WEST DAVIS
CORRIDOR

Technical Memorandum 28: Interstate Access Change Request

in support of the
Environmental Impact Statement

West Davis Corridor Project

Federal Highway Administration
Utah Department of Transportation

in cooperation with

U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
Utah Reclamation, Mitigation, and Conservation Commission

UDOT
udot.utah.gov

Project No. S-0067(14)0

Prepared by
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December 8, 2016

U.S. Department of Transportation
Federal Highway Administration

Memorandum

Subject: **ACTION:** Utah, Interstate Access Change Request, I-15 at West Davis Corridor, Davis County

Date: February 7, 2017

From: Gloria M. Shepherd
Acting Executive Director

In Reply Refer To:
HIPA-20

To: Ivan Marrero
Division Administrator
Salt Lake City, UT

We reviewed the Interstate Access Change Request (IACR) and supporting documentation submitted on December 15, 2016, for construction of a new interchange for the southern connection of the proposed West Davis Corridor at I-15. Two interchange alternatives, Glovers Lane and Shepard Lane, are detailed separately in the IACR to determine engineering and operational acceptability.

Based on our engineering and operations review, the Glovers Lane interchange alternative is acceptable. Significant concerns regarding the Shepard Lane interchange alternative were identified, including: compliance with State standards, Federal standards, and the Manual on Uniform Traffic Control Devices; several left-hand exits and lane balance issues violate driver expectancy; and short and complex weaving sections contribute to an increased risk for crashes. These issues support our determination that the Shepard Lane alternative is not acceptable for engineering and operational reasons.

A draft EIS was released in May 2013 and the final environmental impact statement is scheduled to be completed in 2017. Final approval of the Glovers Lane interchange alternative may be given after the NEPA process has concluded, provided that the scope and design of the proposed project is consistent with the Glovers Lane alternative as described in the IACR of December 15, 2016, and the approved environmental document. This approval is subject to reevaluation if significant changes occur in the final design or if the construction is delayed (as specified in 23 CFR 771.129).

Should you have any questions, please contact Ms. Elizabeth Hilton at 512-536-5970.

Executive Summary

Project Overview

This Interstate Access Change Request (IACR) was prepared by the Utah Department of Transportation (UDOT) in support of the Environmental Impact Statement (EIS) for the West Davis Corridor (WDC) in Davis and Weber Counties, Utah. It has been prepared in accordance with the Federal Highway Administration (FHWA) Utah Division's *Interstate Access Change Request Guidance Document* (April 2015).

This IACR evaluates two alternatives for a system-to-system interchange connection with Interstate Highway 15 (I-15) and the proposed WDC, a four-lane, limited-access facility. The two interchange alternatives being evaluated are the Glovers Lane Alternative and the Shepard Lane Alternative (see Figure ES-1). Since the environmental study is in progress, this IACR has been prepared for the purpose of determining the engineering and operational acceptability of these two alternatives.

Glovers Lane. The Glovers Lane system-to-system interchange would be a new grade-separated system-to-system interchange on I-15 north of Salt Lake City in the city of Farmington. The proposed system-to-system interchange would be located between milepost (MP) 320.3 and MP 323.2 about 1.9 miles south of the existing I-15, U.S. Highway 89 (US 89), and Legacy Parkway interchange. The Glovers Lane interchange would provide access to and from I-15 and Legacy Parkway with system-to-system directional ramps.

Shepard Lane. The Shepard Lane system-to-system interchange would be a new grade-separated system-to-system interchange on I-15 north of Salt Lake City in the cities of Kaysville and Farmington. The proposed system-to-system interchange would be located between MP 321.6 and MP 326.8 immediately north of the existing I-15, US 89, and Legacy Parkway interchange. The Shepard Lane interchange would provide access to and from I-15 and Legacy Parkway with a combination of directional ramps, collector-distributor roads, and a local interchange and street network.

The study website at www.udot.utah.gov/westdavis/documentation#draft_eis hosts the Draft EIS and associated technical memoranda that provide background information on the purpose and need, alternatives development and screening, and costs and impacts of the various alternatives.

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Purpose of and Need for the Improvement

The WDC is intended to achieve the following purposes:

- ***Improve Regional Mobility.*** Improve regional mobility in the EIS study area for automobile, transit, and freight trips by substantially reducing user delay on the road system compared to the No-Action conditions through the consideration of all transportation modes.
- ***Enhance Peak-Period Mobility.*** Substantially enhance mobility in the EIS study area during the AM and PM peak periods for the main travel direction (north-south) to help accommodate the projected travel demand in the EIS study area in 2040.

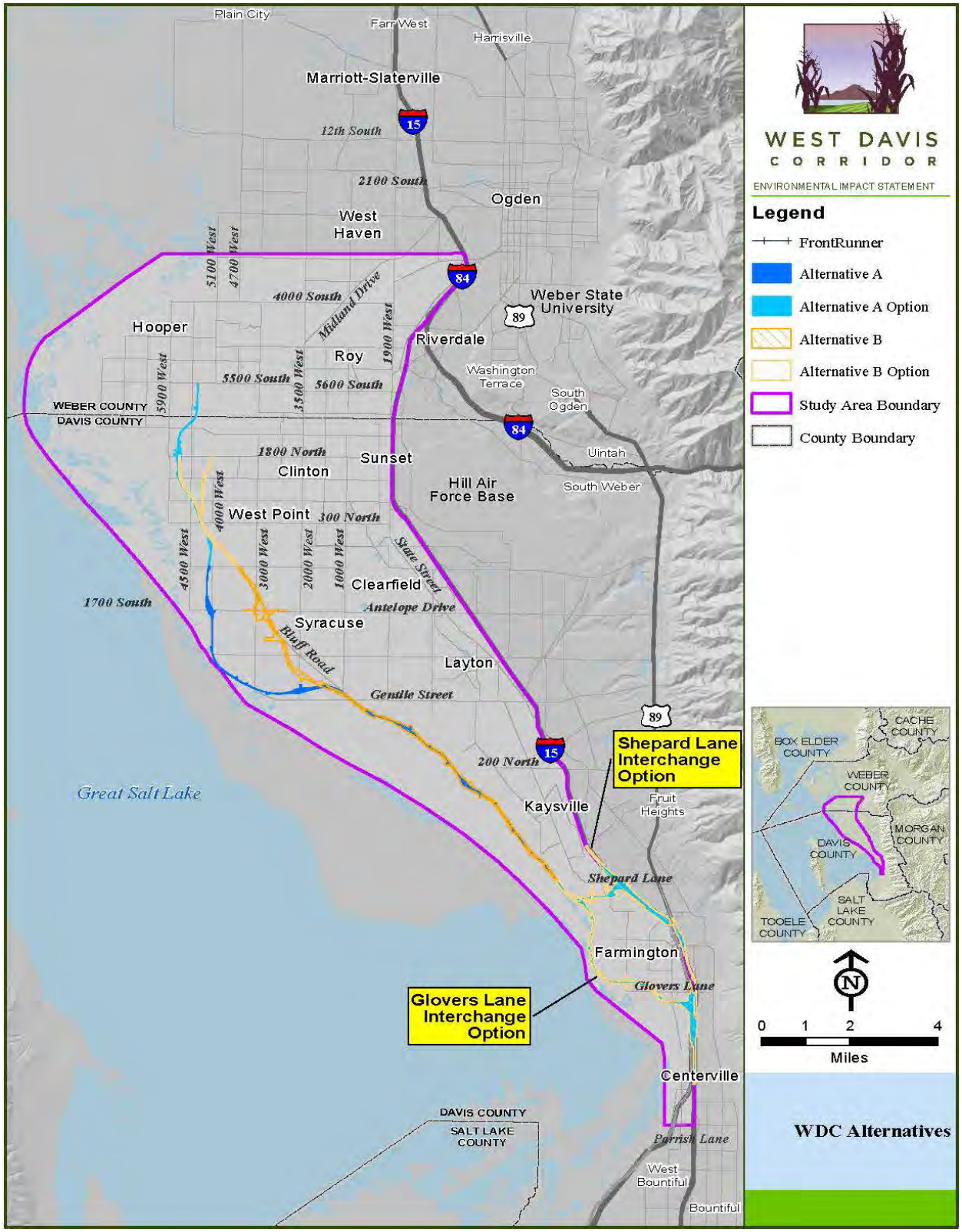
Environmental Process

In January 2010, FHWA and UDOT began an EIS to evaluate potential transportation solutions and the impact of those solutions on the environment. A Draft EIS was released in May 2013. The Final EIS is expected to be completed in the spring of 2017, with a Record of Decision to follow that summer. The EIS process included evaluating 51 alternatives including transportation system management (TSM)/travel demand management (TDM), transit, improvements to existing arterials and interchanges, and new corridors with new system-to-system connections to I-15. The analysis concluded that only a new system-to-system interchange in Farmington would meet the project's purpose and need and environmental screening criteria.

Existing Conditions

Existing traffic conditions in the Glovers Lane and Shepard Lane interchange study area are influenced heavily by commuter traffic patterns on I-15, Legacy Parkway, and US 89 as commuters travel to major employment centers in Salt Lake City to the south and destinations along the Wasatch Front. The I-15 mainline consists of three general-purpose lanes and one high-occupancy vehicle (HOV) lane in each direction north of the Legacy Parkway/US 89 system-to-system interchange and four general-purpose lanes and one HOV lane in each direction south of the Legacy Parkway/US 89 system-to-system interchange. Legacy Parkway and US 89 are four-lane, limited-access highways.

Figure ES-1. WDC Alternatives



Proposed Interchange Action Alternatives

Glovers Lane. The Glovers Lane interchange would provide access to and from I-15 and Legacy Parkway with system-to-system directional ramps (see Figure ES-2). Four directional ramps would provide direct access from southbound WDC to southbound I-15 and Legacy Parkway and northbound from I-15 and Legacy Parkway to northbound WDC. Traffic access from southbound WDC to northbound Legacy Parkway and I-15 would be provided through a directional ramp from the WDC to Legacy Parkway (which connects to I-15 north of the Glovers Lane interchange). Southbound access from I-15 and Legacy Parkway to northbound WDC would be provided from a directional ramp from Legacy Parkway to the WDC. With the proposed Glovers Lane interchange, all system movements would be provided and would be direct and continuous.

Shepard Lane. The Shepard Lane interchange would provide access to and from I-15 and Legacy Parkway with a combination of directional ramps, collector-distributor roads, and a local interchange and street network (see Figure ES-3). Three of the five main movements—northbound I-15/Legacy Parkway to northbound WDC, southbound WDC to southbound I-15, and southbound WDC to southbound Legacy Parkway—would be continuous and would be provided by northbound and southbound collector-distributor roads. The southbound WDC to northbound I-15 movement and the southbound I-15 to northbound WDC movement would be provided by the Shepard Lane local interchange and a signalized street network. Connections from I-15, Legacy Parkway, and the WDC would be provided to and from the local interchanges at Shepard Lane and Park Lane.

Figure ES-2. Glovers Lane Interchange Design

Figure ES-3. Shepard Lane Interchange Design

Methodology

This IACR was prepared in accordance with the FHWA Utah Division's *Interstate Access Change Request Guidance Document* (April 2015). The primary focus of this IACR is an analysis of the eight policy points of FHWA's Interstate Access Policy Statement, as revised on August 18, 2009. The Glovers Lane and Shepard Lane interchange alternatives were each evaluated based on their compliance with these policy points.

This evaluation analyzed the existing and future conditions, the operations and safety of the interchanges and mainline I-15, and the conformance of the interchange alternatives to design standards. The evaluation also included traffic modeling of mainline I-15 and each interchange using VISSIM software, a review of existing and expected crash data, and a compliance review of state and federal standards and guidance.

Compliance with FHWA Policy Points

Table ES-1 summarizes the findings of this IACR for each alternative with respect to the eight FHWA policy points in FHWA's Interstate Access Policy Statement.

The analyses for both alternatives for each policy point are described in detail in Sections 6.0 through 13.0 of this document, and engineering standards are discussed in Section 14.0.

Table ES-1. Summary of FHWA Policy Points for WDC Interchange Alternatives

Policy Point	Glovers Lane	Shepard Lane
1 Need for New Access	UDOT evaluated 51 transportation alternatives in the EIS to determine which alternatives met the regional transportation need. Among these, connections at existing interchanges at other locations on I-15 were considered. The only alternatives that met the purpose and need and environmental screening criteria were new system-to-system interchanges at I-15 with the WDC alignment at either Glovers Lane or Shepard Lane.	Same as Glovers Lane.
2 TSM/Transit	Besides alternatives that provided new access to I-15, UDOT evaluated a TSM/TDM alternative, transit alternatives, a land-use-change alternative (the Shared Solution), and alternatives that included improvements to I-15. None of these met the purpose and need and environmental screening criteria.	Same as Glovers Lane.
3 Operations/ Safety	The operations analysis for the Glovers Lane interchange showed that the interchange and I-15 corridor would function at an acceptable level of service (D or better) in 2040. The safety analysis showed that the interchange would operate safely due to its acceptable interchange spacing, and a straightforward, conventional design that meets all state and federal roadway and signing standards.	The operations analysis for the Shepard Lane interchange showed that the interchange and I-15 corridor would function at an acceptable level of service (D or better) in 2040, though it would have 10% greater overall delay than the Glovers Lane interchange. The safety analysis showed that the interchange would have a significant adverse impact on the safety and operations of I-15. This is due to the interchange being located within ½ mile of the US 89 and Legacy Parkway system-to-system interchanges and the Park Lane and Shepard Lane local interchanges. This results in a very complex interchange design that violates state and federal standards and guidance. It would require design waivers; would violate driver expectancy, interchange spacing, and lane balance; would require extensive weaving; and would not conform to all of the standards and guidance of the Utah *Manual on Uniform Traffic Control Devices* (*MUTCD*) signing standards. The interchange cannot be located at another location due to insufficient capacity and other *MUTCD* violations, as explained in Section 5.1.2.

Table ES-1. Summary of FHWA Policy Points for WDC Interchange Alternatives

Policy Point	Glovers Lane	Shepard Lane
4 Full Access/ Standards Compliance	The Glovers Lane interchange would provide continuous system-to-system connections via directional ramps to and from Legacy Parkway and I-15 for all traffic movements, thereby providing a full-access interchange. The standards compliance review showed that the interchange design meets all state and federal standards.	The Shepard Lane interchange would provide system-to-system connections for three of five movements with directional ramps and collector-distributor roads. The two non-system movements would be provided through a local interchange and a signalized, local street network. The standards compliance review showed that the interchange design does not meet all state and federal standards (see Section 14.0.)
5 Local/Regional Plans	The WDC Project is included in the Wasatch Front Regional Council's *Regional Transportation Plan*, UDOT's *Long-Range Plan*, the State Transportation Improvement Program, the Congestion Management Process, local Cities' land-use and transportation plans, and the transportation conformity requirements for the Wasatch Front.	Same as Glovers Lane.
6 Future Nearby Interchanges	There are no plans for any future interchanges in the Glovers Lane interchange study area. Farther north on I-15 (3.4 miles), a local interchange at Shepard Lane is on the regional transportation plan.	A Shepard Lane local interchange is being planned in the Shepard Lane interchange study area. This interchange would provide local access from I-15 to Shepard Lane in Farmington. If the Shepard Lane system-to-system interchange is selected by FHWA in the Final EIS, the local interchange will be built in conjunction with the larger WDC Project and its system-to-system interchange.
7 Planned Development	The new access proposed at I-15 is not needed based on any particular isolated land-development project.	Same as Glovers Lane.
8 NEPA	Under the requirements of the National Environmental Policy Act (NEPA), an EIS is being prepared for the WDC Project and is expected to be completed in 2017.	Same as Glovers Lane.

Results

As shown in Table ES-1 above, the proposed Glovers Lane Alternative complies with all eight FHWA policy points and meets state and federal design standards. The proposed Shepard Lane Alternative does not comply with Policy Points 3 and 4 because it would adversely affect the safety and operations of I-15 and does not meet design standards.

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1.0 Introduction

This Interstate Access Change Request (IACR) was prepared by the Utah Department of Transportation (UDOT) in support of the Environmental Impact Statement (EIS) for the West Davis Corridor (WDC) in Davis and Weber Counties, Utah. It has been prepared in accordance with the Federal Highway Administration (FHWA) Utah Division's *Interstate Access Change Request Guidance Document* (April 2015). The WDC would be a four-lane, limited-access, north-south highway in western Davis and Weber Counties providing highway access to the adjacent communities.

This report discusses two alternatives for providing a system-to-system interchange with the WDC and Interstate Highway 15 (I-15). These two alternatives, the Glovers Lane and Shepard Lane interchanges, are each described separately in this IACR where there are differences between them. Figure 1-1 shows the study area for the project's EIS and the WDC alternatives, including the locations of both interchanges on I-15.

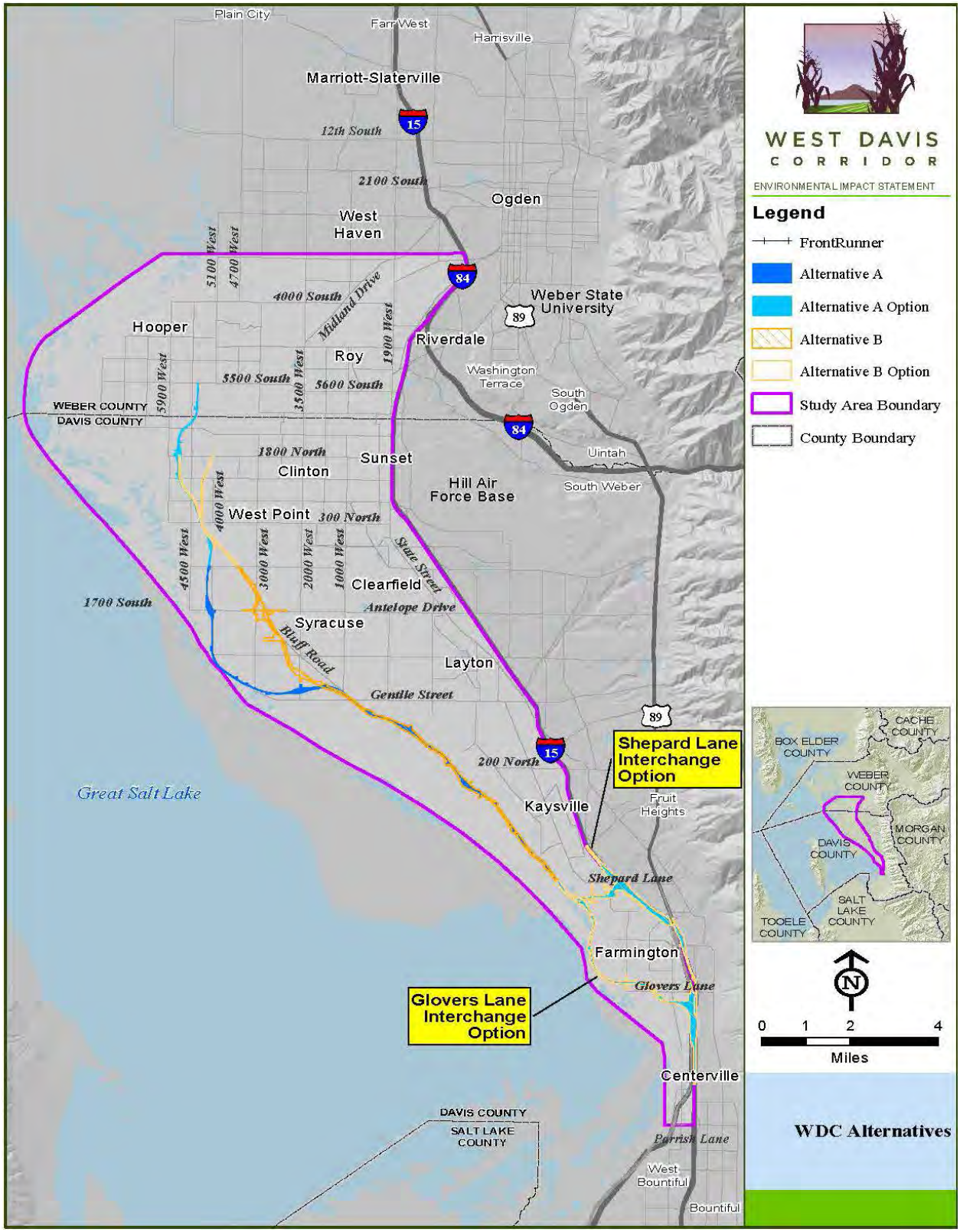
Since the environmental study is in progress, this IACR has been prepared for the purpose of determining the engineering and operational acceptability of these two alternatives. The EIS study website at www.udot.utah.gov/westdavis/documentation#draft_eis hosts the Draft EIS and associated technical memoranda that provide background information on the purpose and need, alternatives development and screening, and costs and impacts of the various alternatives.

1.1 Background

The idea of a north-south transportation facility west of I-15 between Salt Lake County and Weber County was first conceptualized in the 1960s. Since that time, UDOT and the local metropolitan planning organization, the Wasatch Front Regional Council (WFRC), have conducted several planning studies in western Weber and Davis Counties to evaluate and plan for future transportation needs. These studies made recommendations for the location and type of facility, and many of these studies have been adopted by the local municipalities in their plans and are considered in the alternatives-development process for the WDC Project. The need for the project is a result of the projected population growth in Davis County (28%) and Weber County (43%) by 2040. The WDC Project is included in WFRC's current 2015–2040 *Regional Transportation Plan* (*RTP*).

In January 2010, FHWA and UDOT began an EIS to evaluate potential transportation solutions and the impact of those solutions on the environment. Figure 1-1 shows the study area used in the EIS evaluation. A Draft EIS was released in May 2013. The EIS is expected to be completed in the summer of 2017. The EIS process included evaluating 51 alternatives including transportation system management (TSM)/travel demand management (TDM), transit, improvements to existing arterials and interchanges, and new corridors with new system-to-system connections to I-15. The Draft EIS concluded that only a new highway corridor with a system-to-system interchange in Farmington would meet the project purpose and need and environmental screening criteria. The EIS evaluates two alternative connections to I-15: a Shepard Lane interchange and a Glovers Lane interchange. This IACR evaluates both alternatives.

Figure 1-1. WDC Alternatives



1.2 Purpose of and Need for the Improvement

The major transportation needs in the EIS study area are a result of the rapidly growing population and employment projected for this area. The existing road network in the EIS study area and the transportation network to the west primarily consist of arterial and local collector streets that are not intended to accommodate a high volume of long-distance trips, freight movements, or efficient transit (bus) use. The growth has resulted in decreased mobility and increase user delay. These conditions will result in a 62% increase in delay and a 56% increase in lane-miles traveled in congestion in the EIS study area by 2040.

The purpose of the WDC Project consists of both primary purposes and secondary objectives. The WDC is intended to achieve the following purposes:

- ***Improve Regional Mobility.*** Improve regional mobility in the EIS study area for automobile, transit, and freight trips by substantially reducing user delay on the road system compared to the No-Action conditions through the consideration of all transportation modes.
- ***Enhance Peak-Period Mobility.*** Substantially enhance mobility in the EIS study area during the AM and PM peak periods for the main travel direction (north-south) to help accommodate the projected travel demand in the EIS study area in 2040.

The WDC Project will also evaluate the following secondary objectives:

- ***Increase the Interconnection between Transportation Modes.*** Improve regional mobility in the EIS study area by improving the connections between transportation modes such as automobile, transit, bicycle, and pedestrian travel compared to the No-Action conditions.
- ***Support Local Growth Objectives.*** Support the objectives of the adopted local land-use and transportation plans for communities west of I-15 in Weber and Davis Counties.
- ***Increase Bicycle and Pedestrian Options.*** Increase bicycle and pedestrian options consistent with the adopted local and regional plans in the parts of the EIS study area in Weber and Davis Counties.

1.3 Project Location and Scope

1.3.1 Glovers Lane

The Glovers Lane interchange would be a new grade-separated, system-to-system interchange on I-15 north of Salt Lake City in the city of Farmington. The proposed system-to-system interchange would be located between milepost (MP) 320.3 and MP 323.2 about 1.9 miles south of the existing I-15, U.S. Highway 89 (US 89), and Legacy Parkway interchange. The limits and road network for the Glovers Lane interchange are shown in Figure 1-2 and Figure 1-3.

The Glovers Lane interchange would provide access to and from I-15 and Legacy Parkway with system-to-system directional ramps (see Figure 1-4). Four directional ramps would provide direct access from southbound WDC to southbound I-15 and Legacy Parkway and northbound from I-15 and Legacy Parkway to northbound WDC. Traffic access from southbound WDC to northbound Legacy Parkway and I-15 would be provided through a directional ramp from the WDC to Legacy Parkway (which connects to I-15 north of the Glovers Lane interchange). Southbound access from I-15 and Legacy Parkway to northbound WDC would be provided from a directional ramp from Legacy Parkway to the WDC. With the proposed Glovers Lane interchange, all system movements would be provided and would be direct and continuous.

1.3.2 Shepard Lane

The Shepard Lane interchange would be a new grade-separated, system-to-system interchange on I-15 north of Salt Lake City in the cities of Kaysville and Farmington. The proposed system-to-system interchange would be located between MP 321.6 and MP 326.8 immediately north of the existing I-15, US 89, and Legacy Parkway interchange. The limits and road network for the Shepard Lane interchange construction project are shown in Figure 1-5 and Figure 1-6.

The Shepard Lane interchange would provide access to and from I-15 and Legacy Parkway with a combination of directional ramps, collector-distributor roads, and a local interchange and street network (see Figure 1-7). Three of the five main movements—northbound I-15/Legacy Parkway to northbound WDC, southbound WDC to southbound I-15, and southbound WDC to southbound Legacy Parkway—would be continuous and would be provided by northbound and southbound collector-distributor roads. The southbound WDC to northbound I-15 movement and the southbound I-15 to northbound WDC movement would be provided by the Shepard Lane local interchange and a signalized street network. Connections from I-15, Legacy Parkway, and the WDC would be provided to and from the local interchanges at Shepard Lane and Park Lane.

Figure 1-2. Interchange Study Limits – Glovers Lane

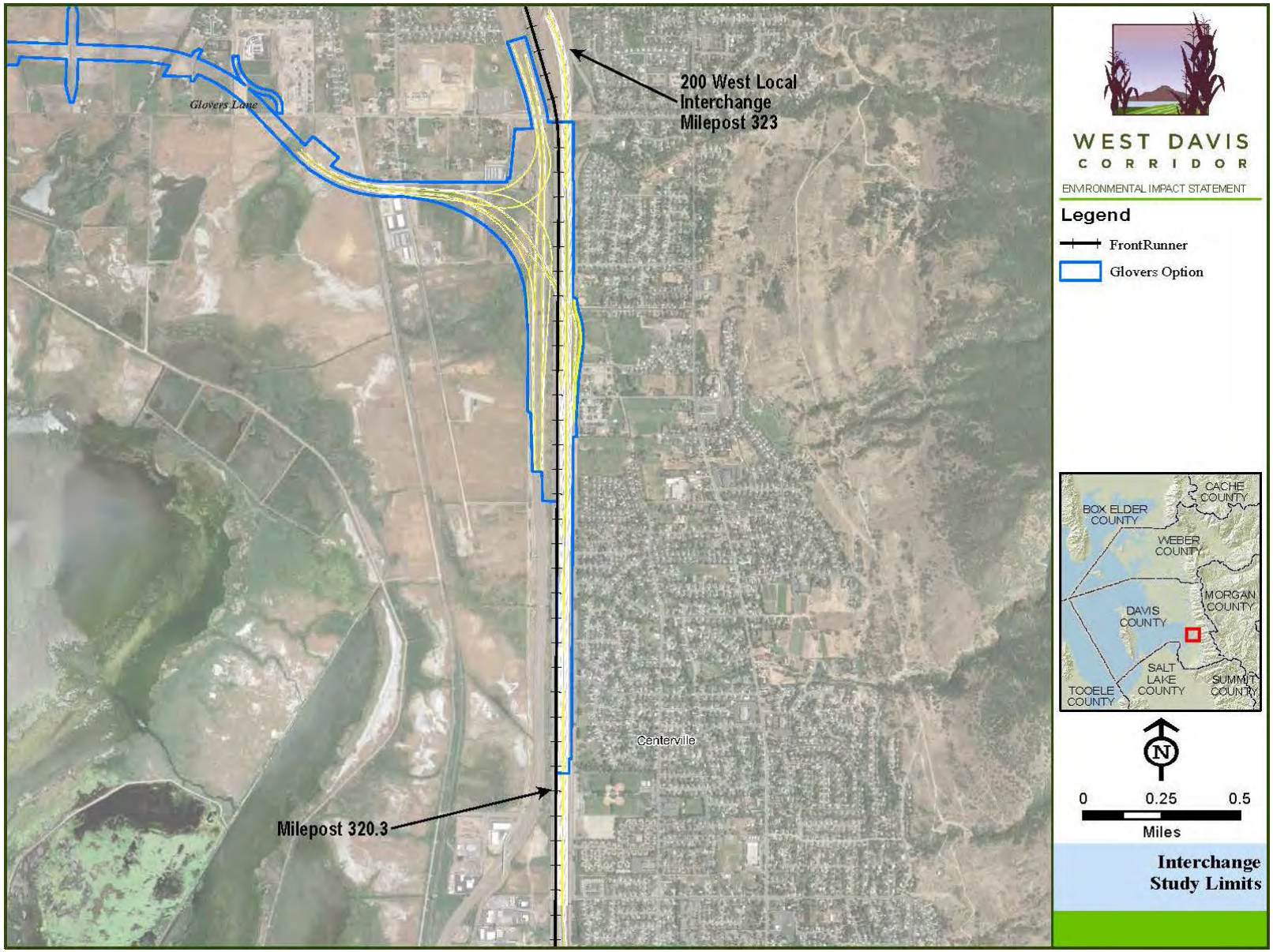


Figure 1-3. Existing Road Network – Glovers Lane

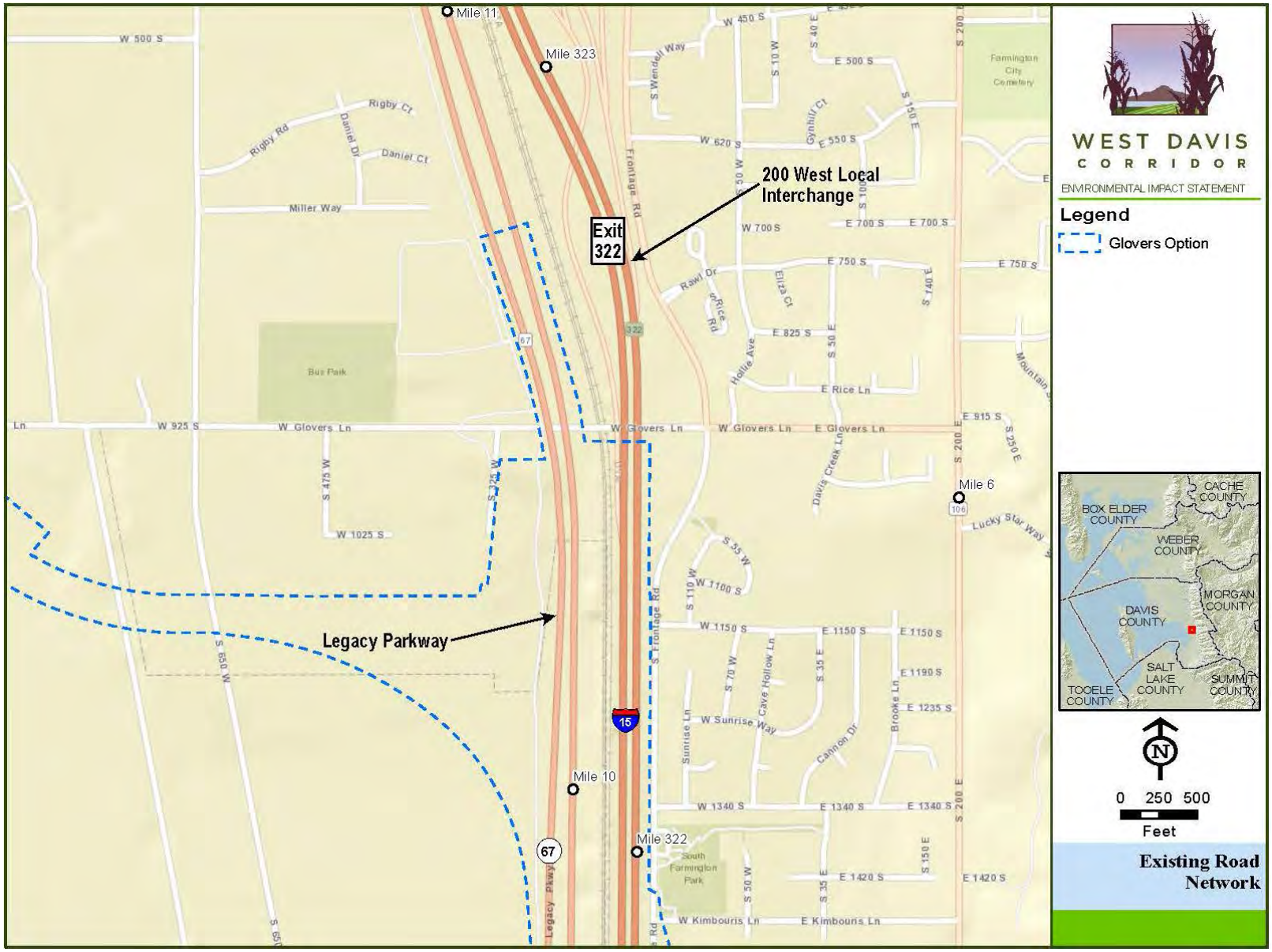


Figure 1-4. Glovers Lane Interchange Design

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Figure 1-5. Interchange Study Limits – Shepard Lane

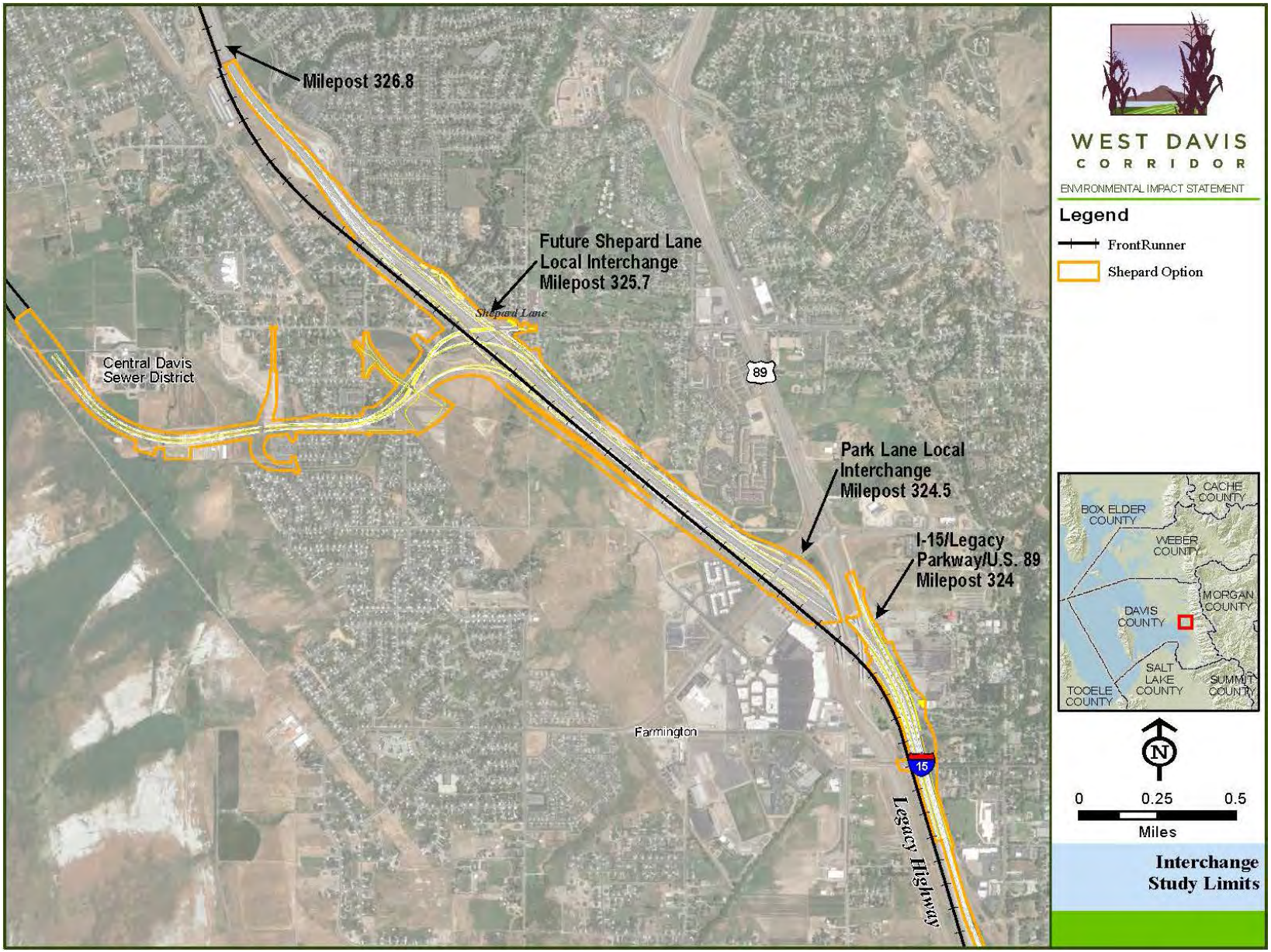

Figure 1-6. Existing Road Network – Shepard Lane

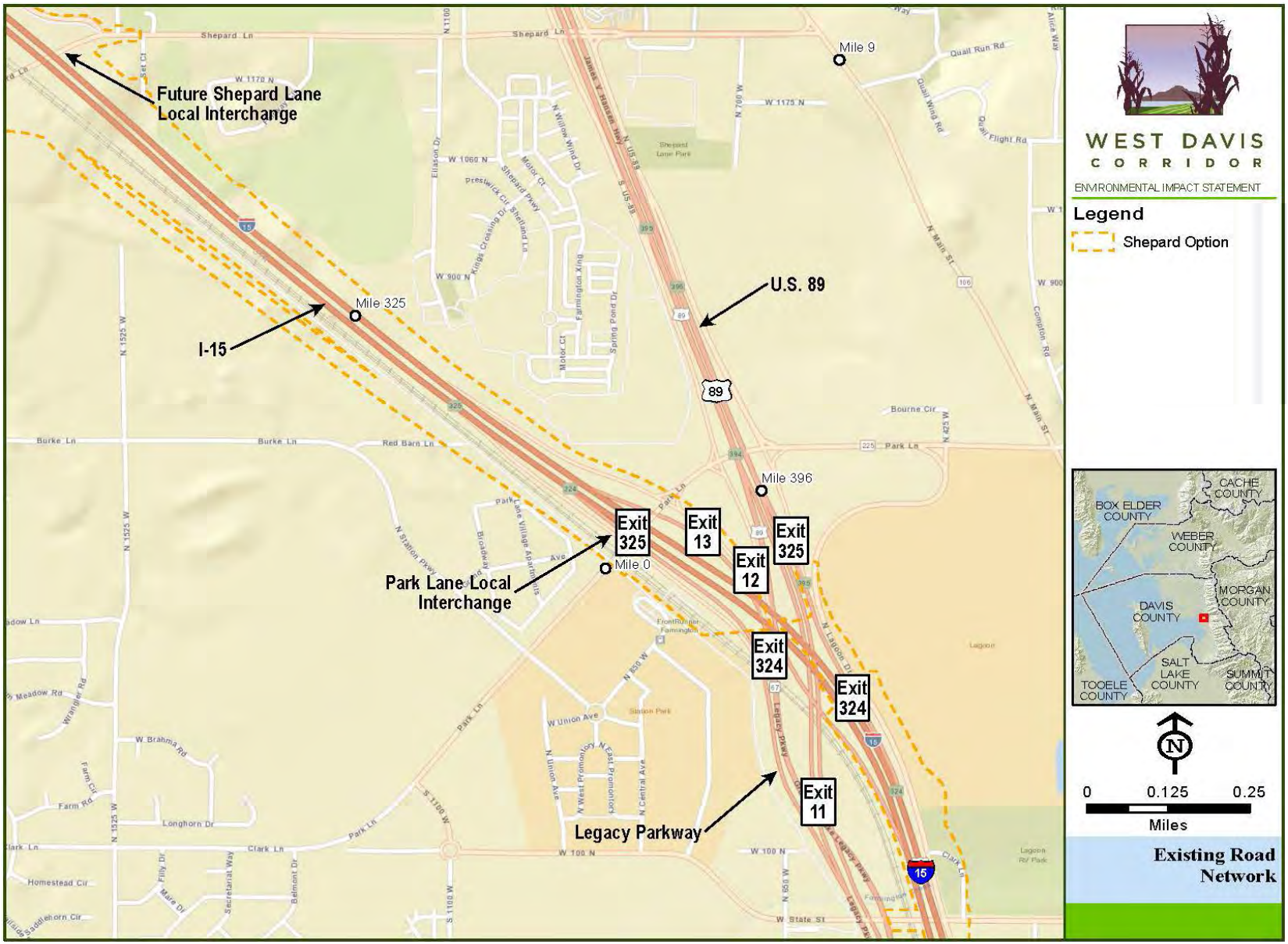

Figure 1-7. Shepard Lane Interchange Design

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2.0 Methodology

This IACR was prepared in accordance with the FHWA Utah Division's *Interstate Access Change Request Guidance Document* (April 2015). The primary focus of this IACR is an analysis of the eight policy points of FHWA's Interstate Access Policy Statement, as revised on August 18, 2009. The Glovers Lane and Shepard Lane interchange alternatives were each evaluated based on their compliance with these policy points.

This evaluation analyzed the existing and future conditions, the operations and safety of the interchanges and mainline I-15, and the conformance of the interchange alternatives to design standards. The evaluation also included traffic modeling of mainline I-15 and each interchange using VISSIM software, a review of existing and expected crash data, and a compliance review of state and federal standards and guidance.

2.1 Traffic Operations Analysis

The purpose of the traffic modeling analysis was to evaluate the effect that the proposed interchange alternatives would have on the long-term operations of the interstate system. In preparing this IACR, modeling was performed for the Glovers Lane and Shepard Lane interchanges. This section summarizes the traffic modeling parameters used for these models.

The Methods and Assumptions Document in Appendix A includes a more detailed description of the traffic modeling methodology that was used to prepare this IACR.

2.1.1 Study Area

In order to evaluate the overall performance of the I-15 corridor throughout the Farmington area, the study area for this IACR combines the operational areas of the proposed Glovers Lane and Shepard Lane interchanges. This allows for a consistent comparison of network measurements in the microsimulation modeling between common points. The study area for travel modeling includes four major facilities:

- I-15 between MP 320.2 and MP 326.8
- Legacy Parkway between MP 8.0 and the US 89 interchange
- US 89 from the I-15 gore to the Park Lane gore
- WDC from about 2000 South in Kaysville to the I-15 interchange, at either Glovers Lane or Shepard Lane, as appropriate

Figure 2-1 shows the limits of the traffic modeling study area.

Figure 2-1. Travel Demand Modeling Study Area

2.1.2 Analysis Years

The following analyses were performed for this IACR:

- A 2015 existing-condition (base-year) analysis
- A 2040 no-build analysis
- A 2040 build analysis for the Glovers Lane interchange
- A 2040 build analysis for the Shepard Lane interchange

For each item listed above, an analysis of weekday AM and PM peak-hour conditions was performed.

2.1.3 Determining Traffic Volumes

The WDC EIS relies on the current WFRC travel demand model (version 8, released in April 2016) for traffic analysis in the study area. The base-year volumes for the existing conditions VISSIM calibration were obtained from 2015 weekday traffic counts from UDOT's Performance Measurement System (PeMS). I-15 between US 89 and Parrish Lane was under construction for HOV lane extensions in 2015; therefore, it was assumed to use the completed HOV geometry and 2016 volumes from PeMS which were more accurate than pre-construction PeMS data. The 2016 volumes on the south end were adjusted and balanced to match the 2015 volumes north of US 89.

According to these data, the weekday AM peak hour on I-15 occurs from 6:45 AM to 7:45 AM in the southbound direction, while the weekday PM peak hour on I-15 occurs from 4:00 PM to 5:00 PM in the northbound direction. Base-year volumes for US 89 and the Park Lane local interchange ramps were based on manual counts from 2009 and adjusted for growth to the 2015 base year.

The future traffic volumes for the 2040 analyses of the No-Action, Glovers Lane, and Shepard Lane Alternatives were based on the current WFRC travel demand model. In these models, all other projects in the RTP were assumed to be built.

The base-year peak-hour factors (PHF) are 0.97 for the AM peak period and 0.99 for the PM peak period. These values were determined from the PeMS traffic data recorded at Station 758 located at MP 321.4 on I-15. A PHF of 0.95 was assumed for the 2040 design year.

2.1.4 Analysis Strategy and Tools

Microsimulation was used as the primary tool for this traffic modeling analysis because of its ability to analyze complex interchange configurations. Specifically, PTV's VISSIM software was used to report measures of effectiveness (MOE) for all scenarios. Densities, speeds, and travel times were reported at the I-15 mainline, merge segments, and diverge segments for the build and no-build conditions.

Table 2-1 summarizes the software package, its applications, and associated performance measures that were used.

Table 2-1. VISSIM Software Applications

Software Package	Analysis Type	Performance Measure	Threshold for Acceptable Operation
VISSIM v8.0 (with latest service pack)	Basic freeway segments	Density and percent of traffic demand served	Density: <35 veh/mile Traffic served: >95%
	Weaving areas	Density and percent of traffic demand served	Density: <35 veh/mile Traffic served: >95%

2.2 Crash Analysis

The crash analysis for this IACR was conducted by reviewing the 3-year crash history from 2013 to 2015 on facilities in the vicinity of the proposed Glovers Lane and Shepard Lane interchanges. The following four segments on I-15 were studied:

- Between Parrish Lane and 200 West (MP 319.512 to MP 322.916)
- Between 200 West and US 89 (MP 322.916 to MP 324.117)
- Between US 89 and Park Lane (MP 324.117 to MP 324.447)
- Between Park Lane and Burton Lane (MP 324.447 to MP 326.400)

The crash history was generated using information from UDOT's crash database. The crash data and analysis contained in this report are protected under 23 United States Code (USC) 409. The crash database is compiled from crash reports completed by law enforcement officers and includes data about the crash itself, road and weather conditions, time of day, location, the vehicles involved, and the vehicle occupants.

The safety analysis for this IACR considers crash rate, average crash severity, crash type, and crash clusters.

- ***Crash Rate.*** The crash rate is calculated as the number of crashes per million vehicle-miles traveled through the four segments during each year.
- ***Average Crash Severity.*** The crash severity rating is a measurement of the damage caused by each crash. The attending law enforcement officer assigns a rating to the crash based on the typical injuries listed in Table 2-2. The average crash severity for a roadway segment is calculated as the average of all severity ratings for crashes occurring on that segment. The severe crash rate is the calculated average for crashes with a severity index of '4' or '5' only.
- ***Crash Type.*** Some common crash types on freeways include single-vehicle, rear-end, sideswipe, and head-on. Patterns in crash type can provide some clues about potential safety issues on roadway segments.
- ***Crash Cluster.*** Crashes sometimes occur in about the same locations over time. The occurrence of crashes in such "clusters" located close together can provide additional clues about the nature of the underlying safety issues.

Table 2-2. Crash Severity Index and Typical Injuries

Severity Index	Typical Injuries
1	No injury
2	Possible injury
3	Minor Injury
4	Serious Injury
5	Fatality

The safety analysis includes a comparison of roadway segment crash rate and average crash severity against statewide averages for those values on facilities of the same functional classification and similar volume levels. UDOT develops these statewide averages by averaging values over a 5-year period. Although safety is a concern on all roadway systems, particular attention is given to roadway segments where the crash rate and/or average crash severity exceed statewide averages. The observed and statewide average crash data are included in Section 3.6.2.

2.3 Analysis for Standards Compliance

In addition to the operations and crash analyses described above, this IACR evaluated the Glovers Lane and Shepard Lane interchanges based on their compliance with state and federal standards and guidance. In compliance with 23 Code of Federal Regulations (CFR) 625.4(a)(2) and 655.603(d), the federal standards include those published by the American Association of State Highway and Transportation Officials (AASHTO) and contained in the *Manual on Uniform Traffic Control Devices*. UDOT also has roadway standards in its *Roadway Design Manual of Instruction and Standard Drawings*. The following standards were reviewed as part of this analysis:

- *A Policy on Geometric Design of Highways and Streets* (AASHTO)
- Interstate Access Design Standards (AASHTO)
- FHWA's 13 Critical Elements (AASHTO)
- UDOT's *Roadway Design Manual of Instruction and Standard Drawings*
- *Manual on Uniform Traffic Control Devices* (*MUTCD*)
- Other AASHTO standards and guidance such as:
  - Driver expectancy
  - Proximity to adjacent interchanges
  - Lane balance
  - Weaving and potential for crashes

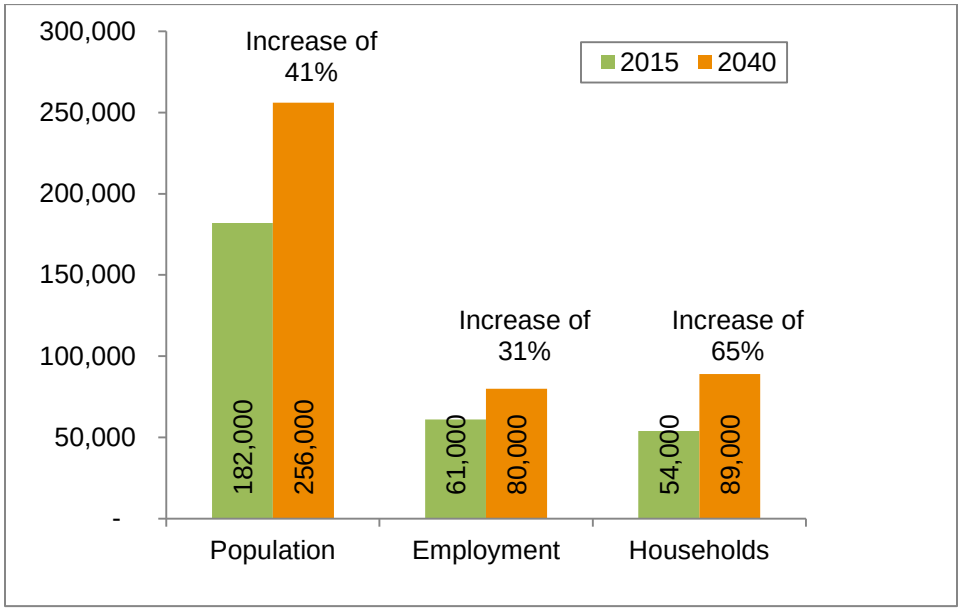
The results of this review are summarized in Section 14.0.

3.0 Existing Conditions

3.1 Demographics

By 2040, population in Davis and Weber Counties is expected to increase by 28% and 43%, respectively, while population in the EIS study area is expected to increase from 182,000 in 2015 to 256,000 in 2040 (an increase of 41%). Figure 3-1 shows the projected population, employment, and household growth in the EIS study area. The traffic analysis zones for the EIS study area came from the WFRC travel demand model and were slightly modified in coordination with WFRC to provide more-accurate travel demand forecasts for the EIS study area.

Figure 3-1. Population, Employment, and Household Growth in the EIS Study Area



3.2 Existing Land Use

3.2.1 EIS Study Area

The EIS study area (Figure 1-1) consists of an area of about 64,300 acres west of I-15 in Davis and Weber Counties. The EIS study area contains parts of 14 incorporated cities in Davis and Weber Counties as well as unincorporated land in each county. Of this land, about 92% is privately owned. The State of Utah is the largest public landholder in the EIS study area with 6% of the total land, followed by the federal government with about 2%. Most of the state and federal land is conservation land (Wildlife Management Areas and mitigation areas) along the shoreline of the Great Salt Lake.

Table 3-1 provides an overview of the existing land use in the EIS study area. Within the EIS study area, the largest percentage of land is residential (38%, or 24,572 acres), and the second-largest percentage of land is agricultural (31%, or 20,192 acres). Open space and conservation areas are the next-largest uses at 12% (7,288 acres) and 8% (4,900 acres), respectively.

3.2.2 Glovers Lane

The proposed Glovers Lane system-to-system interchange would be located in Farmington. The adjacent land uses in Farmington consist of suburban residential use and the Farmington Skater Park east of I-15 and a mix of agricultural, open land, commercial, and rural residential uses west of I-15 and Legacy Parkway. New residential developments are continuing to be developed on the east side of I-15 (Figure 3-2).

3.2.3 Shepard Lane

The proposed Shepard Lane system-to-system interchange would be located in Farmington and Kaysville. The adjacent land use in Farmington west of I-15 consists of a transit-oriented, mixed-use development with residential, commercial, and industrial uses. A Utah Transit Authority commuter-rail (FrontRunner) station is associated with this development. This area is rapidly growing and is expected to be Farmington's main employment center. To the east of I-15 in Farmington are residential land uses and a private golf course. The land use in Kaysville adjacent to I-15 near the proposed Shepard Lane system-to-system interchange is residential (Figure 3-3).

Table 3-1. Land Uses in the EIS Study Area

in acres

Jurisdiction	Agriculture	Commercial	Industrial	Institutional	Open Space	Conservation Area	Recreation	Residential	Total Acres	Percent of Total Land
Unincorporated	5,087	3	116	88	4,851	3,602	195	720	**14,662**	**23%**
Centerville[a]	239	0	160	0	213	238	0	6	**856**	**1%**
Clearfield	262	179	1,244	175	0	0	105	2,169	**4,134**	**6%**
Clinton[a]	931	107	0	108	0	0	219	2,445	**3,810**	**6%**
Farmington[a]	798	135	3	72	88	422	128	1,239	**2,885**	**4%**
Hooper[a]	3,927	39	0	0	1,865	650	46	2,435	**8,962**	**14%**
Kaysville[a]	1,046	130	64	89	16	32	61	2,025	**3,463**	**5%**
Layton[a]	1,512	455	283	116	8	2	174	2,370	**4,920**	**8%**
Ogden	0	0	180	711	0	0	0	49	**940**	**2%**
Riverdale	0	0	0	15	0	0	0	64	**79**	**1%**
Roy	434	183	90	243	0	0	141	3,930	**5,021**	**8%**
Sunset	0	93	0	47	0	0	24	487	**651**	**1%**
Syracuse[a]	2,012	121	16	194	42	17	358	3,135	**5,895**	**9%**
West Haven[a]	1,390	2	47	70	0	0	52	1,902	**3,463**	**5%**
West Point[a]	2,505	9	9	70	131	0	168	1,645	**4,537**	**7%**
Total acres in study area	**20,192**	**1,456**	**2,212**	**1,998**	**7,288**	**4,900**	**1,660**	**24,572**	**64,278**	**100%**
Percent of total land use	**31%**	**2%**	**3%**	**3%**	**12%**	**8%**	**3%**	**38%**	**100%**	—

[a] City would be directly affected by a WDC alternative.

Figure 3-2. Local Features near Glovers Lane

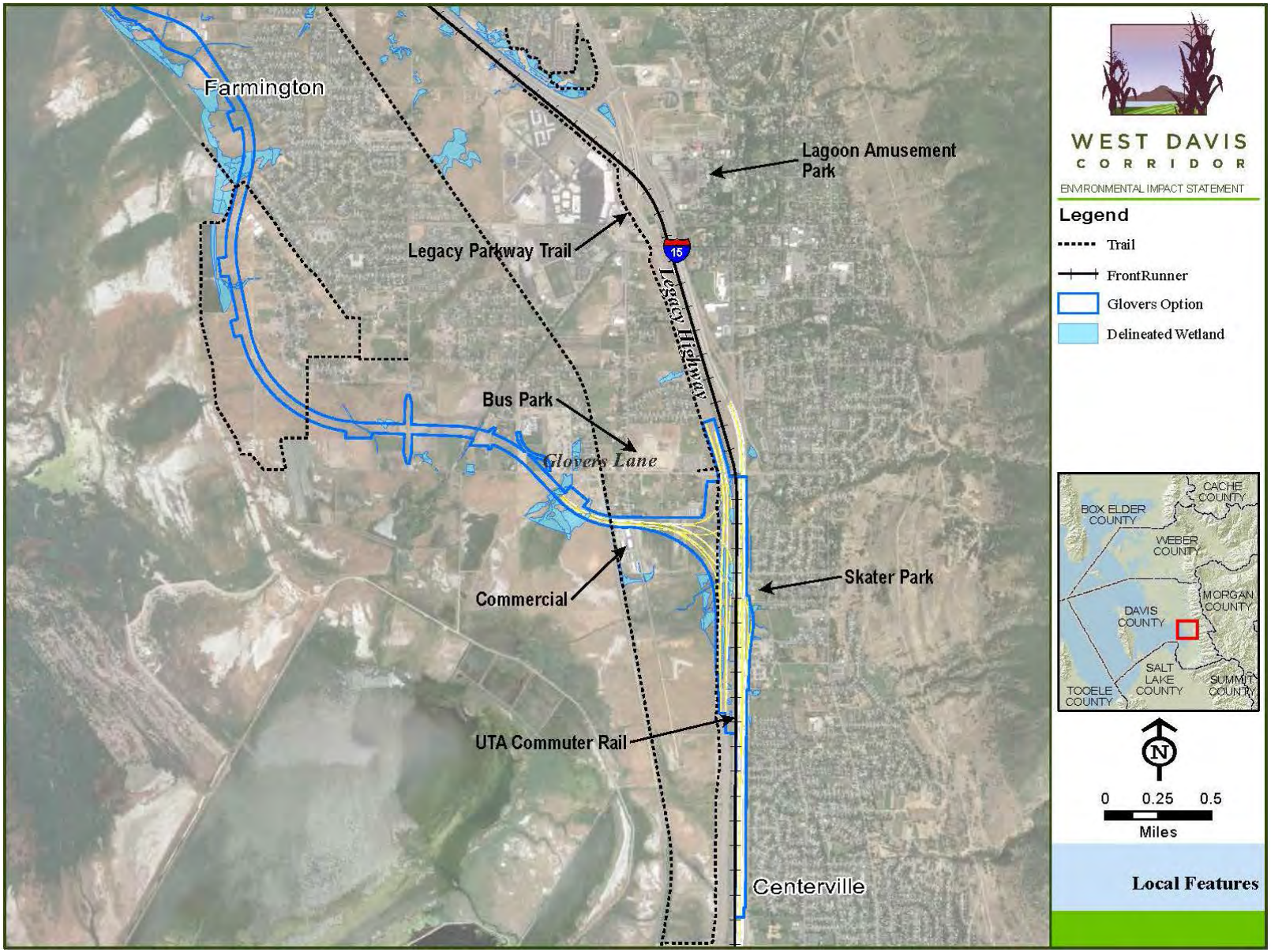
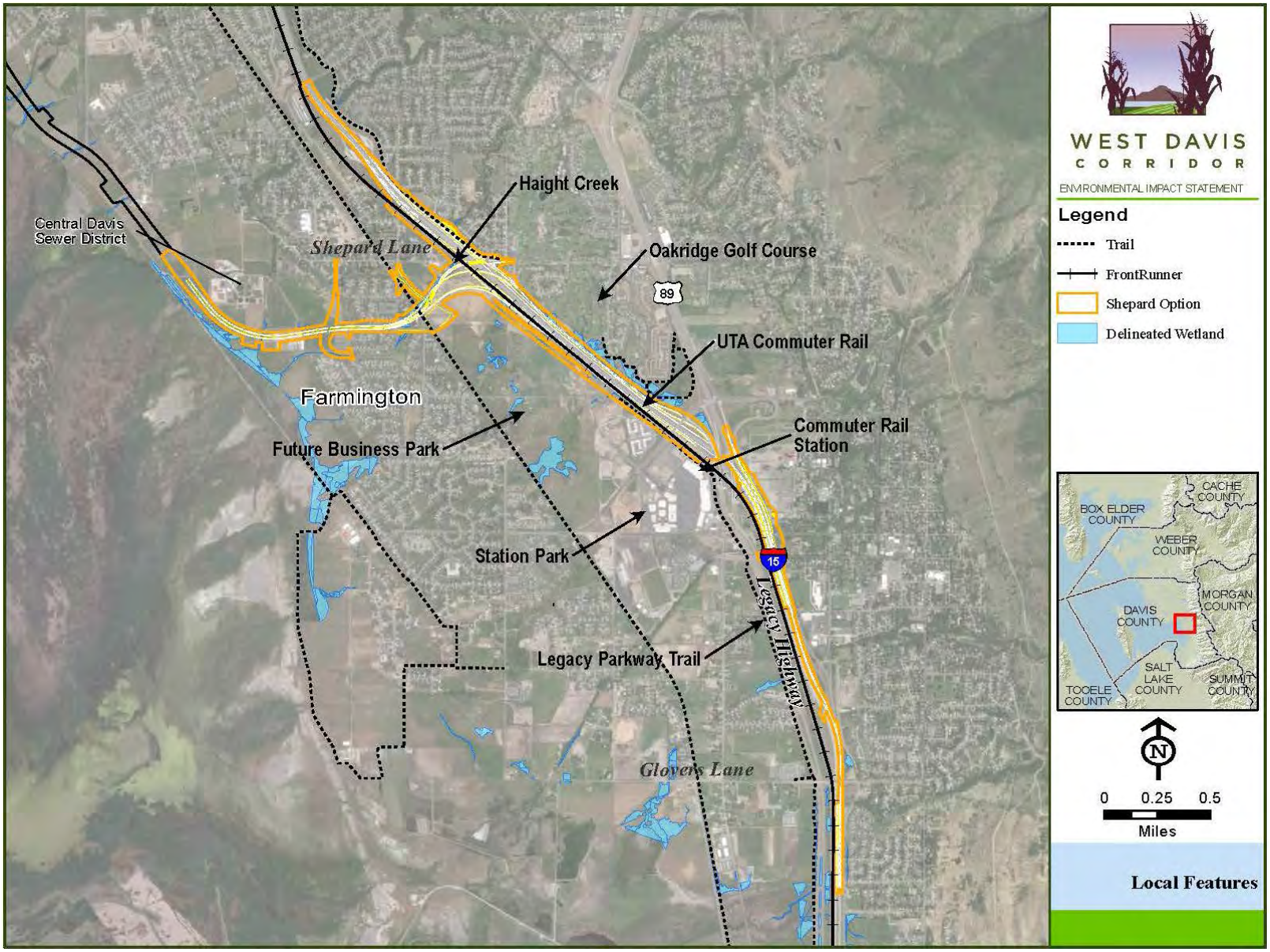


Figure 3-3. Local Features near Shepard Lane



3.3 Existing Roadway Network

3.3.1 Glovers Lane

The primary transportation system that serves the area around the proposed Glovers Lane system-to-system interchange is I-15. The I-15 mainline consist of four general-purpose lanes and one high-occupancy vehicle (HOV) lane in each direction through the proposed Glovers Lane interchange study area. Immediately to the west and parallel to I-15 is the north-south Legacy Parkway, a four-lane, limited-access highway. Immediately east of I-15 is an I-15 frontage road. Additionally, the Glovers Lane interchange study area includes the 200 West Farmington local interchange, which serves Farmington through a northbound direct access to 200 West and a southbound ramp from 200 West to I-15 (see Figure 1-2 through Figure 1-3).

3.3.2 Shepard Lane

The primary transportation system that serves the area around the proposed Shepard Lane system-to-system interchange is I-15. The I-15 mainline consists of three general-purpose lanes and one HOV lane in each direction through the Shepard Lane interchange study area. This area also includes I-15 interchanges with Legacy Parkway and US 89, both of which are four-lane, limited-access highways. Additionally, the area includes the Park Lane local interchange, which serves Farmington's main development of Station Park as well as most of the residential development in western Farmington (see Figure 1-5 and Figure 1-6).

3.4 Alternative Transportation Modes

3.4.1 Glovers Lane

Within the Glovers Lane interchange study area are multiple alternative transportation modes: HOV lanes on I-15, a Utah Transit Authority commuter-rail transit line, and the Legacy Parkway trail, which is used by cyclists for commuting and recreation. I-15 is also used by express buses that provide commuter access from Davis and Weber Counties into Salt Lake City; these buses run about 13 miles south of the Glovers Lane interchange study area. Local bus service east of I-15 includes routes 455 and 477.

3.4.2 Shepard Lane

Within the Shepard Lane interchange study area are multiple alternative transportation modes: HOV lanes on I-15, a Utah Transit Authority commuter-rail transit station (Station Park) and associated track, a park-and-ride lot associated with the transit station, and the Legacy Parkway trail, which is used by cyclists for commuting and recreation. I-15 is also used by express buses that provide commuter access from Davis and Weber Counties into Salt Lake City; these buses run about 15 miles south of the Shepard Lane interchange study area. Local bus routes 455 and 667 stop at Station Park, as do express bus routes 456 and 473.

3.5 Interchanges

3.5.1 Glovers Lane

Within the Glovers Lane interchange study area, the only existing interchange is the Farmington 200 West local interchange, which provides direct access to 200 West in Farmington through two ramps (northbound and southbound). No future local interchanges are proposed for the Glovers Lane interchange study area (Figure 1-2 and Figure 1-3).

3.5.2 Shepard Lane

Within the Shepard Lane interchange study area is the main system-to-system interchange of I-15 with Legacy Parkway and US 89 (see Figure 1-5 and Figure 1-6). This interchange provides the following movements:

- Northbound access from I-15 to US 89
- Northbound access from Legacy Parkway to I-15 and US 89
- Southbound access from I-15 to Legacy Parkway
- Southbound access from US 89 to I-15 and Legacy Parkway

The Shepard Lane interchange study area also includes the Park Lane local interchange, which provides the following access and movements:

- Access to Farmington
- The main access into Farmington's Station Park transit-oriented development
- Local access to and from I-15 and Legacy Parkway
- Southbound I-15 to northbound US 89 traffic
- Southbound US 89 to northbound I-15 traffic

In Phase 1 (2015 to 2024) of WFRC's 2015–2040 *RTP*, a new local interchange is planned on I-15 at Shepard Lane. This interchange's main purpose will be to relieve traffic congestion on the Park Lane interchange as the area continues to develop. This new local interchange is included in the design of the proposed Shepard Lane system-to-system interchange.

3.6 Existing Data

3.6.1 Operational Performance

The base-year traffic modeling analysis shows that overall operations for the I-15 corridor in the Glovers Lane and Shepard Lane interchange study areas under 2015 existing conditions are within acceptable limits. Although there is some congestion near the US 89/Park Lane interchange during the AM and PM peak periods, the mainline I-15 freeway speeds remain near the freeway speed limit. Reductions in speeds are generally due to crashes or other incidents on the freeway.

Table 3-2 summarizes various measures from the 2015 base year calibrated traffic model of the I-15 corridor between milepost 320.2 and 326.8.

Table 3-2. Base Year (2015) Operational Performance on I-15

Average Delay (seconds/vehicle)	Average Speed (mph)	Total Travel Time (hours)	Total Delay (hours)
8.9	67.8	1,595.5	50.4

Travel times (in seconds) on I-15 for this same segment are presented in Table 3-3.

Table 3-3. Base Year (2015) Travel Times on I-15

Segment	Travel Time (sec)
SB I-15 thru traffic	382
NB I-15 thru traffic	366

Appendix C includes the 2015 modeled density and speeds for this segment of I-15. No segments resulted in a density of less than 35 vehicles per mile, which is comparable to LOS D.

3.6.2 Existing Safety Conditions

The I-15 mainline in the Glovers Lane and Shepard Lane interchange study areas was split into four segments based on the locations of existing interchanges on I-15. The average annual daily traffic (AADT) volumes vary among these segments, which affects the crash rate calculations. These segments are defined as follows:

- ***Segment 1:*** Parrish Lane to 200 West (MP 319.512 to MP 322.916)
- ***Segment 2:*** 200 West to US 89 (MP 322.916 to MP 324.117)
- ***Segment 3:*** US 89 to Park Lane (MP 324.117 to MP 324.447)
- ***Segment 4:*** Park Lane to Burton Lane (MP 324.447 to MP 326.400)

Crash rate summaries for these four segments are provided in Table 3-4, Table 3-5, Table 3-6, and Table 3-7, respectively. Overall, crash and severity rates are at or below the UDOT statewide averages for this type of facility, except for the severity rate for Segment 2 (likely due to computing an average from a low number of crashes). Crashes per mile were relatively consistent between segments, ranging between 127 and 140.

Table 3-4. Crash Rate Summary for Segment 1: Parrish Lane to 200 West (MP 319.512 to MP 322.916)

Year	Number of Crashes	Crash Rate[a]	Number of Severe Crashes	Severe Crash Rate[b]	AADT	Average Crash Severity Index[c]
2013	142	0.86	2	1.21	132,900	1.30
2014	155	0.91	3	1.77	136,700	1.45
2015	176	0.99	2	1.12	143,600	1.31
Total/avg.	**473/158**	**0.92**	**7**	**1.36**	**137,700**	**1.36**
UDOT average rates for similar roadway facilities (Interstate, 75,000–250,000 AADT)						
Average rates:		**1.12**		**1.40**		**1.34**
Crashes per mile: 139						

[a] Crashes per million vehicle-miles traveled

[b] Severe crashes (serious injury or fatality) per 100 million vehicle-miles traveled

[c] See Table 2-2 for the definition of the Crash Severity Index

Table 3-5. Crash Rate Summary for Segment 2: 200 West to US 89 (MP 322.916 to MP 324.117)

Year	Number of Crashes	Crash Rate[a]	Number of Severe Crashes	Severe Crash Rate[b]	AADT	Average Crash Severity Index[c]
2013	49	0.91	0	0.00	123,200	1.33
2014	49	0.88	1	1.80	126,800	1.27
2015	70	1.20	2	3.43	133,100	1.41
Total/avg.	**168/56**	**1.00**	**3**	**1.74**	**127,700**	**1.34**
UDOT average rates for similar roadway facilities (Interstate, 75,000–250,000 AADT)						
Average rates:		**1.12**		**1.40**		**1.34**
Crashes per mile: 140						

[a] Crashes per million vehicle-miles traveled

[b] Severe crashes (serious injury or fatality) per 100 million vehicle-miles traveled

[c] See Table 2-2 for the definition of the Crash Severity Index

Table 3-6. Crash Rate Summary for Segment 3: US 89 to Park Lane (MP 324.117 to MP 324.447)

Year	Number of Crashes	Crash Rate[a]	Number of Severe Crashes	Severe Crash Rate[b]	AADT	Average Crash Severity Index[c]
2013	11	0.92	0	0.00	99,100	1.18
2014	13	1.06	0	0.00	102,000	1.00
2015	18	1.40	0	0.00	107,100	1.39
Total/avg.	**42/14**	**1.13**	**0**	**0.00**	**102,700**	**1.19**
UDOT average rates for similar roadway facilities (Interstate, 75,000–250,000 AADT)						
Average rates:		**1.12**		**1.40**		**1.34**
Crashes per mile: 127						

[a] Crashes per million vehicle-miles traveled

[b] Severe crashes (serious injury or fatality) per 100 million vehicle-miles traveled

[c] See Table 2-2 for the definition of the Crash Severity Index

Table 3-7. Crash Rate Summary for Segment 4: Park Lane to Burton Lane (MP 324.447 to MP 326.400)

Year	Number of Crashes	Crash Rate[a]	Number of Severe Crashes	Severe Crash Rate[b]	AADT	Average Crash Severity Index[c]
2013	82	1.01	1	1.24	113,500	1.24
2014	87	1.05	2	2.40	116,800	1.46
2015	103	1.18	1	1.14	122,600	1.39
Total/avg.	**272/91**	**1.08**	**4**	**1.08**	**117,600**	**1.36**
UDOT average rates for similar roadway facilities (Interstate, 75,000–250,000 AADT)						
Average rates:		**1.12**		**1.40**		**1.34**
Crashes per mile: 139						

[a] Crashes per million vehicle-miles traveled

[b] Severe crashes (serious injury or fatality) per 100 million vehicle-miles traveled

[c] See Table 2-2 for the definition of the Crash Severity Index

A review of the crash severity values on mainline I-15 in the Glovers Lane and Shepard Lane interchange study areas between 2013 and 2015 showed that a majority of the crashes (74.3%) had no injuries. Three crashes over the 3-year period resulted in fatalities (Table 3-8).

Table 3-8. Three-Year Crash Severity Summary for the I-15 Mainline in the Glovers Lane and Shepard Lane Interchange Study Areas

Crash Severity	Number of Crashes	Percentage of Total Crashes
No injury	710	74.3
Possible injury	172	18.0
Minor injury	59	6.2
Serious injury	11	1.2
Fatality	3	0.3
Total	**955**	**100.0**

The most common type of collision in this area of I-15 is rear-end vehicle crashes (56.9%) followed by a single-vehicle crashes (24.6%). Sideswipe crashes are also relatively common (16%). These collision types are typically observed near on- and off-ramps and during heavy congestion. Table 3-9 summarizes the types of collisions that occurred over the last 3 years in this area of I-15.

Table 3-9. Three-Year Collision Type Summary for the I-15 Mainline in the Glovers Lane and Shepard Lane Interchange Study Areas

Collision Type	Parrish Lane to 200 West		200 West to US 89		US 89 to Park Lane		Park Lane to Burton Lane		Study Corridor	
	#	%	#	%	#	%	#	%	#	%
Front to rear	221	46.7	74	44.0	23	54.8	136	50.0	454	47.5
Single vehicle	145	30.7	48	28.6	13	31.0	80	29.4	286	29.9
Sideswipe	82	17.3	44	26.2	6	14.3	48	14.7	180	18.8
Angle	20	4.2	1	0.6	0	0.0	5	1.8	26	2.7
Parked vehicle	2	0.4	0	0.0	0	0.0	1	0.4	3	0.3
Rear to rear	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Head on	3	0.6	1	0.6	0	0.0	1	0.4	5	0.5
Rear to side	0	0	0	0	0	0.0	1	0.4	1	0.1
Total	**473**	**100%**	**168**	**100%**	**42**	**100%**	**272**	**100%**	**955**	**100%**

To review the incidence of crash clusters on I-15, the number of crashes was plotted based on location, separately for the northbound and southbound directions, for each segment. These plots are provided in Figure 3-4 and Figure 3-5. From these plots, several locations were identified as crash clusters for northbound and southbound I-15. A detailed summary of data for these crash clusters is included in Appendix B.

Figure 3-4. Northbound Crashes by Milepost in the Study Area

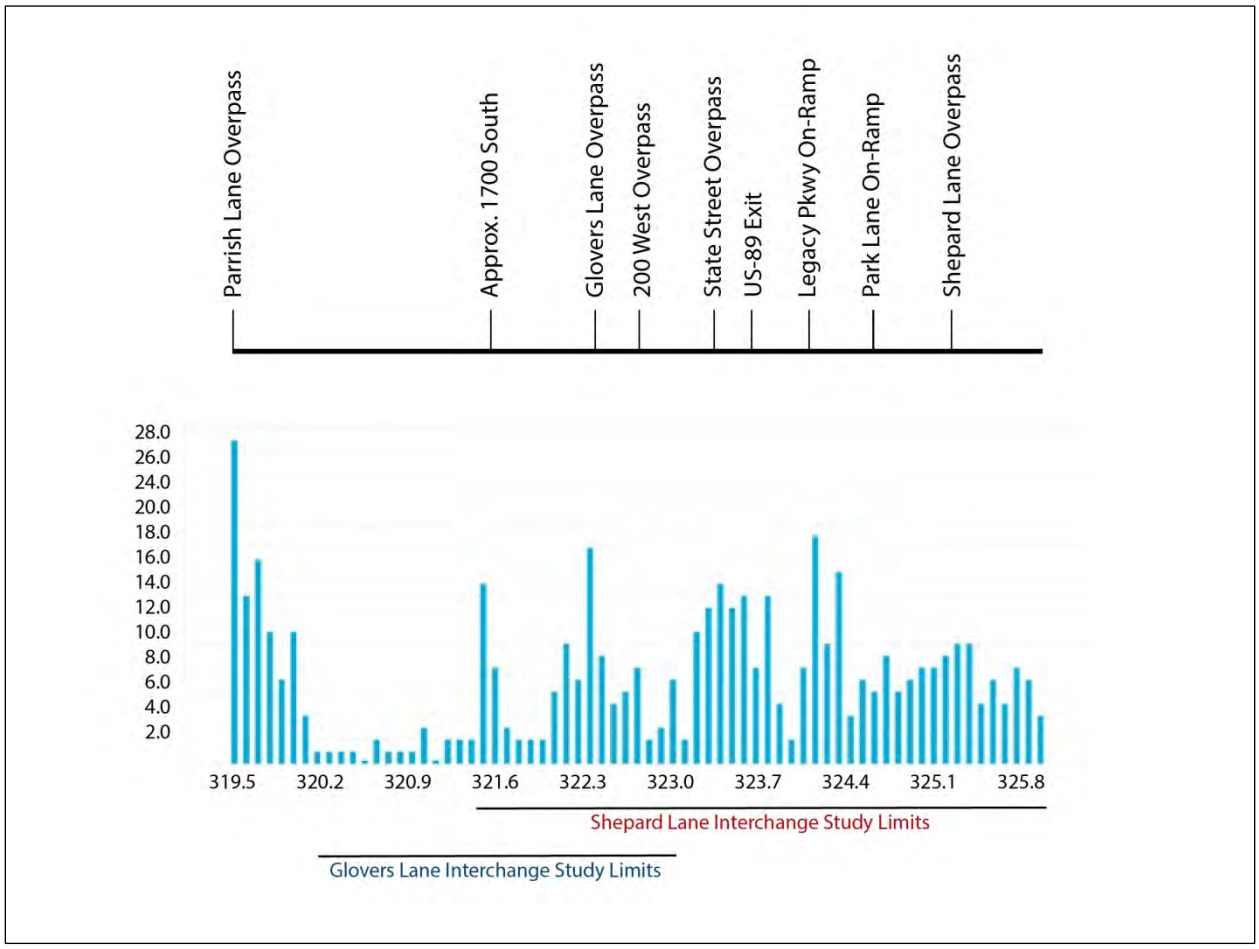


Figure 3-4 above shows that the number of crashes is different within the limits of each interchange. Within the 2.9-mile limits of the Glovers Lane interchange, a total of 127 crashes occurred, or an average of 43.8 per mile. Within the 5.2-mile limits of the Shepard Lane interchange, a total of 411 crashes occurred, or an average of 79 per mile. This higher number of crashes per mile within the limits of the Shepard Lane interchange is likely due to the increase in traffic movements around the US 89 and Legacy Parkway interchanges. These data illustrate that there is an advantage to the location of the Glovers Lane interchange, where the density of crashes is lower.

Figure 3-5. Southbound Crashes by Milepost in the Study Area

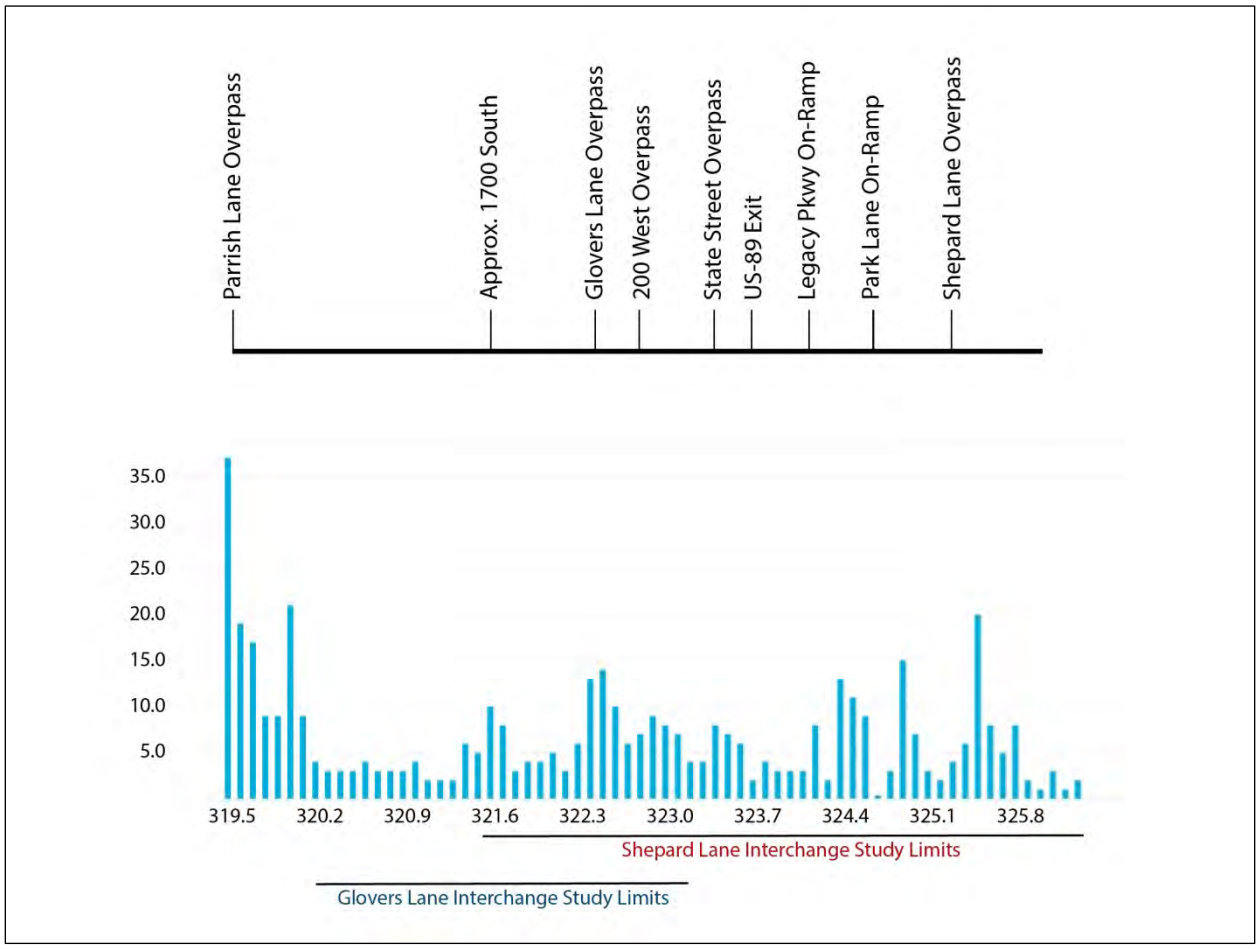


Figure 3-5 above shows that the number of crashes is different within the limits of each interchange. Within the 2.9-mile limits of the Glovers Lane interchange, a total of 161 crashes occurred, or an average of 55.5 per mile. Within the 5.2-mile limits of the Shepard Lane interchange, a total of 306 crashes occurred, or an average of 58.8 per mile. Unlike with the northbound direction, in which the Glovers Lane interchange would be located in an area with fewer crashes, in the southbound direction both interchange locations are comparable in terms of the density of crashes.

3.6.3 Existing Environmental Constraints

UDOT is in the process of preparing an EIS for the WDC Project. In May 2013, UDOT released a Draft EIS, and UDOT expects to release a Final EIS in the summer of 2017. Listed below are the environmental constraints for each interchange alternative.

Glovers Lane

Adjacent to the proposed Glovers Lane system-to-system interchange are the following environmental constraints (see Figure 3-2):

- Wetland areas both east and west of I-15 and Legacy Parkway
- Farmington Skater Park east of I-15
- Legacy Parkway trail west of I-15 and Legacy Parkway
- Utah Transit Authority and Union Pacific Railroad rail lines west of I-15 and east of the Legacy Parkway
- Residential and commercial developments east and west of I-15 and Legacy Parkway

Shepard Lane

Adjacent to the proposed Shepard Lane system-to-system interchange are the following environmental constraints (see Figure 3-3):

- Wetland areas both east and west of I-15 and Legacy Parkway
- Haight Creek riparian corridor west of I-15
- Legacy Parkway trail west of I-15 and Legacy Parkway
- Farmington Station Park development west of I-15 and Legacy Parkway
- Oakridge golf course east of I-15
- Utah Transit Authority and Union Pacific Railroad rail lines west of I-15 and east of Legacy Parkway
- Utah Transit Authority commuter rail station at Farmington Station Park development
- Residential developments east and west of I-15

4.0 Future Conditions

4.1 Future Land Use

4.1.1 Glovers Lane

Similar to the existing land use, future land use in the EIS study area will be primarily residential with commercial uses. The future land use in Farmington will also be similar to the existing land use, with a mix of commercial and residential uses (see Figure 3-2). New commercial and residential developments will continue to be built both east and west of Legacy Parkway and I-15. No major new developments are planned. Some land with wetlands is expected to remain undeveloped.

4.1.2 Shepard Lane

The future land use in Farmington and Kaysville will also be similar to the existing land use; however, in Farmington immediately west of I-15, the Station Park development will continue to expand into the current vacant land (see Figure 3-3). Farmington City plans for this area to be a regional employment center that provides over 6,600 new jobs. This area is proposed by Farmington City to be a master-planned mixed-use development.

4.2 Forecasted Traffic Volumes

Table 4-1 lists the I-15 northbound traffic volumes that were forecasted for the WDC No-Action Alternative in the 2040 design year using WFRC's travel demand model (TDM).

Table 4-1. I-15 Northbound Traffic Volumes for the No-Action Alternative

Location	I-15 2040 Lanes (Northbound)[a]	Existing (2015 Base Year)	Future No-Action (2040 Design Year)
I-15 Mainline	**4 GP** **1 HOV**	**6,360**	**8,020**
Shepard Lane on-ramp (2040 only)		N/A	520
I-15 Mainline at Shepard Lane	**4 GP** **1 HOV**	**6,360**	**7,500**
Shepard Lane off-ramp (2040 only)		N/A	800
NB WDC (Shepard alt. only)		N/A	N/A
I-15 Mainline	**4 GP** **1 HOV**	**6,360**	**8,300**
Park Lane NB on-ramp		690	330
I-15 Mainline	**4 GP** **1 HOV**	**5,670**	**7,970**
Legacy Parkway NB on-ramp		1,350	1,270
I-15 Mainline	**3 GP** **1 HOV**	**4,320**	**6,700**
US 89 NB off-ramp		2,460	3,270
I-15 Mainline	**4 GP** **1 HOV**	**6,780**	**9,970**
200 West NB off-ramp		850	250
Glovers Lane off-ramp (Glovers alt. only)		N/A	N/A
I-15 Mainline	**4 GP** **1 HOV**	**7,630**	**10,220**
Parrish Lane NB on-ramp		780	430
I-15 Mainline at Parrish Lane	**4 GP** **1 HOV**	**6,850**	**9,790**

[a] GP = general-purpose lane, HOV = high-occupancy vehicle lane

Table 4-2 lists the I-15 southbound traffic volumes that were forecasted for the WDC No-Action Alternative in the 2040 design year.

Table 4-2. I-15 Southbound Traffic Volumes for No-Action Alternative

Location	I-15 2040 Lanes (Southbound)[a]	Existing (2015 Base Year)	Future No-Action (2040 Design Year)
I-15 Mainline	**3 GP 1 HOV**	**6,450**	**7,990**
Shepard Lane off-ramp (2040 only)		N/A	700
I-15 Mainline at Shepard Lane	**3 GP 1 HOV**	**6,450**	**7,290**
Shepard Lane on-ramp (2040 only)		N/A	510
I-15 Mainline	**3 GP 1 HOV**	**6,450**	**7,800**
Park Lane SB off-ramp		440	260
Shepard Lane on-ramp (2040 only)		N/A	N/A
I-15 Mainline	**3 GP 1 HOV 1 AUX**	**6,010**	**7,540**
Legacy Parkway SB off-ramp		1,600	1,330
I-15 Mainline	**3 GP 1 HOV**	**4,410**	**6,210**
US 89 SB on-ramp		2,370	3,150
I-15 Mainline	**4 GP 1 HOV**	**6,780**	**9,360**
200 West SB on-ramp		440	440
Glovers Lane on-ramp (Glovers alt. only)		N/A	N/A
I-15 Mainline	**4 GP 1 HOV**	**7,220**	**9,800**
Parrish Lane SB off-ramp		410	390
I-15 Mainline at Parrish Lane	**4 GP 1 HOV**	**6,810**	**9,410**

[a] GP = general-purpose lane, HOV = high-occupancy vehicle lane, AUX = auxiliary lane

Table 4-3 lists the I-15 northbound traffic volumes that were forecasted for the WDC Glovers Lane Alternative in the 2040 design year.

Table 4-3. Forecasted Northbound Traffic Volumes in the PM Peak Hour with the Glovers Lane Alternative in 2040

Location	I-15 2040 Lanes (Northbound)[a]	Volume in 2040	
		No-Action	Glovers Lane Alternative
I-15 Mainline	**4 GP 1 HOV**	**8,020**	**6,610**
Shepard Lane on-ramp		520	580
I-15 Mainline at Shepard Lane	**4 GP 1 HOV**	**7,500**	**6,030**
Shepard Lane off-ramp		800	640
I-15 Mainline	**4 GP 1 HOV**	**8,300**	**6,670**
Park Lane NB on-ramp		330	520
I-15 Mainline	**4 GP 1 HOV**	**7,970**	**6,150**
Legacy Parkway NB on-ramp		1,270	1,000
I-15 Mainline	**3 GP 1 HOV**	**6,700**	**5,150**
US 89 NB off-ramp		3,270	3,170
I-15 Mainline	**4 GP 1 HOV**	**9,970**	**8,320**
200 West NB off-ramp		250	190
Glovers Lane off-ramp (Glovers alt. only)		N/A	2,350
I-15 Mainline	**4 GP 1 HOV 1 AUX**	**10,220**	**10,860**
Parrish Lane NB on-ramp		430	670
I-15 Mainline at Parrish Lane	**4 GP 1 HOV**	**9,790**	**10,190**

[a] GP = general-purpose lane, HOV = high-occupancy vehicle lane, AUX = auxiliary lane

The data in Table 4-3 above show that the Glovers Lane Alternative would remove 2,350 northbound vehicles, or 22% of the traffic, from I-15. This is a benefit to the I-15 mainline as it continues north to the US 89 and Legacy Parkway system interchanges, where congestion is more likely and current crash data show a higher number of crashes. In effect, the alternate route provided by the Glovers Lane Alternative would help reduce congestion, increase safety, and provide a longer service life for I-15 through the US 89 and Legacy Parkway interchanges.

Table 4-4 lists the I-15 southbound traffic volumes that were forecasted for the WDC Glovers Lane Alternative in the 2040 design year.

Table 4-4. Forecasted Southbound Traffic Volumes in the AM Peak Hour with the Glovers Lane Alternative in 2040

Location	I-15 2040 Lanes (Southbound)[a]	Volume in 2040	
		No-Action	Glovers Lane Alternative
I-15 Mainline	**3 GP 1 HOV**	**7,990**	**6,430**
Shepard Lane off-ramp		700	600
I-15 Mainline at Shepard Lane	**3 GP 1 HOV**	**7,290**	**5,830**
Shepard Lane on-ramp (to I-15)		510	440
I-15 Mainline	**3 GP 1 HOV**	**7,800**	**6,270**
Park Lane SB on-ramp		260	400
I-15 Mainline	**3 GP 1 HOV 1 AUX**	**7,540**	**5,870**
Legacy Parkway SB on-ramp		1,330	1,150
I-15 Mainline	**3 GP 1 HOV**	**6,210**	**4,720**
US 89 SB on-ramp		3,150	3,000
I-15 Mainline	**4 GP 1 HOV**	**9,360**	**7,720**
200 West SB on-ramp		440	420
Glovers Lane on-ramp (Glovers alt. only)		N/A	1,990
I-15 Mainline	**4 GP 1 HOV 1 AUX**	**9,800**	**10,130**
Parrish Lane SB off-ramp		390	540
I-15 Mainline at Parrish Lane	**4 GP 1 HOV**	**9,410**	**9,590**

[a] GP = general-purpose lane, HOV = high-occupancy vehicle lane, AUX = auxiliary lane

Similar to the analysis for the northbound direction, the Glovers Lane Alternative would remove 1,990 southbound vehicles, or 20% of the traffic, from I-15. This again shows that the Glovers Lane Alternative, as an alternate route, is a benefit to the I-15 mainline in the area of the US 89 and Legacy Parkway system interchanges.

Table 4-5 lists the I-15 northbound traffic volumes that were forecasted for the WDC Shepard Lane Alternative in the 2040 design year.

Table 4-5. Forecasted Northbound Traffic Volumes in the PM Peak Hour with the Shepard Lane Alternative in 2040

Location	I-15 2040 Lanes (Northbound)[a]	Volume in 2040	
		No-Action	Shepard Lane Alternative
I-15 Mainline	**4 GP 1 HOV**	**8,020**	**6,750**
Shepard Lane and CD on-ramp (Shepard alt. only)		N/A	2,120
Shepard Lane on-ramp		520	520
CD Road		***N/A***	***1,600***
Shepard Lane off-ramp		N/A	480
Off-ramp to WDC from CD		N/A	2,770
I-15 Mainline	**3 GP 1 HOV 1 AUX**	**7,500**	**4,630**
CD Road		***N/A***	***4,850***
NB CD-road off-ramp		N/A	2,170
CD Road		***N/A***	***2,680***
Park Lane NB on-ramp to CD		N/A	460
Legacy Parkway NB on-ramp to CD		N/A	2,220
I-15 Mainline	**3 GP 1 HOV**	**6,700**	**6,800**
US 89 NB off-ramp		3,270	3,080
I-15 Mainline	**4 GP 1 HOV**	**9,970**	**9,880**
200 West NB off-ramp		250	370
I-15 Mainline	**4 GP 1 HOV**	**10,220**	**10,250**
Parrish Lane NB on-ramp		430	490
I-15 Mainline at Parrish Lane	**4 GP 1 HOV**	**9,790**	**9,760**

[a] GP = general-purpose lane, HOV = high-occupancy vehicle lane, AUX = auxiliary lane

Based on the data in Table 4-5 above, there would be more traffic on the northbound collector-distributor road (4,850) than on mainline I-15 (4,630). On the north end of the Shepard Lane interchange, the interchange would reduce northbound I-15 traffic volumes by 2,120 vehicles, for a 24% reduction in I-15 traffic.

Table 4-6 lists the I-15 southbound traffic volumes that were forecasted for the WDC Shepard Lane Alternative in the 2040 design year.

Table 4-6. Forecasted Southbound Traffic Volumes in the AM Peak Hour with the Shepard Lane Alternative in 2040

Location	I-15 2040 Lanes (Southbound)[a]	Volume in 2040	
		No-Action	Shepard Lane Alternative
I-15 Mainline	**3 GP 1 HOV 1 AUX**	**7,990**	**6,720**
Shepard Lane/CD road off-ramp		700	2,120
I-15 Mainline at Shepard Lane	**3 GP 1 HOV**	**7,290**	**4,600**
Shepard Lane off-ramp (from CD road)		N/A	510
CD Road		***N/A***	***1,610***
Shepard Lane on-ramp (to I-15)		N/A	200
Shepard Lane on-ramp (to CD road)		N/A	100
WDC on-ramp (to I-15)		N/A	1,400
WDC on-ramp (to CD road)		N/A	960
CD Road		***N/A***	***2,670***
Shepard/WDC on-ramp (to I-15)		N/A	1,600
Park Lane SB off-ramp (from CD road)		N/A	450
I-15 Mainline	**3 GP 1 HOV**	**6,210**	**6,200**
US 89 SB on-ramp		3,150	3,070
I-15 Mainline	**4 GP 1 HOV**	**9,360**	**9,270**
200 West SB on-ramp		440	390
I-15 Mainline	**4 GP 1 HOV**	**9,800**	**9,660**
Parrish Lane SB off-ramp		390	430
I-15 Mainline at Parrish Lane	**4 GP 1 HOV**	**9,410**	**9,230**

[a] GP = general-purpose lane, HOV = high-occupancy vehicle lane, AUX = auxiliary lane

Similar to the analysis for the northbound direction, at the north end of the Shepard Lane interchange, the interchange would reduce southbound I-15 traffic volumes by 2,120 vehicles, for a 24% reduction in I-15 traffic.

5.0 Interchange Alternatives

5.1 Alternatives

UDOT considered a reasonable range of alternatives during the EIS alternatives-development and screening process. Alternatives consisted of a No-Action Alternative, a TSM/ TDM Alternative, transit alternatives, a land-use-change alternative (the Shared Solution), multiple east-west and north-south arterial expansion alternatives, an arterial expansion alternative that included improvements to I-15, and new north-south highway alternatives. In all, 51 alternatives were evaluated during the screening process. The range of alternatives was evaluated through a two-step process: a purpose and need evaluation and an environmental assessment analysis.

More information about the alternatives considered during the EIS process can be found in *Technical Memorandum 15: Alternatives Screening Report*.

5.1.1 No-Action Alternative

The WDC No-Action Alternative is evaluated in the Draft EIS. This alternative did not meet the project's purpose and need because it did not provide a substantial improvement to regional mobility in the study area. The daily 2040 user delay for the No-Action Alternative is expected to be 62% greater than the existing base year delay, and the vehicle-miles traveled in congestion during the PM peak period would increase by 50%.

The measures of effectiveness (MOEs) for the No-Action Alternative are included in Table 5-2 in Section 5.1.3.

5.1.2 Improvements to Alternate Interchanges

Consideration of Alternate Locations on I-15 for the WDC Interchange

During the alternative development process for the WDC Draft EIS, the WDC team also considered five other southern terminus options for the new roadway alternatives. The five other southern terminus options were suggested by members of the public during the August 2010 public comment period or during the alternatives screening comment period in the spring of 2011. The WDC team found that these five other southern terminus options either would not be feasible to design or would not function from a transportation perspective. Table 5-1 lists the five southern connection options and why they were eliminated from further consideration. Figure 5-1 below shows the locations of the five southern terminus options.

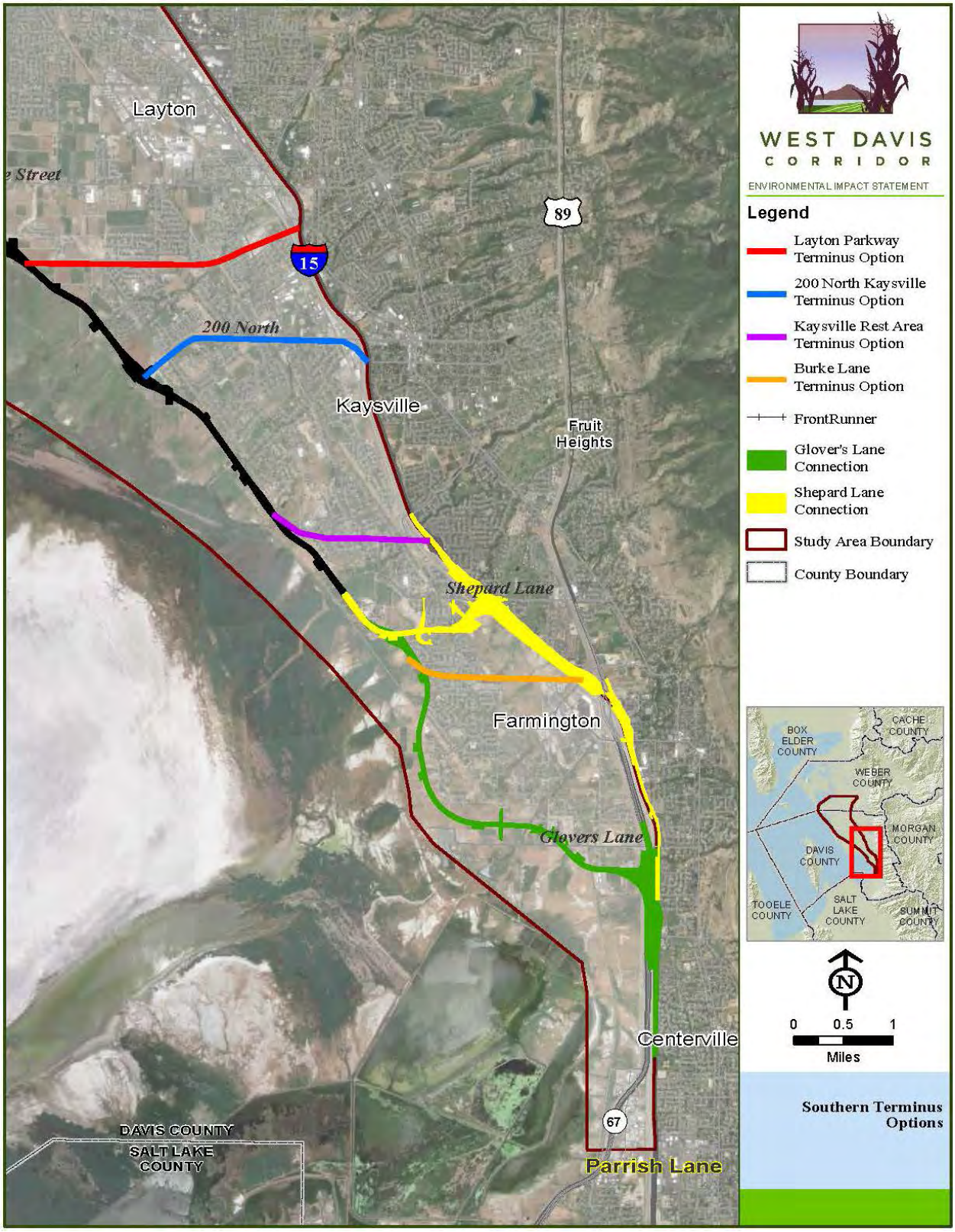
Table 5-1. Southern Terminus Options Eliminated during Level 1 Screening

Southern Terminus Option	Reason for Elimination
Burke Lane connection in Farmington	Engineers determined that a WDC alignment could not connect to I-15 and Legacy Parkway with a system interchange coming in directly from the west on Burke Lane. The existing I-15, Legacy Parkway, Park Lane, and US 89 system-to-system interchange, the FrontRunner commuter-rail line, and Farmington commuter-rail station would need to be realigned and reconstructed in order for a system interchange to be possible at this location. Even if it were possible to design an interchange to connect at Burke Lane, the costs of realigning and reconstructing the I-15, Legacy Parkway, Park Lane, and US 89 system-to-system interchange and the FrontRunner commuter-rail line would be prohibitive. Additionally, analysis completed after the Draft EIS that evaluated the signing requirements at this interchange location showed that the signing design would not meet *MUTCD* standards.
Connection to I-15 in Kaysville near the rest area (I-15 at MP 326)	The travel demand model showed that a connection to I-15 at the Kaysville rest area would not meet the purpose of and need for the project and would cause failure conditions (LOS E or F) on I-15 between the Kaysville rest area and Legacy Parkway. Additionally, analysis completed after the Draft EIS that evaluated the signing requirements at this interchange location showed that the signing design would not meet *MUTCD* standards.
Connection to I-15 at 200 North in Kaysville (I-15 at MP 328)	The travel demand model showed that a connection to I-15 at 200 North in Kaysville would not meet the purpose of and need for the project and would cause failure conditions (LOS E or F) on I-15 between 200 North and Legacy Parkway.
Connection to I-15 at Layton Parkway (I-15 at MP 330)	The travel demand model showed that a connection to I-15 at Layton Parkway would not meet the purpose of and need for the project and would cause failure conditions (LOS E or F) on I-15 between Layton Parkway and Legacy Parkway.
Farmington Couplet Concept	The Farmington Couplet Concept would involve splitting WDC traffic in Farmington. Northbound traffic would use the Shepard Lane Option, and southbound traffic would use the Glovers Lane Option. The Farmington Couplet Concept would be contrary to FHWA policy, since it would not accommodate all four movements to and from the WDC and I-15 at the same location. Additionally, the Farmington Couplet Concept would create major operational and safety concerns because the northbound and southbound movements would connect to I-15 over 3 miles apart with the existing Legacy Parkway and US 89 system-to-system interchanges located between the two connections.

In addition to the transportation issues identified above in Table 5-1, any of these alternatives would also have more impacts to the built and natural environment compared to a WDC interchange located at Shepard Lane or Glovers Lane.

In summary, the WDC analysis concluded that the only potentially reasonable locations on I-15 where a WDC interchange could be located are the Glovers Lane and Shepard Lane interchange locations described in this IACR.

Figure 5-1. Southern Terminus Options



Consideration of Local Service Interchanges

Local Service Interchange at Shepard Lane or Park Lane. The WDC team also evaluated connecting the WDC to a proposed local service interchange at Shepard Lane that is identified on the regional transportation plan and an existing local service interchange at Park Lane. Connecting the WDC to a local interchange through an arterial street would cause the interchange to fail (that is, operate at LOS F) and would increase congestion on the WDC alternative so it would not pass Level 1 screening criteria. The traffic modeling showed a high-volume of traffic exiting I-15 and Legacy Parkway to access WDC and high volume of traffic from WDC to access I-15 and Legacy Parkway. The traffic modeling determined that a local service interchange did not have the capacity to accommodate these high traffic volumes.

Local Service Interchange at Glovers Lane. There are no existing or planned local interchanges near the area where the Glovers Lane interchange would connect with I-15. However, UDOT evaluated this location to determine whether a local service interchange would meet the transportation demand. Similar to the Shepard or Park Lane interchanges above, an arterial WDC connection to I-15 and Legacy Parkway through a local service interchange would operate in failure and not meet the transportation need. As a result, the Glovers Lane interchange was designed as a system-to-system interchange.

Overall, the travel demand modeling showed that only a new system-to-system connection with I-15 would meet the project's purpose.

5.1.3 Transportation Management Alternative

Glovers Lane and Shepard Lane

TSM/TDM Alternative. UDOT evaluated a TSM/TDM Alternative. This alternative would improve roadway operations by 10% by using system-wide mobility improvements on Hinckley Drive, 4000 South, 5500/5600 South, 1800 North, State Route (SR) 193, Antelope Drive, SR 126, and SR 108. This alternative did not meet the WDC Project's purpose and was eliminated from detailed study during the EIS process because the alternative did not provide a substantial improvement to regional mobility. The Level 1 screening results are given in Table 5-2 below.

Transit Alternatives. In addition, the following two transit alternatives were evaluated:

- ***Alternative 01 (Ultimate Transit).*** In addition to the transit projects in the *RTP*, add light-rail transit along 4000 South and Antelope Drive, add bus rapid transit along 1800 North and in Layton (all lines would connect to existing FrontRunner commuter-rail stations), and reduce FrontRunner headway times to 30 minutes.
- ***Alternative 02.*** Assumes the same transit projects listed in Alternative 01 with changes in population to support higher transit use.

Neither of the transit alternatives would meet the project's purpose, and both were eliminated from detailed study during the EIS process.

Shared Solution Alternative. During the screening process, UDOT also evaluated the Shared Solution Alternative. The Shared Solution Alternative is an alternative comprising various improvements to existing highways, transit projects, and land use changes. The Shared Solution Alternative was developed over many months based on input from the Shared Solution Coalition, city and county officials, UDOT, the Utah Transit Authority (UTA), and other stakeholders. For more information about the Shared Solution Alternative, refer to *Development and Evaluation of the Shared Solution Alternative* which can be found on the WDC website at www.udot.utah.gov/westdavis/documentation#shared_solution.

During the screening process, UDOT determined that the Shared Solution Alternative would not meet the project's purpose and would not substantially improve regional mobility, and it was eliminated from detailed study.

Table 5-2 below shows the Level 1 screening results for the TSM/TDM Alternative, the two transit alternatives, and the Shared Solution Alternative.

Table 5-2. Level 1 Screening Results from the 2016 Screening Process

Alternative	Measure of Effectiveness (MOE)				
	Daily Total Delay (hr)	North-South Road Lane-Miles with V/C ≥ 0.9	East-West Road Lane-Miles with V/C ≥ 0.9	Vehicle-Miles Traveled (VMT) with V/C ≥ 0.9	Vehicle-Hours Traveled (VHT) with V/C ≥ 0.9
No-Action	18,310	116.2	30.5	642,000	20,770
TSM/TDM	17,290	110.0	22.8	614,700	19,180
01 (old 1b) Ultimate Transit	17,880	116.2	30.0	639,300	20,510
02 (old 1c) Ultimate Transit with population changes	17,320	112.6	30.5	628,300	19,860
03 Shared Solution Alternative	16,590	111.0	20.7	597,100	17,610
Average	15,240	104.0	22.9	563,700	17,080
1st Quartile	13,680	91.7	18.3	484,400	14,540

Legend

xx,xxx	MOE value is higher than No-Action MOE value.
xx,xxx	MOE value is higher than average of all alternatives.
xx.x	MOE value is lower than average of all alternatives but not in 1st quartile.
xx.x	MOE value is in 1st quartile of all alternatives.
Alt. xxx	Alternative eliminated because at least one MOE value is higher than No-Action.
Alt. xxx	Alternative eliminated because at least one MOE value is higher than average of all alternatives.
Alt. xxx	Alternative eliminated because less than three of five MOE values are in the 1st quartile of all alternatives.
Alt. xxx	Alternative advanced because the above rejection criteria were not met.

V/C refers to volume to capacity, which is a measure of the actual traffic volume on a road compared to the traffic capacity for which the road was designed. A V/C ratio equal to or greater than 0.9 indicates heavy congestion.

TSM/TDM refers to Transportation System Management/Transportation Demand Management.

5.1.4 Proposed Alternatives

Glovers Lane

Figure 5-2 shows the design of the Glovers Lane Alternative's system-to-system interchange. The Glovers Lane interchange would provide access to and from I-15 and Legacy Parkway with system-to-system directional ramps. Four directional ramps would provide direct access from southbound WDC to southbound I-15 and Legacy Parkway and northbound from I-15 and Legacy Parkway to northbound WDC. The other movements (southbound WDC to northbound Legacy Parkway and I-15, and southbound from I 15 and Legacy Parkway to northbound WDC) would be provided with a system-to-system connection to Legacy Parkway, which connects to I-15 2 miles to the north. This approach provides continuous system connections for these relatively minor traffic movements in a cost-effective way. With the proposed Glovers Lane interchange, all system movements would be provided and would be direct and continuous.

Shepard Lane

Figure 5-3 shows the design of the Shepard Lane Alternative's system-to-system interchange. The Shepard Lane interchange would provide access to and from I-15 and Legacy Parkway with a combination of directional ramps, collector-distributor roads, and a local interchange and street network. Three of the five main movements—northbound I-15/Legacy Parkway to northbound WDC, southbound WDC to southbound I-15, and southbound WDC to southbound Legacy Parkway—would be continuous and would be provided by northbound and southbound collector-distributor roads. The southbound WDC to northbound I-15 movement and the southbound I-15 to northbound WDC movement would be provided by the Shepard Lane local interchange and a signalized street network. Connections from I-15, Legacy Parkway, and the WDC would be provided to and from the local interchanges at Shepard Lane and Park Lane.

Figure 5-2. Glovers Lane Interchange Design

Figure 5-3. Shepard Lane Interchange Design

6.0 FHWA Policy Point 1 – Need for New Access

Policy Point 1

The need being addressed by the request cannot be adequately satisfied by existing interchanges to the Interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays or lengthening storage) to satisfactorily accommodate the design-year traffic demands [23 Code of Federal Regulations (CFR) 625.2(a)].

Discussion

The WDC screening process evaluated 51 alternatives including a TSM/TDM alternative, two transit alternatives, the Shared Solution Alternative, and five alternatives that proposed improvements to existing roadways and I-15 interchanges. UDOT also evaluated several arterial versions of the WDC including a five-lane arterial and a two-lane highway that potentially could have connected to local streets through improved existing interchanges.

Of the 51 alternatives evaluated, 7 met the transportation need and therefore passed Level 1 screening. These included alternatives that would widen I-15 and existing arterial routes (Alternatives 5 and 8) and new four-lane divided highway alternatives on various alignments that used either the Shepard Lane or Glovers Lane interchanges (Alternatives 09A, 10A, 11A, 12A, and 13A). During Level 2 screening, which considers costs and impacts, Alternatives 5, 8, 9A, 10A, and 12A were eliminated due to excessive costs, impacts to residents and businesses, and/or impacts to the natural environment. Only Alternatives 11A and 13A, with the Shepard Lane and Glovers Lane interchange options, passed the Level 1 and 2 screening criteria and were advanced for more detailed study in the EIS. (For more information on the WDC alternative screening process, see Technical Memorandum 15: Alternatives Screening Report).

As summarized above in Section 5.1.2, as part of this process, UDOT also evaluated other southern connections for the WDC new highway alternatives. These evaluated connections included the existing Layton Parkway and 200 North interchanges, the Kaysville rest area on I-15 at milepost 326.5, the Burke Lane interchange, and a Farmington couplet concept. The WDC team found that these five other southern terminus options either would not meet the transportation need or would not be technically feasible due to logistical constraints and prohibitive costs. These alternatives would also have more impacts to the built and natural environment compared to a WDC interchange located at Shepard Lane or Glovers Lane.

As summarized above in Section 5.1.2, the WDC team also evaluated connecting the WDC to local service interchanges at Shepard Lane, Glovers Lane, or the existing Park Lane interchange. This analysis concluded that none of these local interchange options would have the capacity to meet the transportation need and would result in failing levels of service.

In summary, the WDC EIS screening analysis demonstrated that 2040 transportation need can be met only by system-to-system interchanges at either Shepard Lane or Glovers Lane. Based

on the information summarized above, both the Glovers Lane interchange and the Shepard Lane interchange comply with Policy Point 1.

7.0 FHWA Policy Point 2 – TSM/Transit

Policy Point 2

The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities), geometric design, and alternative improvements to the Interstate without the proposed change(s) in access [23 CFR 625.2(a)].

Discussion

UDOT considered a reasonable range of alternatives during the EIS alternatives-development and screening process. Among these were a No-Action Alternative, a TSM/TDM Alternative, transit alternatives, and a land-use-change alternative (the Shared Solution). As shown in Table 5-2 in Section 5.1.3, these alternatives did not meet the Level 1 purpose and need screening criteria. Because none of these alternatives met the project's purpose to substantially improve regional mobility, they were eliminated from detailed study and further consideration. More information about the alternatives considered during the EIS process can be found in Technical Memorandum 15: Alternatives Screening Report.

Based on the information summarized above, both the Glovers Lane interchange and the Shepard Lane interchange comply with Policy Point 2.

8.0 FHWA Policy Point 3 – Operations/Safety Analysis

Policy Point 3

An operational and safety analysis has concluded that the proposed change in access [would] not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access [23 CFR 625.2(a), 655.603(d), and 771.111(f)]. The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, shall be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network [23 CFR 625.2(a) and 655.603(d)]. Requests for a proposed change in access must include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute, and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network [23 CFR 625.2(a) and 655.603(d)]. Each request must also include

a conceptual plan of the type and location of the signs proposed to support each design alternative [23 USC 109(d) and 23 CFR 655.603(d)].

Discussion

The operations and safety analysis for the Glovers Lane and Shepard Lane interchanges showed that, although both interchanges would operate within acceptable levels of service, there is a significant difference between the two alternatives in the safety characteristics of each interchange design. This difference is attributed to the interchange location and design.

The Glovers Lane interchange would be located 1.8 miles south of the US 89 and Legacy Parkway system interchanges, where room is available for system-to-system directional ramps with little influence from other interchanges. The Shepard Lane interchange would be less than 0.5 mile north of the US 89 and Legacy Parkway system interchanges where room is not available for directional ramps and where traffic would be heavily influenced by adjacent system and local interchanges. To accommodate traffic, the Shepard Lane interchange must rely on collector-distributor roads to provide the system-to-system movements, some of which would overlap with movements to and from the existing Legacy Parkway interchange. The interchange design is complex, violating driver expectancy and requiring extensive weaving. Furthermore, signing for the Shepard Lane interchange cannot meet *MUTCD* standards. The safety analysis shows that all of these factors combined present a significant safety risk that cannot be reasonably mitigated.

Traffic Modeling Analysis

The traffic modeling analysis showed that the I-15 mainline would operate at acceptable levels of service with either the Glovers Lane or Shepard Lane interchanges.

To compare operations between the Shepard Lane and Glovers Lane Alternatives, the total network delay, total travel time, delay per vehicle, and average vehicle speeds were measured in the VISSIM models (Table 8-1). Measurements for the No-Action Alternative are also presented in Table 8-1 for comparison.

Table 8-1. Comparison of Operational Performance of the Shepard Lane, Glovers Lane, and No-Action Alternatives

Alternative	Average Delay (seconds/vehicle)	Average Speed (mph)	Total Travel Time (hours)	Total Delay (hours)
Shepard Lane	14.37	65.6	2,817.8	135.7
Glovers Lane	13.45	66.3	2,751.6	122.9
No-Action	73.99	55.2	2,991.5	822.6

Both the Shepard Lane and Glovers Lane Alternatives would perform better than the No-Action Alternative, with the Glovers Lane Alternative having about 10% less overall delay than the Shepard Lane Alternative.

Travel times (in seconds) between the alternatives are presented in Table 8-2 below.

Table 8-2. Comparison of Travel Time with the Shepard Lane, Glovers Lane, and No-Action Alternatives

In seconds

Segment	Shepard Lane	Glovers Lane	No-Action
SB I-15 thru traffic	390	378	390
NB I-15 thru traffic	372	378	528
NB I-15 to WDC	414	384	n/a
SB WDC to SB I-15	402	378	n/a

Although both alternatives generally would be better than the No-Action Alternative, the Glovers Lane Alternative would have slightly shorter travel times.

Appendix C includes the 2040 modeled density and speeds for selected analysis segments for the No-Action and action alternatives. All of the analysis segments for the Shepard Lane or Glovers Lane Alternatives have a link density of less than 35 vehicles per mile, which is comparable to LOS D.

Based on the traffic modeling, both the Glovers Lane and Shepard Lane interchanges appear to have capacity and operate with an acceptable level of service, with the Glovers Lane interchange having about 10% less delay.

Safety Analysis

In addition to an operations analysis, Policy Point 3 requires that a safety analysis consider not only the proposed interchange improvements but also how adjacent interchanges could affect the ability of the proposed interchange "to safely and efficiently collect, distribute, and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroads, and local street network." The safety analysis for the Glovers Lane and Shepard Lane interchanges indicates that the difference in safety between the two interchanges is due to their different locations with respect to other interchanges. FHWA's *Interstate System Access Informational Guide* (2010) states that "[i]nterchanges, when spaced too closely along an Interstate corridor, negatively affect the traffic operations and safety performance of the Interstate." The AASHTO *Interstate Access Guide* specifies a minimum spacing of 1 mile for urban service interchanges. For system-to-system interchanges, more spacing might be needed due to higher traffic speeds in merge and diverge areas and adequate advance guide signing.

Glovers Lane

The Glovers Lane interchange would be located 1.8 miles south of the US 89 and Legacy Parkway system interchanges and 2.7 miles north of the Parrish Lane local interchange. In this location, ample room is available for conventional system-to-system directional ramps with little influence from adjacent interchanges. Section 14.0 includes an analysis of the interchange for compliance with engineering safety standards. Based on this review, the interchange design meets all applicable standards, is straightforward and meets driver

expectancy, and minimizes weaving and potential for crashes. Because this interchange is able to fully meet engineering design standards and well exceeds the minimum interchange spacing requirements, the frequency and severity of crashes is expected to be within the normal range for this type of facility. Additionally, from a public safety standpoint, this interchange provides an alternate route for traffic in case of emergency situations or evacuations.

Shepard Lane

The Shepard Lane interchange would be located less than 0.5 mile north of the US 89 and Legacy Parkway system-to-system interchanges and would be between two local interchanges (Park Lane and Shepard Lane) that are spaced 1.2 miles apart. This essentially places three interchanges within the limits of the Shepard Lane system-to-system interchange. In this location, room is not available for directional ramps that would allow for conventional merge and diverge areas.

To accommodate traffic to and from the various interchanges, the Shepard Lane interchange must rely on collector-distributor roads that provide less than 0.5 mile for system-to-system and local interchange movements. This would result in a very constrained and complex interchange and would require extensive weaving with a high potential for vehicle conflicts. The standards compliance analysis in Section 14.0 identified several concerns with the Shepard Lane interchange design, including numerous violations of *MUTCD* standards (see Appendix D), noncompliance with lane balance and driver expectancy, and a short and very complex weaving section. These substandard conditions and concerns would contribute to an increased risk for crashes.

With traffic going to and from the WDC, Legacy Parkway, I-15, Park Lane, and Shepard Lane via the collector-distributor roads that are adjacent to the I-15 mainline, this interchange would not provide an alternate route. Rather, it would present a risk that multiple north-south corridors would be simultaneously blocked when accidents or other emergency situations occur.

Based on the information summarized above, the Glovers Lane interchange complies with Policy Point 3, whereas the Shepard Lane interchange does not comply with Policy Point 3.

9.0 FHWA Policy Point 4 – Full Access/Standards Compliance

Policy Point 4

The proposed access connects to a public road only and [would] provide for all traffic movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access for managed lanes (e.g., transit, HOVs, HOT [high-occupancy toll] lanes), or park-and-ride lots. The proposed access will be designed to meet or exceed current standards [23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)].

Discussion

Glovers Lane

The WDC would be classified as a limited-access highway, would be part of the state highway network, and would be a public road. The proposed Glovers Lane interchange would provide access to and from I-15 and Legacy Parkway with continuous system-to-system directional ramps for all movements. Four directional ramps would provide direct access from southbound WDC to southbound I-15 and Legacy Parkway and northbound from I-15 and Legacy Parkway to the WDC. WDC traffic access to northbound Legacy Parkway and I-15 would be provided by a directional ramp from the WDC to Legacy Parkway (which connects to I-15 north of the Glovers Lane interchange). Southbound access from I-15 and Legacy Parkway would be provided by a directional ramp from Legacy Parkway to the WDC.

The standards compliance review in Section 14.0 shows that the Glovers Lane interchange meets or exceeds all state and federal standards. This includes FHWA's 13 Critical Elements, UDOT's *Roadway Design Manual of Instruction and Standard Drawings*, the *MUTCD*, and AASHTO standards and guidance. Based on this information the Glovers Lane interchange complies Policy Point 3.

Shepard Lane

The WDC would be classified as a limited-access highway, would be part of the state highway network, and would be a public road. The Shepard Lane interchange would provide access to and from I-15 and Legacy Parkway with a combination of directional ramps, collector-distributor roads, and a local interchange and street network. Three of the five main movements—northbound I-15/Legacy Parkway to northbound WDC, southbound WDC to southbound I-15, and southbound WDC to southbound Legacy Parkway—would be continuous and would be provided by northbound and southbound collector-distributor roadways. The southbound WDC to northbound I-15 movement and the southbound I-15 to northbound WDC movement would be provided by the Shepard Lane local interchange and a signalized street network. Connections from I-15, Legacy Parkway, and the WDC would be provided to and from the local interchanges at Shepard Lane and Park Lane. Because two of the five system movements would not be continuous but would be provided through a local interchange and a signalized street network, it is questionable whether the Shepard Lane interchange meets the intent of Policy Point 4 for a full-access interchange.

Furthermore, the Shepard Lane interchange does not fully meet state and federal standards. The design would require design waivers for UDOT standards for left exits and curve radius. A review of the signing plans identified over 30 violations of the *MUTCD* standards (see Appendix D). Also, the standards compliance review, included in Section 14.0, identified several deficiencies with respect to AASHTO standards and guidance in areas such as driver expectancy, interchange spacing, lane balance, and weaving.

To attempt to resolve these concerns, UDOT evaluated moving the Shepard Lane system-to-system interchange to the north or the south of its proposed location on I-15. This analysis showed that the interchange would still result in the numerous violations to the MUTCD standards. Moving the interchange to the south would result in the WDC system-to-system interchange being located closer to the I-15/US 89/Legacy Parkway system-to-system interchange and the I-15/Park Lane local interchange. Moving the WDC Shepard Lane interchange farther north near the rest area in Kaysville would move it farther from the I-15/US 89/Legacy Parkway system-to-system interchange but would still require similar collector-distributor ramp systems to accommodate the I-15/US 89/Legacy Parkway system-to-system interchange movements, the planned Shepard Lane local interchange, and the WDC system-to-system interchange. These collector-distributor ramps and multiple movements in a short distance would still result in numerous violations of the MUTCD standards even if the location were shifted to the south or north of the location evaluated in this IACR. Alternatives farther north of the rest area in Kaysville (200 North in Kaysville and Layton Parkway) were found not to meet the Level 1 screening criteria and were eliminated from detailed evaluation.

Based on the information summarized above, the Shepard Lane interchange does not comply with Policy Point 4.

10.0 FHWA Policy Point 5 – Local/Regional Plans

Policy Point 5

The proposal considers and is consistent with local and regional land use and transportation plans. Prior to receiving final approval, all requests for new or revised access must be included in an adopted Metropolitan Transportation Plan, in the adopted Statewide or Metropolitan Transportation Improvement Program (STIP or TIP), and the Congestion Management Process within transportation management areas, as appropriate, and as specified in 23 CFR part 450, and the transportation conformity requirements of 40 CFR parts 51 and 93.

Discussion

The WDC Project is based on a 2040 planning horizon and is included in WFRC's 2015–2040 *RTP*, UDOT's *Long-Range Plan*, the State Transportation Improvement Program (STIP), and the Congestion Management Process. The *RTP* identifies the WDC project to be constructed during Phase 1 (2015–2024) to Antelope Drive in Syracuse. The remaining project to the north would be built in Phase 2 (2025–2034). No construction funding has been

allocated to the project in the 5-year STIP; however $10 million is identified in fiscal year 2019 for preconstruction engineering. The project is included in the local Cities' land-use and transportation plans. The project is also included in the transportation conformity requirements for the Wasatch Front.

Based on the information summarized above, both the Glovers Lane interchange and the Shepard Lane interchange comply with Policy Point 5.

11.0 FHWA Policy Point 6 – Future Nearby Interchanges

Policy Point 6

In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan [23 USC. 109(d), 23 CFR 625.2(a), 655.603(d), and 771.111].

Discussion

Glovers Lane

There are no plans for any future interchanges in the Glovers Lane interchange study area.

Shepard Lane

A Shepard Lane local interchange is being planned in the Shepard Lane interchange study area. This interchange would provide local access from I-15 to Shepard Lane in Farmington. The Shepard Lane local interchange is included in Phase 1 of WFRC's 2015–2040 *RTP* and Farmington City's transportation plan. The Shepard Lane local interchange has been included in the design of the WDC Shepard Lane system-to-system interchange that also provides connections to I-15 and Legacy Parkway. If the Shepard Lane system-to-system interchange is selected by FHWA in the Final EIS, the local interchange will be built in conjunction with the larger WDC Project and its system-to-system interchange.

Based on the information summarized above, both the Glovers Lane interchange and the Shepard Lane interchange comply with Policy Point 6.

12.0 FHWA Policy Point 7 – Planned Development

Policy Point 7

When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements [23 CFR 625.2(a) and 655.603(d)]. The request must describe the commitments agreed upon to [ensure] adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point [23 CFR 625.2(a) and 655.603(d)].

Discussion

The new access proposed at I-15 is not needed based on any particular isolated land-development project. The proposed access is needed as a result of growing population and employment and a decrease in regional mobility in western Davis and Weber Counties. As previously stated in Section 1.1, Background, the proposed WDC Project is being developed in accordance with WFRC's *RTP* and local and regional land-use and transportation plans. The proposed project is also being coordinated with the land-use and transportation plans of the surrounding communities and jurisdictional agencies of the roadway network.

Based on the information summarized above, both the Glovers Lane interchange and the Shepard Lane interchange comply with Policy Point 7.

13.0 FHWA Policy Point 8 – NEPA

Policy Point 8

The proposal can be expected to be included as an alternative in the required environmental evaluation, review, and processing. The proposal should include supporting information and current status of the environmental processing (23 CFR 771.111).

Discussion

Under the requirements of the National Environmental Policy Act (NEPA), an EIS is being prepared for the WDC Project. As previously discussed in Section 5.1, Alternatives, a range of alternatives were evaluated, and two system-to-system interchanges (at Shepard Lane and Glover Lane) with I-15 are being evaluated. A Draft EIS was released in May 2013, and UDOT expects to release a Final EIS in 2017. FHWA is reviewing the public comments on the Draft EIS, the interstate access reports, an updated travel demand model associated with WFRC's 2015–2040 *RTP*, and other data before making a recommendation regarding a preferred alternative. Ongoing coordination with the appropriate resource agencies, such as the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the Utah Division of Wildlife Resources, and other federal, regional, and local agencies, has occurred throughout the project.

Based on the information summarized above, both the Glovers Lane interchange and the Shepard Lane interchange comply with Policy Point 8.

14.0 Compliance with Engineering Standards

This section summarizes how well each alternative meets engineering standards and guidance, including:

- FHWA's 13 Critical Elements (AASHTO)
- UDOT *Roadway Design Manual of Instruction and Standard Drawings*
- *Manual on Uniform Traffic Control Devices* (*MUTCD*)
- Other AASHTO standards and guidance such as:
  - Driver expectancy
  - Proximity to adjacent interchanges
  - Lane balance
  - Weaving and potential for crashes

Project Design Criteria forms are included in Appendix E.

14.1 FHWA's 13 Critical Elements

Glovers Lane. The Glovers Lane interchange meets all 13 of FHWA's 13 Critical Elements.

Shepard Lane. The Shepard Lane interchange meets all 13 of FHWA's 13 Critical Elements.

14.2 UDOT Standards

Glovers Lane. The Glovers Lane interchange meets the requirements of the UDOT *Manual of Instruction*, including all 14 of UDOT's Additional Criteria. This design meets the UDOT Standard Drawings.

Shepard Lane. The Shepard Lane interchange will require design waivers for two of UDOT's 14 Additional Criteria: ramp terminals (due to left exits) and on-ramp design (due to curve radius). This design also does not meet UDOT's 2017 Standard Drawings DD-5 and ST-5 for exit ramps due to close proximity with the I-15/US 89 interchange.

14.3 *MUTCD* Standards

Glovers Lane. The Glovers Lane interchange is in conformance with the Utah *MUTCD*. Based on a review of the current interstate signing plans, no violations were identified. Appendix D includes the Glovers Lane interchange signing plans.

Shepard Lane. The Shepard Lane interchange is not in conformance with the Utah *MUTCD*. A review of the current interstate signing plans identified 32 violations. The deficiencies are primarily due to the excessive number of destinations in close proximity to the WDC and US 89/Legacy Parkway system-to-system interchanges and the Park Lane and Shepard Lane local interchanges. Additionally, advance signing for destinations served by the collector-distributor roads is deficient due to the short length of these roads and sign placement constraints caused by the adjacent US 89/Legacy Parkway system-to-system interchange.

Appendix D includes the Shepard Lane interchange signing plans and a table identifying these violations.

14.4 Other AASHTO Standards and Guidance

Glovers Lane. Based on the standards review, the Glovers Lane interchange appears to meet all other AASHTO standards and guidance.

Shepard Lane. Based on the standards review, there are several areas in which the Shepard Lane interchange does not meet AASHTO standards and guidance. These include driver expectancy, proximity to other interchanges, lane balance, and weaving and potential for crashes, all of which are discussed below.

14.4.1 Driver Expectancy

Glovers Lane. The Glovers Lane interchange design is a conventional system-to-system interchange design with directional ramps that exit to the right in a logical and reasonable order. All movements have adequate distance in advance for proper guide signing and vehicle positioning. However, the following two movements somewhat vary from the expectations of the driver:

- Southbound vehicles on I-15 heading to northbound WDC must exit first to Legacy Parkway and travel for 2 miles to the connecting ramp to WDC. This is a continuous movement at freeway speeds.
- Southbound vehicles on the WDC heading to northbound I-15 must exit first to Legacy Parkway and travel for 2 miles to the merge onto I-15. This is also a continuous movement at freeway speeds.

During the design process, UDOT found that minimal traffic is expected to use these movements, since they are somewhat out-of-direction. The design team determined that constructing two more ramps, with a total of five structures to make direct connections to I-15 for such a low volume of traffic, would not be cost-effective. To mitigate this concern, advance guide signing is provided well in advance of the required exits. No other driver expectancy concerns were identified.

Shepard Lane. The Shepard Lane interchange design requires multiple movements that are not typically expected at system-to-system interchanges. These include:

- A left exit from the southbound collector-distributor to Shepard Lane (which is also the system-to-system connection from I-15 to northbound WDC).
- A left exit from southbound WDC to Shepard Lane (which is the system-to-system connection to northbound I-15).
- Southbound vehicles on I-15 heading to Park Lane must exit 1.9 miles in advance, north of Shepard Lane.

- Northbound vehicles on I-15 heading to Shepard Lane must make as many as three lane changes within 0.5 mile to make the exit. Advance guide signs from I-15 cannot communicate this to drivers.
- Northbound vehicles from Legacy Parkway heading to the WDC must make as many as two lane changes within 2,000 feet to make the exit. To help mitigate this, a 0.5-mile advance guide sign has been included to help drivers start this maneuver early.
- Northbound vehicles from Park Lane to the WDC must make as many as three lane changes within 0.6 mile to make the exit. Signing for two of these lane changes cannot be placed until a point 2,000 feet in advance of the exit.

Considering the above atypical and unexpected movements, the Shepard Lane interchange design does not fully comply with guidance for driver expectancy.

14.4.2 Proximity to Adjacent Interchanges

Glovers Lane. The Glovers Lane interchange would be located 1.8 miles south of the US 89/Legacy Parkway system-to-system interchange and 2.7 miles north of the Parrish Lane local interchange. In this location, ample room is available for conventional system-to-system directional ramps with little influence from adjacent interchanges. Auxiliary lanes are included in both directions between the Glovers Lane interchange and the Parrish Lane interchange to facilitate the two-lane on- and off-ramps between the WDC and I-15. The Glovers Lane interchange location complies with AASHTO and FHWA guidance of at least 1 mile of spacing between interchanges.

Shepard Lane. The Shepard Lane interchange would be located less than 0.5 mile north of the US 89/Legacy Parkway system-to-system interchange and would be between two local interchanges (Park Lane and Shepard Lane) that are spaced 1.2 miles apart. This essentially places three interchanges within the limits of the Shepard Lane system-to-system interchange. In this location, room is not available for directional ramps that would allow for conventional merge and diverge areas.

To accommodate traffic to and from the various interchanges, the Shepard Lane interchange must rely on collector-distributor roads that provide less than 0.5 mile for system-to-system and local interchange movements. This would result in a very constrained and complex interchange and would require extensive weaving with a high potential for vehicle conflicts. The Shepard Lane interchange location does not comply with AASHTO and FHWA guidance of at least 1 mile of spacing between interchanges.

14.4.3 Lane Balance

Glovers Lane. Because of its straightforward design, the Glovers Lane interchange conforms to lane balance requirements in all locations along I-15 and the WDC.

Shepard Lane. The Shepard Lane interchange conforms to lane balance requirements on all on- and off-ramps to and from I-15. The southbound collector-distributor road also meets lane balance requirements. However, the northbound collector-distributor road does not meet lane balance requirements at the WDC/I-15 split because its four lanes split into two for the WDC and two for I-15. In order to conform to requirements, the collector-distributor road would need to be only three lanes; however, it would not then be able to accommodate traffic volumes. Because of this deficiency, vehicles would need to make additional lane changes to reach their destination, thereby increasing the potential for vehicle conflicts.

14.4.4 Weaving and Potential for Crashes

Glovers Lane. The Glovers Lane interchange is a conventional design that has system-to-system, directional ramps. An example of this design is the schematic shown in Figure 14-1 below for northbound traffic exiting I-15. The traffic model analysis predicted the number of lane changes that would occur during the PM peak hour for vehicles exiting I-15 to the WDC. The model predicts 1,897 lane changes, which is about one lane change every 2 seconds. Within a 1,500-foot segment of the auxiliary lane, the model predicts that 1,897 lane changes would occur, which is about one lane change every 2 seconds.

Shepard Lane. The Shepard Lane interchange uses collector-distributor roads to provide the various movements among I-15, Legacy Parkway, the WDC, Park Lane, and the future Shepard Lane local interchange. Consequently, each collector-distributor road becomes a weaving section that must accommodate numerous lane changes. Figure 14-2 below shows the northbound collector-distributor road with three traffic streams entering from the south and three exiting to the north.

During the PM peak hour, 4,451 lane changes are predicted to occur on the collector-distributor road. This averages to 1.2 lane changes per second. Note that the number of vehicles in this weaving section (4,850) is actually higher than the number of vehicles on mainline I-15 (4,630). The complexity of the weaving section combined with the high volume of traffic and the high number of lane changes demonstrates a high potential for crashes. Since this collector-distributor road is a critical common link among I-15, Legacy Parkway, and the WDC, there would be a high potential for shutting down or severely restricting each of these corridors.

Figure 14-1. Glovers Lane Interchange Lane Changes 2040 PM Peak Period

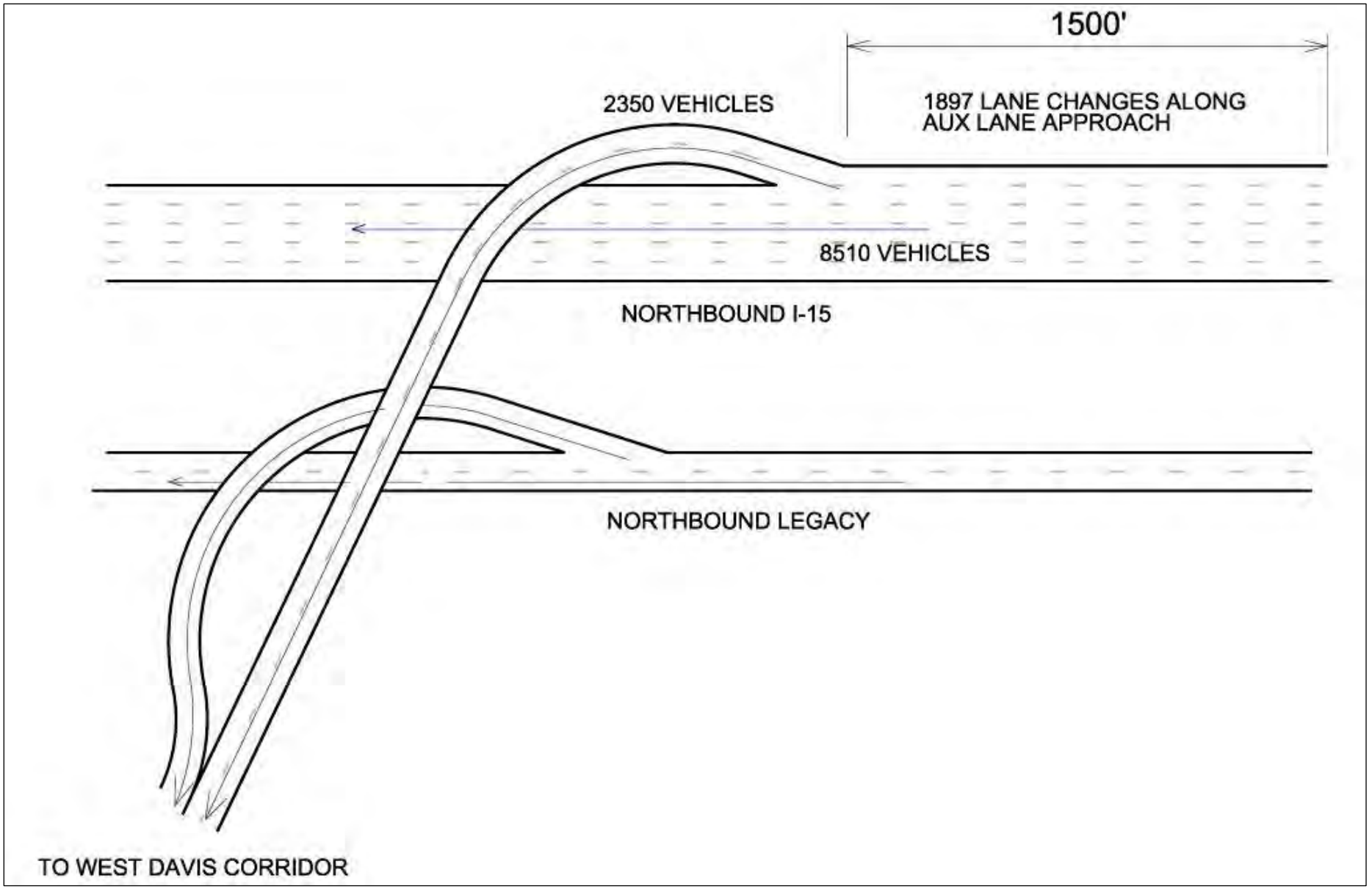
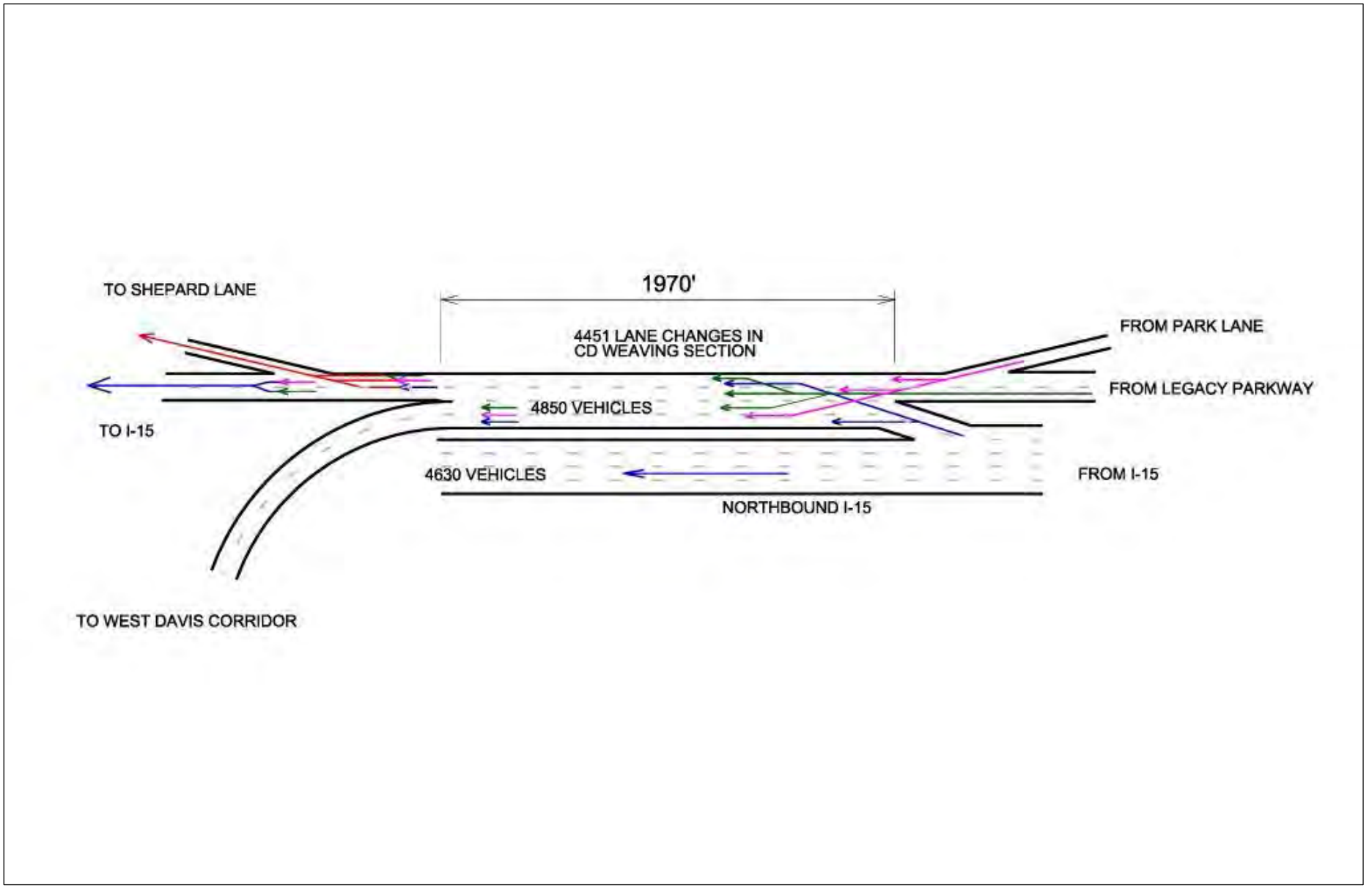


Figure 14-2. Shepard Lane Interchange Lane Change 2040 PM Peak Period



15.0 Funding Plan

UDOT is completing the Final EIS, and funding has not been allocated to the WDC Project by the Utah legislature except for completing the EIS process and limited funding for design and right-of-way. UDOT expects that, following completion of the EIS and selection of a preferred alternative by FHWA, the State of Utah will fund construction of the WDC. The WDC Project is included in the fiscally constrained *RTP* and is included in the regional air quality conformity analysis.

16.0 Results

As demonstrated in the analysis above, the proposed Glovers Lane Alternative complies with all eight FHWA policy points and meets state and federal design standards. The proposed Shepard Lane Alternative does not comply with Policy Points 3 and 4 because it would adversely affect the safety and operations of I-15 and does not meet design standards.

APPENDIX A

Methods and Assumptions Memorandum

1. Introduction and Project Description

The purpose of this memorandum is to present the methods and assumptions utilized in performing the traffic modeling for the Interchange Access Change Request (IACR) for the West Davis Corridor (WDC) Environmental Impact Statement (EIS). This project proposes to connect the proposed West Davis Corridor to I-15 via a System-to-System Interchange. Two alternate locations for this connection have been proposed in the EIS. One is near Shepard Lane in Farmington, Utah at approximately MP 325.7 on I-15. The other location is near Glovers Lane in Farmington, Utah at approximately MP 322.8 on I-15.

2. Problem, Purpose & Needs, Goals and Objectives

The WDC is intended to achieve the following purposes:

- ***Improve Regional Mobility.*** Improve regional mobility in the EIS study area for automobile, transit, and freight trips by substantially reducing user delay on the road system compared to the No-Action conditions through the consideration of all transportation modes.
- ***Enhance Peak-Period Mobility.*** Substantially enhance mobility in the EIS study area during the AM and PM peak periods for the main travel direction (north-south) to help accommodate the projected travel demand in the EIS study area in 2040.

3. Scope of Study

Each interchange alternative was studied for this IACR. The following study limits were used for this report:

<u>I-15 Segments for the Shepard Lane Alternative</u>

Mainline Segments:

- I-15 northbound and southbound between MP 321.6 (near 1400 South, Farmington) and MP 326.8 (near Burton Lane, Kaysville).
- SR-67 (Legacy Parkway) northbound and southbound between MP 10.9 (near 500 South, Farmington) and the US-89/I-15 interchange.

Interchanges within the study area:

- Local Interchange with SR-227 (200 West), Exit 322
- System Interchange with US-89, Exit 324
- System Interchange with SR-67 (Legacy Parkway), Exit 324
- Local Interchange with SR-225 (Park Lane), Exit 325

- Proposed System Interchange, West Davis Corridor (located approximately on I-15, MP 325.3)
- Proposed Local Interchange, Shepard Lane (located approximately on I-15, MP 325.6)

NB Analysis Segments:

- US-89 off-ramp (diverge)
- Legacy Parkway on-ramp (merge)
- Proposed Collector/Distributor off-ramp to Shepard Lane/West Davis Corridor (diverge)
- Proposed Collector/Distributor (weave)
- Proposed Collector/Distributor on-ramp from Shepard Lane/West Davis Corridor (merge)

SB Analysis Segments:

- Proposed Collector/Distributor off-ramp to Shepard Lane, Park Lane, and Legacy Parkway (diverge)
- Park Lane off-ramp (diverge) (existing and no-build scenarios only)
- Legacy Parkway off-ramp (diverge) (existing and no-build scenarios only)
- Proposed Collector/Distributor on-ramp from Shepard Lane and West Davis Corridor (merge)
- US-89 on-ramp to SB I-15 (merge)

<u>I-15 Segments for the Glovers Lane Alternative</u>

Mainline Segments:

- I-15 northbound and southbound between MP 320.3 (near Parrish Lane, Centerville) and MP 323.2 (north of the 200 West Interchange, Farmington).
- SR-67 (Legacy Parkway) northbound and southbound between MP 7.7 (near Parrish Lane, Centerville) and MP 10.9 (near 500 South, Farmington).

Interchanges within the study area:

- Local Interchange, Exit 319 , SR-105 (Parrish Lane)
- Local Interchange, Exit 322 (NB), SR-227 (200 West)
- Proposed System Interchange, West Davis Corridor (located approximately on I-15, MP 321.9)

NB Analysis Segments:

- Parrish Lane on-ramp (merge)
- Proposed West Davis Corridor off-ramp (diverge)
- 200 West off-ramp (diverge)

SB Analysis Segments:

- 200 West SB on-ramp (merge)
- West Davis Corridor SB on-ramp (merge)

- Parrish Lane SB off-ramp (diverge)

4. Project Schedule

Develop Final EIS	Fall 2016/Winter 2017
Release Finale EIS	Spring 2017
Record of Decision	Summer 2017
Funding	Unknown (Some funding for engineering is provided in 2019)
Construction	Depends on funding

5. Project Location

The project location for the Shepard Lane Alternative is shown in Figure 1. The project location for the Glovers Lane Alternative is shown in Figure 2. The limits of the interchange improvements for each option are shown in Figures 3 and 4.

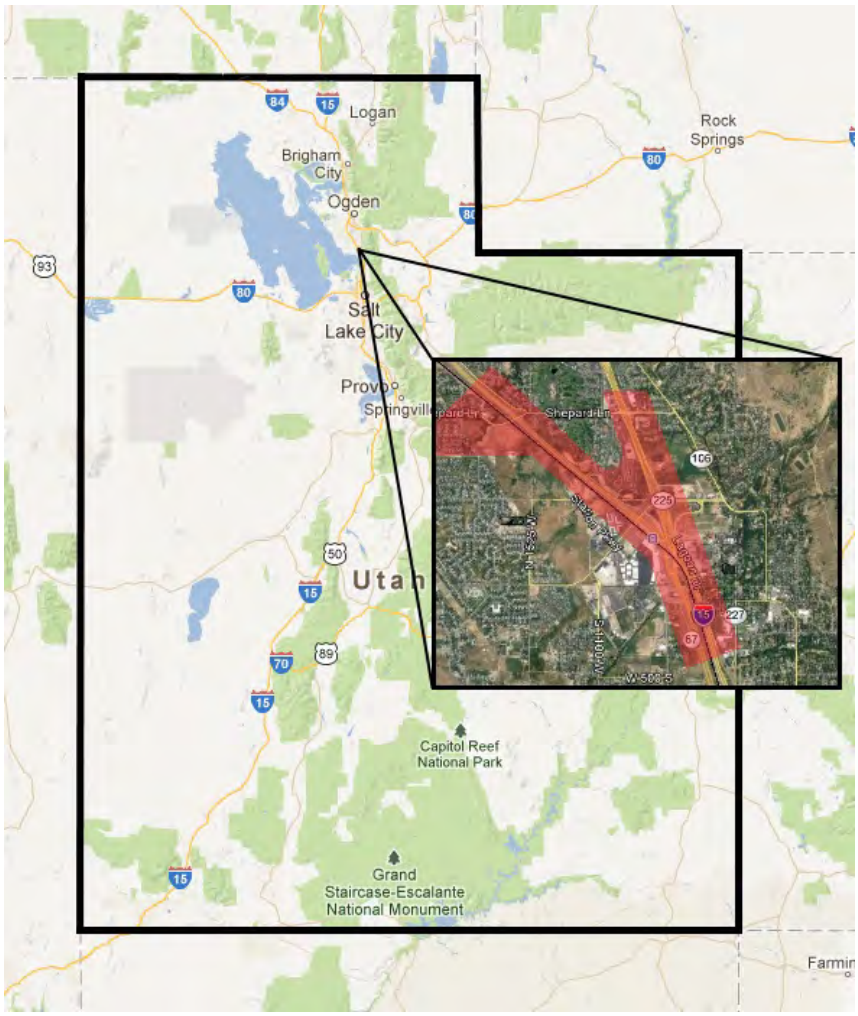


Figure 1 –Project Location, Shepard Lane Alternative

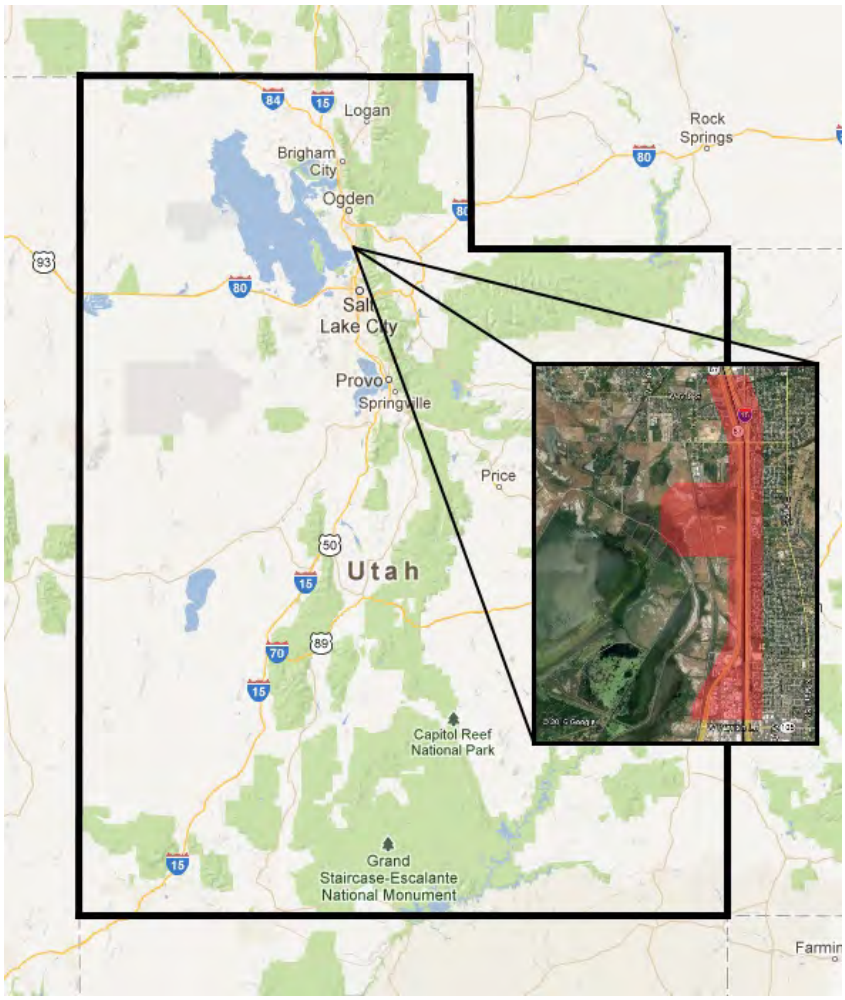


Figure 2 - Project Location for Glovers Lane Alternative

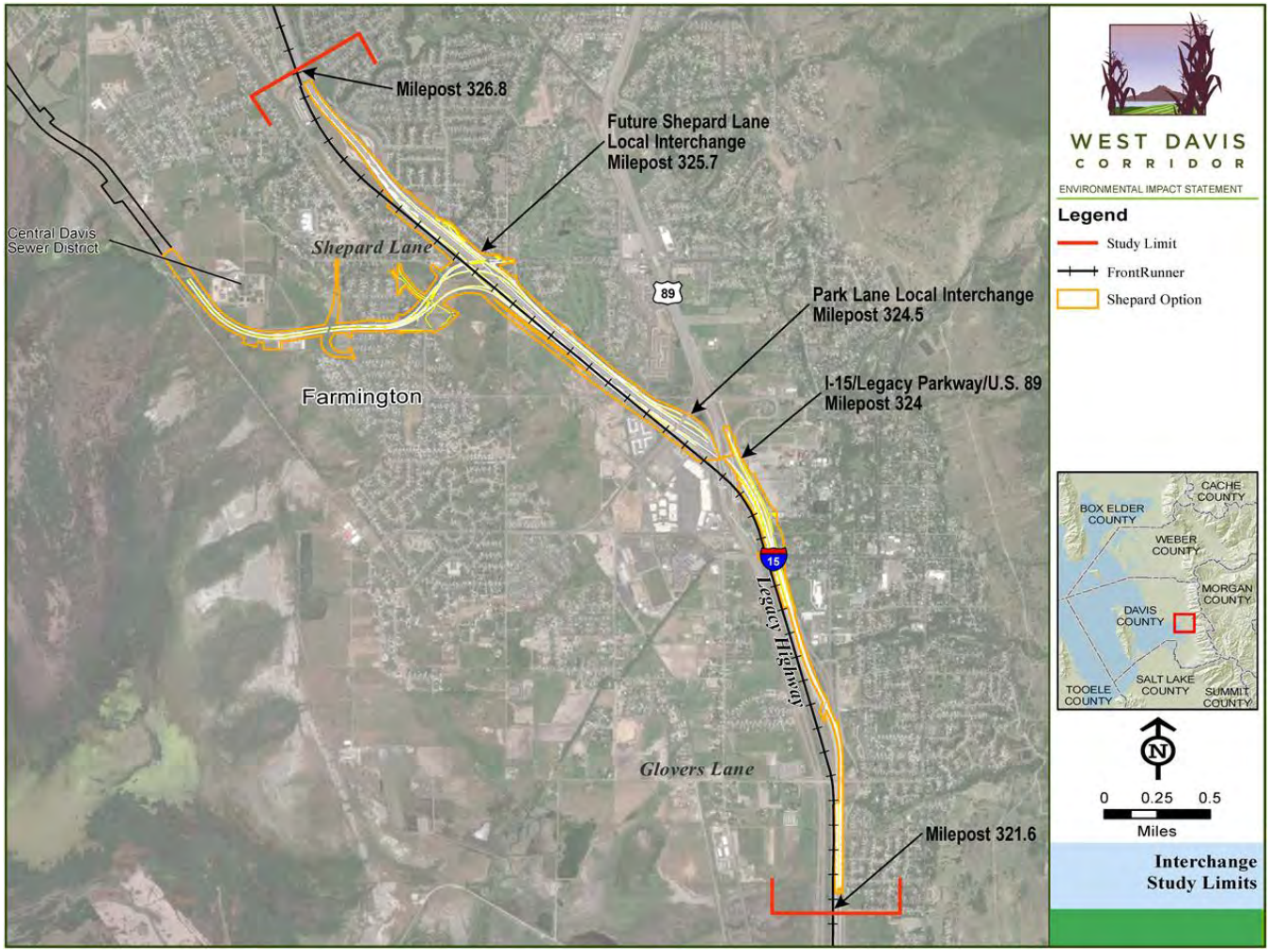


Figure 3 - Project Study Area, Shepard Lane Alternative

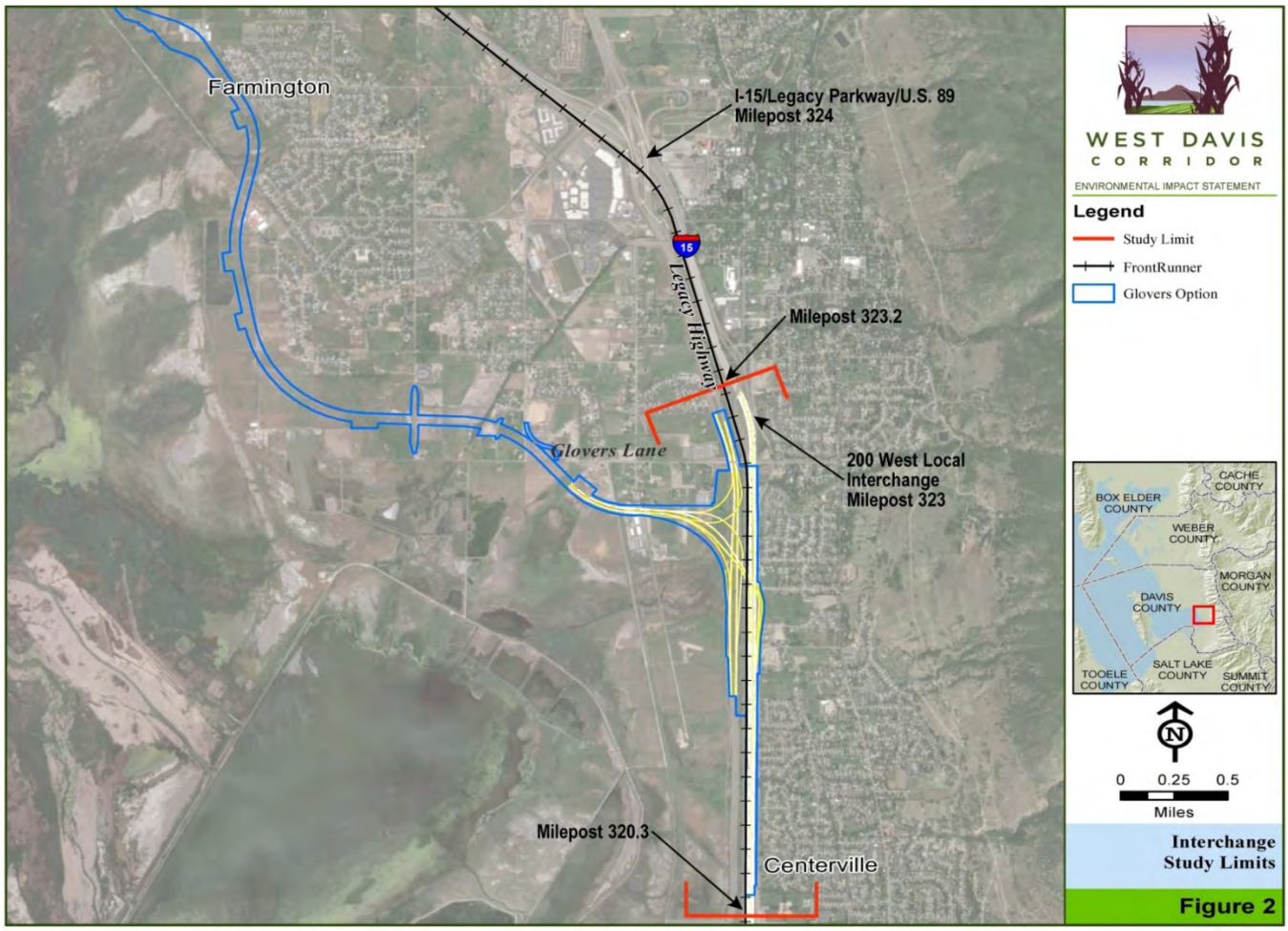


Figure 4 - Project Study Area, Glovers Lane Alternative

6. Analysis Years

The WDC EIS relies on the current Wasatch Front Regional Council (WFRC) travel demand model (version 8, released in April 2016) for traffic analysis in the study area. This model is the basis for the current Regional Transportation Plan (RTP) and used 2040 as the design horizon year. All projects in the RTP, with the exception of the projects being evaluated, are also assumed to be completed by the 2040 horizon year.

The following analyses were performed for this IACR:

- A 2015 existing-condition (base-year) analysis
- A 2040 no-build analysis
- A 2040 build analysis for the Glovers Lane interchange
- A 2040 build analysis for the Shepard Lane interchange

The base year volumes for the existing conditions VISSIM calibration were obtained from 2015 weekday traffic counts from the UDOT Performance Measurement System (PeMS). I-15

between US-89 and Parrish Lane was under construction for HOV lane extensions in 2015; therefore, it was assumed to use the completed HOV geometry and 2016 volumes from PeMS which were more accurate than pre-construction PeMS data. The 2016 volumes on the south end were adjusted and balanced to match the 2015 volumes north of US-89.

7. Analysis Period

For each modeling scenario, an analysis of weekday AM and PM peak-hour conditions was performed. Traffic in this region exhibits a strong directional characteristic, with heaviest southbound traffic during the AM peak, and northbound traffic in the PM peak period. Based on the UDOT PeMS data, it was observed that the weekday AM peak hour on I-15 occurs from 6:45 AM to 7:45 AM in the southbound direction, while the weekday PM peak hour on I-15 occurs from 4:00 PM to 5:00 PM in the northbound direction.

The future traffic volumes for the 2040 AM and PM peak hour analyses of the No-build, Glovers Lane, and Shepard Lane Alternatives were based on the current WFRC travel demand model.

The base year peak-hour factors (PHF) are 0.97 for the AM and 0.99 for the PM peak periods. These values were determined from the PeMS traffic data recorded at Station 758 located at milepost 321.4 on I-15. A PHF of 0.95 was assumed for the 2040 design year.

8. Data Collection

The following data was collected for this study:

- AM/PM peak hour freeway traffic volumes provided by the UDOT PeMS.
- Existing and proposed roadway geometry.
- Calibration data such as volume, speed, and travel time.
- Land Use (both existing and proposed)

9. Travel Demand Forecasting

The WFRC and Mountainland Association of Governments (MAG) jointly maintain a travel demand forecasting model for the four-county metropolitan region (Weber, Davis, Salt Lake, and Utah Counties). The TDM predicts future travel demand based on projections of land use, socioeconomic patterns, and transportation system characteristics. The model is based on the TP+/Cube software (currently using version 6.4.1). References to “the model” in this report refer to the scripts and data maintained by WFRC and MAG, not to the Cube software. At the time the West Davis Corridor alternatives were modeled, version 8.1 beta of the TDM was the officially release. It was calibrated to 2011 and uses 2040 as the forecast year. Version 8.1 was used to evaluate alternatives and generate future traffic volumes for analysis.

Specific inputs to the model include socioeconomic forecasts and transportation system data. The socioeconomic data includes population, households, employment, and average household income. Household data is further classified by household size, number of workers, and average income. Employment data is classified into twelve categories which include two for public schools. The transportation system data includes both roadway and transit networks.

The roadway network includes freeways, arterial routes and collector routes. The transit network includes commuter rail and light-rail lines, bus rapid transit lines, express bus routes, and many local bus routes. New to version 8 is a freight component which estimates truck traffic.

The WFRC/MAG model uses the traditional four-step modeling process, consisting of trip generation, trip distribution, mode split, and trip assignment. It includes an auto ownership model to better estimate trip generation and mode split. The model provides a feedback loop during trip distribution, allowing traffic congestion to influence trip distribution patterns.

The TDM was refined within the study area to improve the accuracy of the model. The original Traffic Analysis Zones (TAZ) in the model are well suited for regional traffic forecasts but generally do not provide adequate detail for a smaller-scale study. Smaller TAZ can provide better loading of traffic onto the roadway network. For these reasons, many of the original WFRC TAZ within or near the study area were split into smaller zones. In most instances, the TAZ are split along barriers such as existing or planned roads, rivers, railroads, and/or major land-use changes. After the splits, the socioeconomic data from the original TAZ were distributed into the new zones. It was assumed that variables such as income and household size for the smaller TAZ were the same as the original TAZ. The roadway network was updated to accommodate the new TAZ structure and to better represent the existing roadway network within the study area.

The TDM was used to produce peak hour traffic volumes for future alternatives. The model generates volume for the three-hour peak AM and PM periods. These were converted to one-hour volumes by using a factor of 0.40 in the AM and 0.37 in the PM. These factors were calculated based on traffic count data in the area. The 2011 model, which is the TDM base model year, was used in conjunction with the 2040 models for calculating intersection turn volumes as described in the UDOT document "Utah Travel Demand Forecasting," which follows Chapter 8 of the National Cooperative Highway Research Program's (NCHRP) Report 255. This process involves comparing the 2011 model volumes with actual 2011 count data. The difference between the two volumes is used to make an adjustment to the final 2040 volume forecast.

The interchange study area is part of WFRC's planning area. The analyses conducted for this IACR used traffic projections from version 8.1 of WFRC's travel demand model. Traffic data from UDOT's automatic traffic recorders (ATRs) were used to calibrate the model.

10. Operational Analysis Procedures

Analysis Strategy and Tools

PTV's VISSIM software was used for micro-simulation purposes to report measures of effectiveness (MOE) for all scenarios. Densities, speeds, and travel times were reported at the I-15 mainline, merge and diverge segments for both build and no-build conditions.

Microsimulation was chosen as the primary analysis tool due to the Highway Capacity Manual's (HCM) inability to analyze some of the interchange configurations that are being analyzed as part of these various studies.

Table 1 summarizes the software package, its applications, and associated performance measures that will be used.

Table 1: Measures of Effectiveness and Analysis Tools

Software Package	Analysis Type	Performance Measure	Threshold for Acceptable Operation
VISSIM v8.0 (with latest service pack)	Basic Freeway Segments	Density and Percent of Traffic Demand Served	Density: <35 veh/mile Traffic served: >95%
	Weaving Areas	Density and Percent of Traffic Demand Served	Density: <35 veh/mile Traffic served: >95%

Microsimulation Modeling

VISSIM software was used to evaluate traffic operations in the study area. The model for this analysis includes each of the study interchanges, the adjacent intersections and I-15 ramps and terminals.

For all VISSIM analyses, balanced origin-destination trip tables were prepared based on 2015 count data and 2040 forecasts. The microsimulation analysis includes a calibration procedure to ensure the model accurately replicates existing conditions at the study location. This calibration process was based upon the principles contained in FHWA's Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software. The primary MOEs used as calibration targets for this model are network travel times and individual link volumes. These model MOE values were compared with field-collected MOE values based on the existing conditions data. The GEH statistic were used to determine acceptance of the model calibration:

$$GEH = \sqrt{\frac{(E-V)^2}{(E+V)/2}}$$

Where: E = Model Volume
V = Actual Volume

The GEH statistic should be less than 5 (GEH<5) for individual link flows, for 85% of the cases.

Modeled network travel times were targeted to be within 10% of field-measured network travel times.

Travel time was used as the MOE to estimate the minimum number of simulation runs that are required to obtain a sample that adequately represents the traffic conditions. The objective is to run the model enough times so that the sampling error is less than the tolerable error, at a 95% confidence level. The tolerable error for this study is 10% of the modeled average travel times. After a small number of runs, the formula below was to estimate the required minimum number of simulations:

$$E = \frac{Z * S_S}{\sqrt{N}}$$

Where: E = sampling error
Z = number of standard deviations from the mean (1.96 for 95% confidence level)
S_s = sample standard deviation
N = sample size

The analysts collected travel time data from a minimum of five model runs. If the sampling error was not greater than the tolerable error, the analysts will proceed, using output statistics from the original model runs. If not, additional model runs would be performed. The process was be repeated until the sampling error was less than or equal to the tolerable error.

11. Crash Analysis

The crash analysis was conducted by reviewing the three-year crash history from 2013 to 2015 on facilities in the study area.

The crash history was be generated from the UDOT crash database. This database is compiled from crash reports completed by law enforcement officers. Crash data collected include data about the crash itself, the vehicles involved, and the vehicle occupants.

The safety analysis considered crash rate, average crash severity, crash type and crash clusters, as described below:

Crash rate: The crash rate is calculated as the number of crashes per million vehicle miles traveled through the segments during each year.

Average crash severity: The crash severity rating is a measurement of the damage caused by each crash. The attending law enforcement officer assigns a rating to crashes based on the following:

1. No injury
2. Possible injury
3. Bruises and abrasions
4. Broken bones or bleeding wounds; and
5. Fatality

The average crash severity for a roadway segment is calculated as the average of all severity ratings for crashes occurring on that segment. The severe crash rate is the calculated average of all crashes with a severity index of 4 or 5.

Crash type: Some common crash types on freeways include single vehicle, rear-end, sideswipe and head-on. Patterns in crash type can provide some clues about potential safety issues existing within roadway segments.

Crash cluster: Crashes sometimes occur in approximately the same locations over time. The occurrence of crashes in such "clusters" located close together may provide additional clues about the nature of the underlying safety issues.

The safety analysis includes a comparison of roadway segment crash rate and average crash severity against statewide averages for those values on facilities of the same functional classification and similar volume levels. UDOT develops these statewide averages by averaging values for similar facilities. While safety is of concern throughout all roadway systems, particular attention is appropriately given to roadway segments where the crash rate and / or average crash severity exceed statewide averages.

APPENDIX B

Crash Cluster Analysis

Appendix B: Crash Cluster Analysis

Table B-1 and Table B-2 present data for crash clusters on northbound I-15 in the Glovers Lane and Shepard Lane interchange study areas.

- ***Cluster 1*** occurs near the merge area for traffic coming onto I-15 from Parrish Lane. These crashes could be a result of heavy congestion as well as the merging of ramp traffic onto the mainline. Lengthening the ramp merge area (or providing an auxiliary lane, as would the Glovers Lane Alternative) might help alleviate this problem.
- ***Cluster 2*** occurs between Parrish Lane and the Glovers Lane overpass. The crash data indicate that teenage drivers, distracted drivers, and work zone conditions were major contributing factors in the crashes at this location.
- ***Cluster 3*** occurs near the 200 West northbound off-ramp. The crashes at this location could be a result of traffic slowing and/or changing lanes to exit the mainline freeway. Providing extra deceleration length or an auxiliary lane might improve conditions at this location.
- ***Cluster 4*** occurs near the US 89 northbound exit. Congestion at this location is a contributing factor in the higher incidence of crashes. Crash reports also indicate that teenage drivers, older drivers, and work zone conditions were contributing factors.
- ***Clusters 5 and 6*** occur at the Legacy Parkway and Park Lane on-ramps. Crashes in these locations could be a result of successive access points to the mainline being in close proximity to one another. Congestion and speed differentials could also be contributing factors.

WEST DAVIS CORRIDOR

Table B-1. Crash Cluster Locations for Northbound I-15

#	Milepost Range		Street Name	Length (Miles)	Crash Type						Total Crashes
					Angle	Rear End	Head On	Side-swipe	Parked Vehicle	Single Vehicle	
1	319.5	320.1	Parrish Lane	0.6	7	36	2	12	1	31	**89**
2	321.6	321.8	1700 South	0.2	0	12	0	2	0	10	**24**
3	322.3	322.7	Glovers Lane	0.4	3	18	0	12	0	13	**46**
4	323.5	324.1	US 89 & Legacy Parkway	0.6	0	41	0	21	0	17	**79**
5	324.4	324.7	Park Lane	0.3	1	28	0	8	0	9	**46**
6	324.8	325.1	Shepard Lane	0.3	0	14	0	4	0	5	**23**

Table B-2. Crash Cluster Severity for Northbound I-15

#	Milepost Range		Street Name	Length (Miles)	Crash Severity					Total Crashes
					No Injury	Possible Injury	Minor Injury	Serious Injury	Fatality	
1	319.5	320.1	Parrish Lane	0.6	64	17	6	0	2	**89**
2	321.6	321.8	1700 South	0.2	16	5	3	0	0	**24**
3	322.3	322.7	Glovers Lane	0.4	35	7	2	2	0	**46**
4	323.5	324.1	US 89 & Legacy Parkway	0.6	56	19	3	1	0	**79**
5	324.4	324.7	Park Lane	0.3	35	7	4	0	0	**46**
6	324.8	325.1	Shepard Lane	0.3	18	5	0	0	0	**23**

Table B-3 and Table B-4 present data for crash clusters on southbound I-15 in the Glovers Lane and Shepard Lane interchange study areas.

- ***Cluster 1*** occurs south of the Parrish Lane diverge area. Heavy congestion in this area might have contributed to the increased number of crashes in this area. Crash data also show work zone conditions as a contributing factor in over half (46 of 79) of the recorded crashes. Teenage drivers were also a factor in this area.
- ***Cluster 2*** occurs at the Parrish Lane off-ramp diverge area. Work zone conditions and teenage drivers contributed to this cluster of crashes.
- ***Cluster 3*** occurs between the Glovers Lane overpass and the Parrish Lane exit. Similar to clusters 1 and 2, work zone conditions contributed to the higher number of crashes in this area.
- ***Cluster 4*** occurs north of the US 89 on-ramp merge area. Heavy congestion in this area during the AM hours contributes to the higher number of crashes. Poor weather conditions are also contributing factors in a number of the crashes. There were fewer work-zone-related crashes in this cluster.
- ***Clusters 5 and 6*** occur at the exits to Park Lane and Legacy Parkway. Heavy AM congestion and the close spacing of these two exits might contribute to the cluster of crashes here.
- ***Cluster 7*** occurs south of the Shepard Lane structure. There does not appear to be any single leading cause of the crashes in this area. Distracted driving, collisions with wild animals, aggressive driving, and DUIs (driving under the influence of alcohol) were all contributing factors in this area.

Table B-3. Crash Cluster Locations for Southbound I-15

#	Milepost Range		Street Name	Length (Miles)	Crash Type						Total Crashes
					Angle	Rear End	Head On	Side-swipe	Parked Vehicle	Single Vehicle	
1	319.5	319.8	Parrish Lane	0.3	1	59	0	6	0	13	**79**
2	320.0	320.1	Parrish Lane	0.1	0	11	0	1	0	10	**22**
3	321.6	321.8	Glovers Lane	0.2	0	9	0	3	0	7	**19**
4	322.4	322.7	US 89 & Legacy Parkway	0.3	2	15	0	12	0	11	**40**
5	324.4	324.7	Park Lane	0.3	0	18	1	8	0	6	**33**
6	324.9	325.1	Park Lane	0.2	0	9	0	6	0	8	**23**
7	325.5	325.6	Shepard Lane	0.1	0	7	0	4	0	9	**20**

Table B-4. Crash Cluster Severity for Southbound I-15

#	Milepost Range		Street Name	Length (Miles)	Crash Severity					Total Crashes
					No Injury	Possible Injury	Minor Injury	Serious Injury	Fatality	
1	319.5	319.8	Parrish Lane	0.3	55	19	4	1	0	**79**
2	320.0	320.1	Parrish Lane	0.1	17	4	1	0	0	**22**
3	321.6	321.8	Glovers Lane	0.2	16	1	2	0	0	**19**
4	322.4	322.7	US 89 & Legacy Parkway	0.3	31	8	1	0	0	**40**
5	324.4	324.7	Park Lane	0.3	25	6	2	0	0	**33**
6	324.9	325.1	Park Lane	0.2	20	1	2	0	0	**23**
7	325.5	325.6	Shepard Lane	0.1	13	6	0	1	0	**20**

APPENDIX C

2011 and 2040 Traffic Modeling Density and Speeds

Figure C-1. 2011 Traffic Model Density and Speeds

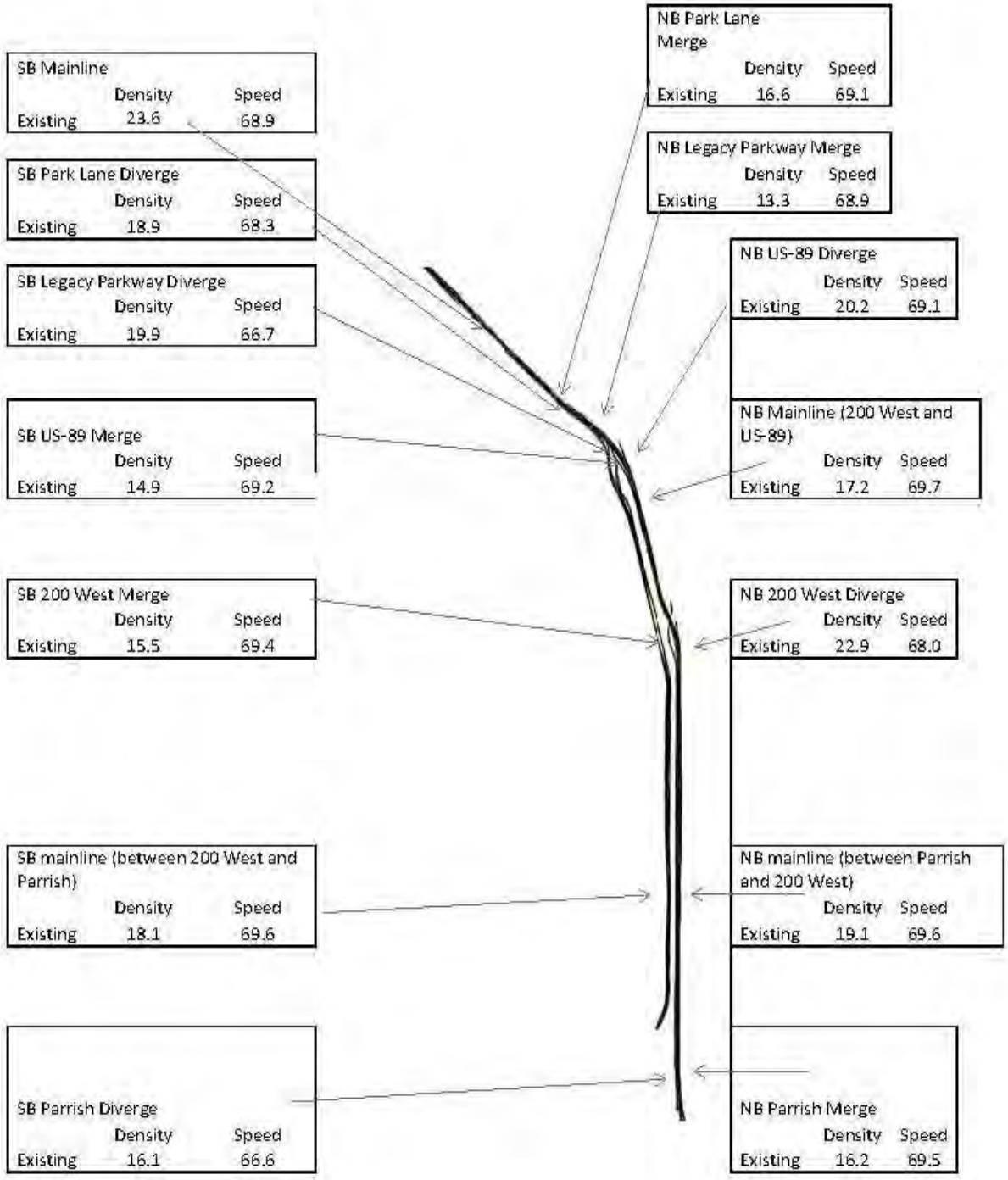
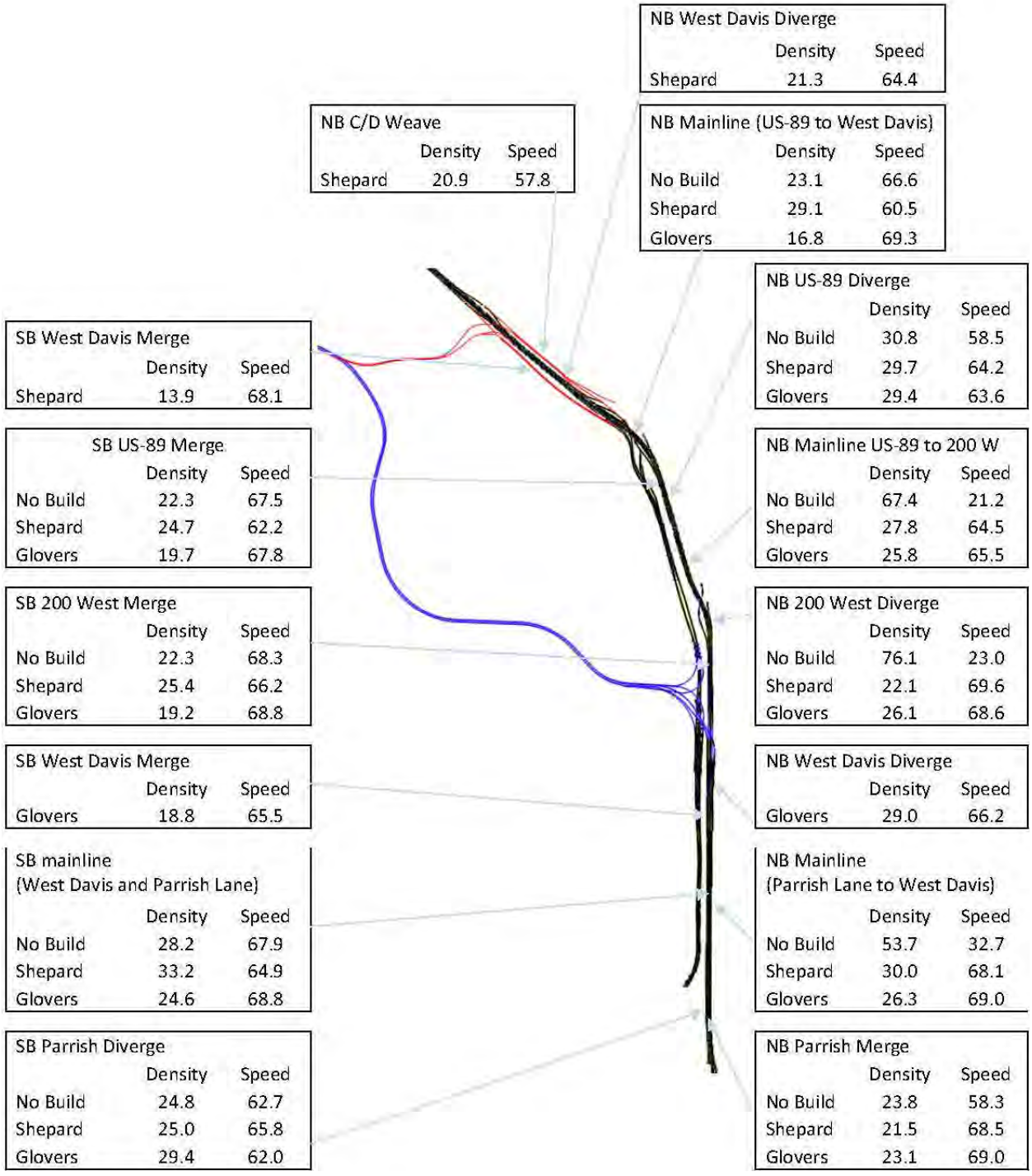


Figure C-2. 2040 Traffic Model Density and Speeds

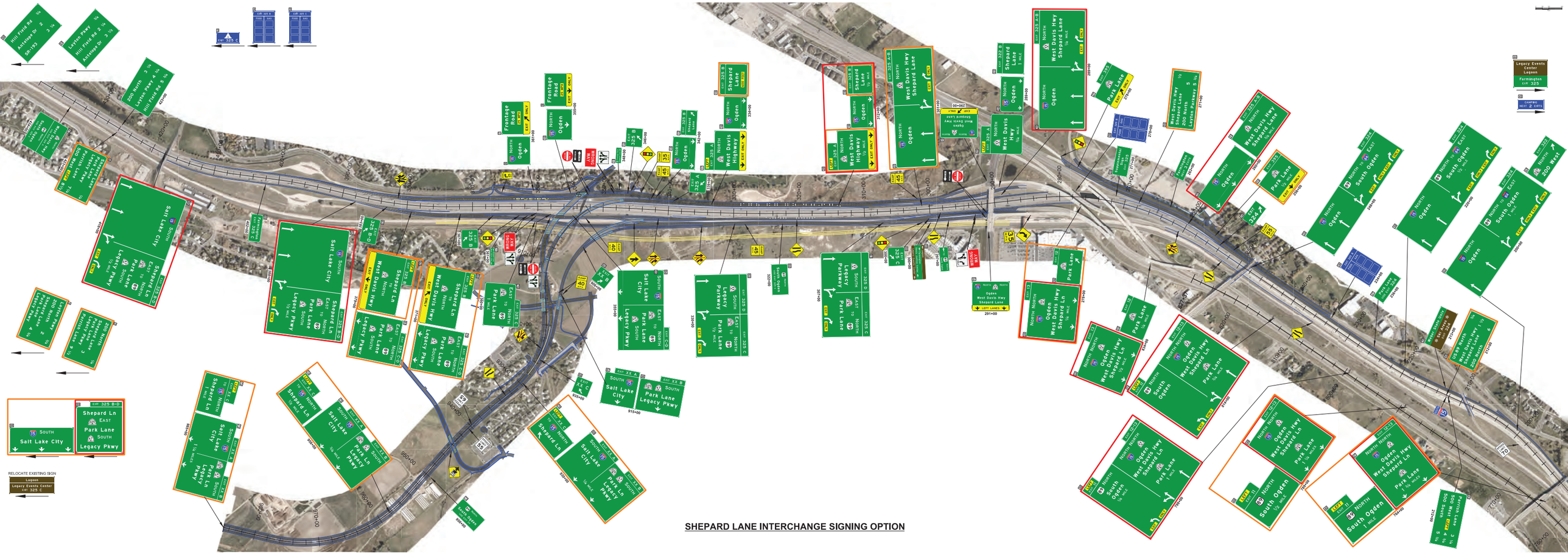


APPENDIX D

Signing Plans and Information

Full-size scroll plot versions of the signing plans for both interchanges are included as separate PDF files with the digital version of this report

GLOVERS INTERCHANGE



SHEPARD LANE INTERCHANGE SIGNING OPTION

WEST DAVIS CORRIDOR - SHEPARD LANE ALTERNATIVE - MUTCD SIGNING VIOLATIONS

Sign Number	Approximate Location	Sign Description	Issue	Reference from 2009 Utah MUTCD
1	I-15; North of Interchange Area	Sequence Sign	5 lines of copy; max is 3	2E.10.01r
2	I-15; North of Interchange Area	Sequence Sign	5 lines of copy; max is 3	2E.10.01r
6	I-15, ~426+00	Sequence Sign	5 lines of copy; max is 3	2E.10.01r
15	Northbound CD Road, ~334+00	Exit 325B Shepard Lane 600 ft	Insufficient spacing (600') to Shepard Lane exit ramp. Fraction less than 1/4 mile; distance in feet should not be shown.	2E.33.02
18	Northbound CD Road, ~314+00	Shepard Lane 1/2 Mile	This is the first advance guide sign for the actual Shepard Lane exit (not the CD Road); the 1 mile sign does not really exist for those entering from I-15	2E.33.02
20	Northbound CD Road, ~314+00	West Davis Highway 1/2 Mile	not really 1/2 mile, 1970' which = 3/8 mile	2E.33.02
18/19/20	Northbound CD Road, ~314+00	Assembly: West Davis Highway 1/2 Mile - Ogden - Shepard Lane 1/2 Mile	There is no room available for the 1 mile Advance Guide Sign; this 1/2 mile assembly is the first Advance Guide Sign for this split. This is the first sign from Legacy Parkway that lets drivers know that they need to merge left for WDC and there is less than 1/2 mile to do so.	2E.21r.05A
21	Northbound I-15, ~301+00	Arrow per Lane / Ogden - West Davis Hwy - Shepard Lane	3 Destinations on sign display, max is 1 per sign or 3 on display. This is considered 2 signs therefore 2 maximum destinations.	2E.10.01r
26	Northbound I-15, ~289+00	Arrow per Lane / Ogden - West Davis Hwy - Shepard Lane	Not at 1/2 mile. There is no way to alert drivers to be in the right lane to then merge two more lanes over to exit to Shepard Lane. Three merges would be required for some drivers. Drivers may not expect to have to make this maneuver and they would have 1/2 mile to do it.	2E.21r.05a
31/32	Northbound I-15, 260+00	Assembly: Ogden / Shepard Lane - West Davis Hwy 3/4 Mile	Sign not able to be placed at 1 mile.	2E.21r.02r, 2E.21r.05a
33	Northbound US-89 ramp; ~254+00	Park Lane 1/2 Mile	This is the first advance guide sign for the actual Park Lane exit (not US-89); the 1 mile sign does not exist	2E.33.02
40	Northbound I-15, ~212+00	Sequence Sign	Sign has 4 lines of copy, max is 3	2E.10.01r
46/47	Northbound Legacy, 764+00	Assembly: South Ogden 1 Mile / Ogden - West Davis Hwy - Shepard Lane - Park Lane 1 3/4 miles	5 Destinations in display, max is 1 per sign or 3 total.	2E.10.01r
47	Northbound Legacy, 764+00	Ogden-West Davis Hwy-Shepard Lane-Park Lane 1 3/4 miles	4 destinations, max is 1 per sign in this display. Mixes city and street names	2E.10.00n, 2E10.01r

48/49	Northbound Legacy, 789+00	Assembly: South Ogden 1/2 Mile / Ogden-West Davis Hwy-Shepard Lane - Park Lane 1-1/4 Mile	5 Destinations in display, max is 1 per sign or 3 total.	2E.10.01r
49	Northbound Legacy, 789+00	Ogden-West Davis Hwy-Shepard Lane - Park Lane 1-1/4 miles	4 destinations, max is 1 per sign in this display. Mixes city and street names	2E.10.00n, 2E10.01r
50	Northbound Legacy, 799+00	Arrow per Lane: South Ogden / Ogden - West Davis Hwy-Shepard Lane/ Park Lane	Center sign - Mixes street and city names, 4 lines of copy-max is 3, 3 destinations - max 1 per partition (sign).	2E.10.00n, 2E10.01r
51	Northbound Legacy, 814+00	Arrow per Lane: South Ogden / Ogden - West Davis Hwy-Shepard Lane/ Park Lane	Center sign - Mixes street and city names, 4 lines of copy-max is 3, 3 destinations - max 1 per partition (sign).	2E.10.00n, 2E10.01r
52	Northbound Legacy Ramp to I-15	Ogden/West Davis Hwy/Shepard Ln	Mixes street and city names, 3 destinations, max is 1 per sign in this display	2E.10.00n
54	Northbound I-15, ~268+00	Sequence Sign	4 lines of copy, maximum is 3	2E.10.01r
55/56	Northbound Ramp from Legacy, ~277+00	Assembly: Ogden - West Davis Corridor - Shepard Ln / Park Ln	4 destinations on display, max is 1 per sign or 3 on display	2E.10.01r
55	Northbound Ramp from Legacy, ~277+00	Ogden - West Davis Corridor - Shepard Ln	Mixes street and city names, 3 destinations, max is 1 per sign in this display	2E.10.00n, 2E10.01r
69/70	Southbound West Davis, ~930+00	Shepard Lane / Salt Lake City - Park Lane - Legacy Parkway	4 Destinations on sign display, max is 1 per sign or 3 on display.	2E.10.01r
72/73	Southbound West Davis, ~984+35	Shepard Lane / Salt Lake City - Park Lane - Legacy Parkway	4 Destinations on sign display, max is 1 per sign or 3 on display.	2E.10.01r
74/75	Southbound West Davis, ~958+00	Shepard Lane / Salt Lake City - Park Lane - Legacy Parkway	4 Destinations on sign display, max is 1 per sign or 3 on display.	2E.10.01r
79/80	Southbound CD Road, ~372+00	Shepard Lane to West Davis Hwy Exit Only / Park Lane - Legacy Parkway	4 Destinations on sign display, max is 1 per sign or 3 on display.	2E.10.01r
82	Southbound CD Road, ~379+00	Shepard Lane to West Davis Hwy Exit Only	Insufficient spacing to Shepard Lane exit ramp. There is no 1/2 or 1 Mile Advance Guide Sign for the actual exit from the CD road, this is the first one. There is no advance notice to drivers exiting I-15 that they need to immediately exit to the left for Shepard and WDC and access to US-89.	2E.33.02
81/82	Southbound CD Road, ~379+00	Shepard Lane to West Davis Hwy Exit Only / Park Lane - Legacy Parkway	4 Destinations on sign display, max is 1 per sign or 3 on display.	2E.10.01r
84	Southbound I-15, ~388+00	Arrow per Lane: Salt Lake City, Shepard Ln - Park Ln - Legacy Pkwy	4 destinations, max is 1 per sign or 3 on display. Right Side Partition - 2 street names, max is 1.	2E.10.00n, 2E10.01r
86	Southbound I-15, 418+00	Arrow per Lane: Salt Lake City, Shepard Ln - Park Ln - Legacy Pkwy	4 destinations, max is 1 per sign or 3 on display. Right Side Partition - 2 street names, max is 1.	2E.10.00n, 2E10.01r

88/89	I-15; North of Interchange Area	Advance Guide Signs Assembly: Salt Lake City / Shepard Lane - Park Lane - Legacy Parkway	4 Destinations in display, max is 2 with 2 signs that are present. A maximum of 3 signs is allowed so even a 3rd sign would not bring this to compliace	2E.10.01r
89	I-15; North of Interchange Area	Shepard Lane - Park Lane - Legacy Parkway	Advance Guide Sign has 2 street names, maximum is 1.	2E.10.00n

Color Key:	Violation of MUTCD Standard
	Violation of MUTCD Guidance

    - The northbound and southbound exits would have different suffixes (A, B, C or C, B, A) exit numbers for the same destinations (West Davis Corridor and Park Lane)
- Signing for the frontage road north of Shepard Lane will be problematic since it is accessed from the freeway on-ramp

Overall, the requirements for signing within the Shepard Lane Interchange design will not meet the minimum standards of the Utah MUTCD.

Additional safety concerns noted regarding the Shepard Lane Interchange Design include:

- Weaving and operation of the NB CD road is a concern
- Speed differential between vehicles on the NB CD road due to vehicles entering at different speeds from the I-15 off-ramp, the Legacy Highway off-ramp, and the Park Lane on-ramp

Glovers Lane Interchange Alternative

Minor concerns that were initially noted have been addressed. One remaining concern (which is not a violation) is that, just as for Shepard Lane interchange signing, the exit numbers for the West Davis Corridor from I-15 will be different in the northbound and southbound directions.

The Glovers Lane interchange alternative can be signed in conformance with the Utah MUTCD.

APPENDIX E

Project Design Criteria Forms

PROJECT DESIGN CRITERIA - FREEWAY

I. PROJECT DESCRIPTION

DATE:

Project No		**Location**	
PIN		**Concept**	

Describe the scope of the project West Davis Corridor - Interchange with I-15; Glovers Lane Alternative

II. DESIGN STANDARDS BY ROADWAY

(Complete a separate PDC for each roadway on your project)

Date of OSR:

Roadway Name: **Glovers Lane Interchange Ramps - See Comments**

Roadway Characteristics

Functional Class	Freeway			**Pavement Type**	TBD	
Current Year	2016	**AADT=**	**varies**	**Terrain**	Flat	
Design Year	2040	**AADT=**	**varies**	**% Trucks (current)**		
Design Vehicle	WB-67			**Posted / Design Speed**	70	70

Comments

Includes the following ramps that directly or indirectly serve I-15:

NB I-15 to NB WDC

SB WDC to SB I-

SB WDC to NB I-15 via Legacy

SB I-15 to NB WDC via Legacy

The following ramps do not carry traffic to/from I-15 and are not included:

NB Legacy to NB WDC

SB WDC to SB Legacy

Proposed Roadway Characteristics

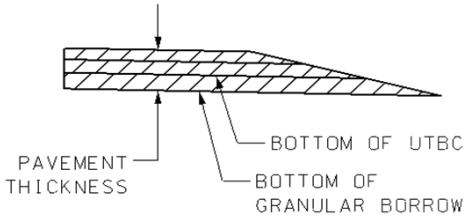
Total Number of Lanes varies

Shoulder Width (Typ) 12' on mainlines

Curb & Gutter Type & Width (Typ) N/A

Pavement Thickness

Section 1		**Section 2**		**Section 3**	
Sta. From		**Sta. From**		**Sta. From**	
Sta. To		**Sta. To**		**Sta. To**	
Hard Surfacing (in)		**Hard Surfacing (in)**		**Hard Surfacing (in)**	
UTBC (in)		**UTBC (in)**		**UTBC (in)**	
Granular Borrow (in)		**Granular Borrow (in)**		**Granular Borrow (in)**	



Pavement Thickness consists of Hard Surfacing, UTBC, and Granular Borrow (if used).

Order of Precedence: SD - 2012 Standard Drawings; MOI - Roadway Design Manual of Instruction; GB - AASHTO Green Book 2011 Edition

FHWA 13 Critical Elements	UDOT Standard	Proposed/Used	Design Exception	References	Date of Decision, Comments, Mitigation, etc.
Design Speed	70 mph (Mainline I-15, Legacy)	70 mph (Mainline I-15, Legacy)	☑ Not Required ☐ Required ☐ Approved	**MOI** 2-1; **GB** pp. 2-53:58, 8-1:2	
	System Ramps: 50-60 mph preferable, 40 mph minimum (Direct connections)	I-15 to WDC = 45 mph WDC to SB I-15 = 45 mph WDC to NB I-15 via Legacy= 40 mph SB I-15 to WDC vis Legacy= 40 mph	☑ Not Required ☐ Required ☐ Approved		
Lane Width	**Mainline** 12'	12'	☑ Not Required ☐ Required ☐ Approved	**SD** (DD & ST series); **MOI** 7-1, 43:47, 107; **GB** pp. 8-2:3	
	LT Turn Lane(s) N/A	N/A			
	RT Turn Lane(s) N/A	N/A			
Shoulder Width	**Outside** / **Inside** / **Barrier Offset**	**Outside** / **Inside** / **Barrier Offset**	☑ Not Required ☐ Required ☐ Approved	**SD** (DD & ST series); **MOI** 7-44:46; **GB** pp. 4-8:11, 8-2:3	
Ramps	8' / 4' / 2'	8' min / 4' min / 2'			
Mainline	12' / 12' / included in 12'	12' / 12' / included in 12'			
Superelevation	**Maximum Superelevation** 6%	**Maximum Superelevation** 6%	☑ Not Required ☐ Required ☐ Approved	**SD** DD 1; **MOI** 7-26:29; **GB** pp. 8-3, 3-45 (T. 3-9)	
Horizontal Alignment	**Minimum Radii Value** Mainline: 2040' Ramps: 40 mph 45 mph	**Minimum Radii Value** Mainline: ~ 2500' to match existing Mainline: ~ 2500' to match existing	☑ Not Required ☐ Required ☐ Approved	**MOI** 7-30:33, 50:55; **GB** pp. 8-6, 3-32 (T. 3-7), 3-45 (T. 3-9), 10-81	Min Values on mainline assume no barrier to
Vertical Alignment	**Sag Curve Min. K Value** / **Crest Curve Min. K Value** 181 (70 mph) 61 (45 mph) 44 (40 mph) 247 (70 mph) 79 (45 mph) 64 (40 mph)	**Sag Curve Min. K Value** / **Crest Curve Min. K Value** match exist (70 mph) 61 (45 mph) 44 (40 mph) match exist (70 mph) 79 (45 mph) 64 (40 mph)	☑ Not Required ☐ Required ☐ Approved	**MOI** 7-56:60; **GB** pp. *crest* 3-155: 157 (T. 3-34:35), *sag* 3-161 (T. 3-36)	
Profile Grades	**% Min** / **% Max** 0.30% 40 mph 6% 45 mph 5% 70 mph 3%	**% Min** / **% Max** 0.30% 40 6% 45 5% 70 3%	☑ Not Required ☐ Required ☐ Approved	**MOI** 7-58:62; **GB** pp. 3-119, 8-3:4 (T. 8-1)	0.50% preferred. Exception may be needed for 2 ramps that exceed 5% slightly
Cross Slope	**Standard Value** 2%	**Value Proposed/Used** 2%	☑ Not Required ☐ Required ☐ Approved	**SD** (DD, DD 4); **MOI** 7-47:48; **GB** pp. 4-1:6, 8-2:3	
Stopping-Sight Distance	**Minimum** 730'	**Minimum** 730'	☑ Not Required ☐ Required ☐ Approved	**MOI** 7-62; **GB** pp. 3-2:8, 3-106:110, 3-4 (T. 3-1)	
Structural Capacity	**Design Loading** HS20 for existing	**Design Loading** HS-20 for existing; HL-93 for new construction	☑ Not Required ☐ Required ☐ Approved	**MOI** 11-2:3; **GB** p. 8-4	HS-20 for existing; HL-93 for new construction
Bridge Width	**Minimum** Lanes x 12' + 2 Shoulders x 12' + Parapet	**Minimum** Lanes x 12' + 2 Shoulders x 12' + Parapet	☑ Not Required ☐ Required ☐ Approved	**SD** DD 9; **MOI** 11-3; **GB** p. 8-4	
Vertical Clearance*	**Minimum**	**Minimum**	☑ Not Required ☐ Required	**SD** DD 8:0; **MOI** 11-4:5;	* Notify FHWA on any changes to Vertical Clearance on the National

Vertical Clearance	16.5' over road, 23.5' over rail	16.5' over road, 23.5' over rail	☐ Required ☐ **Approved**	**GB** p. 8-4	Vertical Clearance on the National Highway System
Lateral Offset to Obstruction	**Minimum** Urban environments shoulder + 2', other locations clearzone.	**Minimum** Clearzone or barrier will be present in all locations	☑ **Not Required** ☐ Required ☐ Approved	**SD** DD 17**; GB** p. 8-5, 10-19:21	

Design Waivers	UDOT Standard				Proposed/Used			Design Waiver	References	Date of Decision, Comments, Mitigation, etc.
Acceleration Lanes	**V**	**Va**	**V'a**	**L**	**Location**	**V/V'a**	**L**	☑ Not Required ☐ Required ☐ Approved	Refer to Table 10-4 **GB** pp. 10-111:112 to adjust for grade. A part of the ramp proper may also be considered in the acceleration length as a design waiver. Table 10-3 **GB** p. 10-110. See also **GB** pp. 9-124:125, 10-107:110, 116:122; **SD** DD 13A:14B, ST 1; **MOI** 7-106	**any deficient in design can be extended to meet standard**
	70 mph	53 mph	22	1420	All	70/53	340			
			26	1350						
			36	1000						
			40	820						
			44	580						
Deceleration Lanes	**V**	**Va**	**V'a**	**L**	**Location**	**V/V'a**	**L**	☑ Not Required ☐ Required ☐ Approved	Refer to Table 10-4 **GB** pp. 10-111:112 to adjust for grade. Table 10-5 **GB** p. 10-115. See also **GB** pp. 9-124:125, 10-107,112:120, 123:124; **SD** DD 13A:14B, ST 3A:3B; **MOI** 7-106	
	70 mph	58 mph	22	550	All	70/58	340			
			26	520						
			36	440						
			40	390						
			44	340						
Guardrail Bridge Connection	UDOT Std Dwg BA 4B1:4B2 & Bridge Rail or Parapet section of UDOT Design Exception Form.				As per Standards			☑ Not Required ☐ Required ☐ Approved	**SD** BA 4B1:4B2, UDOT Design Exception Form	
Clear Zone	Meet clear zone compliant requirements defined in Standard Drawings.				Clear Zone met or Barrier in all locations			☑ Not Required ☐ Required ☐ Approved	2006 Roadside Design Guide pg. 3-6 and Figure 3.2 pg. 3-8; **SD** DD 4, 8, 10-12,17	
Intersection Sight Distance	Meet 2011 AASHTO requirements for sight triangles cases A-F and skew.				N/A			☑ Not Required ☐ Required ☐ Approved	**GB** pp. 9-28:54, **MOI** 7-64:67	
Ramp Terminal Sight Distance	Along the Ramp				Along the Ramp			☑ Not Required ☐ Required ☐ Approved	SSD (Stopping Sight Distance) should be at least as great as design SSD *SSD is 25% greater than minimum SSD. **DSD is Decision Sight Distance based on avoidance maneuver 'E' and is desired where feasible. Document DSD but do not obtain waiver if DSD is not met. **GB** p. 3-4 (T. 3-1) **GB** p. 3-7 (T. 3-3) **GB** p. 10-92	Waiver may be required if barriers installed on SB approach from WDC - LT side of roadway (values listed assume open median)
	Design Speed	**SSD (ft)**			**Location**	**SSD (ft)**				
	70 mph	730			NB I-15 to WDC					
	55 mph	495								
	50 mph	425			WDC to SB I-15	425				
	45 mph	360			SB I-15 to WDC via Legacy	305+				
	40 mph	305								
	35 mph	250								
	30 mph	200			WDC to NB I-15 via Legacy					
	25 mph	155								
	Along the Freeway or Street Preceeding Approach Nose of Exit Ramp				Along the Freeway or Street Preceeding Approach Nose of Exit Ramp					
	Design Speed	**SSD (ft)***	**DSD (ft)****		**Location**	**SSD***	**DSD****			
	70 mph	915	1445		NB I-15 to WDC	915+	1450+			
	55 mph	620	1135							
	50 mph	535	1030		SB I-15 to WDC via Legacy	915+	~1000'			
	45 mph	450	930							
	40 mph	385	825							
	35 mph	315	720		SB WDC to NB I-15 via Legacy	915+	915+			
	30 mph	250	620							
	25 mph	200	N/A							
Shoulder/Travel way (gutter pan)	The gutter pan is not considered a part of the traveled way or shoulder.				N/A			☑ Not Required ☐ Required ☐ Approved	**GB** pp. 4-19, 10-103; **MOI** 7-1, 43:44	

Design Waivers	UDOT Standard	Proposed/Used	Design Waiver	References	Date of Decision, Comments, Mitigation, etc.
Gores	Follow the key points from 2011 AASHTO: • Should be uniform along the freeway; • Geometric shape is appropriate for given speeds; • Mitigation required for major obstructions in a gore; and • Unpaved area beyond the gore nose should be graded nearly level with the roadways as practical.	Location: Meets all Requirements? All: No violations anticipated	☑ Not Required ☐ Required ☐ Approved	**GB** pp. 10-96:101; **SD** DD 6, ST 3A:3B	
Ramp Terminals	Platform Location: Ramp side of the approach nose or merging end. Length: 200 ft At- grade terminal of ramp.: Varies	Platform Location: Ramp side of the approach nose or merging end. Length: 200 ft At- grade terminal of ramp.: varies	☑ Not Required ☐ Required ☐ Approved	Avoid left hand entrances and exits. **GB** pp. 10-103:104. Ramp Terminal means: 1) the exit terminal from the side street onto the freeway entrance ramp; 2) the entrance terminal onto the freeway; 3) the exit terminal from the freeway onto the exit ramp; and 4) the entrance terminal from the freeway exit ramp onto the side street. Refer to **GB** 10-104 for platform lengths. **MOI** 7-105:106	
On Ramp Design	Type: Parallel Curve Radius: 1000 ft Dist. From Physical Nose to Ramp Control Line Terminus: 200 ft Taper: 300 ft min	Ramp Loc. all: Type: Parallel; Curve Rad.: min 2900; Dist.: 200; Taper: 300+	☑ Not Required ☐ Required ☐ Approved	**GB** pp. 10-107:112; **SD** DD 6, ST 1; **MOI** p. 1-2. UDOTs preferred approach is to utilize parallel entrance ramps. See **GB** pp. 10-89:90; **MOI** 7-105:106.	
Off Ramp Design	Type: Taper Divergence Angle (deg): 2-5 Dist. from outer edge alignment break to ramp control line: 200 ft	Ramp Loc. all: Type: Taper; Angle: 2-5; Dist.: N/A yet	☑ Not Required ☐ Required ☐ Approved	**GB** pp. 10-112:116; **SD** DD 6, ST 3A:3B; **MOI** p. 1-2. UDOTs preferred approach is to utilize tapered exit ramps for single lane exits. If multi lane exit, one lane must be parallel. See **GB** pp. 10-89:90; **MOI** 7-105:106.	
Curb Configuration	2011 AASHTO p.10-103	N/A	☑ Not Required ☐ Required ☐ Approved	Determine if the curb is appropriate for the type of facility. **GB** pp. 4-16:19, 10-103; **SD** GW 2	
Traffic Control	Meet Traffic Control Standard Drawings requirements	Meet Traffic Control Standard Drawings requirements	☑ Not Required ☐ Required ☐ Approved	**SD** TC series	
Rumble Strips	Meet Paving Standard Drawings requirements	Meet Paving Standard Drawings requirements	☑ Not Required ☐ Required ☐ Approved	**SD** PV 6A:8B	

Prepared by _____ Date _____

Verified Only _____ Date _____
- Local Government Projects Only

Approved by _____ Date _____

On local government projects that are not on a UDOT road, the Region Preconstruction Engineer signs the "Verified Only" line and the Engineer of Record signs the "Approved by" line. For all other projects, the "Verified Only" line is left blank and the Region Preconstruction Engineer signs the "Approved by" line.

PROJECT DESIGN CRITERIA - FREEWAY

I. PROJECT DESCRIPTION

DATE:

Project No		**Location**	
PIN		**Concept**	

Describe the scope of the project

II. DESIGN STANDARDS BY ROADWAY

(Complete a separate PDC for each roadway on your project)

Date of OSR:

Roadway Name: I-15 and CD Roads - Shepard Lane Interchange

Comments

Roadway Characteristics

Functional Class	Freeway			**Pavement Type**	TBD		
Current Year	2016	**AADT=**	**varies**	**Terrain**	Flat		
Design Year	2040	**AADT=**	**varies**	**% Trucks (current)**			
Design Vehicle	WB-67			**Posted / Design Speed**	70	70	

Proposed Roadway Characteristics

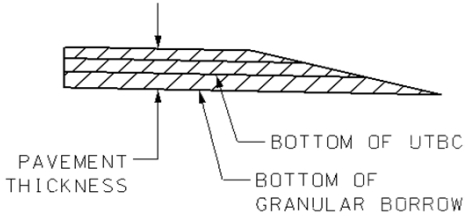
Total Number of Lanes max 6 (freeway), max 4 (CD Road) each direction

Shoulder Width (Typ) 12'

Curb & Gutter Type & Width (Typ) N/A

Pavement Thickness

Section 1		**Section 2**		**Section 3**	
Sta. From		**Sta. From**		**Sta. From**	
Sta. To		**Sta. To**		**Sta. To**	
Hard Surfacing (in)		**Hard Surfacing (in)**		**Hard Surfacing (in)**	
UTBC (in)		**UTBC (in)**		**UTBC (in)**	
Granular Borrow (in)		**Granular Borrow (in)**		**Granular Borrow (in)**	



Pavement Thickness consists of Hard Surfacing, UTBC, and Granular Borrow (if used).

Order of Precedence: SD - 2012 Standard Drawings; MOI - Roadway Design Manual of Instruction; GB - AASHTO Green Book 2011 Edition

FHWA 13 Critical Elements	UDOT Standard	Proposed/Used	Design Exception	References	Date of Decision, Comments, Mitigation, etc.
Design Speed	70 mph (Mainline I-15) 60 mph (CD Roads)	70 mph (Mainline I-15) 60 mph (CD Roads)	☑ Not Required ☐ Required ☐ Approved	**MOI** 2-1; **GB** pp. 2-53:58, 8-1:2	
Lane Width	**Mainline** 12' **LT Turn Lane(s)** 12' **RT Turn Lane(s)** 12'	12' 12' 12'	☑ Not Required ☐ Required ☐ Approved	**SD** (DD & ST series); **MOI** 7-1, 43:47, 107; **GB** pp. 8-2:3	
Shoulder Width	**Outside** / **Inside** / **Barrier Offset** 12' / 12' / included in 12'	**Outside** / **Inside** / **Barrier Offset** 12' / 12' / included in 12'	☑ Not Required ☐ Required ☐ Approved	**SD** (DD & ST series); **MOI** 7-44:46; **GB** pp. 4-8:11, 8-2:3	
Superelevation	**Maximum Superelevation** 6%	**Maximum Superelevation** 6%	☑ Not Required ☐ Required ☐ Approved	**SD** DD 1; **MOI** 7-26:29; **GB** pp. 8-3, 3-45 (T. 3-9)	
Horizontal Alignment	**Minimum Radii Value** 2040' (Mainline) 1330' (CD Roads)	**Minimum Radii Value** Mainline: 2040' or match existing CD: 1330"	☑ Not Required ☐ Required ☐ Approved	**MOI** 7-30:33, 50:55; **GB** pp. 8-6, 3-32 (T. 3-7), 3-45 (T. 3-9), 10-81	
Vertical Alignment	**Sag Curve Min. K Value** / **Crest Curve Min. K Value** 181 (Mainline) 136 (CD Road) / 247 (Mainline) 151 (CD Road)	**Sag Curve Min. K Value** / **Crest Curve Min. K Value** match existing (Main) 136 (CD) / match existing (Main) 151 (CD)	☑ Not Required ☐ Required ☐ Approved	**MOI** 7-56:60; **GB** pp. *crest* 3-155: 157 (T. 3-34:35), *sag* 3-161 (T. 3-36)	
Profile Grades	**% Min** / **% Max** 0.30% / 3% - Mainline 3% - CD Road	**% Min** / **% Max** 0.30% / ~2.1% Mainline ~3.8% CDs	☐ Not Required ☑ Required ☐ Approved	**MOI** 7-58:62; **GB** pp. 3-119, 8-3:4 (T. 8-1)	0.50% preferred. Waiver likely needed for NB CD profile
Cross Slope	**Standard Value** 2%	**Value Proposed/Used** 2%	☑ Not Required ☐ Required ☐ Approved	**SD** (DD, DD 4); **MOI** 7-47:48; **GB** pp. 4-1:6, 8-2:3	
Stopping-Sight Distance	**Minimum** 730' (Mainline I-15) 570' (CD Roads)	**Minimum** 730' (Mainline I-15) 570' (CD Roads)	☑ Not Required ☐ Required ☐ Approved	**MOI** 7-62; **GB** pp. 3-2:8, 3-106:110, 3-4 (T. 3-1)	
Structural Capacity	**Design Loading** HS20 for existing	**Design Loading** HS-20 for existing; HL-93 for new construction	☑ Not Required ☐ Required ☐ **Approved**	**MOI** 11-2:3; **GB** p. 8-4	HS-20 for existing; HL-93 for new construction
Bridge Width	**Minimum** Lanes x 12' + 2 Shoulders x 12' + Parapet	**Minimum** Lanes x 12' + 2 Shoulders x 12' + Parapet	☑ Not Required ☐ Required ☐ Approved	**SD** DD 9; **MOI** 11-3; **GB** p. 8-4	
Vertical Clearance*	**Minimum** 16.5' over road, 23.5' over rail	**Minimum** 16.5' over road, 23.5' over rail	☑ Not Required ☐ **Required** ☐ **Approved**	**SD** DD 8:0; **MOI** 11-4:5; **GB** p. 8-4	* Notify FHWA on any changes to Vertical Clearance on the National Highway System
Lateral Offset to Obstruction	**Minimum** Urban environments shoulder + 2', other locations clearzone.	**Minimum** Clearzone or barrier will be present in all locations	☑ **Not Required** ☐ Required ☐ Approved	**SD** DD 17**; GB** p. 8-5, 10-19:21	

Design Waivers	UDOT Standard				Proposed/Used			Design Waiver	References	Date of Decision, Comments, Mitigation, etc.
Acceleration Lanes	**V**	**Va**	**V'a**	**L**	**Location**	**V/V'a**	**L**	☑ Not Required ☐ Required ☐ Approved	Refer to Table 10-4 **GB** pp. 10-111:112 to adjust for grade. A part of the ramp proper may also be considered in the acceleration length as a design waiver. Table 10-3 **GB** p. 10-110. See also **GB** pp. 9-124:125, 10-107:110, 116:122; **SD** DD 13A:14B, ST 1; **MOI** 7-106	
	70 mph	53 mph	22	1420	All	70/53	340			
			26	1350						
			36	1000						
			40	820						
			44	580						
Deceleration Lanes	**V**	**Va**	**V'a**	**L**	**Location**	**V/V'a**	**L**	☑ Not Required ☐ Required ☐ Approved	Refer to Table 10-4 **GB** pp. 10-111:112 to adjust for grade. Table 10-5 **GB** p. 10-115. See also **GB** pp. 9-124:125, 10-107,112:120, 123:124; **SD** DD 13A:14B, ST 3A:3B; **MOI** 7-106	
	70 mph	58 mph	22	550	All	70/58	340			
			26	520						
			36	440						
			40	390						
			44	340						
Guardrail Bridge Connection	UDOT Std Dwg BA 4B1:4B2 & Bridge Rail or Parapet section of UDOT Design Exception Form.				As per Standards			☑ Not Required ☐ Required ☐ Approved	**SD** BA 4B1:4B2, UDOT Design Exception Form	
Clear Zone	Meet clear zone compliant requirements defined in Standard Drawings.				Clear Zone met or Barrier in all locations			☑ Not Required ☐ Required ☐ Approved	2006 Roadside Design Guide pg. 3-6 and Figure 3.2 pg. 3-8; **SD** DD 4, 8, 10-12,17	
Intersection Sight Distance	Meet 2011 AASHTO requirements for sight triangles cases A-F and skew.				N/A			☑ Not Required ☐ Required ☐ Approved	**GB** pp. 9-28:54, **MOI** 7-64:67	
Ramp Terminal Sight Distance	Along the Ramp				Along the Ramp			☑ Not Required ☐ Required ☐ Approved	SSD (Stopping Sight Distance) should be at least as great as design SSD *SSD is 25% greater than minimum SSD. **DSD is Decision Sight Distance based on avoidance maneuver 'E' and is desired where feasible. Document DSD but do not obtain waiver if DSD is not met. **GB** p. 3-4 (T. 3-1) **GB** p. 3-7 (T. 3-3) **GB** p. 10-92	
	Design Speed	**SSD (ft)**			**Location**	**SSD (ft)**				
	70 mph	730								
	55 mph	495								
	50 mph	425								
	45 mph	360			70 mph zone	730				
	40 mph	305			60 mph zone	570				
	35 mph	250								
	30 mph	200								
	25 mph	155								
	Along the Freeway or Street Preceeding Approach Nose of Exit Ramp				Along the Freeway or Street Preceeding Approach Nose of Exit Ramp					
	Design Speed	**SSD (ft)***	**DSD (ft)****		**Location**	**SSD***	**DSD****			
	70 mph	915	1445							
	55 mph	620	1135							
	50 mph	535	1030			915	1445			
	45 mph	450	930		Exit to NB CD					
	40 mph	385	825		Exit to SB CD	915	1050			
	35 mph	315	720							
	30 mph	250	620							
	25 mph	200	N/A							
Shoulder/Travel way (gutter pan)	The gutter pan is not considered a part of the traveled way or shoulder.				N/A			☑ Not Required ☐ Required ☐ Approved	**GB** pp. 4-19, 10-103; **MOI** 7-1, 43:44	

Design Waivers	UDOT Standard	Proposed/Used	Design Waiver	References	Date of Decision, Comments, Mitigation, etc.
Gores	Follow the key points from 2011 AASHTO: • Should be uniform along the freeway; • Geometric shape is appropriate for given speeds; • Mitigation required for major obstructions in a gore; and • Unpaved area beyond the gore nose should be graded nearly level with the roadways as practical.	Location: Meets all Requirements? All: No violations anticipated	☑ Not Required ☐ Required ☐ Approved	**GB** pp. 10-96:101; **SD** DD 6, ST 3A:3B	
Ramp Terminals	Platform Location: Ramp side of the approach nose or merging end. — Length: 200 ft At- grade terminal of ramp. — Length: Varies	Platform Location: Ramp side of the approach nose or merging end. — Length: 200 ft At- grade terminal of ramp. — Length: Varies	☑ Not Required ☐ Required ☐ Approved	Avoid left hand entrances and exits. **GB** pp. 10-103:104. Ramp Terminal means: 1) the exit terminal from the side street onto the freeway entrance ramp; 2) the entrance terminal onto the freeway; 3) the exit terminal from the freeway onto the exit ramp; and 4) the entrance terminal from the freeway exit ramp onto the side street. Refer to **GB** 10-104 for platform lengths. **MOI** 7-105:106	
On Ramp Design	Type: Parallel Curve Radius: 1000 ft Dist. From Physical Nose to Ramp Control Line Terminus: 200 ft Taper: 300 ft min	Ramp Loc.: Type: Parallel Curve Rad.: 1000 ft All: Dist.: 200 ft All: Taper: 300+	☑ Not Required ☐ Required ☐ Approved	**GB** pp. 10-107:112; **SD** DD 6, ST 1; **MOI** p. 1-2. UDOTs preferred approach is to utilize parallel entrance ramps. See **GB** pp. 10-89:90; **MOI** 7-105:106.	
Off Ramp Design	Type: Taper Divergence Angle (deg): 2-5 Dist. from outer edge alignment break to ramp control line: 200 ft	Ramp Loc.: Type: Taper Angle: 2-5 All: Dist.: 200 ft	☑ Not Required ☐ Required ☐ Approved	**GB** pp. 10-112:116; **SD** DD 6, ST 3A:3B; **MOI** p. 1-2. UDOTs preferred approach is to utilize tapered exit ramps for single lane exits. If multi lane exit, one lane must be parallel. See **GB** pp. 10-89:90; **MOI** 7-105:106.	
Curb Configuration	2011 AASHTO p.10-103	N/A	☑ Not Required ☐ Required ☐ **Approved**	Determine if the curb is appropriate for the type of facility. **GB** pp. 4-16:19, 10-103; **SD** GW 2	
Traffic Control	Meet Traffic Control Standard Drawings requirements	Meet Traffic Control Standard Drawings requirements	☑ Not Required ☐ Required ☐ Approved	**SD** TC series	
Rumble Strips	Meet Paving Standard Drawings requirements	Meet Paving Standard Drawings requirements	☑ Not Required ☐ Required ☐ Approved	**SD** PV 6A:8B	

Prepared by _____ Date _____

Verified Only _____ Date _____
- Local Government Projects Only

Approved by _____ Date _____

On local government projects that are not on a UDOT road, the Region Preconstruction Engineer signs the "Verified Only" line and the Engineer of Record signs the "Approved by" line. For all other projects, the "Verified Only" line is left blank and the Region Preconstruction Engineer signs the "Approved by" line.

PROJECT DESIGN CRITERIA - FREEWAY

I. PROJECT DESCRIPTION

DATE:

Project No		**Location**	
PIN		**Concept**	

Describe the scope of the project

II. DESIGN STANDARDS BY ROADWAY

(Complete a separate PDC for each roadway on your project)

Date of OSR:

Roadway Name: I-15 and CD Ramps - Shepard Lane Interchange

Comments

Roadway Characteristics

Functional Class	Freeway/Ramps			**Pavement Type**	TBD		
Current Year	2016	**AADT=**	**varies**	**Terrain**	Flat		
Design Year	2040	**AADT=**	**varies**	**% Trucks (current)**			
Design Vehicle	WB-67			**Posted / Design Speed**		70	70

Proposed Roadway Characteristics

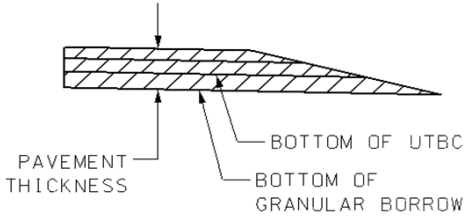
Total Number of Lanes varies - ramps 1 or 2

Shoulder Width (Typ) 4'-12'

Curb & Gutter Type & Width (Typ) N/A

Pavement Thickness

Section 1		**Section 2**		**Section 3**	
Sta. From		**Sta. From**		**Sta. From**	
Sta. To		**Sta. To**		**Sta. To**	
Hard Surfacing (in)		**Hard Surfacing (in)**		**Hard Surfacing (in)**	
UTBC (in)		**UTBC (in)**		**UTBC (in)**	
Granular Borrow (in)		**Granular Borrow (in)**		**Granular Borrow (in)**	



Pavement Thickness consists of Hard Surfacing, UTBC, and Granular Borrow (if used).

Order of Precedence: SD - 2012 Standard Drawings; MOI - Roadway Design Manual of Instruction; GB - AASHTO Green Book 2011 Edition

FHWA 13 Critical Elements	UDOT Standard	Proposed/Used	Design Exception	References	Date of Decision, Comments, Mitigation, etc.
Design Speed	Service Ramp Terminals (at-grade side, within 300' of stop bar) = 25 mph	Service Ramp Terminals (at-grade side, within 300' of stopbar): 25 mph	☑ Not Required ☐ Required ☐ Approved	**MOI** 2-1; **GB** pp. 2-53:58, 8-1:2	
	System Ramps: 50-60 mph preferable, 30 mph minimum (Semidirect connections)	I-15 to WDC = 50 mph WDC to I-15 = 50 mph WDC to SB C-D Road = 45 mph	☑ Not Required ☐ Required ☐ Approved	**GB** 10-89:90	
	System or Service Ramps: 50-60 mph preferable, 40 mph minimum (Direct connections)	40 mph minimum	☑ Not Required ☐ Required ☐ Approved	**GB** 10-89:90	
Lane Width	**Mainline** 12' **LT Turn Lane(s)** 12' **RT Turn Lane(s)** 12'	12' 12' 12'	☑ Not Required ☐ Required ☐ Approved	**SD** (DD & ST series); **MOI** 7-1, 43:47, 107; **GB** pp. 8-2:3	
Shoulder Width	**Outside** 8' / **Inside** 4' / **Barrier Offset** 2'	**Outside** 8' / **Inside** 4' / **Barrier Offset** 2'	☑ Not Required ☐ Required ☐ Approved	**SD** (DD & ST series); **MOI** 7-44:46; **GB** pp. 4-8:11, 8-2:3	
Superelevation	**Maximum Superelevation** 6%	**Maximum Superelevation** 6%	☑ Not Required ☐ Required ☐ Approved	**SD** DD 1; **MOI** 7-26:29; **GB** pp. 8-3, 3-45 (T. 3-9)	
Horizontal Alignment	**Minimum Radii Value** 40 mph 485' 45 mph 643' 50 mph 833' 60 mph 1330' At 6% Super	**Minimum Radii Value** 40 mph 485' 45 mph 643' 50 mph 833' 60 mph 1330' At 6% Super	☑ Not Required ☐ Required ☐ Approved	**MOI** 7-30:33, 50:55; **GB** pp. 8-6, 3-32 (T. 3-7), 3-45 (T. 3-9), 10-81	Horizontal Sight Distances limit min radius if barrier is present. These have been evaluated and design speeds of ramps assigned accordingly
Vertical Alignment	**Sag Curve Min. K Value** 40 mph 44 45 mph 61 50 mph 84 60 mph 151 **Crest Curve Min. K Value** 40 mph 64 45 mph 79 50 mph 96 60 mph 136	**Sag Curve Min. K Value** 40 mph 44 45 mph 61 50 mph 84 60 mph 151 **Crest Curve Min. K Value** 40 mph 64 45 mph 79 50 mph 96 60 mph 136	☑ Not Required ☐ Required ☐ Approved	**MOI** 7-56:60; **GB** pp. *crest* 3-155: 157 (T. 3-34:35), *sag* 3-161 (T. 3-36)	
Profile Grades	**% Min** 0.30% **% Max** 25 mph 7% 40 mph 6% 45 mph 5% 50 mph 5% 60 mph 3%	**% Min** 0.30% **% Max** 25 mph 7% 40 mph 6% 45 mph 5% 50 mph 5% 60 mph 3%	☑ Not Required ☐ Required ☐ Approved	**MOI** 7-58:62; **GB** pp. 3-119, 8-3:4 (T. 8-1)	0.50% preferred Downgrade one-way ramps may add up to 2% to these values
Cross Slope	**Standard Value** 2%	**Value Proposed/Used** 2%	☑ Not Required ☐ Required ☐ Approved	**SD** (DD, DD 4); **MOI** 7-47:48; **GB** pp. 4-1:6, 8-2:3	
Stopping-Sight Distance	**Minimum** 730' (Mainline I-15) 570' (CD Roads)	**Minimum** 730' (Mainline I-15) 570' (CD Roads)	☑ Not Required ☐ Required ☐ Approved	**MOI** 7-62; **GB** pp. 3-2:8, 3-106:110, 3-4 (T. 3-1)	
Structural Capacity	**Design Loading** HS20 for existing	**Design Loading** HS-20 for existing; HL-93 for new construction	☑ Not Required ☐ Required ☐ **Approved**	**MOI** 11-2:3; **GB** p. 8-4	HS-20 for existing; HL-93 for new construction
Bridge Width	**Minimum**	**Minimum**	☑ Not Required ☐ Required	**SD** DD 9; **MOI** 11-3;	

Bridge Width	Lanes x 12' + 2 Shoulders x 12' + Parapet	Lanes x 12' + 2 Shoulders x 12' + Parapet	☐ Approved	**GB** p. 8-4	
Vertical Clearance*	**Minimum**	**Minimum**	☑ Not Required ☐ Required ☐ Approved	**SD** DD 8:0; **MOI** 11-4:5; **GB** p. 8-4	* Notify FHWA on any changes to Vertical Clearance on the National Highway System
	16.5' over road, 23.5' over rail	16.5' over road, 23.5' over rail			
Lateral Offset to Obstruction	**Minimum**	**Minimum**	☑ Not Required ☐ Required ☐ Approved	**SD** DD 17**; GB** p. 8-5, 10-19:21	
	Urban environments shoulder + 2', other locations clearzone.	Clearzone or barrier will be present in all locations			

<table>
<tr><th>Design Waivers</th><th>UDOT Standard</th><th>Proposed/Used</th><th>Design Waiver</th><th>References</th><th>Date of Decision, Comments, Mitigation, etc.</th></tr>
<tr><td>Acceleration Lanes</td><td>
<table>
<tr><th>V</th><th>Va</th><th>V'a</th><th>L</th></tr>
<tr><td rowspan="5">70 mph</td><td rowspan="5">53 mph</td><td>22</td><td>1420</td></tr>
<tr><td>26</td><td>1350</td></tr>
<tr><td>36</td><td>1000</td></tr>
<tr><td>40</td><td>820</td></tr>
<tr><td>44</td><td>580</td></tr>
</table>
</td><td>
<table>
<tr><th>Location</th><th>L</th></tr>
<tr><td>All</td><td>varies</td></tr>
</table>
</td><td>☐ Not Required
☑ Required
☐ Approved</td><td>Refer to Table 10-4 GB pp. 10-111:112 to adjust for grade. A part of the ramp proper may also be considered in the acceleration length as a design waiver. Table 10-3 GB p. 10-110. See also GB pp. 9-124:125, 10-107:110, 116:122; SD DD 13A:14B, ST 1; MOI 7-106</td><td>SB Shepard to SB CD = not enough accel length, others may require ramp proper for accel</td></tr>
<tr><td>Deceleration Lanes</td><td>
<table>
<tr><th>V</th><th>Va</th><th>V'a</th><th>L</th></tr>
<tr><td rowspan="5">70 mph</td><td rowspan="5">58 mph</td><td>22</td><td>550</td></tr>
<tr><td>26</td><td>520</td></tr>
<tr><td>36</td><td>440</td></tr>
<tr><td>40</td><td>390</td></tr>
<tr><td>44</td><td>340</td></tr>
</table>
</td><td>
<table>
<tr><th>Location</th><th>L</th></tr>
<tr><td>All</td><td>varies</td></tr>
</table>
</td><td>☑ Not Required
☐ Required
☐ Approved</td><td>Refer to Table 10-4 GB pp. 10-111:112 to adjust for grade. Table 10-5 GB p. 10-115. See also GB pp. 9-124:125, 10-107,112:120, 123:124; SD DD 13A:14B, ST 3A:3B; MOI 7-106</td><td></td></tr>
<tr><td>Guardrail Bridge Connection</td><td>UDOT Std Dwg BA 4B1:4B2 & Bridge Rail or Parapet section of UDOT Design Exception Form.</td><td>As per Standards</td><td>☑ Not Required
☐ Required
☐ Approved</td><td>SD BA 4B1:4B2, UDOT Design Exception Form</td><td></td></tr>
<tr><td>Clear Zone</td><td>Meet clear zone compliant requirements defined in Standard Drawings.</td><td>Clear Zone met or Barrier in all locations</td><td>☑ Not Required
☐ Required
☐ Approved</td><td>2006 Roadside Design Guide pg. 3-6 and Figure 3.2 pg. 3-8; SD DD 4, 8, 10-12,17</td><td></td></tr>
<tr><td>Intersection Sight Distance</td><td>Meet 2011 AASHTO requirements for sight triangles cases A-F and skew.</td><td>N/A</td><td>☑ Not Required
☐ Required
☐ Approved</td><td>GB pp. 9-28:54, MOI 7-64:67</td><td></td></tr>
<tr><td>Ramp Terminal Sight Distance</td><td>
Along the Ramp
<table>
<tr><th>Design Speed</th><th>SSD (ft)</th></tr>
<tr><td>70 mph</td><td>730</td></tr>
<tr><td>55 mph</td><td>495</td></tr>
<tr><td>50 mph</td><td>425</td></tr>
<tr><td>45 mph</td><td>360</td></tr>
<tr><td>40 mph</td><td>305</td></tr>
<tr><td>35 mph</td><td>250</td></tr>
<tr><td>30 mph</td><td>200</td></tr>
<tr><td>25 mph</td><td>155</td></tr>
</table>
Along the Freeway or Street Preceeding Approach Nose of Exit Ramp
<table>
<tr><th>Design Speed</th><th>SSD (ft)*</th><th>DSD (ft)**</th></tr>
<tr><td>70 mph</td><td>915</td><td>1445</td></tr>
<tr><td>60 mph</td><td>720</td><td>1280</td></tr>
<tr><td>50 mph</td><td>535</td><td>1030</td></tr>
<tr><td>45 mph</td><td>450</td><td>930</td></tr>
<tr><td>40 mph</td><td>385</td><td>825</td></tr>
<tr><td>35 mph</td><td>315</td><td>720</td></tr>
<tr><td>30 mph</td><td>250</td><td>620</td></tr>
<tr><td>25 mph</td><td>200</td><td>N/A</td></tr>
</table>
</td><td>
Along the Ramp
<table>
<tr><th>Location</th><th>SSD (ft)</th></tr>
<tr><td>50 mph zone</td><td>425</td></tr>
<tr><td>45 mph zone</td><td>360</td></tr>
<tr><td>40 mph zone</td><td>305</td></tr>
</table>
Along the Freeway or Street Preceeding Approach Nose of Exit Ramp
<table>
<tr><th>Location</th><th>SSD*</th><th>DSD**</th></tr>
<tr><td>CD Roads (60 mph)</td><td>720</td><td>1280</td></tr>
</table>
</td><td>☑ Not Required
☐ Required
☐ Approved</td><td>SSD (Stopping Sight Distance) should be at least as great as design SSD
*SSD is 25% greater than minimum SSD.
**DSD is Decision Sight Distance based on avoidance maneuver ‘E’ and is desired where feasible. Document DSD but do not obtain waiver if DSD is not met.
GB p. 3-4 (T. 3-1)
GB p. 3-7 (T. 3-3)
GB p. 10-92</td><td>less than 1280' DSD SB CD</td></tr>
<tr><td>Shoulder/Travel way (gutter pan)</td><td>The gutter pan is not considered a part of the traveled way or shoulder.</td><td>N/A</td><td>☑ Not Required
☐ Required
☐ Approved</td><td>GB pp. 4-19, 10-103; MOI 7-1, 43:44</td><td></td></tr>
</table>

Design Waivers	UDOT Standard	Proposed/Used	Design Waiver	References	Date of Decision, Comments, Mitigation, etc.
Gores	Follow the key points from 2011 AASHTO: • Should be uniform along the freeway; • Geometric shape is appropriate for given speeds; • Mitigation required for major obstructions in a gore; and • Unpaved area beyond the gore nose should be graded nearly level with the roadways as practical.	Location: All — Meets all Requirements?: No violations anticipated	☑ Not Required ☐ Required ☐ Approved	**GB** pp. 10-96:101; **SD** DD 6, ST 3A:3B	
Ramp Terminals	Platform Location: Ramp side of the approach nose or merging end. — Length: 200 ft Location: At- grade terminal of ramp. — Length: Varies	Platform Location: Ramp side of the approach nose or merging end. — Length: 200 ft Location: At- grade terminal of ramp. — Length: varies	☐ Not Required ☑ Required ☐ Approved	Avoid left hand entrances and exits. **GB** pp. 10-103:104. Ramp Terminal means: 1) the exit terminal from the side street onto the freeway entrance ramp; 2) the entrance terminal onto the freeway; 3) the exit terminal from the freeway onto the exit ramp; and 4) the entrance terminal from the freeway exit ramp onto the side street. Refer to **GB** 10-104 for platform lengths. **MOI** 7-105:106	Left hand exits and entrances exist
On Ramp Design	Type: Parallel Curve Radius: 1000 ft Dist. From Physical Nose to Ramp Control Line Terminus: 200 ft Taper: 300 ft min	Ramp Loc.: all Type: parallel Curve Rad.: varies Dist.: 200 ft Taper: 300 ft	☐ Not Required ☑ Required ☐ Approved	**GB** pp. 10-107:112; **SD** DD 6, ST 1; **MOI** p. 1-2. UDOTs preferred approach is to utilize parallel entrance ramps. See **GB** pp. 10-89:90; **MOI** 7-105:106.	Not all onramps meet 1000' min rad
Off Ramp Design	Type: Taper Divergence Angle (deg): 2-5 Dist. from outer edge alignment break to ramp control line: 200 ft	Ramp Loc.: All Type: Taper Angle: 2-5 Dist.: 200 ft	☑ Not Required ☐ Required ☐ Approved	**GB** pp. 10-112:116; **SD** DD 6, ST 3A:3B; **MOI** p. 1-2. UDOTs preferred approach is to utilize tapered exit ramps for single lane exits. If multi lane exit, one lane must be parallel. See **GB** pp. 10-89:90; **MOI** 7-105:106.	There are 4 locations considered Splits as opposed to exits - not considered "offramp".
Curb Configuration	2011 AASHTO p.10-103	N/A	☑ Not Required ☐ Required ☐ Approved	Determine if the curb is appropriate for the type of facility. **GB** pp. 4-16:19, 10-103; **SD** GW 2	
Traffic Control	Meet Traffic Control Standard Drawings requirements	Meet Traffic Control Standard Drawings requirements	☑ Not Required ☐ Required ☐ Approved	**SD** TC series	
Rumble Strips	Meet Paving Standard Drawings requirements	Meet Paving Standard Drawings requirements	☑ Not Required ☐ Required ☐ Approved	**SD** PV 6A:8B	

Prepared by _____ Date _____

Verified Only _____ Date _____
- Local Government Projects Only

Approved by _____ Date _____

On local government projects that are not on a UDOT road, the Region Preconstruction Engineer signs the "Verified Only" line and the Engineer of Record signs the "Approved by" line. For all other projects, the "Verified Only" line is left blank and the Region Preconstruction Engineer signs the "Approved by" line.