I-29 Exit 83 (60th St. N.) Interchange Feasibility Study

April, 2017

Sioux Falls, SD

Interchange Feasibility Study
I-29 Exit 83 (60th St. N.)

Sioux Falls, South Dakota
April, 2017

Prepared for:

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Office of Project Development
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Abbreviations

AASHTO	American Association of State Highway Transportation Officials
CMF	Crash Modification Factor
CRM	Critical Rate Method
EA	Environmental Assessment
FHWA	Federal Highway Administration
HCS	Highway Capacity Software
HOT	High Occupancy Transit
HOV	High Occupancy Vehicle
HSM	Highway Safety Manual
LOS	Level of Service
MRM	Mileage Reference Marker
MPO	Metropolitan Planning Organization
MSA	Metropolitan Statistical Area
SDDOT	South Dakota Department of Transportation
STIP	Statewide Transportation Improvement Program
TAZ	Traffic Analysis Zone
TIP	Transportation Improvement Program

EXECUTIVE SUMMARY

This Interchange Feasibility Study (IFS) report provides technical analysis related to proposed changes to the existing 60th Street North interchange (Exit 83) on Interstate 29 in Sioux Falls, SD. The IFS supports a future Environmental Assessment (EA) or Categorical Exclusion (CE).

The proposed action is a reconfiguration of the existing 60th Street North interchange on Interstate 29 in Sioux Falls, SD. The action is proposed to bring the existing interchange up to current design standards and provide appropriate operational capacity for future traffic demand. No adverse impacts to the Interstate highway system are forecast due to the proposed change.

The Federal policy considerations and requirements have been addressed beginning on page 113 and summary responses to the eight requirements are provided below. No action on the Interstate system is anticipated during the next 10 years. This analysis will need to be updated with an Interchange Modification Justification Report prior to approval by the Federal Highway Administration.

The proposed change is a reconfiguration of an existing interchange and improvements to the existing crossroad facility. The changes will improve current interchange and crossroad design deficiencies including short distances between the 60th St. N. service interchange and the I-90 system interchange, low peak hour ramp terminal level of service, and low peak hour crossroad level of service. The proposed change does not result in any new access points on the Interstate Highway System.

The concept scenarios involve changes to the geometric design of an existing interchange and changes to the crossroad arterial street to satisfy current design standards and meet the transportation needs in the study area. Mass transit reaches a limited market in South Dakota and HOV facilities are currently not in use because they have not been shown to be economically feasible. Neither mass transit nor HOV facilities will correct design deficiencies or provide sufficient relief to future travel demand within the study planning horizon.

The operational and safety analysis contained in this study shows that the proposed build scenarios are not expected to adversely affect the safety or efficiency of the Interstate system.

The conceptual signing plans for Scenario 10 are shown in Figure 19.

The proposed access is a reconfiguration of an existing interchange with full access to an arterial city street and includes all movements. The conceptual drawings have been prepared using current standards and further design using current standards is anticipated and will receive additional reviews throughout the next steps of the environmental process and design.

The proposal is the result of land use and transportation plans prepared within the MPO process, including the Sioux Falls MPO Long Range Transportation Plan. It is anticipated that the proposed interchange construction will be included in future versions of the STIP and TIP. An improvement project for 60th St. N. from I-29 to Westport Ave. is scheduled for 2020 in the tentative 2017-2020 Statewide Transportation Improvement Program (STIP) and the Metropolitan Planning Organization (MPO) Transportation Improvement Program (TIP).

Analysis techniques included evaluation of operational capacity using Highway Capacity Manual 2010 techniques via HCS 2010. Highway Safety Manual techniques were used to the extent possible in this report. Other techniques and reference materials are detailed in a Methods and Assumptions document prepared for this study and signed by South Dakota Department of Transportation and Federal Highway Administration participants in July, 2014 and modified as necessary throughout the study.

The proposed interchange modifications at I-90/I-29 and I-29/60th St. N. are expected to be needed outside of the current project programming period. The City of Sioux Falls is planning interim improvements on 60th St. N. to maintain operations until interchange improvements are needed. Those improvements include:

- In 2018, design and install traffic signals at 60th St. N./Granite Ln. The design should accommodate future widening on Granite Ln. and 60th St. N. This improvement will mitigate the crash history that has resulted from the high volumes of trucks and passenger vehicles using this intersection.
- Reconstruct 60th St. N. to allow for three lanes eastbound within 5 years, widening the existing surface to allow for free right turns at the northbound I-29 ramp terminal. The third lane should extend to Westport Ave.
- Within 5 years, reconstruct 60th St. N. /Granite Ln. to provide geometrics as detailed in Scenario 10 included in this report. Coordination with the Red Stone development will be needed to determine roadway oversizing of Granite Ln. While reconstructing this intersection, a third lane westbound should be constructed to allow a free right (southbound to westbound) from Granite Ln. to I-29, as shown in Scenario 10.

INTRODUCTION

Background

SDDOT, the City of Sioux Falls, the Sioux Falls Metropolitan Planning Organization, and the Federal Highway Administration have conducted a study to evaluate the design, operations, policy and funding implications of modifying the 60th Street North interchange (Exit 83) on I-29 in Sioux Falls, SD. This existing interchange serves an urban arterial corridor that carries a significant amount of commuting traffic. This Interchange Feasibility Study is being prepared in advance of an Environmental Assessment (EA) or Categorical Exclusion (CE) document and will provide background analysis for the selection of a preferred alternative.

Purpose

The interchange crossroad has experienced increasing congestion in recent years. The northbound I-29 ramp terminal intersection currently operates at a low level of service during the AM peak hour due to heavy eastbound traffic and northbound right turning traffic. There is also a short distance (about 860') between the northbound ramp terminal and a heavy-volume local street intersection, resulting in vehicles (particularly trucks) weaving through crossroad traffic and stacking to turn.

The subject interchange is also in close proximity to the I-90/I-29 system interchange, requiring consideration of revision of the Exit 83 ramp configuration to provide more spacing between the system and service interchanges.

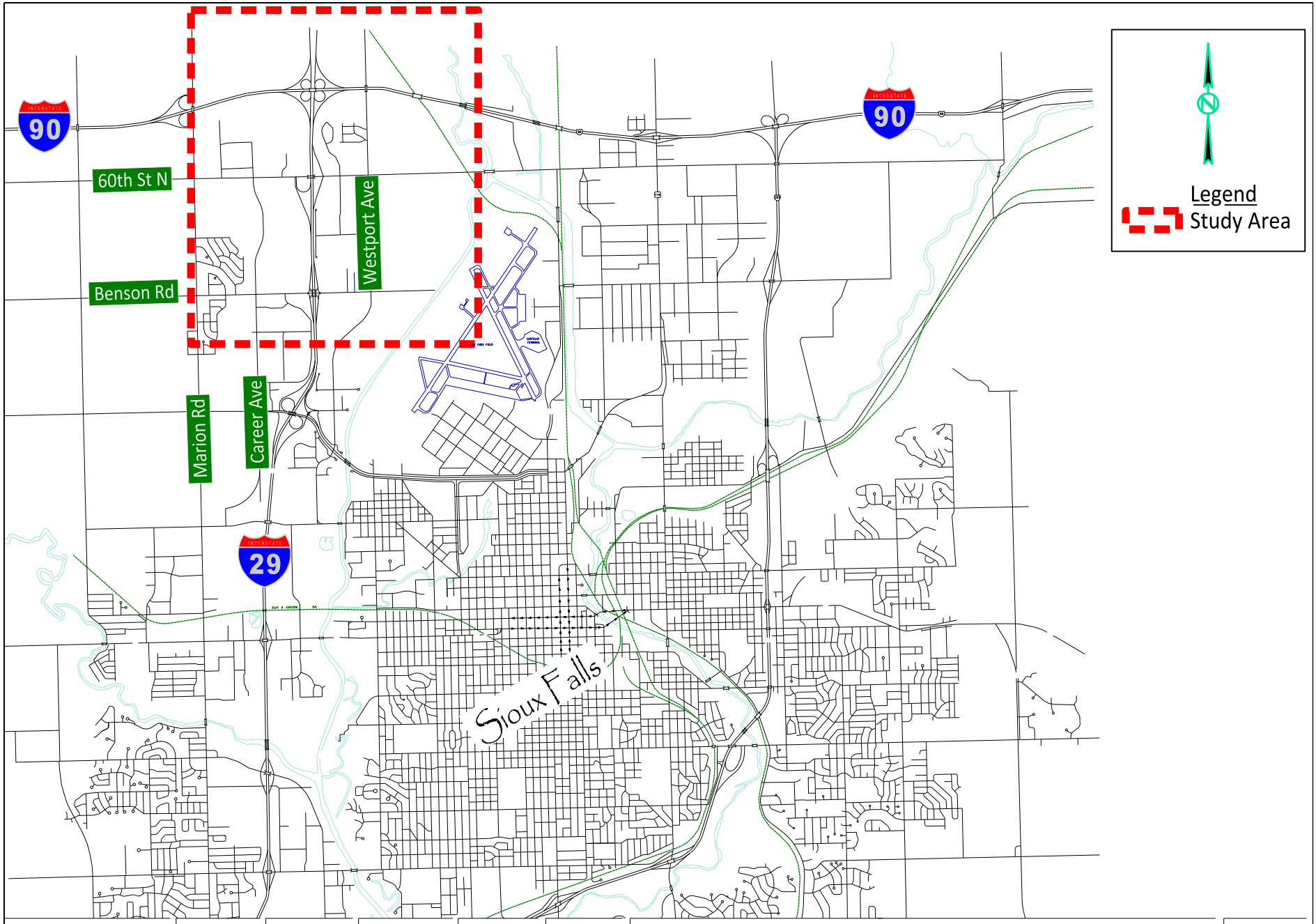
Project Location

The subject interchange is at mileage reference marker 83 on Interstate 29, in northwest Sioux Falls, SD. This location is within the Sioux Falls MPO and also within the developed Sioux Falls urban area. The adjacent interchanges on I-29 are Benson Road (Exit 82) and the I-90 system interchange (Exit 84). Interchange spacing is approximately 1 mile to Benson Road from the subject interchange and about 4000' to Interstate 90.

There are several local roadways in the vicinity of the interchange. The crossroad, 60th Street North, is a four-lane median-divided roadway within the study area. 60th Street N is intersected by Marion Road approximately 1 mile west of I-29. Two collector roadways, Annika Avenue and Career Avenue intersect 60th Street N approximately ¾ mile and ½ mile west of I-29, respectively. The nearest intersection on 60th Street N east of I-29 is Granite Lane/Northview Avenue, approximately 1300' east of the I-29 centerline and 760' from the northbound ramp terminal. Kiwanis Avenue/Westport Avenue intersects 60th Street N approximately ½ mile east of I-29. The 60th /Marion, 60th/Annika, and 60th/Westport intersections are currently controlled by traffic signals, while the other minor streets and driveways are controlled by stop signs. Improvements within the study area, including projects undertaken by the City of Sioux Falls, are planned to provide additional capacity along 60th St. N. A solution to congestion issues in the interchange area, however, may require modification of the interchange itself. Note that the

gore-to-gore distance between the Exit 83 and the I-29/I-90 system interchange is only about 1000'. This can result in difficult weaving as traffic volumes grow.

Other local streets intersect I-29 at the adjacent Benson Road interchange or lie within the street network in the vicinity of the subject interchange. The study area, therefore, has been defined as Interstate 29, from MRM 82 to MRM 84, including Exits 82, 83, and 84, 60th Street N from Marion Road to Westport Avenue, and portions of Benson Road that are part of the local street network served by the subject interchange and the adjoining interchanges. The study area is shown in **Figure 1** and the study area analysis intersections are shown in **Figure 2**.



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Date: 6-20-14
Chked By: R.Laughlin
Date: 6-20-14
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Study Area

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 1

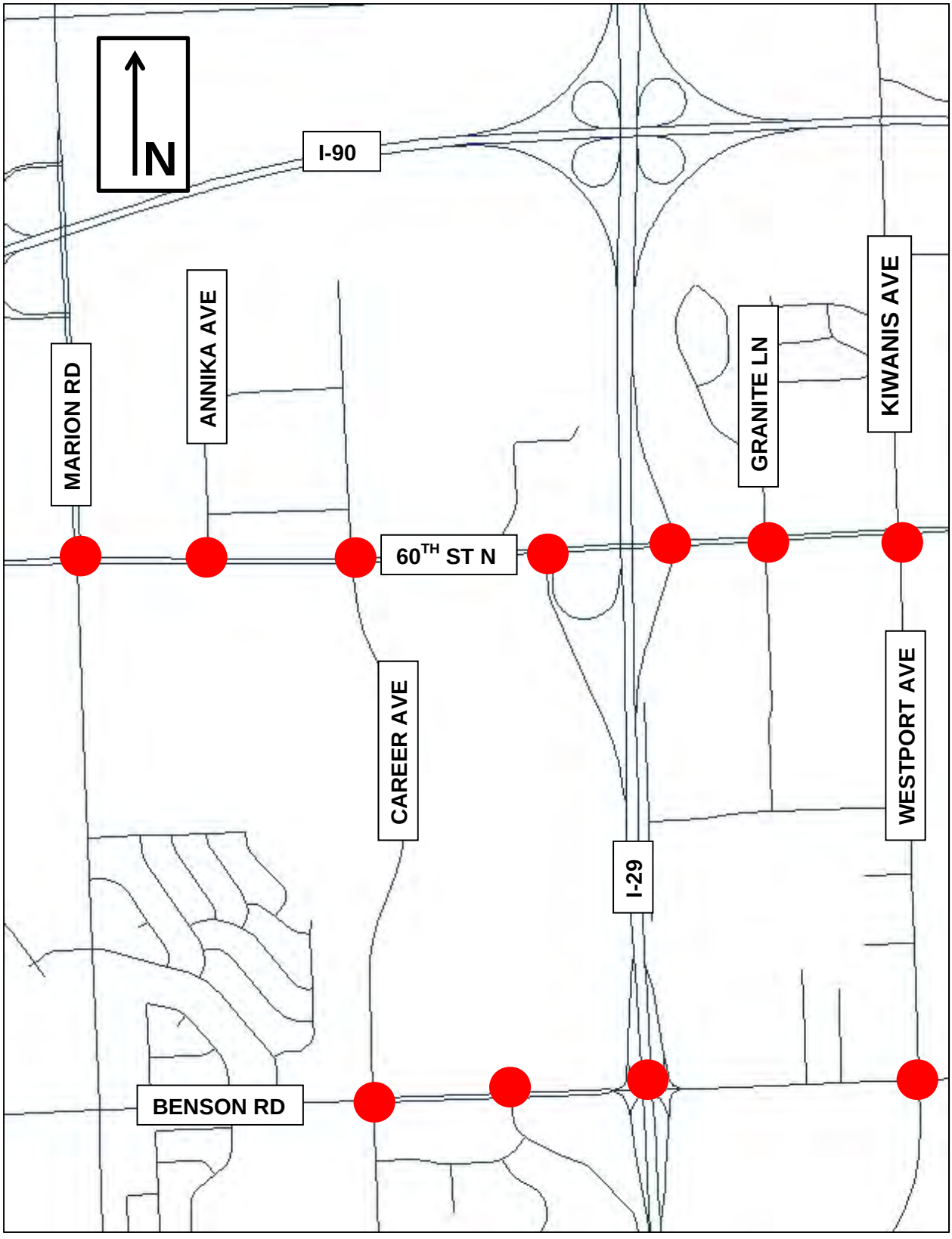


Figure 2 – Study Area Analysis Intersections

METHODOLOGY

Preparation of this report included the following work tasks:

- Data gathering
- Review previous Interstate studies, including feasible alternatives and the recommended alternative.
- Determine existing and future operational characteristics of Interstate and local street facilities.
- Prepare deliverable report.

Traffic forecasts were prepared using output from the regional travel demand model maintained by the City of Sioux Falls and the Sioux Falls MPO. Traffic operations were analyzed using the Highway Capacity Manual techniques using HCS 2010 software modules and Highway Safety Manual techniques.

Additional details on methodology can be found in the Methods and Assumptions agreement (March 2016 latest revision) prepared for this project. The Methods and Assumptions document has been included in **Appendix 8**.

EXISTING CONDITIONS

Demographics

The Sioux Falls metropolitan area enjoys a robust economy and sustained population growth. During the period 1980 – 2000 the population grew at a steady rate of between 2% and 3% per year. Even in the face of the recent recession, the population continued to grow at an annual rate of 1%-2% per year and the 2010 Census shows the city with a population of 153,888, while the Metropolitan Statistical Area (MSA) had a population of 228,261 and the market area had a population of 1,043,450. (Market area is a term used in economics and human geography describing the area surrounding a central place, from which people are attracted to use the place's goods or services.)

Generally, employment for the Sioux Falls area has grown at approximately the same rate as the population and unemployment is approximately 2.1% in Sioux Falls, compared with a statewide rate of 2.7%, regional rate of 3.0%, and a national unemployment rate of 5.0%.

Existing Land Use

The study area is comprised mainly of commercial uses ranging from big-box retail to light industrial with a smaller presence of single family and multifamily residential uses. There is also a large institutional use, University Center Sioux Falls, along Career Avenue, south of 60th St. N. The study area Traffic Analysis Zones (TAZ's) currently reflect the existing population and employment inputs. The future-year TAZ's show gradual infill of uses similar to those currently existing in the study area.

The future land use plan for Sioux Falls shows continued development of the existing land uses for this portion of the urban area.

Existing Roadway Network

As previously identified, the existing major roadways within the study area include:

- Interstate 29 – currently three lanes in each direction, with auxiliary lanes between interchanges (exception: I-29 northbound between Exit 83 and Exit 84 has no auxiliary lane).
- 60th Street North – 4-lane divided urban arterial roadway that transitions to a 2-lane rural roadway east of Westport Avenue
- Benson Road – 4-lane divided urban arterial roadway transitioning to 2-lane rural arterial roadway
- Marion Road – 2-lane rural arterial roadway transitioning to 4-lane divided urban arterial roadway
- Annika Avenue – 2-lane urban collector roadway
- Career Avenue – 2-lane urban collector roadway
- Granite Lane/Northview Avenue – 2-lane urban collector roadway
- Westport Avenue – 2-lane rural collector roadway

Alternative Travel Modes

Travel within the study area is primarily by automobile. Pedestrian and bicycle users are seldom seen along 60th Street N. An extension of the regional recreational trail system is planned for the drainageway that intersects 60th Street N just west of the subject interchange. The area is currently served by municipal transit route 19, operating on portions of Career Avenue, 60th St. N, and Annika Avenue. Buses operate on 60 minute headways.

Interchanges

Interchanges within the study area include:

- I-29/Benson Road (Exit 82) – a single-point interchange configuration.
- I-29/60th Street N (Exit 83) – the subject interchange is a modified diamond configuration with the southbound off ramp looped on the south side of 60th St. N. Both ramp termini are controlled by traffic signals.
- I-29/I-90 (Exit 84) – this system interchange is currently a cloverleaf configuration, but is planned for modification to convert the westbound-to-southbound and eastbound-to-northbound ramps to fly-overs.

Aerial photos of the existing interchanges have been included in the Appendix, Part 6.

Existing Data

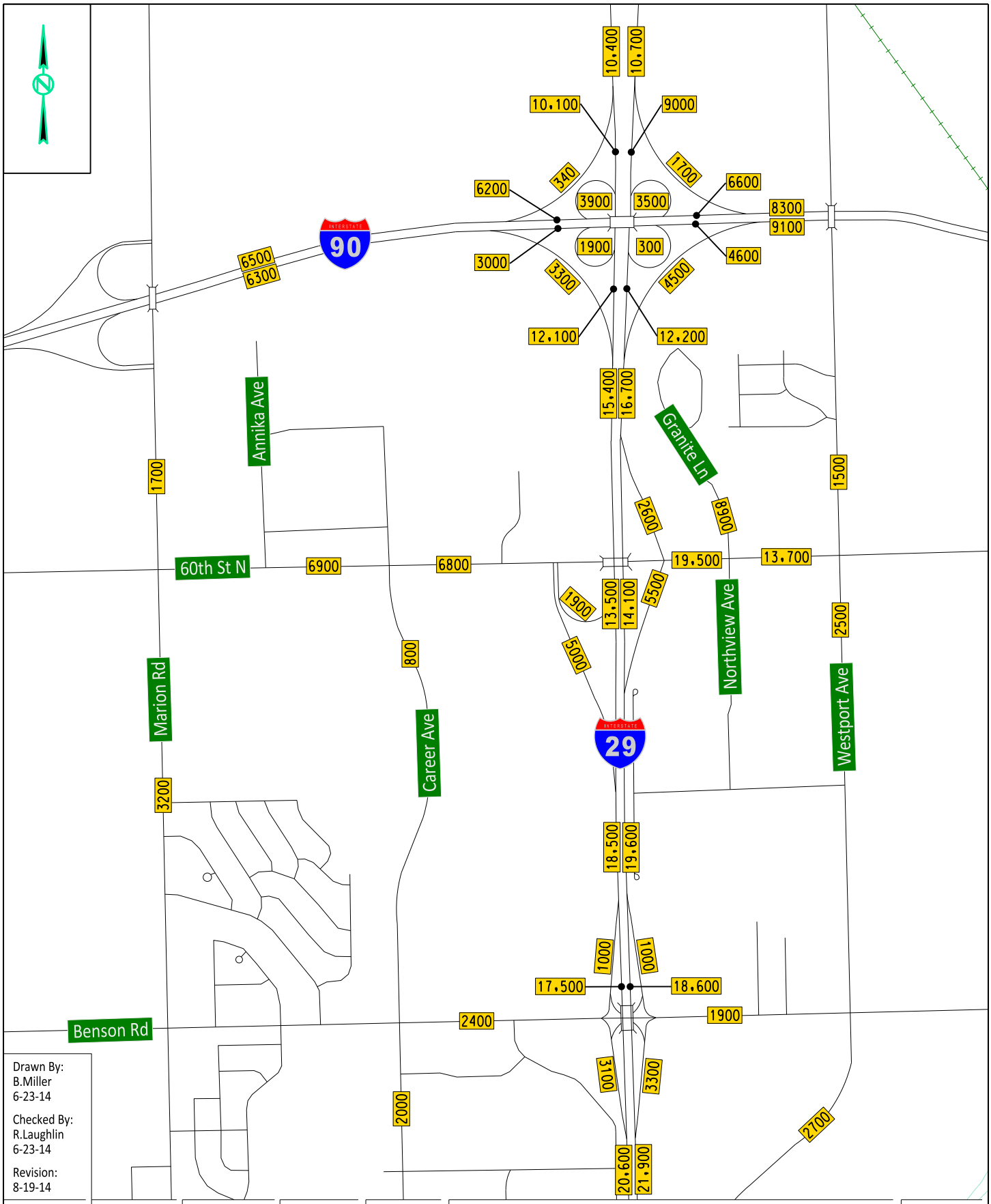
Most arterial roadway study data were available from the participating agencies, including traffic counts, crash data, and raw travel demand model output. The available data were supplemented with Interstate system counts, vehicle classifications, and traffic observations. The data is recent and of high quality.

Operational Performance

Operational performance of highways is evaluated in terms of the quality of service, which describes how well a transportation facility operates from the traveler's perspective. Quality of service is usually measured with "Level of Service", a letter grade similar to those used in school. Level of service A refers to uncongested traffic conditions, with levels of service B through E describing increasingly more congested conditions and level of service F describing the highest congestion or saturation. Level of service is determined in different ways for different roadway facilities, with Interstate highway facilities evaluated in terms of vehicle density, urban intersections evaluated in terms of vehicle delay, and other facilities evaluated using other measures of roadway dynamics. All quality of service is determined using techniques developed for the Highway Capacity Manual (HCM), published by the Transportation Research Board.

The existing study area roadways were evaluated using the HCM methodologies for Interstate highways and urban streets. SDDOT has established a minimum level of service standard of "C" for urban interstate facilities, including ramp terminal intersections. The City of Sioux Falls has established a minimum level of service standard of "D" for arterial signalized intersections. Interstate 29 operates at acceptable levels of service under existing conditions. Two street intersections, including the northbound ramp terminal operate at unacceptable levels of service during peak hours. Daily traffic volumes in the study area are shown in **Figures 3**. Peak hour

traffic volumes and levels of service are summarized in **Figures 4 through 7d**. Supporting analysis printouts are provided in the Appendix 1 and 2.



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R.Laughlin
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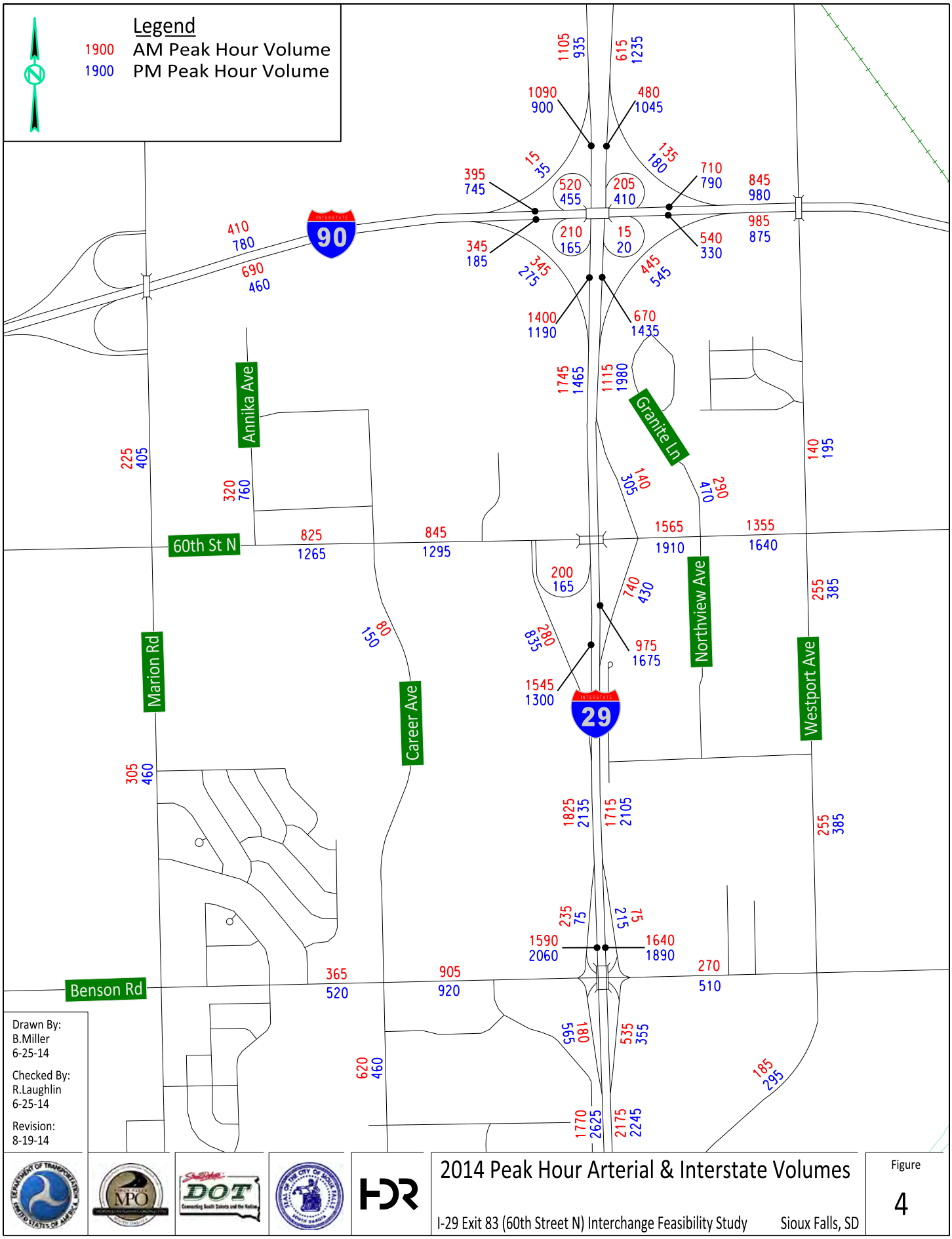
8-19-14

2014 Study Area ADT Volumes

I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD

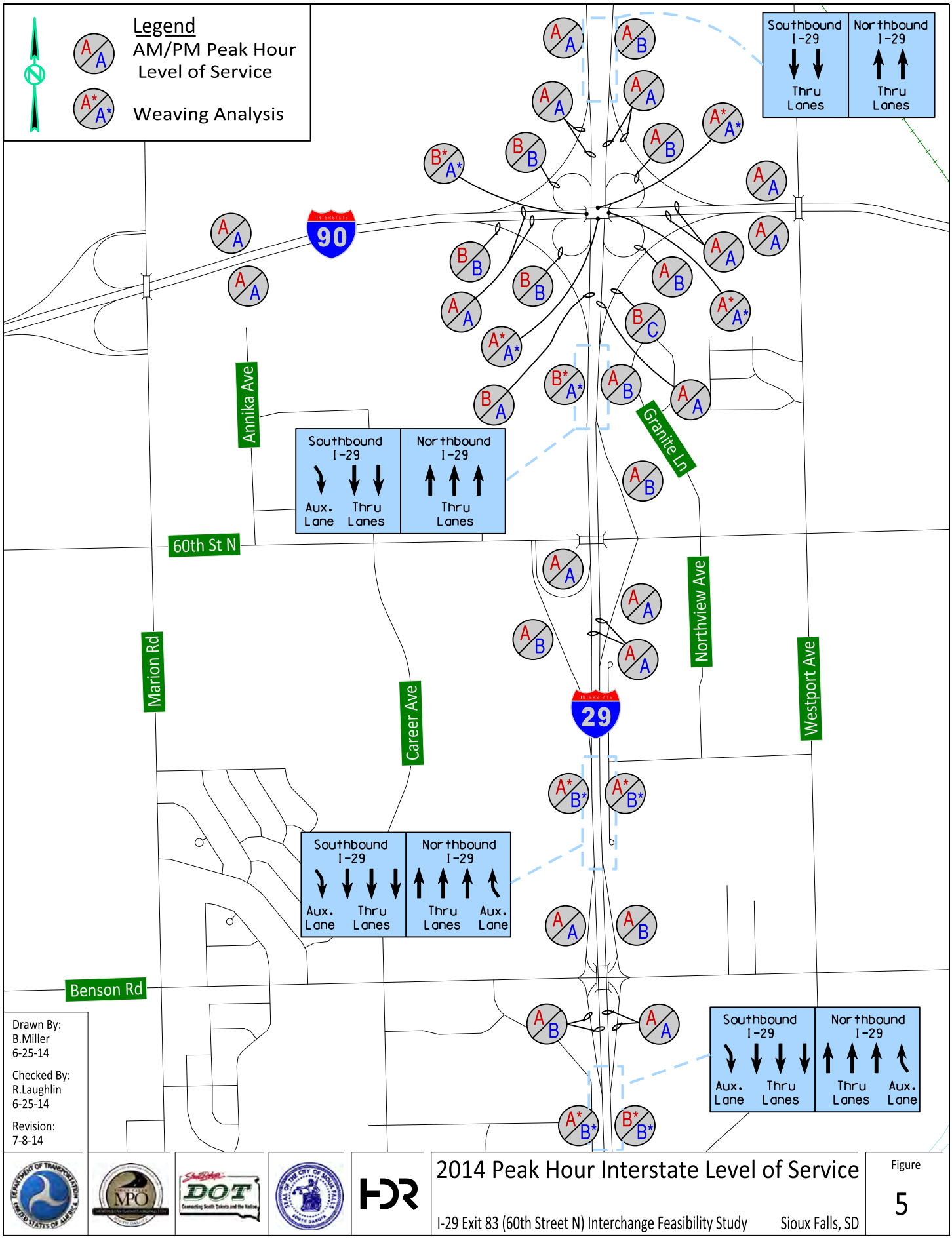
Figure
3



2014 Peak Hour Arterial & Interstate Volumes

I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD

Figure 4


Legend
AM/PM Peak Hour Level of Service
Weaving Analysis
Southbound I-29
Thru Lanes
Northbound I-29
Thru Lanes
90
Annika Ave
Granite Ln
Southbound I-29
Aux. Lane
Thru Lanes
Northbound I-29
Thru Lanes
60th St N
Marion Rd
Career Ave
Northview Ave
Westport Ave
29
Southbound I-29
Aux. Lane
Thru Lanes
Northbound I-29
Thru Lanes
Aux. Lane
Benson Rd
Southbound I-29
Aux. Lane
Thru Lanes
Northbound I-29
Thru Lanes
Aux. Lane
Drawn By: B.Miller 6-25-14
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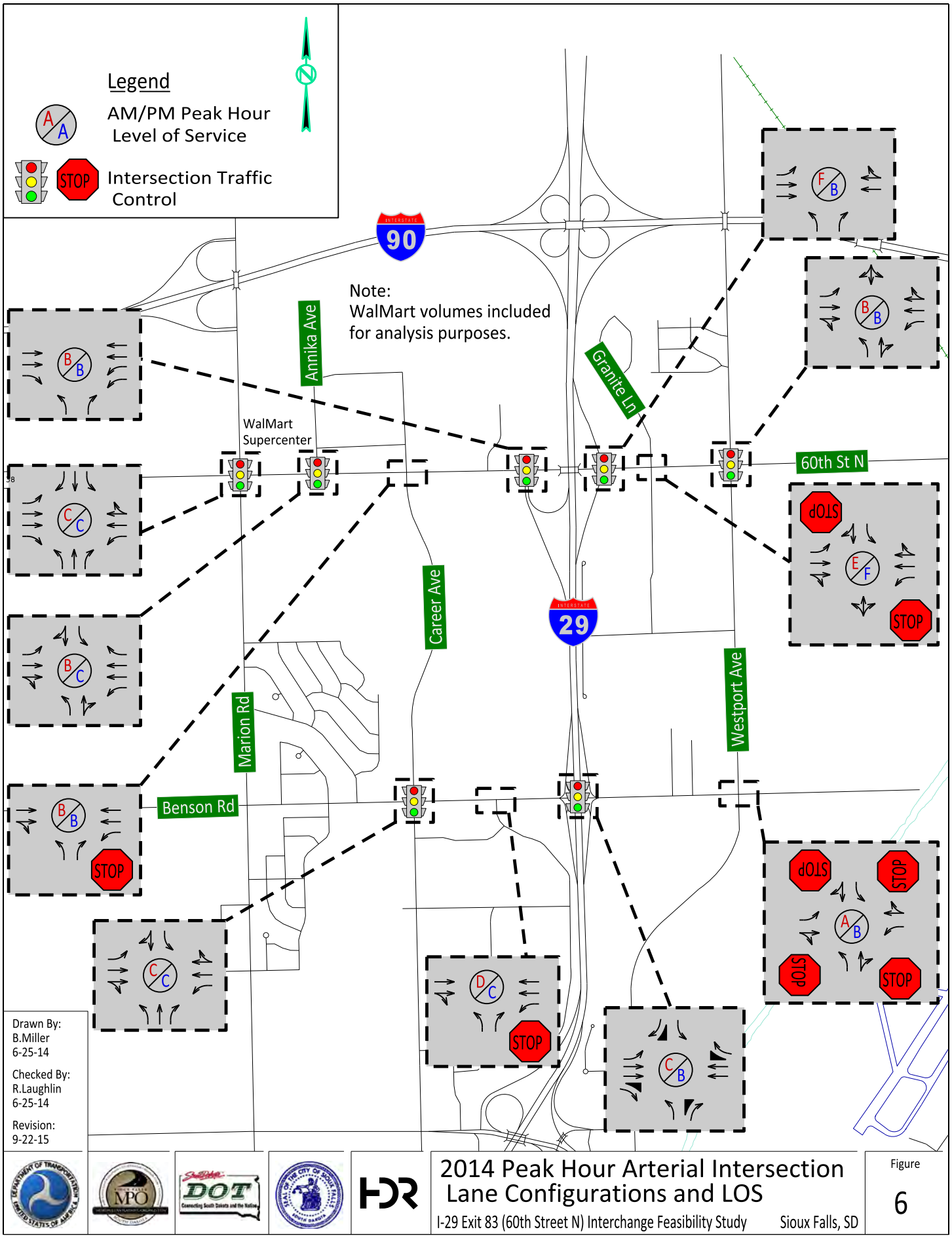
2014 Peak Hour Interstate Level of Service
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
5


Legend
AM/PM Peak Hour Level of Service
Intersection Traffic Control
Note:
WalMart volumes included for analysis purposes.
90
29
Annika Ave
Granite Ln
WalMart Supercenter
60th St N
Career Ave
Marion Rd
Westport Ave
Benson Rd
STOP
Drawn By:
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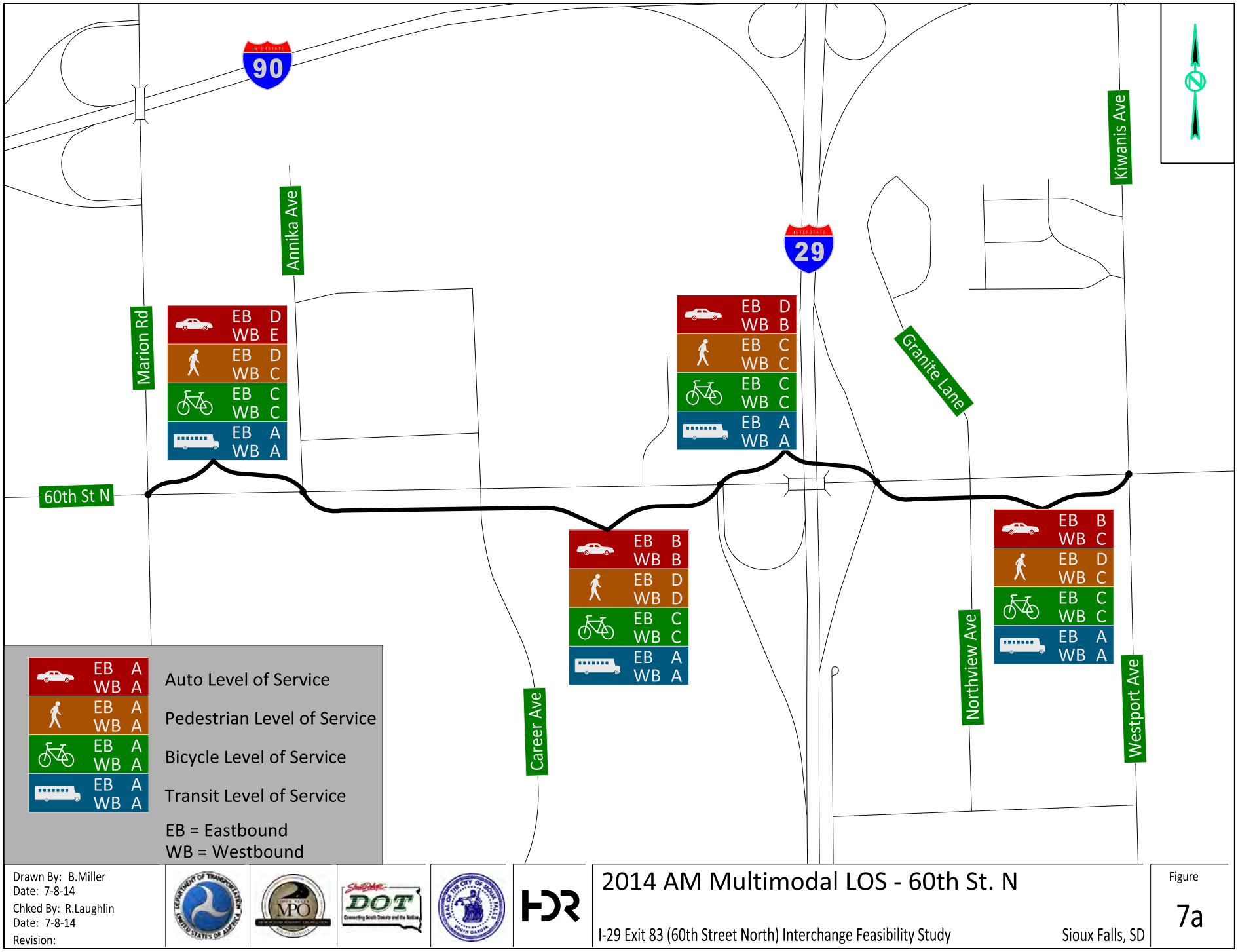
Revision:
9-22-15
2014 Peak Hour Arterial Intersection Lane Configurations and LOS
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
6



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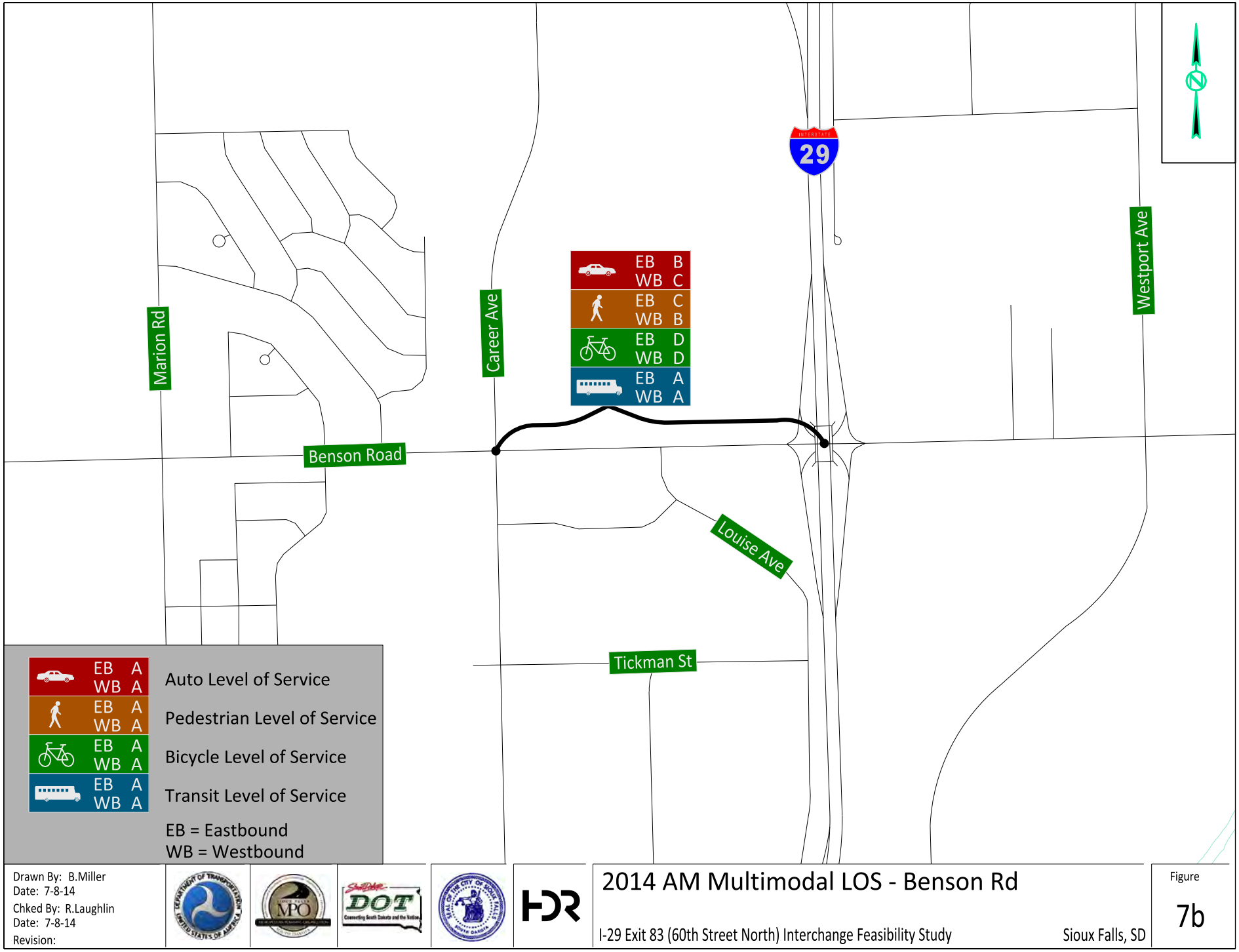
2014 AM Multimodal LOS - 60th St. N

I-29 Exit 83 (60th Street North) Interchange Feasibility Study — Sioux Falls, SD

Figure 7a



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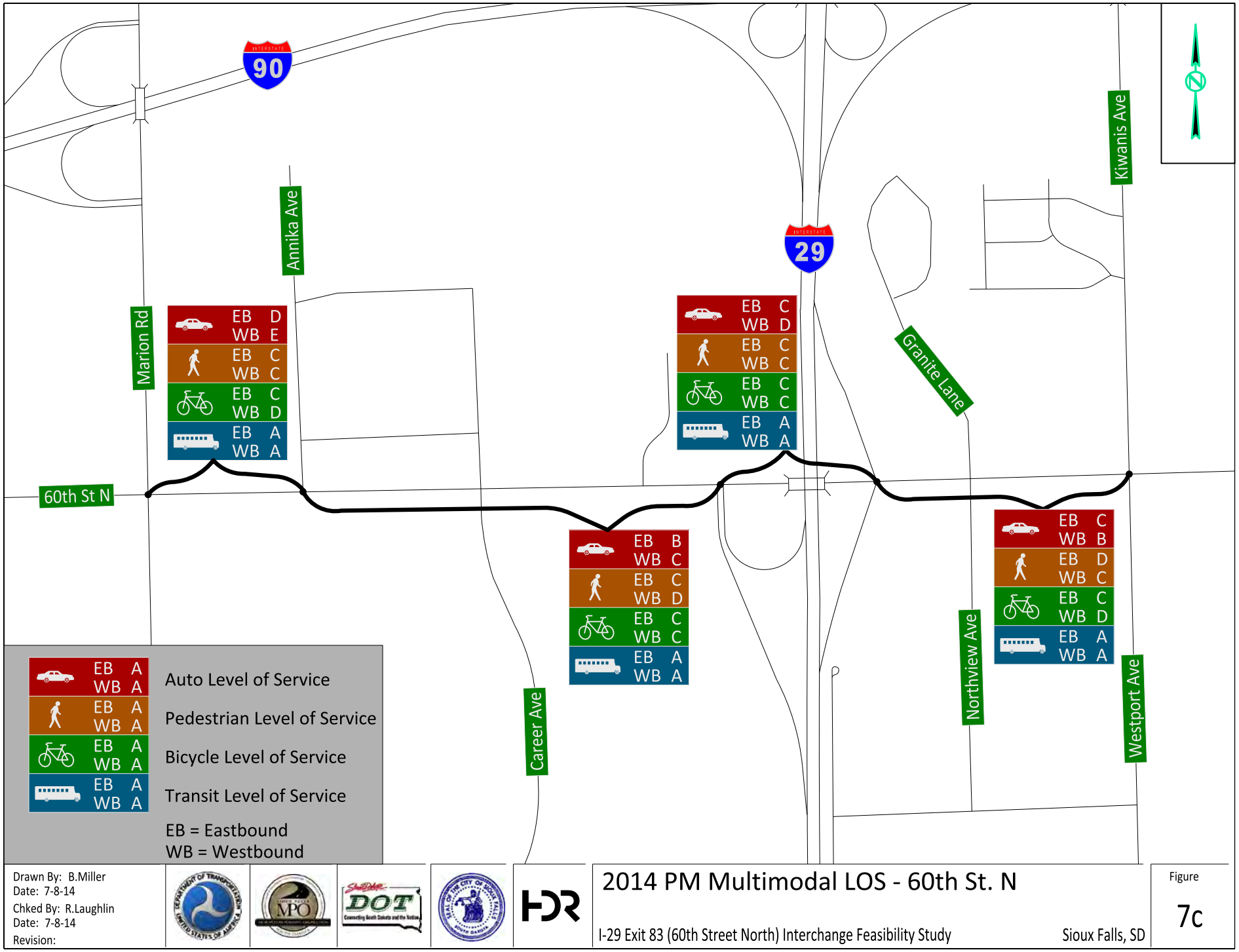
2014 AM Multimodal LOS - Benson Rd

I-29 Exit 83 (60th Street North) Interchange Feasibility Study — Sioux Falls, SD

Figure 7b



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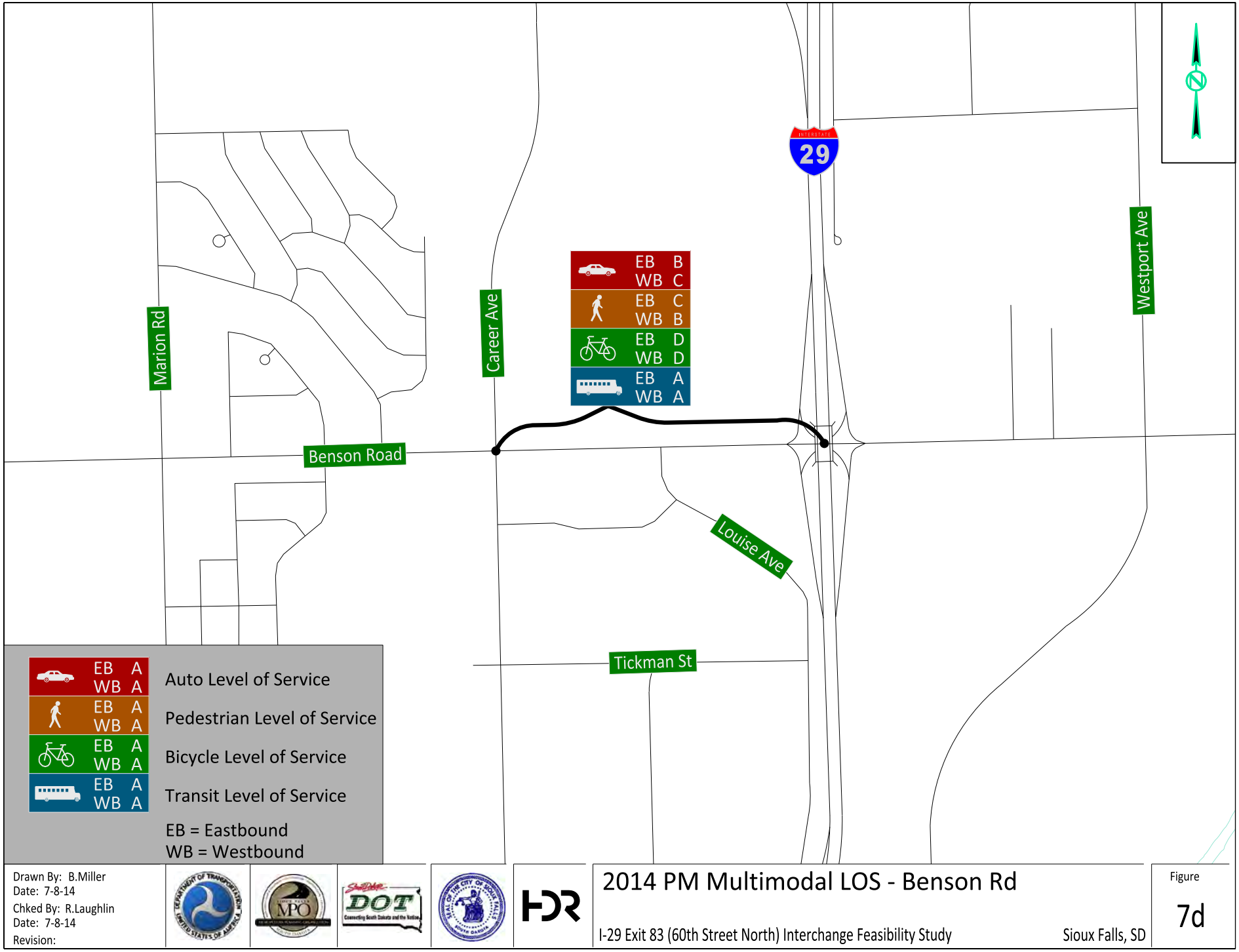
2014 PM Multimodal LOS - 60th St. N

I-29 Exit 83 (60th Street North) Interchange Feasibility Study — Sioux Falls, SD

Figure 7c



Drawn By: B.Miller
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2014 PM Multimodal LOS - Benson Rd

I-29 Exit 83 (60th Street North) Interchange Feasibility Study — Sioux Falls, SD

Figure 7d

Existing Safety Conditions

An analysis of existing safety conditions was conducted, based on crash records provided by SDDOT. The analysis was conducted using the Critical Rate Method, as described in the Highway Safety Manual (HSM), published by the American Association of State Highway and Transportation Officials (AASHTO).

Highway Safety Manual definition:

- *Critical Rate Method (CRM) – a method in which the observed crash rate at each site is compared to a calculated critical crash rate that is unique to each site.*

The crash analysis concentrated on the following roadway facilities:

- Interstate mainline segments (Table 1)
- Interstate ramp segments (Table 2)
- Arterial street intersections (Table 3)

Critical rate crash analysis was conducted for each type of roadway facility using spreadsheets, displayed in Tables 1, 2, and 3 on the following pages. The results of the analysis are displayed in Maps 1, 2, and 3, with segments and intersections with crash rates below the critical rate shown in green and segments and intersections with crash rates above the critical rate shown in red. Crash rates above the critical rate indicate the need for closer investigation and possible employment of crash mitigation measures.

TABLE 1 - INTERSTATE SEGMENT CRASH RATES (2008-2013)

I-29/60TH ST. N. IMJR

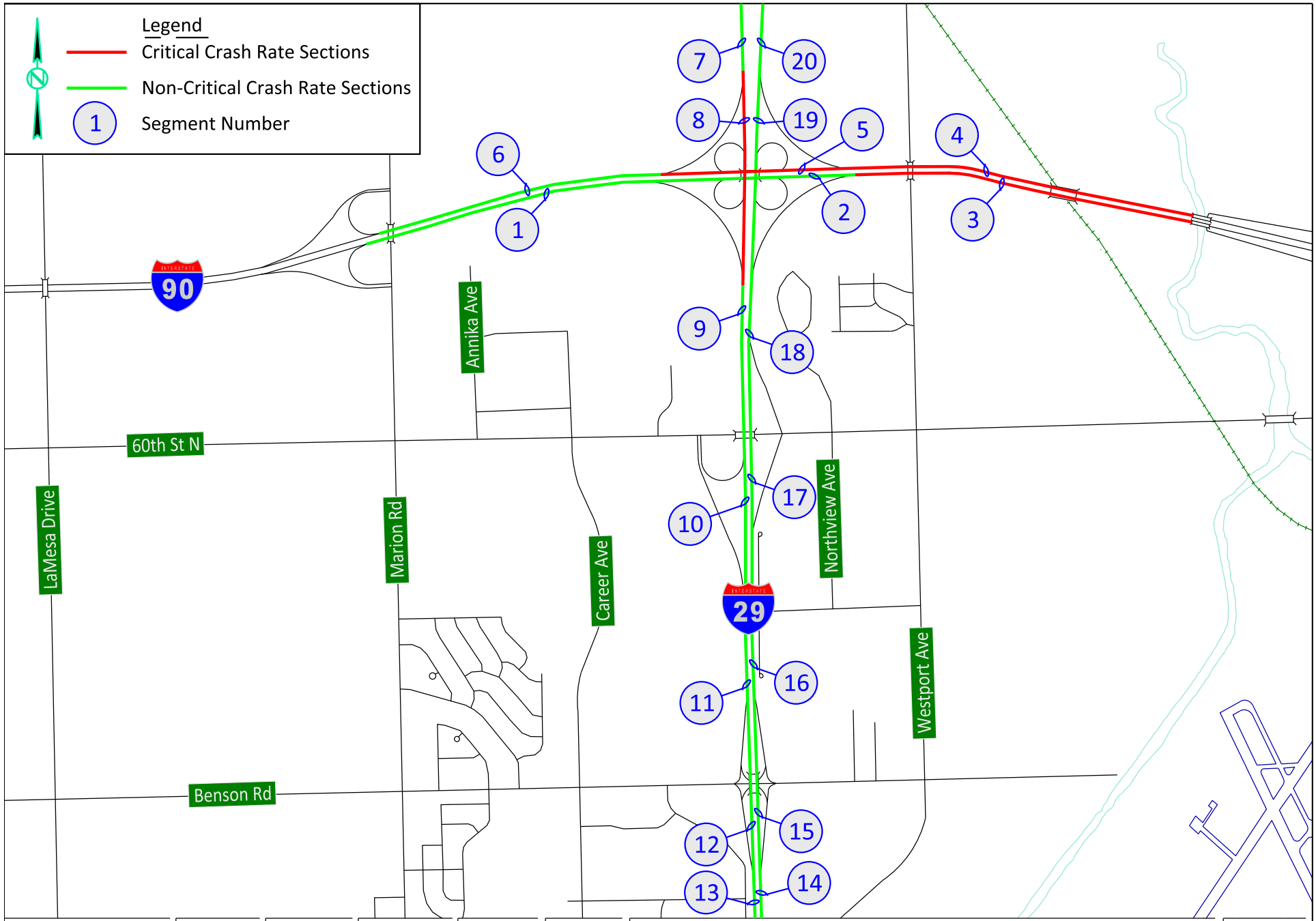
TRAVEL DIRECTION	SEGMENT	NUMBER CRASHES	SEGMENT LENGTH	DAILY VOLUME	MVMT[1]	CRASH RATE	*TEV*R* [2]	CRITICAL RATE	DIFFERENCE
EB	1: I-90, MARION TO I-29	12	0.812	6400	7.59	1.58	10122.14	2.00	-0.42
EB	2: I-90, I-29 TO I-29	10	0.648	7700	7.28	1.37	10569.93	2.02	-0.65
EB	3: I-90, I-29 TO BIG SIOUX RIVER	17	0.598	9000	7.86	2.16	19471.30	1.99	0.17
WB	4: I-90, BIG SIOUX RIVER TO I-29	29	0.586	8300	7.10	4.08	33895.93	2.03	2.05
WB	5: I-90, I-29 TO I-29	15	0.616	7400	6.66	2.25	16678.53	2.06	0.20
WB	6: I-90, I-29 TO MARION	8	0.809	6500	7.68	1.04	6773.12	2.00	-0.96
SB	7: I-29, RAILROAD TO I-90	14	0.501	10400	7.61	1.84	19139.80	2.00	-0.16
SB	8: I-29, I-90 TO I-90	42	0.577	14000	11.79	3.56	49856.37	1.85	1.71
SB	9: I-29, I-90 TO 60TH	16	0.505	15400	11.35	1.41	21700.80	1.86	-0.45
SB	10: I-29, 60TH TO 60TH	7	0.432	13500	8.51	0.82	11098.43	1.96	-1.14
SB	11: I-29, 60TH TO BENSON	12	0.277	18500	7.48	1.60	29672.12	2.01	-0.41
SB	12: I-29, BENSON TO BENSON	9	0.515	17500	13.16	0.68	11969.68	1.81	-1.13
SB	13: I-29, BENSON TO 34TH	6	0.245	20600	7.37	0.81	16773.83	2.02	-1.20
NB	14: I-29, 34TH TO BENSON	4	0.272	21900	8.70	0.46	10072.52	1.95	-1.49
NB	15: I-29, BENSON TO BENSON	12	0.473	18600	12.84	0.93	17376.70	1.82	-0.89
NB	16: I-29, BENSON TO 60TH	10	0.449	19600	12.85	0.78	15254.60	1.82	-1.04
NB	17: I-29, 60TH TO 60TH	9	0.635	14100	13.07	0.69	9707.69	1.82	-1.13
NB	18: I-29, 60TH TO I-90	8	0.139	16900	3.43	2.33	39420.52	2.41	-0.08
NB	19: I-29, I-90 TO I-90	19	0.582	12700	10.79	1.76	22360.31	1.88	-0.12
NB	20: I-29, I-90 TO RAILROAD	14	0.499	10900	7.94	1.76	19216.52	1.99	-0.22

[1]MEV = MILLION ENTERING VEHICLES

[2]TEV*R = TOTAL ENTERING VEHICLES PER DAY, TIMES OBSERVED CRASH RATE

SOURCE: HIGHWAY SAFETY MANUAL, FIRST EDITION, 2010, AASHTO

NOTE: THE RED AND GREEN HIGHLIGHTS PROVIDE A QUICK VISUAL INDICATION OF WHICH SEGMENTS HAVE A CRASH RATE OUTSIDE OF THE STATISTICAL CRITICAL RATE. THE RED SEGMENTS ARE CONSIDERED OUTSIDE THE CRITICAL RATE (HAVING A CRASH RATE OUTSIDE THE NORMAL RANGE AND POSSIBLY REQUIRING ATTENTION AND SAFETY IMPROVEMENTS) WHILE THE GREEN SEGMENTS ARE INSIDE THE CRITICAL RATE. THE CRASH ANALYSIS IS BEING PERFORMED AS PART OF THE IMJR PROCESS, A PLANNING PROCESS FOR FUTURE POTENTIAL INTERCHANGE PROJECTS. THE HIGHWAY SAFETY MANUAL IS BEING USED AS A REFERENCE FOR PROPER PLANNING OF THE ROADWAY FEATURES THAT MAY BE ASSOCIATED WITH POTENTIAL INTERCHANGE IMPROVEMENTS. PROVIDING A COMPLETE EXPLANATION OF THE CRITICAL RATE METHOD WOULD REQUIRE RESTATEMENT OF LARGE PORTIONS OF THE HIGHWAY SAFETY MANUAL IN THIS DOCUMENT. INSTEAD, THE HSM IS INCLUDED BY REFERENCE.



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Map 1 - Interstate Segments for Crash Analysis (See Table 1)

I-29 Exit 83 (60th Street North) Interchange Modification Justification Report Sioux Falls, SD

Map 1

TABLE 2 - INTERSTATE RAMP CRASH RATES (2008-2013)

I-29/60TH ST. N. IMJR

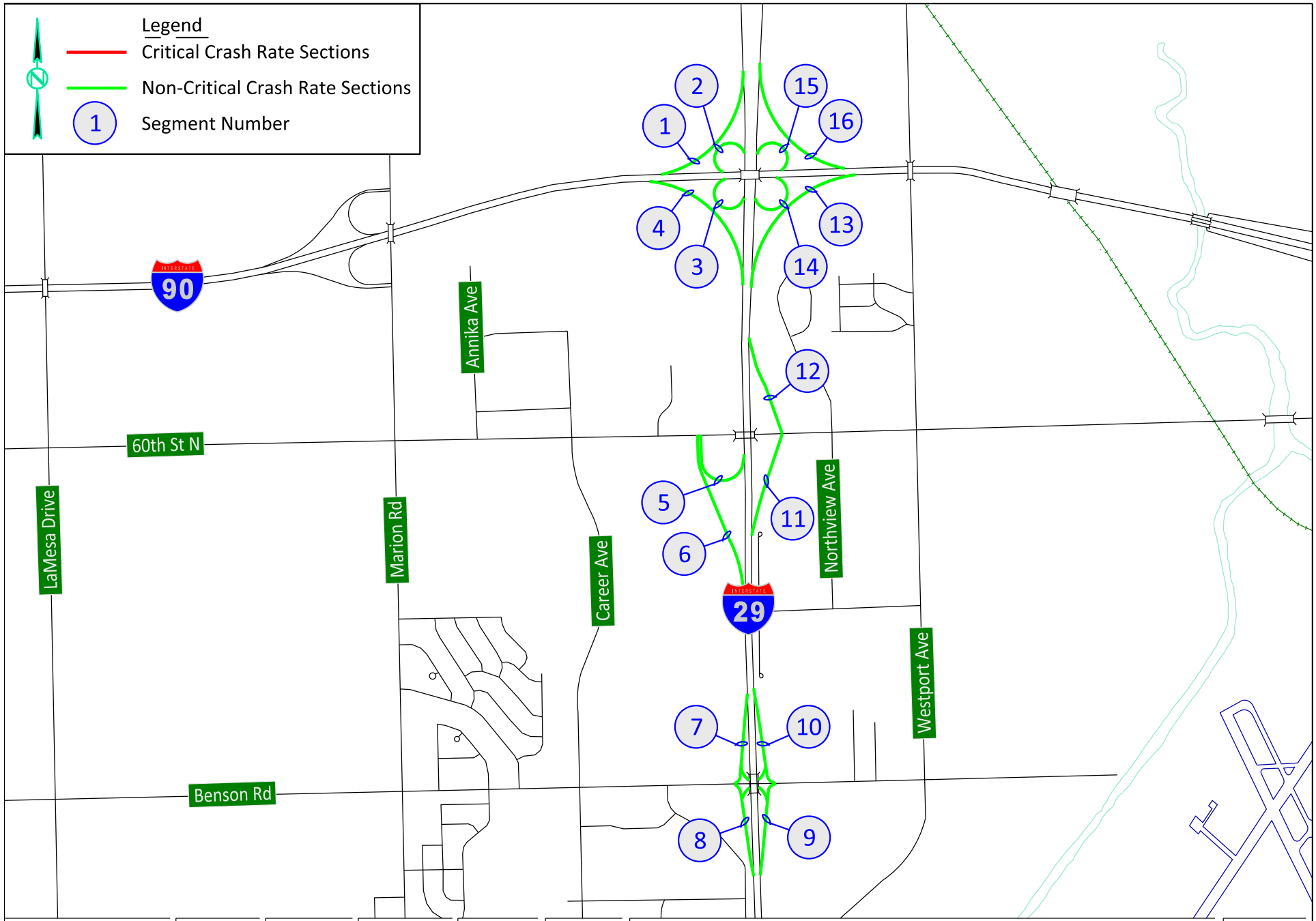
TRAVEL DIRECTION	SEGMENT	NUMBER CRASHES	SEGMENT LENGTH	DAILY VOLUME	MVMT[1]	CRASH RATE	*TEV*R*[2]	CRITICAL RATE	DIFFERENCE
SB	1: SB I-29 TO WB I-90 RAMP	1	0.447	300	0.20	5.11	1532.29	9.64	-4.53
SB	2: SB I-29 FROM WB I-90 RAMP	5	0.234	3900	1.33	3.75	14635.29	4.28	-0.53
SB	3: SB I-29 TO EB I-90 RAMP	2	0.245	1900	0.68	2.94	5591.28	5.43	-2.49
SB	4: SB I-29 FROM EB I-90 RAMP	2	0.460	3300	2.22	0.90	2977.96	3.68	-2.78
SB	5: 60TH ST. N. OFF RAMP	1	0.287	1900	0.80	1.26	2386.52	5.11	-3.86
SB	6: 60TH ST. N. ON RAMP	9	0.483	5000	3.53	2.55	12762.70	3.28	-0.73
SB	7: BENSON RD. OFF RAMP	1	0.253	1000	0.37	2.71	2707.24	7.03	-4.33
SB	8: BENSON RD. ON RAMP	1	0.280	3100	1.27	0.79	2446.18	4.35	-3.56
NB	9: BENSON RD. OFF RAMP	1	0.251	3300	1.21	0.83	2728.81	4.41	-3.59
NB	10: BENSON RD. ON RAMP	1	0.245	1000	0.36	2.80	2795.64	7.14	-4.34
NB	11: 60TH ST. N. OFF RAMP	5	0.322	5500	2.59	1.93	10635.58	3.54	-1.60
NB	12: 60TH ST. N. ON RAMP	0	0.327	2600	1.24	0.00	0.00	4.38	-4.38
NB	13: NB I-29 TO EB I-90 RAMP	6	0.471	4500	3.09	1.94	8725.24	3.38	-1.45
NB	14: NB I-29 FROM EB I-90 RAMP	1	0.242	300	0.11	9.43	2830.30	13.65	-4.22
NB	15: NB I-29 TO WB I-90 RAMP	4	0.245	3500	1.25	3.20	11182.56	4.36	-1.17
NB	16: NB I-29 FROM WB I-90 RAMP	2	0.447	1700	1.11	1.80	3064.57	4.54	-2.74

[1]MVMT = MILLION VEHICLE MILES TRAVELED

[2]TEV*R = TOTAL ENTERING VEHICLES TIMES CRASH RATE

SOURCE: HIGHWAY SAFETY MANUAL, FIRST EDITION, 2010, AASHTO

NOTE: THE RED AND GREEN HIGHLIGHTS PROVIDE A QUICK VISUAL INDICATION OF WHICH SEGMENTS HAVE A CRASH RATE OUTSIDE OF THE STATISTICAL CRITICAL RATE. THE RED SEGMENTS ARE CONSIDERED OUTSIDE THE CRITICAL RATE (HAVING A CRASH RATE OUTSIDE THE NORMAL RANGE AND POSSIBLY REQUIRING ATTENTION AND SAFETY IMPROVEMENTS) WHILE THE GREEN SEGMENTS ARE INSIDE THE CRITICAL RATE. THE CRASH ANALYSIS IS BEING PERFORMED AS PART OF THE IMJR PROCESS, A PLANNING PROCESS FOR FUTURE POTENTIAL INTERCHANGE PROJECTS. THE HIGHWAY SAFETY MANUAL IS BEING USED AS A REFERENCE FOR PROPER PLANNING OF THE ROADWAY FEATURES THAT MAY BE ASSOCIATED WITH POTENTIAL INTERCHANGE IMPROVEMENTS. PROVIDING A COMPLETE EXPLANATION OF THE CRITICAL RATE METHOD WOULD REQUIRE RESTATEMENT OF LARGE PORTIONS OF THE HIGHWAY SAFETY MANUAL IN THIS DOCUMENT. INSTEAD, THE HSM IS INCLUDED BY REFERENCE.



Drawn By: B.Miller
Date: 10-23-14
Chked By: R.Laughlin
Date: 10-23-14
Revision:

Map 2 - Interstate Ramps for Crash Analysis (See Table 2)

I-29 Exit 83 (60th Street North) Interchange Modification Justification Report Sioux Falls, SD

Map 2

TABLE 3 - INTERSECTION CRASH RATES (2008-2013)

I-29/60TH ST. N. IMJR

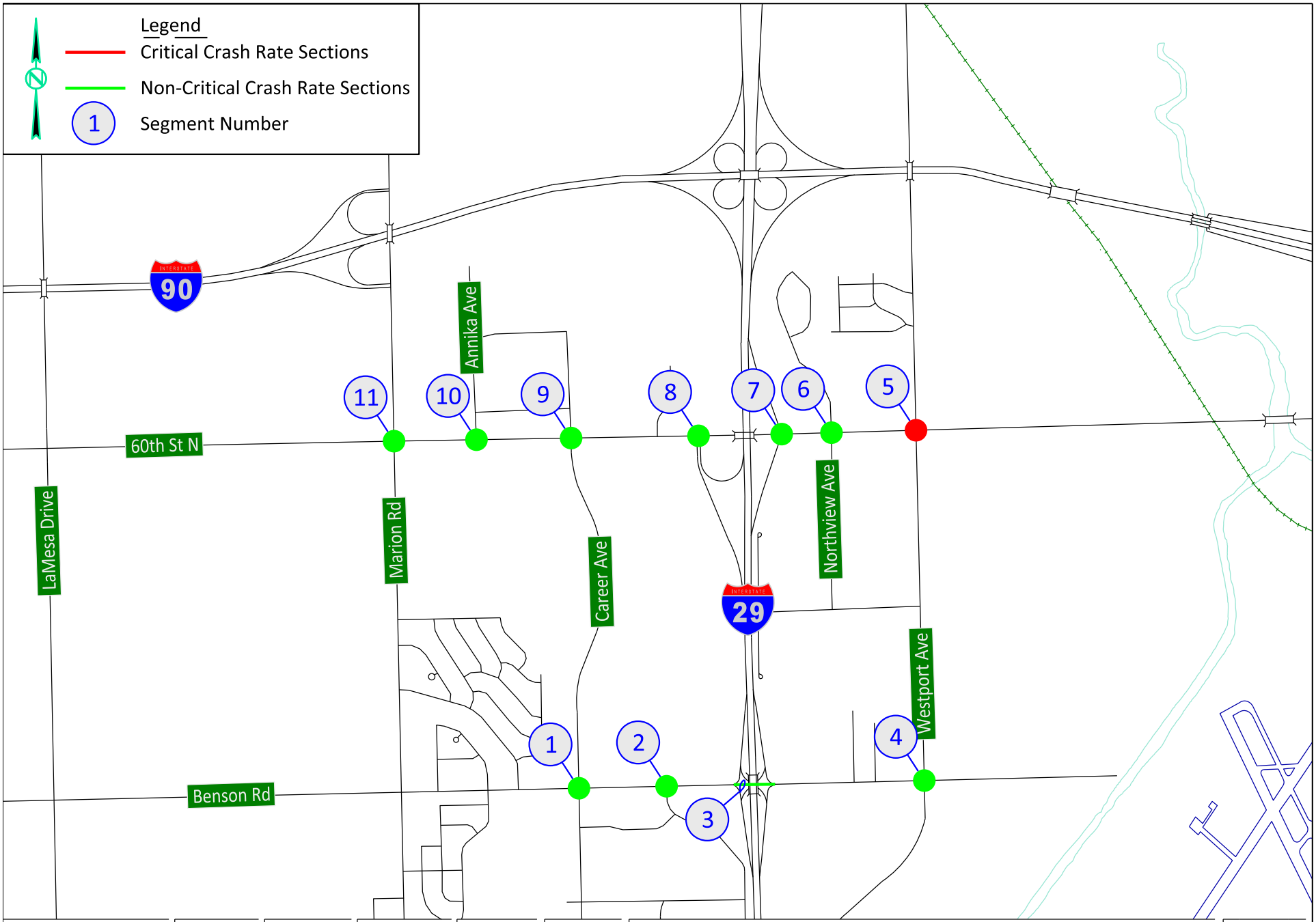
INTERSECTION	NUMBER CRASHES	DAILY VOLUME	MEV[1]	CRASH RATE	*TEV*R* [2]	CRITICAL RATE	DIFFERENCE
1: BENSON/CAREER	0	5100	7.45	0.00	0.00	1.23	-1.23
2: BENSON/LOUISE	1	4300	6.28	0.16	684.93	1.29	-1.13
3: I-29/BENSON	2	6200	9.05	0.22	1369.86	1.17	-0.95
4: BENSON/WESTPORT	0	4600	6.72	0.00	0.00	1.26	-1.26
5: 60TH/WESTPORT	26	17900	26.13	0.99	17808.22	0.95	0.04
6: 60TH/GRANITE	11	28400	41.46	0.27	7534.25	0.89	-0.63
7: 60TH/I-29 NB	25	18300	26.72	0.94	17123.29	0.95	-0.01
8: 60TH/I-29 SB	11	14700	21.46	0.51	7534.25	0.98	-0.47
9: 60TH/CAREER	1	7700	11.24	0.09	684.93	1.12	-1.03
10: 60TH/ANNIKA	0	7000	10.22	0.00	0.00	1.14	-1.14
11: 60TH/MARION	7	10100	14.75	0.47	4794.52	1.05	-0.58

[1]MEV = MILLION ENTERING VEHICLES

[2]TEV*R = TOTAL ENTERING VEHICLES TIMES CRASH RATE

SOURCE: HIGHWAY SAFETY MANUAL, FIRST EDITION, 2010, AASHTO

NOTE: THE RED AND GREEN HIGHLIGHTS PROVIDE A QUICK VISUAL INDICATION OF WHICH SEGMENTS HAVE A CRASH RATE OUTSIDE OF THE STATISTICAL CRITICAL RATE. THE RED SEGMENTS ARE CONSIDERED OUTSIDE THE CRITICAL RATE (HAVING A CRASH RATE OUTSIDE OF THE NORMAL RANGE AND POSSIBLY REQUIRING ATTENTION AND SAFETY IMPROVEMENTS), WHILE THE GREEN SEGMENTS ARE INSIDE THE CRITICAL RATE. THIS CRASH ANALYSIS IS BEING PERFORMED AS PART OF THE IMJR PROCESS, A PLANNING PROCESS FOR FUTURE POTENTIAL INTERCHANGE PROJECTS. THE HIGHWAY SAFETY MANUAL (HSM) IS BEING USED AS A REFERENCE FOR PROPER PLANNING OF THE ROADWAY FEATURES THAT MAY BE ASSOCIATED WITH POTENTIAL INTERCHANGE IMPROVEMENTS. PROVIDING A COMPLETE EXPLANATION OF THE CRITICAL RATE METHOD WOULD REQUIRE RESTATEMENT OF A LARGE PORTION OF THE HIGHWAY SAFETY MANUAL IN THIS DOCUMENT. INSTEAD, THE HSM IS INCLUDED BY REFERENCE.



Drawn By: B.Miller
Date: 10-23-14
Chked By: R.Laughlin
Date: 10-23-14
Revision:

Map 3 - Arterial Street Intersections for Crash Analysis (See Table 3)

I-29 Exit 83 (60th Street North) Interchange Modification Justification Report Sioux Falls, SD

Map 3

Crash Trends:

Review of the crash summaries for each Interstate segment and arterial street intersection revealed a few crash trends:

- Crashes involving wild animals predominated in the I-90 segments east of I-29. These segments included crossings of the Big Sioux River channel and adjacent wooded areas.
- Single vehicle crashes during slippery roadway conditions had a high representation in the Interstate segments having crash rates above the critical threshold.
- Rear-end and sideswipe type crashes were noted in two above-critical segments in the I-29/I-90 interchange area. These crashes were associated with weaving areas.
- While the crash records don't include information on truck-related crash involvement, the high percentage of trucks on 60th Street North and Granite Lane likely contributes to speed variance and crash incidence.

Potential Mitigation Measures:

The general crash trends identified above suggest several potential strategies for reducing crash rates within the study area:

- Employ any proven measures to keep deer and other wild animals out of the roadway. The Wildlife-Vehicle Collision Reduction Study (FHWA, 2008) suggests that wildlife-specific fencing is the most cost effective measure and that animal detection systems also provide good crash reduction results. Previous experiments with reflectors have had limited results.
- Consider ITS-related means of communicating slippery roadway conditions to drivers and continue aggressive winter maintenance.
- A configuration for the I-29/I-90 interchange that reduces the weaving activity has been recommended by a previous study. (The current interchange is configured as a cloverleaf interchange with weaving sections between the loop ramps where entering and exiting traffic cross. The proposed interchange configuration replaces two of the loop ramps with fly-over ramp movements, thereby removing the weaving activity. Illustrations of the existing and recommended configurations are shown in Figure 1.) Continue to plan and program for system interchange reconfiguration.
- Addition of high-friction surface courses on bridges, curves and weaving areas may help reduce crashes that occur during inclement weather. A section of high-friction surfacing has been installed on I-229 and may provide useful guidance about employing this technique for safety enhancement.

Each of the Interstate segments and arterial intersections that were identified as having crash rates outside of the critical rates are discussed in the following points.

Interstate Segments:

- I-90 Eastbound, I-29 to Big Sioux River – 65% of the crashes in this segment involved wild animals (11 of 17 with animal strike as crash type or contributing circumstance) and 29% involved single vehicle crashes during slippery road conditions (5 of 17 with inclement road conditions as contributing circumstance). Continue to employ animal diversion strategies and provide road condition information. High friction surface treatments should be evaluated and considered to determine effectiveness.
- I-90 Westbound, Big Sioux River to I-29 – 21% of the crashes in this segment involved wild animals (6 of 29 with animal strike as crash type or contributing circumstance) and 69% involved single vehicle crashes during slippery road conditions (20 of 29 with inclement road conditions as contributing circumstance). High friction surface treatments should be evaluated and considered to determine effectiveness. Continue to employ animal diversion strategies and provide road condition information.
- I-90 Westbound, I-29 interchange area – 7% of the crashes in this segment involved wild animals (1 of 15 with animal strike as crash type or contributing circumstance), 67% involved single vehicle crashes during slippery road conditions (10 of 15 with inclement road conditions as contributing circumstance), and 27% (4 of 15) involved rear-end or sideswipe crashes. Many of the crashes occurred within the weave area between the loop ramps, indicating driver difficulty in making the rapid speed changes and weaving movements, particularly during inclement weather. Continue to employ animal diversion strategies, provide road condition information and work toward reconfiguration of the interchange. High friction surface treatments should be evaluated and considered to determine effectiveness.
- I-29 Southbound, I-90 interchange area – 2% of the crashes in this segment involved wild animals (1 of 42 with animal strike as crash type or contributing circumstance), 55% involved single vehicle crashes during slippery road conditions (23 of 42 with inclement road conditions as contributing circumstance), and 43% (18 of 42) involved rear-end, angle or sideswipe crashes. Many of the crashes occurred within the weave area between the loop ramps, indicating driver difficulty in making the rapid speed changes and weaving movements, particularly during inclement weather. Continue to employ animal diversion strategies, provide road condition information and work toward reconfiguration of the interchange. High friction surface treatments should be evaluated and considered to determine effectiveness.

Interstate Ramps:

No critical Interstate ramp segments were identified.

Arterial Intersections:

- 60th Street North/Westport Avenue – 15% (4 of 26) of the crashes at this intersection involved single vehicle crashes during slippery road conditions, 42% (11 of 26) involved rear-end, primarily on the 60th Street North approaches, 35% (9 of 26) involved angle crashes, and 4% (1 of 26) involved sideswipe crashes. The crash records indicate that

the relatively high speed on 60th Street North (55 mph) may contribute to driver misjudgment of following distances and gaps. Speed studies also indicate a large range of vehicles speeds, from 42 to 66 mph. Construction is planned on 60th Street North east of the study area to improve the existing rural section to an urban section. Evolution of the roadway and development of the adjacent property will likely lead to an urban speed limit of 40-45 mph and more consistent vehicle operating speeds. Traffic patterns do not appear to play a significant role in normal operations at this intersection, with relatively small volumes on the minor approaches.

- While the crash rate at the 60th Street North/I-29 NB intersection did not reach the critical threshold, it was close enough to warrant more detailed consideration. Most of the crashes at the intersection involved rear-end incidents (14 of 25 or 56%). Possible causes of the rear-end crashes may be related to signalized intersection congestion and aggressive peak-hour driving behaviors.

Existing Environmental Constraints

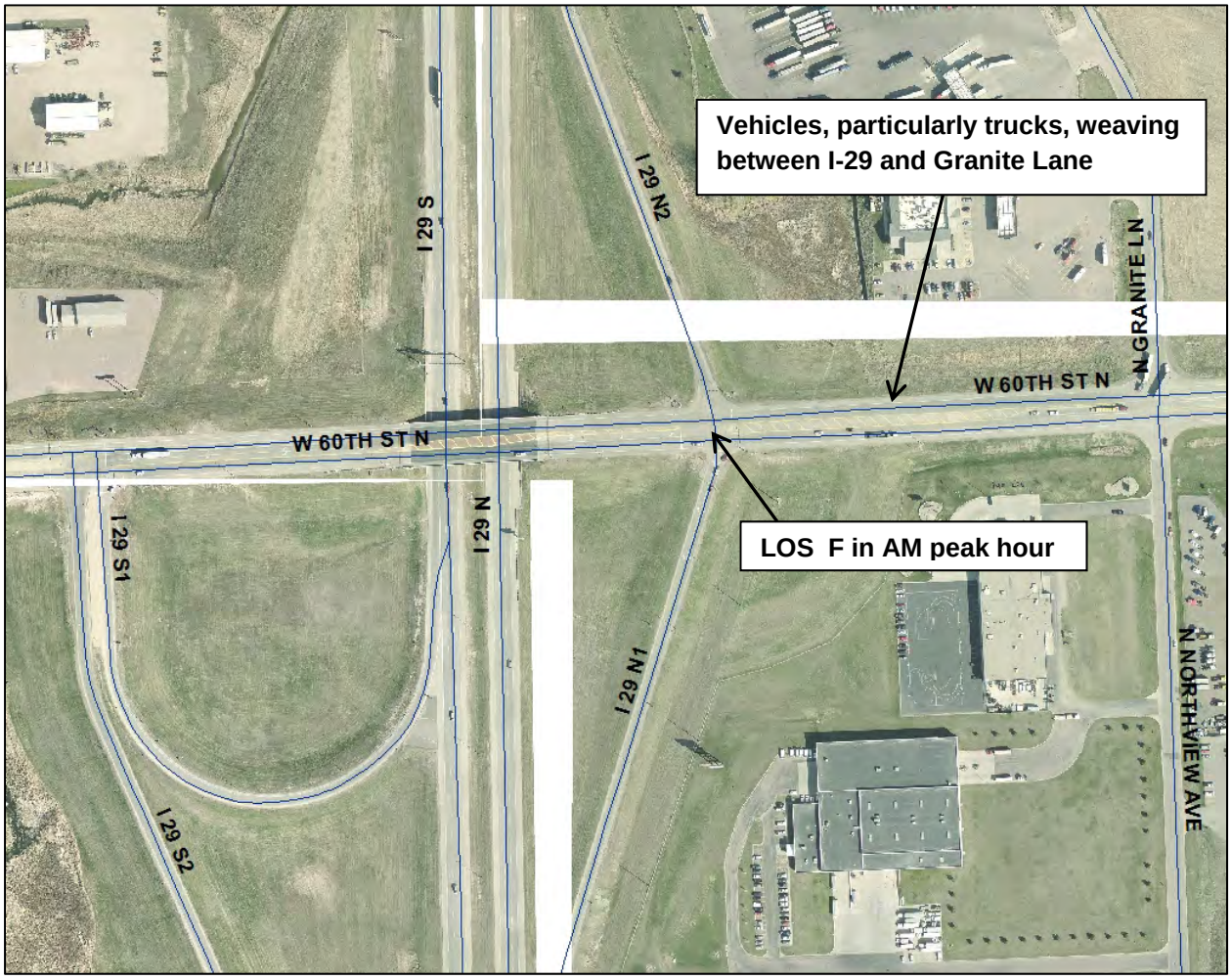
Environmental constraints will be evaluated through a future Environmental Assessment (EA) or Categorical Exclusion (CE). The environmental document will refine the project purpose/need and evaluate the project alternatives in light of environmental analysis. A preferred alternative will be determined through the environmental process.

An environmental screening was conducted as part of a 2012 transportation study of the 60th Street N. corridor, including the Exit 83 interchange area. That screening identified the following issues within the study area of this IMJR:

- Noise – Widening of 60th Street N. and reconfiguration of the Interstate system could produce additional noise impacts on some nearby receivers. Noise impacts should be considered using the SDDOT policy.
- Wetlands – Some potential wetland areas were identified in the study area, including some man-made wetland areas within the Interstate right-of-way. A formal wetland delineation should be completed and used during final design to avoid, minimize and mitigate wetland impacts.
- Water Quality – Widening of 60th Street N. and reconfiguration of the Interstate system could increase the amount of pavement and slightly increase runoff and reduce the groundwater recharge area. Construction could also impact water quality through sedimentation from soil disturbance.
- Right-of-Way – The proposed local street to serve the northeast quadrant of the Exit 83 interchange (Scenarios 4 and 7) will impact Interstate right-of-way. Coordination will be required between SDDOT and the City of Sioux Falls to resolve property ownership and jurisdiction.

PROJECT NEED

The subject interchange (I-29 Exit 83) experiences operational failure at the east ramp terminal during the AM peak hour. Specifically, there is inadequate capacity to satisfactorily accommodate the northbound right turn demand. The close proximity of the subject interchange to the system interchange at I-90 and the close proximity of an arterial street intersection to the east ramp terminal have prompted consideration of changing the Exit 83 configuration. Planned development in the area northeast of the interchange has resulted in proposed changes to the local street system to eliminate weaving of vehicles between I-29 and Granite Lane, improving safety and efficiency on 60th Street N.

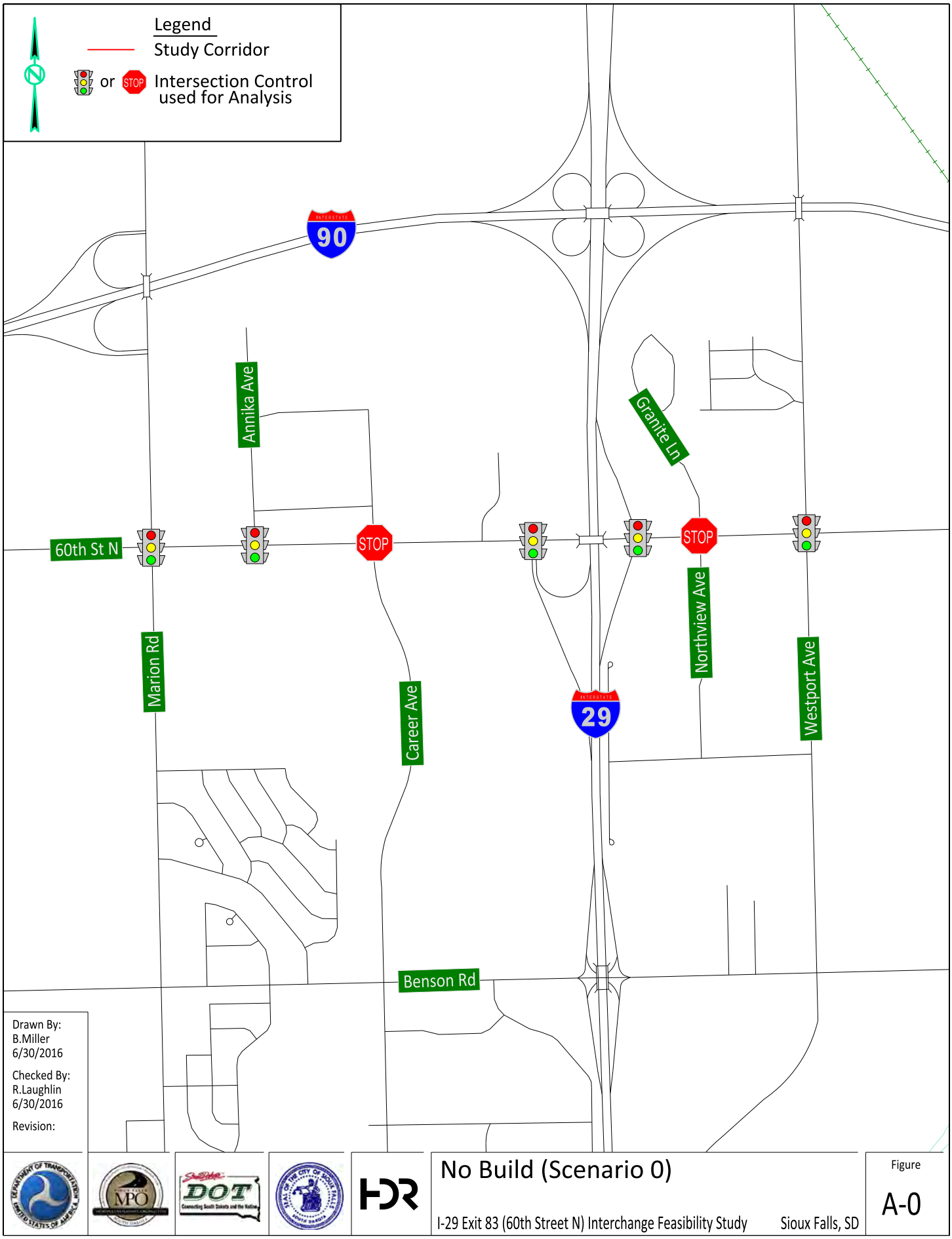


ALTERNATIVES

The following improvement concepts were developed to address the project need (note that a separate project has been programmed to add lanes to 60th Street North between I-29 and Westport Avenue):

- Scenario 0 - No-Build Concept Option
- Scenario 1 – Planned local arterial street improvements only
- Scenario 2 - Provide signalized intersection at 60th St. N./Granite Lane
- Scenario 3 - Provide right-in/right-out access for Granite Lane and ¾ access for Northview Ave.
- Scenario 4 - Provide folded diamond interchange configuration at Exit 83, with new access roadway intersecting at the east ramp terminal and right-in/right-out access for Granite Lane and ¾ access for Northview Ave.
- Scenario 5 - Provide folded diamond interchange configuration at Exit 83, with signalized intersection at 60th St. N./Granite Lane
- Scenario 6 - Provide folded diamond interchange configuration at Exit 83, with right-in/right-out access for Granite Lane and ¾ access for Northview Ave.
- Scenario 7 – Scenario 4 improvements, plus revised system interchange at I-29/I-90
- Scenario 8 - Scenario 5 improvements, plus revised system interchange at I-29/I-90
- Scenario 9 - Scenario 6 improvements, plus revised system interchange at I-29/I-90
- Scenario 10 – Provide folded diamond interchange configuration at Exit 83 with additional westbound to northbound ramp, a signalized intersection of 60th St. N./Granite Lane, and revised system interchange at I-29/I-90
- Scenario 11 – Provide folded diamond interchange configuration at Exit 83 with additional westbound to northbound ramp, a signalized intersection of 60th St. N./Granite lane, and the existing system interchange at I-29/I-90.

The Concept Options are shown in Figures A1 –A11 on the following pages.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60th St N
STOP
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Career Ave
INTERSTATE
29
Northview Ave
Westport Ave
Benson Rd
Drawn By:
B.Miller
6/30/2016
Checked By:
R.Laughlin
6/30/2016
Revision:
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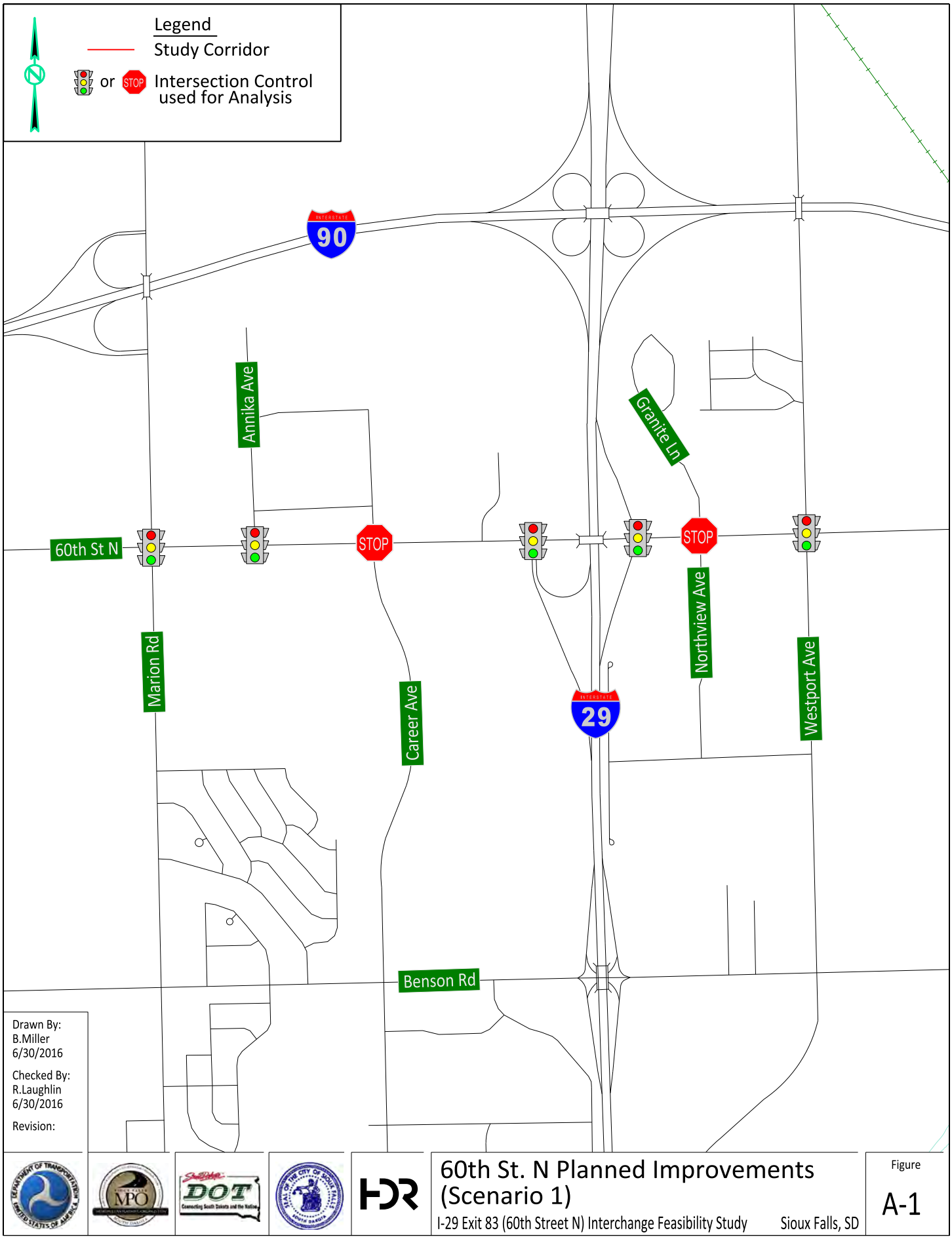
HDR
No Build (Scenario 0)
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
A-0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Drawn By:
B.Miller
6/30/2016
Checked By:
R.Laughlin
6/30/2016
Revision:
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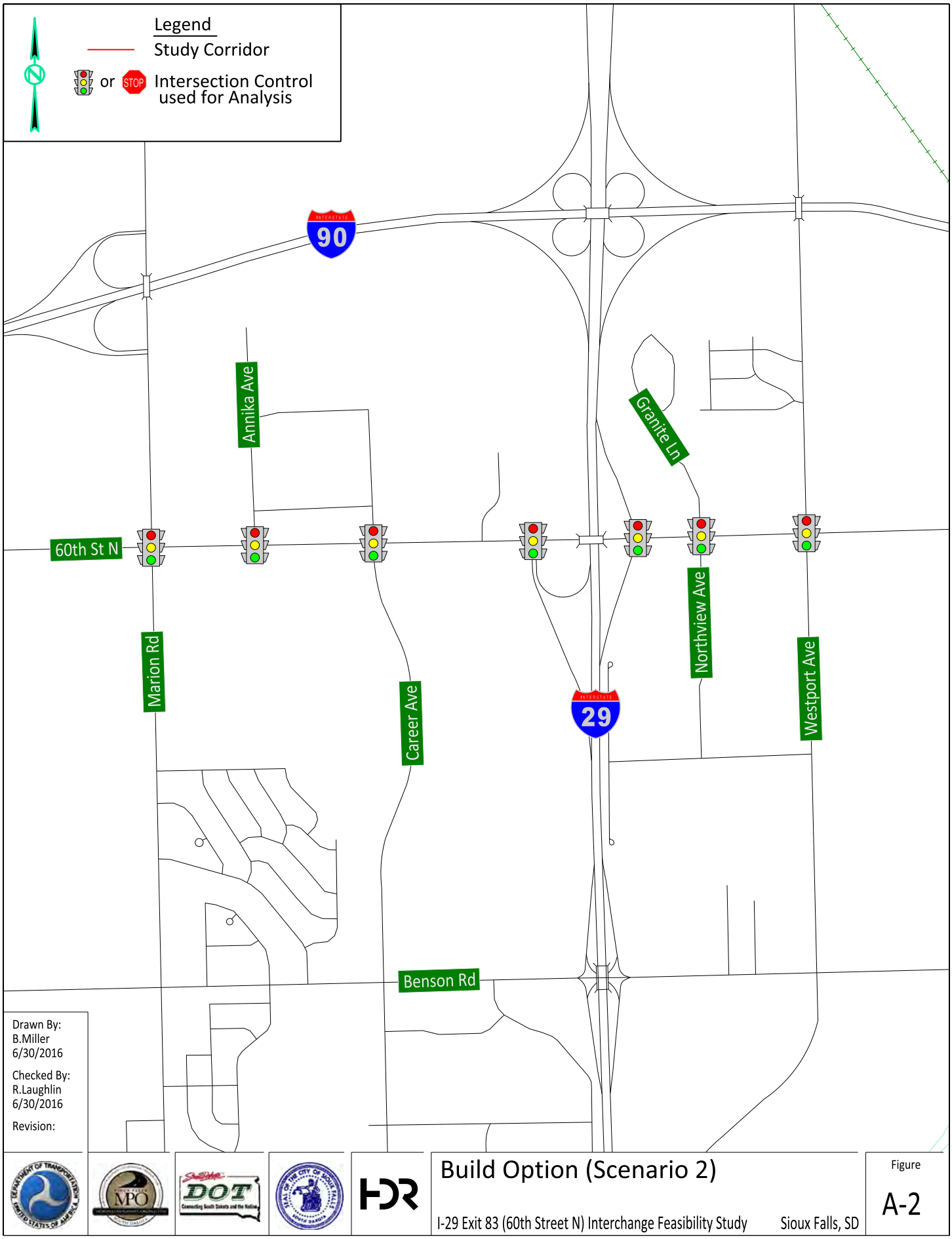
60th St. N Planned Improvements (Scenario 1)
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
A-1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Checked By:
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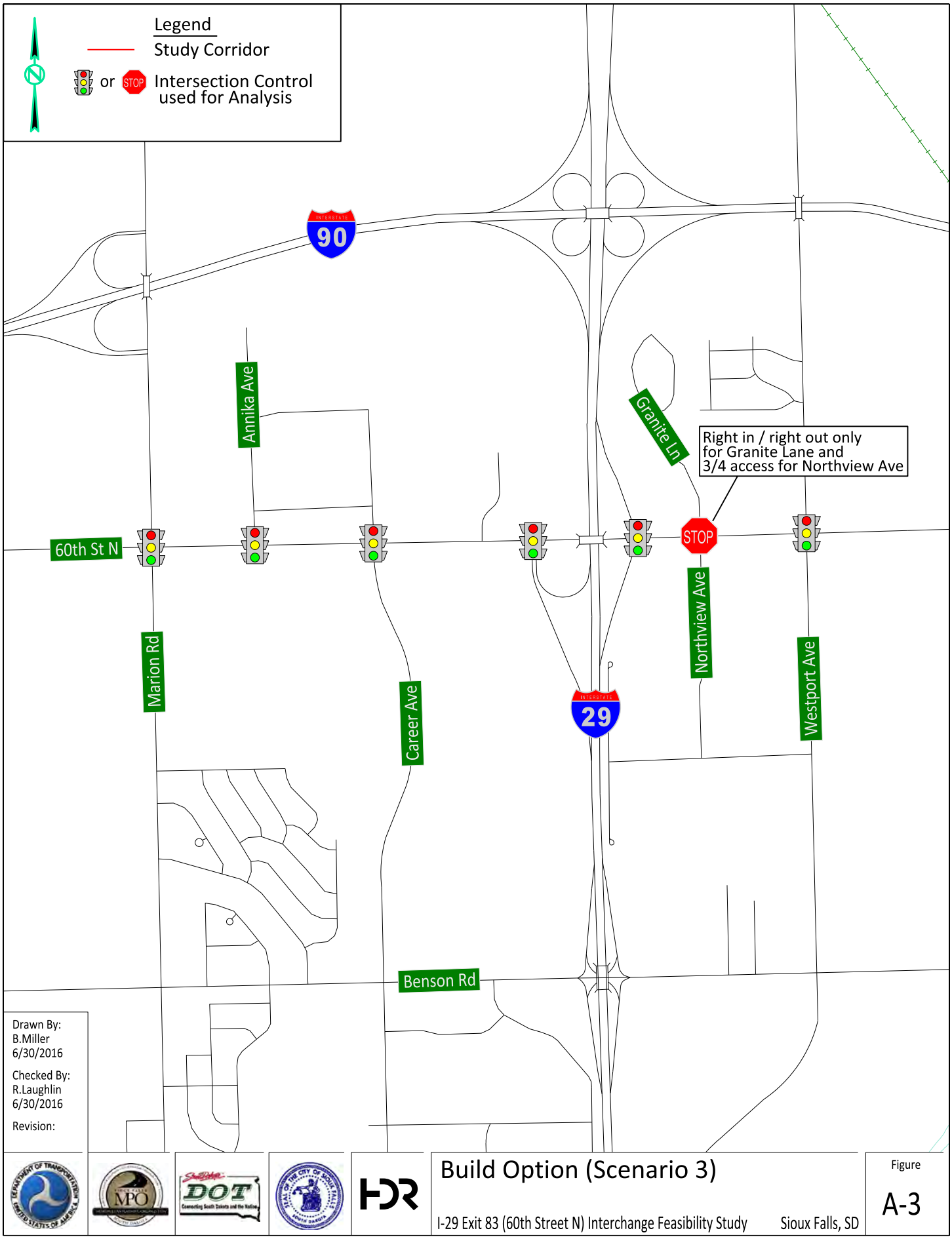
6/30/2016
Revision:
Build Option (Scenario 2)
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
A-2

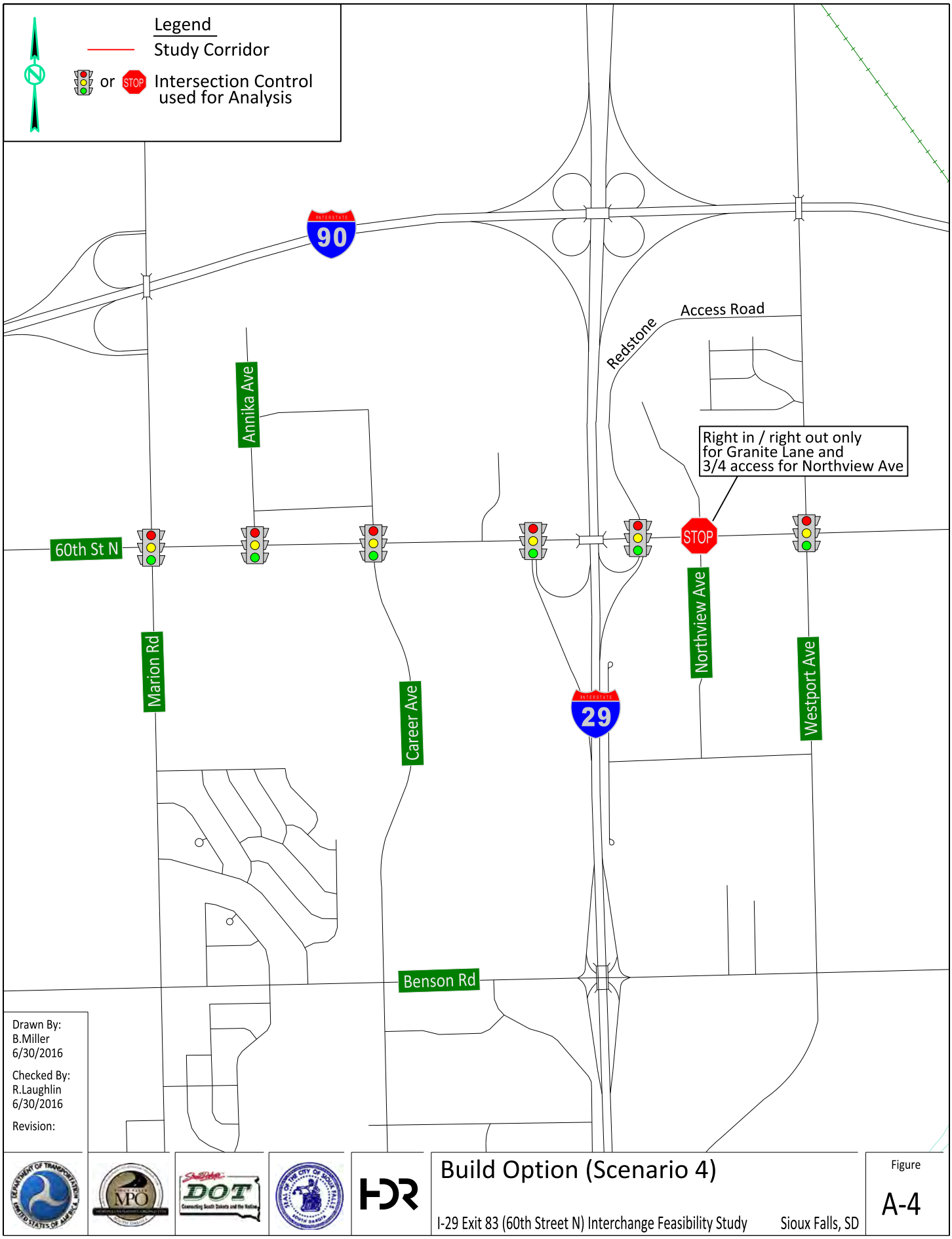


Build Option (Scenario 3)

I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD

Figure

A-3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Westport Ave
Benson Rd
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Checked By:
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I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
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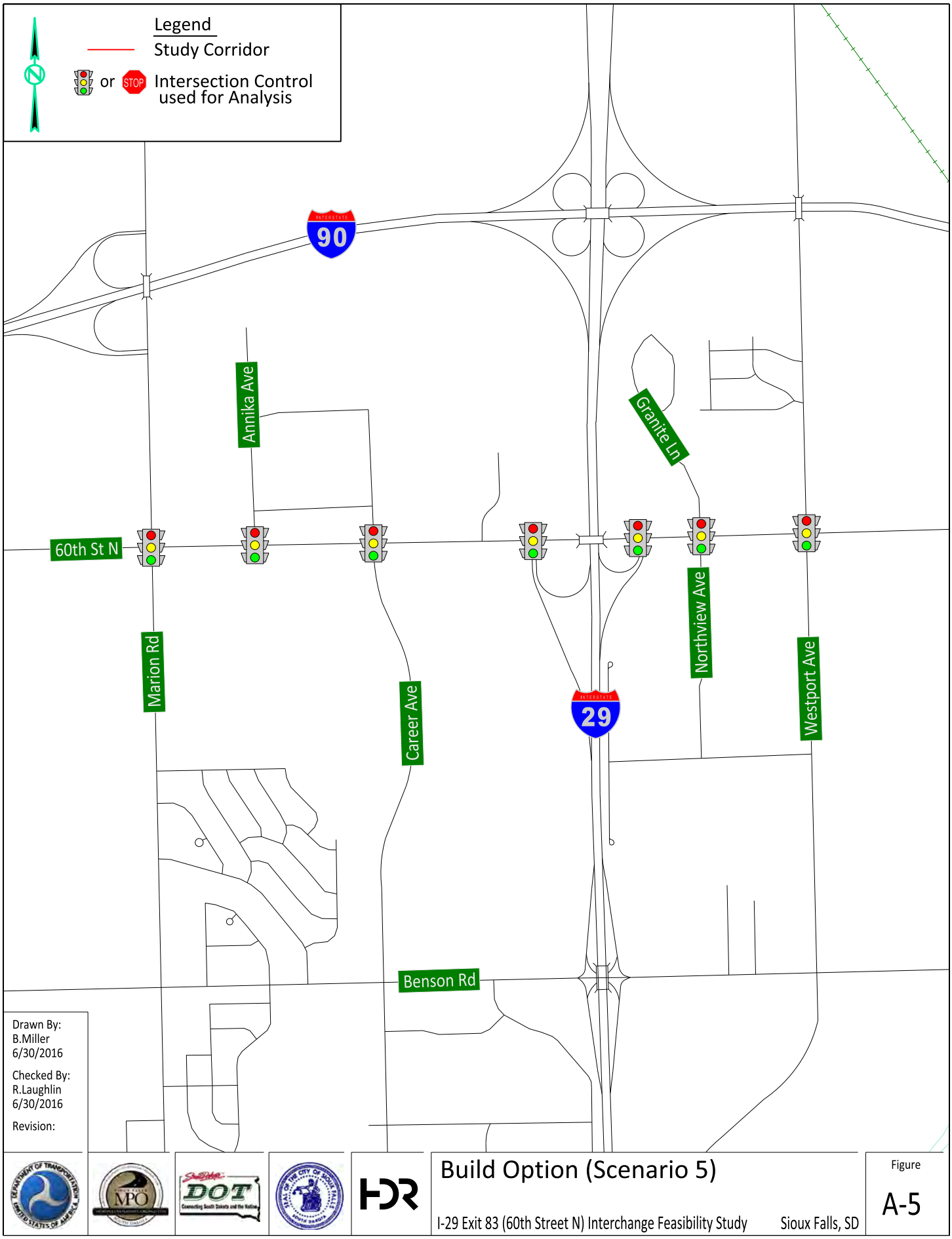
A-4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B.Miller
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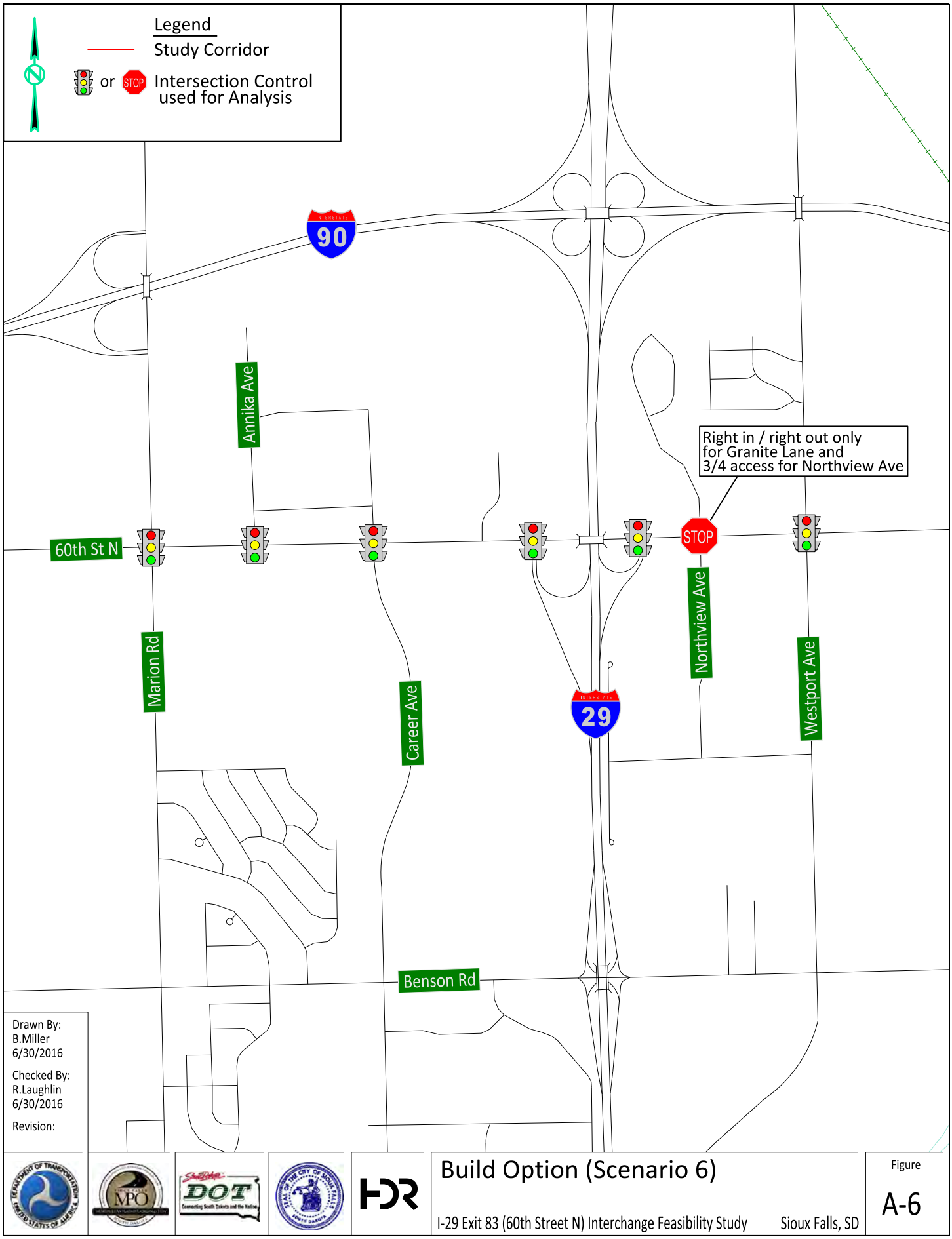
Build Option (Scenario 5)
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
A-5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STOP
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6/30/2016
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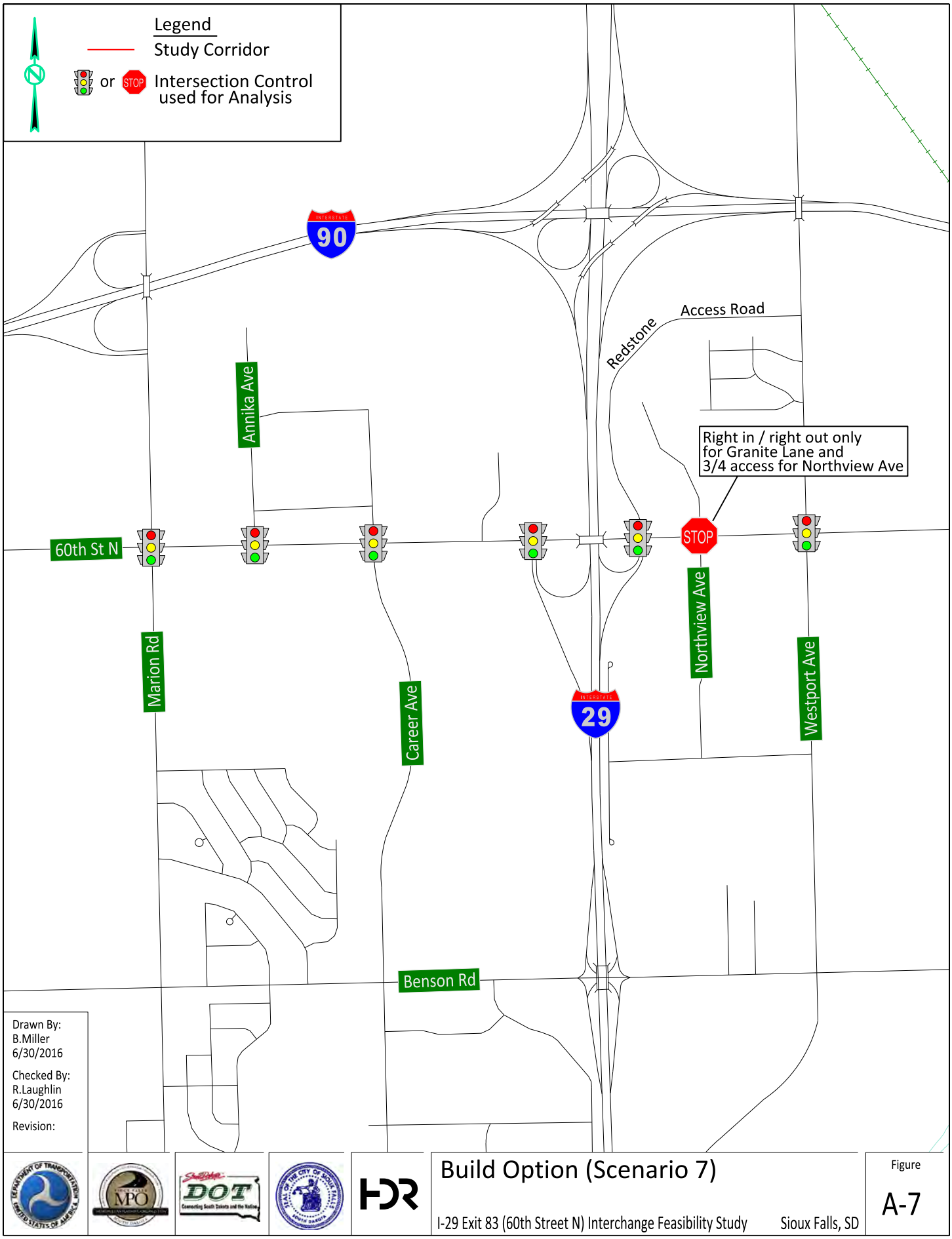
Build Option (Scenario 6)
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
A-6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Right in / right out only
for Granite Lane and
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60th St N
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Marion Rd
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Sioux Falls, SD
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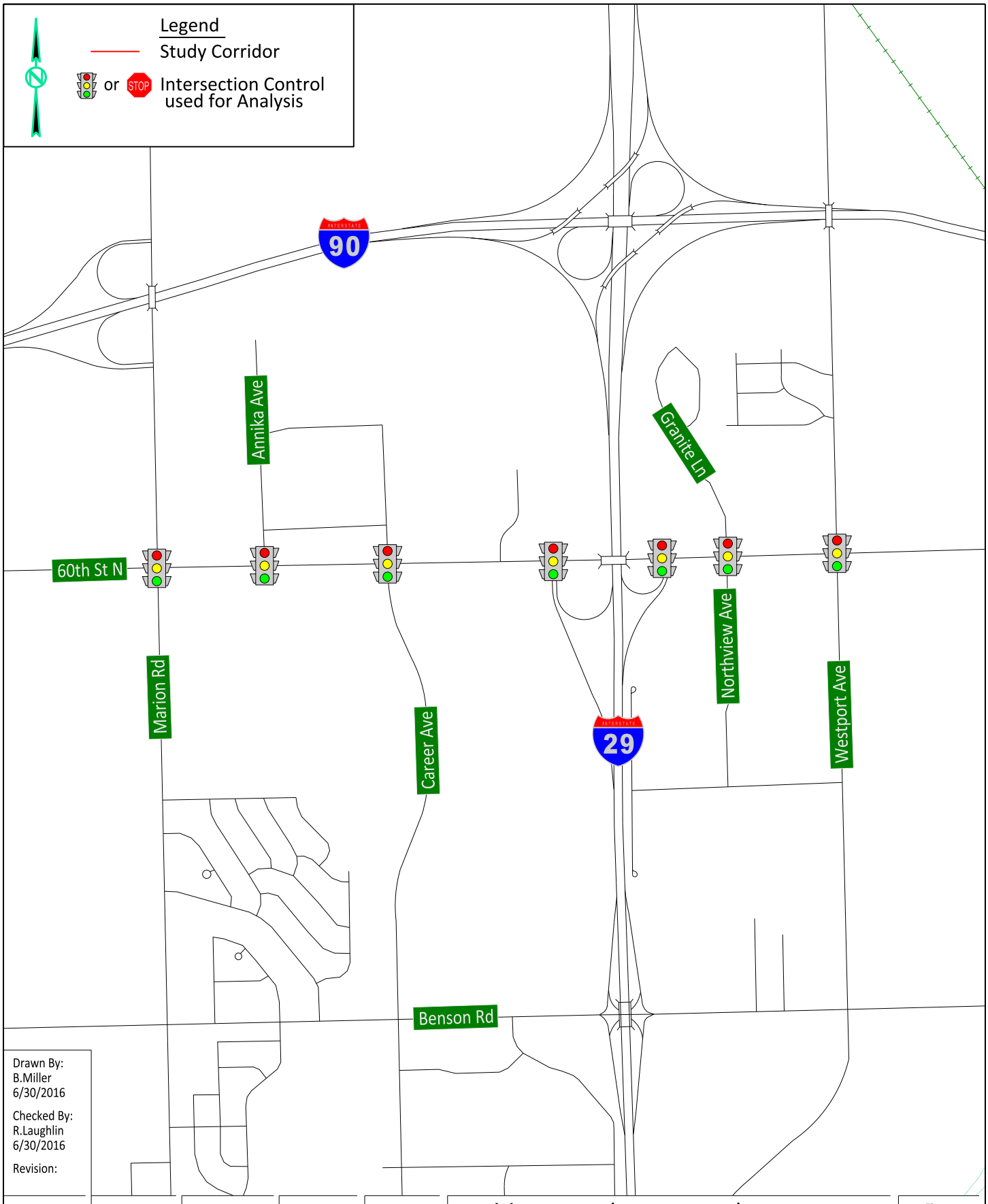
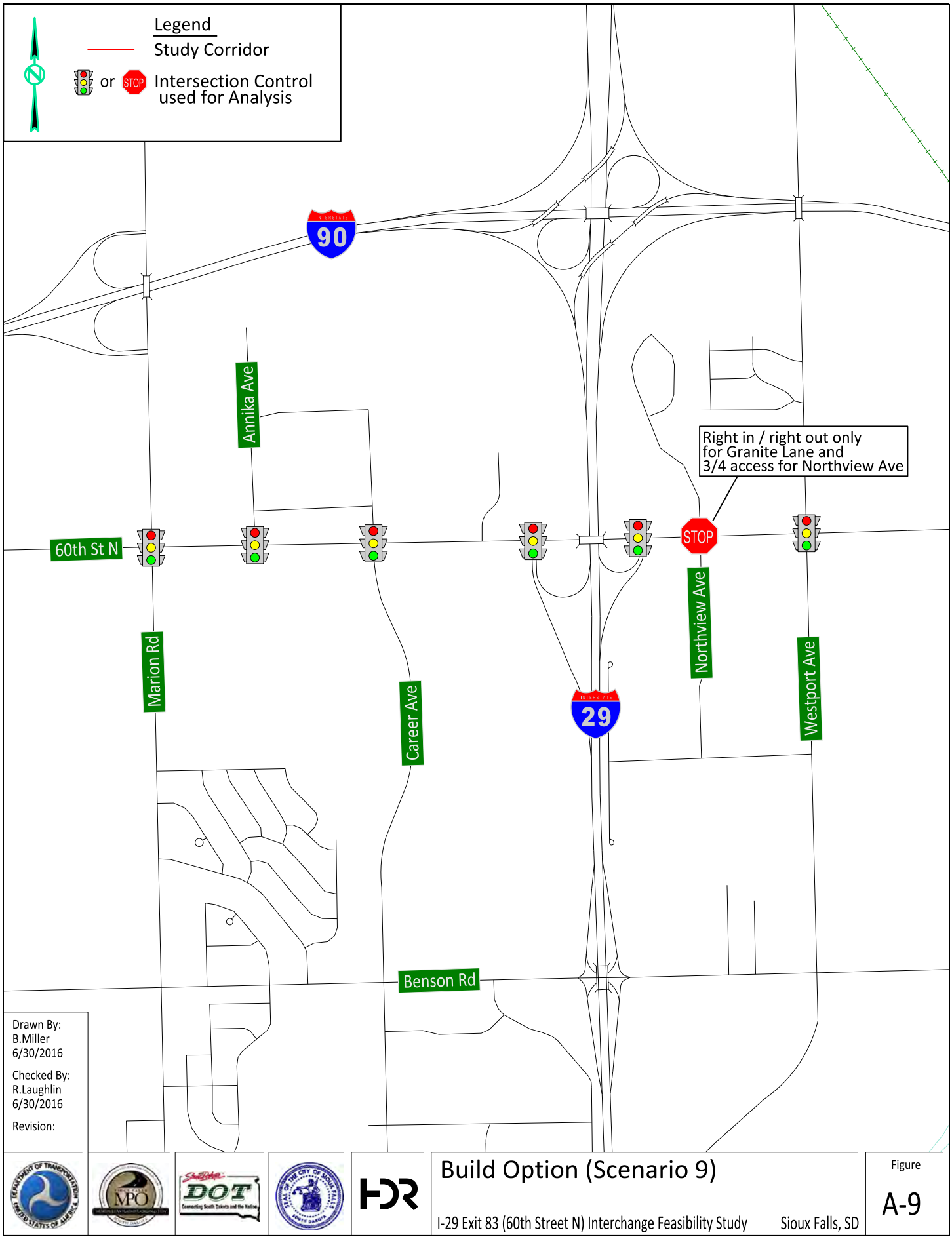


Build Option (Scenario 8)

I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD

Figure

A-8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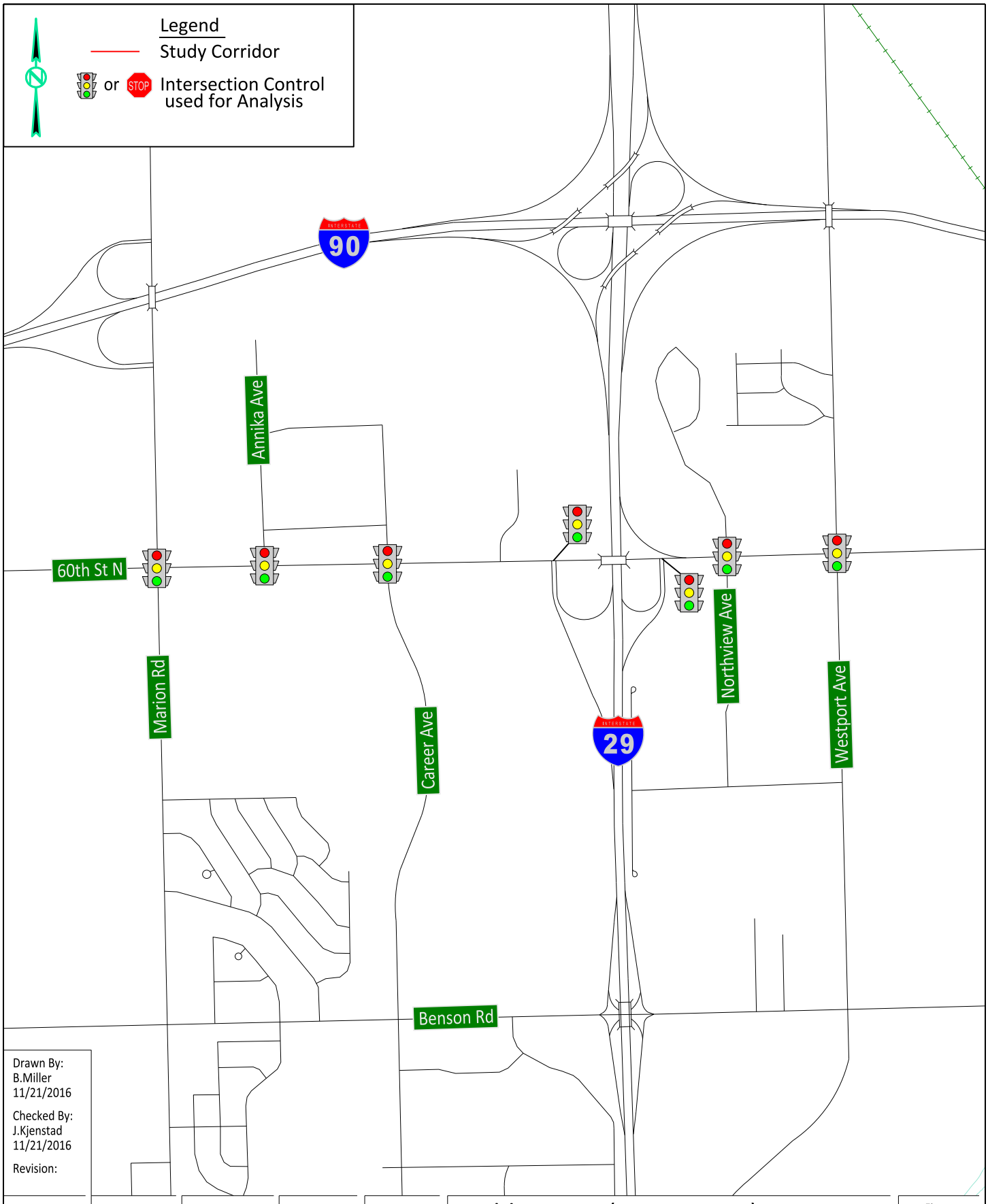
Build Option (Scenario 9)
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
A-9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Build Option (Scenario 10)
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
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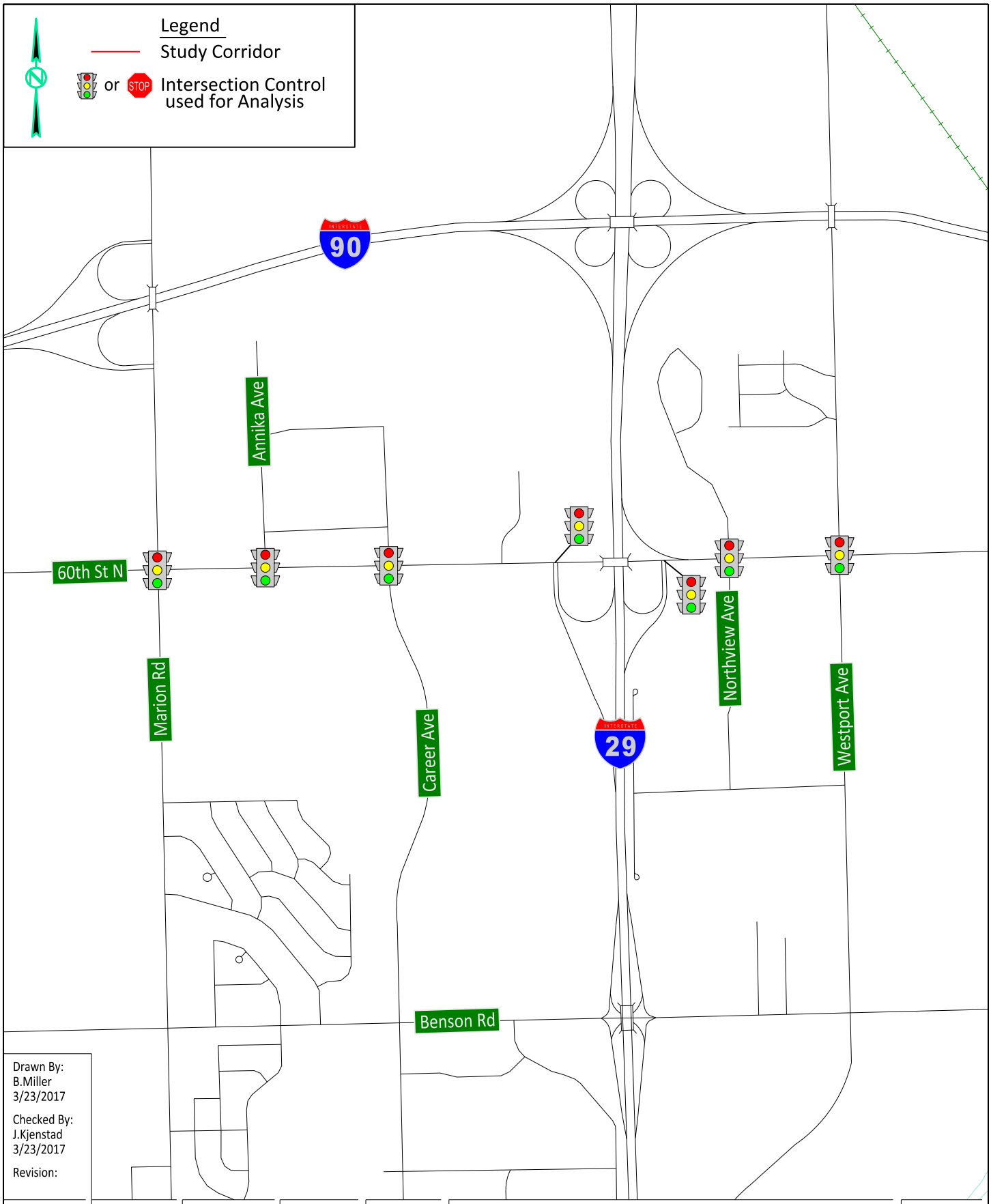
A-10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B.Miller
3/23/2017
Checked By:
J.Kjenstad
3/23/2017
Revision:
Build Option (Scenario 11)
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
A-11

FUTURE YEAR TRAFFIC

Traffic forecasts for the study area were prepared using the regional travel demand model maintained by the City of Sioux Falls and the Sioux Falls MPO. The model horizon year is 2045 and is based on local land use plans. Future year traffic demand reflects planned improvements, including widening of 60th Street North east of I-29 to Veteran's Parkway. The 60th Street North improvements were determined through the *60th Street N. Planning and Feasibility Study*, 2012. Traffic volumes for the reconfigured traffic patterns in Scenarios 4 and 7 were determined based on trip generation for the proposed land uses in the area (*Redstone Village TIS*, 2007 and 2010 update), travel demand model traffic zone analysis, and logical redistribution of trips. Forecasted daily traffic volumes are shown in **Figure 13**. Peak hour traffic volumes and levels of service for the nine scenarios are shown in **Figures 14 through 17j-4.** Level of service output sheets from HCS 2010 are included in the **Appendix**.

The project scope of work and the Methods and Assumptions document called for analysis of Scenarios 0-11 to determine whether the following criteria will be met:

- Level of service for Interstate facilities, including ramp terminal intersections, of C or better, with arterial movement level of service of D or better.
- Level of service for arterial streets not part of the Interstate system of D or better, with arterial movement level of service of E or better.
- Adequate interchange spacing, as determined in the previous *60th Street N. Interchange Study*.
- Adequate arterial intersection spacing.

The 2045 operational analysis revealed the following findings:

- All Interstate segments, ramps, and weaves operate within the level of service criteria for all scenarios.
- Scenario 0 (No Build) has service failures at the following locations:
  - 60th St. N./Marion Rd.
  - 60th St. N./Career Ave.
  - 60th St. N./I-29 NB
  - 60th St. N./Granite Ln.
  - 60th St. N./Westport Ave./Kiwanis Ave.
- The planned arterial improvements (Scenario 1) provide levels of service within the criteria, but do not satisfy the interchange spacing criteria or arterial intersection spacing criteria.
- Scenarios 2-9 either do not satisfy the interchange spacing criteria or level of service criteria.
- Multimodal level of service is variable, but scenarios with a signal at Granite Lane have lower vehicle level of service in the multimodal analysis due to the additional main street delay. Note that the Granite Lane intersection currently warrants signalization, but several of the scenarios provide for rerouting of traffic from the Granite Lane intersection to adjacent signalized intersections.

A comparison of Scenarios 0-11 is provided in **Table 4.**

Scenario 10 was then developed with the goal of finding a solution that satisfied all the screening criteria. Scenario 10 involves a folded diamond interchange configuration at I-29/60th Street North, with an added ramp for westbound 60th Street North vehicles to reach I-29 northbound. This scenario also includes two auxiliary lanes on northbound I-29 between 60th Street North and I-90, all planned arterial improvements on 60th Street North, signalization of all existing intersections on 60th Street North between Marion Road and Westport Avenue, and the revised system interchange at I-90/I-29.

Scenario 10 provides levels of service that satisfy the screening criteria and also provides the following characteristics:

- It allows full access at Granite Lane and reduces the weaving concern to only the eastbound direction on 60th Street North between I-29 and Granite Lane. Westbound traffic on 60th Street North is allowed a free right-turn movement onto northbound I-29 in this scenario, eliminating arterial weaving for vehicles originating on Granite Lane.
- The additional I-29 northbound on-ramp at 60th Street North can tie into I-29 prior to the existing on ramp, increasing the distance between the ramp gores to approximately 1850', which is significantly increased from the existing spacing. The amount of traffic that would be subject to a short area between the service and system interchange would be reduced nearly by half with the eastbound 60th Street North traffic using the single lane loop ramp to access I-29 northbound.
- Left turns are eliminated at the I-29 northbound/60th Street North ramp terminal, preserving future operational efficiency and allowing lane reconfiguration and potentially extending the life of the existing interchange bridge.

Concerns have been identified about the short distance between the Exit 83 interchange and the Granite Lane intersection, particularly in relation to slow trucks weaving between the Interstate and the truck stop on Granite Lane. A comparison of the simulated operations at the I-29 northbound ramp terminal and Granite Lane intersections under Scenario 10 was completed. The results of that analysis are provided in **Appendix 7**.

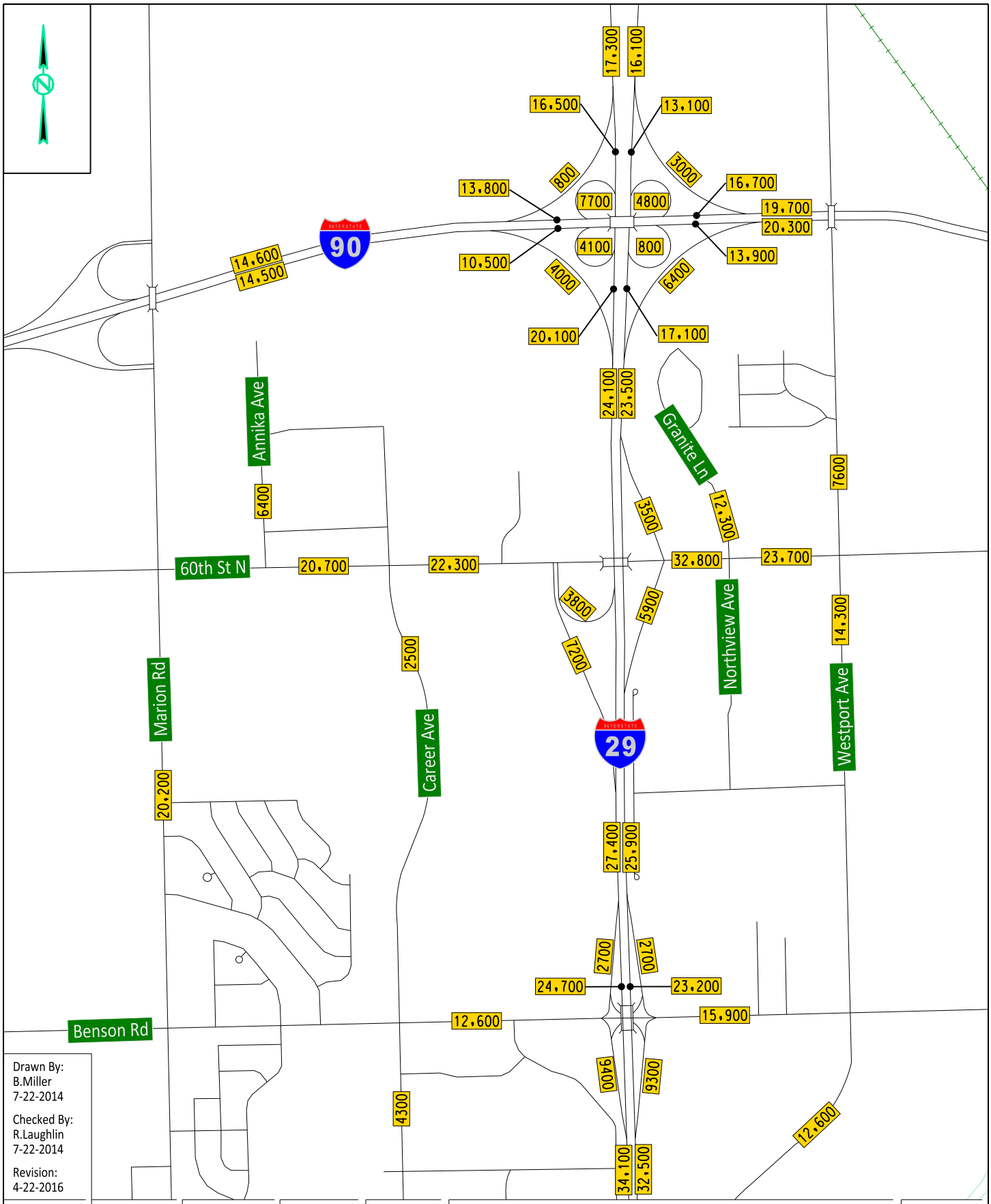
Scenario 11 was developed to evaluate the 60th St. N. interchange concept presented in Scenario 10, combined with the existing I-29/I-90 system interchange. Scenario 11 provides information to facilitate SDDOT future project planning.

Table 4 - 60th Street North Interchange Justification Report Arterial Analysis (Scenario 1 -11)

	2045 AM Peak Hour LOS		2045 AM Lowest Movement LOS		2045 PM Peak Hour LOS		2045 PM Lowest Movement LOS		Urban Weaving Concerns	Conventional Interchange	Meets LOS Criteria as identified in M&A Document	Notes
	I-29 NB On/Off Ramp	Granite Lane / Northview Ave	I-29 NB On/Off Ramp	Granite Lane / Northview Ave	I-29 NB On/Off Ramp	Granite Lane / Northview Ave	I-29 NB On/Off Ramp	Granite Lane / Northview Ave				
Scenario 0	F	F	F	F	F	F	F	F				
Scenario 1	A	F	D	F	B	F	D	F	X	Yes	No	Option does not address LOS issues at Granite Lane with no signal and a low LOS
Scenario 2	A	B	D	D	A	D	D	D	X	Yes	Yes	Weaving concerns exist between I29 and Granite Lane for the NB to EB lefts at I29 and those wanting to go north at Granite Lane, spacing on I29 between 60th Street North does not meet AASHTO recommended
Scenario 3	A	F	C	F	C	F	D	F		Yes	No	Right in/Right Out at Granite Lane moves all SB to EB lefts to Kiwanis Avenue from Red Stone Development
Scenario 4	C	D	F	D	D	F	F	F		No	No	With a direct connection to the Red Stone Access Road, this interchange is not ideal as it connects to a non-arterial street.
Scenario 5	A	C	D	E	B	F	D	F	X	Yes	No	Weaving concerns exist between I29 and Granite Lane for the NB to EB lefts at I29 and those wanting to go north at Granite Lane
Scenario 6	B	F	D	F	B	F	D	F		Yes	No	Right in/Right Out at Granite Lane moves all SB to EB lefts to Kiwanis Avenue from Red Stone Development
Scenario 7	C	D	D	D	E	F	F	F		No	No	With a direct connection to the Red Stone Access Road, this interchange is not ideal as it connects to a non-arterial street.
Scenario 8	A	B	D	D	B	F	D	F	X	Yes	No	Weaving concerns exist between I29 and Granite Lane for the NB to EB lefts at I29 and those wanting to go north at Granite Lane
Scenario 9	B	F	D	F	B	F	E	F		Yes	No	Right in/Right Out at Granite Lane moves all SB to EB lefts to Kiwanis Avenue from Red Stone Development
Scenario 10	A	B	D	D	A	C	D	E		Yes	Yes	Weaving concerns exist between I29 and Granite Lane for the NB to EB lefts at I29 and those wanting to go north at Granite Lane but improves ramp spacing between 60th Street North and I90
Scenario 11	A	B	D	D	B	D	C	E		Yes	Yes	Weaving concerns exist between I29 and Granite Lane for the NB to EB lefts at I29 and those wanting to go north at Granite Lane but improves ramp spacing between 60th Street North and I90

This table only focuses on the intersections of I-29 NB off/on Ramp and Granite Lane, these two intersections are currently the two that are controlling the decsions along the 60th Street North Corridor, all other intersections don't change in geomeotry between the options.

Does not Meet M&A Requirements for LOS
Represents a Stop controlled Intersection - Does not meet LOS Criteria
Meets M&A Requirements for LOS
Most Technically Feasible Scenario



Drawn By:
B.Miller
7-22-2014

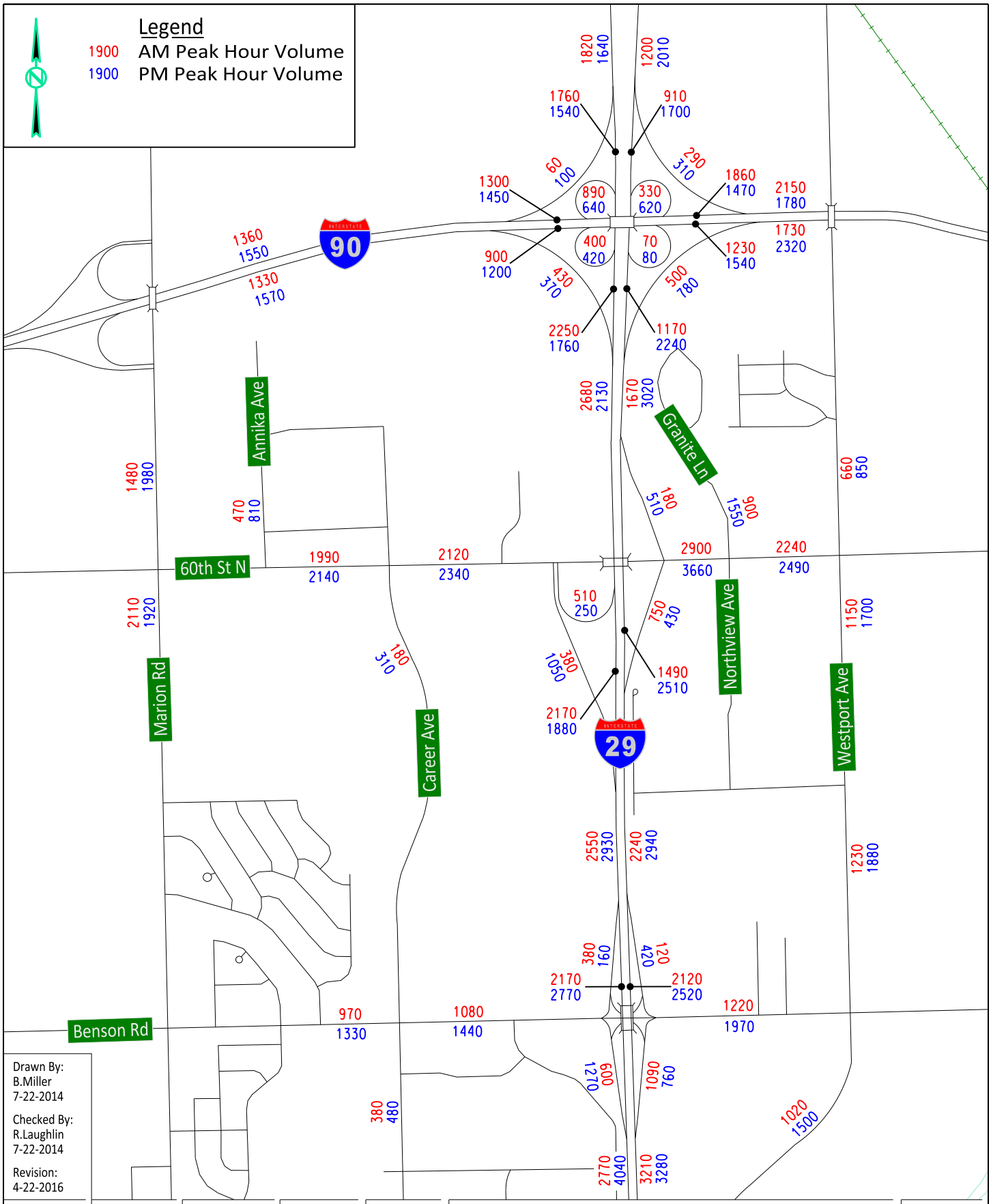
Checked By:
R.Laughlin
7-22-2014

Revision:
4-22-2016

2045 Study Area ADT Volumes

I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD

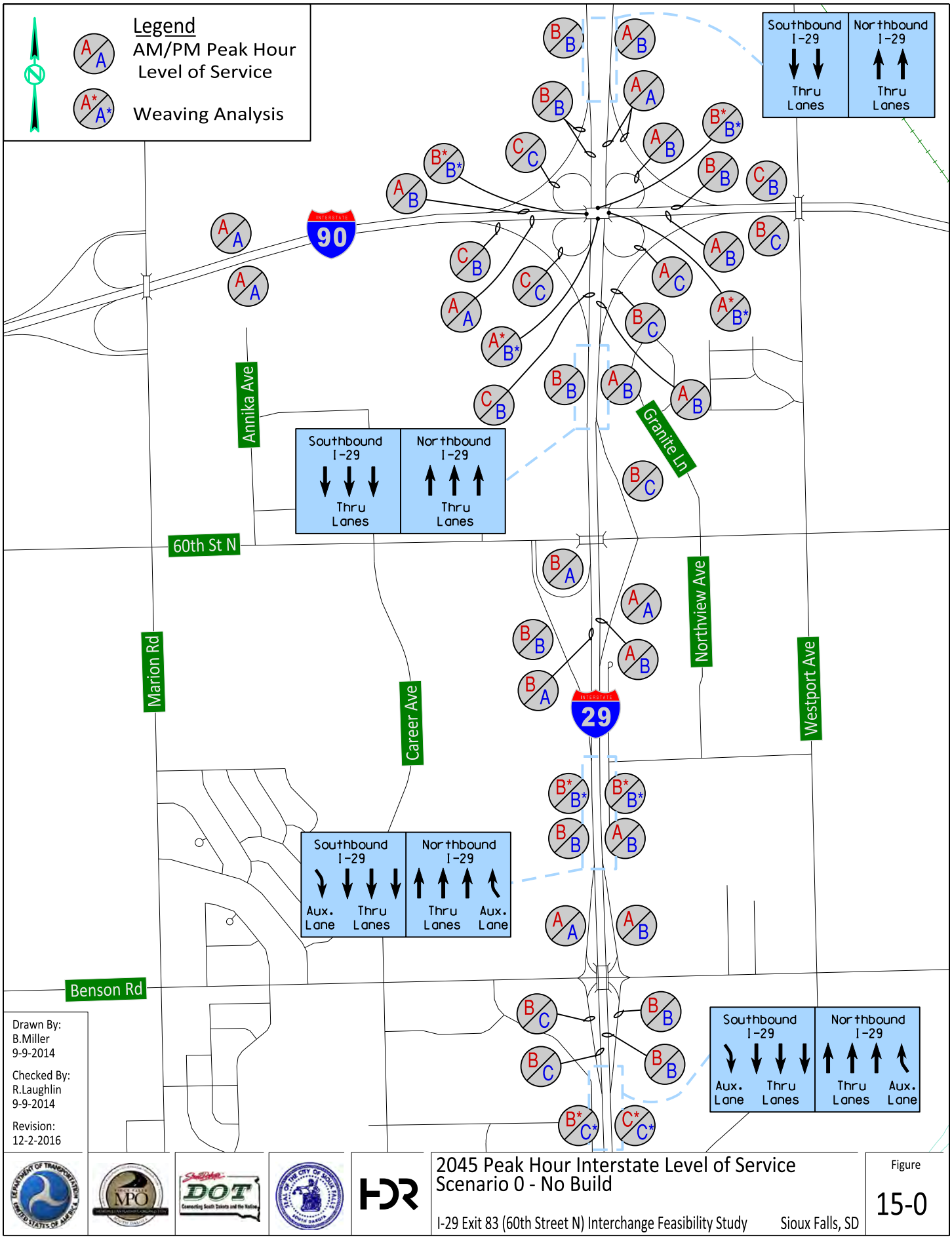
Figure
13



2045 Peak Hour Arterial & Interstate Volumes

I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD

Figure 14



Drawn By:
B.Miller
9-9-2014

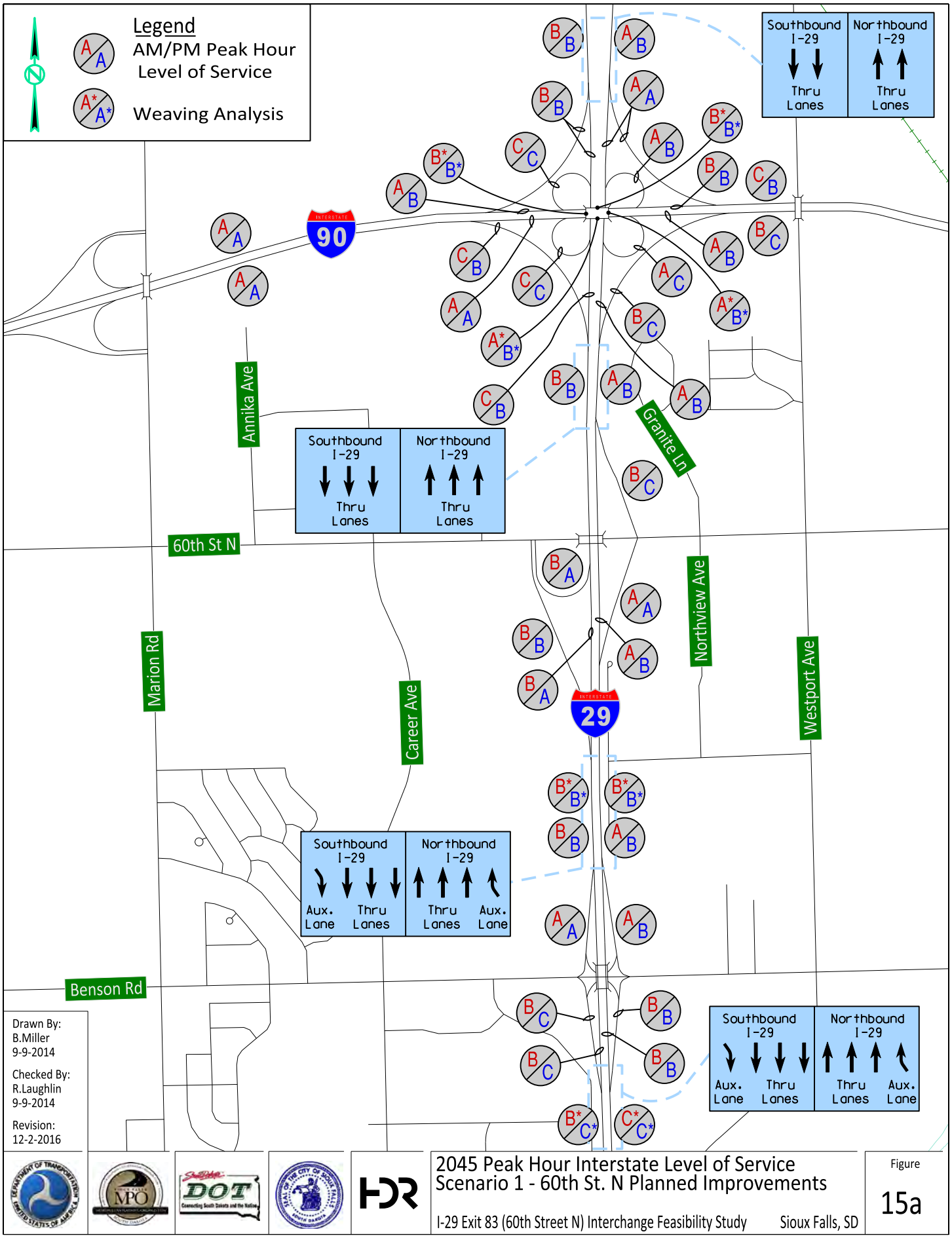
Checked By:
R.Laughlin
9-9-2014

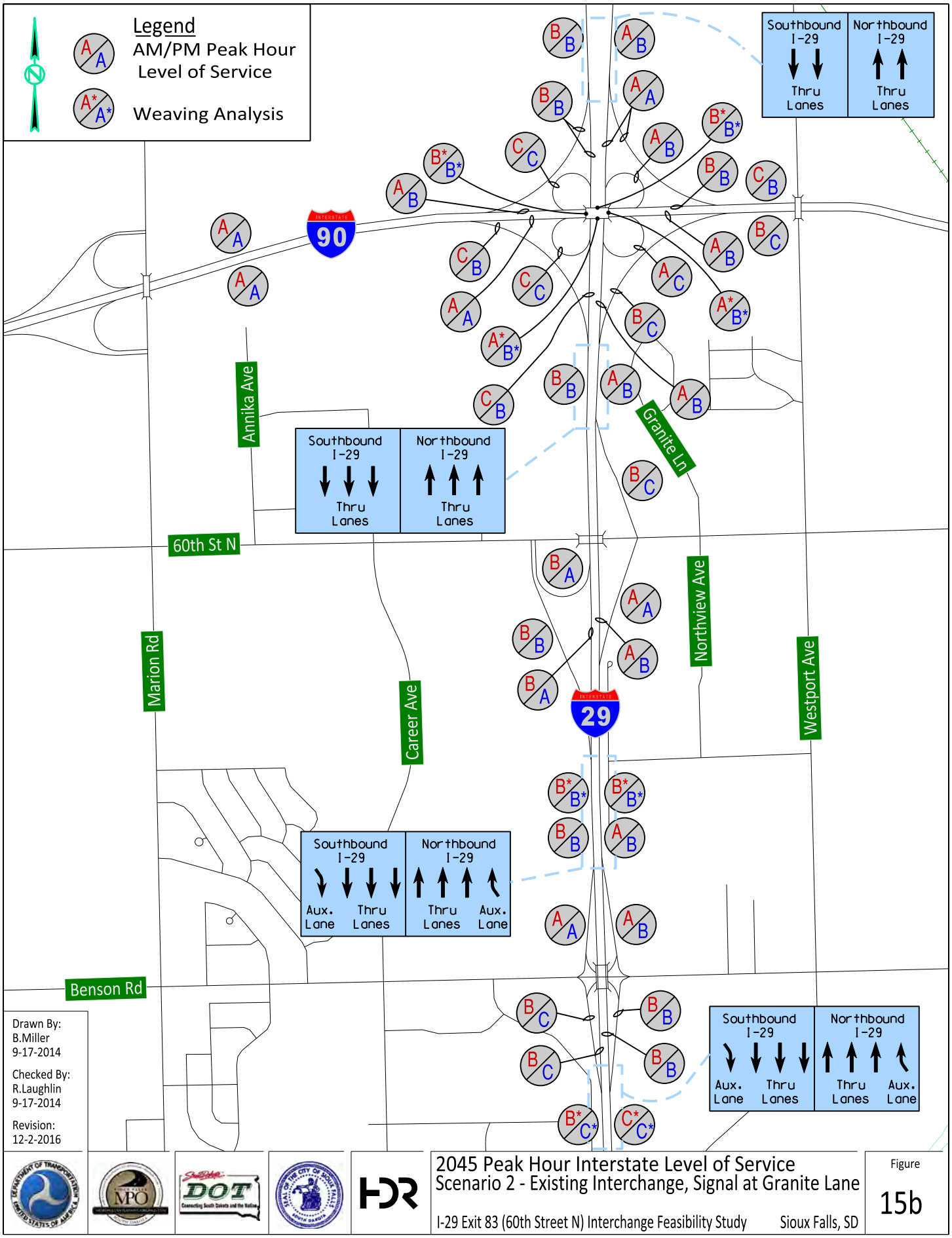
Revision:
12-2-2016

2045 Peak Hour Interstate Level of Service
Scenario 0 - No Build

I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD

Figure
15-0


Legend
AM/PM Peak Hour Level of Service
Weaving Analysis
Southbound I-29 Thru Lanes
Northbound I-29 Thru Lanes
Southbound I-29 Aux. Lane Thru Lanes
Northbound I-29 Thru Lanes Aux. Lane
INTERSTATE 90
INTERSTATE 29
Annika Ave
60th St N
Marion Rd
Career Ave
Granite Ln
Northview Ave
Westport Ave
Benson Rd
Drawn By: B.Miller 9-9-2014
Checked By: R.Laughlin 9-9-2014
Revision: 12-2-2016
2045 Peak Hour Interstate Level of Service
Scenario 1 - 60th St. N Planned Improvements
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
15a



Drawn By:
B.Miller
9-17-2014

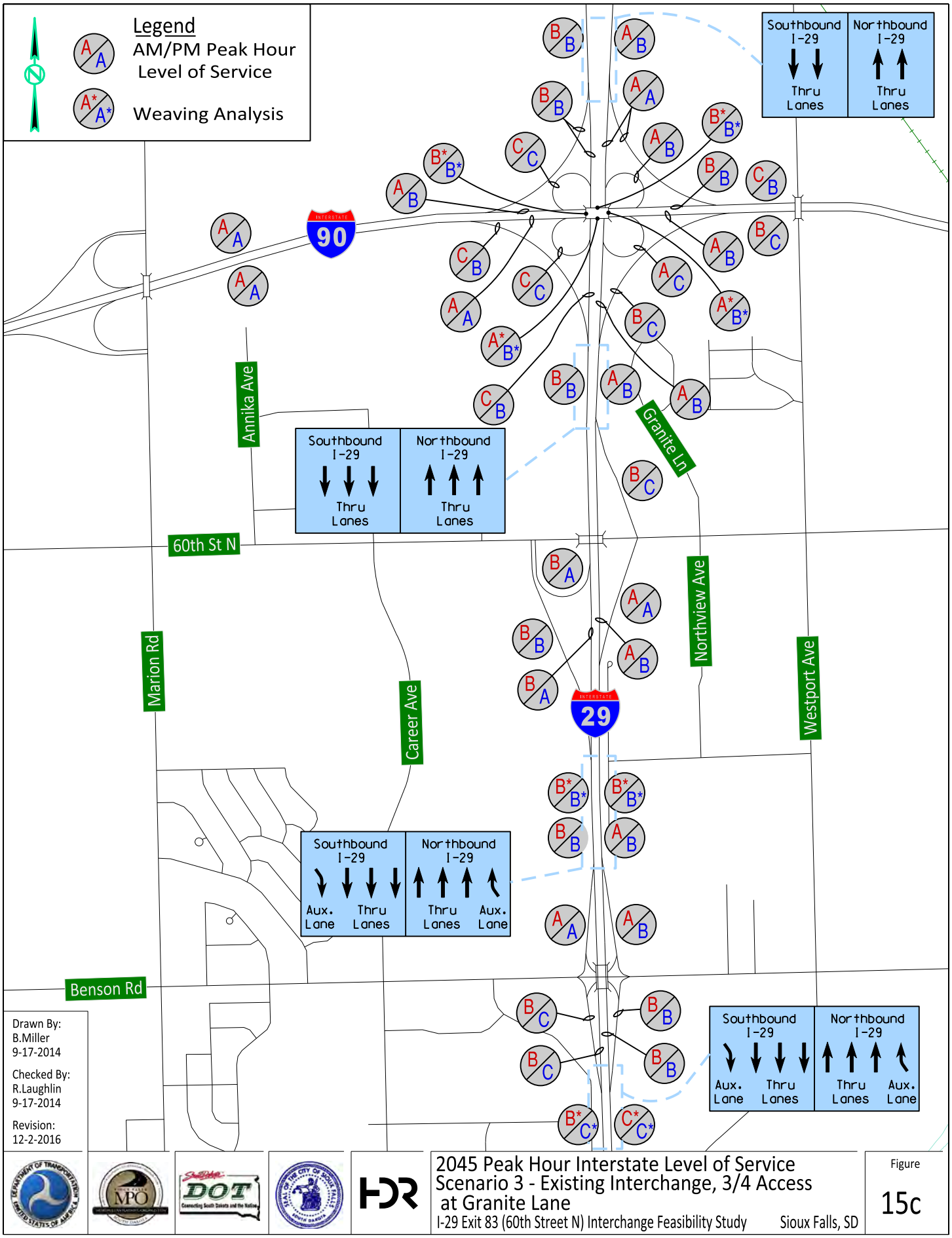
Checked By:
R.Laughlin
9-17-2014

Revision:
12-2-2016

2045 Peak Hour Interstate Level of Service
Scenario 2 - Existing Interchange, Signal at Granite Lane

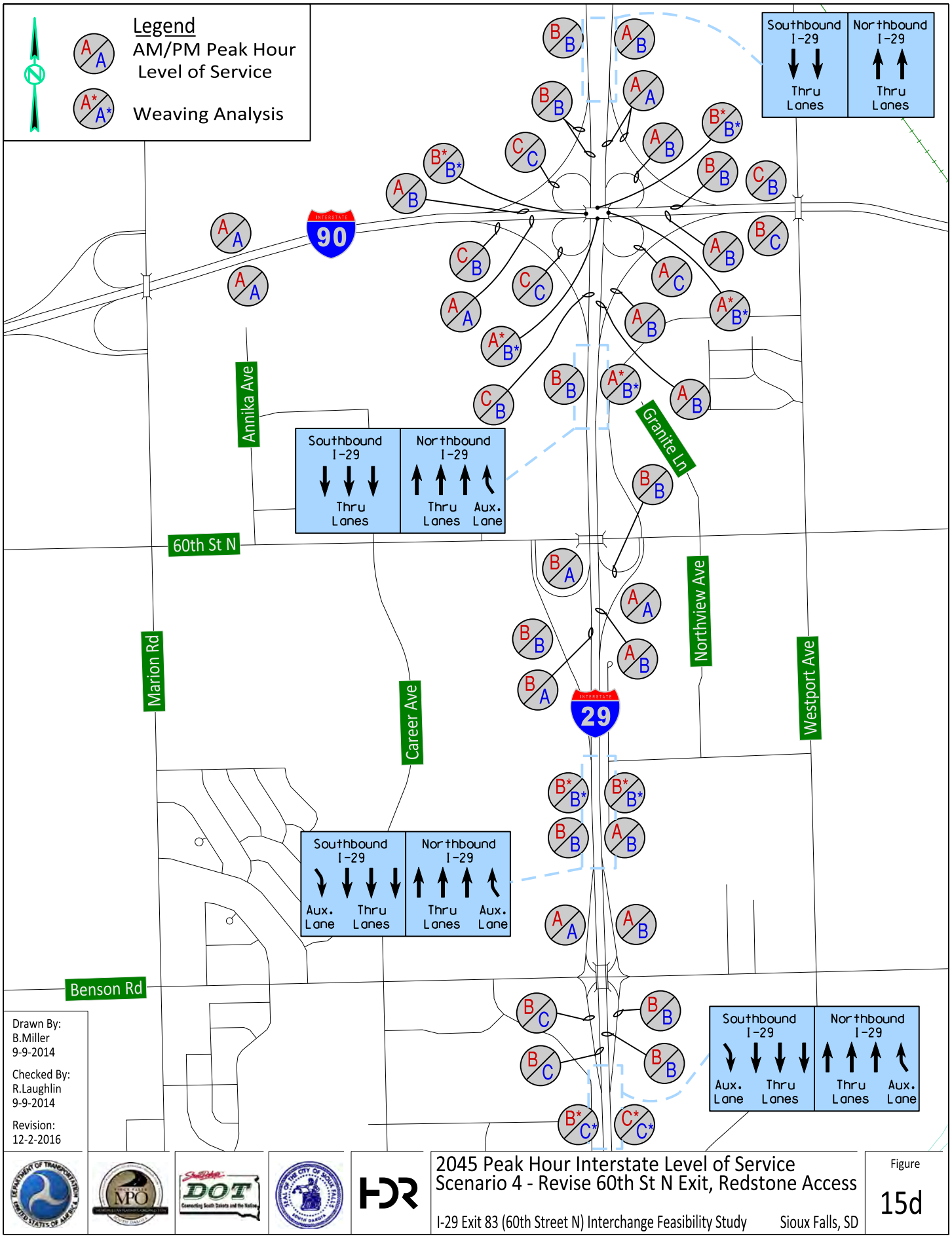
I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD

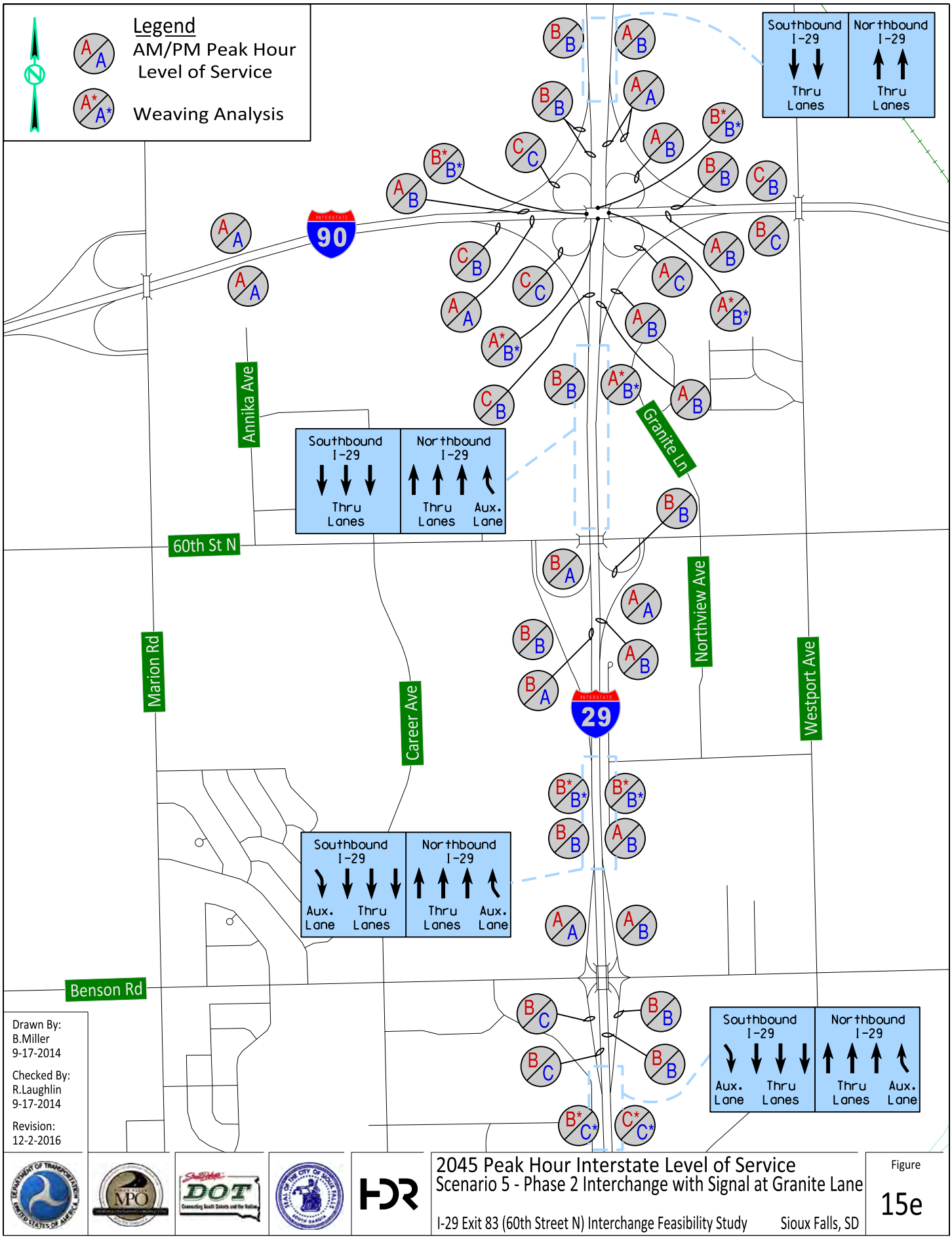
Figure
15b

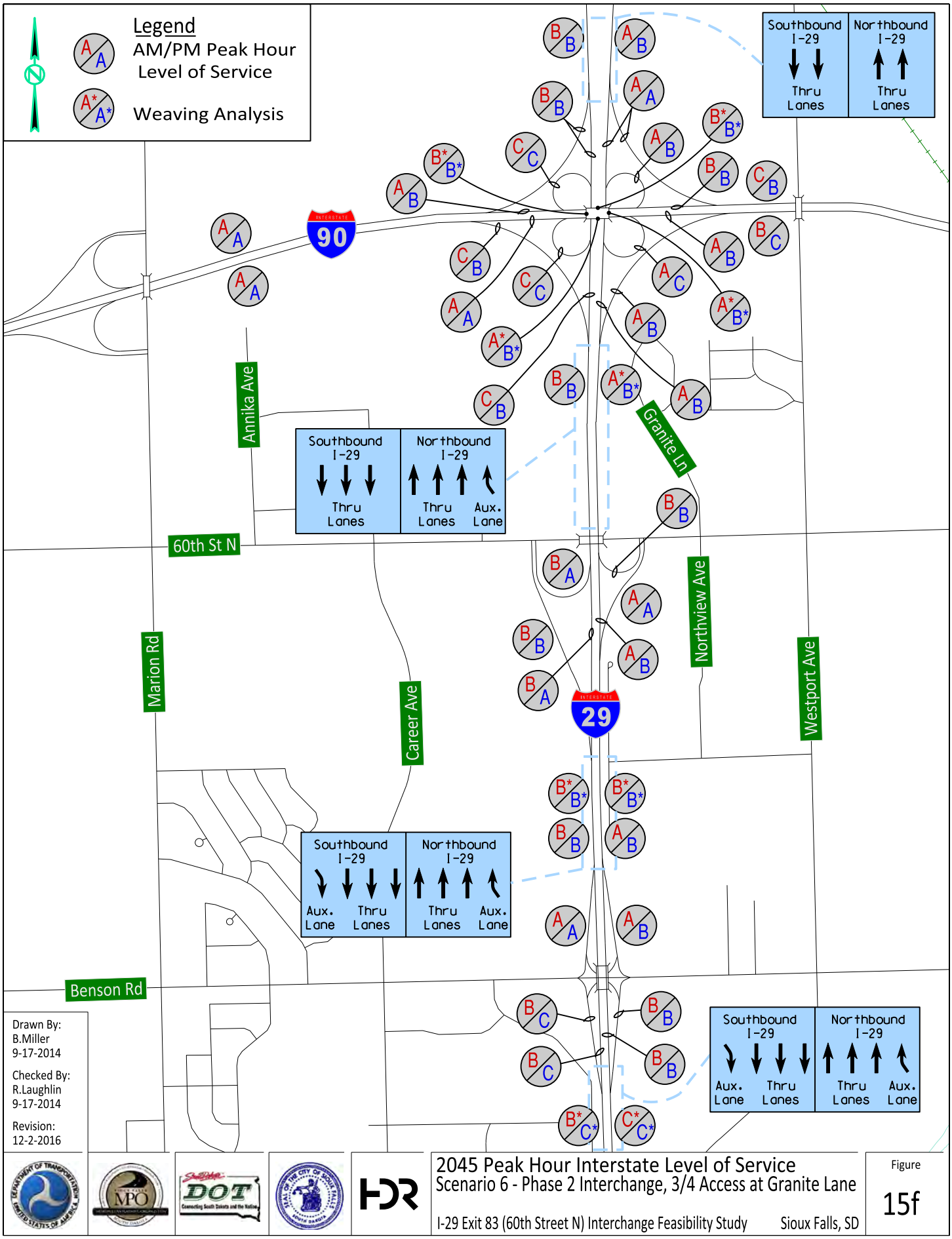


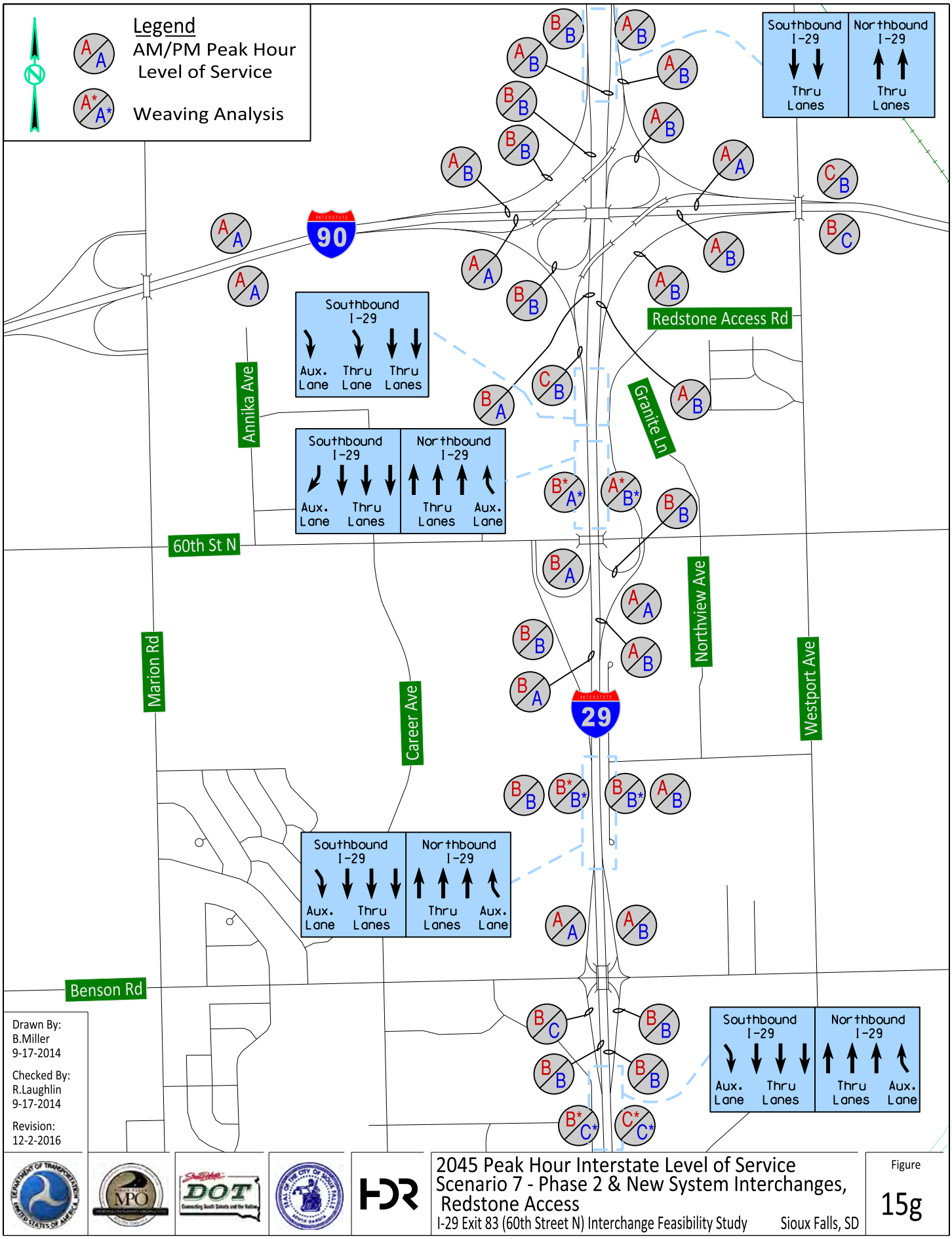
2045 Peak Hour Interstate Level of Service
Scenario 3 - Existing Interchange, 3/4 Access at Granite Lane
I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD

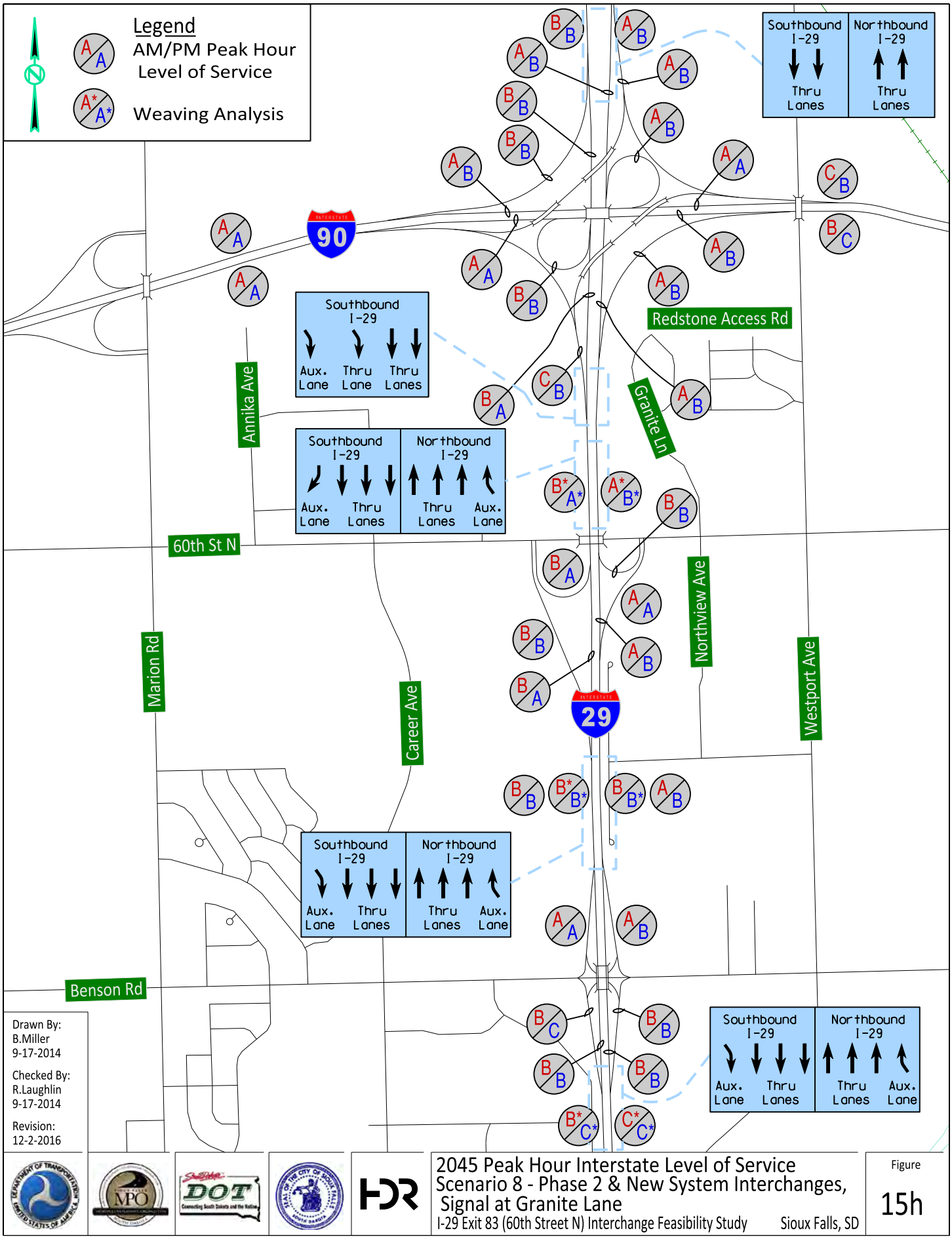
Figure 15c

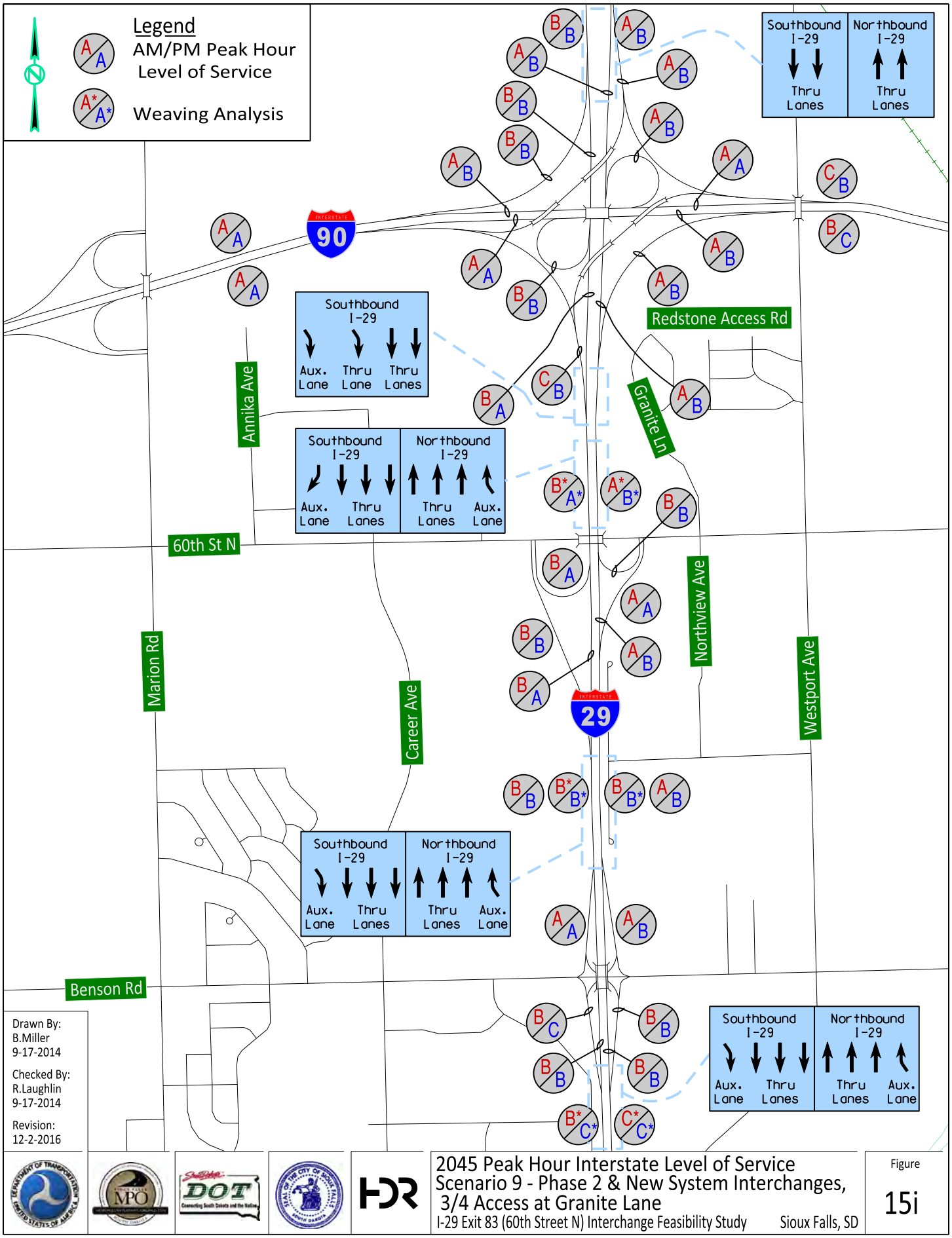

Legend
AM/PM Peak Hour Level of Service
Weaving Analysis
Southbound I-29 Thru Lanes
Northbound I-29 Thru Lanes
Southbound I-29 Thru Lanes
Northbound I-29 Thru Lanes Aux. Lane
Southbound I-29 Aux. Lane Thru Lanes
Northbound I-29 Thru Lanes Aux. Lane
Southbound I-29 Aux. Lane Thru Lanes
Northbound I-29 Thru Lanes Aux. Lane
90
29
Annika Ave
60th St N
Marion Rd
Career Ave
Granite Ln
Northview Ave
Westport Ave
Benson Rd
Drawn By: B.Miller 9-9-2014
Checked By: R.Laughlin 9-9-2014
Revision: 12-2-2016
2045 Peak Hour Interstate Level of Service
Scenario 4 - Revise 60th St N Exit, Redstone Access
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
15d


Legend
AM/PM Peak Hour Level of Service
Weaving Analysis
Southbound I-29
Thru Lanes
Northbound I-29
Thru Lanes
Southbound I-29
Thru Lanes
Northbound I-29
Thru Lanes
Aux. Lane
Southbound I-29
Aux. Lane
Thru Lanes
Northbound I-29
Thru Lanes
Aux. Lane
Southbound I-29
Aux. Lane
Thru Lanes
Northbound I-29
Thru Lanes
Aux. Lane
90
29
Annika Ave
60th St N
Marion Rd
Career Ave
Granite Ln
Northview Ave
Westport Ave
Benson Rd
Drawn By: B.Miller 9-17-2014
Checked By: R.Laughlin 9-17-2014
Revision: 12-2-2016
2045 Peak Hour Interstate Level of Service
Scenario 5 - Phase 2 Interchange with Signal at Granite Lane
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
15e


Legend
AM/PM Peak Hour Level of Service
Weaving Analysis
Southbound I-29 Thru Lanes
Northbound I-29 Thru Lanes
Southbound I-29 Thru Lanes
Northbound I-29 Thru Lanes Aux. Lane
Southbound I-29 Aux. Lane Thru Lanes
Northbound I-29 Thru Lanes Aux. Lane
Southbound I-29 Aux. Lane Thru Lanes
Northbound I-29 Thru Lanes Aux. Lane
90
29
Annika Ave
60th St N
Marion Rd
Career Ave
Granite Ln
Northview Ave
Westport Ave
Benson Rd
Drawn By: B.Miller 9-17-2014
Checked By: R.Laughlin 9-17-2014
Revision: 12-2-2016
2045 Peak Hour Interstate Level of Service
Scenario 6 - Phase 2 Interchange, 3/4 Access at Granite Lane
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
15f

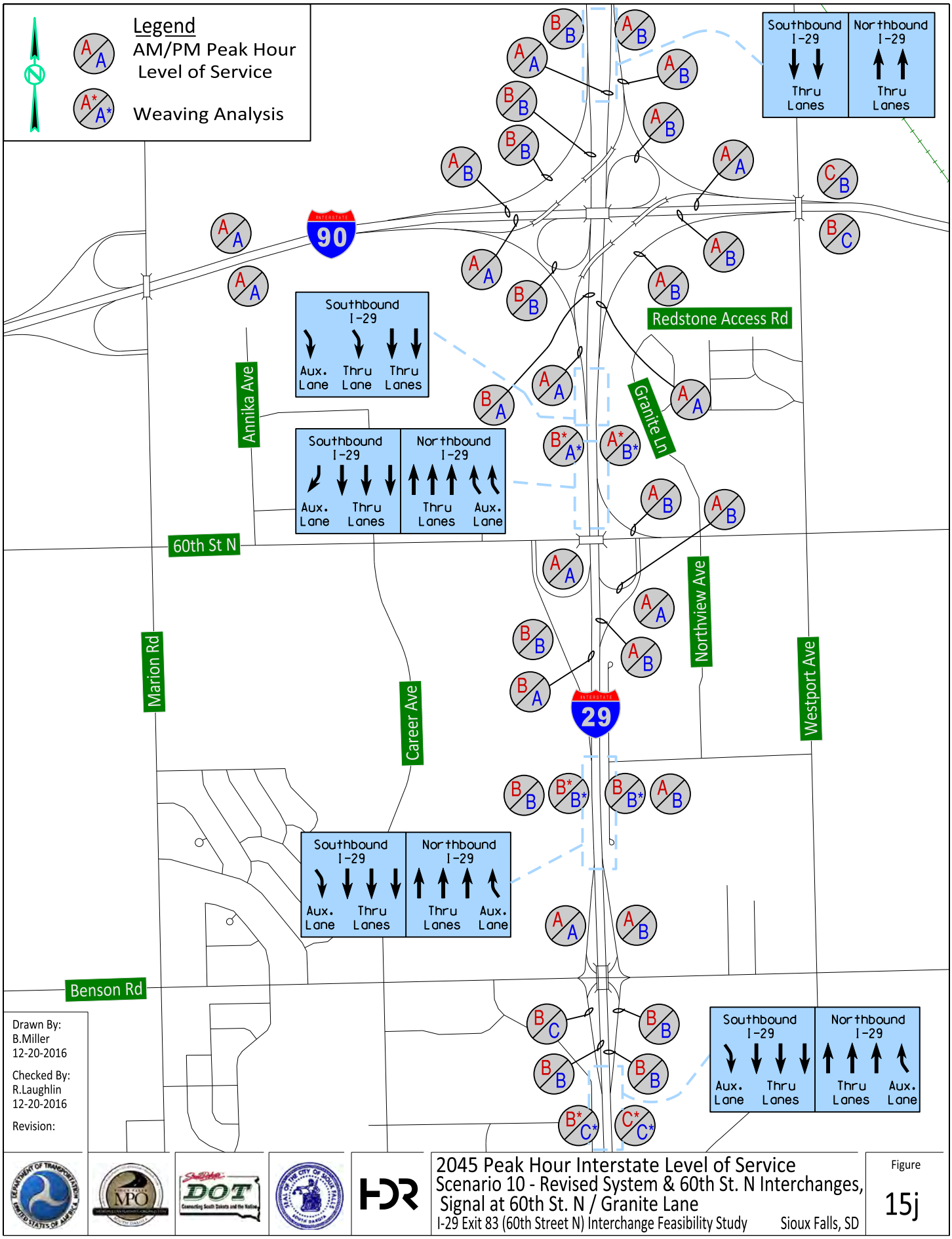

Legend
AM/PM Peak Hour Level of Service
Weaving Analysis
Southbound I-29 Thru Lanes
Northbound I-29 Thru Lanes
Redstone Access Rd
Granite Ln
Annika Ave
Marion Rd
60th St N
Career Ave
Northview Ave
Westport Ave
Benson Rd
Southbound I-29 Aux. Lane Thru Lanes
Northbound I-29 Thru Lanes Aux. Lane
Drawn By: B.Miller 9-17-2014
Checked By: R.Laughlin 9-17-2014
Revision: 12-2-2016
2045 Peak Hour Interstate Level of Service
Scenario 7 - Phase 2 & New System Interchanges, Redstone Access
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
15g


Legend
AM/PM Peak Hour Level of Service
Weaving Analysis
Southbound I-29
Thru Lanes
Northbound I-29
Thru Lanes
Southbound I-29
Aux. Lane
Thru Lanes
Thru Lanes
Southbound I-29
Aux. Lane
Thru Lanes
Northbound I-29
Thru Lanes
Aux. Lane
Southbound I-29
Aux. Lane
Thru Lanes
Northbound I-29
Thru Lanes
Aux. Lane
Southbound I-29
Aux. Lane
Thru Lanes
Northbound I-29
Thru Lanes
Aux. Lane
90
29
Redstone Access Rd
Annika Ave
Granite Ln
60th St N
Marion Rd
Career Ave
Northview Ave
Westport Ave
Benson Rd
Drawn By:
B.Miller
9-17-2014
Checked By:
R.Laughlin
9-17-2014
Revision:
12-2-2016
2045 Peak Hour Interstate Level of Service
Scenario 8 - Phase 2 & New System Interchanges,
Signal at Granite Lane
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
15h



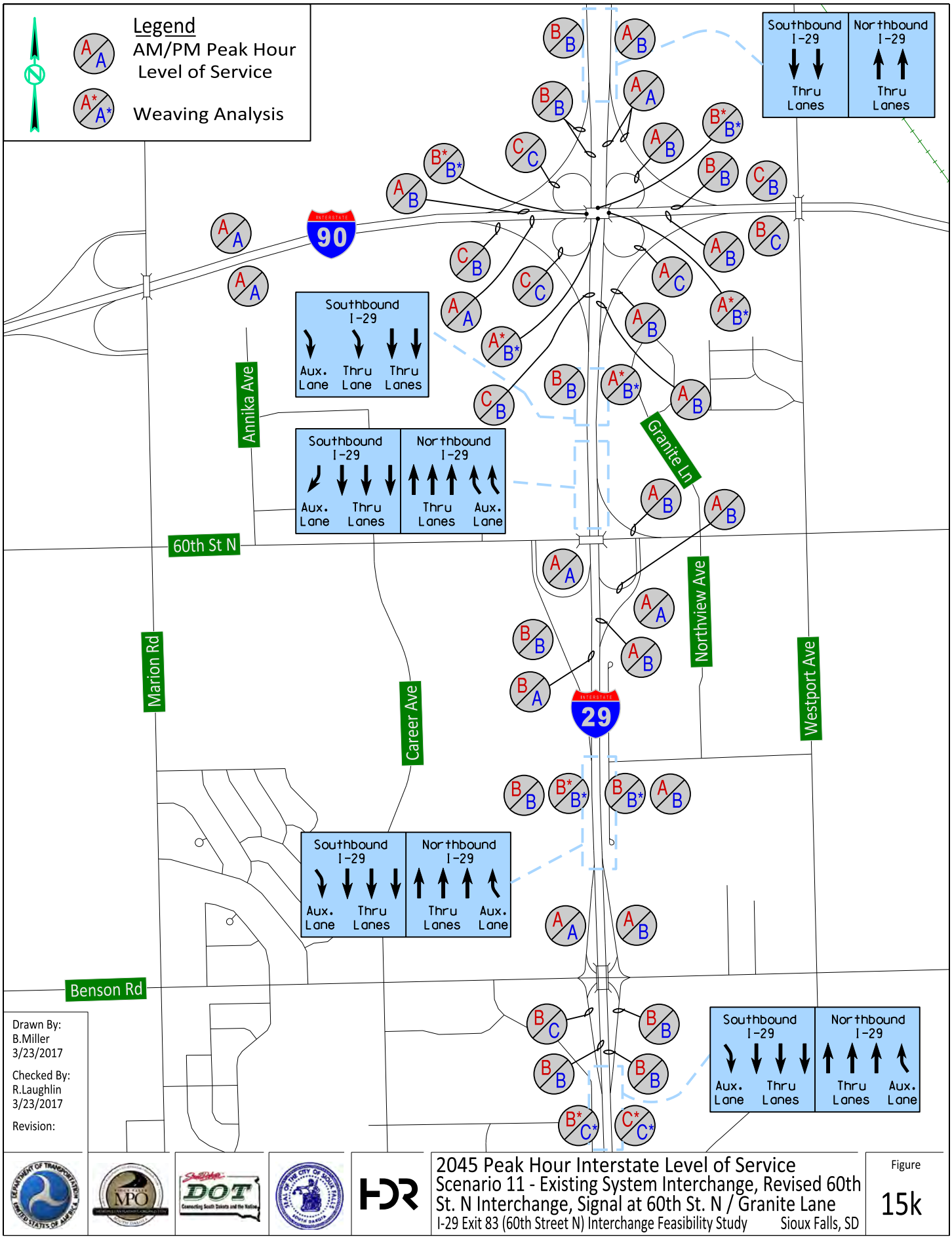
2045 Peak Hour Interstate Level of Service
Scenario 9 - Phase 2 & New System Interchanges, 3/4 Access at Granite Lane
I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD

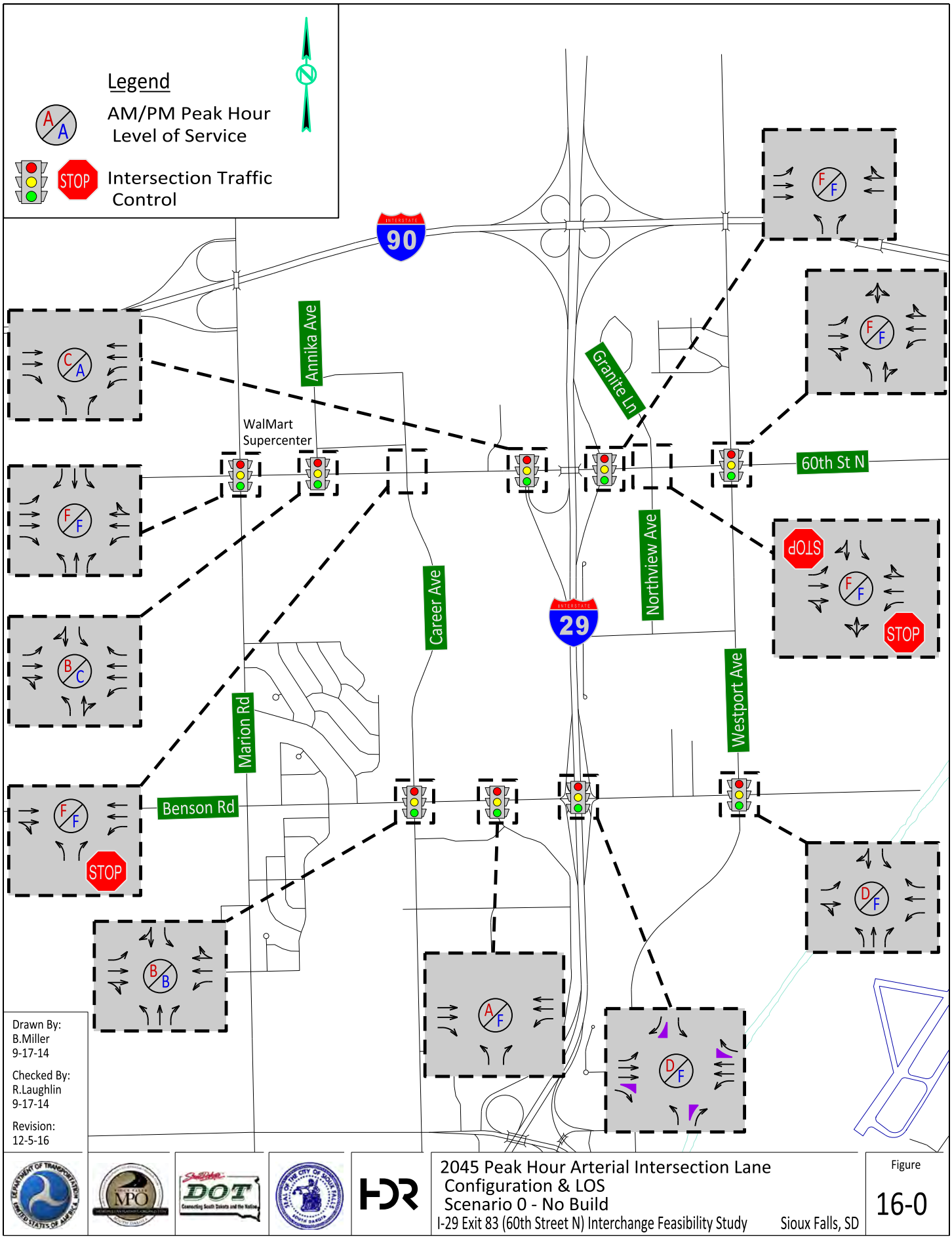
Figure 15i

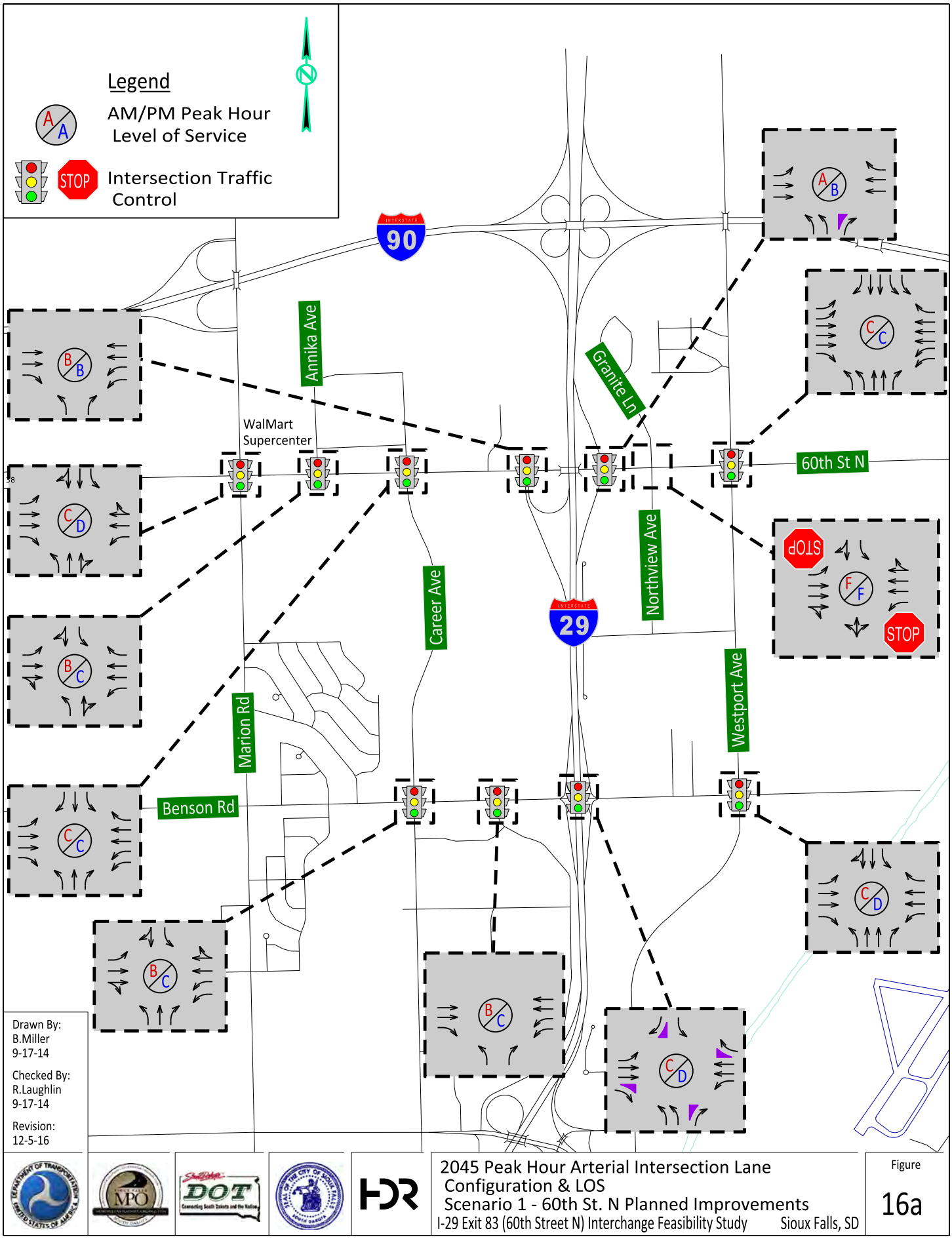


2045 Peak Hour Interstate Level of Service
Scenario 10 - Revised System & 60th St. N Interchanges, Signal at 60th St. N / Granite Lane
I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD

Figure 15j

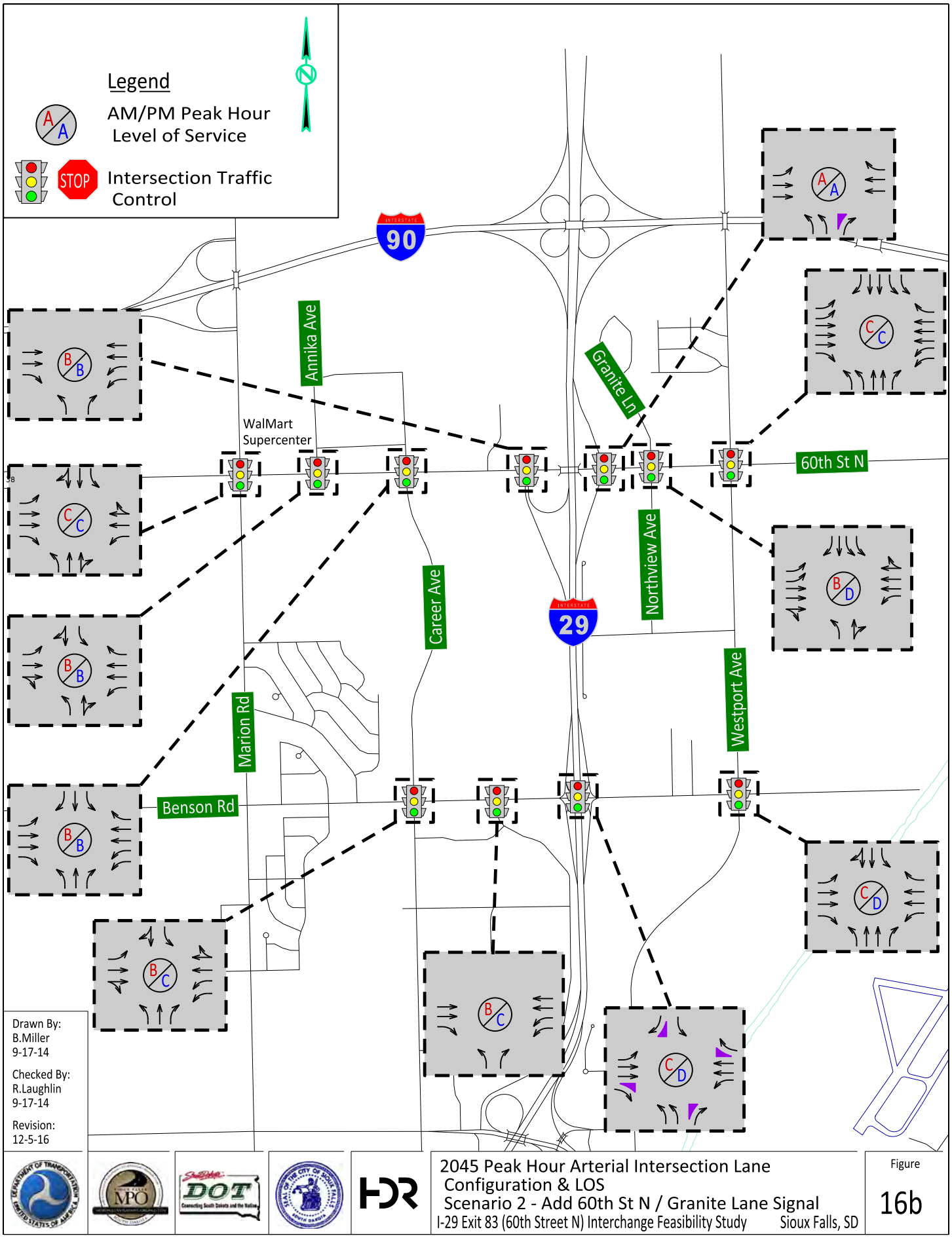

Legend
AM/PM Peak Hour Level of Service
Weaving Analysis
Southbound I-29
Thru Lanes
Northbound I-29
Thru Lanes
Southbound I-29
Aux. Lane
Thru Lane
Thru Lanes
Southbound I-29
Aux. Lane
Thru Lanes
Northbound I-29
Thru Lanes
Aux. Lane
Southbound I-29
Aux. Lane
Thru Lanes
Northbound I-29
Thru Lanes
Aux. Lane
Southbound I-29
Aux. Lane
Thru Lanes
Northbound I-29
Thru Lanes
Aux. Lane
90
29
Annika Ave
Granite Ln
60th St N
Marion Rd
Career Ave
Northview Ave
Westport Ave
Benson Rd
Drawn By:
B.Miller
3/23/2017
Checked By:
R.Laughlin
3/23/2017
Revision:
2045 Peak Hour Interstate Level of Service
Scenario 11 - Existing System Interchange, Revised 60th St. N Interchange, Signal at 60th St. N / Granite Lane
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
15k


Legend
AM/PM Peak Hour Level of Service
Intersection Traffic Control
STOP
90
29
Annika Ave
Granite Ln
WalMart Supercenter
60th St N
Career Ave
Northview Ave
Marion Rd
Westport Ave
Benson Rd
Drawn By: B.Miller 9-17-14
Checked By: R.Laughlin 9-17-14
Revision: 12-5-16
2045 Peak Hour Arterial Intersection Lane Configuration & LOS
Scenario 0 - No Build
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
16-0



2045 Peak Hour Arterial Intersection Lane Configuration & LOS
Scenario 1 - 60th St. N Planned Improvements
I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD

Figure 16a



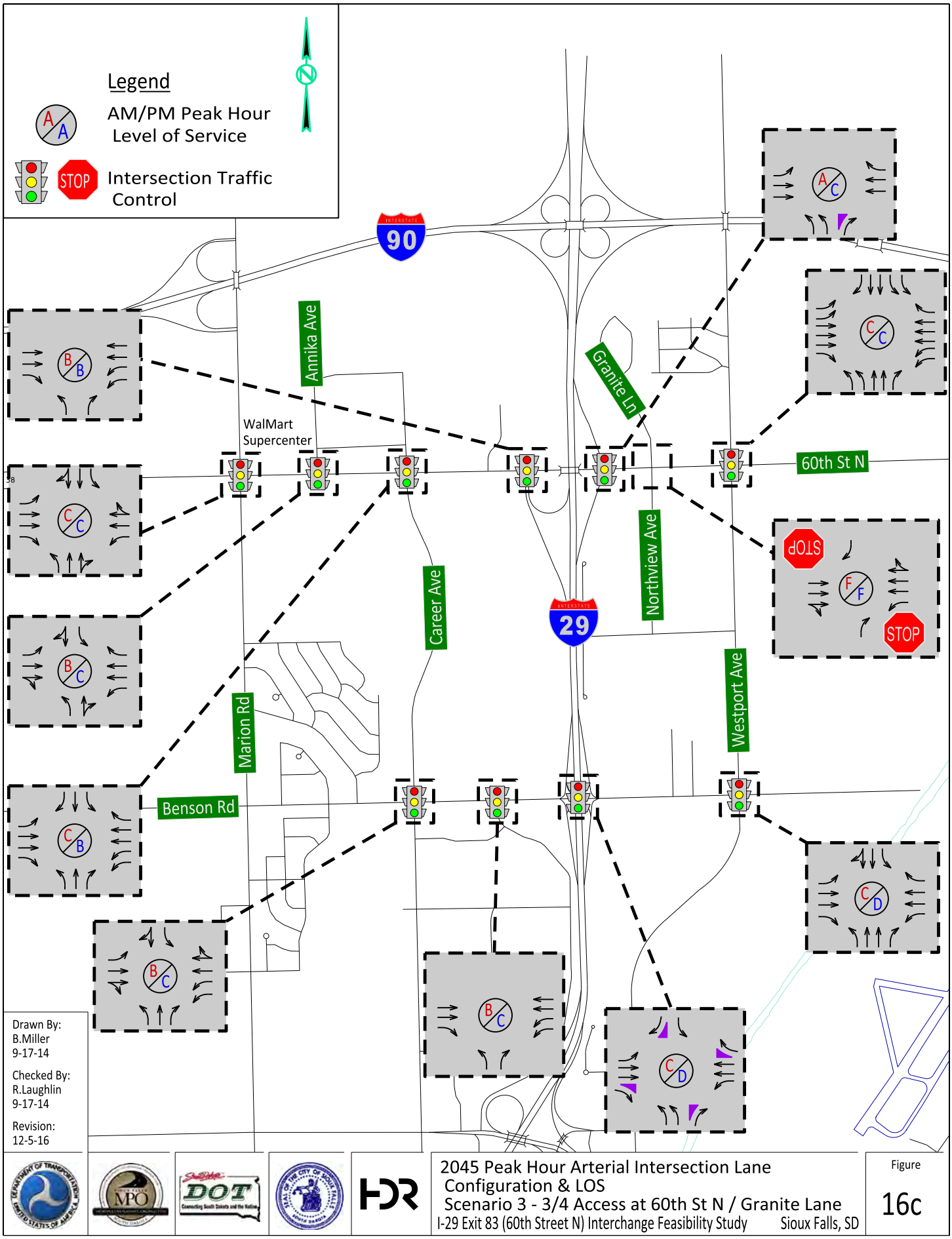
Drawn By: B.Miller 9-17-14

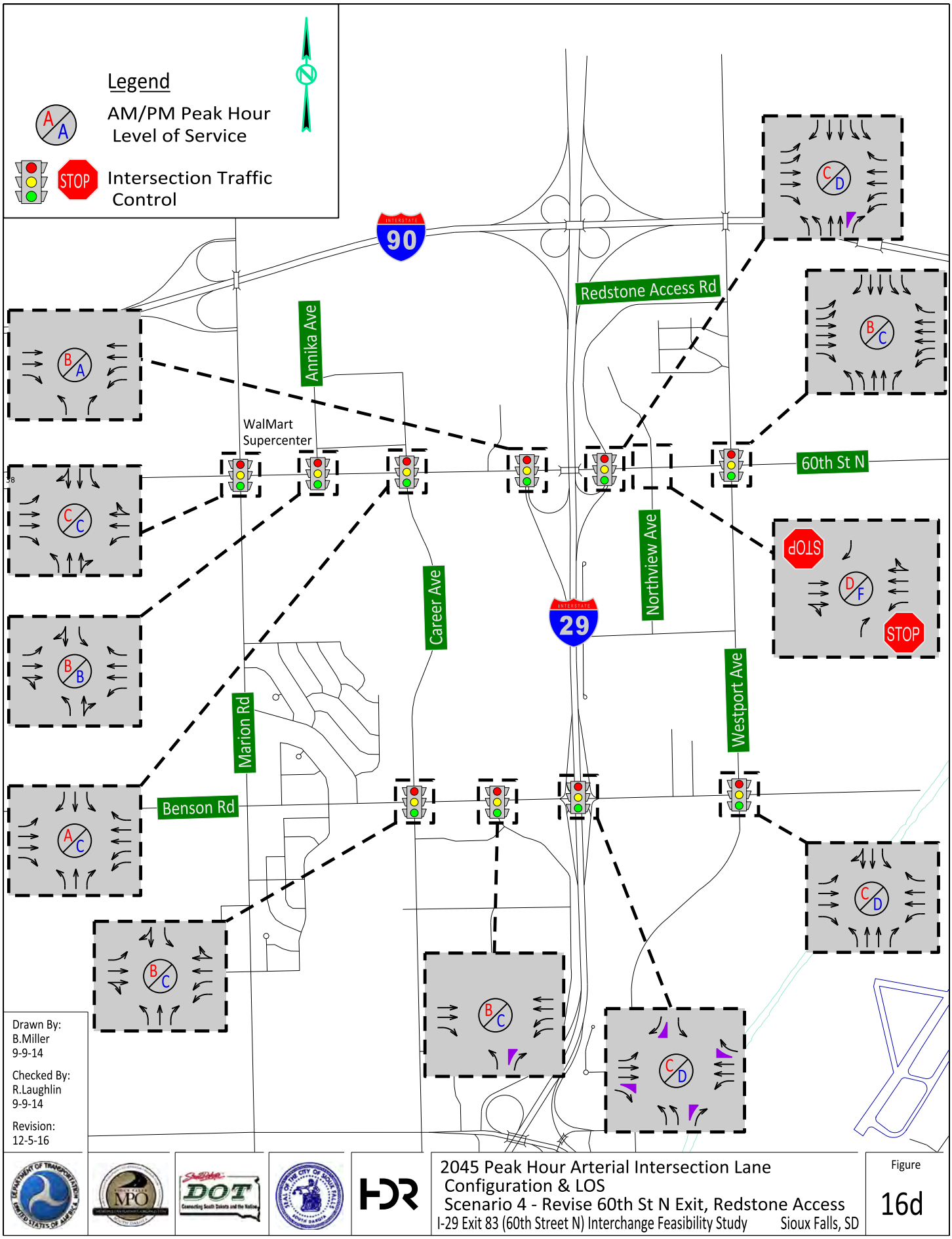
Checked By: R.Laughlin 9-17-14

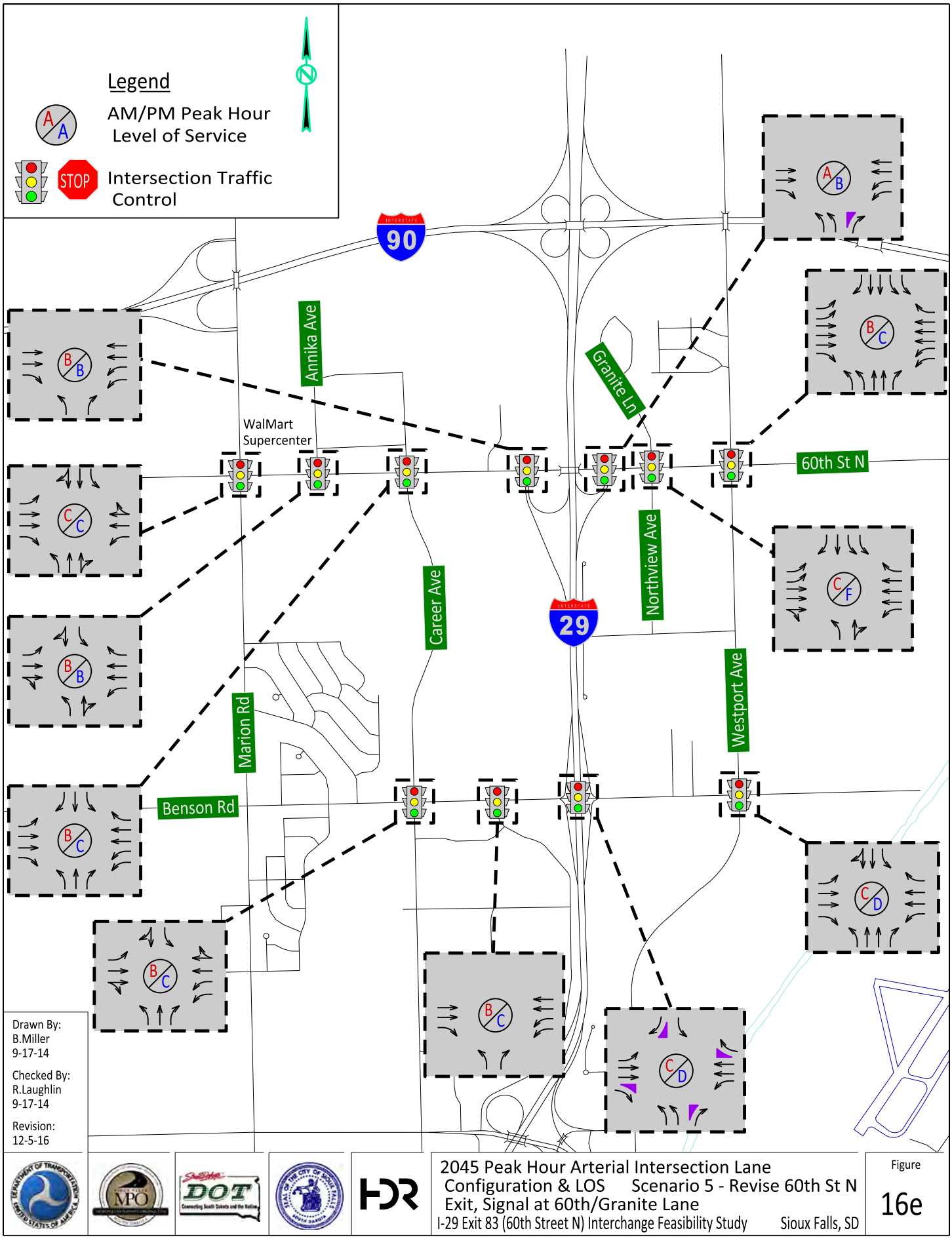
Revision: 12-5-16

2045 Peak Hour Arterial Intersection Lane Configuration & LOS
Scenario 2 - Add 60th St N / Granite Lane Signal
I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD

Figure 16b


Legend
AM/PM Peak Hour Level of Service
Intersection Traffic Control
STOP
90
29
Annika Ave
Granite Ln
WalMart Supercenter
60th St N
Career Ave
Northview Ave
Marion Rd
Westport Ave
Benson Rd
A/C
C/C
B/B
C/C
F/F
STOP
B/C
C/B
B/C
B/C
C/D
C/D
Drawn By: B.Miller 9-17-14
Checked By: R.Laughlin 9-17-14
Revision: 12-5-16
2045 Peak Hour Arterial Intersection Lane Configuration & LOS
Scenario 3 - 3/4 Access at 60th St N / Granite Lane
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
16c


Legend
AM/PM Peak Hour Level of Service
Intersection Traffic Control
STOP
90
29
Redstone Access Rd
Annika Ave
WalMart Supercenter
60th St N
Career Ave
Northview Ave
Westport Ave
Marion Rd
Benson Rd
Drawn By: B.Miller 9-9-14
Checked By: R.Laughlin 9-9-14
Revision: 12-5-16
2045 Peak Hour Arterial Intersection Lane Configuration & LOS
Scenario 4 - Revise 60th St N Exit, Redstone Access
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
16d



Drawn By: B.Miller 9-17-14

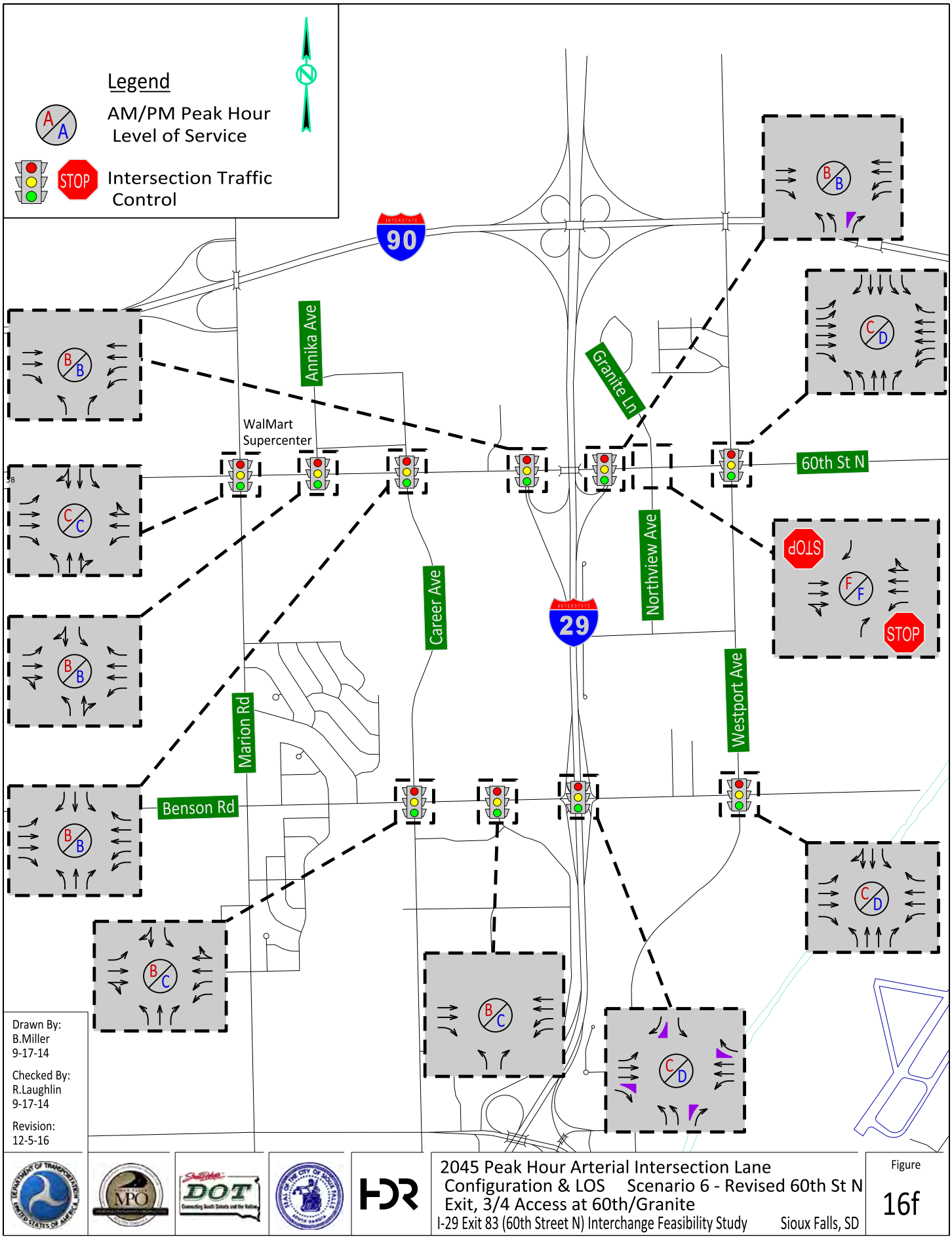
Checked By: R.Laughlin 9-17-14

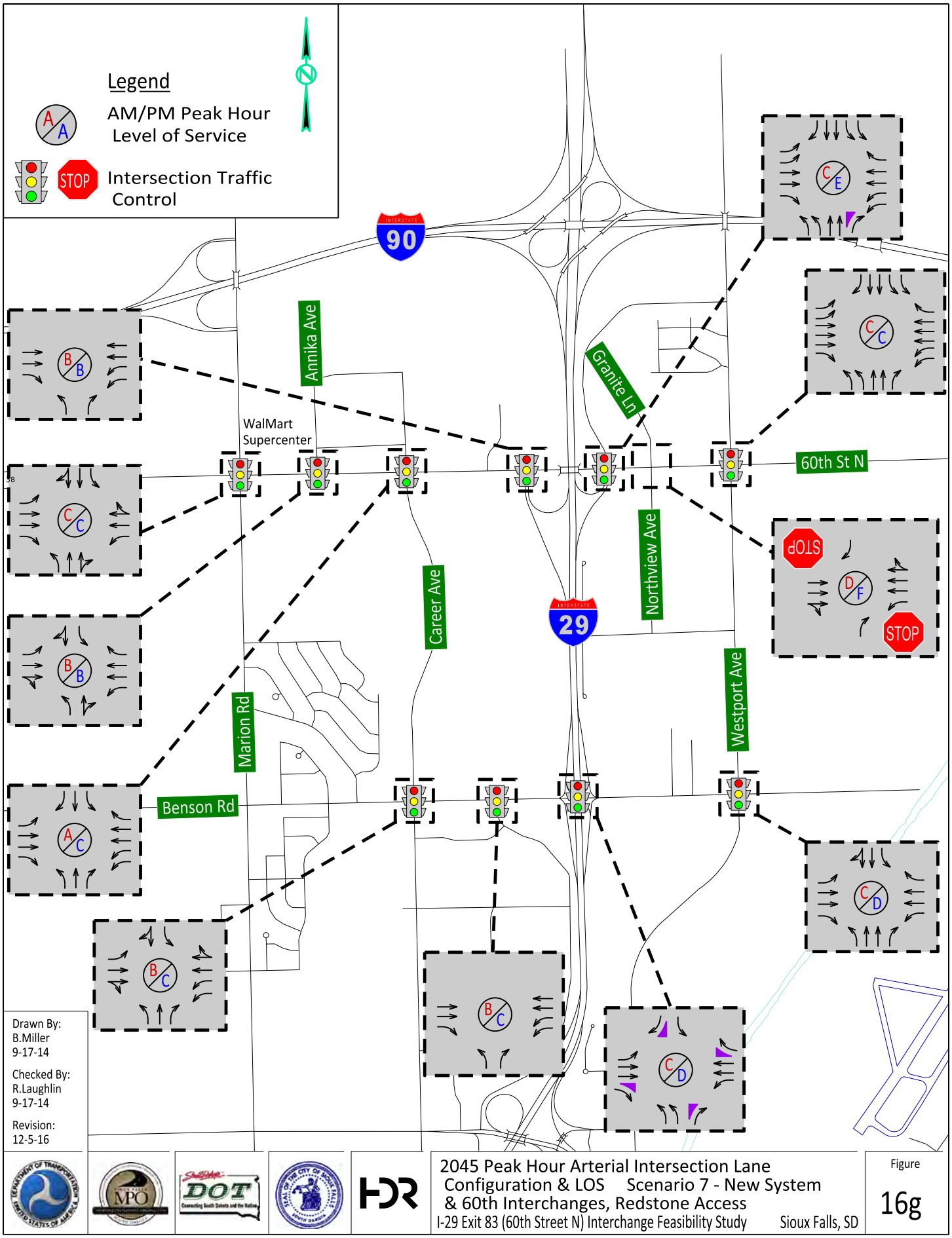
Revision: 12-5-16

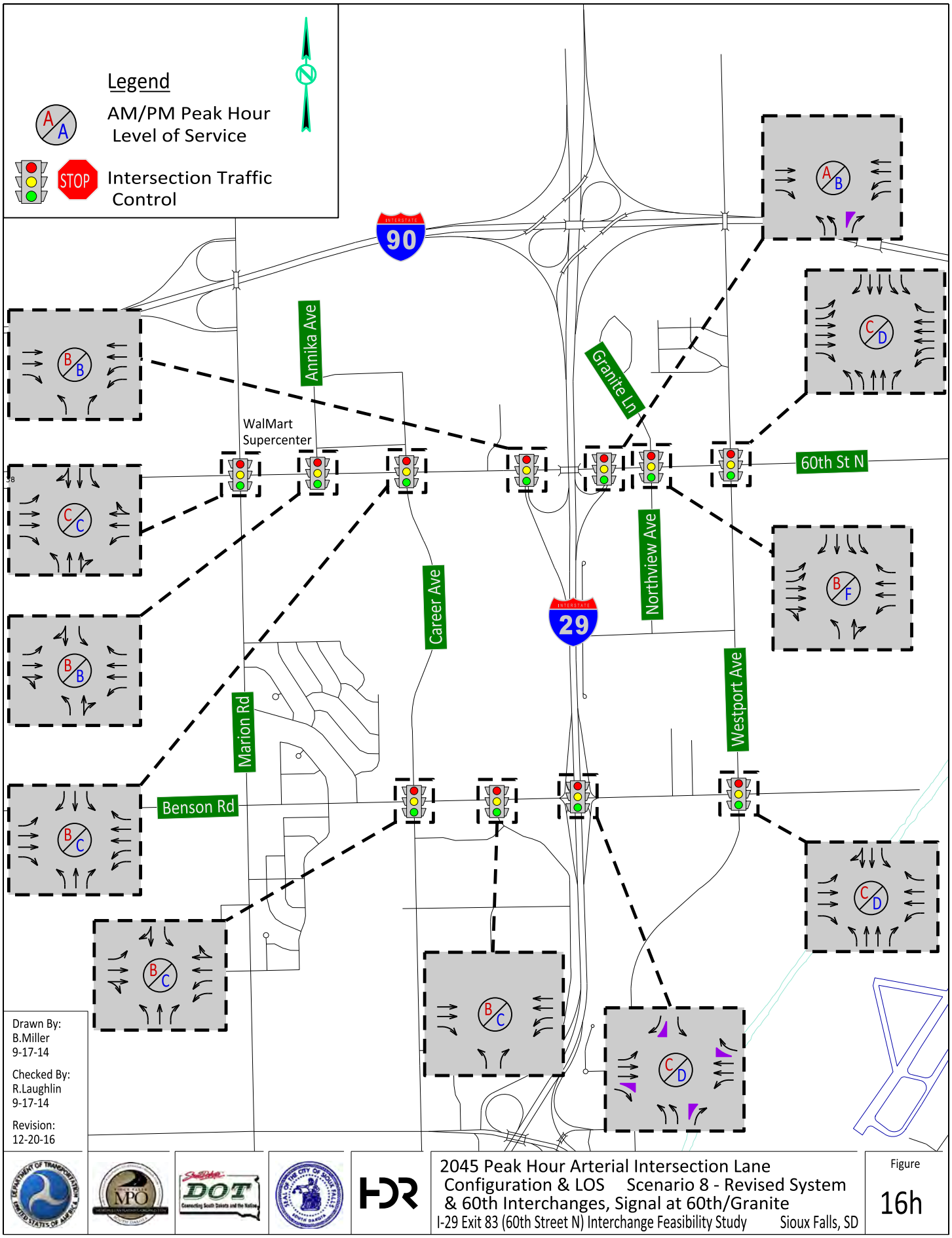
2045 Peak Hour Arterial Intersection Lane Configuration & LOS Scenario 5 - Revise 60th St N Exit, Signal at 60th/Granite Lane

I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD

Figure 16e


Legend
AM/PM Peak Hour Level of Service
Intersection Traffic Control
STOP
90
29
Annika Ave
Granite Ln
WalMart Supercenter
60th St N
Career Ave
Northview Ave
Westport Ave
Marion Rd
Benson Rd
Drawn By: B.Miller 9-17-14
Checked By: R.Laughlin 9-17-14
Revision: 12-5-16
2045 Peak Hour Arterial Intersection Lane Configuration & LOS Scenario 6 - Revised 60th St N Exit, 3/4 Access at 60th/Granite
I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD
Figure 16f


Legend
AM/PM Peak Hour Level of Service
Intersection Traffic Control
STOP
90
29
Annika Ave
Granite Ln
WalMart Supercenter
60th St N
Career Ave
Northview Ave
Marion Rd
Westport Ave
Benson Rd
Drawn By: B.Miller 9-17-14
Checked By: R.Laughlin 9-17-14
Revision: 12-5-16
2045 Peak Hour Arterial Intersection Lane Configuration & LOS Scenario 7 - New System & 60th Interchanges, Redstone Access
I-29 Exit 83 (60th Street N) Interchange Feasibility Study
Sioux Falls, SD
Figure
16g



Drawn By: B.Miller 9-17-14

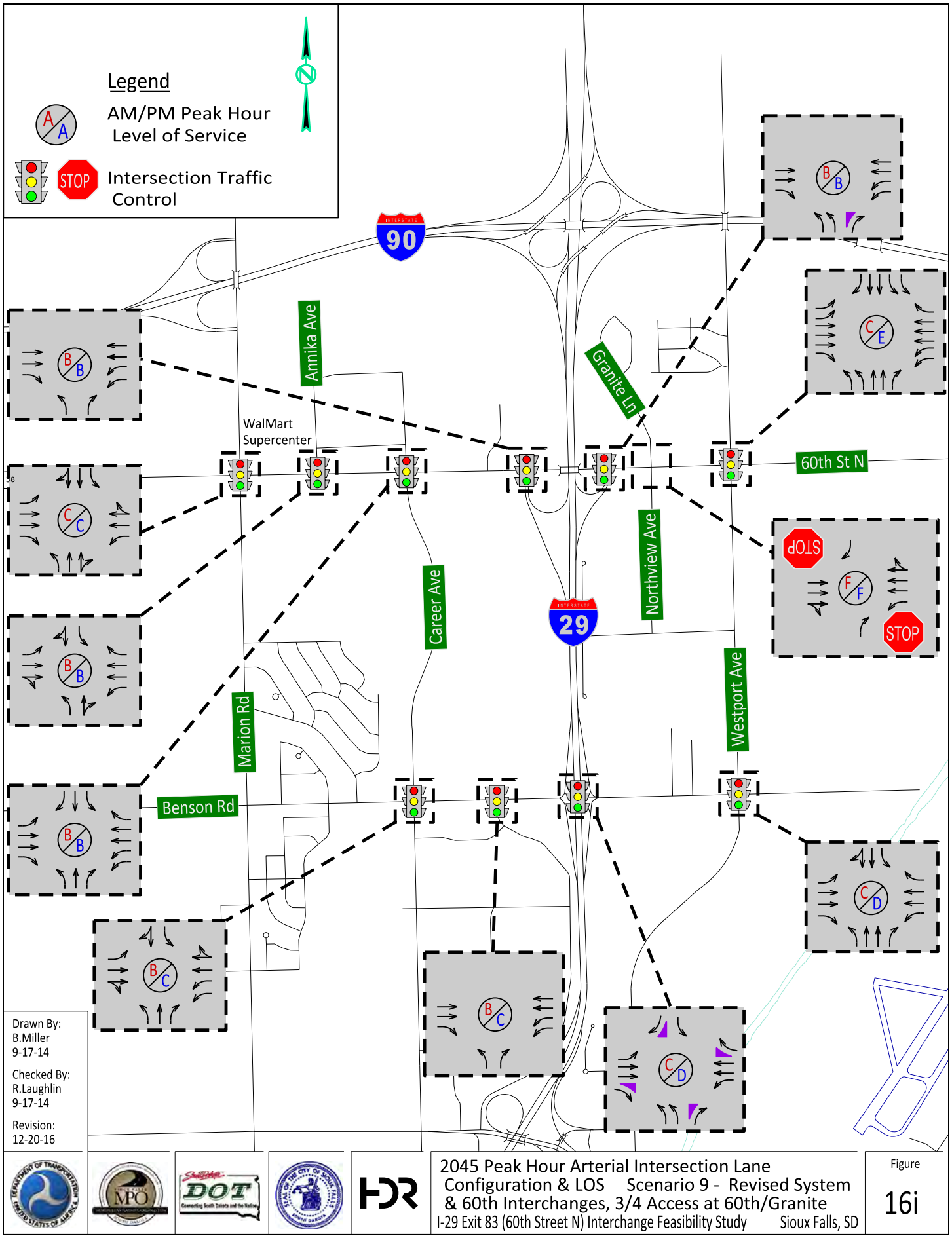
Checked By: R.Laughlin 9-17-14

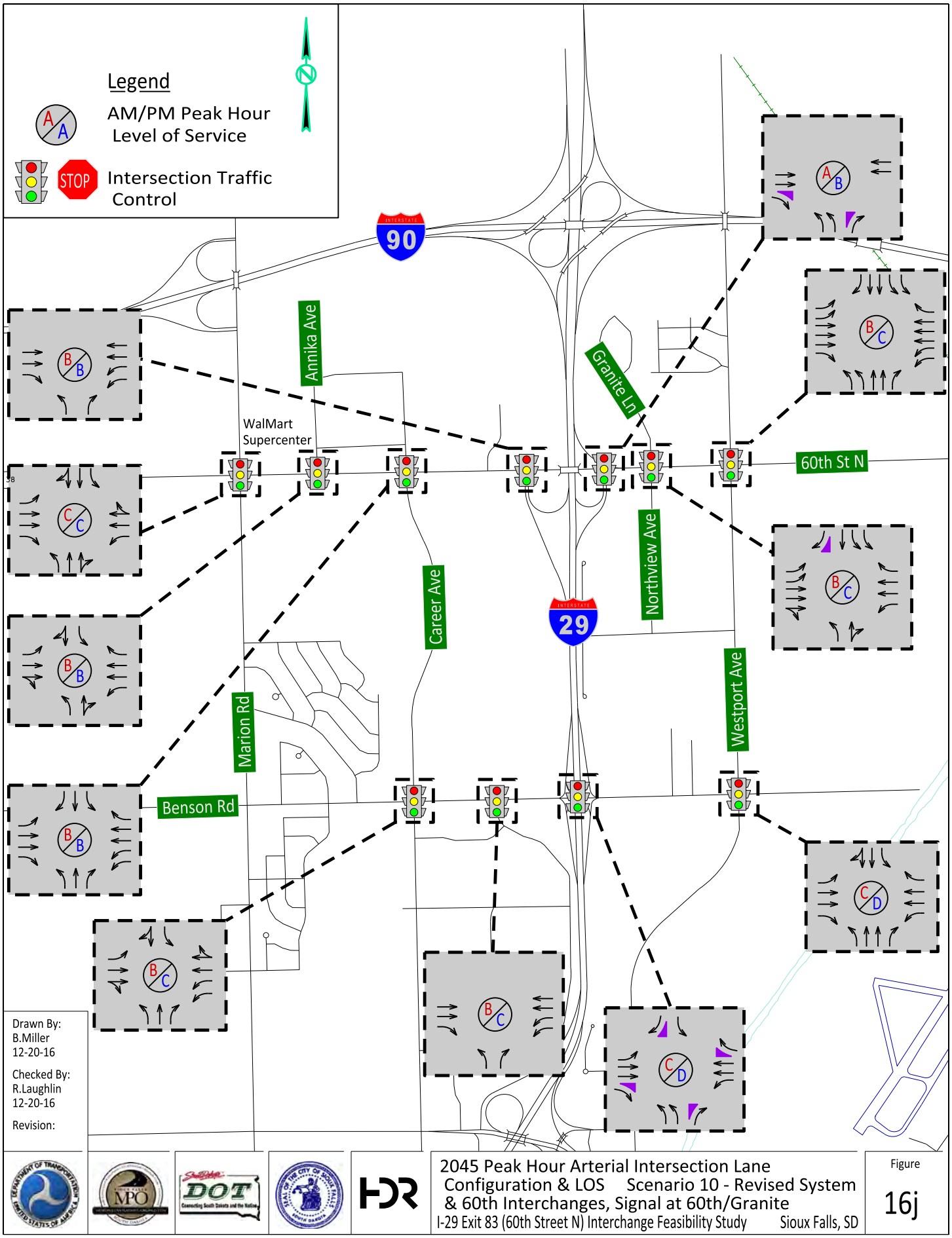
Revision: 12-20-16

2045 Peak Hour Arterial Intersection Lane Configuration & LOS Scenario 8 - Revised System & 60th Interchanges, Signal at 60th/Granite

I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD

Figure 16h

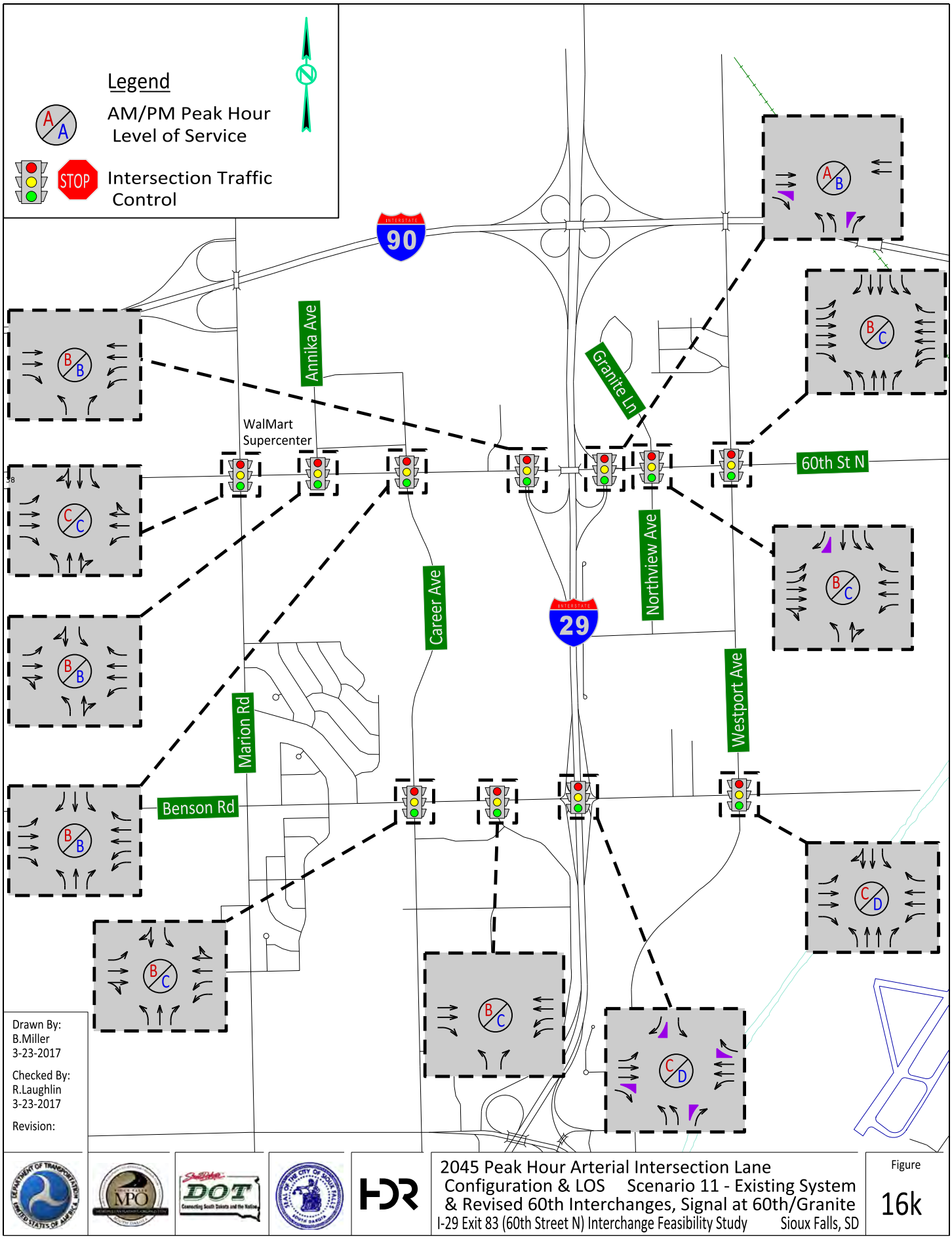

Legend
AM/PM Peak Hour Level of Service
Intersection Traffic Control
STOP
90
29
Annika Ave
Granite Ln
WalMart Supercenter
60th St N
Career Ave
Northview Ave
Westport Ave
Marion Rd
Benson Rd
Drawn By: B.Miller 9-17-14
Checked By: R.Laughlin 9-17-14
Revision: 12-20-16
2045 Peak Hour Arterial Intersection Lane Configuration & LOS Scenario 9 - Revised System & 60th Interchanges, 3/4 Access at 60th/Granite
I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD
Figure
16i

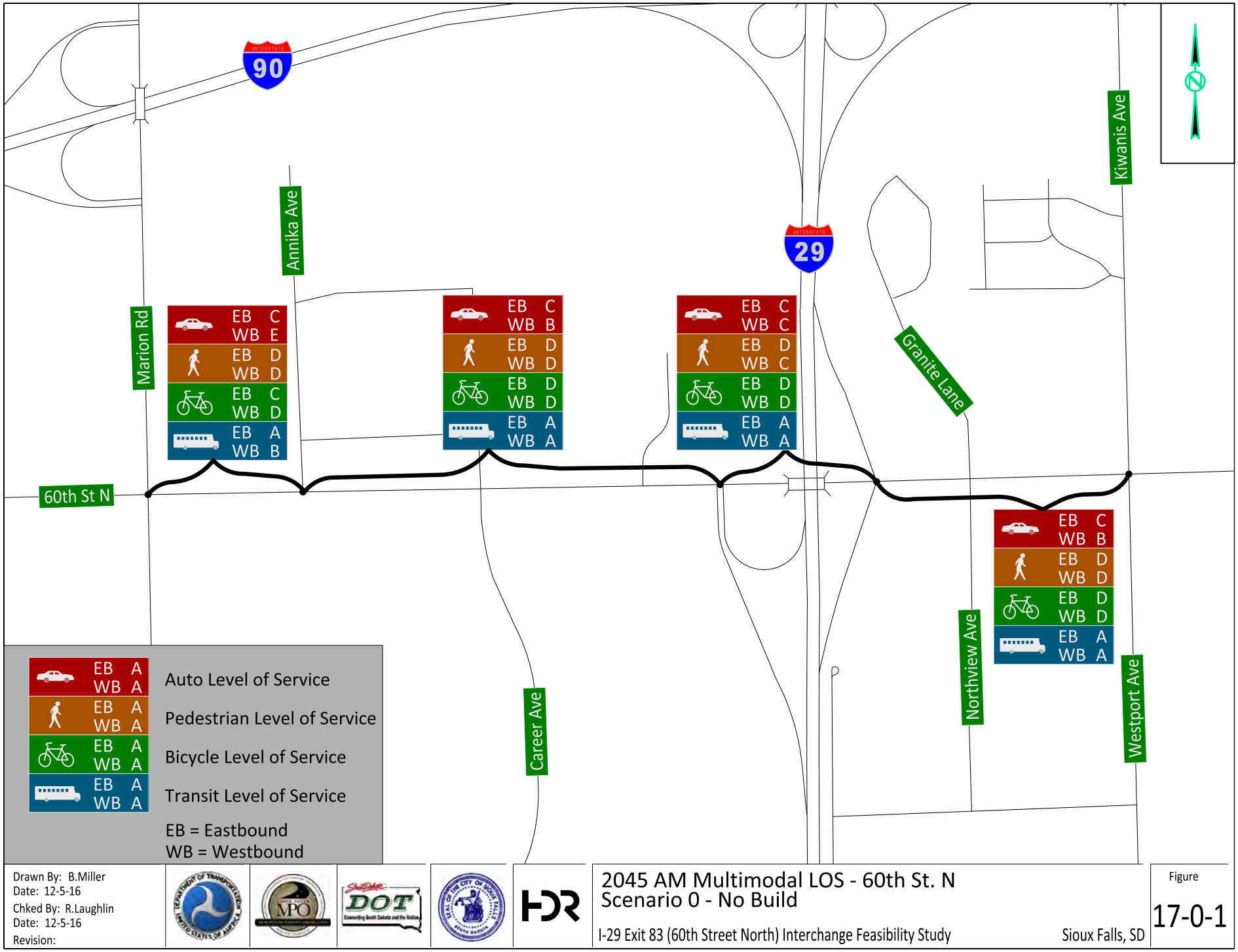


2045 Peak Hour Arterial Intersection Lane Configuration & LOS Scenario 10 - Revised System & 60th Interchanges, Signal at 60th/Granite

I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD

Figure 16j


Legend
AM/PM Peak Hour Level of Service
STOP
Intersection Traffic Control
90
29
Annika Ave
Granite Ln
WalMart Supercenter
60th St N
Career Ave
Northview Ave
Westport Ave
Marion Rd
Benson Rd
A/B
B/B
B/C
C/C
C/D
Drawn By: B.Miller 3-23-2017
Checked By: R.Laughlin 3-23-2017
Revision:
2045 Peak Hour Arterial Intersection Lane Configuration & LOS Scenario 11 - Existing System & Revised 60th Interchanges, Signal at 60th/Granite
I-29 Exit 83 (60th Street N) Interchange Feasibility Study Sioux Falls, SD
Figure
16k



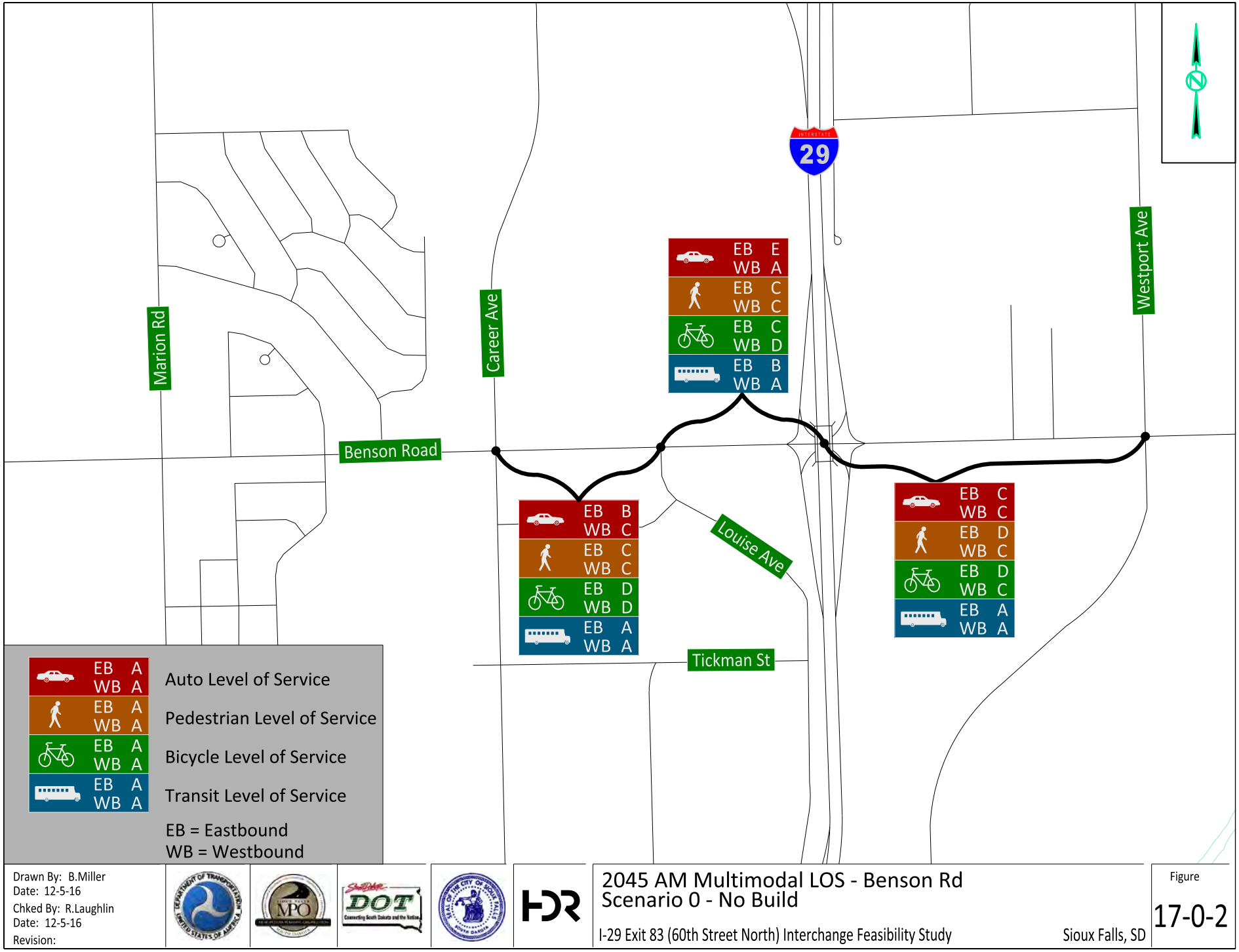
Drawn By: B.Miller
Date: 12-5-16
Chked By: R.Laughlin
Date: 12-5-16
Revision:

2045 AM Multimodal LOS - 60th St. N
Scenario 0 - No Build

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure
17-0-1



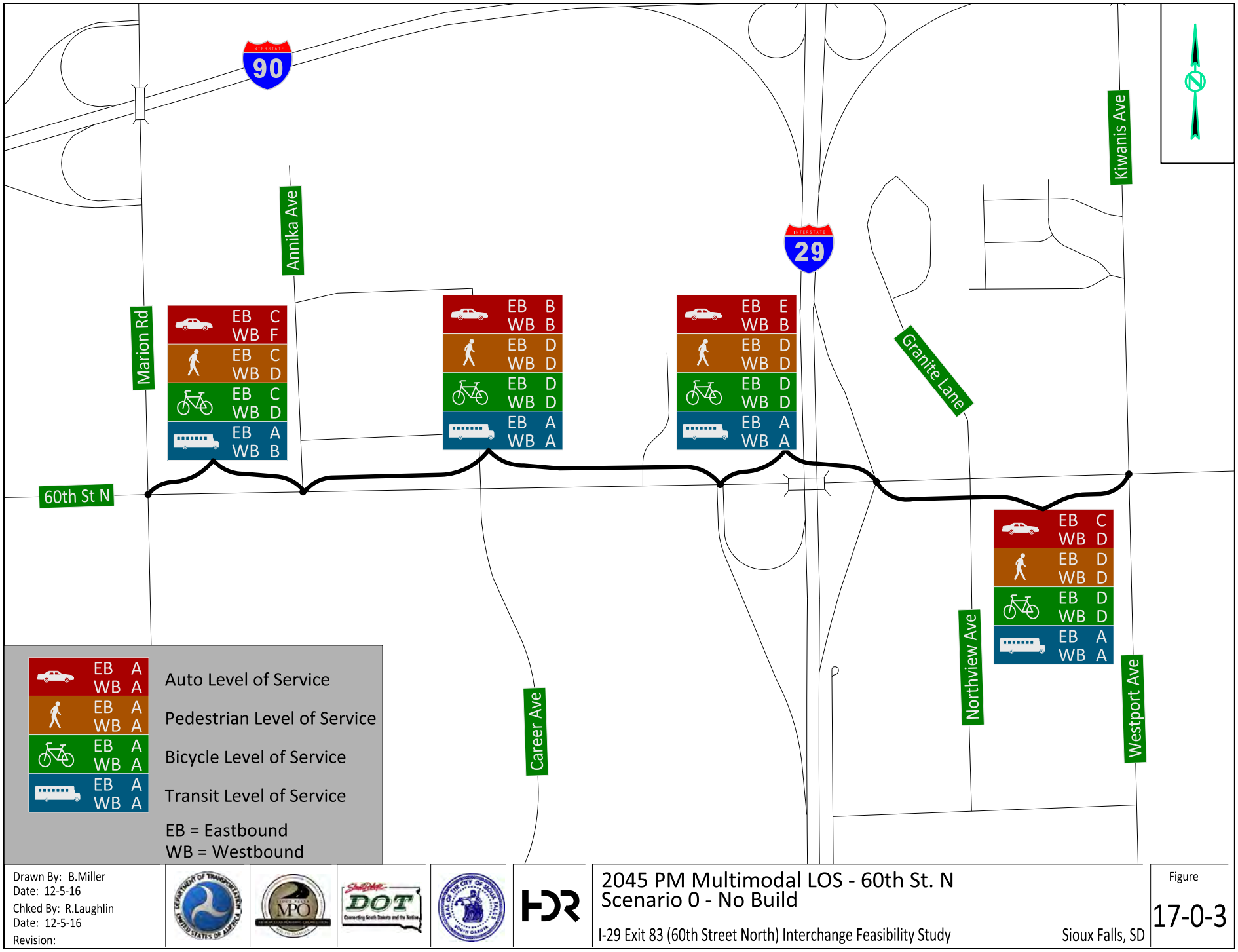
Drawn By: B.Miller
Date: 12-5-16
Chked By: R.Laughlin
Date: 12-5-16
Revision:

2045 AM Multimodal LOS - Benson Rd
Scenario 0 - No Build

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure
17-0-2



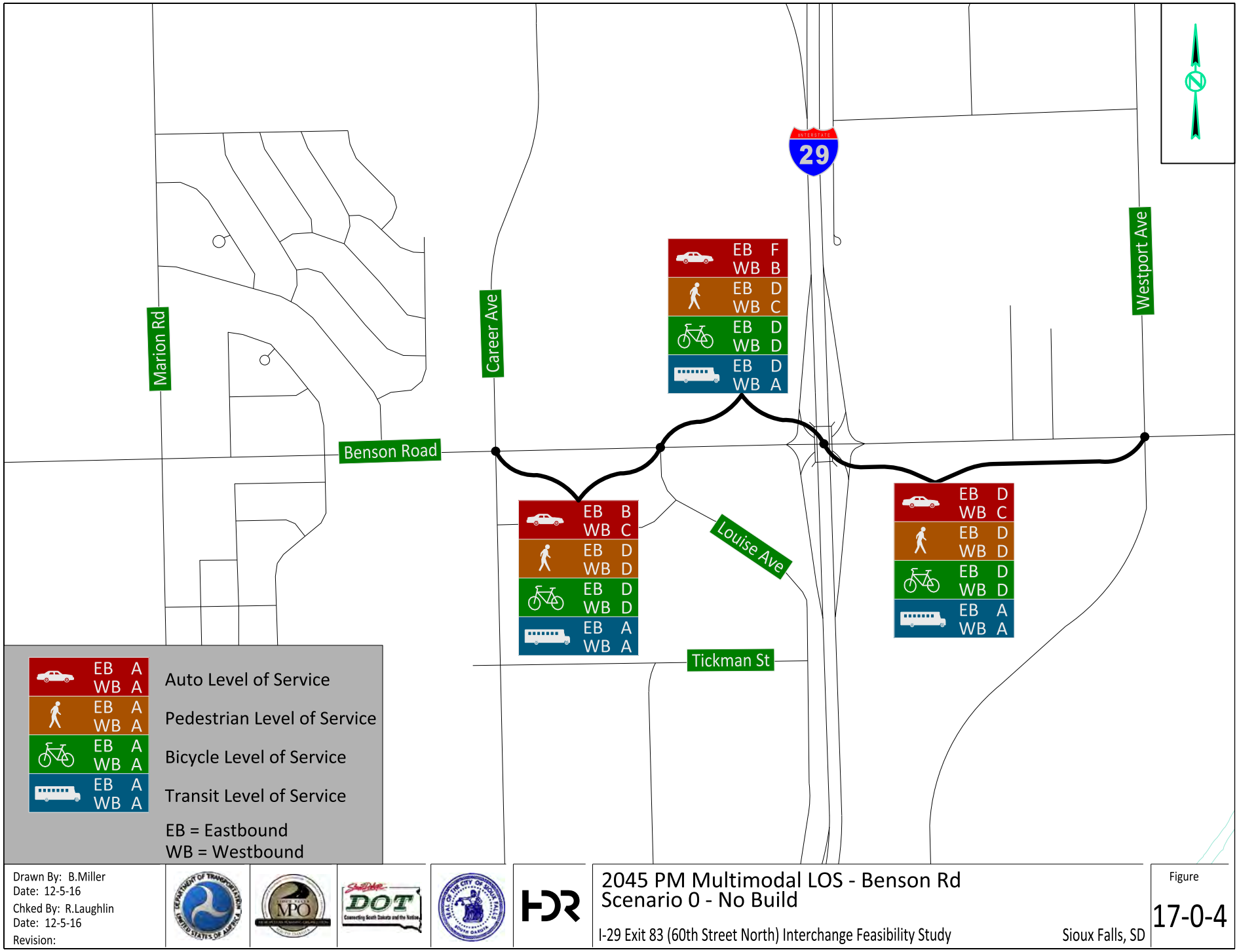
Drawn By: B.Miller
Date: 12-5-16
Chked By: R.Laughlin
Date: 12-5-16
Revision:

2045 PM Multimodal LOS - 60th St. N
Scenario 0 - No Build

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure
17-0-3



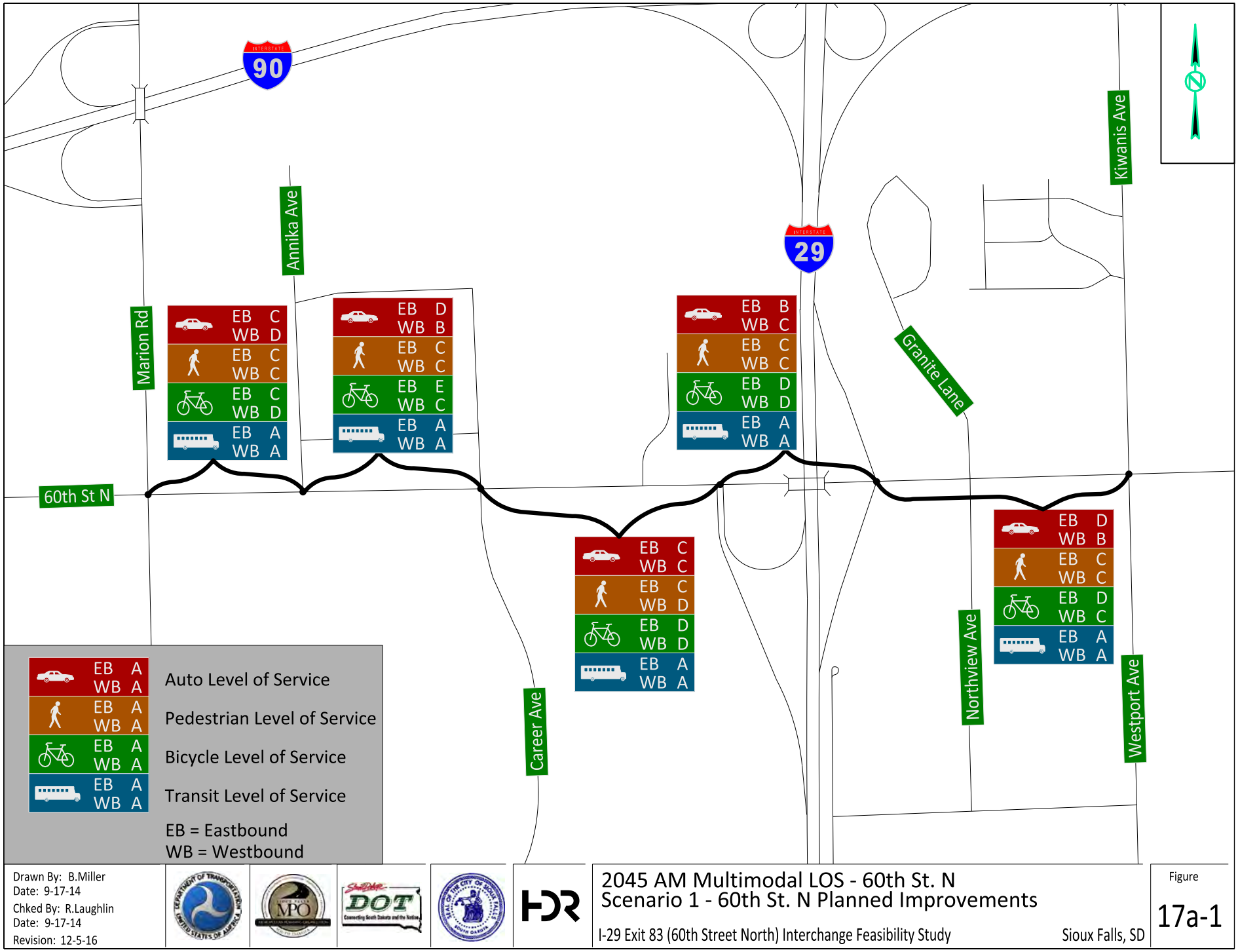
Drawn By: B.Miller
Date: 12-5-16
Chked By: R.Laughlin
Date: 12-5-16
Revision:

2045 PM Multimodal LOS - Benson Rd
Scenario 0 - No Build

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure
17-0-4



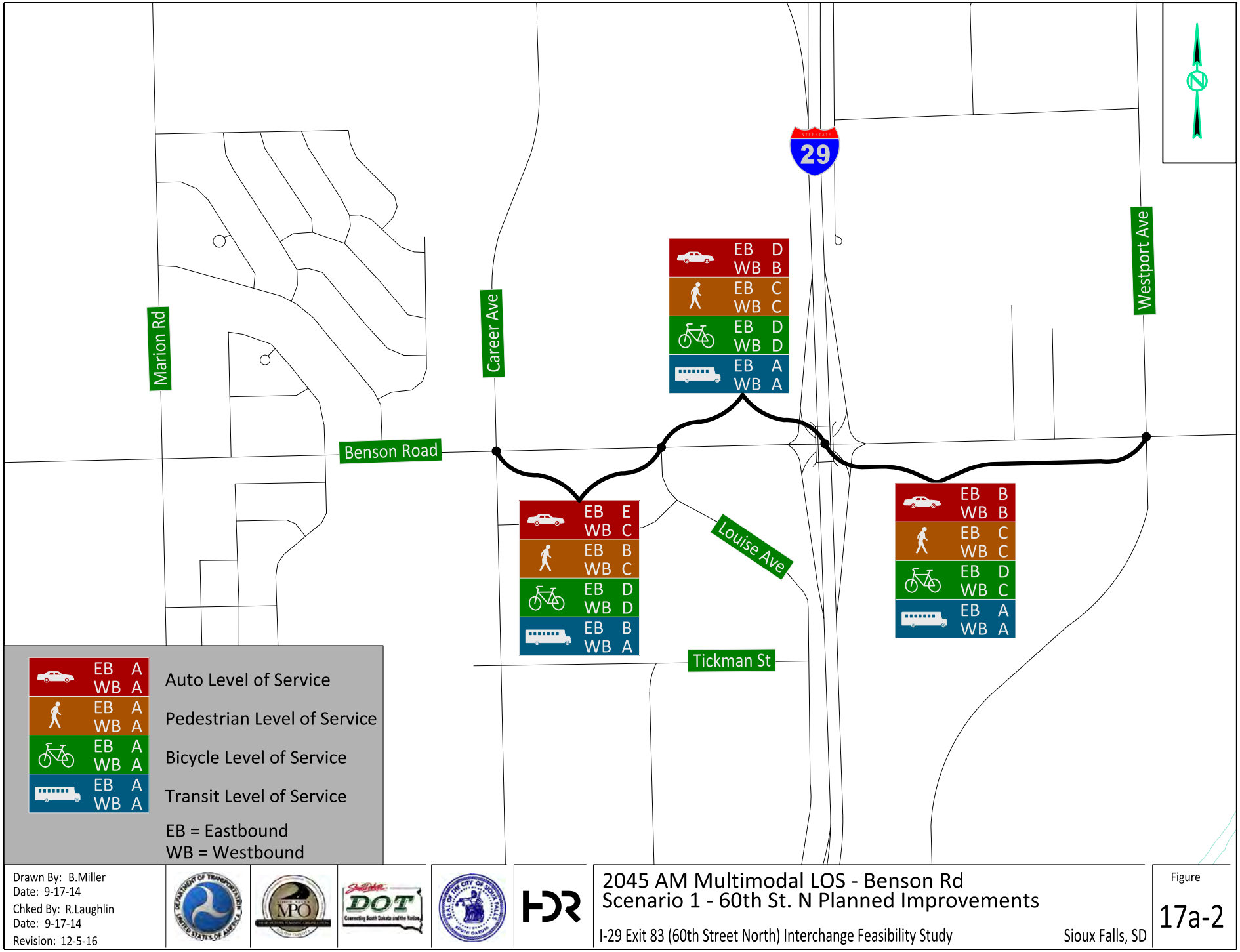
Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 AM Multimodal LOS - 60th St. N
Scenario 1 - 60th St. N Planned Improvements

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure
17a-1



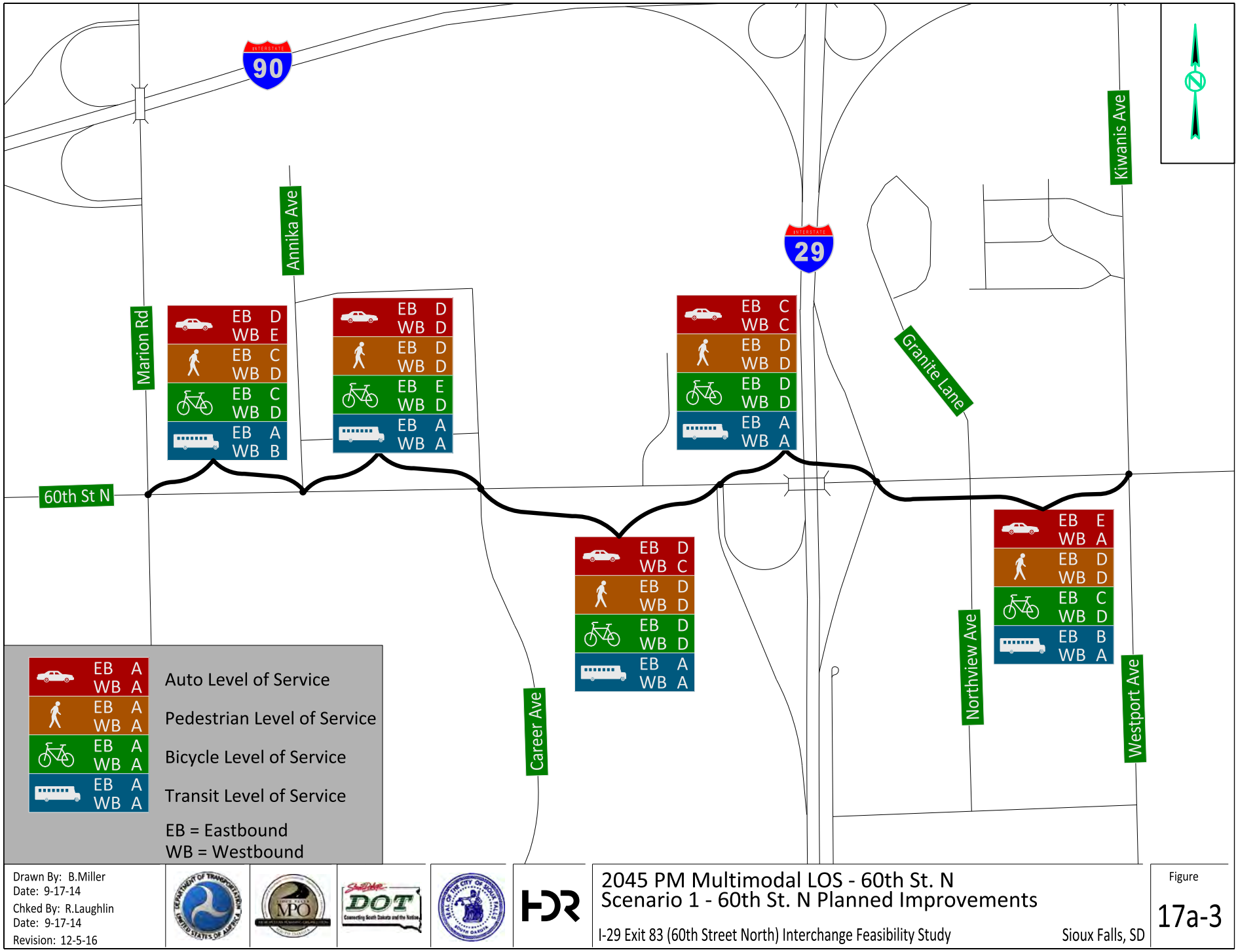
Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 AM Multimodal LOS - Benson Rd
Scenario 1 - 60th St. N Planned Improvements

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure
17a-2



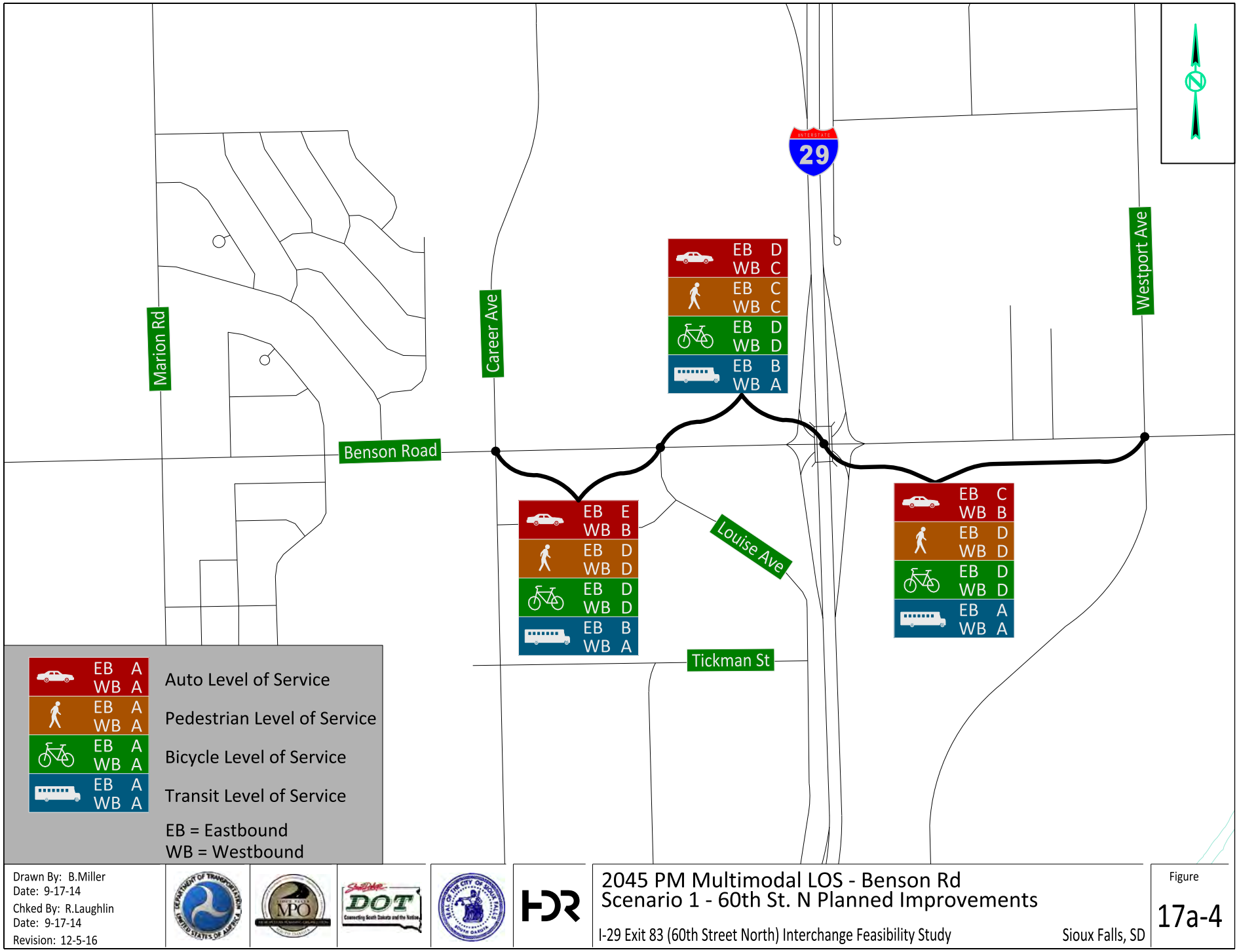
Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 PM Multimodal LOS - 60th St. N
Scenario 1 - 60th St. N Planned Improvements

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17a-3

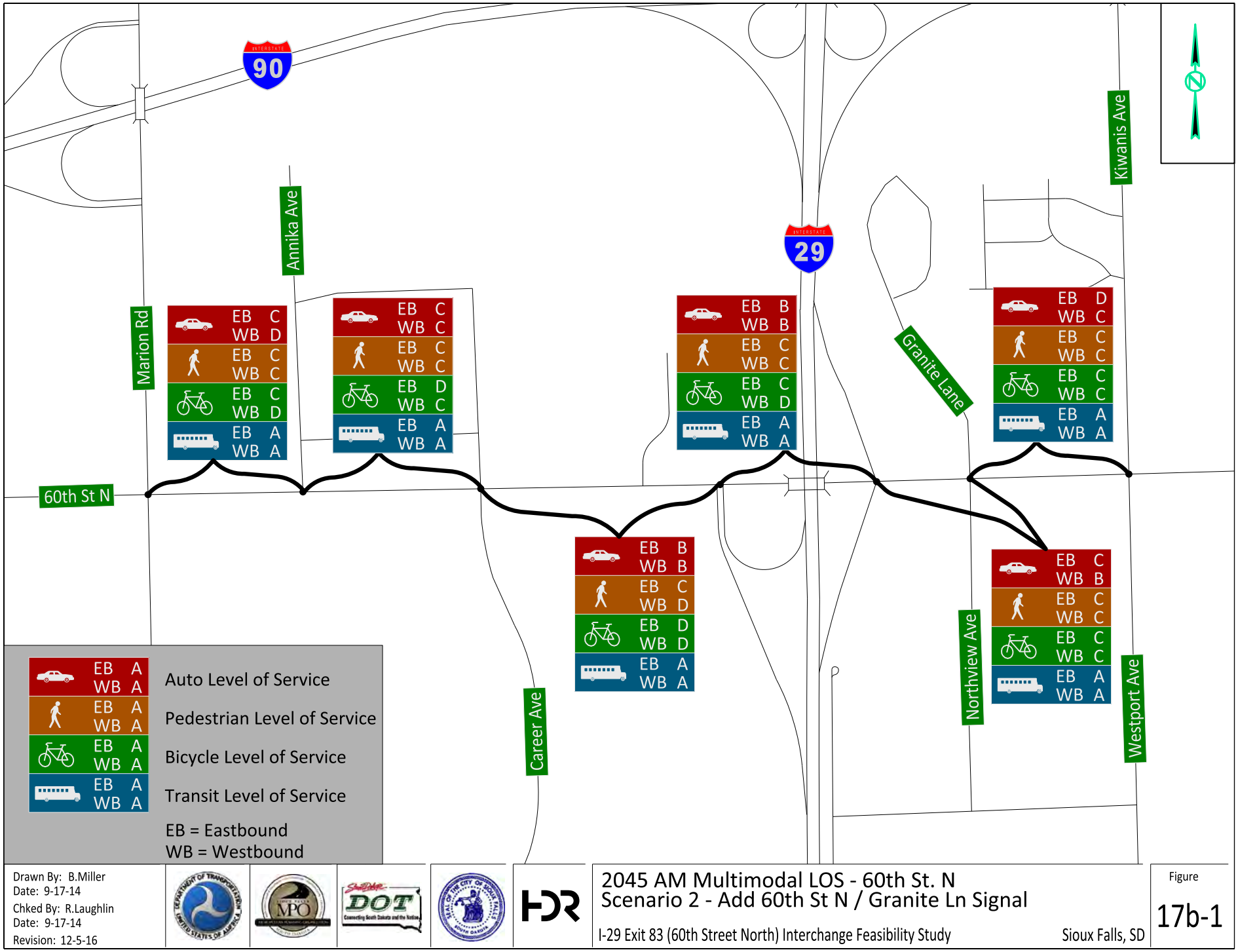


Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 PM Multimodal LOS - Benson Rd
Scenario 1 - 60th St. N Planned Improvements

I-29 Exit 83 (60th Street North) Interchange Feasibility Study — Sioux Falls, SD

Figure 17a-4



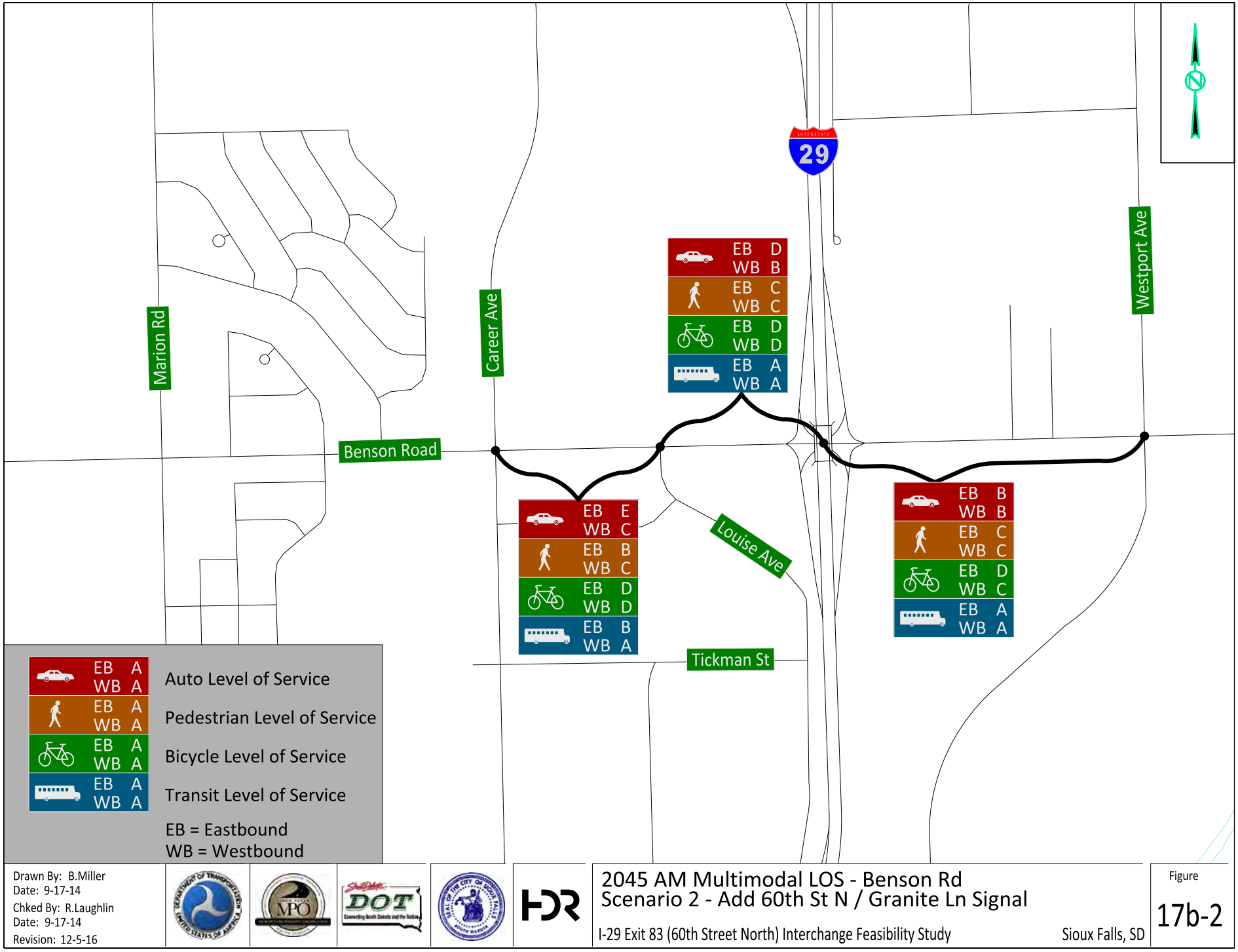
Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 AM Multimodal LOS - 60th St. N
Scenario 2 - Add 60th St N / Granite Ln Signal

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17b-1



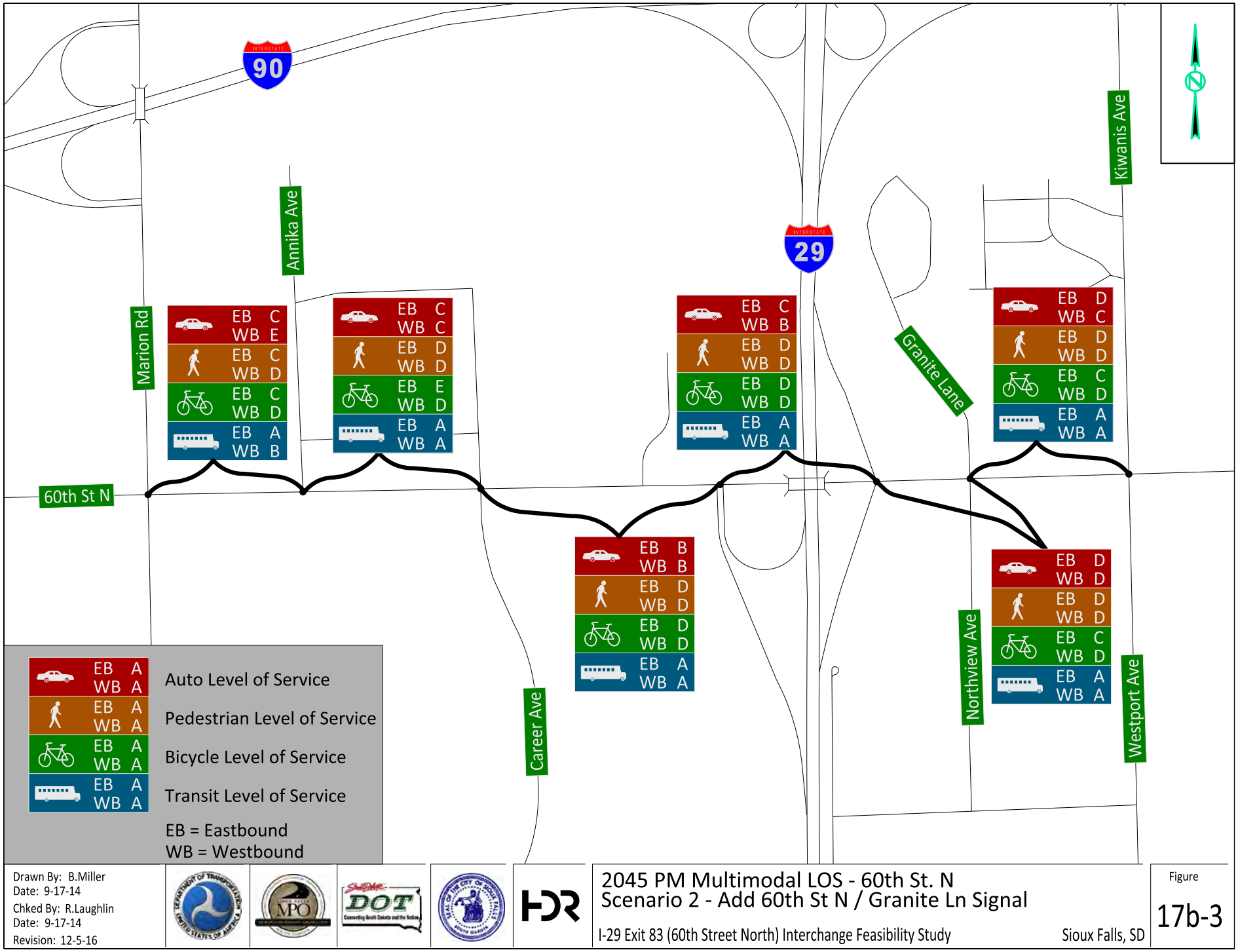
Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 AM Multimodal LOS - Benson Rd
Scenario 2 - Add 60th St N / Granite Ln Signal

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure
17b-2



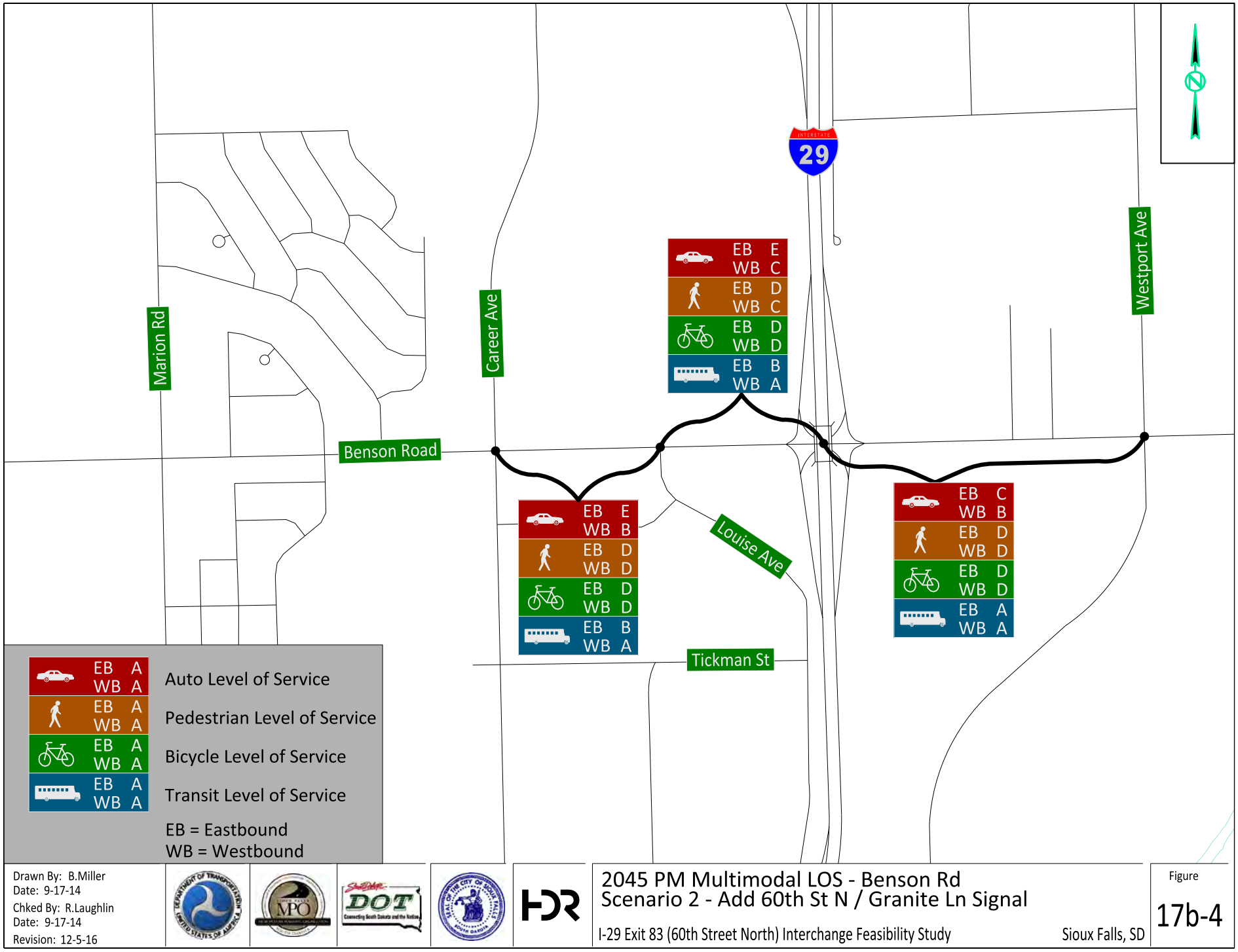
Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 PM Multimodal LOS - 60th St. N
Scenario 2 - Add 60th St N / Granite Ln Signal

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure
17b-3



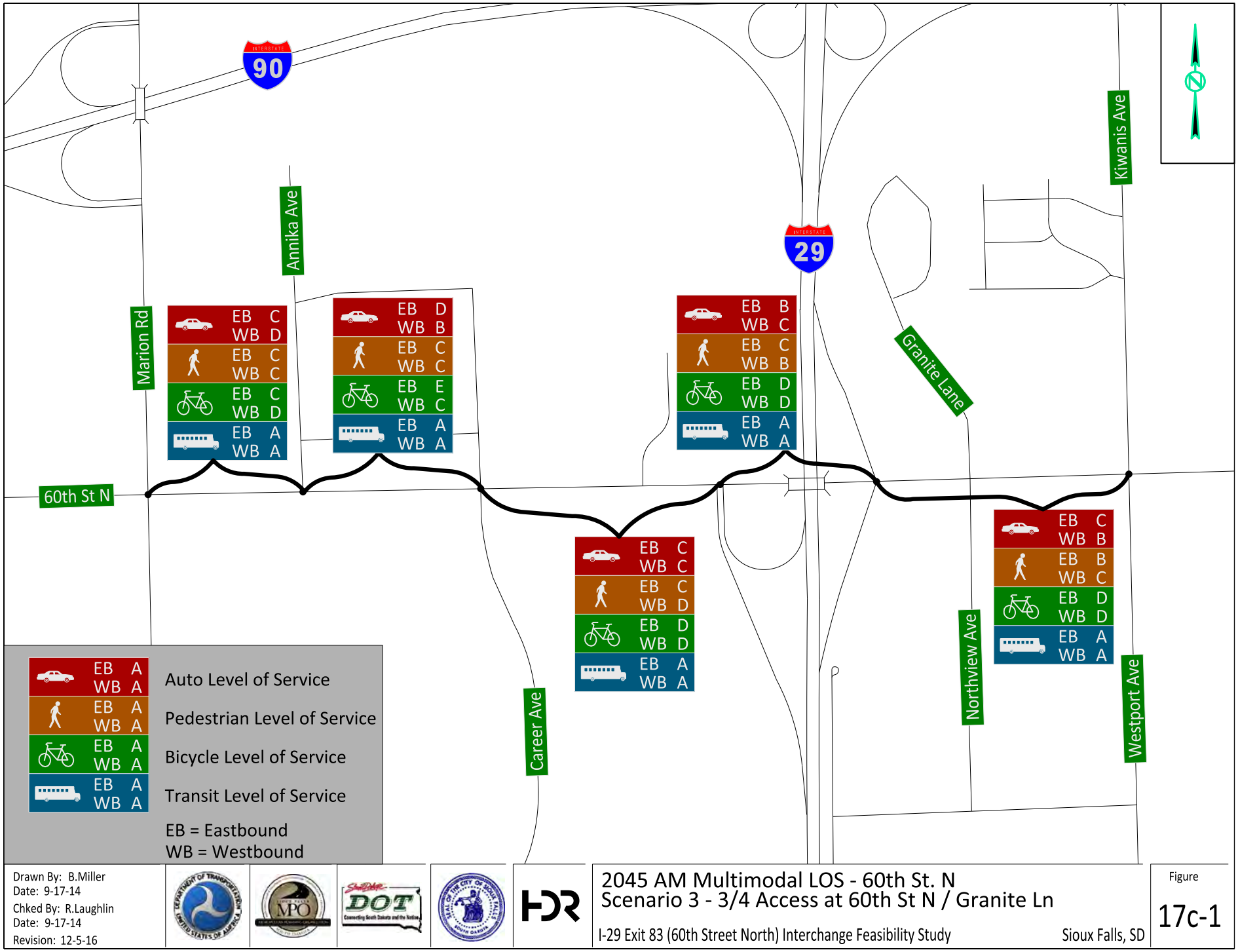
Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 PM Multimodal LOS - Benson Rd
Scenario 2 - Add 60th St N / Granite Ln Signal

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure
17b-4



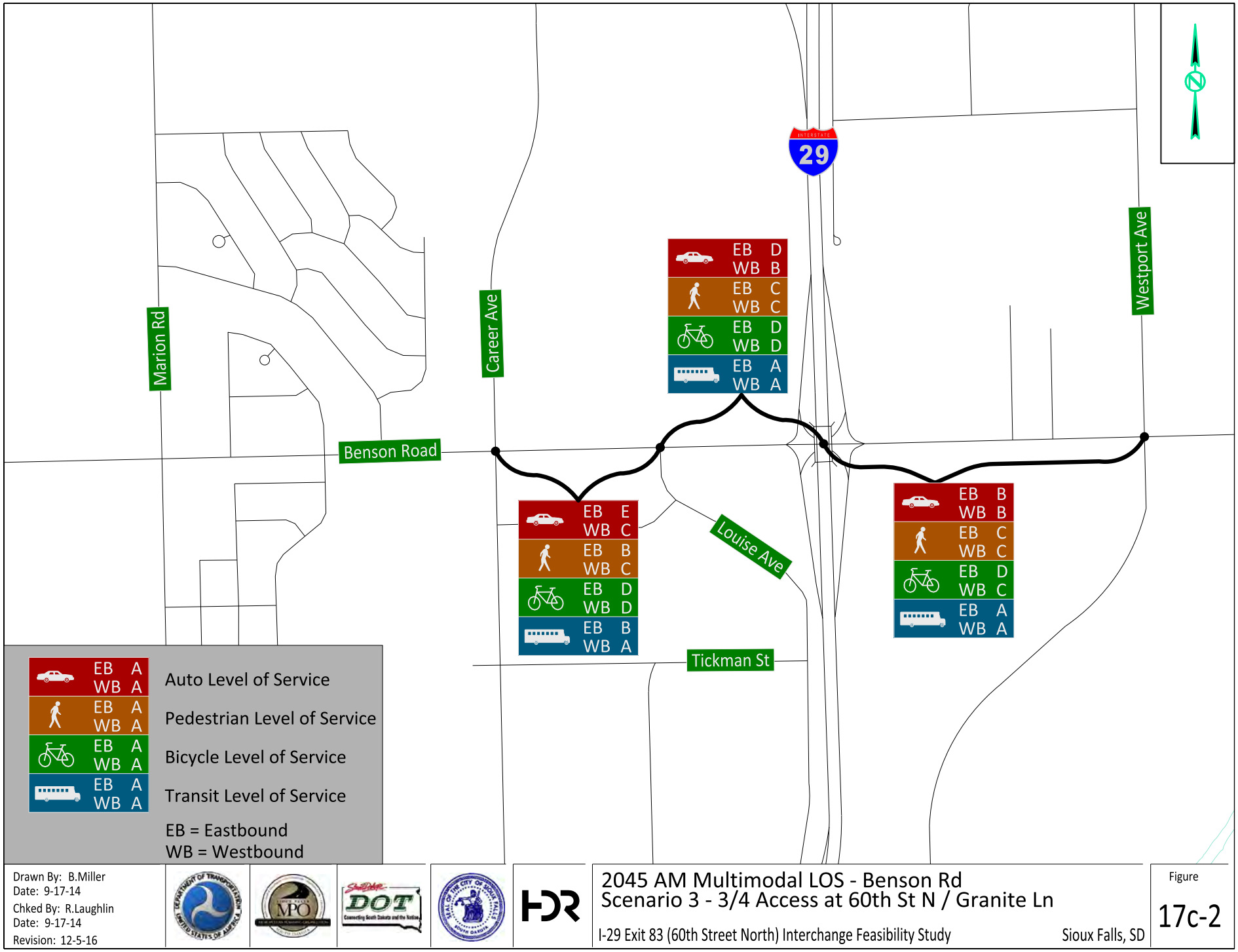
Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 AM Multimodal LOS - 60th St. N
Scenario 3 - 3/4 Access at 60th St N / Granite Ln

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17c-1



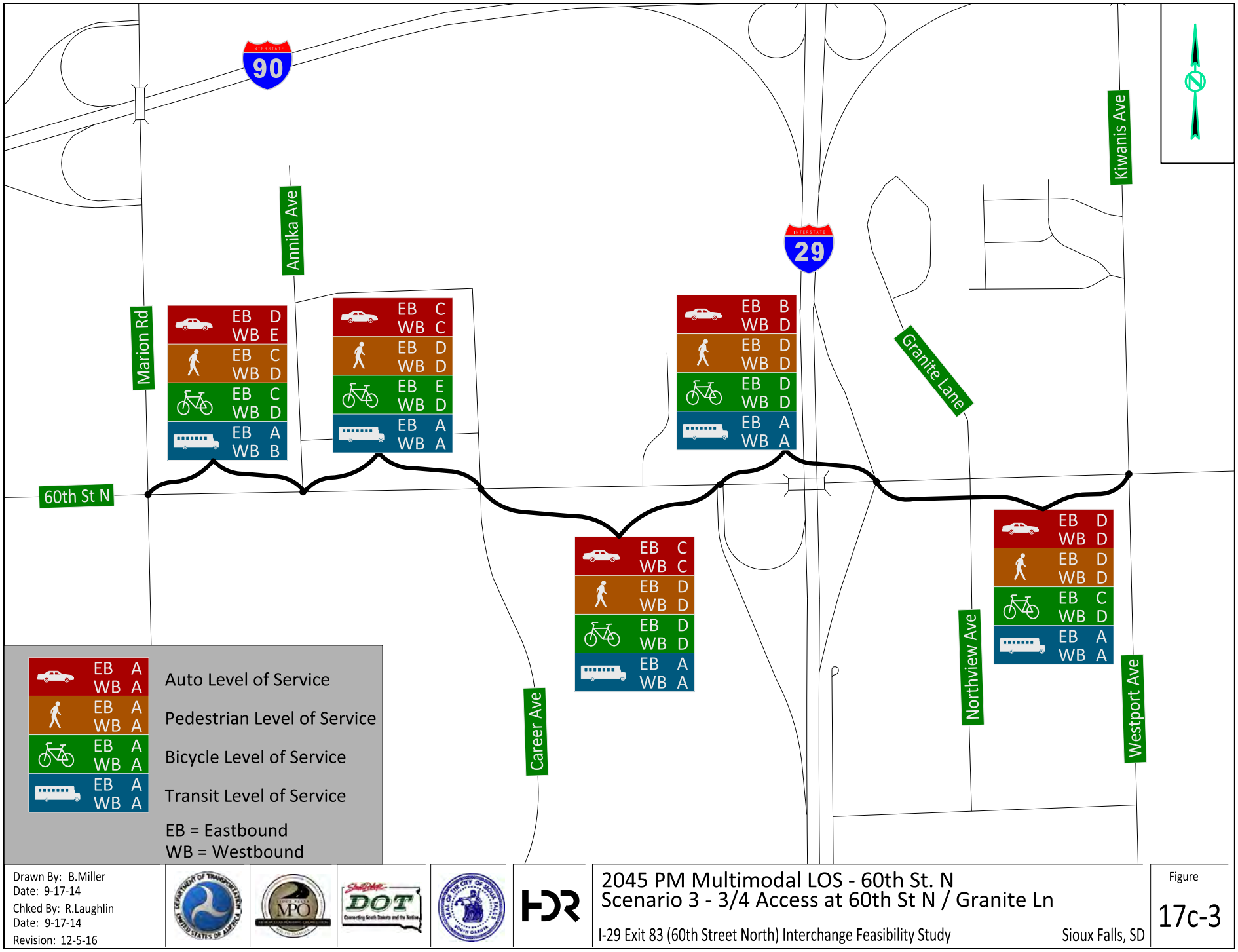
Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 AM Multimodal LOS - Benson Rd
Scenario 3 - 3/4 Access at 60th St N / Granite Ln

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure
17c-2



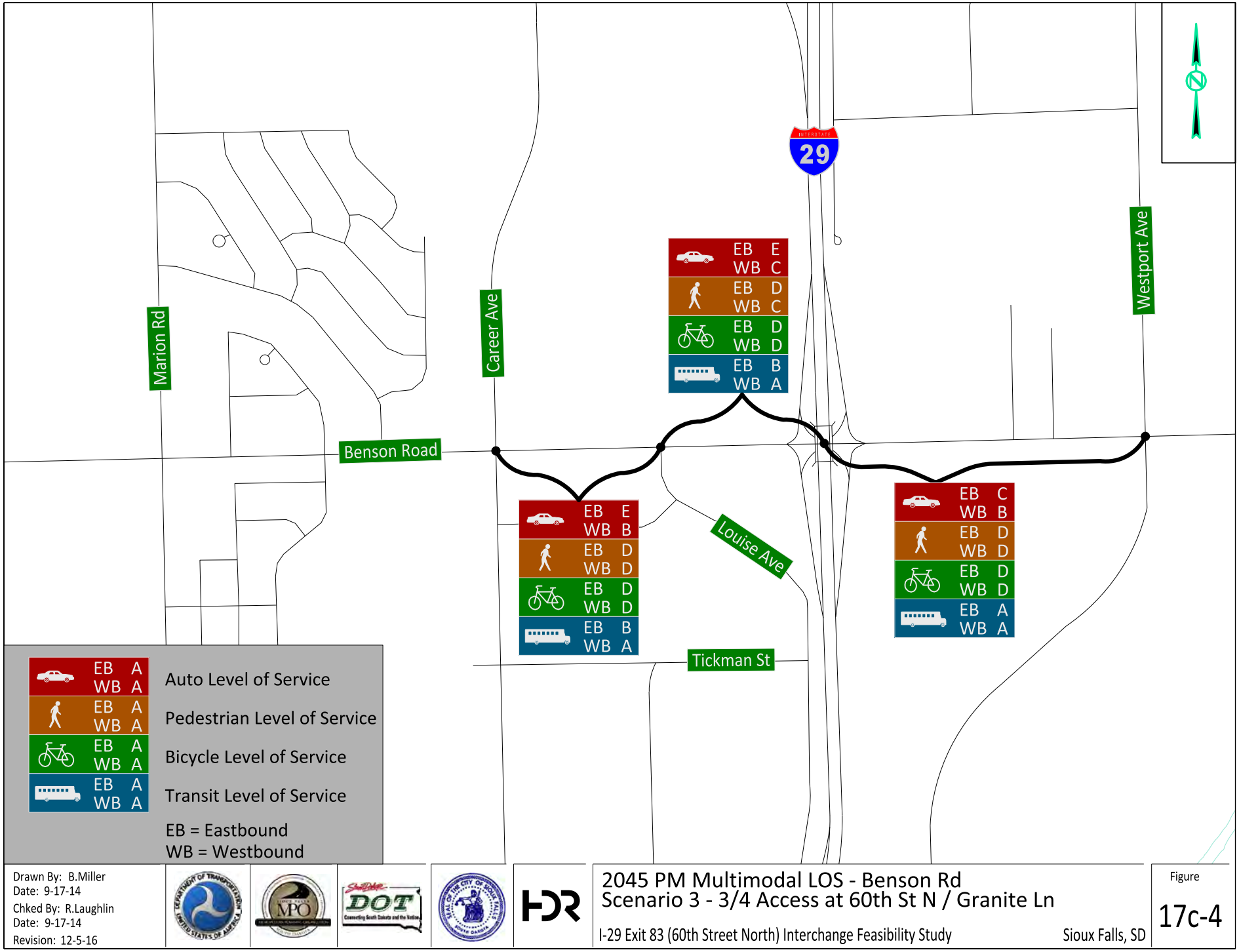
Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 PM Multimodal LOS - 60th St. N
Scenario 3 - 3/4 Access at 60th St N / Granite Ln

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17c-3



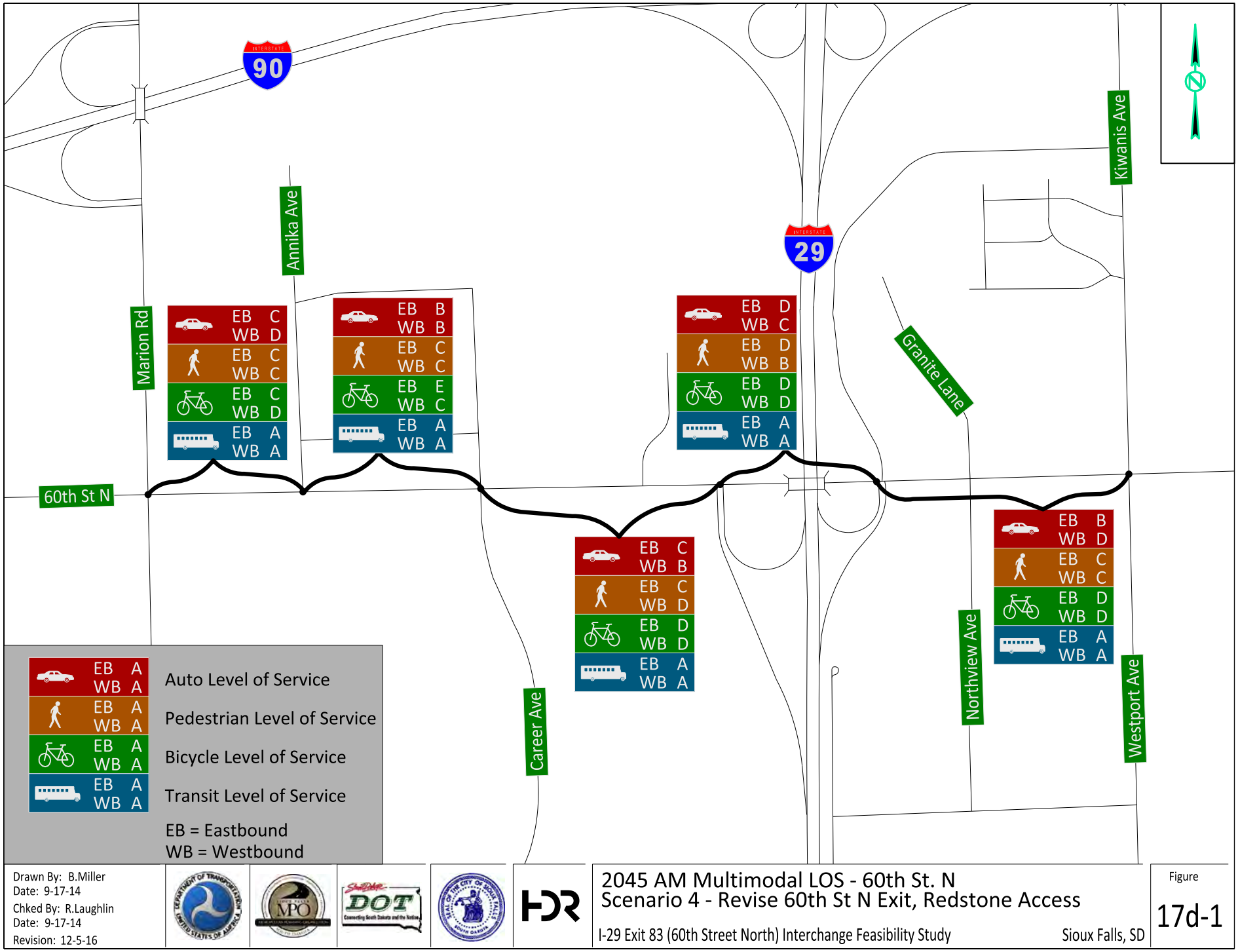
Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 PM Multimodal LOS - Benson Rd
Scenario 3 - 3/4 Access at 60th St N / Granite Ln

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure
17c-4



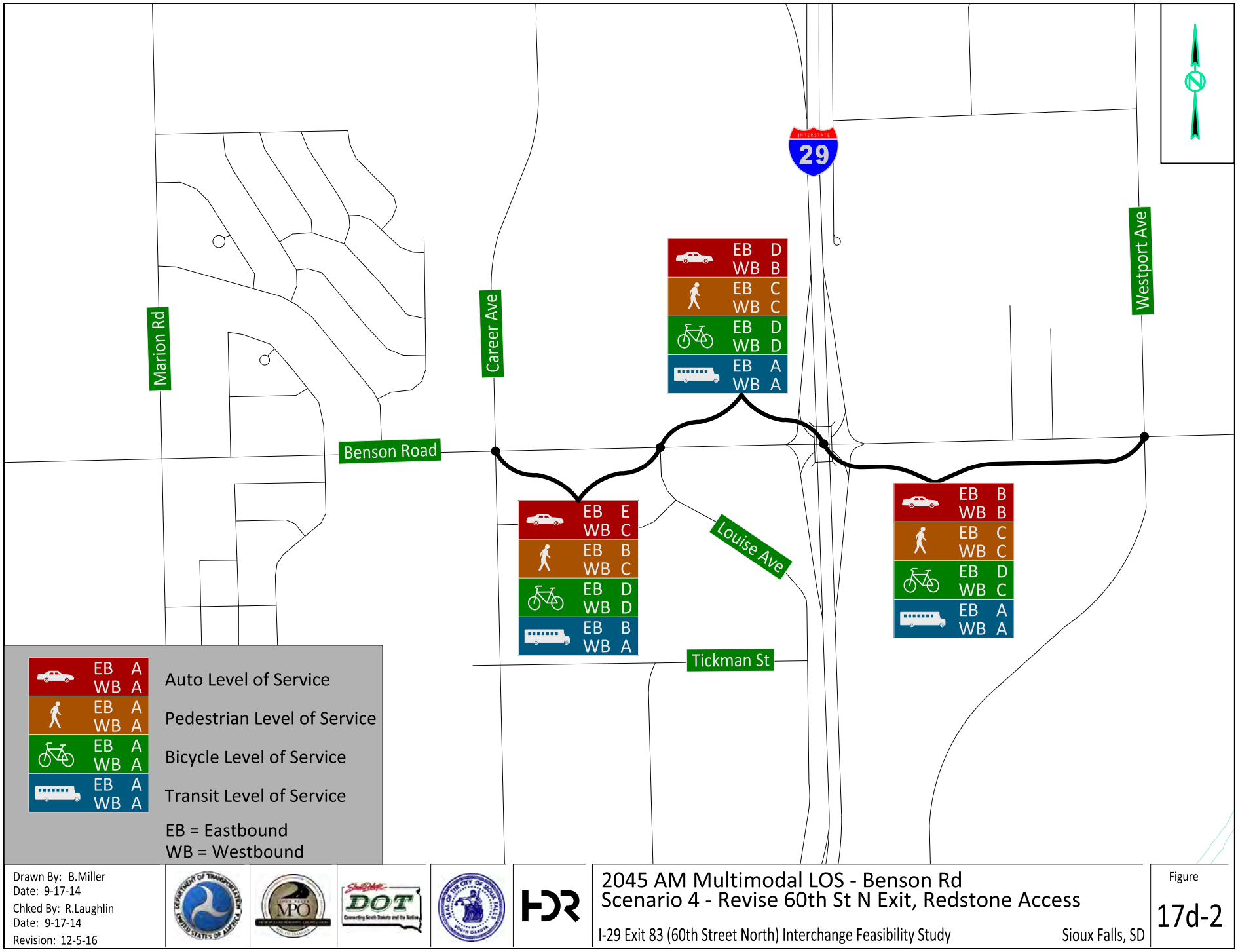
Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 AM Multimodal LOS - 60th St. N
Scenario 4 - Revise 60th St N Exit, Redstone Access

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure
17d-1

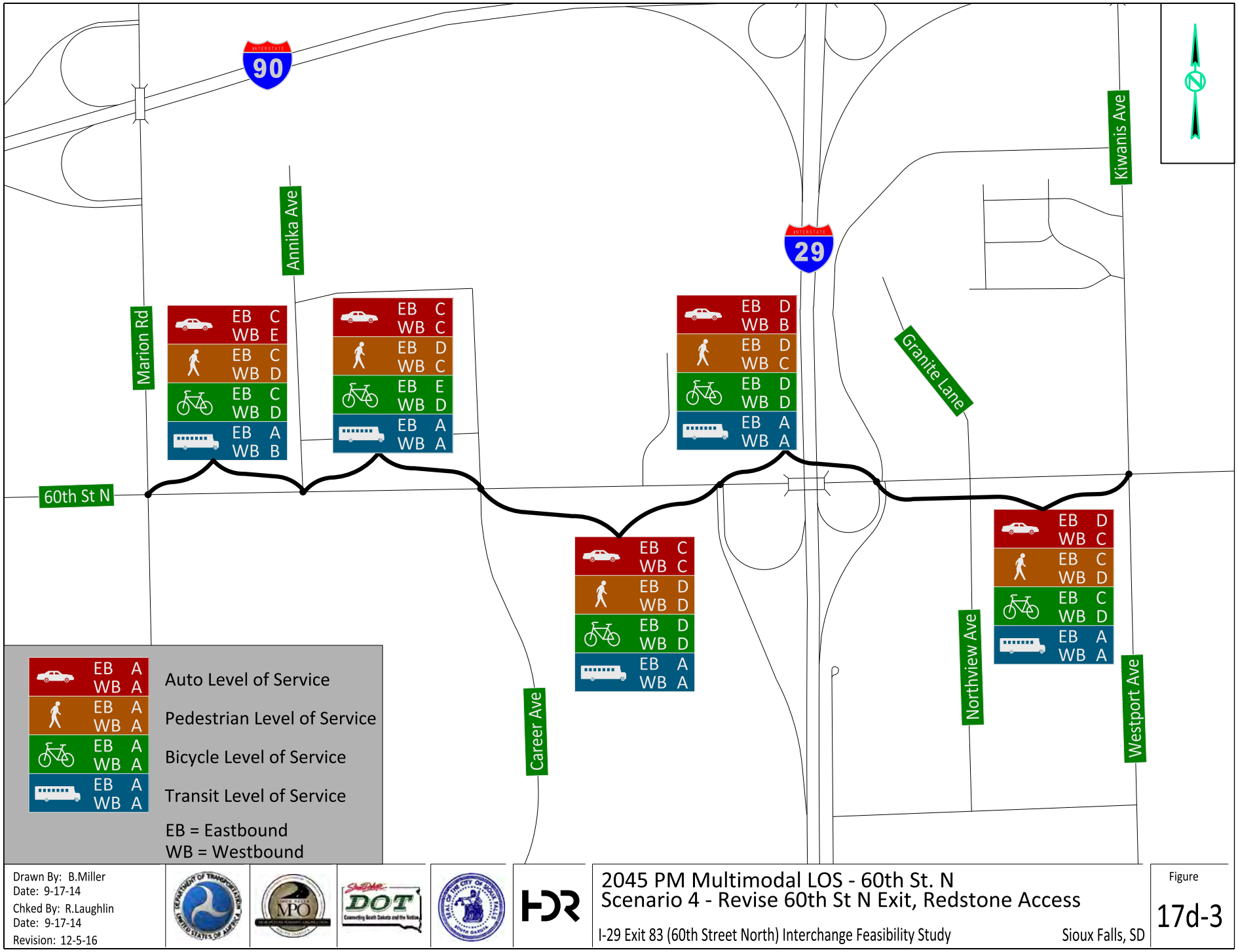


Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 AM Multimodal LOS - Benson Rd
Scenario 4 - Revise 60th St N Exit, Redstone Access

I-29 Exit 83 (60th Street North) Interchange Feasibility Study — Sioux Falls, SD

Figure
17d-2

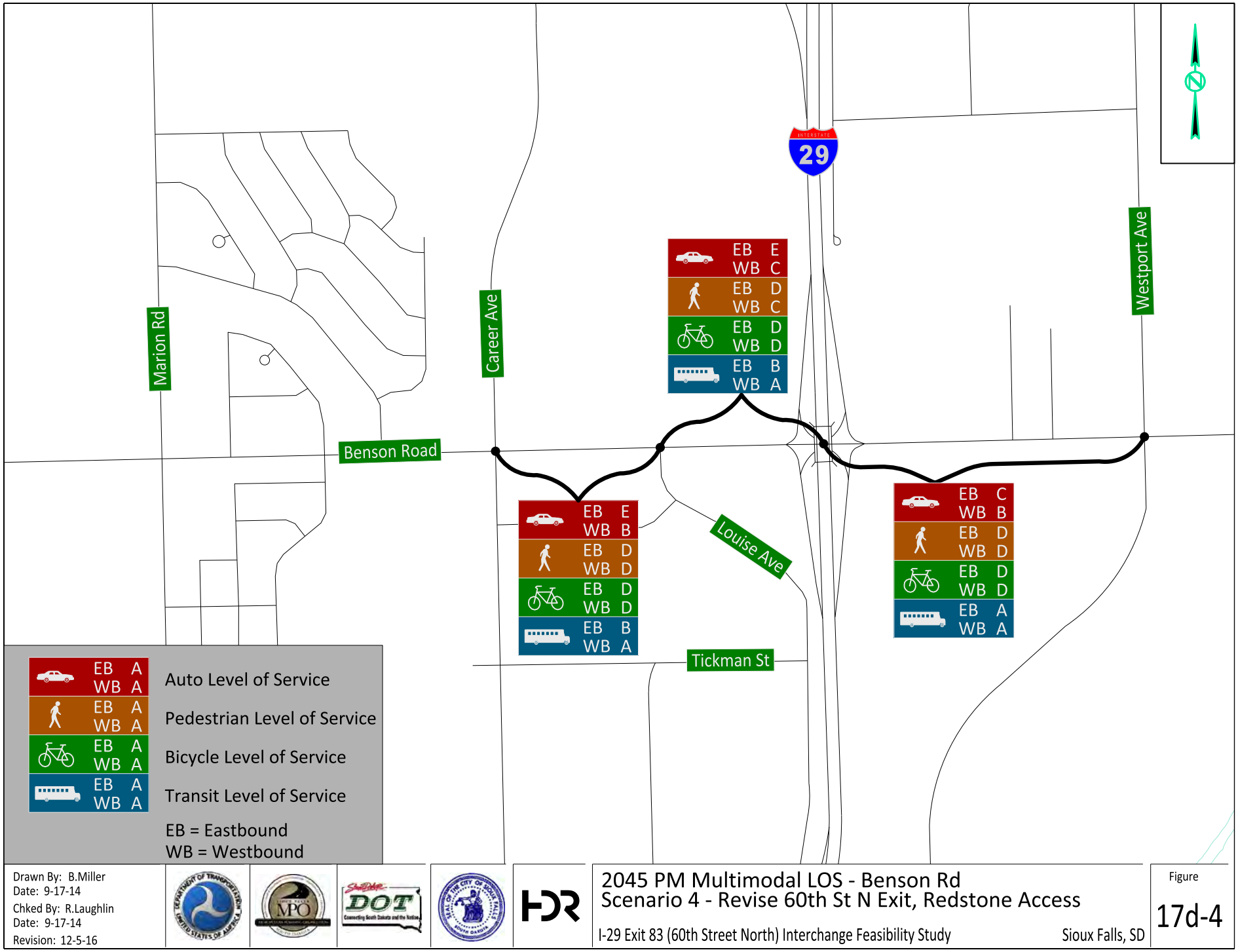


Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 PM Multimodal LOS - 60th St. N
Scenario 4 - Revise 60th St N Exit, Redstone Access

I-29 Exit 83 (60th Street North) Interchange Feasibility Study — Sioux Falls, SD

Figure 17d-3

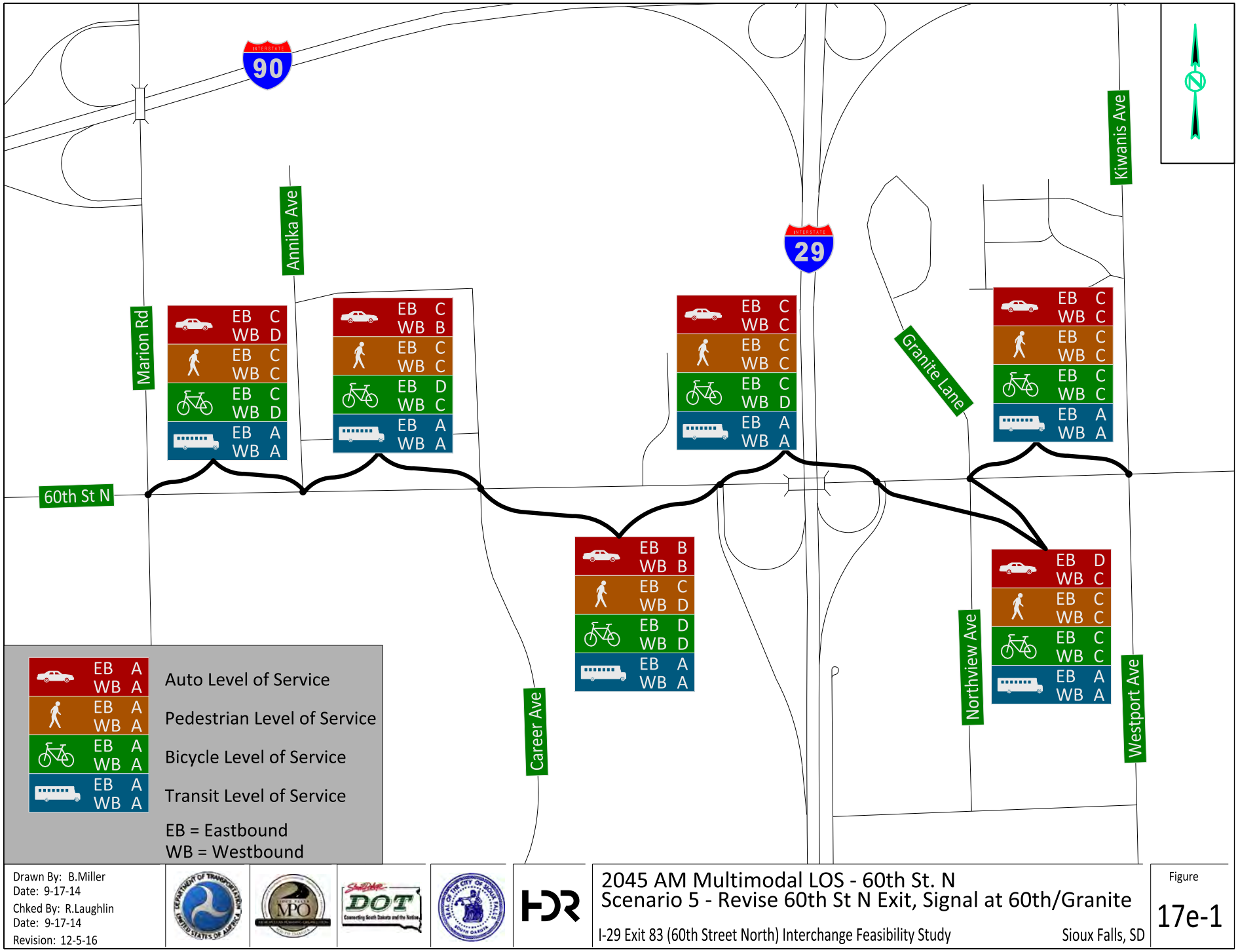


Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 PM Multimodal LOS - Benson Rd
Scenario 4 - Revise 60th St N Exit, Redstone Access

I-29 Exit 83 (60th Street North) Interchange Feasibility Study — Sioux Falls, SD

Figure 17d-4



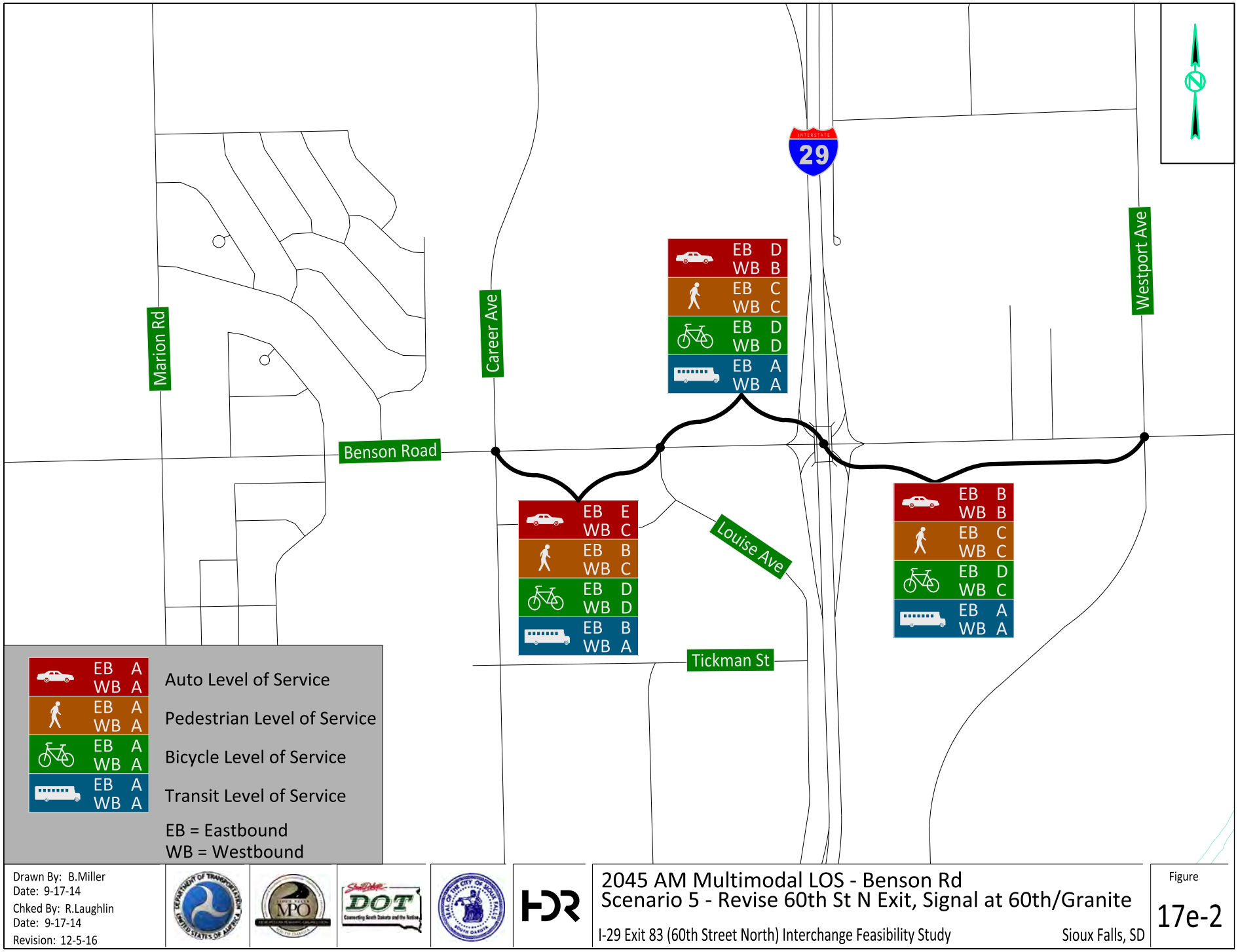
Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 AM Multimodal LOS - 60th St. N
Scenario 5 - Revise 60th St N Exit, Signal at 60th/Granite

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17e-1

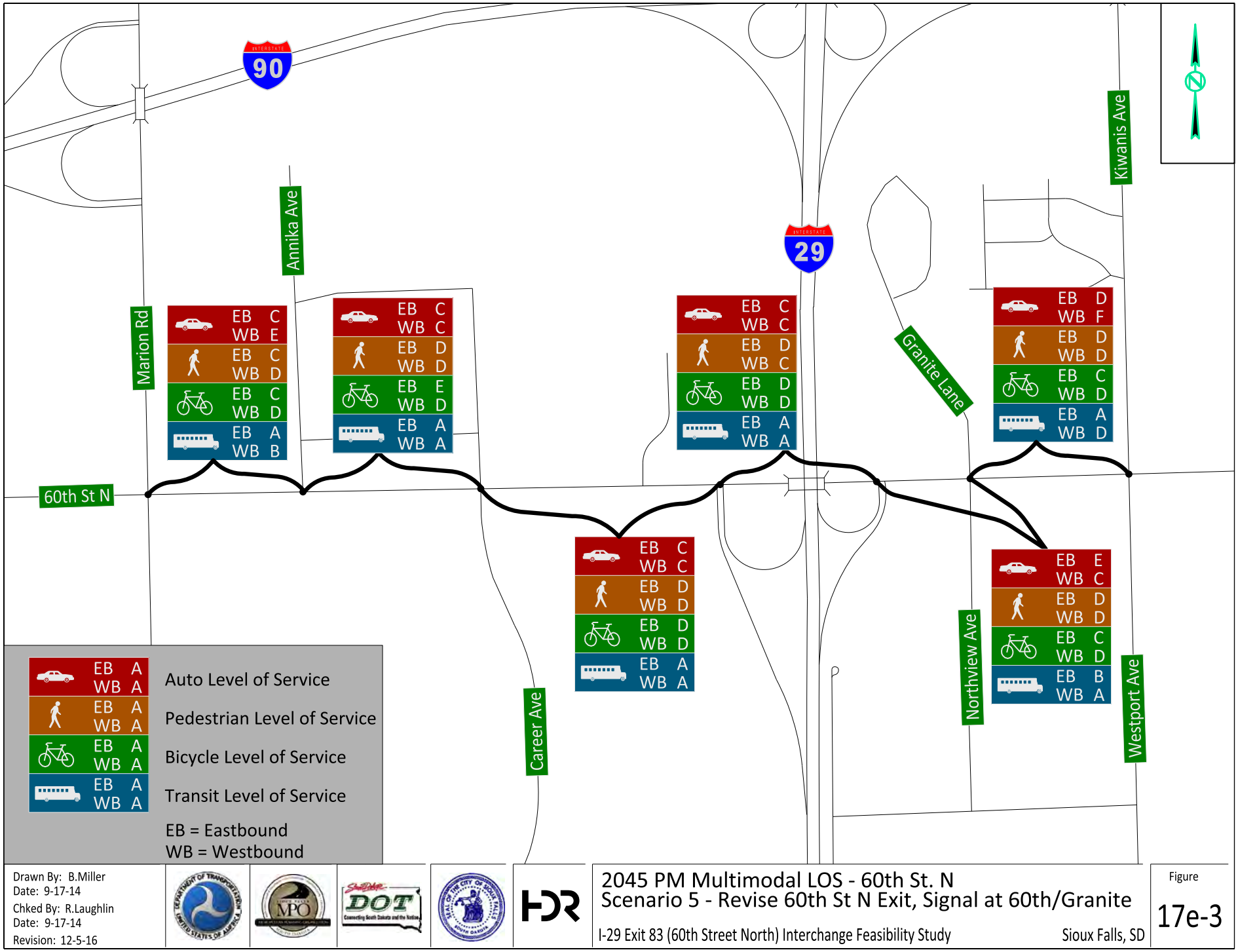


Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 AM Multimodal LOS - Benson Rd
Scenario 5 - Revise 60th St N Exit, Signal at 60th/Granite

I-29 Exit 83 (60th Street North) Interchange Feasibility Study — Sioux Falls, SD

Figure 17e-2

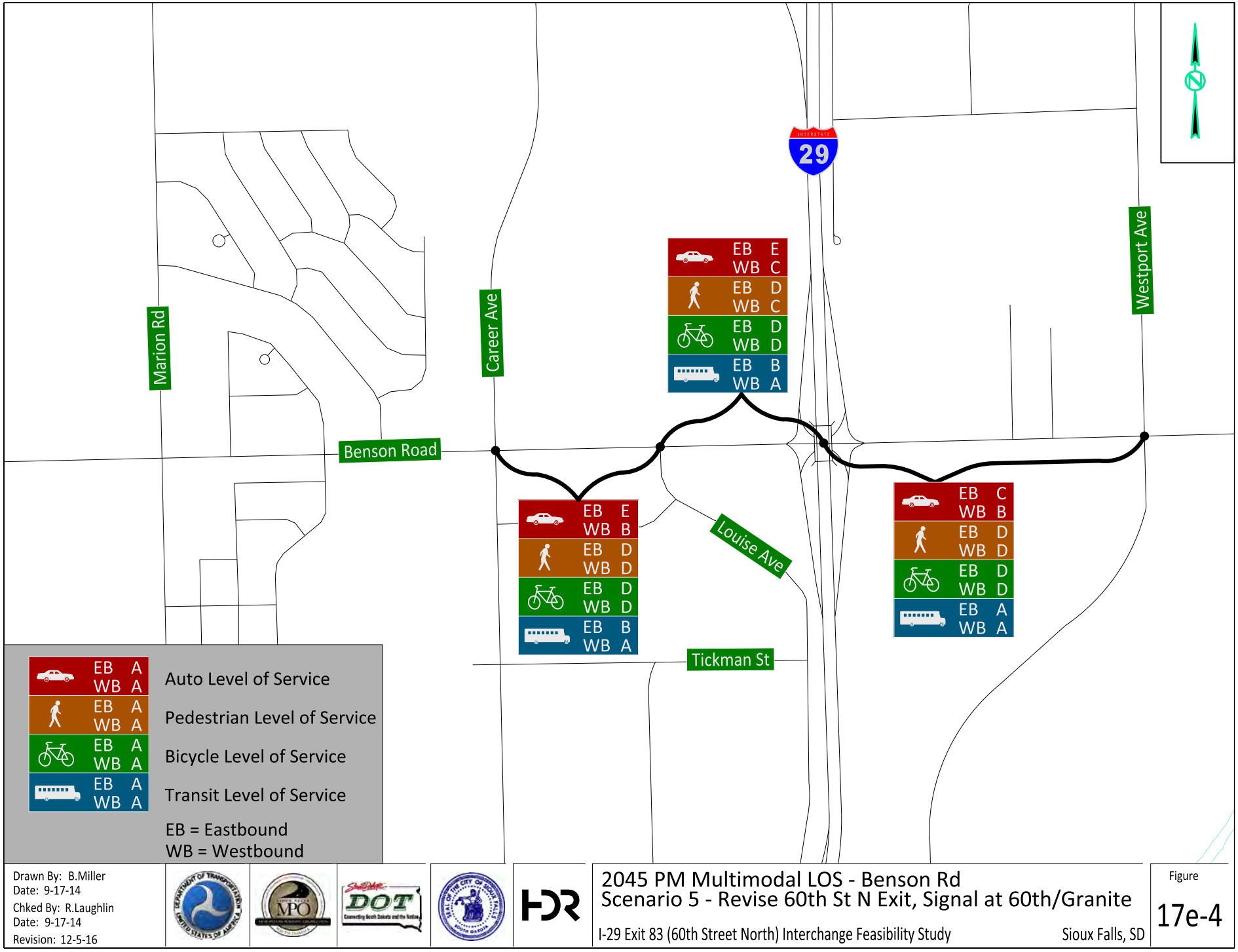


Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 PM Multimodal LOS - 60th St. N
Scenario 5 - Revise 60th St N Exit, Signal at 60th/Granite

I-29 Exit 83 (60th Street North) Interchange Feasibility Study — Sioux Falls, SD

Figure 17e-3

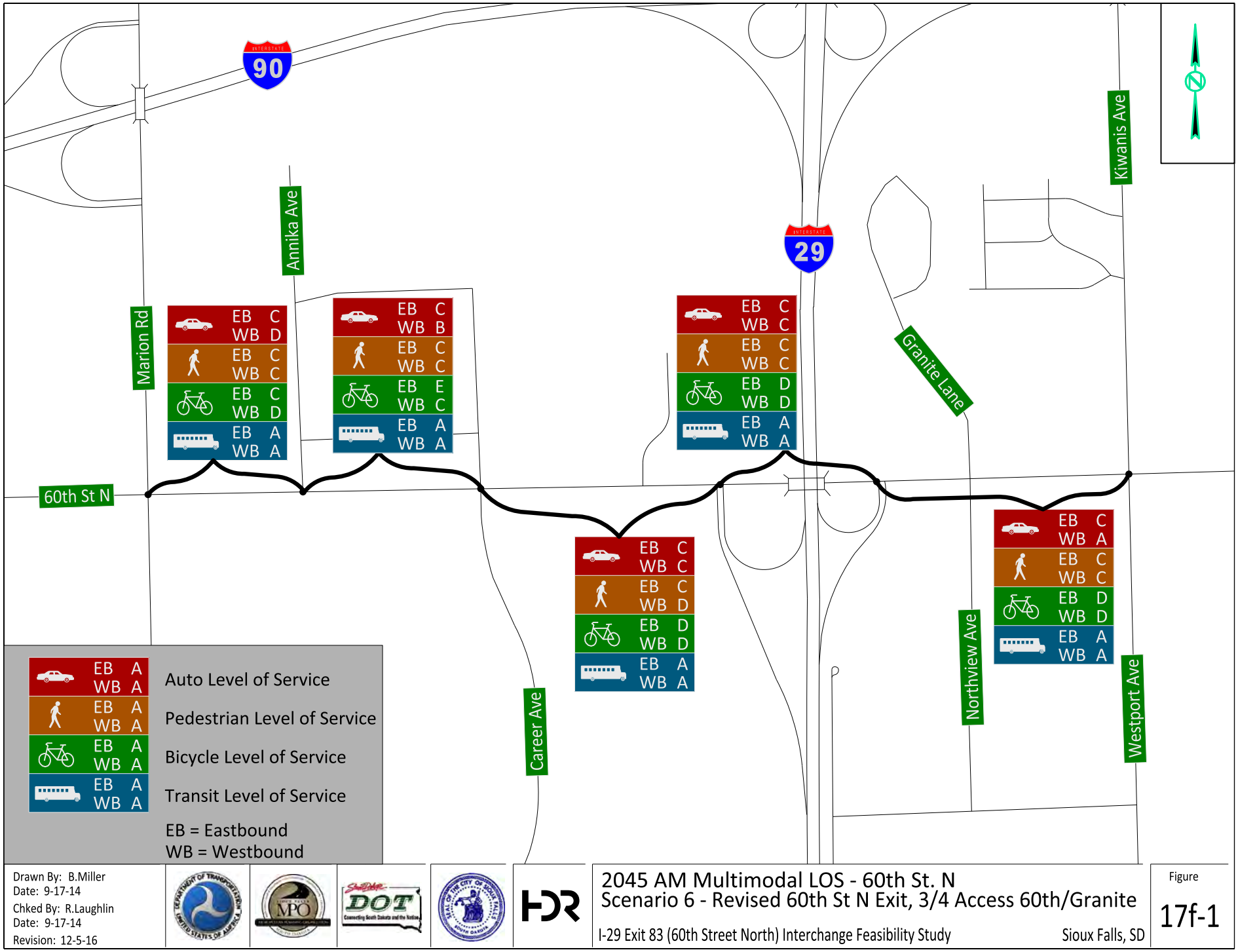


Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 PM Multimodal LOS - Benson Rd
Scenario 5 - Revise 60th St N Exit, Signal at 60th/Granite

I-29 Exit 83 (60th Street North) Interchange Feasibility Study — Sioux Falls, SD

Figure 17e-4



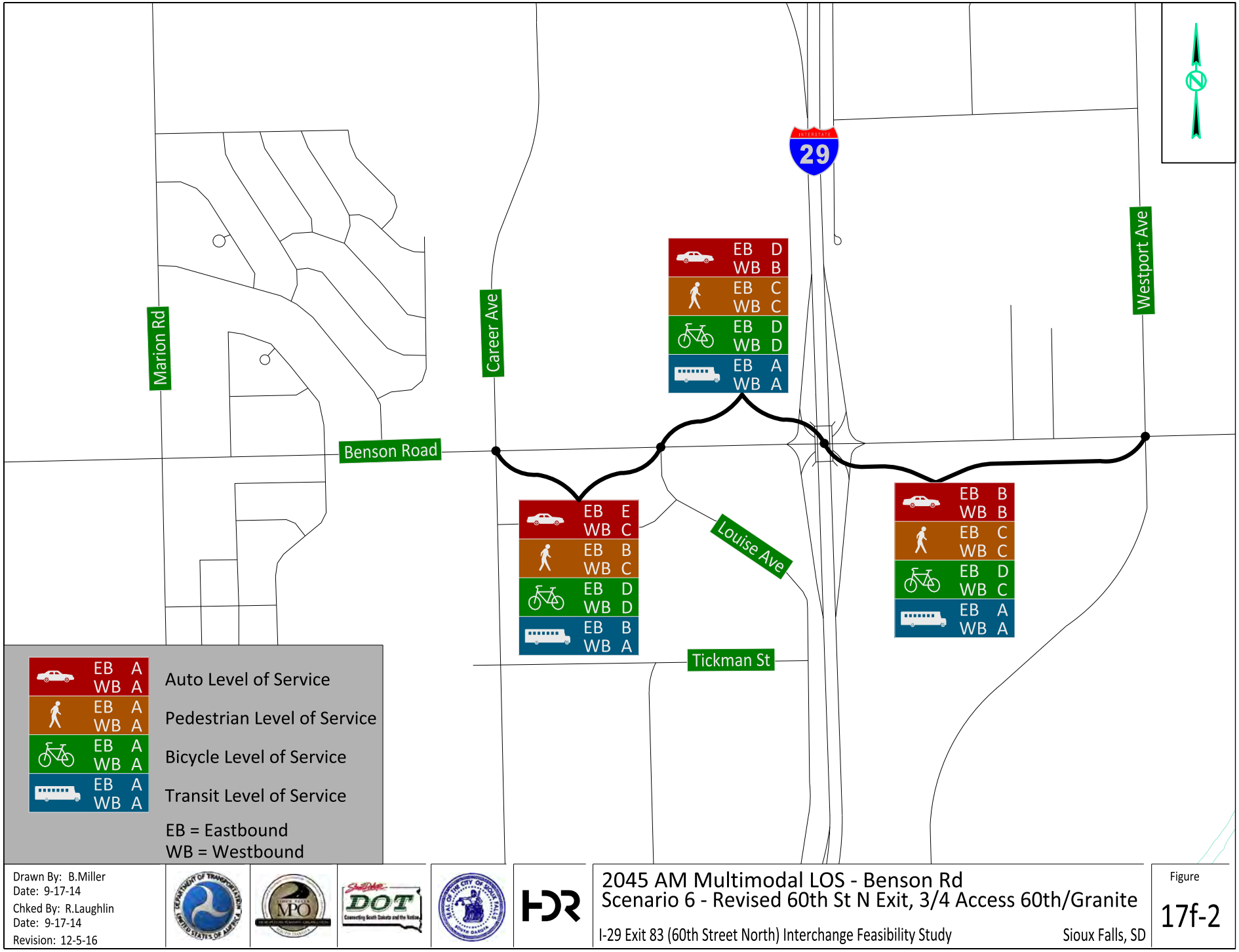
Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 AM Multimodal LOS - 60th St. N
Scenario 6 - Revised 60th St N Exit, 3/4 Access 60th/Granite

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure
17f-1



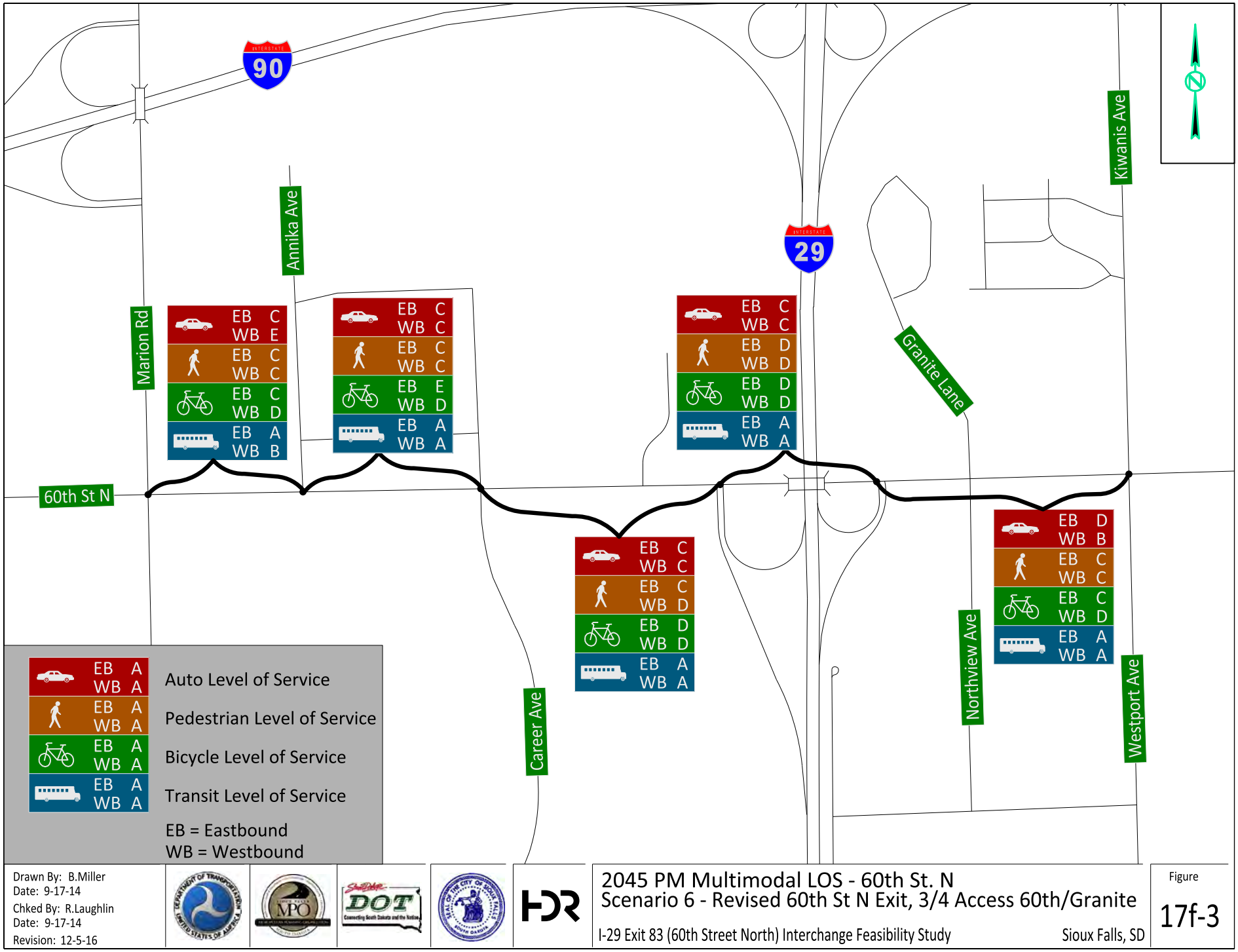
Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 AM Multimodal LOS - Benson Rd
Scenario 6 - Revised 60th St N Exit, 3/4 Access 60th/Granite

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure
17f-2

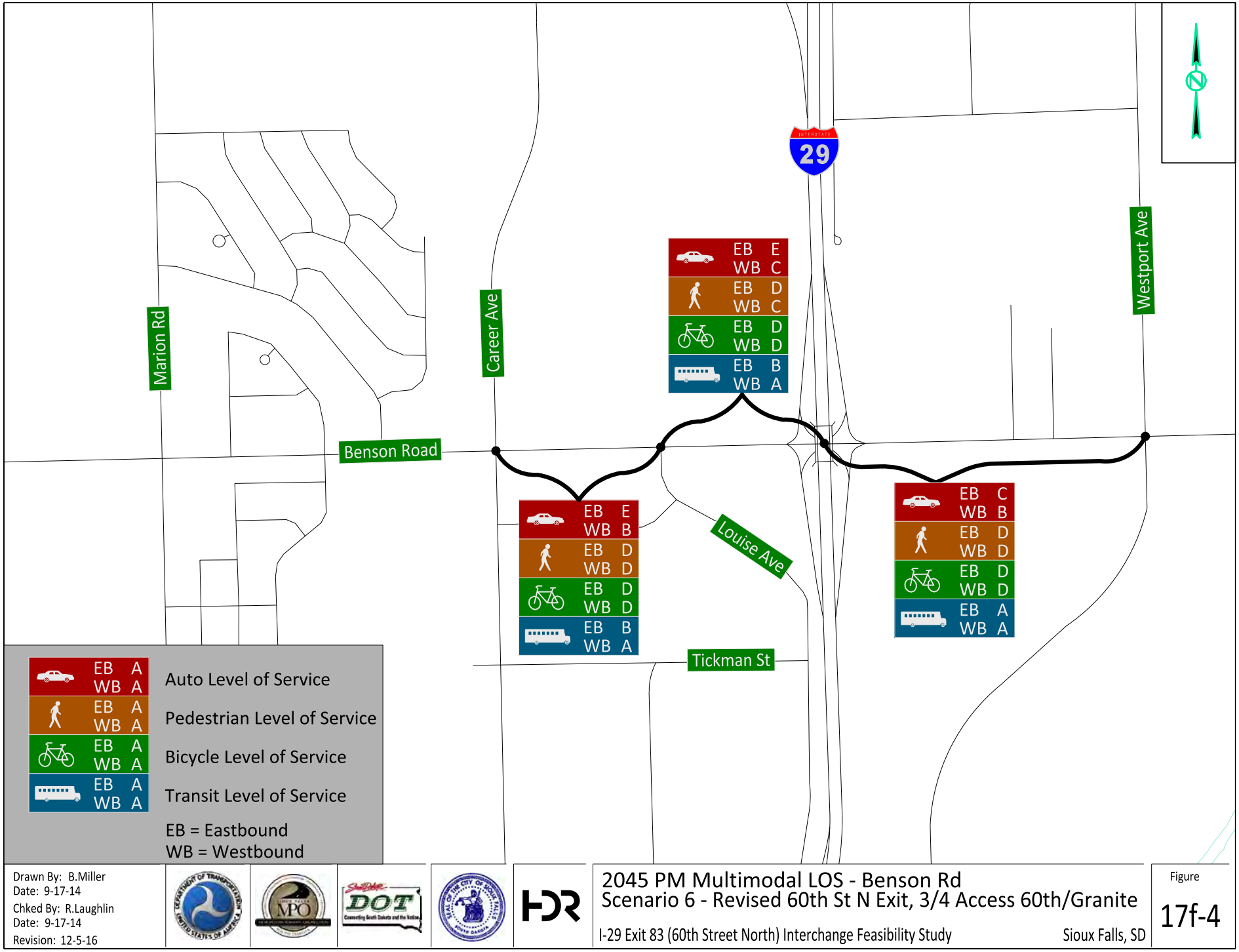


Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 PM Multimodal LOS - 60th St. N
Scenario 6 - Revised 60th St N Exit, 3/4 Access 60th/Granite

I-29 Exit 83 (60th Street North) Interchange Feasibility Study — Sioux Falls, SD

Figure 17f-3

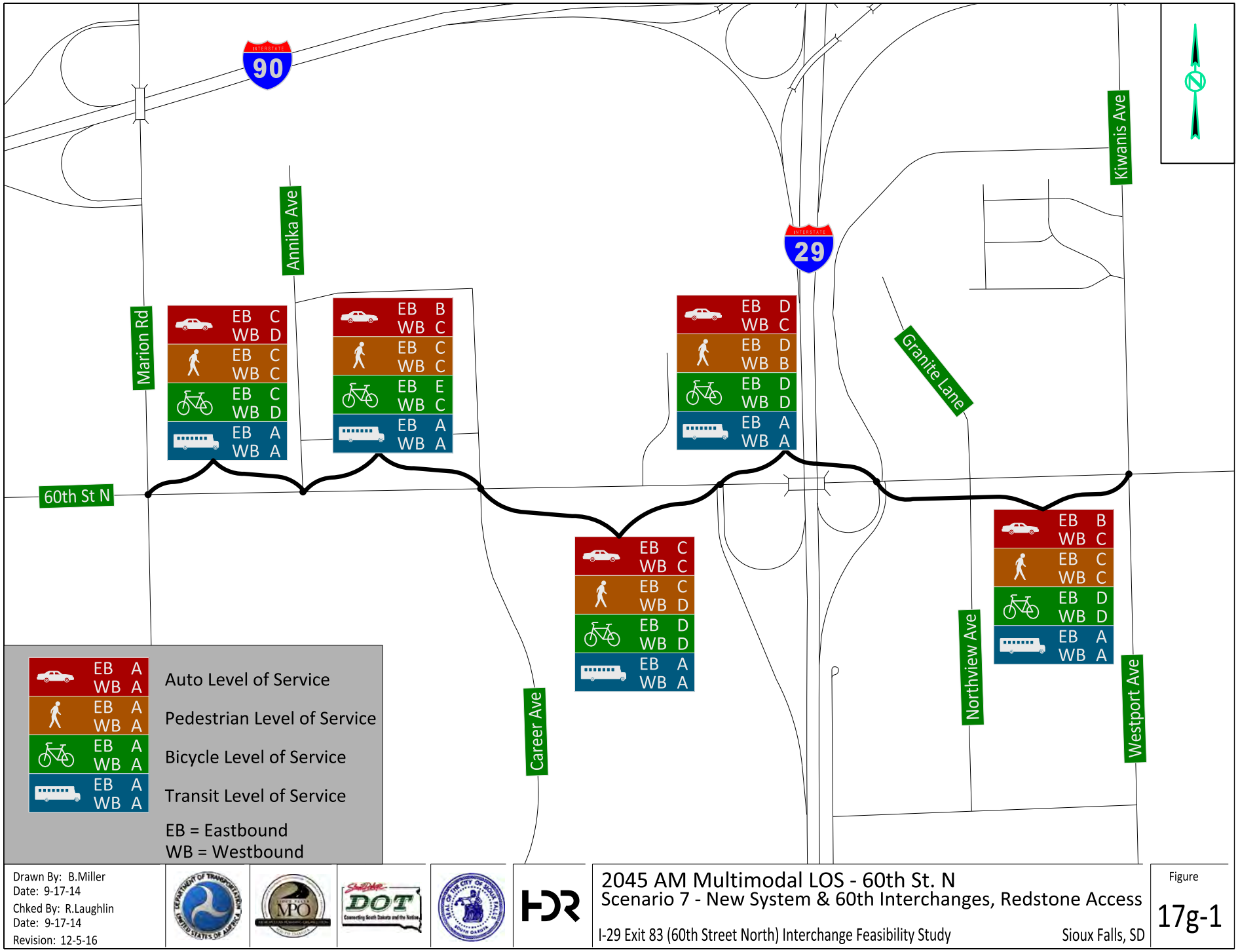


Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 PM Multimodal LOS - Benson Rd
Scenario 6 - Revised 60th St N Exit, 3/4 Access 60th/Granite

I-29 Exit 83 (60th Street North) Interchange Feasibility Study — Sioux Falls, SD

Figure 17f-4



Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

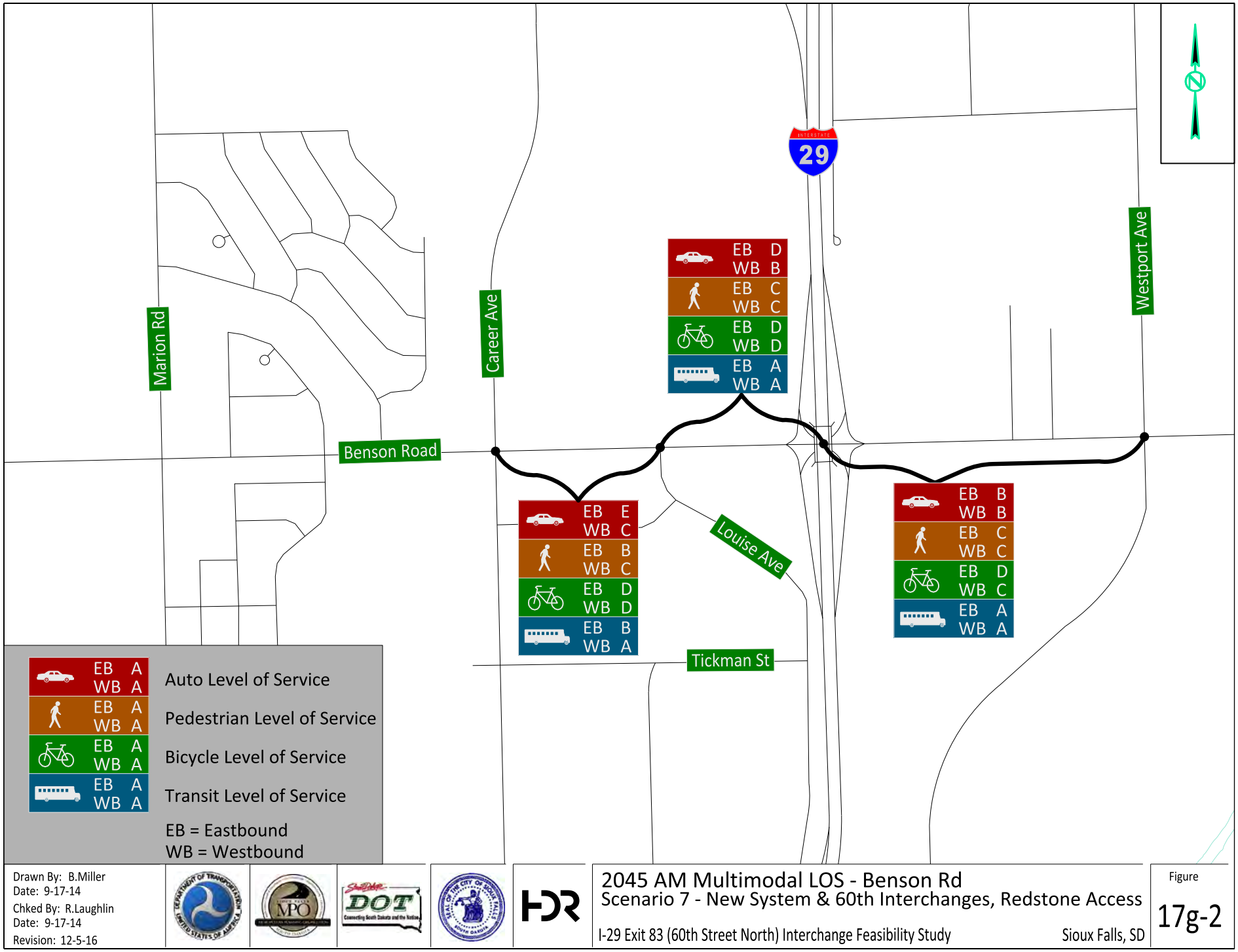
2045 AM Multimodal LOS - 60th St. N

Scenario 7 - New System & 60th Interchanges, Redstone Access

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17g-1



Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

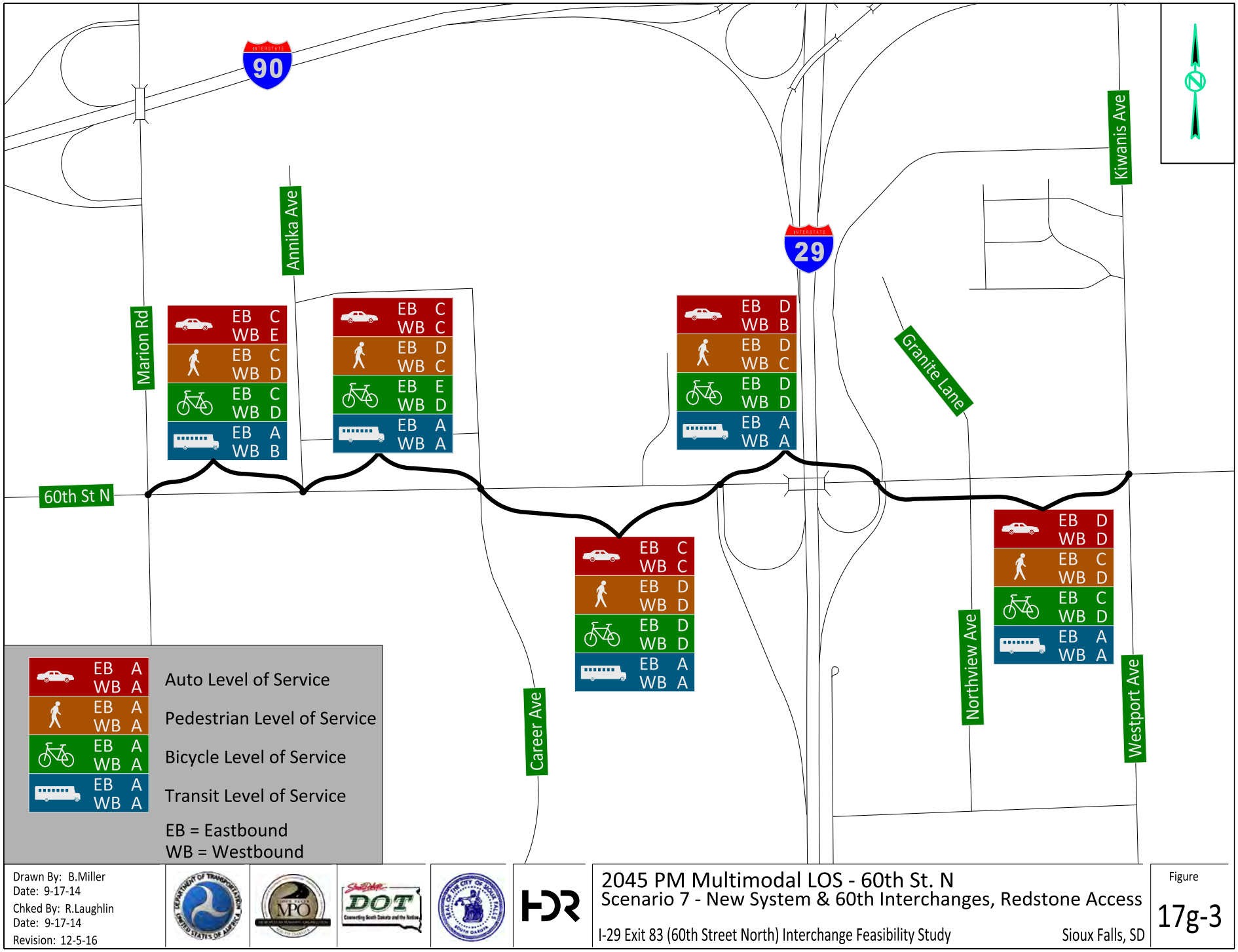
2045 AM Multimodal LOS - Benson Rd

Scenario 7 - New System & 60th Interchanges, Redstone Access

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17g-2



Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

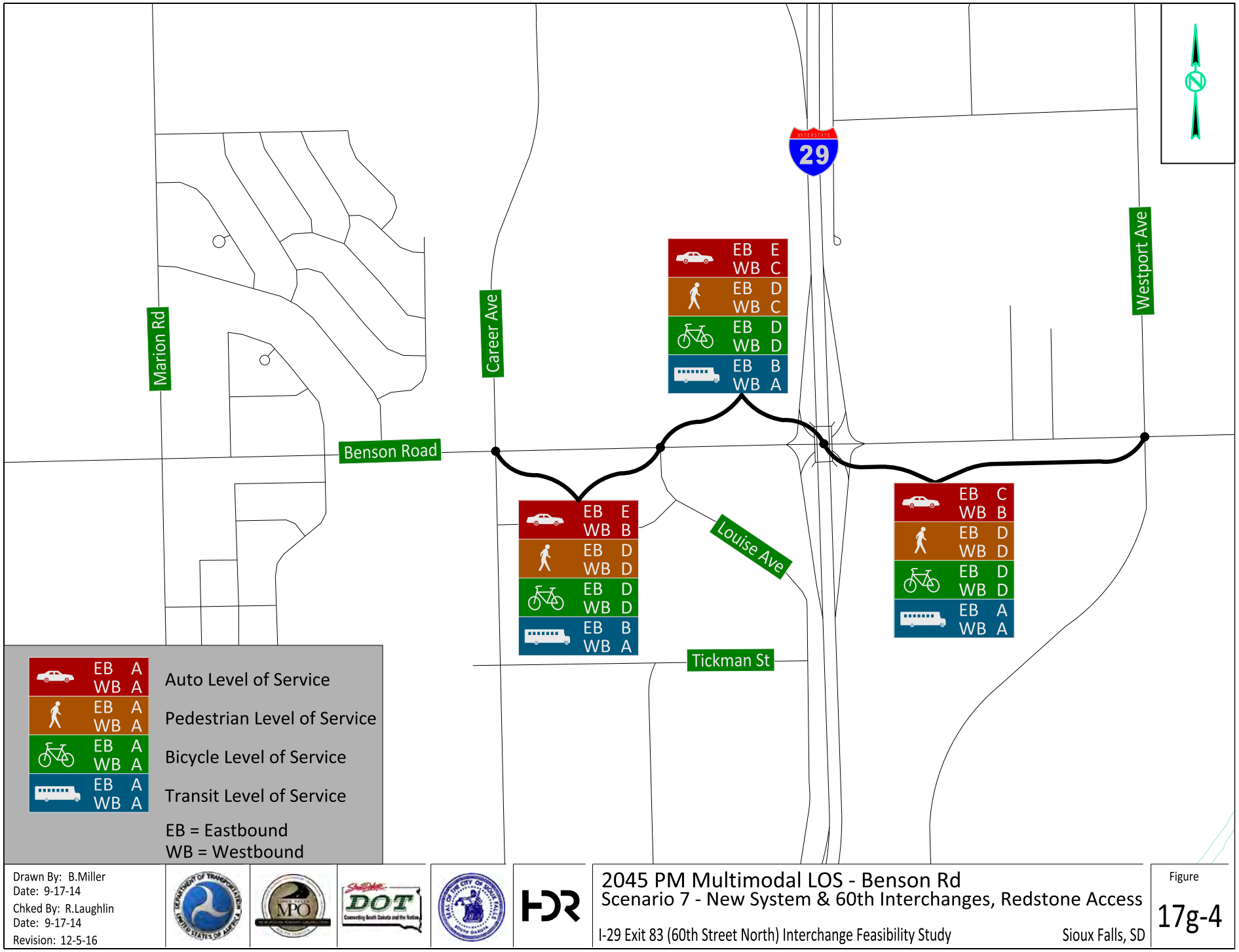
2045 PM Multimodal LOS - 60th St. N

Scenario 7 - New System & 60th Interchanges, Redstone Access

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17g-3



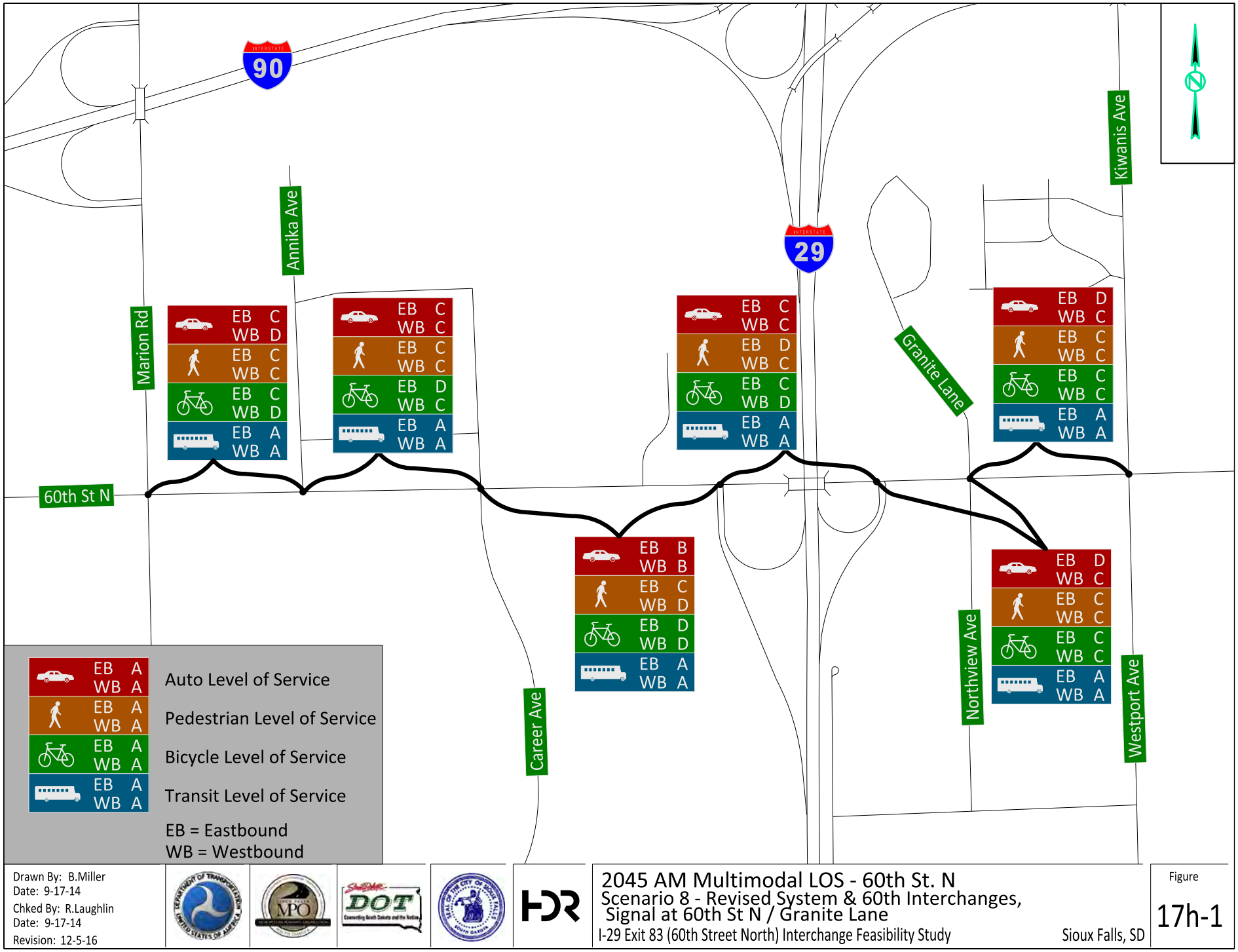
Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 PM Multimodal LOS - Benson Rd
Scenario 7 - New System & 60th Interchanges, Redstone Access

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure
17g-4

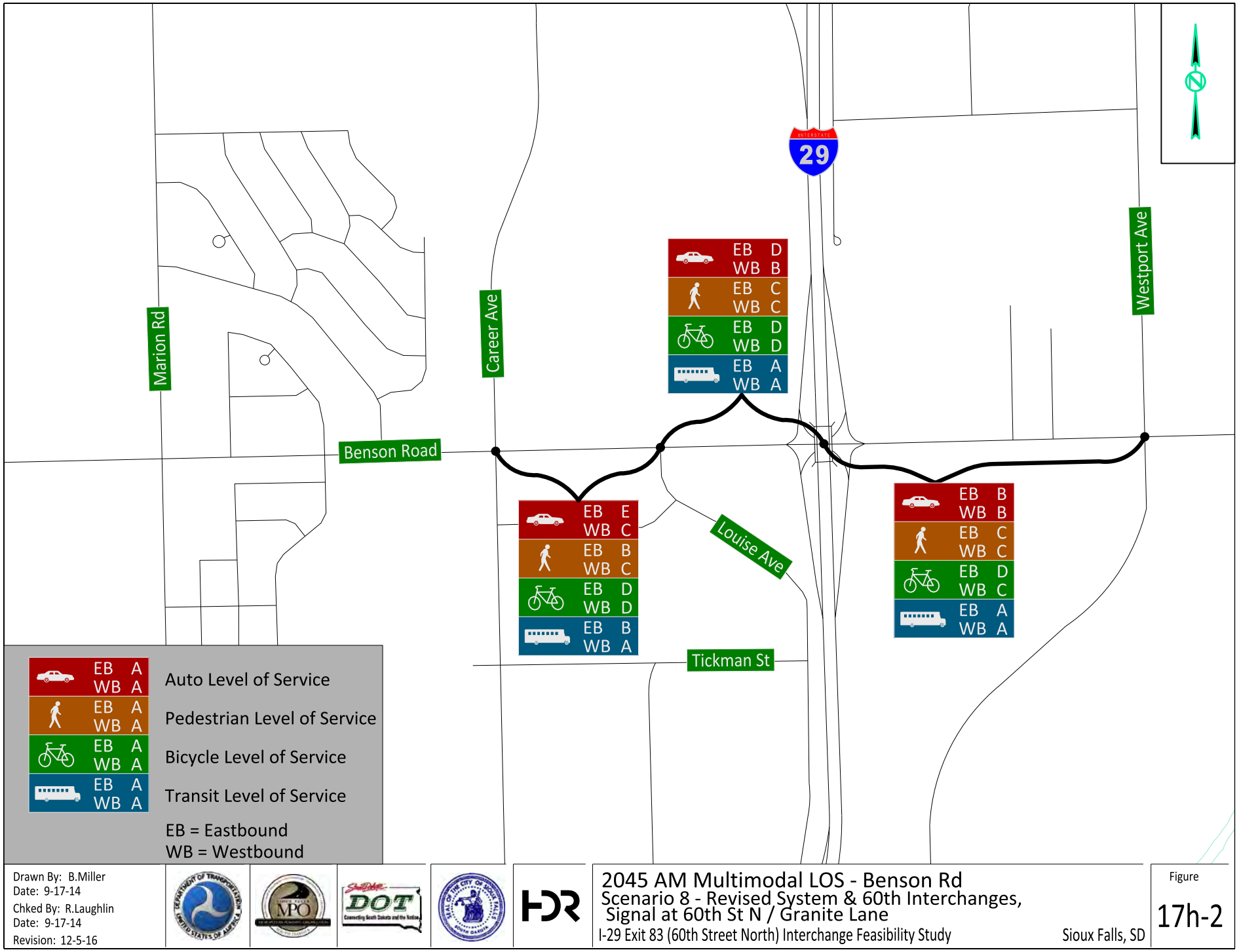


Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 AM Multimodal LOS - 60th St. N
Scenario 8 - Revised System & 60th Interchanges, Signal at 60th St N / Granite Lane
I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17h-1

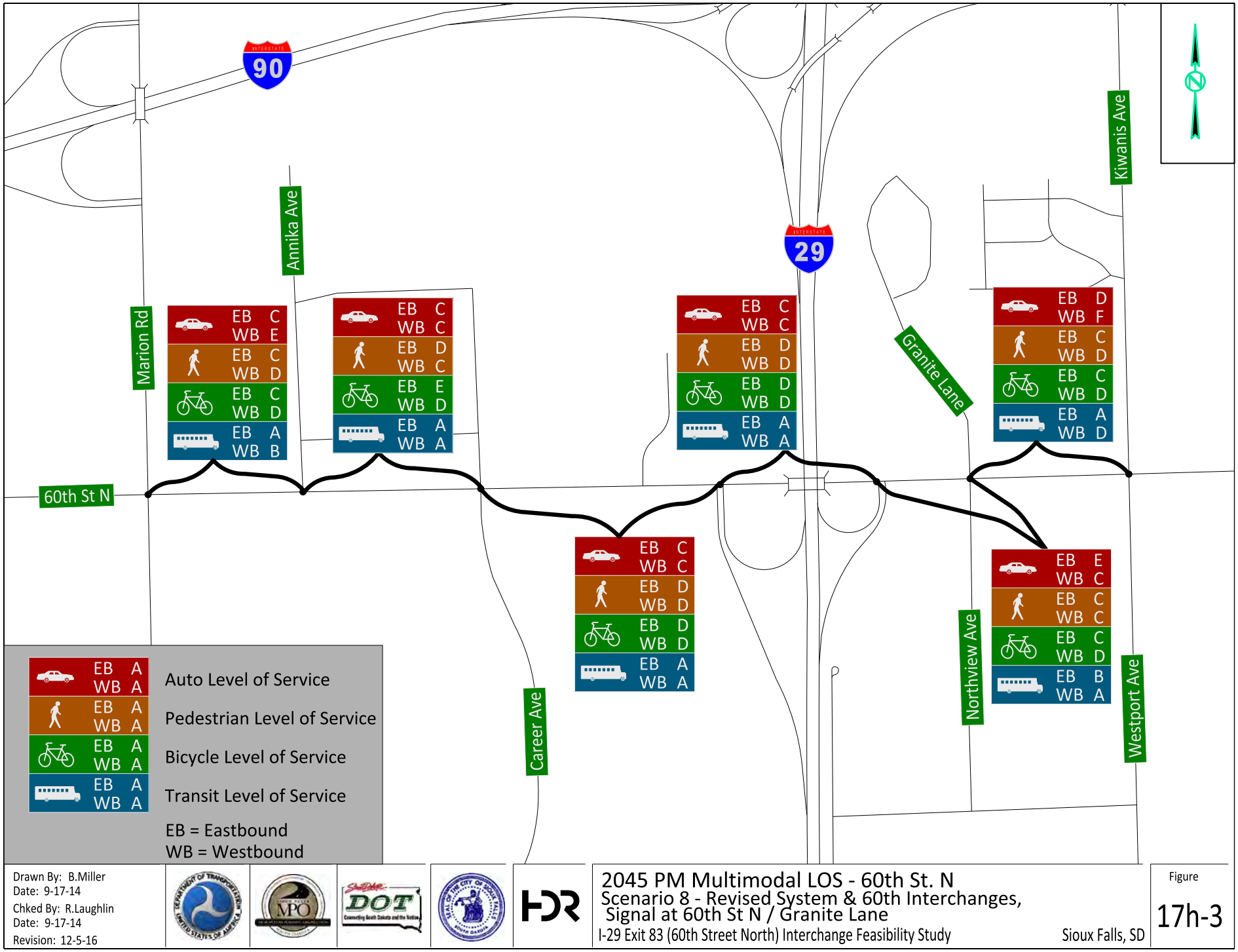


Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 AM Multimodal LOS - Benson Rd
Scenario 8 - Revised System & 60th Interchanges, Signal at 60th St N / Granite Lane
I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17h-2



Drawn By: B.Miller
Date: 9-17-14
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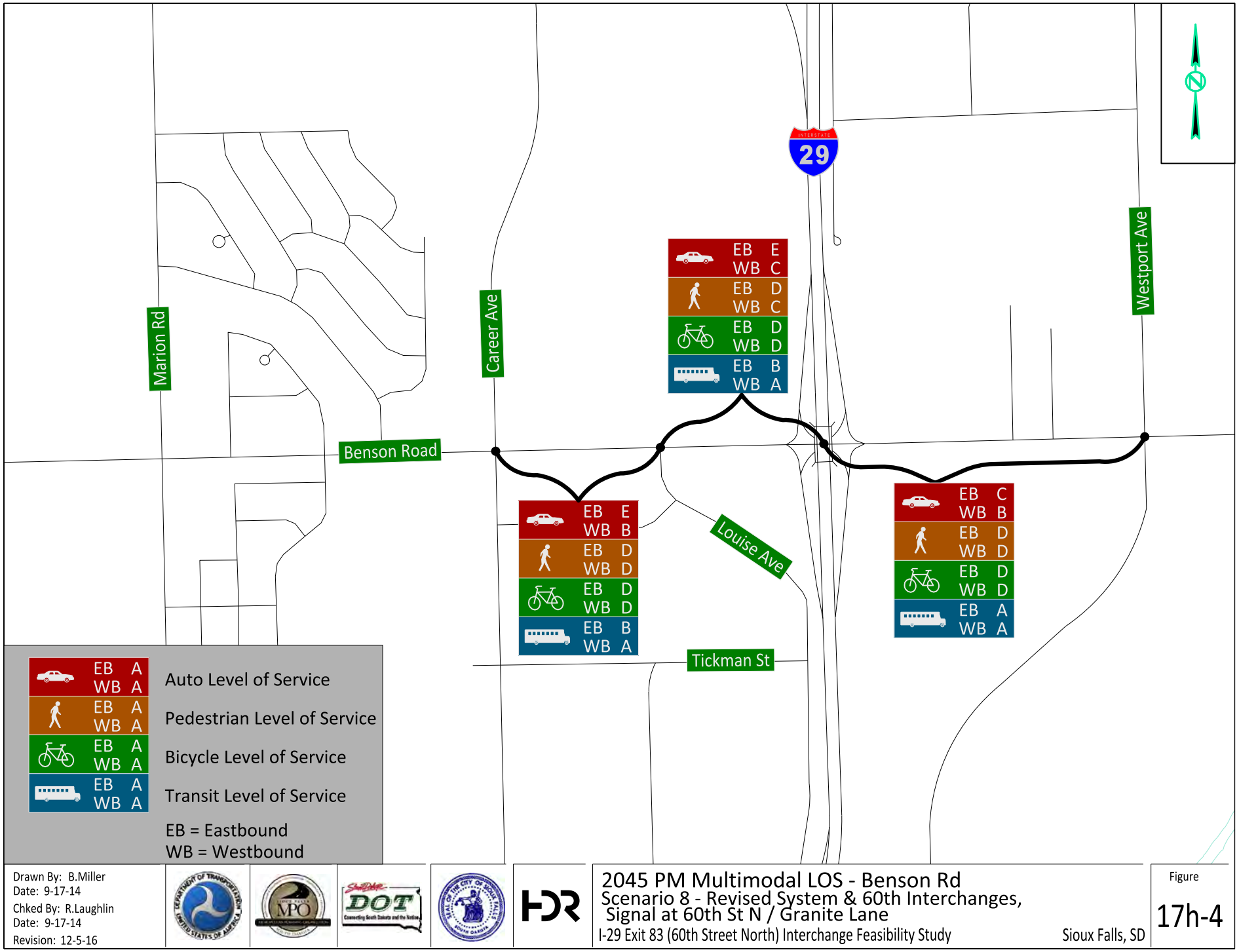
Date: 9-17-14
Revision: 12-5-16

2045 PM Multimodal LOS - 60th St. N
Scenario 8 - Revised System & 60th Interchanges, Signal at 60th St N / Granite Lane
I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17h-3



Drawn By: B.Miller
Date: 9-17-14
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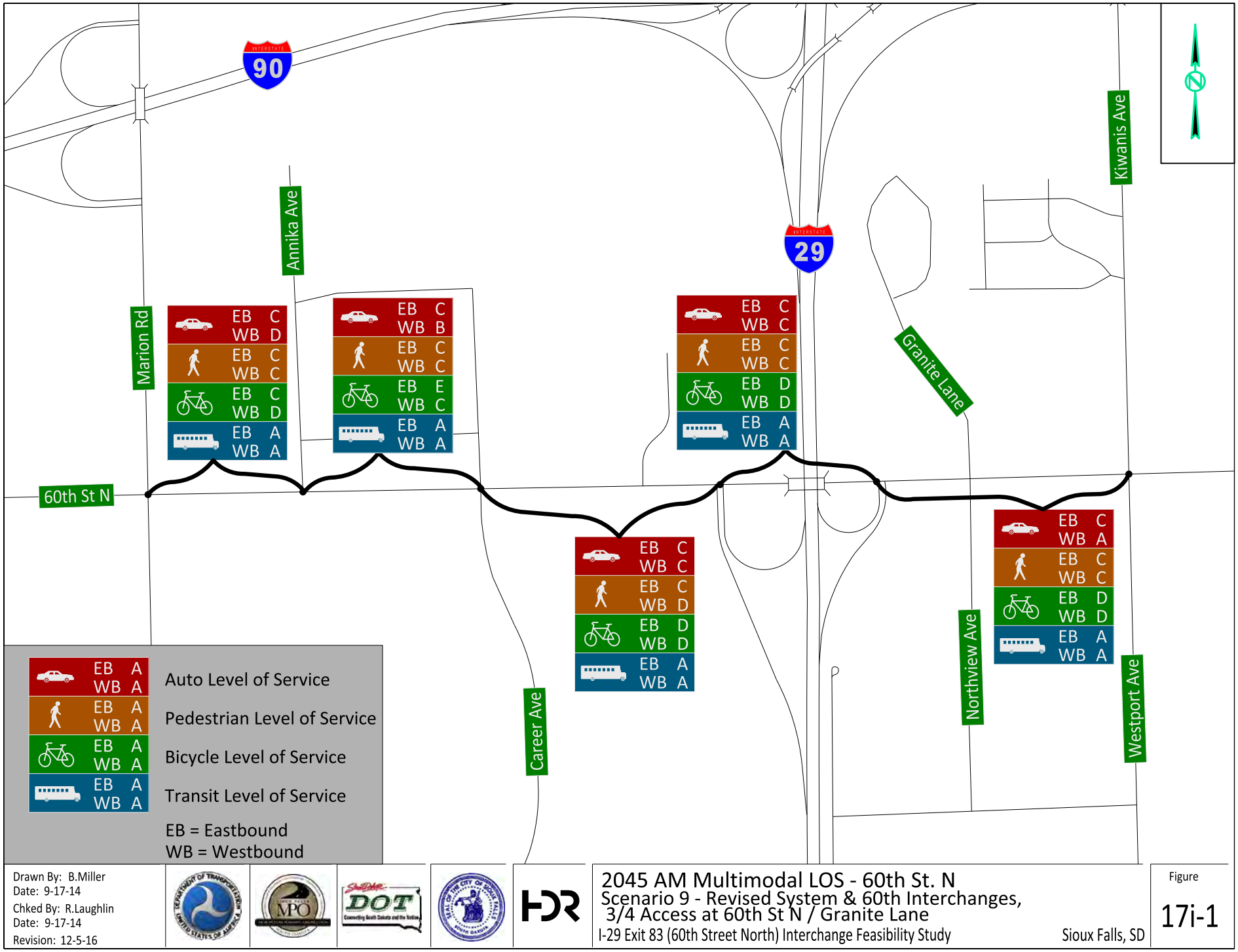
Date: 9-17-14
Revision: 12-5-16

2045 PM Multimodal LOS - Benson Rd
Scenario 8 - Revised System & 60th Interchanges, Signal at 60th St N / Granite Lane
I-29 Exit 83 (60th Street North) Interchange Feasibility Study
Sioux Falls, SD

Figure
17h-4

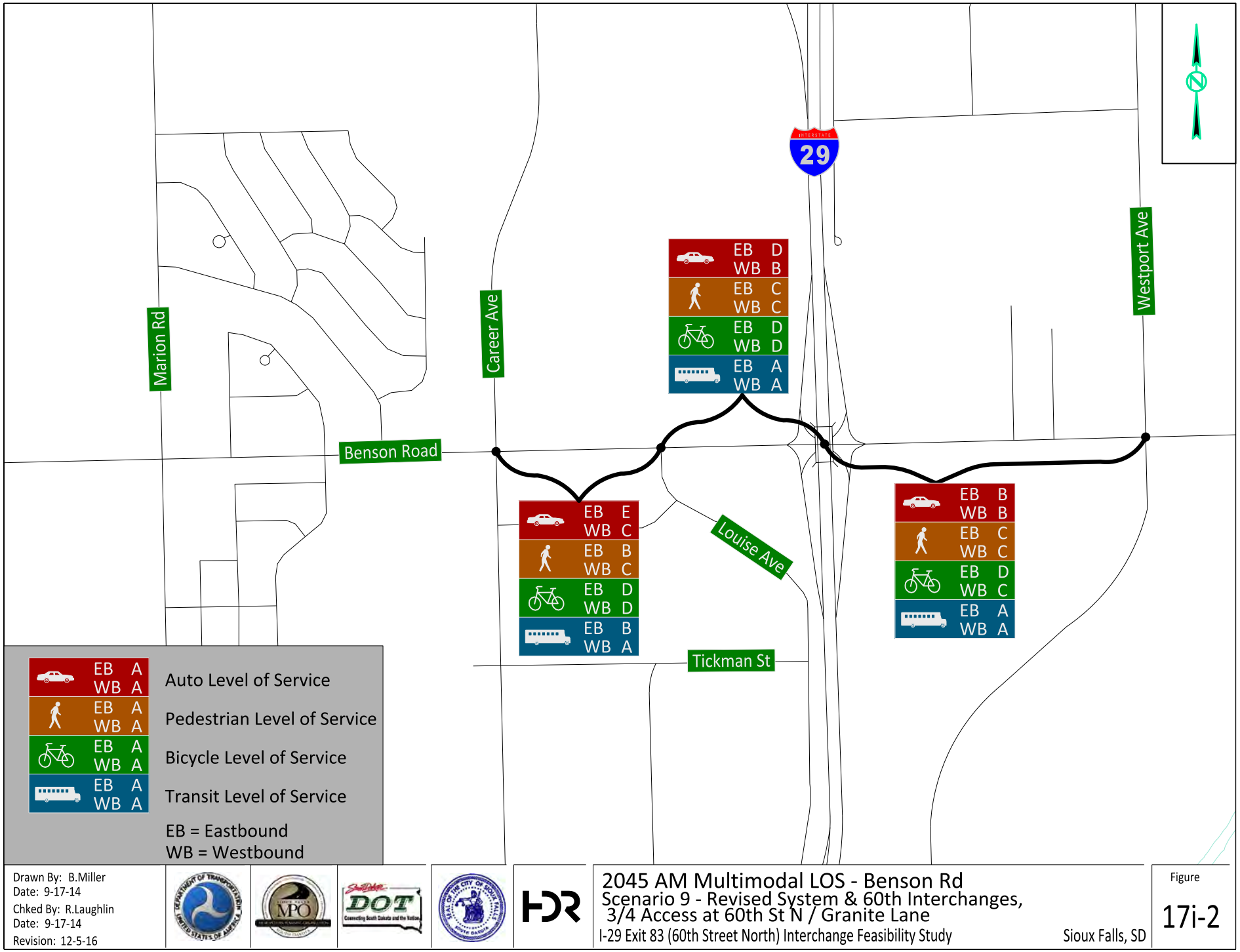


Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 AM Multimodal LOS - 60th St. N
Scenario 9 - Revised System & 60th Interchanges, 3/4 Access at 60th St N / Granite Lane
I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17i-1

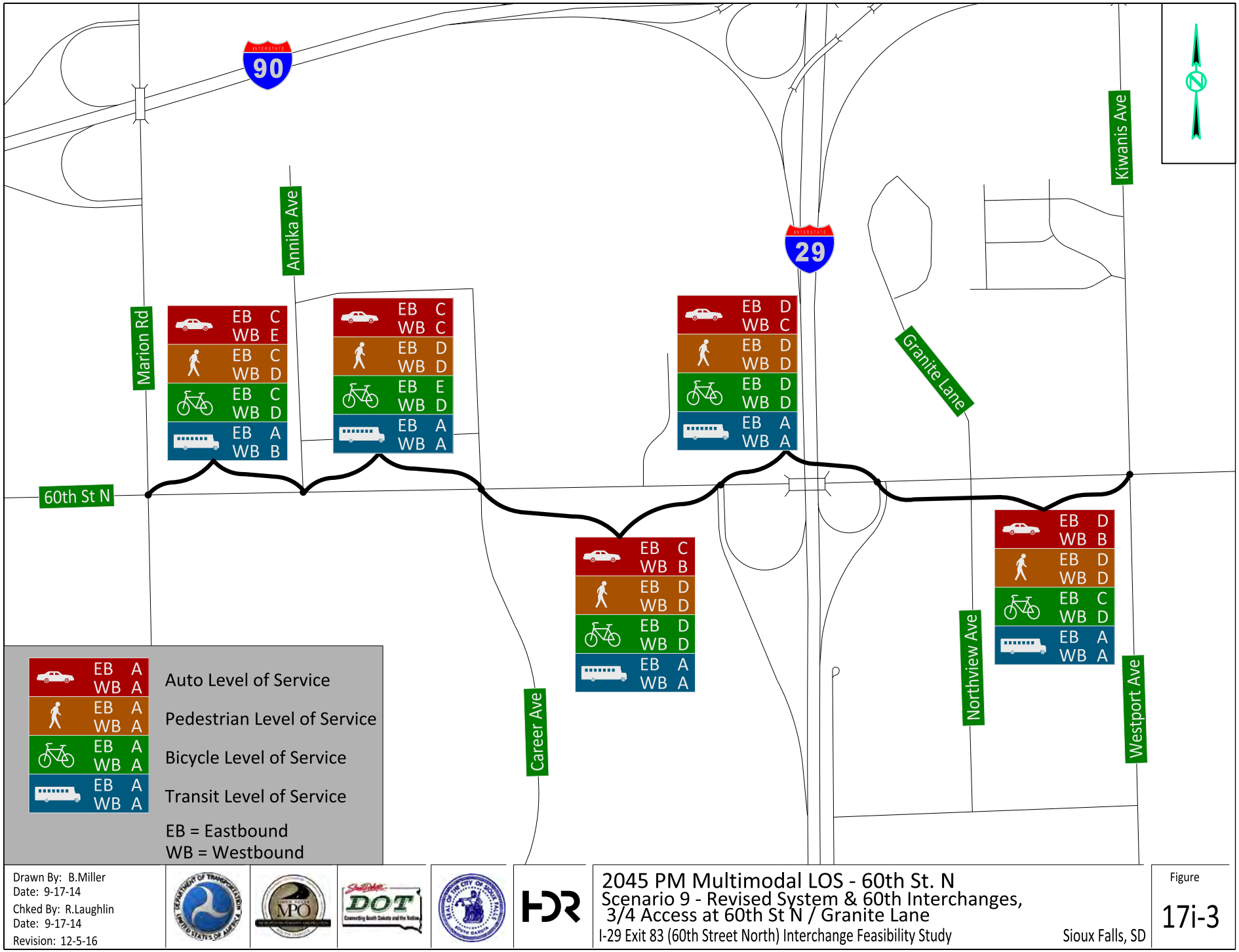


Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 AM Multimodal LOS - Benson Rd
Scenario 9 - Revised System & 60th Interchanges, 3/4 Access at 60th St N / Granite Lane
I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17i-2

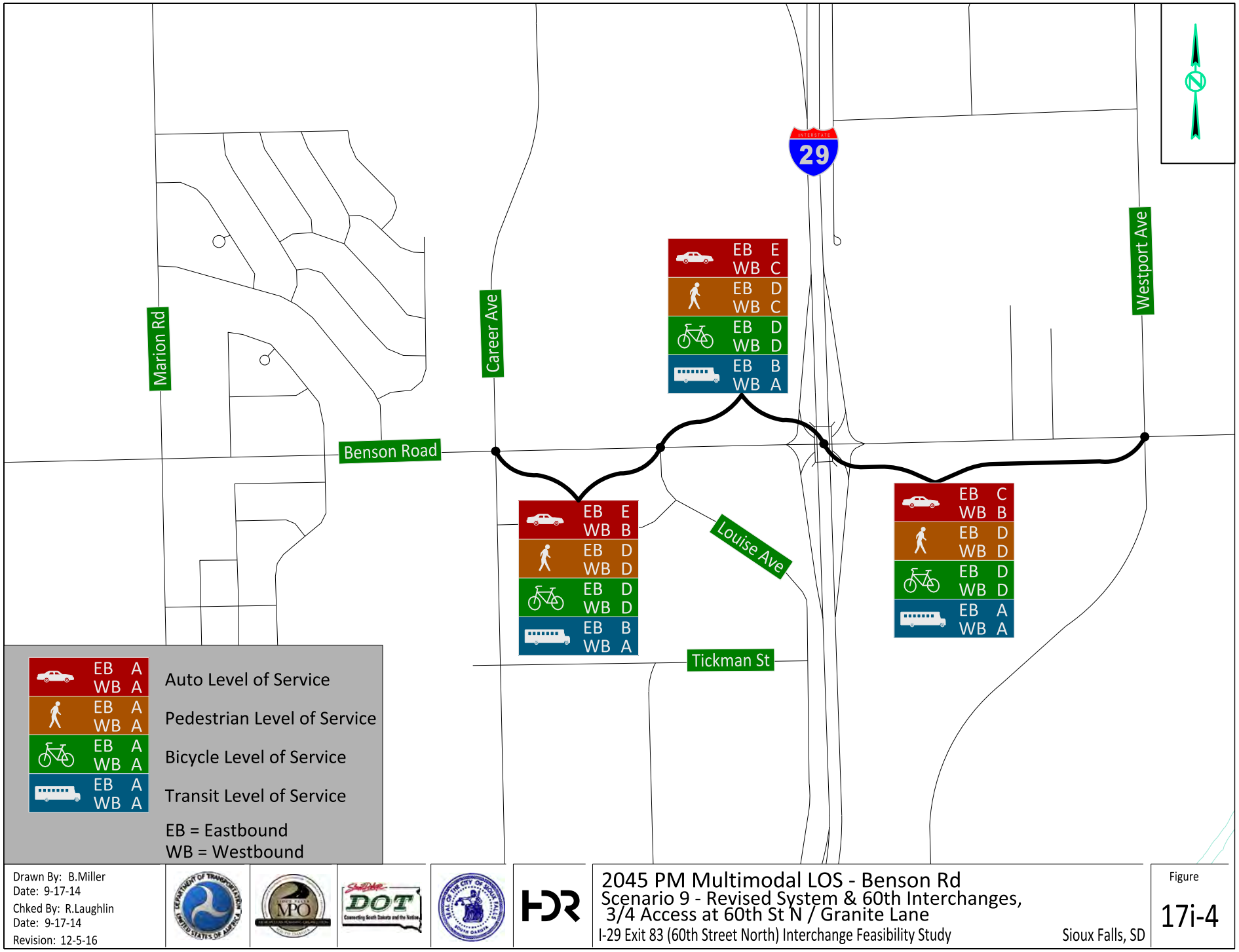


Drawn By: B.Miller
Date: 9-17-14
Chked By: R.Laughlin
Date: 9-17-14
Revision: 12-5-16

2045 PM Multimodal LOS - 60th St. N
Scenario 9 - Revised System & 60th Interchanges, 3/4 Access at 60th St N / Granite Lane
I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17i-3



Drawn By: B.Miller
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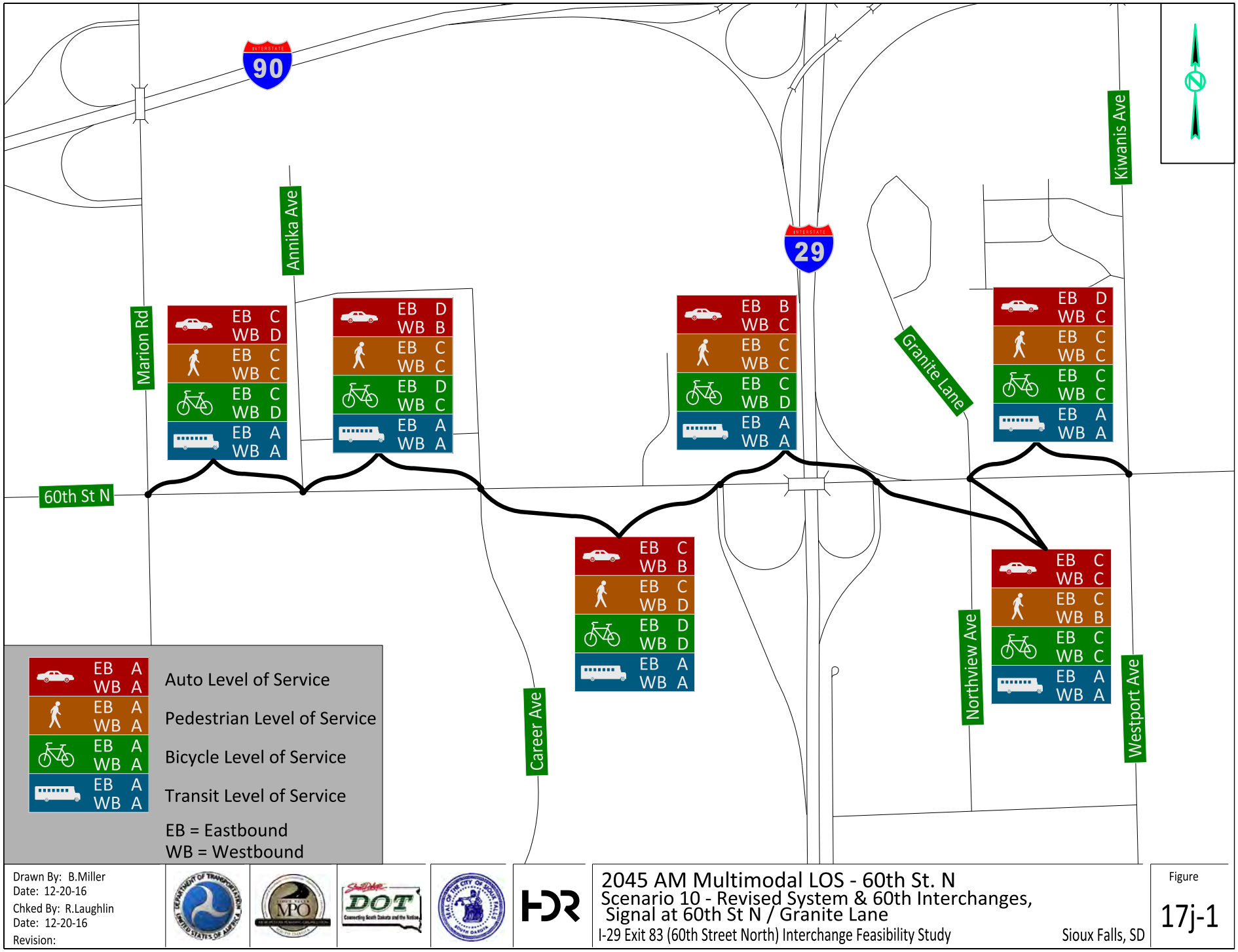
2045 PM Multimodal LOS - Benson Rd
Scenario 9 - Revised System & 60th Interchanges, 3/4 Access at 60th St N / Granite Lane
I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure
17i-4



Drawn By: B.Miller
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Chked By: R.Laughlin
Date: 12-20-16
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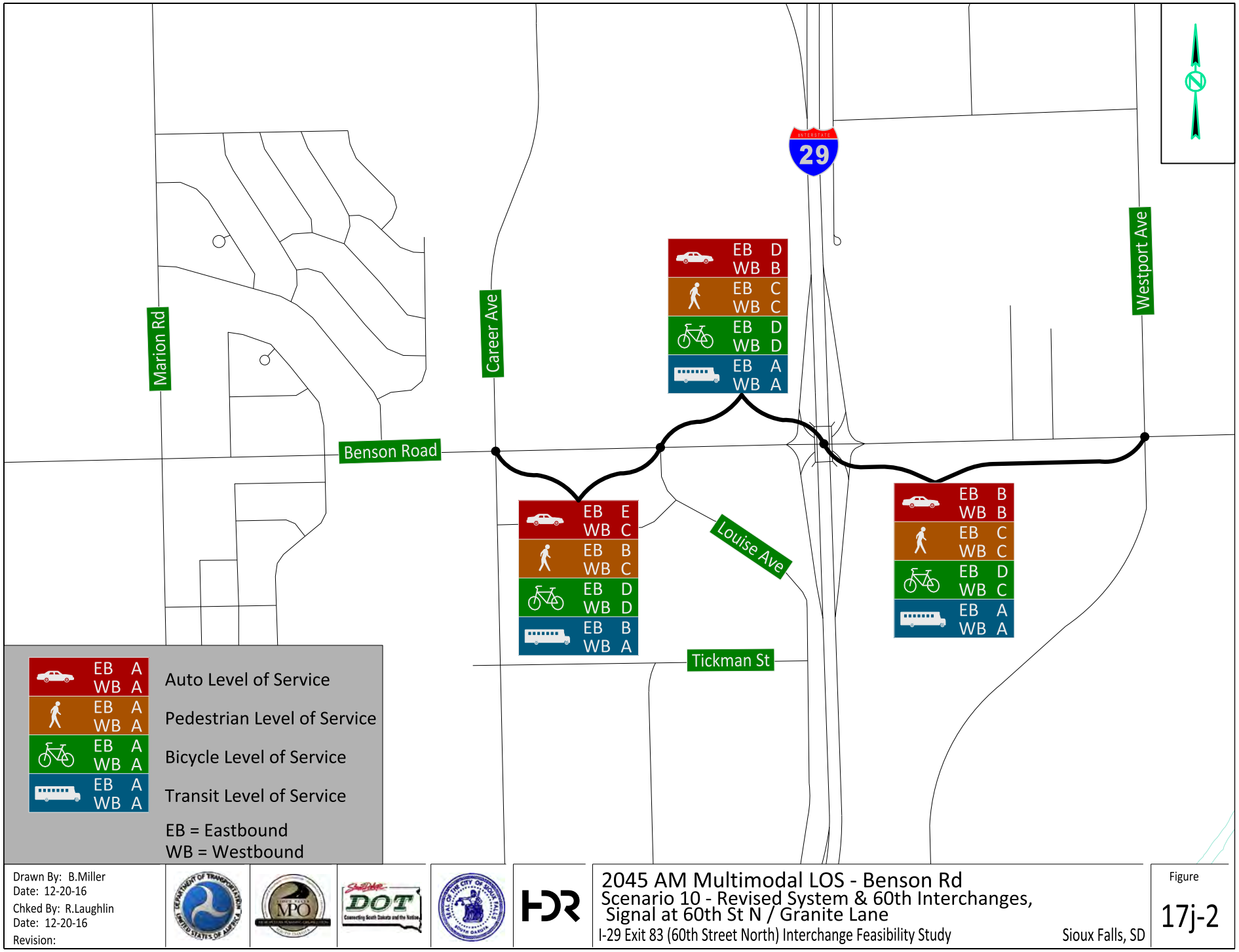
2045 AM Multimodal LOS - 60th St. N
Scenario 10 - Revised System & 60th Interchanges, Signal at 60th St N / Granite Lane
I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17j-1

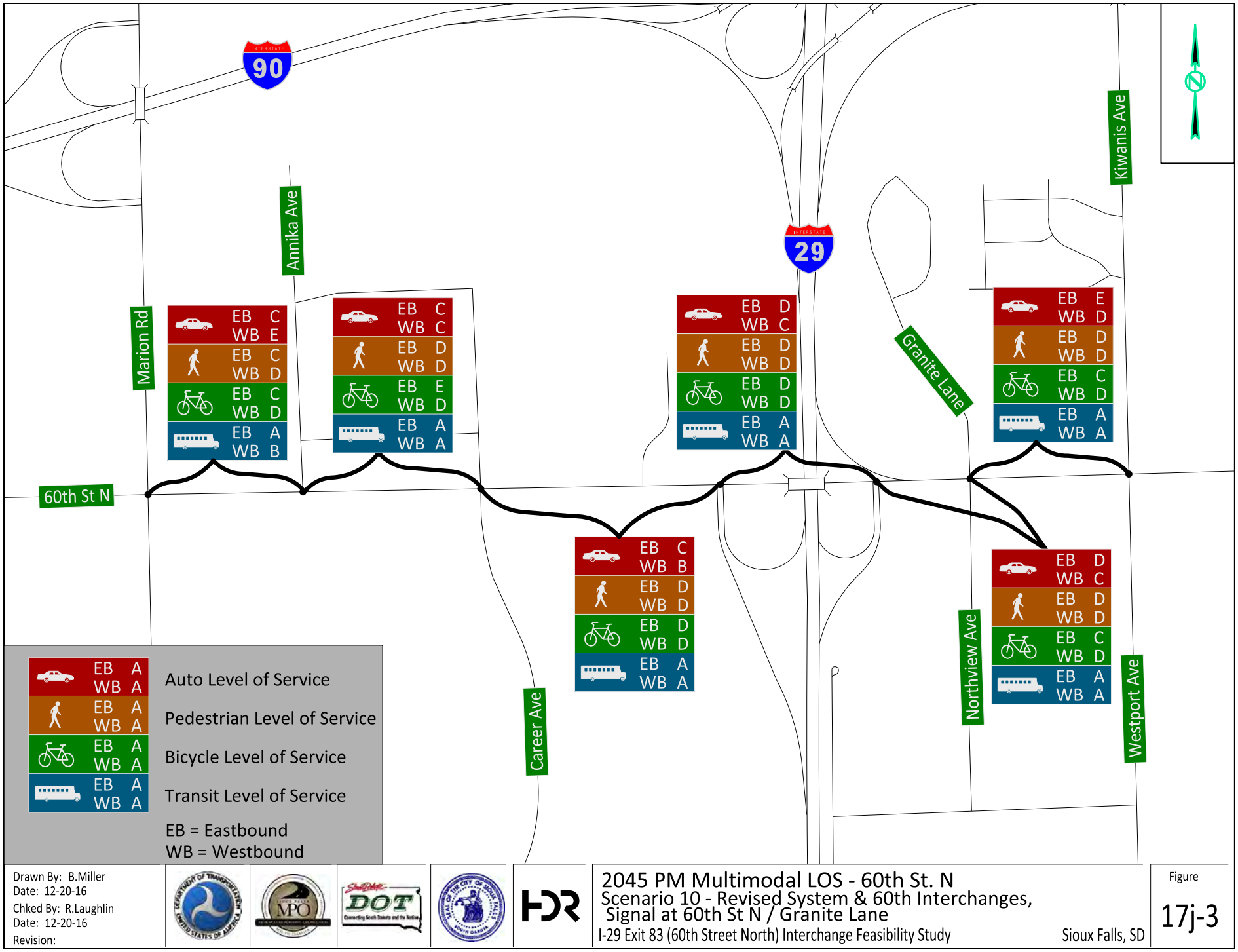


Drawn By: B.Miller
Date: 12-20-16
Chked By: R.Laughlin
Date: 12-20-16
Revision:

2045 AM Multimodal LOS - Benson Rd
Scenario 10 - Revised System & 60th Interchanges, Signal at 60th St N / Granite Lane
I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure
17j-2



Drawn By: B.Miller
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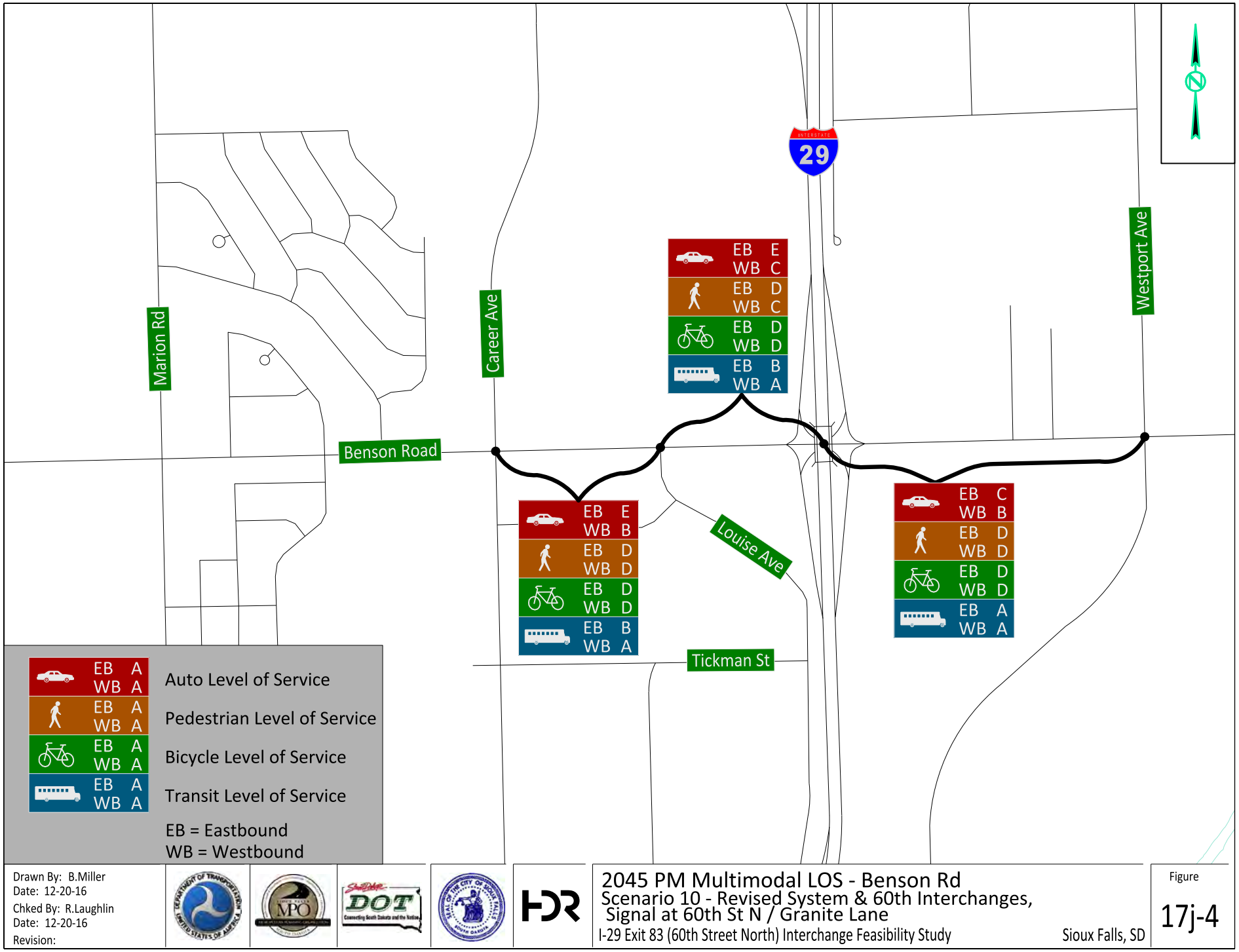
Scenario 10 - Revised System & 60th Interchanges, Signal at 60th St N / Granite Lane
I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17j-3

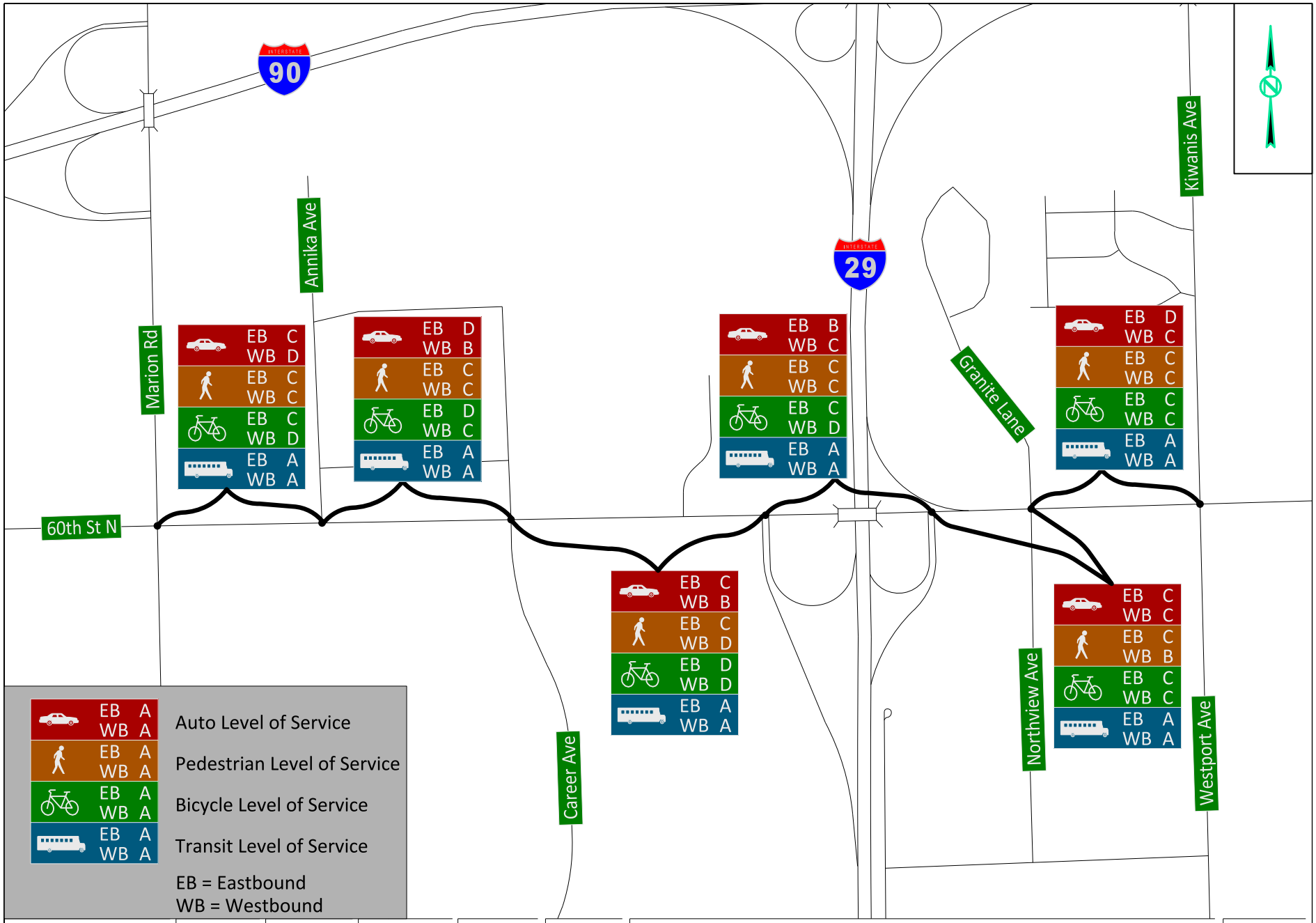


Drawn By: B.Miller
Date: 12-20-16
Chked By: R.Laughlin
Date: 12-20-16
Revision:

2045 PM Multimodal LOS - Benson Rd
Scenario 10 - Revised System & 60th Interchanges, Signal at 60th St N / Granite Lane
I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17j-4



Drawn By: B.Miller
Date: 3-23-2017
Chked By: R.Laughlin
Date: 3-23-2017
Revision:

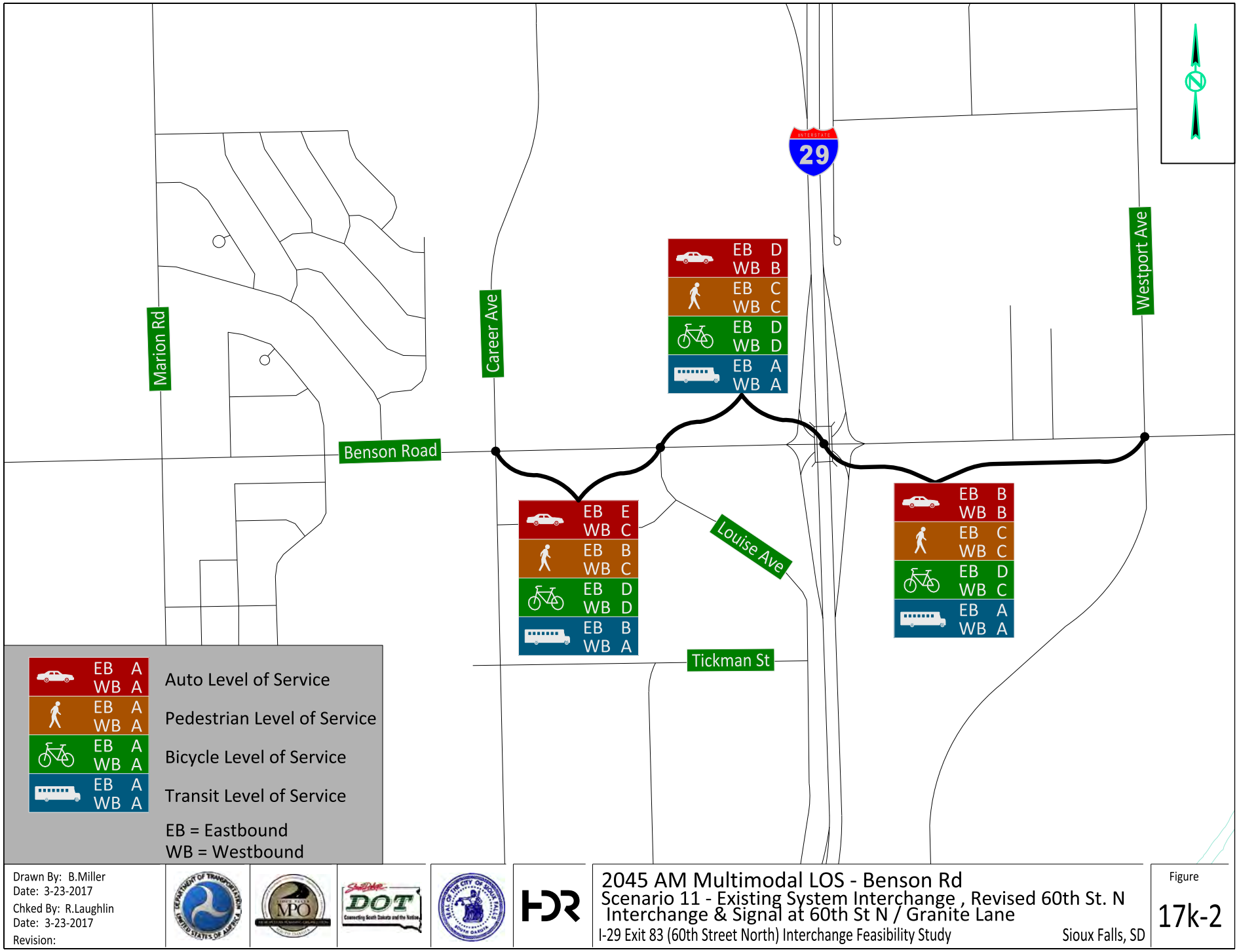
2045 AM Multimodal LOS - 60th St. N

Scenario 11 - Existing System Interchange , Revised 60th St. N Interchange & Signal at 60th St N / Granite Lane

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

Figure 17k-1



Drawn By: B.Miller
Date: 3-23-2017
Chked By: R.Laughlin
Date: 3-23-2017
Revision:

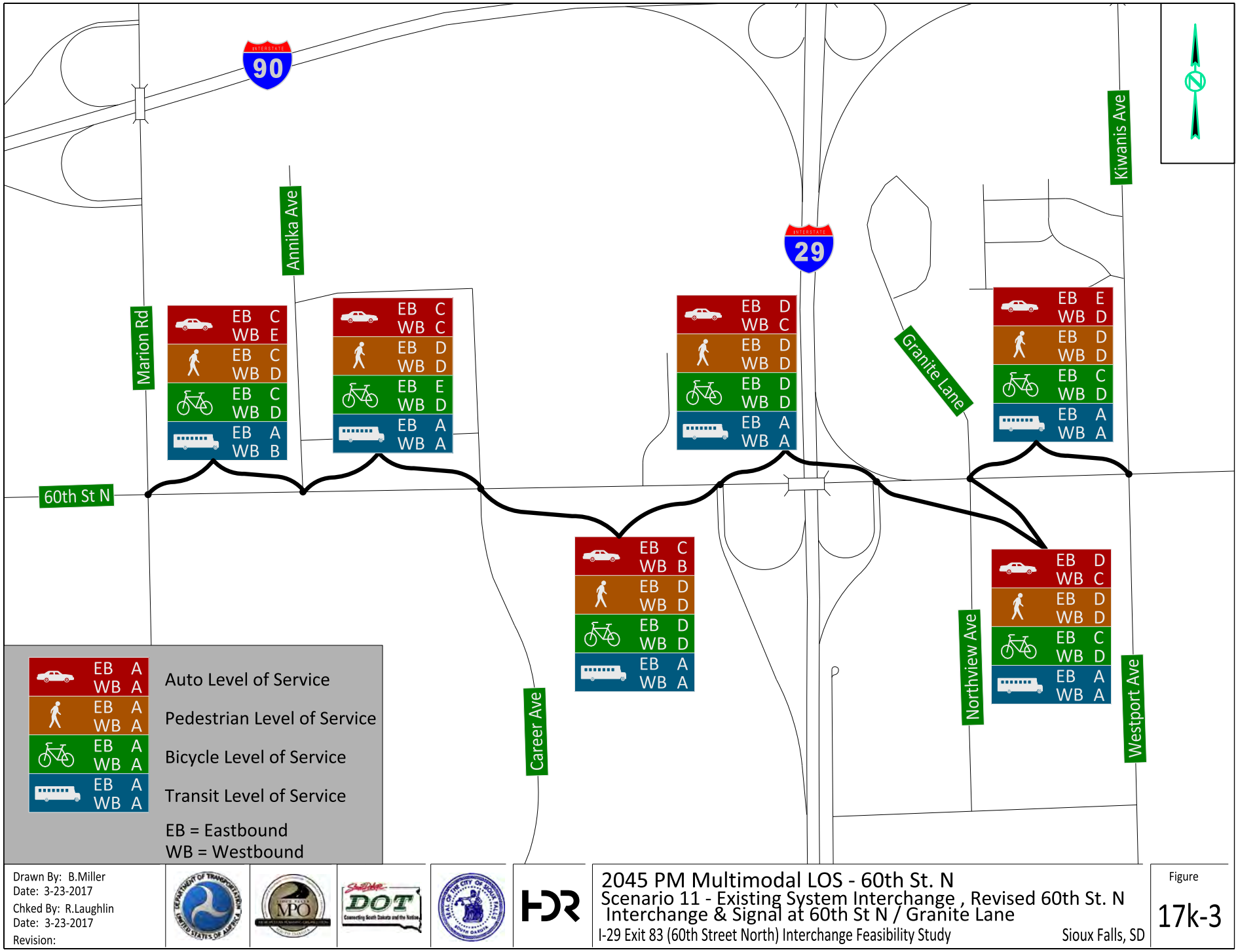
2045 AM Multimodal LOS - Benson Rd

Scenario 11 - Existing System Interchange , Revised 60th St. N Interchange & Signal at 60th St N / Granite Lane

I-29 Exit 83 (60th Street North) Interchange Feasibility Study

Sioux Falls, SD

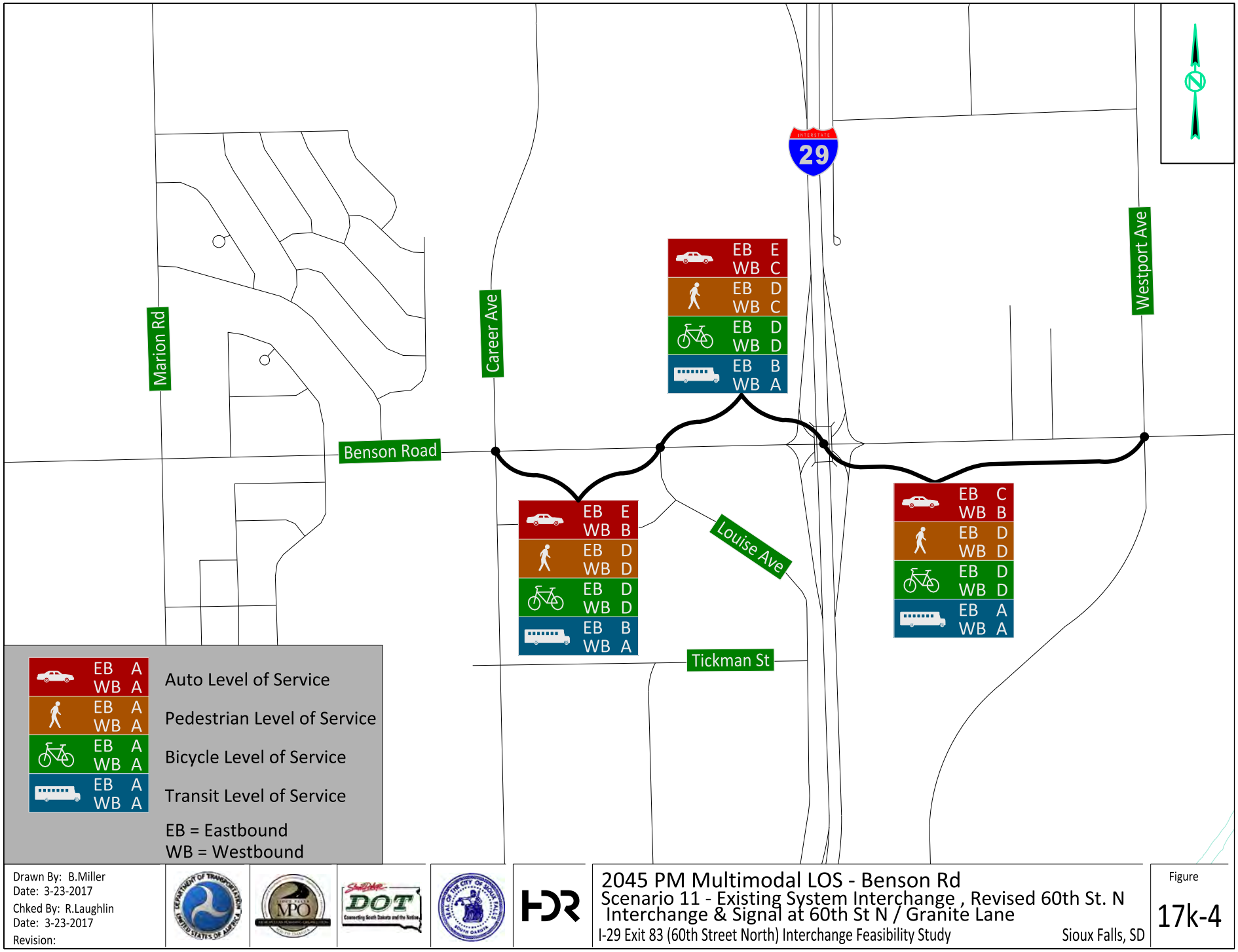
Figure 17k-2



Drawn By: B.Miller
Date: 3-23-2017
Chked By: R.Laughlin
Date: 3-23-2017
Revision:

2045 PM Multimodal LOS - 60th St. N
Scenario 11 - Existing System Interchange , Revised 60th St. N Interchange & Signal at 60th St N / Granite Lane
I-29 Exit 83 (60th Street North) Interchange Feasibility Study
Sioux Falls, SD

Figure
17k-3



Drawn By: B.Miller
Date: 3-23-2017
Chked By: R.Laughlin
Date: 3-23-2017
Revision:

2045 PM Multimodal LOS - Benson Rd
Scenario 11 - Existing System Interchange , Revised 60th St. N Interchange & Signal at 60th St N / Granite Lane
I-29 Exit 83 (60th Street North) Interchange Feasibility Study
Sioux Falls, SD

Figure
17k-4

ALTERNATIVES ANALYSIS

The interchange improvement scenarios were analyzed and compared to determine which may be most suitable for meeting the project need. The areas of analysis and comparison are discussed in the following sections.

Conformance with Transportation Plans

Local (MPO and City) and State transportation plans, including the Sioux Falls MPO Long Range Transportation Plan have identified a need for an improved interchange at I-29/60th Street N. that meets access spacing standards and provides adequate capacity to serve future travel demand. Scenario 10 satisfies the existing transportation planning considerations.

Compliance with Policies and Engineering Standards

Each of the interchange build options has used the latest guidance from AASHTO and FHWA and final design of any of the options may be accomplished without conflict with geometric design standards.

Access management was examined at adjacent local street intersections and commercial driveways. SDDOT design standards call for access spacing of at least 100' from the Interstate highway right-of-way line at ramp termini when rebuilding an existing urban interchange, but further recommend extending the control of access to meet the access spacing requirements established by South Dakota Administrative Rule 70:09. The Administrative Rules call for unsignalized access spacing of 100' to 660' and minimum signalized access spacing of 1320', depending on the classification of the arterial street (60th Street N. is not within SDDOT jurisdiction and is not currently classified in the State system). City of Sioux Falls design standards call for ¼ mile full access spacing on arterial roadways like 60th Street N., but list spacing of unsignalized partial access as "varies". Other guidelines and research recommends signalized intersections no closer than ¼ mile from interchange ramp termini, but allow unsignalized partial access at spacing less than ¼ mile.

Spacing between the I-29 northbound ramp terminal and Granite Lane is currently approximately 860' and would be slightly reduced to accommodate reconfiguration of the Exit 83 to a folded diamond interchange. Since this distance is less than the ¼ mile signalized intersection spacing requirement, Scenario 10 operations were simulated using CORSIM analysis. The analysis results, contained in **Appendix 8**, show levels of service within criteria and no queuing failures.

Environmental Impacts

The proposed interchange scenarios will be thoroughly considered in either an Environmental Assessment (EA) or Categorical Exclusion (CE) study, and a preferred alternative will be selected based on the study findings. It appears that required improvements on 60th Street N. may be constructed within the existing right-of-way for all scenarios. Reconfiguration of the Exit 83 interchange to a folded diamond (Scenarios 4, 7, 8, 9, and 10) may require additional right of

way in the southeast quadrant of the interchange. Construction of a new local street to reroute traffic in the northeast quadrant of the interchange (Scenarios 4 and 7) may require moving a constructed wetland area a short distance or purchasing wetland credits at a commercial wetland to replace the mitigated wetland. Reconfiguration of the I-29/I-90 system interchange will be addressed in a separate environmental document.

Safety

While there are currently no Crash Modification Factors (CMF's) to directly compare the safety effects of different interchange configurations, there are CMF's related to relevant aspects of the interchange design. In general, reconfiguring the Exit 83 interchange to a folded diamond interchange may produce a small number of crashes related to the new loop ramp. These crashes may be offset, however, by a reduction of crashes in the short northbound area between Exit 83 and the I-29/I-90 system interchange and by a reduction of crashes related to replacing the eastbound left turn onto the northbound on ramp with an eastbound right turn.

Specifically, changing the Exit 83 northbound on-ramp to a loop configuration is expected to increase ramp crashes by about 40%. But, the current annual crash average on the northbound ramp is 0, resulting in an expected insignificant crash increase due to the proposed change in interchange configuration.

The reconfiguration of the interchange, however, would provide an additional auxiliary lane and additional weaving distance, which could reduce crashes by about 20%. Currently, there are 1.6 crashes per year in the weaving area, which could be reduced to 1.3 crashes per year or a savings of 6 crashes over a 20-year project life (0.3 crashes per year savings x 20-year project life = 6 crashes saved).

Installing a traffic signal at Granite Lane is expected to increase rear-end crashes on 60th Street N. by a factor of 2.43. There are currently 0.6 rear-end crashes per year in that roadway segment, resulting in an expected increase to 1.5 rear-end crashes per year, or an increase of 18 crashes over a 20-year project life. Additional crashes may also accrue due to congestion between I-29 and Granite Lane.

Therefore, reconfiguration of the interchange could save 6 crashes directly, but may be offset by 18 additional crashes associated with installing a signal at 60th St. N./Granite Lane.

Operational Performance

The operations of the alternative scenarios were evaluated using appropriate level of service techniques. Performance was analyzed for forecast traffic conditions with each of the scenarios place. Results of the operational analyses are shown in **Figures 15a through 17k-4** and are summarized in **Tables 4 and 5.**

The analysis indicates that all the build scenarios result in acceptable level of service on the Interstate system. Scenarios 2 and 10 provide acceptable arterial level of service. Only Scenario 10 appears to provide an adequate solution to all criteria.

Evaluation Matrix

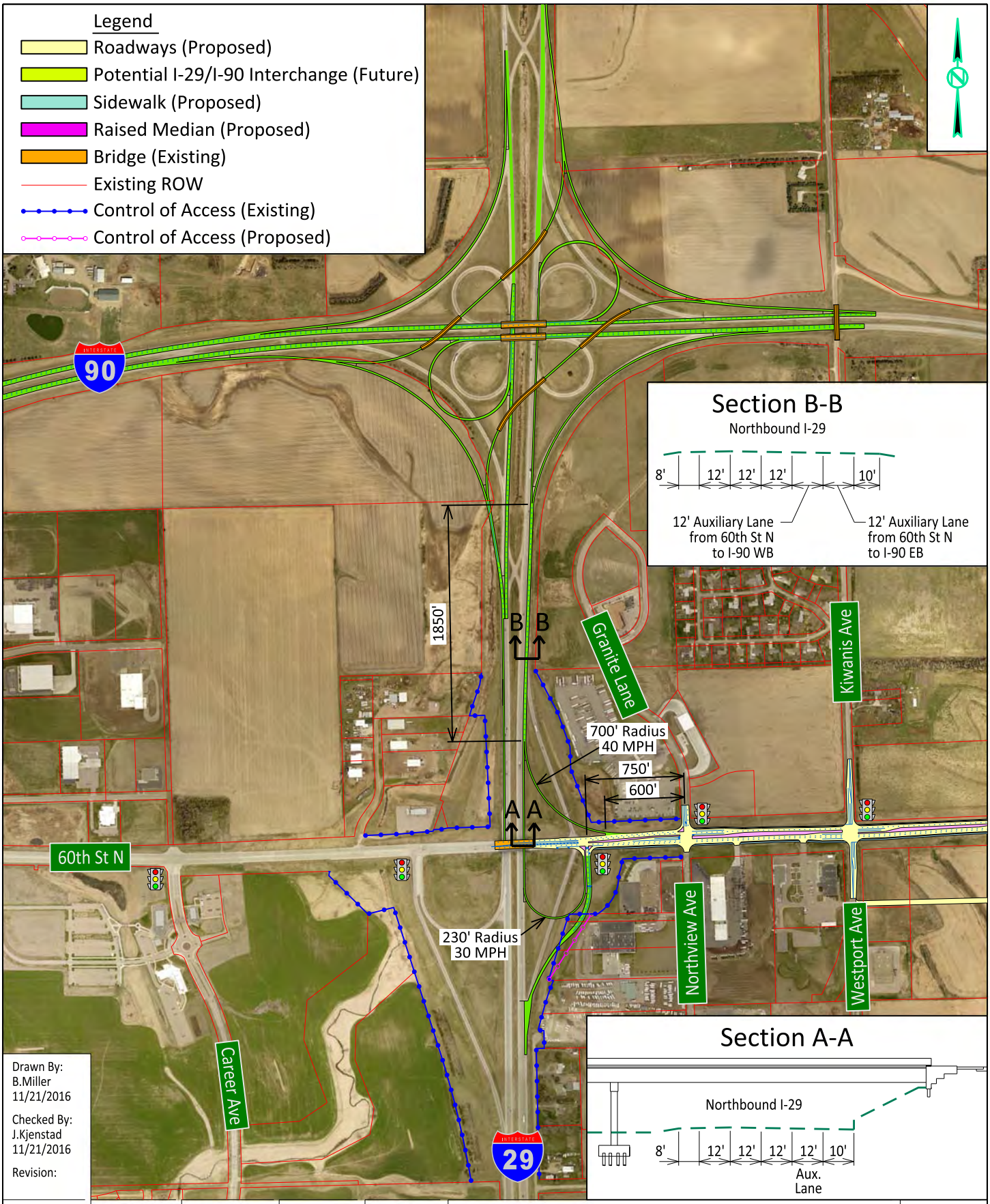
Table 6 provides a comparison of the characteristics of each of the interchange alternatives. The table shows that Scenario 10 appears to provide the best solution to the project needs.

Table 6 – Evaluation Matrix

Alternative	Conformance with Plans	Compliance with Standards	Environmental Impacts	Safety	Operational Performance
Scenario 1	No	No	Did not satisfy project need	Weaving problem remains	Doesn't meet criteria
Scenario 2	No	No	Did not satisfy project need	Weaving problem remains	OK
Scenario 3	No	Yes	Did not satisfy project need	Weaving problem remains	Doesn't meet criteria
Scenario 4	Yes	Yes	Potential ROW required	Possibly improved	Doesn't meet criteria
Scenario 5	No	No	Did not satisfy project need	Weaving problem remains	Doesn't meet criteria
Scenario 6	No	Yes	Did not satisfy project need	Weaving problem remains	Doesn't meet criteria
Scenario 7	Yes	Yes	Potential ROW required	Possibly improved	Doesn't meet criteria
Scenario 8	No	No	Did not satisfy project need; Potential ROW required	Weaving problem remains	Doesn't meet criteria
Scenario 9	No	Yes	Did not satisfy project need; Potential ROW required	Weaving problem remains	Doesn't meet criteria
Scenario 10	Yes	Yes	Potential ROW required	Weaving reduced	OK
Scenario 11	Yes	No	Potential ROW required	Weaving reduced	OK

Coordination

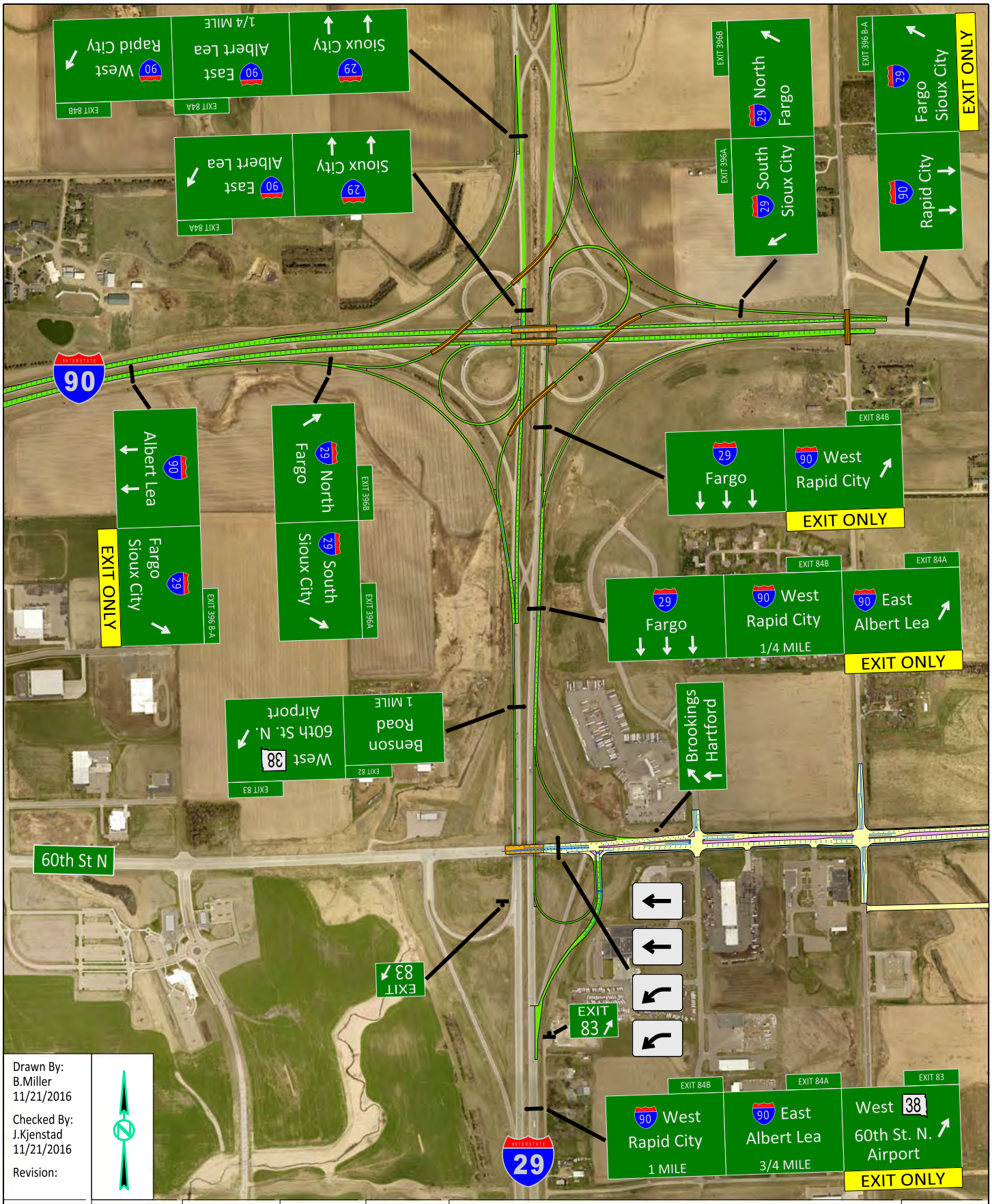
The 60th Street N. corridor, including its interchange at Interstate 29, has been the subject of agency coordination and public involvement as part of the corridor planning process, including public meetings. The potential corridor improvements have also been the subject of review and coordination through the regular meetings of the MPO committees.



Build Option (Scenario 10) Required Geometrics

I-29 Exit 83 (60th Street N) Interchange Feasibility Study — Sioux Falls, SD

Figure 18



Drawn By: B.Miller 11/21/2016

Checked By: J.Kjenstad 11/21/2016

Revision:

Build Option (Scenario 10) Signing

I-29 Exit 83 (60th Street N) Interchange Feasibility Study — Sioux Falls, SD

Figure 19

RECOMMENDATIONS

The technical analysis contained in this Interchange Feasibility Study has found that Scenario 10 provides the best technical solution for transportation needs in the study area. The preferred option will be selected as part of the completion of the environmental assessment process.

The eight considerations and requirements for Interstate access are addressed below:

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

   The proposed change is a reconfiguration of an existing interchange and improvements to the existing crossroad facility. The changes will correct current interchange and crossroad design deficiencies. The proposed change does not result in any new access points on the Interstate Highway System and the changes to the Interstate system allow for better spacing of the interchange gore locations between 60th St. N. and I-90.

2) The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities), geometric design, and alternative improvements to the Interstate with the proposed change(s) in access.

   The concept scenarios involve changes to the geometric design of an existing interchange and changes to the crossroad arterial street to satisfy current design standards and meet the transportation needs in the study area. Mass transit reaches a limited market in South Dakota and HOV facilities are currently not in use because they have not been shown to be economically feasible. Neither mass transit or HOV facilities will correct design deficiencies or provide sufficient relief to future travel demand within the study planning horizon.

3) 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, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access, shall be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network. Requests for a proposed change in access must include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute and accommodate traffic on the Interstate facility, ramps, intersection of ramps with

crossroad, and local street network. Each request must also include a conceptual plan of the type and location of the signs proposed to support each design alternative.

The operational and safety analysis contained in this study shows that the proposed build scenarios are not expected to adversely affect the safety or efficiency of the Interstate system.

The conceptual signing plans for Scenario 10 are shown in Figure 19.

4) 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 for managed lanes (e.g., transit, HOVs, HOT lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards.

The proposed access is a reconfiguration of an existing interchange with full access to an arterial city street and includes all movements. The conceptual drawings have been prepared using current standards and further design using current standards is anticipated. Additional refinement will take place during the environmental and design phases of the project.

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

The proposal is the result of land use and transportation plans prepared within the MPO process, including the Sioux Falls MPO Long Range Transportation Plan. It is anticipated that the proposed construction will be included in upcoming versions of the STIP and TIP.

6) In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan.

SDDOT has prepared a study of the I-29/I-90 system interchange and this Interchange Feasibility Study to address the close proximity between the system and service interchanges. No additional interchanges are anticipated within the study area.

7) When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements. The request must describe the commitments agreed upon to assure adequate collection and

dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point.

The area in the northeast quadrant of the interchange has been the subject of a traffic impact study that proposed the local street improvements shown in Scenarios 4 and 7. The 60th Street North corridor has been the subject of a corridor study that identified programmed improvements to 60th Street N. Developers have already made local street improvements in the northeast quadrant of the interchange and the City and SDDOT have committed to improvement projects on 60th Street N.

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

The scenarios developed in this Interchange Feasibility Study will serve as the technical basis for the environmental assessment or categorical exclusion process. The EA or CE is expected to be completed to comply with future programming and funding.

Implementation Plan

The analysis in this and previous studies has identified the following future actions will be needed to provide the desired level of transportation service in the future in the study area:

- Revise the I-90/I-29 system interchange to provide westbound-to-southbound and eastbound-to-northbound flyover ramps.
- Revise the 60th Street N. service interchange as shown in Scenario 10.
- Revise the 60th Street N. arterial corridor to provide additional future capacity.
- Signalize the 60th Street N./Granite Lane intersection.

The SDDOT and City of Sioux Falls each bear responsibility for these future or related actions. The SDDOT responsibilities include:

- Revise the I-90/I-29 system interchange, including updated planning, programming, funding, design and construction.
- Revise the 60th Street N. service interchange, including updated planning, programming, funding, design and construction.

The City of Sioux Falls responsibilities include:

- Provide signalization at the 60th St. N./Granite Ln. intersection, subject to Federal, State, and Local regulations and requirements.
- Revise the 60th Street N. arterial corridor, including programming, funding, design and construction.
- Work with developers to address access needs:
  - If the Redstone Village development desires to proceed with revision of the I-29 NB/60th St. N. ramp terminal, the City will facilitate the improvement, but costs will be borne by the developer.
  - Provide alternate access roads, as recommended in previous plans.

Tentative programming for these improvements is as follows:

Short-term (0-5 years):

- Signalize 60th St. N./Granite Ln.
- City improvements on 60th St. N.

Mid-term (5-10 years):

- Improvements on Granite Ln.

Long-term(longer than 10 years):

- Improvements to the I-29/60th St. N. interchange
- Improvements to the I-29/I-90 interchange

APPENDIX

1 – 2014 Interstate Level of Service

2 – 2014 Crossroad Level of Service

3 – 2045 Interstate Level of Service

4 – 2045 Crossroad Level of Service

5 – Interchange Area Air Photos

6 – 60th St. N. Environmental Review

7 – Intersection Spacing Analysis

8 – Methods and Assumptions Document