1. COVER PAGE

INTERSTATE 90 EXIT 61 to EXIT 67 CORRIDOR STUDY

METHODS AND ASSUMPTIONS DOCUMENT

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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

Signature

Planning Engineer
Title

July 12, 2016
Date

FHWA

Signature

Planning & Civil Rights Specialist
Title

July 12, 2016
Date

AMENDMENT (IF NEEDED)

SDDOT

Signature

Title

Date

FHWA

Signature

Title

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.

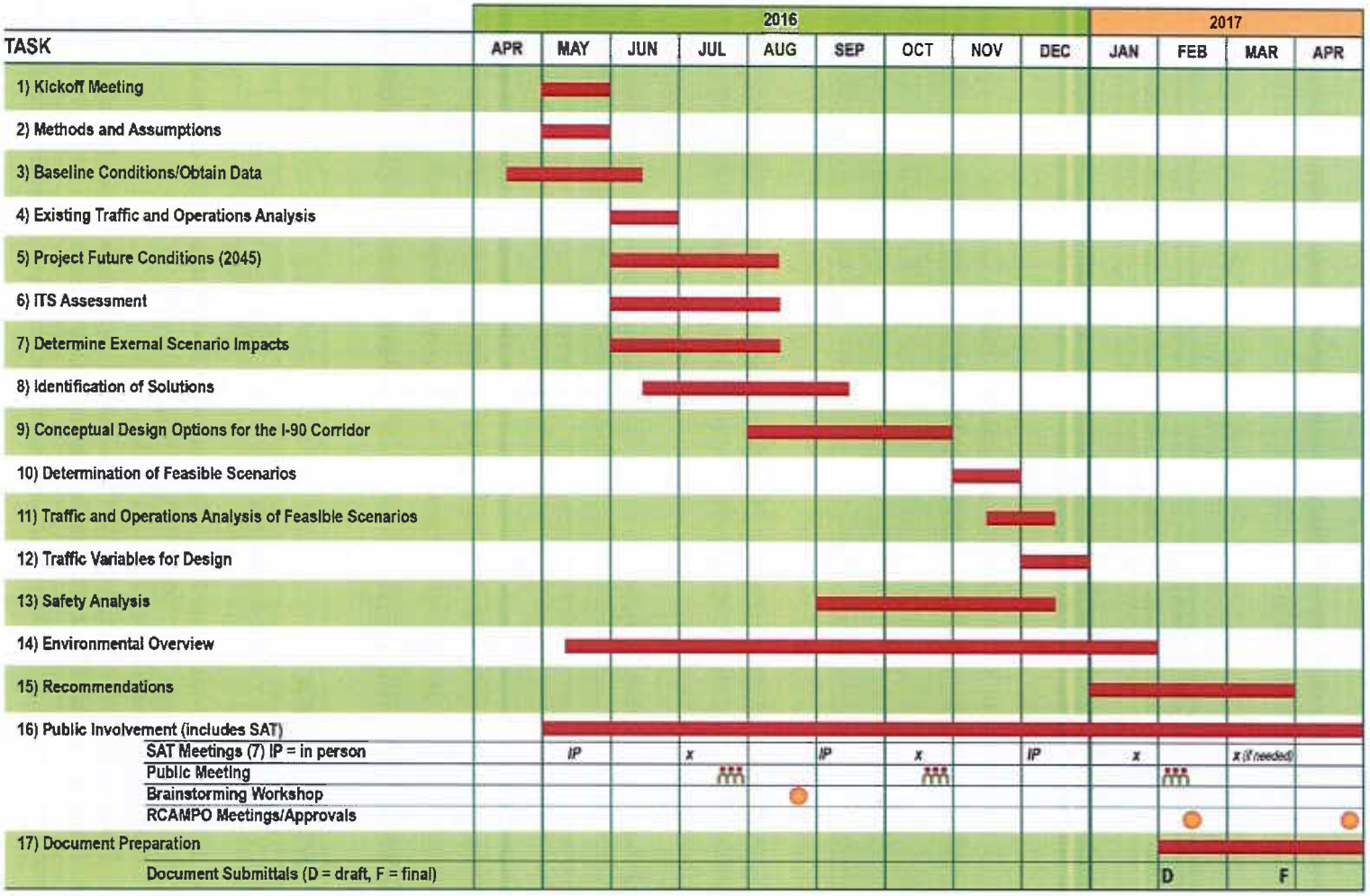
D. Study Schedule

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

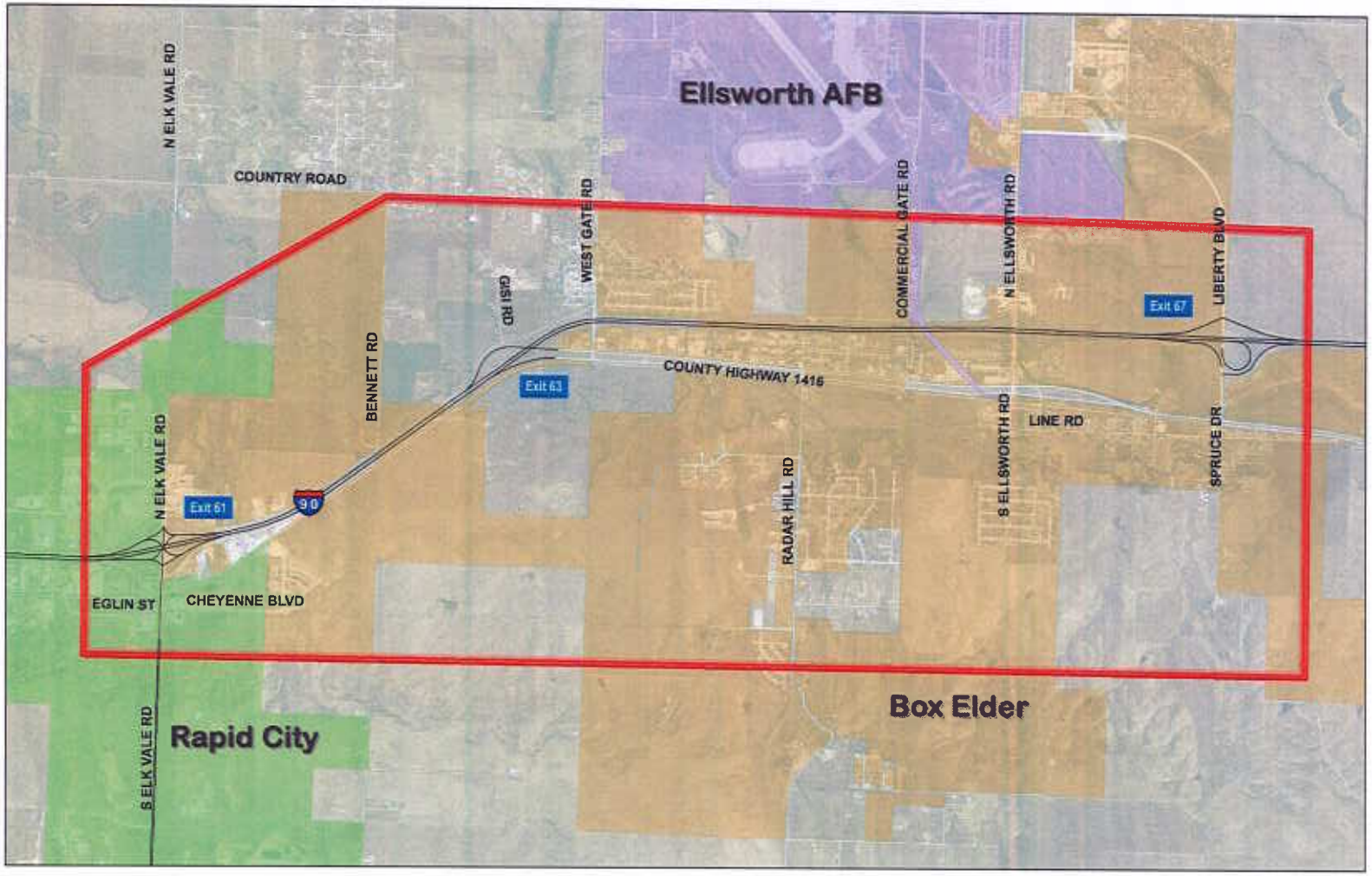
The effort to provide traffic volume data for the project will be conducted using the following three methods:

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

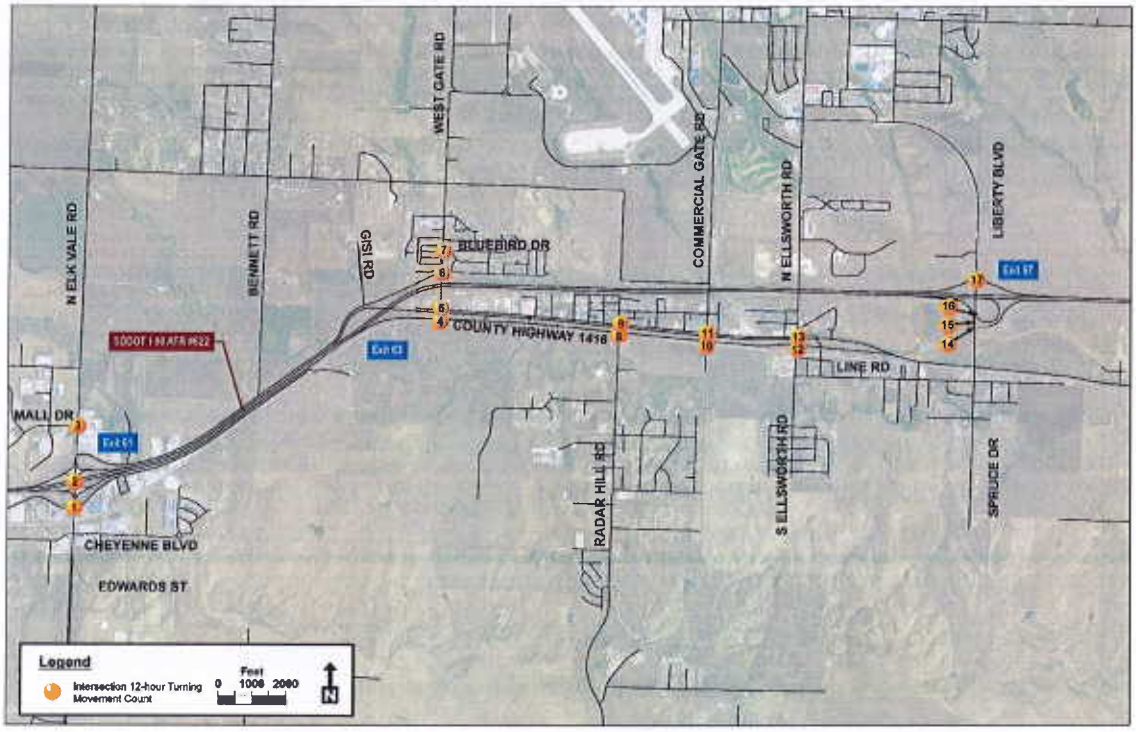
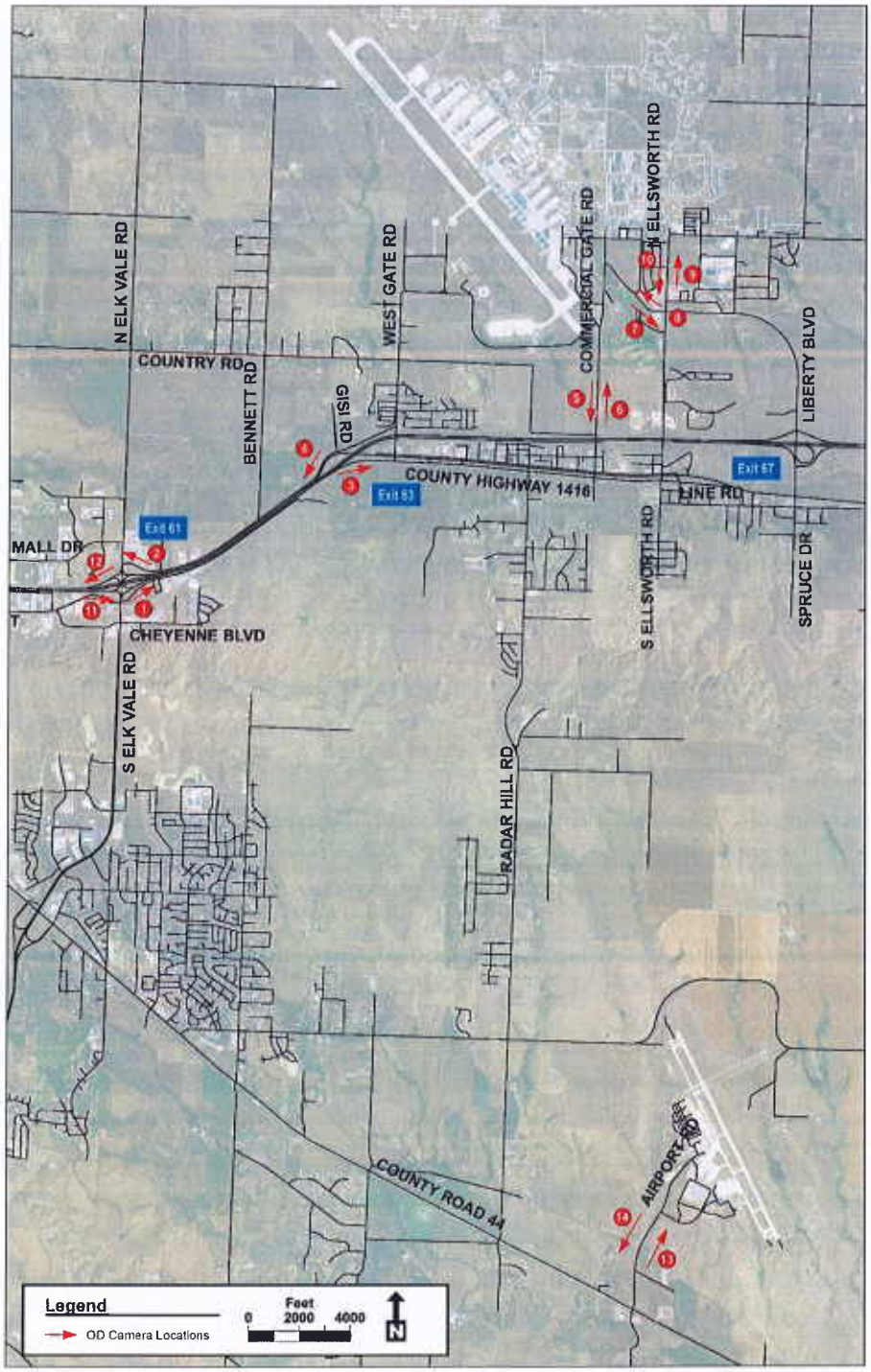


Figure 4. Origin-Destination Locations



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)
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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
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Tammy Williams	SDDOT Belle Fourche Area	605-892-2872	tammy.williams@state.sd.us	X (BF)
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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)