

Technical Memo

Date: Wednesday, December 02, 2020

Project: US14A/US85 Corridor / Deadwood Box Study

To: Study Advisory Team

From: HDR

Subject: Traffic Forecasts

Introduction

The purpose of this technical memorandum is to document the methodology and process used to develop future-year traffic forecasts for the US14A/US85 Corridor / Deadwood Box Study. This methodology aligns with what was agreed upon by the Study Advisory Team in the *Methods and Assumptions* document.

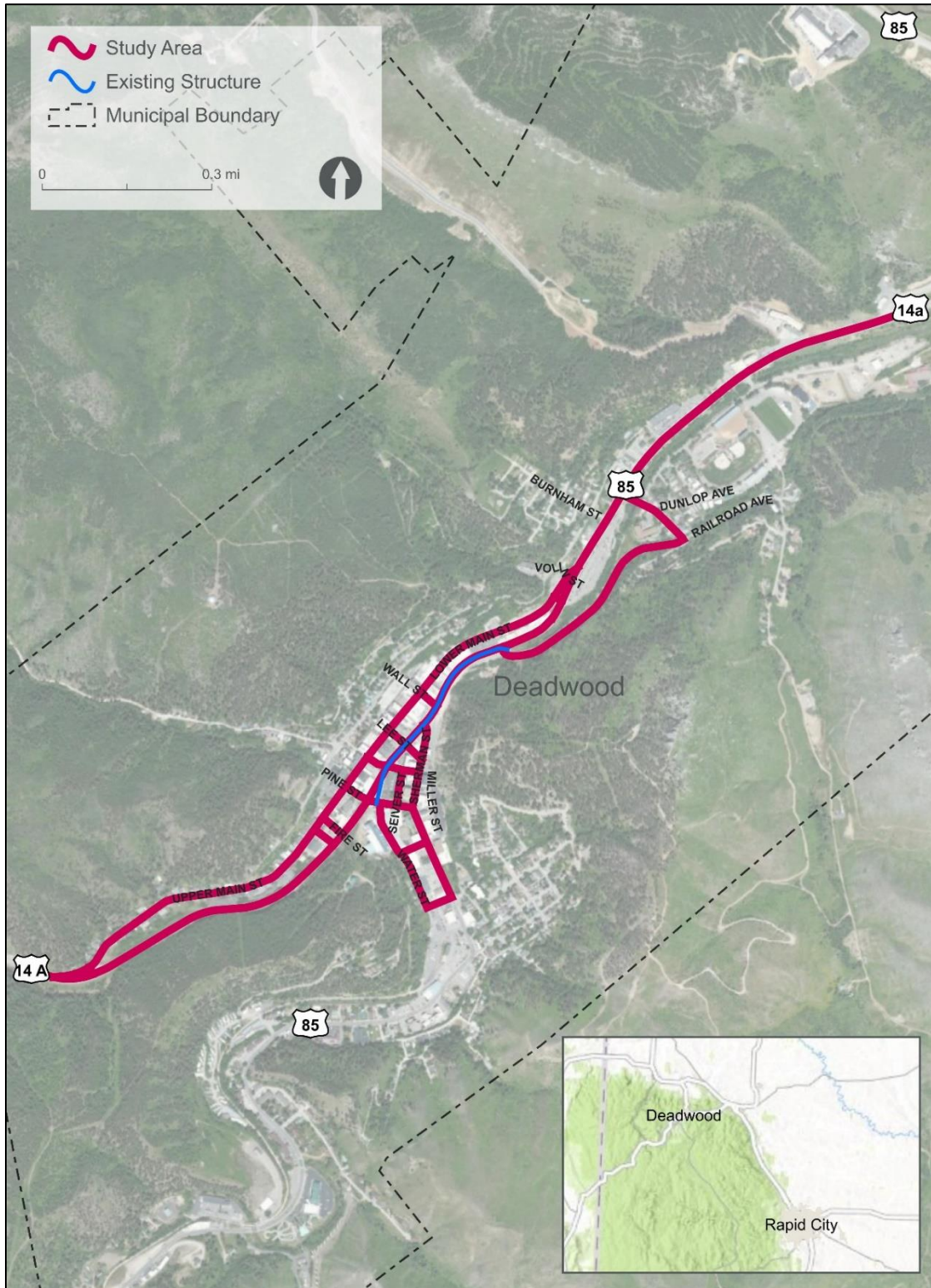
As part of this memo, the following traffic volume sets are presented:

- 2020 Existing Conditions
- 2027 First Possible Year of Project Completion No Build Conditions
- 2050 Planning Horizon No Build Conditions

The study area is located entirely within Deadwood, South Dakota (Lawrence County) city limits, as shown in Figure 1, to reflect the following limits:

- US14A / Pioneer Way - Upper Main Street to US85;
- US85 / Sherman Street - Cemetery Street / Water Street to Pine Street;
- US85 / Pine Street - Sherman Street to US14A / Pioneer Way;
- Upper/Lower Main Street - Armory Street to US14A / Pioneer Way;
- Sherman Street - US85 / Pine Street to US14A / Pioneer Way;
- Pine Street - US14A / Pioneer Way to Main Street;
- Armory Street - US14A / Pioneer Way to Upper Main Street;
- Fire Street - US14A / Pioneer Way to Upper Main Street;
- Siever Street - US85 / Pine Street to Deadwood Street;
- Deadwood Street - Sherman Street to Main Street;
- Lee Street - Sherman Street to Lower Main Street;
- Wall Street - US14A / Pioneer Way to Lower Main Street;
- Railroad Avenue - US14A / Pioneer Way to Dunlop Avenue;
- Dunlop Avenue / McKinley Street - Railroad Avenue to US14A / Pioneer Way;
- Water Street - US85 / Sherman Street to US85 / Pine Street; and
- Center Street - US85 / Sherman Street to Water Street.

Figure 1: Project Study Area





Sources of Data

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

- Peak hour intersection turning movement counts
 - Collected by consultant team on Tuesday, September 15, 2020.
 - Continuous 12-hour counts, from 6:00 AM to 6:00 PM, binned in 15-minute increments by individual movement.
 - Contribution to study: provides peak hour intersection turning movement volumes, peak hour factors, and vehicle classification counts (heavy vehicle percentages and FHWA classification counts).
- 24-hour roadway segment counts
 - Collected by SDDOT on Tuesday and Wednesday, September 15-16, 2020.
 - Continuous 24-hour counts binned in 1-hour increments by direction of travel.
 - Contribution to study: provided daily and peak hour segment volumes.

Intersection and roadway segment count locations are summarized in Table 1 and Table 2, respectively.

Table 1: Intersection Turning Movement Count Locations

	Primary Street	Side Street
1	US14A / Pioneer Way	Upper Main Street (South Junction)
2	US14A / Pioneer Way	Upper Main Street (North Junction)
3	US14A / Pioneer Way	Armory Street
4*	US14A / Pioneer Way	US85 / Pine Street
5	US14A / Pioneer Way	Deadwood Street
6	US14A / Pioneer Way	Lee Street
7*	US14A / Pioneer Way	Sherman Street
8*	US14A / Pioneer Way	Wall Street
9	US14A / Pioneer Way	Railroad Avenue
10	US14A / Pioneer Way	Lower Main Street (South Junction)
11	US14A / Pioneer Way	Lower Main Street (North Junction)
12	US14A / Lower Main Street	Burnham Avenue
13	US14A / Lower Main Street	Dunlop Avenue / McKinley Street
14	US14A / Lower Main Street	US85
15	US85 / Sherman Street	Cemetery Street / Water Street
16*	US85 / Pine Street	Sherman Street
17	Main Street	Pine Street
18	Railroad Avenue	Dunlop Avenue / McKinley Street
19	Main Street	Deadwood Street

Table 2: Segment Count Locations

Primary Street	Segment Boundary Intersection 1	Segment Boundary Intersection 2
US14A	Upper Main Street	US85 / Pine Street
	US85 / Pine Street	Deadwood Street
	Deadwood Street	Sherman Street
	Sherman Street	Railroad Avenue
	Lower Main Street	US85
US85 / Sherman Street	Cemetery Street / Water Street	Pine Street
US85 / Pine Street	Sherman Street	US14A / Pioneer Way
Sherman Street	US85 / Pine Street	US14A / Pioneer Way

The following SDDOT-derived Average Annual Daily Traffic (AADT) seasonal adjustment factors were applied to develop June ‘design season’ traffic volume sets:

- US14A/US85 intersections: 0.83
- Local street intersections: 0.82

Traffic forecasts were based on a review of two sources of data:

- Historical traffic counts collected by SDDOT as part of their annual count programs.
- SDDOT-developed county-wide growth factors for Lawrence County
 - 20-year: 1.481
 - 30-year: 1.720

Existing Volumes

The process used to develop 2020 existing conditions traffic volumes is described in the *2020 Existing Conditions Traffic Operations* technical memo and reflects the following:

- Peak hours:
 - AM: 7:30 AM – 8:30 AM
 - PM: 3:30 PM – 4:30 PM
- Traffic counts were adjusted to reflect a June season volume set.
- Volumes were balanced and smoothed across study intersections.
- Heavy vehicle percent based on intersection turning movement counts.

Forecast Methodology

The following process was used to develop daily and peak hour intersection turning movement and segment volumes:

1. Review historical traffic counts to identify historical growth/decline trends.
2. Review SDDOT county-wide growth factors for Lawrence County.



Review of Historical Traffic Counts

Ten locations along US14A and US85 that the SDDOT regularly counts as part of their statewide count programs were reviewed to identify historical volume trends between 2010 and 2019. As shown in Table 3, trends vary and appear to be influenced by localized traffic patterns and conditions specific to the segment. In a few instances, adjacent segments exhibit volumes trending in opposite directions. Volumes within the downtown area tend to show consistent, modest increases over this timeframe of 1 percent or less.

Table 3: Historical Volume Trends (2010 – 2019 SDDOT Counts)

Primary Street	Segment Boundary Intersection 1	Segment Boundary Intersection 2	Growth Rate - decline + growth
US14A	Deadwood SW City Limits	Upper Main Street	+ 3.7%
	Upper Main Street	Pine Street	- 3.0%
	Pine Street	Sherman Street	+ 0.2%
	Sherman Street	Lower Main Street	0.0%
	Lower Main Street	US 85	- 2.4%
	US 85	Deadwood NE City Limits	+ 0.7%
US85	US 385	Walnut Street	+ 1.2%
	Walnut Street	Cemetery Street	- 3.5%
	Cemetery Street	Pine Street	+ 0.4%
	US 14A	North of US 14A	+ 0.5%

Review of SDDOT Growth Factors for Lawrence County

SDDOT-derived growth factors for Lawrence County urban arterials/collectors/local streets are as follows:

- 20-year growth factor: 1.481
- 30-year growth factor: 1.720
- *Factors reflect an annual straight-line growth rate of 2.4 percent.*

These factors reflect a higher growth rate than most of the reviewed historical count locations.

Forecast Process

It was determined that the SDDOT growth factors for Lawrence County would be used for this study based on the following:

- Provides a more conservative estimate of future-year traffic volumes (than historical count growth rates), reflective of volume trends throughout the county.
- Reflects an increase in traffic volumes on all analysis roadways.

The following process, based on forecast methodology presented in *NCHRP 765: Analytical Travel Forecasting Approaches for Project-Level Planning and Design*, was used to derive future-year traffic volumes:

1. Establish 2020 existing conditions traffic volumes (AM, PM, and daily).
2. Determine 2050 No Build condition AM and PM peak hour traffic volumes.
 - a. Apply the 30-year growth factor to the 2020 existing conditions AM and PM peak hours.
 - b. Review movements for reasonableness and adjust if needed.
 - i. Includes evaluating future potential development, limitations of growth along built-out local roads, proportion of the daily traffic volume occurring in the respective peak hour ('K' factor), etc.
 - c. Balance and smooth volumes across study area intersections.
3. Determine 2027 No Build condition AM and PM peak hour traffic volumes.
 - a. Use straight-line interpolation between 2020 existing conditions and 2050 No Build conditions.
 - b. Balance and smooth volumes across study area intersections.
4. Determine 2050 No Build condition daily traffic volumes.
 - a. Apply the 30-year growth factor to the 2020 existing conditions AM and PM peak hours.
 - b. Review segment volumes for reasonableness and adjust if needed.
 - c. Round to a planning-level volume.
5. Determine 2027 No Build condition daily traffic volumes.
 - a. Use straight-line interpolation between 2020 existing conditions and 2050 No Build conditions.
 - b. Round to a planning-level volume.

Traffic Volumes

A summary of traffic volumes developed for this study are summarized on the following pages.

- Daily segment volumes are summarized in Table 4.
- Peak hour intersection turning movement volumes are summarized in the following figures:
 - Figure 2: 2020 Existing Conditions
 - Figure 3: 2027 No Build Conditions
 - Figure 4: 2050 No Build Conditions
- Traffic design data is summarized in Table 5.
- Traffic classification data is summarized in Table 6.



Table 4: Forecast Daily Segment Volumes

Corridor	Location (Relative to Box Culvert)	Segment		2020 AADT (vpd)	Growth Rate	Growth Factor		Forecast AADT (vpd)	
		Start	End			2027	2050	2027	2050
US 14A/ Pioneer Way	South	Upper Main Street	US 85/Pine Street	6,800	2.4%	1.17	1.72	8,000	12,000
	Within Limits	US 85/Pine Street	Deadwood Street	5,600	2.4%	1.17	1.72	7,000	10,000
		Deadwood Street	Sherman Street	8,500	2.4%	1.17	1.72	10,000	15,000
		Sherman Street	Lower Main Street	11,600	2.4%	1.17	1.72	14,000	20,000
	North	Lower Main Street	US 85	11,700	2.4%	1.17	1.72	14,000	21,000
US 85/ Pine Street	n/a	Cemetery Street	Sherman Street	9,200	2.4%	1.17	1.72	11,000	16,000
		Sherman Street	US 14A/Pioneer Way	4,000	2.4%	1.17	1.72	5,000	7,000
Sherman	n/a	US 85/Pine Street	US 14A/Pioneer Way	6,500	2.4%	1.17	1.72	8,000	12,000

Figure 2: 2020 Existing Conditions Turning Movement Volumes

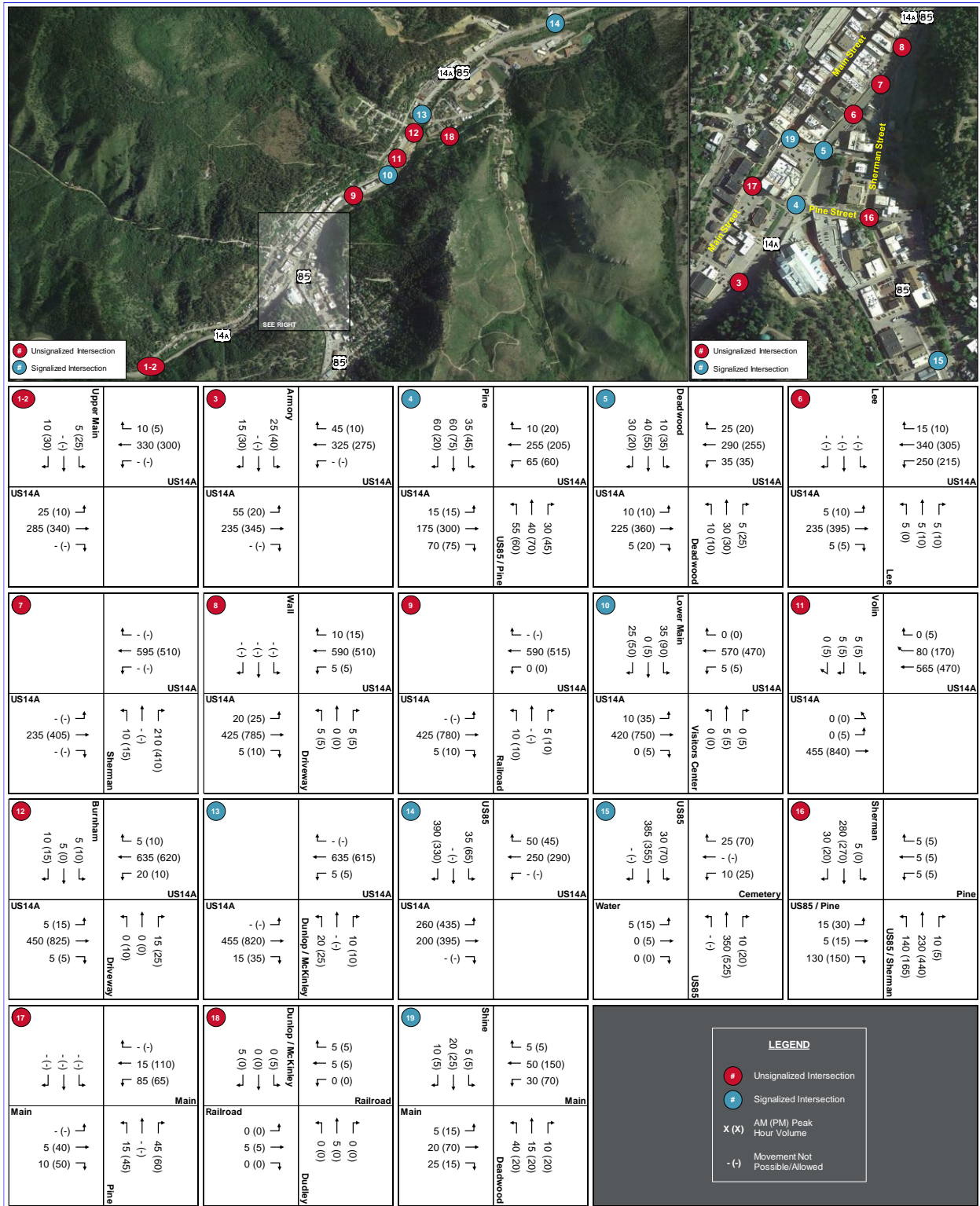


Figure 3: 2027 Forecast Turning Movement Volumes

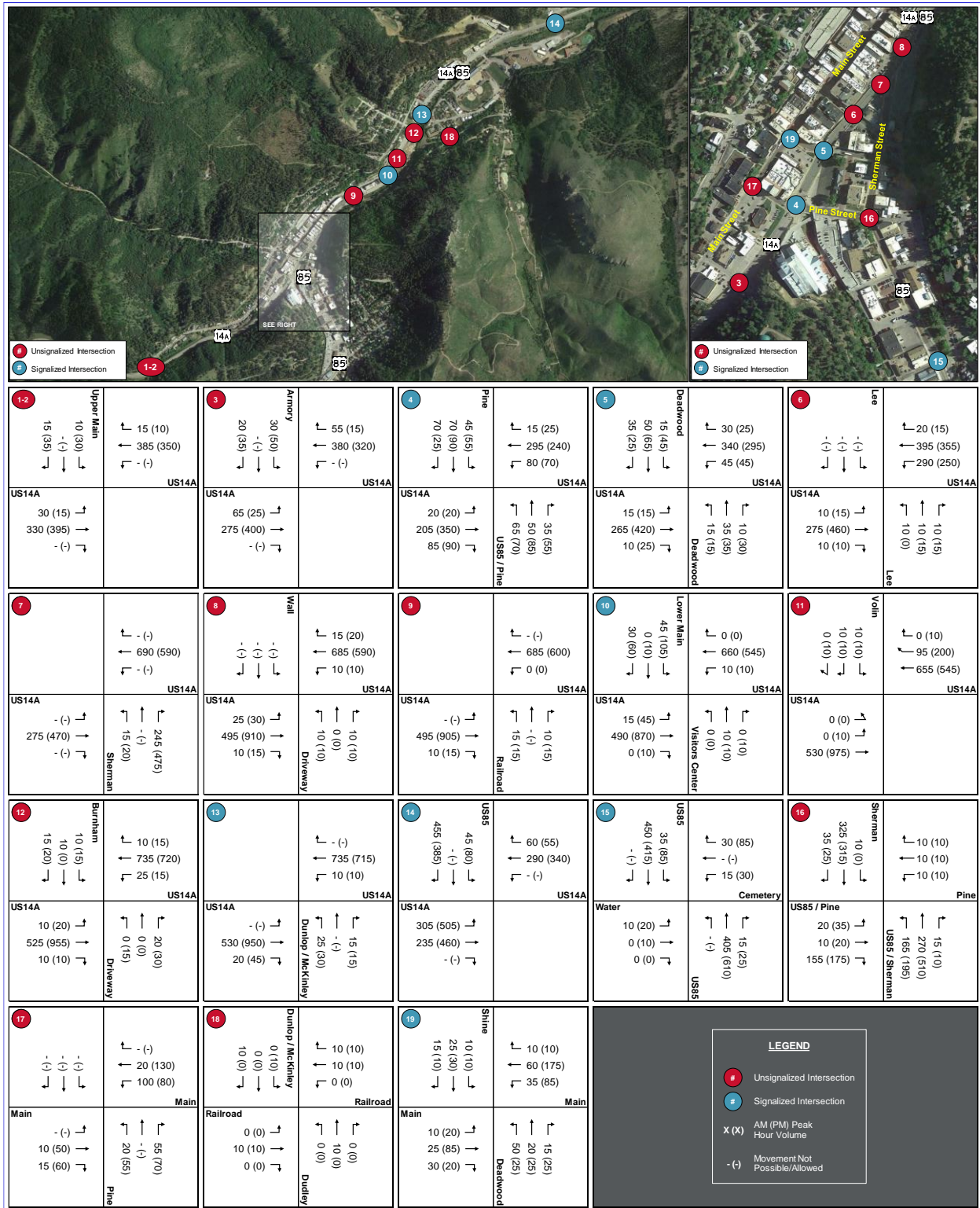


Figure 4: 2050 Forecast Turning Movement Volumes

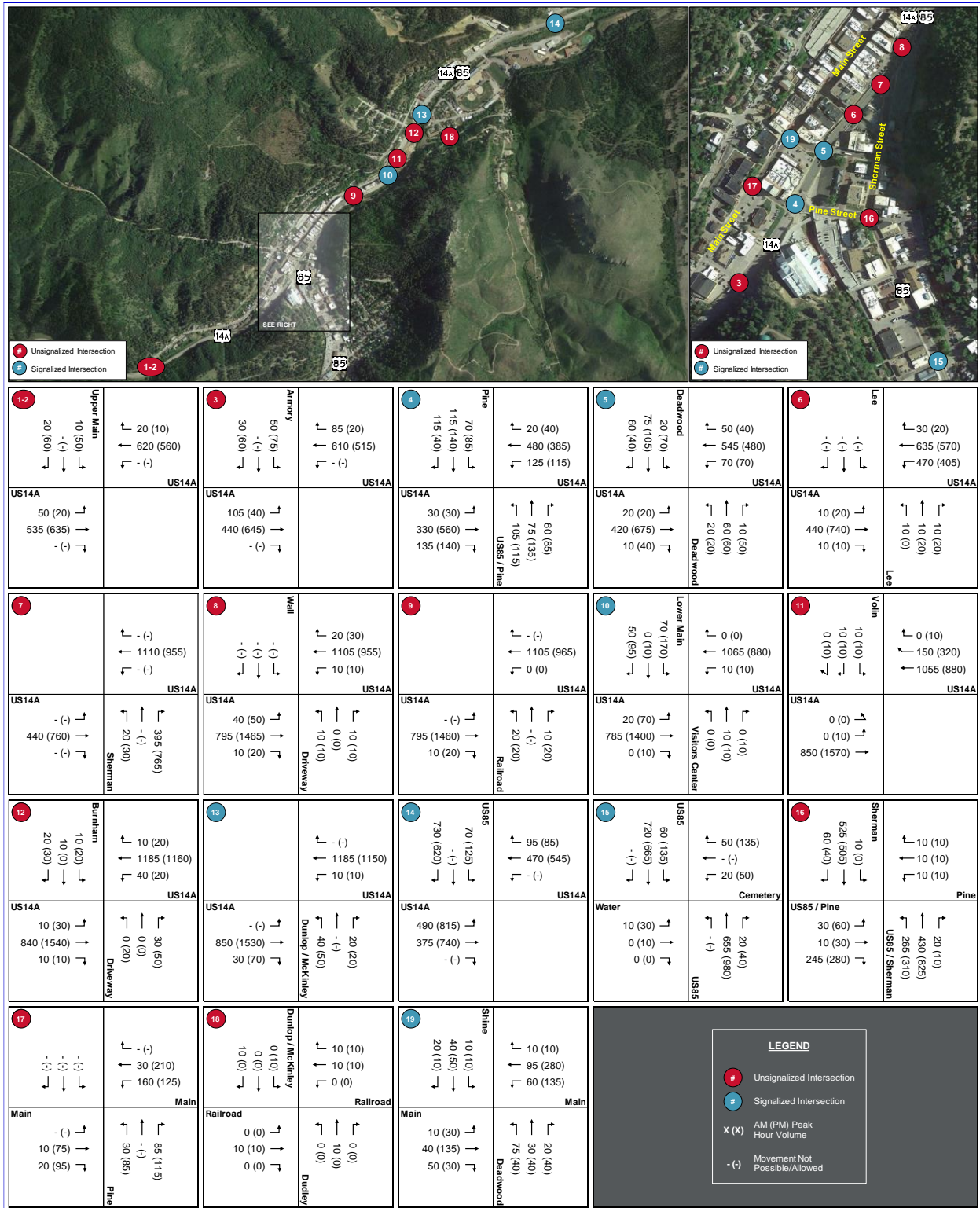




Table 5: Traffic Design Data Summary

Main Corridor	Location (Relative to Box Culvert)	Average Daily Traffic (veh/day)			Existing PM Peak Hour Traffic (veh)			Traffic Factors		Design Hourly Volume (veh)		Directional Design Hourly Volume (veh)	
		2020	2027	2050	EB/NB	WB/SB	Total	K _{PM}	D _{PM}	2027	2050	2027	2050
US 14A/ Pioneer Way	South	6,800	8,000	12,000	390	285	675	0.10	0.58	800	1,200	470	700
	Within Limits	11,600	14,000	20,000	790	530	1,320	0.11	0.60	1,600	2,280	960	1,370
	North	11,700	14,000	21,000	845	645	1,490	0.13	0.57	1,790	2,680	1,020	1,520
US 85/ Pine Street	n/a	4,000	5,000	7,000	195	175	370	0.09	0.53	470	650	250	350



Table 6: Traffic Classification Data Summary

Deadwood Box Study Traffic Classification Data Summary														
Main Corridor	Location (Relative to Box Culvert)	Design Hour Volume by FHWA Vehicle Classification (veh)												
		1	2	3	4	5	6	7	8	9	10	11	12	13
2020 Existing Year														
US 14A/ Pioneer Way	South	28	442	135	2	14	1	5	1	0	5	0	0	0
		4.4%	69.8%	21.3%	0.4%	2.3%	0.2%	0.8%	0.2%	0.0%	0.8%	0.0%	0.0%	0.0%
	Within Limits	65	1,096	101	4	13	7	2	4	1	4	0	0	0
		5.0%	84.5%	7.8%	0.3%	1.0%	0.6%	0.2%	0.3%	0.1%	0.3%	0.0%	0.0%	0.0%
	North	65	983	360	7	7	24	1	0	6	2	0	0	0
		4.5%	67.5%	24.7%	0.5%	0.5%	1.7%	0.1%	0.0%	0.4%	0.2%	0.0%	0.0%	0.0%
US 85/ Pine Street	n/a	30	298	13	6	2	2	2	0	0	2	0	0	
		8.4%	83.4%	3.7%	1.7%	0.7%	0.7%	0.7%	0.0%	0.0%	0.7%	0.0%	0.0%	
2027 Design Year														
US 14A/ Pioneer Way	South	32	517	158	3	17	1	6	1	0	6	0	0	0
		4.4%	69.8%	21.3%	0.4%	2.3%	0.2%	0.8%	0.2%	0.0%	0.8%	0.0%	0.0%	0.0%
	Within Limits	76	1,283	118	4	16	8	3	4	1	4	0	0	0
		5.0%	84.5%	7.8%	0.3%	1.0%	0.6%	0.2%	0.3%	0.1%	0.3%	0.0%	0.0%	0.0%
	North	76	1,150	421	8	8	28	1	0	7	3	0	0	0
		4.5%	67.5%	24.7%	0.5%	0.5%	1.7%	0.1%	0.0%	0.4%	0.2%	0.0%	0.0%	0.0%
US 85/ Pine Street	n/a	35	348	16	7	3	3	3	0	0	3	0	0	
		8.4%	83.4%	3.7%	1.7%	0.7%	0.7%	0.7%	0.0%	0.0%	0.7%	0.0%	0.0%	
2050 Design Year														
US 14A/ Pioneer Way	South	48	761	232	4	25	2	8	2	0	8	0	0	0
		4.4%	69.8%	21.3%	0.4%	2.3%	0.2%	0.8%	0.2%	0.0%	0.8%	0.0%	0.0%	0.0%
	Within Limits	112	1,886	174	6	23	12	4	6	2	6	0	0	0
		5.0%	84.5%	7.8%	0.3%	1.0%	0.6%	0.2%	0.3%	0.1%	0.3%	0.0%	0.0%	0.0%
	North	112	1,691	620	12	12	41	2	0	10	4	0	0	0
		4.5%	67.5%	24.7%	0.5%	0.5%	1.7%	0.1%	0.0%	0.4%	0.2%	0.0%	0.0%	0.0%
US 85/ Pine Street	n/a	52	512	23	10	4	4	4	0	0	4	0	0	
		8.4%	83.4%	3.7%	1.7%	0.7%	0.7%	0.7%	0.0%	0.0%	0.7%	0.0%	0.0%	