I-90 EXIT 63 INTERCHANGE MODIFICATION JUSTIFICATION REPORT

South Dakota Department of Transportation – Box Elder – Pennington County – Rapid City Area MPO – FHWA

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EXECUTIVE SUMMARY

The I-90 Exit 63 interchange serves as the western entrance to Box Elder, South Dakota, and provides significant access to Ellsworth Air Force Base (AFB). The interchange currently provides direct connections from eastbound I-90 to eastbound Highway 1416 and from westbound Highway 1416 to westbound I-90, but it does not provide movements to and from the east on I-90. As Box Elder and Ellsworth AFB grow, traffic through the interchange is increasing. The recent I-90 Exit 61 to Exit 67 Corridor Study identified two key needs at Exit 63:

- The need for additional capacity at I-90 Exit 63
- The need for construction of easterly-facing ramps at Exit 63 to create a fully directional interchange, in accordance with Federal Highway Administration (FHWA) policies

The Corridor Study evaluated numerous alternatives and recommended the following three primary options for detailed analysis in this Interchange Modification Justification Report (IMJR):

- **Feasible Option 1 –** Construction of a new diamond interchange at West Gate Road and removal of the current directional interchange at Highway 1416
- Reconstruction of the existing directional interchange at Highway 1416 as a diamond interchange. This option has since been refined, resulting in two diamond alternatives at Highway 1416:
  - **Feasible Option 2 –** Reconstruction of the interchange as a standard diamond interchange
  - **Feasible Option 3 –** Reconstruction of the interchange as a diverging diamond interchange

Each of the three primary options was further divided into two sub-alternatives to connect with different alignments for Highway 1416, which is undergoing a planning study in parallel to this IMJR. The "a" sub-options reflect a southerly connection, while the "b" sub-options reflect a northerly connection.

Each feasible option provides additional capacity at Exit 63 and easterly-facing ramps within the interchange, so they meet the project needs at a high level. The IMJR documents more detailed analyses required for the South Dakota Department of Transportation (SDDOT) and FHWA approvals of the Most Technically Feasible Alternative. This alternative has been selected from the list above based on traffic operations, safety, and various other evaluation criteria.

The evaluation criteria are based on current FHWA policies regarding changes in interstate access. For this project, they included safety and traffic operations, Ellsworth AFB impacts, physical impacts, compatibility with existing community plans, construction phasing and implementation, design criteria, and multimodal accommodations. A summary of the screening effort is shown on **Table ES-1**. The following represent key points from this process:

- **Safety and Traffic Operations –** Feasible Option 1 rated poorly in this group of evaluation criteria based on out-of-direction travel, safety concerns, and poor rankings for driver expectations and local access. Feasible Option 3 performed best in the safety and traffic operations criteria, while Feasible Option 2 ranked between the other two.
- **Ellsworth AFB Impacts –** Feasible Option 1 rated poorly in this group of evaluation criteria since it is closest to the Accident Protection Zone and creates out-of-direction travel through

Exit 63 along West Gate Road. Feasible Options 2 and 3 performed similarly under these criteria, with slight benefits under Feasible Option 3.

- **Physical Impacts –** Feasible Option 3 rated the best among the three scenarios, with Feasible Option 1 and Feasible Option 2 scoring similarly. The Feasible Option 1 ranking reflects concerns related to environmental justice and noise, while the "b" sub-options reflect concerns relating to a new at-grade railroad crossing on the potentially historic Rapid City, Pierre & Eastern (RCP&E) railroad corridor.
- **Compatibility with Existing Community Plans –** Feasible Option 1 ranked poorly due to lack of compatibility with Box Elder's plans for the E Mall Drive extension. Feasible Options 2 and 3 ranked similarly. In all three cases, the "b" sub-options reflect concerns relating to connecting to the revised Highway 1416 alternative and, therefore, rank lower.
- **Construction Phasing and Implementation –** The feasible options ranked poorly given concerns with bridge replacement or widening and the associated length of detours. However, Feasible Options 2b and 3b ranked slightly better given that railroad coordination would not be required for the new at-grade rail crossing.
- **Design Criteria –** The discriminators in this category focused on intersection spacing. The spacing along West Gate Road is constrained, so Feasible Option 1 scored poorly, while Feasible Options 2 and 3 scored average.
- **Multimodal Accommodation –** No discriminations were identified during the evaluation process. However, the recently completed bicycle and pedestrian plan for this area indicates that Feasible Option 3 would perform better than the other two options.

Based on these reviews, Feasible Option 3b was identified as the Most Technically Feasible Alternative in the IMJR. This option consists of a diverging diamond interchange on the Highway 1416 alignment, with a connection to the extension of E Mall Drive to the west and a connection to the northly Highway 1416 alignment to the east. The diverging diamond configuration will provide full access to I-90 from both directions of Highway 1416, and a signalized intersection at Highway 1416 and West Gate Road will provide access for traffic along that corridor. Both FHWA interstate access policy points were evaluated, and this Feasible Option adequately meets the requirements.

I-90 Exit 63 IMJR
Evaluation Matrix Summary

Table ES-1	Option Evaluation Categories and Criteria	FEASIBLE OPTION 1a - WESTGATE ROAD DIAMOND INTERCHANGE (SOUTH HWY 1416 SECTION)		FEASIBLE OPTION 1b - WESTGATE ROAD DIAMOND INTERCHANGE (NORTH HWY 1416 SECTION)		FEASIBLE OPTION 2a - COUNTY HIGHWAY 1416 DIAMOND INTERCHANGE (SOUTH HWY 1416 SECTION	FEASIBLE OPTION 2b - COUNTY HIGHWAY 1416 DIAMOND INTERCHANGE (NORTH HWY 1416 SECTION)	FEASIBLE OPTION 3a - DIVERGING DIAMOND INTERCHANGE (SOUTH HWY 1416 SECTION)	FEASIBLE OPTION 3b - DIVERGING DIAMOND INTERCHANGE (NORTH HWY 1416 SECTION)
1-Oct-20		East Mall Drive (Connect at West Gate Road)	East Mall Drive (Connect at County Hwy 1416)	East Mall Drive (Connect at West Gate Road)	East Mall Drive (Connect at County Hwy 1416)				
Category	**Criteria**								
Safety and Traffic Operations									
Category Summary: All the options met the FHWA interchange policy for providing all movements; therefore, the rankings were based on meeting the other criteria in this category since these were the differentiators for the options.		For this category, this option ranked second to worse. Safety was ranked medium for this interchange configuration, which brought the overall ranking down. Improving traffic operations was medium high. Meeting driver expectations and providing property access had low rankings.	For this category, this option ranked the worse and tied with 1b options. Safety was ranked medium for this interchange configuration, which brought the overall ranking down. Improving traffic operations was also medium. Meeting driver expectations and providing property access had low rankings.	For this category, this option ranked the worse. Safety was ranked medium for this interchange configuration, which brought the overall ranking down. Improving traffic operations was also medium. Meeting driver expectations and providing property access had low rankings.	For this category, this option ranked the worse. Safety was ranked medium for this interchange configuration, which brought the overall ranking down. Improving traffic operations was also medium. Meeting driver expectations and providing property access had low rankings.	For this category, this option ranked the 4th best. Safety was ranked medium for this interchange configuration. Improving traffic operations was slightly lower. Meeting driver expectations and providing property access had high rankings.	For this category, this option ranked the 3rd best. Safety was ranked medium high for this interchange configuration. Improving traffic operations was slightly lower. Meeting driver expectations and providing property access had high rankings.	For this category, this option ranked the best. Safety was ranked high for this interchange configuration. Improving traffic operations and providing property access had high rankings. Meeting driver expectations was only slightly lower.	For this category, this option ranked the 2nd best. Safety was ranked high for this interchange configuration. Improving traffic operations, meeting driver expectations and providing property access was only slightly lower.
Ellsworth AFB Impacts									
Category Summary: All the criteria provided varying results and were differentiators for these options; therefore, the rankings were based on the average of this criteria		For this category, this option ranked the worst. One of the closest to the APZ and the ability to facilitate movements to and from the AFB was ranked low.	For this category, this option ranked the worst. One of the closest to the APZ and the ability to facilitate movements to and from the AFB was ranked low.	For this category, this option ranked the worst. One of the closest to the APZ and the ability to facilitate movements to and from the AFB was ranked low.	For this category, this option ranked the worst. One of the closest to the APZ and the ability to facilitate movements to and from the AFB was ranked low.	For this category, this option ranked the 2nd best. One of the farthest from the APZ and the ability to facilitate movements to and from the AFB was ranked medium high.	For this category, this option ranked the 2nd best. One of the farthest from the APZ and the ability to facilitate movements to and from the AFB was ranked medium high.	For this category, this option ranked the best. One of the farthest from the APZ and the ability to facilitate movements to and from the AFB was ranked high.	For this category, this option ranked the best. One of the farthest from the APZ and the ability to facilitate movements to and from the AFB was ranked high.
Physical Impacts									
Category Summary: All the criteria provided varying results and were differentiators for these options; therefore, the rankings were based on the average of this criteria		For this category, this option ranked the worst. This option had low rankings for environmental justice and noise impacts; and medium-low property impacts and railroad impacts.	For this category, this option ranked 7th . This option had high and medium-high rankings with minimal impacts to environmental justice and noise, but had low ranking for the substantial impacts to properties.	For this category, this option ranked 2nd to worst. Although this option maintained the existing RR crossing, low environmental justice and noise impact rankings and a substantial number of properties were impacted compared to other options.	For this category, this option ranked 3rd. This option had high and medium-high rankings with minimal impacts to historical, environmental justice, and noise as well as minimal impacts to the railroad.	For this category, this option ranked 5th. This option had low ranking for historical impacts due to new railroad crossing. This option had high and medium-high rankings with minimal impacts to environmental justice and hazardous materials as well as minimal impacts to properties.	For this category, this option ranked 3rd to worst. Although this option had high rankings minimizing environmental justice and hazardous material impacts, it had low rankings for the number of properties impacted compared to other options.	For this category, this option ranked 4th. This option had low ranking for historical impacts due to new railroad crossing. This option had high rankings with minimal impacts to environmental justice, and hazardous materials as well as minimal impacts to properties.	For this category, this option ranked 2nd, with only the No Build Alternative scoring better. This option had minimal impacts to historical, environmental justice and hazardous materials as well as minimal property impacts.
Compatibility with Existing Community Plans									
Category Summary: Since all the alternatives meet the compatibility with JLUS criteria, meeting Box Elder HWY 14-16 and East Mall Drive Extension plans were the differentiators therefore the ranking is based on the average of this criteria.		For this category, this option ranked the worst. This option is not compatible with Box Elder HWY 14-16 and East Mall Drive Extension plans.	For this category, this option ranked the worst. This option is not compatible with Box Elder HWY 14-16 and East Mall Drive Extension plans.	For this category, this option ranked 3rd. Although this option meets planned improvements for HWY 14-16, it does not meet planned improvements for East Mall Drive Extension.	For this category, this option ranked 3rd. Although this option meets planned improvements for HWY 14-16, it does not meet planned improvements for East Mall Drive Extension.	For this category, this option ranked 2nd. Although this option does not preclude the East Mall Drive extension, it only meets existing conditions and not planned improvements for HWY 14-16	For this category, this option ranked the best. This option is compatible with Box Elder HWY 14-16 and East Mall Drive Extension plans.	For this category, this option ranked 2nd. Although this option does not preclude the East Mall Drive extension, it only meets existing conditions and not planned improvements for HWY 14-16	For this category, this option ranked the best. This option is compatible with Box Elder HWY 14-16 and East Mall Drive Extension plans.
Construction Phasing and Implementation									
Category Summary: Only one category was provided, so ranking was based on the extent of detours (out of way travel), duration, relative phasing, ease of obtaining agency/RR approvals, and CTC costs		For this category, this option ranked low.	For this category, this option ranked low.	For this category, this option ranked low.	For this category, this option ranked low.	For this category, this option ranked low.	For this category, this option ranked medium low.	For this category, this option ranked low.	For this category, this option ranked medium low.
Design Criteria									
Category Summary: Since all the alternatives meet ramp criteria, intersection spacing was the differentiator and the ranking is based on this criteria.		For this category, this option ranked the worst and low and had three segments with insufficient spacing.	For this category, this option ranked the worst and low and had three segments with insufficient spacing.	For this category, this option ranked the worst and low and had three segments with insufficient spacing.	For this category, this option ranked the worst and low and had three segments with insufficient spacing.	For this category, this option ranked medium with two segments with insufficient spacing.	For this category, this option ranked medium with two segments with insufficient spacing.	For this category, this option ranked medium with two segments with insufficient spacing.	For this category, this option ranked medium with two segments with insufficient spacing.
Multi-Modal Accommodations									
Category Summary: All alternatives were the same under this category and allow provisions for existing or future multi-modal accommodations		For this category, this option ranked medium to high.	For this category, this option ranked medium to high.	For this category, this option ranked medium to high.	For this category, this option ranked medium to high.	For this category, this option ranked medium to high.	For this category, this option ranked medium to high.	For this category, this option ranked medium to high.	For this category, this option ranked medium to high.
Summary		**Eliminated** Does not meet driver expectations and creates out of direction travel, substantial number of impacts to access along West Gate Road, does not meet community plans, constructability has a low ranking.	**Eliminated** Does not meet driver expectations and creates out of direction travel, substantial number of impacts to access along West Gate Road, does not meet community plans, constructability has a low ranking.	**Eliminated** Does not meet driver expectations and creates out of direction travel, substantial number of impacts to access along West Gate Road, constructability has a low ranking, does not meet intersection spacing criteria.	**Eliminated** Does not meet driver expectations and creates out of direction travel, substantial number of impacts to access along West Gate Road, constructability has a low ranking, does not meet intersection spacing criteria.	**Eliminated** Does not meet community plans, does not meet intersection spacing, requires a new crossing of the railroad, and constructability would be more difficult	**Eliminated** Does not meet intersection spacing, impacts to RR ROW would be significant, and constructability would be more difficult	**Eliminated** Does not meet community plans, does not meet intersection spacing, requires a new crossing of the railroad, and constructability would be more difficult	**Retained** Improved safety, facilitates movements to and from the AFB, minimizes ROW impacts, and reduced impacts with RR

Most Meets Criteria → Least Meets Criteria

1. INTRODUCTION

The I-90 Exit 63 interchange is located in the city of Box Elder, South Dakota, just east of Rapid City. It serves as the western entrance to Box Elder and provides significant access to Ellsworth Air Force Base (AFB), which is located north of I-90. The interchange currently provides direct connections from eastbound I-90 to eastbound Highway 1416 and from westbound Highway 1416 to westbound I-90. As Box Elder and Ellsworth AFB grow, traffic through the interchange is increasing as area residents take advantage of jobs and services in Rapid City to the west.

1.1 Background

The South Dakota Department of Transportation (SDDOT), the Rapid City Area Metropolitan Planning Organization (RCAMPO), the City of Box Elder, and the Federal Highway Administration (FHWA) completed the I-90 Exit 61 to Exit 67 Corridor Study[1] in 2017. The study identified two key needs at the Exit 63 interchange:

- The need for additional capacity at I-90 Exit 63
- The need for construction of easterly-facing ramps at Exit 63 to create a fully directional interchange, in accordance with FHWA policies

The Corridor Study evaluated numerous alternatives and recommended three options for detailed analysis, as follows:

- **Feasible Option 1 –** Construction of a new diamond interchange at West Gate Road and removal of the current directional interchange at Highway 1416
- Reconstruction of the existing directional interchange at Highway 1416 as a diamond interchange. This option has since been refined, resulting in two diamond options at Highway 1416:
  - **Feasible Option 2 –** Reconstruction of the interchange as a standard diamond interchange
  - **Feasible Option 3 –** Reconstruction of the interchange as a diverging diamond interchange

Since the completion of the Corridor Study, a significant development referred to as the Alpha Omega project has been identified south of I-90 and Highway 1416 adjacent to Exit 63. This development will take many years to reach full buildout, but the first stages of the project have received preliminary approval from the City. It is expected to significantly alter growth patterns shown on the Corridor Study, including providing a new east-west connection between West Gate Road and Elk Vale Road, parallel to and south of I-90. Other study area changes include a study of options for upgrading Highway 1416 east of the interchange area and adjustments to the roadway network north if I-90 between Exit 61 and Exit 63, potentially including the extension of E Mall Drive to Exit 63.

1.2 Purpose

This Interchange Modification Justification Report (IMJR) provides documentation for SDDOT and FHWA approvals of the selected interchange modification. The report reflects the three Feasible Options described above, adds detail related to Highway 1416 and E Mall Drive alternatives, and updates the Corridor Study traffic analyses to reflect the Alpha Omega development. Given these updated inputs, this

[1] *I-90 Exit 61 to Exit 67 Corridor Study*, South Dakota Department of Transportation, Pierre, SD, December 2017

IMJR recommends a Most Technically Feasible Alternative for consideration at I-90 Exit 63. It does not provide detailed environmental analysis; that will be provided in a separate document.

1.3 Project Location

The project study area is shown on **Figure 1**. It includes portions of the city of Box Elder, the city of Rapid City, Ashland Heights (unincorporated), and other unincorporated lands within Pennington County. Key area developments include Ellsworth AFB and the planned Alpha Omega development. Along I-90, this study is focused on Exit 63, which connects Highway 1416 to I-90 with west-facing (only) ramps. Highway 1416 provides access to much of Box Elder and parallels I-90 about ¼ mile to the south through the city. Exit 61 is the first interchange to the west, which connects Elk Vale Road to I-90 at a single point urban interchange (SPUI). Elk Vale Road provides access to much of the commercial development on the east side of Rapid City, including several truck stops, hotels, and restaurants. Exit 67 is the first full interchange to the east, which connects Liberty Boulevard to I-90 with a partial cloverleaf interchange. Liberty Boulevard provides access to the city of Box Elder and Ellsworth AFB.

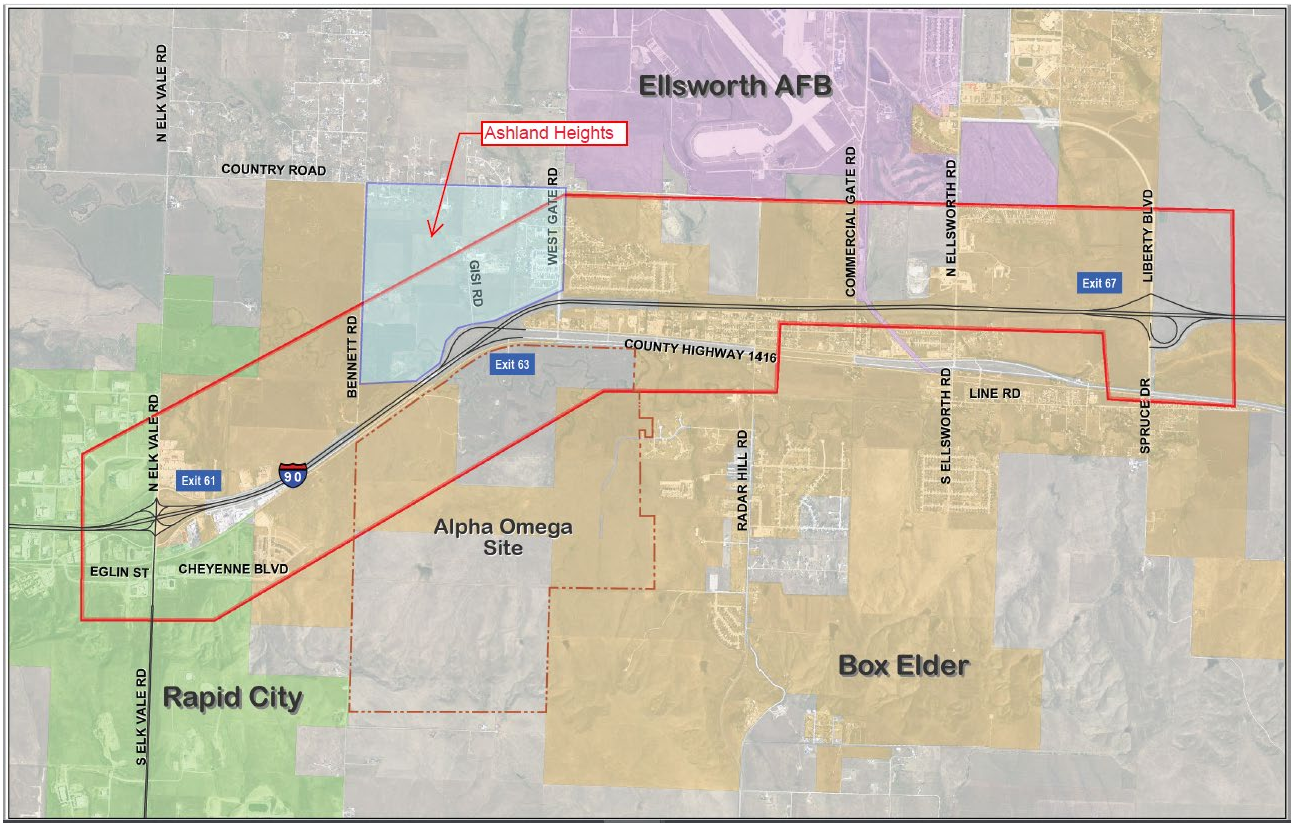


Figure 1. Study Area

1.4 Methods and Assumptions

The analysis methods and assumptions used in this study are based on a separate Methods and Assumptions (M&A) document, initially prepared at the beginning of the IMJR process. This document reflects key study inputs such as the study area, the horizon analysis year (2050), and measures of effectiveness used to compare Feasible Options. The original M&A document (approved April 2019) was revised to accommodate the Alpha Omega project in summer 2020. The revised M&A document was approved in September 2020 and is included in **Appendix A**.

2. EXISTING CONDITIONS

The project team compiled existing conditions information as a baseline for the IMJR process. These data update the information compiled for the Corridor Study where indicated.

2.1 Demographics

The Rapid City metropolitan area consists of the city of Rapid City, the city of Box Elder, and both Meade and Pennington counties. It is a vibrant region that enjoys a robust economy and sustained population growth. The *Rapid City Metropolitan Transportation Plan*[2] indicates that the population has grown between 1 percent and 2 percent annually since 2010. This is down slightly from the overall growth rate of just over 2 percent for the period between 1940 and 2010[3]. The 2010 Census showed that the metropolitan area had a population of about 126,800, which had grown to about 145,300 by 2018[4]. As of 2018, the unemployment for the region was 3.3 percent, which was slightly lower than the statewide average of 3.5 percent and significantly lower than the national average of 5.9 percent[5]. The median household income was approximately $55,700, and about 12.2 percent of the region's population was living below the poverty line[6].

2.2 Existing Land Use

Land uses in the study area include commercial development, hospitality uses, farm and ranchland, and residential uses. Much of the commercial and hospitality development is centered around Exit 61, with smaller pockets of commercial development along the Highway 1416 corridor between Exit 63 and Exit 67 and surrounding Exit 67. Residential land uses are common along West Gate Road north of I-90, along the Highway 1416 corridor, and along the Radar Hill Road corridor south of Highway 1416. Farm and ranchland are common on both sides of I-90 between Exit 61 and Exit 63, as well as south of the Highway 1416 corridor outside the Radar Hill Road residential areas. Ellsworth AFB is located north of I-90 between Exit 63 and Exit 67. The related Air Installation Compatible Use Zone (AICUZ) influences off-base land use decisions within the study area.

2.3 Existing Roadway Network

Study area roadways include I-90 from Elk Vale Road (Exit 61) to Liberty Boulevard (Exit 67), Highway 1416 from I-90 to Radar Hill Road, West Gate Road from Highway 1416 to Country Road / CR 214, Elk Vale Road from Egin Street / Cheyenne Boulevard to E Mall Drive, and Liberty Boulevard from Highway 1416 to Reagan Avenue. Three interchanges are included: Exit 61 (Elk Vale Road), Exit 63 (Highway 1416), and Exit 67 (Liberty Boulevard). Intersections analyzed include:

- Elk Vale Road at Eglin Street / Cheyenne Boulevard (signal)
- Elk Vale Road at Edwards Street / South I-90 Service Road (side street stop control)
- Elk Vale Road at I-90 Ramps (single point urban interchange)
- Elk Vale Road at E Mall Drive (side street stop control)

[2] *Rapid City Metropolitan Transportation Plan*, Rapid City Area Metropolitan Planning Organization, August 2020, page 3-1.
[3] Ibid, Table 3-1.
[4] Ibid, page 3-1.
[5] Ibid, page 3-4.
[6] Ibid, page 3-2.

- West Gate Road at Highway 1416 eastbound (side street stop control)
- West Gate Road at Highway 1416 westbound (side street stop control)
- West Gate Road at Box Elder Road West (side street stop control)
- West Gate Road at North I-90 Service Road (side street stop control)
- West Gate Road at Bluebird Drive (side street stop control)
- West Gate Road at Country Road / CR 214 (side street stop control)
- Radar Hill Road at Highway 1416 eastbound (side street stop control)
- Radar Hill Road at Highway 1416 westbound (side street stop control)
- Radar Hill Road at Box Elder Road West (side street stop control)
- Liberty Boulevard at Highway 1416 (side street stop control)
- Liberty Boulevard at I-90 eastbound entrance ramp (yield control)
- Liberty Boulevard at I-90 eastbound to southbound ramp / eastbound to northbound loop ramp (yield control)
- Liberty Boulevard at I-90 westbound ramps (side street stop control)
- Liberty Boulevard at Reagan Avenue (side street stop control)

2.4 Alternative Travel Modes

Several alternative modes were evaluated as part of the IMJR process.

2.4.1 Transit

The City of Rapid City operates the Rapid Transit System (RTS) within the city. None of the fixed-route services (known as RapidRide and the City View Trolley) extend east to reach the Elk Vale Road corridor or further east to Exit 63. The RTS Dial-a-Ride system covers the entire city and, therefore, does provide service in the Elk Vale Road area. However, it also does not extend east to the Exit 63 area. Prairie Hills Transit provides limited Dial-a-Ride service to areas of Meade and Pennington counties outside Rapid City, including the city of Box Elder and the unincorporated areas of the Exit 63 IMJR study area. Jefferson Lines, an interstate bus provider similar to Greyhound, travels along I-90 through the study area. The only stop in Meade and Pennington Counties is at the Milo Barber Transportation Center in downtown Rapid City, and buses typically do not utilize the study area interchanges to enter or exit Rapid City.

2.4.2 Bicycles and Pedestrians

The RCAMPO recently completed a bicycle and pedestrian plan[7]. That plan identifies the area around the Exit 63 interchange as having low latent demand for both bicycles and pedestrians[8]. However, the plan includes the following regional projects:

- **P239 –** Railway trail (bicycles and pedestrians) along the Rapid City, Pierre & Eastern (RCP&E) Railroad corridor between 1st Street (Rapid City) and ¼ mile east of West Gate Road (Box Elder), including the Exit 63 area[9]

[7] *Rapid City Metropolitan Area Bike and Pedestrian Master Plan Update*, Rapid City Area Metropolitan Planning Organization, August 2020.
[8] Ibid, Figure 11 (Bicycle Demand) and Figure 12 (Pedestrian Demand).
[9] Ibid, Table 14, page 47.

- **P531 –** Buffered Bicycle Lane along Country Road and West Gate Road between Elk Vale Road and Highway 1416, including a crossing of I-90 along West Gate Road[10]
- **P366 –** Buffered Bicycle Lane along Highway 1416 between West Gate Road and Ellsworth Road[11]

None of these projects were identified on the fiscally constrained project list in the bicycle and pedestrian plan, but the Exit 63 IMJR should not preclude these efforts.

2.5 Adjacent Interchange Descriptions

As noted earlier, Exit 61 (Elk Vale Road) is approximately 2 miles west of Exit 63, and Exit 67 (Liberty Boulevard) is approximately 4 miles east of Exit 63. These interchanges are described in more detail below.

2.5.1 Exit 61 – Elk Vale Road

The Elk Vale Road interchange with I-90 is a single point urban interchange (SPUI) with the arterial over the interstate that was constructed in the late 2000s. Before this, the Elk Vale Road interchange was a standard diamond configuration. The current interchange serves all movements to and from I-90 eastbound and westbound. South of I-90, Elk Vale Road serves as US 16 – Bypass, connecting I-90 to SD 44, SD 79, and eventually US 16 south of Rapid City. This alignment allows motorists (and particularly trucks) from the east to reach the Black Hills area without traveling through downtown Rapid City on US 16.

North of I-90, the existing I-90 North Service Road intersects Elk Vale Road within 750 feet of I-90 at a stop-controlled intersection. Regional planning efforts are working toward eliminating this connection and serving the existing traffic via an eastward extension of E Mall Drive. E Mall Drive currently intersects Elk Vale Road about ¼ mile north of I-90 at a stop-controlled intersection and extends west into Rapid City. The planned easterly extension past Elk Vale Road will provide a connection to the relocated service road, Bennet Road, and possibly the reconfigured Exit 63 interchange. The eastward extension is anticipated to result in signalization of the Elk Vale Road / E Mall Drive intersection. Between I-90 and E Mall Drive, development on both sides of Elk Vale Road is interstate-oriented retail, with a large truck stop on the east side of the road and a new gas station / convenience store complex on the west side of the road. Other development on the north side of I-90 includes the Black Hills Visitor Information Center, several hotels, and auto / truck oriented commercial uses. North of E Mall Drive, Elk Vale Road transitions from commercial to rural residential and agricultural uses.

South of I-90, the existing I-90 South Service Road (to the east) and Edwards Street (to the west) intersect Elk Vale Road within 750' of I-90 at a stop-controlled intersection. Because the RCP&E Railroad crosses under Elk Vale Road about 400 feet south of this intersection, the South Service Road provides the only access to properties east of Elk Vale Road in this area. This area includes several hotels and entertainment venues, along with other commercial land uses. To the west, properties along Edwards Street can access Eglin Street to the west, providing a second access to this area. These land uses are similar to those on the east, including several hotels, restaurants, and other commercial uses. Cheyenne Boulevard (to the east) and Eglin Street (to the west) intersect Elk Vale Road approximately 350 feet south of the RCP&E overpass at a signalized intersection. Development to the east along Cheyenne Boulevard includes several restaurants and hotels, the Rapid City campus of Black Hills State University, and residential land uses. Cheyenne Boulevard is anticipated to be extended eastward into the Alpha Omega development, eventually

[10] Ibid, Table 13, page 46
[11] Ibid, Table 13, page 46

connecting to Radar Hill Road along the existing 228th Street alignment. Development to the west along Eglin Street includes another truck stop, various restaurants, and other commercial development. Eglin Street crosses the RCP&E tracks at-grade approximately ½ mile west of Elk Vale Road. South of the Eglin Street / Cheyenne Boulevard intersection, Elk Vale Road transitions from commercial uses to undeveloped land for about a mile, until it enters the Rapid Valley area with adjacent residential and light industrial uses.

2.5.2 Exit 67 – Liberty Boulevard

The Liberty Boulevard interchange with I-90 is a partial cloverleaf, with a loop ramp in the southeast quadrant of the interchange providing a direct connection from I-90 eastbound to Liberty Boulevard northbound. Other movements are accommodated by traditional diamond ramps. The diamond ramp intersections with Liberty Boulevard are stop controlled; the loop ramp creates a second northbound through lane on Liberty Boulevard and is therefore uncontrolled. The interchange was constructed in the early 2000s to replace the Ellsworth Road interchange, which was removed once the Liberty Boulevard interchange was opened to traffic. Ellsworth Road still crosses I-90 as an underpass.

North of I-90, development near the interstate is limited. Reagan Avenue intersects Liberty Boulevard about 750 feet from the north ramp terminal as a stop-controlled side street. Currently, the only business along Reagan Avenue is a truck stop, although additional commercial development is anticipated. About ¼ mile north of Reagan Avenue, Liberty Boulevard begins to curve westward, and adjacent development increases as Liberty Boulevard nears Ellsworth AFB. Liberty Boulevard ends at Ellsworth Road and becomes Davis Drive as it enters the base.

South of I-90, there is no development between the interchange and Highway 1416. The Highway 1416 intersection is stop controlled. South of Highway 1416, Liberty Boulevard is known as Spruce Drive, and it serves low-density residential land uses. Spruce Drive crosses the RCP&E railroad tracks less than 100 feet from the Highway 1416 intersection. There is limited development along Highway 1416 in this area, partially due to the railroad alignment on the south.

2.6 Existing Traffic Volumes

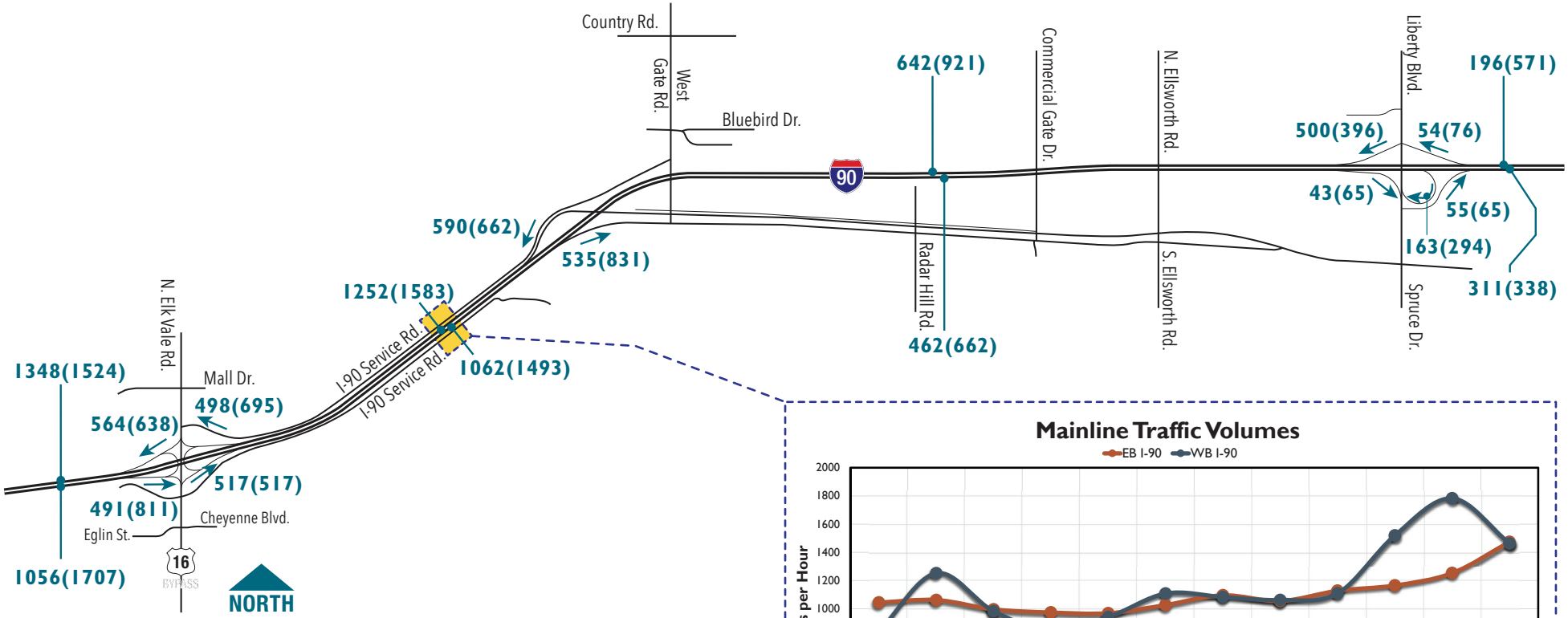
The Corridor Study collected 2016 traffic count data for the study area for use in their analysis. Given changes in the study area due to development (particularly around Exit 61) and general traffic growth, updated traffic counts were collected for the IMJR. This approach was defined in the project's M&A document. These counts were all conducted on middle weekdays (Tuesday, Wednesday, or Thursday) in June 2018.

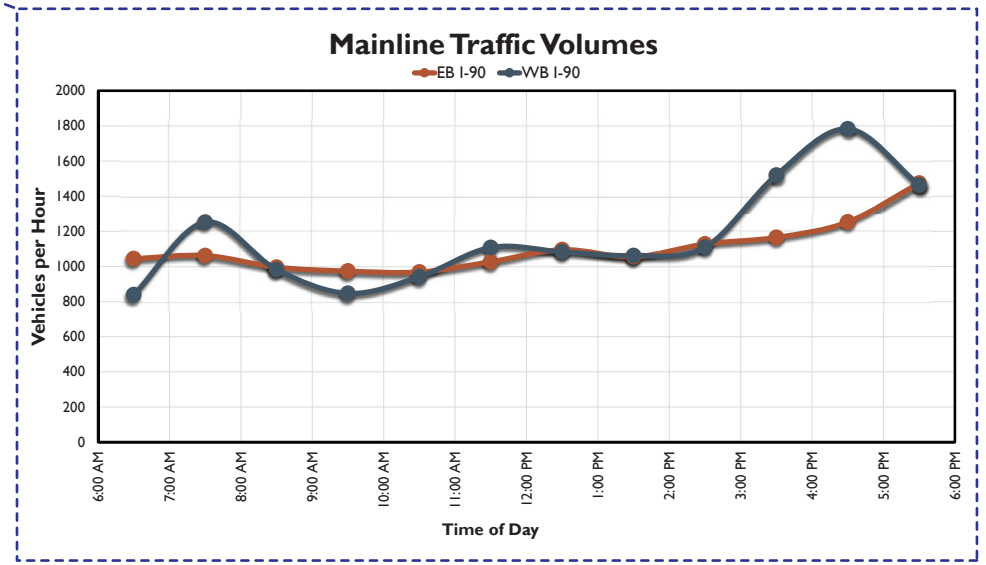
2.6.1 Freeway Volumes

SDDOT maintains a permanent count station on I-90 between Exit 61 and Exit 63. Data from this station during the count week were provided by SDDOT staff. New ramp counts were collected by SDDOT staff during the same week at Exit 61, Exit 63, and Exit 67. Overall, the freeway volumes were slightly lower than those documented in the Corridor Study. Refer to **Figure 2**.

LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes





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Existing Peak Hour Freeway Traffic Volumes

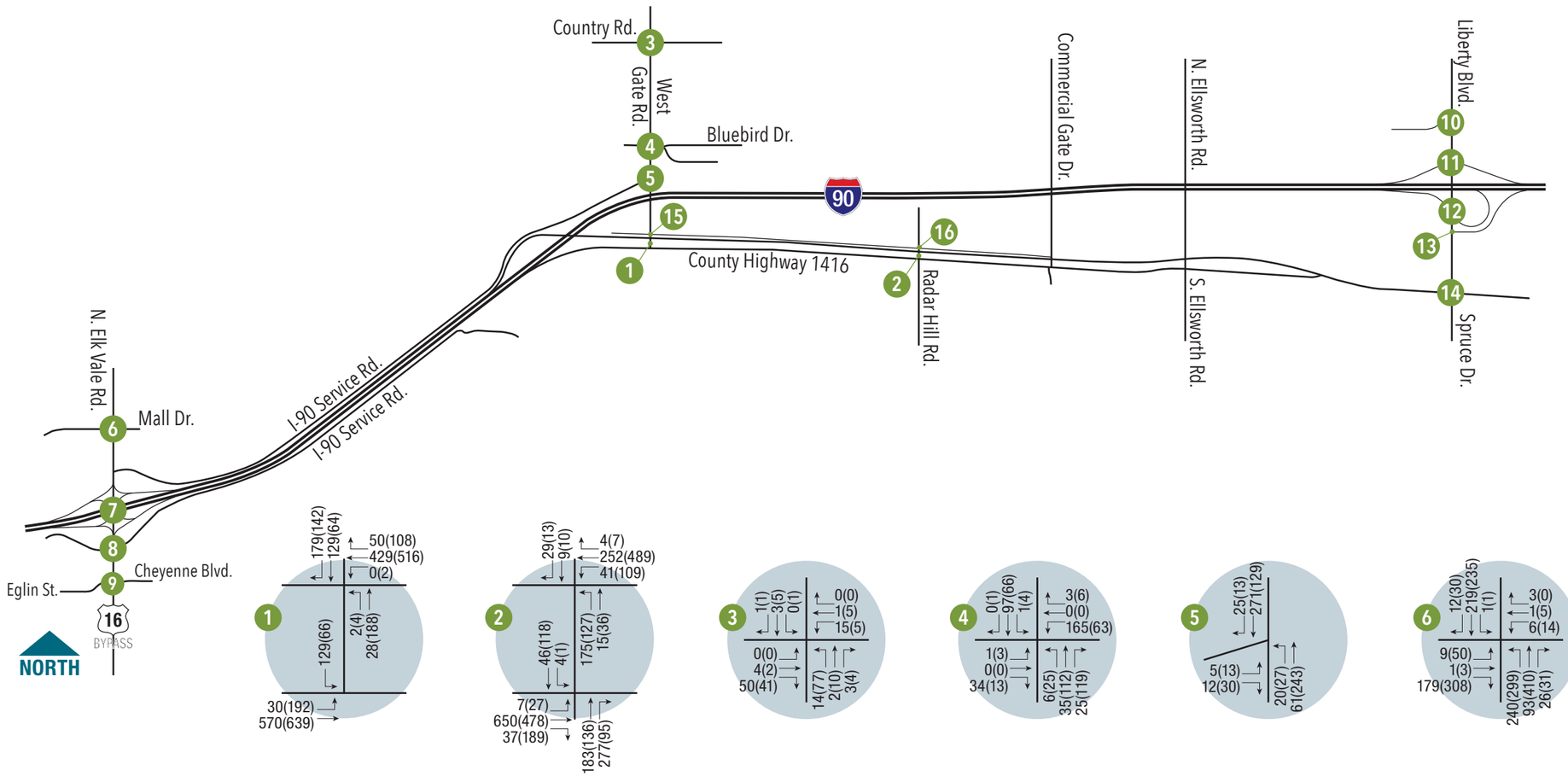
FIGURE 2

2.6.2 Intersection Counts

New intersection turning movement counts were collected during the same week for the 16 locations described previously. When compared to the Corridor Study, new counts were collected at Elk Vale Road / Eglin St / Cheyenne Boulevard, West Gate Road / Country Road, West Gate Road / Box Elder Road, Radar Hill Road / Box Elder Road, Liberty Boulevard / Reagan Avenue and Liberty Boulevard & Spruce Street / Highway 1416, while Ellsworth Road / Highway 1416 and Commercial Gate Drive / Highway 1416 were not counted.

After compiling the various counts, the identified peak hours were 7:00 AM to 8:00 AM and 4:45 PM to 5:45 PM. The compiled volumes are shown on **Figure 3**. Several observations were made when comparing the IMJR intersection counts to the Corridor Study counts:

- Through volumes along Elk Vale Road increased more than expected, and many of these trips went to and from E Mall Drive.
- Travel patterns along Highway 1416 east of Exit 63 changed between the 2016 and the 2018 counts. This is likely due to changes in operations at Ellsworth AFB. When totaled, volumes were slightly higher in 2018.
- Travel patterns in Exit 67 (Liberty Boulevard) changed between the 2016 and the 2018 counts. This is likely due to changes in operations at Ellsworth AFB. When totaled, volumes were slightly higher in 2018.



LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

NOTE:
AM Peak Hour = 7:00AM - 8: 00 AM
PM Peak Hour = 4:45PM - 5:45 PM

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Existing Peak Hour Intersection Traffic Volumes | FIGURE 3

2.7 Existing Traffic Operations

Traffic operations throughout the IMJR have been evaluated using methodologies outlined in the Highway Capacity Manual (HCM)[12]. These methodologies can be used to calculate a level of service (LOS) for the facility being evaluated. The LOS can range from LOS A to LOS F, with LOS A being the least congested (best) operating condition and LOS F being extremely congested (poor) operating conditions. Typically, LOS F represents conditions where the demand for the roadway facility exceeds the ability of the roadway to accommodate that demand. For the purposes of the IMJR, an overall LOS C or better has been defined as acceptable in the M&A document. This is consistent with SDDOT goals for urbanized areas throughout the state.

The HCM methodologies have been incorporated into HCS7, a computerized tool that can be used to evaluate both interrupted flow (streets and intersections) and uninterrupted flow (freeways and ramps) facilities. The project team used HCS7 to evaluate both intersections and freeways in the study area. Various input assumptions for the HCM analyses are provided in the M&A document. Outputs from HCS7 for existing conditions are included in **Appendix B**.

2.7.1 Intersection Operations

Existing conditions intersection traffic operations have been evaluated using related methodologies in the HCM, as described in the M&A document. The HCM LOS criteria for intersections are delay-based and are shown in **Table 1**.

Table 1. Intersection Level of Service (LOS) Criteria

Level of Service	Average Control Delay (seconds per vehicle)	
	Signalized Intersections	Stop Controlled Intersections
A	≤ 10	≤ 10
B	> 10 to 20	> 10 to 15
C	> 20 to 35	> 15 to 25
D	> 35 to 55	> 25 to 35
E	> 55 to 80	> 35 to 50
F	> 80	> 50

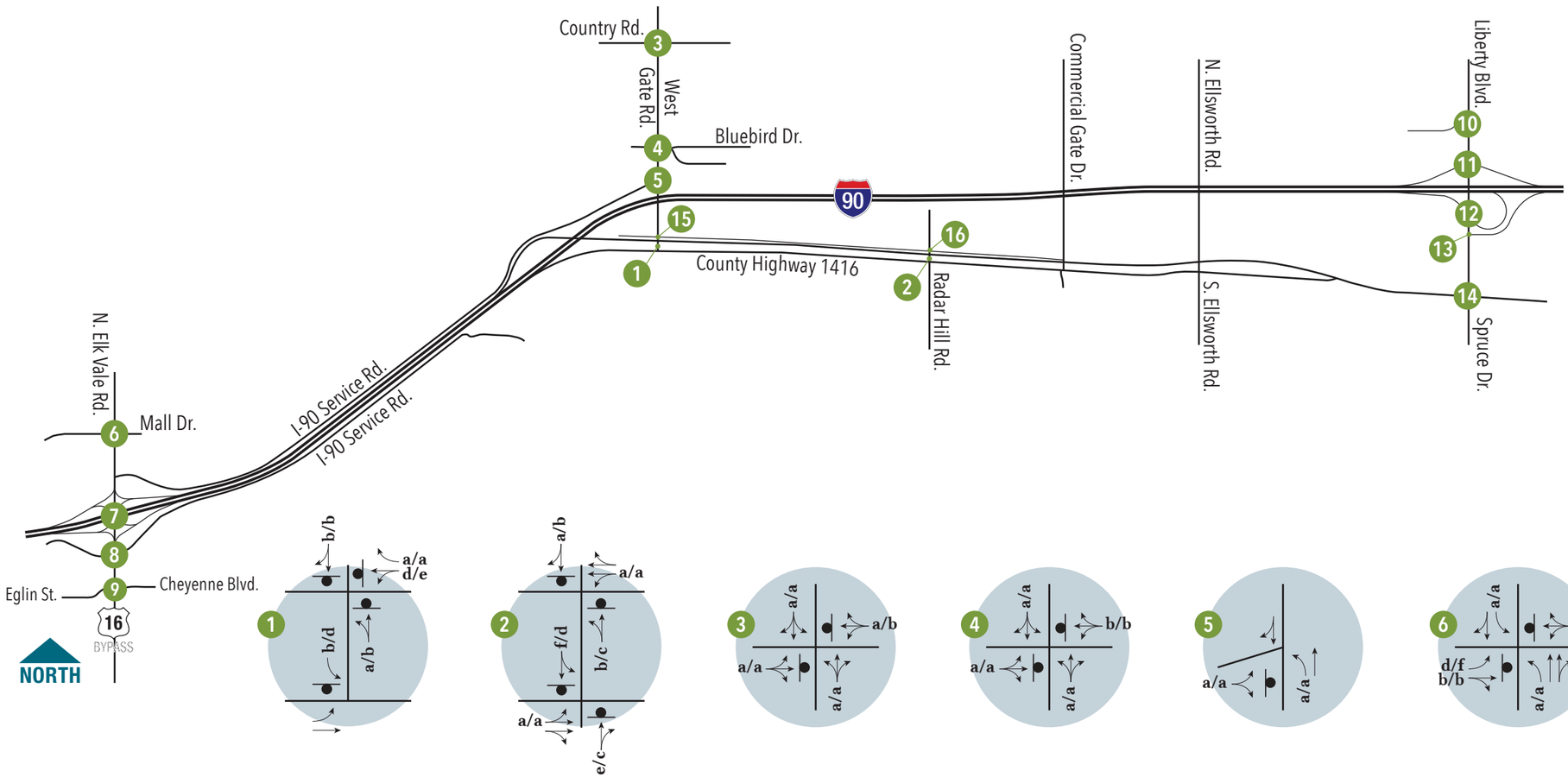
* HCM 6th Edition, Exhibit 19-8 & Exhibit 20-2.

[12] *Highway Capacity Manual, 6th Edition*, Transportation Research Board, Washington DC, 2016).

Based on the criteria identified in **Table 1**, LOS values were calculated for the intersections and ramp terminals in the study area. Refer to **Figure 4**. The following operational concerns at intersections were identified under existing conditions:

- Several unsignalized left turn movements in the West Gate Road / Highway 1416 intersection experience LOS d or LOS e. This is common at unsignalized intersections but exceeds the project's LOS threshold.
- Several unsignalized movements in the south side of the Radar Hill Road / Highway 1416 intersection experience LOS e/f operations in the AM peak hour and LOS d operations in the PM peak hour. The City of Box Elder is currently studying improvements along the Highway 1416 corridor that may address these concerns if implemented.
- Several unsignalized movements in the E Mall Drive / Elk Vale Road intersection experience LOS e/f operations in the AM peak hour and LOS d operations in the PM peak hour. The planned extension of E Mall Drive to the east and related signalization of this intersection may address these concerns if implemented.
- The eastbound to southbound yield-controlled right turn at the I-90 Exit 61 SPUI experiences LOS f operations in the PM peak hour. The signalized approaches operate acceptably.
- The unsignalized side street approaches where Edwards Street and the South I-90 Service Road meet Elk Vale Road operate at LOS f in the AM and PM peak hours. As noted earlier, options are limited at this intersection since Edwards Street and the South I-90 Service Road serve areas that are land-locked between I-90 and the RCP&E Railroad.
- The signalized intersection of Eglin Street & Cheyenne Boulevard / Elk Vale Road operates at LOS D in the PM peak hour.

Many of the concerns identified above are related to the Elk Vale Road corridor (at Exit 61). Some concerns were identified along Highway 1416 near Exit 63. These concerns are being considered during alternative development. No concerns were identified along the Liberty Boulevard corridor (Exit 67).



LEGEND

- X/X = AM/PM Peak Hour Signalized Intersection Level of Service
- x/x = AM/PM Peak Hour Unsignalized Intersection Level of Service
- = Stop Sign
- = Yield Sign
- = Traffic Signal

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Existing Peak Hour Intersection Traffic Operations | FIGURE 4

2.7.2 Freeway Operations

Existing conditions freeway traffic operations have also been evaluated using related methodologies in the HCM, as described in the M&A document. The HCM LOS criteria for freeways are density-based and are shown in **Table 2**. It should be noted that freeway operations were calculated for 15-minute increments over the 12-hour period from 6:00AM to 6:00PM, reflecting the busiest 12 hours of the day.

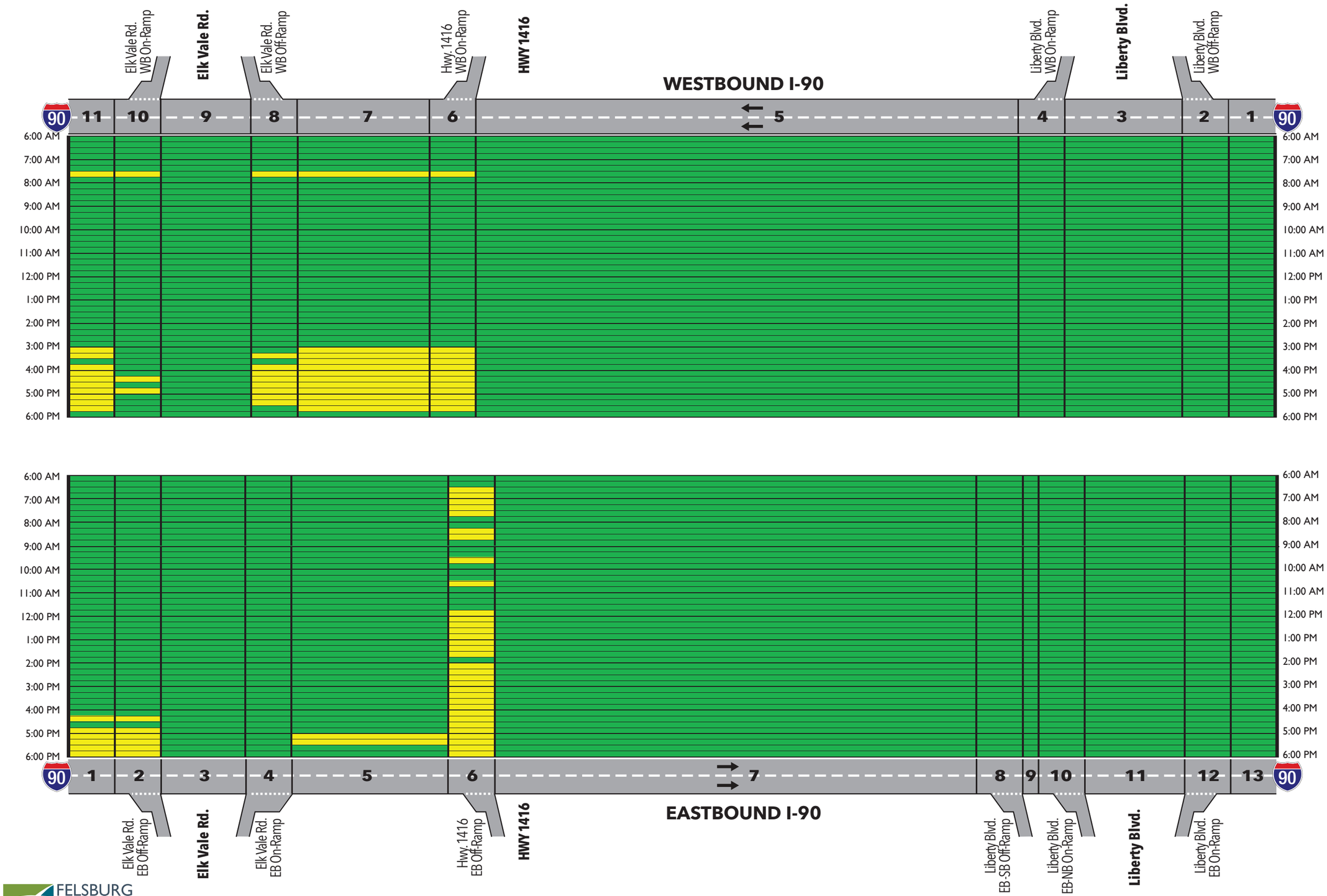
Table 2. Freeway Level of Service (LOS) Criteria

LOS	Freeway Segment Density (pc/mi/ln)		
	Basic Freeway Segment[1]	Merge/Diverge Segment	Weaving Segment
A	≤ 11	≤ 10	≤ 10
B	> 11 – 18	> 10 – 20	> 10 – 20
C	> 18 – 26	> 20 – 28	> 20 – 28
D	> 26 – 35	> 28 – 35	> 28 – 35
E	> 35 – 45	> 35	> 35 – 43
F	> 45 OR v/c ratio[2] > 1.00	v/c ratio[2] > 1.00	> 43 OR v/c ratio[2] > 1.00

[1]LOS thresholds for basic freeway segments also apply to composite freeway LOS determinations.

[2]Also, demand-to-capacity ratio. When v/c > 1.00, traffic flow is characterized as congested with significant upstream queueing on mainline and ramp segments.

Based on these criteria, freeway LOS values were calculated for the I-90 segments in the study area for the 12-hour analysis period. Refer to **Figure 5**. The freeway segments evaluated operate acceptably under existing traffic volumes and geometries. When comparing segments east of Exit 63 to segments west of Exit 63, slightly lower LOS values were observed to the west of Exit 63, reflecting higher volumes in this segment.



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Existing Freeway Operations | FIGURE 5

2.8 Existing Safety Conditions

Existing safety conditions were evaluated using historic crash data. SDDOT currently maintains a GIS crash database for monitoring crash history and trends. For this study, crash data were collected for a five-year period to identify significant crash patterns within a subset of the study area. The analysis was conducted based on crashes reported between 2014 and 2018.

2.8.1 Crash Summary

The IMJR's crash history analysis evaluated the following segments:

- I-90 mainline from east of the Exit 61 interchange to west of the Exit 67 interchange
- I-90 Exit 61 east-facing ramps
- I-90 Exit 63 ramps
- Highway 1416 & West Gate Road intersection

Table 3 provides an overall summary of crashes reported in the study area.

Table 3. Reported Crash Summary

Location		Total Crashes	PDO* Crashes	Injury Crashes	Fatality Crashes
I-90 EB	Ex. 61 On-Ramp	2	2	0	0
	Ex. 61 to Ex. 63	28	25	3	0
	Ex. 63 Off-Ramp	1	1	0	0
	Ex. 63 to Ex. 67	12	7	5	0
I-90 WB	Ex. 67 to Ex. 63	21	20	0	1
	Ex. 63 On-Ramp	18	14	4	0
	Ex. 63 to Ex. 61	37	27	10	0
	Ex. 61 Off-Ramp	0	0	0	0
Hwy 1416 & W Gate Rd		19	13	6	0
Total		**138**	**109**	**28**	**1**

*Property Damage Only

2.8.2 Safety Evaluation

The assessment of the magnitude of safety problems was refined using Safety Performance Functions (SPFs). An SPF reflects the relationship between traffic exposure (measured in ADT) and the observed crash frequency (measured in crashes per mile per year). SPF models provide an estimate of the normal or expected crash frequency and severity for a range of annual average daily traffic (ADT) among similar roadway facilities.

The SPFs facilitate the determination of Level of Service of Safety (LOSS). The concept of LOSS uses qualitative measures that characterize safety of a roadway segment in reference to its expected performance and severity. If the LOSS predicted by the SPF represents a normal or an expected number of

crashes at a specific level of AADT, then the degree of deviation from the norm can be stratified to represent specific safety levels.

- LOSS I – Indicates low potential for crash reduction
- LOSS II – Indicates low to moderate potential for crash reduction
- LOSS III – Indicates moderate to high potential for crash reduction
- LOSS IV – Indicates high potential for crash reduction

For this analysis, SPFs from the Highway Safety Manual[13] were used to calculate LOSS for the corridors and intersections. **Table 4** provides the LOSS for the total number of crashes and the severity of crashes for each roadway segment and intersection analyzed. It should be noted that the wide median at Highway 1416 and West Gate Road creates two intersections that effectively operate independently with separate stop controls. There is no SPF that precisely models the nature of split intersections. Therefore, the intersection was evaluated as a single, four-leg intersection with the caveat that calculated LOSS may not be a perfect representation of the safety characteristics of the intersection.

Table 4. Levels of Service of Safety (LOSS)

Location	ADT	Severity	Multi-Vehicle Crashes	Single-Vehicle Crashes
I-90 Exit 61 to Exit 63[1]	30,500	PDO[2]	III	III
		Severe[3]	II	II
I-90 Exit 63 to Exit 67[1]	18,400	PDO[2]	III	III
		Severe[3]	II	II
I-90 Ex. 61 EB On Ramp	7,700	PDO[2]	IV	IV
		Severe[3]	II	II
I-90 Ex. 63 EB Off Ramp	8,750	PDO[2]	II	III
		Severe[3]	II	I
I-90 Ex. 63 WB On Ramp	7,450	PDO[2]	III	IV
		Severe[3]	III	IV
I-90 Ex. 61 WB Off-Ramp	7,500	PDO[2]	II	I
		Severe[3]	II	I
Highway 1416 and West Gate Rd	Major: 16,200 Minor: 3,750	Total	III	IV
		PDO[2]	III	IV
		Severe[3]	III	IV

[1]Evaluation of LOSS for I-90 mainline includes both eastbound and westbound crashes
[2]Property Damage Only (PDO)
[3]Severe Crashes include Injury and Fatality crashes

The following sections describe in greater detail potential crash causes for each location.

[13] *Highway Safety Manual*, American Association of State Highway and Transportation Officials, Washington, DC, 2010 with the 2014 Freeway supplement and errata through 2016.

I-90 Mainline (Exit 61 to Exit 63)

Classification: Four-Lane Urban Divided Freeway

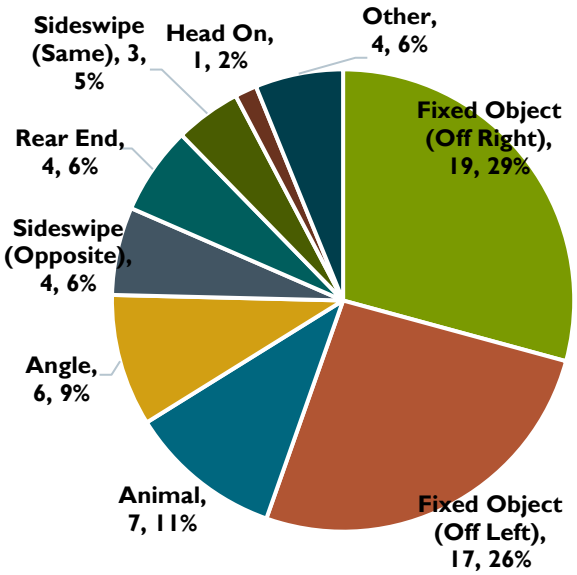
ADT: 30,500 vpd

Total Crashes: 65 (13 INJ)

Multi-Vehicle Crash LOSS: III (PDO), II (Severe)

Single-Vehicle Crash LOSS: III (PDO), II (Severe)

Notable Crash Type Patterns: Right Angle, Animal, Fixed Object (Severe)



During the study period, the portion of I-90 between the Exit 61 and Exit 63 ramps experienced 55 crashes. This corresponds to about 9 crashes per mile per year. Of these, 28 involved eastbound vehicles and 37 involved westbound vehicles. As shown in the crash type distribution chart, Fixed Object crashes represented the most recorded crashes (36 of 65). Of these, 19 Fixed Object crashes occurred with right-hand road departures and 17 occurred with left-hand road departures.

In the eastbound direction, 11 of the 28 crashes were Fixed Object (5 left-hand departure, 6 right-hand). The next most common eastbound crash type was Sideswipe – Opposite Direction, with 4 crashes during the study period. Adverse road conditions were a prominent causal factor, making up 11 of the recorded eastbound crashes, including 7 Fixed Object crashes and 2 Sideswipes (same direction). Four crashes occurred during adverse weather, 2 of which were Fixed Object. Seven crashes occurred at night, and all but one was classified as "not-lighted." Additionally, 4 eastbound crashes occurred at dawn/dusk.

In the westbound direction, 25 of the 37 crashes were Fixed Object (12 left-hand departure, 13 right-hand). The next most common westbound crash types were Animal with 4 crashes, Sideswipes (same direction) with 3 crashes, and Angle with 3 crashes during the study period. Adverse road conditions contributed to 23 crashes, including 20 Fixed Object crashes. Adverse weather was a prominent contributing factor for 16 crashes, including 15 Fixed Object crashes. Eleven crashes occurred at night and were classified as "not-lighted." Additionally, one westbound crash occurred at dawn/dusk.

Six Angle crashes occurred during the study period (3 eastbound, 3 westbound). The context of these crashes is uncertain because Angle crashes do not typically occur on freeway facilities.

Seven Animal crashes occurred during the study period (3 eastbound, 4 westbound) and represented a higher proportion of crashes than expected for a typical four-lane urban freeway. This segment is at the edge of the Rapid City urban area, resulting in more wildlife interactions on the freeway.

Overall, severe crashes (injury + fatal) occur at LOSS II conditions on this freeway segment, indicating low to moderate potential for crash reduction. However, Fixed Object crashes made up a disproportionate number of severe crashes compared to typical urban freeways.

Based on these evaluations, the following potential countermeasures should be considered during the evaluation of the Feasible Options along I-90 between Exit 61 and Exit 63:

- The prevalence of Fixed Object crashes suggests that mitigation measures should be implemented to reduce the frequency and severity of roadway departure crashes. Consider restriping mainline I-90 to improve visibility, especially at night and during adverse weather. Twelve of the Fixed Object crashes involved left-hand departures into the median, and one head-on crash involved a vehicle crossing over the median. The potential effectiveness of median treatments, such as cable barrier, should be further investigated along this segment.
- Adverse weather and road conditions were prominent causal factors, especially for westbound Fixed Object crashes. Consider restriping I-90 to increase visibility and increase winter roadway maintenance. Consider installing variable speed limit (VSL) signs along I-90. VSL signs can be used to safely transition speed limits between urban and rural areas and mitigate speed differentials that develop during incident response, or vehicle speeds during inclement weather.
- Seventeen crashes occurred at night and of these, 16 were characterized as "not lighted." Consider the potential for adding lighting in this segment. Also consider restriping I-90 to improve visibility.
- Review the placement of fixed objects along the roadway, including utility and luminaire poles, culverts, embankments, etc. Provide suitable protection from these roadway elements that can help reduce the severity of fixed object crashes such as crash cushions, guardrail, or cable barrier.
- As development continues in the surrounding area, monitor wildlife migration and crash patterns to determine if additional mitigations are necessary. Potential solutions could include underpass crossings and/or wildlife fencing.

I-90 Mainline (Exit 63 to Exit 67)

Classification: Four-Lane Urban Divided Freeway

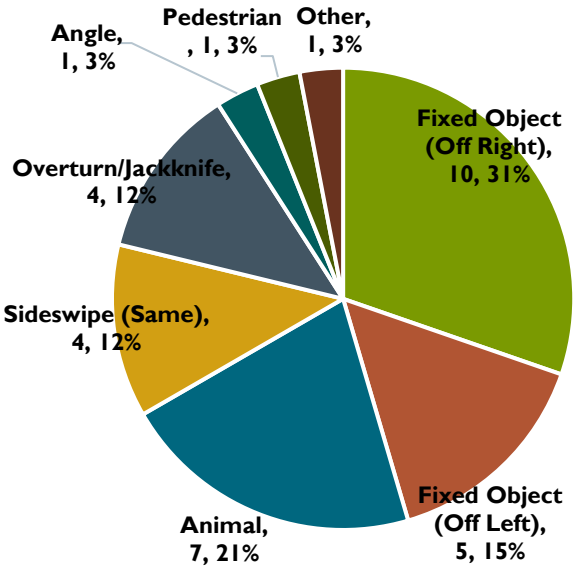
ADT: 18,400 vpd

Total Crashes: 33 (5 INJ, 1 FAT)

Multi-Vehicle Crash LOSS: III (PDO), II (Severe)

Single-Vehicle Crash LOSS: III (PDO), II (Severe)

Notable Crash Type Patterns: Sideswipe (Same Direction), Animal



During the study period, the portion of I-90 between the Exit 63 and Exit 67 ramps experienced 33 crashes. This corresponds to about 2.0 crashes per mile per year. Of these, 12 involved eastbound vehicles and 21 involved westbound vehicles. As shown in the crash type distribution chart, Fixed Object crashes represented the most recorded crashes (15 of 33). Of these, 10 Fixed Object crashes occurred with right-hand road departures and 5 occurred with left-hand road departures. The next most common crash type was Animal, making up 7 of 33 crashes.

In the eastbound direction, 6 of the 12 crashes were Fixed Object (2 left-hand departure, 4 right-hand). The next most common eastbound crash type was Animal, with 3 crashes during the study period. Of the

12 crashes, 4 occurred during adverse road conditions and 2 occurred with active weather events—all of which were Fixed Object crashes. Five crashes occurred at night—2 Animal crashes, 2 Fixed Object crashes, and one Angle crash. All 5 crashes were classified as "not-lighted." One eastbound Animal crash occurred at dawn; sun glare may have been a contributing factor.

In the westbound direction, 9 of the 21 crashes were Fixed Object (3 left-hand departure, 6 right-hand). The next most common westbound crash types were Overturn/Jackknife and Animal, with 4 crashes each during the study period. Of the 21 total westbound crashes, 12 occurred during adverse road conditions, including 8 Fixed Object crashes. Nine crashes occurred during active weather events, including 6 Fixed Object crashes. Six of the 21 crashes occurred at night and were classified as "not-lighted," including 3 Fixed Object crashes, 2 Animal crashes, and a fatal Pedestrian crash. Two westbound crashes occurred at dawn, including one Animal crash and one Overturning/Jackknife crash.

Four Sideswipe (Same Direction) crashes occurred in this segment of I-90 (2 eastbound, 2 westbound). This made up 80 percent of the multi-vehicle crashes recorded for the segment during the study period, which is higher than the expected proportion of 27 percent for typical urban four-lane freeways. This discrepancy can be attributed to the low ADT on I-90 east of Exit 63, which reduces the frequency of other common crash types on urban freeways such as Rear Ends.

Seven Animal crashes occurred during the study period (3 eastbound, 4 westbound), including one that resulted in injury, which represented a higher proportion of crashes than expected for a typical four-lane urban freeway. This segment is at the edge of the Rapid City urban area, resulting in more wildlife interactions on the freeway.

A fatal crash occurred on October 30, 2015, on the segment of I-90 between Exit 63 and Exit 67. A pedestrian attempted to cross westbound I-90 at night when he was struck by two vehicles. Alcohol was a contributing factor for the pedestrian.

Based on these evaluations, the following potential countermeasures should be considered during the evaluation of the Feasible Options along I-90 between Exit 61 and Exit 63:

- Recommendations for this segment of I-90 are similar to those for the segment between Exit 61 and Exit 63. The prevalence of Fixed Object crashes suggests that mitigation measures should be implemented to reduce the frequency and severity of roadway departure crashes. Consider restriping mainline I-90 to improve visibility, especially at night and during adverse weather. Only 5 of the Fixed Object crashes involved left-hand departures into the median, indicating that median treatments may not be as effective in reducing departure crashes for this segment but could still be investigated.
- Adverse weather and road conditions were prominent causal factors, especially for westbound Fixed Object crashes. Consider restriping I-90 to increase visibility and increase winter roadway maintenance. Consider installing VSL signs along I-90. VSL signs can be used to safely transition speed limits between urban and rural areas and mitigate speed differentials that develop during incident response, or vehicle speeds during inclement weather.
- Eleven crashes occurred at night under "not lighted" conditions. Investigate the potential implications of providing overhead roadway lighting in this segment. Also consider restriping I-90 to improve visibility.

- Review the placement of fixed objects along the roadway, including utility and luminaire poles, culverts, embankments, etc. Provide suitable protection from these roadway elements that can help reduce the severity of fixed object crashes such as crash cushions, guardrail, or cable barrier.
- As development continues in the surrounding area, monitor wildlife migration and crash patterns to determine if additional mitigations are necessary. Potential solutions could include underpass crossings and/or wildlife fencing.

I-90 Exit 61 Eastbound On-Ramp

Classification: One-Lane Urban Freeway On-Ramp

ADT: 7,700 vpd

Total Crashes: 2 (all PDO)

Multi-Vehicle Crash LOSS: IV (PDO), II (Severe)

Single-Vehicle Crash LOSS: IV (PDO), II (Severe)

Notable Crash Type Patterns: None

Two crashes occurred on the I-90 Exit 61 Eastbound On-Ramp. One crash was a Sideswipe, the other was a Fixed Object collision with a light pole. Both crashes occurred during daylight with no adverse weather or road conditions.

Based on this evaluation, the following potential countermeasures should be considered during the evaluation of the Feasible Options that affect Exit 61:

- Consider extending the acceleration lane for northbound right-turns onto the On-Ramp. This improvement would provide additional space for vehicles to merge safely, reducing the risk of Sideswipe crashes.

I-90 Exit 63 Eastbound Off-Ramp

Classification: One-Lane Urban Freeway Off-Ramp

ADT: 8,750 vpd

Total Crashes: 1 (all PDO)

Multi-Vehicle Crash LOSS: II (PDO), II (Severe)

Single-Vehicle Crash LOSS: III (PDO), I (Severe)

Notable Crash Type Patterns: None

One Animal crash occurred on the I-90 Exit 63 Eastbound Off-Ramp. The crash occurred at night with no adverse weather or road conditions.

Based on this evaluation, the following potential countermeasures should be considered during the evaluation of the Feasible Options for the Exit 63 eastbound off ramp:

- As development continues in the surrounding area, monitor wildlife migration and crash patterns to determine if additional mitigations are necessary. Potential solutions could include underpass crossings and/or wildlife fencing.

I-90 Exit 63 Westbound On-Ramp

Classification: One-Lane Urban Freeway On-Ramp

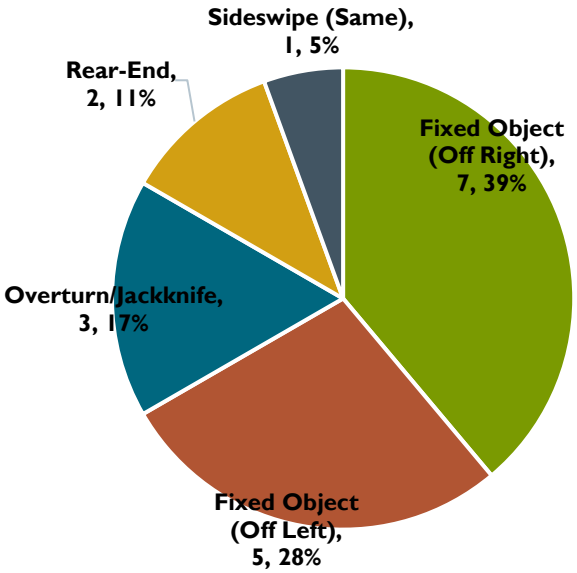
ADT: 7,450 vpd

Total Crashes: 18 (4 INJ)

Multi-Vehicle Crash LOSS: III (PDO), III (Severe)

Single-Vehicle Crash LOSS: IV (PDO), IV (Severe)

Notable Crash Type Patterns: None



Eighteen crashes were recorded on the I-90 Exit 63 Westbound On-Ramp during the study period. As shown in the crash type distribution chart, the most common types were Fixed Object (12 crashes) and Overturn/Jackknife (3 crashes). Of the Fixed Object crashes, 5 involved a left-hand road departure and 7 involved a right-hand road departure. LOSS analysis indicates that single-vehicle crash frequency is significantly worse than expected, which is also reflected in the crash type distribution chart.

Adverse road conditions were a prominent causal factor for crashes on the I-90 Exit 63 Westbound On-Ramp, accounting for 10 of the 18 crashes, including 7 Fixed Object crashes (5 left-hand departure, 2 right-hand departure) and 2 Overturn/Jackknife crashes. Six crashes occurred during adverse weather – 4 Fixed Object (all left-hand departure) and 2 Overturn/Jackknife. Eight crashes occurred at night in "not-lighted" conditions, including 5 Fixed Object crashes (3 left-hand departure, 2 right-hand departure).

Environmental factors were less common in Fixed Object crashes with right-hand roadway departures. The ramp is signed with an advisory speed limit of 35 miles per hour (mph), but excessive speed was identified as a causal factor in only 2 of the 7 crashes. Visibility of the on-ramp curve may also be a contributing factor for right-hand roadway departure crashes.

Based on these evaluations, the following potential countermeasures should be considered during the evaluation of the Feasible Options for the Exit 63 westbound on ramp:

- Consider revising the ramp geometry to encourage slower speeds on curved segments or removing the curved segments entirely. As an interim measure, consider installing chevron alignment signs (MUTCD W1-8) along the on-ramp curve to better identify the change in horizontal alignment. Also consider restriping and providing lighting for the on-ramp to improve visibility. Finally, consider increasing winter maintenance for the on-ramp.

I-90 Exit 61 Westbound Off-Ramp

Classification: One-Lane Urban Freeway Off-Ramp

ADT: 7,500 vpd

Total Crashes: 0

Multi-Vehicle Crash LOSS: II (PDO), II (Severe)

Single-Vehicle Crash LOSS: I (PDO), I (Severe)

Notable Crash Type Patterns: None

No crashes were recorded at the I-90 Exit 61 Westbound Off-Ramp during the study period.

Based on this evaluation, the following potential countermeasures should be considered during the evaluation of the Feasible Options for the Exit 61 westbound off ramp:

- Consistent with other safety recommendations for I-90, consider restriping the off-ramp and reviewing lighting conditions to improve visibility. Also consider increasing winter maintenance for the ramp.

Highway 1416 & West Gate Road Intersection

Classification: Urban 3-Leg Stop-Controlled Intersection

Major Street ADT: 16,200 vpd

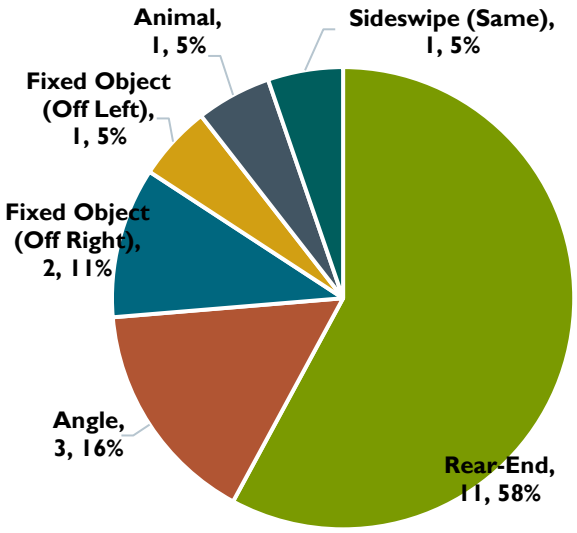
Minor Street ADT: 3,750 vpd

Total Crashes: 19 (6 INJ)

Multi-Vehicle Crash LOSS: III (Total), III (PDO), III (Severe)

Single-Vehicle Crash LOSS: IV (Total), IV (PDO), IV (Severe)

Notable Crash Type Patterns: None



Nineteen crashes were recorded at the Highway 1416 and West Gate Road intersection during the study period. As shown in the crash type distribution chart, the most common types were Rear-End (11 crashes) and Angle (3 crashes).

Adverse road and weather conditions were not significant contributing factors compared to the I-90 segments, accounting for only 3 of the 19 recorded crashes. Six crashes occurred at night, including 3 Rear-End crashes.

Disproportionate crash frequencies were observed at the individual intersections within the split configuration. Twelve crashes occurred at the northern intersection, which serves westbound

Highway 1416 traffic. This included 9 Rear-End crashes and 2 angle crashes. Eight of the Rear-End crashes involved westbound vehicles.

Seven crashes occurred at the southern intersection which serves eastbound Highway 1416 traffic. Of these, 2 were Rear-End, 2 were Fixed Object (Off-Right), one angle, and one Sideswipe. Despite the lower crash frequency, the southern intersection experienced 4 of the 6 recorded injury crashes.

Based on these evaluations, the following potential countermeasures should be considered during the evaluation of the Feasible Options for the Highway 1416 and West Gate Road intersection:

- Highway 1416 operates as an urban arterial with a posted speed of 55 mph. The westbound approach is stop-controlled with flashing beacons and upstream warning signs. Still, the frequency of Rear-End crashes indicates that further mitigation may be necessary. Consider reducing the posted speed limit on westbound Highway 1416 approaching this intersection to further alert drivers to the upcoming stop.
- Eastbound Highway 1416 at this intersection serves as the continuation of the I-90 Eastbound Exit 63 Off-Ramp. As a result, drivers who are acclimated to freeway conditions may not immediately recognize the change in facility type on Highway 1416 and prepare to slow down for lane changes or left turns. Consider placing a W19-3 "Freeway Ends" sign along the off-ramp to warn drivers of changing roadway characteristics.
- Future interchange configuration for I-90 Exit 63 should consider eliminating high-speed ramp approaches at the Highway 1416 and West Gate Road intersection and providing separate interchange ramp terminal intersections. Additionally, future projects along Highway 1416 should consider consolidating intersections from their current directional configurations. Only 3 Angle crashes occurred, which could be corrected by signalization. A traffic signal may be warranted at this intersection based on traffic volumes if consolidated into a two-way arterial.

2.9 Existing Environmental Constraints

Substantial modifications to interstate interchanges can have effects on the surrounding environment. An initial environmental overview was completed in the Corridor Study in 2017. That effort was based on readily available environmental resource datasets and limited high level field verification. This information was used as a basis for the Environmental Scan and resources were updated as necessary to use the latest available information. Key elements from that process are summarized here, as these key resources have helped guide the alternative development and review process.

- **Floodplains –** The existing Exit 63 interchange area is generally in the Box Elder Creek floodplain, and Box Elder Creek passes under I-90 just southwest of the existing Exit 63 ramp terminals. Due to the proximity of the creek to the interchange, supplemental floodplain analyses have been conducted as part of the alternative evaluation process.
- **Historic Resources –** Various sites throughout the study area were identified as eligible or potentially eligible for the National Register of Historic Places. The RCP&E Railroad corridor (immediately southeast of the existing interchange) is on this list, as are several properties near the West Gate Road / Highway 1416 intersection. These properties have been considered as part of the alternative evaluation process.
- **Hazardous Materials –** Existing hazardous material sites were identified in the 2017 Corridor Study, but few of those sites were in the area being considered for interchange alternatives. The

Environmental Scan noted a fueling station in the study area located on the northeast corner of Box Elder Road and West Gate Road. A minor concern is the RCP&E Railroad alignment. It was not evaluated in detail, but railroad corridors may accumulate soil and groundwater contamination due to past undocumented events and/or historic and ongoing drips, leaks, and spills from rail traffic.

- **Wetlands –** Wetlands were identified (but not delineated) in areas along Box Elder Creek and its tributaries, and in various roadside ditches. Most were considered poor quality in the study area, except those associated with Box Elder Creek.
- **Wildlife / Threatened and Endangered Species –** The Environmental Scan notes that the existing roadways and urban development limit the habitat potential for wildlife. However, the Box Elder Creek corridor may provide low to medium potential for wildlife. Potential habitat was identified for several threatened and endangered species, and the Environmental Scan noted the need for a more in-depth evaluation of migratory bird and raptor nests in the study area.
- **Section 4(f) and 6(f) Properties –** Section 4(f) properties include publicly owned parks, recreational areas, wildlife and waterfowl refuges, or public and private historical sites as defined in the US Department of Transportation (DOT) Act of 1966. Section 6(f) properties include recreational resources developed with federal funding through the Land and Water Conservation Fund (LWCF). No parks, trails, or other recreational areas are located within the environmental study area. In addition, there are no Section 6(f) properties located within the environmental study area. One historic site, the Chicago & North Western Railroad (RCP&E), was identified as eligible for the NRHP, located south of Hwy 1416. However, the segment located within the study area has not been formally surveyed and evaluated. Therefore, recordation of the segment within the study area will be needed to determine whether the segment is eligible for the NRHP. If it is eligible, it would qualify for protection under Section 4(f).
- **Noise –** Although the Environmental Scan did not complete an in-depth noise study, it identified several noise sensitive areas near Exit 63, including the Thunderbird Subdivision and other residential land uses along the West Gate Road and Highway 1416 corridors. It also noted that the Ellsworth AFB AICUZ documents noise considerations for the base.
- **Minority and Low-Income Populations –** The Environmental Scan identified both minority and low-income populations in the census blocks surrounding the Exit 63 interchange area. These populations tended to be more prevalent between Box Elder Road and West Gate Road and north of I-90. However, given the size of the census blocks, additional evaluations were recommended to refine the extent and nature of these communities and how the project may affect them.
- **Cumulative Impacts –** This environmental measure looks at potential impacts of the subject action in the geographic and temporal context of all potential actions within the larger community. Based on the Corridor Study evaluation, it was determined that the proposed project would not substantially contribute to cumulative impacts when combined with other past, present, and reasonably foreseeable projects.

Based on these assessments, the key measures the project team considered during the Feasible Option evaluation were proximity to Box Elder Creek (including wetland, floodplain, and wildlife / threatened and endangered species concerns) and the RCP&E Railroad (including historic and hazardous materials concerns).Further analyses of these environmental considerations are being developed and will be summarized in a separate environmental study.

3. PROJECT NEED

Several project needs have been identified for the Exit 63 project.

3.1 I-90 Access

The current Exit 63 interchange configuration only provides connections from I-90 eastbound to Highway 1416 and to I-90 westbound from Highway 1416 westbound. Current FHWA guidance requires system interchanges to provide for all movements. Hence, a goal of the Exit 63 project is to provide east-facing ramps.

3.2 Operations

Although no operational concerns were identified along I-90 under existing conditions, LOS D operations were identified in the 2050 horizon year along I-90 between Exit 61 and Exit 63 without improvements. Both existing and future scenarios reflect operational deficiencies at Exit 61 and Exit 67. Although this project is not intended to construct enhancements at those interchanges, improvements at Exit 63 will minimize the amount of traffic that diverts from the Exit 63 area to the congested adjacent interchanges.

3.3 Safety

As noted in the safety evaluation, LOSS IV conditions exit along the I-90 Exit 61 eastbound on-ramp, the I-90 westbound Exit 63 on-ramp, and at the Highway 1416 and West Gate Road intersection. Although Exit 61 is not a focus of this IMJR, the LOSS IV areas identified at Exit 63 and at the adjacent Highway 1416 and West Gate Road intersection demonstrate project-related safety needs. LOSS III conditions have also been identified in and adjacent to the Exit 63 interchange.

3.4 Structural

The westbound Highway 1416 structure over I-90 (at Mileage Reference Marker [MRM] 63.8) was built in 1963, is in fair condition, and has a sufficiency rating of 63. Although this does not represent a structure in immediate need of replacement, significant maintenance or capital improvements are anticipated to be needed within the IMJR forecasting horizon. Further, several options for a planned connection between Highway 1416 and E Mall Drive would use this alignment, and the existing 30' wide structure could be inadequate to accommodate two-way traffic.

The structure on I-90 over Box Elder Creek (at MRM 63.4) was built in 1994, is in fair condition, and has a sufficiency rating over 95. The twin structures on I-90 over a Box Elder Creek tributary (at MRM 64.0) were built in 1962, are in fair condition, and have a sufficiency rating of 86 and 97. The West Gate Road structure over I-90 (at MRM 64.2) was built in 2006, is in fair condition, and has a sufficiency rating of 85. Although ongoing maintenance will be required for all of these structures, none are anticipated to require significant capital investments in the IMJR forecasting horizon.

Further structural needs may be identified as part of a local floodplain evaluation being jointly performed by this IMJR effort and the separate Highway 1416 study being undertaken by the City of Box Elder. It is anticipated that additional hydraulic capacity may be required to manage flows from the IMJR study area to Box Elder Creek. The existing Box Elder Creek tributary that passes under I-90 between Highway 1416 and West Gate Road at approximately MRM 63.9 may be an appropriate location for this mitigation based on the outcome of the floodplain evaluation.

4. ALTERNATIVES

Based on the work competed in the Corridor Study, eight future year Feasible Options have been included in the IMJR. These include the No Action Feasible Option, six Interchange Build Feasible Options, and the Transportation System Management (TSM) Feasible Option. This chapter further describes the Feasible Options and includes concept drawings for the Interchange Build Feasible Options.

4.1 No Action Feasible Option

The No Action Feasible Option would leave the interchange in its current configuration. Maintenance (resurfacing, bridge maintenance, etc.) would continue through the IMJR horizon, but no capital improvements that would modify the current interchange layout are assumed. This is the baseline scenario to which other options are compared.

4.2 Interchange Build Feasible Options

The six Interchange Build Feasible Options look to address the project's needs through the construction of a new interchange or reconstruction of the existing facility in a manner that better fits the project's needs. The Corridor Study identified multiple Build alternatives and screened them to obtain three Feasible Options. Since the completion of the Corridor Study, potential new alignments for Highway 1416 have been developed by others, effectively expanding the three Feasible Options to six. The Highway 1416 scenarios are described further below. Each of these six Feasible Options is evaluated in this IMJR.

The City of Box Elder is currently evaluating improvements to Highway 1416 between West Gate Road and Liberty Boulevard. Since that effort is still in progress and does not have a defined outcome, this IMJR has evaluated two scenarios for Highway 1416. One scenario includes a 5-lane Highway 1416 corridor along a northerly alignment (generally located where the existing westbound lanes are today), while the other includes a 5-lane Highway 1416 corridor along a southerly alignment (generally located where the existing eastbound lanes are today). Since the City's study is not complete, each of the Exit 63 Interchange Build Feasible Options includes a sub-option with Highway 1416 on the northerly alignment east of West Gate Road and a sub-option with Highway 1416 on the southerly alignment east of West Gate Road. These options affect how local access and roadway connections are provided in the Exit 63 area, as shown in the Interchange Build Feasible Options.

4.2.1 Feasible Option 1: Diamond Interchange at West Gate Road

Feasible Option 1 includes a new diamond interchange at the existing West Gate Road overpass along I-90. This location is approximately ½ mile east of the existing interchange. Since West Gate Road is a north-south roadway, Highway 1416 traffic would have to turn at the West Gate Road / Highway 1416 intersection to access the interchange. If the E Mall Drive extension uses the Highway 1416 alignment to access the city of Box Elder, a new structure may be provided at the existing westbound Highway 1416 overpass; otherwise the overpass would be removed. The two existing ramps (eastbound I-90 to eastbound Highway 1416 and westbound Highway 1416 to westbound I-90) would be removed regardless of the E Mall Drive extension. Feasible Option 1 with the southerly Highway 1416 alignment (referred to as Feasible Option 1a) is shown on **Figure 6**, and Feasible Option 1 with the northerly Highway 1416 alignment (referred to as Feasible Option 1b) is shown on **Figure 7**. Guide signing for Feasible Option 1 was also developed during the conceptual design process. The signing layout does not vary significantly between the northerly and southerly alignment of Highway 1416, so only one plan has been developed, and it is shown on **Figure 8**. No significant guide signing concerns were noted during this process.

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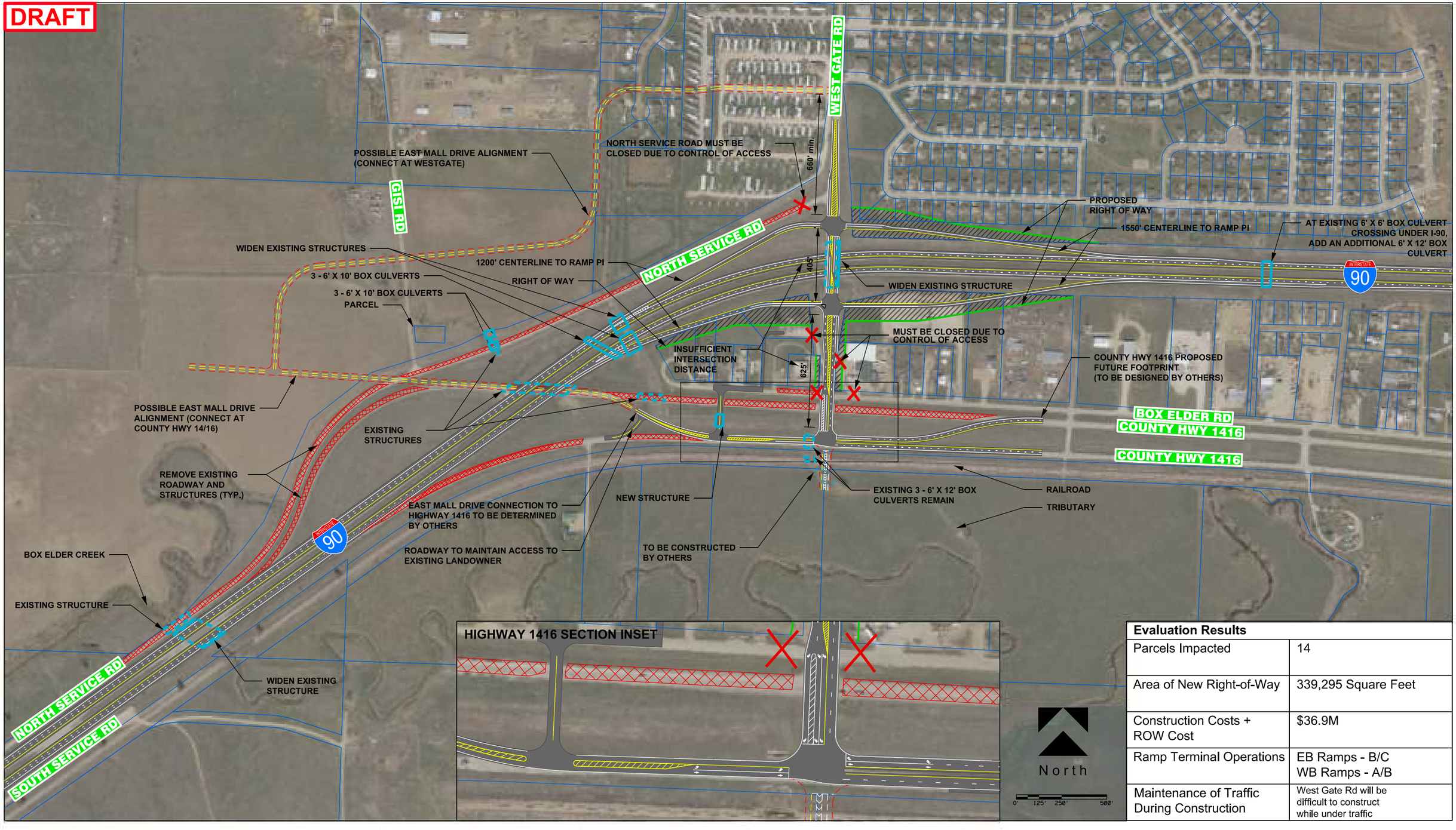
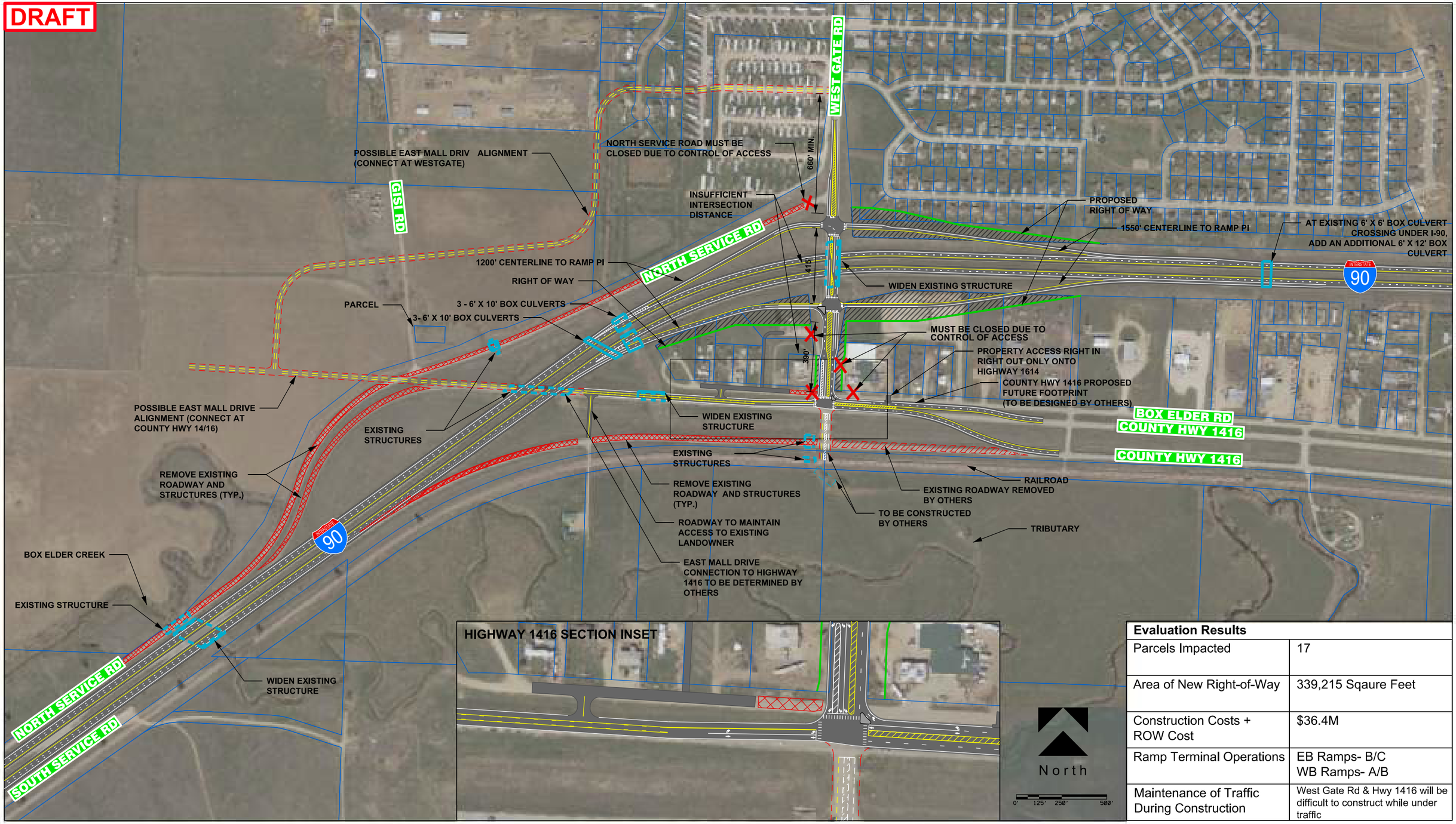


Evaluation Results	
Parcels Impacted	14
Area of New Right-of-Way	339,295 Square Feet
Construction Costs + ROW Cost	$36.9M
Ramp Terminal Operations	EB Ramps - B/C WB Ramps - A/B
Maintenance of Traffic During Construction	West Gate Rd will be difficult to construct while under traffic

I-90 EXIT 63
FEASIBLE OPTION 1a: WEST GATE ROAD DIAMOND INTERCHANGE (SOUTH HWY 1416 SECTION)

FIGURE 6

DRAFT



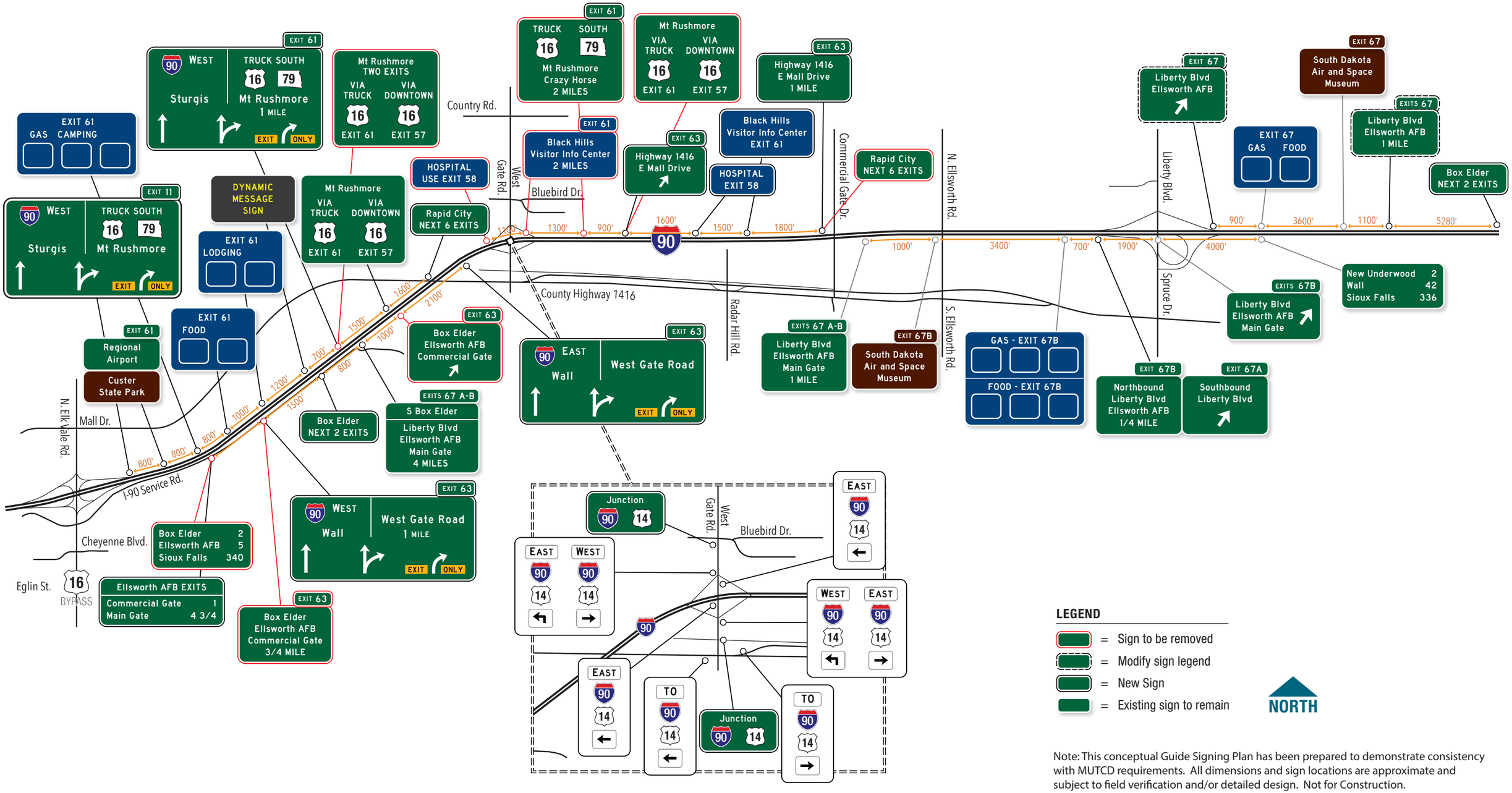
North

0' 125' 250' 500'

Evaluation Results	
Parcels Impacted	17
Area of New Right-of-Way	339,215 Sqaure Feet
Construction Costs + ROW Cost	$36.4M
Ramp Terminal Operations	EB Ramps- B/C WB Ramps- A/B
Maintenance of Traffic During Construction	West Gate Rd & Hwy 1416 will be difficult to construct while under traffic

I-90 EXIT 63
FEASIBLE OPTION 1b: WEST GATE ROAD DIAMOND INTERCHANGE (NORTH HWY 1416 SECTION)

FIGURE 7



LEGEND

- = Sign to be removed
- = Modify sign legend
- = New Sign
- = Existing sign to remain

NORTH

Note: This conceptual Guide Signing Plan has been prepared to demonstrate consistency with MUTCD requirements. All dimensions and sign locations are approximate and subject to field verification and/or detailed design. Not for Construction.

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Feasible Option 1
Diamond Interchange at West Gate Guide Signing

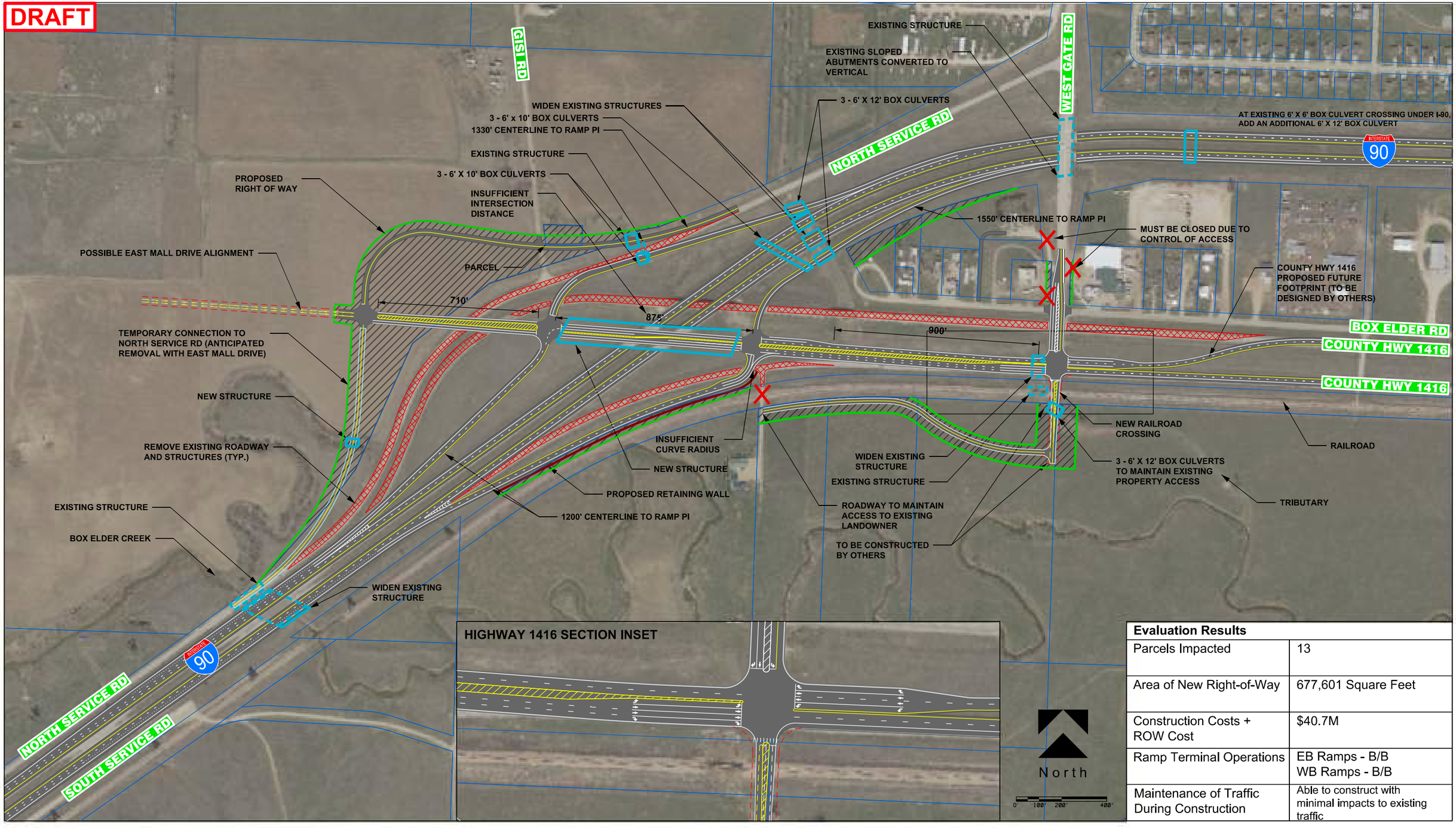
FIGURE 8

4.2.2 Feasible Option 2: Diamond Interchange at Highway 1416

Feasible Option 2 includes a new diamond interchange at the existing Highway 1416 overpass along I-90. This option does not relocate the existing interchange. If the E Mall Drive extension uses the Highway 1416 alignment to access the city of Box Elder, it would connect to the west side of the interchange. The two existing ramps (eastbound I-90 to eastbound Highway 1416 and westbound Highway 1416 to westbound I-90) would be retained and reconstructed, and new east-facing ramps would be constructed. Feasible Option 2 with the southerly Highway 1416 alignment (referred to as Feasible Option 2a) is shown on **Figure 9**, and Feasible Option 2 with the northerly Highway 1416 alignment (referred to as Feasible Option 2b) is shown on **Figure 10**.

Guide signing for Feasible Option 2 was also developed during the conceptual design process. The signing layout does not vary significantly between the northerly and southerly alignment of Highway 1416, so only one plan has been developed, and it is shown on **Figure 11**. Due to the new east-facing ramps at Exit 63, it is necessary to relocate the westbound "Rapid City / NEXT 6 EXITS" sign from its exiting location near Commercial Gate Drive (approximately MRM 66.5) to a location west of the Exit 63 interchange. However, the existing density of signs along I-90 westbound between Exit 63 and Exit 61 does not allow for a new sign to be installed in this segment while maintaining sign spacing. Hence, this sign has been removed. Further options for this sign should be explored during detailed design.

DRAFT



Evaluation Results	
Parcels Impacted	13
Area of New Right-of-Way	677,601 Square Feet
Construction Costs + ROW Cost	$40.7M
Ramp Terminal Operations	EB Ramps - B/B WB Ramps - B/B
Maintenance of Traffic During Construction	Able to construct with minimal impacts to existing traffic

I-90 EXIT 63

FEASIBLE OPTION 2a: COUNTY HIGHWAY 1416 DIAMOND INTERCHANGE (SOUTH HWY 1416 SECTION) FIGURE 9

DRAFT

GISI RD

EXISTING STRUCTURE

EXISTING SLOPED ABUTMENTS CONVERTED TO VERTICAL

WEST GATE RD

1250' CENTERLINE TO RAMP PI

3- 6' x 12' BOX CULVERTS

WIDEN EXISTING STRUCTURES

3- 6' x 10' BOX CULVERTS

1375' CENTERLINE TO RAMP PI

3 - 6' X 10' BOX CULVERTS

NORTH SERVICE RD

AT EXISTING 6' X 6' BOX CULVERT CROSSING UNDER I-90, ADD AN ADDITIONAL 6' X 12' BOX CULVERT

INTERSTATE 90

PROPOSED RIGHT OF WAY

INSUFFICIENT INTERSECTION DISTANCE

MUST BE CLOSED DUE TO CONTROL OF ACCESS

PROPERTY ACCESS RIGHT IN RIGHT OUT ONLY ONTO HIGHWAY 1416

POSSIBLE EAST MALL DRIVE ALIGNMENT

PARCEL

770'

880'

710'

COUNTY HWY 1416 PROPOSED FUTURE FOOTPRINT (TO BE DESIGNED BY OTHERS)

TEMPORARY CONNECTION TO NORTH SERVICE RD (ANTICIPATED REMOVAL WITH EAST MALL DRIVE PROJECT)

EXISTING 3-6' X 12' BOX CULVERTS REMAIN

BOX ELDER RD

COUNTY HWY 1416

COUNTY HWY 1416

NEW STRUCTURE

REMOVE EXISTING ROADWAY AND STRUCTURES (TYP.)

NEW STRUCTURES

PROPOSED RETAINING WALL

ROADWAY TO MAINTAIN ACCESS TO EXISTING LANDOWNER

TO BE CONSTRUCTED BY OTHERS

RAILROAD

EXISTING ROADWAY TO BE REMOVED BY OTHERS

TRIBUTARY

BOX ELDER CREEK

EXISTING STRUCTURE

BOX ELDER CREEK

WIDEN EXISTING STRUCTURE

1200' CENTERLINE TO RAMP PI

INTERSTATE 90

NORTH SERVICE RD

SOUTH SERVICE RD

HIGHWAY 1416 SECTION INSET

North

0' 100' 200' 400'

Evaluation Results	
Parcels Impacted	7
Area of New Right-of-Way	522,598 Square Feet
Construction Costs + ROW Cost	$40.1M
Ramp Terminal Operations	EB Ramps - B/B WB Ramps - B/B
Maintenance of Traffic During Construction	Able to construct with minimal impacts on existing traffic.

I-90 EXIT 63

FEASIBLE OPTION 2b: COUNTY HIGHWAY 1416 DIAMOND INTERCHANGE (NORTH HWY 1416 SECTION) FIGURE 10

LEGEND

- = Sign to be removed
- = Modify sign legend
- = New Sign
- = Existing sign to remain

NORTH

Note: This conceptual Guide Signing Plan has been prepared to demonstrate consistency with MUTCD requirements. All dimensions and sign locations are approximate and subject to field verification and/or detailed design. Not for Construction.

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Feasible Option 2
Highway 1416 Diamond Interchange Guide Signing

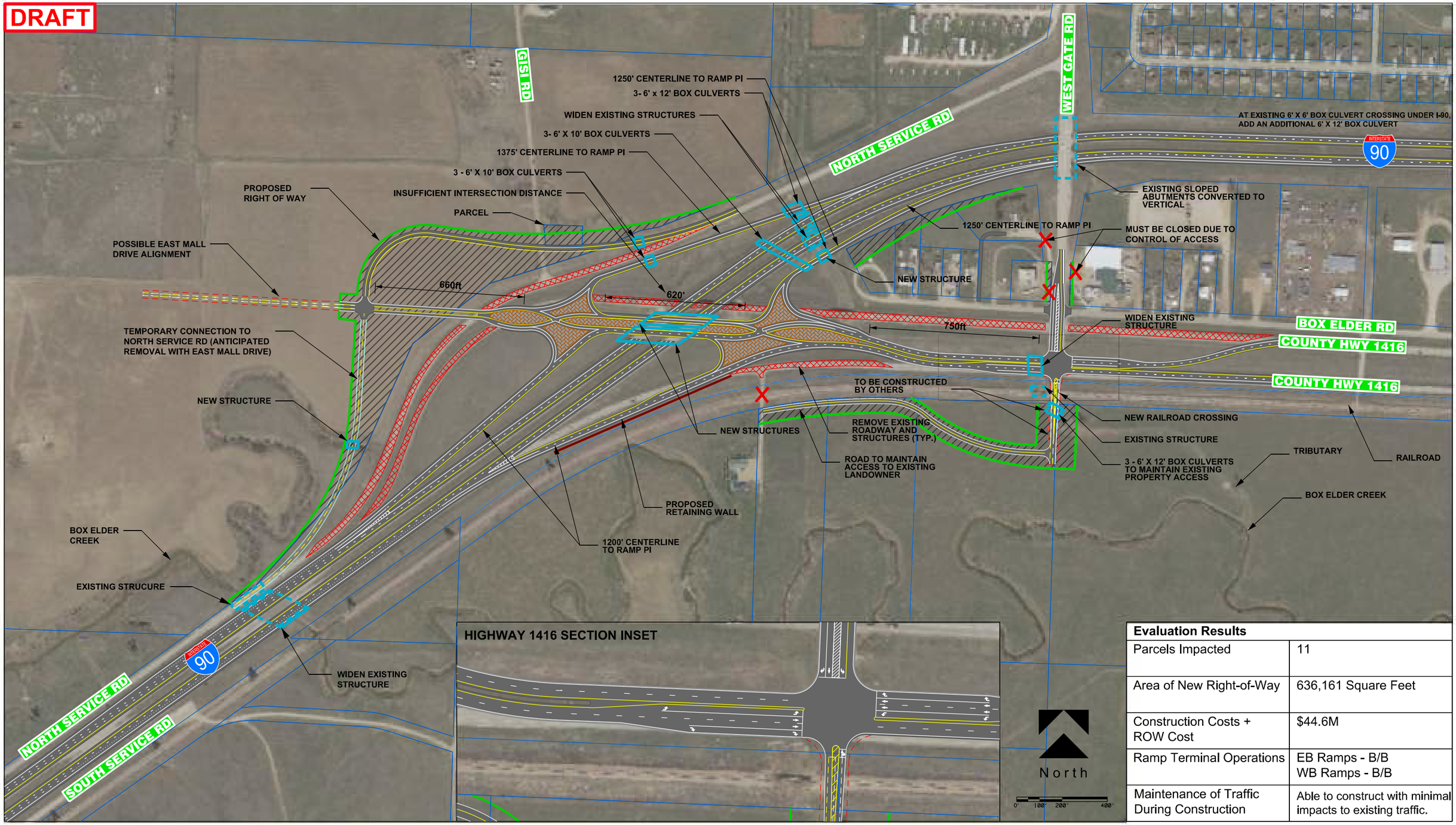
FIGURE 11

4.2.3 Feasible Option 3: Diverging Diamond Interchange at Highway 1416

Feasible Option 3 includes a new diverging diamond interchange at the existing Highway 1416 overpass along I-90. This option does not relocate the existing interchange. If the E Mall Drive extension uses the Highway 1416 alignment to access the city of Box Elder, it would connect to the west side of the interchange. The two existing ramps (eastbound I-90 to eastbound Highway 1416 and westbound Highway 1416 to westbound I-90) would be retained and reconstructed, and new east-facing ramps would be constructed. Feasible Option 3 with the southerly Highway 1416 alignment (referred to as Feasible Option 3a) is shown on **Figure 12**, and Feasible Option 2 with the northerly Highway 1416 alignment (referred to as Feasible Option 3b) is shown on **Figure 13**.

Guide signing for Feasible Option 3 was also developed during the conceptual design process. The signing layout does not vary significantly between the northerly and southerly alignment of Highway 1416, so only one plan has been developed, and it is shown on **Figure 14**. Guide signing is very similar to the plan for Feasible Option 2. The "Rapid City / NEXT 6 EXITS" sign has been removed in Feasible Option 3, as the spacing issue noted in the Feasible Option 2 text does not change under this option. Further options for this sign should be explored during detailed design.

DRAFT



Evaluation Results	
Parcels Impacted	11
Area of New Right-of-Way	636,161 Square Feet
Construction Costs + ROW Cost	$44.6M
Ramp Terminal Operations	EB Ramps - B/B WB Ramps - B/B
Maintenance of Traffic During Construction	Able to construct with minimal impacts to existing traffic.

I-90 EXIT 63
FEASIBLE OPTION 3a: DIVERGING DIAMOND INTERCHANGE (SOUTH HWY 1416 SECTION)

FIGURE 12

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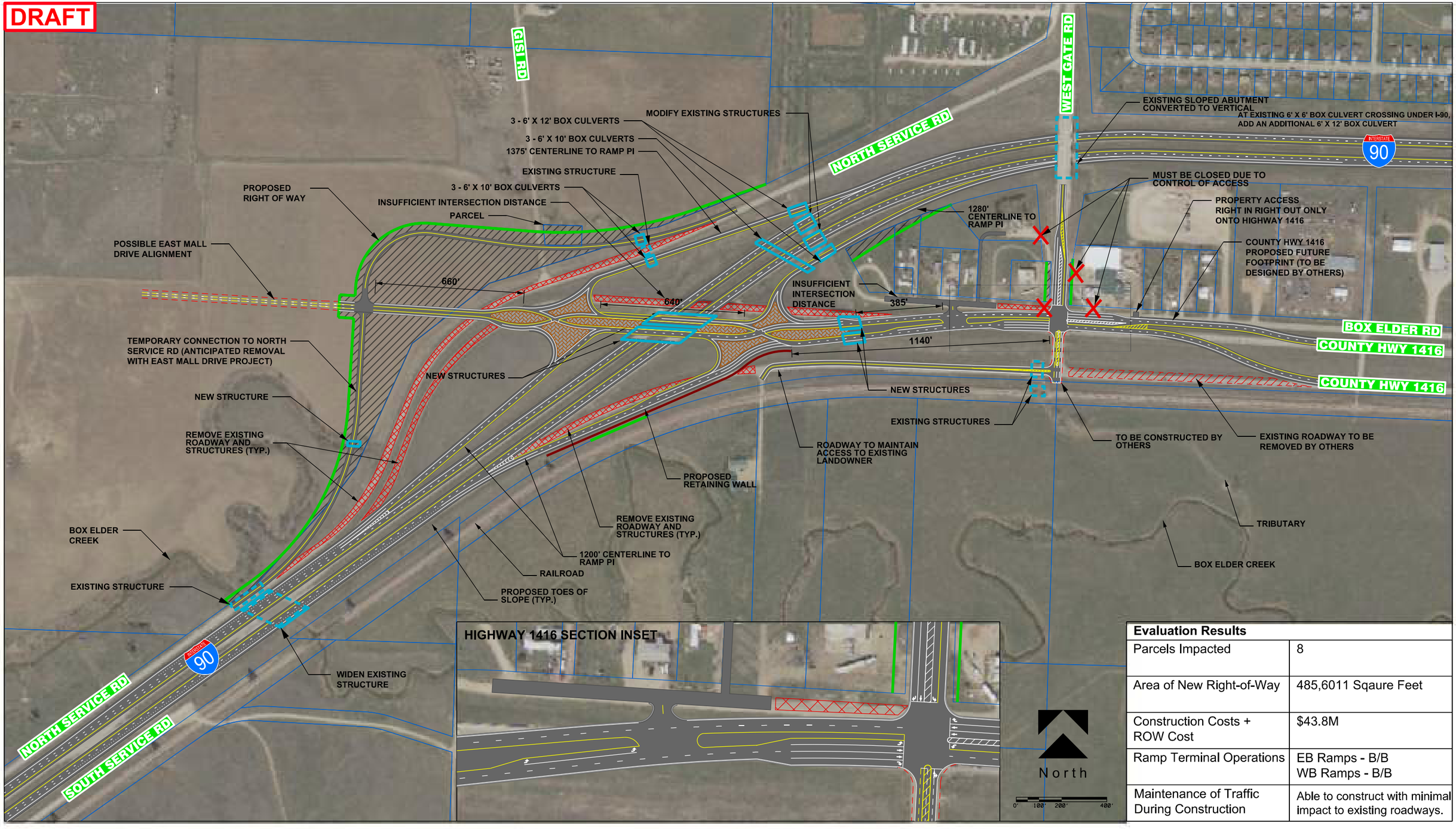
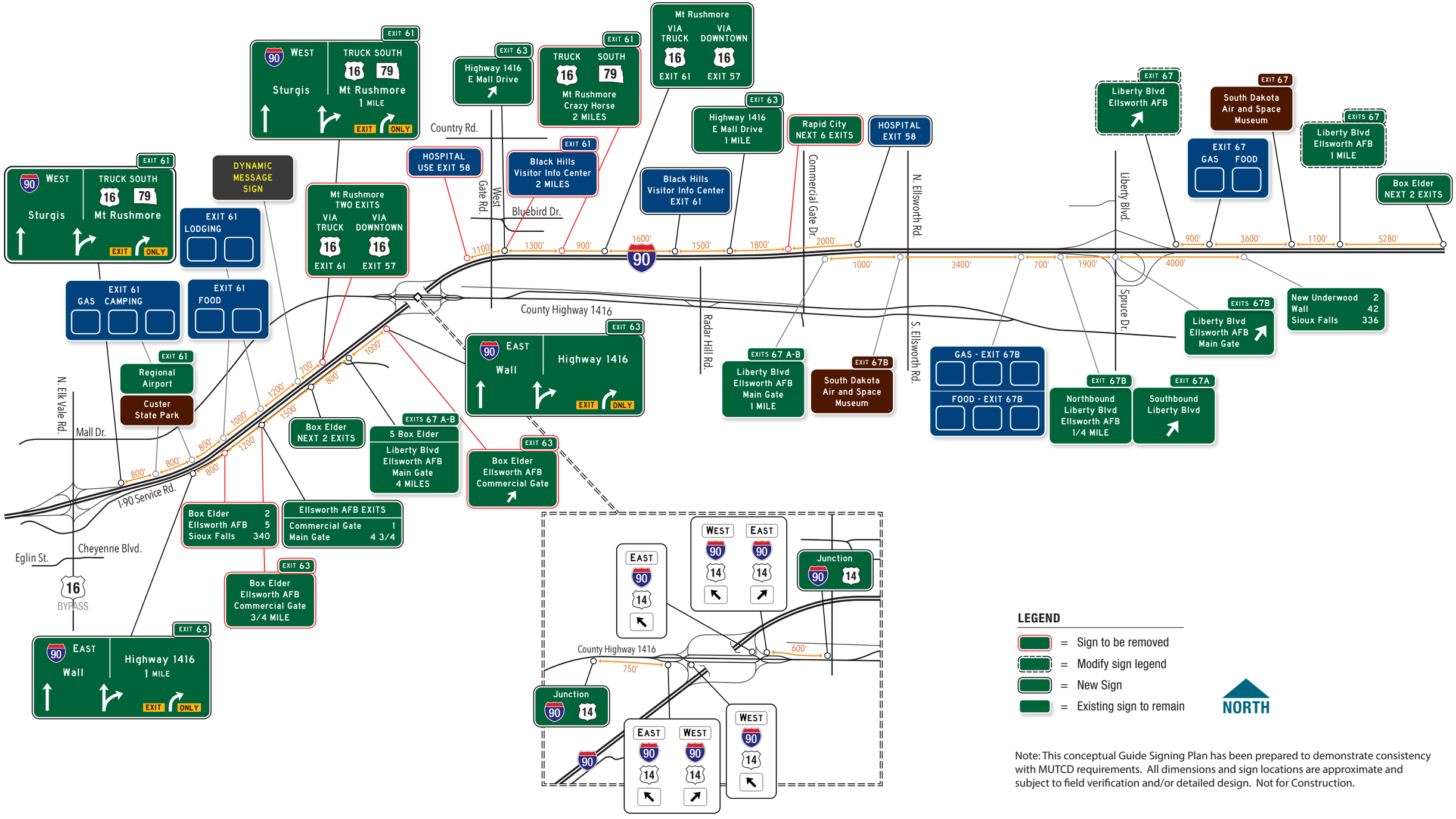


Evaluation Results	
Parcels Impacted	8
Area of New Right-of-Way	485,6011 Sqaure Feet
Construction Costs + ROW Cost	$43.8M
Ramp Terminal Operations	EB Ramps - B/B WB Ramps - B/B
Maintenance of Traffic During Construction	Able to construct with minimal impact to existing roadways.

I-90 EXIT 63
FEASIBLE OPTION 3b: DIVERGING DIAMOND INTERCHANGE (NORTH HWY 1416 SECTION)

FIGURE 13



LEGEND

- = Sign to be removed
- = Modify sign legend
- = New Sign
- = Existing sign to remain

NORTH

Note: This conceptual Guide Signing Plan has been prepared to demonstrate consistency with MUTCD requirements. All dimensions and sign locations are approximate and subject to field verification and/or detailed design. Not for Construction.

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Feasible Option 3
Highway 1416 Diverging Diamond Interchange Guide Signing

FIGURE 14

4.3 Transportation System Management Feasible Options

Transportation System Management (TSM) Feasible Options are typically lower-cost packages of improvements that do not require significant new infrastructure but are targeted to the project area to help manage the available infrastructure. TSM alternatives can include transit service modifications, conversion of existing facilities into managed facilities, bicycle and pedestrian improvements, and intelligent transportation system (ITS) improvements. The scope of TSM improvements is usually tailored to the project under consideration to create an alternative that addresses project needs with targeted, minimally invasive projects.

In the Exit 63 project area, the existing transit infrastructure would require significant improvements that are well beyond the scope of the Exit 63 project to make a meaningful difference in travel patterns. Similarly, although regional bicycle and pedestrian improvements have already been identified in the Exit 63 project area, these tools are not anticipated to make a meaningful difference in travel patterns. The Corridor Study provides an overview of the existing ITS infrastructure in the project area and defines a series of ITS needs. Those needs are summarized below:

- The need for personnel to manually operate road closure gates/flashers
- Limited remote detection of roadway conditions, hampering the ability of emergency responders to reach incidents and/or maintenance forces to address concerns
- Multiple communications paths for ITS devices
- CCTV only supplying still images
- Lack of unified control interface for devices/cameras

Upgrades to the existing ITS infrastructure and /or new components to address the needs above would help SDDOT manage travel through the Exit 63 area during weather events and provide improved emergency service responses during incidents. This would help address the project's safety and operational reliability needs but would not address 1-90 access, capacity, or structural needs.

The TSM Feasible Option evaluated in this IMJR includes an upgrade to the exiting Road Weather Information System (RWIS) station at MRM 65.2 (east of the Exit 63 interchange) and enhanced communications (fiber optic) between the RWIS, the existing dynamic message sign (DMS) at MRM 63.2, the automated traffic recorder (also at MRM 63.2), and SDDOT's existing facility on Eglin Street near Exit 60. This would allow SDDOT staff to access streaming video from both the RWIS station and the existing camera mounted at the DMS, control the cameras in real time, and eliminate redundant communications paths.

5. FUTURE YEAR TRAFFIC

The Exit 63 future year traffic evaluations are based on a 2025 opening day scenario and a 2050 horizon year scenario. Traffic forecasts were developed in accordance with the M&A document and reflect regional travel growth plus the effect of local developments. Once volume forecasts for these years were developed, traffic operations for the No Action and Feasible Options were evaluated.

It should be noted that future traffic conditions have changed significantly since the Corridor Study. First, the horizon year has been extended from 2045 to 2050 due to the currently anticipated schedule for the Exit 63 interchange project. Second, the City of Box Elder is working with a developer to plan the Alpha Omega development, which could bring as many as 50,000 new vehicle trips to the area immediately south of I-90 between Exit 61 and Exit 63. Third, the extension of E Mall Drive from Elk Value Road to the Exit 63 interchange area, along with related changes to the North I-90 Service Road will shift traffic patterns in the study area. Although the E Mall Drive extension was noted in the Corridor Study, it was not explicitly modeled as it was not anticipated to significantly change traffic patterns in the Corridor Study's forecasts[14].

5.1 Travel Demand Forecasting

Traffic forecasts for 2025 and 2050 were developed using the following process:

- The RCAMPO model was used as the starting point for 2045 forecasts in the study area. These forecasts are based on regionally approved land use plans and roadway improvement projects.
- The project team worked with RCAMPO staff and the City of Box Elder to define a reasonable 2045 development scenario for the Alpha Omega development site. This scenario was coded into the model, increasing the development intensity (and hence traffic generated) in the model's analysis zones where the Alpha Omega development is located. The revised model was run and forecasted 2045 volumes were extracted for study area roadway links.
- Based on the existing year and 2045 link volumes, annual growth factors were developed for study area roadways.
- The annual growth factors were used to increase the link volumes from 2045 to the 2050 study horizon year and to decrease the 2045 volumes to the 2025 opening day scenario.

Once the link volumes were developed for 2025 and 2050, the methodologies described in National Cooperative Highway Research Project (NCHRP) Report 765[15] were used to generate turning movement volumes at study intersections. These volumes were then used in the future year analyses.

[14] OpCit, *I-90 Exit 61 to Exit 67 Corridor Study,* Section 4.3.2, page 4-5

[15] *NCHRP Report 765: Analytical Travel Forecasting Approaches for Project-Level Planning and Design*, Transportation Research Board, Washington DC, 2014.

5.2 No Action Traffic Conditions

As noted earlier, the No Action scenario reflects conditions where no improvements (other than routine maintenance) are made in the Exit 63 area. It should be noted that the Alpha Omega development is currently expected to extend West Gate Road south into the development site, crossing the RCP&E Railroad alignment just south of the existing intersection. This extension is reflected in both the No Action and Build Feasible Options traffic volumes and intersection geometry.

5.2.1 Year 2025

Forecasted No Action freeway volumes for 2025 are shown on **Figure 15**, and the associated LOS results are shown on **Figure 16**. As can be seen, there are no locations where the 2025 traffic operations exceed the LOS C threshold. HCS outputs for 2025 No Action conditions are included in **Appendix B**.

Forecasted No Action intersection volumes for 2025 are shown on **Figure 17**, and the associated LOS results are shown on **Figure 18**. This scenario includes the signalization of the West Gate Road / Highway 1416 intersection and the Radar Hill Road / Highway 1416 intersection, as anticipated in the City of Box Elder's Highway 1416 study. It also includes the extension of E Mall Drive to the I-90 North Service Road and the related removal of the I-90 North Service Road / Elk Vale Road intersection and signalization of the E Mall Drive / Elk Vale Road intersection. With signalization, these intersections operate acceptably. Poor LOS results continue to be present for the eastbound to southbound right turn at the Exit 61 SPUI and for the side street approaches at the Edwards Street / South I-90 Service Road intersection with Elk Vale Road. Operations at the Cheyenne Boulevard & Eglin Street / Elk Vale Road deteriorate from LOS C / D (AM/PM) under existing conditions to LOS F / F in the 2025 No Action scenario. No significant differences were noted along Liberty Boulevard.

LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

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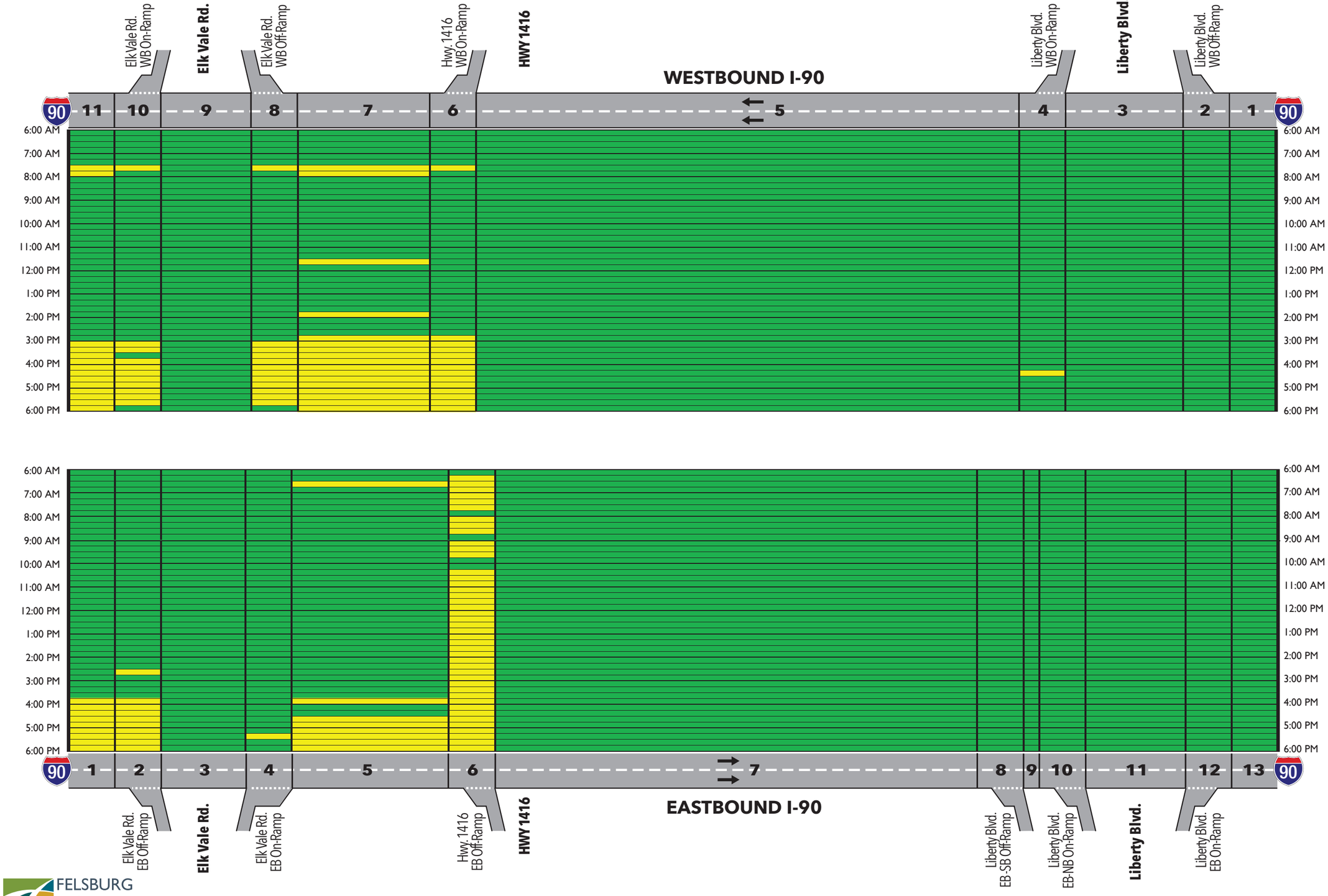
2025 No Action Freeway Volumes | **FIGURE 15**



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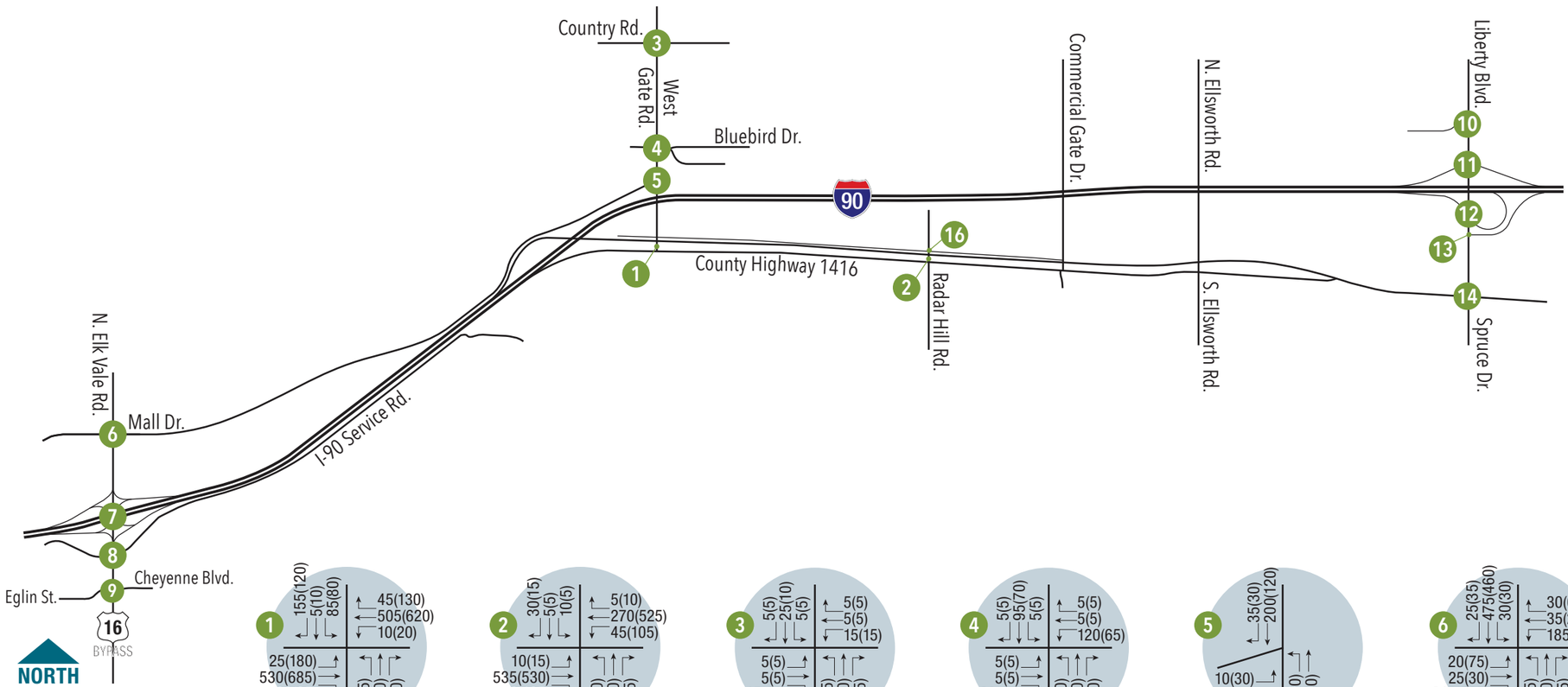
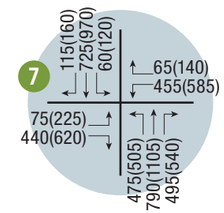
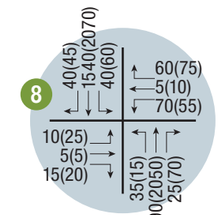
2025 No Action Freeway Operations | FIGURE 16

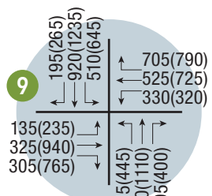


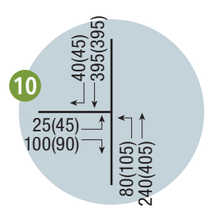
LEGEND

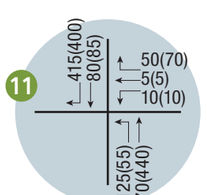
XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

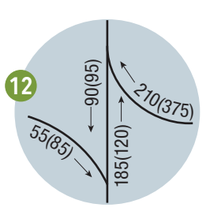


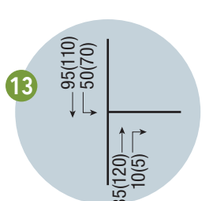


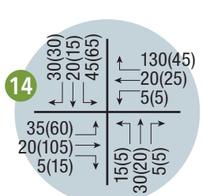


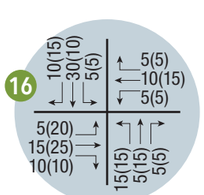












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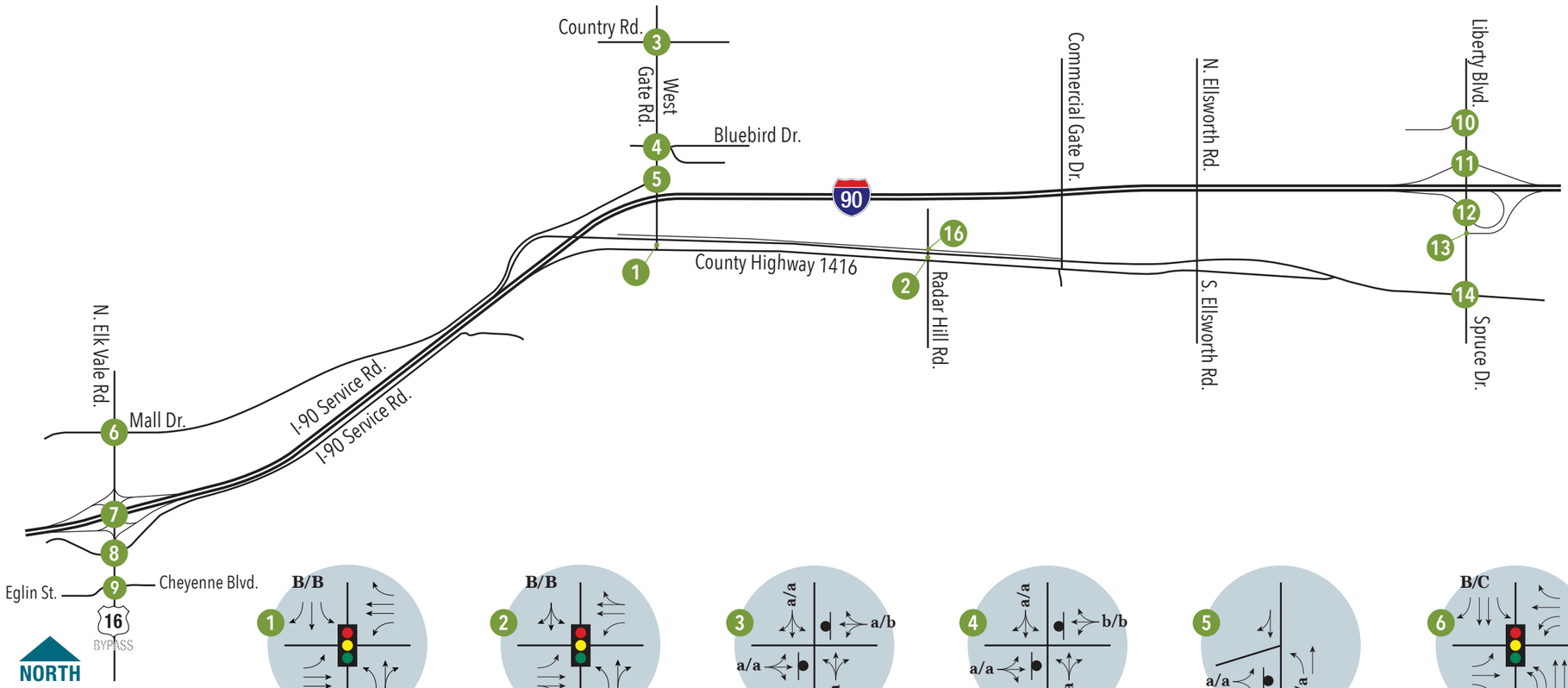
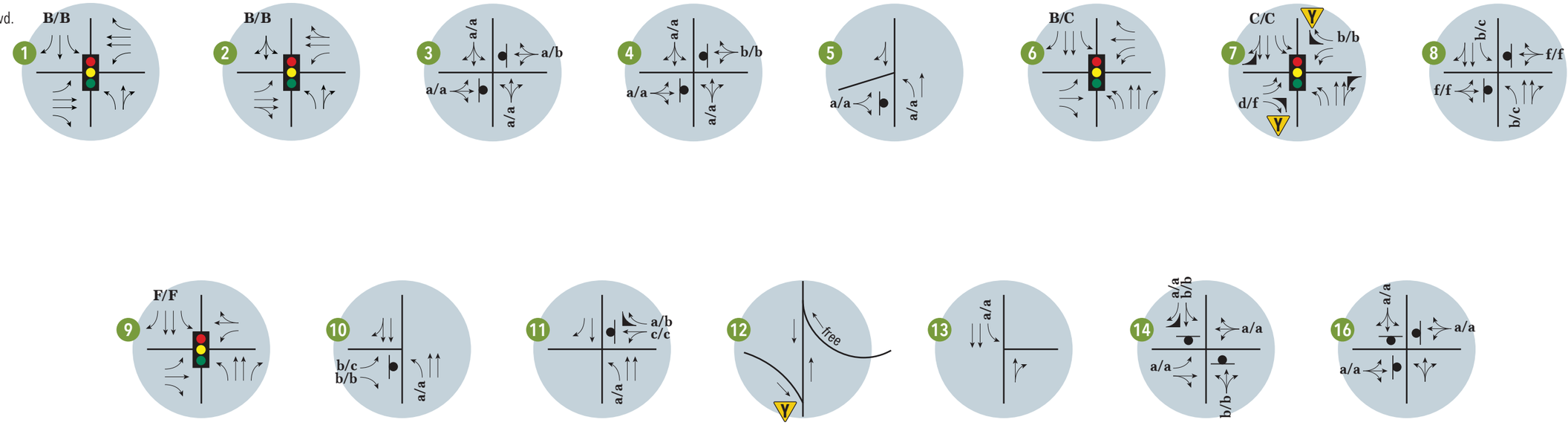
2025 No Action Intersection Volumes | **FIGURE 17**



LEGEND

- **X/X** = AM/PM Peak Hour Signalized Intersection Level of Service
- **x/x** = AM/PM Peak Hour Unsignalized Intersection Level of Service
- = Stop Sign
- = Yield Sign
- = Traffic Signal



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2025 No Action Intersection Operations | FIGURE 18

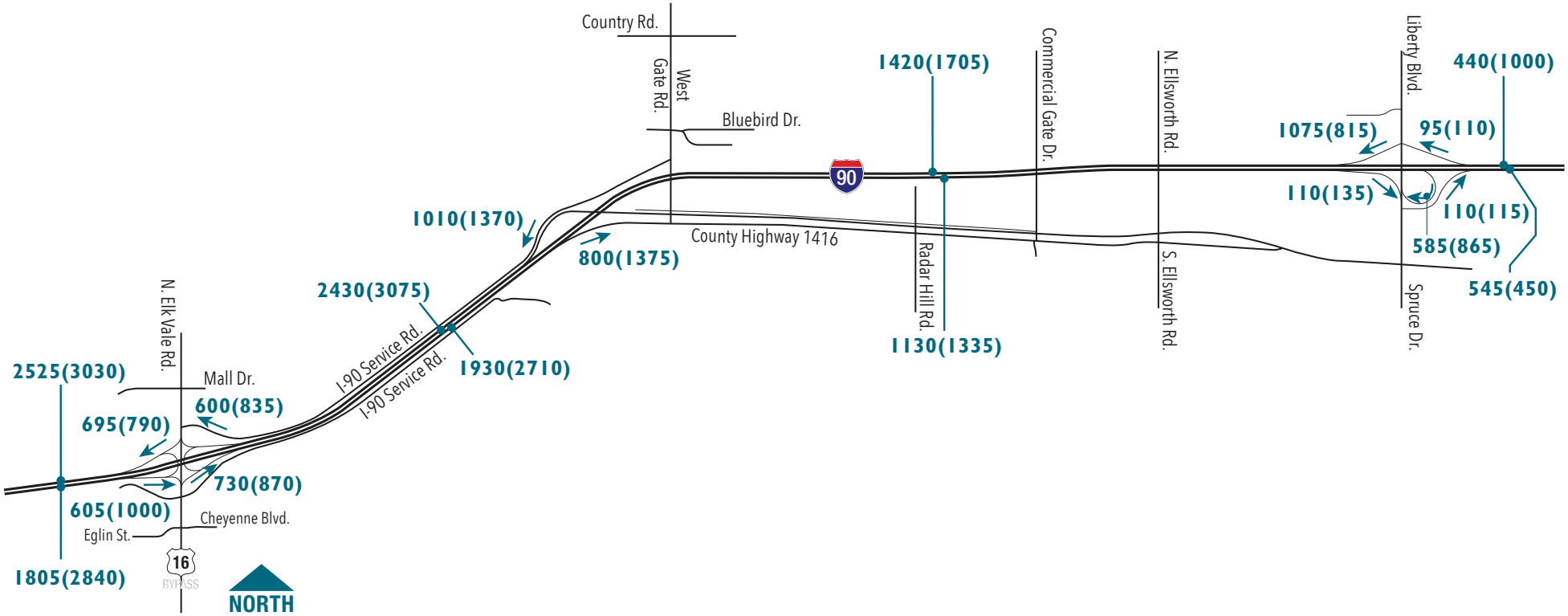
5.2.2 Year 2050

Forecasted No Action freeway volumes for 2050 are shown on **Figure 19**, and the associated LOS results are shown on **Figure 20**. The increases in traffic volumes lead to westbound LOS D operations at the Highway 1416 westbound on-ramp, on the freeway between Exit 63 and Exit 61, at the Exit 61 off-ramp, and on I-90 west of Exit 61. A similar LOS D result was obtained on eastbound I-90 approaching Exit 61. These LOS values exceed the LOS thresholds established for the project and can be expected as traffic growth occurs in the study area. HCS outputs for 2050 No Action conditions are included in **Appendix B**.

Forecasted No Action intersection volumes for 2050 are shown on **Figure 21**, and the associated LOS results are shown on **Figure 22**. Again, this scenario includes the signalization of the West Gate Road / Highway 1416 intersection and the Radar Hill Road / Highway 1416 intersection. These intersections continue to operate acceptably. It also includes the E Mall Drive modifications described earlier. However, even with signalization, the E Mall Drive / Elk Vale Road intersection operates at LOS D in the PM peak hour. The signal in the Exit 61 SPUI drops to LOS D / F (AM/PM) and the eastbound to southbound right turn continues to operate at LOS f / f. The side street approaches and the left turns from Elk Vale Road at the Edwards Street / South I-90 Service Road intersection also operate at LOS f / f. Operations at the Cheyenne Boulevard & Eglin Street / Elk Vale Road continues at LOS F / F. Operational deficiencies were also noted along the Liberty Boulevard corridor in the 2050 No Action scenario. The left turn exiting Reagan Avenue onto Liberty Boulevard operates at LOS f / f, and westbound I-90 off-ramp left turn to Liberty Boulevard southbound also operates at LOS f / f.

LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes



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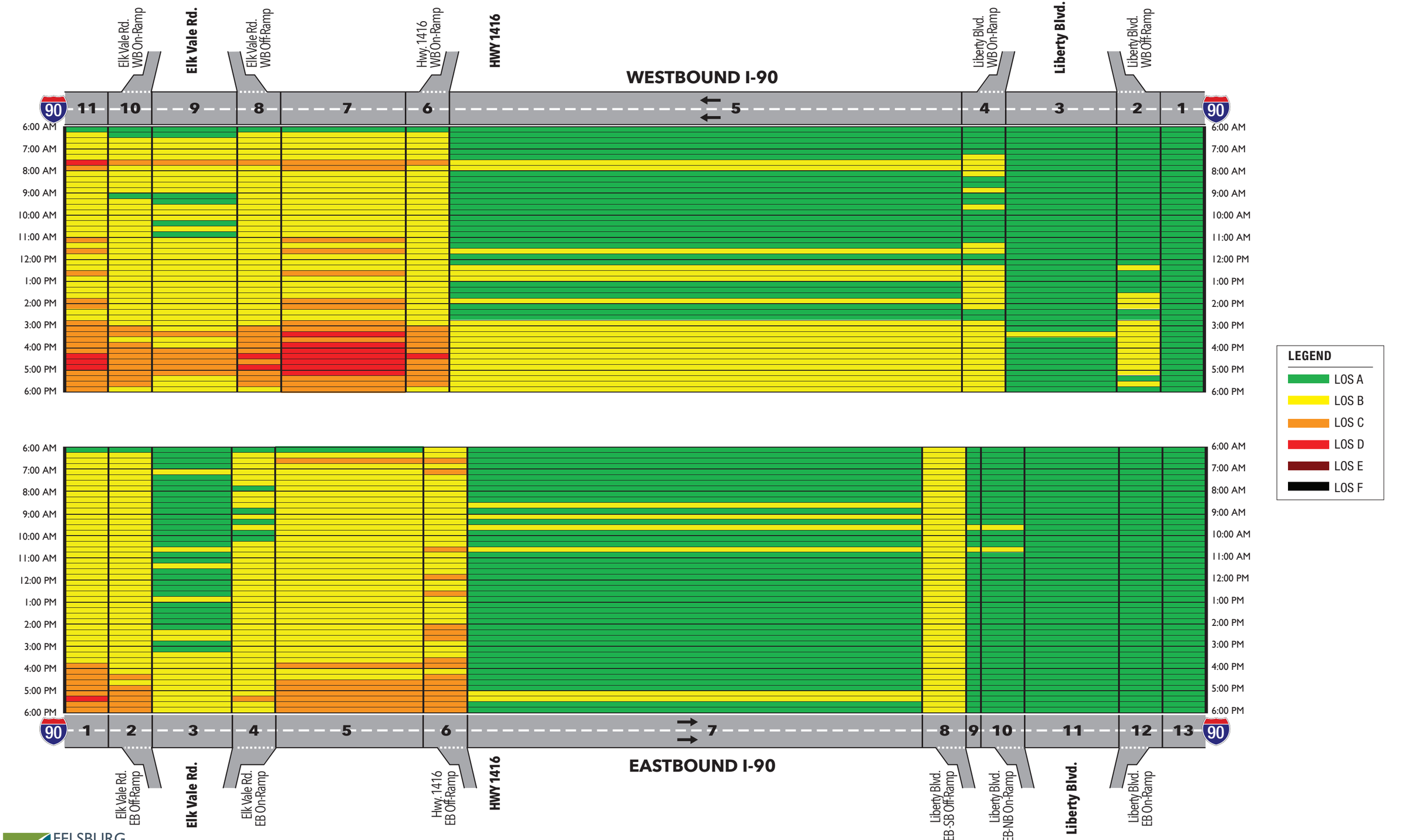
2050 No Action Freeway Volumes | **FIGURE 19**



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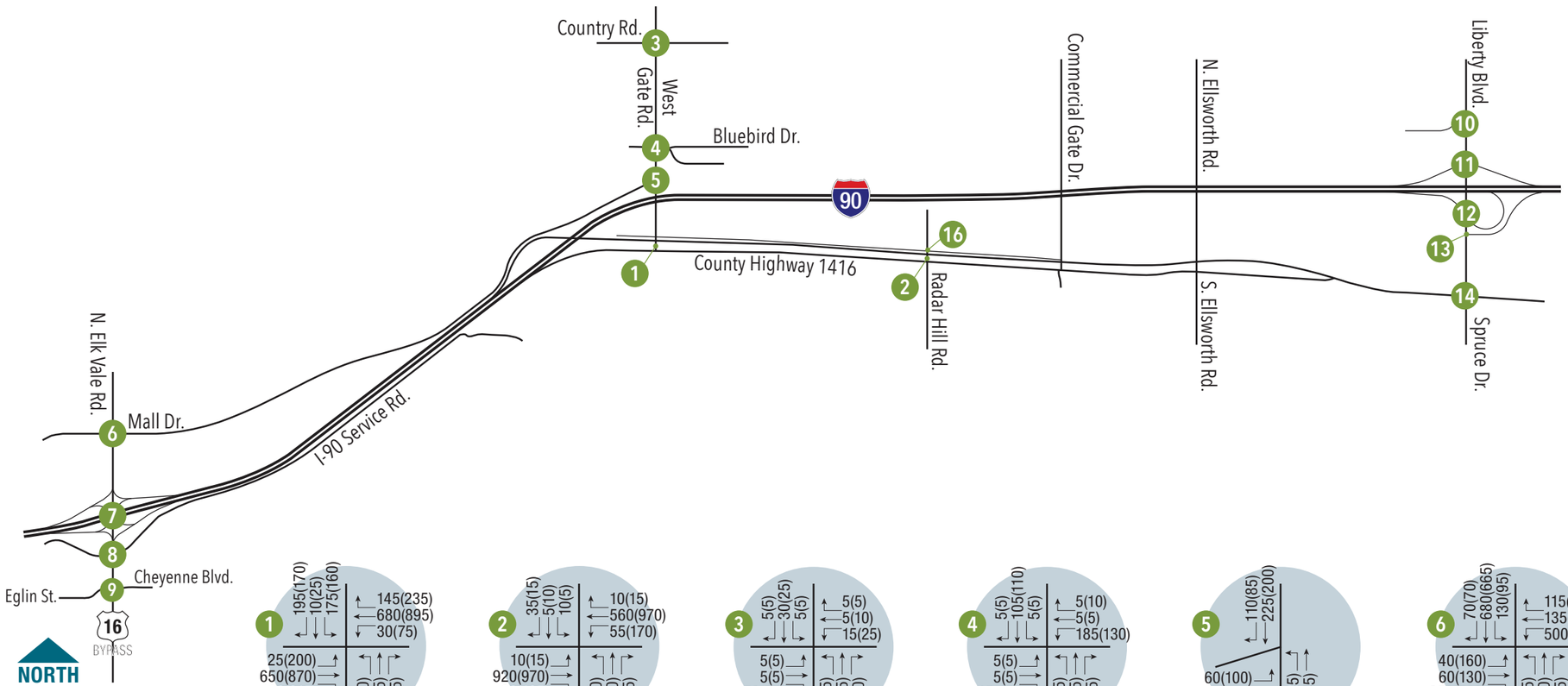
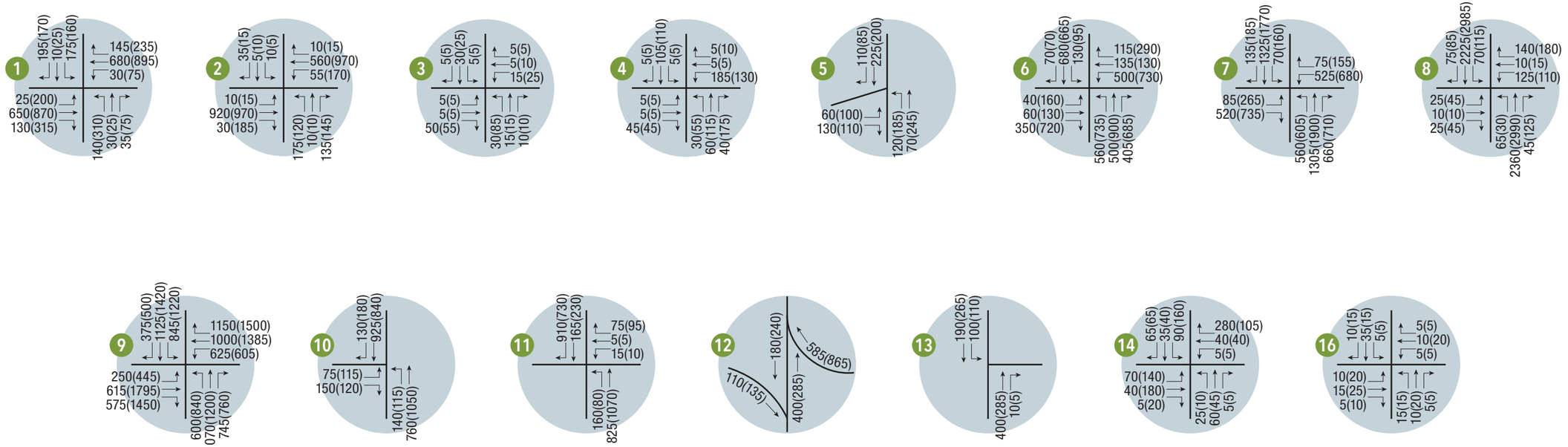
2050 No Action Freeway Operations | FIGURE 20





LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

NOTE:
AM Peak Hour = 7:00AM - 8: 00 AM
PM Peak Hour = 4:45PM - 5:45 PM

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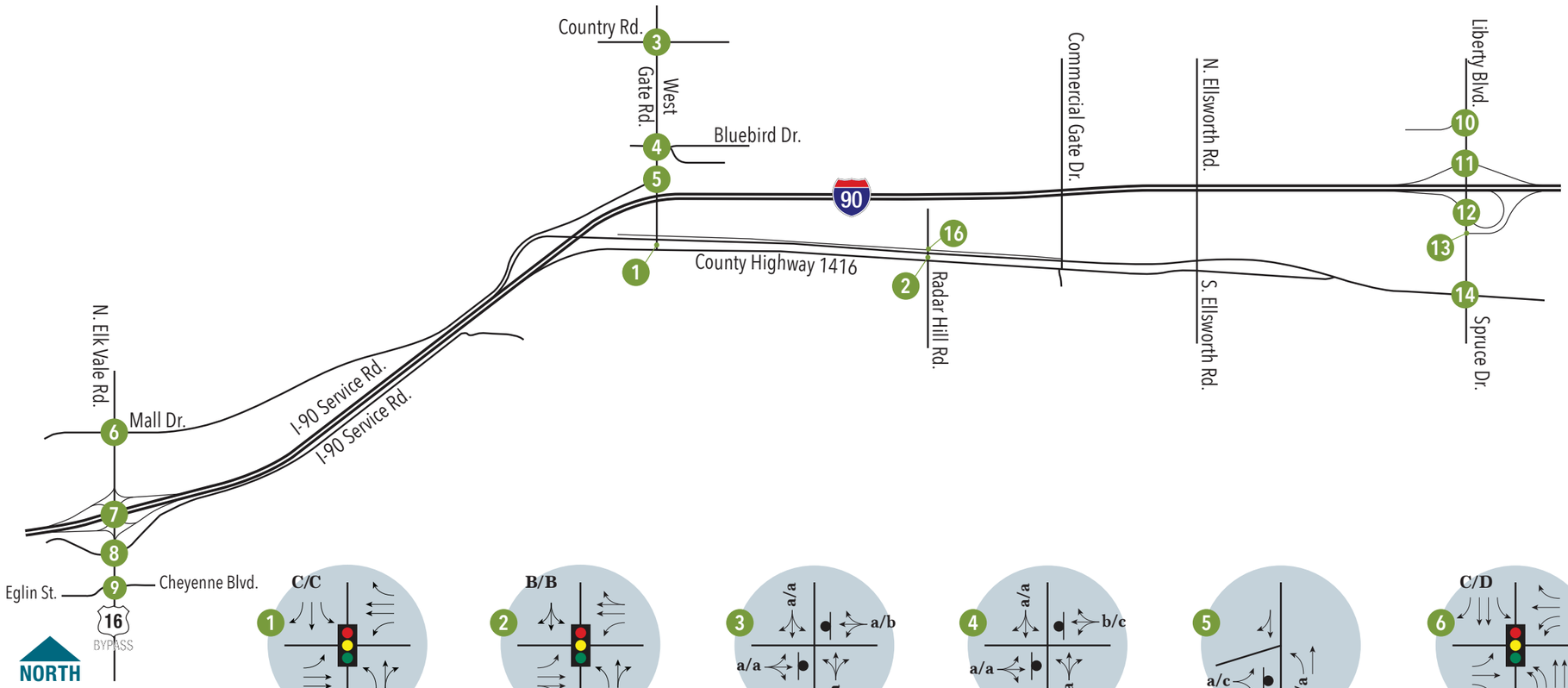
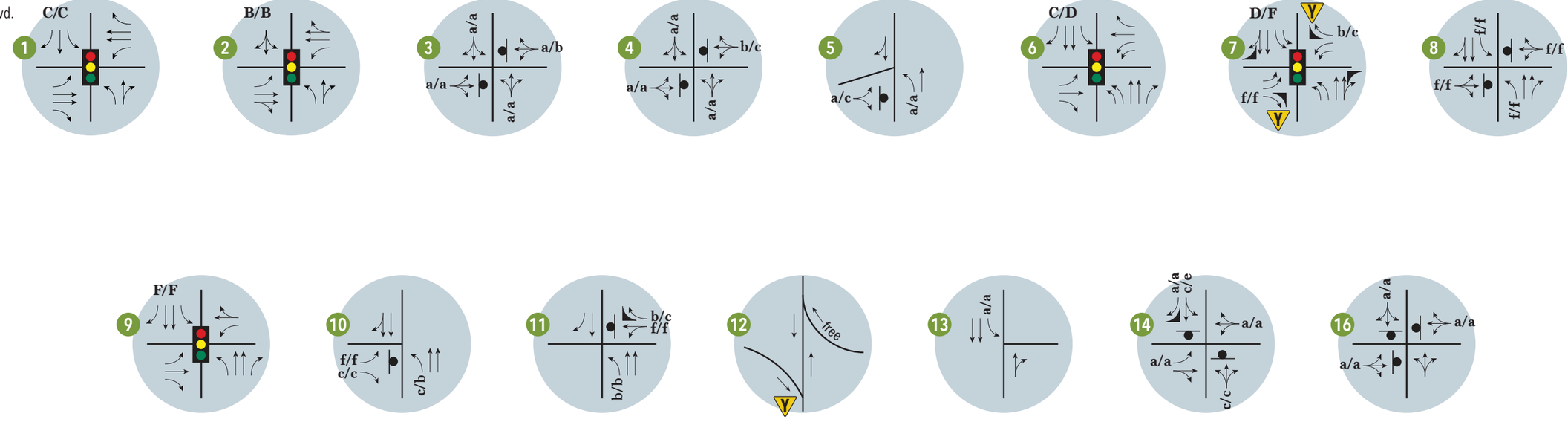
2050 No Action Intersection Volumes | **FIGURE 21**



LEGEND

- **X/X** = AM/PM Peak Hour Signalized Intersection Level of Service
- **x/x** = AM/PM Peak Hour Unsignalized Intersection Level of Service
- = Stop Sign
- = Yield Sign
- = Traffic Signal



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2050 No Action Intersection Operations | FIGURE 22

5.3 Build Traffic Conditions

As noted earlier, six Feasible Options are being evaluated in this IMJR. They are based on the Feasible Options identified in the Corridor Study, with added detail for the potential Highway 1416 alignments. Opening day (2025) and horizon year (2050) traffic operations have been evaluated for each option. No Action traffic volumes have been reassigned / redistributed within each option to reflect geometric changes associated with the option, including the construction of east-facing ramps and the option's location with respect to the Highway 1416 / West Gate Road intersection. Details of these modifications and the related operational results are summarized below. As noted earlier, the extension of West Gate Road into the Alpha Omega development is also included in the traffic volumes and intersection geometry.

It should be noted that the traffic operations analyses for the Feasible Options do not distinguish between the northerly Highway 1416 alignment and the southerly Highway 1416 alignment. Although these two alignments create differences in right-of-way (ROW), access, and other metrics, the intersection geometry (number of lanes, turn lanes, etc.) is assumed to be the same regardless of the location of Highway 1416. Access constraints and similar concerns cannot be evaluated through the HCM methodologies and were considered separately in the Feasible Option evaluation matrix. Hence, the operational results presented for each Feasible Option below represent anticipated operating conditions for both the "a" and "b" scenarios.

5.3.1 Feasible Option 1: Diamond Interchange at West Gate

The diamond interchange at West Gate Road will require vehicles along Highway 1416 to turn to / from West Gate Road to reach a new diamond interchange constructed at the existing West Gate Road overpass on I-90. It is assumed that the E Mall Drive extension will connect along the Highway 1416 alignment, crossing I-90 at the location of the existing Highway 1416 overpass. Hence, east-west through volumes will remain along Highway 1416 through the West Gate Road intersection. A sub-option with the E Mall Drive connection near Bluebird Drive (north of I-90) was also considered in the overall evaluation process. From a traffic perspective, this northerly sub-option results in lower volumes in the interchange, so the traffic analyses presented here (assuming the Highway 1416 connection) are conservative.

Year 2025

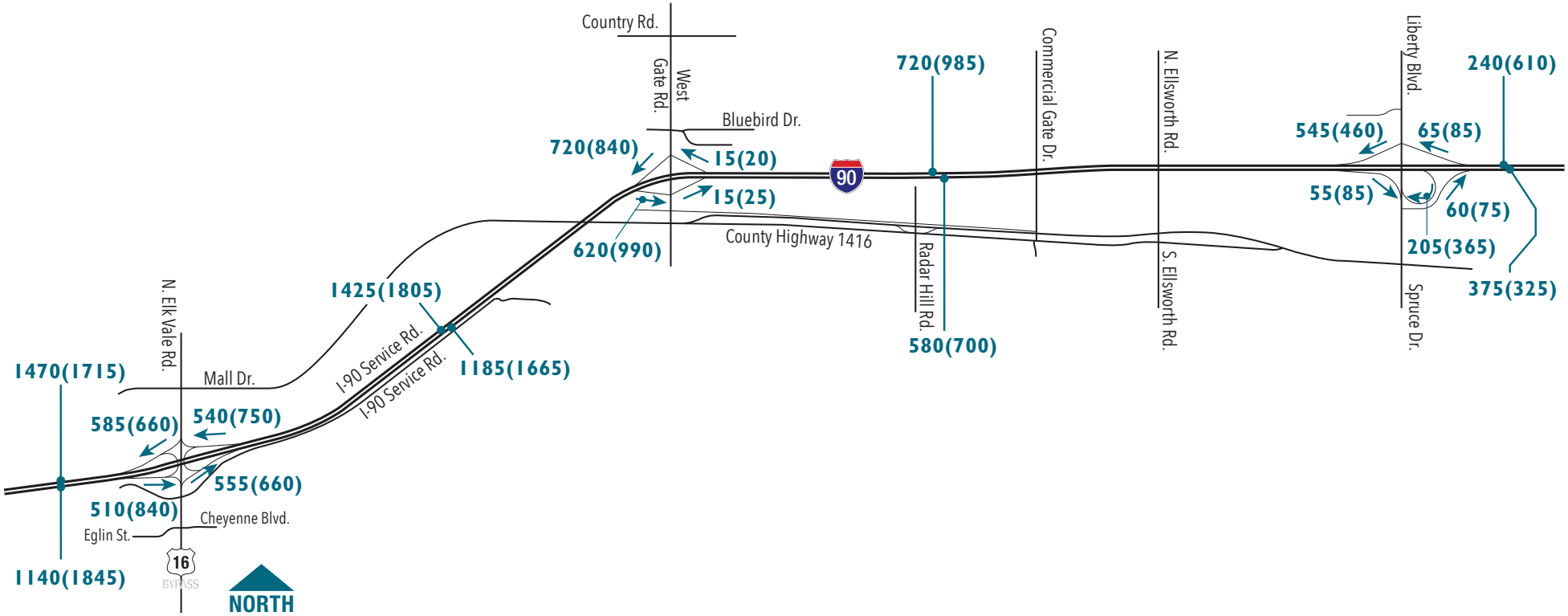
Forecasted Feasible Option 1 freeway volumes for 2025 are shown on **Figure 23**, and the associated LOS results are shown on **Figure 24**. As can be seen, there are no locations where the 2025 traffic operations exceed the LOS C threshold. HCS outputs for 2025 Feasible Option 1 conditions are included in **Appendix B**.

Forecasted Feasible Option 1 intersection volumes for 2025 are shown on **Figure 25**, and the associated LOS results are shown on **Figure 26**. Again, this scenario includes the signalization of the West Gate Road / Highway 1416 intersection and the Radar Hill Road / Highway 1416 intersection and the E Mall Drive / Elk Vale Road modifications described previously. These signalized intersections continue to operate acceptably under this Feasible Option in 2025. Poor LOS results continue to be present for the eastbound to southbound right turn at the Exit 61 SPUI and for the side street approaches at the Edwards Street / South I-90 Service Road intersection with Elk Vale Road. Operations at the Cheyenne Boulevard & Eglin Street / Elk Vale Road continue at LOS F / F. No operational deficiencies were noted along Liberty Boulevard.

The proposed Exit 63 diamond interchange ramp terminals were evaluated assuming signalization, and both ramp terminals operate at LOS A / A (AM/PM) in the 2025 scenario. This assumes a 5-lane overpass with a northbound through lane, a northbound dual left turn lane, a single southbound left turn lane, and a southbound through lane. This geometry would require widening the existing West Gate Road structure over I-90.

LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes



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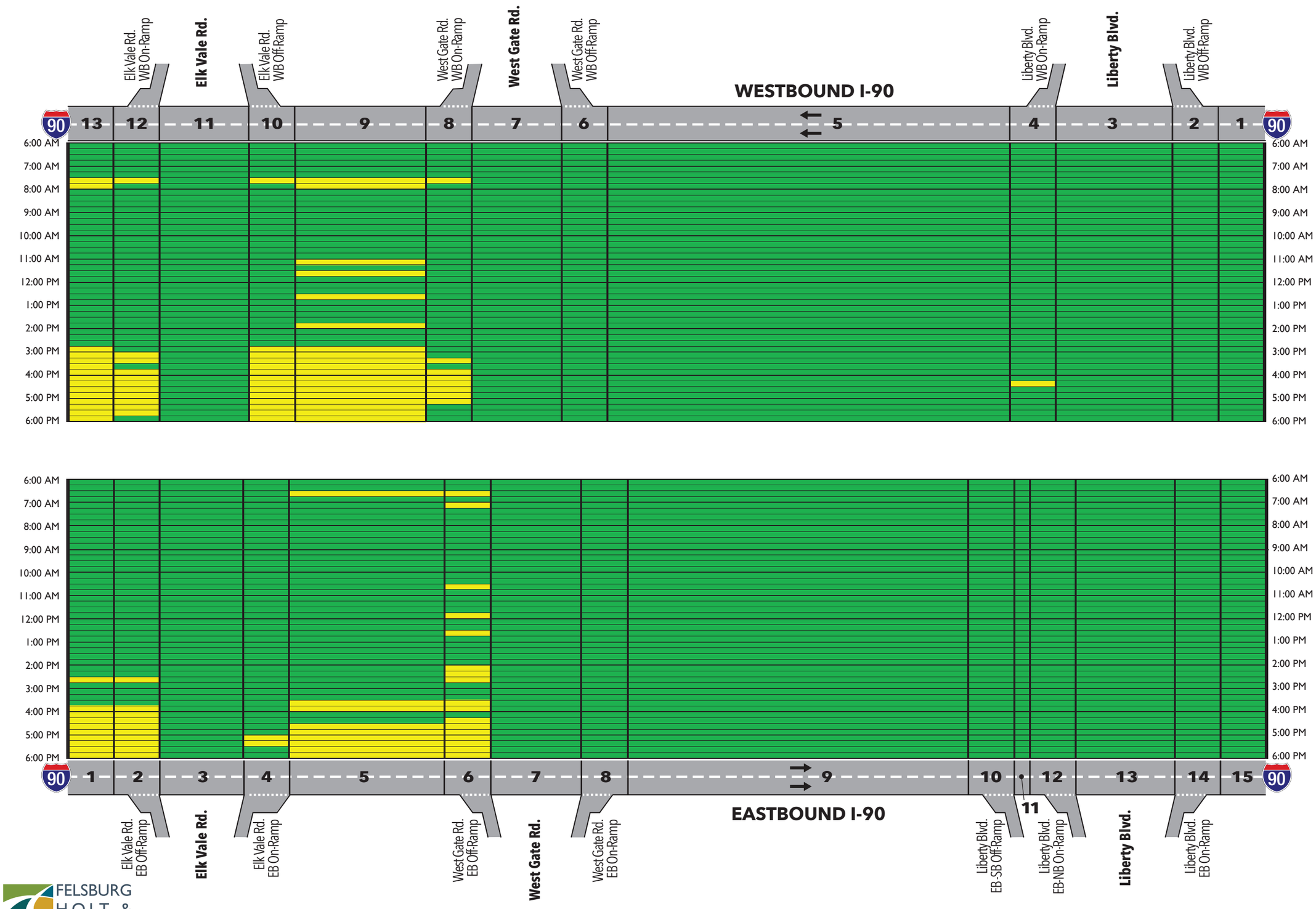
2025 Feasible Option 1: West Gate Diamond Peak Hour Freeway Traffic Volumes

FIGURE 23



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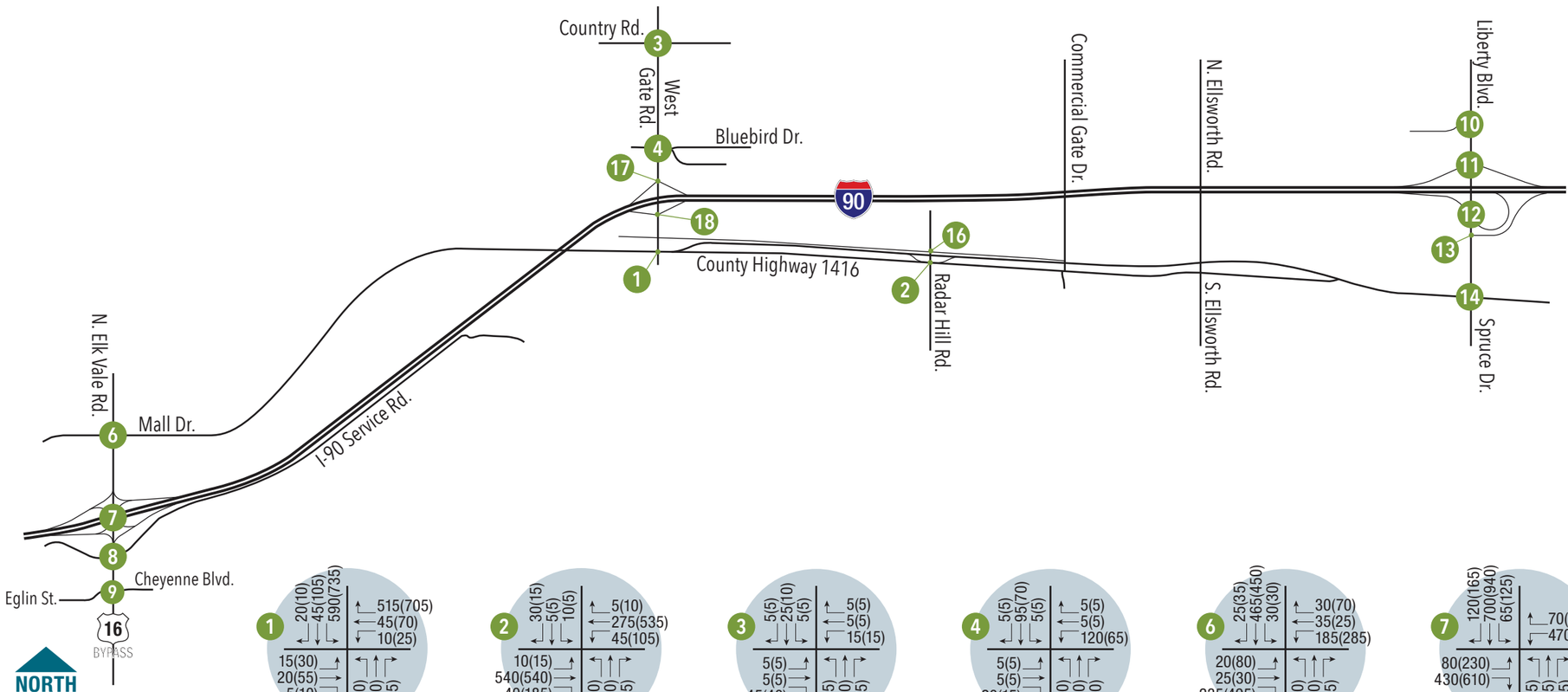
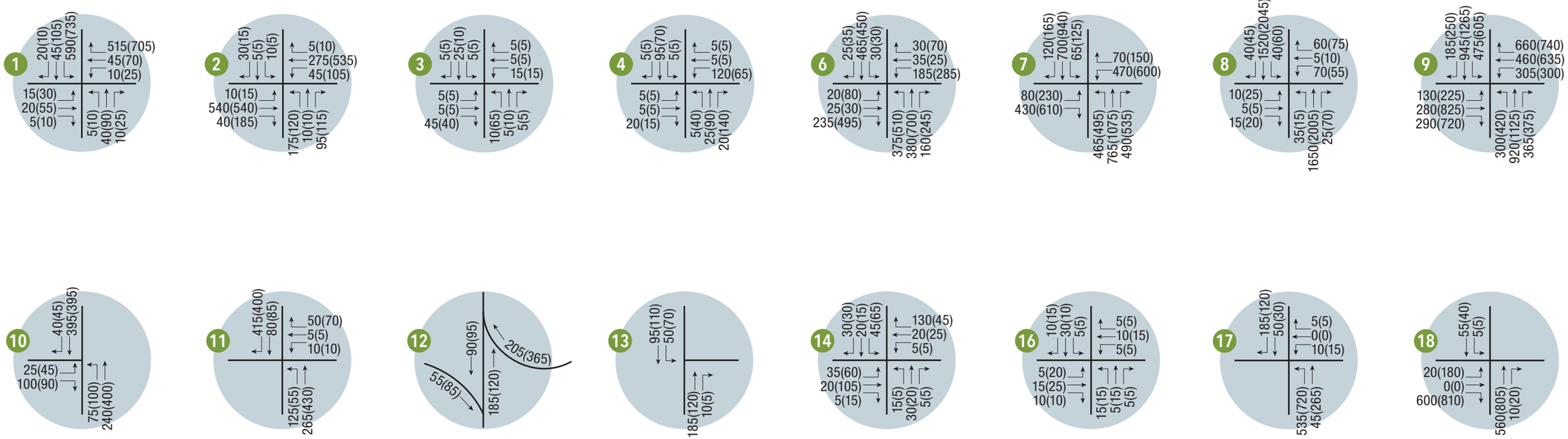
2025 Feasible Option 1: West Gate Diamond Peak Hour Freeway Traffic Operations | **FIGURE 24**



LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

NOTE:
AM Peak Hour = 7:00AM - 8: 00 AM
PM Peak Hour = 4:45PM - 5:45 PM



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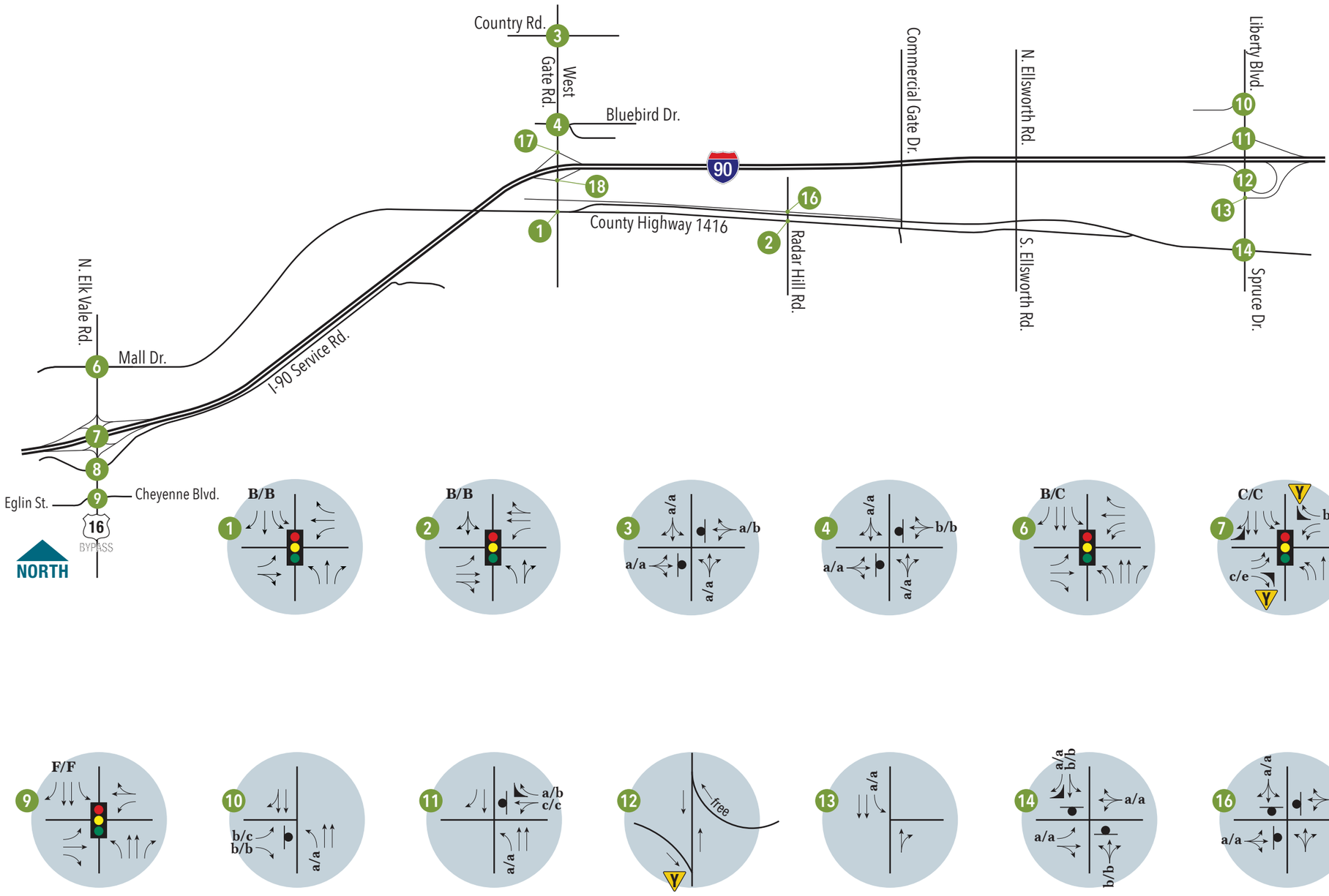
2025 Feasible Option 1: West Gate Diamond
Peak Hour Intersection Traffic Volumes

FIGURE 25

LEGEND

- **X/X** = AM/PM Peak Hour Signalized Intersection Level of Service
- **x/x** = AM/PM Peak Hour Unsignalized Intersection Level of Service
- = Stop Sign
- = Yield Sign
- = Traffic Signal



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2025 Feasible Option 1: West Gate Diamond Peak Hour Intersection Traffic Operations

FIGURE 26

Year 2050

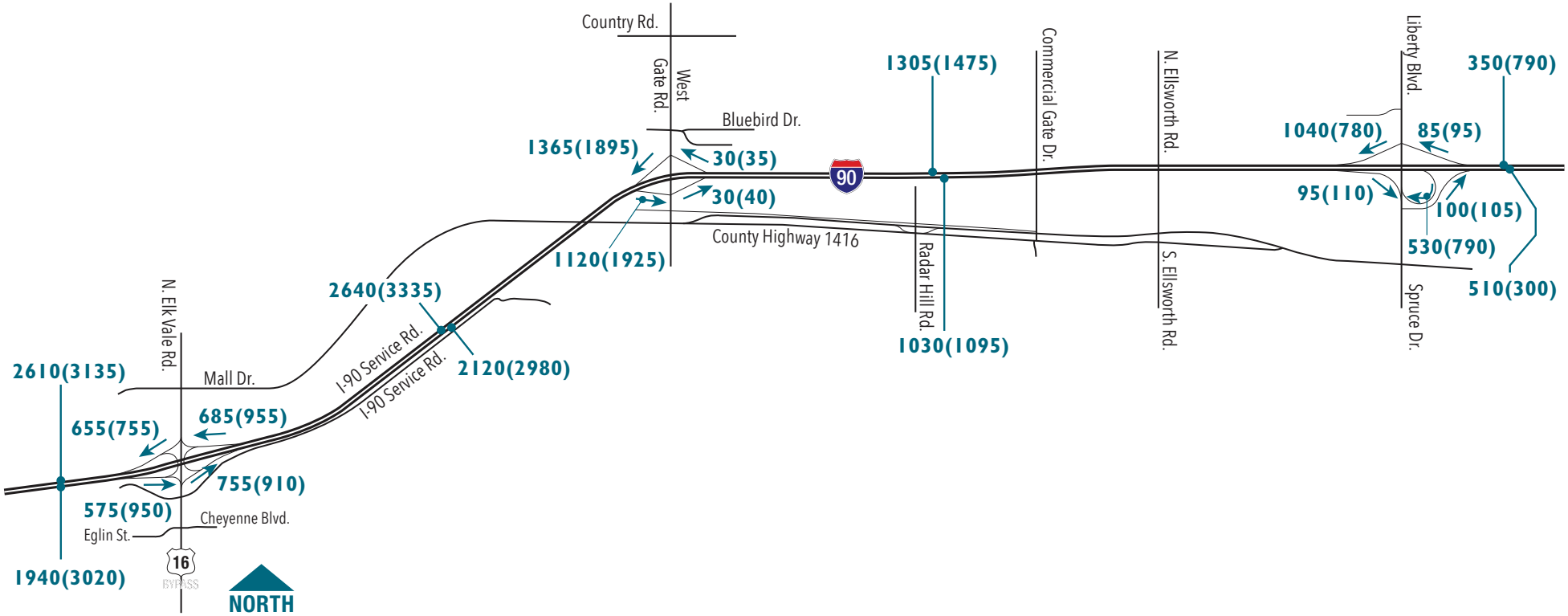
Forecasted Feasible Option 1 freeway volumes for 2050 are shown on **Figure 27**, and the associated LOS results are shown on **Figure 28**. These volumes result in reasonable operations (LOS B or better) between Exit 63 and Exit 61 westbound, but poor operations (LOS D) are still evident between Exit 61 and Exit 63 eastbound. The identified LOS D operations are for one 15-minute period out of the 12-hour analysis day and represent a significant reduction in LOS D operations when compared to No Action conditions. Hence, no targeted mitigations have been developed, but this area should be monitored for operational issues beyond the 2050 horizon year. Operational issues were also noted within and west of the Exit 61 interchange, as indicated in the No Action scenario. HCS outputs for 2050 Feasible Option 1 conditions are included in **Appendix B**.

Forecasted Feasible Option 1 intersection volumes for 2050 are shown on **Figure 29**, and the associated LOS results are shown on **Figure 30**. Again, this scenario includes the signalization of the West Gate Road/Highway 1416 intersection and the Radar Hill Road / Highway 1416 intersection and the E Mall Drive/ Elk Vale Road modifications previously described. These intersections operate acceptably, which reflects a slight improvement in operations to acceptable levels at the E Mall Drive / Elk Vale Road intersection due to traffic shifts. The signal in the Exit 61 SPUI operates at LOS D / E (AM/PM) and the eastbound to southbound right turn continue to operate at LOS f / f. This also represents a slight improvement from No Action, although operations continue at unacceptable levels. The side street approaches and the left turns from Elk Vale Road at the Edwards Street / South I-90 Service Road intersection operate at LOS f / f, as does the signal at the Cheyenne Boulevard & Eglin Street / Elk Vale Road. Along the Liberty Boulevard corridor, the left turn exiting Reagan Avenue onto Liberty Boulevard operates at LOS f / f, and the westbound I-90 off-ramp left turn to Liberty Boulevard southbound also operates at LOS f / f. These results are consistent with the No Action scenario.

The proposed Exit 63 diamond interchange ramp terminals were evaluated assuming signalization, and both ramp terminals operate at LOS A / A (AM/PM) in the 2050 scenario. This assumes a 5-lane overpass with a northbound through lane, a northbound dual left turn lane, a single southbound left turn lane, and a southbound through lane. This geometry would require widening the existing West Gate Road structure over I-90.

LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes



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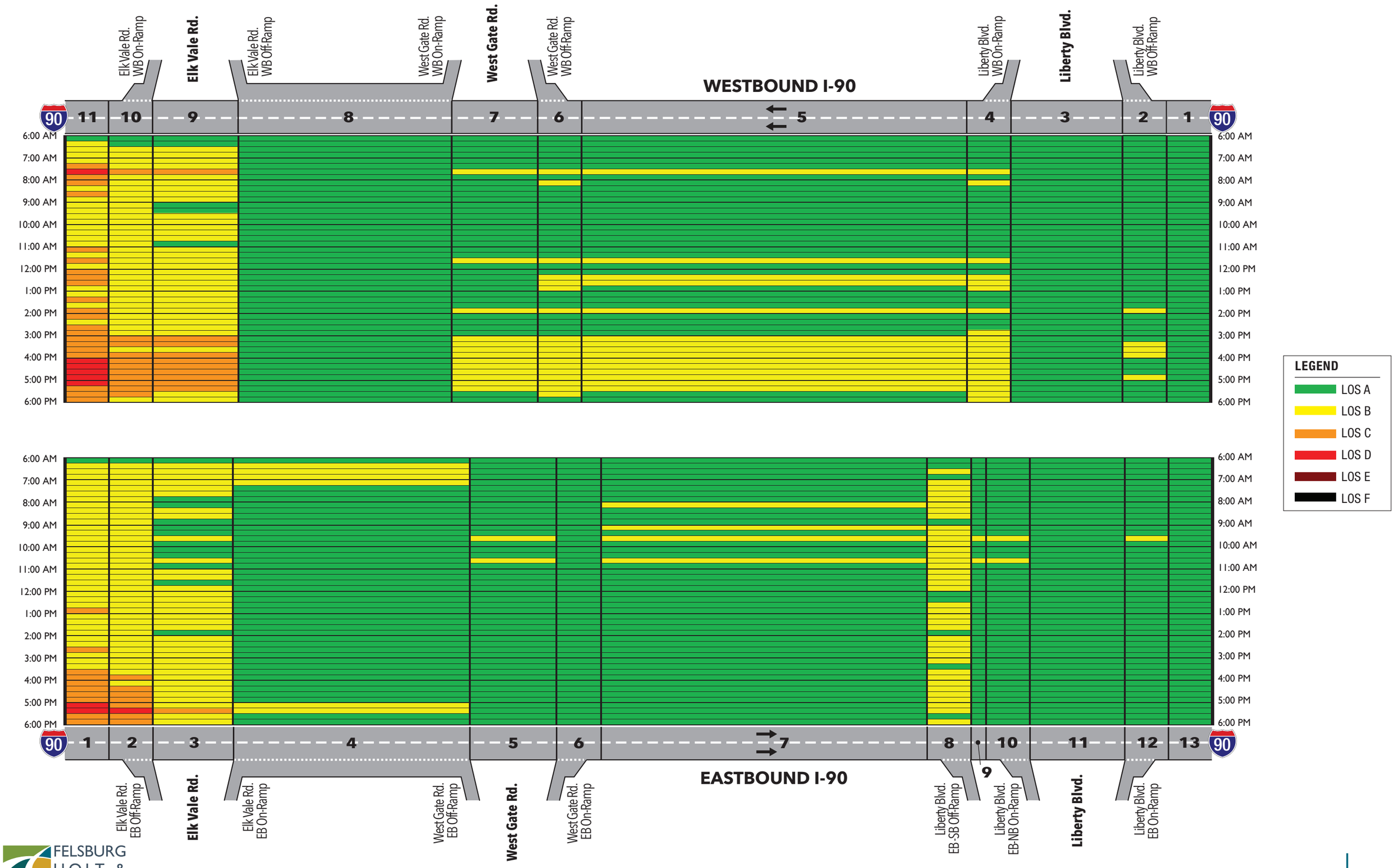
2050 Feasible Option 1: West Gate Diamond Peak Hour Freeway Traffic Volumes

FIGURE 27



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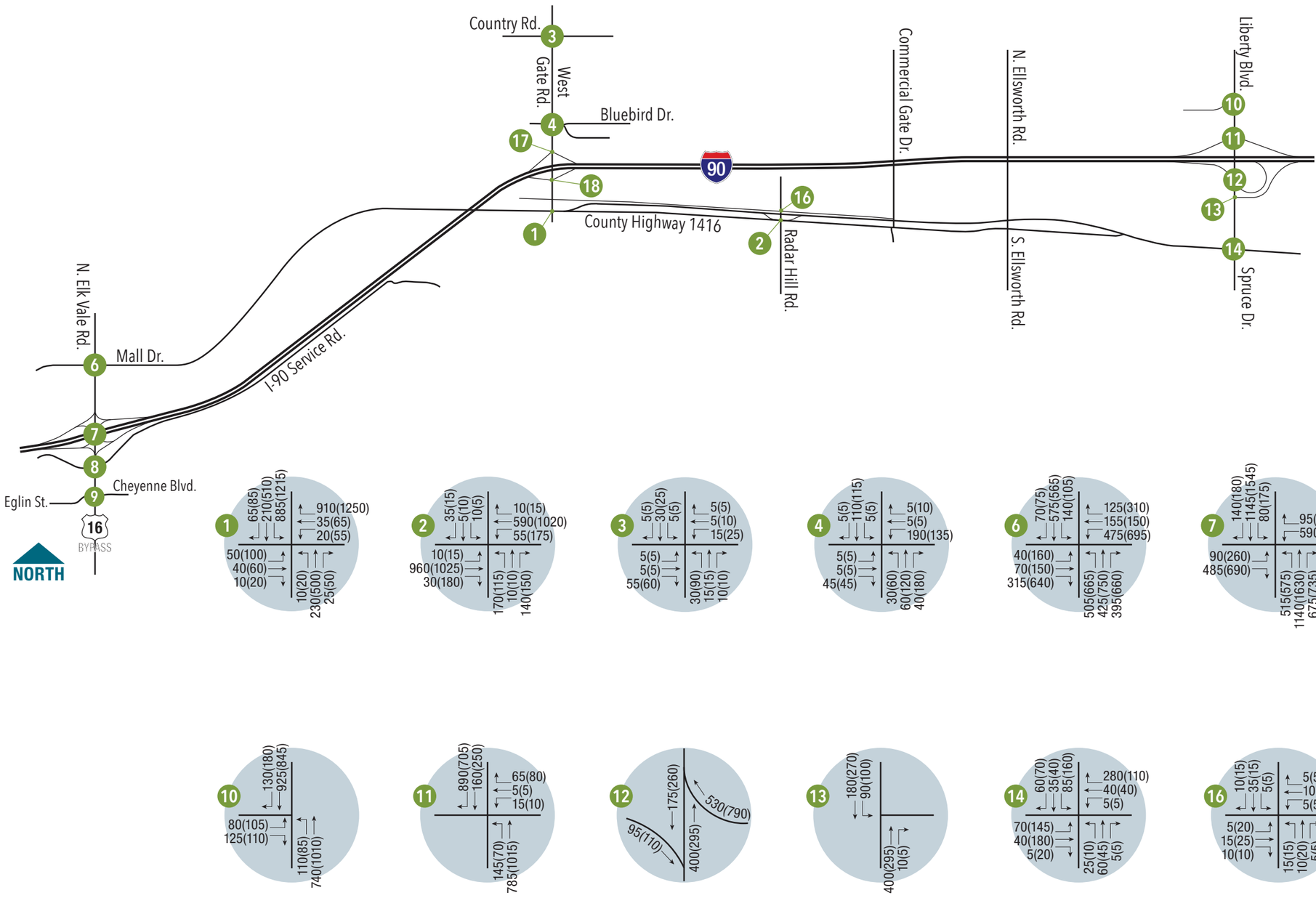
2050 Alternative 1 West Gate Road Diamond Freeway Operations | FIGURE 28



LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

NOTE:
AM Peak Hour = 7:00AM - 8: 00 AM
PM Peak Hour = 4:45PM - 5:45 PM

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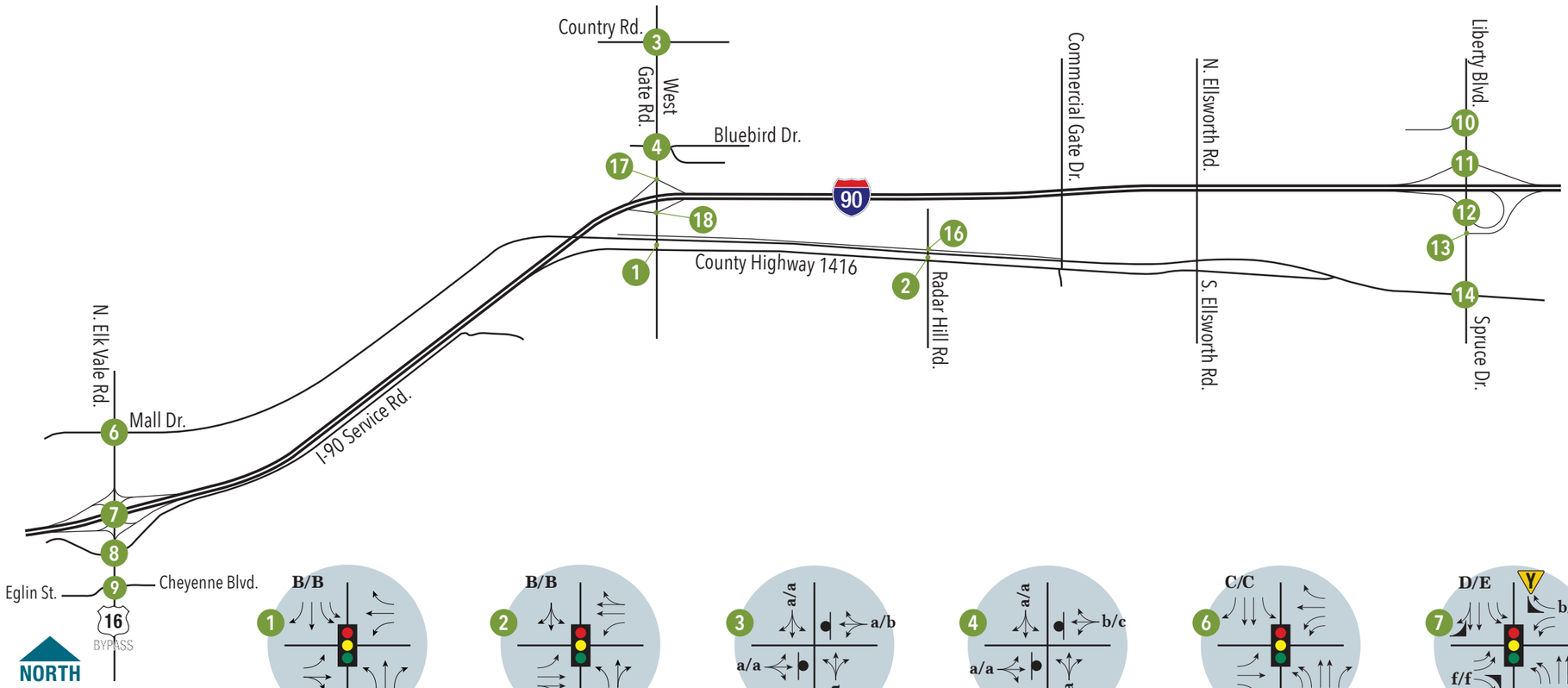
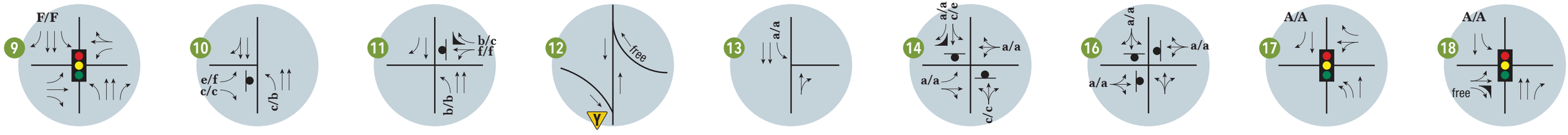
2050 Feasible Option 1: West Gate Diamond
Peak Hour Intersection Traffic Volumes

FIGURE 29



LEGEND

- **X/X** = AM/PM Peak Hour Signalized Intersection Level of Service
- **x/x** = AM/PM Peak Hour Unsignalized Intersection Level of Service
- = Stop Sign
- = Yield Sign
- = Traffic Signal



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2050 Feasible Option 1: West Gate Diamond Peak Hour Intersection Traffic Operations

FIGURE 30

5.3.2 Feasible Option 2: Diamond Interchange at Highway 1416

The diamond interchange at Highway 1416 will replace the existing directional interchange at the same location but with the addition of east-facing ramps and the reconstruction of the eastbound off-ramp and westbound on-ramp. It is assumed that the E Mall Drive extension will connect along the Highway 1416 alignment, crossing I-90 through the interchange.

Year 2025

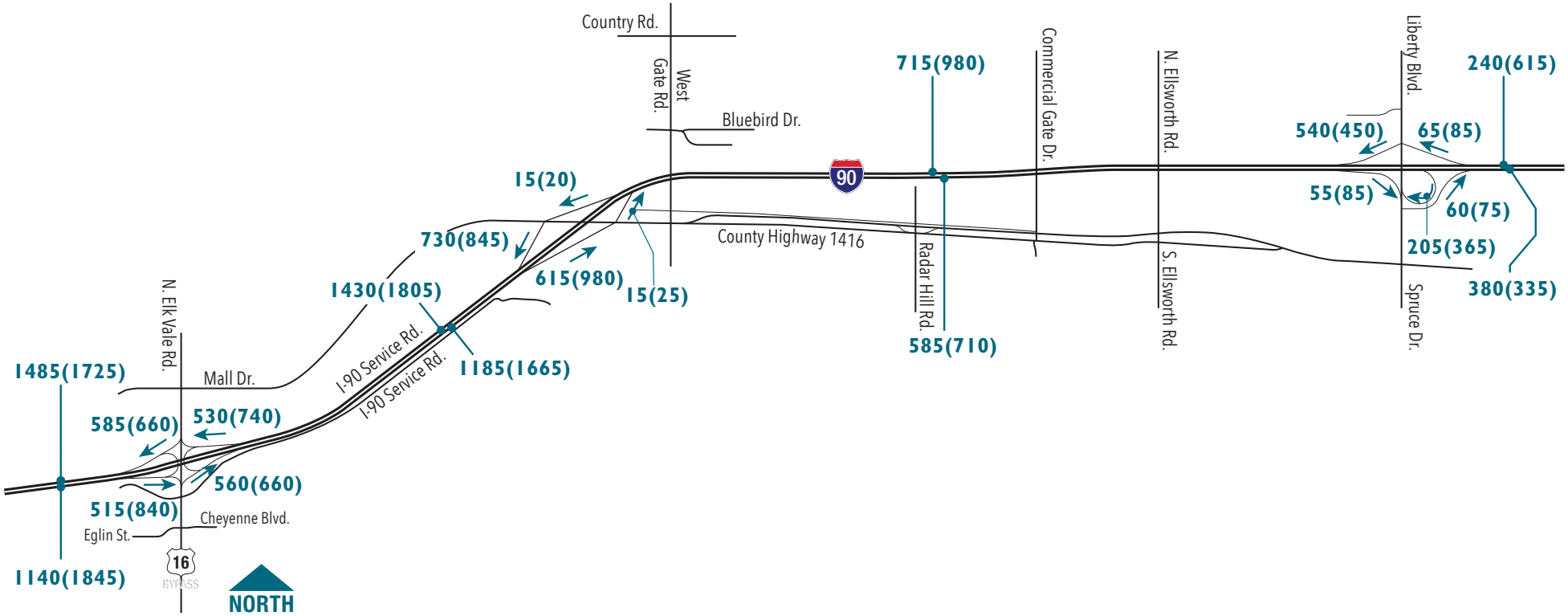
Forecasted Feasible Option 2 freeway volumes for 2025 are shown on **Figure 31**, and the associated LOS results are shown on **Figure 32**. As can be seen, there are no locations where the 2025 traffic operations exceed the LOS C threshold. HCS outputs for 2025 Feasible Option 2 conditions are included in **Appendix B**.

Forecasted Feasible Option 2 intersection volumes for 2025 are shown on **Figure 33**, and the associated LOS results are shown on **Figure 34**. Again, this scenario includes the signalization of the West Gate Road/Highway 1416 intersection and the Radar Hill Road / Highway 1416 intersection and the E Mall Drive/ Elk Vale Road modifications described previously. These signalized intersections continue to operate acceptably under this Feasible Option in 2025. Poor LOS results continue to be present for the eastbound to southbound right turn at the Exit 61 SPUI and for the side street approaches at the Edwards Street / South I-90 Service Road intersection with Elk Vale Road. Operations at the Cheyenne Boulevard & Eglin Street / Elk Vale Road continue at LOS F / F. No operational deficiencies were noted along Liberty Boulevard.

The proposed Exit 63 diamond interchange ramp terminals were evaluated assuming signalization. The west ramp terminal intersection operates at LOS A / A (AM / PM), while the east ramp terminal intersection operates at LOS B / A (AM/PM) in the 2025 scenario. This assumes a 5-lane overpass with a westbound through lane, a westbound dual left turn lane, a single eastbound left turn lane back-to-back with one of the westbound left turn lanes, and two eastbound through lanes. This geometry would require replacing the existing Highway 1416 structure over I-90.

LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes



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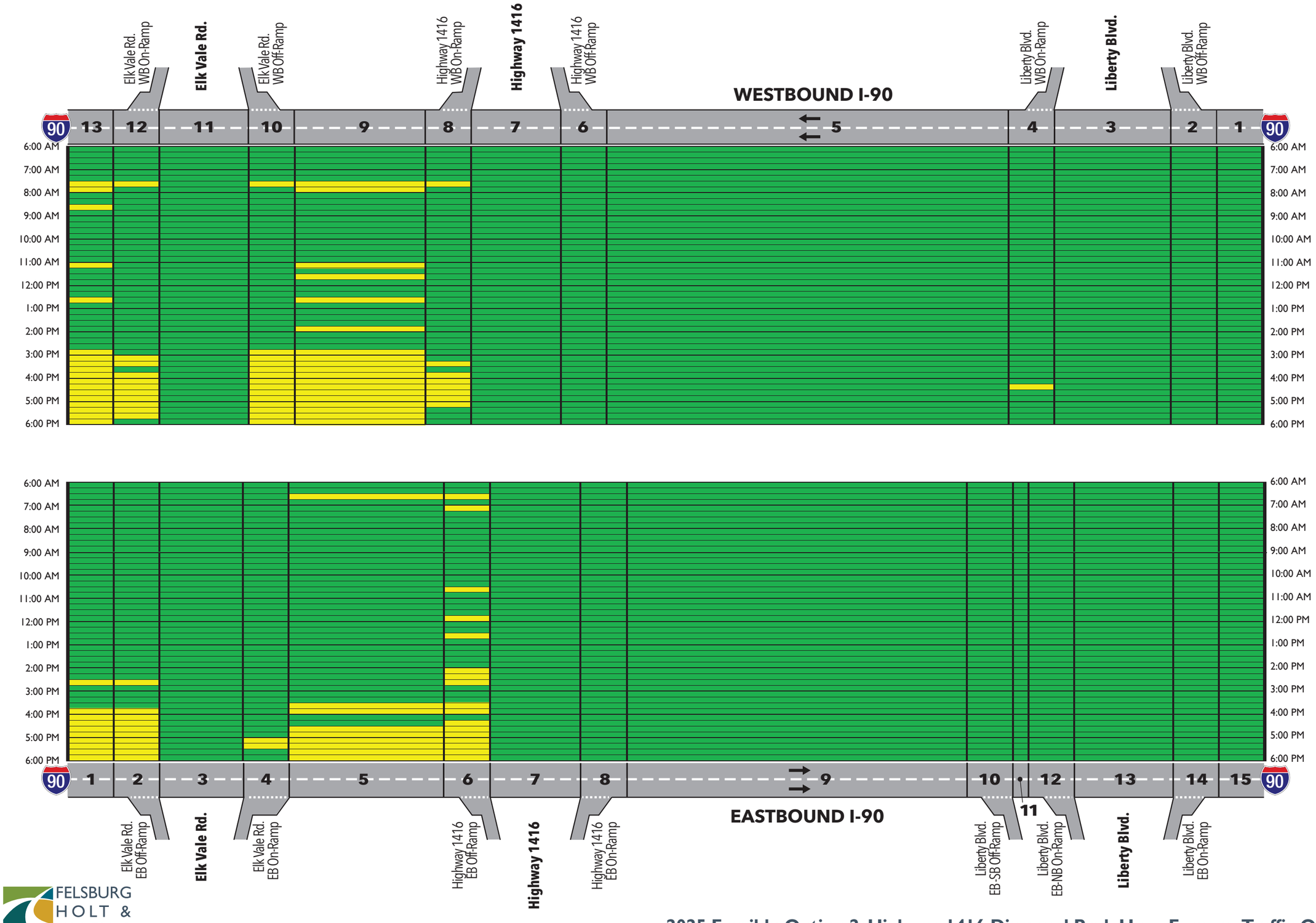
2025 Feasible Option 2: Highway 1416 Diamond Peak Hour Freeway Traffic Volumes

FIGURE 31



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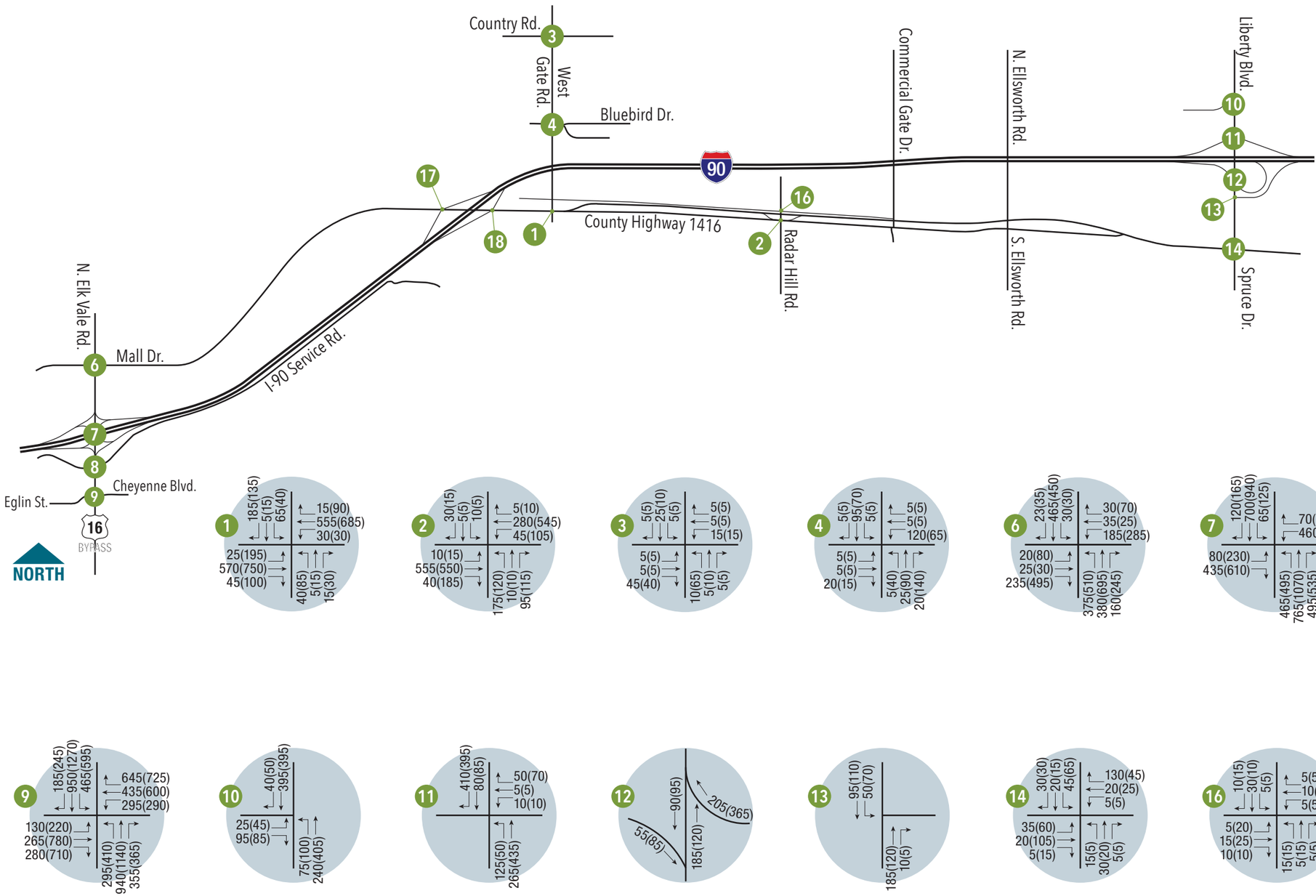
SDDOT I-90 Exit 63 Interchange 18-324 12/3/20

2025 Feasible Option 2: Highway 1416 Diamond Peak Hour Freeway Traffic Operations | FIGURE 32



LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

NOTE:
AM Peak Hour = 7:00AM - 8: 00 AM
PM Peak Hour = 4:45PM - 5:45 PM

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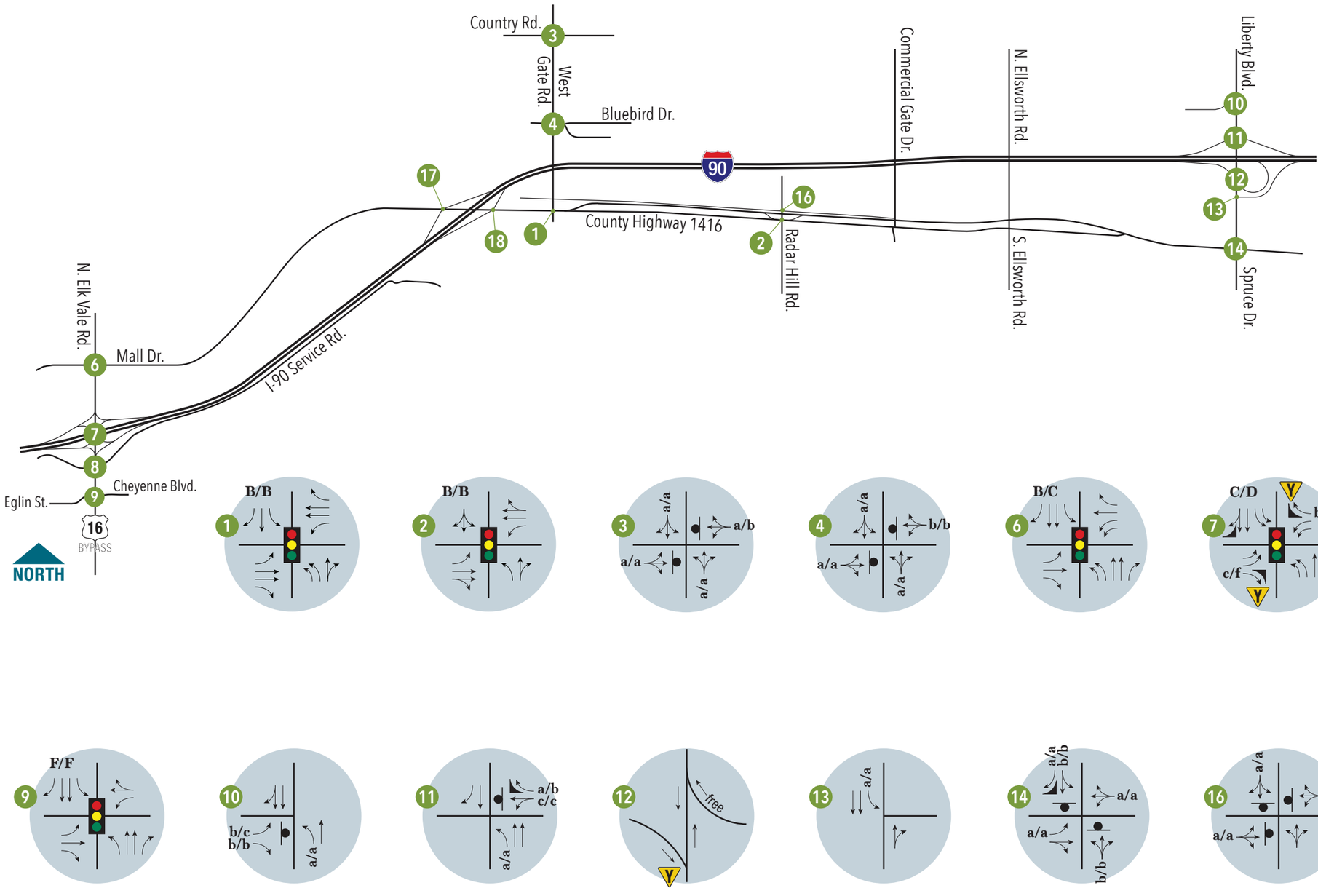
SDDOT I-90 Exit 63 Interchange 18-324 12/3/20

2025 Feasible Option 2: Highway 1416 Diamond Peak Hour Intersection Traffic Volumes

FIGURE 33



LEGEND

- X/X = AM/PM Peak Hour Signalized Intersection Level of Service
- x/x = AM/PM Peak Hour Unsignalized Intersection Level of Service
- = Stop Sign
- = Yield Sign
- = Traffic Signal

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SDDOT I-90 Exit 63 Interchange 18-324 12/3/20

2025 Feasible Option 2: Highway 1416 Diamond Peak Hour Intersection Traffic Operations

FIGURE 34

Year 2050

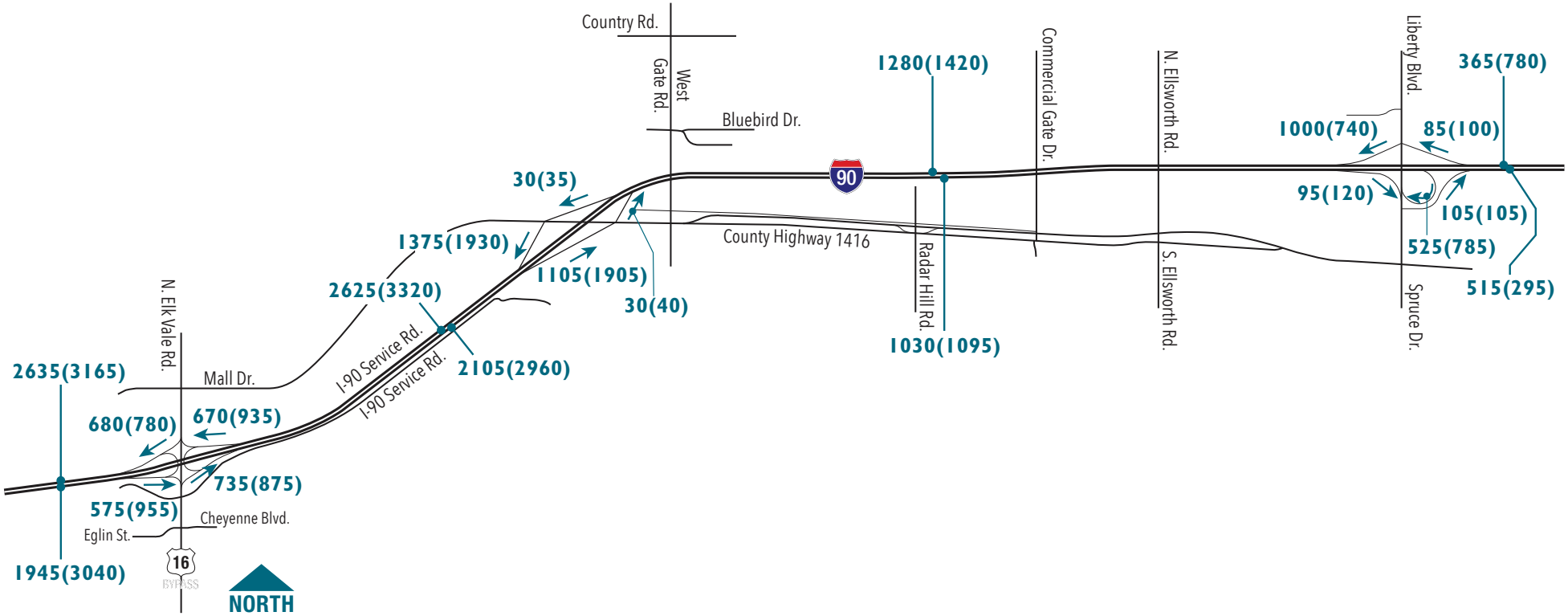
Forecasted Feasible Option 2 freeway volumes for 2050 are shown on **Figure 35**, and the associated LOS results are shown on **Figure 36**. These volumes result in acceptable operations (LOS C or better) between Exit 63 and Exit 61 westbound, but poor operations (LOS D) are still evident between Exit 61 and Exit 63 eastbound. The identified LOS D operations are for one 15-minute period out of the 12-hour analysis day and represent a significant reduction in LOS D operations when compared to No Action conditions. Hence, no targeted mitigations have been developed, but this area should be monitored for operational issues beyond the 2050 horizon year. Operational issues were also noted within and west of the Exit 61 interchange, as indicated in the No Action scenario. HCS outputs for 2050 Feasible Option 2 conditions are included in **Appendix B**.

Forecasted Feasible Option 2 intersection volumes for 2050 are shown on **Figure 37** and the associated LOS results are shown on **Figure 38**. Again, this scenario includes the signalization of the West Gate Road/Highway 1416 intersection and the Radar Hill Road / Highway 1416 intersection and the E Mall Drive/ Elk Vale Road modifications described previously. These intersections operate acceptably, which reflects a slight improvement in operations to acceptable levels at the E Mall Drive / Elk Vale Road intersection due to traffic shifts. The signal in the Exit 61 SPUI operates at LOS D / D (AM/PM) and the eastbound to southbound right turn continues to operate at LOS f / f. This also represents a slight improvement from No Action, although operations continue at unacceptable levels. The side street approaches and the left turns from Elk Vale Road at the Edwards Street / South I-90 Service Road intersection operate at LOS f / f, as does the signal at the Cheyenne Boulevard & Eglin Street / Elk Vale Road. Along the Liberty Boulevard corridor, the left turn exiting Reagan Avenue onto Liberty Boulevard operates at LOS f / f, and the westbound I-90 off-ramp left turn to Liberty Boulevard southbound also operates at LOS f / f. These results are consistent with the No Action scenario.

The proposed Exit 63 diamond interchange ramp terminals were evaluated assuming signalization, The west ramp terminal intersection operates at LOS A / B (AM/PM), while the east ramp terminal intersection operates at LOS B / A (AM/PM) in the 2050 scenario. This assumes a 5-lane overpass with a westbound through lane, a westbound dual left turn lane, a single eastbound left turn lane back-to-back with one of the westbound left turn lanes, and two eastbound through lanes. This geometry would require replacing the existing Highway 1416 structure over I-90.

LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

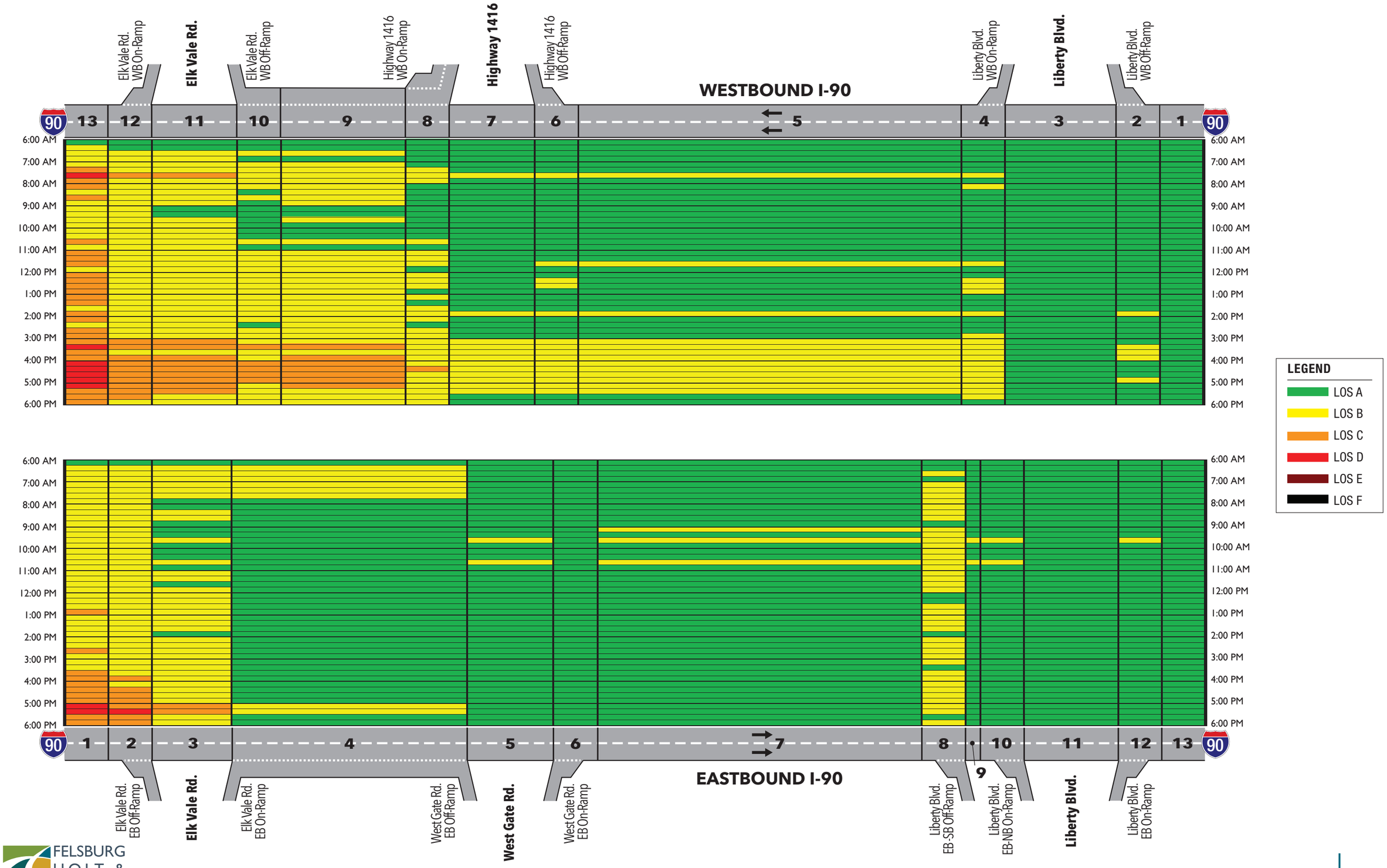


FELSBURG HOLT & ULLEVIG

SDDOT I-90 Exit 63 Interchange 18-324 12/3/20

2050 Feasible Option 2: Highway 1416 Diamond Peak Hour Freeway Traffic Volumes

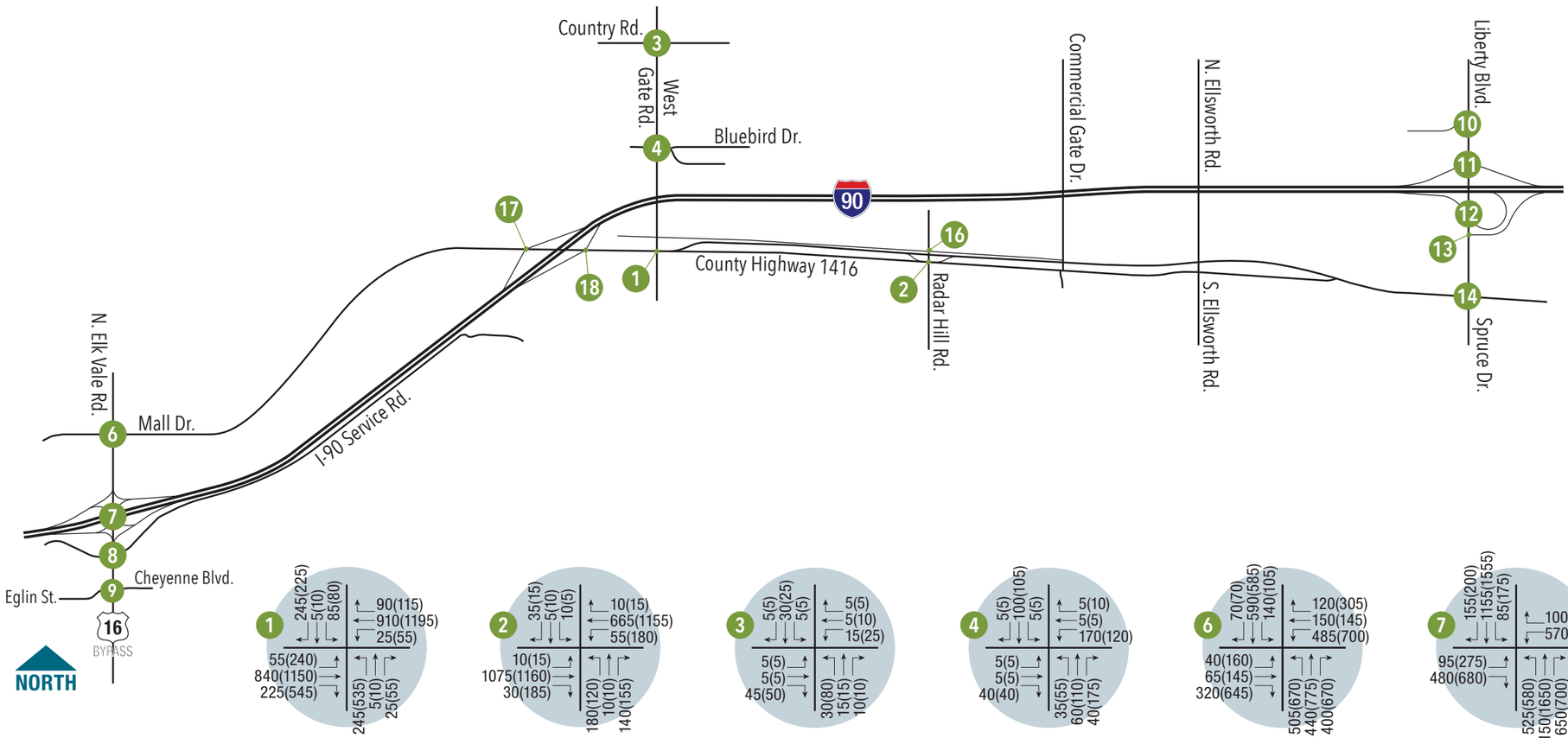
FIGURE 35

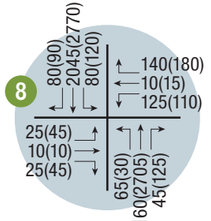


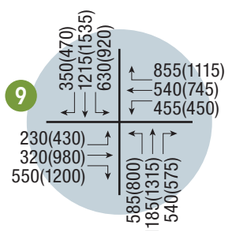
FELSBURG HOLT & ULLEVIG

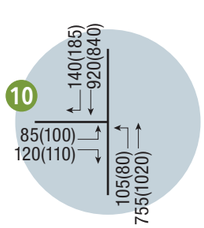
SDDOT I-90 Exit 63 Interchange 18-324 2/15/21

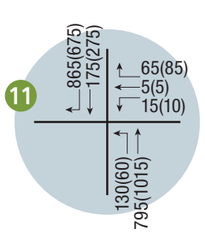
2050 Alternative 2 - County Highway 1416 Diamond Freeway Operations | FIGURE 36

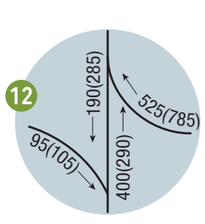


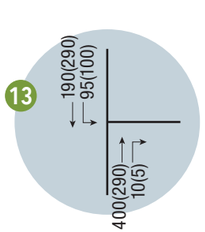


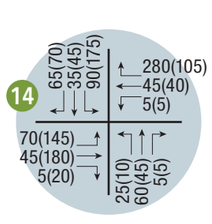


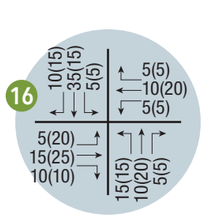


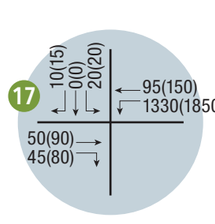


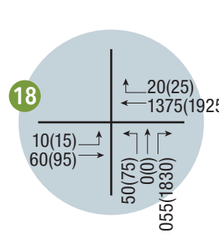












LEGEND

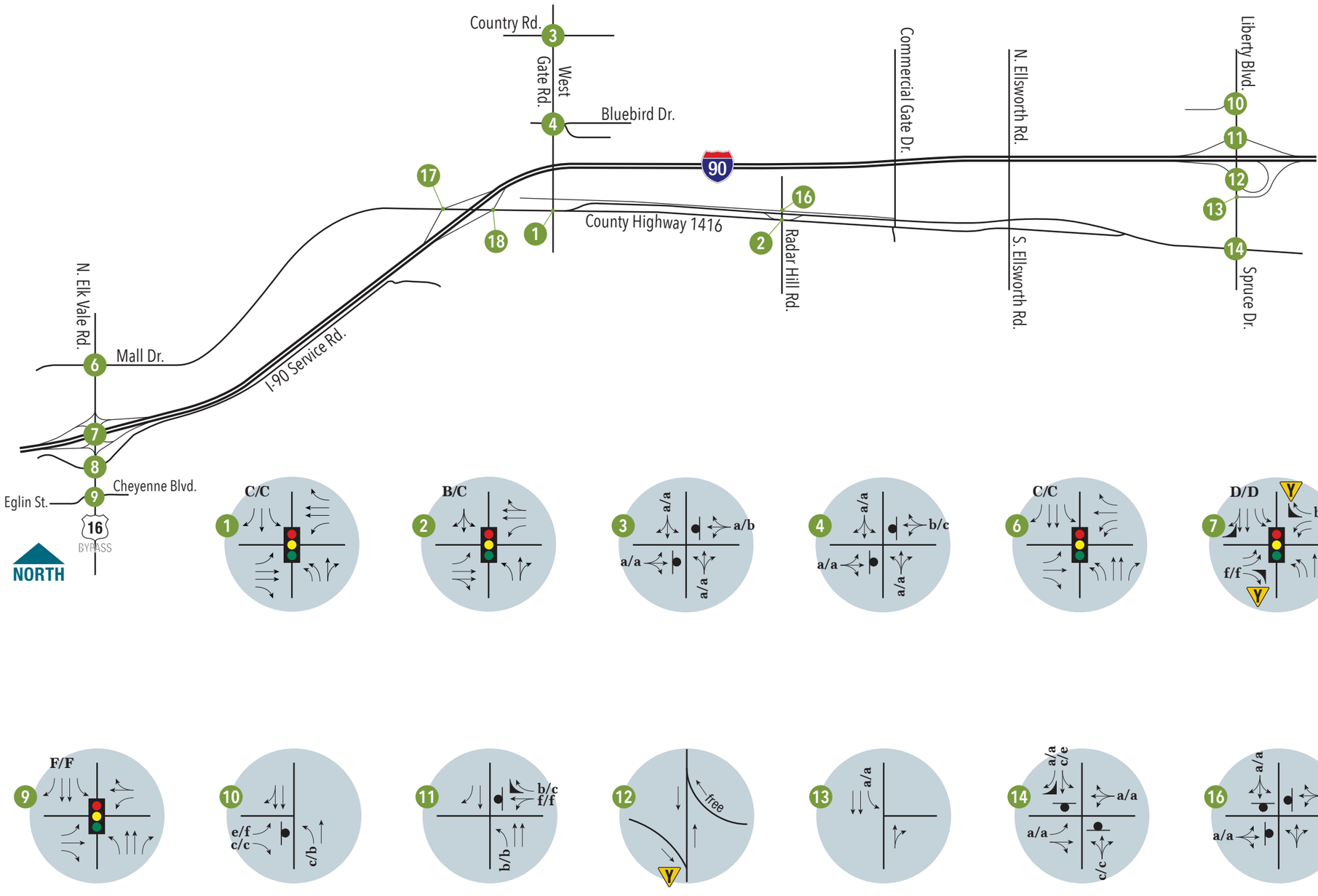
XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

NOTE:
AM Peak Hour = 7:00AM - 8: 00 AM
PM Peak Hour = 4:45PM - 5:45 PM

FELSBURG HOLT & ULLEVIG
SDDOT I-90 Exit 63 Interchange 18-324 12/3/20

2050 Feasible Option 2: Highway 1416 Diamond
Peak Hour Intersection Traffic Volumes

FIGURE 37



LEGEND

- X/X = AM/PM Peak Hour Signalized Intersection Level of Service
- x/x = AM/PM Peak Hour Unsignalized Intersection Level of Service
- = Stop Sign
- = Yield Sign
- = Traffic Signal

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SDDOT I-90 Exit 63 Interchange 18-324 12/3/20

2050 Feasible Option 2: Highway 1416 Diamond Peak Hour Intersection Traffic Operations

FIGURE 38

5.3.3 Feasible Option 3: Diverging Diamond Interchange at Highway 1416

The diverging diamond interchange at Highway 1416 will replace the existing directional interchange at the same location but with the addition of east-facing ramps and reconstruction of the eastbound off-ramp and westbound on-ramp in a diverging diamond configuration. It is assumed that the E Mall Drive extension will connect along the Highway 1416 alignment, crossing I-90 through the interchange.

Year 2025

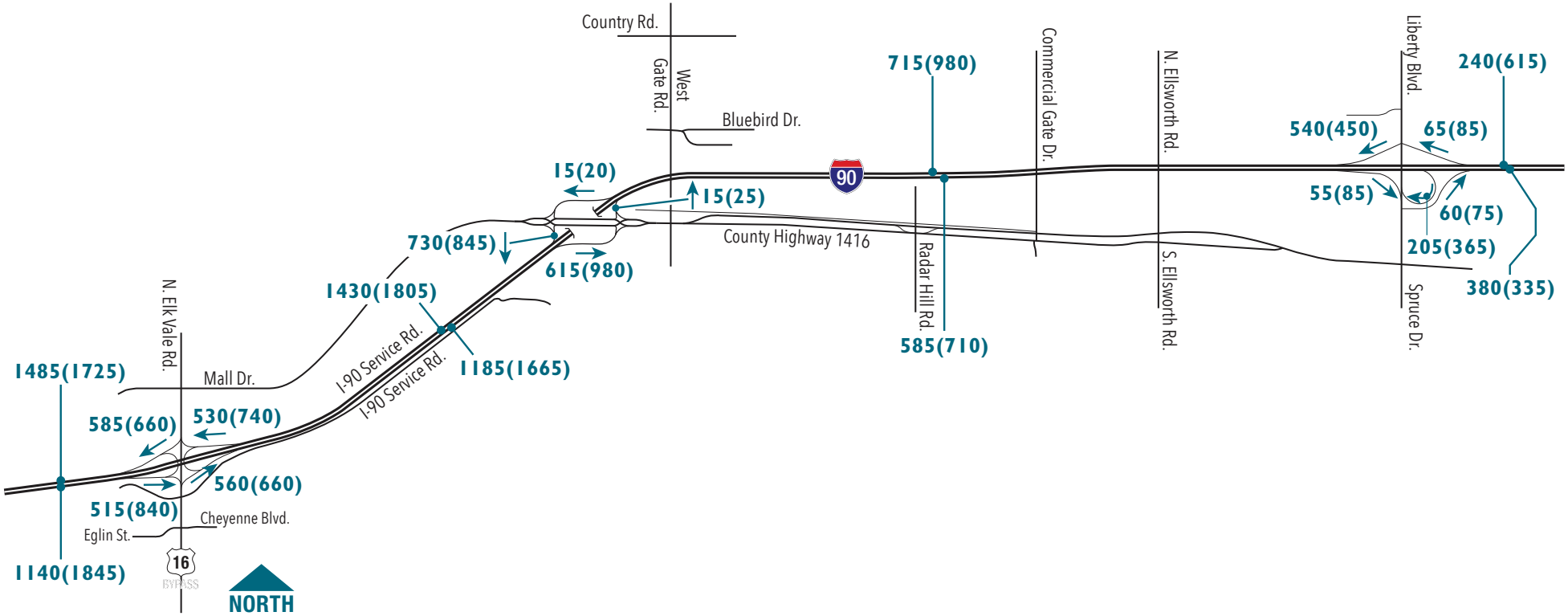
Forecasted Feasible Option 3 freeway volumes for 2025 are shown on **Figure 39**, and the associated LOS results are shown on **Figure 40**. As can be seen, there are no locations where the 2025 traffic operations exceed the LOS C threshold. HCS outputs for 2025 Feasible Option 3 conditions are included in **Appendix B**.

Forecasted Feasible Option 3 intersection volumes for 2025 are shown on **Figure 41**, and the associated LOS results are shown on **Figure 42**. Again, this scenario includes the signalization of the West Gate Road/Highway 1416 intersection and the Radar Hill Road / Highway 1416 intersection and the E Mall Drive/ Elk Vale Road modifications described previously. These signalized intersections continue to operate acceptably under this Feasible Option in 2025. Poor LOS results continue to be present for the eastbound to southbound right turn at the Exit 61 SPUI and for the side street approaches at the Edwards Street / South I-90 Service Road intersection with Elk Vale Road. Operations at the Cheyenne Boulevard & Eglin Street / Elk Vale Road continue at LOS F / F. No operational deficiencies were noted along Liberty Boulevard.

The proposed Exit 63 diverging diamond interchange ramp terminals were evaluated assuming signalization, and both ramp terminals operate at LOS A / A (AM/PM) in the 2025 scenario. This assumes two 2-lane overpasses of I-90, each with a single through lane and a dedicated left turn lane. This geometry would require replacing the existing Highway 1416 structure over I-90.

LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

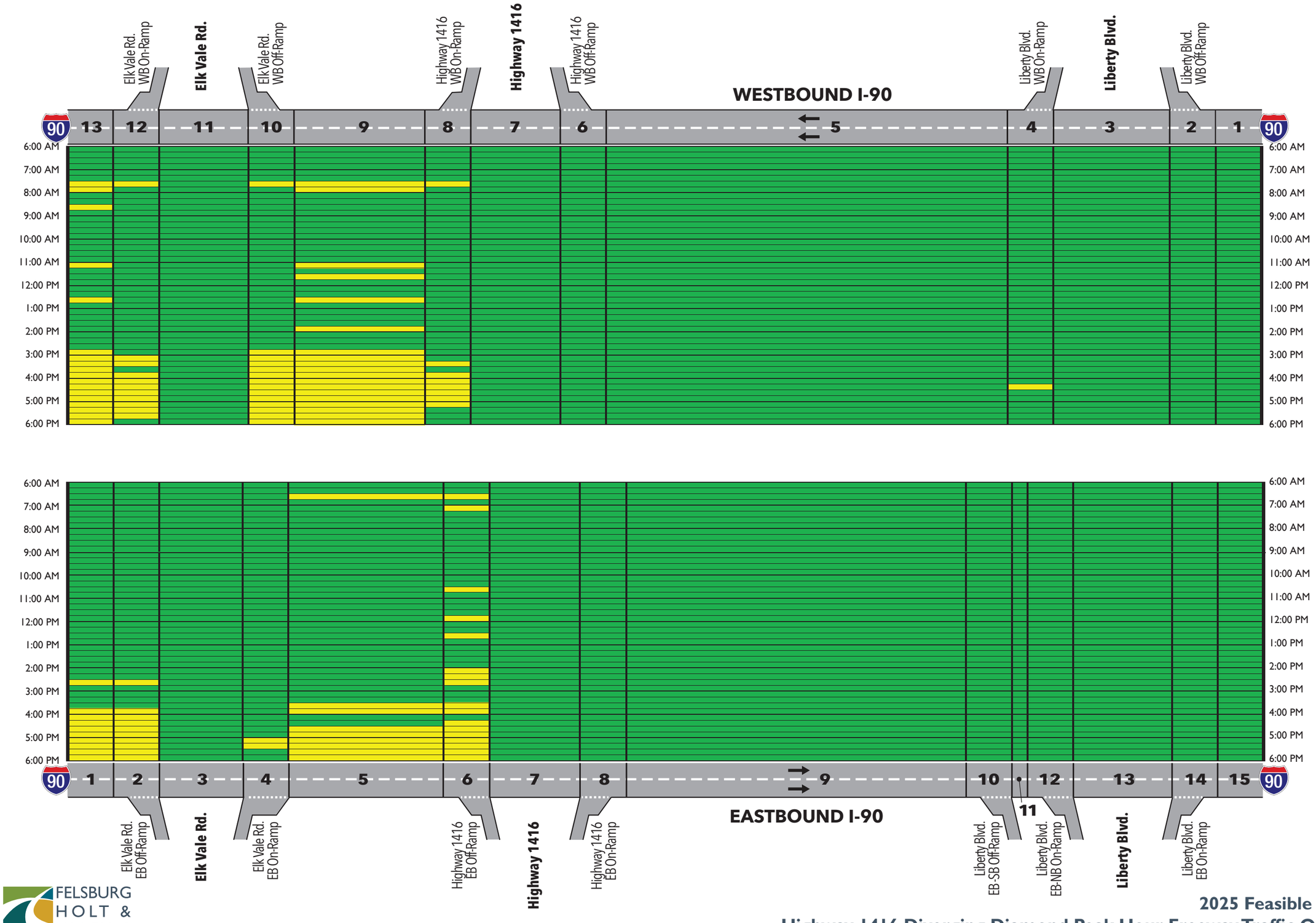


FELSBURG HOLT & ULLEVIG

SDDOT I-90 Exit 63 Interchange 18-324 12/3/20

2025 Feasible Option 3: Highway 1416 Diverging Diamond Peak Hour Freeway Traffic Volumes

FIGURE 39

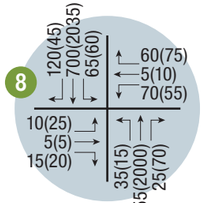


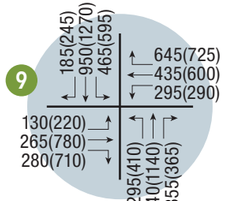
FELSBURG HOLT & ULLEVIG

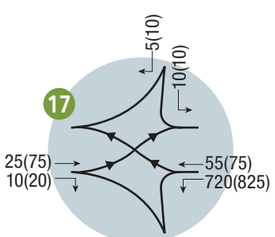
SDDOT I-90 Exit 63 Interchange 18-324 12/3/20

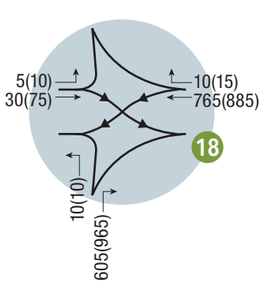
2025 Feasible Option 3:
Highway 1416 Diverging Diamond Peak Hour Freeway Traffic Operations

FIGURE 40









LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

NOTE:
AM Peak Hour = 7:00AM - 8: 00 AM
PM Peak Hour = 4:45PM - 5:45 PM

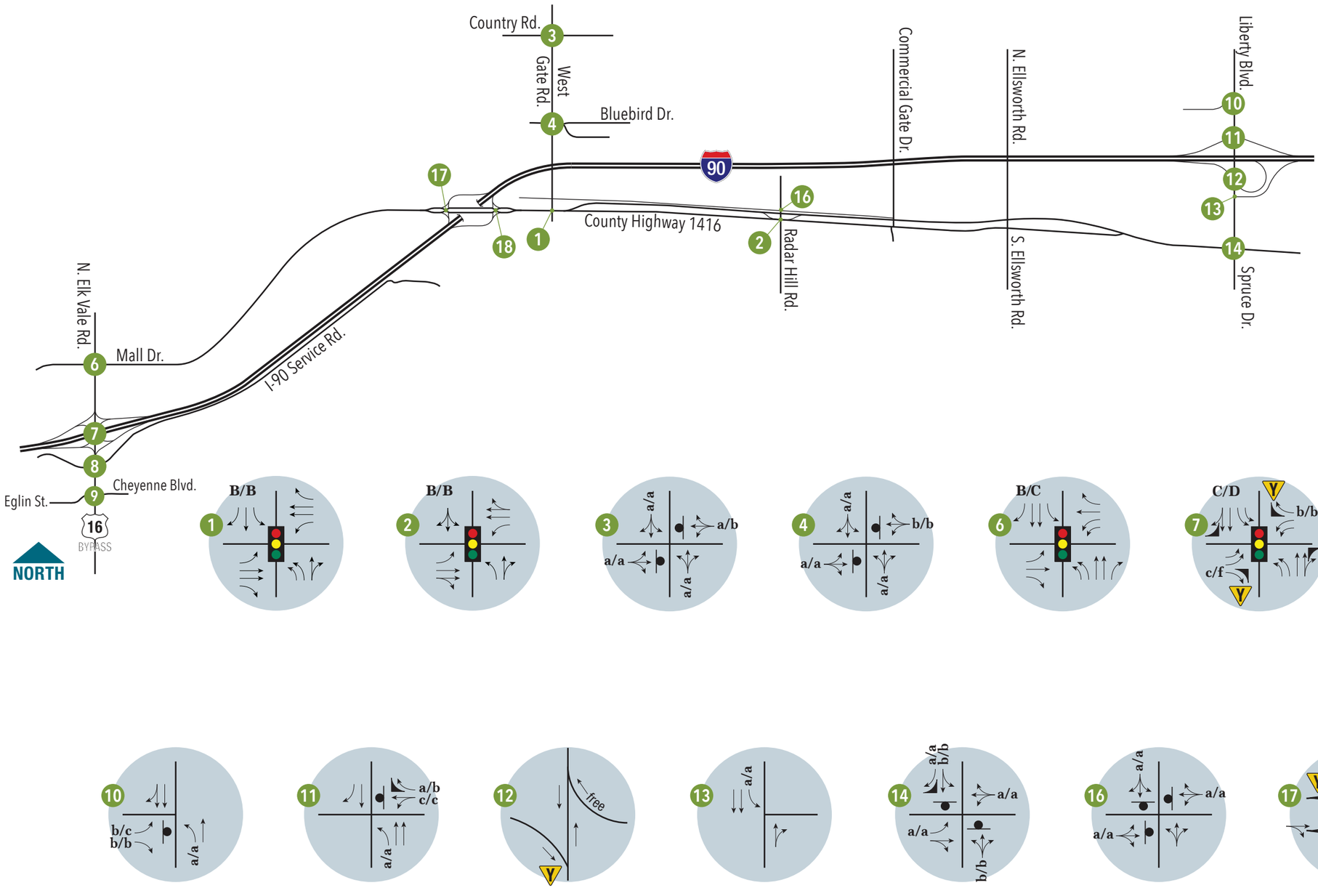
FELSBURG HOLT & ULLEVIG
SDDOT I-90 Exit 63 Interchange 18-324 12/3/20

2025 Feasible Option 3: Highway 1416 Diverging Diamond
Peak Hour Intersection Traffic Volumes

FIGURE 41

LEGEND

- **X/X** = AM/PM Peak Hour Signalized Intersection Level of Service
- **x/x** = AM/PM Peak Hour Unsignalized Intersection Level of Service
- = Stop Sign
- = Yield Sign
- = Traffic Signal



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SDDOT I-90 Exit 63 Interchange 18-324 12/3/20

2025 Feasible Option 3: Highway 1416 Diverging Diamond Peak Hour Intersection Traffic Operations

FIGURE 42

Year 2050

Forecasted Feasible Option 3 freeway volumes for 2050 are shown on **Figure 43**, and the associated LOS results are shown on **Figure 44**. These volumes result in acceptable operations (LOS C or better) between Exit 63 and Exit 61 westbound, but poor operations (LOS D) are still evident between Exit 61 and Exit 63 eastbound. The identified LOS D operations are for one 15-minute period out of the 12-hour analysis day and represent a significant reduction in LOS D operations when compared to No Action conditions. Hence, no targeted mitigations have been developed, but this area should be monitored for operational issues beyond the 2050 horizon year. Operational issues were also noted within and west of the Exit 61 interchange, as indicated in the No Action scenario. HCS outputs for 2050 Feasible Option 3 conditions are included in **Appendix B**.

Forecasted Feasible Option 3 intersection volumes for 2050 are shown on **Figure 45** and the associated LOS results are shown on **Figure 46**. Again, this scenario includes the signalization of the West Gate Road/Highway 1416 intersection and the Radar Hill Road / Highway 1416 intersection and the E Mall Drive/ Elk Vale Road modifications described previously. These intersections operate acceptably, which reflects a slight improvement in operations to acceptable levels at the E Mall Drive / Elk Vale Road intersection due to traffic shifts. The signal in the Exit 61 SPUI operates at LOS D / D (AM/PM) and the eastbound to southbound right turn continues to operate at LOS f / f. This also represents a slight improvement from No Action, although operations continue at unacceptable levels. The side street approaches and the left turns from Elk Vale Road at the Edwards Street / South I-90 Service Road intersection operate at LOS f / f, as does the signal at the Cheyenne Boulevard & Eglin Street / Elk Vale Road. Along the Liberty Boulevard corridor, the left turn exiting Reagan Avenue onto Liberty Boulevard operates at LOS e / f, and the westbound I-90 off-ramp left turn to Liberty Boulevard southbound operates at LOS f / f. These results are consistent with the No Action scenario.

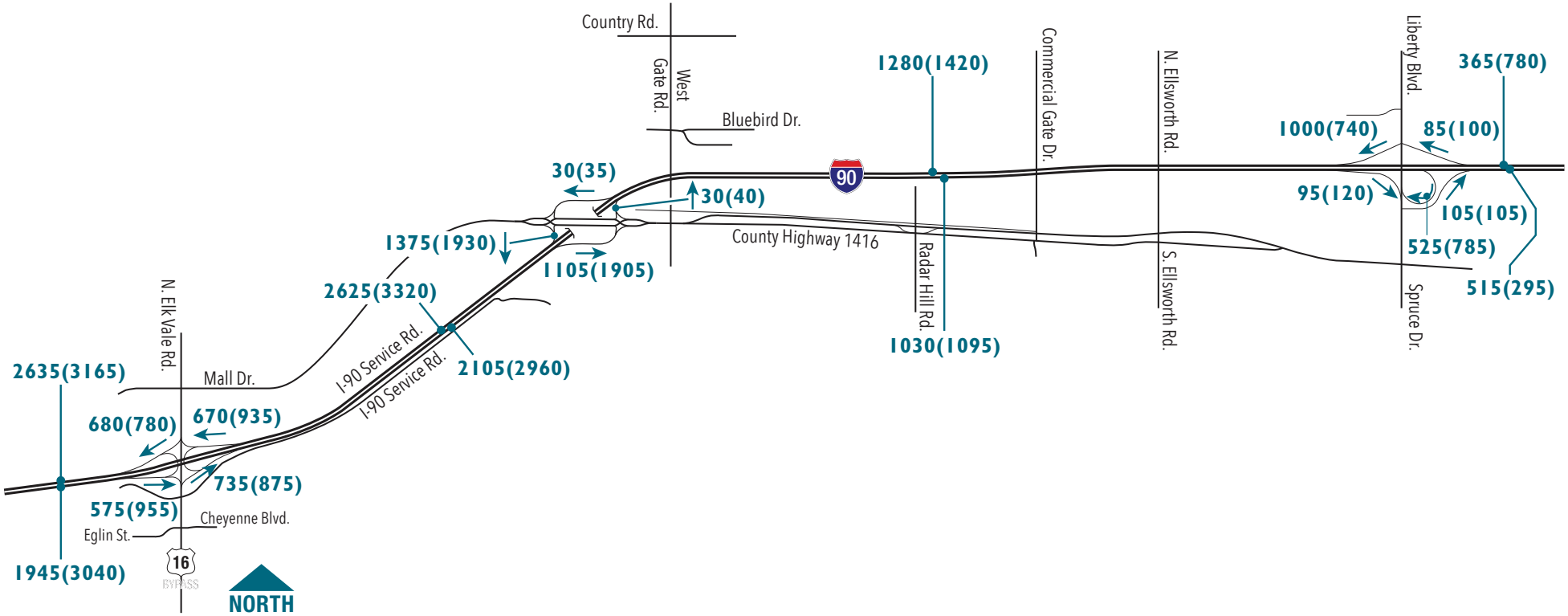
The proposed Exit 63 diverging diamond interchange ramp terminals were evaluated assuming signalization. The west ramp terminal intersection operates at LOS A / A (AM/PM), while the east ramp terminal intersection operates at LOS B / C (AM/PM) in the 2050 scenario. This assumes two 2-lane overpasses of I-90, each with a single through lane and a dedicated left turn lane. This geometry would require replacing the existing Highway 1416 structure over I-90.

5.3.4 TSM Feasible Option

Although the TSM Feasible Option would provide benefits such as improved incident management and enhanced weather response, these measures are not measurable as operational improvements through the HCM methodologies. Hence, the operational results for the TSM Feasible Option are assumed to be the same as those for the No Action Feasible Option in both 2025 and 2050.

LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes



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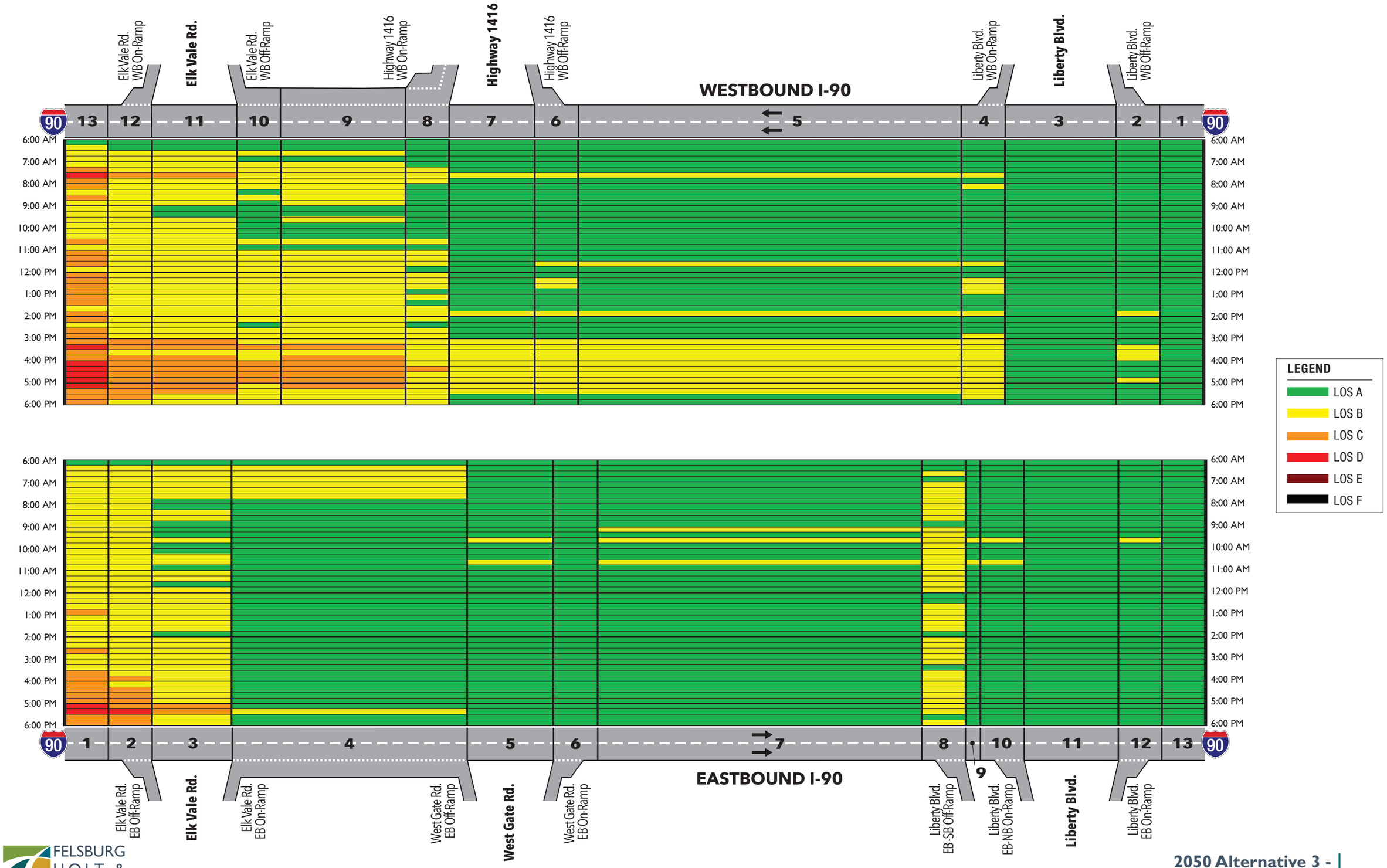
SDDOT I-90 Exit 63 Interchange 18-324 12/3/20

2050 Feasible Option 3: Highway 1416 Diverging Diamond Peak Hour Freeway Traffic Volumes

FIGURE 43



FELSBURG HOLT & ULLEVIG

SDDOT I-90 Exit 63 Interchange 18-324 2/15/21

2050 Alternative 3 -
County Highway 1416 Diverging Diamond Interchange (DDI) Freeway Operations

FIGURE 44

LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

NOTE:
AM Peak Hour = 7:00AM - 8: 00 AM
PM Peak Hour = 4:45PM - 5:45 PM

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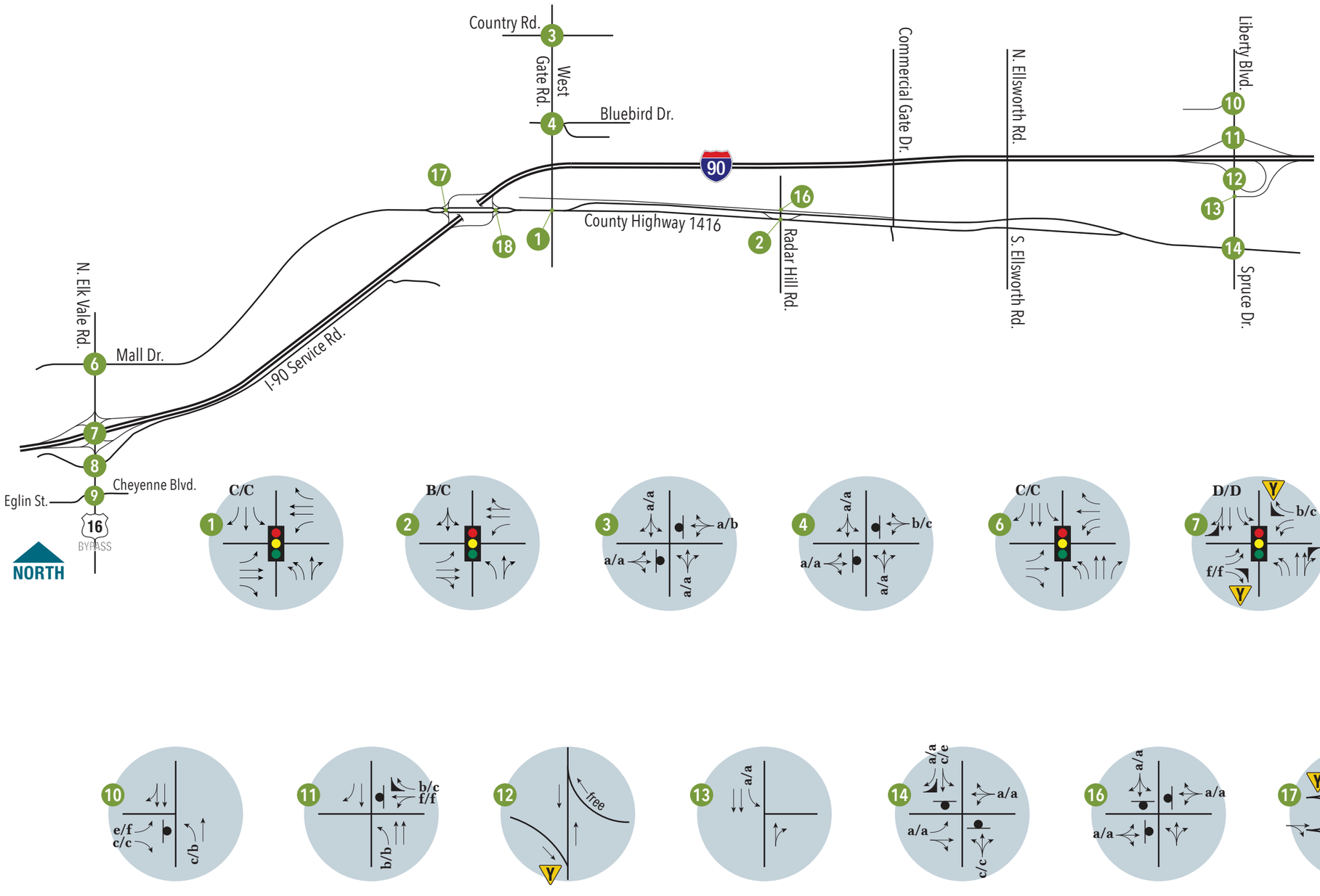
SDDOT I-90 Exit 63 Interchange 18-324 12/3/20

2050 Feasible Option 3: Highway 1416 Diverging Diamond Peak Hour Intersection Traffic Volumes

FIGURE 45



LEGEND

- **X/X** = AM/PM Peak Hour Signalized Intersection Level of Service
- **x/x** = AM/PM Peak Hour Unsignalized Intersection Level of Service
- = Stop Sign
- = Yield Sign
- = Traffic Signal

FELSBURG HOLT & ULLEVIG

SDDOT I-90 Exit 63 Interchange 18-324 12/3/20

2050 Feasible Option 3: Highway 1416 Diverging Diamond Peak Hour Intersection Traffic Operations

FIGURE 46

5.4 Operational Evaluation Conclusions

The operational analyses presented previously provide comparative measures of how each Feasible Option (including the No Action Feasible Option) will accommodate projected 2025 and 2050 traffic flows. These results are summarized below for both freeways and intersections.

5.4.1 Freeway Operations Results Summary

The detailed freeway operational analysis results presented previously have been summarized for comparative purposes. No unacceptable freeway operations (LOS D or worse) were identified in 2025. Unacceptable operations were identified in 2050, with the most unacceptable 15-mintue periods occurring under the No Action scenario. Refer to **Table 5**. Of the three Build Feasible Options, Feasible Option 1 provides the fewest poor LOS segments, and Feasible Option 2 and Feasible Option 3 have the same number of poor LOS segments since they are essentially the same along I-90.

Table 5. 2050 Freeway Operational Results

I-90 Segment	Number of 15-minute Periods at LOS D or Worse			
	No Action	Feasible Option 1	Feasible Option 2	Feasible Option 3
Westbound				
East of Exit 67	0	0	0	0
Exit 67 diverge	0	0	0	0
Between Exit 67 diverge and merge	0	0	0	0
Exit 67 merge	0	0	0	0
Between Exit 67 and Exit 63	0	0	0	0
Exit 63 diverge	n/a	0	0	0
Between Exit 63 diverge and merge	n/a	0	0	0
Exit 63 merge	1	0	0	0
Between Exit 63 and Exit 61	7	0	0	0
Exit 61 diverge	2	0	0	0
Between Exit 61 diverge and merge	0	0	0	0
Exit 61 merge	0	0	0	0
West of Exit 61	4	6	7	7
Eastbound				
West of Exit 61	1	2	2	2
Exit 61 diverge	0	1	1	1
Between Exit 61 diverge and merge	0	0	0	0
Exit 61 merge	0	0	0	0
Between Exit 61 and Exit 63	0	1	1	1
Exit 63 diverge	0	0	0	0
Between Exit 63 diverge and merge	n/a	0	0	0
Exit 63 merge	n/a	0	0	0
Between Exit 63 and Exit 67	0	0	0	0
Exit 67 diamond ramp diverge	0	0	0	0

Table 5. 2050 Freeway Operational Results

I-90 Segment	Number of 15-minute Periods at LOS D or Worse			
	No Action	Feasible Option 1	Feasible Option 2	Feasible Option 3
Between Exit 67 diverges	0	0	0	0
Exit 67 loop ramp diverge	0	0	0	0
Between Exit 67 diverge and merge	0	0	0	0
Exit 67 merge	0	0	0	0
East of Exit 67	0	0	0	0
Totals	**15**	**10**	**11**	**11**

5.4.2 Intersection Operations Results Summary

The detailed intersection operational analysis results presented previously have been summarized in **Table 6** for 2025 and in **Table 7** for 2050. Minimal differences were noted among Feasible Options in 2025. More differences were noted in 2050, as follows:

- Feasible Option 1 provides improved operations at Highway 1416 / West Gate Road and Highway 1416 / Radar Hill Road, although operations under all three scenarios are acceptable.
- Feasible Option 2 and Feasible Option 3 provide improved operations at the Exit 61 SPUI. Operations under all three scenarios are not acceptable.
- Feasible Option 1 provides improved operations at the proposed Exit 63 ramp terminal intersections, although operations under all three scenarios are acceptable.

Table 6. 2025 Intersection Operational Results

Intersection		LOS (AM/PM)			
ID	Location / Movement	No Action	Feasible Option 1	Feasible Option 2	Feasible Option 3
1	Highway 1416 / West Gate Road	B / B	B / B	B / B	B / B
2	Highway 1416 / Radar Hill Road	B / B	B / B	B / B	B / B
3	Country Road / West Gate Road*	a / b	a / b	a / b	a / b
4	Bluebird Drive / West Gate Road*	b / b	b / b	b / b	b / b
5	I-90 North Service Road / West Gate Road*	a / a	*n/a*	*n/a*	*n/a*
6	E Mall Drive / Elk Vale Road	B / C	B / C	B / C	B / C
7	I-90 SPUI / Elk Vale Road – signal	C / C	C / C	C / D	C / D
7	I-90 SPUI / Elk Vale Road – free rights*	d / f	c / e	c / f	c / f
8	Edwards St & I-90 S Service Rd / Elk Vale Road – main street lefts*	b / c	b / c	b / c	b / c
8	Edwards St & I-90 S Service Rd / Elk Vale Road – side street*	f / f	f / f	f / f	f / f
9	Eglin St & Cheyenne Blvd / Elk Vale Road	F / F	F / F	F / F	F / F
10	Reagan Avenue / Liberty Boulevard*	b / c	b / c	b / c	b / c
11	I-90 WB Ramps / Liberty Boulevard*	c / c	c / c	c / c	c / c
12	I-90 EB Exit Ramps / Liberty Boulevard*	free / yield	free / yield	free / yield	free / yield
13	I-90 EB Entrance Ramp / Liberty Boulevard*	a / a	a / a	a / a	a / a
14	Highway 1416 / Liberty Boulevard & Spruce Drive*	b / b	b / b	b / b	b / b
15	Box Elder Road / West Gate Road*	yield	*n/a*	*n/a*	*n/a*
16	Box Elder Road / Radar Hill Road*	a / a	a / a	a / a	a / a
17	I-90 WB ramps / West Gate Road	*n/a*	A / A	*n/a*	*n/a*
18	I-90 EB ramps / West Gate Road	*n/a*	A / A	*n/a*	*n/a*
17	I-90 WB ramps / Highway 1416	*n/a*	*n/a*	A / A	A / A
18	I-90 EB ramps / Highway 1416	*n/a*	*n/a*	B / A	A / A

* - worst minor street approach

Table 7. 2050 Intersection Operational Results

Intersection		LOS (AM/PM)			
ID	Location / Movement	No Action	Feasible Option 1	Feasible Option 2	Feasible Option 3
1	Highway 1416 / West Gate Road	C / C	B / B	C / C	C / C
2	Highway 1416 / Radar Hill Road	B / B	B / B	B / C	B / C
3	Country Road / West Gate Road*	a / b	a / b	a / b	a / b
4	Bluebird Drive / West Gate Road*	b / b	b / b	b / b	b / b
5	I-90 North Service Road / West Gate Road*	a / c	*n/a*	*n/a*	*n/a*
6	E Mall Drive / Elk Vale Road	C / D	C / C	C / C	C / C
7	I-90 SPUI / Elk Vale Road – signal	D / F	D / E	D / D	D / D
7	I-90 SPUI / Elk Vale Road – free rights*	f / f	f / f	f / f	f / f
8	Edwards St & I-90 S Service Rd / Elk Vale Road – main street lefts*	f / f	e / f	e / f	e / f
8	Edwards St & I-90 S Service Rd / Elk Vale Road – side street*	f / f	f / f	f / f	f / f
9	Eglin St & Cheyenne Blvd / Elk Vale Road	F / F	F / F	F / F	F / F
10	Reagan Avenue / Liberty Boulevard*	f / f	e / f	e / f	e / f
11	I-90 WB Ramps / Liberty Boulevard*	f / f	f / f	f / f	f / f
12	I-90 EB Exit Ramps / Liberty Boulevard*	free / yield	free / yield	free / yield	free / yield
13	I-90 EB Entrance Ramp / Liberty Boulevard*	a / a	a / a	a / a	a / a
14	Highway 1416 / Liberty Boulevard & Spruce Drive*	c / c	c / c	c / c	c / c
15	Box Elder Road / West Gate Road*	yield	*n/a*	*n/a*	*n/a*
16	Box Elder Road / Radar Hill Road*	a / a	a / a	a / a	a / a
17	I-90 WB ramps / West Gate Road	*n/a*	A / A	*n/a*	*n/a*
18	I-90 EB ramps / West Gate Road	*n/a*	A / A	*n/a*	*n/a*
17	I-90 WB ramps / Highway 1416	*n/a*	*n/a*	A / B	A / A
18	I-90 EB ramps / Highway 1416	*n/a*	*n/a*	B / A	B / C

* - worst minor street approach

6. ALTERNATIVE ANALYSIS

The No Action and Build Feasible Options were analyzed and compared to determine which may be most suitable for meeting the defined project purpose and need. These evaluations are presented below and have also been compiled in an evaluation matrix that is included at the end of this chapter.

6.1 Safety

For the purposes of Feasible Option screening, a qualitative safety evaluation was performed. Along I-90, the three options are well separated from adjacent interchanges, with limited weaving conflicts. The west-facing ramp connections for Feasible Option 1 are in a horizontal curve along I-90, while the east-facing ramp connections for Feasible Options 2 and 3 are in the same horizontal curve.

In the local street network, Feasible Option 1 represented average safety conditions, with a new diamond interchange located along an arterial roadway (West Gate Road) with adjacent access points. Feasible Option 2 represented slightly better conditions, with a new diamond interchange along an arterial (Highway 1416) with fewer nearby local access points. Feasible Option 3 represented the best conditions of the three Feasible Options, with the diverging diamond eliminating left turn conflicts in the ramp terminal intersections.

Given these points, Feasible Option 3 was considered to have the best safety performance, while Feasible Option 1 was considered to have the worst safety performance.

A detailed evaluation of Feasible Option 3 is being conducted using procedures in the Interactive Highway Safety Design Model (IHSDM). The results of this effort will be included here once the analysis is complete.

6.2 Operational Performance

Three metrics were used to evaluate operational performance: traffic operations (LOS), driver expectations, and local access issues. Based on these evaluations, Feasible Option 2 and Feasible Option 3 are very similar, with poorer results for Feasible Option 1. Within Feasible Option 2 and Feasible Option 3, the southerly Highway 1416 scenarios provide slightly better operational performance.

6.2.1 Traffic Operations

The traffic operations evaluation was based on the LOS calculations presented earlier in this report. It also considered the number of new intersections and turns that motorists will travel through to complete trips that are occurring today in the field. Feasible Option 1 provides the best operations within the interchange and along West Gate Road, but this is accomplished through widening West Gate Road beyond what is required for Feasible Option 2 and Feasible Option 3. More turn lanes are also required at the West Gate Road / Highway 1416 intersection. Feasible Option 2 provides similar operations within the intersection, does not require significant improvements along West Gate Road, and requires only limited improvements at the Highway 1416 / West Gate Road intersection. However, the heavy westbound Highway 1416 to westbound I-90 movement is signalized in the standard diamond configuration. Feasible Option 3 is similar to Feasible Option 2 away from the interchange, but the diverging diamond configuration allows the westbound Highway 1416 to westbound I-90 movement to be free flow on the west side of I-90, after passing through the crossover intersection at the east ramp terminal. Hence, operations for key movements are best facilitated by Feasible Option 3.

6.2.2 Driver Expectations

Driver expectation is a qualitative measure that considers out-of-direction travel and familiarity with potential design Feasible Options. For the Exit 63 effort, Feasible Option 1 creates out-of-direction travel, where motorists will have to travel north from Highway 1416 along West Gate Road to enter I-90 and travel back southwest past the Highway 1416 alignment to go west into Rapid City. However, diamond interchanges are common in the Rapid City area and would be familiar to drivers. Feasible Option 2 is a standard diamond interchange and does not result in out-of-direction travel. Feasible Option 3 includes a diverging diamond interchange. There are no interchanges of this type in the Rapid City area, so many local drivers will not be familiar with it, but proper design will allow unfamiliar motorists to navigate the diverging diamond successfully. Feasible Option 3 does not create out-of-direction travel. Hence, Feasible Option 2 provides the best results in this category, while Feasible Option 1 provides the poorest results.

6.2.3 Local Property Access

The local property access evaluation is intended to document how existing access needs to be modified to accommodate the Feasible Options. Feasible Option 1 creates considerable local access issues, as it is difficult to provide local access between the Highway 1416 intersection and the southerly diamond ramp terminal along West Gate Road. Most accesses would be removed or restricted to right-in / right out. Similar concerns exist between the northerly ramp terminal and Country Road, although volumes and related improvements in this area are not as substantial. Access constraints with Feasible Option 2 and Feasible Option 3 are similar, with slightly fewer concerns with the southerly Highway 1416 alignment.

6.3 Ellsworth AFB

Because Ellsworth Air Force Base is within 2½ miles of the interchange and contributes significant traffic to the roadway network included in the IMJR, it has been explicitly included in the IMJR's evaluation criteria. Two criteria were considered: Accident Protection Zone conflicts and traffic flow between the base and I-90 west of the interchange. Based on these evaluations, Feasible Option 3 provides the best results under the Ellsworth AFB criteria.

6.3.1 Accident Protection Zone Conflicts

The APZ is a defined area approaching and along the airport runways. The zone is intended to manage development within the area that could be affected by an aircraft incident on approach or departure from the runways. None of the Feasible Options are within the APZ, but the West Gate Feasible Options are closer to the APZ and, therefore, ranked slightly lower than the Highway 1416 Feasible Options.

6.3.2 Movements Between I-90 (West) and Ellsworth AFB

This criterion is similar to the driver expectation benchmark but is focused specifically on Ellsworth AFB traffic. Feasible Option 1 would require Ellsworth AFB traffic to travel out of direction from Highway 1416 north on West Gate Road to the proposed interchange and then back southwest along I-90. This would introduce several additional turns and traffic signals. Feasible Option 2 would require exiting Ellsworth AFB traffic to travel through two new traffic signals and would slow entering traffic at the east diamond ramp terminal (although this movement would not be signalized). Feasible Option 3 would require exiting Ellsworth AFB traffic to travel through one new traffic signal and would slow entering traffic somewhat (although not at an intersection). Hence, Feasible Option 3 provides the best movements for Ellsworth AFB traffic.

6.4 Environmental Concerns

As noted earlier, the Corridor Study performed a limited environmental overview. These efforts were updated and compiled for the IMJR evaluation. Further environmental resource details are being documented in a separate environmental scan report. Key areas evaluated include historic properties, environmental justice, noise, wetlands, and hazardous materials. Based on these evaluations, the Feasible Options that connect to the northerly Highway 1416 alignment perform better from an environmental perspective. Also, the favored alignment for the E Mall Drive connection is along the existing Highway 1416 corridor, as noted in the environmental justice analysis.

6.4.1 Qualitative Historic Properties Analysis

Although no formally designated properties were identified in the study area, there are multiple age-eligible properties and it is anticipated that the RCP&E Railroad alignment may be historic. Given local access needs south of Highway 1416, the Feasible Options that connect to the potential southerly Highway 1416 alignment would require a new at-grade crossing of the RCP&E Railroad. Hence, the southerly Feasible Options were assumed to have more historic property concerns. For the northerly Highway 1416 scenarios, there was little historic property distinction between Feasible Options.

6.4.2 Qualitative Environmental Justice Analysis

As noted in the Corridor Study, there are potential environmental justice communities along West Gate Road, particularly north of I-90. Hence, Feasible Option 1 raises various environmental justice concerns that are not evident under Feasible Options 2 and 3. Further, the E Mall Drive sub-option that connects to West Gate Road north of I-90 passes through a neighborhood that may include minority and/or low income populations, resulting in environmental justice concerns for this sub-option.

6.4.3 Qualitative Noise Analysis

The noise evaluation determined that there are no existing receptors near the existing Highway 1416 interchange that would be affected by changes to the interchange layout. Hence, Feasible Option 2 and Feasible Option 3 are neutral with respect to noise concerns. Feasible Option 1 had differing results based on the E Mall Drive alignment. If W Mall Drive is assumed to connect to Box Elder via Highway 1416, potential noise concerns in the area around the interchange would be reduced, as the new diamond interchange ramps would serve to shield existing neighborhoods from I-90 traffic noise. However, if E Mall Drive connects north of the interchange (assuming the Highway 1416 structure is not replaced for E Mall Drive use), then the addition of E Mall Dive traffic to the communities north of I-90 could raise noise concerns that outweigh the benefits obtained from the new interchange ramps.

6.4.4 Qualitative Wetlands Analysis

The wetlands review identified roadside diches that may qualify as wetlands along both I-90 and the south side of Highway 1416. Hence, Feasible Options that connect to the potential southerly Highway 1416 alignment have the potential for larger wetland concerns. For the northerly Highway 1416 scenarios, there was little wetland distinction between Feasible Options.

6.4.5 Qualitative Hazardous Materials Analysis

The hazardous materials review determined that there is a potential to encounter contaminated groundwater along the West Gate Road alignment, including the fueling station on the northeast corner of

Box Elder Road and West Gate Road. Hence, Feasible Option 1 has more potential hazardous materials concerns. Feasible Options 2 and 3 are similar in their potential for hazardous material concerns.

6.5 Property and Right-of-Way Concerns

Property and ROW concerns were evaluated based on the potential number of parcels affected and the severity of those effects. Feasible Option 1 affects the most parcels (many along west Gate Road) and is, therefore, poorest under this criterion. Feasible Option 2 affects fewer parcels but is expected to affect the RCP&E Railroad alignment, and these effects are considered substantial. Feasible Option 3 affects a similar number of parcels as Feasible Option 2 but has fewer substantial effects. Hence, Feasible Option 3 is considered best under this criterion.

6.6 Railroad Concerns

The railroad concerns are the result of two components: new railroad crossings and railroad right-of-way impacts. The Feasible Options that connect to the northerly Highway 1416 alignment (the "b" Feasible Options) do not require an additional crossing. Feasible Option 2 is anticipated to have ROW concerns. Hence, Feasible Option 1b and Feasible Option 3b are best under this criterion, and Feasible Option 2a is worst.

6.7 Conformance with Transportation Plans

The transportation plan conformance evaluation considered four components: the existing regional transportation plan, plans for Highway 1416, plans for the E Mall Drive extension, and compatibility with recent land use planning related to Ellsworth AFB. Based on these evaluations, local and regional plans acknowledge the need for interchange improvements, and limited preference among various Feasible Options is offered.

6.7.1 Regional Transportation Plan Conformance

SDDOT's 2010 Decennial Interstate Corridor Study[16] proposed construction of a full diamond interchange at Exit 63. The City of Box Elder's BESTPlan[17] from 2014 describes a potential interchange reconstruction at Exit 63, subject to future study. RapidTrip 2020, RCAMPO's Long Range Transportation Plan, also identified interchange improvements or replacement at Exit 63[18]. The Build Feasible Options meet the identified needs in both plans, while the No Action Feasible Option and the TSM Feasible Option do not.

[16] *South Dakota Decennial Interstate Corridor Study - Phase 1 Report*, South Dakota Department of Transportation, March 2010, page 3-6.
[17] *BESTPlan - Box Elder Strategic Transportation Plan*, City of Box Elder, Box Elder, SD, November 2014, Figure 16.
[18] *RapidTrip 2040 – Long Range Transportation Plan*, Rapid City Area Metropolitan Planning Organization, Rapid City, SD, September 2015, Table 13, page 41.

6.7.2 Plans for Highway 1416

The conversion of Highway 1416 to a 3-lane cross-section (without the existing wide center median) from I-90 to Liberty Boulevard was included in Box Elder BESTPlan[19]. Since that time, the City has been working to move this project into conceptual design. Although no concepts have been published, the City has identified a northerly alignment as more feasible during the IMJR's stakeholder process. Hence, the Feasible Options that are designed to connect with a northerly Highway1416 alignment (the "b" Feasible Options) best align with the planned Highway 1416 improvements.

6.7.3 Plans for E Mall Drive

The City of Box Elder has been studying alignments for E Mall Drive for several years. Various efforts show connections along the Highway 1416 corridor west of I-90 and along the Bluebird Drive alignments west of West Gate Road. For purposes of the IMJR, the City shared concept alignments for the E Mall Drive Extension dated December 2018[20]. The various conceptual alignments connect E Mall Drive to Highway 1416 via an alignment along the existing Highway 1416 overpass at I-90. Hence, Feasible Option 2 and Feasible Option 3 best fit with the City's plans for E Mall Drive. The No Action Feasible Option and Feasible Option 1 would require replacement of the existing overpass (without constructing an interchange overpass) to allow two-way traffic.

6.7.4 Compatibility with Ellsworth AFB Joint Land Use Study

The South Dakota Ellsworth Development Authority completed the Ellsworth AFB Joint Land Use Study (JLUS) in 2016. This study acknowledges the need for coordination between Ellsworth AFB and SDDOT as part of efforts to improve access in the Corridor Study area[21].

6.8 Construction Phasing

The construction phasing evaluation provides a snapshot of the constructability of the proposed Feasible Options. In general, the Exit 63 Feasible Options present construction phasing difficulties because both structures (Highway 1416 and West Gate Road) over I-90 already exist and would have to be modified or replaced to accommodate the respective Feasible Option configurations. Alternate routes for these bridges are limited given the limited number of I-90 crossings in the study area and lack of parallel route connectivity created by Ellsworth AFB north of I-90 and limited development south of I-90. Further, the "a" Feasible Options (connecting to the south Highway 1416 alignment) require a new at-grade railroad crossing, necessitating railroad coordination that can be time-consuming and costly. Due to the lack of railroad coordination, the "b" Feasible Options are considered slightly better.

6.9 Compliance with Policies and Standards

Compliance with policies and engineering standards was evaluated using two metrics: FHWA interstate access policies and SDDOT intersection / ramp terminal spacing requirements. Based on these evaluations, the No Action and TSM Feasible Options do not meet FHWA guidance. The conceptual designs generally

[19] OpCit, BESTPlan, Figure ES-5.
[20] *East Mall Drive Extension – Conceptual Alignment Options*, prepared by FEC for the City of Box Elder Public Works Department, December 14, 2018.
[21] *Ellsworth AFB Joint Land Use Study*, South Dakota Ellsworth Development Authority, Rapid City, SD, May 2016, Issues / Strategies Table, page 70.

meet standards except for intersection / ramp terminal spacing, where Feasible Option 3 (a & b) performs the best and Feasible Option 1 (a & b) performs the worst.

6.9.1 FHWA Interstate Access Policy

As the interstate network is critical for both interstate and intrastate travel, the FHWA has developed a Policy on Access to the Interstate System. In part, this policy requires that proposed accesses provide for all traffic movements. The current Exit 63 configuration does not allow movements to/from the east on I-90; hence this policy is not met in the No Action scenario or the TSM Feasible Option. The three Build Feasible Options add east-facing ramps to reflect this policy.

6.9.2 SDDOT Engineering Standards

The conceptual designs for the Feasible Options were developed to meet SDDOT engineering standards. However, due to constraints such as the RCP&E Railroad corridor, Box Elder Creek, and adjacent development (particularly along West Gate Road), it was not possible to meet SDDOT roadway intersection and ramp terminal intersection requirements. Feasible Option 3 (a & b) comes closest to meeting the standards, while Feasible Option 1 (a & b) is furthest from meeting the standards. The No Action and TSM Feasible Options do not have ramp terminal intersections that are subject to these standards.

6.10 Construction Costs

The construction cost evaluation was based on general quantities of key cost items, including bridge structure, retaining walls, and paved areas. Feasible Options 1 and 2 ranked similar in cost, while Feasible Option 3 ranked slightly poorer due to the need for two separate structures across I-90 in the diverging diamond.

After the initial order of magnitude cost evaluation, conceptual costs were developed for each Feasible Option. The costs include major construction elements (bridges, walls, paving, etc.), percentages for minor construction elements (signing and striping, utility relocations, erosion control), percentages for engineering costs, and cursory ROW costs. These are presented in **Table 8**. Details are provided in **Appendix C.** As can be seen, Feasible Option 3 does, in fact, have the highest conceptual cost, while the TSM Feasible Option has the lowest cost.

Table 8. Conceptual Level Opinion of Probable Cost

Feasible Option	Conceptual Cost ($)
1a	$40,665,000
1b	$40,152,000
2a	$45,386,000
2b	$44,742,000
3a	$49,748,000
3b	$48,872,000
TSM	$1,754,000

6.11 Multimodal Accommodations

The evaluation of multimodal accommodations considered the provision of fixed infrastructure (trails, sidewalks, and bike lane) and the potential for transit to use the new interchange. The various Feasible Options were ranked equally, as none had a distinguishing effect on these elements.

Since the evaluation matrix was prepared, the Rapid City Metropolitan Area Bike and Pedestrian Master Plan Update[22] has been completed. Based on the recommendations from that study, Feasible Option 1 would raise concerns for Project P531[23], which is anticipated to add a buffered bike lane along West Gate Road between Country Road and Highway 1416. A buffered bike lane is typically incompatible with a diamond interchange. Similarly, Feasible Option 2 would raise concerns for Project P239[24], which is anticipated to create a railway trail along the RCP&E railroad corridor adjacent to the diamond interchange. Feasible Option 3 would also raise concerns for Project P239, but the diverging diamond is anticipated to be further away from the railroad alignment, reducing these concerns. Hence, Feasible Option 3 results in the fewest concerns for the planned bicycle and pedestrian network.

6.12 Evaluation Matrix

The various evaluations have been compiled into an evaluation matrix presented as **Table 9**. The matrix and related supporting material have been shared with the Study Advisory Team and their input has been reflected as appropriate. Based on this process, Feasible Option 3b is the Most Technically Feasible Alternative for the Exit 63 interchange. This Feasible Option creates a new diverging diamond interchange along the Highway 1416 alignment, connects to the northerly Highway 1416 project under consideration by Box Elder, and allows the E Mall Drive extension to connect to the west side of the interchange.

[22] *Rapid City Metropolitan Area Bike and Pedestrian Master Plan Update*, Rapid City Area Metropolitan Planning Organization, Rapid City, SD, August 2020.
[23] Ibid, Table 13, page 46.
[24] Ibid, Table 14, page 47.

I-90 Exit 63 IMJR
Evaluation Matrix

Table 9	Option Evaluation Categories and Criteria	FEASIBLE OPTION 1a - WESTGATE ROAD DIAMOND INTERCHANGE (SOUTH HWY 1416 SECTION)		FEASIBLE OPTION 1b - WESTGATE ROAD DIAMOND INTERCHANGE (NORTH HWY 1416 SECTION)		FEASIBLE OPTION 2a - COUNTY HIGHWAY 1416 DIAMOND INTERCHANGE (SOUTH HWY 1416 SECTION	FEASIBLE OPTION 2b - COUNTY HIGHWAY 1416 DIAMOND INTERCHANGE (NORTH HWY 1416 SECTION)	FEASIBLE OPTION 3a - DIVERGING DIAMOND INTERCHANGE (SOUTH HWY 1416 SECTION)	FEASIBLE OPTION 3b - DIVERGING DIAMOND INTERCHANGE (NORTH HWY 1416 SECTION)
13-Jul-21		East Mall Drive (Connect at West Gate Road)	East Mall Drive (Connect at County Hwy 1416)	East Mall Drive (Connect at West Gate Road)	East Mall Drive (Connect at County Hwy 1416)				
Category	**Criteria**								
Safety and Traffic Operations									
Improve Safety	Qualitative Review (H, M, L rankings)	M	M	M	M	M	MH	H	H
FHWA Policy	Does it meet FHWA interchange policy for providing all movements?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Improve Traffic Operations	Does it improve traffic operations compared to existing configuration (LOS)? Does it improve traffic operations compared to other alternatives with regard to Level of Service (LOS)?	EB and WB movements to / from I-90 have additional turns / signals	EB and WB movements to / from I-90 and Mall Drive have additional turns / signals	EB and WB movements to / from I-90 have additional turns / signals; access concerns south of interchange	EB and WB movements to / from I-90 and Mall Drive have additional turns / signals; access concerns south of interchange	EB and WB movements to / from I-90 have few turns / signals	Few turns/signals, but added intersection on Hwy 14/16 adjacent to interchange	EB and WB movements to / from I-90 have fewest turns / signals	Fewest turns/signals, but added intersection on Hwy 14/16 adjacent to interchange
Driver Expectations	Does the alternative, including the interchange configuration and ramps, meet driver expectations?	Drivers on Hwy 1416 may not expect to need to turn on West Gate Road to access I-90 and would expect to access I-90 directly. Mall Drive users may expect to access I-90 directly and not need to use West Gate Road.	Drivers on Hwy 1416 may not expect to need to turn on West Gate Road to access I-90 and would expect to access I-90 directly. Mall Drive users may expect to access I-90 directly and not need to use West Gate Road.	Drivers on Hwy 1416 may not expect to need to turn on West Gate Road to access I-90 and would expect to access I-90 directly. Mall Drive users may expect to access I-90 directly and not need to use West Gate Road.	Drivers on Hwy 1416 may not expect to need to turn on West Gate Road to access I-90 and would expect to access I-90 directly. Mall Drive users may expect to access I-90 directly and not need to use West Gate Road.	Yes	Yes	The Diverging Diamond Interchange may not meet most expectations	The Diverging Diamond Interchange may not meet most expectations
Property Access Issues	Minimize number of properties and magnitude of mitigation (High (H), Medium (M), Low (L) rankings)	L - Along West Gate Road, three full access points would need to be refined to right-in/right-out. Direct access to West Gate Road would no longer be available for properties along Box Elder Road, east of West Gate Road and along North Service Road, west of West Gate Road.	L - Along West Gate Road, three full access points would need to be refined to right-in/right-out. Direct access to West Gate Road would no longer be available for properties along Box Elder Road, east of West Gate Road and along North Service Road, west of West Gate Road.	L - Along West Gate Road, three full access points would need to be refined to right-in/right-out and one closure of first access point west of West Gate Road along Box Elder Road. Direct access to West Gate Road would no longer be available for properties along North Service Road, west of West Gate Road.	L - Along West Gate Road, three full access points would need to be refined to right-in/right-out and one closure of first access point west of West Gate Road along Box Elder Road. Direct access to West Gate Road would no longer be available for properties along North Service Road, west of West Gate Road.	H - Maintains all accesses	MH - Affects accesses NW of Hwy 1416 at West Gate, left turns from the first access point east of West Gate Road would need to do a U-turn from Hwy 1416 intersection at West Gate Road and one closure of first access point west of West Gate Road along Box Elder Road.	H - Maintains all accesses	MH - Affects accesses NW of Hwy 1416 at West Gate, left turns from the first access point east of West Gate Road would need to be right-in/right-out and one closure of first access point west of West Gate Road along Box Elder Road.
Ellsworth AFB Impacts									
Accident Protection Zone (APZ) Conflicts	Is the proximity of the alternative to the Ellsworth AFB (AFB) accident protection zone close or far? (H, M, L rankings)	MH - Closest to APZ, but not significantly different	MH - Closest to APZ, but not significantly different	MH - Closest to APZ, but not significantly different	MH - Closest to APZ, but not significantly different	H - Farthest from APZ, but not significantly different	H - Farthest from APZ, but not significantly different	H - Farthest from APZ, but not significantly different	H - Farthest from APZ, but not significantly different
Facilitates Movements to/from the AFB	Is the travel time to go to and from the main gate at the AFB to the new I-90 interchange at exit 63 improved? Is the travel time to go to and from the commercial gate at the AFB and the new I-90 interchange at exit 63 improved? (H, M, L rankings)	L - Out of Direction at West Gate	L - Out of Direction at West Gate	L - Out of Direction at West Gate	L - Out of Direction at West Gate	M - Signalized turns onto / off of ramps in Hwy 14/16 interchange	M - Signalized turns onto / off of ramps in Hwy 14/16 interchange	H - No signalized turns onto / off of ramps in Hwy 14/16 interchange	H - No signalized turns onto / off of ramps in Hwy 14/16 interchange

Most Meets Criteria → Least Meets Criteria

I-90 Exit 63 IMJR
Evaluation Matrix

Table 9	Option Evaluation Categories and Criteria	FEASIBLE OPTION 1a - WESTGATE ROAD DIAMOND INTERCHANGE (SOUTH HWY 1416 SECTION)		FEASIBLE OPTION 1b - WESTGATE ROAD DIAMOND INTERCHANGE (NORTH HWY 1416 SECTION)		FEASIBLE OPTION 2a - COUNTY HIGHWAY 1416 DIAMOND INTERCHANGE (SOUTH HWY 1416 SECTION	FEASIBLE OPTION 2b - COUNTY HIGHWAY 1416 DIAMOND INTERCHANGE (NORTH HWY 1416 SECTION)	FEASIBLE OPTION 3a - DIVERGING DIAMOND INTERCHANGE (SOUTH HWY 1416 SECTION)	FEASIBLE OPTION 3b - DIVERGING DIAMOND INTERCHANGE (NORTH HWY 1416 SECTION)
13-Jul-21		East Mall Drive (Connect at West Gate Road)	East Mall Drive (Connect at County Hwy 1416)	East Mall Drive (Connect at West Gate Road)	East Mall Drive (Connect at County Hwy 1416)				
Category	**Criteria**								
Physical Impacts									
Environmental	Historic property Qualitative Analysis (H, M, L rankings)	M - County Hwy 1416 improvements cause indirect effects to Railroad. East Mall Drive connection and I-90 connections at West Gate Road may require ROW from age-eligible/unsurveyed properties. Additional impacts from noise increases may contribute to impacts.	M - County Hwy 1416 improvements cause indirect effects to Railroad. New I-90 connections at West Gate Road may require ROW from age-eligible/unsurveyed properties.	MH - East Mall Drive connection and I-90 connections at West Gate Road may require ROW from age-eligible/unsurveyed properties. Additional impacts from noise increases may contribute to impacts.	MH - New I-90 connections at West Gate Road may require ROW from age-eligible/unsurveyed properties.	L - Would require crossing at Rapid City, Pierre & Eastern Railroad	MH - Changes to setting from elevated interchange pose potential indirect effects to railroad. Few other potential impacts to age-eligible/ unsurveyed properties.	L - Would require crossing at Rapid City, Pierre & Eastern Railroad	MH - Changes to setting from elevated interchange pose potential indirect effects to Railroad. Few other potential impacts to age-eligible/ unsurveyed properties.
	Environmental Justice Qualitative Analysis (H, M, L rankings)	L - East Mall Drive connection would go through a mobile home park	M - Potential impact to EJ properties along West Gate	L - East Mall Drive connection would go through a mobile home park	M - Potential impact to EJ properties along West Gate	H - No impacts to EJ properties are anticpated.	H - No impacts to EJ properties are anticpated.	H - No impacts to EJ properties are anticpated.	H - No impacts to EJ properties are anticpated.
	Noise Qualitative Analysis (H, M, L rankings)	L - noise levels would increase for adjacent homes with new East Mall Drive connection	MH - the ramps would also serve as berms to block some I-90 noise for some homes.	L - noise levels would increase for adjacent homes with new East Mall Drive connection	MH - the ramps would also serve as berms to block some I-90 noise for some homes.	M - There are no existing receptors near the interchanges that might be meaningfully affected by the differences. This is essentially the same as No Action for the neighborhood.	M - There are no existing receptors near the interchanges that might be meaningfully affected by the differences. This is essentially the same as No Action for the neighborhood.	M - There are no existing receptors near the interchanges that might be meaningfully affected by the differences. This is essentially the same as No Action for the neighborhood.	M - There are no existing receptors near the interchanges that might be meaningfully affected by the differences. This is essentially the same as No Action for the neighborhood.
	Wetlands Qualitative Analysis (H, M, L rankings)	M - Potential to impact a few wetlands along I-90	ML - Potential to impact several wetlands along I-90 and Hwy 1416	M - Potential to impact a few wetlands along I-90	ML - Potential to impact several wetlands along I-90 and one along Hwy 1416	ML - Potential to impact several wetlands along I-90, along Hwy 1416, and at the railroad crossing	M - Potential to impact a few wetlands along I-90, one along frontage road, and one along Hwy 1416	ML - Potential to impact several wetlands along I-90, along frontage road, westbound ramp, along Hwy 1416, and at the railroad crossing	M - Potential to impact a few wetlands along I-90, one along frontage road, and one along Hwy 1416
	Hazardous Materials Qualitative Analysis (H, M, L rankings)	M - There is more of a potential to encounter contaminated groundwater.	M - There is more of a potential to encounter contaminated groundwater.	M - There is more of a potential to encounter contaminated groundwater.	M - There is more of a potential to encounter contaminated groundwater.	H - Less of a potential to encounter contaminated groundwater.	H - Less of a potential to encounter contaminated groundwater.	H - Less of a potential to encounter contaminated groundwater.	H - Less of a potential to encounter contaminated groundwater.
Property and ROW Impacts	ROW impacts (H, M, L rankings)	L (22 parcels impacted)	L (22 parcels impacted)	L (25 parcels impacted)	L (25 parcels impacted)	L (13 parcels - 2 with substantial impacts + 1 impact is RCP&E RR)	L (9 parcels - 2 with substantial impacts + 1 impact is RCP&E RR)	ML (11 parcels - 2 with substantial impacts)	H (8 parcels - 1 with substantial impacts)
Railroad Impacts	Review minimizing railroad impacts for each alternative (H, M, L rankings)	ML (Maintain existing crossing and construct along RR)	ML (Maintain existing crossing and construct along RR)	H (Maintain existing crossing)	H (Maintain existing crossing)	L (New crossing and construction along RR)	ML (Construction of Ramp along RR)	L (New crossing and construction along RR)	H (Maintain existing crossing)
Compatibility with Existing Community Plans									
City of Box Elder and Pennington County Plans for Hwy 14 -16	Review alternative with potential planned improvements and rate compatibility (H, M, L rankings)	L (Does not meet existing access nor plan expectations)	L (Does not meet existing access nor plan expectations)	H (meets plan expectations)		M (meets existing access)	H (meets plan expectations)	M (meets existing access)	H (meets plan expectations)
East Mall Drive Extension Improvements	Review alternative with potential planned improvements and rate compatibility (H, M, L rankings)	L (may not meet interchange connection plan expectations)	L (may not meet interchange connection plan expectations)	L (may not meet interchange connection plan expectations)		H (meets plan expectations)	H (meets plan expectations)	H (meets plan expectations)	H (meets plan expectations)
Compatibility with JLUS	Is the alternative compatible with air installation compatible use zones (yes or no)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

I-90 Exit 63 IMJR
Evaluation Matrix

Table 9	Option Evaluation Categories and Criteria	FEASIBLE OPTION 1a - WESTGATE ROAD DIAMOND INTERCHANGE (SOUTH HWY 1416 SECTION)		FEASIBLE OPTION 1b - WESTGATE ROAD DIAMOND INTERCHANGE (NORTH HWY 1416 SECTION)		FEASIBLE OPTION 2a - COUNTY HIGHWAY 1416 DIAMOND INTERCHANGE (SOUTH HWY 1416 SECTION	FEASIBLE OPTION 2b - COUNTY HIGHWAY 1416 DIAMOND INTERCHANGE (NORTH HWY 1416 SECTION)	FEASIBLE OPTION 3a - DIVERGING DIAMOND INTERCHANGE (SOUTH HWY 1416 SECTION)	FEASIBLE OPTION 3b - DIVERGING DIAMOND INTERCHANGE (NORTH HWY 1416 SECTION)
13-Jul-21		East Mall Drive (Connect at West Gate Road)	East Mall Drive (Connect at County Hwy 1416)	East Mall Drive (Connect at West Gate Road)	East Mall Drive (Connect at County Hwy 1416)				
Category	**Criteria**								
	Construction Phasing and Implementation								
Constructability	Extent of detours (out of way travel), duration, relative phasing, ease of obtaining agency/RR approvals, and CTC costs (H, M, L rankings)	L (Detours needed, most of the interchange built on existing roadways)	L (Detours needed, most of the interchange built on existing roadways)	L (Detours needed, most of the interchange built on existing roadways)	L (Detours needed, most of the interchange built on existing roadways)	L (Some detours needed, some of interchange built offline and railroad crossing detours will need to be phased, New RR Crossing approval difficult)	ML (Detours needed, some of interchange built offline and railroad crossing detours will need to be phased)	L (Detours needed, some of interchange built offline and railroad crossing detours will need to be phased, New RR Crossing approval difficult)	ML (Detours needed, some of interchange built offline and railroad crossing detours will need to be phased)
	Design Criteria								
Intersection Spacing/ Control of Access	Does the spacing of the intersections meet SDDOT criteria (yes or no)?	No (Spacing between Interchange ramps and between the south ramp intersection and Hwy 1416 on West Gate Rd and along east side of Hwy 1416 do not meet criteria, three segments)	No (Spacing between Interchange ramps and between the south ramp intersection and Hwy 1416 on West Gate Rd and along east side of Hwy 1416 do not meet criteria, three segments)	No (Spacing between Interchange ramps on West Gate Rd and spacing between the south ramp and County Hwy 1416 do not meet criteria, three segments)	No (Spacing between Interchange ramps on West Gate Rd and spacing between the south ramp and County Hwy 1416 do not meet criteria, three segments)	No (Spacing between the ramp intersections and spacing between County Hwy 1416 and Box Elder Rd do not meet criteria)	No (Spacing between east ramp and business access, and spacing between business access, west of West Gate Rd, and West Gate Rd, along County Hwy 1416, do not meet criteria)	No (Spacing between the ramp intersections and spacing between County Hwy 1416 and Box Elder Rd do not meet criteria)	No (spacing between the ramp intersections, access between business access intersection, west of West Gate Rd, and West Gate Rd, along County Hwy 1416, do not meet criteria)
Ramp Configurations and Roadway Improvements	Does the ramp configuration and the roadway improvements meet SDDOT design standards and criteria (yes or no)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Construction Cost		M (Requires less Bridge SF, more Wall LF, more Pavement CY, and No new RR Crossing)	M (Requires less Bridge SF, more Wall LF, more Pavement CY, and No new RR Crossing)	M (Requires moderate Bridge SF, moderate Wall LF, moderate Pavement CY, and No new RR Crossing)	M (Requires moderate Bridge SF, moderate Wall LF, moderate Pavement CY, and No new RR Crossing)	M (Requires moderate Bridge SF, moderate Wall LF, moderate Pavement CY, new RR Crossing, and fewer ROW impacts)	M (Requires moderate Bridge SF, moderate Wall LF, moderate Pavement CY, No new RR Crossing, and Significant ROW impacts)	ML (Requires more Bridge SF, less Wall LF, more Pavement CY, and new RR Crossing)	ML (Requires more Bridge SF, moderate Wall LF, more Pavement CY, and No new RR Crossing)
	Multi-Modal Accommodations								
Trail and Transit Facilities	Does the alternative allow provisions for existing or future multi-modal accommodations? (H, M, L rankings)	MH (trails, sidewalks, and bike lanes and transit buses could be provided along County Hwy 1416 and East Mall Drive in the future, these are not precluded)	MH (trails, sidewalks, and bike lanes and transit buses could be provided along County Hwy 1416 and East Mall Drive in the future, these are not precluded)	MH (trails, sidewalks, and bike lanes and transit buses could be provided along County Hwy 1416 and East Mall Drive in the future, these are not precluded)	MH (trails, sidewalks, and bike lanes and transit buses could be provided along County Hwy 1416 and East Mall Drive in the future, these are not precluded)	MH (trails, sidewalks, and bike lanes and transit buses could be provided along County Hwy 1416 and East Mall Drive in the future, these are not precluded)	MH (trails, sidewalks, and bike lanes and transit buses could be provided along County Hwy 1416 and East Mall Drive in the future, these are not precluded)	MH (trails, sidewalks, and bike lanes and transit buses could be provided along County Hwy 1416 and East Mall Drive in the future, these are not precluded)	MH (trails, sidewalks, and bike lanes and transit buses could be provided along County Hwy 1416 and East Mall Drive in the future, these are not precluded)
Summary		**Eliminated**	**Eliminated**	**Eliminated**	**Eliminated**	**Eliminated**	**Eliminated**	**Eliminated**	**Retained**
		Does not meet driver expectations with out of direction travel, substantial number of impacts to access along West Gate Road, does not meet community plans, constructability has a low ranking.	Does not meet driver expectations with out of direction travel, substantial number of impacts to access along West Gate Road, does not meet community plans, constructability has a low ranking.	Does not meet driver expectations with out of direction travel, substantial number of impacts to access along West Gate Road, constructability has a low ranking, does not meet intersection spacing criteria.	Does not meet driver expectations with out of direction travel, substantial number of impacts to access along West Gate Road, constructability has a low ranking, does not meet intersection spacing criteria.	Does not meet community plans, does not meet intersection spacing, impacts to RR ROW would be significant, and constructability would be more difficult	Does not meet intersection spacing, impacts to RR ROW would be significant, and constructability would be more difficult	Improved safety and traffic operations and facilitates movements to and from the AFB	Improved safety, facilitates movements to and from the AFB, minimizes ROW impacts, and reduced impacts with RR

Most Meets Criteria → Least Meets Criteria

7. FUNDING PLAN

Construction of the Most Technically Feasible Alternative for Exit 63 is anticipated to begin in 2025. As such, the project is not listed in the current 5-year Statewide Transportation Improvement Program (STIP). Long range funding is currently being evaluated, and it is anticipated that Federal National Highway Performance Program funds will be used to complete the project. No state or local contributions have been identified to date. The estimated construction cost for the Most Technically Feasible Alternative (Feasible Option 3b) is $48,872,000 in 2020 dollars. Refer to **Table 10**.

Table 10. Anticipated Funding Allocation Breakdown

Project Number	State Funding Category	Federal Funding Category	Federal Funds	State Funds	Total Funds
IM 0902(111)62 N, PCN 3022	Interstate	National Highway Performance Program	$44.429 Million	$4.443 Million	$48.872 Million
Total			**$44.429 Million**	**$4.443 Million**	**$48.872 Million**

Note: As funding is fluid, category breakdown may be different at time of project authorization.

As the project is anticipated to be let to contract in Federal fiscal year 2027, the inflated estimated cost for the Most Technically Feasible Alternative is $53.841 million. Various funds may be available for the Exit 63 project under Federal discretionary grant programs. No formal grant applications have been made for this project. However, SDDOT plans to pursue Federal grant funding for the project in the future.

8. RECOMMENDATIONS

The technical analyses in this IMJR indicate that a diverging diamond interchange configuration on I-90 at Exit 63 (Highway 1416) in Box Elder, South Dakota, will provide future operational and safety benefits. Further, the analyses indicate that this configuration is the Most Technically Feasible Alternative and will have fewer environmental impacts than the other interchange Feasible Options that were evaluated. The Most Technically Feasible Alternative (described as Alternative 3b in previous sections of this study) is presented on **Figure 47**. Control of Access for this alternative is presented on **Figure 48** and the related Guide Signing Plan is presented as **Figure 49**.

As noted earlier in this IMJR, the FHWA has two policy points that must be evaluated when completing an interchange modification on the intestate network. Each of these points is presented below, along with documentation of how the Most Technically Feasible Alternative addresses them.

8.1.1 Policy Point 1

An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, and ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis should, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (Title 23, Code of Federal Regulations (CFR), paragraphs 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, should 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 should 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 should also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d))

The operational and safety evaluations presented earlier in this document show that the proposed diverging diamond interchange at Exit 63 is not expected to adversely affect the safety or efficiency of the interstate system, including the I-90 mainline lanes; existing, new, or modified ramps; and ramp / crossroad intersections or on the local street network based on current conditions, opening day (2025) conditions, and horizon year (2050) future traffic conditions.

The IMJR study area included the first interchange to the west (Exit 61 – Elk Vale Road) and the first interchange to the east (Exit 67 – Liberty Boulevard). The Exit 61 portion of the evaluation included the first major intersection to the north (E Mall Drive) and to the south (Eglin Street / Cheyenne Boulevard). The Exit 63 portion of the evaluation included the first major intersection to the east (Radar Hill Road) but did not include any intersections to the west as Highway 1416 terminates at I-90. The Exit 67 portion of the evaluation included the first major intersection to the north (Reagan Avenue) and to the south (Highway 1416).

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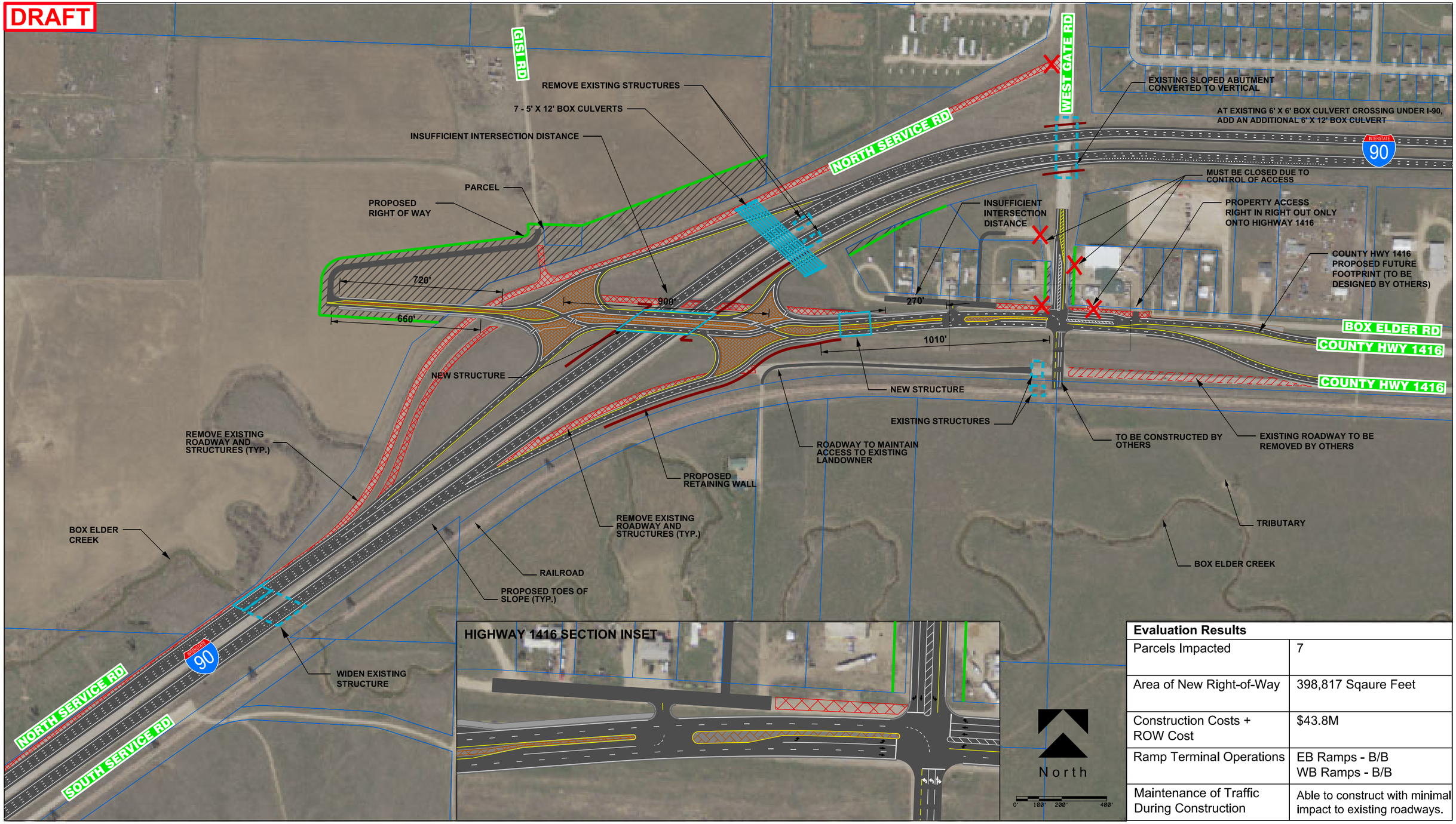

Evaluation Results	
Parcels Impacted	7
Area of New Right-of-Way	398,817 Sqaure Feet
Construction Costs + ROW Cost	$43.8M
Ramp Terminal Operations	EB Ramps - B/B WB Ramps - B/B
Maintenance of Traffic During Construction	Able to construct with minimal impact to existing roadways.

I-90 EXIT 63
MOST TECHNICALLY FEASIBLE ALTERNATIVE: DIVERGING DIAMOND INTERCHANGE

FIGURE 47

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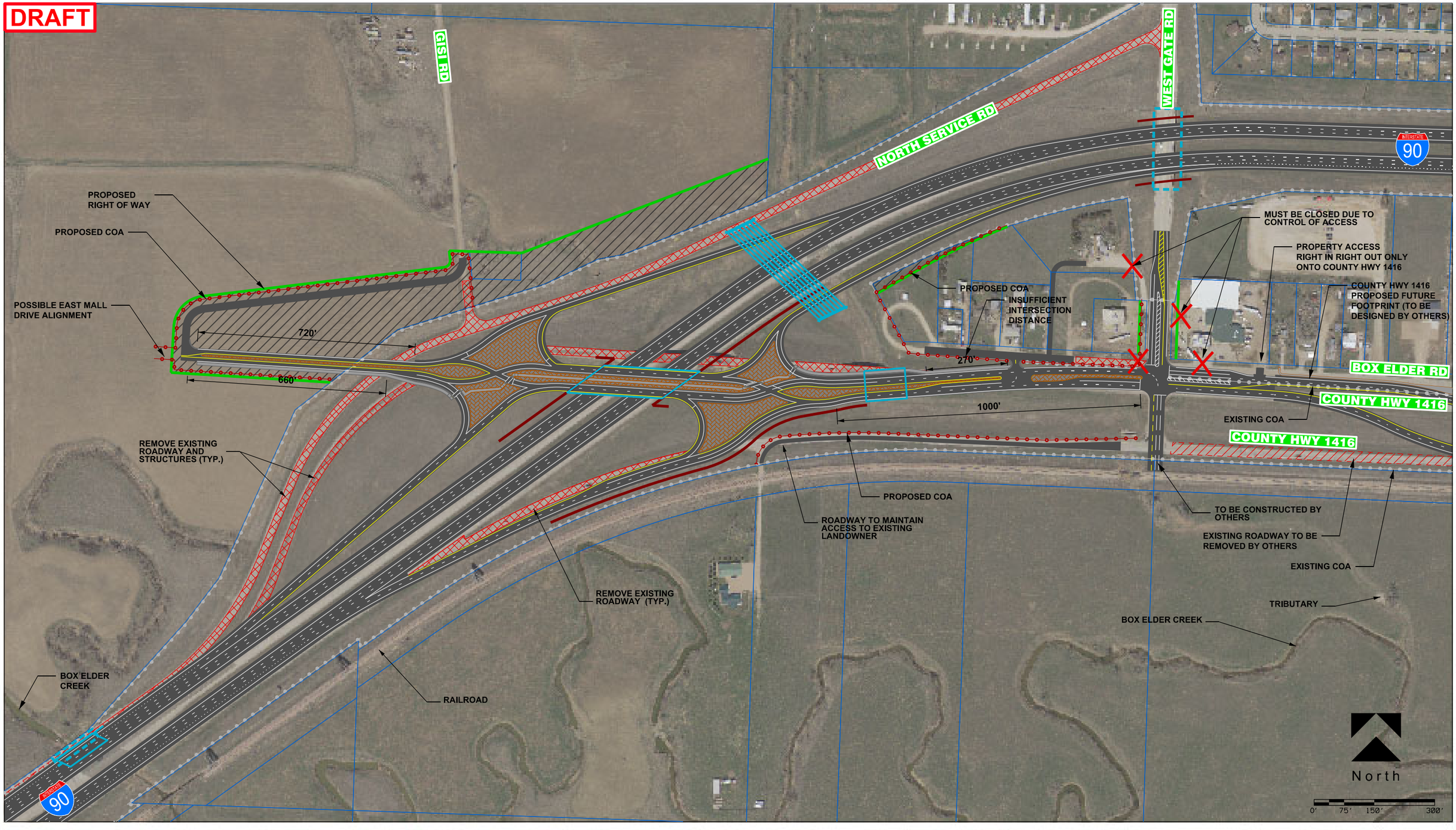
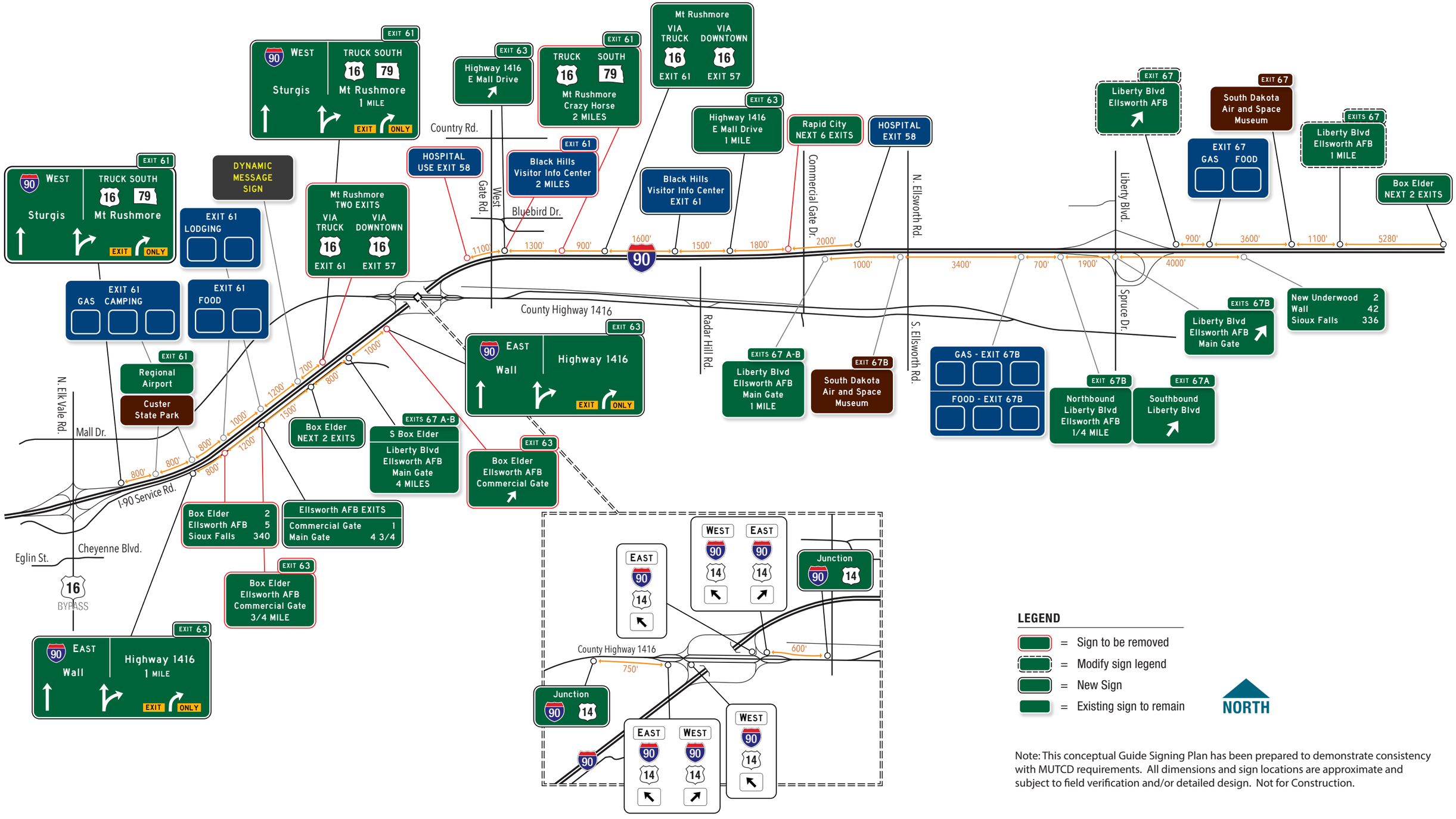


I-90 EXIT 63
MOST TECHNICALLY FEASIBLE OPTION: CONTROL OF ACCESS

FIGURE 48



LEGEND

- = Sign to be removed
- = Modify sign legend
- = New Sign
- = Existing sign to remain

NORTH

Note: This conceptual Guide Signing Plan has been prepared to demonstrate consistency with MUTCD requirements. All dimensions and sign locations are approximate and subject to field verification and/or detailed design. Not for Construction.

FELSBURG HOLT & ULLEVIG

SDDOT I-90 Exit 63 Interchange 18-324 8/20/21

Most Technically Feasible Option
Highway 1416 Diverging Diamond Interchange Guide Signing

FIGURE 49

Traffic operations for the No Action and Build Feasible Options were reviewed for impacts using methodologies contained in the Highway Capacity Manual as implemented in HCS7. The Build Feasible Options maintain LOS C or better for freeway operations at the proposed Exit 63 diverging diamond and to the east. West of Exit 63, one 15-minute analysis period on I-90 eastbound is projected to operate at LOS D, while the remainder of the 12-hour analysis period operates at LOS C or better. Each of the Build Feasible Options evaluated improves operations for westbound I-90 in this segment to acceptable levels when compared to the identified poor operations in the No Action scenario. Various freeway segments in the Exit 61 interchange and west of Exit 61 also exhibit LOS D operations, generally in the PM peak period. Intersection operations at Exit 63 maintain LOS C or better operations with the diverging diamond, and access management improvements have been included in the conceptual design. Projected operating conditions under the 2050 No Action scenario at Exit 61 and at Exit 67 are poor. The proposed Exit 63 project results in minor improvements at some intersections, but it does not address the forecasted operational shortfalls at these remote interchanges.

Initial safety evaluations were performed using tools defined in the Highway Safety Manual. Key areas of concern included the Exit 63 westbound on-ramp to I-90 and the Highway 1416 / West Gate Road intersection. Feasible Option 1 will replace the on-ramp at a new location, while Feasible Options 2 and 3 will reconstruct the ramp at approximately the existing location. In each case, current ramp design standards will be used to address existing safety concerns. The Highway 1416 / West Gate Road intersection will also be reconstructed under all three Feasible Options. However, Feasible Option 1 will result in a significant increase in turning vehicles at this intersection that may increase safety concerns when compared to Feasible Options 2 and 3.

In conclusion, the proposed diverging diamond interchange at Exit 63 will enhance safety, provide acceptable operations, and maintain compatibility with local and regional planning efforts.

8.1.2 Policy Point 2

The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access, such as managed lanes (e.g., transit or high occupancy vehicle and 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)). In rare instances where all basic movements are not provided by the proposed design, the report should include a full-interchange option with a comparison of the operational and safety analyses to the partial-interchange option. The report should also include the mitigation proposed to compensate for the missing movements, including wayfinding signage, impacts on local intersections, mitigation of driver expectation leading to wrong-way movements on ramps, etc. The report should describe whether future provision of a full interchange is precluded by the proposed design.

As noted in the project's need statement, the existing Exit 63 interchange does not provide for all traffic movements. The Feasible Options evaluated in this IMJR provide full access for all traffic movements and connect to a public road (Highway 1416). No request for a "less than full" interchange is being made. The proposed conceptual designs have been prepared using current standards, except for intersection spacing. Conceptual designs for interchanges with adequate intersection spacing were deemed infeasible in the previous Exit 61 to Exit 67 Corridor Study due to concerns associated with the wider interchange footprints, including floodplain, historic, and property acquisition issues. For each of the three Feasible Options evaluated in the IMJR, the intersection spacing was maximized within identified constraints. Additional refinement will occur during future phases of the Exit 63 project.