1. COVER PAGE

INTERSTATE 90 EXIT 61 to EXIT 67 CORRIDOR STUDY

METHODS AND ASSUMPTIONS DOCUMENT

Prepared for:

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FHU Reference No. 116034-01
July 2016

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2. STAKEHOLDER ACCEPTANCE

The undersigned parties concur with the Methods and Assumptions for the Exit 61 to 67 Corridor Study as presented in this document.

SDDOT	FHWA
Signature	Signature
Planning Engineer Title	Planning & Civil Rights Specialist Title
July 12, 2016 Date	July 12, 2016 Date

AMENDMENT (IF NEEDED)

SDDOT	FHWA
Signature	Signature
Title	Title
Date	Date

Participation of the Study Advisory Team and/or signing of this document do not constitute approval of the Exit 61 to 67 Corridor Study Final Report or conclusions.

All members of the Study Advisory Team will accept this document as a guide and reference as the study progresses through the various stages of development. If there are any agreed upon changes to the assumptions in this document a revision will be created, endorsed and signed by all the signatories.

3. INTRODUCTION AND PROJECT DESCRIPTION

A. Background Information

The Interstate 90 (I-90) corridor from Exit 61 to Exit 67 is anticipated to be in need of surfacing improvements within the next eight to 10 years. Long range traffic projections along the corridor suggest the possible need to expand I-90 from four to six lanes. In addition, the partial interchange at Exit 63 does not meet FHWA policy on Interstate access and the location and the configuration of Exit 63 may not serve the transportation needs of the community. It is likely that the near-term need to rehabilitate the pavement along I-90 will likely occur before funding is available for a new interchange at Exit 63. Therefore, it is important to consider the long term transportation needs of the study area to ensure that any major pavement rehabilitation or reconstruction effort can accommodate future I-90 traffic volumes and any future improvement or the relocation of the Exit 63 interchange.

The Exit 61 to 67 Corridor Study will generate a purpose and need for the project that will enhance the economic and social well-being of corridor users while developing a solution that can accommodate future traffic conditions along this section of the I-90 corridor. This document provides the Methods and Assumptions by which the Corridor Study will be conducted.

B. Location and Affected Facilities

Interstate 90 from Exit 61 to Exit 67 extends from the eastern edge of Rapid City through most of the City of Box Elder. The affected facilities include interchanges at Exit 61 (Elk Vale Road), Exit 63 (County Highway 1416) and Exit 67 (Liberty Boulevard). In addition to these interchanges, affected roadway facilities include Elk Vale Road, County Highway 1416, Westgate Road, Radar Hill Road, Commercial Gate Road, Ellsworth Road, Liberty Boulevard and the I-90 service roads.

C. Need for Study

The Corridor Study is needed to evaluate alternatives for the I-90 corridor, including how to replace or reconfigure Exit 63. This study needs to be completed prior to any significant pavement rehabilitation or reconstruction effort along the corridor.

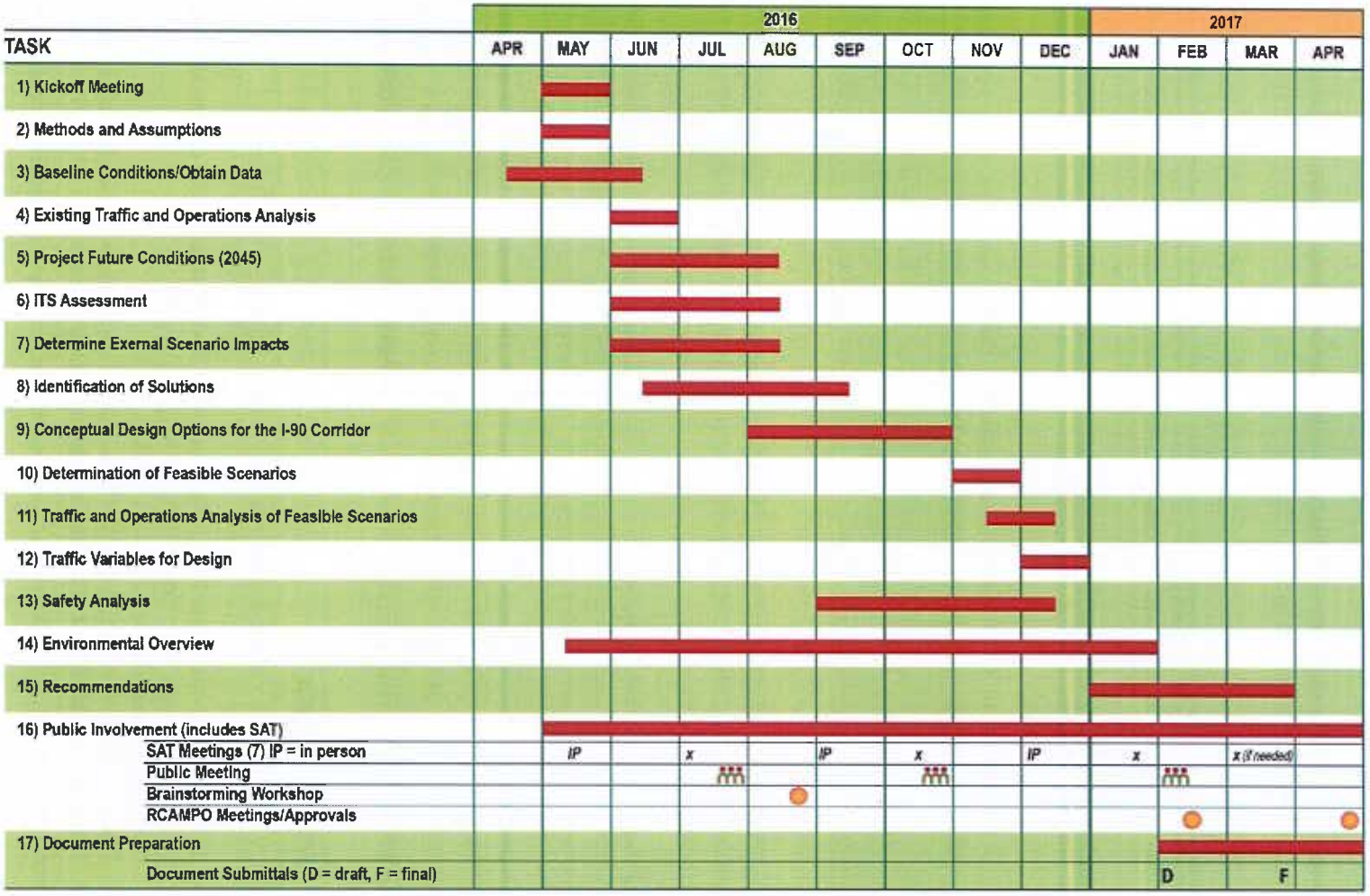
D. Study Schedule

The project will officially begin with a kickoff meeting with the Study Advisory Team in May, 2016. The anticipated project schedule, provided below, assumes this initiation date and details key activities and events needed to complete the Corridor Study. Key events include:

- Public meeting and landowner meetings conducted in July and October 2016 as well as February 2017.
- Study Advisory Team meetings held in May, June, September, October, and December of 2016 and January and March of 2017.
- Brainstorming session in August 2016.

It is anticipated that a draft Corridor Study will be completed by February 2017 with the final report by late March 2017. **Figure 1** presents the study schedule.

Figure 1. Study Schedule



E. Previous Studies

The following are the known previous studies relevant to this study.

- 2010 SDDOT Decennial Interstate Corridor Study (Phases 1-3)
- Meade County Transportation Plan
- Rapid TRIP 2040
- Rapid City Area Bicycle and Pedestrian Master Plan
- Elk Creek Road Corridor Plan
- Air Installation Compatible Use Zone Study for Ellsworth Air Force Base
- County Highway 1416 Traffic Analysis
- County Highway 1416 Corridor Study
- Box Elder Strategic Transportation Plan (BESTPlan)
- Moving Forward with Ellsworth Transportation Plan
- Ellsworth Air Force Base Joint Land Use Study

F. Study Advisory Team Members

Ron Koan	City of Box Elder	Tom Lehmkuhl	SDDOT – Environmental
Bob Kaufman	City of Box Elder	Norris Leone	SDDOT – Rapid City Region
Larry Larson	City of Box Elder Mayor	Karen Olson	SDDOT – Road Design
Patsy Horton	Rapid City Area MPO	Todd Thompson	SDDOT – Bridge
Kip Harrington	Rapid City Area MPO	Tammy Williams	SDDOT - Belle Fourche Area (Rapid City Region)
Linda Fry	Ellsworth AFB	Jeff Brosz	SDDOT – Trans. Inv. Management
Glen Kane	Ellsworth Authority	Rich Zacher	SDDOT – Custer Area (Rapid City Region)
Sonia Downs	SDDOT – Project Development	Mark Hoines	FHWA - Planning
Joanne Hight	SDDOT - Environmental	Marc Hoelscher	FHWA - Operations
Dave Huft	SDDOT – Research	Brad Remmich	SDDOT – Project Development
Doug Kinniburgh	SDDOT – Local Government	Steve Gramm	

4. STUDY AREA

The study area includes the following roadways and is depicted on **Figure 2**.

- I-90 from Elk Vale Road to Liberty Boulevard and all ramps and ramps terminals
- County Highway 1416 from I-90 to Liberty Boulevard
- Westgate Road north of County Highway 1416
- Radar Hill Road south of County Highway 1416 to future Cheyenne Blvd. alignment
- Ellsworth Road north of County Highway 1416 to EAFB

- Commercial Gate Drive north of County Highway 1416 to EAFB
- Liberty Boulevard from County Highway 1416 to EAFB
- Elk Vale Road between Cheyenne Blvd./Eglin Street and Mall Drive

5. ANALYSIS YEARS/PERIODS

It is anticipated that operational analyses will be conducted for existing conditions and for the Year 2045. Existing conditions analyses will be performed using Year 2016 traffic data. Intersection turning movements counts will be collected for a 12-hour period on a weekday from 6:00 AM to 6:00 PM. The morning and evening peaks hours from these time frames will be selected for peak hour operational analyses.

6. DATA COLLECTION

Many sources of data will be used to establish the current baseline conditions assessment and identify existing issues affecting the transportation system. The data collection effort includes:

- Obtain and review current ordinances and guidelines
- Gather base mapping data from agencies
- Obtain existing traffic volume and turning movement data
- Gather other relevant data (e.g. land use, design plans, aerial photography, utilities, topographic survey data, existing development plans)
- Obtain and inventory existing crash history data
- Identify existing bicycle and pedestrian facilities
- Obtain available information regarding future development in the study area

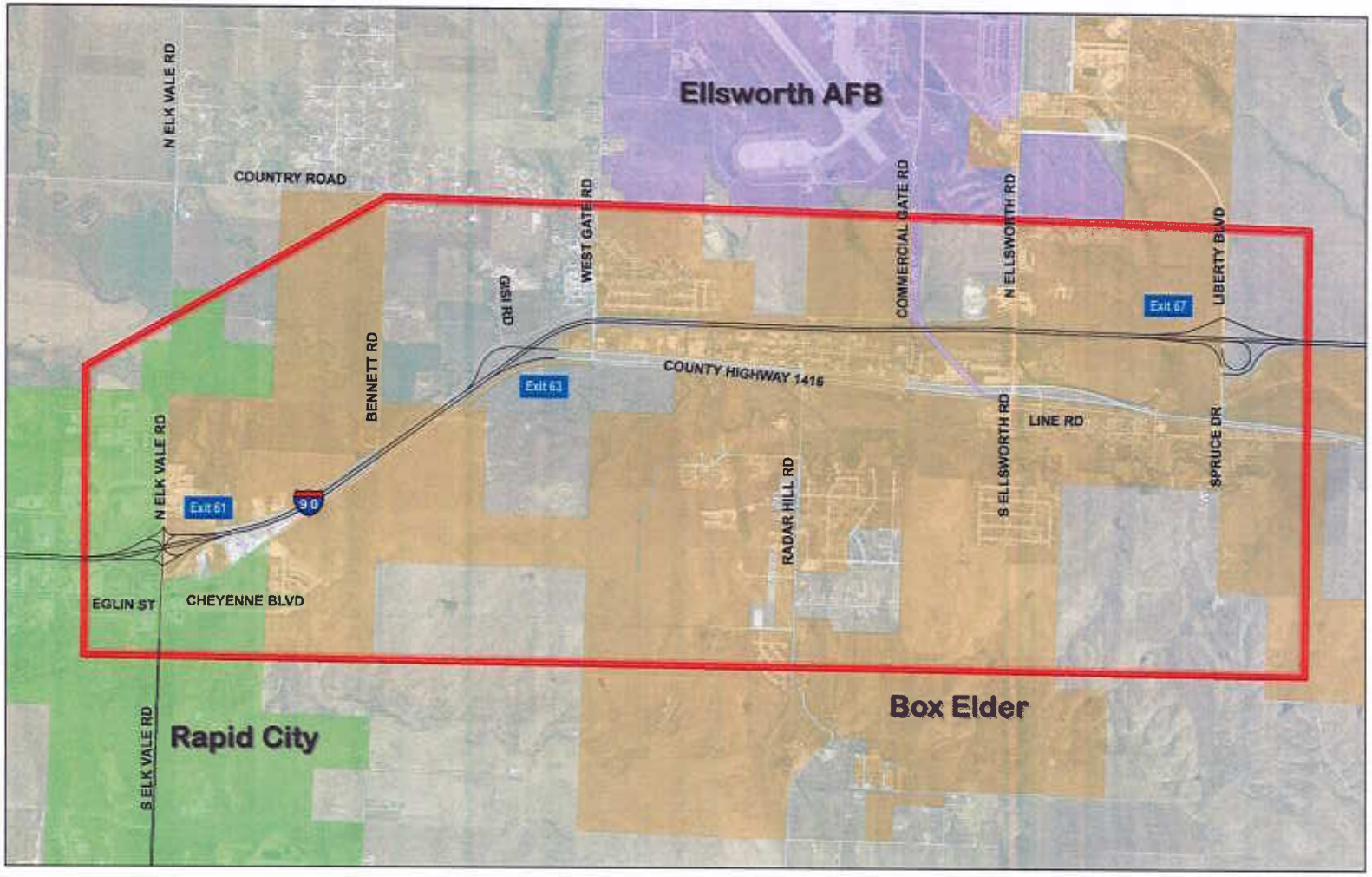
The effort to provide traffic volume data for the project will be conducted using the following three methods:

1. Compile data from available historical and recent data with the study area from studies in the area and the SDDOT sources.

2. Collect weekday peak hour turning movement data at the study intersections during the school year. Turning movement data will be collected from 6:00 AM to 6:00 PM on a weekday to determine the peak hours of travel. Data collection will occur on Thursday, May 19.

3. Origin-destination information will be recorded to quantify interchange use to access Ellsworth Air Force Base and the airport. Data will be recorded for three hours during the AM peak and three hours during the PM peak for all locations. Locations along Airport Road and at Exit 61 would also be recorded for three hours during the midday peak. Data collection will occur on Thursday, May 19.

Figure 2. Study Area



Turning movement counts will be conducted at the following intersections:

Ref #	Street #1	Street #2
1.	Elk Vale Road	Edwards Street
2.	Elk Vale Road	I-90 Ramps
3.	Elk Vale Road	Mall Drive
4.	West Gate Road	County Highway 1416 Eastbound
5.	West Gate Road	County Highway 1416 Westbound
6.	West Gate Road	I-90 Service Road
7.	West Gate Road	Bluebird Dr
8.	Radar Hill Road	County Highway 1416 Eastbound
9.	Radar Hill Road	County Highway 1416 Westbound
10.	Commercial Gate Road	County Highway 1416 Eastbound
11.	Commercial Gate Road	County Highway 1416 Westbound
12.	Ellsworth Road	County Highway 1416 Eastbound
13.	Ellsworth Road	County Highway 1416 Westbound
14.	Liberty Boulevard	I-90 Eastbound On-Ramp
15.	Liberty Boulevard	I-90 Eastbound to Southbound Off-Ramp
16.	Liberty Boulevard	I-90 Eastbound to Northbound Off-Ramp
17.	Liberty Boulevard	I-90 Westbound Ramps

Origin-destination will be recorded at the following locations:

Ref #	Location	Direction
1.	Elk Vale Road Eastbound On-Ramp	Eastbound
2.	Elk Vale Road Westbound Off-Ramp	Westbound
3.	County Highway 1416 E/O I-90	Eastbound
4.	County Highway 1416 E/O I-90	Westbound
5.	Commercial Gate Road N/O I-90	Southbound
6.	Commercial Gate Road N/O I-90	Northbound
7.	Liberty Boulevard W/O Ellsworth Road	Eastbound
8.	Liberty Boulevard W/O Ellsworth Road	Westbound
9.	Ellsworth Road N/O Liberty Boulevard	Northbound
10.	Ellsworth Road N/O Liberty Boulevard	Southbound
11.	Elk Vale Road Eastbound Off-Ramp	Eastbound
12.	Elk Vale Road Westbound On-Ramp	Westbound
13.	Airport Road N/O SD 44	Northbound
14.	Airport Road N/O SD 44	Southbound

Traffic counts will be collected by All Traffic Data, Inc. (ATD). All turning movement counts will be field collected using video cameras, with counts conducted after compiling the video footage. ATD will also be recording the origin-destination data using License Plate Recognition (LPR) technology. This data will be compiled and summarized by ATD. Legal requirements prevent ATD from sharing license plate numbers collected during data collection.

Traffic data will be obtained from multiple sources and from different months and years. All traffic data will be factored to May 2016 using seasonal adjustment factors obtained from the Automated Traffic Recorder (ATR #622) located along the study corridor between Exits 61 and 63. Data from the ATR will also provide vehicle classification and speed data for the corridor.

Figures 3 and **4** depict traffic count locations and origin-destination locations.

Figure 3. Traffic Count Locations

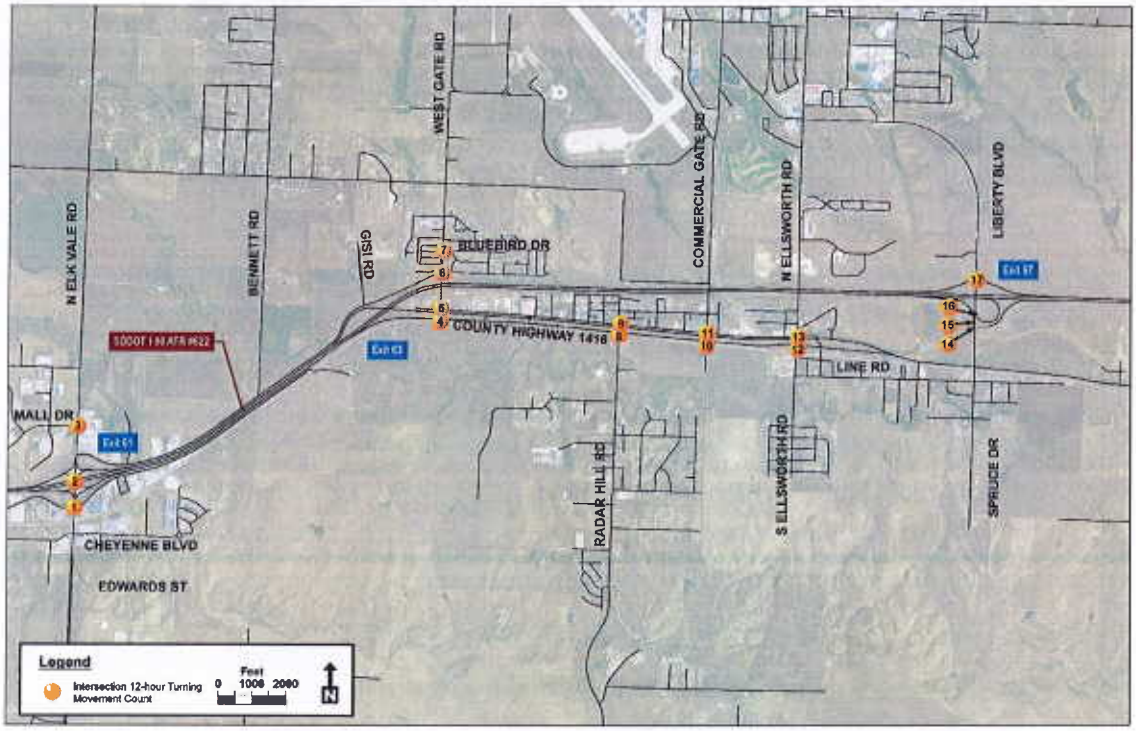
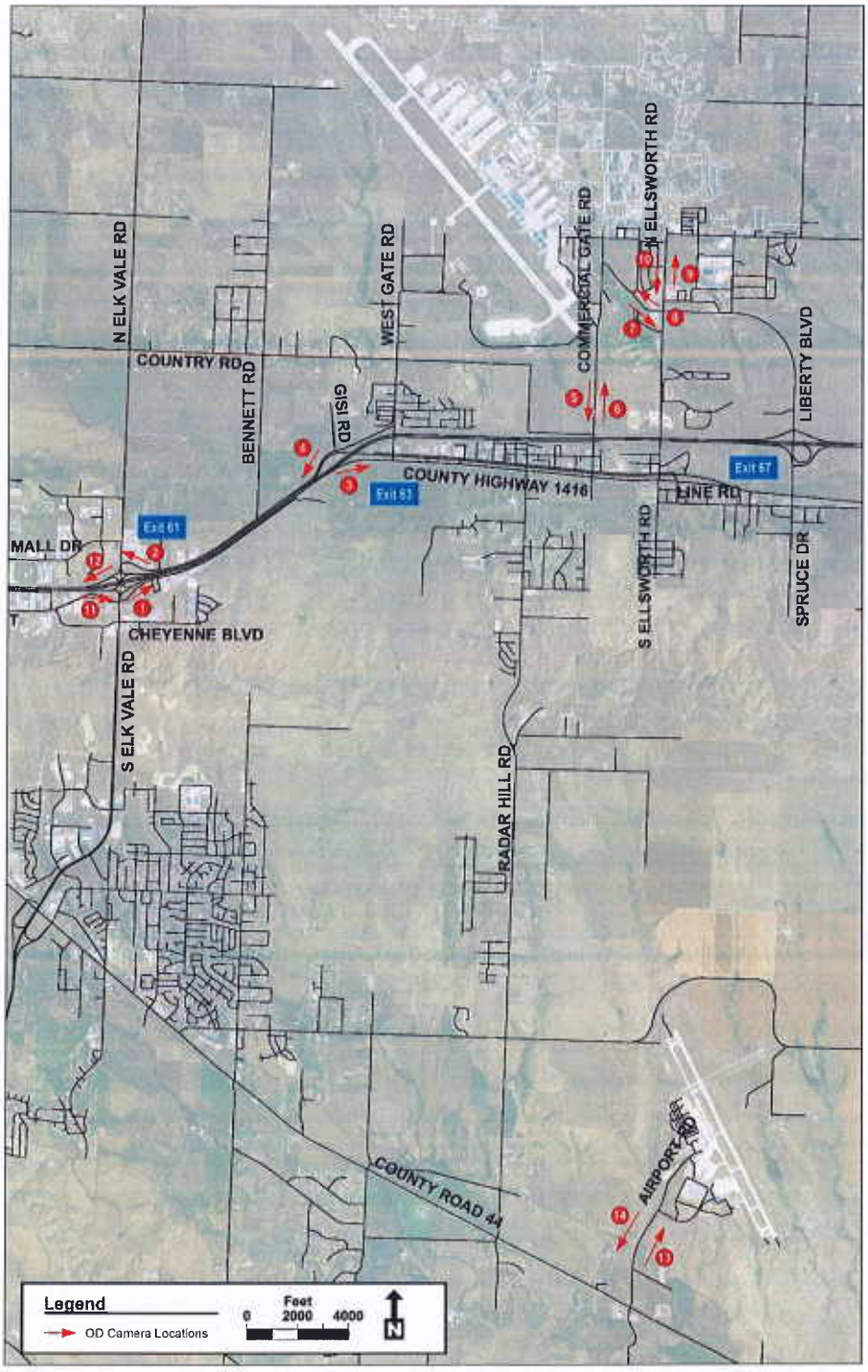


Figure 4. Origin-Destination Locations



7. TRAFFIC OPERATIONS ANALYSIS

Operational analyses will be based on procedures documented in the *Highway Capacity Manual (HCM) 2010* (Transportation Research Board, 2010). However, if the 2016 update to the HCM is released prior to the start of Task 4 – Existing Traffic and Operational Analysis (see Figure 1), then all operational analyses will be based on the procedures of the 2016 HCM update.

It is anticipated that the following chapters of the HCM could be used to analyze specific operational conditions:

Operational Analysis

- Chapter 10 – Freeway Facilities
- Chapter 11 – Basic Freeway Segments
- Chapter 12 – Freeway Weaving Segments
- Chapter 13 – Freeway Merge and Diverge Segments
- Chapter 18 – Signalized Intersections
- Chapter 19 – Two-Way Stop Controlled Intersections
- Chapter 20 – All-Way Stop Controlled Intersections
- Chapter 21 – Roundabouts
- Chapter 22 – Interchange Ramp Terminals

Highway Capacity Software (HCS) will be used to conduct operational analyses for freeway segments, freeway weaving segments, freeway ramp merge and diverge junctions, ramp terminals and surface street intersections.

HCM 2010 analysis procedures require the use of certain parameters, summarized in the following table:

Traffic Parameter		I-90	Surface Streets
% heavy vehicles	Trucks and buses	Determined from recorded vehicle class on I-90	5%
	RV's	0%	0%
Existing Conditions Peak Hour Factor		Determined from existing intersection counts – calculated as the PHF for each approach	
Future Conditions Peak Hour Factor		0.90	
Free-flow Speed (mph)		65	n/a
Terrain/Area Type		Level	Level
Saturation Flow Rate (vehicles per hour per lane) for two-way stop- controlled and signalized intersections		n/a	1800 vphpl
Queue Length Percentile		n/a	95%ile

8. TRAVEL FORECAST

Interstate 90 falls within the Rapid City Area MPO boundary. Therefore, the RCAMPO regional travel demand model will be the basis for long range transportation projections. FHU possesses the MPO travel demand model and will utilize the model to develop traffic forecasts for the planning horizon year (2045) using the 2045 land use projections made available by RCAMPO staff.

9. SAFETY ISSUES

Crash history data for the most recently available five (5) complete years will be analyzed (2011-2015) to identify crash concentrations and trends within the study area, including mainline I-90 from exit 61 to 67 and County Highway 1416. Locations showing elevated crash experience will be noted and reviewed to identify particular crash type and severity patterns.

During the alternative evaluation phase the Interactive Highway Design Safety Modal (IHDSM) will be employed. This model will be used to estimate the expected number of crashes based on the design and traffic characteristics of the alternative.

10. SELECTION OF MEASURES OF EFFECTIVENESS (MOE)

The primary measures of effectiveness for this effort will include the following:

- Freeway facility operations will use density and speed as calculated by the Highway Capacity Software (HCS) to determine Level of Service (LOS).
- Intersection operations will use average delay per vehicle as calculated by the Highway Capacity Software (HCS) to determine Level of Service (LOS).

In general, the primary mobility goal for the study will be Level of Service (LOS) C or better for overall signalized intersection operations, ramp terminals, mainline freeway, ramp merge/diverge areas and weaving segments. At stop-controlled intersections, it is understood that there might be some instances where minor street level of service is LOS E or LOS F, in which case the volume-to-capacity ratio and 95th percentile queue lengths will also be considered.

11. FHWA INTERSTATE ACCESS MODIFICATION POLICY POINTS

The study does not involve an Interchange Justification Report (IJR) and/or Interchange Modification Justification Report (IMJR).

12. DEVIATIONS / JUSTIFICATIONS

We do not anticipate any deviations from stated standards.

13. CONCLUSION

This study will develop I-90 corridor alternatives between Exit 61 and Exit 67. The study will include a HCM2010 based traffic analysis of existing and future conditions, a conceptual design of alternatives and the recommended alternative and an environmental overview of the potential impacts to the natural and built environments.

14. APPENDICES

Appendix A Methods & Assumptions Meeting Notes

Appendix A Methods & Assumptions Meeting Notes

I-90 Exit 61 to 67 Corridor Study
Methods and Assumptions Meeting
May 23, 2016
SDDOT Rapid City Region Office
SDDOT Videoconference
MEETING NOTES

Meeting Attendees

See attached sign in sheet

Meeting Overview
The primary purpose of this meeting was to review the draft Method and Assumptions document to ensure that project stakeholders agree to the approach to traffic data collection, analysis years, traffic projections and traffic operations analysis.

The following documents comments and changes by document sections discussed at this meeting.

Table of Contents

- Page numbers for Figures 3 and 4 are wrong.

Introduction and Project Description

- 1st paragraph line 5 the phrase "Exit 63 does not serve" should be changed to "Exit 63 **may** not serve."
- 2nd paragraph line 2 a hyphen will be added to the word wellbeing.
- In the section Location and Affected Facilities the reference to "Highway 1416" should be changed to "County Highway 1416." All references to Highway 1416 will be changed to County Highway 1416 throughout the document.
- Under the section Previous Studies two additional documents will be added to the list of relevant studies.
    - Moving Forward with Ellsworth
    - Ellsworth AFB and Box Elder Joint Land Use Study (update available June 2016)
    - Pennington County Master Transportation Plan (CHAPS)
- Under the section entitled Study Advisory Team Members the following changes will be made:
    - Monica Heller will be removed from the list due to recent retirement from SDDOT
    - Bob Kaufman, Box Elder's Public Works Director, will be added to the list
    - Box Elder Mayor Larry Larson will be added to the list
    - A Pennington County representative will be added to the list of SAT members but a representative has not been officially identified yet. Mark Schock, Assistant Superintendent, was mentioned as a possible candidate.
    - Change Sonia Downs to SDDOT Project Development

Study Area

- The last bullet on page 4 "north I-90 service road" will be changed to "Mall Drive" and "Cheyenne Blvd" will be changed to "Cheyenne Blvd/Eglin Road".
- Additional road names will be added to the map

Analysis Years / Periods

- No changes to this section; however, it was mentioned that the MPO now has land use projections for Year 2045.

Data Collection

- Reference points 1 and 3 in the turning movement counts table on page 7 don't match the count map shown in Figure 3 on page 8. The table will be modified to show Elk Vale Road / Edwards Street as reference #1 and Elk Vale Road / Mall Drive as reference #3.
- The City of Box Elder mentioned that two hotel projects are planned along Cheyenne Boulevard at Elk Vale Road.
- Figure 3 should show the location of the Automated Traffic Recorder (ATR).
- Interchange exit numbers will be added to Figures 3 and 4.

Traffic Operations Analysis

- It was mentioned that a new version of the Highway Capacity Manual will be released soon. The SAT decided if the new version is released prior to the start of Task 4 (Existing Traffic and Operations Analysis), then the project team will use this version for all analyses.
- The following chapters will be added to the list of HCM chapters to be used in analysis efforts:
    - Chapter 21 – Roundabouts
    - Chapter 22 – Interchange Ramp Terminals
- Highway Capacity Software will be used for all analyses. Any references to Synchro will be removed.
- Reference to microsimulation in the last sentence of the 2nd paragraph on page 10 will be removed from the document.
- The following changes will be made to the parameter table on page 10
    - I-90 free-flow speed will be changed from 75 to 65 mph.
    - The future conditions peak hour factor will be changed from 0.92 to 0.90
    - The saturation flow rate for surface streets will be changed from 1750 to 1800.
    - The note about peak hour factor in the last column of the table will be removed.

Travel Forecast

- Year 2045 land use projections have been prepared by the RCAMPO and the SAT agreed that these forecasts should be utilized in conjunction with the RCAMPO travel demand model to develop Year 2045 traffic projections.

Safety Issues

- The reference to 2010-2014 crash data will be changed to 2011-2015, as this more accurately reflects the available data.
- A new paragraph will be added to this section indicating that the project team will use the Interactive Highway Design Safety Modal (IHDSM) to estimate the expected number of crashes based on the design and traffic characteristics of the alternative.

Selection of Measure of Effectiveness (MOE)

- Reference to Synchro in the second bullet will be removed.

FHWA Interstate Access Modification Policy Points

- The phrase "or result in" will be removed from the paragraph in this section.

STUDY ADVISORY TEAM (SAT) Kickoff and Methods and Assumptions Meetings
May 23, 2016

90 Exit 61 to Exit 67 **Corridor Study**

Name	Organization	Phone	E-Mail	✓if present
Steve Gramm	SDDOT Project Development	(605)773-6641	steve.gramm@state.sd.us	X (Pierre)
Linda Fry	Ellsworth AFB	605-385-2706	linda.fry.4@us.af.mil	X (RC)
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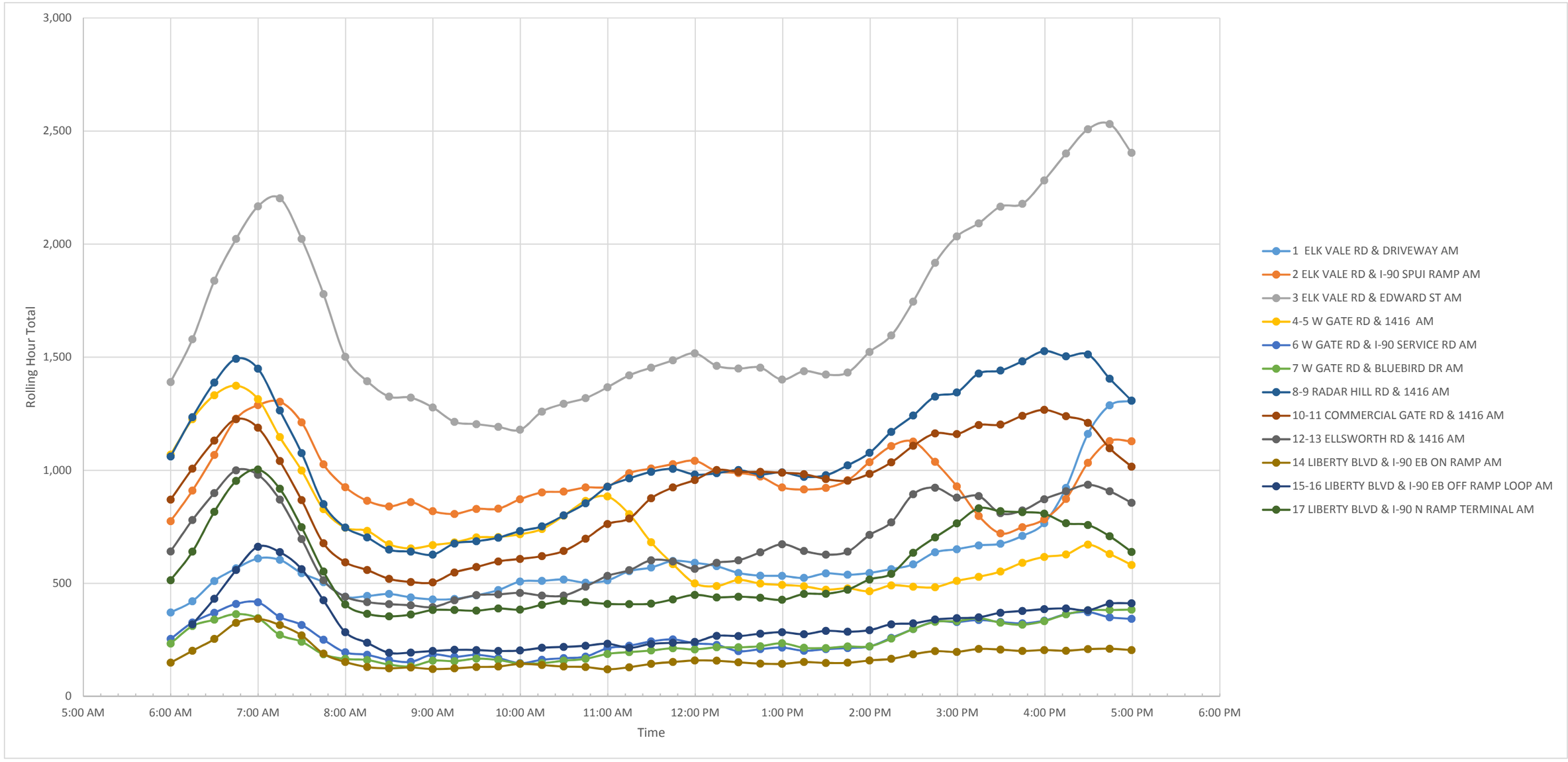
Kip Harrington	Rapid City Area MPO	605-394-4120	kip.harrington@rcgov.org	X (RC)
Tom Lehmkuhl	SDDOT Environmental	605-773-3721	tom.lehmkuhl@state.sd.us	X (Pierre)
Norris Leone	SDDOT Road Design	605-394-2245	norris.leone@state.sd.us	X (Pierre)

STUDY ADVISORY TEAM (SAT) Kickoff and Methods and Assumptions Meetings
May 23, 2016

90 Exit 61 to Exit 67 **Corridor Study**

Name	Organization	Phone	E-Mail	✓if present
Lyle DeVries	Felsburg, Holt & Ullevig	303-721-1440	lyle.devries@fhueng.com	X (RC)
Mark Hoines	FHWA Planning	605-776-1010	Mark.Hoines@fhwa.dot.gov	X (Pierre)
Todd Thompson	SDDOT Bridge	605-773-4175	todd.thompson@state.sd.us	☐
Tammy Williams	SDDOT Belle Fourche Area	605-892-2872	tammy.williams@state.sd.us	X (BF)
Ron Koan	City of Box Elder	605-923-1404	rkoan@boxelder.us	X (RC)
Jeff Brosz	Transportation Inventory Management	605-773-5439	jeff.brosz@state.sd.us	X (Pierre)
Todd Frisbie	Felsburg, Holt & Ullevig	719-201-1804	todd.frisbie@fhueng.com	X (RC)
Rich Zacher	SDDOT Rapid City Region, Custer Area	605-673-4948	rich.zacher@state.sd.us	X (Custer)
Marc Hoelscher	FHWA Operations	605-776-1008	marc.hoelscher@fhwa.dot.gov	X (Pierre)
Bob Kaufman	City of Box Elder – Director of Public Works	605-923-1404	public.works@boxelder.us	X (RC)
Larry Larson	City of Box Elder - Mayor	605-923-1404	mayor@boxelder.us	X (RC)
Karen Olson	SDDOT Road Design	605-773-5409	Karen.olson@state.sd.us	X (Pierre)

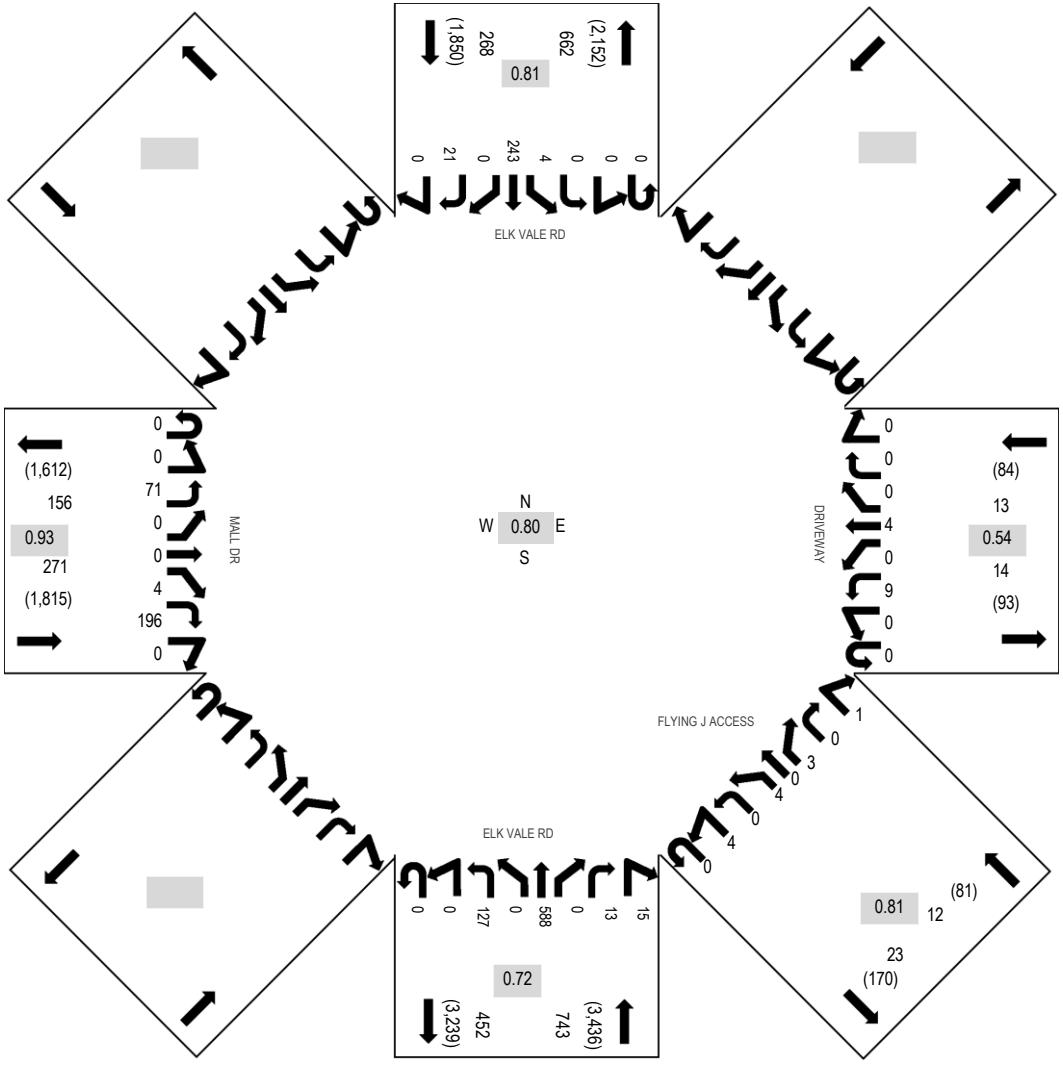

3,000
2,500
2,000
1,500
1,000
500
0
Rolling Hour Total
5:00 AM
6:00 AM
7:00 AM
8:00 AM
9:00 AM
10:00 AM
11:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
6:00 PM
Time
1 ELK VALE RD & DRIVEWAY AM
2 ELK VALE RD & I-90 SPUI RAMP AM
3 ELK VALE RD & EDWARD ST AM
4-5 W GATE RD & 1416 AM
6 W GATE RD & I-90 SERVICE RD AM
7 W GATE RD & BLUEBIRD DR AM
8-9 RADAR HILL RD & 1416 AM
10-11 COMMERCIAL GATE RD & 1416 AM
12-13 ELLSWORTH RD & 1416 AM
14 LIBERTY BLVD & I-90 EB ON RAMP AM
15-16 LIBERTY BLVD & I-90 EB OFF RAMP LOOP AM
17 LIBERTY BLVD & I-90 N RAMP TERMINAL AM

All Traffic Data Services Inc.

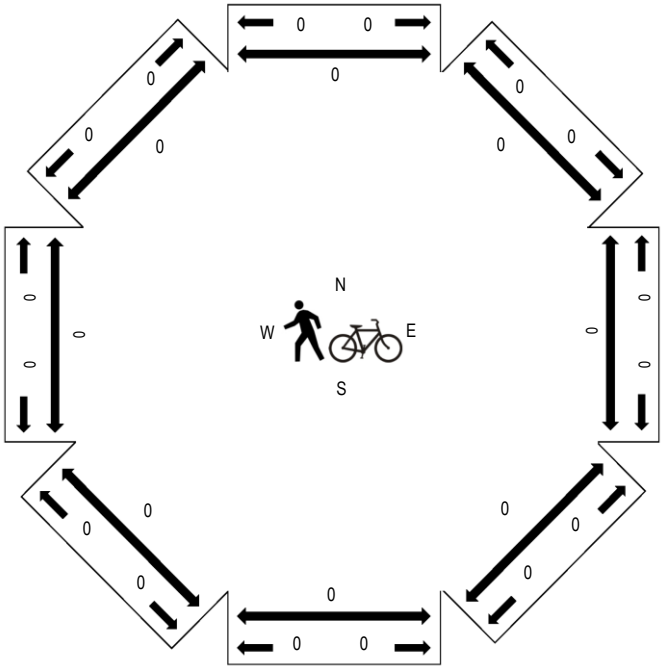
(303) 216-2439
www.alltrafficdata.net

Location: 1 ELK VALE RD & DRIVEWAY AM
Date and Start Time: Thursday, May 19, 2016
Peak Hour: 05:00 PM - 06:00 PM
Peak 15-Minutes: 05:15 PM - 05:30 PM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles on Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

Interval Start Time	Westbound								Northwestbound								Northbound								Northeastbound							
	U	HL	L	BL	T	BR	R	HR	U	HL	L	BL	T	BR	R	HR	U	HL	L	BL	T	BR	R	HR	U	HL	L	BL	T	BR	R	HR
6:00 AM	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	6	0	23	0	1	0								
6:15 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	11	0	17	0	1	2								
6:30 AM	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	22	0	3	1								
6:45 AM	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	23	0	33	0	1	1								
7:00 AM	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	29	0	25	0	0	2								
7:15 AM	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	39	0	34	0	2	5								
7:30 AM	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	28	0	29	0	5	2								
7:45 AM	0	0	1	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	37	0	40	0	2	3								
8:00 AM	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	25	0	21	0	0	0								
8:15 AM	0	0	0	0	1	0	1	0	0	2	0	1	0	0	0	0	0	0	16	0	23	0	2	0								
8:30 AM	0	0	4	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	24	0	27	0	0	3								
8:45 AM	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	25	0	0	4								
9:00 AM	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	22	0	23	0	1	3								
9:15 AM	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	24	0	27	0	2	3								
9:30 AM	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	0	22	0	1	2								
9:45 AM	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	12	0	19	0	3	5								
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	26	0	0	4								
10:15 AM	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	0	20	0	1	3								
10:30 AM	0	0	3	0	2	0	0	0	0	2	0	0	0	1	0	0	0	0	30	0	17	0	2	2								
10:45 AM	0	0	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	27	0	30	0	1	3								
11:00 AM	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	23	0	22	0	0	1								
11:15 AM	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	32	0	26	0	2	3								
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	19	0	0	0								
11:45 AM	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	32	0	30	0	2	3								
12:00 PM	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	29	0	0	2								
12:15 PM	0	0	2	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	38	0	32	0	2	1								
12:30 PM	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	30	0	34	0	1	1								
12:45 PM	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	21	0	1	4								
1:00 PM	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	31	0	28	0	3	7								
1:15 PM	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	34	0	1	2								
1:30 PM	0	0	1	0	1	0	0	0	0	2	0	0	0	0	0	1	0	0	36	0	23	0	1	5								
1:45 PM	0	0	2	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	24	0	22	0	3	2								
2:00 PM	0	0	2	0	1	0	0	0	0	2	0	1	0	0	0	0	0	0	16	0	35	0	2	1								
2:15 PM	0	0	2	0	1	0	0	0	0	2	0	1	0	0	0	0	0	0	28	0	22	0	0	2								
2:30 PM	0	0	0	0	1	0	0	0	0	2	0	1	0	1	0	0	0	0	31	0	28	0	2	3								
2:45 PM	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	32	0	36	0	0	0								
3:00 PM	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	39	0	39	0	0	0								
3:15 PM	0	0	1	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	16	0	51	0	1	2								
3:30 PM	0	0	1	0	0	0	1	0	0	0	0	2	0	1	0	0	0	0	41	0	35	0	3	4								
3:45 PM	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	39	0	37	0	1	0								
4:00 PM	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	41	0	36	0	0	1								

4:15 PM	0	0	2	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	41	0	32	0	0	6
4:30 PM	0	0	2	0	2	0	0	0	0	2	0	0	0	1	0	0	0	0	48	0	45	0	0	3
4:45 PM	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	37	0	53	0	0	3
5:00 PM	0	0	4	0	3	0	0	0	0	1	0	2	0	1	0	0	0	0	39	0	105	0	4	5
5:15 PM	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	35	0	219	0	1	2
5:30 PM	0	0	1	0	1	0	0	0	0	2	0	2	0	0	0	0	0	0	37	0	160	0	5	5
5:45 PM	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	16	0	104	0	3	3
Count Total	0	0	56	0	23	0	5	0	0	49	0	15	0	14	0	3	0	0	1,391	0	1,860	0	66	119
Peak Hour	0	0	9	0	4	0	0	0	0	4	0	4	0	3	0	1	0	0	127	0	588	0	13	15

Interval Start Time	Eastbound								Southeastbound								Southbound								Southwestbound								Total	Rolling Hour
	U	HL	L	BL	T	BR	R	HR	U	HL	L	BL	T	BR	R	HR	U	HL	L	BL	T	BR	R	HR	U	HL	L	BL	T	BR	R	HR		
6:00 AM	0	0	0	0	0	0	2	0									0	0	0	0	29	0	0	0									62	371
6:15 AM	0	0	3	0	0	3	7	0									0	0	0	0	29	0	1	0									75	421
6:30 AM	0	0	6	0	0	1	16	0									0	0	0	0	42	0	2	0									113	510
6:45 AM	0	0	1	0	0	0	16	0									0	0	0	0	43	0	1	0									121	566
7:00 AM	0	0	1	0	0	1	11	0									0	0	0	0	39	0	3	0									112	610
7:15 AM	0	0	3	0	0	0	22	0									0	0	0	1	55	0	1	0									164	604
7:30 AM	0	0	3	0	1	0	25	0									0	0	0	1	65	0	6	0									169	545
7:45 AM	0	0	2	0	1	2	29	0									0	0	0	0	35	0	10	0									165	505
8:00 AM	0	0	1	0	0	0	27	0									0	0	0	0	27	0	2	0									106	441
8:15 AM	0	0	4	0	2	2	16	0									0	0	0	0	30	0	5	0									105	444
8:30 AM	0	0	4	0	2	1	27	0									0	0	0	0	30	0	5	0									129	453
8:45 AM	0	0	6	0	0	0	20	0									0	0	0	0	25	0	1	0									101	438
9:00 AM	0	0	6	0	0	0	20	0									0	0	1	0	24	0	7	0									109	429
9:15 AM	0	0	4	0	0	1	24	0									0	0	0	0	23	0	4	0									114	431
9:30 AM	0	0	3	0	0	1	26	0									0	0	0	0	29	0	3	0									114	447
9:45 AM	0	0	5	0	0	0	20	0									0	0	0	0	24	0	0	0									92	470
10:00 AM	0	0	5	0	0	0	20	0									0	0	0	0	21	0	2	0									111	508
10:15 AM	0	0	8	0	2	2	22	0									0	0	0	0	31	0	3	0									130	511
10:30 AM	0	0	4	0	2	0	31	0									0	0	0	0	38	0	3	0									137	517
10:45 AM	0	0	1	0	0	1	38	0									0	0	0	1	22	0	2	0									130	503
11:00 AM	0	0	4	0	1	2	30	0									0	0	0	1	23	0	4	0									114	513
11:15 AM	0	0	6	0	0	1	28	0									0	0	0	1	29	0	5	0									136	554
11:30 AM	0	0	7	0	0	0	35	0									0	0	0	1	33	0	3	0									123	570
11:45 AM	0	0	2	0	1	0	45	0									0	0	0	0	19	0	3	0									140	599
12:00 PM	0	0	4	0	0	0	43	0									0	0	0	1	39	0	0	0									155	591
12:15 PM	0	0	5	0	0	0	34	0									0	0	0	0	31	0	5	0									152	576
12:30 PM	0	0	7	0	0	0	27	0									0	0	0	2	42	0	6	0									152	546
12:45 PM	0	0	8	0	0	0	32	0									0	0	0	0	21	0	3	0									132	534
1:00 PM	0	0	4	0	0	0	32	0									0	0	0	0	25	0	7	0									140	533
1:15 PM	0	0	8	0	1	2	28	0									0	0	1	1	16	0	2	0									122	524
1:30 PM	0	0	2	0	2	1	39	0									0	0	0	0	23	0	3	0									140	544
1:45 PM	1	0	5	0	0	0	37	0									0	0	1	1	26	0	4	0									131	538

2:00 PM	0	0	6	0	1	1	34	0	0	0	0	2	25	0	2	0	131	546
2:15 PM	0	0	9	0	0	0	29	0	0	0	0	0	43	0	3	0	142	563
2:30 PM	0	0	8	0	0	0	28	0	0	0	1	0	26	0	2	0	134	584
2:45 PM	0	0	4	0	0	0	34	0	0	0	0	1	24	0	6	0	139	637
3:00 PM	0	0	5	0	0	0	32	0	0	0	0	1	27	0	3	0	148	651
3:15 PM	0	0	9	0	0	0	44	0	0	0	1	0	34	0	1	0	163	668
3:30 PM	0	0	7	0	1	1	40	0	0	0	0	0	43	0	7	0	187	675
3:45 PM	0	0	1	0	0	1	30	0	0	0	0	0	35	0	6	0	153	710
4:00 PM	0	0	1	0	1	0	41	0	0	0	0	2	37	0	3	0	165	766
4:15 PM	0	0	6	0	0	0	42	0	0	0	0	0	32	0	5	0	170	922
4:30 PM	0	0	2	0	1	0	66	0	0	0	0	0	41	0	9	0	222	1,161
4:45 PM	0	0	12	0	0	1	48	0	0	0	0	1	43	0	8	0	209	1,287
5:00 PM	0	0	12	0	0	2	59	0	0	0	0	0	77	0	7	0	321	1,307
5:15 PM	0	0	24	0	0	0	51	0	0	0	0	1	64	0	7	0	409	
5:30 PM	0	0	21	0	0	1	49	0	0	0	0	0	60	0	4	0	348	
5:45 PM	0	0	14	0	0	1	37	0	0	0	0	3	42	0	3	0	229	
Count Total	1	0	273	0	19	29	1,493	0	0	0	5	22	1,641	0	182	0	7,266	
Peak Hour	0	0	71	0	0	4	196	0	0	0	0	4	243	0	21	0	1,307	

All Traffic Data Services Inc.

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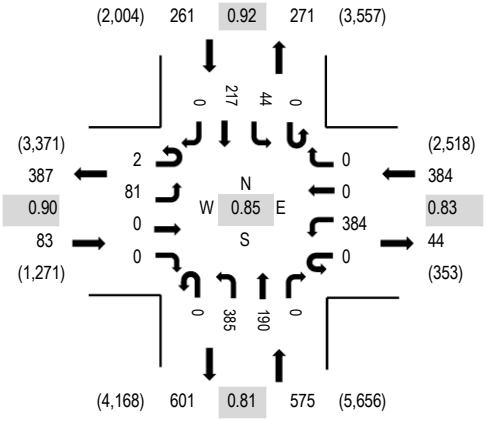
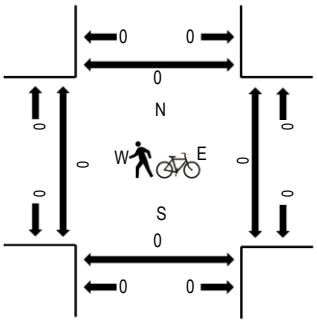
Location: 2 ELK VALE RD & I-90 SPUI RAMP AM
Date and Start Time: Thursday, May 19, 2016
Peak Hour: 07:15 AM - 08:15 AM
Peak 15-Minutes: 07:30 AM - 07:45 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	I-90 VALE RD Eastbound				I-90 SPUI RAMP Westbound				ELK VALE RD Northbound				ELK VALE RD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:00:00 AM	0	9	0	0	0	29	0	0	0	29	22	0	0	3	27	0	119	775	0	0	0	0
6:15:00 AM	0	9	0	0	0	56	0	0	0	36	20	0	0	8	30	0	159	910	0	0	0	0
6:30:00 AM	0	16	0	0	0	70	0	0	0	64	22	0	0	11	41	0	224	1,068	0	0	0	0
6:45:00 AM	0	23	0	0	0	77	0	0	0	76	37	0	0	10	50	0	273	1,228	0	0	0	0
7:00:00 AM	1	20	0	0	0	87	0	0	0	70	33	0	0	11	32	0	254	1,288	0	0	0	0
7:15:00 AM	1	18	0	0	0	99	0	0	0	87	44	0	0	9	59	0	317	1,303	0	0	0	0
7:30:00 AM	1	19	0	0	0	115	0	0	0	132	46	0	0	12	59	0	384	1,212	0	0	0	0
7:45:00 AM	0	23	0	0	0	98	0	0	0	92	61	0	0	9	50	0	333	1,026	0	0	0	0
8:00:00 AM	0	21	0	0	0	72	0	0	0	74	39	0	0	14	49	0	269	925	0	0	0	0
8:15:00 AM	0	23	0	0	0	55	0	0	0	65	40	0	0	11	32	0	226	865	0	0	0	0
8:30:00 AM	1	14	0	0	0	48	0	0	0	59	30	0	0	8	38	0	198	840	0	0	0	0
8:45:00 AM	0	28	0	0	0	63	0	0	0	56	48	0	0	6	31	0	232	859	0	0	0	0
9:00:00 AM	0	21	0	0	0	47	0	0	0	52	32	0	0	7	50	0	209	819	0	0	0	0
9:15:00 AM	0	20	0	0	1	63	0	0	0	42	39	0	0	10	26	0	201	807	0	0	0	0
9:30:00 AM	0	19	0	0	0	54	0	0	0	46	41	0	0	10	47	0	217	829	0	1	0	0
9:45:00 AM	0	15	0	0	0	41	0	0	0	58	32	0	0	7	39	0	192	830	0	0	0	0
10:00:00 AM	0	20	0	0	1	50	0	0	0	42	38	0	0	10	36	0	197	872	0	0	0	0
10:15:00 AM	0	20	0	0	0	68	0	0	0	57	35	0	0	11	32	0	223	902	0	1	0	0
10:30:00 AM	1	22	0	0	1	54	0	0	0	52	31	0	0	8	49	0	218	906	0	0	0	0
10:45:00 AM	2	26	0	0	0	65	0	0	0	56	37	0	0	8	40	0	234	924	0	0	0	0
11:00:00 AM	0	19	0	0	1	53	0	0	0	67	40	0	0	8	39	0	227	928	0	0	0	0
11:15:00 AM	1	13	0	0	0	57	0	0	0	52	43	0	0	7	54	0	227	987	0	0	0	0
11:30:00 AM	0	21	0	0	1	54	0	0	0	53	37	0	0	8	62	0	236	1,008	0	0	0	0
11:45:00 AM	0	26	0	0	0	68	0	0	0	58	42	0	0	8	36	0	238	1,027	0	0	0	0
12:00:00 PM	1	27	0	0	0	62	0	0	0	67	54	0	0	3	72	0	286	1,042	0	0	0	0
12:15:00 PM	1	19	0	0	0	61	0	0	0	46	49	0	0	15	57	0	248	996	0	0	0	0
12:30:00 PM	0	32	0	0	0	61	0	0	0	51	52	0	0	10	49	0	255	988	0	0	0	0
12:45:00 PM	2	20	0	0	1	69	0	0	0	53	56	0	0	10	42	0	253	972	0	0	0	0
1:00:00 PM	1	20	0	0	0	56	0	0	0	66	38	0	0	13	46	0	240	924	0	0	0	0
1:15:00 PM	2	26	0	0	0	75	0	0	0	58	42	0	0	7	30	0	240	915	0	0	0	0
1:30:00 PM	1	27	0	0	0	61	0	0	0	46	51	0	0	7	46	0	239	922	0	0	0	0
1:45:00 PM	0	15	0	0	0	61	0	0	0	39	34	0	1	11	44	0	205	956	0	0	0	0
2:00:00 PM	0	20	0	0	1	72	0	0	0	49	37	0	0	5	47	0	231	1,036	0	0	0	0
2:15:00 PM	1	18	0	0	0	87	0	0	0	41	38	0	0	12	50	0	247	1,107	0	0	0	0
2:30:00 PM	1	23	0	0	0	79	0	0	0	68	47	0	0	8	47	0	273	1,127	0	0	0	0

2:45:00 PM	0	31	0	0	0	81	0	0	0	65	49	0	0	7	52	0	285	1,037	0	0	0	0
3:00:00 PM	1	22	0	0	1	78	0	0	0	77	58	0	0	17	48	0	302	929	0	0	0	0
3:15:00 PM	1	22	0	0	0	64	0	0	0	108	46	0	0	6	20	0	267	798	0	0	0	0
3:30:00 PM	2	28	0	0	0	0	0	0	0	95	58	0	0	0	0	0	183	721	0	0	0	0
3:45:00 PM	0	32	0	0	0	0	0	0	0	97	48	0	0	0	0	0	177	748	0	0	0	0
4:00:00 PM	1	27	0	0	0	0	0	0	0	99	44	0	0	0	0	0	171	783	0	0	0	0
4:15:00 PM	0	22	0	0	0	0	0	0	0	101	67	0	0	0	0	0	190	873	0	0	0	0
4:30:00 PM	0	25	0	0	0	0	0	0	0	124	61	0	0	0	0	0	210	1,033	0	0	0	0
4:45:00 PM	0	35	0	0	0	0	0	0	0	105	72	0	0	0	0	0	212	1,129	0	0	0	0
5:00:00 PM	0	52	0	0	0	0	0	0	0	124	85	0	0	0	0	0	261	1,128	0	0	0	0
5:15:00 PM	0	111	0	0	0	0	0	0	0	108	131	0	0	0	0	0	350		0	0	0	0
5:30:00 PM	0	87	0	0	0	0	0	0	0	88	131	0	0	0	0	0	306		0	0	0	0
5:45:00 PM	0	42	0	0	0	0	0	0	0	98	71	0	0	0	0	0	211		0	0	0	0
Count Total	23	1,248	0	0	8	2,510	0	0	0	3,348	2,308	0	1	345	1,658	0	11,449		0	2	0	0
Peak Hour	2	81	0	0	0	384	0	0	0	385	190	0	0	44	217	0	1,303		0	0	0	0

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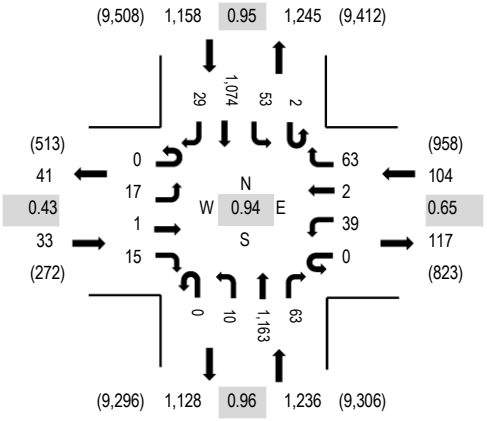
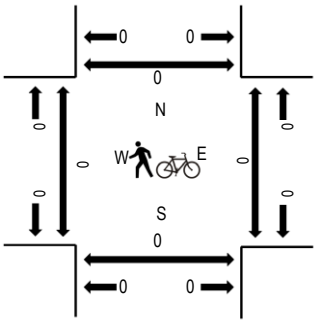
Location: 3 ELK VALE RD & EDWARD ST AM
Date and Start Time: Thursday, May 19, 2016
Peak Hour: 04:45 PM - 05:45 PM
Peak 15-Minutes: 05:15 PM - 05:30 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

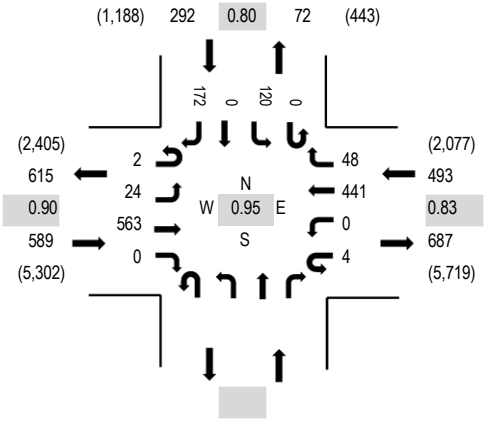
Interval Start Time	EDWARD ST Eastbound				EDWARD ST Westbound				ELK VALE RD Northbound				ELK VALE RD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:00:00 AM	1	0	1	2	0	6	0	6	0	1	108	2	0	2	84	2	215	1,390	0	0	0	0
6:15:00 AM	0	1	0	2	0	11	0	5	0	2	158	0	0	3	112	2	296	1,579	0	0	0	0
6:30:00 AM	0	1	0	1	0	8	0	8	0	3	168	2	0	2	195	3	391	1,838	0	0	0	0
6:45:00 AM	0	3	0	3	0	11	0	9	0	2	244	3	0	7	203	3	488	2,023	0	0	0	0
7:00:00 AM	0	1	3	3	1	5	2	9	1	5	190	4	0	5	169	6	404	2,167	0	0	0	0
7:15:00 AM	0	4	1	3	0	11	0	11	0	3	256	4	0	3	253	6	555	2,203	0	0	0	0
7:30:00 AM	0	1	0	1	0	18	2	14	0	5	246	3	0	4	272	10	576	2,023	0	0	0	0
7:45:00 AM	0	0	0	4	0	19	1	15	0	16	261	7	0	19	279	11	632	1,779	0	0	0	0
8:00:00 AM	0	5	1	5	0	9	1	12	0	7	165	10	0	6	214	5	440	1,502	0	0	0	0
8:15:00 AM	0	4	1	6	0	6	2	9	0	1	166	7	0	4	157	12	375	1,394	0	0	0	0
8:30:00 AM	0	1	1	3	0	12	1	9	1	4	148	4	0	5	136	7	332	1,326	0	0	0	0
8:45:00 AM	0	2	0	4	0	5	0	15	0	4	146	16	0	9	149	5	355	1,321	0	1	0	0
9:00:00 AM	0	5	2	1	0	11	3	16	0	5	147	2	0	11	120	9	332	1,278	0	0	0	0
9:15:00 AM	0	1	1	2	0	12	2	15	0	1	129	3	0	4	135	2	307	1,214	0	0	0	0
9:30:00 AM	0	2	0	4	0	12	1	21	0	4	134	4	1	3	136	5	327	1,204	0	1	0	0
9:45:00 AM	0	3	0	2	0	4	0	13	0	3	147	3	0	10	123	4	312	1,192	0	0	0	0
10:00:00 AM	0	2	0	1	0	6	0	12	0	1	105	7	0	3	128	3	268	1,179	0	0	0	0
10:15:00 AM	0	2	0	3	0	7	1	8	0	0	132	3	1	3	128	9	297	1,259	0	1	0	0
10:30:00 AM	0	3	0	1	0	6	2	5	0	1	138	6	0	8	140	5	315	1,294	0	0	0	0
10:45:00 AM	0	2	0	1	0	7	0	5	0	3	120	2	1	6	149	3	299	1,319	0	0	0	0
11:00:00 AM	0	1	0	4	0	6	1	10	0	4	161	5	0	6	147	3	348	1,367	0	0	0	0
11:15:00 AM	0	4	1	3	0	3	2	7	0	3	137	5	0	8	154	5	332	1,420	0	0	0	0
11:30:00 AM	0	2	0	1	0	9	2	14	0	3	159	5	0	9	131	5	340	1,454	0	0	0	0
11:45:00 AM	0	4	0	3	0	2	0	13	0	5	150	5	0	10	146	9	347	1,486	0	0	0	0
12:00:00 PM	0	4	0	7	0	10	2	10	0	2	156	6	2	5	193	4	401	1,517	0	0	0	0
12:15:00 PM	0	1	1	3	0	6	1	12	0	4	144	7	0	11	170	6	366	1,462	0	0	0	0
12:30:00 PM	0	1	2	1	0	8	0	6	0	5	165	9	1	17	153	4	372	1,450	0	0	0	0
12:45:00 PM	0	5	0	2	0	5	2	10	0	2	166	10	0	8	161	7	378	1,454	0	0	0	0
1:00:00 PM	0	3	1	4	0	9	0	9	0	2	155	6	0	9	143	5	346	1,401	0	0	0	0
1:15:00 PM	0	2	1	0	0	6	2	7	1	2	166	8	0	6	148	5	354	1,438	0	0	0	0
1:30:00 PM	0	2	1	1	0	4	3	3	0	4	177	6	0	9	159	7	376	1,423	0	0	0	0
1:45:00 PM	0	3	0	0	0	2	0	2	0	2	132	7	0	9	163	5	325	1,432	0	0	0	0
2:00:00 PM	0	1	1	7	0	9	1	13	0	8	153	5	0	11	169	5	383	1,523	0	0	0	0
2:15:00 PM	0	1	0	0	0	4	1	7	0	3	138	5	1	9	162	8	339	1,596	0	0	0	0
2:30:00 PM	0	4	1	2	0	6	0	8	0	6	165	8	0	8	173	4	385	1,746	0	0	0	0

2:45:00 PM	0	1	0	1	0	6	0	8	0	6	180	11	0	17	183	3	416	1,917	0	0	0	0
3:00:00 PM	0	2	0	0	0	9	1	8	0	2	217	11	0	14	182	10	456	2,034	0	0	0	0
3:15:00 PM	0	3	1	3	0	7	3	16	0	2	214	10	0	16	203	11	489	2,092	0	0	0	0
3:30:00 PM	0	4	0	5	0	7	3	17	0	6	204	13	0	11	280	6	556	2,166	0	0	0	0
3:45:00 PM	0	4	0	3	0	5	4	3	0	1	230	15	0	12	249	7	533	2,178	0	0	0	0
4:00:00 PM	0	2	0	2	0	13	2	12	2	4	209	16	0	16	232	4	514	2,282	0	0	0	0
4:15:00 PM	0	3	2	3	0	6	1	19	0	4	218	12	0	9	278	8	563	2,401	0	0	0	0
4:30:00 PM	0	0	1	3	0	6	1	14	0	3	257	13	0	16	246	8	568	2,508	0	0	0	0
4:45:00 PM	0	1	0	3	0	2	1	20	0	3	294	20	0	10	278	5	637	2,531	0	0	0	0
5:00:00 PM	0	8	1	10	0	10	1	16	0	4	260	17	0	12	287	7	633	2,404	0	0	0	0
5:15:00 PM	0	2	0	2	0	24	0	16	0	1	308	14	2	15	279	7	670		0	0	0	0
5:30:00 PM	0	6	0	0	0	3	0	11	0	2	301	12	0	16	230	10	591		0	0	0	0
5:45:00 PM	0	3	0	1	0	8	1	15	0	5	236	19	0	9	203	10	510		0	0	0	0
Count Total	1	120	25	126	1	381	53	523	5	169	8,760	372	9	425	8,784	290	20,044		0	3	0	0
Peak Hour	0	17	1	15	0	39	2	63	0	10	1,163	63	2	53	1,074	29	2,531		0	0	0	0

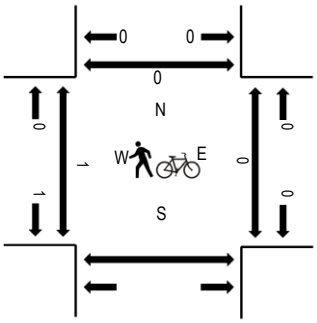
All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

Location: 4-5 W GATE RD & 1416 AM
Date and Start Time: Thursday, May 19, 2016
Peak Hour: 06:45 AM - 07:45 AM
Peak 15-Minutes: 07:15 AM - 07:30 AM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles in Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

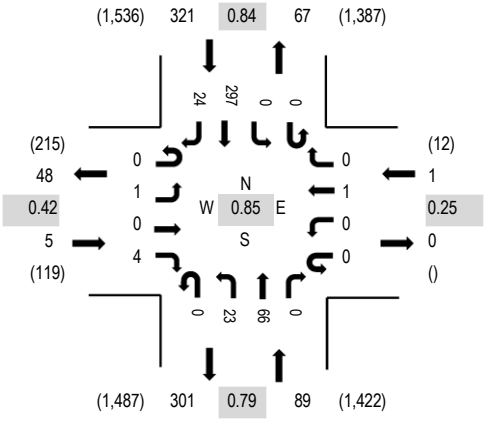
Interval Start Time	1416 Eastbound				1416 Westbound				Northbound				W GATE RD Southbound				Total	Rolling Hour	Pedestrain Crossings		
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South North
6:00:00 AM	0	3	117	0	1	0	38	3					0	17	0	19	198	1,069	0	0	0
6:15:00 AM	1	9	133	0	2	0	53	6					0	23	0	27	254	1,226	0	0	0
6:30:00 AM	1	7	150	0	3	0	86	9					0	20	0	42	318	1,332	0	0	0
6:45:00 AM	0	10	149	0	0	0	80	8					0	15	0	37	299	1,374	1	0	0
7:00:00 AM	1	4	142	0	0	0	119	10					0	38	0	41	355	1,315	0	0	0
7:15:00 AM	1	7	155	0	2	0	111	14					0	34	0	36	360	1,147	0	0	0
7:30:00 AM	0	3	117	0	2	0	131	16					0	33	0	58	360	999	0	0	0
7:45:00 AM	1	12	94	0	2	0	75	14					0	18	0	24	240	828	0	0	0
8:00:00 AM	1	6	76	0	1	0	59	15					0	8	0	21	187	746	0	0	0
8:15:00 AM	0	9	69	0	0	0	96	8					0	8	0	22	212	732	0	0	0
8:30:00 AM	0	11	68	0	0	0	65	9					0	10	0	26	189	673	0	0	0
8:45:00 AM	0	7	71	0	1	0	53	6					0	8	0	12	158	654	0	0	0
9:00:00 AM	2	7	64	0	0	0	62	9					0	10	0	19	173	669	0	0	0
9:15:00 AM	1	5	51	0	1	0	65	5					0	9	0	16	153	681	0	0	0
9:30:00 AM	0	14	62	0	1	0	62	8					0	9	0	14	170	703	0	0	0
9:45:00 AM	2	8	64	0	0	0	60	11					0	6	0	22	173	705	0	0	0
10:00:00 AM	2	7	72	0	0	0	72	8					0	8	0	16	185	717	0	0	0
10:15:00 AM	1	8	69	0	1	0	60	11					0	3	0	22	175	740	0	0	0
10:30:00 AM	2	7	68	0	0	0	73	4					0	9	0	9	172	799	0	0	0
10:45:00 AM	1	13	69	0	2	0	63	13					0	9	0	15	185	864	0	0	0
11:00:00 AM	1	13	76	0	0	0	93	6					0	8	0	11	208	884	0	0	0
11:15:00 AM	1	17	75	0	0	0	95	13					0	11	0	22	234	806	0	0	0
11:30:00 AM	0	18	85	0	0	0	108	12					0	1	0	13	237	682	0	0	0
11:45:00 AM	0	8	112	0	0	0	45	12					0	10	0	18	205	585	0	0	0
12:00:00 PM	0	0	112	0	0	0	0	0					0	18	0	0	130	500	0	0	0
12:15:00 PM	0	0	102	0	0	0	0	0					0	8	0	0	110	488	0	0	0
12:30:00 PM	0	0	128	0	0	0	0	0					0	12	0	0	140	515	0	0	0
12:45:00 PM	0	0	108	0	0	0	0	0					0	12	0	0	120	499	0	0	0
1:00:00 PM	0	0	106	0	0	0	0	0					0	12	0	0	118	493	0	0	0
1:15:00 PM	0	0	126	0	0	0	0	0					0	11	0	0	137	487	0	0	0
1:30:00 PM	0	0	106	0	0	0	0	0					0	18	0	0	124	472	0	0	0
1:45:00 PM	0	0	100	0	0	0	0	0					0	14	0	0	114	478	0	0	0
2:00:00 PM	0	0	104	0	0	0	0	0					0	8	0	0	112	465	0	0	0
2:15:00 PM	0	0	111	0	1	0	0	0					0	10	0	0	122	491	0	0	0
2:30:00 PM	0	0	114	0	0	0	0	0					0	16	0	0	130	485	0	0	0

2:45:00 PM	0	0	95	0	0	0	0	0		0	6	0	0	101	483	0	0	0
3:00:00 PM	0	0	125	0	0	0	0	0		0	13	0	0	138	511	0	0	0
3:15:00 PM	0	0	106	0	0	0	0	0		0	10	0	0	116	529	0	0	0
3:30:00 PM	0	0	108	0	0	0	0	0		0	20	0	0	128	552	0	0	0
3:45:00 PM	0	0	121	0	0	0	0	0		0	8	0	0	129	591	0	0	0
4:00:00 PM	0	0	139	0	1	0	0	0		0	16	0	0	156	617	0	0	0
4:15:00 PM	0	0	123	0	0	0	0	0		0	16	0	0	139	628	0	0	0
4:30:00 PM	0	0	152	0	0	0	0	0		0	15	0	0	167	671	0	0	0
4:45:00 PM	0	0	138	0	0	0	0	0		0	17	0	0	155	630	0	0	0
5:00:00 PM	0	0	159	0	1	0	0	0		0	7	0	0	167	581	0	0	0
5:15:00 PM	0	0	168	0	1	0	0	0		0	13	0	0	182		0	0	0
5:30:00 PM	0	0	114	0	0	0	0	0		0	12	0	0	126		0	0	0
5:45:00 PM	0	0	97	0	0	0	0	0		0	9	0	0	106		0	0	0
Count Total	19	213	5,070	0	23	0	1,824	230		0	626	0	562	8,567		1	0	0
Peak Hour	2	24	563	0	4	0	441	48		0	120	0	172	1,374		0	0	0

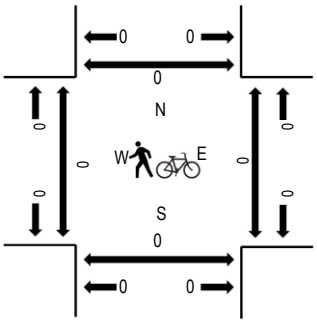
All Traffic Data
Services Inc.
(303) 216-2439
www.alltrafficdata.net

Location: 6 W GATE RD & I-90 SERVICE RD AM
Date and Start Time: Thursday, May 19, 2016
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:30 AM - 07:45 AM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles in Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

Interval Start Time	I-90 SERVICE RD Eastbound				Westbound				W GATE RD Northbound				W GATE RD Southbound				Total	Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
6:00:00 AM	0	0	0	1	0	0	1	0	0	0	8	0	0	0	32	3	45	254	0	0	0	0
6:15:00 AM	0	0	0	4	0	0	0	0	0	1	11	0	0	0	31	2	49	327	0	0	0	0
6:30:00 AM	0	0	0	2	0	0	0	0	0	3	16	0	0	0	57	5	83	370	0	0	0	0
6:45:00 AM	0	3	0	1	0	0	0	0	0	3	15	0	0	0	52	3	77	409	0	0	0	0
7:00:00 AM	0	1	0	0	0	0	1	0	0	7	14	0	0	0	88	7	118	416	0	0	0	0
7:15:00 AM	0	0	0	0	0	0	0	0	0	4	12	0	0	0	68	8	92	351	0	0	0	0
7:30:00 AM	0	0	0	3	0	0	0	0	0	6	18	0	0	0	90	5	122	316	0	0	0	0
7:45:00 AM	0	0	0	1	0	0	0	0	0	6	22	0	0	0	51	4	84	251	0	0	0	0
8:00:00 AM	0	1	0	1	0	0	1	0	0	4	21	0	0	0	23	2	53	195	0	0	0	0
8:15:00 AM	0	2	0	1	0	0	0	0	0	2	23	0	0	0	28	1	57	184	0	0	0	0
8:30:00 AM	0	3	0	0	0	0	0	0	0	3	13	0	0	0	36	2	57	161	0	0	0	0
8:45:00 AM	0	2	0	1	0	0	0	0	0	0	12	0	0	0	10	3	28	153	0	0	0	0
9:00:00 AM	0	1	0	0	0	0	1	0	0	2	11	0	0	0	23	4	42	185	0	0	0	0
9:15:00 AM	0	0	0	1	0	0	0	0	0	2	9	0	0	0	21	1	34	175	0	0	0	0
9:30:00 AM	0	2	0	2	0	0	0	0	0	3	20	0	0	0	21	1	49	184	0	0	0	0
9:45:00 AM	0	2	0	3	0	0	0	0	0	1	20	0	0	0	32	2	60	170	0	0	0	0
10:00:00 AM	0	1	0	1	0	0	1	0	0	0	12	0	0	0	15	2	32	147	0	0	0	0
10:15:00 AM	0	1	0	0	0	0	0	0	0	2	15	0	0	0	24	1	43	162	0	0	0	0
10:30:00 AM	0	2	0	0	0	0	0	0	0	0	19	0	0	0	11	3	35	169	0	0	0	0
10:45:00 AM	0	0	0	0	0	0	0	0	0	1	22	0	0	0	10	4	37	176	0	0	0	0
11:00:00 AM	0	1	0	2	0	0	1	0	0	3	21	0	0	0	19	0	47	213	0	0	0	0
11:15:00 AM	0	0	0	1	0	0	0	0	0	0	27	0	0	0	20	2	50	224	0	0	0	0
11:30:00 AM	0	1	0	2	0	0	0	0	0	0	24	0	0	0	13	2	42	243	0	0	0	0
11:45:00 AM	0	2	0	5	0	0	0	0	0	4	32	0	0	0	28	3	74	252	0	0	0	0
12:00:00 PM	0	1	0	3	0	0	1	0	0	3	21	0	0	0	27	2	58	235	0	0	0	0
12:15:00 PM	0	2	0	5	0	0	0	0	0	1	32	0	0	0	24	5	69	228	0	0	0	0
12:30:00 PM	0	0	0	4	0	0	0	0	0	3	24	0	0	0	19	1	51	200	0	0	0	0
12:45:00 PM	0	1	0	5	0	0	0	0	0	3	20	0	0	0	26	2	57	209	0	0	0	0
1:00:00 PM	0	0	0	3	0	0	1	0	0	2	24	0	0	0	21	0	51	216	0	0	0	0
1:15:00 PM	0	0	0	1	0	0	0	0	0	2	13	0	0	0	24	1	41	202	0	0	0	0
1:30:00 PM	0	3	0	1	0	0	0	0	0	2	27	0	0	0	26	1	60	209	0	0	0	0
1:45:00 PM	0	0	0	0	0	0	0	0	0	0	30	0	0	0	32	2	64	214	0	0	0	0
2:00:00 PM	0	2	0	0	0	0	1	0	0	0	19	0	0	0	14	1	37	221	0	0	0	0
2:15:00 PM	0	2	0	1	0	0	0	0	0	1	24	0	0	0	16	4	48	259	0	0	0	0
2:30:00 PM	0	0	0	0	0	0	0	0	0	0	34	0	0	0	28	3	65	298	0	0	0	0

2:45:00 PM	0	1	0	1	0	0	0	0	0	0	42	0	0	0	26	1	71	331	0	0	0	0
3:00:00 PM	0	2	0	3	0	0	1	0	0	2	42	0	0	0	23	2	75	329	0	0	0	0
3:15:00 PM	0	0	0	0	0	0	0	0	0	1	56	0	0	0	29	1	87	338	0	0	0	0
3:30:00 PM	0	1	0	1	0	0	0	0	0	2	46	0	0	0	47	1	98	329	0	0	0	0
3:45:00 PM	0	0	0	0	0	0	0	0	0	0	44	0	0	0	23	2	69	323	0	0	0	0
4:00:00 PM	0	4	0	2	0	0	1	0	0	2	48	0	0	0	23	4	84	335	0	0	0	0
4:15:00 PM	0	2	0	0	0	0	0	0	0	0	53	0	0	0	21	2	78	364	0	0	0	0
4:30:00 PM	0	2	0	0	0	0	0	0	0	1	65	0	0	0	23	1	92	373	0	0	0	0
4:45:00 PM	0	1	0	0	0	0	0	0	0	1	43	0	0	0	33	3	81	350	0	0	0	0
5:00:00 PM	0	3	0	1	0	0	1	0	0	3	71	0	0	0	31	3	113	343	0	0	0	0
5:15:00 PM	0	1	0	2	0	0	0	0	0	2	56	0	0	0	25	1	87		0	0	0	0
5:30:00 PM	0	1	0	0	0	0	0	0	0	1	44	0	0	0	23	0	69		0	0	0	0
5:45:00 PM	0	0	0	0	0	0	0	0	0	0	38	0	0	0	35	1	74		0	0	0	0
Count Total	0	54	0	65	0	0	12	0	0	89	1,333	0	0	0	1,422	114	3,089		0	0	0	0
Peak Hour	0	1	0	4	0	0	1	0	0	23	66	0	0	0	297	24	416		0	0	0	0

All Traffic Data Services Inc.

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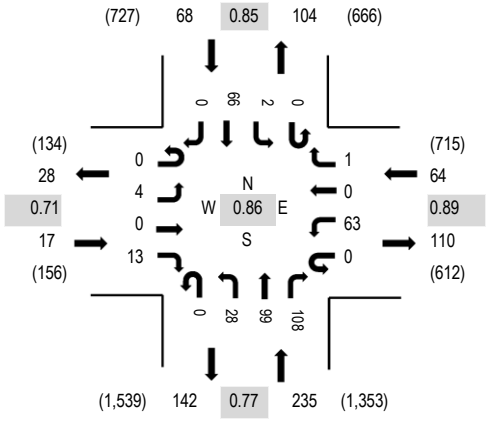
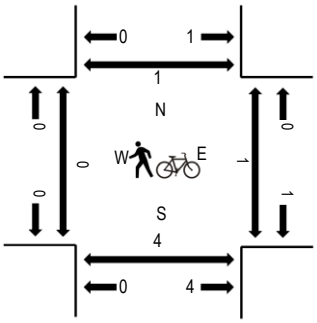
Location: 7 W GATE RD & BLUEBIRD DR AM
Date and Start Time: Thursday, May 19, 2016
Peak Hour: 05:00 PM - 06:00 PM
Peak 15-Minutes: 05:00 PM - 05:15 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	DRIVEWAY Eastbound				BLUEBIRD DR Westbound				W GATE RD Northbound				W GATE RD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:00:00 AM	0	0	0	3	0	14	0	0	0	0	1	3	0	0	17	0	38	234	0	0	0	0
6:15:00 AM	0	0	0	1	0	21	0	0	0	0	10	0	0	0	19	0	51	311	0	0	0	0
6:30:00 AM	0	0	0	2	0	33	0	0	0	1	11	8	0	0	25	0	80	339	0	0	0	0
6:45:00 AM	0	1	0	4	0	26	0	0	0	2	4	6	0	1	21	0	65	364	0	0	0	0
7:00:00 AM	0	0	0	9	0	56	1	0	0	1	9	4	0	1	33	1	115	346	0	0	0	0
7:15:00 AM	0	0	0	10	0	31	0	0	0	2	6	7	0	2	21	0	79	272	0	0	0	0
7:30:00 AM	0	0	0	9	0	47	0	0	0	1	8	3	0	0	37	0	105	242	0	0	0	0
7:45:00 AM	0	0	0	2	0	15	0	0	1	0	6	7	0	0	16	0	47	186	0	0	0	0
8:00:00 AM	0	0	0	5	0	7	0	1	0	1	8	10	0	0	9	0	41	166	0	0	0	0
8:15:00 AM	0	0	0	1	0	7	0	0	0	4	11	7	0	0	19	0	49	161	0	0	0	0
8:30:00 AM	0	0	0	7	0	15	0	0	0	2	7	7	0	0	11	0	49	141	0	0	0	0
8:45:00 AM	0	0	0	0	0	8	0	0	0	0	6	6	0	0	7	0	27	133	0	2	0	0
9:00:00 AM	0	0	0	2	0	11	0	1	0	1	5	4	0	1	11	0	36	158	0	0	0	0
9:15:00 AM	0	0	0	0	0	13	0	0	0	2	1	5	0	0	7	1	29	156	0	0	1	0
9:30:00 AM	0	0	0	1	0	13	0	1	0	2	11	4	0	0	9	0	41	167	1	0	0	0
9:45:00 AM	0	0	0	2	0	11	0	1	0	3	10	9	0	1	15	0	52	161	0	0	0	0
10:00:00 AM	0	0	0	3	0	9	0	1	0	0	10	4	0	0	7	0	34	145	0	2	0	0
10:15:00 AM	0	0	0	3	0	3	0	0	0	0	10	4	0	1	18	1	40	147	0	0	0	0
10:30:00 AM	0	0	0	0	0	5	0	1	0	4	10	5	0	1	9	0	35	158	0	0	0	0
10:45:00 AM	0	0	0	4	0	2	0	0	0	0	13	6	0	1	10	0	36	166	0	0	0	0
11:00:00 AM	0	0	0	2	0	11	0	0	0	1	9	9	0	0	4	0	36	188	0	0	0	0
11:15:00 AM	0	1	0	2	0	10	1	1	0	0	10	15	0	0	11	0	51	196	0	0	0	0
11:30:00 AM	0	1	0	3	0	6	0	0	0	5	7	15	0	0	6	0	43	203	1	0	1	1
11:45:00 AM	0	0	0	1	0	13	0	0	0	2	14	12	0	1	15	0	58	213	0	1	0	0
12:00:00 PM	0	0	0	0	0	14	0	0	0	2	10	7	0	0	11	0	44	208	1	1	1	0
12:15:00 PM	0	0	0	3	0	18	0	1	0	6	14	10	0	0	6	0	58	217	0	0	0	1
12:30:00 PM	0	1	0	2	0	8	0	2	0	1	17	8	0	0	14	0	53	217	0	2	0	0
12:45:00 PM	0	0	0	2	0	9	0	0	0	3	11	11	0	0	17	0	53	222	0	0	1	0
1:00:00 PM	0	0	0	2	0	9	0	1	0	2	13	10	0	3	12	1	53	235	0	0	0	0
1:15:00 PM	0	0	0	6	0	9	0	0	0	2	13	7	0	0	21	0	58	215	0	0	1	0
1:30:00 PM	0	1	0	3	0	16	0	1	0	2	10	10	0	0	14	1	58	214	0	0	0	0
1:45:00 PM	0	0	0	4	0	12	1	0	0	3	8	16	0	0	21	1	66	221	0	0	0	0
2:00:00 PM	0	0	0	0	0	12	0	0	0	0	8	10	0	0	3	0	33	221	0	0	0	0
2:15:00 PM	0	0	0	4	0	9	0	1	1	4	13	13	0	1	11	0	57	256	0	0	0	0
2:30:00 PM	0	1	0	3	0	9	0	2	0	3	19	11	0	0	16	1	65	298	0	0	1	0

2:45:00 PM	0	0	0	2	0	11	0	0	0	5	17	17	0	1	13	0	66	330	0	0	1	0
3:00:00 PM	0	0	0	2	0	12	0	0	0	4	18	23	0	0	9	0	68	333	0	0	0	0
3:15:00 PM	0	1	0	7	0	14	1	0	0	7	26	26	0	1	16	0	99	346	1	0	0	0
3:30:00 PM	0	0	0	3	0	25	0	0	0	2	26	22	0	0	19	0	97	326	0	3	0	0
3:45:00 PM	0	0	0	2	0	7	0	0	0	2	23	16	0	2	17	0	69	317	0	3	0	0
4:00:00 PM	0	0	0	1	0	14	0	1	0	1	24	26	0	0	14	0	81	333	0	0	0	0
4:15:00 PM	0	0	0	4	0	11	0	0	0	5	25	24	0	0	10	0	79	363	0	0	0	0
4:30:00 PM	0	0	0	4	0	10	0	0	0	5	25	33	0	0	11	0	88	381	0	0	0	0
4:45:00 PM	0	0	0	2	0	15	0	0	0	2	22	22	0	2	20	0	85	382	0	0	0	0
5:00:00 PM	0	1	0	1	0	17	0	1	0	11	28	37	0	0	15	0	111	384	0	0	0	0
5:15:00 PM	0	2	0	3	0	16	0	0	0	4	25	33	0	1	13	0	97		0	0	0	0
5:30:00 PM	0	1	0	5	0	13	0	0	0	9	25	16	0	0	20	0	89		0	0	0	0
5:45:00 PM	0	0	0	4	0	17	0	0	0	4	21	22	0	1	18	0	87		0	1	4	1
Count Total	0	11	0	145	0	694	4	17	2	123	638	590	0	22	698	7	2,951		4	15	11	3
Peak Hour	0	4	0	13	0	63	0	1	0	28	99	108	0	2	66	0	384		1	6	0	0

All Traffic Data Services Inc.
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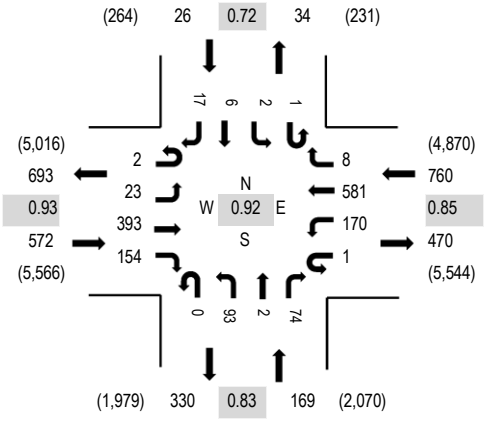
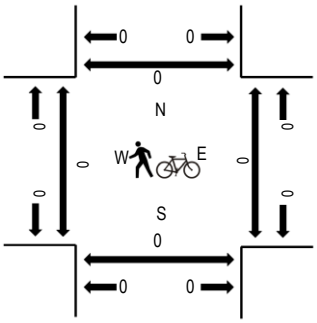
Location: 8-9 RADAR HILL RD & 1416 AM
Date and Start Time: Thursday, May 19, 2016
Peak Hour: 04:00 PM - 05:00 PM
Peak 15-Minutes: 04:00 PM - 04:15 PM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles in Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

Interval Start Time	1416 Eastbound				1416 Westbound				RADAR HILL RD Northbound				GUMBO DR Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:00:00 AM	0	1	123	2	0	6	21	1	0	14	1	27	0	1	0	3	200	1,061	0	0	0	0
6:15:00 AM	0	1	147	10	0	6	28	0	0	18	0	37	0	1	0	2	250	1,235	0	0	0	0
6:30:00 AM	0	1	145	8	0	9	54	2	0	39	0	39	0	0	0	2	299	1,388	0	0	0	0
6:45:00 AM	0	1	156	5	0	9	48	1	0	27	0	56	0	0	0	9	312	1,493	0	2	0	0
7:00:00 AM	0	1	168	6	0	14	78	1	0	43	0	53	0	1	0	9	374	1,449	0	0	0	0
7:15:00 AM	2	0	177	11	0	15	76	1	0	37	0	72	0	3	2	7	403	1,264	0	0	0	0
7:30:00 AM	0	0	137	11	0	16	93	1	0	44	0	87	0	0	4	11	404	1,076	0	0	0	0
7:45:00 AM	1	1	110	15	0	26	53	1	0	27	0	25	0	0	2	7	268	850	0	0	0	0
8:00:00 AM	1	2	63	11	0	22	55	0	0	12	0	19	0	0	0	4	189	747	0	0	0	0
8:15:00 AM	0	1	65	15	0	14	74	1	0	27	2	10	0	0	0	6	215	703	0	0	0	0
8:30:00 AM	0	3	60	13	0	8	57	0	0	18	0	14	0	0	1	4	178	649	0	0	0	0
8:45:00 AM	0	2	62	14	0	14	39	1	0	16	0	14	0	0	0	3	165	640	0	0	0	0
9:00:00 AM	0	1	56	8	0	3	49	0	0	13	0	10	0	1	1	3	145	627	0	0	0	0
9:15:00 AM	1	0	52	7	0	10	57	1	0	17	0	12	0	0	0	4	161	676	0	0	0	0
9:30:00 AM	0	2	54	12	0	13	46	1	0	22	0	13	0	0	1	5	169	686	0	0	0	0
9:45:00 AM	0	0	55	14	0	11	52	1	0	9	0	8	0	0	0	2	152	702	0	0	0	0
10:00:00 AM	0	0	67	12	0	12	67	0	0	16	0	18	0	0	1	1	194	731	0	0	0	0
10:15:00 AM	1	4	63	7	0	11	57	1	0	11	3	7	0	2	1	3	171	752	0	0	0	0
10:30:00 AM	1	4	61	7	0	20	56	1	0	18	1	10	0	1	2	3	185	801	0	0	0	0
10:45:00 AM	0	2	57	16	0	10	70	1	0	8	1	13	0	1	0	2	181	854	0	0	0	0
11:00:00 AM	0	7	62	11	0	21	87	1	0	16	0	5	0	1	0	4	215	927	0	0	0	0
11:15:00 AM	1	4	64	13	0	13	81	1	0	21	1	17	0	0	1	3	220	964	0	0	0	0
11:30:00 AM	0	3	72	12	0	18	92	1	0	19	0	14	0	1	0	6	238	993	0	0	0	0
11:45:00 AM	0	5	86	27	0	21	82	2	0	14	0	15	0	0	0	2	254	1,006	0	0	0	0
12:00:00 PM	0	3	94	21	0	10	72	2	0	20	0	25	0	0	0	5	252	981	0	0	0	0
12:15:00 PM	1	3	88	16	0	10	80	1	0	18	0	25	0	1	2	4	249	987	0	0	0	0
12:30:00 PM	0	4	108	22	0	12	66	1	0	19	1	13	0	0	0	5	251	1,001	0	0	0	0
12:45:00 PM	2	2	87	27	0	16	57	1	0	18	0	17	0	0	0	2	229	982	0	0	0	0
1:00:00 PM	0	4	102	20	0	15	56	3	0	22	1	19	0	3	3	10	258	991	0	0	0	0
1:15:00 PM	0	4	115	16	0	15	53	3	0	27	2	23	0	0	2	3	263	971	0	0	0	0
1:30:00 PM	1	4	100	14	0	19	53	4	0	13	0	17	0	4	1	2	232	978	0	0	0	0
1:45:00 PM	0	3	101	14	0	24	57	1	0	21	0	16	0	1	0	0	238	1,022	0	0	0	0
2:00:00 PM	0	1	87	22	1	19	75	1	0	15	0	15	0	0	1	1	238	1,077	0	0	0	0
2:15:00 PM	0	3	99	26	0	26	70	4	0	16	1	22	0	0	3	0	270	1,170	0	0	0	0
2:30:00 PM	0	1	101	17	0	18	92	1	0	14	0	24	0	1	4	3	276	1,242	0	0	0	0

2:45:00 PM	0	0	81	26	0	39	113	2	0	11	0	20	0	0	1	0	293	1,326	0	0	0	0
3:00:00 PM	2	1	100	33	0	39	119	2	0	15	1	11	0	0	0	8	331	1,344	0	0	0	0
3:15:00 PM	0	3	86	25	0	62	130	5	0	16	0	12	0	0	0	3	342	1,428	0	0	0	0
3:30:00 PM	0	4	87	33	0	40	141	2	0	23	1	20	0	1	0	8	360	1,441	0	0	0	0
3:45:00 PM	0	8	93	28	0	31	111	2	0	20	0	13	0	0	1	4	311	1,482	0	0	0	0
4:00:00 PM	1	6	98	42	0	54	169	1	0	19	1	15	1	1	1	6	415	1,527	0	0	0	0
4:15:00 PM	0	1	88	35	0	35	138	2	0	30	0	21	0	0	0	5	355	1,504	0	0	0	0
4:30:00 PM	1	9	97	41	0	45	160	3	0	21	0	18	0	0	4	2	401	1,512	0	0	0	0
4:45:00 PM	0	7	110	36	1	36	114	2	0	23	1	20	0	1	1	4	356	1,405	0	0	0	0
5:00:00 PM	1	4	109	44	0	41	131	1	0	37	3	17	0	0	3	1	392	1,308	0	0	0	0
5:15:00 PM	0	3	120	55	0	37	100	1	0	27	1	16	0	0	3	0	363		0	0	0	0
5:30:00 PM	0	6	87	23	0	18	84	5	0	43	3	20	0	3	2	0	294		0	0	0	0
5:45:00 PM	1	3	86	26	0	17	83	1	0	25	0	12	0	1	2	2	259		0	0	0	0
Count Total	18	133	4,486	929	2	1,000	3,796	72	0	1,019	25	1,026	1	30	50	183	12,770		0	2	0	0
Peak Hour	2	23	393	154	1	170	581	8	0	93	2	74	1	2	6	17	1,527		0	0	0	0

All Traffic Data Services Inc.

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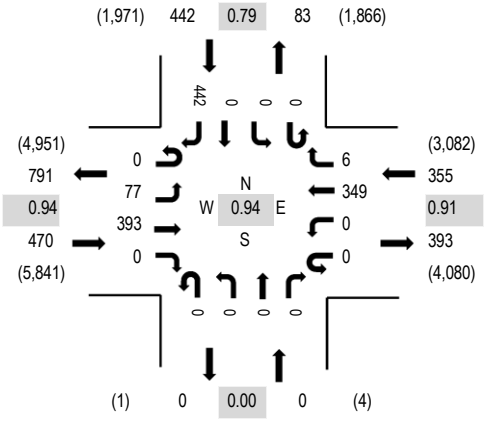
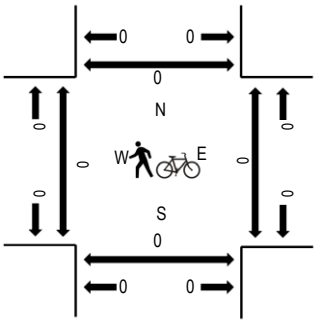
Location: 10-11 COMMERCIAL GATE RD & 1416 AM
Date and Start Time: Thursday, May 19, 2016
Peak Hour: 04:00 PM - 05:00 PM
Peak 15-Minutes: 04:30 PM - 04:45 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	1416 Eastbound				1416 Westbound				COMMERCIAL GATE RD Northbound				COMMERICAL GATE RD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:00:00 AM	1	77	63	0	0	0	23	0	0	0	0	0	0	0	0	2	166	870	0	0	0	0
6:15:00 AM	0	64	112	0	0	0	29	0	0	0	0	0	0	1	0	6	212	1,007	0	0	0	0
6:30:00 AM	0	59	111	0	0	0	46	2	0	2	0	0	0	0	0	14	234	1,131	0	0	0	0
6:45:00 AM	0	65	130	0	0	0	44	3	0	0	0	0	0	3	0	13	258	1,226	0	0	0	0
7:00:00 AM	0	66	143	0	0	0	68	0	0	0	0	0	0	1	0	25	303	1,188	0	0	0	0
7:15:00 AM	0	64	174	0	0	0	61	0	0	0	0	0	0	5	0	32	336	1,041	0	0	0	0
7:30:00 AM	0	53	161	0	1	0	80	0	0	0	0	0	0	3	0	31	329	868	0	0	0	0
7:45:00 AM	1	54	79	0	1	0	70	1	0	0	0	0	0	2	0	12	220	677	0	0	0	0
8:00:00 AM	2	25	51	0	0	0	65	0	0	1	0	0	0	1	0	11	156	593	0	0	0	0
8:15:00 AM	0	35	39	0	0	0	54	0	0	0	0	0	0	2	0	33	163	559	0	0	0	0
8:30:00 AM	0	31	41	0	0	0	41	0	0	1	0	0	0	1	0	23	138	520	0	0	0	0
8:45:00 AM	0	27	49	0	1	0	39	1	0	0	0	0	0	3	0	16	136	506	0	0	0	0
9:00:00 AM	0	21	47	0	0	0	37	1	0	0	0	0	0	2	0	14	122	504	0	0	0	0
9:15:00 AM	0	19	40	0	0	0	45	0	0	0	0	0	0	0	0	20	124	548	0	0	0	0
9:30:00 AM	0	22	42	0	0	0	37	2	0	0	0	0	0	0	0	21	124	572	0	0	0	0
9:45:00 AM	0	13	51	0	0	0	42	2	0	0	0	0	0	0	0	26	134	597	0	0	0	0
10:00:00 AM	1	27	58	0	0	0	52	2	0	0	0	0	0	4	0	22	166	608	0	0	0	0
10:15:00 AM	0	23	50	0	1	0	47	3	0	0	0	0	0	0	0	24	148	620	0	0	0	0
10:30:00 AM	0	15	52	0	0	0	50	2	0	0	0	0	0	2	0	28	149	643	0	0	0	0
10:45:00 AM	1	19	45	1	0	0	41	3	0	0	0	0	0	1	0	34	145	697	0	0	0	0
11:00:00 AM	0	21	42	0	0	0	56	2	0	0	0	0	0	6	0	51	178	762	0	0	0	0
11:15:00 AM	2	25	48	0	0	0	43	1	0	0	0	0	0	1	0	51	171	787	0	0	0	0
11:30:00 AM	0	22	63	0	0	0	63	2	0	0	0	0	0	2	0	51	203	876	0	0	0	0
11:45:00 AM	0	33	70	0	0	0	56	1	0	0	0	0	0	2	0	48	210	924	0	0	0	0
12:00:00 PM	1	40	71	0	0	0	53	3	0	0	0	0	0	2	0	33	203	957	0	0	0	0
12:15:00 PM	0	81	87	0	0	0	64	1	0	0	0	0	0	0	0	27	260	1,001	0	0	0	0
12:30:00 PM	0	64	106	0	0	0	53	1	0	0	0	0	0	0	0	27	251	993	0	0	0	0
12:45:00 PM	0	65	87	0	0	0	65	1	0	0	0	0	0	0	0	25	243	993	0	0	0	0
1:00:00 PM	0	70	100	0	0	0	47	1	0	0	0	0	0	0	0	29	247	989	0	0	0	0
1:15:00 PM	0	69	112	0	0	0	52	3	0	0	0	0	0	0	0	16	252	983	0	0	0	0
1:30:00 PM	0	62	103	0	0	0	65	0	0	0	0	0	0	0	0	21	251	961	0	0	0	0
1:45:00 PM	0	54	99	0	0	0	54	2	0	0	0	0	0	0	0	30	239	954	0	0	0	0
2:00:00 PM	0	59	80	0	0	0	64	4	0	0	0	0	0	0	0	34	241	984	0	0	0	0
2:15:00 PM	0	29	97	0	0	0	50	0	0	0	0	0	0	0	0	54	230	1,035	0	0	0	0
2:30:00 PM	0	33	102	0	0	0	67	0	0	0	0	0	0	0	0	42	244	1,108	0	0	0	0

2:45:00 PM	0	36	78	0	0	0	108	2	0	0	0	0	0	0	0	45	269	1,163	0	0	0	0
3:00:00 PM	0	22	100	0	0	0	105	1	0	0	0	0	0	0	0	64	292	1,160	0	0	0	0
3:15:00 PM	0	23	84	0	0	0	139	4	0	0	0	0	0	0	0	53	303	1,200	0	0	0	0
3:30:00 PM	0	23	84	0	0	0	101	6	0	0	0	0	0	0	0	85	299	1,202	0	0	0	0
3:45:00 PM	0	24	92	0	0	0	76	0	0	0	0	0	0	0	0	74	266	1,241	0	0	0	0
4:00:00 PM	0	16	96	0	0	0	80	0	0	0	0	0	0	0	0	140	332	1,267	0	0	0	0
4:15:00 PM	0	24	89	0	0	0	91	2	0	0	0	0	0	0	0	99	305	1,239	0	0	0	0
4:30:00 PM	0	21	99	0	0	0	95	3	0	0	0	0	0	0	0	120	338	1,210	0	0	0	0
4:45:00 PM	0	16	109	0	0	0	83	1	0	0	0	0	0	0	0	83	292	1,097	0	0	0	0
5:00:00 PM	0	20	106	0	0	0	88	0	0	0	0	0	0	0	0	90	304	1,016	0	0	0	0
5:15:00 PM	0	23	117	0	0	0	86	0	0	0	0	0	0	0	0	50	276		0	0	0	0
5:30:00 PM	0	24	88	0	0	0	65	1	0	0	0	0	0	0	0	47	225		0	0	0	0
5:45:00 PM	0	21	85	0	0	0	71	3	0	0	0	0	0	0	0	31	211		0	0	0	0
Count Total	9	1,799	4,032	1	4	0	3,011	67	0	4	0	0	0	44	0	1,927	10,898		0	0	0	0
Peak Hour	0	77	393	0	0	0	349	6	0	0	0	0	0	0	0	442	1,267		0	0	0	0

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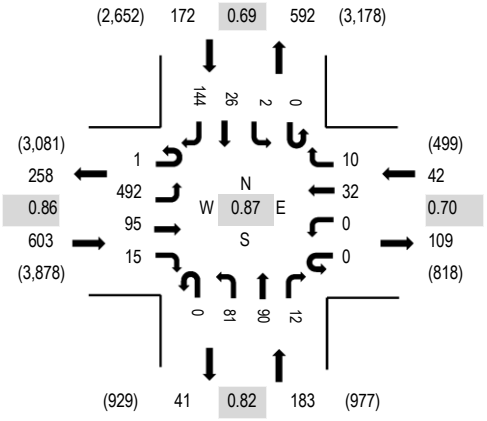
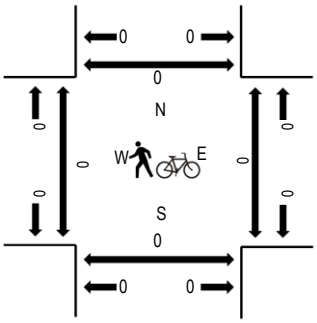
Location: 12-13 ELLSWORTH RD & 1416 AM
Date and Start Time: Thursday, May 19, 2016
Peak Hour: 06:45 AM - 07:45 AM
Peak 15-Minutes: 07:30 AM - 07:45 AM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles in Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

Interval Start Time	1416 Eastbound				1416 Westbound				ELLSWORTH RD Northbound				ELLSWORTH RD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:00:00 AM	1	57	2	1	0	0	3	0	0	6	11	1	0	0	0	14	96	641	0	0	0	0
6:15:00 AM	0	94	15	3	0	1	3	0	0	8	11	0	0	0	4	18	157	780	0	0	0	0
6:30:00 AM	0	102	9	1	0	0	8	2	0	13	17	0	0	0	3	30	185	899	0	0	0	0
6:45:00 AM	1	113	14	4	0	0	2	3	0	18	14	1	0	1	5	27	203	1,000	0	0	0	0
7:00:00 AM	0	116	20	2	0	0	10	2	0	22	20	4	0	0	4	35	235	980	0	0	0	0
7:15:00 AM	0	143	29	3	0	0	13	2	0	17	28	3	0	0	2	36	276	870	0	0	0	0
7:30:00 AM	0	120	32	6	0	0	7	3	0	24	28	4	0	1	15	46	286	696	0	0	0	0
7:45:00 AM	0	69	17	2	0	0	10	4	0	11	10	1	0	2	7	50	183	514	0	0	0	0
8:00:00 AM	1	44	3	3	0	0	13	4	0	4	4	1	0	2	3	43	125	441	0	0	0	0
8:15:00 AM	0	33	4	6	0	0	8	1	0	3	2	0	0	0	2	43	102	417	0	0	0	0
8:30:00 AM	0	37	10	3	0	0	3	1	0	13	10	0	0	0	4	23	104	408	0	0	0	0
8:45:00 AM	0	37	10	10	0	0	6	3	0	6	7	0	0	0	5	26	110	403	0	0	0	0
9:00:00 AM	0	38	9	2	0	0	3	0	0	8	4	1	0	2	3	31	101	395	0	0	0	0
9:15:00 AM	0	31	4	3	0	1	6	0	0	9	5	1	0	0	3	30	93	425	0	0	0	0
9:30:00 AM	0	27	12	2	0	0	4	1	0	4	4	1	0	0	9	35	99	448	0	0	0	0
9:45:00 AM	0	36	14	3	0	0	6	5	0	12	1	0	0	0	1	24	102	451	0	0	0	0
10:00:00 AM	0	40	14	7	0	0	8	2	0	8	7	0	0	2	3	40	131	458	0	0	0	0
10:15:00 AM	0	33	11	7	0	0	11	0	0	6	4	1	0	1	7	35	116	446	0	0	0	0
10:30:00 AM	0	36	10	4	0	0	5	0	0	6	3	0	0	0	3	35	102	446	0	0	0	0
10:45:00 AM	0	31	6	6	0	0	9	1	0	9	6	0	0	1	11	29	109	485	0	0	0	0
11:00:00 AM	0	38	4	5	0	0	9	2	0	8	6	0	0	0	8	39	119	533	0	0	0	0
11:15:00 AM	0	28	11	9	0	0	8	2	0	8	7	1	0	1	10	31	116	558	0	0	0	0
11:30:00 AM	0	36	13	8	0	0	7	1	0	14	8	0	0	0	11	43	141	602	0	0	0	0
11:45:00 AM	0	47	13	9	0	0	8	2	0	10	11	1	0	2	14	40	157	597	0	0	0	0
12:00:00 PM	0	49	10	7	0	0	7	2	0	13	15	1	0	0	7	33	144	564	0	0	0	0
12:15:00 PM	1	45	21	9	0	0	7	2	0	7	10	2	0	0	11	45	160	591	0	0	0	0
12:30:00 PM	0	46	9	9	0	0	8	2	0	8	8	3	0	2	4	37	136	602	0	0	0	0
12:45:00 PM	1	36	13	8	0	1	6	2	0	11	6	0	0	3	6	31	124	637	0	0	0	0
1:00:00 PM	0	70	15	13	0	0	4	2	0	9	13	0	0	2	7	36	171	673	0	0	0	0
1:15:00 PM	0	73	17	16	0	1	10	0	0	7	5	0	0	1	5	36	171	643	0	0	0	0
1:30:00 PM	1	66	13	12	0	2	10	1	0	9	8	1	0	0	4	44	171	627	0	0	0	0
1:45:00 PM	1	62	16	8	0	0	7	0	0	12	9	0	0	0	4	41	160	640	0	0	0	0
2:00:00 PM	0	46	13	10	0	1	7	0	0	8	2	1	0	0	4	49	141	714	0	0	0	0
2:15:00 PM	0	53	16	8	0	1	5	6	0	6	7	0	0	2	13	38	155	770	0	0	0	0
2:30:00 PM	1	61	13	12	0	0	8	0	0	5	7	1	0	4	10	62	184	894	0	0	0	0

2:45:00 PM	0	54	19	14	0	1	13	2	0	6	10	1	0	3	14	97	234	923	0	0	0	0
3:00:00 PM	0	41	22	15	0	0	7	2	0	5	6	1	0	2	9	87	197	879	0	0	0	0
3:15:00 PM	1	53	18	18	0	3	15	4	0	13	6	1	0	2	23	122	279	886	0	0	0	0
3:30:00 PM	0	47	22	6	0	1	10	2	0	16	8	1	0	6	13	81	213	810	0	0	0	0
3:45:00 PM	0	50	15	15	0	0	15	2	0	9	9	0	0	3	20	52	190	822	0	0	1	0
4:00:00 PM	0	47	30	20	0	0	13	1	0	7	9	0	0	4	9	64	204	872	0	0	0	0
4:15:00 PM	0	56	21	13	0	3	11	2	0	12	5	1	0	1	17	61	203	907	0	0	0	0
4:30:00 PM	2	43	21	26	0	0	12	0	0	14	11	2	0	1	16	77	225	936	0	0	0	0
4:45:00 PM	1	61	18	29	0	1	12	1	0	20	14	1	0	6	25	51	240	907	0	0	0	0
5:00:00 PM	1	63	21	30	0	1	6	2	0	11	10	3	0	3	16	72	239	856	0	0	0	0
5:15:00 PM	0	50	27	39	0	0	10	4	0	16	4	4	0	0	19	59	232		0	0	0	0
5:30:00 PM	0	59	17	26	0	1	7	1	0	24	8	0	0	1	16	36	196		0	0	0	0
5:45:00 PM	0	52	14	17	0	2	12	5	0	12	5	2	0	3	10	55	189		0	0	0	0
Count Total	13	2,669	707	489	0	21	392	86	0	507	423	47	0	64	419	2,169	8,006		0	0	1	0
Peak Hour	1	492	95	15	0	0	32	10	0	81	90	12	0	2	26	144	1,000		0	0	1	0

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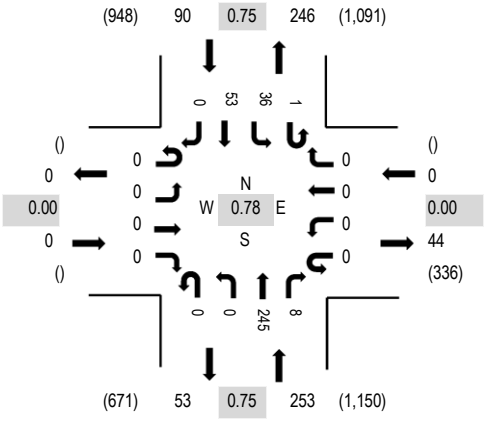
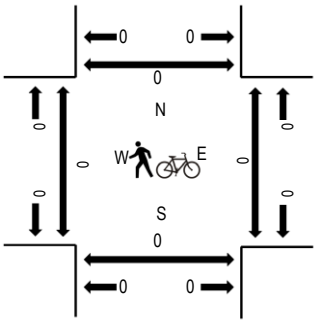
Location: 14 LIBERTY BLVD & I-90 EB ON RAMP AM
Date and Start Time: Thursday, May 19, 2016
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:30 AM - 07:45 AM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles in Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

Interval Start Time	I-90 EB ON RAMP Eastbound				I-90 EB ON RAMP Westbound				LIBERTY BLVD Northbound				LIBERTY BLVD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:00:00 AM	0	0	0	0	0	0	0	0	0	0	15	1	0	4	2	0	22	149	0	0	0	0
6:15:00 AM	0	0	0	0	0	0	0	0	0	0	28	1	0	1	3	0	33	202	0	0	0	0
6:30:00 AM	0	0	0	0	0	0	0	0	0	0	26	0	0	3	10	0	39	254	0	0	0	0
6:45:00 AM	0	0	0	0	0	0	0	0	0	0	44	0	0	8	3	0	55	325	0	0	0	0
7:00:00 AM	0	0	0	0	0	0	0	0	0	0	52	1	0	14	8	0	75	343	0	0	0	0
7:15:00 AM	0	0	0	0	0	0	0	0	0	0	70	3	0	7	5	0	85	316	0	0	0	0
7:30:00 AM	0	0	0	0	0	0	0	0	0	0	82	2	0	7	19	0	110	270	0	0	0	0
7:45:00 AM	0	0	0	0	0	0	0	0	0	0	41	2	1	8	21	0	73	189	0	0	0	0
8:00:00 AM	0	0	0	0	0	0	0	0	0	0	26	1	1	7	13	0	48	152	0	0	0	0
8:15:00 AM	0	0	0	0	0	0	0	0	0	0	20	1	0	2	16	0	39	130	0	0	0	0
8:30:00 AM	0	0	0	0	0	0	0	0	0	0	16	2	0	3	8	0	29	124	0	0	0	0
8:45:00 AM	0	0	0	0	0	0	0	0	0	0	20	1	0	5	10	0	36	128	0	0	2	0
9:00:00 AM	0	0	0	0	0	0	0	0	0	0	12	3	0	5	6	0	26	121	0	0	0	0
9:15:00 AM	0	0	0	0	0	0	0	0	0	0	13	3	0	8	9	0	33	124	0	0	0	0
9:30:00 AM	0	0	0	0	0	0	0	0	0	0	12	1	1	7	12	0	33	130	0	0	0	0
9:45:00 AM	0	0	0	0	0	0	0	0	0	0	13	0	0	8	8	0	29	132	0	0	0	0
10:00:00 AM	0	0	0	0	0	0	0	0	0	0	18	1	1	0	9	0	29	144	0	0	0	0
10:15:00 AM	0	0	0	0	0	0	0	0	0	0	19	4	1	4	11	0	39	139	0	0	0	0
10:30:00 AM	0	0	0	0	0	0	0	0	0	0	17	0	0	7	11	0	35	132	0	0	0	0
10:45:00 AM	0	0	0	0	0	0	0	0	0	0	23	2	0	5	11	0	41	130	0	0	0	0
11:00:00 AM	0	0	0	0	0	0	0	0	0	0	13	1	0	5	5	0	24	120	0	0	0	0
11:15:00 AM	0	0	0	0	0	0	0	0	0	0	17	1	1	4	9	0	32	129	0	0	0	0
11:30:00 AM	0	0	0	0	0	0	0	0	0	0	12	1	0	5	15	0	33	144	0	0	0	0
11:45:00 AM	0	0	0	0	0	0	0	0	0	0	13	2	0	6	10	0	31	152	0	0	0	0
12:00:00 PM	0	0	0	0	0	0	0	0	0	0	17	2	0	5	9	0	33	159	0	0	0	0
12:15:00 PM	0	0	0	0	0	0	0	0	0	0	29	1	0	9	8	0	47	158	0	0	0	0
12:30:00 PM	0	0	0	0	0	0	0	0	0	0	25	0	0	3	13	0	41	151	0	0	0	0
12:45:00 PM	0	0	0	0	0	0	0	0	0	0	18	2	0	6	12	0	38	145	0	0	0	0
1:00:00 PM	0	0	0	0	0	0	0	0	0	0	19	1	0	2	10	0	32	144	0	0	0	0
1:15:00 PM	0	0	0	0	0	0	0	0	0	0	18	2	0	5	15	0	40	152	0	0	0	0
1:30:00 PM	0	0	0	0	0	0	0	0	0	0	17	2	0	6	10	0	35	148	0	0	0	0
1:45:00 PM	0	0	0	0	0	0	0	0	0	0	15	2	0	9	11	0	37	149	0	0	0	0
2:00:00 PM	0	0	0	0	0	0	0	0	0	0	14	1	0	6	19	0	40	159	0	0	0	0
2:15:00 PM	0	0	0	0	0	0	0	0	0	0	14	2	0	5	15	0	36	166	0	0	0	0
2:30:00 PM	0	0	0	0	0	0	0	0	0	0	18	2	0	2	14	0	36	186	0	0	0	0

2:45:00 PM	0	0	0	0	0	0	0	0	0	0	17	1	0	9	20	0	47	200	0	0	0	0
3:00:00 PM	0	0	0	0	0	0	0	0	0	0	12	3	0	8	24	0	47	197	0	0	0	0
3:15:00 PM	0	0	0	0	0	0	0	0	0	0	18	1	0	4	33	0	56	210	0	0	0	0
3:30:00 PM	0	0	0	0	0	0	0	0	0	0	20	0	0	8	22	0	50	207	0	0	0	0
3:45:00 PM	0	0	0	0	0	0	0	0	0	0	26	0	0	4	14	0	44	201	0	0	0	0
4:00:00 PM	0	0	0	0	0	0	0	0	0	0	23	1	0	10	26	0	60	205	0	0	0	0
4:15:00 PM	0	0	0	0	0	0	0	0	0	0	23	2	0	9	19	0	53	202	0	0	0	0
4:30:00 PM	0	0	0	0	0	0	0	0	0	0	17	0	0	3	24	0	44	209	0	0	0	0
4:45:00 PM	0	0	0	0	0	0	0	0	0	0	21	0	0	4	23	0	48	211	0	0	0	0
5:00:00 PM	0	0	0	0	0	0	0	0	0	0	26	3	0	8	20	0	57	205	0	0	0	0
5:15:00 PM	0	0	0	0	0	0	0	0	0	0	21	2	0	4	33	0	60		0	0	0	0
5:30:00 PM	0	0	0	0	0	0	0	0	0	0	22	1	0	6	17	0	46		0	0	0	0
5:45:00 PM	0	0	0	0	0	0	0	0	0	0	13	0	0	3	26	0	42		0	0	0	0
Count Total	0	0	0	0	0	0	0	0	0	0	1,085	65	6	271	671	0	2,098		0	0	2	0
Peak Hour	0	0	0	0	0	0	0	0	0	0	245	8	1	36	53	0	343		0	0	0	0

All Traffic Data Services Inc.

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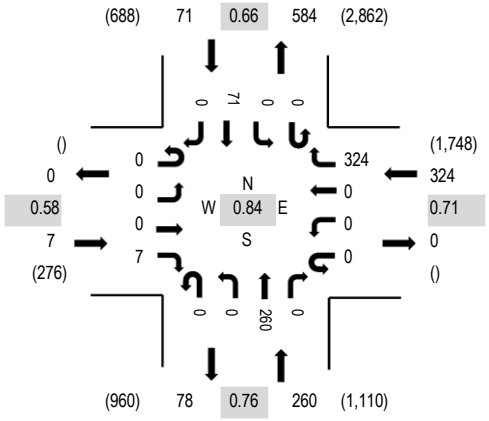
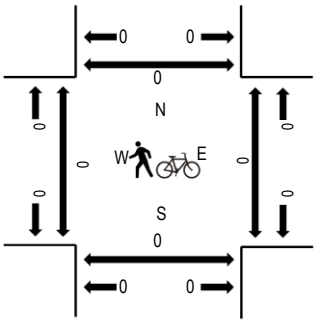
Location: 15-16 LIBERTY BLVD & I-90 EB OFF RAMP LOOP AM
Date and Start Time: Thursday, May 19, 2016
Peak Hour: 06:45 AM - 07:45 AM
Peak 15-Minutes: 07:15 AM - 07:30 AM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles in Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

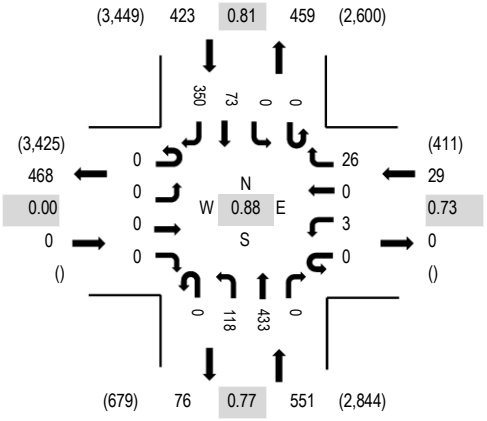
Interval Start Time	I-90 EB OFF RAMP Eastbound				I-90 EB OFF RAMP LOOP Westbound				LIBERTY BLVD Northbound				LIBERTY BLVD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:00:00 AM	0	0	0	2	0	0	0	25	0	0	16	0	0	0	5	0	48	319	0	0	0	0
6:15:00 AM	0	0	0	0	0	0	0	34	0	0	30	0	0	0	6	0	70	432	0	0	0	0
6:30:00 AM	0	0	0	2	0	0	0	50	0	0	22	0	0	0	9	0	83	559	0	0	0	0
6:45:00 AM	0	0	0	1	0	0	0	63	0	0	44	0	0	0	10	0	118	662	0	0	0	0
7:00:00 AM	0	0	0	1	0	0	0	76	0	0	62	0	0	0	22	0	161	638	0	0	0	0
7:15:00 AM	0	0	0	2	0	0	0	114	0	0	69	0	0	0	12	0	197	563	0	0	0	0
7:30:00 AM	0	0	0	3	0	0	0	71	0	0	85	0	0	0	27	0	186	425	0	0	0	0
7:45:00 AM	0	0	0	5	0	0	0	34	0	0	34	0	0	0	21	0	94	284	0	0	0	0
8:00:00 AM	0	0	0	3	0	0	0	36	0	0	30	0	0	0	17	0	86	237	0	0	0	0
8:15:00 AM	0	0	0	8	0	0	0	21	0	0	19	0	0	0	11	0	59	193	0	0	0	0
8:30:00 AM	0	0	0	1	0	0	0	18	0	0	17	0	0	0	9	0	45	194	0	0	0	0
8:45:00 AM	0	0	0	1	0	0	0	14	0	0	19	0	0	0	13	0	47	201	0	0	0	0
9:00:00 AM	0	0	0	5	0	0	0	18	0	0	11	0	0	0	8	0	42	206	0	0	0	0
9:15:00 AM	0	0	0	8	0	0	0	26	0	0	14	0	0	0	12	0	60	205	0	0	0	0
9:30:00 AM	0	0	0	5	0	0	0	23	0	0	14	0	0	0	10	0	52	201	0	0	0	0
9:45:00 AM	0	0	0	3	0	0	0	24	0	0	12	0	0	0	13	0	52	203	0	0	0	0
10:00:00 AM	0	0	0	4	0	0	0	10	0	0	20	0	0	0	7	0	41	215	0	0	0	0
10:15:00 AM	0	1	0	4	0	0	0	20	0	0	19	0	0	0	12	0	56	219	0	0	0	0
10:30:00 AM	0	0	0	3	0	0	0	19	0	0	18	0	0	0	14	0	54	224	0	0	0	0
10:45:00 AM	0	0	0	7	0	0	0	22	0	0	25	0	0	0	10	0	64	233	0	0	0	0
11:00:00 AM	0	0	0	3	0	0	0	23	0	0	12	0	0	0	7	0	45	215	0	0	0	0
11:15:00 AM	0	0	0	1	0	0	0	32	0	0	16	0	0	0	12	0	61	232	0	0	0	0
11:30:00 AM	0	0	0	6	0	0	0	29	0	0	14	0	0	0	14	0	63	237	0	0	0	0
11:45:00 AM	0	0	0	8	0	0	0	16	0	0	13	0	0	0	9	0	46	241	0	0	0	0
12:00:00 PM	0	0	0	5	0	0	0	29	0	0	18	0	0	0	10	0	62	268	0	0	0	0
12:15:00 PM	0	0	0	3	0	0	0	23	0	0	26	0	0	0	14	0	66	267	0	0	0	0
12:30:00 PM	0	0	0	5	0	0	0	28	0	0	23	0	0	0	11	0	67	277	0	0	0	0
12:45:00 PM	0	0	0	8	0	0	0	33	0	0	19	0	0	0	13	0	73	284	0	0	0	0
1:00:00 PM	0	1	0	2	0	0	0	28	0	0	19	0	0	0	11	0	61	275	0	0	0	0
1:15:00 PM	0	0	0	2	0	0	0	39	0	0	18	0	0	0	17	0	76	290	0	0	0	0
1:30:00 PM	0	0	0	6	0	0	0	38	0	0	18	0	0	0	12	0	74	286	0	0	0	0
1:45:00 PM	0	0	0	8	0	0	0	30	0	0	16	0	0	0	10	0	64	293	0	0	0	0
2:00:00 PM	0	0	0	11	0	0	0	36	0	0	15	0	0	0	14	0	76	319	0	0	0	0
2:15:00 PM	0	0	0	8	0	0	0	34	0	0	17	0	0	0	13	0	72	323	0	0	0	0
2:30:00 PM	0	0	0	3	0	0	0	46	0	0	19	0	0	0	13	0	81	340	0	0	0	0

2:45:00 PM	0	1	0	5	0	0	0	41	0	0	18	0	0	0	25	0	90	346	0	0	0	0
3:00:00 PM	0	0	0	10	0	0	0	30	0	0	15	0	0	0	25	0	80	350	0	0	0	0
3:15:00 PM	0	0	0	6	0	0	0	33	0	0	18	0	0	0	32	0	89	370	0	0	0	0
3:30:00 PM	0	0	0	6	0	0	0	35	0	0	21	0	0	0	25	0	87	378	0	0	0	0
3:45:00 PM	0	0	0	7	0	0	0	47	0	0	27	0	0	0	13	0	94	386	0	0	0	0
4:00:00 PM	0	0	0	8	0	0	0	42	0	0	23	0	0	0	27	0	100	389	0	0	0	0
4:15:00 PM	0	0	0	9	0	0	0	48	0	0	22	0	0	0	18	0	97	381	0	0	0	0
4:30:00 PM	0	0	0	10	0	0	0	49	0	0	19	0	0	0	17	0	95	410	0	0	0	0
4:45:00 PM	0	0	0	10	0	0	0	51	0	0	20	0	0	0	16	0	97	412	0	0	0	0
5:00:00 PM	0	0	0	14	0	0	0	39	0	0	26	0	0	0	13	0	92	391	0	0	0	0
5:15:00 PM	0	1	0	23	0	0	0	67	0	0	20	0	0	0	15	0	126		0	0	0	0
5:30:00 PM	0	0	0	9	0	0	0	50	0	0	24	0	0	0	14	0	97		0	0	0	0
5:45:00 PM	0	0	0	8	0	0	0	34	0	0	14	0	0	0	20	0	76		0	0	0	0
Count Total	0	4	0	272	0	0	0	1,748	0	0	1,110	0	0	0	688	0	3,822		0	0	0	0
Peak Hour	0	0	0	7	0	0	0	324	0	0	260	0	0	0	71	0	662		0	0	0	0

All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

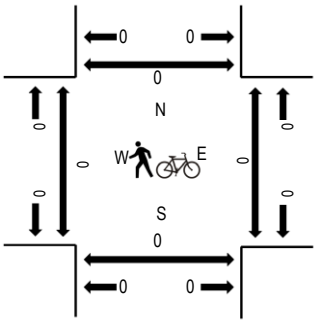
Location: 17 LIBERTY BLVD & I-90 N RAMP TERMINAL AM
Date and Start Time: Thursday, May 19, 2016
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:30 AM - 07:45 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	I-90 N RAMP TERMINAL Eastbound				I-90 N RAMP TERMINAL Westbound				LIBERTY BLVD Northbound				LIBERTY BLVD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:00:00 AM	0	0	0	0	0	0	0	7	0	17	26	0	0	0	4	33	87	514	0	0	0	0
6:15:00 AM	0	0	0	0	0	0	0	7	0	16	38	0	0	0	4	38	103	640	0	0	0	0
6:30:00 AM	0	0	0	0	0	0	0	6	0	17	55	0	0	0	10	60	148	816	0	0	0	0
6:45:00 AM	0	0	0	0	0	1	0	7	0	21	84	0	0	0	8	55	176	953	0	0	0	0
7:00:00 AM	0	0	0	0	0	1	0	6	0	25	101	0	0	0	20	60	213	1,003	0	0	0	0
7:15:00 AM	0	0	0	0	0	1	0	9	0	30	150	0	0	0	7	82	279	918	0	0	0	0
7:30:00 AM	0	0	0	0	0	0	0	7	0	38	109	0	0	0	22	109	285	748	0	0	0	0
7:45:00 AM	0	0	0	0	0	1	0	4	0	25	73	0	0	0	24	99	226	552	0	0	0	0
8:00:00 AM	0	0	0	0	0	2	0	5	0	19	32	0	0	0	16	54	128	407	0	0	0	0
8:15:00 AM	0	0	0	0	0	4	0	4	0	15	35	0	0	0	8	43	109	365	0	0	0	0
8:30:00 AM	0	0	0	0	0	1	0	2	0	11	28	0	0	0	7	40	89	354	0	0	0	0
8:45:00 AM	0	0	0	0	0	2	0	4	0	11	23	0	0	0	11	30	81	362	0	0	0	0
9:00:00 AM	0	0	0	0	0	0	0	5	0	8	27	0	0	0	8	38	86	382	0	0	0	0
9:15:00 AM	0	0	0	0	0	1	0	5	0	9	24	0	0	0	10	49	98	382	0	0	0	0
9:30:00 AM	0	0	0	0	0	1	0	4	0	7	30	0	0	0	11	44	97	379	0	0	0	0
9:45:00 AM	0	0	0	0	0	1	0	8	0	7	26	0	0	0	12	47	101	389	0	0	0	0
10:00:00 AM	0	0	0	0	0	2	0	3	0	14	20	0	0	0	5	42	86	384	0	0	0	0
10:15:00 AM	0	0	0	0	0	3	0	7	0	12	25	0	0	0	9	39	95	405	0	0	0	0
10:30:00 AM	0	0	0	0	0	3	0	6	0	11	28	0	0	0	12	47	107	422	0	0	0	0
10:45:00 AM	0	0	0	0	0	2	0	6	0	12	26	0	0	0	9	41	96	417	0	0	0	0
11:00:00 AM	0	0	0	0	0	0	0	10	0	12	32	0	0	0	8	45	107	409	0	0	0	0
11:15:00 AM	0	0	0	0	0	1	0	6	0	11	36	0	1	0	10	47	112	408	0	0	0	0
11:30:00 AM	0	0	0	0	0	1	0	5	0	3	40	0	0	0	12	41	102	410	0	0	0	0
11:45:00 AM	0	0	0	0	0	0	0	9	0	5	18	0	0	0	11	45	88	429	0	0	0	0
12:00:00 PM	0	0	0	0	0	1	0	5	0	8	41	0	0	0	7	44	106	449	0	0	0	0
12:15:00 PM	0	0	0	0	0	2	0	10	0	18	37	0	0	0	10	37	114	438	0	0	0	0
12:30:00 PM	0	0	0	0	0	2	0	7	0	12	39	0	0	0	10	51	121	441	0	0	0	0
12:45:00 PM	0	0	0	0	0	1	0	3	0	9	43	0	0	0	10	42	108	436	0	0	0	0
1:00:00 PM	0	0	0	0	0	0	0	2	0	10	34	0	1	0	13	35	95	427	0	0	0	0
1:15:00 PM	0	0	0	0	0	2	0	9	0	6	54	0	0	0	13	33	117	453	0	0	0	0
1:30:00 PM	0	0	0	0	0	3	0	10	0	10	46	0	0	0	12	35	116	454	0	0	0	0
1:45:00 PM	0	0	0	0	0	0	0	5	0	5	39	0	0	0	8	42	99	472	0	0	0	0
2:00:00 PM	0	0	0	0	0	1	0	9	0	6	43	0	0	0	15	47	121	517	0	0	0	0
2:15:00 PM	0	0	0	0	0	2	1	3	0	9	46	0	0	0	12	45	118	542	0	0	0	0
2:30:00 PM	0	0	0	0	0	2	0	8	0	5	63	0	0	0	11	45	134	635	0	0	0	0

2:45:00 PM	0	0	0	0	0	1	0	7	0	6	50	0	0	0	22	58	144	703	0	0	0	0
3:00:00 PM	0	0	0	0	0	1	0	11	0	4	37	0	0	0	22	71	146	765	0	0	0	0
3:15:00 PM	0	0	0	0	0	1	0	12	0	9	46	0	0	0	32	111	211	832	0	0	0	0
3:30:00 PM	0	0	0	0	0	0	0	12	0	12	38	0	0	0	22	118	202	819	0	0	0	0
3:45:00 PM	0	0	0	0	0	1	0	14	0	13	58	0	0	0	15	105	206	815	0	0	0	0
4:00:00 PM	0	0	0	0	0	0	0	10	0	11	53	0	0	0	21	118	213	808	0	0	0	0
4:15:00 PM	0	0	0	0	0	3	0	10	0	16	54	0	0	0	18	97	198	766	0	0	0	0
4:30:00 PM	0	0	0	0	0	3	0	9	0	8	55	0	0	0	14	109	198	758	0	0	0	0
4:45:00 PM	0	0	0	0	0	3	0	10	0	11	68	0	0	0	14	93	199	708	0	0	0	0
5:00:00 PM	0	0	0	0	0	1	0	11	0	14	43	0	0	0	11	91	171	639	0	0	0	0
5:15:00 PM	0	0	0	0	0	1	0	9	0	11	76	0	0	0	16	77	190		0	0	0	0
5:30:00 PM	0	0	0	0	0	2	0	11	0	14	58	0	0	0	11	52	148		0	0	0	0
5:45:00 PM	0	0	0	0	0	5	0	5	0	7	47	0	0	0	16	50	130		0	0	0	0
Count Total	0	0	0	0	0	66	1	344	0	590	2,254	0	2	0	613	2,834	6,704		0	0	0	0
Peak Hour	0	0	0	0	0	3	0	26	0	118	433	0	0	0	73	350	1,003		0	0	0	0

All Traffic Data Services, Inc
9660 W 44th Ave
Wheat Ridge,CO 80033
www.alltrafficdata.net

Site Code: 1 AM
Station ID: 1 AM
EXIT 63 EB OFF RAMP

Start Time	19-May-1 Thu	EB								
12:00 AM		76								
01:00		41								
02:00		16								
03:00		24								
04:00		47								
05:00		207								
06:00		**592**								
07:00		558								
08:00		349								
09:00		358								
10:00		299								
11:00		425								
12:00 PM		470								
01:00		468								
02:00		564								
03:00		555								
04:00		750								
05:00		**752**								
06:00		492								
07:00		455								
08:00		399								
09:00		293								
10:00		215								
11:00		94								
Total		8499								
AM Peak	-	06:00	-	-	-	-	-	-	-	-
Vol.	-	592	-	-	-	-	-	-	-	-
PM Peak	-	17:00	-	-	-	-	-	-	-	-
Vol.	-	752	-	-	-	-	-	-	-	-
Grand Total		8499								
ADT		ADT 8,499	AADT 8,499							

All Traffic Data Services, Inc
9660 W 44th Ave
Wheat Ridge,CO 80033
www.alltrafficdata.net

Site Code: 1 - NOON
Station ID: 1 - NOON
I-90 EXIT 61 EB ON RAMP

Start Time	19-May-1 Thu	EB								
12:00 AM		34								
01:00		27								
02:00		18								
03:00		32								
04:00		54								
05:00		152								
06:00		466								
07:00		**555**								
08:00		351								
09:00		328								
10:00		303								
11:00		311								
12:00 PM		357								
01:00		349								
02:00		396								
03:00		439								
04:00		**481**								
05:00		436								
06:00		305								
07:00		240								
08:00		220								
09:00		177								
10:00		137								
11:00		47								
Total		6215								
AM Peak	-	07:00	-	-	-	-	-	-	-	-
Vol.	-	555	-	-	-	-	-	-	-	-
PM Peak	-	16:00	-	-	-	-	-	-	-	-
Vol.	-	481	-	-	-	-	-	-	-	-
Grand Total		6215								
ADT		ADT 1,887	AADT 1,887							

All Traffic Data Services, Inc
9660 W 44th Ave
Wheat Ridge,CO 80033
www.alltrafficdata.net

Site Code: 1 - PM
Station ID: 1 - PM
SB ELLSWORTH RD AT PATRIO

Start Time	19-May-1 Thu	SB								
12:00 AM		0								
01:00		0								
02:00		0								
03:00		0								
04:00		0								
05:00		0								
06:00		0								
07:00		0								
08:00		0								
09:00		91								
10:00		148								
11:00		**206**								
12:00 PM		189								
01:00		165								
02:00		169								
03:00		272								
04:00		**426**								
05:00		249								
06:00		2								
07:00		0								
08:00		0								
09:00		0								
10:00		0								
11:00		0								
Total		1917								
AM Peak	-	11:00	-	-	-	-	-	-	-	-
Vol.	-	206	-	-	-	-	-	-	-	-
PM Peak	-	16:00	-	-	-	-	-	-	-	-
Vol.	-	426	-	-	-	-	-	-	-	-
Grand Total		1917								
ADT		ADT 4,719	AADT 4,719							

All Traffic Data Services, Inc
9660 W 44th Ave
Wheat Ridge,CO 80033
www.alltrafficdata.net

Site Code: 2 - PM
Station ID: 2 - PM
EB MAIN GATE RD

Start Time	19-May-1 Thu	EB								
12:00 AM		50								
01:00		35								
02:00		10								
03:00		8								
04:00		17								
05:00		28								
06:00		15								
07:00		40								
08:00		50								
09:00		56								
10:00		80								
11:00		**95**								
12:00 PM		95								
01:00		56								
02:00		87								
03:00		108								
04:00		173								
05:00		141								
06:00		**274**								
07:00		157								
08:00		125								
09:00		65								
10:00		44								
11:00		126								
Total		1935								
AM Peak	-	11:00	-	-	-	-	-	-	-	-
Vol.	-	95	-	-	-	-	-	-	-	-
PM Peak	-	18:00	-	-	-	-	-	-	-	-
Vol.	-	274	-	-	-	-	-	-	-	-
Grand Total		1935								
ADT		ADT 4,225	AADT 4,225							

All Traffic Data Services, Inc
9660 W 44th Ave
Wheat Ridge,CO 80033
www.alltrafficdata.net

Site Code: 2 - NOON
Station ID: 2 - NOON
I-90 EXIT 61 WB OFF RAMP

Start Time	19-May-1 Thu	WB								
12:00 AM		23								
01:00		19								
02:00		13								
03:00		22								
04:00		38								
05:00		106								
06:00		331								
07:00		**502**								
08:00		293								
09:00		284								
10:00		332								
11:00		316								
12:00 PM		332								
01:00		359								
02:00		454								
03:00		570								
04:00		**613**								
05:00		517								
06:00		312								
07:00		249								
08:00		182								
09:00		148								
10:00		124								
11:00		42								
Total		6181								
AM Peak	-	07:00	-	-	-	-	-	-	-	-
Vol.	-	502	-	-	-	-	-	-	-	-
PM Peak	-	16:00	-	-	-	-	-	-	-	-
Vol.	-	613	-	-	-	-	-	-	-	-
Grand Total		6181								
ADT		ADT 6,181	AADT 6,181							

All Traffic Data Services, Inc
9660 W 44th Ave
Wheat Ridge,CO 80033
www.alltrafficdata.net

Site Code: 2 - AM
Station ID: 2 - AM
NB COMMERCIAL GATE DR

Start Time	19-May-1 Thu	NB								
12:00 AM		0								
01:00		0								
02:00		0								
03:00		0								
04:00		0								
05:00		18								
06:00		**287**								
07:00		208								
08:00		136								
09:00		99								
10:00		125								
11:00		122								
12:00 PM		**157**								
01:00		114								
02:00		121								
03:00		73								
04:00		66								
05:00		47								
06:00		0								
07:00		0								
08:00		0								
09:00		0								
10:00		0								
11:00		0								
Total		1573								
AM Peak	-	06:00	-	-	-	-	-	-	-	-
Vol.	-	287	-	-	-	-	-	-	-	-
PM Peak	-	12:00	-	-	-	-	-	-	-	-
Vol.	-	157	-	-	-	-	-	-	-	-
Grand Total		1573								
ADT		ADT 1,573	AADT 1,573							

All Traffic Data Services, Inc
9660 W 44th Ave
Wheat Ridge,CO 80033
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Site Code: 3 - NOON
Station ID: 3 - NOON
I-90 EXIT 61 WB ON RAMP

Start Time	19-May-1 Thu	WB								
12:00 AM		50								
01:00		24								
02:00		17								
03:00		51								
04:00		220								
05:00		196								
06:00		391								
07:00		**634**								
08:00		479								
09:00		386								
10:00		436								
11:00		400								
12:00 PM		388								
01:00		390								
02:00		395								
03:00		552								
04:00		606								
05:00		**641**								
06:00		513								
07:00		369								
08:00		204								
09:00		147								
10:00		91								
11:00		55								
Total		7635								
AM Peak	-	07:00	-	-	-	-	-	-	-	-
Vol.	-	634	-	-	-	-	-	-	-	-
PM Peak	-	17:00	-	-	-	-	-	-	-	-
Vol.	-	641	-	-	-	-	-	-	-	-
Grand Total		7635								
ADT		ADT 7,478	AADT 7,478							

All Traffic Data Services, Inc
9660 W 44th Ave
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Site Code: 3 - PM
Station ID: 3 - PM
SB COMMERCIAL GATE RD

Start Time	19-May-1 Thu	SB								
12:00 AM		0								
01:00		0								
02:00		0								
03:00		0								
04:00		0								
05:00		0								
06:00		0								
07:00		0								
08:00		0								
09:00		0								
10:00		109								
11:00		**212**								
12:00 PM		118								
01:00		90								
02:00		178								
03:00		280								
04:00		**449**								
05:00		200								
06:00		3								
07:00		4								
08:00		0								
09:00		0								
10:00		0								
11:00		0								
Total		1643								
AM Peak	-	11:00	-	-	-	-	-	-	-	-
Vol.	-	212	-	-	-	-	-	-	-	-
PM Peak	-	16:00	-	-	-	-	-	-	-	-
Vol.	-	449	-	-	-	-	-	-	-	-
Grand Total		1643								
ADT		ADT 4,263	AADT 4,263							

All Traffic Data Services, Inc
9660 W 44th Ave
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Site Code: 3 - AM
Station ID: 3 - AM
WB MAIN GATE RD

Start Time	19-May-1 Thu	WB								
12:00 AM		8								
01:00		9								
02:00		4								
03:00		13								
04:00		55								
05:00		217								
06:00		**379**								
07:00		277								
08:00		80								
09:00		68								
10:00		75								
11:00		84								
12:00 PM		90								
01:00		71								
02:00		82								
03:00		73								
04:00		67								
05:00		64								
06:00		**174**								
07:00		119								
08:00		107								
09:00		104								
10:00		124								
11:00		38								
Total		2382								
AM Peak	-	06:00	-	-	-	-	-	-	-	-
Vol.	-	379	-	-	-	-	-	-	-	-
PM Peak	-	18:00	-	-	-	-	-	-	-	-
Vol.	-	174	-	-	-	-	-	-	-	-
Grand Total		2382								
ADT		ADT 4,225	AADT 4,225							

All Traffic Data Services, Inc
9660 W 44th Ave
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Site Code: 4 - NOON
Station ID: 4 - NOON
I-90 EXIT 61 EB OFF RAMP

Start Time	19-May-1 Thu	EB								
12:00 AM		46								
01:00		25								
02:00		14								
03:00		26								
04:00		84								
05:00		183								
06:00		396								
07:00		**623**								
08:00		417								
09:00		342								
10:00		384								
11:00		391								
12:00 PM		466								
01:00		408								
02:00		399								
03:00		505								
04:00		639								
05:00		**813**								
06:00		417								
07:00		308								
08:00		292								
09:00		202								
10:00		125								
11:00		58								
Total		7563								
AM Peak	-	07:00	-	-	-	-	-	-	-	-
Vol.	-	623	-	-	-	-	-	-	-	-
PM Peak	-	17:00	-	-	-	-	-	-	-	-
Vol.	-	813	-	-	-	-	-	-	-	-
Grand Total		7563								
ADT		ADT 7,426	AADT 7,426							

All Traffic Data Services, Inc
9660 W 44th Ave
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Site Code: 4 - PM
Station ID: 4 - PM
I-90 EXIT 63 WB ON RAMP

Start Time	19-May-1 Thu	WB								
12:00 AM		0								
01:00		0								
02:00		0								
03:00		0								
04:00		0								
05:00		0								
06:00		0								
07:00		0								
08:00		0								
09:00		0								
10:00		254								
11:00		**459**								
12:00 PM		412								
01:00		394								
02:00		443								
03:00		615								
04:00		**695**								
05:00		620								
06:00		402								
07:00		176								
08:00		0								
09:00		0								
10:00		0								
11:00		0								
Total		4470								
AM Peak	-	11:00	-	-	-	-	-	-	-	-
Vol.	-	459	-	-	-	-	-	-	-	-
PM Peak	-	16:00	-	-	-	-	-	-	-	-
Vol.	-	695	-	-	-	-	-	-	-	-
Grand Total		4470								
ADT		ADT 11,293	AADT 11,293							

All Traffic Data Services, Inc
9660 W 44th Ave
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Site Code: 4 - AM
Station ID: 4 - AM
NB ELLSWORTH RD AT PATRIO

Start Time	19-May-1 Thu	NB								
12:00 AM		1								
01:00		1								
02:00		0								
03:00		0								
04:00		0								
05:00		2								
06:00		**292**								
07:00		190								
08:00		103								
09:00		89								
10:00		93								
11:00		108								
12:00 PM		115								
01:00		116								
02:00		**157**								
03:00		118								
04:00		129								
05:00		82								
06:00		3								
07:00		0								
08:00		0								
09:00		0								
10:00		0								
11:00		0								
Total		1599								
AM Peak	-	06:00	-	-	-	-	-	-	-	-
Vol.	-	292	-	-	-	-	-	-	-	-
PM Peak	-	14:00	-	-	-	-	-	-	-	-
Vol.	-	157	-	-	-	-	-	-	-	-
Grand Total		1599								
ADT		ADT 1,382	AADT 1,382							

All Traffic Data Services, Inc
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Site Code: 5 - NOON
Station ID: 5 - NOON
NB AIRPORT RD

Start Time	19-May-1 Thu	NB								
12:00 AM		2								
01:00		1								
02:00		0								
03:00		21								
04:00		75								
05:00		82								
06:00		136								
07:00		96								
08:00		113								
09:00		114								
10:00		**138**								
11:00		109								
12:00 PM		61								
01:00		54								
02:00		82								
03:00		**90**								
04:00		57								
05:00		48								
06:00		23								
07:00		14								
08:00		46								
09:00		11								
10:00		21								
11:00		22								
Total		1416								
AM Peak	-	10:00	-	-	-	-	-	-	-	-
Vol.	-	138	-	-	-	-	-	-	-	-
PM Peak	-	15:00	-	-	-	-	-	-	-	-
Vol.	-	90	-	-	-	-	-	-	-	-
Grand Total		1416								
ADT		ADT 2,893	AADT 2,893							

All Traffic Data Services, Inc
9660 W 44th Ave
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Site Code: 6 - NOON
Station ID: 6 - NOON
SB AIRPORT RD

Start Time	19-May-1 Thu	SB								
12:00 AM		11								
01:00		2								
02:00		1								
03:00		0								
04:00		19								
05:00		47								
06:00		28								
07:00		43								
08:00		28								
09:00		103								
10:00		**129**								
11:00		104								
12:00 PM		125								
01:00		59								
02:00		118								
03:00		79								
04:00		**133**								
05:00		100								
06:00		57								
07:00		16								
08:00		45								
09:00		69								
10:00		67								
11:00		44								
Total		1427								
AM Peak	-	10:00	-	-	-	-	-	-	-	-
Vol.	-	129	-	-	-	-	-	-	-	-
PM Peak	-	16:00	-	-	-	-	-	-	-	-
Vol.	-	133	-	-	-	-	-	-	-	-
Grand Total		1427								
ADT		ADT 2,893	AADT 2,893							

I-90 Exit 61 - 67 OD STUDY

Peak Hour Volumes

Location	AM (6:00-9:00)	Noon (10:30-1:30)	PM (3:00-6:00)
1	1372	994	1356
2	1126	994	1700
3	1499	1279	2057
4	0	1195	1930
5	0	430	929
6	631	399	186
7	105	264	422
8	736	247	204
9	585	328	329
10	0	552	947
11	1436	1253	1957
12	1504	1201	1799
13	345	266	195
14	99	323	312

###	LRP Camera Not Operating

OD CAMERA LOCATION ID'S

1	Exit 61 EB On-Ramp
2	Exit 61 WB Off-Ramp
3	Exit 63 EB Off-Ramp
4	Exit 63 WB On-Ramp
5	Commerical Gate SB (Out)
6	Commercial Gate NB (In)
7	Main Gate EB (Out)
8	Main Gate WB (In)
9	Patriot Gate NB (In)
10	Patriot Gate SB (Out)
11	Exit 61 EB Off-Ramp
12	Exit 61 WB On-Ramp
13	Airport NB (In)
14	Airport SB (Out)

I-90 Exit 63 to Air Force Base Gates

Origination and Destination Traffic Study - License Plate Matches

"20 Minute Match Intervals"

"20 Minutes" OD LPR Matrix

LPR		Destination				O Total	Pk Total	LPR/Pk %
		4	6	8	9			
Origin	3	-	311	465	176	952	1499	63.5%
	5	524	-	-	-	524	929	56.4%
	7	301	-	-	-	301	422	71.3%
	10	456	-	-	-	456	947	48.2%
D Total		1281	311	465	176			
Pk Total		1930	631	736	585			
LPR/Tot %		66.4%	49.3%	63.2%	30.1%			

###	AM
###	PM
3,4	I-90 Exit 63
5,6	Commercial Gate
7,8	Main Gate
9,10	Patriot Gate

ENTERING VEHICLES (AM)

Gate	Commercial	Main	Patriot	Total	Exit 63
Total Veh.	631	736	585	1952	1499
Veh. Ex. 63	338	505	191	1034	69.0% of Exit 63 traffic goes to EAFB
% by gate	32.7%	48.8%	18.5%	100.0%	
of overall	22.5%	33.7%	12.7%		
% Exit 63	53.6%	68.6%	32.6%	53.0%	
% Else	46.4%	31.4%	67.4%	47.0%	

EXITING VEHICLES (PM)

Gate	Commercial	Main	Patriot	Total	Exit 63
Total Veh.	929	422	947	2298	1930
Veh. Ex. 63	570	327	496	1393	72.2% comes from EAFB
% by gate	40.9%	23.5%	35.6%	100.0%	
of overall	29.5%	16.9%	25.7%		
% Exit 63	61.4%	77.5%	52.4%	60.6%	
% Else	38.6%	22.5%	47.6%	39.4%	

AGGREGATE

Gate	Commercial	Main	Patriot	Total	Exit 63
Total Veh.	1560	1158	1532	4250	1930
Veh. Ex. 63	908	832	687	2427	125.8% comes from EAFB
% by gate	37.4%	34.3%	28.3%	100.0%	
of overall	47.0%	43.1%	35.6%		
% Exit 63	58.2%	71.8%	44.8%	57.1%	
% Else	41.8%	28.2%	55.2%	42.9%	

Airport to I-90 Exit 61

Origination and Destination Traffic Study - License Plate Matches

20 Minute Match Interval

AM

LPR		Destination			O Total	Pk Total	LPR/Pk %
		1	12	13			
Origin	2	7	21	1	29	1126	2.6%
	11	21	23	25	69	1436	4.8%
	14	0	5	15	20	99	20.2%
D Total		28	49	41			
Pk Total		1372	1504	345			
LPR/Pk %		2.0%	3.3%	11.9%			

Noon

LPR		Destination			O Total	Pk Total	LPR/Pk %
		1	12	13			
Origin	2	15	22	5	42	994	4.2%
	11	13	32	25	70	1253	5.6%
	14	1	17	1	19	323	5.9%
D Total		29	71	31			
Pk Total		994	1201	266			
LPR/Pk %		2.9%	5.9%	11.7%			

PM

LPR		Destination			O Total	Pk Total	LPR/Pk %
		1	12	13			
Origin	2	9	41	1	51	1700	3.0%
	11	18	44	7	69	1957	3.5%
	14	2	12	0	14	312	4.5%
D Total		29	97	8			
Pk Total		1356	1799	195			
LPR/Pk %		2.1%	5.4%	4.1%			

MORNING

Gate	NB AIRPORT (13)	SB AIRPORT (14)	Total
Total Veh.	345	99	444
Veh. Ex. 61	28	5	33
% Ex. 61	8.1%	5.1%	7.4%
% Else	91.9%	94.9%	92.6%

NOON

Gate	NB AIRPORT (13)	SB AIRPORT (14)	Total
Total Veh.	266	323	589
Veh. Ex. 61	33	20	53
% Ex. 61	12.4%	6.2%	9.0%
% Else	87.6%	93.8%	91.0%

EVENING

Gate	NB AIRPORT (13)	SB AIRPORT (14)	Total
Total Veh.	195	312	507
Veh. Ex. 61	9	15	24
% Ex. 61	4.6%	4.8%	4.7%
% Else	95.4%	95.2%	95.3%

AGGREGATE

Gate	NB AIRPORT (13)	SB AIRPORT (14)	Total
Total Veh.	806	734	1540
Veh. Ex. 61	70	40	110
% Ex. 61	8.7%	5.4%	7.1%
% Else	91.3%	94.6%	92.9%

I-90 Exit 61 to Exit 63

Origination and Destination Traffic Study - License Plate Matches

20 Minute Match Interval

		Destination		O Total	Pk Total	LPR/Pk %
		2	**3**			
Origin	**1**	-	183	183	1372	13.3%
	4	359	-	359	1930	18.6%
D Total		359	183			
Pk Total		1700	1499			
LPR/Pk %		21.1%	12.2%			

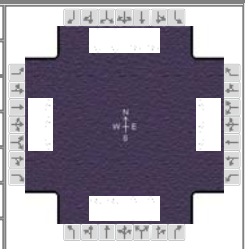
###	**AM**
###	**PM**

Gate	MORNING **Exit 63 EB OFF**	EVENING **Exit 63 WB ON**	**TOTAL**
Tot Veh.	1499	1930	3429
Veh. Ex. 61	199	390	589
% Ex. 61	13.3%	20.2%	17.2%
% Else	86.7%	79.8%	82.8%

Gate	MORNING **Exit 61 EB ON**	EVENING **Exit 61 WB OFF**	**TOTAL**
Tot Veh.	1372	1700	3072
Veh. Ex. 63	199	390	589
% Ex. 63	14.5%	22.9%	19.2%
% Else	85.5%	77.1%	80.8%

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	7/24/2016	Area Type	Other
Jurisdiction	South Dakota	Time Period	AM Peak	PHF	0.89
Urban Street	Elk Vale	Analysis Year	2016	Analysis Period	1> 7:00
Intersection	Interchange I-90	File Name	1.AM peak Elk Vale and I-90 SPUI existing timing....		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	83		0	378		0	365	160		42	200	

Signal Information			
Cycle, s	84.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

	1	2	3	4	5	6	7	8
Green	0.0	0.0	0.0	0.0	0.0	0.0		
Yellow	0.0	0.0	0.0	0.0	0.0	0.0		
Red	0.0	0.0	0.0	0.0	0.0	0.0		

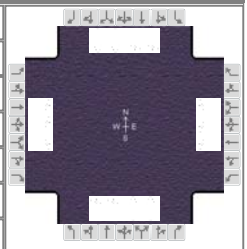
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		5.0		5.0	2.0	4.0	2.0	4.0
Phase Duration, s		19.0		19.0	21.8	49.8	15.2	43.2
Change Period, ($Y+R_c$), s		8.5		8.5	8.5	8.5	8.5	8.5
Max Allow Headway (*MAH*), s		0.0		0.0	0.0	0.0	0.0	0.0
Queue Clearance Time (g_s), s		0.0		0.0	0.0	0.0	0.0	0.0
Green Extension Time (g_e), s		0.0		0.0	0.0	0.0	0.0	0.0
Phase Call Probability		0.00		0.00	0.00	0.00	0.00	0.00
Max Out Probability		0.00		0.00	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	7		14	3		18	5	2		1	6	
Adjusted Flow Rate (*v*), veh/h	0		0	0		0	0	0		0	0	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	0		0	0		0	0	0		0	0	
Queue Service Time (g_s), s	0.0		0.0	0.0		0.0	0.0	0.0		0.0	0.0	
Cycle Queue Clearance Time (g_c), s	0.0		0.0	0.0		0.0	0.0	0.0		0.0	0.0	
Green Ratio (*g/C*)	0.12		0.12	0.12		0.12	0.16	0.49		0.08	0.41	
Capacity (*c*), veh/h	545		175	575		175	508	1430		186	1171	
Volume-to-Capacity Ratio (*X*)	0.171		0.000	0.739		0.000	0.808	0.126		0.253	0.192	
Back of Queue (*Q*), ft/ln (50 th percentile)	23.1		0	118		0	103.2	24.1		14.6	38.1	
Back of Queue (*Q*), veh/ln (50 th percentile)	0.8		0.0	4.6		0.0	4.0	0.9		0.4	1.4	
Queue Storage Ratio (*RQ*) (50 th percentile)	0.06		0.00	0.29		0.00	0.34	0.00		0.05	0.00	
Uniform Delay (d_1), s/veh	33.2		0.0	36.9		0.0	34.1	11.6		36.3	15.7	
Incremental Delay (d_2), s/veh	0.1		0.0	4.4		0.0	1.2	0.2		0.3	0.4	
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	33.2		0.0	41.3		0.0	35.3	11.7		36.6	16.1	
Level of Service (LOS)	C			D			D	B		D	B	
Approach Delay, s/veh / LOS	33.2		C	41.3		D	28.1		C	19.7		B
Intersection Delay, s/veh / LOS	30.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.0	C	2.8	C	2.8	C
Bicycle LOS Score / LOS		F		F	1.0	A	0.7	A

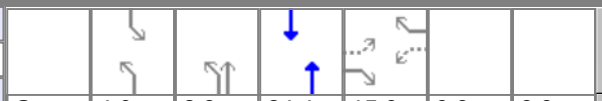
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	7/24/2016	Area Type	Other
Jurisdiction	South Dakota	Time Period	PM Peak	PHF	0.89
Urban Street	Elk Vale	Analysis Year	2016	Analysis Period	1> 7:00
Intersection	Interchange I-90	File Name	1.PM peak Elk Vale and I-90 SPUI existing timing....		
Project Description					

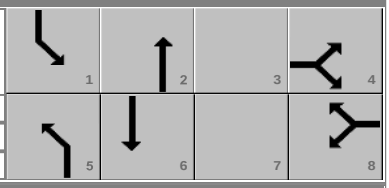


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	227		0	459		0	461	349		25	200	

Signal Information			
Cycle, s	80.0	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	4.6	2.0	24.4	15.0	0.0	0.0
Yellow	6.5	6.5	6.5	6.5	0.0	0.0
Red	2.0	2.0	2.0	2.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		5.0		5.0	2.0	4.0	2.0	4.0
Phase Duration, s		23.5		23.5	23.7	43.4	13.1	32.9
Change Period, ($Y+R_c$), s		8.5		8.5	8.5	8.5	8.5	8.5
Max Allow Headway (*MAH*), s		3.0		3.0	3.1	0.0	3.1	0.0
Queue Clearance Time (g_s), s		7.7		13.7	14.3		2.7	
Green Extension Time (g_e), s		1.6		1.2	0.9	0.0	0.0	0.0
Phase Call Probability		1.00		1.00	1.00		0.46	
Max Out Probability		0.01		0.15	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	7		14	3		18	5	2		1	6	
Adjusted Flow Rate (*v*), veh/h	255		0	516		0	518	392		28	225	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1548		1403	1639		1403	1626	1608		1639	1595	
Queue Service Time (g_s), s	5.7		0.0	11.7		0.0	12.3	6.3		0.7	4.2	
Cycle Queue Clearance Time (g_c), s	5.7		0.0	11.7		0.0	12.3	6.3		0.7	4.2	
Green Ratio (*g/C*)	0.19		0.19	0.19		0.19	0.19	0.44		0.06	0.30	
Capacity (*c*), veh/h	759		262	793		262	617	1403		190	971	
Volume-to-Capacity Ratio (*X*)	0.336		0.000	0.651		0.000	0.840	0.279		0.148	0.231	
Back of Queue (*Q*), ft/ln (50 th percentile)	55.8		0	116.7		0	124.7	55.9		6.5	39.8	
Back of Queue (*Q*), veh/ln (50 th percentile)	2.1		0.0	4.6		0.0	4.9	2.2		0.3	1.6	
Queue Storage Ratio (*RQ*) (50 th percentile)	0.14		0.00	0.29		0.00	0.42	0.00		0.02	0.00	
Uniform Delay (d_1), s/veh	28.7		0.0	31.2		0.0	31.2	14.5		35.8	20.8	
Incremental Delay (d_2), s/veh	0.1		0.0	0.4		0.0	3.3	0.5		0.1	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	28.8		0.0	31.6		0.0	34.5	15.0		35.9	21.4	
Level of Service (LOS)	C			C			C	B		D	C	
Approach Delay, s/veh / LOS	28.8		C	31.6		C	26.1		C	23.0		C
Intersection Delay, s/veh / LOS	27.5						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.0	C	2.8	C	2.8	C
Bicycle LOS Score / LOS		F		F	1.2	A	0.7	A

HCS7 Two-Way Stop-Control Report

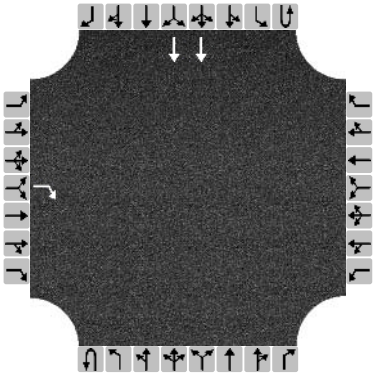
General Information

Analyst	TSF
Agency/Co.	
Date Performed	7/24/2016
Analysis Year	2016
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	EB Off Right Turn / Elk V
Jurisdiction	
East/West Street	EB I-90 Off Ramp Right
North/South Street	Elk Vale
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	0	0	0	0	0	0	0	2	0
Configuration				R											T	
Volume, V (veh/h)				480											576	
Percent Heavy Vehicles (%)				3												
Proportion Time Blocked				0.330											0.000	
Percent Grade (%)	0															
Right Turn Channelized	Yes				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				522												
Capacity, c (veh/h)				724												
v/c Ratio				0.72												
95% Queue Length, Q_{95} (veh)				6.2												
Control Delay (s/veh)				21.7												
Level of Service, LOS				C												
Approach Delay (s/veh)	21.7															
Approach LOS	C															

HCS7 Two-Way Stop-Control Report

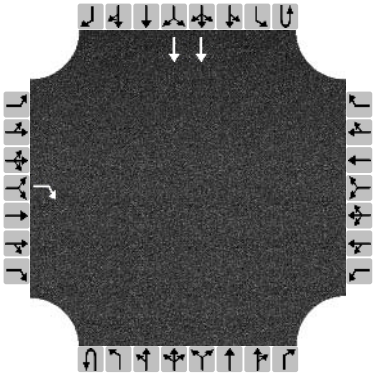
General Information

Analyst	TSF
Agency/Co.	
Date Performed	7/24/2016
Analysis Year	2016
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	EB Off Right Turn / Elk V
Jurisdiction	
East/West Street	EB I-90 Off Ramp Right
North/South Street	Elk Vale
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	0	0	0	0	0	0	0	2	0
Configuration				R											T	
Volume, V (veh/h)				549											659	
Percent Heavy Vehicles (%)				3												
Proportion Time Blocked				0.330											0.000	
Percent Grade (%)	0															
Right Turn Channelized	Yes				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				597												
Capacity, c (veh/h)				724												
v/c Ratio				0.82												
95% Queue Length, Q_{95} (veh)				9.0												
Control Delay (s/veh)				28.8												
Level of Service, LOS				D												
Approach Delay (s/veh)	28.8															
Approach LOS	D															

HCS7 Two-Way Stop-Control Report

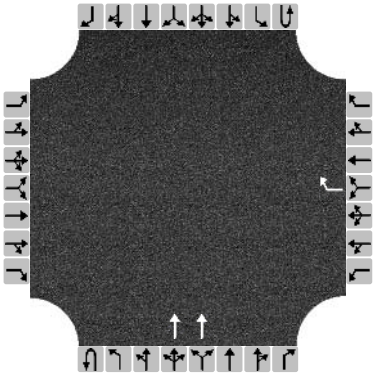
General Information

Analyst	TSF
Agency/Co.	
Date Performed	7/24/2016
Analysis Year	2016
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	WB Off Right Turn / Elk V
Jurisdiction	
East/West Street	WB I-90 Off Ramp Right
North/South Street	Elk Vale
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	0	0	0	0	0
Configuration								R			T					
Volume, V (veh/h)								111			243					
Percent Heavy Vehicles (%)								3								
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				Yes				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								121								
Capacity, c (veh/h)								890								
v/c Ratio								0.14								
95% Queue Length, Q_{95} (veh)								0.5								
Control Delay (s/veh)								9.7								
Level of Service, LOS								A								
Approach Delay (s/veh)						9.7										
Approach LOS						A										

HCS7 Two-Way Stop-Control Report

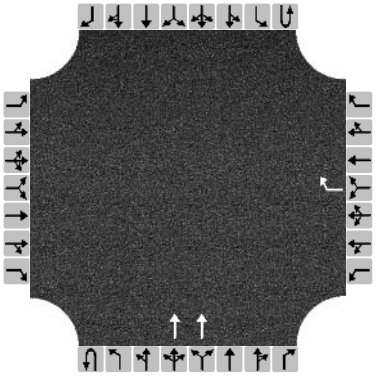
General Information

Analyst	TSF
Agency/Co.	
Date Performed	7/24/2016
Analysis Year	2016
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	WB Off Right Turn / Elk V
Jurisdiction	
East/West Street	WB I-90 Off Ramp Right
North/South Street	Elk Vale
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	0	0	0	0	0
Configuration								R			T					
Volume, V (veh/h)								140			576					
Percent Heavy Vehicles (%)								3								
Proportion Time Blocked								0.120			0.000					
Percent Grade (%)						0										
Right Turn Channelized		No				Yes				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								152								
Capacity, c (veh/h)								951								
v/c Ratio								0.16								
95% Queue Length, Q_{95} (veh)								0.6								
Control Delay (s/veh)								9.5								
Level of Service, LOS								A								
Approach Delay (s/veh)						9.5										
Approach LOS						A										

HCS7 Two-Way Stop-Control Report

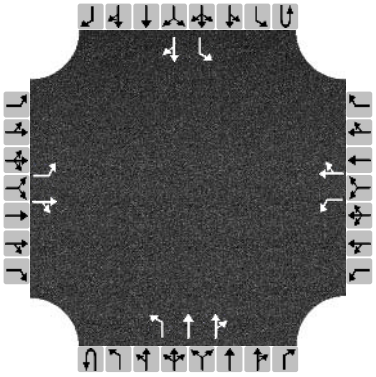
General Information

Analyst	
Agency/Co.	
Date Performed	6/24/2016
Analysis Year	2016
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Elk Vale Rd & Mall Dr
Jurisdiction	
East/West Street	Mall Dr
North/South Street	Elk Vale Rd
Peak Hour Factor	0.84
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		1	1	0	0	1	2	0	0	1	1	0
Configuration		L		TR		L		TR		L	T	TR		L		TR
Volume, V (veh/h)		8	1	74		6	2	1		119	121	18		2	202	11
Percent Heavy Vehicles (%)		0	0	12		100	100	0		4				0		
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		10		89		7		3		142				2		
Capacity, c (veh/h)		348		749		142		263		1295				1426		
v/c Ratio		0.03		0.12		0.05		0.01		0.11				0.00		
95% Queue Length, Q_{95} (veh)		0.1		0.4		0.2		0.0		0.4				0.0		
Control Delay (s/veh)		15.6		10.5		31.6		18.8		8.1				7.5		
Level of Service, LOS		C		B		D		C		A				A		
Approach Delay (s/veh)		11.0				27.8				3.8				0.1		
Approach LOS		B				D										

HCS7 Two-Way Stop-Control Report

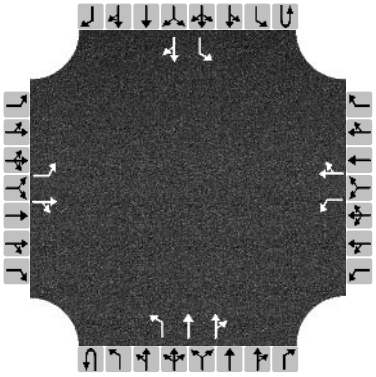
General Information

Analyst	
Agency/Co.	
Date Performed	6/24/2016
Analysis Year	2016
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Elk Vale Rd & Mall Dr
Jurisdiction	
East/West Street	Mall Dr
North/South Street	Elk Vale Rd
Peak Hour Factor	0.71
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		1	1	0	0	1	2	0	0	1	1	0
Configuration		L		TR		L		TR		L	T	TR		L		TR
Volume, V (veh/h)		50	1	224		4	2	4		159	422	18		2	225	31
Percent Heavy Vehicles (%)		2	0	2		11	0	100		5				0		
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		70		316		6		9		224				3		
Capacity, c (veh/h)		139		690		33		225		1173				971		
v/c Ratio		0.50		0.46		0.18		0.04		0.19				0.00		
95% Queue Length, Q_{95} (veh)		2.8		2.5		0.6		0.1		0.7				0.0		
Control Delay (s/veh)		56.3		14.6		140.3		21.6		8.8				8.7		
Level of Service, LOS		F		B		F		C		A				A		
Approach Delay (s/veh)		22.2				69.1				2.3				0.1		
Approach LOS		C				F										

HCS7 Two-Way Stop-Control Report

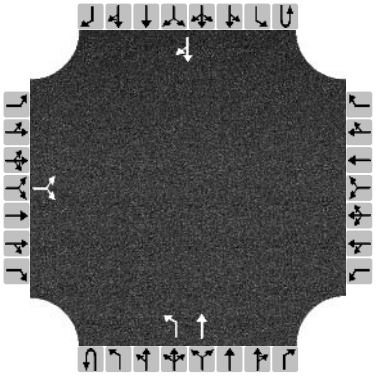
General Information

Analyst	
Agency/Co.	
Date Performed	6/24/2016
Analysis Year	2016
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	I-90 Service Rd & W Gate
Jurisdiction	
East/West Street	I-90 Service Rd
North/South Street	W Gate Rd
Peak Hour Factor	0.84
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LR							L	T					TR
Volume, V (veh/h)		4		4						20	59				298	23
Percent Heavy Vehicles (%)		0		0						0						
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			10							24						
Capacity, c (veh/h)			598							1188						
v/c Ratio			0.02							0.02						
95% Queue Length, Q_{95} (veh)			0.1							0.1						
Control Delay (s/veh)			11.1							8.1						
Level of Service, LOS			B							A						
Approach Delay (s/veh)		11.1								2.1						
Approach LOS		B														

HCS7 Two-Way Stop-Control Report

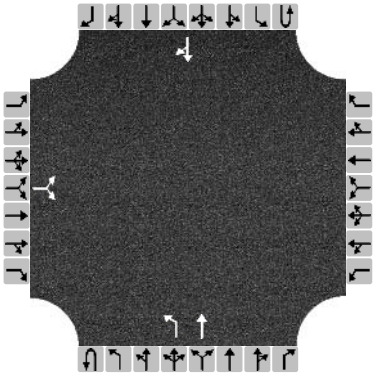
General Information

Analyst	
Agency/Co.	
Date Performed	6/24/2016
Analysis Year	2016
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	I-90 Service Rd & W Gate
Jurisdiction	
East/West Street	I-90 Service Rd
North/South Street	W Gate Rd
Peak Hour Factor	0.83
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LR							L	T					TR
Volume, V (veh/h)		7		3						7	235				112	8
Percent Heavy Vehicles (%)		0		0						0						
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			12							8						
Capacity, c (veh/h)			657							1450						
v/c Ratio			0.02							0.01						
95% Queue Length, Q_{95} (veh)			0.1							0.0						
Control Delay (s/veh)			10.6							7.5						
Level of Service, LOS			B							A						
Approach Delay (s/veh)		10.6								0.2						
Approach LOS		B														

HCS7 Two-Way Stop-Control Report

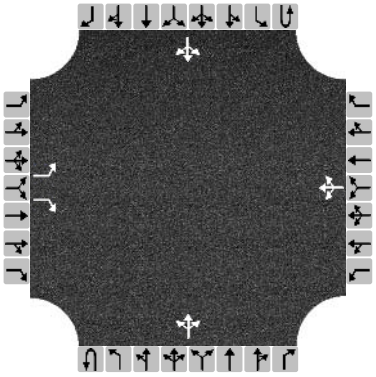
General Information

Analyst	
Agency/Co.	
Date Performed	6/24/2016
Analysis Year	2016
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	West Gate & Bluebird
Jurisdiction	
East/West Street	Bluebird Dr
North/South Street	West Gate
Peak Hour Factor	0.79
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	1	0	0	0	1	0	0	0	1	0
Configuration		L		R			LTR				LTR				LTR	
Volume, V (veh/h)		1		32		160	1	0		6	27	20		4	112	1
Percent Heavy Vehicles (%)		0		6		3	100	3		0				25		
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		1		41			204			8				5		
Capacity, c (veh/h)		738		896			677			1452				1407		
v/c Ratio		0.00		0.05			0.30			0.01				0.00		
95% Queue Length, Q_{95} (veh)		0.0		0.1			1.3			0.0				0.0		
Control Delay (s/veh)		9.9		9.2			12.6			7.5				7.6		
Level of Service, LOS		A		A			B			A				A		
Approach Delay (s/veh)		9.2				12.6				0.9				0.3		
Approach LOS		A				B										

HCS7 Two-Way Stop-Control Report

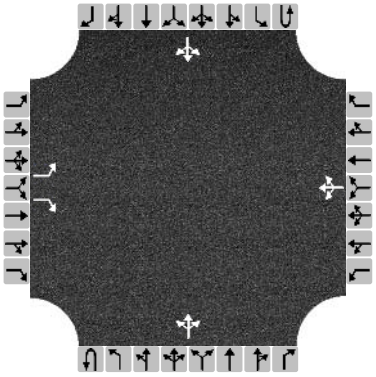
General Information

Analyst	
Agency/Co.	
Date Performed	6/24/2016
Analysis Year	2016
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	West Gate & Bluebird
Jurisdiction	
East/West Street	Bluebird Dr
North/South Street	West Gate
Peak Hour Factor	0.86
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	1	0	0	0	1	0	0	0	1	0
Configuration		L		R			LTR				LTR				LTR	
Volume, V (veh/h)		3		10		58	0	1		22	100	125		3	59	0
Percent Heavy Vehicles (%)		0		0		2	0	0		0				0		
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		3		12			68			26				3		
Capacity, c (veh/h)		629		1000			615			1545				1315		
v/c Ratio		0.00		0.01			0.11			0.02				0.00		
95% Queue Length, Q_{95} (veh)		0.0		0.0			0.4			0.1				0.0		
Control Delay (s/veh)		10.8		8.6			11.6			7.4				7.7		
Level of Service, LOS		B		A			B			A				A		
Approach Delay (s/veh)		9.1				11.6				0.8				0.3		
Approach LOS		A				B										

HCS7 Two-Way Stop-Control Report

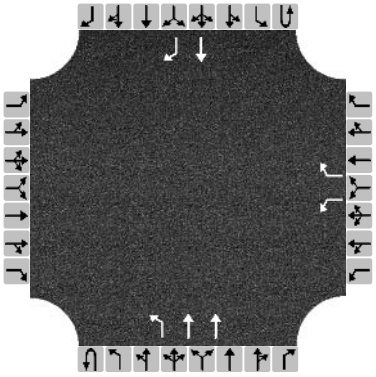
General Information

Analyst	
Agency/Co.	
Date Performed	6/27/2016
Analysis Year	2016
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Liberty and I-90 N Ramp
Jurisdiction	
East/West Street	I-90 Ramp
North/South Street	Liberty
Peak Hour Factor	0.84
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	1	2	0	0	0	1	1
Configuration						L		R		L	T				T	R
Volume, V (veh/h)						3		29		114	444				57	306
Percent Heavy Vehicles (%)						0		31		4						
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						4		35		136						
Capacity, c (veh/h)						226		654		1110						
v/c Ratio						0.02		0.05		0.12						
95% Queue Length, Q_{95} (veh)						0.1		0.2		0.4						
Control Delay (s/veh)						21.2		10.8		8.7						
Level of Service, LOS						C		B		A						
Approach Delay (s/veh)						11.9				1.8						
Approach LOS						B										

HCS7 Two-Way Stop-Control Report

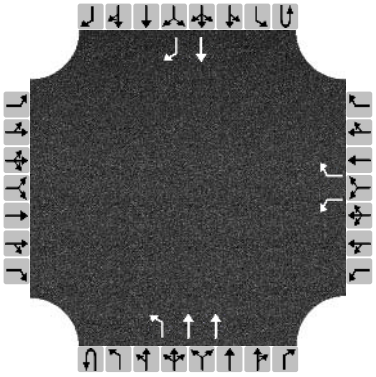
General Information

Analyst	
Agency/Co.	
Date Performed	6/27/2016
Analysis Year	2016
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Liberty and I-90 N Ramp
Jurisdiction	
East/West Street	I-90 Ramp
North/South Street	Liberty
Peak Hour Factor	0.95
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	1	2	0	0	0	1	1
Configuration						L		R		L	T				T	R
Volume, V (veh/h)						8		39		44	242				55	370
Percent Heavy Vehicles (%)						38		46		7						
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						8		41		46						
Capacity, c (veh/h)						357		775		1075						
v/c Ratio						0.02		0.05		0.04						
95% Queue Length, Q_{95} (veh)						0.1		0.2		0.1						
Control Delay (s/veh)						15.3		9.9		8.5						
Level of Service, LOS						C		A		A						
Approach Delay (s/veh)						10.8				1.3						
Approach LOS						B										

HCS7 Two-Way Stop-Control Report

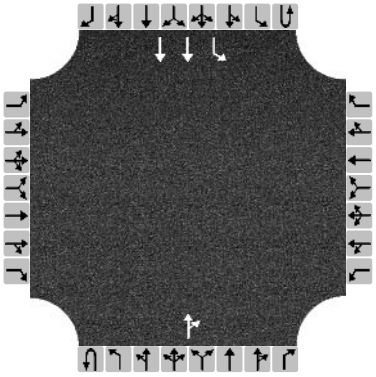
General Information

Analyst	
Agency/Co.	
Date Performed	6/27/2016
Analysis Year	2016
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Liberty & I90 EB On Ramp
Jurisdiction	
East/West Street	I90 EB On Ramp
North/South Street	Liberty
Peak Hour Factor	0.74
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	1	0	0	1	2	0
Configuration												TR		L	T	
Volume, V (veh/h)											248	6		36	35	
Percent Heavy Vehicles (%)														42		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														49		
Capacity, c (veh/h)														970		
v/c Ratio														0.05		
95% Queue Length, Q_{95} (veh)														0.2		
Control Delay (s/veh)														8.9		
Level of Service, LOS														A		
Approach Delay (s/veh)														4.5		
Approach LOS																

HCS7 Two-Way Stop-Control Report

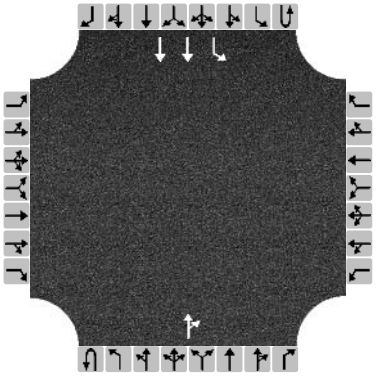
General Information

Analyst	
Agency/Co.	
Date Performed	6/27/2016
Analysis Year	2016
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Liberty & I90 EB On Ramp
Jurisdiction	
East/West Street	I90 EB On Ramp
North/South Street	Liberty
Peak Hour Factor	0.87
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	1	0	0	1	2	0
Configuration												TR		L	T	
Volume, V (veh/h)											85	5		19	100	
Percent Heavy Vehicles (%)														26		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														22		
Capacity, c (veh/h)														1327		
v/c Ratio														0.02		
95% Queue Length, Q_{95} (veh)														0.1		
Control Delay (s/veh)														7.8		
Level of Service, LOS														A		
Approach Delay (s/veh)														1.2		
Approach LOS																

HCS7 Two-Way Stop-Control Report

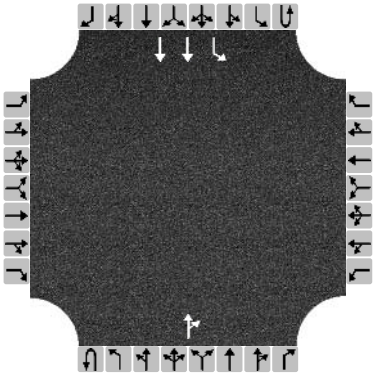
General Information

Analyst	
Agency/Co.	
Date Performed	6/27/2016
Analysis Year	2016
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Liberty & I90 EB On Ramp
Jurisdiction	
East/West Street	I90 EB On Ramp
North/South Street	Liberty
Peak Hour Factor	0.74
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	1	0	0	1	2	0
Configuration												TR		L	T	
Volume, V (veh/h)											248	6		36	35	
Percent Heavy Vehicles (%)														42		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

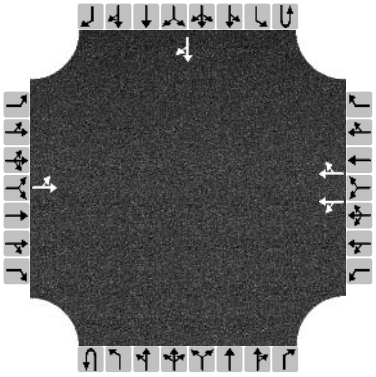
Flow Rate, v (veh/h)														49		
Capacity, c (veh/h)														970		
v/c Ratio														0.05		
95% Queue Length, Q_{95} (veh)														0.2		
Control Delay (s/veh)														8.9		
Level of Service, LOS														A		
Approach Delay (s/veh)														4.5		
Approach LOS																

HCS7 Two-Way Stop-Control Report

General Information

Analyst		Intersection	Ellsworth and W 1416
Agency/Co.		Jurisdiction	
Date Performed	6/27/2016	East/West Street	1416 W
Analysis Year	2016	North/South Street	Ellsworth
Time Analyzed	AM Peak	Peak Hour Factor	0.87
Intersection Orientation	North-South	Analysis Time Period (hrs)	1.00
Project Description	I-90 Corridor Study		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	2	0	0	0	0	0	0	0	1	0
Configuration		LT				LT		TR								TR
Volume, V (veh/h)		582	82			0	32	10							28	144
Percent Heavy Vehicles (%)		2	1			3	6	50								
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		763				19		30								
Capacity, c (veh/h)		984				691		772								
v/c Ratio		0.78				0.03		0.04								
95% Queue Length, Q_{95} (veh)		9.5				0.1		0.1								
Control Delay (s/veh)		20.9				10.4		9.8								
Level of Service, LOS		C				B		A								
Approach Delay (s/veh)	20.9				10.3											
Approach LOS	C				B											

HCS7 Two-Way Stop-Control Report

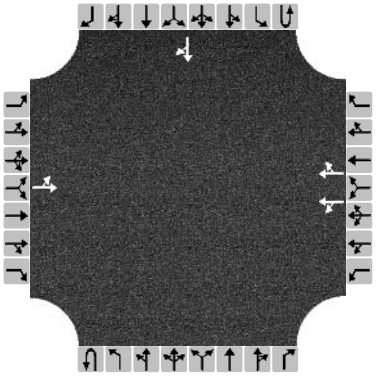
General Information

Analyst	
Agency/Co.	
Date Performed	6/27/2016
Analysis Year	2016
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Ellsworth and W 1416
Jurisdiction	
East/West Street	1416 W
North/South Street	Ellsworth
Peak Hour Factor	0.98
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	2	0	0	0	0	0	0	0	1	0
Configuration		LT				LT		TR								TR
Volume, V (veh/h)		256	65			2	40	7							86	259
Percent Heavy Vehicles (%)		3	0			0	10	14								
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		327				23		28								
Capacity, c (veh/h)		927				571		636								
v/c Ratio		0.35				0.04		0.04								
95% Queue Length, Q_{95} (veh)		1.6				0.1		0.1								
Control Delay (s/veh)		11.0				11.6		10.9								
Level of Service, LOS		B				B		B								
Approach Delay (s/veh)	11.0				11.5											
Approach LOS	B				B											

HCS7 Two-Way Stop-Control Report

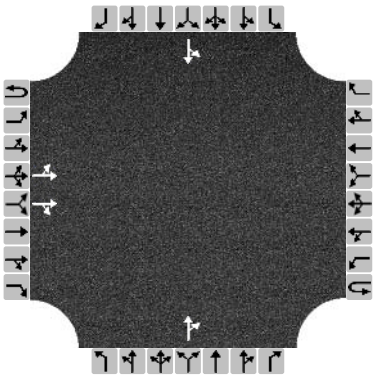
General Information

Analyst	
Agency/Co.	
Date Performed	6/27/2016
Analysis Year	2016
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	I-90 Corridor Study

Site Information

Intersection	Ellsworth and 1416 E
Jurisdiction	
East/West Street	1416 E
North/South Street	Ellsworth
Peak Hour Factor	0.87
Analysis Time Period (hrs)	1.00

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	0	0	0		0	1	0		0	1	0
Configuration		LT		TR								TR		LT		
Volume, V (veh/h)		493	95	15							171	12		2	26	
Percent Heavy Vehicles (%)		2									2	0		50	0	
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		567										211		32		
Capacity, c (veh/h)		1622										113		101		
v/c Ratio		0.35										1.86		0.32		
95% Queue Length, Q_{95} (veh)		1.6										54.6		1.3		
Control Delay (s/veh)		8.4										1653.6		57.2		
Level of Service, LOS		A										F		F		
Approach Delay (s/veh)		6.9								1653.6				57.2		
Approach LOS										F				F		

HCS7 Two-Way Stop-Control Report

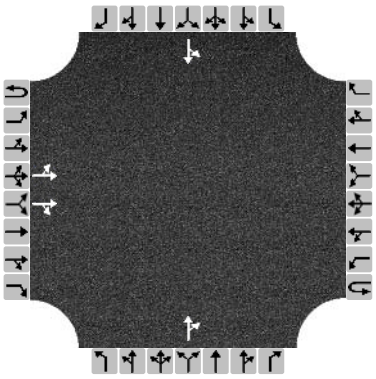
General Information

Analyst	
Agency/Co.	
Date Performed	6/27/2016
Analysis Year	2016
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	I-90 Corridor Study

Site Information

Intersection	Ellsworth and 1416 E
Jurisdiction	
East/West Street	1416 E
North/South Street	Ellsworth
Peak Hour Factor	0.98
Analysis Time Period (hrs)	1.00

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	0	0	0		0	1	0		0	1	0
Configuration		LT		TR								TR		LT		
Volume, V (veh/h)		221	87	124							100	10		10	78	
Percent Heavy Vehicles (%)		3									2	0		0	1	
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		226										112		90		
Capacity, c (veh/h)		1614										365		323		
v/c Ratio		0.14										0.31		0.28		
95% Queue Length, Q_{95} (veh)		0.5										1.3		1.1		
Control Delay (s/veh)		7.6										19.2		20.4		
Level of Service, LOS		A										C		C		
Approach Delay (s/veh)		3.9								19.2				20.4		
Approach LOS										C				C		

HCS7 Two-Way Stop-Control Report

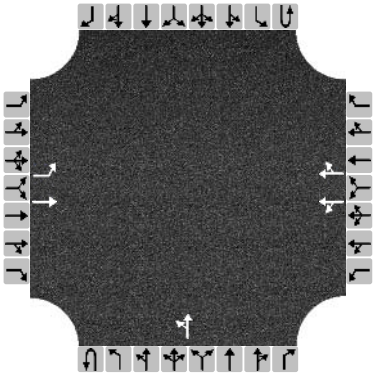
General Information

Analyst	
Agency/Co.	
Date Performed	6/27/2016
Analysis Year	2016
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Commercial Gate & 1416 W
Jurisdiction	
East/West Street	1416 W
North/South Street	Commercial Gate
Peak Hour Factor	0.91
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	2	0	0	0	1	0	0	0	0	0
Configuration		L	T			LT		TR		LT						
Volume, V (veh/h)		12	101			1	253	3		0	248					
Percent Heavy Vehicles (%)		17	5			0	4	67		0						
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		13	111			140		142		0						
Capacity, c (veh/h)		524	630			632		630		1636						
v/c Ratio		0.02	0.18			0.22		0.23		0.00						
95% Queue Length, Q_{95} (veh)		0.1	0.6			0.9		0.9		0.0						
Control Delay (s/veh)		12.1	11.9			12.3		12.4		7.2						
Level of Service, LOS		B	B			B		B		A						
Approach Delay (s/veh)		12.0				12.4				0.0						
Approach LOS		B				B										

HCS7 Two-Way Stop-Control Report

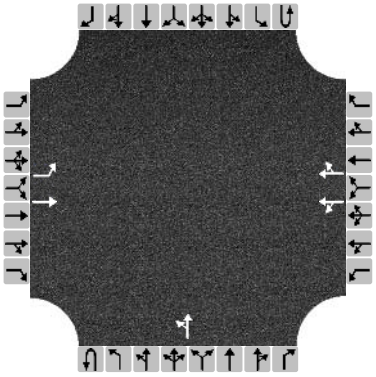
General Information

Analyst	
Agency/Co.	
Date Performed	6/27/2016
Analysis Year	2016
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Commercial Gate & 1416 W
Jurisdiction	
East/West Street	1416 W
North/South Street	Commercial Gate
Peak Hour Factor	0.90
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	2	0	0	0	1	0	0	0	0	0
Configuration		L	T			LT		TR		LT						
Volume, V (veh/h)		0	343			0	352	4		0	80					
Percent Heavy Vehicles (%)		17	0			0	2	0		0						
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		0	381			196		200		0						
Capacity, c (veh/h)		638	805			801		804		1636						
v/c Ratio		0.00	0.47			0.24		0.25		0.00						
95% Queue Length, Q_{95} (veh)		0.0	2.7			1.0		1.0		0.0						
Control Delay (s/veh)		10.6	13.5			10.9		11.0		7.2						
Level of Service, LOS		B	B			B		B		A						
Approach Delay (s/veh)		13.5				11.0				0.0						
Approach LOS		B				B										

HCS7 Two-Way Stop-Control Report

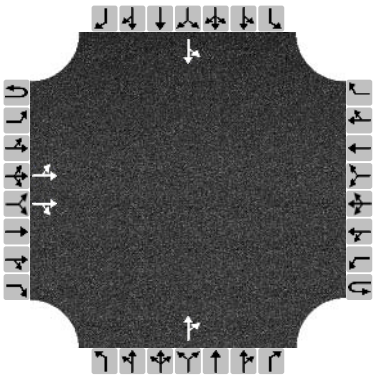
General Information

Analyst	
Agency/Co.	
Date Performed	6/27/2016
Analysis Year	2016
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	I-90 Corridor Study

Site Information

Intersection	Radar Hill & 1416 E
Jurisdiction	
East/West Street	1416 East
North/South Street	Radar Hill Rd
Peak Hour Factor	0.92
Analysis Time Period (hrs)	1.00

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	0	0	0		0	1	0		0	1	0
Configuration		LT		TR								TR		LT		
Volume, V (veh/h)		4	638	33							151	268		4	60	
Percent Heavy Vehicles (%)		0									2	4		0	7	
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		4										455		69		
Capacity, c (veh/h)		1636										489		340		
v/c Ratio		0.00										0.93		0.20		
95% Queue Length, Q_{95} (veh)		0.0										19.0		0.8		
Control Delay (s/veh)		7.2										77.3		18.3		
Level of Service, LOS		A										F		C		
Approach Delay (s/veh)		0.1								77.3				18.3		
Approach LOS										F				C		

HCS7 Two-Way Stop-Control Report

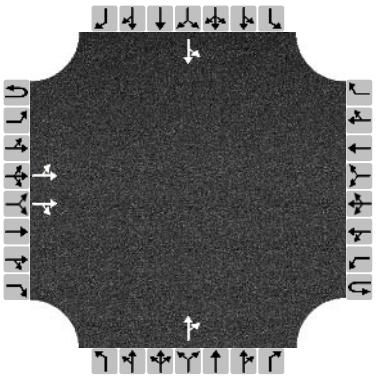
General Information

Analyst	
Agency/Co.	
Date Performed	6/27/2016
Analysis Year	2016
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	I-90 Corridor Study

Site Information

Intersection	Radar Hill & 1416 E
Jurisdiction	
East/West Street	1416 East
North/South Street	Radar Hill Rd
Peak Hour Factor	0.94
Analysis Time Period (hrs)	1.00

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	0	0	0		0	1	0		0	1	0
Configuration		LT		TR								TR		LT		
Volume, V (veh/h)		25	436	176							113	71		2	170	
Percent Heavy Vehicles (%)		0									3	1		0	1	
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		27										196		183		
Capacity, c (veh/h)		1636										469		353		
v/c Ratio		0.02										0.42		0.52		
95% Queue Length, Q_{95} (veh)		0.1										2.1		3.1		
Control Delay (s/veh)		7.2										18.1		26.0		
Level of Service, LOS		A										C		D		
Approach Delay (s/veh)		0.3								18.1				26.0		
Approach LOS										C				D		

HCS7 Two-Way Stop-Control Report

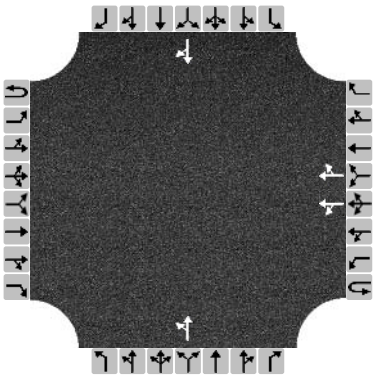
General Information

Analyst	
Agency/Co.	
Date Performed	6/27/2016
Analysis Year	2016
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	I-90 Corridor Study

Site Information

Intersection	Radar Hill and 1416 W
Jurisdiction	
East/West Street	1416 W
North/South Street	Radar Hill
Peak Hour Factor	0.92
Analysis Time Period (hrs)	1.00

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	0	0	0	0	2	0		0	1	0		0	1	0
Configuration						LT		TR		LT						TR
Volume, V (veh/h)						54	295	4		153	2				10	36
Percent Heavy Vehicles (%)						7				2	0				0	0
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						59				168						50
Capacity, c (veh/h)						1586				620						738
v/c Ratio						0.04				0.27						0.07
95% Queue Length, Q_{95} (veh)						0.1				1.1						0.2
Control Delay (s/veh)						7.4				13.0						10.2
Level of Service, LOS						A				B						B
Approach Delay (s/veh)					1.2				13.0				10.2			
Approach LOS									B				B			

HCS7 Two-Way Stop-Control Report

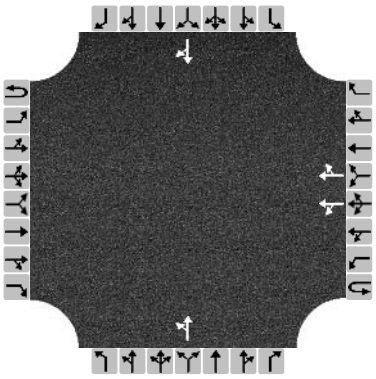
General Information

Analyst	
Agency/Co.	
Date Performed	6/27/2016
Analysis Year	2016
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	I-90 Corridor Study

Site Information

Intersection	Radar Hill and 1416 W
Jurisdiction	
East/West Street	1416 W
North/South Street	Radar Hill
Peak Hour Factor	0.94
Analysis Time Period (hrs)	1.00

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	0	0	0	0	2	0		0	1	0		0	1	0
Configuration						LT		TR		LT						TR
Volume, V (veh/h)						160	505	7		110	28				12	7
Percent Heavy Vehicles (%)						1				3	0				0	0
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						170				147						20
Capacity, c (veh/h)						1629				311						319
v/c Ratio						0.10				0.47						0.06
95% Queue Length, Q_{95} (veh)						0.3				2.6						0.2
Control Delay (s/veh)						7.5				26.9						17.0
Level of Service, LOS						A				D						C
Approach Delay (s/veh)						2.0				26.9				17.0		
Approach LOS										D				C		

Phone: Fax:
E-Mail:

ALL-WAY STOP CONTROL(AWSC) ANALYSIS

Analyst:
Agency/Co.:
Date Performed: 6/27/2016
Analysis Time Period: AM Peak
Intersection: W Gate & 1416 W
Jurisdiction:
Units: U. S. Customary
Analysis Year:
Project ID:
East/West Street: 1416 W
North/South Street: W Gate

Worksheet 2 - Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	0	0	0	4	441	48	2	24	0	0	120	172
% Thrus Left Lane												

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration			LT	R	LT		TR	
PHF			0.95	0.95	0.95		0.95	
Flow Rate			468	50	27		307	
% Heavy Veh			3	8	0		0	
No. Lanes			2		1		1	
Opposing-Lanes			0		1		1	
Conflicting-lanes			1		2		2	
Geometry group			1		2		2	

Duration, T 1.00 hrs.

Worksheet 3 - Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rates:								
Total in Lane			468	50	27		307	
Left-Turn			4	0	2		0	
Right-Turn			0	50	0		181	
Prop. Left-Turns			0.0	0.0	0.1		0.0	
Prop. Right-Turns			0.0	1.0	0.0		0.6	
Prop. Heavy Vehicle			0.0	0.1	0.0		0.0	
Geometry Group			1		2		2	
Adjustments Exhibit 17-33:								
hLT-adj			0.2		0.2		0.2	

hRT-adj			-0.6		-0.6		-0.6	
hHV-adj			1.7		1.7		1.7	
hadj, computed			0.1	-0.5	0.0		-0.4	

Worksheet 4 - Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow rate			468	50	27		307	
hd, initial value	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
x, initial			0.42	0.04	0.02		0.27	
hd, final value			4.81	4.29	5.62		4.83	
x, final value			0.626	0.060	0.042		0.412	
Move-up time, m			2.0		2.0		2.0	
Service Time			2.8	2.3	3.6		2.8	

Worksheet 5 - Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rate			468	50	27		307	
Service Time			2.8	2.3	3.6		2.8	
Utilization, x			0.626	0.060	0.042		0.412	
Dep. headway, hd			4.81	4.29	5.62		4.83	
Capacity			743	833	675		749	
95% Queue Length								
Delay			15.8	7.6	8.9		11.2	
LOS			C	A	A		B	
Approach:								
Delay				15.0-		8.9		11.2
LOS				B		A		B

Intersection Delay 13.4 Intersection LOS B

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

ALL-WAY STOP CONTROL(AWSC) ANALYSIS

Analyst:
Agency/Co.:
Date Performed: 6/27/2016
Analysis Time Period: AM Peak
Intersection: W Gate & 1416 W
Jurisdiction:
Units: U. S. Customary
Analysis Year:
Project ID: I-90 Corridor Study
East/West Street: 1416 W
North/South Street: W Gate

Worksheet 2 - Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	0	0	0	2	513	90	2	24	0	0	52	82
% Thrus Left Lane												

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration			LT	R	LT		TR	
PHF			0.94	0.87	0.95		0.76	
Flow Rate			547	103	27		175	
% Heavy Veh			0	0	0		2	
No. Lanes			2		1		1	
Opposing-Lanes			0		1		1	
Conflicting-lanes			1		2		2	
Geometry group			1		2		2	

Duration, T 1.00 hrs.

Worksheet 3 - Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rates:								
Total in Lane			547	103	27		175	
Left-Turn			2	0	2		0	
Right-Turn			0	103	0		107	
Prop. Left-Turns			0.0	0.0	0.1		0.0	
Prop. Right-Turns			0.0	1.0	0.0		0.6	
Prop. Heavy Vehicle			0.0	0.0	0.0		0.0	
Geometry Group			1		2		2	
Adjustments Exhibit 17-33:								
hLT-adj			0.2		0.2		0.2	

hRT-adj			-0.6		-0.6		-0.6	
hHV-adj			1.7		1.7		1.7	
hadj, computed			0.0	-0.6	0.0		-0.3	

Worksheet 4 - Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow rate			547	103	27		175	
hd, initial value	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
x, initial			0.49	0.09	0.02		0.16	
hd, final value			4.44	3.84	5.55		4.97	
x, final value			0.674	0.110	0.042		0.241	
Move-up time, m			2.0		2.0		2.0	
Service Time			2.4	1.8	3.6		3.0	

Worksheet 5 - Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rate			547	103	27		175	
Service Time			2.4	1.8	3.6		3.0	
Utilization, x			0.674	0.110	0.042		0.241	
Dep. headway, hd			4.44	3.84	5.55		4.97	
Capacity			816	936	675		729	
95% Queue Length								
Delay			16.5	7.3	8.8		9.5	
LOS			C	A	A		A	
Approach:								
Delay				15.0+		8.8		9.5
LOS				C		A		A

Intersection Delay 13.7 Intersection LOS B

HCS7 Two-Way Stop-Control Report

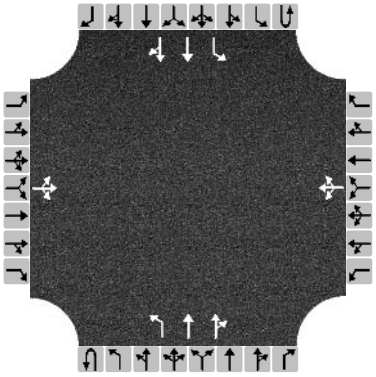
General Information

Analyst	
Agency/Co.	
Date Performed	6/27/2016
Analysis Year	2016
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	S. Service and Elk Vale
Jurisdiction	
East/West Street	Edward St/S. Service Road
North/South Street	Elk Vale
Peak Hour Factor	0.88
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	1	2	0	0	1	2	0
Configuration			LTR				LTR			L	T	TR		L	T	TR
Volume, V (veh/h)		9	4	10		46	4	43	1	15	936	14		19	897	25
Percent Heavy Vehicles (%)		0	0	11		2	0	11	0	0				4		
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			26				106			18				22		
Capacity, c (veh/h)			78				89			631				630		
v/c Ratio			0.33				1.19			0.03				0.03		
95% Queue Length, Q_{95} (veh)			1.4				17.5			0.1				0.1		
Control Delay (s/veh)			73.7				554.4			10.9				10.9		
Level of Service, LOS			F				F			B				B		
Approach Delay (s/veh)		73.7				554.4				0.2				0.2		
Approach LOS		F				F										

HCS7 Two-Way Stop-Control Report

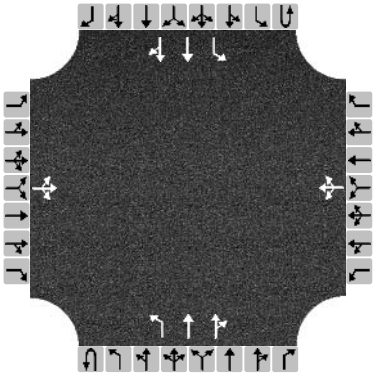
General Information

Analyst	
Agency/Co.	
Date Performed	6/27/2016
Analysis Year	2016
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	S. Service and Elk Vale
Jurisdiction	
East/West Street	Edward St/S. Service Road
North/South Street	Elk Vale
Peak Hour Factor	0.94
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	1	2	0	0	1	2	0
Configuration			LTR				LTR			L	T	TR		L	T	TR
Volume, V (veh/h)		11	2	18		42	3	66		11	1119	64	2	53	1090	27
Percent Heavy Vehicles (%)		9	0	0		2	0	0		0			0	2		
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			33				118			12				58		
Capacity, c (veh/h)			56				68			594				516		
v/c Ratio			0.59				1.73			0.02				0.11		
95% Queue Length, Q_{95} (veh)			3.4				30.6			0.1				0.4		
Control Delay (s/veh)			153.6				1478.3			11.2				12.9		
Level of Service, LOS			F				F			B				B		
Approach Delay (s/veh)		153.6				1478.3				0.1				0.6		
Approach LOS		F				F										

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB I-90
From/To:	Exit 60 to Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	1150	veh/h
Peak-hour factor, PHF	0.81	
Peak 15-min volume, v15	355	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	749	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	749	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	11.5	pc/mi/ln
Level of service, LOS	B	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB I-90
From/To:	Exit 60 to Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	1610	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	437	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	923	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	923	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	14.2	pc/mi/ln
Level of service, LOS	B	

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1150	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	83	vph
Length of first accel/decel lane	660	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1150	83		vph
Peak-hour factor, PHF	0.81	0.81		
Peak 15-min volume, v15	355	26		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1498	108	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1498 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1498	4700	No
$v_{FO} = v_F - v_R$	1390	4700	No
v_R	108	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1498 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1498	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 11.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D_S = 0.438	
Space mean speed in ramp influence area,	S_R = 54.9	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.9	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1610	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	275	vph
Length of first accel/decel lane	660	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1610	275		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	437	75		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1846	315	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1846 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1846	4700	No
$v_{FO} = v_F - v_R$	1531	4700	No
v_R	315	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1846 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1846	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 14.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D_S = 0.456	
Space mean speed in ramp influence area,	S_R = 54.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.5	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1067	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	21	vph
Length of first accel/decel lane	1100	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1067	21		vph
Peak-hour factor, PHF	0.81	0.81		
Peak 15-min volume, v15	329	6		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1390	27	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1390 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1417	4700	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1390 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1417	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 9.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	M_S = 0.260	
Space mean speed in ramp influence area,	S_R = 59.0	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 59.0	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1335	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	21	vph
Length of first accel/decel lane	1100	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1335	21		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	363	6		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1531	24	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1531 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1555	4700	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1531 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1555	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 10.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.262	
Space mean speed in ramp influence area,	S_R = 59.0	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 59.0	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB I-90
From/To:	Exit 61 to Exit 63
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	1190	veh/h
Peak-hour factor, PHF	0.81	
Peak 15-min volume, v15	367	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	775	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	775	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	11.9	pc/mi/ln
Level of service, LOS	B	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB I-90
From/To:	Exit 61 to Exit 63
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	1330	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	361	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	763	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	763	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	11.7	pc/mi/ln
Level of service, LOS	B	

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 63
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1190	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	565	vph
Length of first accel/decel lane	275	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1190	565		vph
Peak-hour factor, PHF	0.81	0.81		
Peak 15-min volume, v15	367	174		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1550	736	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1550 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1550	4700	No
$v_{FO} = v_F - v_R$	814	4700	No
v_R	736	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1550 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1550	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_{12}$ = 15.1 pc/mi/ln D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.494

Space mean speed in ramp influence area, S_R = 53.6 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 53.6 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 63
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1330	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	617	vph
Length of first accel/decel lane	275	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1330	617		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	361	168		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1525	708	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1525 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1525	4700	No
$v_{FO} = v_F - v_R$	817	4700	No
v_R	708	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1525 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1525	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_{12}$ = 14.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D_S = 0.492	
Space mean speed in ramp influence area,	S_R = 53.7	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 53.7	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB I-90
From/To:	Exit 63 to Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	600	veh/h
Peak-hour factor, PHF	0.81	
Peak 15-min volume, v15	185	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	391	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	391	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	6.0	pc/mi/ln
Level of service, LOS	A	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB I-90
From/To:	Exit 63 to Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	560	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	152	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	321	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	321	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	4.9	pc/mi/ln
Level of service, LOS	A	

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 67A
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	600	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	7	vph
Length of first accel/decel lane	325	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	600	7		vph
Peak-hour factor, PHF	0.81	0.81		
Peak 15-min volume, v15	185	2		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	781	9	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 781 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	781	4700	No
$v_{FO} = v_F - v_R$	772	4700	No
v_R	9	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 781 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	781	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 8.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	D_S = 0.429	
Space mean speed in ramp influence area,	S_R = 55.1	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 55.1	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 67A
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	560	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	58	vph
Length of first accel/decel lane	325	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	560	58		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	152	16		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	642	67	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 642 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	642	4700	No
$v_{FO} = v_F - v_R$	575	4700	No
v_R	67	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12}/2	No	

If yes, v_{12A} = 642 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	642	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 6.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	D_S = 0.434	
Space mean speed in ramp influence area,	S_R = 55.0	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 55.0	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 67B
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	593	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	324	vph
Length of first accel/decel lane	675	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	593	324		vph
Peak-hour factor, PHF	0.81	0.81		
Peak 15-min volume, v15	183	100		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	772	422	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 772 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	772	4700	No
$v_{FO} = v_F - v_R$	350	4700	No
v_R	422	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 772 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	772	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 4.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, D_S = 0.466

Space mean speed in ramp influence area, S_R = 54.3 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 54.3 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 67B
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	502	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	206	vph
Length of first accel/decel lane	675	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	502	206		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	136	56		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	576	236	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 576 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	576	4700	No
$v_{FO} = v_F - v_R$	340	4700	No
v_R	236	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 576 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	576	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 3.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	D_S = 0.449	
Space mean speed in ramp influence area,	S_R = 54.7	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.7	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	269	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	42	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	269	42		vph
Peak-hour factor, PHF	0.81	0.81		
Peak 15-min volume, v15	83	13		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	350	55	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 350 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	405	4700	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 350 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	405	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 3.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	M_S = 0.271	
Space mean speed in ramp influence area,	S_R = 58.8	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 58.8	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.80

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	296	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	24	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	296	24		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	80	7		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	339	28	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 339 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	367	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 339 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	367	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 3.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	M_S = 0.271	
Space mean speed in ramp influence area,	S_R = 58.8	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 58.8	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB I-90
From/To:	Exit 67 to Pull Off
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	310	veh/h
Peak-hour factor, PHF	0.81	
Peak 15-min volume, v15	96	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	202	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	202	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	3.1	pc/mi/ln
Level of service, LOS	A	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB I-90
From/To:	East of Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	325	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	88	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	186	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	186	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	2.9	pc/mi/ln
Level of service, LOS	A	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB I-90
From/To:	East of Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	260	veh/h
Peak-hour factor, PHF	0.84	
Peak 15-min volume, v15	77	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	163	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	163	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	2.5	pc/mi/ln
Level of service, LOS	A	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB I-90
From/To:	East of Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	410	veh/h
Peak-hour factor, PHF	0.89	
Peak 15-min volume, v15	115	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	243	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	243	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	3.7	pc/mi/ln
Level of service, LOS	A	

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	260	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	32	vph
Length of first accel/decel lane	350	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	260	32		vph
Peak-hour factor, PHF	0.84	0.84		
Peak 15-min volume, v15	77	10		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	327	40	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 327 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	327	4700	No
$v_{FO} = v_F - v_R$	287	4700	No
v_R	40	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 327 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	327	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 3.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	D_S = 0.432	
Space mean speed in ramp influence area,	S_R = 55.1	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 55.1	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	410	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	47	vph
Length of first accel/decel lane	350	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	410	47		vph
Peak-hour factor, PHF	0.89	0.89		
Peak 15-min volume, v15	115	13		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	486	56	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 486 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	486	4700	No
$v_{FO} = v_F - v_R$	430	4700	No
v_R	56	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 486 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	486	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 5.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	D_S = 0.433	
Space mean speed in ramp influence area,	S_R = 55.0	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 55.0	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	228	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	420	vph
Length of first accel/decel lane	875	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	228	420		vph
Peak-hour factor, PHF	0.84	0.84		
Peak 15-min volume, v15	68	125		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	286	528	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 286 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	814	4700	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 286 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	814	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 6.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	M_S = 0.269	
Space mean speed in ramp influence area,	S_R = 58.8	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 58.8	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	363	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	414	vph
Length of first accel/decel lane	875	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	363	414		vph
Peak-hour factor, PHF	0.89	0.89		
Peak 15-min volume, v15	102	116		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948
Driver population factor, fP	1.00	1.00
Flow rate, vp	430	491 pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 430 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	921	4700	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 430 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	921	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 6.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	M_S = 0.270	
Space mean speed in ramp influence area,	S_R = 58.8	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 58.8	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB I-90
From/To:	Exit 67 to Exit 63
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	680	veh/h
Peak-hour factor, PHF	0.84	
Peak 15-min volume, v15	202	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	427	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	427	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	6.6	pc/mi/ln
Level of service, LOS	A	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB I-90
From/To:	Exit 67 to Exit 63
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	980	veh/h
Peak-hour factor, PHF	0.89	
Peak 15-min volume, v15	275	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	581	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	581	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	8.9	pc/mi/ln
Level of service, LOS	A	

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 63
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	680	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	615	vph
Length of first accel/decel lane	1050	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	680	615		vph
Peak-hour factor, PHF	0.84	0.84		
Peak 15-min volume, v15	202	183		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	854	772	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 854 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1626	4700	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 854 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1626	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 11.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.267	
Space mean speed in ramp influence area,	S_R = 58.9	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 58.9	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 63
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	980	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	595	vph
Length of first accel/decel lane	1050	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	980	595		vph
Peak-hour factor, PHF	0.89	0.89		
Peak 15-min volume, v15	275	167		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1162	705	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1162 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1867	4700	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1162 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1867	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 13.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.273	
Space mean speed in ramp influence area,	S_R = 58.7	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 58.7	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB I-90
From/To:	Exit 63 to Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	1270	veh/h
Peak-hour factor, PHF	0.84	
Peak 15-min volume, v15	378	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	798	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	798	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	12.3	pc/mi/ln
Level of service, LOS	B	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB I-90
From/To:	Exit 63 to Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	1580	veh/h
Peak-hour factor, PHF	0.89	
Peak 15-min volume, v15	444	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	936	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	936	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	14.4	pc/mi/ln
Level of service, LOS	B	

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1270	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	9	vph
Length of first accel/decel lane	710	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1270	9		vph
Peak-hour factor, PHF	0.84	0.84		
Peak 15-min volume, v15	378	3		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1595	11	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1595 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1595	4700	No
$v_{FO} = v_F - v_R$	1584	4700	No
v_R	11	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1595 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1595	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 11.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.429

Space mean speed in ramp influence area, S_R = 55.1 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 55.1 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1580	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	10	vph
Length of first accel/decel lane	710	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1580	10		vph
Peak-hour factor, PHF	0.89	0.89		
Peak 15-min volume, v15	444	3		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1873	12	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1873 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1873	4700	No
$v_{FO} = v_F - v_R$	1861	4700	No
v_R	12	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1873 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1873	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 14.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.429

Space mean speed in ramp influence area, S_R = 55.1 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 55.1 mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1261	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	132	vph
Length of first accel/decel lane	1150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1261	132		vph
Peak-hour factor, PHF	0.84	0.84		
Peak 15-min volume, v15	375	39		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1584	166	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1584 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1750	4700	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1584 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1750	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 11.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.263	
Space mean speed in ramp influence area,	S_R = 59.0	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 59.0	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1570	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	192	vph
Length of first accel/decel lane	1150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1570	192		vph
Peak-hour factor, PHF	0.89	0.89		
Peak 15-min volume, v15	441	54		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1861	228	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1861 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2089	4700	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1861 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2089	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 14.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.272	
Space mean speed in ramp influence area,	S_R = 58.7	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 58.7	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB I-90
From/To:	Exit 61 to Exit 60
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	1350	veh/h
Peak-hour factor, PHF	0.84	
Peak 15-min volume, v15	402	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	848	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	848	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	13.0	pc/mi/ln
Level of service, LOS	B	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB I-90
From/To:	Exit 61 to Exit 60
Jurisdiction:	SDDOT
Analysis Year:	2016
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	1640	veh/h
Peak-hour factor, PHF	0.89	
Peak 15-min volume, v15	461	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	972	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	972	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	15.0	pc/mi/ln
Level of service, LOS	B	

APPENDIX E. SUPPLEMENTAL ENVIRONMENTAL INFORMATION

Table 1. Previously Identified Historic Properties (Listed from West to East)

Site #	Name	Address	Description	Status
I-90 Exit 61-67				
39PN2003	RCPE Railroad	Parallel to I-90	Located immediately adjacent to I-90 between exit 61-63, and about 1,400 feet south of I-90 east of Exit 63, the historic Chicago and North Western Railway (CNW) dates to 1879. The railway became the Chicago and North Western Transportation Company.	Eligible
39PN2696	Native American Artifact Scatter			Unevaluated
39PN3579	Euro-American Isolated Find			Recommended Not Eligible; No SHPO Determination
39PN3254	Early/mid Archaic Isolated Find			Recommended Not Eligible; No SHPO Determination

Table 2. Potential Historic Properties (Listed from West to East)

Site #	Name	Address	Description	Status
I-90 Exit 61-67				
39PN2815	Euro-American Burial			Unevaluated
N/A	Historic Road	South of, and roughly parallel to, I-90.	Historic road, documented in 1879 survey, BLM General Land Office.	
N/A	Auto repair garage	4700 S. Interstate 90 Service Road, Box Elder, SD	One story wooden clapboard office or residence with attached 5 bay, two story masonry garage, constructed between 1930-1942.	Age-Eligible/ Unevaluated
N/A	Farm	2001 146th Ave., Rapid City, SD	Historic farm, with large red wooden barn and two smaller barns. Animal enclosure fence still present.	Age-Eligible/ Unevaluated

Table 2. Potential Historic Properties (Listed from West to East)

Site #	Name	Address	Description	Status
N/A	House	22635 GISI Rd, Rapid City, SD	House constructed in 1889.	Age-Eligible/ Unevaluated
N/A	House	308 C and F Ave, Box Elder, SD	Two story gabled ell house, constructed in 1905.	Age-Eligible/ Unevaluated
N/A	House	784 D and R Ave, Box Elder, SD	Hipped roof box house, constructed in 1970.	Age-Eligible/ Unevaluated
N/A	House	787 D and R Ave, Box Elder SD	Ranch style house, constructed in 1969.	Age-Eligible/ Unevaluated
N/A	House	757 D and R Ave, Box Elder, SD	Ranch style house constructed in 1950.	Age-Eligible/ Unevaluated
N/A	House	175 West Gate Rd, Box Elder, SD	Hipped roof ranch style house, constructed in 1965.	Age-Eligible/ Unevaluated
N/A	House	150 West Gate Rd, Box Elder, SD	One story brick ranch style house, constructed in 1954.	Age-Eligible/ Unevaluated
N/A	House	148 West Gate Rd, Box Elder, SD	One story brick ranch, constructed in 1954.	Age-Eligible/ Unevaluated
N/A	House	146 West Gate Rd, Box Elder, SD	One story brick ranch, constructed in 1954.	Age-Eligible/ Unevaluated
N/A	House	144 West Gate Rd, Box Elder, SD	One story brick ranch, constructed in 1954.	Age-Eligible/ Unevaluated
N/A	House	142 West Gate Rd, Box Elder, SD	One story brick ranch, constructed in 1954.	Age-Eligible/ Unevaluated
N/A	House	140 West Gate Rd, Box Elder, SD	One story brick ranch style house, constructed in 1954.	Age-Eligible/ Unevaluated
N/A	House	718 Box Elder Rd. W, Box Elder, SD	One story brick ranch house, constructed in 1940.	Age-Eligible/ Unevaluated
N/A	House	636 Box Elder Rd. W, Box Elder, SD	Ranch style house constructed in 1956.	Age-Eligible/ Unevaluated
N/A	House	632 Box Elder Rd. W, Box Elder, SD	Ranch style house constructed in 1958	Age-Eligible/ Unevaluated
N/A	House	624 Box Elder Rd. W, Box Elder, SD	Ranch style house constructed in 1942.	Age-Eligible/ Unevaluated
N/A	House	502 Cardinal Ct., Box Elder, SD	Two story, foursquare style house constructed in 1914.	Age-Eligible/ Unevaluated

Table 2. Potential Historic Properties (Listed from West to East)

Site #	Name	Address	Description	Status
N/A	House	101 Shady Dr., Box Elder, SD	One story bungalow style house, constructed in 1920.	Age-Eligible/ Unevaluated
N/A	House	105 Rosehill Dr., Box Elder, SD	Two story split level style house, constructed in 1942.	Age-Eligible/ Unevaluated
N/A	House	403 Highway 1416, Box Elder, SD	One story bungalow style house constructed in 1908.	Age-Eligible/ Unevaluated
N/A	House	101 Hillside Dr., Box Elder, SD	Split level style house, constructed in 1942.	Age-Eligible/ Unevaluated
N/A	House	201 Country Rd, Box Elder, SD	Ranch style house, constructed in 1965.	Age-Eligible/ Unevaluated
N/A	House	235 Country Rd, Box Elder, SD	Ranch style house, constructed in 1946.	Age-Eligible/ Unevaluated
N/A	House	100 Gumbo Dr., Box Elder, SD	Ranch style house, constructed in 1954.	Age-Eligible/ Unevaluated
N/A	House	101 Gumbo Dr., Box Elder, SD	Ranch style house, constructed in 1964.	Age-Eligible/ Unevaluated
N/A	House	106 Gumbo Dr., Box Elder, SD	Ranch style house, constructed in 1952.	Age-Eligible/ Unevaluated
N/A	House	204 Gumbo Dr., Box Elder, SD	Ranch style house, constructed in 1964.	Age-Eligible/ Unevaluated
N/A	House	114 Box Elder Rd. W, Box Elder, SD	One story ranch house style, constructed in 1953	Age-Eligible/ Unevaluated
N/A	House	110 South Gate Rd., Box Elder SD	One story ranch house style, constructed in 1950.	Age-Eligible/ Unevaluated
N/A	House	116 South Gate Rd., Box Elder SD	Ranch house style, constructed in 1952.	Age-Eligible/ Unevaluated
N/A	House	118 South Gate Rd., Box Elder, SD	Ranch house style, constructed in 1966.	Age-Eligible/ Unevaluated
N/A	House	122 South Gate Rd., Box Elder, SD	Ranch house style, constructed in 1957.	Age-Eligible/ Unevaluated
N/A	House	126 South Gate Rd., Box Elder, SD	Ranch house style, constructed in 1942.	Age-Eligible/ Unevaluated
N/A	House	103 Morningside Dr., Box Elder, SD	Ranch house style, constructed in 1925.	Age-Eligible/ Unevaluated
N/A	House	109 Morningside Dr., box Elder, SD	Ranch house style, constructed in 1952.	Age-Eligible/ Unevaluated
N/A	House	127 Morningside Dr., Box Elder, SD	Ranch house style, constructed in 1960.	Age-Eligible/ Unevaluated

Table 2. Potential Historic Properties (Listed from West to East)

Site #	Name	Address	Description	Status
N/A	House	119 Morningside Dr., Box Elder, SD	Ranch house style, constructed in 1952.	Age-Eligible/ Unevaluated
N/A	House	121 Morningside Dr., Box Elder, SD	Minimal traditional style, constructed in 1942.	Age-Eligible/ Unevaluated
N/A	House	131 Morningside Dr., Box Elder SD	Ranch house style, constructed in 1961.	Age-Eligible/ Unevaluated
N/A	Retail Store	114 Box Elder Road W., Box Elder SD	Wood and steel framed exterior commercial building with partially stucco, constructed in 1918.	Age-Eligible/ Unevaluated
N/A	Auto repair garage	116 Box Elder Road W., Box Elder SD	Metal Quonset Hut constructed in 1956 or earlier.	Age-Eligible/ Unevaluated
N/A	Retail store	139 S. Ellsworth Rd., Box Elder, SD	Wood or steel frame commercial building, constructed in 1965.	Age-Eligible/ Unevaluated
N/A	Retail shopping center	230 Frontage Rd Box Elder SD	Masonry exterior retail shopping center, constructed in 1960.	Age-Eligible/ Unevaluated
N/A	Church	200 N. Ellsworth Rd, Box Elder SD	Wood frame church, constructed in 1960.	Age-Eligible/ Unevaluated
N/A	House	329 Line Rd, Box Elder, SD	One story bungalow style house, constructed in 1935.	Age-Eligible/ Unevaluated
N/A	House	416 Line Rd, Box Elder, SD	Two story gabled ell house, constructed in 1904.	Age-Eligible/ Unevaluated
N/A	House	412 Line Rd, Box Elder SD	Two story shingle style frame house constructed in 1898.	Age-Eligible/ Unevaluated
N/A	House	514 Line Rd, Box Elder, SD	One story, side gable house, constructed in 1940.	Age-Eligible/ Unevaluated
N/A	Farm	536 Highway 1416, Box Elder, SD	Farm complex with barn, pasture, and several out buildings. One story minimal traditional house, constructed in 1928.	Age-Eligible/ Unevaluated
N/A	House	350 Cottonwood Dr., Box Elder, SD	One story bungalow style house, constructed in 1935.	Age-Eligible/ Unevaluated
N/A	House	327 Cottonwood Dr. Box Elder, SD	One story ranch style house, constructed in 1965.	Age-Eligible/ Unevaluated

Table 2. Potential Historic Properties (Listed from West to East)

Site #	Name	Address	Description	Status
N/A	House	327 Sunnydale Rd., Box Elder, SD	One story ranch style house, constructed in 1964.	Age-Eligible/ Unevaluated
N/A	House	317 Circle Dr., Box Elder, SD	Ranch style house, constructed in 1960.	Age-Eligible/ Unevaluated
N/A	House	321 Circle Dr., Box Elder, SD	Split level style house, constructed in 1962.	Age-Eligible/ Unevaluated
N/A	House	333 Circle Dr., Box Elder, SD	One story ranch style house, constructed in 1960.	Age-Eligible/ Unevaluated
N/A	House	306 Spruce Dr., Box Elder SD	One story ranch style house, constructed in 1950.	Age-Eligible/ Unevaluated
N/A	House	605 Sunnydale Rd., Box Elder, SD	One story house constructed in 1923.	Age-Eligible/ Unevaluated
N/A	House	743 Sunnydale Rd, Box Elder, SD	Two story I-House style house, constructed in 1947.	Age-Eligible/ Unevaluated
N/A	House	710 Harmony Dr., Box Elder, SD	One and a half story ranch style house constructed in 1963.	Age-Eligible/ Unevaluated
N/A	House	711 Harmony Dr., Box Elder, SD	One story minimal traditional house constructed in 1949.	Age-Eligible/ Unevaluated
N/A	Shed	731 Harmony Dr., Box Elder, SD	One story corrugated metal shed, date unknown.	Unevaluated
N/A	House	719 Line Rd., Box Elder, SD	One and a half story minimal traditional house, constructed in 1948.	Age-Eligible/ Unevaluated
N/A	House	733 Line Rd., Box Elder, SD	One story minimal traditional house, constructed in 1957.	Age-Eligible/ Unevaluated
N/A	House	300 Willow Dr., Box Elder, SD	One and a half story Cape Cod style house, constructed in 1939.	Age-Eligible/ Unevaluated
39PN2043	Government Railroad	Perpendicular to DM&E Railroad, crosses I-90 400 ft. east of Commercial Gate Dr.	Historic rail line branching north from DM&E just west of Town of Box Elder.	Unevaluated

Table 3. Hazardous, Toxic, and Radioactive Waste Summary for I-90 Exit 61 to Exit 67

Property Name and Address/Location	Location in relation to project	Environmental Conditions and General Comments
Patrons Cooperative Association 3504 Edward Street Rapid City, SD 57703 & 4507 S Interstate 90 Service Road Rapid City, SD 57701	Southwest of Exit 61 Southeast of Exit 61	Oil storage and handling site, potential for petroleum spills. Several aboveground storage tanks (AST) observed on property. No violations reported. A second location was observed behind a tattoo shop and RV dealer on I-90 Service Road. Oil storage and handling site, potential for petroleum spills. One aboveground storage tank was observed. No violations reported and the property was not reported by the EPA.
Northern Truck Equipment Corp 3505 Edward Street Rapid City, SD 57703	Southwest of Exit 61	Truck equipment and trailer dealer. EPA reported as a SQG under RCRA. It appears that truck maintenance is conducted on site, thus there is a potential for contamination due to hazardous waste handling/generation. No violations reported.
Magellan Pipeline Company, LP 3225 Eglin Street Rapid City, SD 57703	Southwest of Exit 61	Oil storage and handling site, potential for petroleum spills. No violations reported.
Wyoming Refining Company 2945 Eglin Street Rapid City, SD 57703	Southwest of Exit 61	Oil storage and handling site, potential for petroleum spills. No violations reported.
M G Oil Co 3250 Eglin St Rapid City, SD 57703	Southwest of Exit 61	Oil storage and handling site, potential for petroleum spills. Stacks of plastic oil tote tanks were observed on the property containing what appears to be a petroleum product. The site is not listed in the EPA databases
Ace Steel & Recycling 2830 Eglin St Rapid City, SD 57703	Southwest of Exit 61	Scrap yard and recycling site. Listed by EPA under RCRA and AIRS. 55-gallon drums were observed on the property. No violations reported. Historic material management, handling, and disposal practices at this property are unknown; therefore, it is an environmental concern.
Logan's Transmission Inc 3153 Beale Street Rapid City, SD 57703	Southwest of Exit 61	Vehicle maintenance shop. Has potential to create and improperly dispose of petroleum products and other hazardous materials. Not listed in the EPA databases.
LaGrand Station 3851 Eglin Street Rapid City, SD 57703	South of Exit 61	Gas Station. Recently built so leaking tanks are not expected. Not listed in the EPA databases.

Table 3. Hazardous, Toxic, and Radioactive Waste Summary for I-90 Exit 61 to Exit 67

Property Name and Address/Location	Location in relation to project	Environmental Conditions and General Comments
Don's Valley Express 4030 Cheyenne Boulevard Rapid City, SD 57703	South of Exit 61	Gas Station. Recently built so leaking tanks are not expected. Not listed in the EPA databases.
Unknown (Possibly Black Hills Truck & Trailer from EPA data) 4301-4309 Interstate 90 Service Rd Rapid City, SD 57703	East of Exit 61	Unknown warehouse demolished between 2013 and 2015, Appears to be a newly built structure and large parking lot. Site previously reported under RCRA so there is a potential for hazardous materials. Site in compliance with RCRA regulations up through 2016.
I-90 RV and Auto Super Center 4505 S Interstate 90 Service Road Rapid City, SD 57703	East of Exit 61	Large RV and auto dealer. Business likely includes some maintenance and repair activity which could generate hazardous material waste. Not listed in the EPA databases.
Smoking Gun Indoor Range & Training Center 4711 S Interstate 90 Service Road Rapid City, SD 57701	East of Exit 61	Newly constructed indoor shooting range. Shooting ranges produce large quantities of lead debris from ammunition; many ranges do not properly manage this hazardous material. There is a potential for elevated lead pollution inside and adjoining this property.
Flying J Franchise 4200 N I-90 Service Rd Exit 61 Rapid City, SD 57701	North of Exit 61	Large gas station, restaurant, travel center, and trucker stop. Structure dates back to before 1997. Site has potential for leaking tanks and potential for accumulation of truck waste fluids from idling and parked vehicles. The property also contained a large AST containing propane. A monitoring observation well was observed on the property, indicating a possibility of contamination on the site. Not listed in the EPA databases despite presence of monitoring well. Site will require additional investigation if construction activities occur on the property.
Ditch Witch 2108 Elk Vale Road Rapid City, SD 57701	North of Exit 61	A construction equipment supplier that sells and services large scale equipment, specifically trenchers and plows. It appears they do on-site service which means there is potential handling of hazardous waste. Not listed in EPA databases.

Table 3. Hazardous, Toxic, and Radioactive Waste Summary for I-90 Exit 61 to Exit 67

Property Name and Address/Location	Location in relation to project	Environmental Conditions and General Comments
Excel Truck & Trailer Repair 2108 Elk Vale Road #8 Rapid City, SD 57701	North of Exit 61	Listed as a full service heavy duty truck and trailer repair facility. The facility likely handles and generates petroleum and hazardous wastes. Not listed in EPA databases.
Ultramax Ammunition 2112 Elk Vale Road Rapid City, SD 57701	North of Exit 61	Site listed in EPA databases under Toxic Release Inventory System for lead, which was disposed of off-site. Also listed under RCRA and ICIS which is noted as having a Formal Enforcement Action in 2002, although no further information about the action is available. The manufacturing of ammunition uses heavy metals, such as lead, which pose a potential environmental risk on the property.
Border States Electric 3100 E Mall Drive Rapid City, SD 57701	Northwest of Exit 61	Electrical supply store with a large amount of outdoor storage and a warehouse. Business offers a wide array of services and products. There is a potential for their electrical and mechanical supplies to contain hazardous materials, particularly heavy metals. Not listed in EPA databases.
Black Hills Truck & Trailer 2910 E Mall Drive Rapid City, SD 57701	Northwest of Exit 61	Truck and trailer dealer. Listed in EPA databases under RCRA as a CESQG. It appears that they do conduct vehicle maintenance on site thus there is a potential for hazardous material release on the property. Two plastic oil tote tanks and an AST (extremely rusty and appears to be no longer used) were observed during the field investigation. The site is located over 1000 feet from I-90, therefore potential contamination would not be expected to impact an I-90 construction project.
Great Western Tire Inc 1645 Dyess Avenue Rapid City, SD 57701	Northwest of Exit 61	A used tire shop with two large buildings. Listed under ICIS for "tires and tubes" and "tire retreading and repair shops". Unknown exact activities conducted on site therefore the site is a potential environmental concern.

Table 3. Hazardous, Toxic, and Radioactive Waste Summary for I-90 Exit 61 to Exit 67

Property Name and Address/Location	Location in relation to project	Environmental Conditions and General Comments
M G Oil Co 4300 N I 90 Service Road Rapid City, SD 57701	Northeast of Exit 61	An auto repair shop very close to I-90. Potential for solvents and other hazardous waste contamination. Field inspection revealed several plastic oil tote tanks and a mobile AST. Additionally, at least fifty 55-gallon metal drums were observed on the property; the drums appear empty but that could not be confirmed from outside of the property. Not listed in EPA databases.
Allstate Peterbilt of Rapid City 4650 S Interstate 90 Service Road Box Elder, SD 57719	Northeast of Exit 61	Truck Dealer with a large amount of outdoor storage. Suspected vehicle maintenance occurring on site therefore the site has potential for hazardous materials. Not listed in EPA databases.
K&M Tire 4700 S Interstate Service Road Rapid City, SD 57701	Northeast of Exit 61	The facility is a regional tire distributor. The site is conducting business in a warehouse with several large garage doors. The assumed use for the property is as a storage warehouse and transportation hub for the tire wholesale business. Hazardous materials concerns would not be expected. Not listed in EPA databases.
4-U Stores Gas Station 640 Box Elder Road Box Elder, SD 57719	Northeast of Exit 63	Gas station in an industrial and residential area between I-90 and Highway 1416. Not listed in EPA databases. Potential for unreported LUSTs on site. The northeast corner of the property contains debris including 55-gallon drums, bottles and buckets of discarded chemicals, old paint cans, vehicles that appear abandoned, and a variety of other wastes. This property is less than 500 feet from I-90, therefore the property should be further investigated if construction activities are proposed on or adjoining this property.
Federal Property Agency 616 Box Elder Road West Box Elder, SD 57719	South of I-90 Between Exit 63 and Exit 67	Property with a mix of personal vehicles, large scale machinery, and various parts. Unknown exact site operations but has potential for vehicle maintenance on site therefore should be considered a potential environmental concern. Not listed in EPA databases.

Table 3. Hazardous, Toxic, and Radioactive Waste Summary for I-90 Exit 61 to Exit 67

Property Name and Address/Location	Location in relation to project	Environmental Conditions and General Comments
Vermeer Equipment-Black Hills 550 W Box Elder Road Box Elder, SD 57719	South of I-90 Between Exit 63 and Exit 67	Retailer of large scale agricultural equipment and vehicles. Likely do some on-site maintenance therefore the property is a potential environmental concern. The site also contains what appears to be a cell tower with electrical infrastructure at the base. Not listed in EPA databases.
Eddie's Truck Body Shop 500 Box Elder Road W Box Elder, SD 57719	South of I-90 Between Exit 63 and Exit 67	Auto shop. Has potential for generation, handling, and disposal of petroleum and other hazardous materials. Site is a potential environmental concern. Not listed in EPA databases.
West River Electric Association 498 Box Elder Road W Box Elder, SD 57719	South of I-90 Between Exit 63 and Exit 67	This parcel owned by the utility West River Electric Association contains a transformer station in the southwest corner of the property. Additionally, the property contains a fenced storage area for various utility materials, most prominently there are several stacks of utility poles. Due to the presence of electrical transformers that may contain PCBs and utility poles which are composed of heavily treated wood, the site should be considered a potential environmental concern. Not listed in EPA databases.
Jerry's Sales 428 Box Elder Road W Box Elder, SD 57719	South of I-90 Between Exit 63 and Exit 67	Car dealer – sign states 'Service & Recyclables'. Due to on-site service of vehicles, there is a potential environmental condition on the property. Not listed in EPA databases.
S & S Autobody 328 Box Elder Road W Box Elder, SD 57719	South of I-90 Between Exit 63 and Exit 67	Auto shop. Has potential for generation, handling, and disposal of petroleum and other hazardous materials. Site is a potential environmental concern. Not listed in EPA databases.
Paul's Repair 312 Box Elder Road W Box Elder, SD 57719	South of I-90 Between Exit 63 and Exit 67	Auto shop. Has potential for generation, handling, and disposal of petroleum and other hazardous materials. Site is a potential environmental concern. Not listed in EPA databases.

Table 3. Hazardous, Toxic, and Radioactive Waste Summary for I-90 Exit 61 to Exit 67

Property Name and Address/Location	Location in relation to project	Environmental Conditions and General Comments
B & M Machine 126 Gumbo Drive Box Elder, SD 57719	South of I-90 Between Exit 63 and Exit 67	Listed as an Auto Machine Shop on google. Would have the potential for hazardous materials with vehicle maintenance and repairs, although it appears as if operation has ceased. Site is a potential environmental concern. Not listed in EPA databases.
The Cheap Seats 122 Box Elder Road W Box Elder, 57719	South of I-90 Between Exit 63 and Exit 67	Used car dealer. Appears to have a central structure where car maintenance is conducted. Site is a potential environmental concern. Not listed in EPA databases.
Box Elder Auto Parts & Service Approx. 134 Box Elder Road W Box Elder, SD 57719	South of I-90 Between Exit 63 and Exit 67	Appears to be a vehicle scrap yard. The building at the front of the property appears to be abandoned but there is a newer building in the back corner of the property which may be where the operation now takes place. One hundred or more vehicles sitting on property, possible on-site maintenance. Site is a potential environmental concern. Site listed in EPA databases under ICIS, most recent compliance in 2014.
Tipmann Bros 104 Box Elder Road W Box Elder, SD 57719	South of I-90 Between Exit 63 and Exit 67	Used car dealer with an auto shop. Has potential for generation, handling, and disposal of petroleum and other hazardous materials. Site has a potential environmental condition. Not listed in EPA databases.
Harms Oil* 624 Box Elder Road W Box Elder, SD 57719 *Name presumed from tanker signs – Parcel data lists property under owner: Real Estate Company 4	South of I-90 Between Exit 63 and Exit 67	Appears to be a storage area for tanker trucks and tanks, likely containing petroleum products. Due to the concentration of oil tank trailers and trucks on site this property is a potential environmental concern. Not listed in EPA databases. The site is directly adjoining I-90.
Stern Oil Co Inc 105 S Gate Road Box Elder, SD 57719	South of I-90 Between Exit 63 and Exit 67	Appears to be an auto repair shop for oil trucks and related vehicles. Has potential for generation, handling, and disposal of petroleum and other hazardous materials. The site contains several ASTs, some with containment structures and some without. Site is a potential environmental concern. Not listed in EPA databases.

Table 3. Hazardous, Toxic, and Radioactive Waste Summary for I-90 Exit 61 to Exit 67

Property Name and Address/Location	Location in relation to project	Environmental Conditions and General Comments
RR Waste Solutions 105 Rosehill Drive Box Elder, SD 57719	South of I-90 Between Exit 63 and Exit 67	A waste solutions property with several garbage trucks and a storage area on site. Aerial images from 2015 show an active operation but the site visit in September 2016 observed what appeared to be an abandoned site. Signs from RR Waste Solutions had been removed. An abandoned AST remains in the center of the property. Site is a potential environmental concern. Not listed in EPA databases.
ACDC Automotive 114 Box Elder Road W Box Elder, SD 55719	South of I-90 Between Exit 63 and Exit 67	Auto shop. Has potential for generation, handling, and disposal of petroleum and other hazardous materials. Site is a potential environmental concern. Not listed in EPA databases.
Con-Way Freight 124 Box Elder Road W Box Elder, SD 57719	South of I-90 Between Exit 63 and Exit 67	Appears to be a freight exchange and storage hub for Con-Way Freight. The property has a many plastic tote tanks that contain an unknown liquid and there is an above-ground storage tank behind the structure. This site is a potential environmental concern due to these factors. Not listed in EPA databases.
Pat Meier Trucking 152 Douglas Road Box Elder, SD 57719	South of I-90 Between Exit 63 and Exit 67	Appears to be a base of operations for a trucking company. The central building appears to contain maintenance activities therefore the site is a potential environmental concern. Not listed in EPA databases.
Ellsworth Air Force Base 1940 EP Howe Drive Ellsworth AFB, SD 57706	North of I-90 Between Exit 63 and Exit 67	The Ellsworth Air Force Base has a wide array of recognized environmental conditions and hazardous materials contaminations. The site is a superfund site. All surface contaminations have been cleaned and the surface areas were removed from the National Priorities List in 2012. The groundwater still requires additional cleanup. Although I-90 is downgradient of the base, reviews conducted by the EPA have concluded the groundwater contamination is contained at the base boundary and high concentration areas have been identified and are being treated.

Table 3. Hazardous, Toxic, and Radioactive Waste Summary for I-90 Exit 61 to Exit 67

Property Name and Address/Location	Location in relation to project	Environmental Conditions and General Comments
Cono-Mart 117 North Ellsworth Road Box Elder, SD 57719	North of I-90 Between Exit 63 and Exit 67	Appears to be closed and abandoned. Using historic aerial imagery from Google Earth, it appears it closed sometime after 2006. A portion of the concrete on the property has been removed and there is some excavation activity behind the structure. The site is listed in the EPA databases under RCRA as a CESQG (Last update in December 2006). With the potential for LUST and the excavation on site, this site is a potential environmental concern.
Love's Travel Stop 679 Reagan Avenue (I-90 Exit 67B) Box Elder, SD 57719	North of I-90 (Exit 67)	A gas station located directly adjacent to I-90. The property and structures were constructed in the past 2 or 3 years. There is a structure in the back corner of the property which is used for on-site vehicle maintenance. Due to the site being very recently constructed it is unlikely that their tanks are leaking. To be cautious, the site is considered to have a potential environmental condition due to the on-site vehicle maintenance and potential for LUSTs. Not listed in EPA databases.

Table 4. Threatened and Endangered Species Potentially Within Study Area

Resource Name	Status	Habitat	Potential for Impact?
Black-footed Ferret (*Mustela nigripes*)	SE	Historically associated with prairie dog colonies and distribution is consistent with distribution of prairie dogs in South Dakota. It's estimated that 100 to 150 acres of prairie dog colony are needed to support one ferret. There are some prairie dog colonies located near the site; however, none are the size required to support Black-footed Ferrets. Therefore, no suitable habitat is likely present.	May affect, but not likely to adversely affect
Northern Long-eared Bat (*Myotis septentrionalis*)	FT, ST	Typically found near water and dense coniferous and riparian forest conditions. Roost sites in exfoliating bark and tree cavities, open buildings, and caves or mines. Winter hibernacula are frequently caves and mines. Habitat is potentially present in riparian areas along Boxelder Creek.	May affect, but not likely to adversely affect
Northern River Otter (*Lontra canadensis*)	ST	Prefers slow-moving rivers and streams with deep pools, abundant riparian vegetation, and plentiful fish; often associated with beaver activity. No suitable habitat is likely present.	No effect
Swift Fox (*Vulpes velox*)	ST	Prefers heavily grazed shortgrass or mixed-grass prairies with open gently rolling topography for high visibility of surrounding area; usually associated with prairie dogs or ground squirrel colonies. Habitat is potentially present.	May affect, but not likely to adversely affect
American Dipper (*Cinclus mexicanus*)	ST	Prefers clean, cold, fast flowing mountain streams with abundant aquatic insects. No suitable habitat is likely present.	No effect
Interior Least Tern (*Sterna antillarum*)	FE, SE	Prefers open areas for feeding and nesting; feeding occurs in the shallow water of lakes, ponds, and rivers located close to nesting areas with an abundance of small fish; nesting habitat is bare or sparsely vegetated sand, shell, and/or gravel beaches, sandbars, islands, and salt flats associated with rivers or lakes. No suitable habitat is likely present.	No effect
Red Knot (*Calidris canutus rufa*)	FT	Heavily migratory bird. When located in the Northern Great Plains on a stopover there is evidence that red knots use inland saline lakes for habitat. Some evidence suggests that they may utilize manmade freshwater habitats.	No effect
Osprey (*Pandion haliaetus*)	ST	Always found near water – rivers, lakes, ponds; large open-top trees used for nesting and roosting. No suitable habitat is likely present.	No effect
Peregrine Falcon (*Falco peregrinus*)	SE	Prefers open grasslands with suitable nesting cliffs and rock outcroppings near a concentrated prey base such as waterfowl or colonial ground squirrels. May be present during migration; however, no suitable habitat is likely present.	May affect, but not likely to adversely affect

Table 4. Threatened and Endangered Species Potentially Within Study Area

Resource Name	Status	Habitat	Potential for Impact?
Whooping Crane (*Grus americana*)	FE, SE	Migration habitat includes marshes and submerged sandbars in rivers with good horizontal visibility, water depth of 12 in or less, and minimum wetland size of 0.1 ac for roosting. No suitable habitat is likely present.	No effect
Longnose Sucker (*Catostomus catostomus*)	ST	Prefers cool, clear, spring-fed streams and lakes. Found in tributaries to the Cheyenne and Belle Fourche River basins. Suitable habitat is potentially present.	May affect, but not likely to adversely affect
Sturgeon Chub (*Macrhybopsis gelida*)	ST	Prefer areas with moderate to strong current on large rivers with rocks, gravel or coarse sand substrates. Found in tributaries to the Cheyenne, White, Grand and Missouri River basins. Suitable habitat is potentially present.	May affect, but not likely to adversely affect
Leedy's roseroot (*Rhodiola integrifolia ssp. leedyi*)	FT	Grows primarily on cool cliffs. Seems to prefer cool air from caves rising from cracks in cliff surfaces. Most populations found on privately owned property.	No effect

Table 5. Noise Abatement Criteria

Activity Category	Activity Description
A	Lands on which serenity and quiet are of extraordinary significance and serve an important public need
B	Residential
C	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios trails and trail crossings.
D	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E	Hotels, motels, office, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical) and warehousing
G	Undeveloped lands that have been permitted for development on or before the date of public Undeveloped lands that are not permitted

Table 6. Noise Sensitive Areas

Location Description	Distance from Project Area	Property Description	SDDOT Land Use Category
I-90/W. Gate Road	Within	Residential Properties	B
East of I-90/W. Gate Road	Adjacent	Boykin Park	C
Between I-90 and Highway 1416 (W. Gate to Ellsworth)	Within	Residential Properties	B
Between I-90 and Highway 1416 (W. Gate to Ellsworth)	Adjacent	Harvest Time Free Will Baptist Church	C
South of Highway 1416	Adjacent	Box Elder Community Park	C
Highway 1416. Liberty Boulevard/Spruce Drive	Adjacent	Residential Neighborhood	B

Table 7. Current and reasonably foreseeable projects

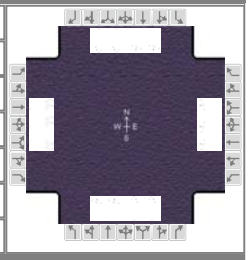
Project Name/Location	Description	Status
SDDOT Projects		
Sheffer St. to Sturgis Road in Rapid City	Urban Grading, Roadway Lighting Storm Sewer, Curb & Gutter, Sidewalk, Traffic Signals, Pedestrian Crossing & PCC Surfacing	Upcoming Project
Bridge Rehabilitation – Rapid City Region	Bridge Rehabilitation	Current and Upcoming Project (ongoing)
Local Agency Projects		
Radar Hill Road	Repair Slide area that occurred on the west side of the new Radar Hill alignment constructed in 2011	Current Project
I-90 Exit 40-44 (Tilford to Piedmont)	Complete reconstruction of the interstate between exits 40-44	Current Project
I-190/Silver Street Interchange	New interchange	Current Project
Railroad Safety Improvements-Rapid City Region	Various Railroad Safety Improvements	Current and Upcoming Project (ongoing)
Box Elder-Pennington Co Rd 14-16, from Exit 63 East to end of the divided section East of Ellsworth Rd	Reconstruct-convert divided section to a 3-lane section; PE	

Table 8. Impacts of Planning Studies on Study Area

Current or Reasonably Foreseeable Future Projects	Potential Impacts within the Study Area
Rapid City Area Metropolitan Planning Organization Transportation Plan Update	The plan will have a beneficial effect on the multi-modal improvements transportation facilities.
Rapid City Railroad Safety/Quiet Zone Feasibility Study	The plan will have a beneficial effect on rail facilities and adjacent land use.
Rapid City Downtown Master Plan	The plan will have a beneficial effect on the overall transportation system.
Rapid City Comprehensive Plan	The plan will have a beneficial effect on the overall transportation system.

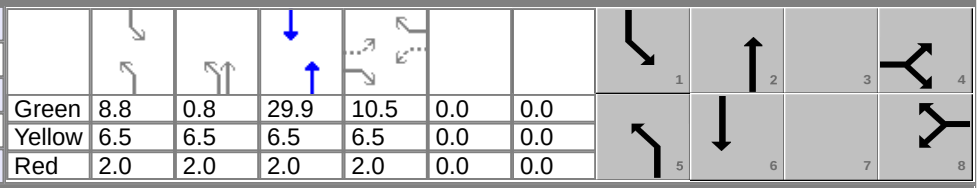
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	7/24/2016	Area Type	Other
Jurisdiction	South Dakota	Time Period	AM Peak	PHF	0.89
Urban Street	Elk Vale	Analysis Year	2016	Analysis Period	1> 7:00
Intersection	Interchange I-90	File Name	1.AM peak Elk Vale and I-90 SPUI .xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	110		0	560		0	520	485		80	550	

Signal Information			
Cycle, s	84.0	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	8.8	0.8	29.9	10.5	0.0	0.0
Yellow	6.5	6.5	6.5	6.5	0.0	0.0
Red	2.0	2.0	2.0	2.0	0.0	0.0

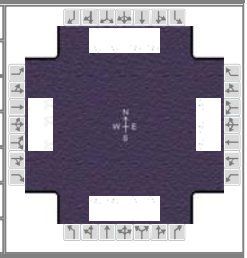
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		5.0		5.0	2.0	4.0	2.0	4.0
Phase Duration, s		19.0		19.0	26.6	47.7	17.3	38.4
Change Period, ($Y+R_c$), s		8.5		8.5	8.5	8.5	8.5	8.5
Max Allow Headway (*MAH*), s		3.0		3.0	3.1	0.0	3.1	0.0
Queue Clearance Time (g_s), s		5.1		12.5	16.7		5.0	
Green Extension Time (g_e), s		1.1		0.0	1.3	0.0	0.2	0.0
Phase Call Probability		1.00		1.00	1.00		0.88	
Max Out Probability		0.29		1.00	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	7		14	3		18	5	2		1	6	
Adjusted Flow Rate (*v*), veh/h	124		0	629		0	584	545		90	618	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1496		1403	1613		1403	1600	1482		1171	1449	
Queue Service Time (g_s), s	3.1		0.0	10.5		0.0	14.7	10.1		3.0	14.7	
Cycle Queue Clearance Time (g_c), s	3.1		0.0	10.5		0.0	14.7	10.1		3.0	14.7	
Green Ratio (*g/C*)	0.12		0.12	0.12		0.12	0.22	0.47		0.10	0.36	
Capacity (*c*), veh/h	545		175	575		175	688	1384		245	1033	
Volume-to-Capacity Ratio (*X*)	0.227		0.000	1.095		0.000	0.849	0.394		0.367	0.598	
Back of Queue (*Q*), ft/ln (50 th percentile)	31		0	285.8		0	144.2	90.3		27.5	142.3	
Back of Queue (*Q*), veh/ln (50 th percentile)	1.1		0.0	11.1		0.0	5.5	3.3		0.8	5.0	
Queue Storage Ratio (*RQ*) (50 th percentile)	0.08		0.00	0.71		0.00	0.48	0.00		0.09	0.00	
Uniform Delay (d_1), s/veh	33.5		0.0	38.2		0.0	31.7	14.6		35.0	22.1	
Incremental Delay (d_2), s/veh	0.1		0.0	66.1		0.0	1.2	0.8		0.3	2.6	
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	33.6		0.0	104.3		0.0	32.8	15.5		35.4	24.7	
Level of Service (LOS)	C			F			C	B		D	C	
Approach Delay, s/veh / LOS	33.6		C	104.3		F	24.4		C	26.0		C
Intersection Delay, s/veh / LOS	44.7						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.0	C	2.8	C	2.8	C
Bicycle LOS Score / LOS		F		F	1.4	A	1.1	A

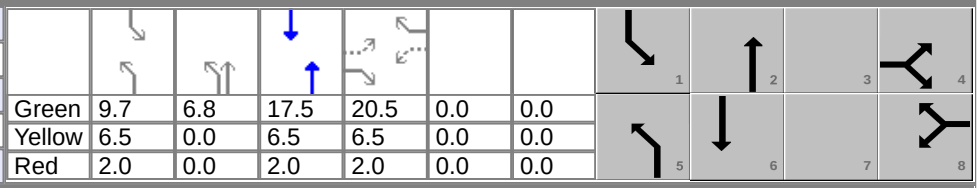
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	7/24/2016	Area Type	Other
Jurisdiction	South Dakota	Time Period	PM Peak	PHF	0.89
Urban Street	Elk Vale	Analysis Year	2016	Analysis Period	1> 7:00
Intersection	Interchange I-90	File Name	1.PM peak Elk Vale and I-90 SPUI .xus		
Project Description	I-90 Corridor Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400		0	800		0	710	830		140	640	

Signal Information			
Cycle, s	80.0	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	9.7	6.8	17.5	20.5	0.0	0.0
Yellow	6.5	0.0	6.5	6.5	0.0	0.0
Red	2.0	0.0	2.0	2.0	0.0	0.0

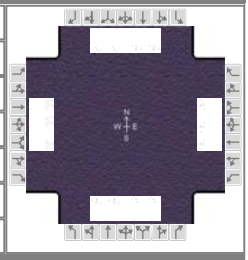
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		5.0		5.0	2.0	4.0	2.0	4.0
Phase Duration, s		29.0		29.0	25.0	32.8	18.2	26.0
Change Period, ($Y+R_c$), s		8.5		8.5	8.5	8.5	8.5	8.5
Max Allow Headway (*MAH*), s		3.0		3.0	3.1	0.0	3.1	0.0
Queue Clearance Time (g_s), s		11.8		22.5	18.5		5.5	
Green Extension Time (g_e), s		2.6		0.0	0.0	0.0	0.2	0.0
Phase Call Probability		1.00		1.00	1.00		0.97	
Max Out Probability		0.19		1.00	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	7		14	3		18	5	2		1	6	
Adjusted Flow Rate (*v*), veh/h	449		0	899		0	798	933		157	719	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1548		1403	1639		1403	1626	1654		1639	1636	
Queue Service Time (g_s), s	9.8		0.0	20.5		0.0	16.5	21.9		3.5	17.5	
Cycle Queue Clearance Time (g_c), s	9.8		0.0	20.5		0.0	16.5	21.9		3.5	17.5	
Green Ratio (*g/C*)	0.26		0.26	0.26		0.26	0.21	0.30		0.12	0.22	
Capacity (*c*), veh/h	973		360	1020		360	671	1005		397	716	
Volume-to-Capacity Ratio (*X*)	0.462		0.000	0.881		0.000	1.190	0.928		0.396	1.005	
Back of Queue (*Q*), ft/ln (50 th percentile)	94.6		0	240.7		0	394.7	258.8		34.8	253.5	
Back of Queue (*Q*), veh/ln (50 th percentile)	3.5		0.0	9.5		0.0	15.4	10.2		1.4	10.0	
Queue Storage Ratio (*RQ*) (50 th percentile)	0.24		0.00	0.60		0.00	1.32	0.00		0.12	0.00	
Uniform Delay (d_1), s/veh	25.8		0.0	30.1		0.0	31.8	27.0		32.4	31.3	
Incremental Delay (d_2), s/veh	0.1		0.0	8.8		0.0	99.8	15.6		0.2	34.8	
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	25.9		0.0	38.9		0.0	131.5	42.6		32.7	66.1	
Level of Service (LOS)	C			D			F	D		C	F	
Approach Delay, s/veh / LOS	25.9	C		38.9	D		83.6	F		60.1	E	
Intersection Delay, s/veh / LOS	61.7						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	2.8	C	2.8	C
Bicycle LOS Score / LOS		F		F	1.9	B	1.2	A

HCS7 Signalized Intersection Results Summary

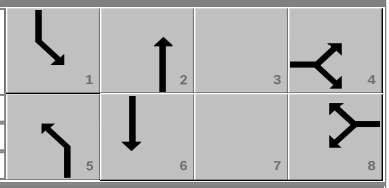
General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	7/24/2016	Area Type	Other
Jurisdiction		Time Period		PHF	0.89
Urban Street	Elk Vale	Analysis Year	2016	Analysis Period	1> 7:00
Intersection	Interchange I-90	File Name	PM peak Elk Vale and I-90 SPUI 2045.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400		0	800		0	710	830		140	640	

Signal Information			
Cycle, s	120.0	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	7.0	23.0	25.0	37.0	0.0	0.0	
Yellow	5.0	5.0	5.0	5.0	0.0	0.0	
Red	2.0	2.0	2.0	2.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		5.0		5.0	2.0	4.0	2.0	4.0
Phase Duration, s		44.0		44.0	44.0	62.0	14.0	32.0
Change Period, ($Y+R_c$), s		7.0		7.0	7.0	7.0	7.0	7.0
Max Allow Headway (*MAH*), s		3.0		3.0	3.1	0.0	3.1	0.0
Queue Clearance Time (g_s), s		14.8		30.0	27.1		7.4	
Green Extension Time (g_e), s		3.4		2.3	1.7	0.0	0.0	0.0
Phase Call Probability		1.00		1.00	1.00		1.00	
Max Out Probability		0.00		0.32	0.04		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	7		14	3		18	5	2		1	6	
Adjusted Flow Rate (*v*), veh/h	449		0	899		0	798	933		157	719	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1634		1481	1730		1481	1716	1791		1730	1760	
Queue Service Time (g_s), s	12.8		0.0	28.0		0.0	25.1	22.9		5.4	24.4	
Cycle Queue Clearance Time (g_c), s	12.8		0.0	28.0		0.0	25.1	22.9		5.4	24.4	
Green Ratio (*g/C*)	0.31		0.31	0.31		0.31	0.31	0.46		0.06	0.21	
Capacity (*c*), veh/h	1127		457	1187		457	1058	1641		202	733	
Volume-to-Capacity Ratio (*X*)	0.399		0.000	0.758		0.000	0.754	0.568		0.780	0.981	
Back of Queue (*Q*), ft/ln (50 th percentile)	143.1		0	323.8		0	284	247.5		77.1	341.7	
Back of Queue (*Q*), veh/ln (50 th percentile)	5.3		0.0	12.7		0.0	11.1	9.7		3.0	13.5	
Queue Storage Ratio (*RQ*) (50 th percentile)	0.36		0.00	0.81		0.00	0.95	0.00		0.26	0.00	
Uniform Delay (d_1), s/veh	33.1		0.0	38.4		0.0	37.4	23.8		55.7	47.3	
Incremental Delay (d_2), s/veh	1.1		0.0	4.5		0.0	5.0	1.4		25.2	28.8	
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	34.2		0.0	42.9		0.0	42.4	25.2		80.9	76.1	
Level of Service (LOS)	C			D			D	C		F	E	
Approach Delay, s/veh / LOS	34.2	C		42.9	D		33.1	C		77.0	E	
Intersection Delay, s/veh / LOS	45.2						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.0	C	2.8	C	2.9	C
Bicycle LOS Score / LOS		F		F	1.9	B	1.2	A

HCS7 Two-Way Stop-Control Report

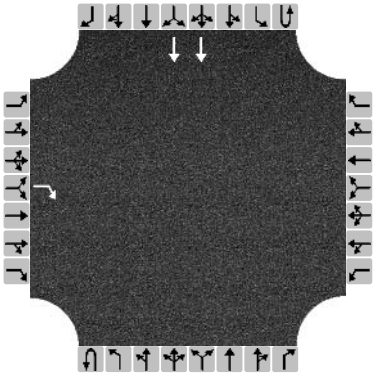
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	EB Off Right Turn / Elk V
Jurisdiction	
East/West Street	EB I-90 Off Ramp Right
North/South Street	Elk Vale
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	0	0	0	0	0	0	0	2	0
Configuration				R											T	
Volume, V (veh/h)				720											550	
Percent Heavy Vehicles (%)				3												
Proportion Time Blocked				0.317											0.000	
Percent Grade (%)	0															
Right Turn Channelized	Yes				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				783												
Capacity, c (veh/h)				738												
v/c Ratio				1.06												
95% Queue Length, Q_{95} (veh)				20.1												
Control Delay (s/veh)				73.6												
Level of Service, LOS				F												
Approach Delay (s/veh)	73.6															
Approach LOS	F															

HCS7 Two-Way Stop-Control Report

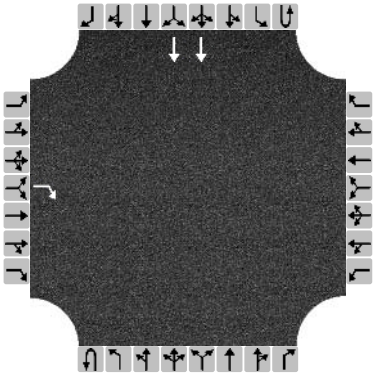
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	EB Off Right Turn / Elk V
Jurisdiction	
East/West Street	EB I-90 Off Ramp Right
North/South Street	Elk Vale
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	0	0	0	0	0	0	0	2	0
Configuration				R											T	
Volume, V (veh/h)				700											640	
Percent Heavy Vehicles (%)				3												
Proportion Time Blocked				0.325											0.000	
Percent Grade (%)		0														
Right Turn Channelized		Yes				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				761												
Capacity, c (veh/h)				730												
v/c Ratio				1.04												
95% Queue Length, Q_{95} (veh)				19.0												
Control Delay (s/veh)				68.6												
Level of Service, LOS				F												
Approach Delay (s/veh)		68.6														
Approach LOS		F														

HCS7 Two-Way Stop-Control Report

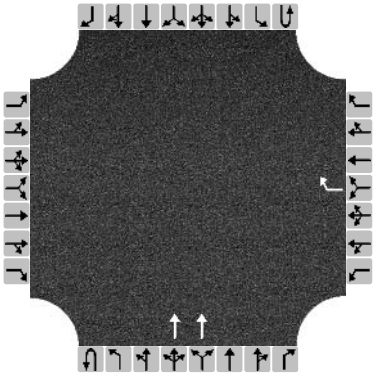
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	WB Off Right Turn / Elk V
Jurisdiction	
East/West Street	WB I-90 Off Ramp Right
North/South Street	Elk Vale
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	0	0	0	0	0
Configuration								R			T					
Volume, V (veh/h)								145			485					
Percent Heavy Vehicles (%)								3								
Proportion Time Blocked								0.133			0.000					
Percent Grade (%)						0										
Right Turn Channelized		No				Yes				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)								6.9								
Critical Headway (sec)								6.96								
Base Follow-Up Headway (sec)								3.3								
Follow-Up Headway (sec)								3.33								

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								158								
Capacity, c (veh/h)								937								
v/c Ratio								0.17								
95% Queue Length, Q_{95} (veh)								0.6								
Control Delay (s/veh)								9.6								
Level of Service, LOS								A								
Approach Delay (s/veh)						9.6										
Approach LOS						A										

HCS7 Two-Way Stop-Control Report

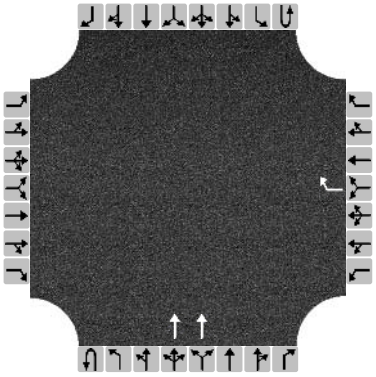
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	WB Off Right Turn / Elk V
Jurisdiction	
East/West Street	WB I-90 Off Ramp Right
North/South Street	Elk Vale
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	0	0	0	0	0
Configuration								R			T					
Volume, V (veh/h)								270			830					
Percent Heavy Vehicles (%)								3								
Proportion Time Blocked								0.158			0.000					
Percent Grade (%)						0										
Right Turn Channelized		No				Yes				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)								6.9								
Critical Headway (sec)								6.96								
Base Follow-Up Headway (sec)								3.3								
Follow-Up Headway (sec)								3.33								

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								293								
Capacity, c (veh/h)								910								
v/c Ratio								0.32								
95% Queue Length, Q_{95} (veh)								1.4								
Control Delay (s/veh)								10.8								
Level of Service, LOS								B								
Approach Delay (s/veh)						10.8										
Approach LOS						B										

HCS7 Two-Way Stop-Control Report

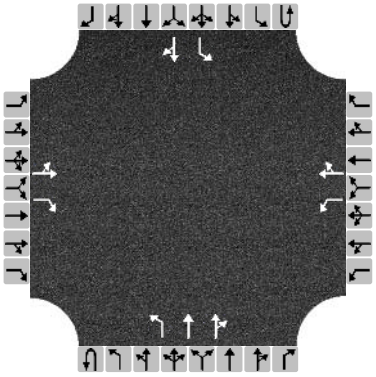
General Information

Analyst	
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	

Site Information

Intersection	Elk Vale Rd & Mall Dr
Jurisdiction	
East/West Street	Mall Dr
North/South Street	Elk Vale Rd
Peak Hour Factor	0.84
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	1		1	1	0	0	1	2	0	0	1	1	0
Configuration		LT		R		L		TR		L	T	TR		L		TR
Volume, V (veh/h)		10	60	460		470	135	70		380	210	150		115	440	20
Percent Heavy Vehicles (%)		0	0	12		100	100	0		4				0		
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		83		548		560		244		452				137		
Capacity, c (veh/h)				515		0		12		1004				1141		
v/c Ratio				1.06				20.05		0.45				0.12		
95% Queue Length, Q_{95} (veh)				38.1				119.0		2.4				0.4		
Control Delay (s/veh)				198.9				34907.5		11.5				8.6		
Level of Service, LOS				F				F		B				A		
Approach Delay (s/veh)										5.9				1.7		
Approach LOS																

HCS7 Two-Way Stop-Control Report

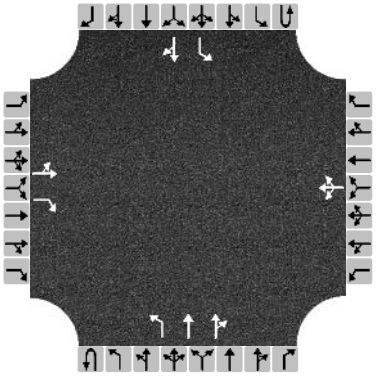
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	

Site Information

Intersection	Elk Vale Rd & Mall Dr
Jurisdiction	
East/West Street	Mall Dr
North/South Street	Elk Vale Rd
Peak Hour Factor	0.71
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	1		0	1	0	0	1	2	0	0	1	1	0
Configuration		LT		R			LTR			L	T	TR		L		TR
Volume, V (veh/h)		80	120	580		410	120	290		650	700	150		60	220	30
Percent Heavy Vehicles (%)		2	0	2		11	0	100		5				0		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

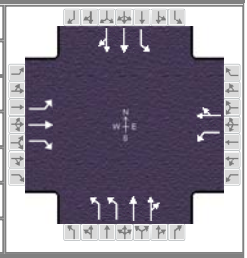
Base Critical Headway (sec)		7.5	6.5	6.2		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.50	6.24		7.72	6.50	8.90		4.20				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.00	3.32		3.61	4.00	4.30		2.25				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		282		817			1154			915				85		
Capacity, c (veh/h)				709						1182				590		
v/c Ratio				1.15						0.77				0.14		
95% Queue Length, Q_{95} (veh)				71.2						9.6				0.5		
Control Delay (s/veh)				318.4						18.2				12.1		
Level of Service, LOS				F						C				B		
Approach Delay (s/veh)										7.9				2.4		
Approach LOS																

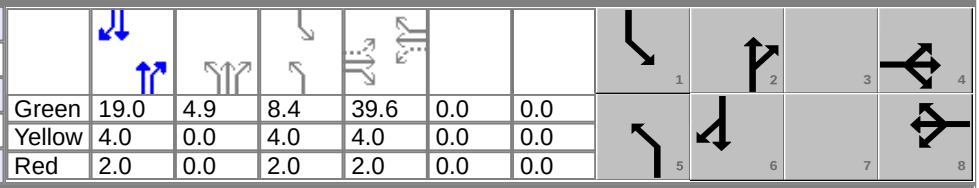
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	10/27/2017	Area Type	Other
Jurisdiction		Time Period		PHF	0.92
Urban Street	Elk Vale	Analysis Year	2017	Analysis Period	1> 7:00
Intersection	Mall Dr	File Name	2. Elk Vale & Mall Dr AM (With Improvements).xus		
Project Description					



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	60	0	470	135	70	380	210	150	115	440	20

Signal Information			
Cycle, s	90.0	Reference Phase	6
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	19.0	4.9	8.4	39.6	0.0	0.0
Yellow	4.0	0.0	4.0	4.0	0.0	0.0
Red	2.0	0.0	2.0	2.0	0.0	0.0

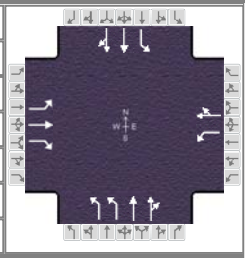
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		5.0		6.0	2.0	4.0	2.0	4.0
Phase Duration, s		45.6		45.6	19.3	29.9	14.4	25.0
Change Period, ($Y+R_c$), s		6.0		6.0	6.0	6.0	6.0	6.0
Max Allow Headway (*MAH*), s		3.3		3.3	3.1	0.0	3.1	0.0
Queue Clearance Time (g_s), s		9.8		40.3	12.6		8.1	
Green Extension Time (g_e), s		1.8		0.0	0.8	0.0	0.7	0.0
Phase Call Probability		1.00		1.00	1.00		0.96	
Max Out Probability		0.00		1.00	0.11		0.15	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	11	65	0	511	223		413	205	186	125	251	249
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1176	1900	1459	1241	1762		1702	1856	1603	1810	1856	1827
Queue Service Time (g_s), s	0.5	1.8	0.0	36.5	7.3		10.6	8.2	8.7	6.1	11.1	11.2
Cycle Queue Clearance Time (g_c), s	7.8	1.8	0.0	38.3	7.3		10.6	8.2	8.7	6.1	11.1	11.2
Green Ratio (*g/C*)	0.44	0.44	0.44	0.44	0.44		0.15	0.27	0.27	0.30	0.21	0.21
Capacity (*c*), veh/h	503	837	643	602	776		505	494	427	169	392	386
Volume-to-Capacity Ratio (*X*)	0.022	0.078	0.000	0.849	0.287		0.818	0.415	0.437	0.740	0.642	0.644
Back of Queue (*Q*), ft/ln (50 th percentile)	3.5	18	0	311	69.4		114.8	97.7	88.7	67.6	143.7	139.3
Back of Queue (*Q*), veh/ln (50 th percentile)	0.1	0.7	0.0	11.4	2.7		4.5	3.8	3.5	2.7	5.6	5.6
Queue Storage Ratio (*RQ*) (50 th percentile)	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	18.6	14.6	0.0	25.7	16.1		37.1	27.3	27.4	39.7	32.4	32.4
Incremental Delay (d_2), s/veh	0.0	0.0	0.0	10.5	0.1		3.3	2.6	3.2	2.4	7.9	8.0
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
Control Delay (*d*), s/veh	18.6	14.6	0.0	36.2	16.2		40.5	29.8	30.7	42.1	40.2	40.5
Level of Service (LOS)	B	B		D	B		D	C	C	D	D	D
Approach Delay, s/veh / LOS	15.2	B		30.1	C		35.5	D		40.7	D	
Intersection Delay, s/veh / LOS	34.5						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.8	C	2.3	B	2.8	C
Bicycle LOS Score / LOS	0.6	A	1.7	B	1.2	A	1.0	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	10/27/2017	Area Type	Other
Jurisdiction	SDDOT	Time Period	PM Peak	PHF	0.92
Urban Street	Elk Vale	Analysis Year	2017	Analysis Period	1> 7:00
Intersection	Mall Dr	File Name	2. Elk Vale & Mall Dr PM (With Improvements).xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	80	20	0	410	120	290	650	700	150	60	220	30

Signal Information			
Cycle, s	90.0	Reference Phase	6
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	19.7	9.0	6.0	33.3	0.0	0.0	5	6	7	8
Yellow	4.0	4.0	4.0	4.0	0.0	0.0				
Red	2.0	2.0	0.0	2.0	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		5.0		6.0	2.0	4.0	1.4	4.0
Phase Duration, s		39.3		39.3	25.0	40.7	10.0	25.7
Change Period, ($Y+R_c$), s		6.0		6.0	6.0	6.0	6.0	6.0
Max Allow Headway (*MAH*), s		3.3		3.3	3.1	0.0	3.1	0.0
Queue Clearance Time (g_s), s		30.2		32.9	20.8		2.0	
Green Extension Time (g_e), s		1.1		0.4	0.0	0.0	0.7	0.0
Phase Call Probability		1.00		1.00	1.00		0.80	
Max Out Probability		0.86		1.00	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	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	87	22	0	446	446		707	477	447	65	137	134
Adjusted Saturation Flow Rate (*s*), veh/h/ln	944	1900	1585	1291	1685		1689	1856	1741	1810	1856	1778
Queue Service Time (g_s), s	7.8	0.7	0.0	30.2	20.4		18.8	19.1	19.1	0.0	5.6	5.8
Cycle Queue Clearance Time (g_c), s	28.2	0.7	0.0	30.9	20.4		18.8	19.1	19.1	0.0	5.6	5.8
Green Ratio (*g/C*)	0.37	0.37	0.37	0.37	0.37		0.43	0.39	0.39	0.26	0.22	0.22
Capacity (*c*), veh/h	216	703	587	548	624		713	715	671	165	406	389
Volume-to-Capacity Ratio (*X*)	0.403	0.031	0.000	0.813	0.715		0.991	0.667	0.667	0.396	0.338	0.346
Back of Queue (*Q*), ft/ln (50 th percentile)	44.7	6.9	0	266.9	201.5		270.7	222.4	205.6	34.1	67.9	65.5
Back of Queue (*Q*), veh/ln (50 th percentile)	1.8	0.3	0.0	9.8	8.1		10.4	8.7	8.2	1.4	2.7	2.6
Queue Storage Ratio (*RQ*) (50 th percentile)	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	36.3	18.1	0.0	27.9	24.3		35.4	22.9	22.9	41.1	29.7	29.7
Incremental Delay (d_2), s/veh	0.5	0.0	0.0	8.2	3.2		31.3	4.9	5.2	0.6	2.2	2.4
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	36.8	18.1	0.0	36.1	27.4		66.7	27.8	28.1	41.6	31.9	32.1
Level of Service (LOS)	D	B		D	C		E	C	C	D	C	C
Approach Delay, s/veh / LOS	33.1	C		31.8	C		44.7	D		33.9	C	
Intersection Delay, s/veh / LOS	39.2						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.8	C	2.3	B	2.8	C
Bicycle LOS Score / LOS	0.7	A	2.0	B	1.8	B	0.8	A

HCS7 Two-Way Stop-Control Report

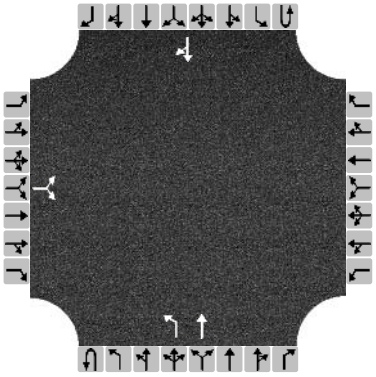
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	I-90 Service Rd & W Gate
Jurisdiction	
East/West Street	I-90 Service Rd
North/South Street	W Gate Rd
Peak Hour Factor	0.84
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LR							L	T					TR
Volume, V (veh/h)		60		130						120	185				280	95
Percent Heavy Vehicles (%)		0		0						0						
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			226							143						
Capacity, c (veh/h)			458							1125						
v/c Ratio			0.49							0.13						
95% Queue Length, Q_{95} (veh)			2.9							0.4						
Control Delay (s/veh)			20.4							8.7						
Level of Service, LOS			C							A						
Approach Delay (s/veh)		20.4								3.4						
Approach LOS		C														

HCS7 Two-Way Stop-Control Report

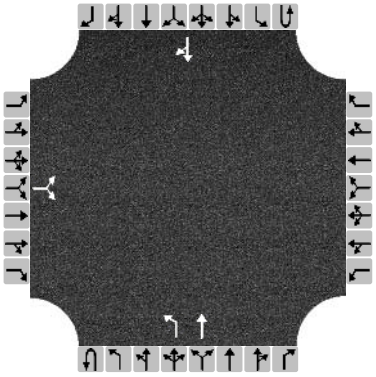
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	I-90 Service Rd & W Gate
Jurisdiction	
East/West Street	I-90 Service Rd
North/South Street	W Gate Rd
Peak Hour Factor	0.83
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LR							L	T					TR
Volume, V (veh/h)		90		90						200	330				110	100
Percent Heavy Vehicles (%)		0		0						0						
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			216							241						
Capacity, c (veh/h)			326							1324						
v/c Ratio			0.66							0.18						
95% Queue Length, Q_{95} (veh)			5.4							0.7						
Control Delay (s/veh)			37.1							8.3						
Level of Service, LOS			E							A						
Approach Delay (s/veh)		37.1								3.1						
Approach LOS		E														

HCS7 Two-Way Stop-Control Report

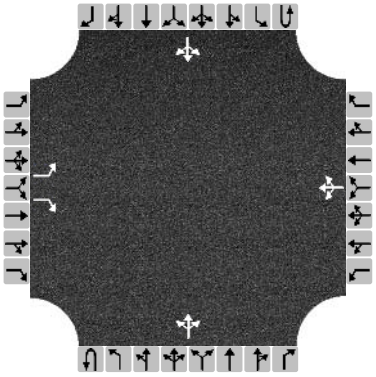
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	West Gate & Bluebird
Jurisdiction	
East/West Street	Bluebird Dr
North/South Street	West Gate
Peak Hour Factor	0.79
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	1	0	0	0	1	0	0	0	1	0
Configuration		L		R			LTR				LTR				LTR	
Volume, V (veh/h)		1		60		220	1	0		55	100	90		5	95	1
Percent Heavy Vehicles (%)		0		6		3	100	3		0				25		
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		1		76			279			70				6		
Capacity, c (veh/h)		492		922			423			1479				1200		
v/c Ratio		0.00		0.08			0.66			0.05				0.01		
95% Queue Length, Q_{95} (veh)		0.0		0.3			5.4			0.1				0.0		
Control Delay (s/veh)		12.3		9.3			29.6			7.6				8.0		
Level of Service, LOS		B		A			D			A				A		
Approach Delay (s/veh)		9.3				29.6				2.0				0.4		
Approach LOS		A				D										

HCS7 Two-Way Stop-Control Report

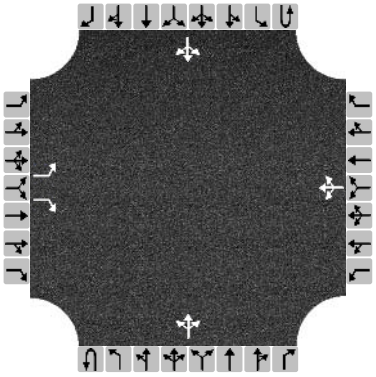
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	West Gate & Bluebird
Jurisdiction	
East/West Street	Bluebird Dr
North/South Street	West Gate
Peak Hour Factor	0.86
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	1	0	0	0	1	0	0	0	1	0
Configuration		L		R			LTR				LTR				LTR	
Volume, V (veh/h)		4		20		90	0	1		60	180	180		4	100	1
Percent Heavy Vehicles (%)		0		0		2	0	0		0				0		
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		5		23			106			70				5		
Capacity, c (veh/h)		406		942			388			1484				1152		
v/c Ratio		0.01		0.02			0.27			0.05				0.00		
95% Queue Length, Q_{95} (veh)		0.0		0.1			1.1			0.1				0.0		
Control Delay (s/veh)		14.0		8.9			17.7			7.5				8.1		
Level of Service, LOS		B		A			C			A				A		
Approach Delay (s/veh)		9.8				17.7				1.5				0.4		
Approach LOS		A				C										

HCS7 Two-Way Stop-Control Report

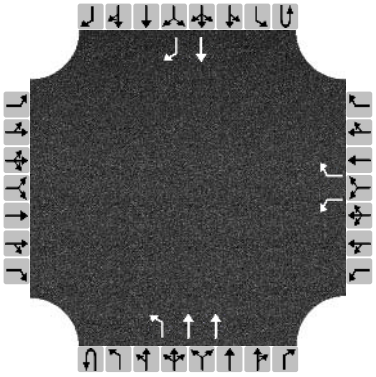
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Liberty and I-90 N Ramp
Jurisdiction	
East/West Street	I-90 Ramp
North/South Street	Liberty
Peak Hour Factor	0.84
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	1	2	0	0	0	1	1
Configuration						L		R		L	T				T	R
Volume, V (veh/h)						10		52		210	955				165	700
Percent Heavy Vehicles (%)						0		31		4						
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						12		62		250						
Capacity, c (veh/h)						36		399		659						
v/c Ratio						0.33		0.16		0.38						
95% Queue Length, Q_{95} (veh)						1.3		0.5		1.8						
Control Delay (s/veh)						152.1		15.7		13.8						
Level of Service, LOS						F		C		B						
Approach Delay (s/veh)						37.8				2.5						
Approach LOS						E										

HCS7 Two-Way Stop-Control Report

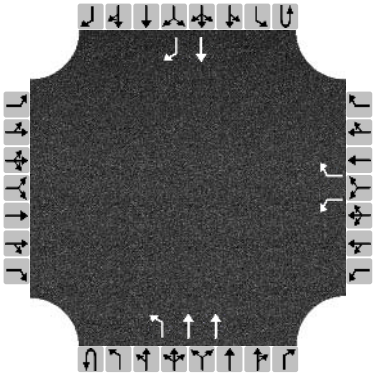
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Liberty and I-90 N Ramp
Jurisdiction	
East/West Street	I-90 Ramp
North/South Street	Liberty
Peak Hour Factor	0.95
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	1	2	0	0	0	1	1
Configuration						L		R		L	T				T	R
Volume, V (veh/h)						25		75		80	520				115	1080
Percent Heavy Vehicles (%)						38		46		7						
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						26		79		84						
Capacity, c (veh/h)						94		607		522						
v/c Ratio						0.28		0.13		0.16						
95% Queue Length, Q_{95} (veh)						1.1		0.4		0.6						
Control Delay (s/veh)						57.5		11.8		13.2						
Level of Service, LOS						F		B		B						
Approach Delay (s/veh)						23.1				1.8						
Approach LOS						C										

HCS7 Two-Way Stop-Control Report

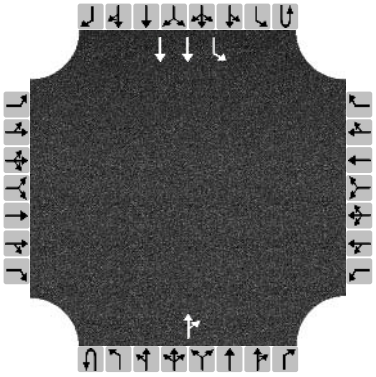
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Liberty & I90 EB On Ramp
Jurisdiction	
East/West Street	I90 EB On Ramp
North/South Street	Liberty
Peak Hour Factor	0.74
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	1	0	0	1	2	0
Configuration												TR		L	T	
Volume, V (veh/h)											465	15		125	70	
Percent Heavy Vehicles (%)														42		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														169		
Capacity, c (veh/h)														708		
v/c Ratio														0.24		
95% Queue Length, Q_{95} (veh)														0.9		
Control Delay (s/veh)														11.7		
Level of Service, LOS														B		
Approach Delay (s/veh)													7.5			
Approach LOS																

HCS7 Two-Way Stop-Control Report

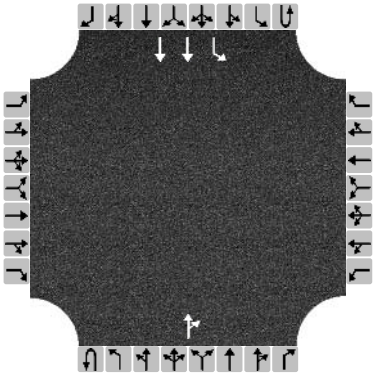
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Liberty & I90 EB On Ramp
Jurisdiction	
East/West Street	I90 EB On Ramp
North/South Street	Liberty
Peak Hour Factor	0.87
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	1	0	0	1	2	0
Configuration												TR		L	T	
Volume, V (veh/h)											160	11		50	200	
Percent Heavy Vehicles (%)														26		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														57		
Capacity, c (veh/h)														1215		
v/c Ratio														0.05		
95% Queue Length, Q_{95} (veh)														0.1		
Control Delay (s/veh)														8.1		
Level of Service, LOS														A		
Approach Delay (s/veh)														1.6		
Approach LOS																

HCS7 Two-Way Stop-Control Report

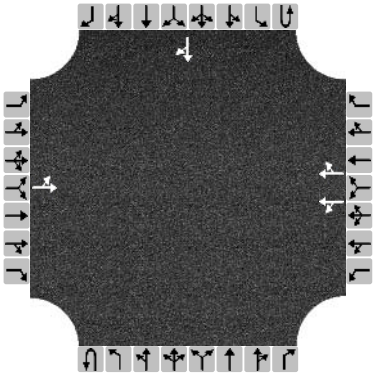
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Ellsworth and W 1416
Jurisdiction	
East/West Street	1416 W
North/South Street	Ellsworth
Peak Hour Factor	0.87
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	2	0	0	0	0	0	0	0	1	0
Configuration		LT				LT		TR								TR
Volume, V (veh/h)		860	120			0	45	25							40	400
Percent Heavy Vehicles (%)		2	1			3	6	50								
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		1127				26		55								
Capacity, c (veh/h)		951				464		637								
v/c Ratio		1.18				0.06		0.09								
95% Queue Length, Q_{95} (veh)		104.2				0.2		0.3								
Control Delay (s/veh)		364.4				13.2		11.2								
Level of Service, LOS		F				B		B								
Approach Delay (s/veh)		364.4				12.0										
Approach LOS		F				B										

HCS7 Two-Way Stop-Control Report

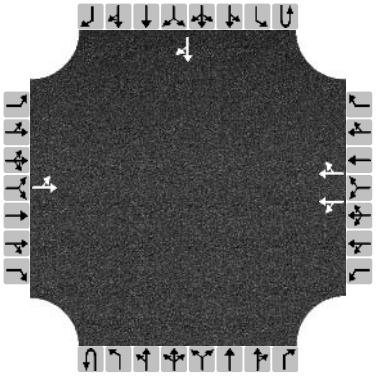
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Ellsworth and W 1416
Jurisdiction	
East/West Street	1416 W
North/South Street	Ellsworth
Peak Hour Factor	0.98
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	2	0	0	0	0	0	0	0	1	0
Configuration		LT				LT		TR								TR
Volume, V (veh/h)		455	115			3	60	20							120	500
Percent Heavy Vehicles (%)		3	0			0	10	14								
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

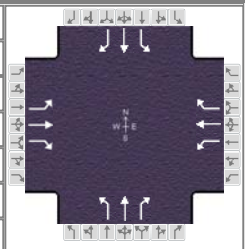
Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		581				34		51								
Capacity, c (veh/h)		874				397		516								
v/c Ratio		0.66				0.08		0.10								
95% Queue Length, Q_{95} (veh)		5.7				0.3		0.3								
Control Delay (s/veh)		17.2				14.9		12.7								
Level of Service, LOS		C				B		B								
Approach Delay (s/veh)	17.2				13.8											
Approach LOS	C				B											

HCS 2010 Signalized Intersection Results Summary

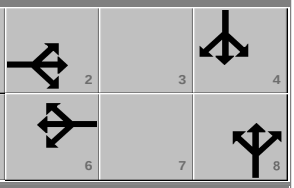
General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	10/28/2017	Area Type	Other
Jurisdiction	SDDOT	Time Period	AM Peak	PHF	0.92
Urban Street	County Highway 1416	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Ellesworth Road	File Name	8. Ellsworth & 1416 AM.xus		
Project Description	I-90 Corridor Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	713	112	28	0	45	26	117	113	20	9	30	0

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

	1	2	3	4	5	6	7	8
Green	0.0	0.0	0.0	0.0	0.0	0.0		
Yellow	0.0	0.0	0.0	0.0	0.0	0.0		
Red	0.0	0.0	0.0	0.0	0.0	0.0		



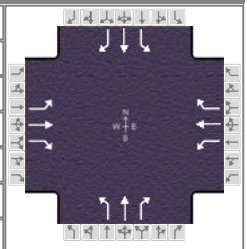
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		5.0		5.0		5.0		5.0
Phase Duration, s		72.1		72.1		17.9		17.9
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		0.0		0.0		0.0		0.0
Queue Clearance Time (g_s), s		0.0		0.0		0.0		0.0
Green Extension Time (g_e), s		0.0		0.0		0.0		0.0
Phase Call Probability		0.00		0.00		0.00		0.00
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	0	0	0	0	0	0	0	0	0	0	0	0
Adjusted Saturation Flow Rate (*s*), veh/h/ln	0	0	0	0	0	0	0	0	0	0	0	0
Queue Service Time (g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Queue Clearance Time (g_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Green Ratio (*g/C*)	0.73	0.73	0.73	0.73	0.73	0.73	0.13	0.13	0.13	0.13	0.13	0.13
Capacity (*c*), veh/h	1062	1368	1159	80	1368	1159	240	246	209	170	246	209
Volume-to-Capacity Ratio (*X*)	0.730	0.089	0.026	0.000	0.036	0.024	0.529	0.499	0.104	0.058	0.132	0.000
Back of Queue (*Q*), ft/ln (50 th percentile)	193.8	12.1	2.9	0	4.6	2.7	67.8	62.3	10.4	5	15.6	0
Back of Queue (*Q*), veh/ln (50 th percentile)	7.6	0.5	0.1	0.0	0.2	0.1	2.7	2.5	0.4	0.2	0.6	0.0
Queue Storage Ratio (*RQ*) (50 th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	7.9	3.4	3.2	0.0	3.3	3.2	38.7	36.3	34.4	39.1	34.5	0.0
Incremental Delay (d_2), s/veh	4.4	0.1	0.0	0.0	0.0	0.0	0.7	0.6	0.1	0.1	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	12.3	3.5	3.3	0.0	3.3	3.3	39.4	36.9	34.4	39.2	34.6	0.0
Level of Service (LOS)	B	A	A		A	A	D	D	C	D	C	
Approach Delay, s/veh / LOS	10.8	B		3.3	A		37.8	D		35.6	D	
Intersection Delay, s/veh / LOS	16.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.4	B	2.5	B	2.5	B
Bicycle LOS Score / LOS	2.0	B	0.6	A	0.9	A	0.6	A

HCS 2010 Signalized Intersection Results Summary

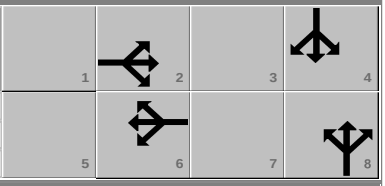
General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	10/28/2017	Area Type	Other
Jurisdiction	SDDOT	Time Period	AM Peak	PHF	0.92
Urban Street	County Highway 1416	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Ellesworth Road	File Name	8. Ellsworth & 1416 PM.xus		
Project Description	I-90 Corridor Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	345	118	175	3	60	20	90	100	20	43	80	0

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

	1	2	3	4	5	6	7	8
Green	0.0	0.0	0.0	0.0	0.0	0.0		
Yellow	0.0	0.0	0.0	0.0	0.0	0.0		
Red	0.0	0.0	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		5.0		5.0		5.0		5.0
Phase Duration, s		72.1		72.1		17.9		17.9
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		0.0		0.0		0.0		0.0
Queue Clearance Time (g_s), s		0.0		0.0		0.0		0.0
Green Extension Time (g_e), s		0.0		0.0		0.0		0.0
Phase Call Probability		0.00		0.00		0.00		0.00
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	0	0	0	0	0	0	0	0	0	0	0	0
Adjusted Saturation Flow Rate (*s*), veh/h/ln	0	0	0	0	0	0	0	0	0	0	0	0
Queue Service Time (g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Queue Clearance Time (g_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Green Ratio (*g/C*)	0.73	0.73	0.73	0.73	0.73	0.73	0.13	0.13	0.13	0.13	0.13	0.13
Capacity (*c*), veh/h	1062	1368	1159	80	1368	1159	240	246	209	170	246	209
Volume-to-Capacity Ratio (*X*)	0.730	0.089	0.026	0.000	0.036	0.024	0.529	0.499	0.104	0.058	0.132	0.000
Back of Queue (*Q*), ft/ln (50 th percentile)	193.8	12.1	2.9	0	4.6	2.7	67.8	62.3	10.4	5	15.6	0
Back of Queue (*Q*), veh/ln (50 th percentile)	7.6	0.5	0.1	0.0	0.2	0.1	2.7	2.5	0.4	0.2	0.6	0.0
Queue Storage Ratio (*RQ*) (50 th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	7.9	3.4	3.2	0.0	3.3	3.2	38.7	36.3	34.4	39.1	34.5	0.0
Incremental Delay (d_2), s/veh	4.4	0.1	0.0	0.0	0.0	0.0	0.7	0.6	0.1	0.1	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	12.3	3.5	3.3	0.0	3.3	3.3	39.4	36.9	34.4	39.2	34.6	0.0
Level of Service (LOS)	B	A	A		A	A	D	D	C	D	C	
Approach Delay, s/veh / LOS	10.8	B		3.3	A		37.8	D		35.6	D	
Intersection Delay, s/veh / LOS	16.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.4	B	2.5	B	2.5	B
Bicycle LOS Score / LOS	2.0	B	0.6	A	0.9	A	0.6	A

HCS7 Two-Way Stop-Control Report

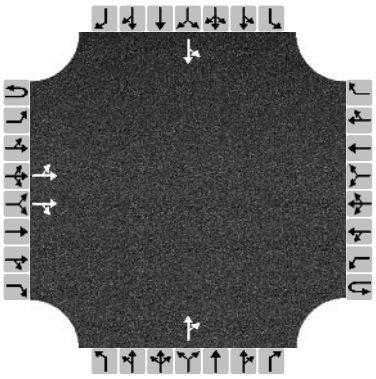
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	I-90 Corridor Study

Site Information

Intersection	Ellsworth and 1416 E
Jurisdiction	
East/West Street	1416 E
North/South Street	Ellsworth
Peak Hour Factor	0.87
Analysis Time Period (hrs)	1.00

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	0	0	0		0	1	0		0	1	0
Configuration		LT		TR								TR		LT		
Volume, V (veh/h)		750	110	40							230	20		10	30	
Percent Heavy Vehicles (%)		2									2	0		50	0	
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									6.5	6.9		7.5	6.5	
Critical Headway (sec)		4.14									6.54	6.90		8.50	6.50	
Base Follow-Up Headway (sec)		2.2									4.0	3.3		3.5	4.0	
Follow-Up Headway (sec)		2.22									4.02	3.30		4.00	4.00	

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		862										287		45		
Capacity, c (veh/h)		1622										32		21		
v/c Ratio		0.53										9.10		2.18		
95% Queue Length, Q_{95} (veh)		3.4										131.0		16.3		
Control Delay (s/veh)		9.7										14820.1		2591.2		
Level of Service, LOS		A										F		F		
Approach Delay (s/veh)		8.1								14820.1				2591.2		
Approach LOS										F				F		

HCS7 Two-Way Stop-Control Report

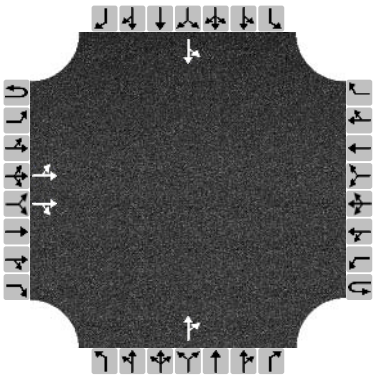
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	I-90 Corridor Study

Site Information

Intersection	Ellsworth and 1416 E
Jurisdiction	
East/West Street	1416 E
North/South Street	Ellsworth
Peak Hour Factor	0.98
Analysis Time Period (hrs)	1.00

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	0	0	0		0	1	0		0	1	0
Configuration		LT		TR								TR		LT		
Volume, V (veh/h)		360	120	190							210	20		43	80	
Percent Heavy Vehicles (%)		3									2	0		0	1	
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		367										234		126		
Capacity, c (veh/h)		1614										198		169		
v/c Ratio		0.23										1.18		0.74		
95% Queue Length, Q_{95} (veh)		0.9										29.8		6.7		
Control Delay (s/veh)		7.9										442.4		81.5		
Level of Service, LOS		A										F		F		
Approach Delay (s/veh)	4.3								442.4				81.5			
Approach LOS									F				F			

HCS7 Two-Way Stop-Control Report

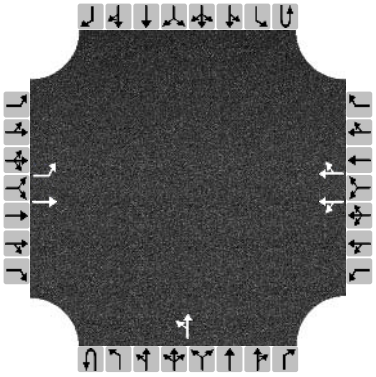
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Commercial Gate & 1416 W
Jurisdiction	
East/West Street	1416 W
North/South Street	Commercial Gate
Peak Hour Factor	0.91
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	2	0	0	0	1	0	0	0	0	0
Configuration		L	T			LT		TR		LT						
Volume, V (veh/h)		38	190			5	540	15		0	403					
Percent Heavy Vehicles (%)		17	5			0	4	67		0						
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		42	209			302		313		0						
Capacity, c (veh/h)		311	505			510		505		1636						
v/c Ratio		0.14	0.41			0.59		0.62		0.00						
95% Queue Length, Q_{95} (veh)		0.5	2.1			4.2		4.6		0.0						
Control Delay (s/veh)		18.4	17.1			22.1		23.5		7.2						
Level of Service, LOS		C	C			C		C		A						
Approach Delay (s/veh)		17.3				22.8				0.0						
Approach LOS		C				C										

HCS7 Two-Way Stop-Control Report

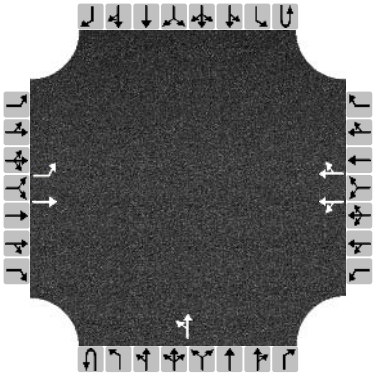
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	Commercial Gate & 1416 W
Jurisdiction	
East/West Street	1416 W
North/South Street	Commercial Gate
Peak Hour Factor	0.90
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	2	0	0	0	1	0	0	0	0	0
Configuration		L	T			LT		TR		LT						
Volume, V (veh/h)		10	500			5	650	20		0	120					
Percent Heavy Vehicles (%)		17	0			0	2	0		0						
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

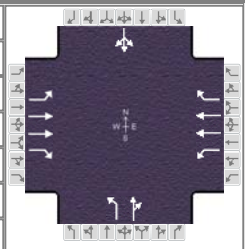
Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		11	556			367		383		0						
Capacity, c (veh/h)		455	762			761		765		1636						
v/c Ratio		0.02	0.73			0.48		0.50		0.00						
95% Queue Length, Q_{95} (veh)		0.1	7.6			2.8		3.0		0.0						
Control Delay (s/veh)		13.1	22.2			14.1		14.4		7.2						
Level of Service, LOS		B	C			B		B		A						
Approach Delay (s/veh)		22.0				14.3				0.0						
Approach LOS		C				B										

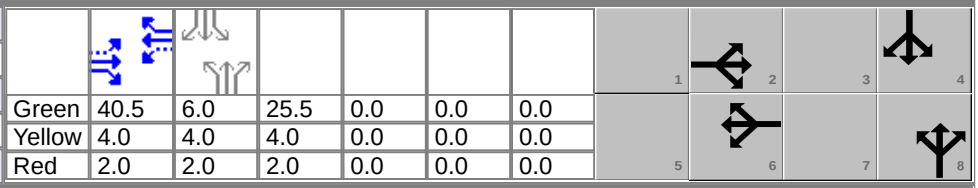
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	10/28/2017	Area Type	Other
Jurisdiction	SDDOT	Time Period	AM Peak	PHF	0.92
Urban Street	County Highway 1416	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Radar Hill Road	File Name	10. Radar Hill & 1416 AM.xus		
Project Description	I-90 Corridor Study				



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	890	85	80	630	20	200	20	355	10	20	50

Signal Information			
Cycle, s	90.0	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	40.5	6.0	25.5	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						

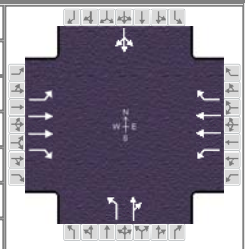
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		5.0		5.0		10.0		12.0
Phase Duration, s		46.5		46.5		31.5		12.0
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		0.0		0.0		3.2		3.2
Queue Clearance Time (g_s), s						24.2		6.6
Green Extension Time (g_e), s		0.0		0.0		1.3		0.1
Phase Call Probability						1.00		0.89
Max Out Probability						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	11	967	92	87	685	22	217	408			87	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	754	1773	1579	579	1773	1579	1774	1592			1665	
Queue Service Time (g_s), s	0.9	18.5	3.1	12.0	11.8	0.7	9.0	22.2			4.6	
Cycle Queue Clearance Time (g_c), s	12.7	18.5	3.1	30.6	11.8	0.7	9.0	22.2			4.6	
Green Ratio (*g/C*)	0.45	0.45	0.45	0.45	0.45	0.45	0.28	0.28			0.07	
Capacity (*c*), veh/h	320	1598	711	221	1598	711	502	451			111	
Volume-to-Capacity Ratio (*X*)	0.034	0.605	0.130	0.393	0.429	0.031	0.433	0.905			0.786	
Back of Queue (*Q*), ft/ln (50 th percentile)	4.3	185.4	27.8	48.6	116.8	6.2	92.7	221.4			50.2	
Back of Queue (*Q*), veh/ln (50 th percentile)	0.2	7.3	1.1	1.9	4.6	0.2	3.6	8.7			2.0	
Queue Storage Ratio (*RQ*) (50 th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			0.00	
Uniform Delay (d_1), s/veh	21.2	18.7	14.4	30.2	16.8	13.8	26.4	31.1			41.4	
Incremental Delay (d_2), s/veh	0.2	1.7	0.4	5.2	0.8	0.1	0.2	5.7			4.6	
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	
Control Delay (*d*), s/veh	21.4	20.4	14.8	35.4	17.7	13.9	26.6	36.8			46.0	
Level of Service (LOS)	C	C	B	D	B	B	C	D			D	
Approach Delay, s/veh / LOS	19.9	B		19.5	B		33.2	C		46.0	D	
Intersection Delay, s/veh / LOS	23.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.3	B	2.1	B	3.0	C	2.9	C
Bicycle LOS Score / LOS	1.4	A	1.1	A	1.5	A	0.6	A

HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	10/28/2017	Area Type	Other
Jurisdiction	SDDOT	Time Period	AM Peak	PHF	0.92
Urban Street	County Highway 1416	Analysis Year	2045	Analysis Period	1> 7:00
Intersection	Radar Hill Road	File Name	10. Radar Hill & 1416 PM.xus		
Project Description	I-90 Corridor Study				



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	650	250	265	860	25	150	40	115	10	5	10

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	58.0	2.5	11.6	0.0	0.0	0.0	5	6	7	8
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		4
Case Number		5.0		5.0		10.0		12.0
Phase Duration, s		64.0		64.0		17.6		8.5
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		0.0		0.0		3.1		3.1
Queue Clearance Time (g_s), s						11.0		3.4
Green Extension Time (g_e), s		0.0		0.0		0.6		0.0
Phase Call Probability						1.00		0.49
Max Out Probability						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	43	707	272	288	935	27	163	168			27	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	597	1773	1579	739	1773	1579	1774	1643			1706	
Queue Service Time (g_s), s	3.4	8.0	6.7	25.6	11.5	0.6	7.9	9.0			1.4	
Cycle Queue Clearance Time (g_c), s	14.9	8.0	6.7	33.6	11.5	0.6	7.9	9.0			1.4	
Green Ratio (*g/C*)	0.64	0.64	0.64	0.64	0.64	0.64	0.13	0.13			0.03	
Capacity (*c*), veh/h	388	2284	1017	490	2284	1017	228	211			47	
Volume-to-Capacity Ratio (*X*)	0.112	0.309	0.267	0.588	0.409	0.027	0.715	0.797			0.581	
Back of Queue (*Q*), ft/ln (50 th percentile)	12	65.2	50.8	110.9	93.8	4.3	86.7	91.9			16.1	
Back of Queue (*Q*), veh/ln (50 th percentile)	0.5	2.6	2.0	4.4	3.7	0.2	3.4	3.6			0.6	
Queue Storage Ratio (*RQ*) (50 th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			0.00	
Uniform Delay (d_1), s/veh	11.4	7.1	6.9	14.6	7.7	5.8	37.6	38.1			43.3	
Incremental Delay (d_2), s/veh	0.6	0.4	0.6	5.1	0.5	0.0	1.6	2.6			4.2	
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	
Control Delay (*d*), s/veh	11.9	7.5	7.5	19.7	8.3	5.9	39.2	40.7			47.5	
Level of Service (LOS)	B	A	A	B	A	A	D	D			D	
Approach Delay, s/veh / LOS	7.7	A		10.9	B		39.9	D		47.5	D	
Intersection Delay, s/veh / LOS	13.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.2	B	2.1	B	3.0	C	3.0	C
Bicycle LOS Score / LOS	1.3	A	1.5	A	1.0	A	0.5	A

Phone: Fax:
E-Mail:

ALL-WAY STOP CONTROL(AWSC) ANALYSIS

Analyst: TSF
Agency/Co.:
Date Performed: 6/27/2016
Analysis Time Period: AM Peak
Intersection: W Gate & 1416 W
Jurisdiction:
Units: U. S. Customary
Analysis Year:
Project ID: I-90 Corridor Study
East/West Street: 1416 W
North/South Street: W Gate

Worksheet 2 - Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	0	0	0	10	610	260	4	45	0	0	210	200
% Thrus Left Lane												

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration			LT	R	LT		TR	
PHF			0.95	0.95	0.95		0.95	
Flow Rate			652	273	51		431	
% Heavy Veh			3	8	0		0	
No. Lanes			2		1		1	
Opposing-Lanes			0		1		1	
Conflicting-lanes			1		2		2	
Geometry group			1		2		2	

Duration, T 1.00 hrs.

Worksheet 3 - Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rates:								
Total in Lane			652	273	51		431	
Left-Turn			10	0	4		0	
Right-Turn			0	273	0		210	
Prop. Left-Turns			0.0	0.0	0.1		0.0	
Prop. Right-Turns			0.0	1.0	0.0		0.5	
Prop. Heavy Vehicle			0.0	0.1	0.0		0.0	
Geometry Group			1		2		2	
Adjustments Exhibit 17-33:								
hLT-adj			0.2		0.2		0.2	

hRT-adj			-0.6		-0.6		-0.6	
hHV-adj			1.7		1.7		1.7	
hadj, computed			0.1	-0.5	0.0		-0.3	

Worksheet 4 - Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow rate			652	273	51		431	
hd, initial value	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
x, initial			0.58	0.24	0.05		0.38	
hd, final value			5.38	4.86	6.68		5.61	
x, final value			0.975	0.369	0.095		0.671	
Move-up time, m			2.0		2.0		2.0	
Service Time			3.4	2.9	4.7		3.6	

Worksheet 5 - Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rate			652	273	51		431	
Service Time			3.4	2.9	4.7		3.6	
Utilization, x			0.975	0.369	0.095		0.671	
Dep. headway, hd			5.38	4.86	6.68		5.61	
Capacity			665	738	567		643	
95% Queue Length								
Delay			85.8	10.7	10.4		19.8	
LOS			F	B	B		C	
Approach:								
Delay				63.7		10.4		19.8
LOS				F		B		C

Intersection Delay 48.3 Intersection LOS E

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

ALL-WAY STOP CONTROL(AWSC) ANALYSIS

Analyst: TSF
Agency/Co.:
Date Performed: 6/27/2016
Analysis Time Period: AM Peak
Intersection: W Gate & 1416 W
Jurisdiction:
Units: U. S. Customary
Analysis Year: 2045
Project ID: I-90 Corridor Study
East/West Street: 1416 W
North/South Street: W Gate

Worksheet 2 - Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	0	0	0	10	690	320	5	210	0	0	110	
% Thrus Left Lane												

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration			LT	R	LT		TR	
PHF			0.94	0.87	0.95		0.76	
Flow Rate			744	367	226		251	
% Heavy Veh			0	0	0		2	
No. Lanes			2		1		1	
Opposing-Lanes			0		1		1	
Conflicting-lanes			1		2		2	
Geometry group			1		2		2	

Duration, T 1.00 hrs.

Worksheet 3 - Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rates:								
Total in Lane			744	367	226		251	
Left-Turn			10	0	5		0	
Right-Turn			0	367	0		107	
Prop. Left-Turns			0.0	0.0	0.0		0.0	
Prop. Right-Turns			0.0	1.0	0.0		0.4	
Prop. Heavy Vehicle			0.0	0.0	0.0		0.0	
Geometry Group			1		2		2	
Adjustments Exhibit 17-33:								
hLT-adj			0.2		0.2		0.2	

hRT-adj			-0.6		-0.6		-0.6	
hHV-adj			1.7		1.7		1.7	
hadj, computed			0.0	-0.6	0.0		-0.2	

Worksheet 4 - Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow rate			744	367	226		251	
hd, initial value	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
x, initial			0.66	0.33	0.20		0.22	
hd, final value			5.38	4.77	6.38		6.11	
x, final value			1.113	0.487	0.400		0.426	
Move-up time, m			2.0		2.0		2.0	
Service Time			3.4	2.8	4.4		4.1	

Worksheet 5 - Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rate			744	367	226		251	
Service Time			3.4	2.8	4.4		4.1	
Utilization, x			1.113	0.487	0.400		0.426	
Dep. headway, hd			5.38	4.77	6.38		6.11	
Capacity			670	749	565		584	
95% Queue Length								
Delay			254.8	12.3	13.6		13.6	
LOS			F	B	B		B	
Approach:								
Delay				174.7		13.6		13.6
LOS				F		B		B
Intersection Delay 126.3				Intersection LOS F				

HCS7 Two-Way Stop-Control Report

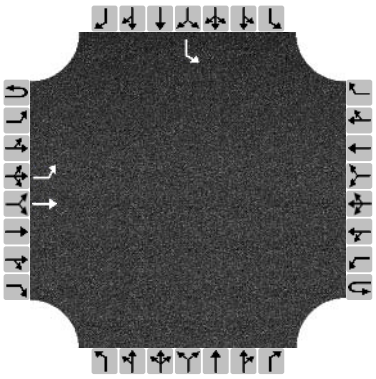
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	I-90 Corridor Study

Site Information

Intersection	SB Left Turn / 1416
Jurisdiction	
East/West Street	County Highway 1416
North/South Street	W. Gate Road
Peak Hour Factor	0.92
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	0	0	0	0	0		0	0	0		1	0	0
Configuration		L	T											L		
Volume, V (veh/h)		50	765											220		
Percent Heavy Vehicles (%)		3												3		
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												7.1		
Critical Headway (sec)		4.13												6.43		
Base Follow-Up Headway (sec)		2.2												3.5		
Follow-Up Headway (sec)		2.23												3.53		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		54												239		
Capacity, c (veh/h)		1614												282		
v/c Ratio		0.03												0.85		
95% Queue Length, Q_{95} (veh)		0.1												7.2		
Control Delay (s/veh)		7.3												61.5		
Level of Service, LOS		A												F		
Approach Delay (s/veh)		0.4												61.5		
Approach LOS														F		

HCS7 Two-Way Stop-Control Report

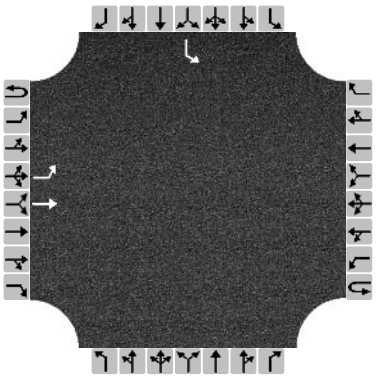
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	I-90 Corridor Study

Site Information

Intersection	SB Left Turn / 1416
Jurisdiction	
East/West Street	County Highway 1416
North/South Street	W. Gate Road
Peak Hour Factor	0.92
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	0	0	0	0	0		0	0	0		1	0	0
Configuration		L	T											L		
Volume, V (veh/h)		215	820											120		
Percent Heavy Vehicles (%)		3												3		
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												7.1		
Critical Headway (sec)		4.13												6.43		
Base Follow-Up Headway (sec)		2.2												3.5		
Follow-Up Headway (sec)		2.23												3.53		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		234												130		
Capacity, c (veh/h)		1614												139		
v/c Ratio		0.14												0.93		
95% Queue Length, Q_{95} (veh)		0.5												6.4		
Control Delay (s/veh)		7.6												120.9		
Level of Service, LOS		A												F		
Approach Delay (s/veh)		1.6												120.9		
Approach LOS														F		

HCS7 Two-Way Stop-Control Report

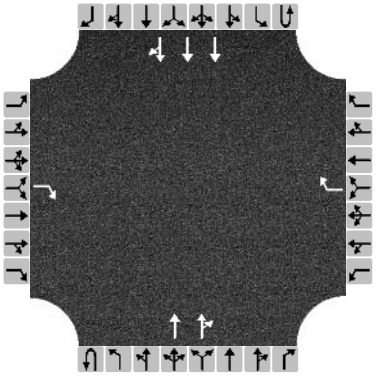
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	S. Service and Elk Vale
Jurisdiction	
East/West Street	Edward St/S. Service Road
North/South Street	Elk Vale
Peak Hour Factor	0.88
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	1	0	0	2	0	0	0	3	0
Configuration				R				R			T	TR			T	TR
Volume, V (veh/h)				20				132			1703	25			1755	74
Percent Heavy Vehicles (%)				11				11								
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				23				150								
Capacity, c (veh/h)				183				212								
v/c Ratio				0.13				0.71								
95% Queue Length, Q_{95} (veh)				0.4				6.1								
Control Delay (s/veh)				27.5				60.5								
Level of Service, LOS				D				F								
Approach Delay (s/veh)	27.5				60.5											
Approach LOS	D				F											

HCS7 Two-Way Stop-Control Report

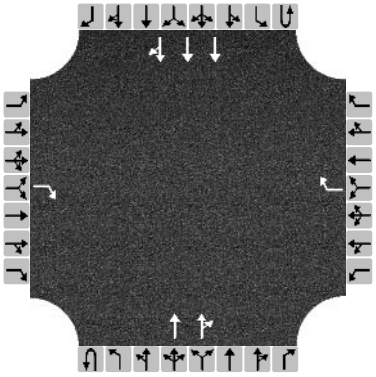
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	S. Service and Elk Vale
Jurisdiction	
East/West Street	Edward St/S. Service Road
North/South Street	Elk Vale
Peak Hour Factor	0.94
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	1	0	0	2	0	0	0	3	0
Configuration				R				R			T	TR			T	TR
Volume, V (veh/h)				43				178			2045	100			2058	67
Percent Heavy Vehicles (%)				0				0								
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				46				189								
Capacity, c (veh/h)				172				181								
v/c Ratio				0.27				1.05								
95% Queue Length, Q_{95} (veh)				1.1				19.1								
Control Delay (s/veh)				33.4				265.1								
Level of Service, LOS				D				F								
Approach Delay (s/veh)	33.4				265.1											
Approach LOS	D				F											

HCS7 Two-Way Stop-Control Report

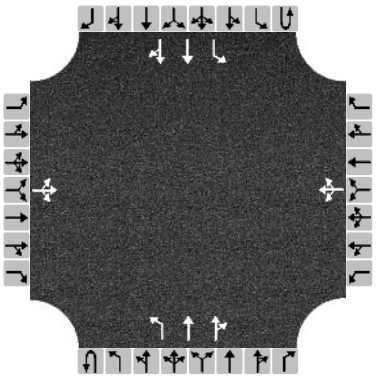
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	S. Service and Elk Vale
Jurisdiction	
East/West Street	Edward St/S. Service Road
North/South Street	Elk Vale
Peak Hour Factor	0.88
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	1	2	0	0	1	2	0
Configuration			LTR				LTR			L	T	TR		L	T	TR
Volume, V (veh/h)		25	10	20		111	10	132		38	1703	25		66	1755	74
Percent Heavy Vehicles (%)		0	0	11		2	0	11		0				4		
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			62				287			43				75		
Capacity, c (veh/h)										271				285		
v/c Ratio										0.16				0.26		
95% Queue Length, Q_{95} (veh)										0.6				1.1		
Control Delay (s/veh)										20.8				22.1		
Level of Service, LOS										C				C		
Approach Delay (s/veh)										0.4				0.8		
Approach LOS																

HCS7 Two-Way Stop-Control Report

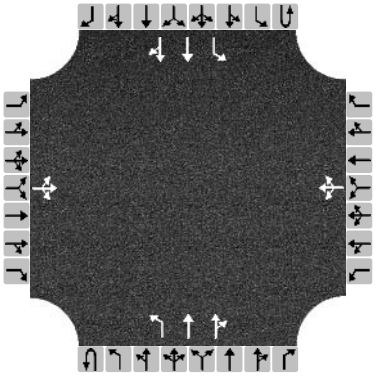
General Information

Analyst	TSF
Agency/Co.	
Date Performed	9/23/2016
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	I-90 Corridor Study

Site Information

Intersection	S. Service and Elk Vale
Jurisdiction	
East/West Street	Edward St/S. Service Road
North/South Street	Elk Vale
Peak Hour Factor	0.94
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	1	2	0	0	1	2	0
Configuration			LTR				LTR			L	T	TR		L	T	TR
Volume, V (veh/h)		45	10	43		110	10	178		20	2045	100		100	2058	67
Percent Heavy Vehicles (%)		9	0	0		2	0	0		0				2		
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)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			105				317			21				106		
Capacity, c (veh/h)										230				219		
v/c Ratio										0.09				0.48		
95% Queue Length, Q_{95} (veh)										0.3				2.7		
Control Delay (s/veh)										22.2				36.6		
Level of Service, LOS										C				E		
Approach Delay (s/veh)										0.2				1.6		
Approach LOS																

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB I-90
From/To:	Exit 60 to Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	1945	veh/h
Peak-hour factor, PHF	0.81	
Peak 15-min volume, v15	600	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	1267	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1267	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	19.5	pc/mi/ln
Level of service, LOS	C	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB I-90
From/To:	Exit 60 to Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	2425	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	659	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	1390	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1390	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	21.4	pc/mi/ln
Level of service, LOS	C	

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1945	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	830	vph
Length of first accel/decel lane	660	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1945	830		vph
Peak-hour factor, PHF	0.81	0.81		
Peak 15-min volume, v15	600	256		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2533	1081	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2533 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2533	4700	No
$v_{FO} = v_F - v_R$	1452	4700	No
v_R	1081	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 2533 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2533	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 20.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D_S = 0.525	
Space mean speed in ramp influence area,	S_R = 52.9	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 52.9	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2425	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1100	vph
Length of first accel/decel lane	660	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2425	1100		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	659	299		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2781	1261	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2781 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2781	4700	No
$v_{FO} = v_F - v_R$	1520	4700	No
v_R	1261	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 2781 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2781	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 22.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D_S = 0.541	
Space mean speed in ramp influence area,	S_R = 52.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 52.5	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1115	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	910	vph
Length of first accel/decel lane	1100	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1115	910		vph
Peak-hour factor, PHF	0.81	0.81		
Peak 15-min volume, v15	344	281		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1452	1185	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1452 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2637	4700	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1452 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2637	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 18.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.298	
Space mean speed in ramp influence area,	S_R = 58.1	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 58.1	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1325	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	840	vph
Length of first accel/decel lane	1100	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1325	840		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	360	228		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1519	963	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1519 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2482	4700	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1519 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2482	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 17.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.291	
Space mean speed in ramp influence area,	S_R = 58.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 58.3	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB I-90
From/To:	Exit 61 to Exit 63
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	2025	veh/h
Peak-hour factor, PHF	0.81	
Peak 15-min volume, v15	625	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	1319	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1319	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	20.3	pc/mi/ln
Level of service, LOS	C	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB I-90
From/To:	Exit 61 to Exit 63
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	2165	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	588	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	1241	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1241	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	19.1	pc/mi/ln
Level of service, LOS	C	

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 63
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2025	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	815	vph
Length of first accel/decel lane	275	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2025	815		vph
Peak-hour factor, PHF	0.81	0.81		
Peak 15-min volume, v15	625	252		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2638	1062	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2638 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2638	4700	No
$v_{FO} = v_F - v_R$	1576	4700	No
v_R	1062	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 2638 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2638	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 24.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, D_S = 0.524

Space mean speed in ramp influence area, S_R = 53.0 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 53.0 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.80

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 63
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2165	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1035	vph
Length of first accel/decel lane	275	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2165	1035		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	588	281		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2483	1187	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2483 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2483	4700	No
$v_{FO} = v_F - v_R$	1296	4700	No
v_R	1187	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 2483 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2483	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 23.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, D_S = 0.535

Space mean speed in ramp influence area, S_R = 52.7 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 52.7 mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB I-90
From/To:	Exit 63 to Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	1210	veh/h
Peak-hour factor, PHF	0.81	
Peak 15-min volume, v15	373	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	788	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	788	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	12.1	pc/mi/ln
Level of service, LOS	B	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB I-90
From/To:	Exit 63 to Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	1130	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	307	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	648	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	648	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	10.0	pc/mi/ln
Level of service, LOS	A	

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 67A
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1210	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	20	vph
Length of first accel/decel lane	325	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1210	20		vph
Peak-hour factor, PHF	0.81	0.81		
Peak 15-min volume, v15	373	6		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1576	26	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1576 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1576	4700	No
$v_{FO} = v_F - v_R$	1550	4700	No
v_R	26	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1576 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1576	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D$ = 14.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.430

Space mean speed in ramp influence area, S_R = 55.1 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 55.1 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 67A
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1130	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	110	vph
Length of first accel/decel lane	325	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1130	110		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	307	30		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1296	126	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1296 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1296	4700	No
$v_{FO} = v_F - v_R$	1170	4700	No
v_R	126	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 1296 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1296	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 12.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D_S = 0.439	
Space mean speed in ramp influence area,	S_R = 54.9	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.9	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 67B
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1190	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	710	vph
Length of first accel/decel lane	675	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1190	710		vph
Peak-hour factor, PHF	0.81	0.81		
Peak 15-min volume, v15	367	219		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1550	925	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1550 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1550	4700	No
$v_{FO} = v_F - v_R$	625	4700	No
v_R	925	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1550 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1550	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 11.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.511

Space mean speed in ramp influence area, S_R = 53.2 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 53.2 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 67B
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1020	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	440	vph
Length of first accel/decel lane	675	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1020	440		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	277	120		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1170	505	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1170 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1170	4700	No
$v_{FO} = v_F - v_R$	665	4700	No
v_R	505	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 1170 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1170	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 8.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	D_S = 0.473	
Space mean speed in ramp influence area,	S_R = 54.1	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.1	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	480	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	15	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	480	15		vph
Peak-hour factor, PHF	0.81	0.81		
Peak 15-min volume, v15	148	5		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	625	20	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 625 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	645	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 625 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	645	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 5.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	M_S = 0.272	
Space mean speed in ramp influence area,	S_R = 58.7	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 58.7	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 EB
Junction:	Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	580	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	11	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	580	11		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	158	3		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	665	13	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 665 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	678	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 665 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	678	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 5.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	M_S = 0.273	
Space mean speed in ramp influence area,	S_R = 58.7	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 58.7	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB I-90
From/To:	Exit 67 to Pull Off
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	480	veh/h
Peak-hour factor, PHF	0.81	
Peak 15-min volume, v15	148	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	313	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	313	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	4.8	pc/mi/ln
Level of service, LOS	A	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB I-90
From/To:	East of Exit 67
Jurisdiction:	SDDOT
Analysis Year:	
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	580	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	158	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	333	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	333	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	5.1	pc/mi/ln
Level of service, LOS	A	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB I-90
From/To:	East of Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	470	veh/h
Peak-hour factor, PHF	0.84	
Peak 15-min volume, v15	140	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	295	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	295	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	4.5	pc/mi/ln
Level of service, LOS	A	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB I-90
From/To:	East of Exit 67
Jurisdiction:	SDDOT
Analysis Year:	
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	740	veh/h
Peak-hour factor, PHF	0.89	
Peak 15-min volume, v15	208	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	439	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	439	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	6.8	pc/mi/ln
Level of service, LOS	A	

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	472	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	62	vph
Length of first accel/decel lane	350	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	472	62		vph
Peak-hour factor, PHF	0.84	0.84		
Peak 15-min volume, v15	140	18		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	593	78	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 593 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	593	4700	No
$v_{FO} = v_F - v_R$	515	4700	No
v_R	78	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 593 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	593	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 6.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, D_S = 0.435

Space mean speed in ramp influence area, S_R = 55.0 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 55.0 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	7
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	744	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	100	vph
Length of first accel/decel lane	350	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	744	100		vph
Peak-hour factor, PHF	0.89	0.89		
Peak 15-min volume, v15	209	28		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	882	119	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 882 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	882	4700	No
$v_{FO} = v_F - v_R$	763	4700	No
v_R	119	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 882 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	882	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 8.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, D_S = 0.439

Space mean speed in ramp influence area, S_R = 54.9 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 54.9 mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	410	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	910	vph
Length of first accel/decel lane	875	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	410	910		vph
Peak-hour factor, PHF	0.84	0.84		
Peak 15-min volume, v15	122	271		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	515	1143	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 515 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1658	4700	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 515 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1658	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 12.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.280	
Space mean speed in ramp influence area,	S_R = 58.6	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 58.6	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 67
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	640	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1160	vph
Length of first accel/decel lane	875	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	640	1160		vph
Peak-hour factor, PHF	0.89	0.89		
Peak 15-min volume, v15	180	326		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	759	1375	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 759 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2134	4700	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 759 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2134	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 16.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.293	
Space mean speed in ramp influence area,	S_R = 58.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 58.3	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB I-90
From/To:	Exit 67 to Exit 63
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	1320	veh/h
Peak-hour factor, PHF	0.84	
Peak 15-min volume, v15	393	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	829	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	829	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	12.8	pc/mi/ln
Level of service, LOS	B	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB I-90
From/To:	Exit 67 to Exit 63
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	1800	veh/h
Peak-hour factor, PHF	0.89	
Peak 15-min volume, v15	506	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	1067	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1067	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	16.4	pc/mi/ln
Level of service, LOS	B	

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 63
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1320	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	810	vph
Length of first accel/decel lane	1050	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1320	810		vph
Peak-hour factor, PHF	0.84	0.84		
Peak 15-min volume, v15	393	241		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1658	1017	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1658 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2675	4700	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1658 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2675	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 19.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.304	
Space mean speed in ramp influence area,	S_R = 58.0	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 58.0	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 63
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1800	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	780	vph
Length of first accel/decel lane	1050	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1800	780		vph
Peak-hour factor, PHF	0.89	0.89		
Peak 15-min volume, v15	506	219		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2134	925	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2134 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3059	4700	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 2134 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	3059	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 22.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.331	
Space mean speed in ramp influence area,	S_R = 57.4	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 57.4	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB I-90
From/To:	Exit 63 to Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	2130	veh/h
Peak-hour factor, PHF	0.84	
Peak 15-min volume, v15	634	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	1338	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1338	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	20.6	pc/mi/ln
Level of service, LOS	C	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB I-90
From/To:	Exit 63 to Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	2580	veh/h
Peak-hour factor, PHF	0.89	
Peak 15-min volume, v15	725	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	1529	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1529	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.8	mi/h
Number of lanes, N	2	
Density, D	23.6	pc/mi/ln
Level of service, LOS	C	

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2130	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	705	vph
Length of first accel/decel lane	710	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2130	705		vph
Peak-hour factor, PHF	0.84	0.84		
Peak 15-min volume, v15	634	210		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2675	885	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2675 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2675	4700	No
$v_{FO} = v_F - v_R$	1790	4700	No
v_R	885	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 2675 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2675	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 20.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, D_S = 0.508

Space mean speed in ramp influence area, S_R = 53.3 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 53.3 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2580	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1070	vph
Length of first accel/decel lane	710	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2580	1070		vph
Peak-hour factor, PHF	0.89	0.89		
Peak 15-min volume, v15	725	301		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3058	1268	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3058 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3058	4700	No
$v_{FO} = v_F - v_R$	1790	4700	No
v_R	1268	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 3058 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3058	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 24.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D_S = 0.542	
Space mean speed in ramp influence area,	S_R = 52.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 52.5	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1425	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	850	vph
Length of first accel/decel lane	1150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1425	850		vph
Peak-hour factor, PHF	0.84	0.84		
Peak 15-min volume, v15	424	253		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1790	1068	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1790 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2858	4700	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1790 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2858	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 20.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.308	
Space mean speed in ramp influence area,	S_R = 57.9	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 57.9	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	Felsburg Holt & Ullevig
Date performed:	7/21/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	I-90 WB
Junction:	Exit 61
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1510	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	950	vph
Length of first accel/decel lane	1150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1510	950		vph
Peak-hour factor, PHF	0.89	0.89		
Peak 15-min volume, v15	424	267		v
Trucks and buses	11	11		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.948	0.948	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1790	1126	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1790 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2916	4700	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1790 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2916	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 20.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.313	
Space mean speed in ramp influence area,	S_R = 57.8	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 57.8	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB I-90
From/To:	Exit 61 to Exit 60
Jurisdiction:	SDDOT
Analysis Year:	2045
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	2275	veh/h
Peak-hour factor, PHF	0.84	
Peak 15-min volume, v15	677	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	1429	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1429	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	22.0	pc/mi/ln
Level of service, LOS	C	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	7/20/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB I-90
From/To:	Exit 61 to Exit 60
Jurisdiction:	SDDOT
Analysis Year:	
Description:	I-90 Exit 61 to 67 Corridor Study

Flow Inputs and Adjustments

Volume, V	2460	veh/h
Peak-hour factor, PHF	0.89	
Peak 15-min volume, v15	691	v
Trucks and buses	11	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.948	
Driver population factor, fp	1.00	
Flow rate, vp	1458	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1458	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	22.4	pc/mi/ln
Level of service, LOS	C	