

# Technical Memo

Date: Tuesday, August 06, 2019

Project: US16 Corridor Study

To: Study Advisory Team

From: HDR

Subject: 2019 Existing Conditions Traffic Operations

## Introduction

This memorandum presents the existing conditions traffic operations analysis along the US16 corridor and other study area roadways for the US16 Corridor Study. The existing conditions scenario analyzes the current network, using recently collected traffic counts (2019) and existing roadway conditions such as number of lanes, intersection traffic control, speed limits, signal timings, etc. Traffic volumes represent traffic counts factored to a summer design season (June).

The purpose of this memorandum is to identify current traffic operational needs along the study corridor. This analysis also serves as a baseline for future analyses in terms of analysis intersections and roadway segments.

## Traffic 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 Thursday, May 30, 2019.
  - Peak hour intersection turning movement volumes, peak hour factors, and heavy vehicle percentages (trucks, RVs, and lights pulling boats/campers/trailers).
- 24-hour roadway segment counts
  - Collected by SDDOT on Thursday, May 30, 2019, and through the weekend.
  - Daily segment volumes, heavy vehicle percentages, and speeds.

Seasonal adjustment factors were applied to these counts to develop a 'peak season' traffic count reflective of a June design season volume. Adjustment factors used for this study include:

- May: 0.93
- June: 0.84

The intersection and roadway segment count locations are summarized in **Table 1** and **Table 2**, respectively.



**Table 1: Study Area Intersection Turning Movement Count Locations (Analysis Intersections)**

Ref #	Street #1	Street #2
1	US16	Cosmos Road
2	US16	Beretta Road
3	US16	Silver Mountain Road
4	US16 E	16 E1 55.42 (Off-Ramp to Rockerville)
5	US16 W	Silver Mountain Road – Main Street – 16 WF 55.70
6	US16 W	Pine Haven Drive / Private Road
7	US16 E	Rockerville Road / 16 EF 55.78
8	US16 W	16 W2 55.67 (On-Ramp from Rockerville)
9	US16 W	16 W1 56.16 (Off-Ramp to Rockerville)
10	US16 E	Golden Hills Drive / 16 EF 55.93
11	US16 W	Main Street / 16WF 55.70
12	US16 E	16 E2 56.09 (On-Ramp from Rockerville)
13	US16	Strato Bowl Road
14	US16	Strato Rim Drive
15	US16	Busted Five Lane
16	US16	Wilderness Canyon Road
17	US16	Bear Country Exit
18	US16	Bear Country Entrance
19	US16	Croell Pit West/Main Entrance
20	US16	Neck Yoke Road / Reptile Gardens South
21	US16	Reptile Gardens Center
22	US16	Reptile Gardens North
23	US16	unknown road
24	US16	Sammis Trail
25	US16	Moon Meadows Drive
26	US16	Addison Avenue
27	US16	US16B / Catron Blvd
28	US16	Tucker Street
29	US16	Promise Road
30	US16	Table Rock Road
31	US16	Enchantment Road
32	US16	Service Road / school entrances
33	US16	Echo Ridge Drive
34	US16	Fairmont Blvd / Cathedral Drive
35	US16B / Catron Blvd	Healing Way
36	Catron Boulevard	Les Hollers Way
37	US16B / Catron Blvd	Wellington Drive (west)
38	US16B / Catron Blvd	Wellington Drive (east)
39	Neck Yoke Road	Spring Creek Road / Rockerville Road

See traffic volume figures for map.



**Table 2: US16 Segment Count Locations**

Ref #	MRM	US16 Segment Area Description
A	55.00	2.5 miles east of US16/US16A junction (Keystone Wye)
B	63.00	South of Moon Meadows Drive
C	63.89	Between Moon Meadows Drive and US16B/Catron Blvd
D	64.00	Between Promise Road and Tablerock Road
E	64.90	Between Tower Road and Echo Ridge Drive

See traffic volume figures for map.

Traffic data collected in eastbound and westbound directions at all locations.

## Existing Volumes

2019 Existing Conditions traffic data is the basis for both an assessment of current conditions and the development of segment and intersection turning movement forecasts. Daily (24-hour) traffic volumes were developed for segments reflective of the segment count locations. Peak hour volumes were developed for both the AM (morning) and PM (afternoon or evening) peak hours.

Daily 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 (June) to account for seasonal fluctuations in traffic along the corridor.

In general, the intersection peak hour volumes are reflective of the following peak hours:

- AM (morning)
  - North of Moon Meadows: 7:15 a.m. – 8:15 a.m.
  - South of Moon Meadows Drive: 9:30 a.m. – 10:30 a.m.
- PM (afternoon/evening)
  - Corridor: 4:30 p.m. – 5:30 p.m.

Through a review of the collected traffic volumes, it was found that the AM peak hour south of Moon Meadows Drive differed from the AM peak hour north of Moon Meadows Drive. Because traffic characteristics, such as directionality and overall magnitude of volumes, differed between the two AM peak periods, it was determined that separate volume data sets be developed for each segment.

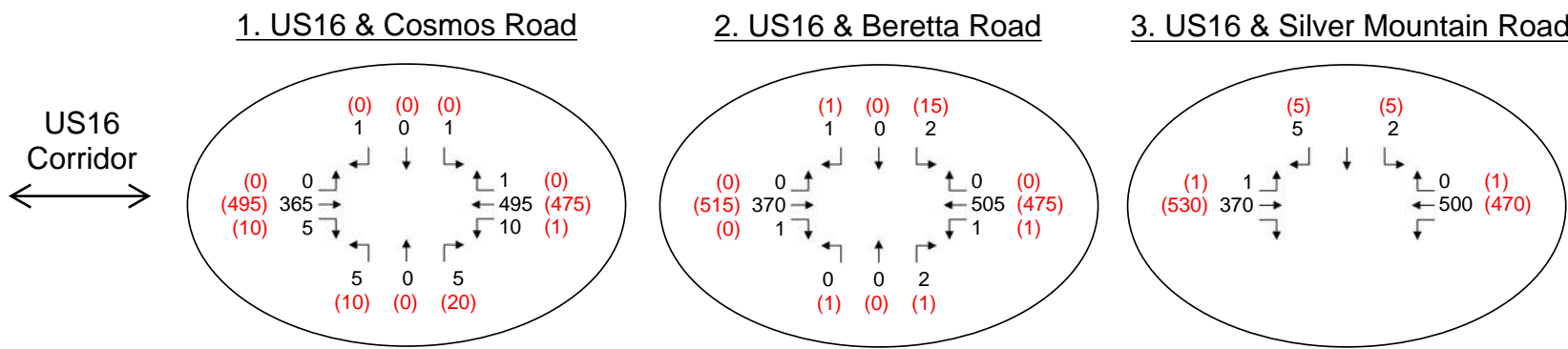
In the PM peak period, a cohesive corridor-wide volume set was developed reflective of traffic volumes in the 4:30 to 5:30 p.m. timeframe.

A summary of volume characteristics for the respective peak hours are as follows:

- AM (morning)
  - North of Moon Meadows Drive
    - Reflects the early morning commute northward to Rapid City.
    - Intersection peak hours did not vary significantly, either starting at 7:15 a.m. or 7:30 a.m.
    - Highly directional traffic northward to Rapid City (approximately 60/40 eastbound/westbound).
  - South of Moon Meadows Drive
    - Reflected a mix of commuter traffic north and south, tourist traffic, and daily business traffic.
    - Intersection peak hours did not vary significantly, starting between 9:15 a.m. and 9:45 a.m.
    - Directional traffic southward towards the Black Hills (approximately 55/45 westbound/eastbound).
    - Greater mix of vehicles (trucks, RVs, etc.) present in this traffic volume.
    - Early morning commute period segment volumes were notably less than the mid-morning peak period (generally 20-30 percent less).
- PM (afternoon/evening)
  - Corridor-wide
    - Intersection peak hours contained within the 4:00 p.m. to 5:45 p.m. window.
    - North of Moon Meadows Drive, segments exhibited higher volumes southbound out of Rapid City.
    - South of Neck Yoke Road, segments exhibited higher volumes northbound from the Black Hills tourist areas.
    - 50/50 split in traffic directionality through the Neck Yoke Road to Moon Meadows Drive area.

It is anticipated that residential development will continue southward from Rapid City in the future. Thus, AM peak hour volumes reflective of both the early morning commute and mid-morning peak time periods were developed for the Neck Yoke Road and Sammis Trail intersections to provide overlap and capture volume characteristics and patterns of both peak periods for future analysis.

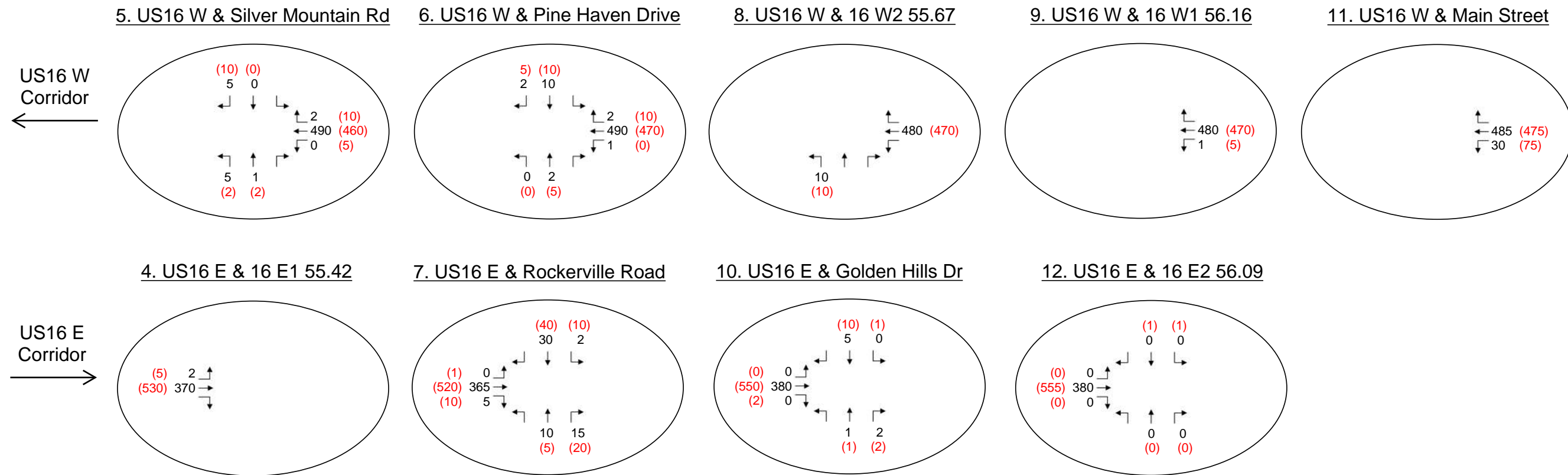
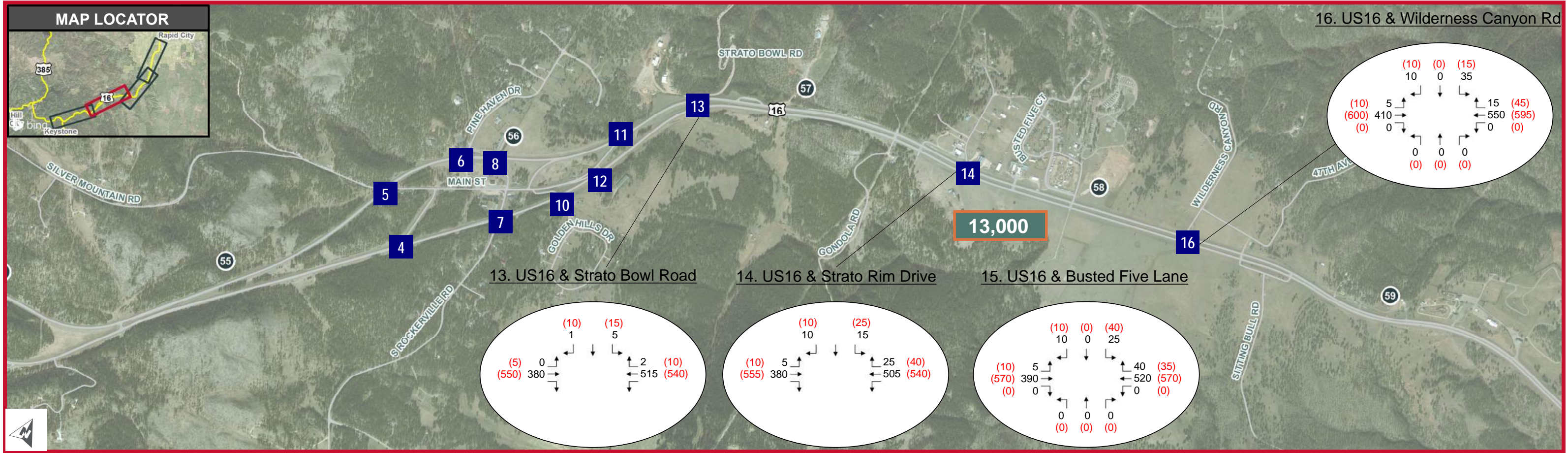
2019 existing conditions traffic volumes are summarized in **Figure 1**.



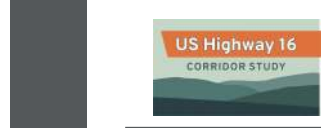
**Legend**

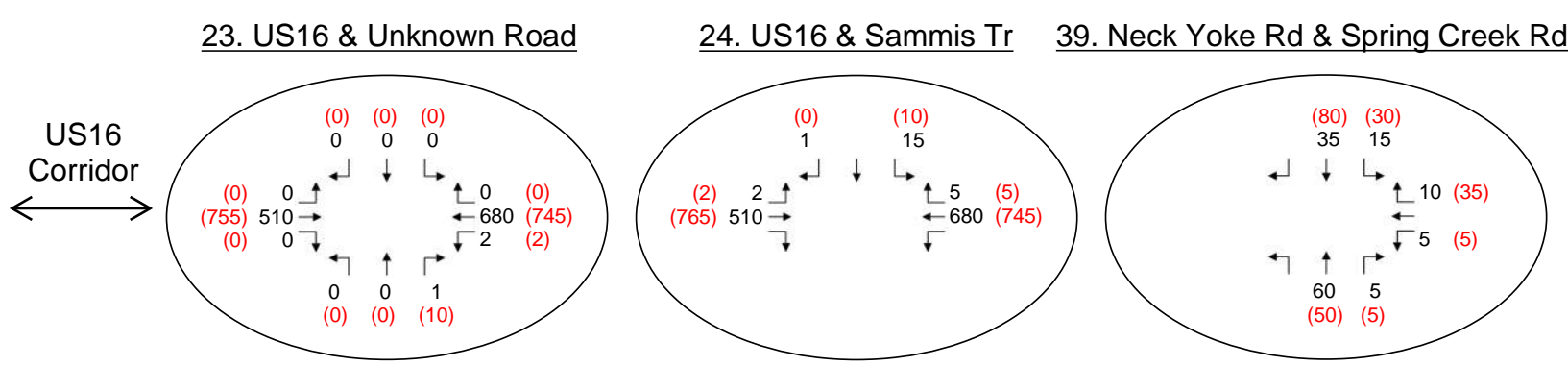
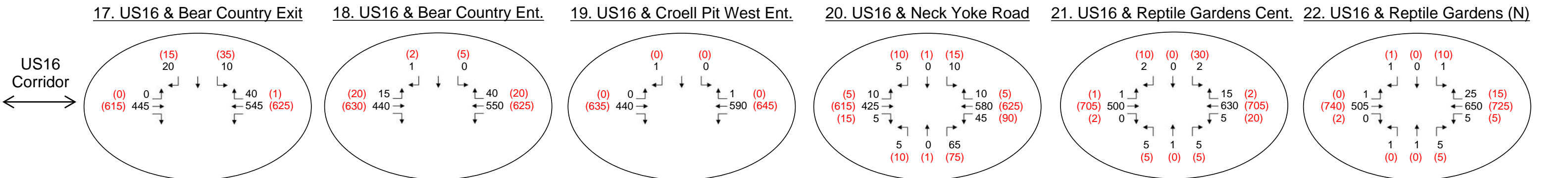
- Mileage Reference Marker (MRM)
- Study Intersection
- 2019 Daily Traffic Volumes\*
- AM (PM) 2019 Peak Hour Traffic Volumes\*

*Notes:*  
 \* Volumes reflect June design season  
 Stop-controlled intersections are two-way stop-control unless noted.

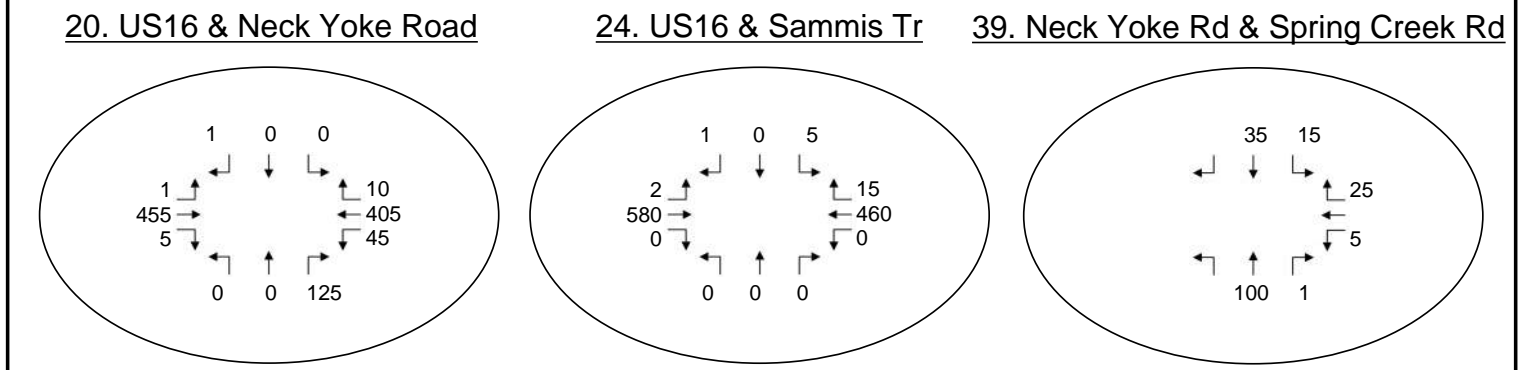


2019 EXISTING CONDITIONS TRAFFIC VOLUMES AND LEVEL OF SERVICE  
 US16 CORRIDOR STUDY  
 FIGURE 1, PAGE 2 OF 4





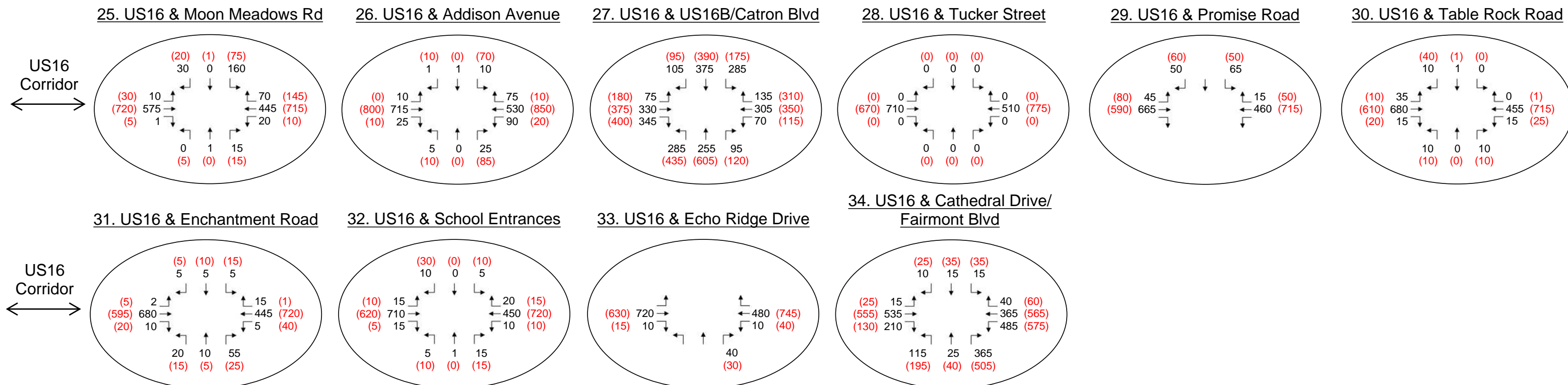
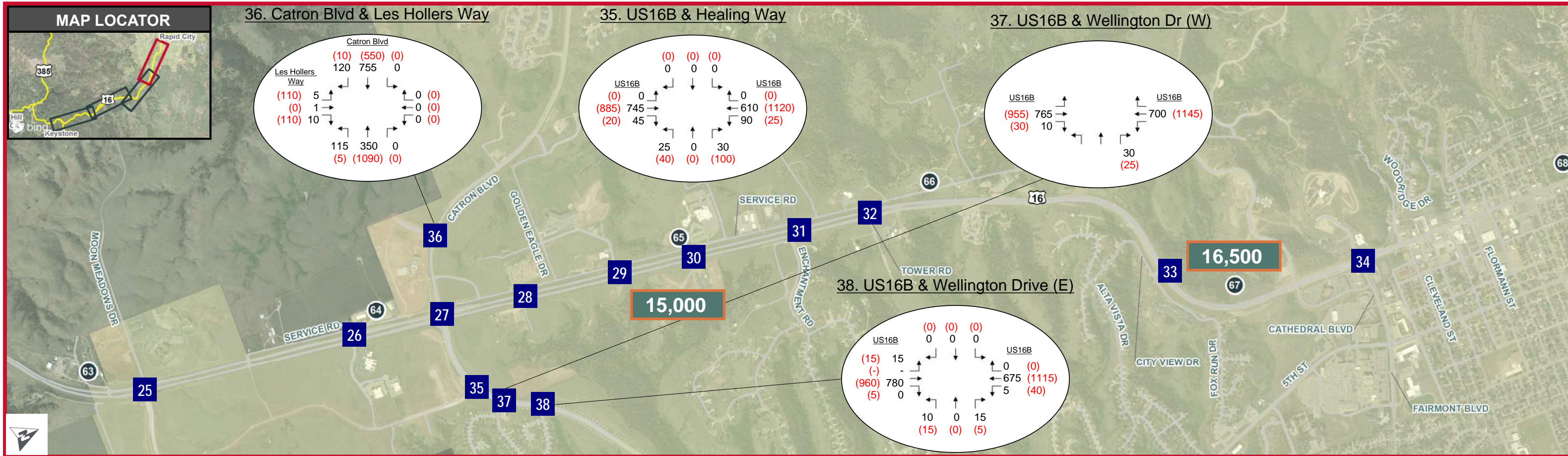
**AM - Early Morning Commute (Directional to Rapid City)**



AM volumes are balanced with intersections to the north and represent the early morning commute period towards Rapid City.

**2019 EXISTING CONDITIONS TRAFFIC VOLUMES AND LEVEL OF SERVICE**

**US16 CORRIDOR STUDY**







# Traffic Operations Analysis Methodology

Peak hour level of service (LOS) was calculated for study area intersections and roadway segments using Highway Capacity Software, Version 7 (HCS7) and methodology described in the 6<sup>th</sup> Edition of the Highway Capacity Manual (HCM6).

## Intersection LOS

HCM6 analysis methodology measures intersection average control delay in terms of seconds of delay per vehicle (sec/veh) and applies a LOS value in accordance with thresholds presented in **Table 3**.

**Table 3: Intersection Level of Service Thresholds**

LOS	Intersection Delay per Vehicle (sec/veh)	
	Signalized Intersections	Two-Way Stop-Control*, All-Way Stop-Control, and Roundabouts
A	≤ 10	≤ 10
B	> 10 – 20	> 10 – 15
C	> 20 - 35	> 15 - 25
D	> 35 – 55	> 25 – 35
E	> 55 – 80	> 35 – 50
F	Demand exceeds capacity; > 80	Demand exceeds capacity; > 50

Source: Transportation Research Board, HCM6.

\* Two-way stop-control LOS reflects worst-case stop-controlled approach.

Weighted intersection delay was also calculated to present a second average delay measure at two-way stop-control intersections. This method accounts for the operational benefits afforded to the major, high volume through movements that are not stop or signal-controlled at intersections. HCM6 reporting in HCS7 provides an average intersection delay value that reflects the weighted average delay of all vehicles entering the intersection. A LOS measure is applied to this average intersection delay value using HCM6 All-Way Stop-Control LOS thresholds.

## Multilane Highway Segment LOS

HCM6 methodology was used to analyze multilane highway segments. HCM6 analysis methods measure lane density in terms of passenger cars per mile per lane (pc/mi/l<sub>n</sub>) and applies a LOS value in accordance with thresholds presented in **Table 4**.



**Table 4: Multilane Highway Segment Level of Service Thresholds**

LOS	Density (pc/mi/ln)
A	≤ 11
B	> 11 – 18
C	> 18 – 26
D	> 26 – 35
E	> 35 – 45
F	Demand exceeds capacity OR Density > 45

## Merge and Diverge Segment LOS

For merge and diverge locations around the Rockerville area, HCM6 methodology for freeway merge and diverge segments was used to analyze similar locations around the Rockerville area. HCM analysis methods measure merge and diverge segment density in terms of passenger cars per mile per lane (pc/mi/ln) and applies a LOS value in accordance with thresholds presented in **Table 5**.

**Table 5: Freeway Merge and Diverge Segment Level of Service Thresholds**

LOS	Density (pc/mi/ln)
A	≤ 10
B	> 10 – 20
C	> 20 – 28
D	> 28 – 35
E	> 35
F	Demand exceeds capacity

## Level of Service Goals

The following minimum allowable LOS thresholds in **Table 6** have been established for this study, applicable to the existing conditions.

**Table 6: Minimum Allowable Level of Service by Facility and Area Type**

Facility Type	Minimum Allowable LOS		Notes
	Rural Area	Urban Area	
Signalized Intersections	LOS B	LOS C	Individual movements allowed to operate at LOS D.
Two-Way Stop-Controlled Intersections	LOS B	LOS C	TWSC intersection LOS will be based on weighted average intersection delay. The worst-cast stop-controlled approach delay and LOS may be lower than the minimum allowable LOS.
Multilane Highways	LOS B	LOS C	LOS B desirable in urban area.

Different LOS goals are identified for rural and urban areas. Currently, the urban-rural classification boundary is as follows:

- Urban – north of section line between Sammis Trail and Neck Yoke Road
- Rural – south of section line between Sammis Trail and Neck Yoke Road

Study LOS goals will be used to identify areas of operational needs along the corridor. Later in the study, these thresholds will be used to guide the development of potential improvements and subsequent evaluation of concepts.

## Existing Conditions Traffic Operations Analysis

The Existing Conditions traffic operations analysis reflects a scenario that analyzes the current network, using recently collected traffic counts (2019) factored to an analysis season and existing roadway conditions such as number of lanes, intersection traffic control, speed limits, signal timings, etc.

The 2019 existing conditions intersection and highway segment operations are summarized in the following tables. HCS7 analysis reports are provided in the **Appendix**.

### Intersections

The intersections are grouped by urban and rural classifications, based on whether they are north or south of the section line between Sammis Trail and Neck Yoke Road.

#### Urban Area Intersections

**Table 7** through **Table 10** and **Figure 2**, provide operational results for the urban area TWSC and signalized intersections.

Currently, all TWSC intersections meet LOS goals for this study based on the weighted average intersection delay goal of LOS C. There are intersections south of and along US16B/Catron Boulevard where the worst-case stop-controlled approach operates at LOS D or worse.

At signalized intersections, the US16/US16B/Catron Boulevard intersection operations currently exceeds the urban LOS goal of LOS C in both analysis peak periods. Current operational results, using existing signal timings, reflect LOS D and LOS E in the AM and PM peak periods, respectively.

It should be noted that the controller at the US16/US16B/Catron Boulevard intersection runs 'free' and has a dynamic maximum timing parameter. This controller function can incrementally increase the maximum green time when a phase maxes out two times in a row. For subsequent phases, a dynamic maximum green step may be added to the green time (based on timing parameter input) to better accommodate high demand movements. For this analysis, the dynamic maximum green time was coded into the HCS7 file where needed based on patterns in each peak period and spreads delay throughout the intersection.



**Table 7: US16 Corridor Two-Way Stop-Control Intersection Traffic Operations – Urban Area**

US16 Corridor Intersection	Measure*	AM			PM		
		Control Delay (sec/veh)	LOS	95% Queue (veh)	Control Delay (sec/veh)	LOS	95% Queue (veh)
Echo Ridge Drive	Overall	0.4	A	-	0.4	A	-
	TWSC	11.7	B	0.3	10.7	B	0.2
Service Road / school entrances	Overall	0.6	A	-	0.8	A	-
	TWSC	14.0	B	0.2	13.8	B	0.2
Enchantment Road	Overall	1.0	A	-	1.1	A	-
	TWSC	14.8	B	0.1	19.5	C	0.4
Table Rock Road	Overall	0.9	A	-	0.9	A	-
	TWSC	13.7	B	0.2	12.2	B	0.1
Promise Road	Overall	1.7	A	-	1.9	A	-
	TWSC	14.2	B	1.0	14.9	B	1.0
Tucker Street	Overall	0.0	A	-	0.0	A	-
	TWSC	0.0	A	0.0	0.0	A	0.0
Addison Avenue	Overall	1.2	A	-	2.1	A	-
	TWSC	25.8	D	0.2	33.3	D	1.8
Moon Meadows Drive	Overall	4.0	A	-	1.7	A	-
	TWSC	25.8	D	3.2	23.3	C	1.3
Sammis Trail	Overall	0.1	A	-	0.0	A	-
	TWSC	13.3	B	0.0	0.0	A	0.0

\* Measure notes: Overall intersection control delay represents the weighted average of each approach.  
 TWSC control delay represents the worst-cast stop-controlled approach delay and the associated 95<sup>th</sup>% queue.

**Table 8: Other Study Area Two-Way Stop-Control Intersection Traffic Operations – Urban Area**

Intersection	Measure*	AM			PM		
		Control Delay (sec/veh)	LOS	95% Queue (veh)	Control Delay (sec/veh)	LOS	95% Queue (veh)
US16B/Catron Blvd & Healing Way	Overall	1.5	A	-	1.9	A	-
	TWSC	25.9	B	0.8	27.7	D	1.7
US16B/Catron Blvd & Wellington Dr (W)	Overall	0.2	A	-	0.1	A	-
	TWSC	11.4	B	0.2	12.5	B	0.2
US16B/Catron Blvd & Wellington Dr (E)	Overall	0.4	A	-	0.9	A	-
	TWSC	19.6	C	0.3	62.9	F	0.9

\* Measure notes: Overall intersection control delay represents the weighted average of each approach.  
 TWSC control delay represents the worst-cast stop-controlled approach delay and the associated 95<sup>th</sup>% queue.



**Table 9: US16 Corridor Signalized Intersection Traffic Operations – Urban Area**

US16 Corridor Intersection	Measure	AM		PM	
		Control Delay (sec/veh)	LOS	Control Delay (sec/veh)	LOS
Fairmont Blvd / Cathedral Drive	Signal	21.3	C	22.4	C
US16B / Catron Blvd	Signal	37.8	D	46.1	D

**Table 10: Other Signalized Intersection Traffic Operations – Urban Area**

Intersection	Measure	AM		PM	
		Control Delay (sec/veh)	LOS	Control Delay (sec/veh)	LOS
Catron Blvd & Les Hollers Way	Signal	6.0	A	8.2	A

**Rural Area Intersections**

The following tables, **Table 11** through **Table 13**, provide operational results for the rural area TWSC intersections.

It was found that all rural area TWSC intersections meet study operational goals of weighted average intersection of LOS B or better. There are several locations, however, that exhibit worst-case stop-controlled approach LOS C or D. These locations are most prominent in the Neck Yoke Road area, Busted Five Lane area, and other tourist exits.



**Table 11: US16 Corridor Two-Way Stop-Control Intersection Traffic Operations – Rural Area (Neck Yoke Road Area to Strato Bowl Road)**

US16 Corridor Intersection	Measure*	AM			PM		
		Control Delay (sec/veh)	LOS	95% Queue (veh)	Control Delay (sec/veh)	LOS	95% Queue (veh)
Unknown Road	<b>Overall</b>	<b>0.0</b>	<b>A</b>	-	<b>0.1</b>	<b>A</b>	-
	<i>TWSC</i>	9.9	A	0.0	11.1	B	0.1
Reptile Gardens North	<b>Overall</b>	<b>0.1</b>	<b>A</b>	-	<b>0.3</b>	<b>A</b>	-
	<i>TWSC</i>	14.1	B	0.0	29.1	D	0.2
Reptile Gardens Center	<b>Overall</b>	<b>0.2</b>	<b>A</b>	-	<b>1.0</b>	<b>A</b>	-
	<i>TWSC</i>	16.5	C	0.1	29.2	D	0.8
Neck Yoke Road / Reptile Gardens S	<b>Overall</b>	<b>1.2</b>	<b>A</b>	-	<b>1.7</b>	<b>A</b>	-
	<i>TWSC</i>	19.0	C	0.2	28.1	D	0.5
Croell Pit West / Main Entrance	<b>Overall</b>	<b>0.0</b>	<b>A</b>	-	<b>0.0</b>	<b>A</b>	-
	<i>TWSC</i>	10.1	B	0.0	5.0	A	0.0
Bear Country Entrance	<b>Overall</b>	<b>0.1</b>	<b>A</b>	-	<b>0.2</b>	<b>A</b>	-
	<i>TWSC</i>	5.0	A	0.0	16.8	C	0.1
Bear Country Exit	<b>Overall</b>	<b>0.3</b>	<b>A</b>	-	<b>0.7</b>	<b>A</b>	-
	<i>TWSC</i>	9.0	A	0.1	17.7	C	0.6
Wilderness Canyon Road	<b>Overall</b>	<b>1.0</b>	<b>A</b>	-	<b>0.5</b>	<b>A</b>	-
	<i>TWSC</i>	21.8	C	0.7	0.3	C	0.3
Busted Five Lane	<b>Overall</b>	<b>0.7</b>	<b>A</b>	-	<b>1.2</b>	<b>A</b>	-
	<i>TWSC</i>	18.4	C	0.4	27.0	D	0.9
Strato Rim Drive	<b>Overall</b>	<b>0.5</b>	<b>A</b>	-	<b>0.7</b>	<b>A</b>	-
	<i>TWSC</i>	15.1	C	0.2	21.0	C	0.5
Strato Bowl Road	<b>Overall</b>	<b>0.1</b>	<b>A</b>	-	<b>0.5</b>	<b>A</b>	-
	<i>TWSC</i>	19.6	C	0.1	17.7	C	0.3

\* Measure notes: Overall intersection control delay represents the weighted average of each approach.

*TWSC* control delay represents the worst-cast stop-controlled approach delay and the associated 95<sup>th</sup> queue.



**Table 12: US16 Corridor Two-Way Stop-Control Intersection Traffic Operations – Rural Area (Rockerville Area to Keystone Wye)**

US16 Corridor Intersection	Measure*	AM			PM		
		Control Delay (sec/veh)	LOS	95% Queue (veh)	Control Delay (sec/veh)	LOS	95% Queue (veh)
US16 E & Golden Hills Drive	Overall	0.0	A	-	0.0	A	-
	TWSC	0.0	A	0.0	0.0	A	0.0
US16 E & Rockerville Road	Overall	0.7	A	-	0.4	A	-
	TWSC	11.3	B	0.1	10.9	B	0.1
US16 W & Pine Haven Drive	Overall	0.3	A	-	0.4	A	-
	TWSC	12.6	B	0.0	12.8	B	0.0
US16 W & Silver Mountain Road / Main Street	Overall	0.1	A	-	0.2	A	-
	TWSC	9.8	A	0.0	9.8	A	0.0
Silver Mountain Road	Overall	0.1	A	-	0.1	A	-
	TWSC	8.5	A	0.0	10.3	B	0.0
Beretta Road	Overall	0.1	A	-	0.3	A	-
	TWSC	14.6	B	0.0	17.8	C	0.2
Cosmos Road	Overall	0.3	A	-	0.3	A	-
	TWSC	13.2	B	0.0	9.1	A	0.1

\* Measure notes: Overall intersection control delay represents the weighted average of each approach.  
TWSC control delay represents the worst-cast stop-controlled approach delay and the associated 95<sup>th</sup> queue.

**Table 13: Other Study Area Two-Way Stop-Control Intersection Traffic Operations – Rural Area**

Intersection	Measure*	AM			PM		
		Control Delay (sec/veh)	LOS	95% Queue (veh)	Control Delay (sec/veh)	LOS	95% Queue (veh)
Neck Yoke Road & Spring Creek Road	Overall	1.7	A	-	2.8	A	-
	TWSC	2.3	A	0.0	2.1	A	0.1

\* Measure notes: Overall intersection control delay represents the weighted average of each approach.  
TWSC control delay represents the worst-cast stop-controlled approach delay and the associated 95<sup>th</sup> queue.



## Multilane Highway Segments

The US16 corridor was segmented in accordance with HCM6 methodology, with segment break points typically reflective of changes in grade. The respective segment was then analyzed based on ‘level’ or ‘rolling’ terrain or a specific grade for segments areas where long, steep grades were present (typically for segments longer than 0.25 miles and with grades of 3 percent or greater).

The US16 multilane highway segments are grouped by urban and rural classifications, based on whether they are north or south of the section line between Sammis Trail and Neck Yoke Road, in the following tables. A key that shows approximate limits of each segment is provided in the **Appendix**.

Overall, all US16 corridor multilane highway segments currently operate at LOS A.

**Table 14: US16 Corridor Multilane Highway Traffic Operations – Urban Area**

Seg. #	Mainline	Approximate Limits		Approx. Length (miles)*	Analysis Grade (%)**	AM LOS		PM LOS	
		From	To			EB	WB	EB	WB
35	US 16	MRM 63.00	Addison Ave	0.8	Rolling	A	A	A	A
36	US 16	Addison Ave	US16B/ Catron Blvd	0.3	5.2	A	A	A	A
37	US 16	US16B/ Catron Blvd	MRM 66.00	1.5	Rolling	A	A	A	A
38 - 39	US 16	MRM 66.00	Cathedral Dr/ Fairmont Blvd	1.4	5.9	A	A	A	A

\* Where multiple grades are shown, first length reflects eastbound direction and second length reflects westbound direction.

\*\* Analysis grade reflects level, rolling or specific grade (segment upgrade typically shown for segments representing two directions of travel), per HCM6 methodology.

Existing profile information obtained from SDDOT profile GIS layer (current spring 2019).

Note: limits and length are approximate, and thus may not align due to rounding and approximation of MRM locations.





**Table 15: US16 Corridor Multilane Highway Traffic Operations – Rural Area (Keystone Wye to Busted Five Lane Area)**

Seg. #	Mainline	Approximate Limits		Approx. Length (miles)*		Analysis Grade (%)**	AM LOS		PM LOS	
		From	To				EB	WB	EB	WB
1 - 2	US 16	Project Beginning MRM 50.75	Cosmos Road	0.5		4.5	A	A	A	A
3	US 16	Cosmos Road	MRM 52.00	0.6		Rolling	A	A	A	A
4	US 16	MRM 52.00	MRM 52.50	0.5		4.0	A	A	A	A
5	US 16	MRM 52.50	MRM 52.75	0.25		3.9	A	A	A	A
6	US 16	MRM 52.75	MRM 53.00	0.2		Level	A	A	A	A
7	US 16	MRM 53.00	Silver Mountain Rd	0.3		5.0	A	A	A	A
8	US 16	Silver Mountain Rd	MRM 54.00 (EB) / MRM 53.75 (WB)	0.7	0.6	3.1	A	A	A	A
9	US 16 (EB)	MRM 54.00	MRM 54.25	0.54		Rolling	A	-	A	-
10	US 16 (WB)	MRM 53.75	MRM 54.25	0.4		-3.5	-	A	-	A
11	US 16 (EB)	MRM 54.00	MRM 54.25	0.25		4.8	-	A	-	A
12	US 16	MRM 54.25	MRM 54.50	0.3		6.0	A	A	A	A
13	US 16	MRM 54.50	MRM 55.00	0.3		6.0	A	A	A	A
14	US 16 (EB)	MRM 55.00	MRM 55.25	0.25		Level	A	-	A	-
15	US 16 (WB)	MRM 55.00	MRM 55.25	0.25		4.0	-	A	-	A
16	US 16	MRM 55.25	MRM 55.75 (EB) / Silver Mtn Rd (WB)	0.4	0.3	6.0	A	A	A	A
17	US 16 (WB)	Silver Mountain Rd	Pine Haven Dr	0.2		3.2	-	A	-	A
18	US 16	MRM 55.75 (EB) / Pine Haven Rd (WB)	Golden Hills Dr (EB) / MRM 56.00 (WB)	0.3	0.2	Level	A	A	A	A
19	US 16 (EB)	Golden Hills Dr	MRM 56.50	0.3		-5.7	A	-	A	-
20	US 16 (WB)	MRM 56.00	Strato Bowl Rd	0.5		3.0	-	A	-	A

\* Where multiple grades are shown, first length reflects eastbound direction and second length reflects westbound direction.

\*\* Analysis grade reflects level, rolling or specific grade (segment upgrade typically shown for segments representing two directions of travel), per HCM6 methodology.

Existing profile information obtained from SDDOT profile GIS layer (current spring 2019).

Note: limits and length are approximate, and thus may not align due to rounding and approximation of MRM locations.



**Table 16: US16 Corridor Multilane Highway Traffic Operations – Rural Area (Busted Five Lane Area to Urban Area Boundary)**

Seg. #	Mainline	Approximate Limits		Approx. Length (miles)*		Analysis Grade (%)**	AM LOS		PM LOS	
		From	To				EB	WB	EB	WB
21	US 16	MRM 56.50 (EB) / Strato Bowl Rd (WB)	MRM 57.00	0.5	0.3	Rolling	A	A	A	A
22	US 16	MRM 57.00	MRM 57.25	0.25		4.6	A	A	A	A
23	US 16	MRM 57.25	MRM 57.50	0.25		6.0	A	A	A	A
24	US 16	MRM 57.50	MRM 58.75	1.2		Level	A	A	A	A
25	US 16	MRM 58.75	MRM 59.25	0.7		6.0	A	A	A	A
26	US 16	MRM 59.25	Croell Pit West Entrance	0.35		Level	A	A	A	A
27 - 31	US 16	Croell Pit West Entrance	MRM 61.50	1.8		6.0	A	A	A	A
32	US 16	MRM 61.50	MRM 62.00	0.4		Level	A	A	A	A
33 - 34	US 16	MRM 62.00	MRM 63.00	1.0		6.5	A	A	A	A

\* Where multiple grades are shown, first length reflects eastbound direction and second length reflects westbound direction.

\*\* Analysis grade reflects level, rolling or specific grade (segment upgrade typically shown for segments representing two directions of travel), per HCM6 methodology.

Existing profile information obtained from SDDOT profile GIS layer (current spring 2019).

Note: limits and length are approximate, and thus may not align due to rounding and approximation of MRM locations.



## Merge and Diverge Segments

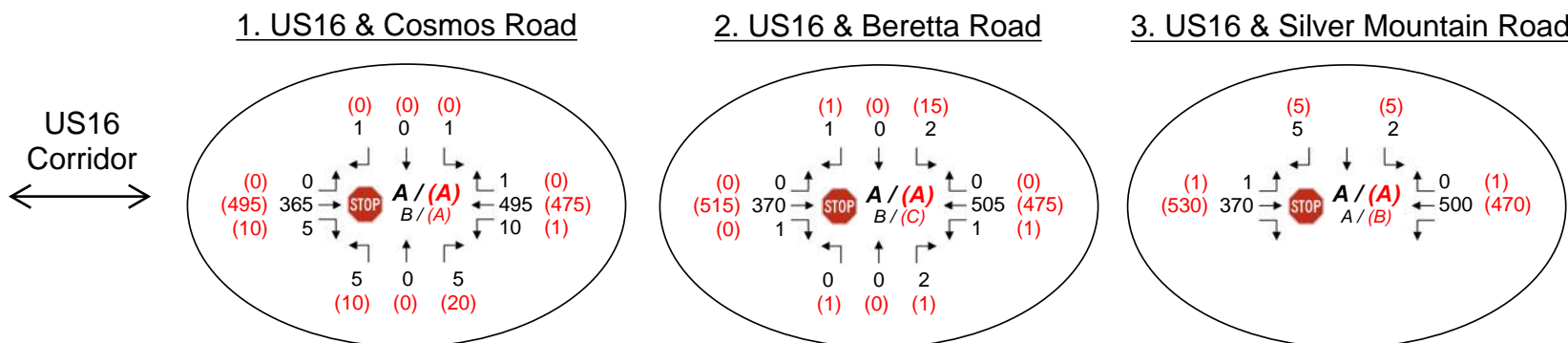
US16 merge and diverge locations around the Rockerville area were analyzed as freeway merge and diverge segments to give an indication to how these locations are operating in terms of vehicle density. **Table 17** presents a summary of merge and diverge segment density.

**Table 17: US16 Corridor Merge/Diverge Segment Traffic Operations – Rural Area (Rockerville Area)**

Merge/ Diverge Location	Segment Type	AM			PM		
		LOS	Average Density (pc/mi/ln)	Ramp Influence Area Density (pc/mi/ln)	LOS	Average Density (pc/mi/ln)	Ramp Influence Area Density (pc/mi/ln)
US16 E & 16 E1 55.42 <i>Off-ramp to Rockerville</i>	Diverge	A	3.7	2.9	A	5.4	4.6
US16 W & 16 W2 55.67 <i>On-ramp to Rockerville</i>	Merge	A	4.9	6.8	A	5.0	6.9
US16 W & WB 55.70/Main Street <i>Off-ramp to Rockerville</i>	Diverge	A	5.1	5.1	A	5.5	5.5
US16 E & 16 E2 56.09 <i>On-ramp to Rockerville</i>	Merge	A	4.1	4.2	A	5.5	5.4
US16 W & 16 W1 56.15 <i>Off-ramp to Rockerville</i>	Diverge	A	5.0	5.0	A	4.9	5.0

## Conclusions

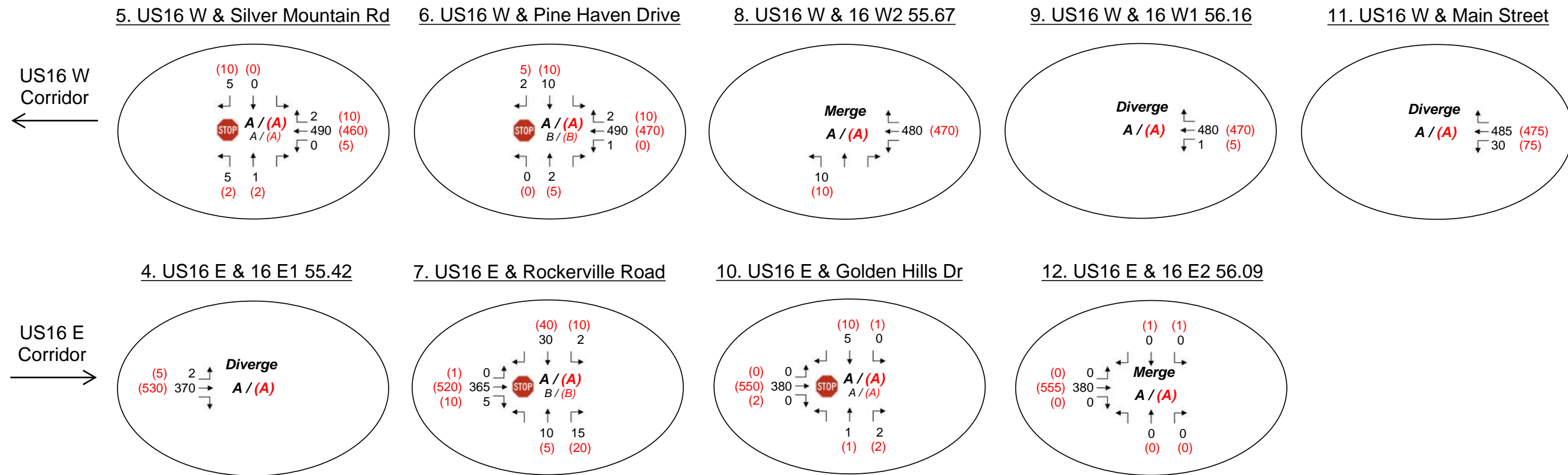
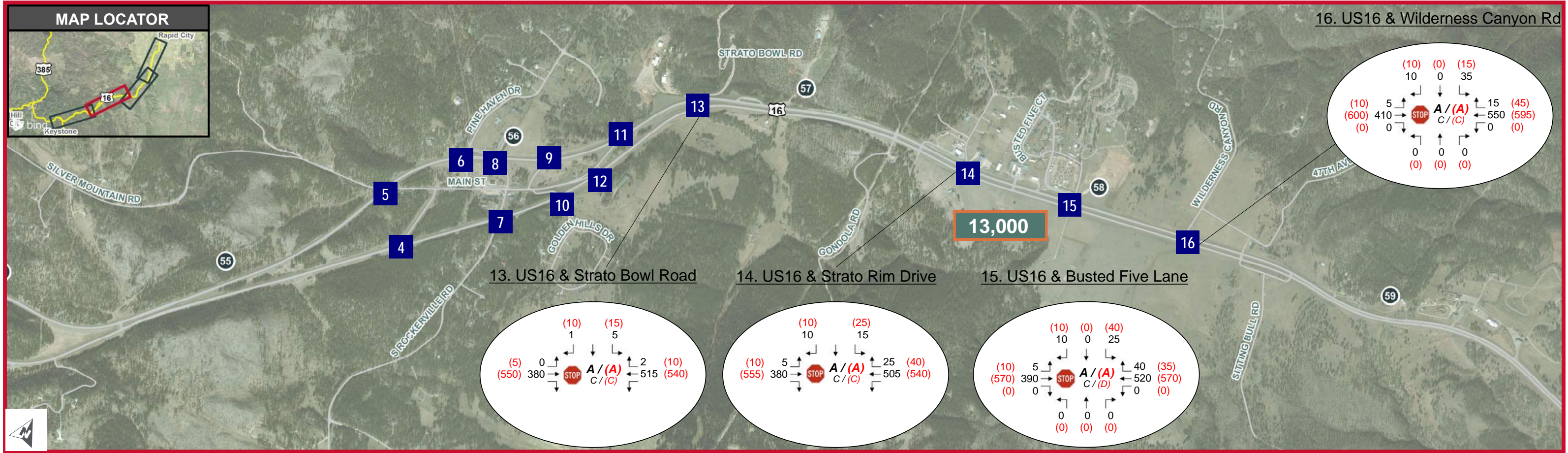
It can be concluded that nearly all intersections and highway segment operations along the US16 study corridor for a June 2019 volume set meet LOS goals for this study. There were some stop-controlled approaches that operate at LOS D or worse, particularly through the higher volume areas along US16B and along US16 south of US16B. The lone intersection that currently does not meet LOS goals based on volumes developed for this study is the US16/US16B/Catron Boulevard intersection. Here, the overall intersection delay was measured at LOS D in the AM and PM peak hours, respectively.

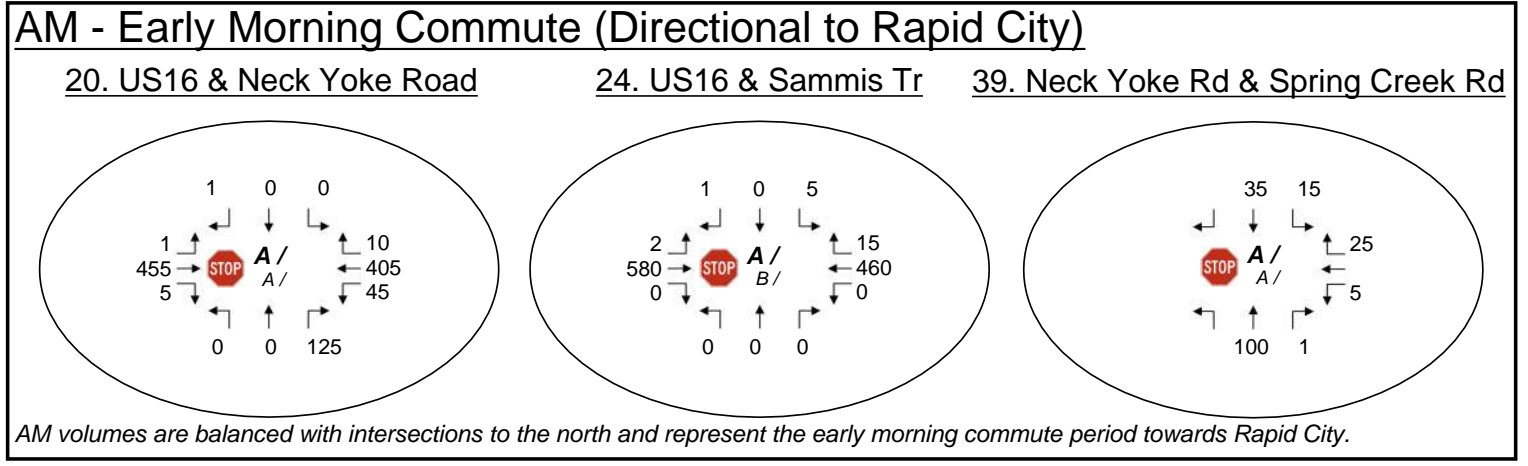
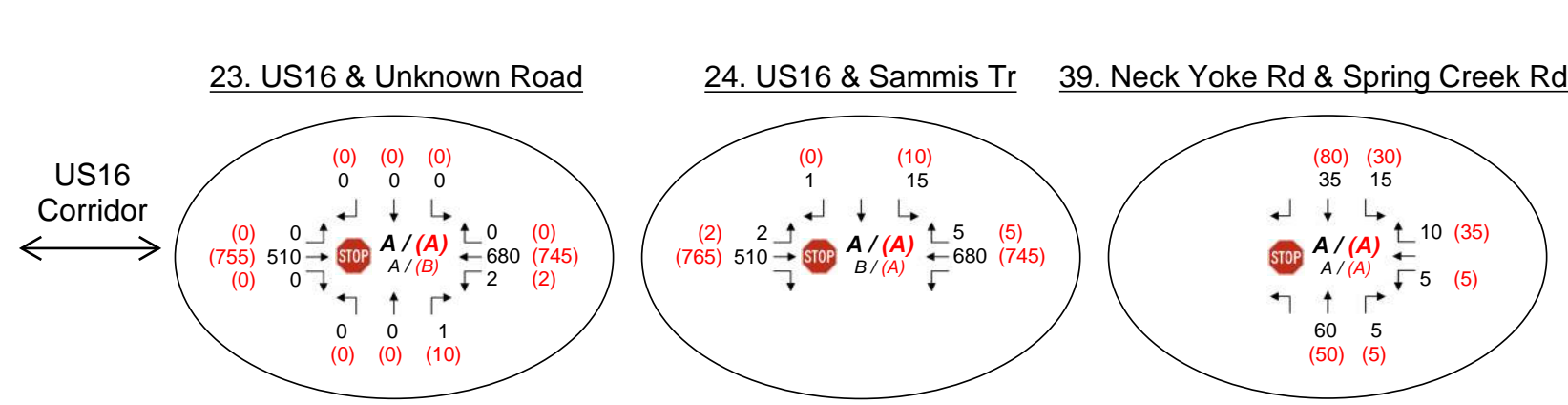
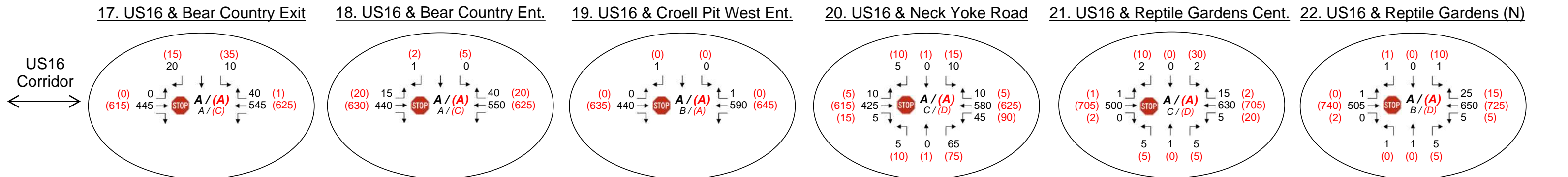


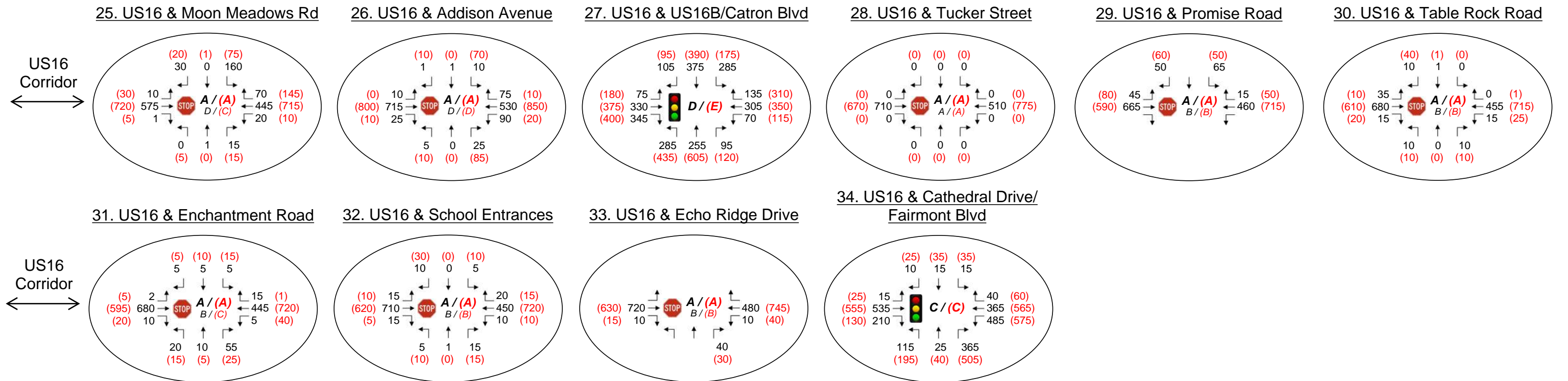
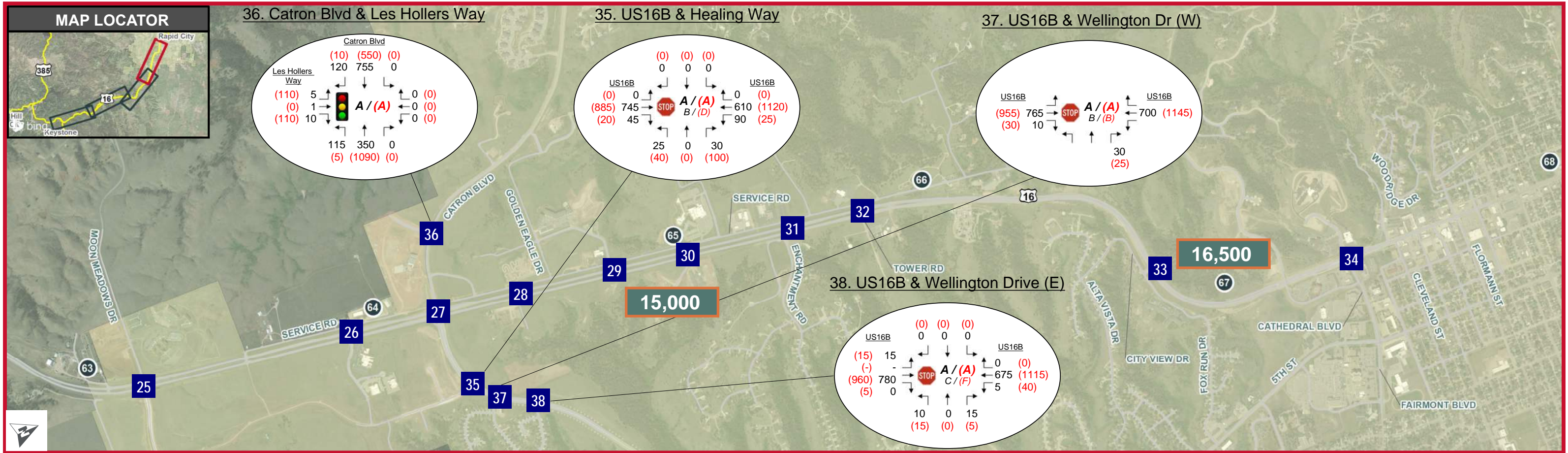
### Legend

- Mileage Reference Marker (MRM)
- Study Intersection
- 2019 Daily Traffic Volumes\*
- AM (PM) 2019 Peak Hour Traffic Volumes\*
- Intersection Traffic Control and AM / (PM) Level of Service (LOS)**
- A / (B) Signalized Intersection
- Two-way Stop Control Intersection**
- A / (B) Overall Intersection
- A / (B) Worst-case Stop-controlled Approach

*Notes:*  
 \* Volumes reflect June design season  
 Stop-controlled intersections are two-way stop control unless noted.







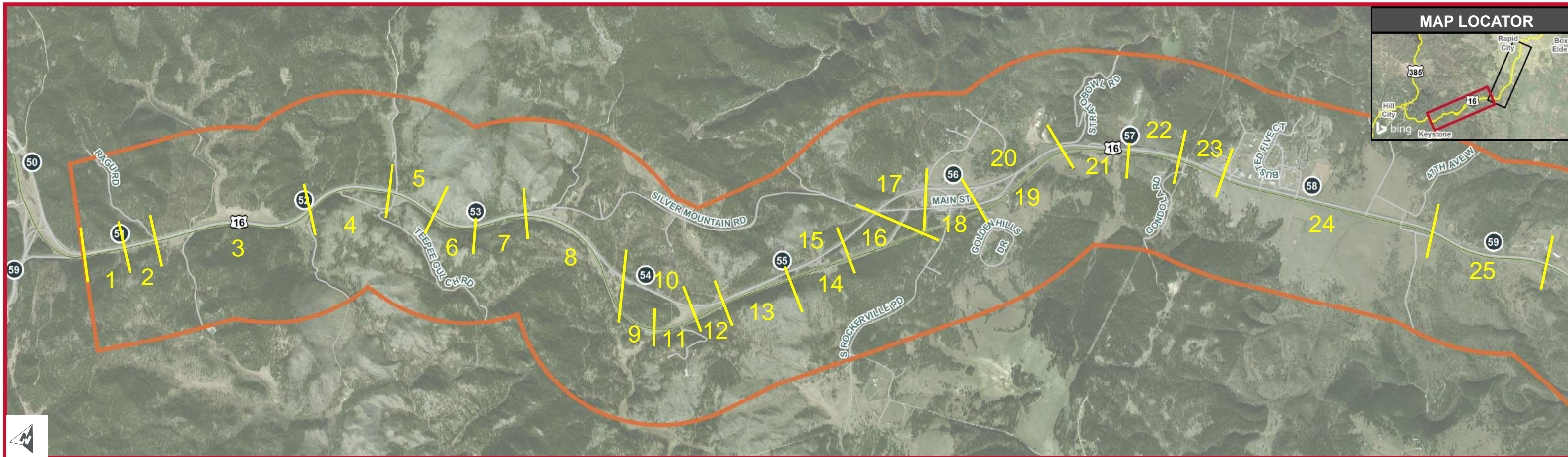
# Appendix

- A. Multilane Highway Segmentation Key
- B. HCS7 Reports





## Appendix A – Multilane Highway Segmentation Key



Seg. #	Mainline	Approximate Limits		Approx. Length (miles)*	Specific Grade (%)	
		From	To		EB	WB
1	US 16	Project Beginning MRM 50.75	MRM 51.00	0.3	-4.1	4.1
2	US 16	MRM 51.00	Cosmos Rd	0.2	-4.5	4.5
3	US 16	Cosmos Road	MRM 52.00	0.6	Rolling	Rolling
4	US 16	MRM 52.00	MRM 52.50	0.5	4.0	-4.0
5	US 16	MRM 52.50	MRM 52.75	0.25	-3.9	3.9
6	US 16	MRM 52.75	MRM 53.00	0.2	Level	Level
7	US 16	MRM 53.00	Silver Mountain Rd	0.3	-5.0	5.0
8	US 16	Silver Mountain Rd	MRM 54.00 (EB) / MRM 53.75 (WB)	0.7   0.6	-3.2	3.1
9	US 16 (EB)	MRM 54.00	MRM 54.25	0.54	Rolling	-
10	US 16 (WB)	MRM 53.75	MRM 54.25	0.4	-	-3.5
11	US 16 (EB)	MRM 54.00	MRM 54.25	0.25	-	4.8
12	US 16	MRM 54.25	MRM 54.50	0.3	6	-4.5

Seg. #	Mainline	Approximate Limits		Approx. Length (miles)*	Specific Grade (%)	
		From	To		EB	WB
13	US 16	MRM 54.50	MRM 55.00	0.3	-7	6
14	US 16 (EB)	MRM 55.00	MRM 55.25	0.25	Level	-
15	US 16 (WB)	MRM 55.00	MRM 55.25	0.25	-	3.8
16	US 16	MRM 55.25	MRM 55.75 (EB) / Silver Mtn Rd (WB)	0.4   0.3	-6	6
17	US 16 (WB)	Silver Mountain Rd	Pine Haven Dr	0.2	-	3.2
18	US 16	MRM 55.75 (EB) / Pine Haven Rd (WB)	Golden Hills Dr (EB) / MRM 56.00 (WB)	0.3   0.2	Level	Level
19	US 16 (EB)	Golden Hills Dr	MRM 56.50	0.3	-5.7	-
20	US 16 (WB)	MRM 56.00	Strato Bowl Rd	0.5	-	3.0

Seg. #	Mainline	Approximate Limits		Approx. Length (miles)*	Specific Grade (%)	
		From	To		EB	WB
21	US 16	MRM 56.50 (EB) / Strato Bowl Rd (WB)	MRM 57.00	0.5   0.3	Rolling	Rolling
22	US 16	MRM 57.00	MRM 57.25	0.25	4.6	-4.6
23	US 16	MRM 57.25	MRM 57.50	0.25	-6	6
24	US 16	MRM 57.50	MRM 58.75	1.2	Level	Level
25	US 16	MRM 58.75	MRM 59.25	0.7	-6	6

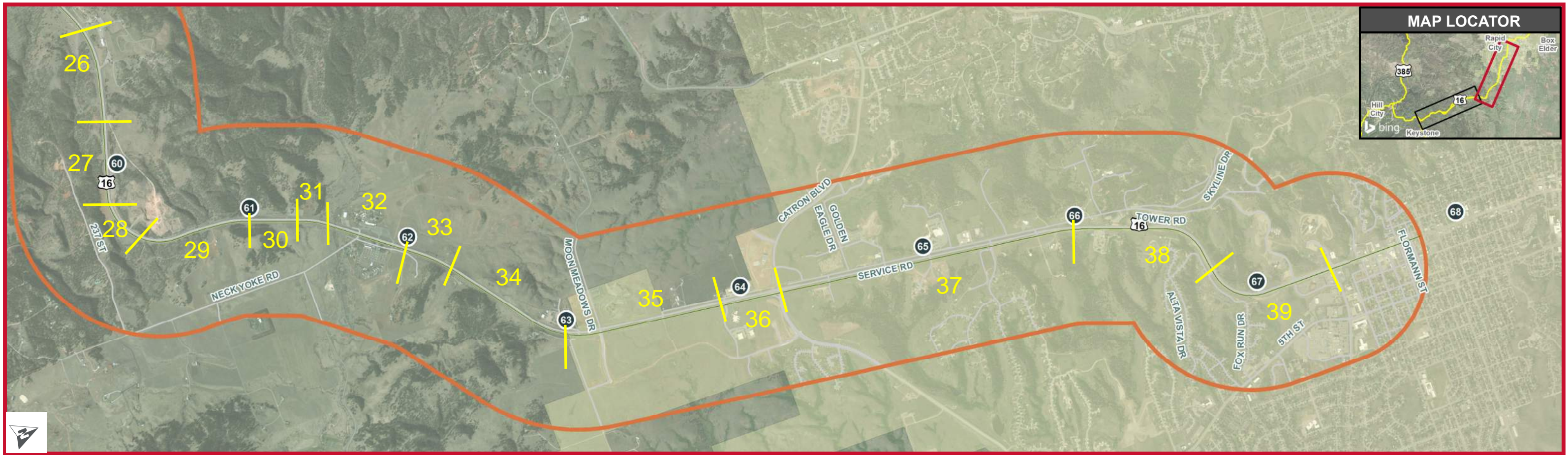
\*\* Analysis grade reflects level, rolling or specific grade (segment upgrade typically shown for segments representing two directions of travel), per HCM6 methodology.

Existing profile information obtained from SDDOT profile GIS layer (current spring 2019).

Note: limits and length are approximate, and thus may not align due to rounding and approximation of MRM locations.

### Legend

- Segment Boundary
- 35 Segment Number



Seg. #	Mainline	Approximate Limits		Approx. Length (miles)*	Analysis Grade (%)**	Specific Grade (%)	
		From	To			EB	WB
26	US 16	MRM 59.25	Croell Pit West Entrance	0.35	Level	Level	Level
27	US 16	Croell Pit West Entrance	MRM 60.25	0.5	6.0	-6	6
28	US 16	MRM 60.25	MRM 60.50	0.2	4.7	-4.7	4.7
29	US 16	MRM 60.50	MRM 61.00	0.7	6.0	-6	6
30	US 16	MRM 61.00	MRM 61.25	0.2	5.0	-5	5
31	US 16	MRM 61.25	MRM 61.50	0.2	5.8	-5.8	5.8
32	US 16	MRM 61.50	MRM 62.00	0.4	Level	Level	Level
33	US 16	MRM 62.00	MRM 62.25	0.4	6.5	6.5	-6.5
34	US 16	MRM 62.25	MRM 63.00	0.6	4.3	4.3	-4.3

Seg. #	Mainline	Approximate Limits		Approx. Length (miles)*	Specific Grade (%)	
		From	To		EB	WB
35	US 16	MRM 63.00	Addison Ave	0.8	Rolling	Rolling
36	US 16	Addison Ave	US16B/ Catron Blvd	0.3	-5.2	5.2
37	US 16	US16B/ Catron Blvd	MRM 66.00	1.5	Rolling	Rolling
38	US 16	MRM 66.00	Echo Ridge Dr	0.8	-5.9	5.9
39	US 16	Echo Ridge Dr	Cathedral Dr/ Fairmont Blvd	0.6	-5.3	5.3

\*\* Analysis grade reflects level, rolling or specific grade (segment upgrade typically shown for segments representing two directions of travel), per HCM6 methodology.  
 Existing profile information obtained from SDDOT profile GIS layer (current spring 2019).  
 Note: limits and length are approximate, and thus may not align due to rounding and approximation of MRM locations.

**Legend**

- Segment Boundary
- Segment Number



## Appendix B – HCS7 Reports