Metro Area Travel Improvement Study

MAPA-D2(105), CN 22547

Sarpy County I-80 Interchange Assessment

April 2017

Introduction

This Sub-Area operations assessment memorandum details the potential need for a new interchange along I-80 in Sarpy County. The premise for this evaluation is the assumption that a new interchange will not be approved for I-80 unless it is shown that the adjacent interchanges will not be able to serve future traffic demands. This traffic operations assessment was conducted for ramp terminals at N-31, N-370, and N-50.

Methodologies

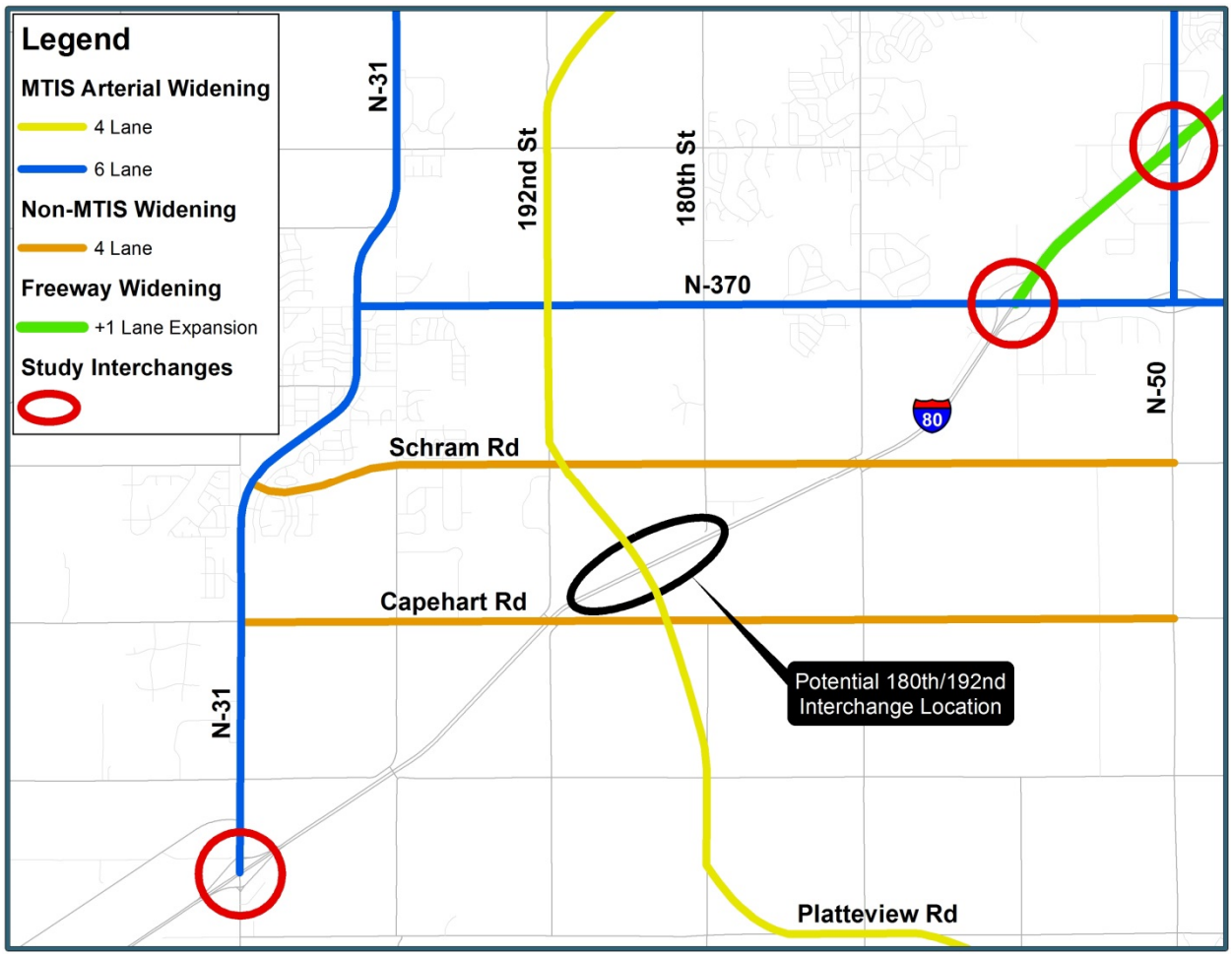
Study Area Network

As directed by the Management Team, the roadway network used to develop future year traffic volumes is shown in **Figure 1**. This roadway network included all projects selected for the Metro Area Travel Improvement Study (MTIS) preferred regional strategy package with the addition of two non-MTIS projects on Schram Road and Capehart Road. It was determined through technical analyses and discussions with MAPA and Sarpy County staff that these non-MTIS projects would be required to support mobility in the area given the development growth.

Volume Development

Traffic counts were collected from NDOR at the N-31, N-370, and N-50 interchanges and at adjacent intersections. The traffic volumes were evaluated and balanced along each corridor for the AM and PM peak hours. Peak hour volumes were developed using existing segment Average Daily Traffic (ADT) in combination with the Metro Area Planning Agency (MAPA) 2040 travel demand model output. Peak hour volumes are shown in the analysis figures in the appendix.

Figure 1. Study Area Network



Level of Service

Level of Service (LOS) analyses for the ramp terminal intersections were performed using procedures from Chapter 18 procedures of the Highway Capacity Manual 2010 Edition (HCM 2010). Highway Capacity Software 2010 (HCS 2010) version 6.50, a computerized analytical tool based on the HCM, was utilized for the intersection operational analysis. LOS for signalized intersections is evaluated based on control delay per vehicle (in seconds per vehicle).

Note that the HCM 2010 does not have a standard methodology to analyze all types of interchange configurations. A supplemental methodology was developed by the consultant team that analyzes a Diverging Diamond Interchange (DDI) by redistributing traffic at the ramp terminals to replicate the non-conflicting left and right turns that occur at the interchange.

Signalized intersection LOS delay thresholds are shown in **Table 1**.

Table 1. Delay Thresholds for Signalized Intersections

LOS	Control Delay (seconds/vehicle)
A	<10
B	>10-20
C	>20-35
D	>35-55
E	>55-80
F	>80

Results

LOS performance measure targets have been established for MTIS. The threshold for acceptable HCM operations for the overall intersection is LOS 'D' or better. The threshold for acceptable HCM operations for individual movements at each intersection is LOS 'E' or better. If the overall intersection or individual movement LOS thresholds are not met, they are noted in the analysis figures by highlighting the intersection or individual movement in red text. Note that all lane configurations for the analysis interchanges can be found in the appendix.

Year 2040 Without 180th/192nd Interchange Traffic Operations

This section covers traffic operations at the existing interchanges in the sub-area. It is assumed that all projects shown in **Figure 1** are complete except the 180th/192nd interchange.

No-Build Traffic Operations

The HCM LOS results for the No-Build Traffic Operations are shown in **Table 2**. Note that the planned widening projects included in **Figure 1** are assumed to be in place for the no-build scenario. For example, N-370 is assumed to be widened to a 6 lane section through the interchange with the number of turn lanes that exist today staying the same.

Table 2. Year 2040 No-Build Operations without 180th/192nd Interchange HCM LOS

Intersection	AM LOS	PM LOS
N-31 & I-80 WB	B	E*
N-31 & I-80 EB	E*	E*
N-370 & I-80 WB	F*	F*
N-370 & I-80 EB	F*	F*
N-50 & I-80 WB	E*	D*
N-50 & I-80 EB	B*	D*

** Failing Individual Movement(s)*

Note that the No-Build HCM LOS for N-31 assumes re-striping the WB off-ramp to dual rights.

Build Traffic Operations

This section's purpose is to address the deficiencies identified in the No-Build without 180th/192nd Interchange section through various interchange reconfigurations including:

- Diamond Interchange Expansion (through additional turn lanes)
- Diverging Diamond Interchange (DDI)
- Partial Cloverleaf Interchange (Parclo)

The HCM LOS results for the interchange reconfigurations are shown in **Table 3**.

Table 3. Year 2040 Interchange Reconfiguration Operations without 180th/192nd Interchange HCM LOS

Intersection	Diamond Interchange Expansion		Diverging Diamond Interchange		Partial Cloverleaf Interchange	
	AM LOS	***PM LOS***	***AM LOS***	***PM LOS***	***AM LOS***	***PM LOS***
N-31 & I-80 WB	C	C	B	B	C	C
N-31 & I-80 EB	F*	D	B	B	F*	C
N-370 & I-80 WB	F*	F*	E*	D*	F*	F*
N-370 & I-80 EB	F*	E*	B	B	B	B
N-50 & I-80 WB	C	B	C	B	B	C
N-50 & I-80 EB	B	C	C	B	B	B

** Failing Individual Movement(s)*

Year 2040 without 180th/192nd Interchange Summary

- N-31: A DDI will be needed to provide acceptable LOS in 2040. See **Figure A5** for lane configurations and LOS.
- N-370: A DDI configuration provides the best LOS compared to the other interchange configurations in 2040. Failing movements exist at the interchange and overall intersection LOS 'E' exists in the AM peak hour. See **Figure A8** for lane configurations and LOS.
- N-50: A standard diamond, Parclo, and DDI all provide acceptable LOS in 2040, but a DDI will provide a longer operational life. See **Figures A10, A11, and A12** for lane configurations and LOS.

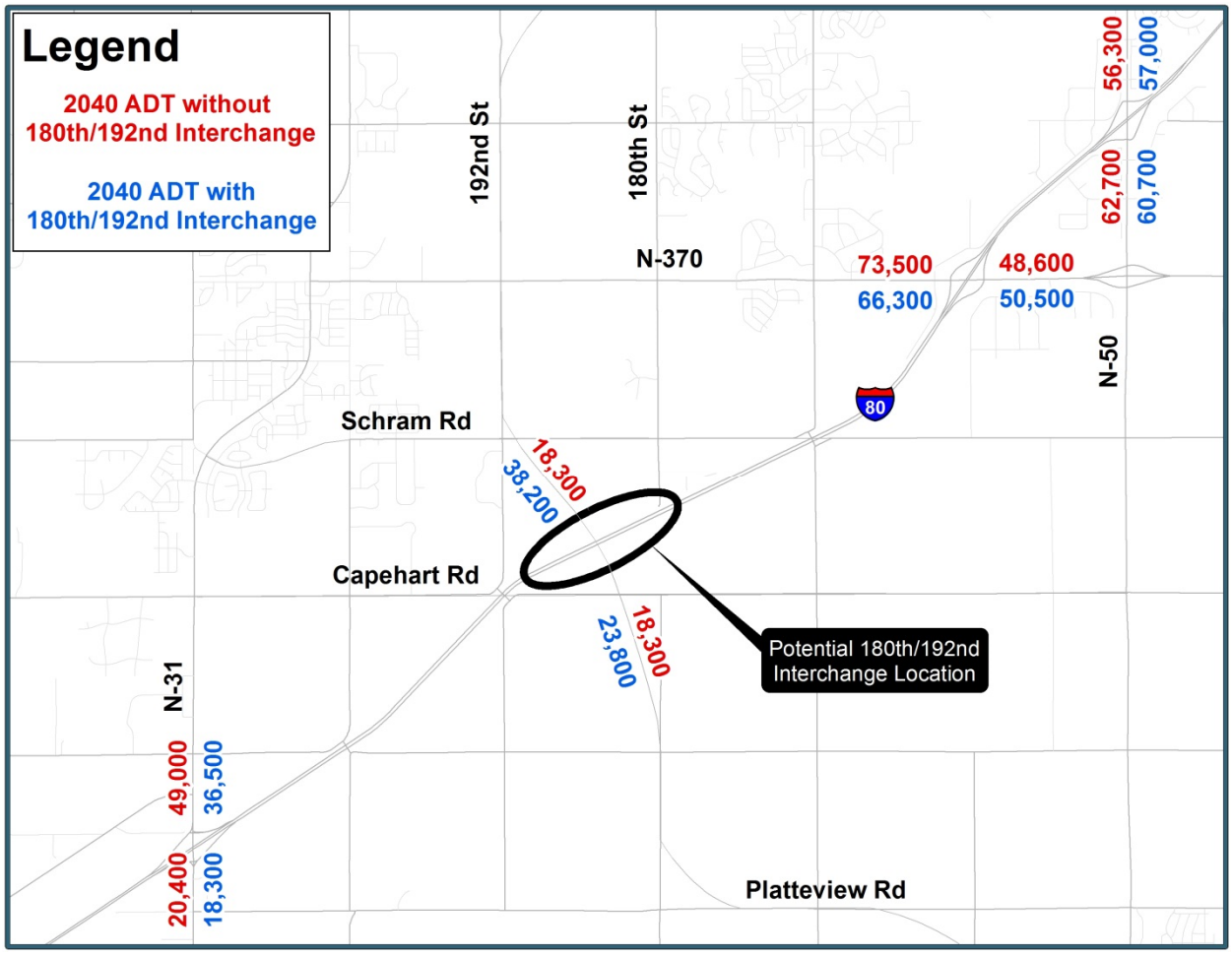
Year 2040 Traffic Operations with 180th/192nd Interchange

This section covers traffic operations at the existing interchanges and the proposed 180th/192nd interchange. It is assumed that all projects shown in **Figure 1** are complete including the 180th/192nd interchange.

Average Daily Traffic Comparison

Year 2040 forecasted ADTs were compared at the service interchanges between the (with and without) 180th/192nd Interchange scenarios. The 2040 forecasts are shown in **Figure 2**.

Figure 2. Year 2040 ADT Forecast Comparison



No-Build Traffic Operations

The HCM LOS results for the No-Build Traffic Operations are shown in **Table 4**.

Table 4. Year 2040 No-Build Operations with 180th/192nd Interchange HCM LOS

Intersection	AM LOS	PM LOS
N-31 & I-80 WB	A	C
N-31 & I-80 EB	B	C
N-370 & I-80 WB	F*	F*
N-370 & I-80 EB	F*	F*
N-50 & I-80 WB	E*	D*
N-50 & I-80 EB	C*	C*

** Failing Individual Movement(s)*

Build Traffic Operations

The HCM LOS results for the interchange reconfigurations are shown in **Table 5**.

Table 5. Year 2040 Interchange Reconfiguration Operations with 180th/192nd Interchange HCM LOS

Intersection	Diamond Interchange Expansion		Diverging Diamond Interchange		Partial Cloverleaf Interchange	
	AM LOS	*PM LOS*	*AM LOS*	*PM LOS*	*AM LOS*	*PM LOS*
N-370 & I-80 WB	E*	E*	B	C	D*	C
N-370 & I-80 EB	F*	F*	B	B	B	B
N-50 & I-80 WB	B	B	B	B	B	C
N-50 & I-80 EB	B	C	B	B	B	B
180th/192nd & I-80 WB	A	C	B	B	A	C
180th/192nd & I-80 EB	C	B	B	B	A	A

** Failing Individual Movement(s)*

Note that the N-31 interchange was not analyzed with interchange reconfigurations since the existing configuration provides acceptable LOS.

Year 2040 with 180th/192nd Interchange Summary

- The 180th/192nd Interchange primarily relieves congestion on N-31 & N-370
  - The 180th/192nd Interchange pulls enough daily traffic from N-31 to minimize the need for a 6 lane widening from N-370 to US-6 from the MTIS preferred regional strategy package.
- Interchange Fixes
  - N-31: No reconstruction will be needed at the N-31 interchange to accommodate Year 2040 peak hour volumes. See **Figure A13** for lane configurations and LOS.
  - N-370: A DDI will be needed to provide acceptable LOS in 2040. See **Figure A17** for lane configurations and LOS.
  - N-50: A standard diamond, Parclo, and DDI all provide acceptable LOS in 2040. See **Figures A19, A20, and A21** for lane configurations and LOS.
- 180th/192nd New Interchange: A standard diamond, DDI, and Parclo all provide acceptable LOS. See **Figures A22, A23, and A24** for lane configurations and LOS.

Next Steps

This traffic operations assessment identified the need for a new interchange between N-370 and N-31 along I-80. However, a more detailed Interchange Justification Report (IJR) would be required for a new interchange on I-80.

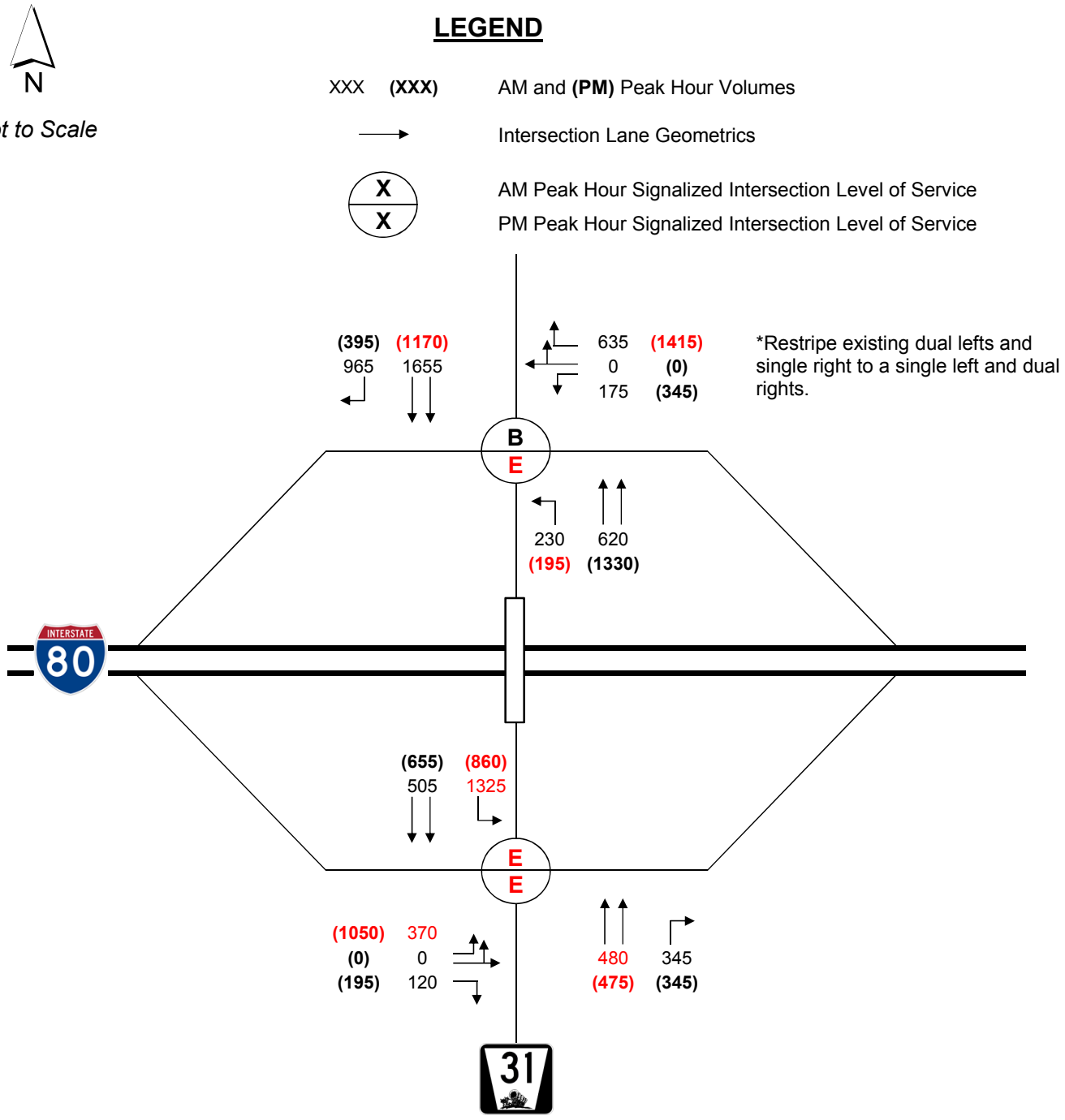
Appendix

Year 2040 without 180th/192nd Interchange

- **Figure A1**: N-31 No-Build
- **Figure A2**: N-370 No-Build
- **Figure A3**: N-50 No-Build
- **Figure A4**: N-31 Build Diamond Interchange Expansion
- **Figure A5**: N-31 Build DDI
- **Figure A6**: N-31 Build Parclo
- **Figure A7**: N-370 Build Diamond Interchange Expansion
- **Figure A8**: N-370 Build DDI
- **Figure A9**: N-370 Build Parclo
- **Figure A10**: N-50 Build Diamond Interchange Expansion
- **Figure A11**: N-50 Build DDI
- **Figure A12**: N-50 Build Parclo

Year 2040 with 180th/192nd Interchange

- **Figure A13**: N-31 No-Build
- **Figure A14**: N-370 No-Build
- **Figure A15**: N-50 No-Build
- **Figure A16**: N-370 Build Diamond Interchange Expansion
- **Figure A17**: N-370 Build DDI
- **Figure A18**: N-370 Build Parclo
- **Figure A19**: N-50 Build Diamond Interchange Expansion
- **Figure A20**: N-50 Build DDI
- **Figure A21**: N-50 Build Parclo
- **Figure A22**: 180th/192nd New Interchange (Diamond Configuration)
- **Figure A23**: 180th/192nd New Interchange (DDI Configuration)
- **Figure A24**: 180th/192nd New Interchange (Parclo Configuration)



Notes:
1. LOS 'F' movements shown in Red
2. LOS may be worse due to metered volumes upstream.

Sources:
1. Traffic Volumes - Developed by HDR using MAPA 2040 Travel Model (February 2017).
2. Traffic Capacity Analysis (HCS 2010) - Conducted by HDR (February 2017).

Metro Area Travel Improvement Study

Sarpy County I-80 Interchange Assessment

Year 2040 without 180th/192nd Interchange

N-31 No-Build
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

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Figure
A1

LEGEND

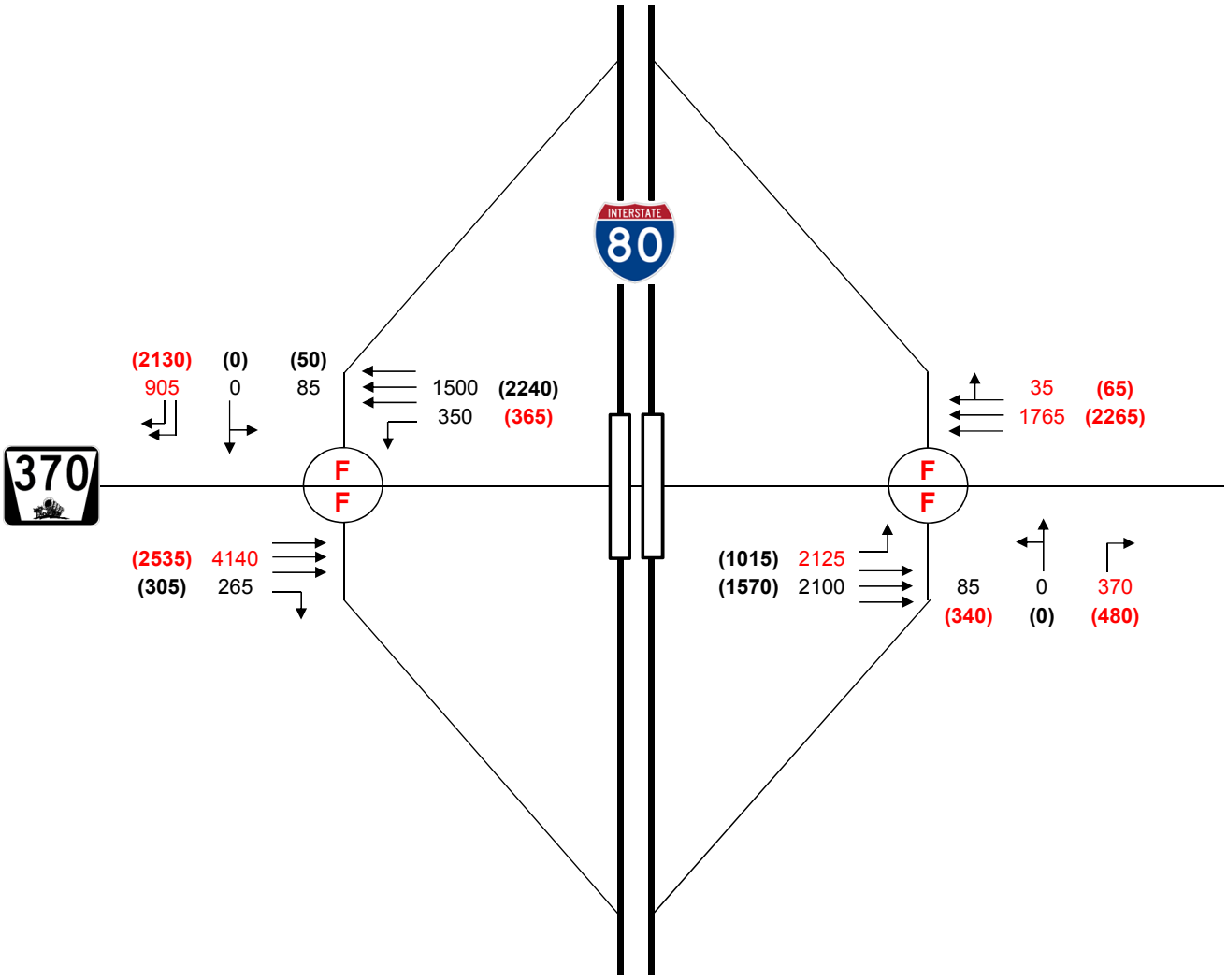
N

Not to Scale

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

Intersection Lane Geometrics

X / X — AM Peak Hour Signalized Intersection Level of Service; PM Peak Hour Signalized Intersection Level of Service



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Sarpy County I-80 Interchange Assessment

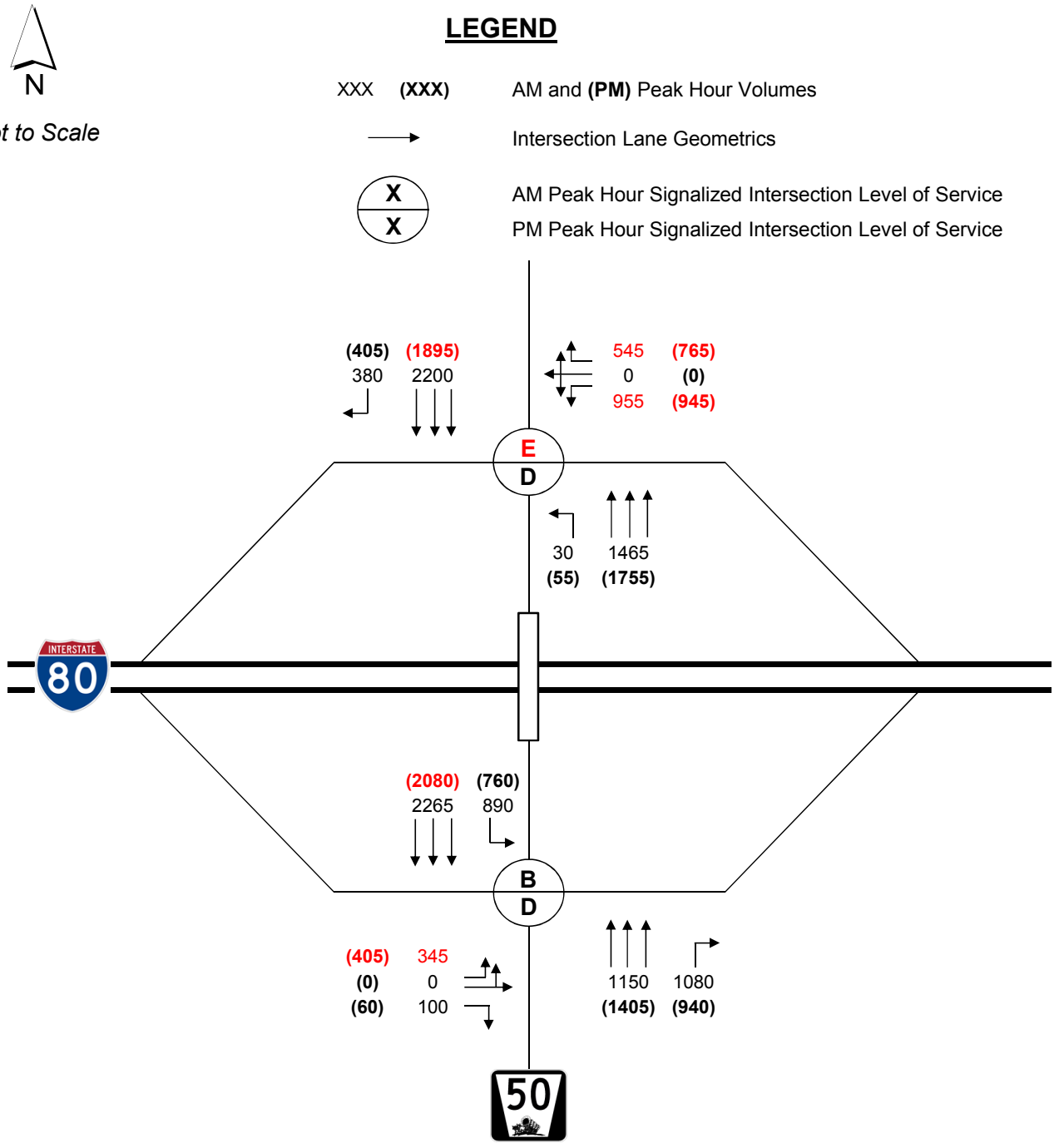
Year 2040 without 180th/192nd Interchange

N-370 No-Build
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
April 2017

Figure
A2



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Sarpy County I-80 Interchange Assessment

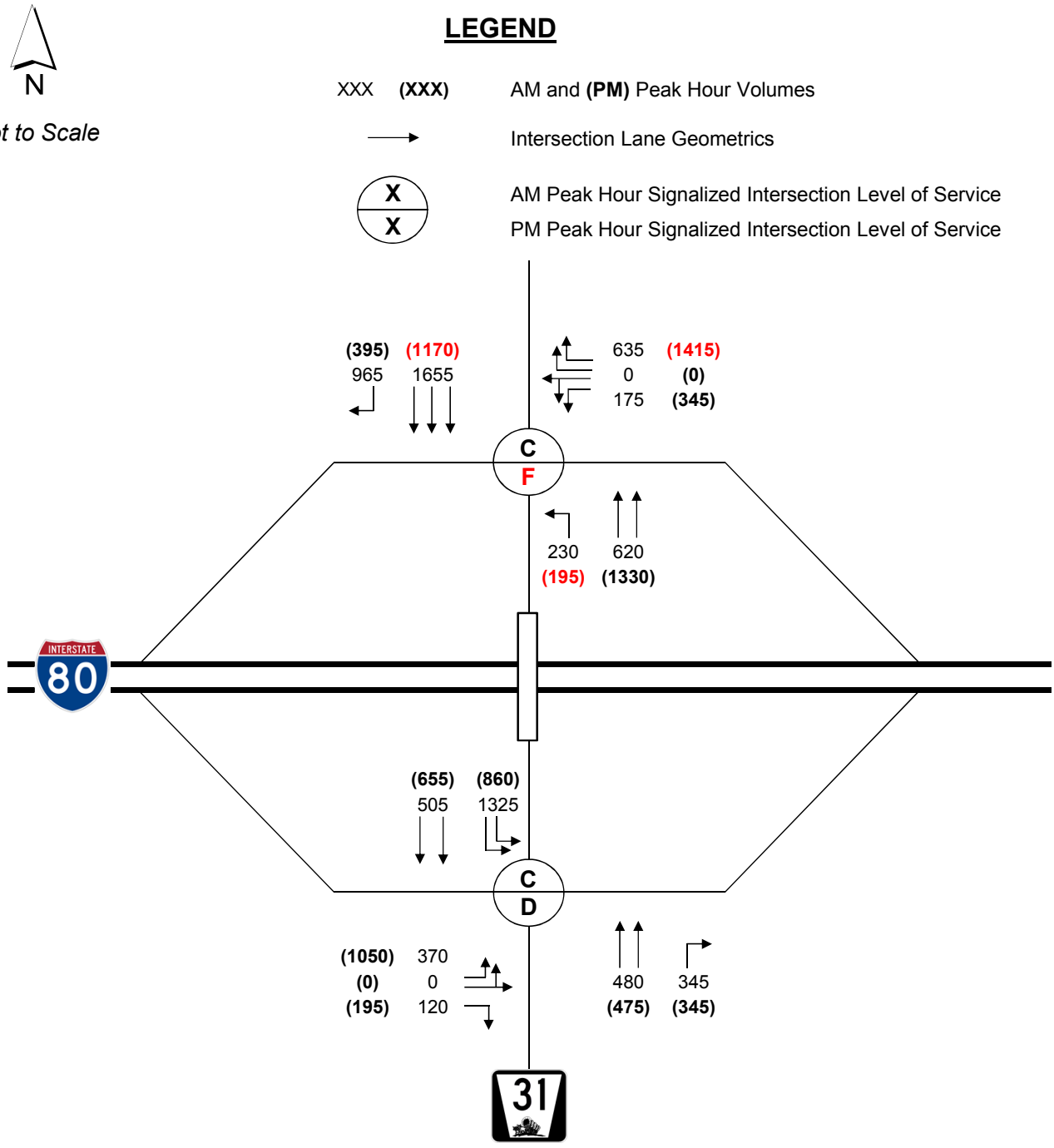
Year 2040 without 180th/192nd Interchange

N-50 No-Build
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
April 2017

Figure
A3



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Sarpy County I-80 Interchange Assessment

Year 2040 without 180th/192nd Interchange

N-31 Build Diamond Interchange Expansion
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

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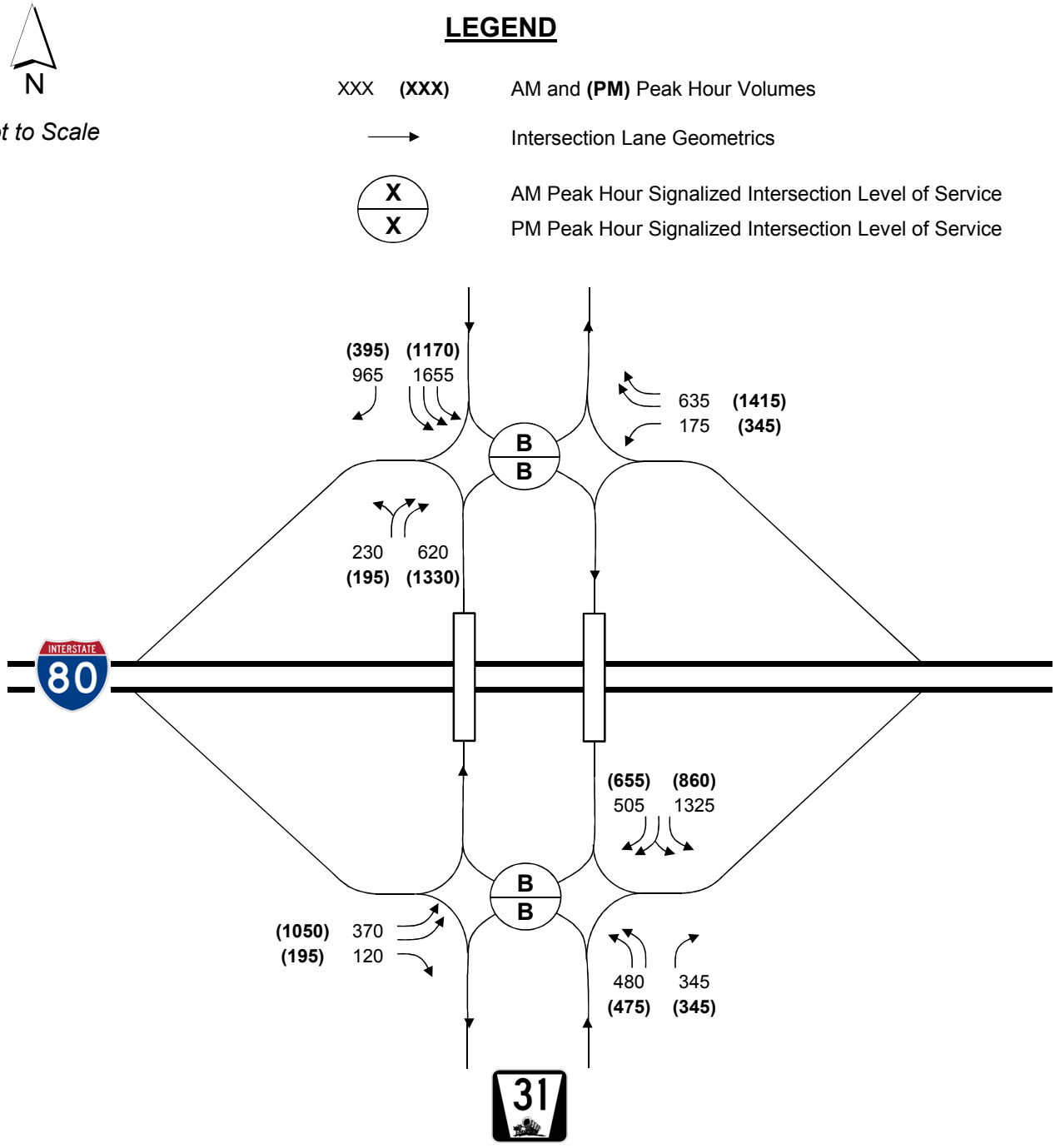
Figure
A4



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Sarpy County I-80 Interchange Assessment

Year 2040 without 180th/192nd Interchange

N-31 Build Diverging Diamond Interchange
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

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Figure
A5

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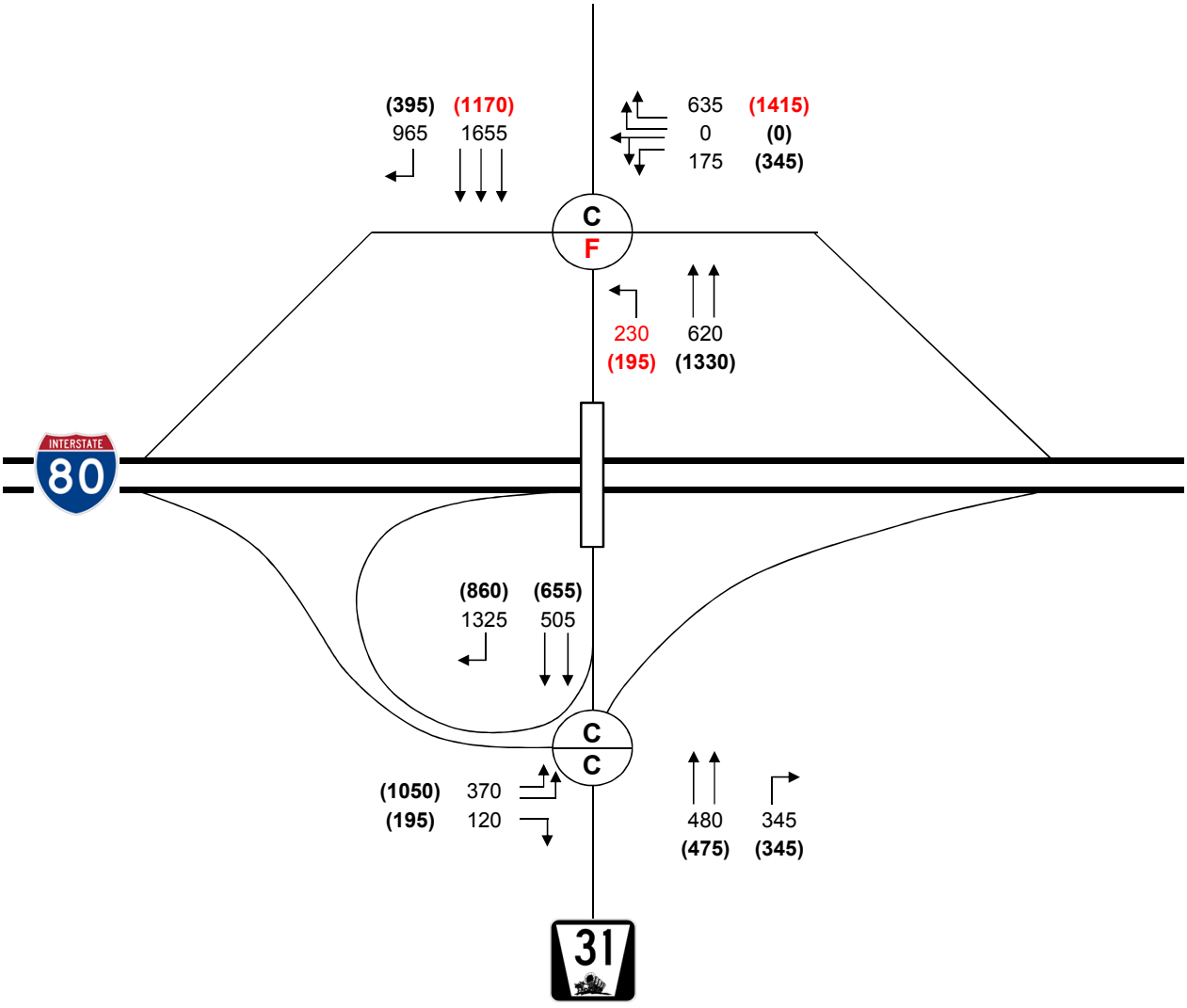
XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

Intersection Lane Geometrics

X / X — AM Peak Hour Signalized Intersection Level of Service / PM Peak Hour Signalized Intersection Level of Service



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Sarpy County I-80 Interchange Assessment

Year 2040 without 180th/192nd Interchange

N-31 Build Partial Cloverleaf Interchange
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
April 2017

Figure
A6

N

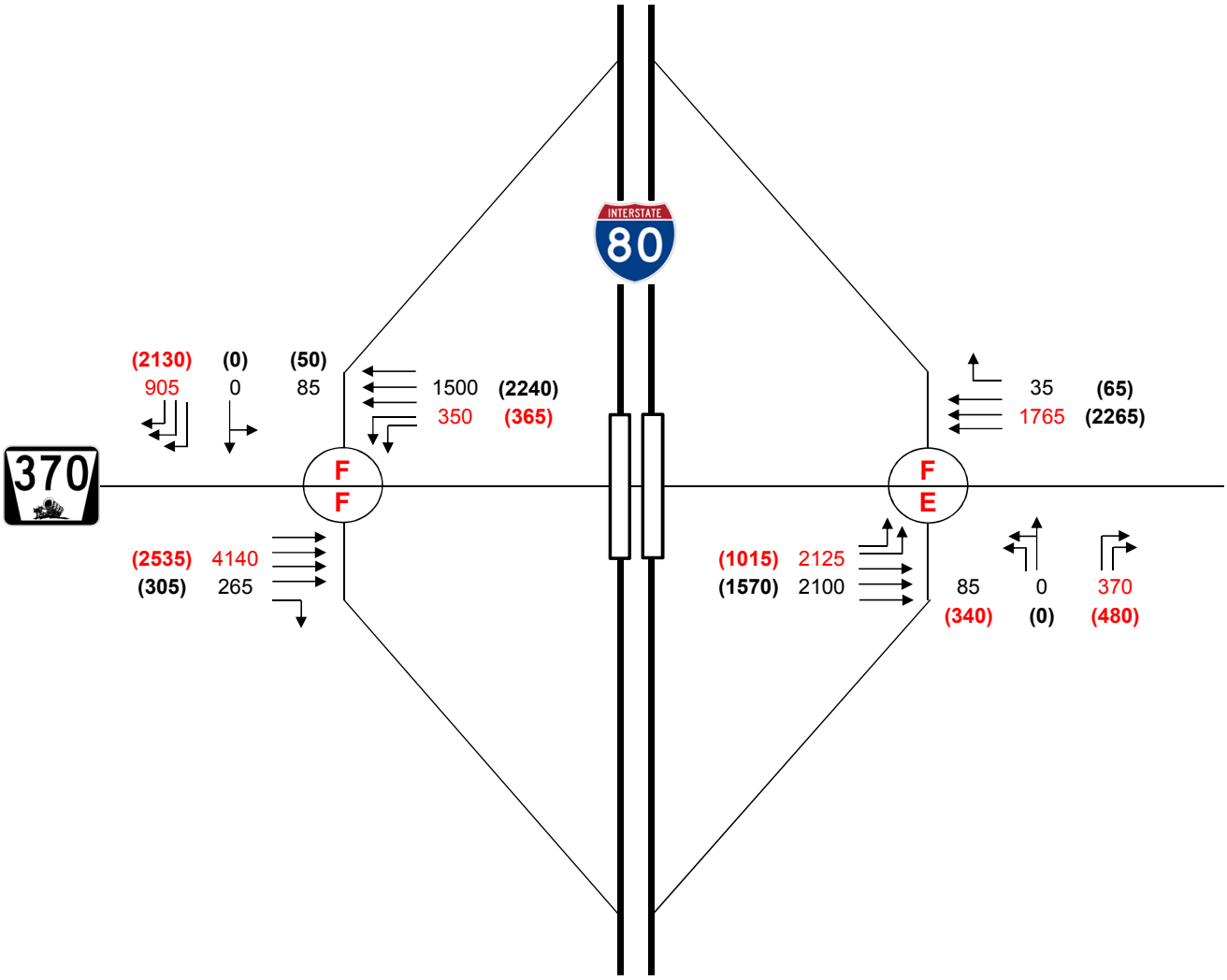
Not to Scale

LEGEND

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

Intersection Lane Geometrics

X / X — AM Peak Hour Signalized Intersection Level of Service; PM Peak Hour Signalized Intersection Level of Service



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Metro Area Travel Improvement Study

Sarpy County I-80 Interchange Assessment

Year 2040 without 180th/192nd Interchange

N-370 Build Diamond Interchange Expansion
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
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Figure
A7

N

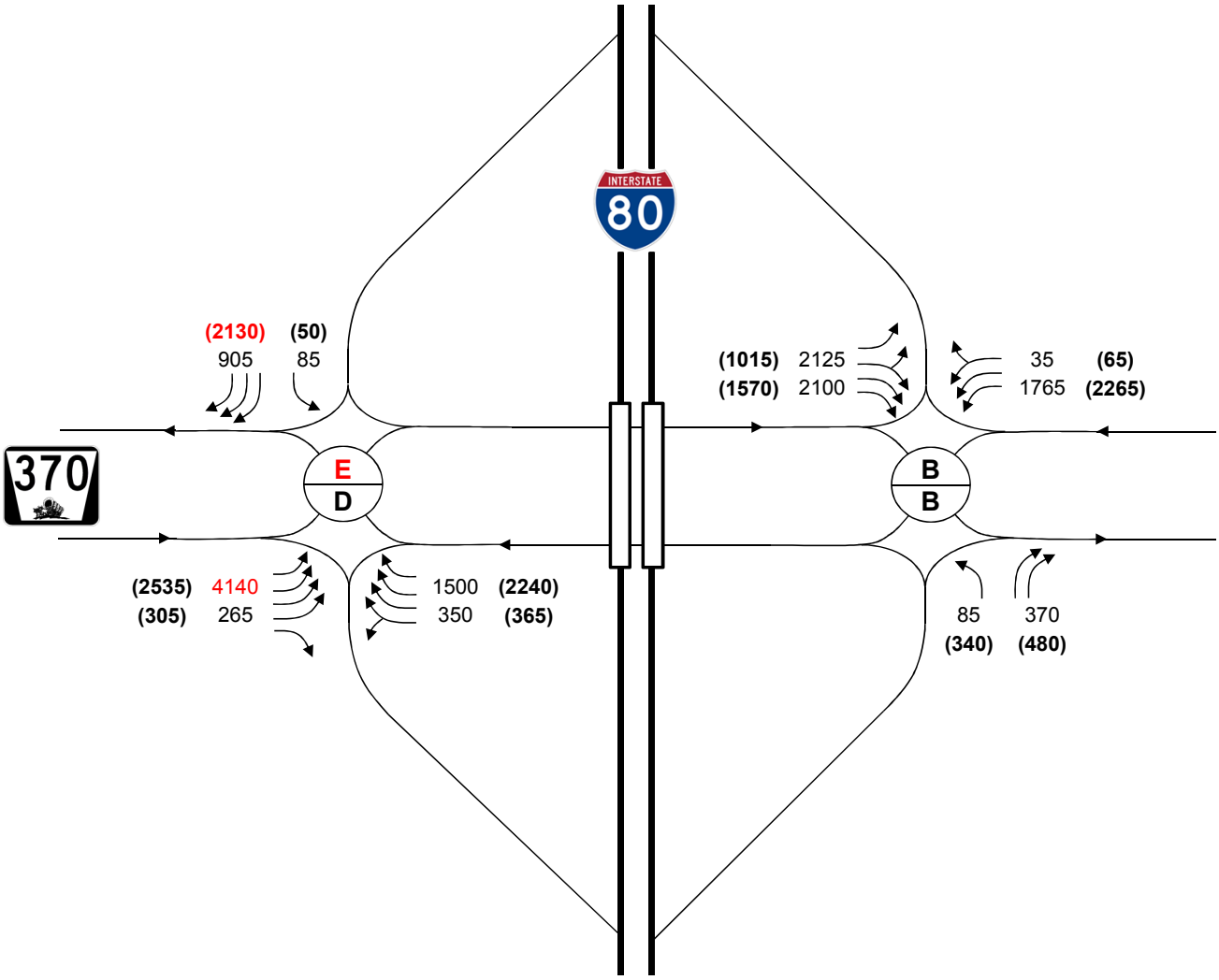
Not to Scale

LEGEND

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

Intersection Lane Geometrics

X / X — AM Peak Hour Signalized Intersection Level of Service / PM Peak Hour Signalized Intersection Level of Service



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Sarpy County I-80 Interchange Assessment

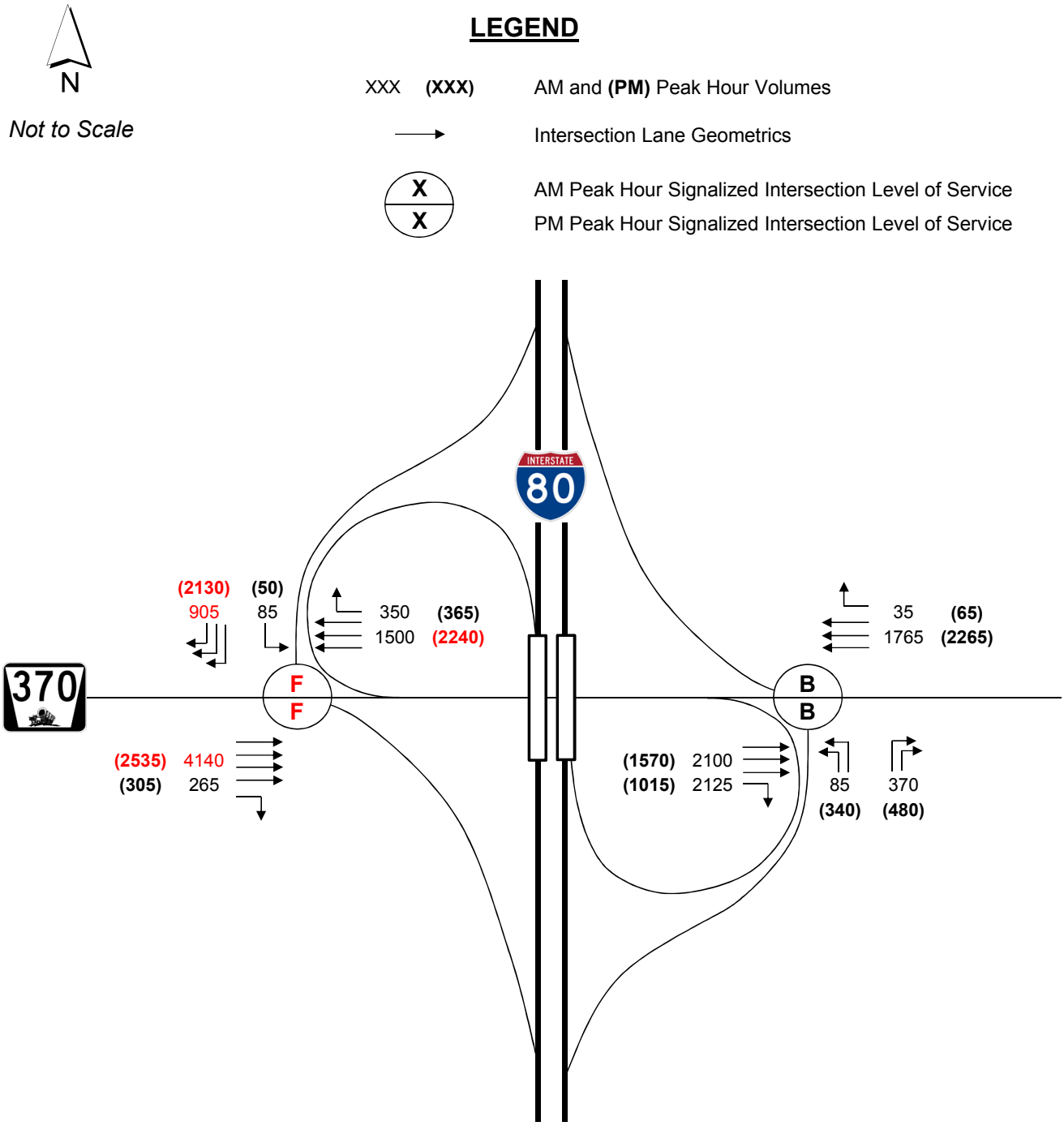
Year 2040 without 180th/192nd Interchange

N-370 Build Diverging Diamond Interchange
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
April 2017

Figure
A8



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Metro Area Travel Improvement Study

Sarpy County I-80 Interchange Assessment

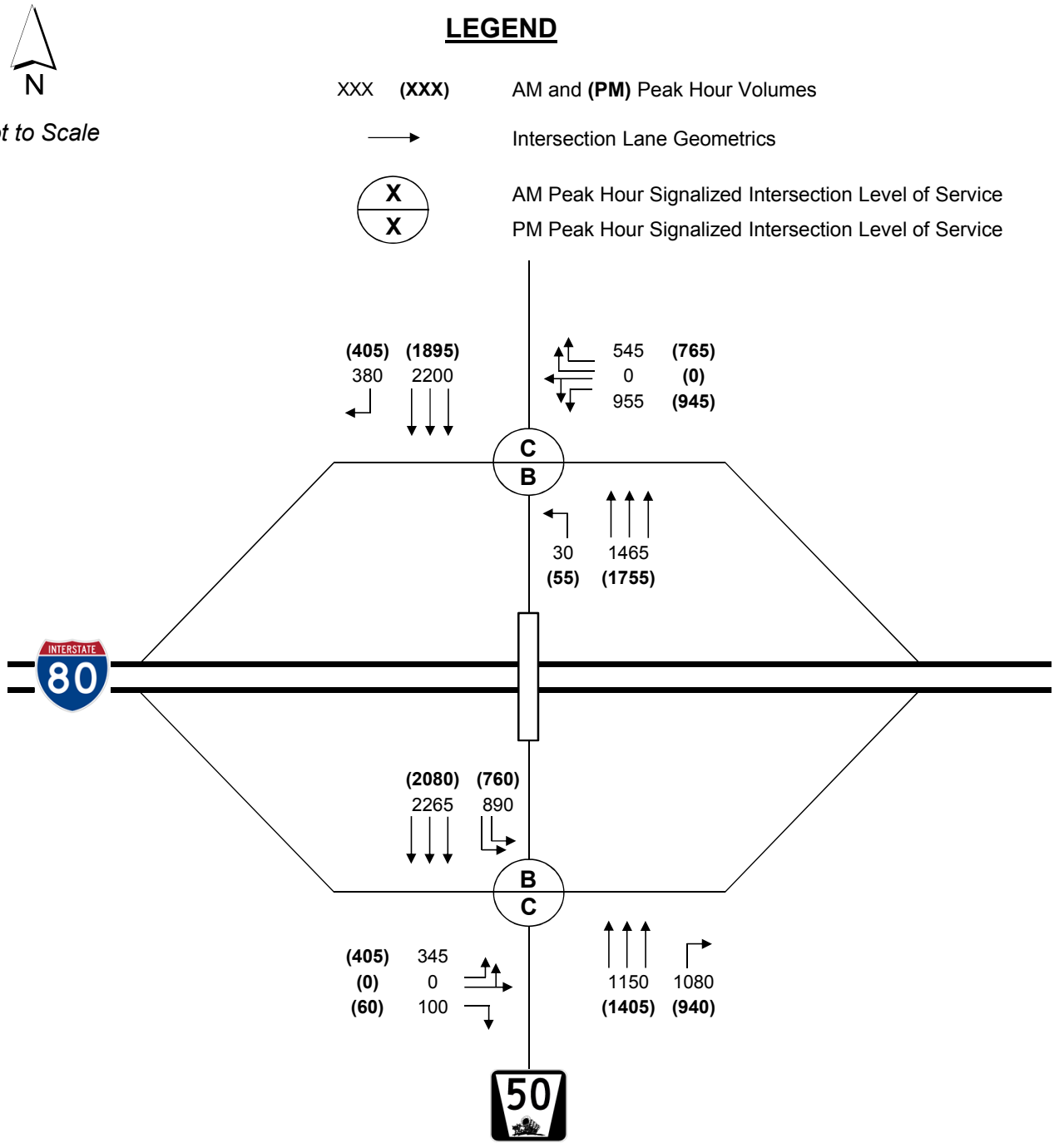
Year 2040 without 180th/192nd Interchange

N-370 Build Partial Cloverleaf Interchange
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
April 2017

Figure
A9



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Sarpy County I-80 Interchange Assessment

Year 2040 without 180th/192nd Interchange

N-50 Build Diamond Interchange Expansion
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
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Figure
A10

N

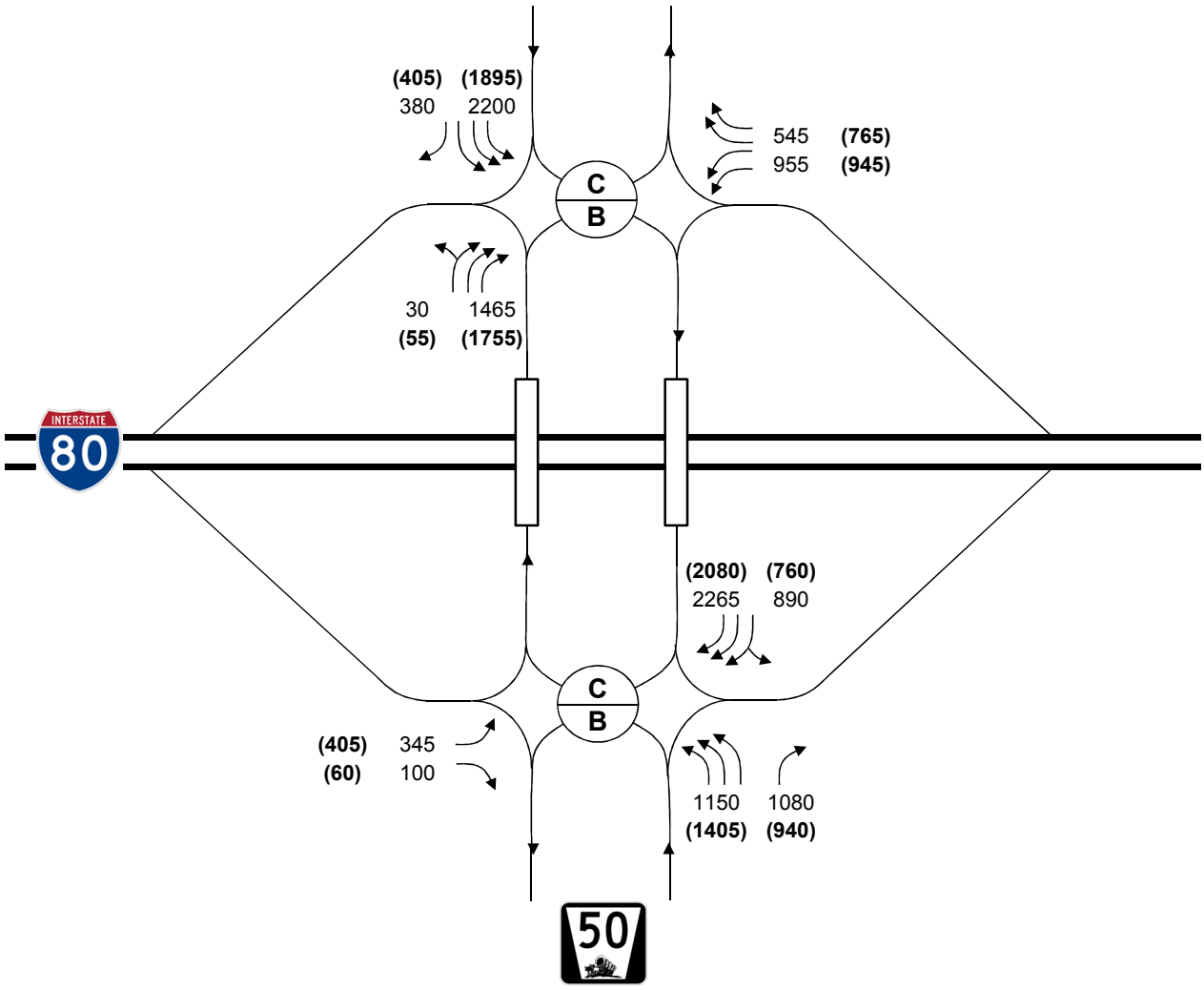
Not to Scale

LEGEND

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

Intersection Lane Geometrics

X / X — AM Peak Hour Signalized Intersection Level of Service; PM Peak Hour Signalized Intersection Level of Service



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Metro Area Travel Improvement Study

Sarpy County I-80 Interchange Assessment

Year 2040 without 180th/192nd Interchange

N-50 Build Diverging Diamond Interchange
Traffic Volumes and Operations Analysis Results

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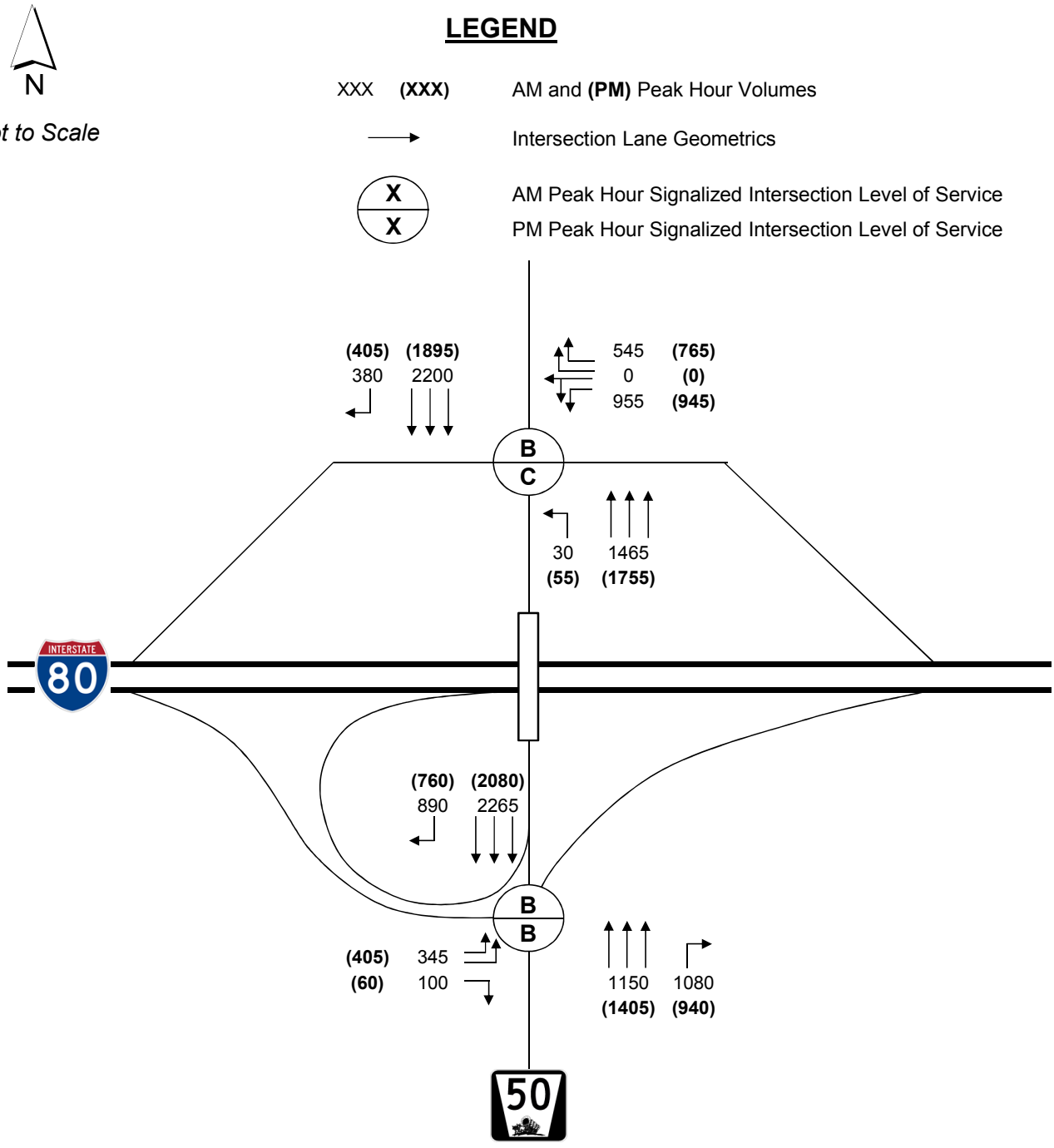
Figure
A11



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Sarpy County I-80 Interchange Assessment

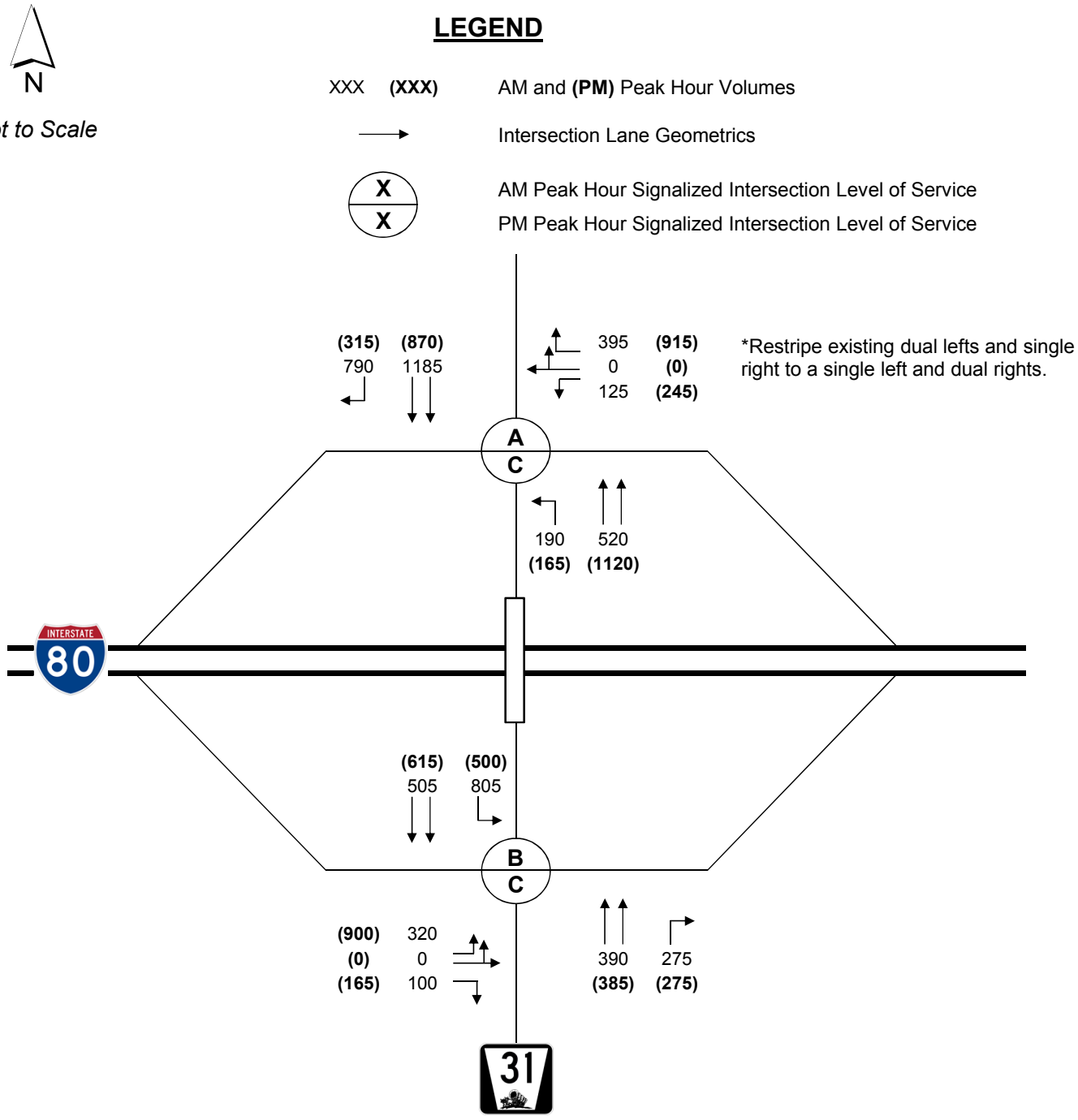
Year 2040 without 180th/192nd Interchange

N-50 Build Partial Cloverleaf Interchange
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
April 2017

Figure
A12



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Metro Area Travel Improvement Study

Sarpy County I-80 Interchange Assessment

Year 2040 with 180th/192nd Interchange

N-31 No-Build
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

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Figure
A13

LEGEND

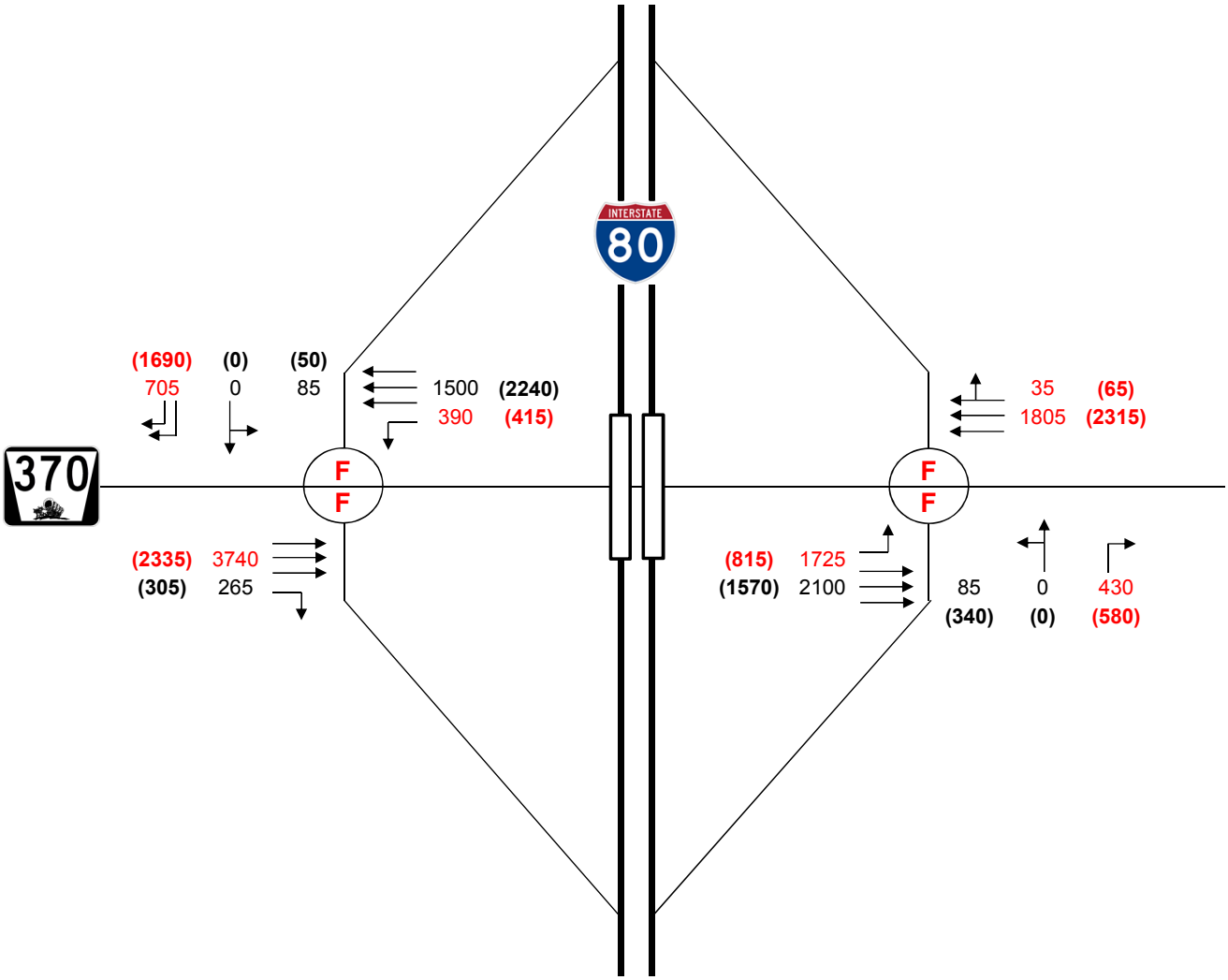
N

Not to Scale

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

Intersection Lane Geometrics

X / X — AM Peak Hour Signalized Intersection Level of Service; PM Peak Hour Signalized Intersection Level of Service



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Metro Area Travel Improvement Study

Sarpy County I-80 Interchange Assessment

Year 2040 with 180th/192nd Interchange

N-370 No-Build
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
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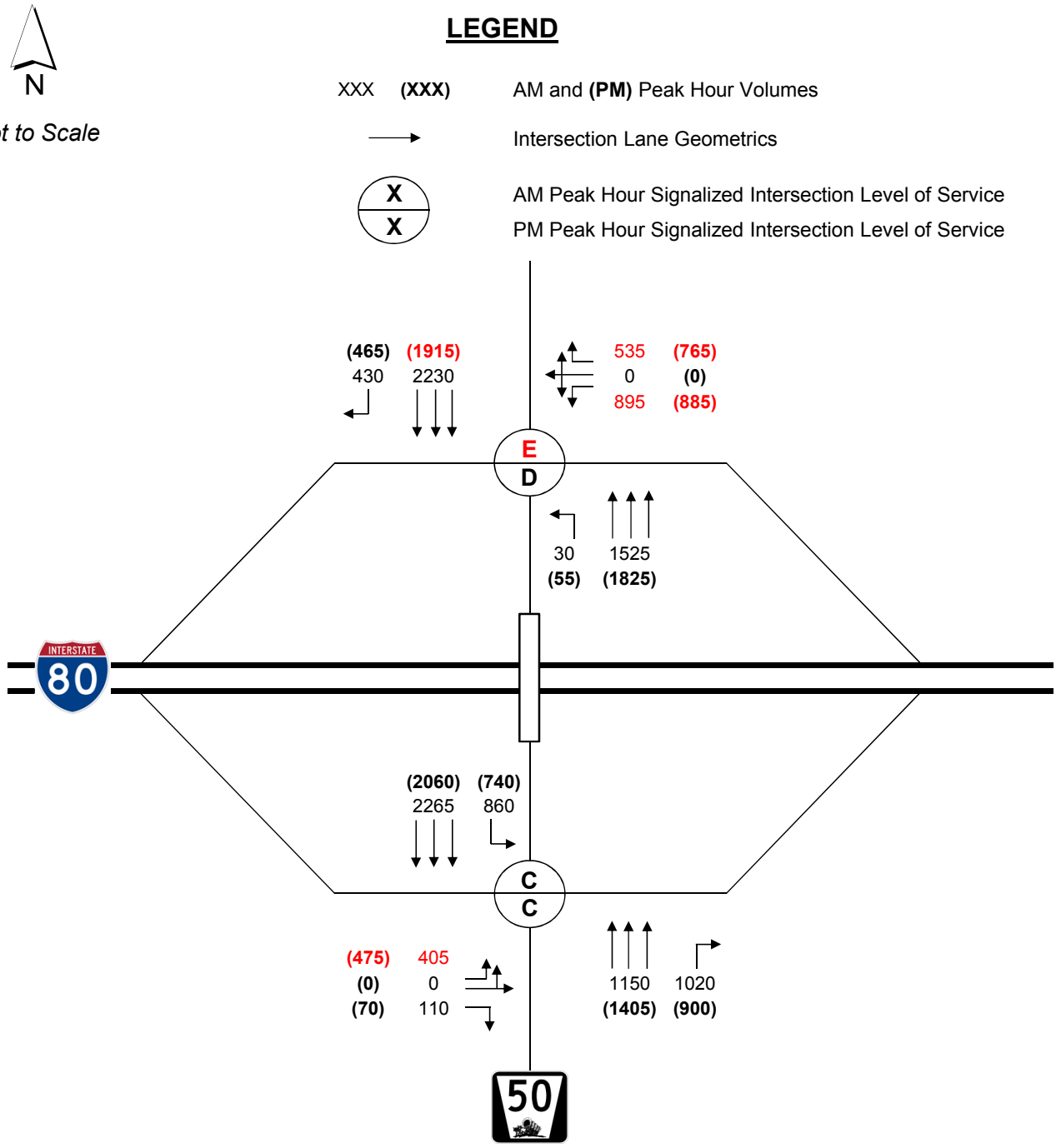
Figure
A14



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Metro Area Travel Improvement Study

Sarpy County I-80 Interchange Assessment

Year 2040 with 180th/192nd Interchange

N-50 No-Build
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

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Figure
A15

LEGEND

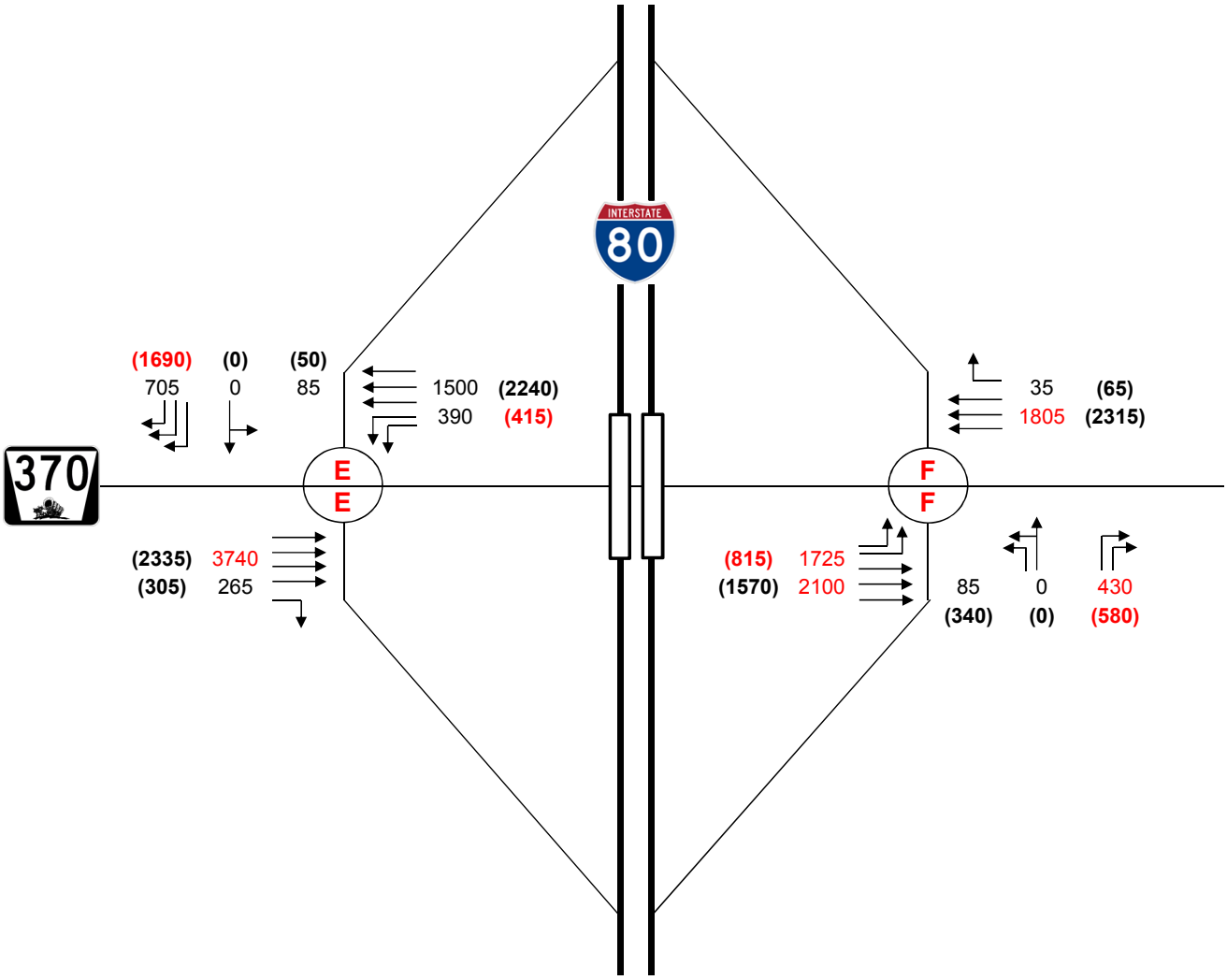
N

Not to Scale

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

Intersection Lane Geometrics

X / X — AM Peak Hour Signalized Intersection Level of Service / PM Peak Hour Signalized Intersection Level of Service



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Metro Area Travel Improvement Study

Sarpy County I-80 Interchange Assessment

Year 2040 with 180th/192nd Interchange

N-370 Build Diamond Interchange Expansion
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
April 2017

Figure
A16

N

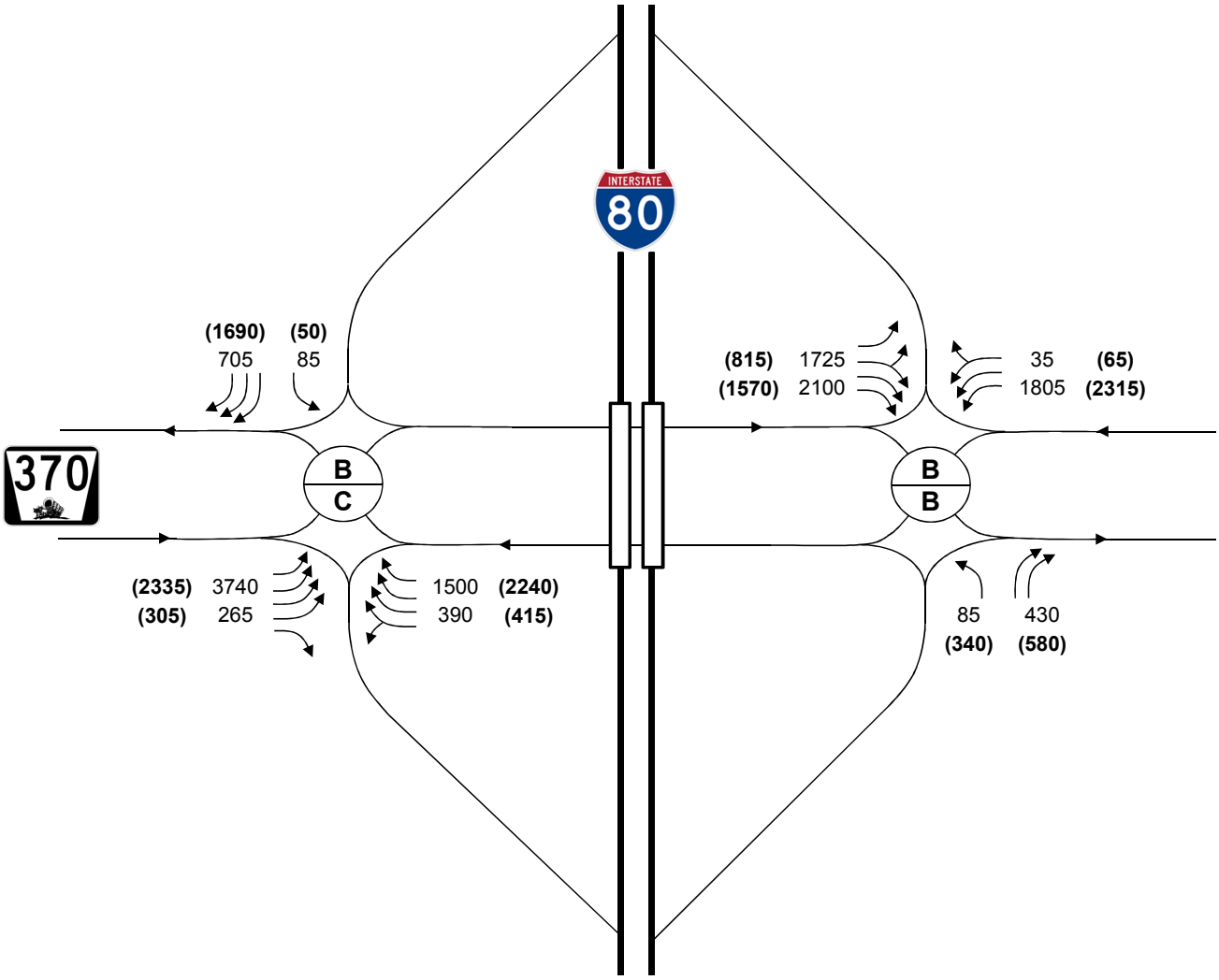
Not to Scale

LEGEND

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

Intersection Lane Geometrics

X / X — AM Peak Hour Signalized Intersection Level of Service
PM Peak Hour Signalized Intersection Level of Service



Notes:
1. LOS 'F' movements shown in Red
2. LOS may be worse due to metered volumes upstream.

Sources:
1. Traffic Volumes - Developed by HDR using MAPA 2040 Travel Model (February 2017).
2. Traffic Capacity Analysis (HCS 2010) - Conducted by HDR (February 2017).

Metro Area Travel Improvement Study

Sarpy County I-80 Interchange Assessment

Year 2040 with 180th/192nd Interchange

N-370 Build Diverging Diamond Interchange
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
April 2017

Figure
A17

LEGEND

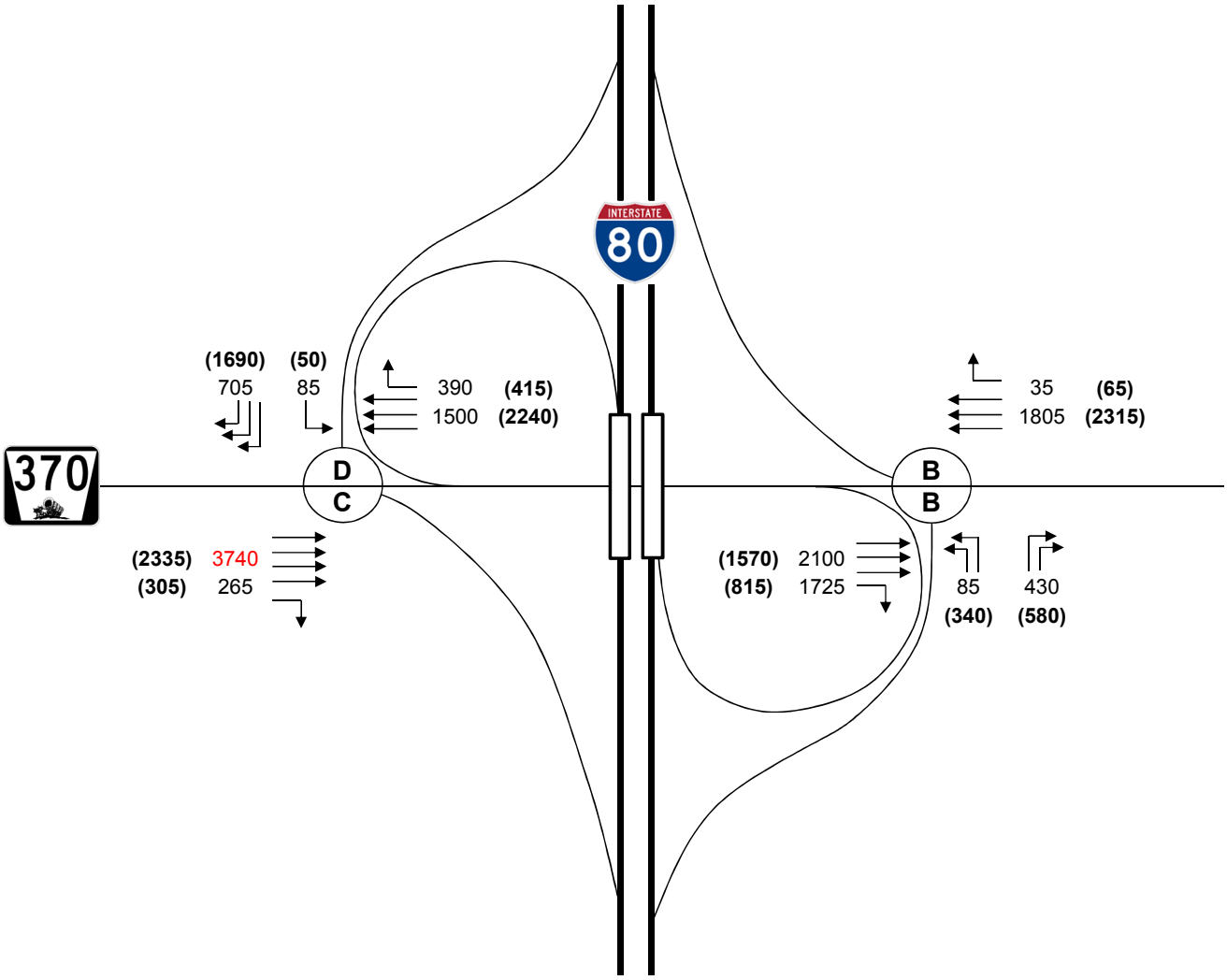
N

Not to Scale

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

Intersection Lane Geometrics

X / X — AM Peak Hour Signalized Intersection Level of Service; PM Peak Hour Signalized Intersection Level of Service



Notes:
1. LOS 'F' movements shown in Red
2. LOS may be worse due to metered volumes upstream.

Sources:
1. Traffic Volumes - Developed by HDR using MAPA 2040 Travel Model (February 2017).
2. Traffic Capacity Analysis (HCS 2010) - Conducted by HDR (February 2017).

Metro Area Travel Improvement Study

Sarpy County I-80 Interchange Assessment

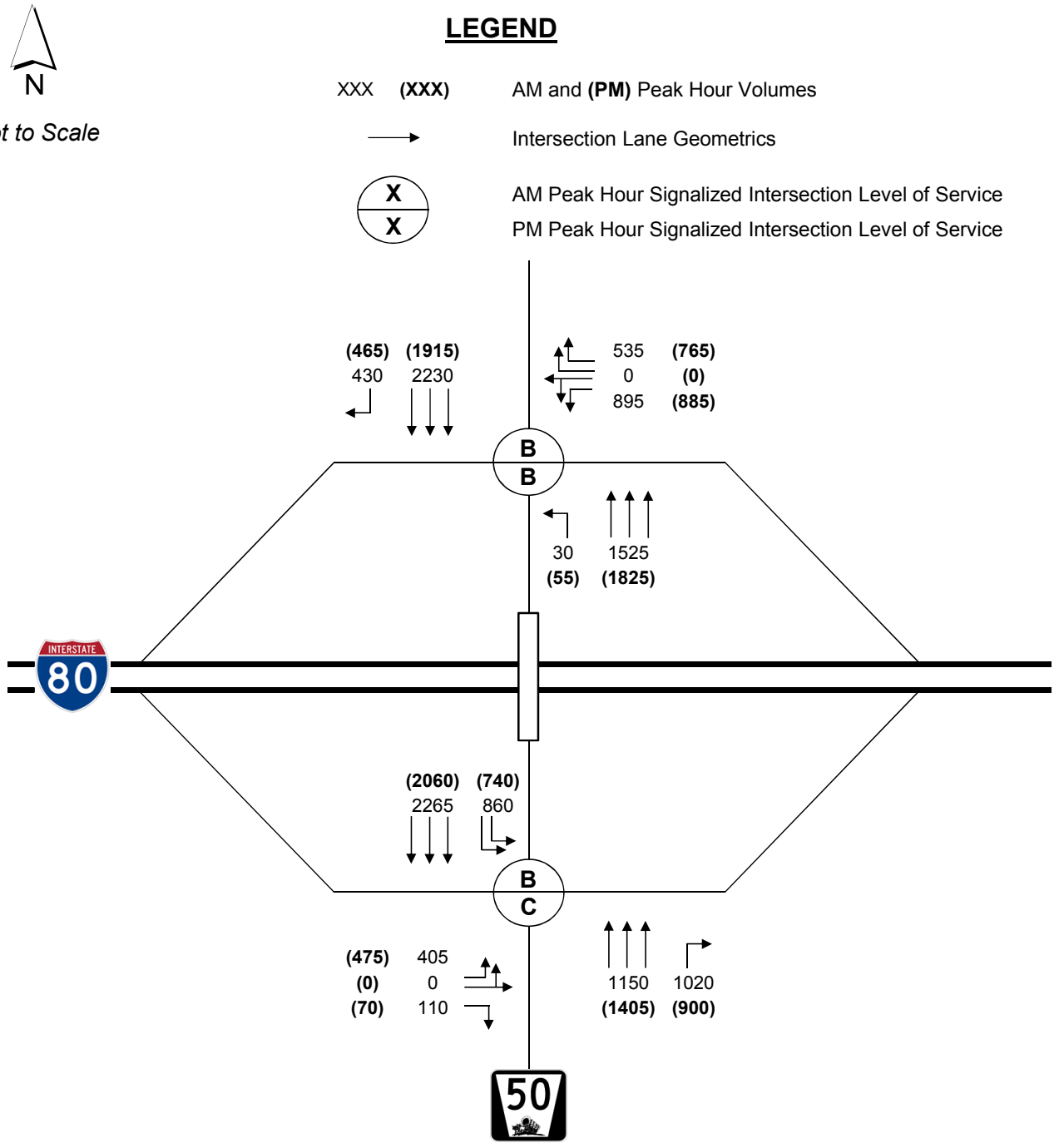
Year 2040 with 180th/192nd Interchange

N-370 Build Partial Cloverleaf Interchange
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
April 2017

Figure
A18



Notes:
1. LOS 'F' movements shown in Red
2. LOS may be worse due to metered volumes upstream.

Sources:
1. Traffic Volumes - Developed by HDR using MAPA 2040 Travel Model (February 2017).
2. Traffic Capacity Analysis (HCS 2010) - Conducted by HDR (February 2017).

Metro Area Travel Improvement Study

Sarpy County I-80 Interchange Assessment

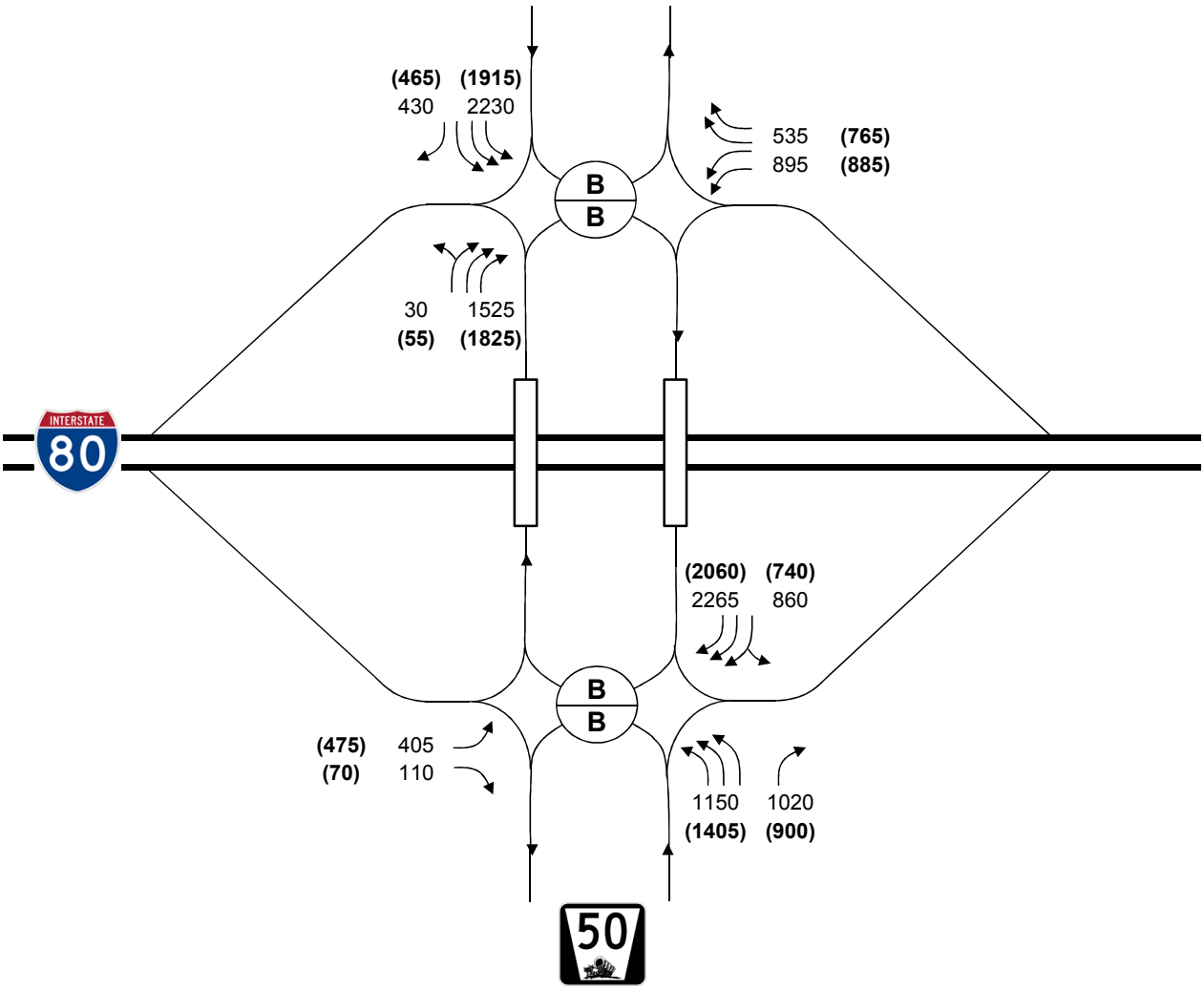
Year 2040 with 180th/192nd Interchange

N-50 Build Diamond Interchange Expansion
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
April 2017

Figure
A19



Notes:
1. LOS 'F' movements shown in Red
2. LOS may be worse due to metered volumes upstream.

Sources:
1. Traffic Volumes - Developed by HDR using MAPA 2040 Travel Model (February 2017).
2. Traffic Capacity Analysis (HCS 2010) - Conducted by HDR (February 2017).

Metro Area Travel Improvement Study

Sarpy County I-80 Interchange Assessment

Year 2040 with 180th/192nd Interchange

N-50 Build Diverging Diamond Interchange
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
April 2017

Figure
A20

N

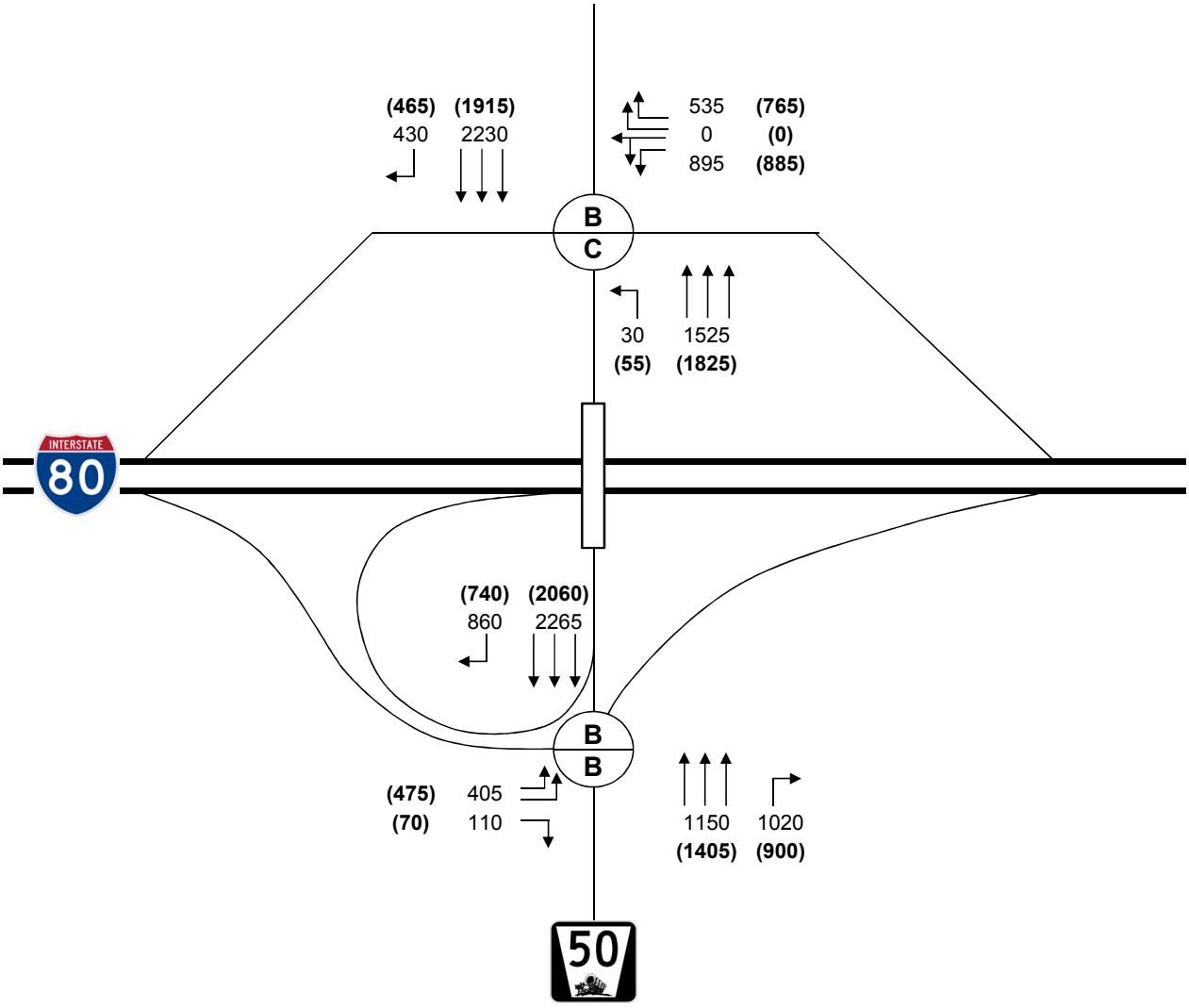
Not to Scale

LEGEND

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

Intersection Lane Geometrics

X / X — AM Peak Hour Signalized Intersection Level of Service / PM Peak Hour Signalized Intersection Level of Service



Notes:
1. LOS 'F' movements shown in Red
2. LOS may be worse due to metered volumes upstream.

Sources:
1. Traffic Volumes - Developed by HDR using MAPA 2040 Travel Model (February 2017).
2. Traffic Capacity Analysis (HCS 2010) - Conducted by HDR (February 2017).

Metro Area Travel Improvement Study

Sarpy County I-80 Interchange Assessment

Year 2040 with 180th/192nd Interchange

N-50 Build Partial Cloverleaf Interchange
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
April 2017

Figure
A21

N

Not to Scale

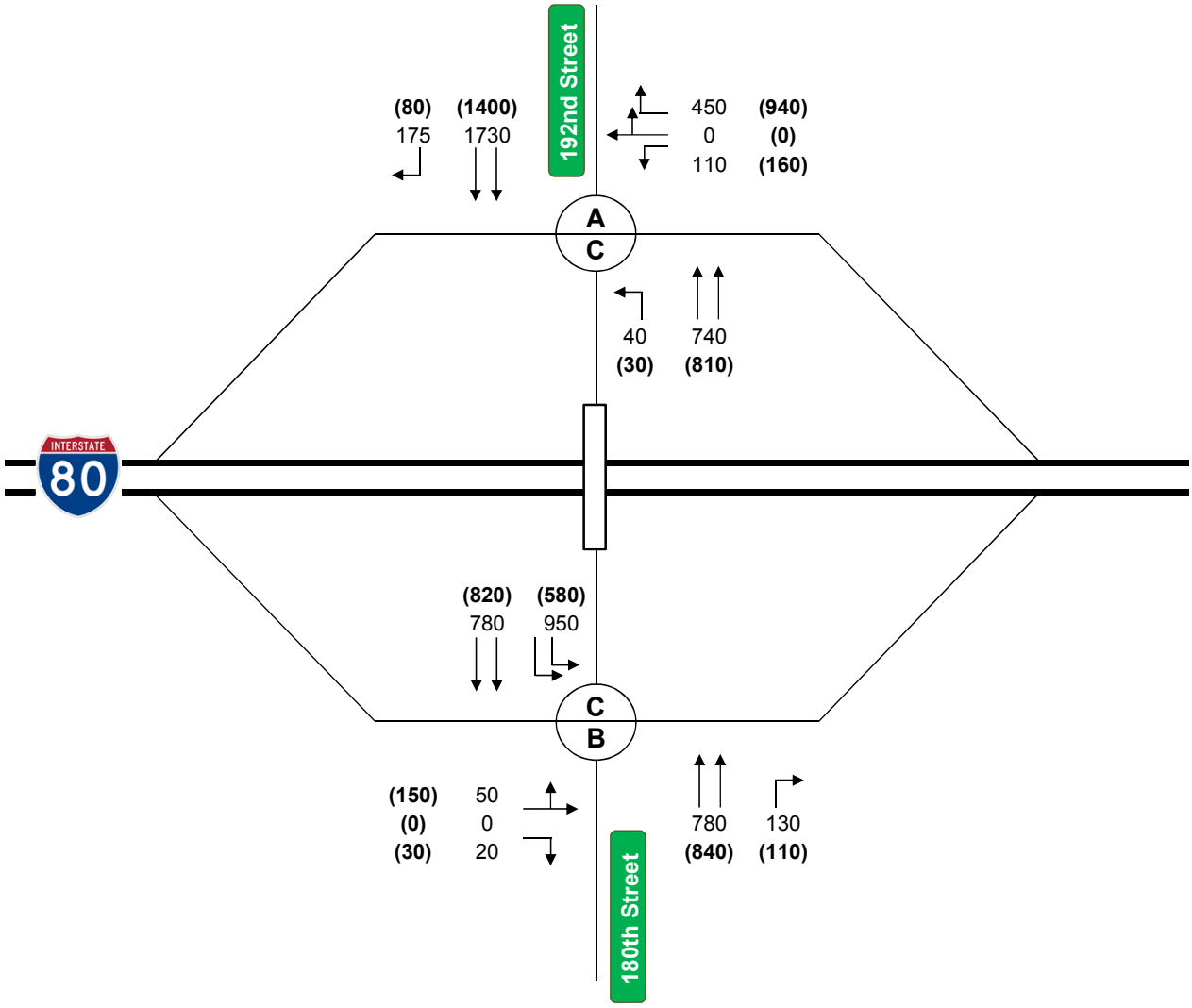
LEGEND

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

Intersection Lane Geometrics

X / X — AM Peak Hour Signalized Intersection Level of Service

PM Peak Hour Signalized Intersection Level of Service



Notes:
1. LOS 'F' movements shown in Red
2. LOS may be worse due to metered volumes upstream.

Sources:
1. Traffic Volumes - Developed by HDR using MAPA 2040 Travel Model (February 2017).
2. Traffic Capacity Analysis (HCS 2010) - Conducted by HDR (February 2017).

Metro Area Travel Improvement Study

Sarpy County I-80 Interchange Assessment

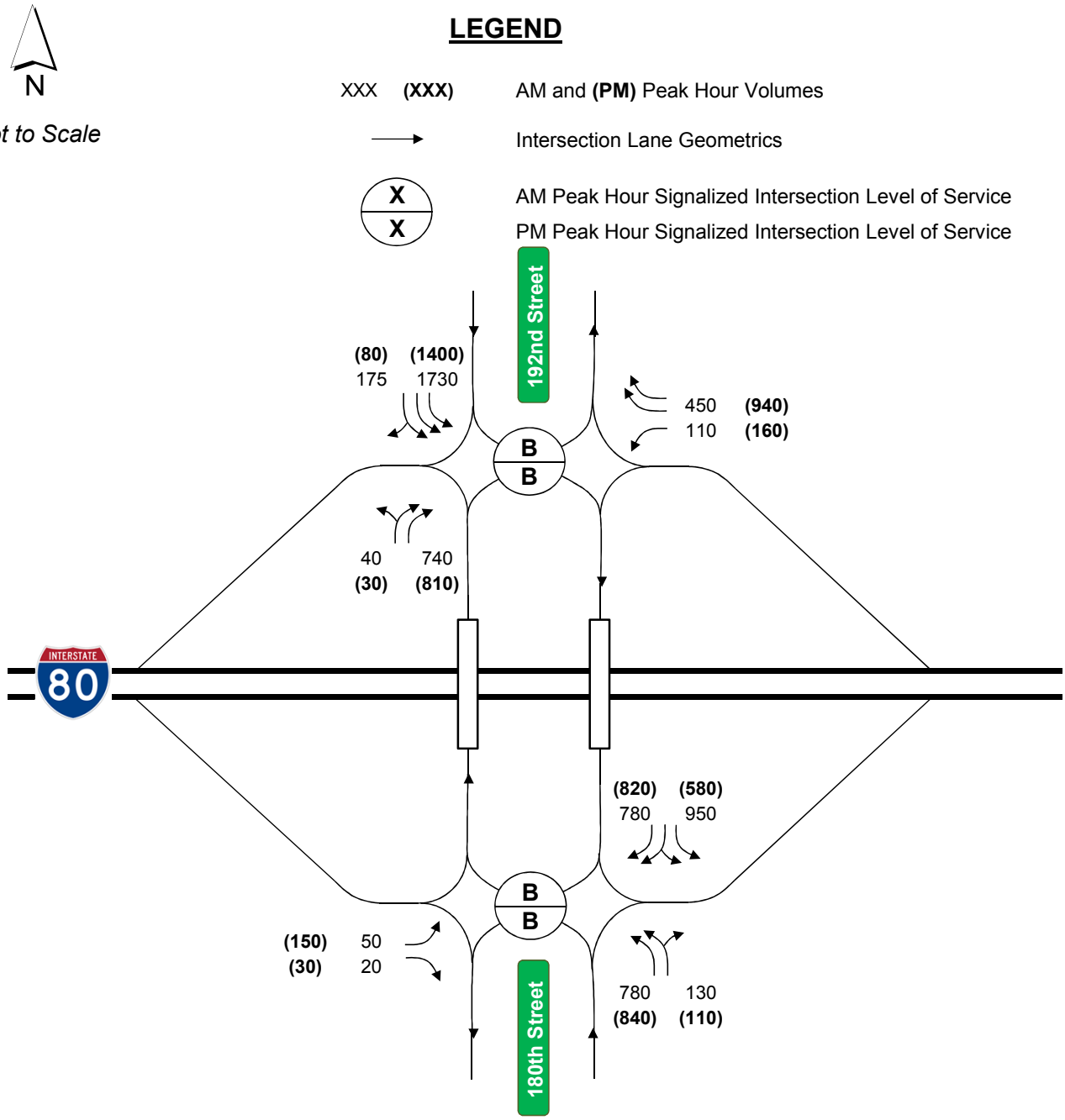
Year 2040 with 180th/192nd Interchange

180th/192nd New Interchange (Diamond Configuration)
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
April 2017

Figure
A22



Notes:
1. LOS 'F' movements shown in Red
2. LOS may be worse due to metered volumes upstream.

Sources:
1. Traffic Volumes - Developed by HDR using MAPA 2040 Travel Model (February 2017).
2. Traffic Capacity Analysis (HCS 2010) - Conducted by HDR (February 2017).

Metro Area Travel Improvement Study

Sarpy County I-80 Interchange Assessment

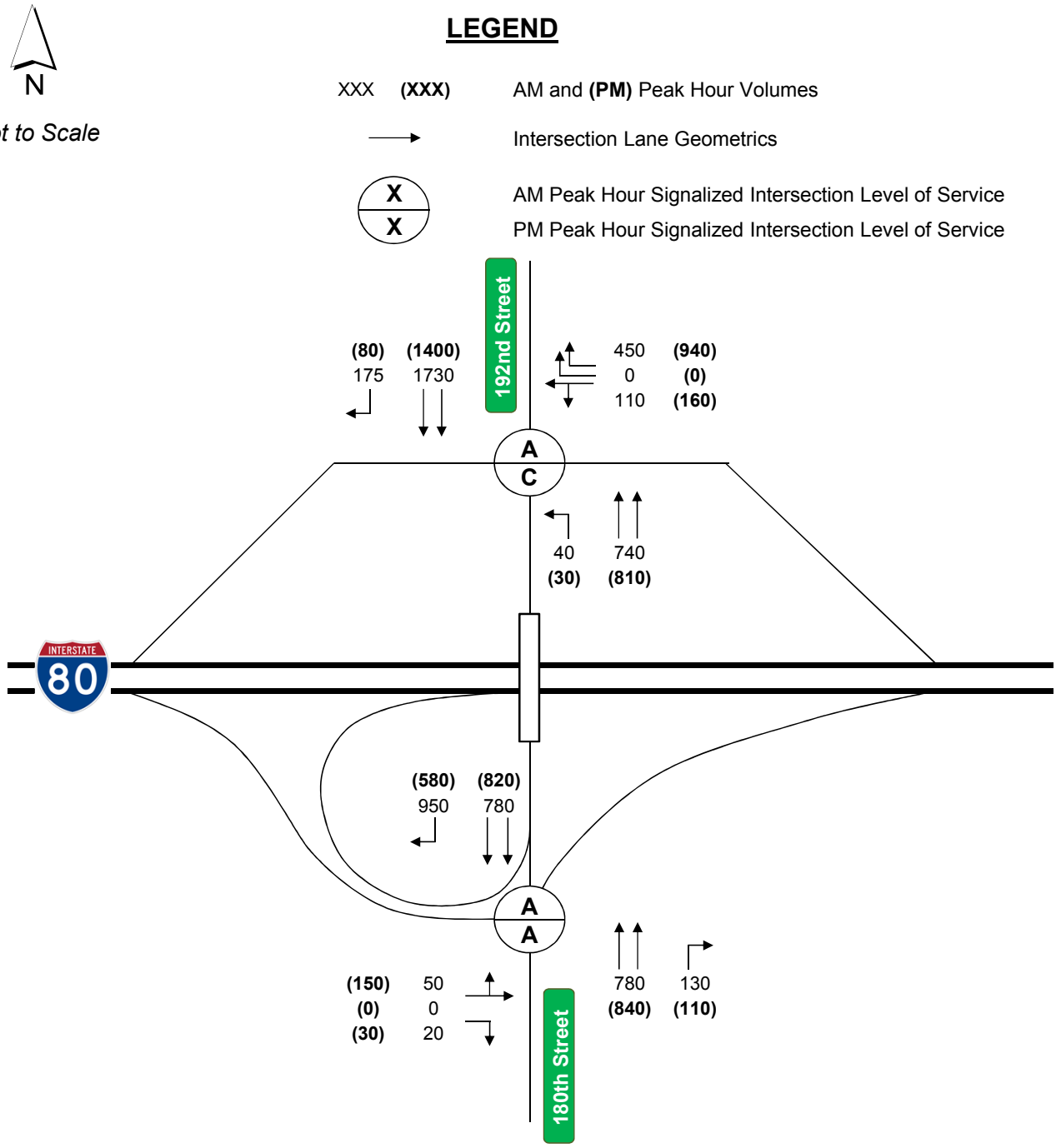
Year 2040 with 180th/192nd Interchange

180th/192nd New Interchange (DDI Configuration)
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
April 2017

Figure
A23



Notes:
1. LOS 'F' movements shown in Red
2. LOS may be worse due to metered volumes upstream.

Sources:
1. Traffic Volumes - Developed by HDR using MAPA 2040 Travel Model (February 2017).
2. Traffic Capacity Analysis (HCS 2010) - Conducted by HDR (February 2017).

Metro Area Travel Improvement Study

Sarpy County I-80 Interchange Assessment

Year 2040 with 180th/192nd Interchange

180th/192nd New Interchange (Parclo Configuration)
Traffic Volumes and Operations Analysis Results

Sarpy County, NE

Date
April 2017

Figure
A24