	119.74	141.16
Facility Travel Speed, mph	31.32	26.57
Facility Spatial Stop Rate, stops/mi	0.97	1.54
Facility Base Free Flow Speed, mph	41.72	41.72
Facility Percent Base Free Flow Speed	75.07	63.67
Facility Level of Service	B	C
Facility Automobile Perception Score	2.43	2.51
Facility Pedestrian Space	Infinity	Infinity
Facility Pedestrian Travel Speed	4.26	4.22
Facility Pedestrian LOS Score	2.97	2.9
Facility Pedestrian LOS	C	C
Facility Bicycle Travel Speed	13.52	13.38
Facility Bicycle LOS Score	2.87	2.61
Facility Bicycle LOS	C	C
Facility Transit Travel Speed	34.44	17.58

Facility Transit LOS Score		0.73	0.9
Facility Transit LOS		A	A
SPILLBACK TIME, h		999	

Multimodal Results

1	Average Pedestrian Space, ft2/p	Infinity	Infinity
1	Pedestrian Travel Speed, ft/s	3.93	3.93
1	Ped LOS Score for Intersection	1.67	2.86
1	Cross-section Adjustment Factor	-4.74	-4.74
1	Volume Adjustment Factor	0.98	1.08
1	Speed Adjustment Factor	0.47	0.47
1	Ped LOS Score for Link	2.76	2.86
1	Ped Link LOS	C	C
1	Roadway Crossing Difficulty Factor	0.96	0.8
1	Ped LOS Score for Segment	2.8	2.64
1	Ped Segment LOS	C	B
1	Bicycle Travel Speed	11.01	13.95
1	Bicycle LOS Score for Intersection	3.01	2.92
1	Cross-section Adjustment Factor	-1.28	-1.28
1	Volume Adjustment Factor	2.37	2.42
1	Speed Adjustment Factor	0.76	0.75
1	Pavement Adjustment Factor	0.58	0.58
1	Bicycle LOS Score for Link	3.19	3.23
1	Bicycle Link LOS	C	C
1	Number of access point approaches	0	0
1	Segment Length, ft	1020	1020
1	Unsignalized Conflicts Factor	-0.7	-0.7
1	Bicycle LOS Score for Segment	2.85	2.79
1	Bicycle Segment LOS	C	C
1	Transit Running Speed, mi/h	34.44	34.35
1	g/C Ratio	0.51	0.35
1	Transit Running Time, s	20.19	20.25
1	Delay at Intersection, s/veh	0	19.32
1	Transit Travel Speed, mi/h	34.44	17.58
1	Transit Wait-Ride Score	3.84	2.98
1	Ped LOS Score for Link	2.76	2.86
1	Transit LOS Score for Segment	0.66	1.96
1	Transit Segment LOS	A	A
2	Average Pedestrian Space, ft2/p	Infinity	Infinity
2	Pedestrian Travel Speed, ft/s	4.37	4.37
2	Ped LOS Score for Intersection	0.68	1.72
2	Cross-section Adjustment Factor	-4.74	-4.74
2	Volume Adjustment Factor	1.08	0.54
2	Speed Adjustment Factor	0.64	0.66
2	Ped LOS Score for Link	3.03	2.5
2	Ped Link LOS	C	C
2	Roadway Crossing Difficulty Factor	0.8	1.2
2	Ped LOS Score for Segment	2.68	3.12
2	Ped Segment LOS	B	C
2	Bicycle Travel Speed	14.68	13.42
2	Bicycle LOS Score for Intersection	1.27	2.61
2	Cross-section Adjustment Factor	-1.28	-1.28
2	Volume Adjustment Factor	2.42	2.07
2	Speed Adjustment Factor	0.83	0.83
2	Pavement Adjustment Factor	0.58	0.58
2	Bicycle LOS Score for Link	3.31	2.96
2	Bicycle Link LOS	C	C
2	Number of access point approaches	0	0
2	Segment Length, ft	3460	3460
2	Unsignalized Conflicts Factor	-0.7	-0.7
2	Bicycle LOS Score for Segment	2.81	2.6
2	Bicycle Segment LOS	C	B
2	Transit Running Speed, mi/h	39.93	40.48
2	g/C Ratio	0.57	0.51
2	Transit Running Time, s	59.08	58.28
2	Delay at Intersection, s/veh	9.85	0
2	Transit Travel Speed, mi/h	34.23	40.48
2	Transit Wait-Ride Score	3.83	4.05
2	Ped LOS Score for Link	3.03	2.5
2	Transit LOS Score for Segment	0.71	0.3
2	Transit Segment LOS	A	A
3	Average Pedestrian Space, ft2/p	Infinity	Infinity

3	Pedestrian Travel Speed, ft/s	4.27	4.08
3	Ped LOS Score for Intersection	2.28	1.91
3	Cross-section Adjustment Factor	-4.74	-4.74
3	Volume Adjustment Factor	1.95	0.64
3	Speed Adjustment Factor	0.45	0.48
3	Ped LOS Score for Link	3.71	2.43
3	Ped Link LOS	D	B
3	Roadway Crossing Difficulty Factor	1.18	0.86
3	Ped LOS Score for Segment	4.13	2.43
3	Ped Segment LOS	D	B
3	Bicycle Travel Speed	12.99	12.73
3	Bicycle LOS Score for Intersection	3.72	0.87
3	Cross-section Adjustment Factor	-1.28	-1.28
3	Volume Adjustment Factor	2.72	2.16
3	Speed Adjustment Factor	0.74	0.76
3	Pavement Adjustment Factor	0.58	0.58
3	Bicycle LOS Score for Link	3.52	2.98
3	Bicycle Link LOS	D	C
3	Number of access point approaches	0	0
3	Segment Length, ft	1020	1020
3	Unsignalized Conflicts Factor	-0.7	-0.7
3	Bicycle LOS Score for Segment	3.09	2.47
3	Bicycle Segment LOS	C	B
3	Transit Running Speed, mi/h	33.45	34.74
3	g/C Ratio	0.53	0.3
3	Transit Running Time, s	20.79	20.02
3	Delay at Intersection, s/veh	0	19.36
3	Transit Travel Speed, mi/h	33.45	17.66
3	Transit Wait-Ride Score	3.8	2.98
3	Ped LOS Score for Link	3.71	2.43
3	Transit LOS Score for Segment	0.86	1.89
3	Transit Segment LOS	A	A

ACCESS POINT DATA

SEGMENT 2

	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
Movement	1	2	3	4	5	6	7	8	9	10	11	12
1: Volume, veh/h	0	936	16.8	70.4	405	0	60	0	30	0	0	0
1: Lanes	0	2	0	1	2	0	0	1	0	0	0	0
1: Prop blocked												
1: Thru veh delay		0.01			0							
1: Prob inside blk		0			0							
1: Dist to upstream signal	3030											

This Urban Streets text report was created in HCS7 Streets Version 7.4 on January 29, 2018 at 02:58:45