Appendix E – Traffic Forecasts Technical Memorandum

Technical Memo

Date:	Tuesday, May 7, 2019
Project:	Southern Meade County Corridor Study
To:	Study Advisory Team
From:	HDR
Subject:	Traffic Forecasts

The purpose of this memorandum is to present the traffic volume data sets to be used for analysis of the Southern Meade County Corridor Study. This study is looking at a potential new corridor between Erickson Ranch Road and 143rd Street in southern Meade County, just north of Rapid City.

The following traffic volume data sets have been developed:

- 2019 Existing Conditions
- 2045 No-Build Conditions
- 2045 Build Conditions – includes a new corridor between Erickson Ranch Road and 143rd Street

This memorandum also presents the process and methodology used to develop these volumes.

Sources of Data

The following data was obtained for the development of the corridor study volume sets:

- Peak hour (morning and afternoon/evening) intersection turning movement counts:
  - Collected by consultant team on Tuesday, February 19, 2019
- 24-hour roadway segment counts:
  - Collected by consultant team on Tuesday, February 19, 2019

Figure 1 displays the count locations for this study. While the corridor study area is defined as a rectangle that generally bounds Erickson Ranch Road, Elk Creek Road, 143rd Avenue, and the Meade County border, traffic forecasts were also developed for the Elk Vale Road corridor. Elk Vale Road is an important north/south corridor, one mile east of 143rd Avenue, that has regional ties to an I-90 interchange and the US16 Bypass south of the study area. These additional forecasts lay the foundation for understanding future-year traffic demand adjacent to the study area as well as the potential attractiveness of a new east/west corridor in southern Meade County to Elk Vale Road traffic.

Traffic forecasts were based on output from the Rapid City Metropolitan Planning Organization (MPO) travel demand model. The following model versions were used:

- 2013 – base year
- 2040 – planning horizon

Existing Volumes

2019 Existing Conditions traffic data is the basis for an assessment of current conditions and the development of both daily and intersection turning movement forecasts.

Daily (24-hour) segment and peak hour turning movement counts were post-processed to develop the 2019 Existing Conditions volume data set presented in this memorandum. All existing counts were factored to a design season (August) to account for seasonal fluctuations throughout the year.

AM and PM peak hour intersection turning movement counts were smoothed throughout the study area, but were not balanced due to the spacing of intersections and notable mid-segment traffic generators. In the 2019 Existing Conditions figure, **Figure 2**, low–volume movements (one or two vehicles over the peak hour) are presented as '<5' to depict the low-volume nature of the specific movement.

Forecast Methodology

This study's forecast year is 2045 and reflects the planning horizon for traffic operations analysis and conceptual design. Traffic forecasts help assess future-year capacity and operational needs throughout the study area due growth in traffic demand and/or changes in traffic patterns.

The following process was used to develop daily and peak hour intersection turning movement forecasts throughout the study area for the 2045 No-Build Conditions:

1. The 2040 travel demand model scenario was evaluated for reasonableness, whether it met study goals, consistency in planned future roadway network, and any gaps in future development.

2. 2040 model output was post-processed consistent with travel demand model forecast methodologies presented in *NCHRP 765: Analytical Travel forecasting Approaches for Project-Level Planning and Design*.
    a. 2045 daily segment forecasts were developed using:
        i. Seasonally adjusted existing volumes (August, 2019).
        ii. 2045 growth factors were calculated from a comparison of 2013 base model and 2040 planning horizon model output.
    b. 2045 peak hour intersection turning movement forecasts were developed using:
        i. Seasonally adjusted existing volumes (August, 2019).
        ii. 2045 growth factors were calculated from a comparison of 2013 base model and 2040 planning horizon model output.
        iii. The iterative directional volume estimation method as described in *NCHRP 765*.

c. Peak hour intersection turning movement volumes and segment peak hour volumes were smoothed or balanced, depending on the size of a mid-segment trip generator.

Travel Demand Model Review

General findings from a review of the travel demand model and future land use include:

- Future land use
  - Future land use for the study area was reviewed in the *Rapid City Comprehensive Plan* (2014 update)[1].
    - Mix of agriculture and rural residential.
  - Low trip generation land uses.
  - Land use will likely maintain the highly directional traffic patterns to/from Rapid City through this study's 2045 planning horizon.

- Low traffic volumes
  - Model volumes are typically less than 1,500 in the 2040 model scenario and generally decrease towards the northeast of the study area. The greatest model volumes are towards the southern study limits of Haines Avenue.
  - Due to the low volumes, rounding, smoothing, and balancing of peak hour volumes may provide a relatively large increase in peak hour traffic volumes and may skew the resulting proportion of presented peak hour traffic in comparison to a daily traffic volume.

- Comparison of volumes to the Meade *Moving Forward 2040 Transportation Plan*[2] (*Meade 2040 Plan*), which indicated a range of 2% to 4% growth within the study area.
  - Model-derived growth factors (comparison of 2013 vs. 2040 model volume) and model adjustments (*NCHRP 765* travel demand model methods) generally aligned with estimates from the *Meade 2040 Plan*.
    - The most notable difference was along Erickson Ranch Road, just north of Peaceful Pines Road where the *Meade 2040 Plan* noted a future-year volume range of 2,501-5,000 vehicles per day (vpd). This study estimates volumes along that segment at 1,900 vpd.

- North/south routes of Erickson Ranch Road (via Deadwood Avenue), Haines Avenue, and Elk Vale Road all have connectivity to the Rapid City area and I-90 to the south.
  - The *Rapid City Comprehensive Plan* (2014 update) identifies Deadwood Avenue and Haines Avenue as entrance corridors to Rapid City.

- East/west Elk Creek Road and Peaceful Pines Road routes connect to I-90 to the west.

[1] http://planrapidcity.com/updates/welcome-to-the-rapid-city-comprehensive-plan-update-website

[2] http://www.sddot.com/transportation/highways/planning/specialstudies/docs/MeadeCountyTransportationPlanFinal.pdf

2045 Build Conditions Traffic Distribution and Assignment

The current 2040 travel demand model does not include an east/west roadway connecting Erickson Ranch Road and Elk Vale Road. Therefore, the traffic demand, distribution, and assignment for this potential corridor was estimated based on available planning data and existing traffic data in the area, including:

- Transportation Analysis Zones (TAZs) and future land use in the travel demand model.
- Existing traffic counts and patterns.
- Estimation of the attractiveness of a potential east/west corridor to meeting access and linkage needs for future development.
- Natural barriers or limitations to a future local street/collector network.

The specific location of the potential east/west corridor has not yet been determined and thus there are a number of possible locations between Elk Creek Road and the Meade County line. The goal of the 2045 Build Conditions volume set is to provide a generalized estimate of traffic volumes that are applicable across this range.

The following process was used to estimate future-year traffic volumes for the 2045 Build Conditions.

A. Estimate traffic volumes that would access the potential corridor based on travel demand model TAZ/land use for adjacent TAZs.
    a. Model network with TAZ boundaries and centroid connectors is presented in the Appendix.
    b. Estimated percentages of traffic using a future corridor from applicable centroid connectors are shown in the figure.
    c. Adjust 2040 model volumes to the 2045 Build Conditions scenario that reflects peak season demand using *NCHRP 765* methodology.
B. Estimate traffic distribution.
    a. Because the potential corridor is entirely contained within the study area, distribution patterns to external stations are assumed to be similar between the No-Build and Build Conditions scenarios. The internal patterns, particularly for traffic interaction between Elk Creek Road and the potential corridor, are most affected between the two scenarios.
C. Assign TAZ/land use-based traffic to the potential corridor at mid-segments.
    a. Based on proportionality of existing peak hour traffic, assessment of route choice between potential origins or destinations, and topography limitations.
        i. Cross-check the ratio of segment peak hour volume with daily volume (existing range between 10% and 18%).
    b. Adjust existing intersection volumes based on changes to traffic patterns.
D. Estimate north/south through trips at the potential corridor intersections.
E. Estimate east/west corridor through trips and add to the potential corridor.
    a. It is estimated that there would be relatively few ‘pass through’ trips along a future corridor and the bulk of the corridor traffic would originate or be destined to a location along the corridor.

i. There are currently complimentary routes that accommodate pass-through traffic and a future corridor has distinct termini that 'T' into north/south corridors.

b. A small number of 'Internal' through trips, that would have an origin and destination along the corridor were also added.

F. Smooth intersection volumes and balance where applicable.

The 2045 Build Conditions, **Figure 4**, shows a potential location of a future east/west corridor. This location is considered illustrative at this point in the study and is used to present study area traffic volumes. It should be understood that the final location of this corridor will have an impact on the attractiveness of traffic and these volumes may vary depending on how far north or south the proposed corridor is located.

The 224th Street segment between 143rd Avenue and Elk Vale Road may serve as an eastward extension of a future east/west corridor to Elk Vale Road. Volumes for a potential corridor segment east of 143rd Avenue would be applicable to the 224th Street segment, and provide an estimate of potential traffic increases along this existing segment if a new east/west corridor is constructed between Erickson Ranch Road and 143rd Avenue.

Traffic Volumes

Existing and forecast volume sets for the Southern Meade County Corridor Study are shown in the following figures:

- **Figure 2: 2018 Existing Conditions Traffic Volumes**
- **Figure 3: 2045 No-Build Conditions Traffic Volumes**
- **Figure 4: 2045 Build Conditions Traffic Volumes**

N

0 0.5 1
MILES

Empire Pl.
Ricard Rd.
Elk Creek Rd.
142nd Ave.
144th Ave.
139th Pl.
220th St.
Husker Pl.
Elk Vale Rd.
Summerset
Piedmont
Meadow Retreat Dr.
Rocky Rd.
Drolc Ln.
Forest Pl.
Peterson Rd.
Lofty Pines Rd.
143rd Ave.
Horseshoe Rd.
N. Haines Ave.
Erickson Ranch Rd.
Bison Point Rd.
Virgina Ln.
Estimated
Dyess Ave.
Norman Ave.
Marvel Mountain Rd.
Peaceful Pines Rd.
224th St.
Blackhawk
Interstate 90
Deadwood Ave.
W. Nike Rd.
Rapid City

LEGEND
- Study Area
- County Line
- Existing Roads

City Limits
- Blackhawk
- Piedmont
- Rapid City
- Summerset

TRAFFIC LEGEND
- Intersection Peak Hour Turning Movement Counts (5)
- 24-Hour Segment Counts (6)

All counts collected on Tuesday, February 21, 2019.

PATH: Z:\PROJECTS\10151063 - MEADE CTY CORRIDOR STUDY\GIS\HDR\TRAFFIC FIGURES BASE.MXD - USER: SSLOWEY - DATE: 4/22/2019

TRAFFIC COUNT LOCATIONS

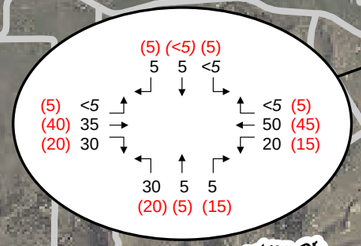
SOUTHERN MEADE COUNTY CORRIDOR STUDY

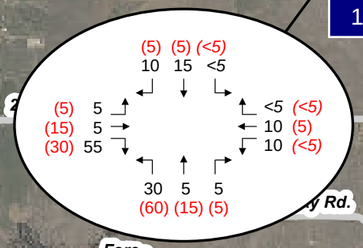
DATE
4/23/2019

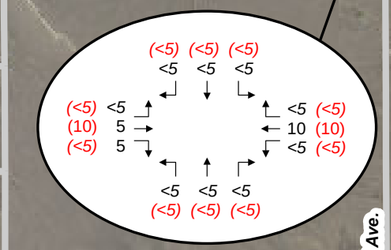
FIGURE
1

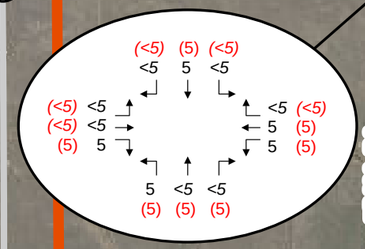
N

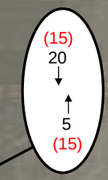
0 0.5 1
MILES

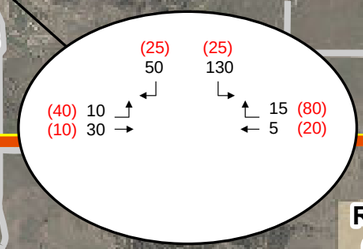


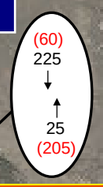


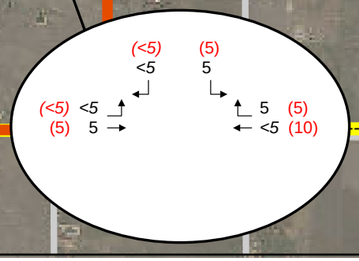












Summerset
Piedmont
Blackhawk
Rapid City

Empire Pl.
Ricard Rd.
Elk Creek Rd.
142nd Ave.
144th Ave.
139th Pl.
Elk Vale Rd.
Retreat Dr.
Meadow
Drolc Ln.
Forest Pl.
Peterson Rd.
Lofty Pines Rd.
143rd Ave.
N. Haines Ave.
Horseshoe Rd.
Erickson Ranch Rd.
Virgina Ln.
Bison Point Rd.
Norman Ave.
Peaceful Pines Rd.
Marvel Mountain Rd.
Interstate 90
Deadwood Ave.
W. Nike Rd.
Dyess Ave.
224th St.

1,000
1,050
150
275
1,300
2,350
75

LEGEND
- Study Area
- County Line
- Existing Roads

City Limits
- Blackhawk
- Piedmont
- Rapid City
- Summerset

TRAFFIC LEGEND

20 (40) AM (PM) Traffic Volumes

1,900 Daily Traffic Volumes

All volumes reflect a peak season (August).

PATH: Z:\PROJECTS\10151063 - MEADE CTY CORRIDOR STUDY\GIS\SHORT\TRAFFIC FIGURES BASE.MXD - USER: SSLOWEY - DATE: 4/22/2019

2019 EXISTING CONDITIONS TRAFFIC VOLUMES PEAK SEASON

SOUTHERN MEADE COUNTY CORRIDOR STUDY

DATE
5/6/2019

FIGURE
2

N

0 0.5 1
MILES

Empire Pl.
Ricard Rd.
Elk Creek Rd.
142nd Ave.
144th Ave.
139th Pl.
Elk Vale Rd.
Horseshoe Rd.
Summerset
Piedmont
Meadow Retreat Dr.
Drolc Ln.
Forest Pl.
Peterson Rd.
Lofty Pines Rd.
143rd Ave.
N. Haines Ave.
Erickson Ranch Rd.
Virgina Ln.
Bison Point Rd.
Dyess Ave.
224th St.
Norman Ave.
Peaceful Pines Rd.
Marvel Mountain Rd.
Interstate 90
Deadwood Ave.
W. Nike Rd.
Blackhawk
Rapid City

1,000
1,500
300
1,600
650
1,900
250
4,800

(10) (5) (10)
15 10 5
(10) 5 5 (10)
(90) 75 130 (110)
(55) 80 25 (20)
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LEGEND
- Study Area
- County Line
- Existing Roads

City Limits
- Blackhawk
- Piedmont
- Rapid City
- Summerset

TRAFFIC LEGEND

20 (40) AM (PM) Traffic Volumes

1,900 Daily Traffic Volumes

All volumes reflect a peak season (August).

PATH: Z:\PROJECTS\10151063 - MEADE CTY CORRIDOR STUDY\GIS\SHORT\TRAFFIC FIGURES BASE.MXD - USER: SSLOWEY - DATE: 4/22/2019

HDR

2045 NO-BUILD CONDITIONS TRAFFIC VOLUMES PEAK SEASON

SOUTHERN MEADE COUNTY CORRIDOR STUDY

DATE
5/6/2019

FIGURE
3

N

0 0.5 1
MILES

Empire Pl.
Ricard Rd.
Elk Creek Rd.
142nd Ave.
144th Ave.
139th Pl.
143rd Ave.
Elk Vale Rd.
Summerset
Piedmont
Wedgewood Retreat Dr.
Drolc Ln.
Forest Pl.
Peterson Rd.
Lofty Pines Rd.
N. Haines Ave.
Horseshoe Rd.
Erickson Ranch Rd.
Virgina Ln.
Bison Point Rd.
Dyess Ave.
Norman Ave.
Peaceful Pines Rd.
Marvel Mountain Rd.
Interstate 90
Deadwood Ave.
W. Nike Rd.
224th St.
Blackhawk
Rapid City

1,000
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1,500
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1,600
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1,900
250
4,800

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(70) 65 120 (95)
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80 10 10
(65) (10) (30)

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(35) 75 20 (10)
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(25) (45)

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(5) 5 10 (10)
(10) 10 10 (20)

LEGEND
- Study
- County Line
- Existing Roads
- Example Alignment (See Preliminary Alternative Analysis Memo for all Potential Alignment Locations)

City Limits
- Blackhawk
- Piedmont
- Rapid City
- Summerset

TRAFFIC LEGEND
- 20 (40) AM (PM) Traffic Volumes
- 1,900 Daily Traffic Volumes

All volumes reflect a peak season (August).

PATH: Z:\PROJECTS\191\91983 - MEADE CTY CORRIDOR STUDY\GIS\HDR\TRAFFIC FIGURES BASE.MXD - USER: SSLOWEY - DATE: 4/22/2019

HDR

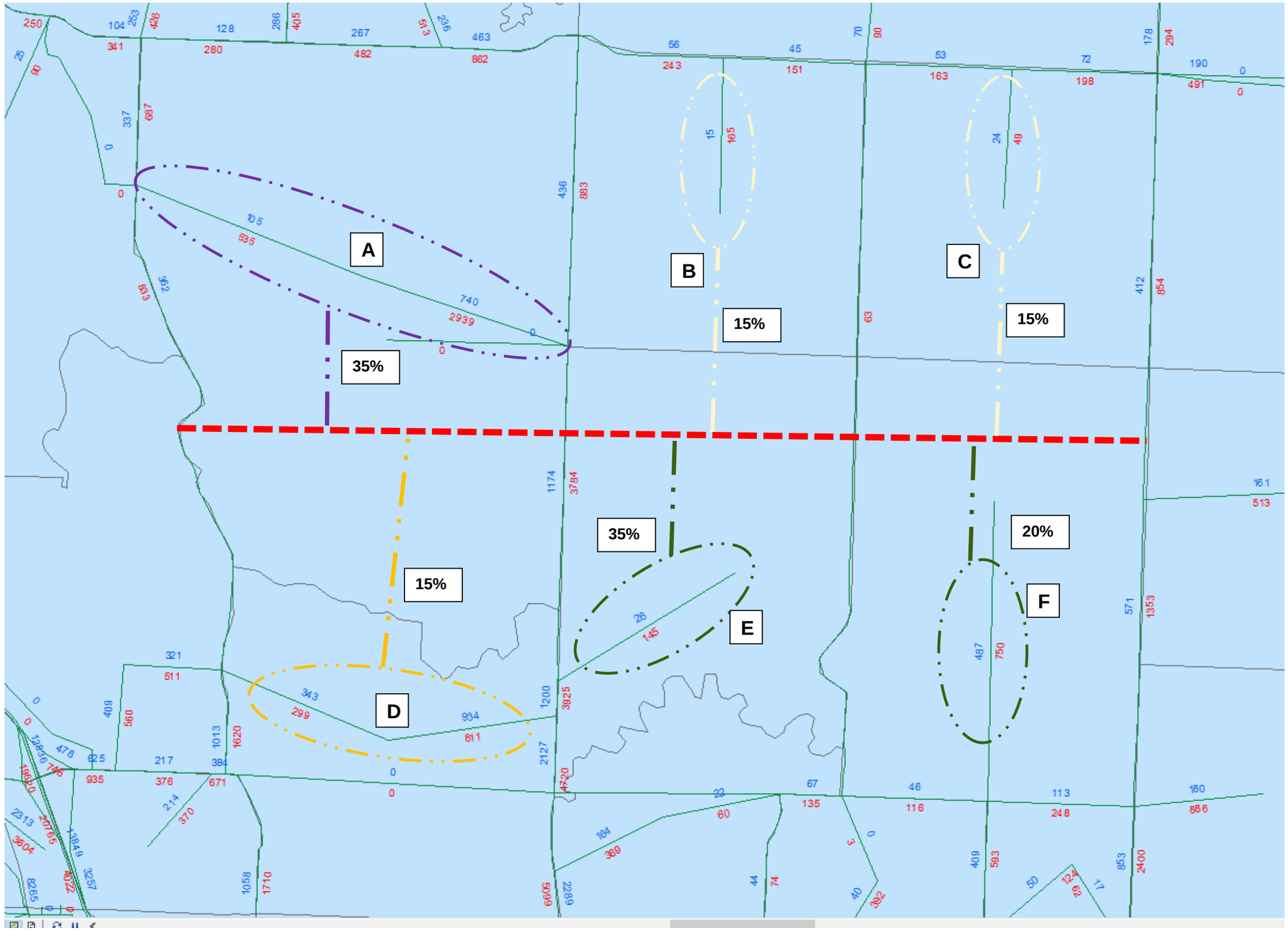
2045 BUILD CONDITIONS TRAFFIC FORECASTS PEAK SEASON

SOUTHERN MEADE COUNTY CORRIDOR STUDY

DATE
5/6/2019

FIGURE
4

Appendix A. Proposed Corridor Travel Demand Estimation with 2040 Travel Demand Model Output and TAZ Boundaries



Legend

267
482
2013 Model Volume
2040 Model Volume

A
TAZ Centroid Connectors Used to Estimate Proposed Corridor Demand (A, B, C, D, E, F)

Consolidated Location Where Volume Accesses Proposed Corridor

35%
Estimated % of TAZ Volume to Use Potential Corridor

Proposed Corridor

Reflects 2040 Rapid City MPO Travel Demand Model

- 2013 Base Year
- 2040 Planning Horizon

North

Revised 4/23/19