HIGHWAY 1416 AND RADAR HILL ROAD CORRIDOR ANALYSIS STUDY

> Pennington County / Box Elder, SD February 2024

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Chapter 1 – EXECUTIVE SUMMARY

Background

Highway 1416 is an east/west corridor running parallel and to the south of I-90 through Box Elder, SD. Radar Hill Road runs north/south from its intersection with Highway 1416 to the north, to its intersection with Highway 44 to the south. Expansion at the nearby Ellsworth Air Force Base is expected to occur and will lead to considerable development in the areas surrounding these roadways, leading to shifts in traffic patterns. A corridor analysis study was prepared to analyze these changes and provide recommendations to mitigate any deficiencies.

Existing and Future Conditions

The study area consists of two main corridors (Highway 1416 and Radar Hill Road) and includes six study intersections. Existing conditions regarding within the study area were analyzed, as well as future conditions, using projections to 2030 (build year) and 2050 (forecast). Lack of turn lanes, operational deficiencies, safety, future development, and a lack of pedestrian and bicycle facilities were identified as corridor issues prior to the beginning of this study. Several study intersections were found to operate at unacceptable delay and Level of Service, and conditions are anticipated to worsen with continued development and the expansion of the Ellsworth Air Force Base. Safety, capacity, and access management were identified as primary corridor issues to be addressed through alternative design.

Alternatives Analysis

Due to the severity of existing capacity deficiencies, an interim alternative was proposed and implemented at the intersections of Highway 1416 and S Ellsworth Road, and Highway 1416 and Radar Hill Road. This interim alternative includes all-way stop-control at these intersections. While all-way stop-control is not expected to bring the intersections to acceptable operations, the delay and Level of Service is expected to improve in the short term.

Alternative designs were analyzed for the intersections of Highway 1416 and Liberty Boulevard, Highway 1416 and S Ellsworth Road, and Highway 1416 and Radar Hill Road. It was determined that the intersections of Highway 1416 and 151st Avenue, Radar Hill Road and Long View Road, and Radar Hill Road and Highway 44 are expected to operate under acceptable conditions in the projected future years, and therefore no alternatives were developed for these intersections.

The alternative designs included signalization, single- and multi-lane roundabouts, as well as a displaced left intersection to accommodate high left-turning volumes at Highway 1416 and S Ellsworth Road. Each of the proposed alternatives are anticipated to improve delay and Level of Service at the study

intersections. Final recommendations were made based on level of anticipated improvement, anticipated safety improvements, anticipated cost, and available right-of-way.

Recommendations

After analyzing each alternative, the following improvements are ultimately recommended at the study intersections:

- » Highway 1416 and Liberty Boulevard: Maintaining two-way-stop-control is recommended for now. Intersection signalization may eventually be needed for this intersection, due to the possible need for improvements regarding delay and Level of Service, and right-of-way constraints with proximity to the adjacent railroad, utilities, and wetlands making a roundabout difficult to design.
- » Highway 1416 and S Ellsworth Road: A hybrid roundabout, including an additional dedicated eastbound left-turn lane to accommodate for high volumes, with two circulating lanes at the northbound approach. This design also includes an uncontrolled channelized southbound right-turn lane. This alternative is recommended due to anticipated improvements regarding safety, delay, and Level of Service.
- » Highway 1416 and Radar Hill Road: A 2x1 roundabout with a yield-controlled channelized northbound right is recommended for this intersection, due to anticipated improvements regarding safety, delay, and Level of Service. The inclusion of the northbound right-turn lane accounts for high volumes completing this movement. This design would also include closing access to Gumbo Drive on the north.

Chapter 2 – EXISTING CONDITIONS

Introduction

Highway 1416 is an east/west corridor running parallel and to the south of I-90 through Box Elder, SD. Radar Hill Road runs north/south from its intersection with Highway 1416 to the north, to its intersection with Highway 44 to the south. Expansion at the nearby Ellsworth Air Force Base is expected to occur and will lead to considerable development in the areas surrounding these roadways, leading to shifts in traffic patterns. A corridor analysis study was prepared to analyze these changes and provide recommendations to mitigate any deficiencies. This section of the corridor analysis study will address existing traffic conditions, including roadway characteristics, safety, operations, and capacity.

Study Area

Key intersections were selected for detailed analysis within the corridor study. Intersections that were identified for analysis are listed below.

- » Highway 1416 & 151st Avenue
- » Highway 1416 & Liberty Boulevard/Spruce Drive
- » Highway 1416 & S Ellsworth Road
- » Highway 1416 & Radar Hill Road/Gumbo Drive
- » Radar Hill Road & Long View Road
- » Radar Hill Road & Highway 44

At the start of the study, all intersections were two-way or all-way stop controlled. The intersection of Highway 1416 and Radar Hill Road/Gumbo Drive had additional stop-control in the eastbound direction on Highway 1416. Additional stop-control in the westbound direction on Highway 1416 existed at the intersections with Commercial Gate Road, S Ellsworth Road, and W Gate Road.

All northbound and southbound approaches along Highway 1416 (including the medians) were stopcontrolled, except at westbound Highway 1416 and S Ellsworth Road where the northbound approach was a free movement, and the southbound approach was yield controlled. The control noted at these four intersections were atypical designs and could result in driver confusion especially with those unfamiliar with the area.

The study area and labeled intersections are shown in Figure 2-1.

Figure 2-1 – Study Area



Source: Pennington County, SD GIS Data, SDGS, USGS, ESRI, Aerial from 2021

June 2023

Objective

The objective of this report is to collect, analyze, and document existing conditions along the Highway 1416 and Radar Hill Road corridors and present any deficiencies regarding safety, operations, and/or capacity. This section of the study will focus on the analysis of existing no-build conditions and present issues currently being experienced to be used for alternatives development and a basis of comparison for the analysis of the alternatives.

Previous Studies

There have been several previous planning efforts and studies completed in Box Elder along the study segments. These documents provide important background information to support the development of this planning study.

RAPID CITY METROPOLITAN TRANSPORTATION PLAN (2020)

The *Rapid City Metropolitan Transportation Plan (MTP)* is the Rapid City Area Metropolitan Planning Organization's (MPO) long range plan for the regional transportation system. Growth projections and the regional travel demand model generated as part of the MPO's planning process were used as primary components in establishing traffic projections for this corridor study. The MTP provides mid-term (2026-2030) recommendations to improve the Exit 63 interchange.

BOX ELDER COMPREHENSIVE PLAN (2014 REVISION)

The *Box Elder Comprehensive Plan* provides a long-term vision for the city. The intersections of Highway 1416 and W Gate Road, Radar Hill Road, S Ellsworth Road, and Liberty Boulevard are identified as needing safety and mobility improvements. The discussion of future land use identifies Highway 1416 from Exit 63 to Liberty Boulevard and Radar Hill Road extending to Highway 1416 as potential locations for an entry corridor overlay. This involves coordination with SDDOT and the consistent application of aesthetic standards and design elements. Natural drainages along Highway 1416 that contain floodway, and 100-and 500-year floodplain are recognized as constraints that will need to be addressed in new development. Elevated crash occurrence and traffic congestion along Highway 1416 is identified as a top-priority transportation issue.

BOX ELDER STRATEGIC TRANSPORTATION PLAN (2014)

The *Box Elder Strategic Transportation Plan* was created to address a series of desired planning outcomes and transportation objectives, including the alignment of the built environment with regional and local goals, the enhancement of livability within the Box Elder community, and the identification of priorities among future transportation improvement projects. The existing traffic operations analysis includes five intersections along Highway 1416, at W Gate Road, Radar Hill Road, Commercial Gate Drive, S Ellsworth Road, and Liberty Boulevard. It is concluded that the intersection of westbound Highway 1416 with Ellsworth Road operates at LOS F during peak hours, with all other intersections operating at LOS C. Highway 1416 intersections with W Gate Road, Radar Hill Road, and S Ellsworth Road are anticipated to require signalized or roundabout control in order to operate at LOS C or better in the year 2035. The provision of a shared-use path from W Gate Road to S Ellsworth Road along Highway 1416 is identified as a high-priority pedestrian and bicycle project. The conversion of Highway 1416 from a four-lane divided highway to a two-lane undivided roadway with a center left turn lane is identified as a near-term priority included in the contemporaneous statewide transportation improvement plan (STIP). The construction of a side path along Radar Hill Road is identified as a low-priority pedestrian and bicycle project.

HIGHWAY 1416 CORRIDOR STUDY (2010)

The *Highway 1416 Corridor Study* was commissioned by the Rapid City Area Metropolitan Planning Organization (RCAMPO) and the City of Box Elder in order to access existing traffic safety and operations along the corridor and develop recommendations for improvements. It was found that the current four-lane configuration of Highway 1416 has excess traffic-carrying capacity, providing an opportunity for reconfiguration into a non-divided city street that would improve accessibility, traffic circulation, and motorist safety. Several recommendations are made in this study, including the addition of right- and left-turn lanes at several intersections, widening of the northbound approach of the Radar Hill Road intersection, addition of pedestrian facilities where appropriate, and the development of a network model to allow for comparative analysis.

RAPID CITY AREA TRANSPORTATION IMPROVEMENT PROGRAM (2022)

The *Rapid City Area Transportation Improvement Program for fiscal years 2023-2026* provides a priority listing and financial plan for highway and transit projects. This document includes the design and reconstruction of Radar Hill Road at Highway 1416 to a three-lane configuration.

Known Issues

CONGESTION AND INTERSECTION DELAY

Recent and continuing development in the study area vicinity has shifted traffic patterns and resulted in erratic lane usage, congestion from turning movements, and intersection delay along the study corridors. Median storage can also become congested furthering delay by impeding movements upstream.

FUTURE DEVELOPMENT

Ellsworth Airforce Base, a major economic driver in the Box Elder region, is anticipated to experience rapid growth in the coming years and will likely have an influence on travel patterns along and near Highway 1416 and Radar Hill Road. Two new schools are also anticipated to be constructed near the study area, as well as a public park south of Highway 1416.

CRASH HISTORY

As noted in the *Box Elder Strategic Transportation Plan*, multiple intersections along Highway 1416 are configured with a split between the eastbound and westbound directions, creating unusual intersection geometry and traffic control that is counter-intuitive. Elevated crash rates are exhibited as a result, with angle and rear-end crashes particularly prominent at these intersections.

CORRIDOR CONSTRAINTS

Box Elder Road runs parallel to westbound Highway 1416 from east of S Ellsworth Road to west of W Gate Road. The median ditch separating the two roadways is approximately 45 feet, considerably closer than the 120-foot median ditch separating eastbound and westbound Highway 1416. Box Elder Road is meant to operate as a frontage road to Highway 1416, providing access to businesses and homes. The narrow

median has very limited storage, and though the northbound approaches onto Box Elder Road are uncontrolled, vehicles attempting to turn left onto Box Elder Road can cause queueing in the narrow median spilling over to the westbound approach of Highway 1416.

To the south, a single railroad track runs parallel to eastbound Highway 1416 throughout the study area, separated by a median ditch approximately 60 feet wide. The railroad restricts right-of-way along the south edge of the study area. Of the three study intersections that intersect at-grade with the railroad tracks (Liberty Boulevard, S Ellsworth Road, and Radar Hill Road), only the Radar Hill Road crossing has flashing-light signals and gate arms. The crossings at S Ellsworth Road and Liberty Boulevard are yield-controlled. The proximity of Highway 1416 to the railroad tracks leads to severe safety concerns regarding vehicle-rail collisions and can lead to operational concerns with queueing on Highway 1416.

LACK OF PEDESTRIAN FACILITIES

No dedicated sidewalks, paths, or trails exist within the study area. There are also no dedicated or marked crossing locations on Highway 1416 or Radar Hill Road within the study area.

LACK OF BICYCLE FACILITIES

As noted in the *Rapid City Area Bicycle and Pedestrian Master Plan*, very limited bicycle facilities exist in Box Elder. Major streets connecting the area to surrounding jurisdictions have high speeds and volumes that make reduce safety for cycling.

Planned Improvements

The City of Box Elder plans to complete an active transportation plan by the spring of 2024. A recent assessment of walking and biking routes was completed in conjunction with the USDOT Safe Streets and Roads for All (SS4A) grant.

The I-90 interchange connecting to Highway 1416 (Exit 63) is also planned to be reconstructed. The proposed design is a diverging diamond interchange, with construction expected to begin in 2027 (depending on federal funding availability). The interchange reconstruction was spurred by issues regarding safety, congestion, capacity, accessibility and connectivity, and a lack of pedestrian facilities. This project also recommends consolidating the Highway 1416 and W Gate Road intersection into one signalized intersection.

General road repairs are expected to take place during the summer of 2023 along Radar Hill Road between Highway 1416 and Long View Road. The repairs are expected to address issues of severe degradation and potholes along this section of the corridor.

The City of Box Elder Active Transportation Recommendations document also provides the following recommendations within the study area:

- » Installing sidewalks along Highway 1416 from W Gate Road to Liberty Boulevard, and along Radar Hill Road from Highway 1416 to Box Elder city limits.
- Implementing multimodal connection nodes on Highway 1416 at the I-90 interchange, Radar Hill Road, and Liberty Boulevard.
- » Converting the intersection of Highway 1416 and Liberty Boulevard to a roundabout and installing a traffic signal and dedicated crosswalks at Highway 1416 and S Ellsworth Road.

- » Creating a Farmers' Market or city park near the I-90 interchange.
- » Extending Cheyenne Road to connect to Radar Hill Road (with a connection point at the 228th Street intersection).

Existing Conditions

Corridor Characteristics

FUNCTIONAL CLASSIFICATIONS

Highway 1416 is classified as an Urban Minor Arterial within the study area. Radar Hill Road is classified as a Rural Local Road between Highway 1416 and 229th Street. From 229th Street to Long View Road, Radar Hill Road is classified as an Urban Collector. From Long View Road to Highway 44, Radar Hill Road is classified as a Rural Major Collector. The functional classifications for roadways within the study area are shown in **Figure 2-2**.

LAND USE

Several land use categories are present adjacent to Highway 1416 and Radar Hill Road within the study area. The land along the north side of Highway 1416 is primarily industrial, high-density residential, and open space and park land. A large parcel north of Highway 1416 between Hillview Drive and Liberty Boulevard is classified as highway service land. The south side of Highway 1416 is bounded by the railroad.

Land surrounding Radar Hill Road is primarily low-, mid-, and high-density residential, as well as industrial and highway service. There are small parcels dedicated to industrial space near Mule Deer Trail, Fox Trail, and Plymouth Drive. The remaining area surrounding the study area is primarily agricultural.

Box Elder city limits end near Old Cavalry Road. The areas adjacent to Radar Hill Road between 229th Street and Highway 44 are under Pennington County jurisdiction. This land is primarily residential and agricultural.

Land use is presented in Figure 2-3, using data provided by Pennington County.



Figure 2-2 – Road Functional Classifications

Source: Pennington County, SD GIS Data, SDGS, USGS, ESRI, SDDOT Traffic Data 2022, Aerial from 2021

Figure 2-3 – Land Use



Source: Pennington County, SD GIS Data, SDGS, USGS, ESRI, SDDOT Traffic Data 2022, Aerial from 2021

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RIGHT-OF-WAY (ROW)

Right-of-way (ROW) is the available space owned by the County on which its roads and highways reside. ROW is often the constraining factor in developing alternatives, because acquiring additional ROW can be costly, increase project delivery deadlines, or stop a project altogether. ROW widths vary along the corridor, depending on the location. ROW information will need to be verified through the project development, as the widths shown were obtained from publicly available GIS information.

Highway 1416

- » W Gate Road to Radar Hill Road Generally ranges from 300 to 320 ft.
- » From Radar Hill Road to S Ellsworth Road Generally ranges from 300 to 350 ft.
- » From S Ellsworth Road to End of divided roadway Generally ranges from 200 ft to 400 ft.
- » Start of undivided roadway to 151st Avenue Generally ranges from 90 ft to 120 ft.

Radar Hill Road

- » Highway 1416 to Creekside Drive Generally ranges from 70 to 120 ft.
- » Creekside Drive to 228th Street Generally ranges from 66 to 90 ft.
- » 228th Street to 229th Street Generally 100 ft
- » 229th Street to Long View Road Generally ranges from 85 ft to 110 ft.
- » Long View Road to Hwy 44 Generally ranges from 66 to 85 ft.

<u>SPEED</u>

Figure 2-5 shows the posted speed limits in the study area.

Highway 1416

Highway 1416 has a posted speed limit of 65 miles per hour (mph) between 151st Avenue and east of Liberty Boulevard. Between Liberty Boulevard and S Ellsworth Road, the speed limit drops to 50 mph. West of S Ellsworth Road, the speed limit is 55 mph through the remainder of the study area to W Gate Road.

Radar Hill Road

Radar Hill Road has a posted speed limit of 45 mph between Highway 1416 and 229th Street. Between 229th Street and Highway 44, Radar Hill Road has a posted speed limit of 50 mph.

Figure 2-4 – Cross-Sections



Source: Pennington County, SD GIS Data, SDGS, USGS, ESRI, SDDOT Traffic Data 2022, Aerial from 2021

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Figure 2-5 – Speed Limit



Source: Pennington County, SD GIS Data, SDGS, USGS, ESRI, SDDOT Traffic Data 2022, Aerial from 2021

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ACCESS MANAGEMENT

Access management is the process of balancing the competing needs of mobility and land access. Access locations introduce conflict points into the traffic stream. Allowing dense, uncontrolled access spacing results in safety, operational, and aesthetic deficiencies.

SDDOT's *Road Design Manual* (Chapter 17 – Access Management) states the minimum desirable spacing of access points in both Urban Fringe and Rural areas is **five accesses per side per mile**. Along the Highway 1416 and Radar Hill Road study corridors, the number of intersection and driveway accesses along each side of the roadway were calculated. Highway 1416 was split into three distinct segments: the undivided segment between 151st Avenue and the directional split, westbound Highway 1416 to W Gate Road, and eastbound Highway 1416 to the directional split. Radar Hill Road was analyzed as a single segment. For each segment, the average number of accesses per side per mile was calculated and compared to the SDDOT threshold of five accesses per side per mile. Access management results are shown in **Table 2-1**.

Segment	Length (mi)	Side	Intersection Accesses	Driveway Accesses	Total Accesses	Total Accesses (per side per mile)	Intersection Accesses (per side per mile)
Hwy 1416	1 50	North	4	3	7	4.4	2.5
EB/WB split	1.58	South	3	2	5	3.2	1.9
WB Hwy 1416	2 5 4	North	8	0	8	3.1	3.1
W Gate Rd	2.54	South	7	0	7	2.8	2.8
EB Hwy 1416	2 50	North	7	0	7	2.8	2.8
EB/WB split	2.50 South		5	0	5	2.0	2.0
Radar Hill Rd	E 42	West	17	17	34	6.3	3.1
Hwy 44	5.43	East	15	31	46	8.5	2.8

Table 2-1	- Access	Manaae	ement	Results
	Access	manage		nesures

Existing accesses along Highway 1416 meet SDDOT standards. Accesses along Radar Hill Road do not meet SDDOT standards, particularly on the east side of the roadway. Intersection access spacing does meet requirements along Radar Hill Road.

The southbound approach of EB Highway 1416 and S Ellsworth Road is also offset from the northbound approach. This intersection is classified as a negative offset, as defined by the SDDOT *Road Design Manual*. This offset poses a safety risk for several movements, therefore geometric realignment should be considered.

LIGHTING

Highway 1416

Overhead lighting is present at the following intersections along Highway 1416:

- » Trenton Lane single pole in the northeast corner of the intersection
- » Liberty Boulevard three poles illuminating the southbound, eastbound, and westbound approaches
- » S Ellsworth Road four poles illuminating the southbound, eastbound, and westbound approaches, as well as the median
- » Radar Hill Road four poles illuminating the southbound, eastbound, and westbound approaches, as well as the median
- » W Gate Road four poles illuminating the southbound, eastbound, and westbound approaches, as well as the median

No other intersections are lit. No segments along the Highway 1416 study corridor are lit.

Radar Hill Road

Overhead lighting is present at the following intersections along Radar Hill Road:

- » Highway 1416 four poles illuminating the southbound, eastbound, and westbound approaches, as well as the median
- » Wilo Drive single overhead light mounted on a telephone pole in the northeast corner of the intersection
- » Mule Deer Trail single pole in the southeast corner of the intersection
- » Fox Trail single pole in the northeast corner of the intersection
- » Flying Eagle Drive single overhead light mounted on a telephone pole in the northwest corner of the intersection
- » Radar Hills Drive single overhead light mounted on a telephone pole in the northeast corner of the intersection
- » 228th Street single pole in the southwest corner of the intersection
- » Old Cavalry Road single overhead light mounted on a telephone pole in the southeast corner of the intersection

No other intersections are lit. No segments along the Radar Hill Road study corridor are lit.

ENVIRONMENTAL JUSTICE OVERVIEW

The US Environmental Protection Agency's (EPA) Environmental Justice Screening and Mapping tool (i.e., EJSCREEN) was used to review the presence of readily identifiable low-income and minority populations by evaluating their percentages. The Environmental Justice (EJ) study area for this review included the project roadways: Highway 1416 and Radar Hill Road in Box Elder, Pennington County, South Dakota and a 0.25-mile buffer surrounding the roadways. Data obtained from EJSCREEN and US Census Bureau were used to determine percentages of low-income and minority populations within the EJ study area and the City of Box Elder. This limited analysis did not include investigating the presence of community facilities in the EJ study area that serve minority and low-income populations, or businesses in the EJ study area that are owned by, employ, and serve minority and low-income populations.

For the purposes of this review, the smallest unit of geography (i.e., city) was used for comparison with the EJ study area. An EJ population is identified when:

- 1. The minority or low-income population of a study area exceeds 50 percent, or
- 2. The minority or low-income population percentage is at least 10 percentage points higher than the city average.

As shown in Table 2-2, the minority and low-income populations in the entire study area do not exceed 50 percent and are not at least 10 percentage points higher than the average for the City of Box Elder. Therefore, an EJ population is not present in the EJ study area.

Demographic	Study Area	City of Box Elder
Minority Population	21%	22%
Low-Income Population	23%	28%

Table 2-2 – Minority and Low-Income Populations

MULTIMODAL FACILITY

No dedicated sidewalks, paths, or trails exist within the study area. There are also no dedicated or marked crossing locations on Highway 1416 or Radar Hill Road within the study area.

The South Dakota Road Design Manual (Chapter 7 – Cross Sections; Chapter 16 – Miscellaneous) states that shoulders considered to be bikeable should be paved and a minimum of four feet in width. There is an unpaved shoulder along the north edge of westbound Highway 1416, between the median split near Cottonwood Drive and the I-90 on-ramp. This shoulder is a six-foot unpaved shoulder that does not meet design requirements for bikeability. There is no shoulder serving the eastbound direction of Highway 1416.

Radar Hill Road has a six-foot paved shoulder on the east and west sides of the roadway, between Wilo Drive and Creekside Drive. There is also a 10-foot paved shoulder on both sides of Radar Hill Road between 228th Street and 229th Street.

Though some existing shoulders within the Radar Hill Road corridor meet bicycle lane design requirements, there are sections of both the Highway 1416 corridor and the Radar Hill Road corridor that are not accessible via non-motorized modes of travel. Highway 1416 and Radar Hill Road are also high-speed corridors, with vehicular speed limits ranging from 45 to 65 miles per hour, which reduces safety for bicyclists and pedestrians utilizing the shoulders.

Pedestrian Level of Service (PLOS) and Bicycle Level of Service (BLOS) analyses were conducted and are discussed later in this report. Shoulder widths throughout the study area (paved and unpaved) are shown in **Figure 2-6**.

ADJACENT FACILITIES

There are parallel facilities on either side of Highway 1416. South of Highway 1416 is an active railroad line. The distance between the edge of roadway and the rail line can vary from 65 to 210 feet. In areas where the distance between facilities is lesser, as it is at the Radar Hill Road and Ellsworth Drive intersections, queueing in the northbound direction can cross the railroad creating a potential safety risk.

Box Elder Road runs parallel to Highway 1416 on the north side of the roadway. The roadways are separated by a 50-foot grass median. Due to the short distance between the roadways, southbound queues at the Highway 1416 intersections can create potential operational and safety deficiencies at the adjacent Box Elder Road intersections.

Traffic Volumes

Traffic volumes were collected by KLJ at five of the six study intersections on Tuesday, May 9, 2023, and traffic volumes at Highway 1416 and 151st Avenue were collected on Tuesday, May 23, 2023. Volumes were collected for a 13-hour period and included pedestrian and bicycle movements.

The intersections of Highway 1416 and S Ellsworth Road, and Highway 1416 and Radar Hill Road/Gumbo Drive were modeled with the westbound and eastbound directions of Highway 1416 separately. There is a large median (approximately 120 feet) separating the eastbound and westbound directions, with additional stop control at the northbound and southbound approaches between the two highway movements. The volumes were collected with each eastbound and westbound intersection operating as one and were balanced appropriately as distinct eastbound and westbound intersections.

The 2022 Average Daily Traffic (ADT) volumes are shown in **Figure 2-7** and they were collected by Pennington County. The AM and PM peak turning movement counts are shown in **Table 2-3** and **Table 2-4**, respectively. Raw traffic volume counts can be found in **Appendix A**.



Figure 2-6 – Shoulder Width

Source: Pennington County, SD GIS Data, SDGS, USGS, ESRI, SDDOT Traffic Data 2022, Aerial from 2021

June 2023



Figure 2-7 – 2022 Daily Traffic Volumes

Source: Pennington County SD GIS Data SDGS_USGS_ESRI_SDDOT Traffic Data 2022 Aerial from 2021

June 2023

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Intersection	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Highway 1416 and 151st Ave	-	-	-	5	-	34	7	38	-	-	94	8
Highway 1416 and Liberty Blvd	3	32	2	20	8	28	134	23	2	1	15	139
Highway 1416 and S Ellsworth Rd*	86	56	7	10	16	194	618	115	15	0	44	13
Highway 1416 and Radar Hill Rd*	167	1	236	8	9	16	4	527	55	79	334	5
Radar Hill Rd and Long View Rd	1	24	3	3	38	102	70	6	1	5	16	9
Radar Hill Rd and Highway 44	4	0	1	19	2	10	15	217	5	2	207	17

Table 2-3 – Turning Movement Counts (AM Peak)

*Intersection split between eastbound and westbound Highway 1416. See split counts below.

NB - Northbound; SB - Southbound; EB - Eastbound; WB - Westbound

L – Left; T – Through; R – Right

Table 2-3a – Turning Movement Counts (AM Peak)

Intersection	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
WB Highway 1416 and S Ellsworth Rd	86	674	-	-	26	194	-	-	-	0	44	13
EB Highway 1416 and S Ellsworth Rd	-	142	7	10	16	-	618	115	15	-	-	-
WB Highway 1416 and Radar Hill Rd	167	5	-	-	17	16	-	-	-	79	334	5
EB Highway 1416 and Radar Hill Rd	-	168	236	8	88	-	4	527	55	-	-	-

NB - Northbound; SB - Southbound; EB - Eastbound; WB - Westbound

L – Left; T – Through; R – Right

Table 2-4 – Turning Movement Counts (PM Peak)

Intersection	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Highway 1416 and 151st Ave	-	-	-	3	-	15	36	84	-	-	50	1
Highway 1416 and Liberty Blvd	7	10	0	110	20	54	37	42	12	3	27	54
Highway 1416 and S Ellsworth Rd*	36	37	6	6	59	256	291	79	143	14	71	6
Highway 1416 and Radar Hill Rd*	112	9	116	4	9	10	19	401	193	184	531	3
Radar Hill Rd and Long View Rd	1	46	4	7	37	107	127	10	1	2	6	4
Radar Hill Rd and Highway 44	6	1	0	23	7	24	39	132	12	1	221	24

*Intersection split between eastbound and westbound Highway 1416. See split counts below.

NB – Northbound; SB – Southbound; EB – Eastbound; WB – Westbound

L – Left; T – Through; R – Right

Table 2-4a – Turning Movement Inputs	for Operations Analysis (PM Peak)
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Intersection	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
WB Highway 1416 and S Ellsworth Rd	36	328	-	-	65	256	-	-	-	14	71	6
EB Highway 1416 and S Ellsworth Rd	-	73	6	6	73	-	291	79	143	-	-	-
WB Highway 1416 and Radar Hill Rd	112	28	-	-	13	10	-	-	-	184	531	3
EB Highway 1416 and Radar Hill Rd	-	121	116	4	193	-	19	401	193	-	-	-

 $\mathsf{NB}-\mathsf{Northbound};\,\mathsf{SB}-\mathsf{Southbound};\,\mathsf{EB}-\mathsf{Eastbound};\,\mathsf{WB}-\mathsf{Westbound}$

L – Left; T – Through; R – Right

Traffic Patterns

13-hour counts were collected from 5:30 AM to 6:30 PM. The AM peak in vehicular volume was determined to begin at approximately 7:00 AM, and the PM peak begins at approximately 4:30 PM. The peak hours determined from KLJ's data collection and analysis was validated using StreetLight. The intersections of Highway 1416 and S Ellsworth Road, and Highway 1416 and Radar Hill Road experienced the highest volumes out of all study intersections. The AM and PM peak turning movement counts are shown in **Figure 2-8**.





Crash Analysis

Reviewing historic crash information can help identify existing deficiencies that can be addressed through this study. Ten years of crash records from January 1, 2013, through December 31, 2022, were requested from SDDOT. There were 357 crashes reported during the analysis period in the study area. The density of crashes along the study area and the location of crash events are shown in **Figure 2-9**. The frequency of crashes was generally high along the intersections of Highway 1416 with W Gate Road, Radar Hill Road, Commercial Gate Road, and S Ellsworth Road. The summary of crashes for study intersections only are shown in **Table 2-5**.

Table 2-5 – Crashes at Study Intersections								
Intersection with Highway 1416	Incapacitating	Non- Incapacitating	Possible Injury	Non-Injury	TOTAL			
151st Ave	-	-	1	1	2			
Liberty Blvd / Spruce Dr	1	-	2	5	8			
S Ellsworth Rd	1	1	6	17	25			
Commercial Gate Rd*	-	4	3	19	26			
Radar Hill Rd	7	23	18	53	101			
W Gate Rd*	1	3	6	17	27			
TOTAL	10	31	36	112	189			
Intersection with Radar Hill Road	Incapacitating	Non- Incapacitating	Possible Injury	Non-Injury	тот			
Long View Rd	-	-	-	-	0			
Hwy 44	1	-	-	4	5			
TOTAL	1	0	0	4	5			

*Not among the intersections for study but added for statistics and reporting purposes.

The corridor was divided into the following analysis segments based on engineering judgement and local knowledge:

- » Crash Segment A: Highway 1416 From 151st Avenue to west of Cottonwood Drive
- » Crash Segment B: Highway 1416 From west of Cottonwood Drive to Radar Hill Road
- » Crash Segment C: Highway 1416 From Radar Hill Road to W Gate Road
- » Crash Segment D: Radar Hill Road From Highway 1416 to 229th Street
- » Crash Segment E: Radar Hill Road From 229th Street to Long View Road
- » Crash Segment F: Radar Hill Road From Long View Road to Highway 44

The summary of non-junction related crashes for crash segments are shown in **Table 2-6**.

Crash Segment ID	Fatal injury	Incapacitating	Non- incapacitating	Possible Injury	No injury	Wild animal hit	тот
А	1	3	3	4	7	3	21
В	-	-	5	4	11	7	27
С	1	2	6	2	23	-	34
D	-	1	5	4	14	3	27
E	-	3	-	2	14	2	21
F	-		-	2	1	4	7
TOTAL	2	9	19	18	70	19	137

 Table 2-6 – Non-Junction Related Crashes

» There were 82 non-junction related crashes reported along Highway 1416 during the analysis period, which corresponds to 8.2 crashes per year.

» There were 55 non-junction related crashes reported along Radar Hill Road during the analysis period, which corresponds to 5.5 crashes per year.



Figure 2-9 – Crash Density (Year 2013-2022)

Source: Pennington County. SD GIS Data. SDGS. USGS. ESRI. Aerial from 2021

May 2023

CRASH TRENDS AND PATTERNS

The trend and pattern of corridor crashes by year and month were analyzed from crash records.

Highway 1416

There were 177 crashes reported in the Highway 1416 segments of the study area during the analysis period. This corresponds to 17.7 crashes per year. The ten-year crash summary at Highway 1416 roadway is shown in **Figure 2-10**.



Figure 2-10 – Highway 1416 Ten-Year Crash Summary (Year 2013-2022)

The number of crashes has varied during the analysis period. The total crashes peaked in 2014, and recently there has been a modest drop in crashes. This may be attributed to recent improvements made on the Highway 1416 corridor with stop signs added to the main line in a single direction at the intersections of West Gate Road, Radar Hill Road, and S Ellsworth Road. The number of fatal and incapacitating crashes have been highest in 2022, with two fatal and three incapacitating crashes.

The trends of crashes by months of the year are shown in **Figure 2-11**. Frequency of crashes were generally high from October through February. This timeframe coincides with the typical winter months and snowy/icy roadways.



Figure 2-11 – Highway 1416 Crashes by Month (Years 2013-2022)

Radar Hill Road

There were 180 crashes reported in the Radar Hill Road segment of the study area during the analysis period. This corresponds to 18 crashes per year. The ten-year crash summary at Radar Hill Road segment of the study is shown in **Figure 2-12**.





The number of crashes has varied during the analysis period. There were no fatal crashes reported during the analysis period on the Radar Hill Road corridor.

The trends of crashes by months of the year are shown in **Figure 2-13**. Frequency of crashes were generally high from September through January.



Figure 2-13 – Radar Hill Road Crashes by Month (Years 2013-2022)

FATAL CRASHES ON BOTH CORRIDORS

There were two (2) fatal and twenty (20) incapacitating injury crashes reported in the study area during the analysis period. The first fatal crash incident, which was reported in September 2014 took place at the intersection of Highway 1416 with Cottonwood Drive. The incident involved the collision of a motorist with an oncoming train. The railroad crossing at Cottonwood Drive near Highway 1416 is yield controlled. The second fatal crash incident, which was reported in February 2018 took place at the intersection of Eastbound Highway 1416 with Radar Hill Road. The incident involved a pedestrian and a motorist under the influence which occurred during dark conditions and the intersection was not well illuminated.

CRASHES INVOLVING PEDESTRIAN/BICYCLIST

There was one pedestrian- and three bicyclist-involved crashes reported during the analysis period. The only pedestrian crash incident was a fatal crash that was described previously in the report.

The first crash involving a bicyclist was reported in July 2014 near the intersection of Radar Hill Road with 229th Street. The incident involved the collision of a bicyclist with a lightweight truck and occurred under dark conditions with no streetlight illumination. The bicyclist experienced an incapacitating injury.

The second crash involving a bicyclist was reported in September 2016 at the intersection of Highway 1416 and Radar Hill Road. The incident involved the collision of a bicyclist traveling northbound to cross

Highway 1416 with an oncoming vehicle traveling westbound. The bicyclist experienced an incapacitating injury.

The third crash involving a bicyclist was reported in November 2020 at the intersection of Highway 1416 with W Gate Road. The incident involved the collision of a bicyclist traveling southbound to cross Highway 1416 with an oncoming vehicle traveling westbound. The bicyclist experienced a possible injury.

CRASHES WITH TRAIN

There were five crashes reported that involved collision of a vehicle with an oncoming train. There were three crashes reported for the intersection of Highway 1416 with Radar Hill Road, of which two resulted in non-incapacitating and one non-injury crashes. The major contributing factor for the crashes were failure to yield. The railroad crossing at Radar Hill Road is controlled by flashing lights and lowering arms. There were two crashes reported at the railroad crossing near the intersection of Highway 1416 with 151st Avenue, of which one resulted in a fatality and the other resulted in no injury. The major contributing factor for the crashes were failure to yield. The railroad crossing at 151st Avenue is controlled by a yield sign at each approach.

CRASH COLLISION TYPES

Identifying crash types at roadways assists in developing countermeasures to mitigate or minimize the crash type. Angle (120 crashes) and rear-end (43 crashes) were the most typical crash types at the study intersections along Highway 1416. **Figure 2-14** on the following page shows the crashes by crash type at the study intersections during the analysis period. The larger the pie chart, the more crashes that occurred at the corresponding intersection.

Table 2-7 – Non-Junction Related Crashes by Collision Types

Crach	Manner of Collision							
Segment ID	Single- Vehicle	Rear- End	Angle	Head- On	Sideswipe	Wild Animal	Total	
Α	18	1		2			21	
В	21	3	1	1	1		27	
C	18	12	1		2	1	34	
D	15	9	1	1		1	27	
E	17	1		1	1	1	21	
F	6					1	7	
TOTAL	95	26	3	5	4	4	137	

The non-junction related crashes by collision types are summarized in **Table 2-7**.

» Crash Segment A: Highway 1416 – From 151st Avenue to west of Cottonwood Drive

» Crash Segment B: Highway 1416 – From west of Cottonwood Drive to Radar Hill Road

» Crash Segment C: Highway 1416 – From Radar Hill Road to W Gate Road

» Crash Segment D: Radar Hill Road – From Highway 1416 to 229th Street

» Crash Segment E: Radar Hill Road – From 229th Street to Long View Road

» Crash Segment F: Radar Hill Road – From Long View Road to Highway 44.

Most (95 crashes, or 69 percent) of the non-junction related crashes involved a single-vehicle (i.e., run-off-road, rollover, etc.).



Figure 2-14 – Intersection Crashes by Collision Type (Ten-Year Crashes from 2013-2022)

Source: Pennington County, SD GIS Data, SDGS, USGS, ESRI, Aerial from 2021

June 2023

CRASH HOTSPOTS

Using the trends identified earlier, additional analysis and evaluation was completed in the study area for the intersections and segments that experienced a high frequency of crashes. This crash hotspot analysis is used to identify specific combinations of crash type and direction to further understand the specific issues at the study intersections and segments.

Highway 1416 and Radar Hill Road

The intersection of Highway 1416 and Radar Hill Road experienced the highest number of crashes during the analysis period with 102 crashes. Angle crashes were the most predominant type of crashes (77 crashes, or 75.5 percent) at the intersection. The intersection of Highway 1416 with Radar Hill Road is a divided intersection where the eastbound and westbound approaches of Highway 1416 operate as independent intersections with Radar Hill Road due to the large median (approximately 120 feet) between them.

The intersection of eastbound Highway 1416 and Radar Hill Road experienced 36 angle crashes during the ten-year analysis period. The intersection was converted to an all-way stop-control (AWSC) intersection in 2020. Prior to that, the intersection operated as a side-street stop-controlled intersection with stops on the northbound and southbound approaches. Between 2013 and 2019, the intersection experienced 30 angle crashes, which corresponds to 4.3 angle crashes per year. The major contributing factor to the angle crashes was failure to yield. The number of crashes involving eastbound- and northbound-traveling vehicles, and eastbound- and southbound-traveling vehicles were equal. The rate of angle crashes reduced between 2020 and 2022 (while operating as an AWSC intersection), with the intersection experiencing six angle crashes that corresponds to two angle crashes per year. However, the rate of rearend crashes went up from six crashes in seven years between 2013 and 2019 (0.9 rear-end crashes per year) to six crashes in three years between 2020 and 2022 (two rear-end crashes per year). Rear-end crashes generally occurred along the eastbound approach and northbound approach.

The intersection of westbound Highway 1416 and Radar Hill Road experienced 41 angle crashes. The major contributing factor to the angle crashes was failure to yield. The intersection operates as a side-street stop-controlled intersection with stops on the northbound and southbound approaches. Most of the angle crashes involved vehicles traveling northbound and westbound (20 crashes).

Highway 1416 and S Ellsworth Road

There were 25 crashes reported at the intersection of Highway 1416 and S Ellsworth Road during the analysis period. Angle crashes were the most prominent type of crashes (20 crashes, or 80-percent) at the intersection. The intersection of Highway 1416 with S Ellsworth Road is a divided intersection, with a median of approximately 150 feet. Due to the large median, the westbound and eastbound approaches of Highway 1416 are controlled as independent intersections with S Ellsworth Road.

The intersection of eastbound Highway 1416 and S Ellsworth Road experienced 12 crashes, with 10 angle crashes. The number of crashes involving eastbound- and northbound-traveling vehicles, and eastbound- and southbound-traveling vehicles were equal. The major contributing factors to the angle crashes were failure to yield. The northbound approach of the intersection has a negative offset which creates additional conflict points for motorists and increases the crash potential due to poor driver visual cognition of conflicting traffic.

The intersection of westbound Highway 1416 and S Ellsworth Road experienced 13 crashes, with 10 angle crashes. There were seven angle crashes involving northbound- and westbound-traveling vehicles. The intersection is controlled by side-street stop signs. The stop signs were moved from the S Ellsworth Rd approaches to the westbound approach of Highway 1416 in 2020. The northbound approach is uncontrolled, and the southbound approach is yield-controlled. The number of crashes were reduced from 10 crashes between 2013 and 2018 (1.4 crashes per year) to three crashes between 2020 to 2022 (one crash per year).

Segment Lighting

The segments of Highway 1416 and Radar Hill Road within the study area do not currently have continuous lighting. The non-junction related crashes by lighting conditions in the study area are summarized in **Table 2-8**.

Segment	Dark conditions with No street Lighting	Day conditions or dark conditions with some street lighting	Total
Α	12	9	21
В	12	15	27
С	13	21	34
D	7	20	27
E	10	11	21
F	5	2	7
TOTAL	59	78	137

 Table 2-8 – Non-Junction Related Crashes by Lighting Conditions

» Crash Segment A: Highway 1416 – From 151st Avenue to west of Cottonwood Drive

» Crash Segment B: Highway 1416 – From west of Cottonwood Drive to Radar Hill Road

» Crash Segment C: Highway 1416 – From Radar Hill Road to W Gate Road

» Crash Segment D: Radar Hill Road – From Highway 1416 to 229th Street

» Crash Segment E: Radar Hill Road – From 229th Street to Long View Road

» Crash Segment F: Radar Hill Road – From Long View Road to Highway 44

There were 59, or 43-percent, non-junction related crashes reported during the analysis period. There were 95 single-vehicle non-junction crashes reported for the study area during the analysis period. This includes 41, or 43 percent, single-vehicle non-junction related crashes that occurred during dark conditions where street lighting was minimum to non-existent.

Capacity Analysis and Demand

Intersection Capacity Analysis

Intersection capacity analysis was conducted using HCS 2023 software for each of the study intersections, using both AM and PM peak vehicular and pedestrian volumes. Intersection performance was measured based on delay and Level of Service (LOS). The methodology for vehicular and pedestrian LOS is described in the following sections.
VEHICULAR LEVEL OF SERVICE (VLOS)

Vehicular Level of Service (VLOS) is a function of average delay per vehicle. LOS "A" represents free-flow traffic, whereas LOS "F" represents unacceptable delay. LOS "D" or better is considered acceptable for Minor Arterials and Collectors, in accordance with SDDOT standards. LOS delay thresholds are presented in **Table 2-9**.

	Average De	lay / venicle
Level of	Stop, Yield, and Roundabout	Signalized
Service	Intersections	Intersections
A	< 10 seconds	< 10 seconds
В	10 to 15 seconds	10 to 20 seconds
С	15 to 25 seconds	20 to 35 seconds
D	25 to 35 seconds	35 to 55 seconds
E	35 to 50 seconds	55 to 80 seconds
F	> 50 seconds	> 80 seconds

LOS for two-way stop controlled (TWSC) intersections is currently undefined by the Highway Capacity Manual (HCM). Major roadway through and right-turn movements generally experience no delay, as they are uncontrolled and do not need to yield to any conflicting movements. However, vehicles turning left or crossing the major street can experience significant delay. For this reason, LOS assigned to TWSC intersections in this study were determined based on the delay experienced by side street approaches and left-turning movements, weighted by movement volume. All-way stop controlled (AWSC) intersections are currently signalized or roundabout controlled.

The intersections of Highway 1416 and S Ellsworth Road, and Highway 1416 and Radar Hill Road were modeled as separate intersections due to large median separation between eastbound and westbound approaches, as well as differences in stop-control in each approach. The intersection delay and LOS were measured as a weighted average of all approaches experiencing delay by the volume of each approach.

Vehicular LOS results for each intersection are shown in **Table 2-10**. The intersection delay is presented based on methodology described above. The corresponding LOS value for the intersection delay is shown, as well as the LOS value for the worst approach. Detailed Vehicular Level of Service results can be found in **Appendix B**.

	AM Pea	ak	PM Peak			
Intersection	Delay (sec/veh)	LOS*	Delay (sec/veh)	LOS*		
Highway 1416 and 151st Ave	9.1	A/A	8.0	A/A		
Highway 1416 and Liberty Blvd	9.8	A/B	10.2	B / B		
Highway 1416 and S Ellsworth Rd	677.2	F/F	13.5	B/E		
Highway 1416 and Radar Hill Rd	26.9	D/E	32.8	D/F		
Radar Hill Rd and Long View Rd	8.4	A/A	8.8	A/A		
Radar Hill Rd and Highway 44	10.5	B/B	2.6	A/B		

Table 2-10 – Existing Intersection Vehicular Capacity Analysis

*[Intersection LOS] / [Worst approach LOS]

AM Peak

During the AM peak, it was determined that the intersection of Highway 1416 and S Ellsworth Road experiences severely unacceptable delay and LOS, with both the intersection and worst approach reaching LOS F. The unacceptable conditions are primarily caused by a significant number of eastbound vehicles making a left turn at the intersection. On the recorded day, this uncontrolled movement had 618 vehicles during the peak hour. This equates to approximately one vehicle every 6 seconds for the entire hour leaving few gaps for all other movements.

The intersection of Highway 1416 and Radar Hill Road also experiences severely unacceptable delay and LOS, with the worst approach reaching LOS E. The worst approach at this intersection is the northbound approach of the eastbound portion of Highway 1416 (south of the median). The unacceptable delay at this approach is the result of the minimal storage space in the median separating eastbound and westbound Highway 1416 being exceeded by queueing vehicles, which causes queueing and delays for vehicles attempting to enter the median.

All other intersections operate under acceptable delay and LOS during the AM peak.

PM Peak

During the PM peak, it was determined that the intersection of Highway 1416 and S Ellsworth Road experiences unacceptable delay and LOS, with the worst approach reaching LOS E. The worst approach at this intersection is the southbound approach of the eastbound portion of Highway 1416 (south of the median). High eastbound volumes at this intersection make it difficult for drivers to find acceptable gaps to cross or merge onto the highway. This intersection also experiences higher southbound volumes during the PM peak as vehicles travel away from the Ellsworth Air Force Base.

The Highway 1416 and Radar Hill Road intersection also experiences severely unacceptable delay and LOS, with the worst approach reaching LOS F. The worst approaches at this intersection are the northbound and eastbound left/thru approaches of the eastbound portion of Highway 1416 (south of the median). Minimal median storage causes significant queueing and delays for vehicles attempting to enter the median.

All other intersections operate under acceptable delay and LOS during the PM peak.

PEDESTRIAN AND BICYCLE LEVEL OF SERVICE (PLOS/BLOS)

Pedestrian Level of Service (PLOS) and Bicycle Level of Service (BLOS) are measures of a segment's walkability and bikeability. The *Highway Capacity Manual* provides a PLOS and BLOS calculation for segments, incorporating roadway design, adjacent vehicular volume, presence of parking and other buffers, and existing pedestrian and bicycle facilities. The segments are scored with LOS A through F, with LOS A representing satisfactory facilities for bicycles and pedestrians, and LOS F representing a facility that is unsuitable for bicycles and pedestrians. A score value that corresponds to PLOS and BLOS characteristics within a given system is shown in **Table 2-11**.

Score Range	PLOS or BLOS
≤ 1.50	A
≥1.51 and ≤2.50	В
≥2.51 and ≤3.50	С
≥3.51 and ≤4.50	D
≥4.51 and ≤5.50	E
≥5.51	F

Table 2-11 – PLOS and BLOS Scoring Thresholds

The study area was split into eight segments for the PLOS and BLOS analysis, due to difference in directional ADT, speed limit changes, and the presence and width of shoulders. The segment descriptions and PLOS and BLOS results are shown in **Table 2-12**. Detailed PLOS and BLOS results can be found in **Appendix C**.

Commont	PLC)S	BLOS			
Segment	Score	LOS	Score	LOS		
Highway 1416 151st Ave to Liberty Blvd	4.92	E	4.20	D		
WB Highway 1416 Liberty Blvd to S Ellsworth Rd	4.08	D	4.08	D		
WB Highway 1416 S Ellsworth Rd to W Gate Rd	4.55	E	4.87	E		
EB Highway 1416 Liberty Blvd to S Ellsworth Rd	4.06	D	4.89	E		
EB Highway 1416 S Ellsworth Rd to W Gate Rd	4.57	E	4.90	E		
Radar Hill Rd Highway 1416 to 228th St	4.02	D	4.26	D		
Radar Hill Rd 228th St to 229th St	3.07	С	1.50	А		
Radar Hill Rd 229th St to Highway 44	3.92	D	3.81	D		

Table 2-12 – Existing Pedestrian LOS (PLOS) and Bicycle LOS (BLOS) Results

PLOS and BLOS scores are generally unfavorable throughout the study area. This is primarily due to a lack of walkable and bikeable facilities. The Radar Hill Road segment from 228th Street to 229th Street has a ten-foot shoulder on both sides of the roadway, which contributes to the increased PLOS, and the satisfactory BLOS.

Providing adequate pedestrian and bicycle facilities along Highway 1416 and Radar Hill Road is expected to increase the PLOS and BLOS.

Summary

Corridor Characteristics

- » The access management analysis determined that Radar Hill Road exceeds SDDOT standards of five accesses per side per mile between Highway 1416 and Highway 44, with an average of 6.3 and 8.5 accesses per mile, on the west and east sides, respectively.
- » A negative offset exists on S Ellsworth Road at the intersection with eastbound Highway 1416. Realignment of this intersection to remove the negative offset should be considered.
- The only existing multimodal facilities within the study area consists of a ten-foot shoulder on both sides of Radar Hill Road between 228th Street and 229th Street. No dedicated sidewalks or bike lanes exist within the study area.
- Proximity to Box Elder Road to the north and the railroad tracks to the south limits available right-ofway for Highway 1416. The proximity also leads to safety and operational concerns at the intersections along Box Elder Road and the railroad.
- The northbound queues entering Highway 1416 at Radar Hill Road and Ellsworth Drive can extend to the railroad tracks causing safety concerns. Likewise, the southbound approaches onto Highway 1416 can extend across Box Elder Road causing delays and safety concerns with the intersections of the frontage road.
- » The atypical traffic control at Highway 1416's intersections with Radar Hill Road, Commercial Gate Road, and Ellsworth Drive could lead to driver confusion and become a potential safety hazard.

Safety

- » There were 357 crashes reported during the 10-year analysis period in the study area.
- » There were 177 crashes reported in the Highway 1416 segments of the study area.
- » There were 180 crashes reported in the Radar Hill Road segment of the study area.
- » There were two (2) fatal and twenty (20) incapacitating injury crashes reported.
- » There was one pedestrian-related crash and three crashes involving bicyclists reported.
- » The frequency of crashes was generally high along the intersections of Highway 1416 with W Gate Road, Radar Hill Road, Commercial Gate Road, and S Ellsworth Road.
- » Angle (120 crashes) and rear-end (43 crashes) were the most typical crash types at the study intersections along Highway 1416.

- » Most (95 crashes, or 69 percent) of the non-junction related crashes were single-vehicle related, like run-off-road, roll over, etc. This includes 41, or 43 percent, single-vehicle non-junction related crashes that occurred during dark conditions where street lighting were minimum to non-existent.
- The intersection of Highway 1416 and Radar Hill Road experienced the highest number of crashes during the analysis period, with 102 crashes. Angle crashes were the most prominent type of crashes (77 crashes, or 75.5 percent) at the intersection.
- There were 25 crashes reported at the Highway 1416 and S Ellsworth Road intersection during the analysis period. Angle crashes were the most prominent type of crashes (20 crashes, or 80 percent) at the intersection.

Traffic Volumes

- » KLJ collected traffic volumes at six study intersections on May 9 and May 23, 2023.
- The AM peak was determined to be 7:00 AM, and the PM peak was determined to be 4:30 PM. These peak times were validated using StreetLight data.

Capacity Analysis

- » Highway 1416 and S Ellsworth Road operates at LOS F during the AM peak, and LOS E during the PM peak.
- » Highway 1416 and Radar Hill Road operates at LOS E during the AM peak, and LOS F during the PM peak, brought on by queueing in the median.
- » All other study intersections operate under acceptable delay and LOS during the AM and PM peaks.
- The majority of the segments within the study area operate under unacceptable Pedestrian LOS (PLOS) and Bicycle LOS (BLOS), due to a lack of dedicated pedestrian and bicycle facilities.

Chapter 3 – FUTURE CONDITIONS

Future Volumes

Existing traffic counts were collected by KLJ in May of 2023 at the six study intersections. These volumes were projected to the 2030 and 2050 analysis years. The basis of the growth was derived from the Rapid City Area MPO regional model. However, the model does not currently account for some planned developments in the study area. The projection for the general background growth was adjusted to account for anticipated growth due to expansion of the Ellsworth Air Force Base. Annual growth rates were estimated using the Rapid City Area MPO regional model. Furthermore, additional traffic due to the development of two new schools and a multi-family housing development directly adjacent to the study area were also incorporated into the future volume counts. The methodology for the development of the volumes used in the analysis is included in this section.

Annual Growth Rate

Annual growth rates by movement at each of the study intersections were developed using Average Daily Traffic (ADT) values within the study area, and accounting for additional growth expected from the Ellsworth Air Force Base. ADTs for the years 2018 and 2045 were provided by the Rapid City Area MPO along the relevant segments of the Highway 1416 and Radar Hill Road corridors. The Ellsworth Air Force Base is expected to expand by approximately 4,000 people by the year 2030, which represents a population growth of 2.30% in the City of Box Elder. This growth rate was applied to the anticipated growth between the 2018 and 2045 ADTs to develop an annual growth rate using **Equation 1**.

Equation 1 – Annual Growth Rate

Annual Growth Rate = $\left(\frac{ADT2045 * (1 + 2.30\%)}{ADT2018}\right)^{\frac{1}{2045 - 2018}} - 1$

This equation provided annual growth rate by approach, which was then averaged between relevant movements to determine annual growth rate by movement, as ADT is bi-directional (e.g., the annual growth rate applied to northbound left movements was an average of the *northbound* annual growth rate and the *eastbound* annual growth rate). The annual growth rates by movement are presented in **Table 3-1**.

	No	orthbou	nd	So	uthbou	nd	E	astbour	nd	Westbound			
	L	Т	R	L	Т	R	L	Т	R	L	Т	R	
Highway 1416 and 151st Ave	-	-	-	0.61%	-	0.61%	0.61%	0.45%	-	-	0.45%	0.61%	
Highway 1416 and Liberty Blvd	0.30%	0.19%	0.30%	0.24%	0.19%	0.24%	0.24%	0.30%	0.30%	0.30%	0.30%	0.24%	
WB Highway 1416 and S Ellsworth Rd	0.61%	0.76%	-	-	0.76%	0.91%	-	-	-	0.75%	0.89%	0.90%	
EB Highway 1416 and S Ellsworth Rd	-	0.61%	0.89%	0.61%	0.61%	-	0.71%	0.81%	0.81%	-	-	-	
WB Highway 1416 and Radar Hill Rd	0.62%	0.62%	-	-	0.62%	0.61%	-	-	-	0.69%	0.77%	0.77%	
EB Highway 1416 and Radar Hill Rd	-	0.62%	0.77%	0.62%	0.62%	-	0.69%	0.77%	0.77%	-	-	-	
Radar Hill Rd and Long View Rd	1.67%	1.01%	0.78%	0.92%	1.01%	1.82%	1.82%	1.58%	1.67%	0.78%	1.58%	0.92%	
Radar Hill Rd and Highway 44	0.91%	0.91%	0.91%	0.91%	0.91%	0.91%	0.91%	0.91%	0.91%	0.91%	0.91%	0.91%	

Table 3-1 – Annual Growth Rate by Movement

L – Left; I – Through; R – Right

The annual growth rates were then applied to the existing (2023) volumes and projected to design years 2030 and 2050 for the AM and PM peaks.

Future Development

There have been two Traffic Impact Studies (TISs) completed that are expected to have measurable impact on the study intersections before the 2030 analysis year. One TIS discussed impacts from two different developments (Box Elder High School and Multi-Family Housing). These TISs were reviewed, and the additional trips expected due to the new developments were included in the projected traffic volumes for this study.

BOX ELDER HIGH SCHOOL (2021)

A new high school is proposed to be constructed on a 60-acre site between 151st Avenue and Liberty Boulevard, north of Highway 1416. This school is anticipated have 1,400 students and generate 728 trips during the AM peak, and 196 trips during the PM peak.

The additional volumes anticipated at each of the study intersections during the AM and PM peaks is shown in Table 3-2. The afternoon school peak does not fall during the network PM peak; therefore, additional trips were added based on the PM peak of adjacent traffic. No additional trips are expected at the intersections of Radar Hill Road and Long View Drive, or Radar Hill Road and Highway 44.

	No	orthbou	nd	Sou	uthbou	und	Ea	stbou	nd	Westbound								
	L	Т	R	L	Т	R	L	Т	R	L	Т	R						
Highway 1/16 and 151st Ave				5		89	165	1			1	9						
				(1)		(36)	(32)					(2)						
Highway 1416 and Liberty Blvd		17	7	37	8	89	182	121		4	59	24						
		(3)	(1)	(8)	(4)	(38)	(35)	(24)		(2)	(26)	(8)						
M/D Lichwow 141C and C Ellowenth Dd					49					24	100	24						
WB Highway 1410 and 5 Elisworth Ru					(9)					(10)	(43)	(10)						
ED Highway 141C and C Ellowenth Dd			49	49	24			205										
EB Highway 1410 and 5 Elisworth Ru			(9)	(9)	(10)			(39)										
M/D Highway 1416 and Dadar Hill Dd										19	80	1						
WB Highway 1416 and Radar Hill Rd										(11)	(32)							
EB Highway 1416 and Radar Hill Rd			63	2				140										
			(9)					(30)										
		1.0 T	T 1		0 0'	. 1. 1												

Table 3-2 – Box Elder High School – Additional Trips

L – Left; T – Through; R – Right AM (PM)

MULTI-FAMILY HOUSING

A new multi-family housing development is expected to be constructed before the 2030 analysis year. The additional trips generated by this development were included in the TIS for the Box Elder High School. The multi-family housing development is anticipated to be developed south of the High School, north of Highway 1416, and between Liberty Boulevard and 151st Avenue. The development is expected to have 200 dwelling units and generate 80 trips during the AM peak, and 102 trips during the PM Peak.

The additional volumes anticipated at each of the study intersections during the AM and PM peaks is shown in **Table 3-3**. No additional trips are expected at the intersections of Radar Hill Road and Long View Drive, or Radar Hill Road and Highway 44.

	No	rthbou	ınd	Sou	uthbou	ınd	Ea	stbou	nd	Westbound		
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Highway 1416 and 151st Ave				(1)		21 (13)	6 (22)					1 (1)
Highway 1416 and Liberty Blvd		1 (2)	(1)	2 (5)	2 (1)	23 (14)	7 (24)	5 (16)		1 (1)	15 (10)	5 (3)
WB Highway 1416 and S Ellsworth Rd					2 (6)					6 (4)	26 (16)	6 (4)
EB Highway 1416 and S Ellsworth Rd			2 (6)	2 (6)	6 (4)			8 (27)				
WB Highway 1416 and Radar Hill Rd										5 (4)	21 (12)	
EB Highway 1416 and Radar Hill Rd			2 (6)	1				5 (21)				

Table 3-3 – Multi-Family Housing Development – Additional Trips

L – Left; T – Through; R – Right AM (PM)

DOUGLAS SCHOOL DISTRICT (2022)

A new elementary school is anticipated to be constructed on a site along Creekside Drive between Coyote Trail and Morgen Road. This school is anticipated have 600 students and generate 450 trips during the AM peak, and 96 trips during the PM peak.

The additional volumes anticipated at each of the study intersections during the AM and PM peaks is shown in **Table 3-4**. The afternoon school peak does not fall during the network PM peak; therefore, additional trips were added based on the PM peak of adjacent traffic. No additional trips are expected at the intersections of Radar Hill Road and Long View Drive, or Radar Hill Road and Highway 44.

	Nort	nbound	k	South	bound		East	bound		Westbound		
	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Highway 1416 and 151st Ave												
Highway 1416 and Liberty Blvd												
WB Highway 1416 and S Ellsworth Rd		41			49							
		(10)			(9)							
EB Highway 1/16 and S Ellsworth Rd		41			49							
		(10)			(9)							
W/P Highway 1416 and Padar Hill Pd	4	22			19							
WB Highway 1416 and Radar Hill Rd	(1)	(4)			(4)							
EB Highway 1416 and Radar Hill Rd		21			19				5			
		(5)			(4)				(1)			

Table 3-4 – Douglas School District Elementary School – Additional Trips

L – Left; T – Through; R – Right AM (PM)

Future Volumes

The future volumes for the analysis years 2030 and 2050 were determined by applying the annual growth rates (**Table 3-1**) to the existing 2023 turning movement counts and adding the expected volumes due to the three new developments described above (**Table 3-2**, **Table 3-3**, and **Table 3-4**). The projected volumes for the AM and PM peaks of the build year 2030 are shown in **Table 3-5** and **Table 3-6**, respectively.

2030 No-Build Volumes	Northbound			Southbound			Ea	stbou	nd	Westbound		
AM Peak – 7:00	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Highway 1416 and 151st Ave	-	-	-	11	-	146	179	41	-	-	99	19
Highway 1416 and Liberty Blvd	4	51	10	60	19	141	326	150	3	7	90	171
WB Highway 1416 and S Ellsworth Rd	90	752	-	-	128	207	-	-	-	30	173	44
EB Highway 1416 and S Ellsworth Rd	-	190	59	62	96	-	650	335	16	-	-	-
WB Highway 1416 and Radar Hill Rd	179	28	-	-	37	17	-	-	-	107	454	7
EB Highway 1416 and Radar Hill Rd	-	197	314	12	111	-	5	702	64	-	-	-
Radar Hill Rd and Long View Rd	2	26	4	4	41	116	80	7	2	6	18	10
Radar Hill Rd and Highway 44	5	2	2	21	3	11	16	232	6	3	221	19

Table 3-5 – Projected Volumes – 2030 (AM Peak)

L – Left; T – Through; R – Right

2030 No-Build Volumes	No	rthbou	und	Southbound			Ea	stbou	nd	Westbound		
PM Peak – 16:30	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Highway 1416 and 151st Ave	-	-	-	6	-	65	92	87	-	-	52	5
Highway 1416 and Liberty Blvd	8	16	2	125	26	107	97	83	13	7	64	66
WB Highway 1416 and S Ellsworth Rd	38	356	-	-	93	273	-	-	-	29	135	21
EB Highway 1416 and S Ellsworth Rd	-	87	22	22	100	-	306	150	152	-	-	-
WB Highway 1416 and Radar Hill Rd	118	34	-	-	18	11	-	-	-	209	605	4
EB Highway 1416 and Radar Hill Rd	-	132	138	5	206	-	20	475	205	-	-	-
Radar Hill Rd and Long View Rd	2	50	5	8	40	122	145	12	2	3	7	5
Radar Hill Rd and Highway 44	7	2	2	25	8	26	42	141	13	2	236	26
I - Left: T - Through: R - Right												

Table 3-6 – Projected Volumes – 2030 (PM Peak)

L – Left; T – Through; R – Right

The projected volumes for the AM and PM peaks of the design year 2050 are shown in Table 3-7 and Table **3-8**, respectively.

2050 No-Build Volumes	No	rthbou	ınd	Southbound			Ea	stbou	nd	Westbound		
AM Peak – 7:00	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Highway 1416 and 151st Ave	-	-	-	11	-	151	180	44	-	-	108	20
Highway 1416 and Liberty Blvd	4	52	10	61	19	142	333	151	3	7	91	178
WB Highway 1416 and S Ellsworth Rd	102	868	-	-	132	248	-	-	-	30	182	47
EB Highway 1416 and S Ellsworth Rd	-	209	60	63	98	-	748	356	19	-	-	-
WB Highway 1416 and Radar Hill Rd	202	28	-	-	40	19	-	-	-	120	512	8
EB Highway 1416 and Radar Hill Rd	-	220	356	13	123	-	5	794	73	-	-	-
Radar Hill Rd and Long View Rd	2	32	4	4	50	166	114	10	2	7	25	12
Radar Hill Rd and Highway 44	6	2	2	25	3	13	20	278	7	3	265	22

L – Left; T – Through; R – Right

Table 3-8 – Projected Volumes – 2050 (PM Peak)

2050 No-Build Volumes	No	rthbou	ınd	Sou	uthbou	ind	Ea	stbou	nd	We	estbou	nd
PM Peak – 16:30	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Highway 1416 and 151st Ave	-	-	-	6	-	67	97	95	-	-	57	5
Highway 1416 and Liberty Blvd	8	16	2	131	27	110	99	86	13	7	66	69
WB Highway 1416 and S Ellsworth Rd	43	413	-	-	104	327	-	-	-	32	150	22
EB Highway 1416 and S Ellsworth Rd	-	96	23	23	109	-	352	165	178	-	-	-
WB Highway 1416 and Radar Hill Rd	134	38	-	-	20	12	-	-	-	237	697	4
EB Highway 1416 and Radar Hill Rd	-	148	158	5	232	-	23	545	239	-	-	-
Radar Hill Rd and Long View Rd	2	61	5	9	49	174	207	16	2	3	10	6
Radar Hill Rd and Highway 44	8	2	2	30	9	31	50	169	16	2	283	31
	1	oft. T	The	auahi		aht						

L – Left; T – Through; R – Right

Capacity Analysis and Demand

Intersection Capacity Analysis

Intersection capacity analysis was conducted using HCS 2023 software for each of the study intersections, using both AM and PM peak vehicular volumes. Intersection performance was measured based on delay and Level of Service (LOS). The vehicular Level of Service was determined using the methodology described in Existing Conditions. Detailed Vehicular Level of Service results can be found in **Appendix D**.

LEVEL OF SERVICE RESULTS – 2030

The LOS results under 2030 projected conditions are presented in **Table 3-9**.

	AM Pea	ak	PM Peak		
Intersection	Delay (sec/veh)	LOS*	Delay (sec/veh)	LOS*	
Highway 1416 and 151st Ave	9.0	A/B	6.5	A/A	
Highway 1416 and Liberty Blvd	116.5	F/F	12.7	B/C	
Highway 1416 and S Ellsworth Rd	4493.0	F/F	90.6	F/F	
Highway 1416 and Radar Hill Rd	66.5	F/F	68.7	F/F	
Radar Hill Rd and Long View Rd	8.6	A/A	9.1	A/A	
Radar Hill Rd and Highway 44	11.0	B / B	2.8	A / B	
	-		-		

Table 3-9 – Future Intersection Vehicular Capacity Analysis Results (2030)

*[Intersection LOS] / [Worst approach LOS]

AM Peak

During the AM peak under forecasted 2030 conditions, it was determined that the Intersection of Highway 1416 and Liberty Boulevard is expected to experience unacceptable delay and LOS, with both the intersection and worst approach reaching LOS F. The unacceptable conditions are due to northbound and southbound vehicles experiencing significant delay, as they are unable to find an acceptable gap in the high eastbound and westbound volumes.

The intersection of Highway 1416 and S Ellsworth Road is also expected to experience severely unacceptable delay and LOS during the AM peak in 2030, with both the intersection and worst approach reaching LOS F. These conditions were reached under existing conditions as well. The unacceptable conditions are primarily caused by a significant number of eastbound vehicles making a left turn, causing severe queueing in the median separating eastbound and westbound Highway 1416. The eastbound approach at this intersection is free flowing (i.e., there is no stop control at this approach). However, some delay is still experienced, as the high volume of left-turning vehicles exceeds the capacity of a single lane. This queueing causes spillback for eastbound movements, as well as northbound vehicles along S Ellsworth Road.

The intersection of Highway 1416 and Radar Hill Road is also expected to experience unacceptable delay and LOS during the AM peak in 2030, with both the intersection and worst approach reaching LOS F. These conditions were reached under existing conditions as well. The unacceptable conditions are primarily

caused by a high northbound volume, and vehicles being unable to find an acceptable gap to cross or enter Highway 1416 due to high eastbound and westbound volumes. Minimal storage space in the median separating eastbound and westbound Highway 1416 also causes significant queuing and spillback affecting the northbound movements, as well as eastbound vehicles attempting to turn left.

All other study intersections are expected to operate under acceptable delay and LOS during the AM peak in 2030.

PM Peak

During the PM peak under projected 2030 conditions, it was determined that the intersection of Highway 1416 and S Ellsworth Road is expected to experience unacceptable delay and LOS, with the intersection reaching LOS C, and the worst approach reaching LOS F. The worst approach at this intersection during the PM peak is the southbound approach of the eastbound portion of Highway 1416 (south of the median). High eastbound volumes at this intersection make it difficult for southbound vehicles to find acceptable gaps to cross or enter Highway 1416, causing significant queueing and delay that impacts the southbound and westbound vehicles. This intersection also experiences higher southbound volumes during the PM peak as vehicles travel away from the Ellsworth Air Force Base.

The intersection of Highway 1416 and Radar Hill Road is also expected to experience unacceptable delay and LOS during the PM peak in 2030, with the intersection reaching LOS E and the worst approach reaching LOS F. The worst approaches at this intersection during the PM peak are the northbound and eastbound approaches of the eastbound portion of Highway 1416 (south of the median). Minimal storage space in the median and high eastbound left volumes cause significant queueing and delay that affects eastbound and northbound vehicles.

All other study intersections are expected to operate under acceptable delay and LOS during the PM peak in 2030.

LEVEL OF SERVICE RESULTS – 2050

The LOS results under 2050 projected conditions are presented in Table 3-10.

	AM Pea	ak	PM Peak		
Intersection	Delay (sec/veh)	LOS*	Delay (sec/veh)	LOS*	
Highway 1416 and 151st Ave	9.8	A/B	8.4	A/A	
Highway 1416 and Liberty Blvd	152.5	F/F	13.1	B/C	
Highway 1416 and S Ellsworth Rd	15432.5	F/F	166.1	F/F	
Highway 1416 and Radar Hill Rd	202.5	F/F	359.3	F/F	
Radar Hill Rd and Long View Rd	9.4	A/A	13.3	B/C	
Radar Hill Rd and Highway 44	11.9	B / B	2.9	A/B	

Table 3-10 – Future Intersection Vehicular Capacity Analysis Results (2050)

^{*[}Intersection LOS] / [Worst approach LOS]

AM Peak

During the AM peak under projected 2050 conditions, it was determined that the intersection of Highway 1416 and Liberty Boulevard is expected to experience unacceptable delay and LOS, with both the intersection and worst approach reaching LOS F. These conditions were met under 2030 conditions and are expected to worsen with continued growth in the surrounding network.

The intersection of Highway 1416 and S Ellsworth Road is also expected to experience severely unacceptable delay and LOS during the AM peak in 2050, with both the intersection and worst approach reaching LOS F. These conditions were reached under existing conditions, as well as projected 2030 conditions, and are expected to worsen with continued growth in the surrounding network.

The intersection of Highway 1416 and Radar Hill Road is also expected to experience severely unacceptable delay and LOS during the AM peak in 2050, with both the intersection and worst approach reaching LOS F. Unacceptable conditions were reached under existing conditions, as well as projected 2030 conditions, and are expected to worsen with continued growth in the surrounding network.

All other study intersections are expected to operate under acceptable delay and LOS during the AM peak in 2050.

PM Peak

During the PM peak under projected 2050 conditions, it was determined that the inter section of Highway 1416 and S Ellsworth Road is expected to experience unacceptable delay and LOS, with the intersection reaching LOS D, and the worst approach reaching LOS F. Unacceptable conditions were reached under existing conditions, as well as projected 2030 conditions, and are expected to worsen with continued growth in the surrounding network.

The intersection of Highway 1416 and Radar Hill Road is also expected to experience severely unacceptable delay and LOS during the PM peak in 2050, with both the intersection and worst approach reaching LOS F. Unacceptable conditions were reached under existing conditions, as well as projected 2030 conditions, and are expected to worsen with continued growth in the surrounding network.

All other study intersections are expected to operate under acceptable delay and LOS during the PM peak in 2050.

Signal Warrant Analysis

The *Manual on Uniform Traffic Control Devices* (MUTCD) provides guidance and standards for the installation of traffic control methods. Intersection control warrant analysis was conducted at the intersections of Highway 1416 and Liberty Boulevard, Highway 1416 and S Ellsworth Road, and Highway 1416 and Radar Hill Road. Warrants are met based on the number of hours volume criteria are met. The 13-hour volume was projected to 2030 and 2050 using the annual growth rates presented in Table 3-1, with additional volumes added during the AM and school peaks due to the anticipated school developments.

The most commonly analyzed signal warrants are the following:

- Warrant 1: Eight-Hour Vehicular Volume Specific volume thresholds must be met for at least eight hours of an average day.
 - **Warrant 1a** This warrant applies to locations where a large volume of intersecting traffic is the primary reason for installing a traffic signal.
 - Warrant 1b This warrant applies to locations where Warrant 1a is not met, and where volumes on the major road is so heavy that minor road traffic is unable to enter or cross the major road.
- » Warrant 2: Four-Hour Vehicular Volume Specific volume thresholds must be met for at least four hours of an average day. This warrant applies to locations where the volume of intersecting traffic is the primary reason for installing a traffic signal.
- Warrant 3: Peak Hour Specific volume thresholds must be met during a peak hour of an average day. This warrant applies to locations that have higher-than-average volumes during peak hours, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.
- Warrant 7: Crash Experience Specific volume thresholds (similar to Warrants 1a and 1b) must be met for at least eight hours of an average day, and five or more reported crashes of types susceptible to correction by a traffic signal have occurred within one year.
- » MWSA: Multi-Way Stop Application This warrant is to determine if the implementation of a multiway stop control is warranted at an intersection. Specific volume thresholds must be met for at least eight hours of an average day, or five or more reported crashes of types susceptible to correction by a multi-way stop installation have occurred within one year. This warrant applies to locations where the volume of traffic on the intersecting roads is approximately equal.

The signal warrant analysis results for 2030 and 2050 are presented in **Table 3-11** and **Table 3-12**, respectively. Detailed Signal Warrant Analysis results can be found in **Appendix E**.

No-Build (2030)	1a	1b	2	3	7	MWSA
Highway 1416 and Liberty Blvd	1/8	1/8	1/4	0/1	1/8	4/8
Highway 1416 and S Ellsworth Rd	7/8	4/8	7/4	4/1	7/8	14 / 8
Highway 1416 and Radar Hill Rd	13 / 8	9/8	11 / 4	6/1	9/8	6/8

Table 3-11 – Signal Warrant Analysis Results (2030)

Table 3-12 – Signal Warrant Analysis Results (2050)

No-Build (2050)	1a	1b	2	3	7	MWSA
Highway 1416 and Liberty Blvd	1/8	1/8	1/4	0/1	1/8	4/8
Highway 1416 and S Ellsworth Rd	10 / 8	5/8	9/4	5/1	8/8	15 / 8
Highway 1416 and Radar Hill Rd	13 / 8	13 / 8	13 / 4	8/1	11/8	9/8

A signal is warranted at the intersections of Highway 1416 and S Ellsworth Road, and Highway 1416 and Radar Hill Road under 2030 and 2050 projected conditions.

Standard signal warrants are not met at the intersection of Highway 1416 and Liberty Boulevard. However, MUTCD **Signal Warrant 9: Intersection Near a Grade Crossing** is met at this intersection. This warrant is intended to apply to locations near an at-grade railroad crossing that is currently stop- or yield-controlled and is within 140 feet of the intersection stop line. Specific volume thresholds must be met, and the thresholds vary based on the railroad crossing distance from the intersection stop line. If a traffic signal is installed at an intersection due to this warrant, the MUTCD recommends that the signal shall have actuation on the minor street, preemption control shall be provided, and the railroad crossing shall have flashing-light signals. The intersection of Highway 1416 and Liberty Boulevard was also very close to meeting **Signal Warrant 3: Peak Hour** under projected 2050 no-build conditions. This intersection will have to be monitored and reevaluated periodically to determine if intersection control is warranted after the area around it continues to develop.

Summary

Traffic Volumes

- » Traffic volumes collected in 2023 were projected to design years 2030 and 2050 using growth rates developed from ADT data provided by the Rapid City Area MPO, accounting for additional growth due to anticipated expansion of the Ellsworth Air Force Base.
- » Additional trips generated by three new developments near the study area were added to the projected AM and PM peak volumes. Two of the new developments are schools, and the afternoon peaks do not occur during the network PM peak, so additional trips were conservatively added based on the PM peak of adjacent traffic.

Capacity Analysis

- » Highway 1416 and Liberty Boulevard is expected to operate at LOS F during the AM peak under 2030 and 2050 projected no-build conditions.
- » Highway 1416 and S Ellsworth Road is expected to operate at LOS F during both the AM and PM peak under 2030 and 2050 projected no-build conditions.
- » Highway 1416 and Radar Hill Road is expected to operate at LOS F during both the AM and PM peak under 2030 and 2050 projected no-build conditions.
- » Delay and LOS at these intersections are expected to worsen with continued growth in the surrounding network.
- » All other study intersections are expected to operate under acceptable delay and LOS during the AM and PM peaks under 2030 and 2050 projected no-build conditions.

Signal Warrant Analysis

- » A signal is warranted at the intersections of Highway 1416 and S Ellsworth Road, and Highway 1416 and Radar Hill Road under 2030 and 2050 projected no-build conditions.
- The intersection of Highway 1416 and Liberty Boulevard meets the requirements of Signal Warrant 9 due to its proximity to an at-grade railroad crossing. This intersection was very close to meeting Signal Warrant 3 under projected 2050 no-build conditions.

Chapter 4 – ALTERNATIVES ANALYSIS

Interim Alternatives

Due to severe deficiencies in vehicular Level of Service found in the existing 2023 analysis, interim alternatives were analyzed to provide short-term relief as more permanent solutions continue to develop. The intersections of Highway 1416 and S Ellsworth Road and Highway 1416 and Radar Hill Road were analyzed assuming all-way stop control for the interim scenario. The results of this analysis, along with existing no-build results for comparison, are shown in **Table 4-1**.

		Existing - 2023				Future - 2030				
		AM Peak		PM Peak		AM Peak		PM Peak		
Intersection	Scenario	Delay (s/veh)	LOS*	Delay (s/veh)	LOS*	Delay (s/veh)	LOS*	Delay (s/veh)	LOS*	
Highway 1416 and S	No-Build	598.3	F/F	10.1	B/E	4493.0	F/F	90.6	F/F	
Ellsworth Rd	Interim	347.5	F	12.0	В	928.4	F	15.0	В	
Highway 1416 and	No-Build	26.9	D/E	32.8	D/F	66.5	F/F	68.7	F/F	
Radar Hill Rd	Interim	19.2	С	17.5	С	38.8	E	22.0	С	

Table 4-1 – Interim Alternative Results

*[Intersection LOS] / [Worst approach LOS] (for TWSC)

While all-way stop control at the intersections listed above is not expected to bring the intersections to acceptable operations, the delay and Level of Service is expected to improve significantly. At the time of this report, all-way stop control has been implemented as a short-term solution for the intersections of Highway 1416 and S Ellsworth Road, and Highway 1416 and Radar Hill Drive, while more permanent and effective alternatives are analyzed, funded, and implemented.

Alternatives Development

Based on Future Conditions results, it was determined that the intersections of Highway 1416 and 151st Avenue, and Radar Hill Road and Long View Road, and Radar Hill Road and Highway 44 are expected to operate under acceptable conditions in the projected 2030 build year and 2050 design year, and therefore no intersection alternatives are proposed for these locations other than the TWLTL being added to the Radar Hill Road corridor.

Bicycle and Pedestrian Level of Service (LOS) was determined for segments along Highway 1416 and Radar Hill Road in the Existing Conditions Report for this study. Bicycle and Pedestrian LOS was determined to be inadequate for the majority of the segments along both corridors, aside from a portion of Radar Hill Road between 228th Street and 229th Street, where ten-foot shoulders are present on both sides of the roadway. Though no intersection alternatives are proposed along the Radar Hill Road corridor, the

implementation of a shared-use path along Highway 1416 and the city owned portion of Radar Hill Road as well as widened shoulders on the remainder of Radar Hill Road are expected to greatly improve the Bicycle and Pedestrian LOS.

The intersections of Highway 1416 and Liberty Boulevard, Highway 1416 and S Ellsworth Road, and Highway 1416 and Radar Hill Road are expected to operate under unacceptable conditions for both the build year and design year. For this reason, alternative designs for each intersection were proposed to mitigate these deficiencies.

The Highway 1416 corridor is proposed to be converted to a semi-urban corridor to remove the large median separating eastbound and westbound travel. The median area occupies otherwise developable land and the two-stage crossing required perpendicular to Highway 1416 causes severe deficiencies in queueing and delay. It is recommended that Highway 1416 be converted to a combination of a three-lane and five-lane urban corridor, with the centerline aligning more closely with the current westbound travel lanes of Highway 1416 to provide more distance from the adjacent railroad.

Due to existing travel patterns and volumes, all alternatives assume that Highway 1416 is a two-lane rural corridor from 151st Avenue to S Ellsworth Road with dedicated left-turn lanes at the Liberty Boulevard intersection. West of the intersection with S Ellsworth Road, Highway 1416 becomes a four-lane semi-urban corridor.

Conceptual designs for each alternative can be found in **Appendix F**. The development of alternatives for each intersection is discussed in the following paragraphs.

Highway 1416 and Liberty Boulevard

As determined in the Future Conditions chapter of this study, the intersection of Highway 1416 and Liberty Boulevard did not meet signal warrant thresholds for the 2030 build year or 2050 design year. However, **Signal Warrant 9: Intersection Near a Grade Crossing** was met, due to high volumes and its proximity to a railroad crossing that is currently yield-controlled. The alternatives selected for this intersection included a traffic signal, and a single-lane roundabout. The Box Elder Comprehensive Plan (2014) also identifies this intersection as needing safety and mobility improvements.

Capacity analysis results showed that this intersection is expected to operate at LOS F during the AM peak by 2030 under no-build conditions. This is primarily due to significant queueing in the northbound and southbound approaches, as the eastbound and westbound movements experience high volumes and high speeds. Recent development near this intersection is also expected to generate additional trips traveling through this intersection. A traffic signal or roundabout can be reasonably expected to mitigate these deficiencies, if either is shown to be both warranted and feasible.

Highway 1416 and S Ellsworth Road

The intersection of Highway 1416 and S Ellsworth Road met criteria for three signal warrants, as well as the multi-way stop application warrant, in both the build year and design year. This intersection experiences high volumes making eastbound left-turn movements, particularly during the AM peak, and high southbound right-turn movements, as vehicles travel to and from the Ellsworth Air Force Base north of the study area. Current roadway geometry requires left-turning movements to occur in two stages,

with additional stopping and delay at the median separating eastbound and westbound travel along Highway 1416. This configuration paired with exceptionally high eastbound left-turn movements results in Level of Service failure during the AM and PM peaks. Intersection signalization was considered, with dual left-turn lanes at the eastbound approach to accommodate the high volumes, and a single eastbound through lane. A single-lane roundabout and hybrid roundabout were also analyzed. A fourth alternative was also developed for this intersection that includes a displaced left-turn at the eastbound approach, where eastbound left-turning vehicles cross conflicting westbound through traffic at a signalized crossing before making a left turn onto S Ellsworth Road.

All alternatives developed at the intersection of Highway 1416 and S Ellsworth Road assume that Highway 1416 is a three-lane corridor east of this intersection, and a five-lane corridor west of the intersection.

Highway 1416 and Radar Hill Road

The intersection of Highway 1416 and Radar Hill Road met criteria for all signal warrants analyzed in both 2030 and 2050. This intersection experiences high volumes in the northbound approach. Minimal storage space in the median separating eastbound and westbound Highway 1416 causes significant queueing and spillback affecting the northbound movements, as well as eastbound vehicles attempting to turn left. A signalized alternative was analyzed, with dedicated left-turn lanes added to all approaches.

Multiple roundabout alternatives were also considered. The first roundabout alternative included a 2x1 design, with two lanes at the eastbound and westbound approaches, and single lanes at the northbound and southbound approaches. The second roundabout was a 2x1 design, with a channelized northbound right lane to accommodate high volumes making this movement during the AM and PM peaks. The third roundabout design included a two-lane westbound approach, and a single-lane eastbound approach, to better align with the off-ramp design of the I-90 interchange to the west. This design also includes a channelized northbound right.

Alternatives Summary

The final alternatives selected for analysis for each of the study intersections are described below.

HIGHWAY 1416 AND LIBERTY BOULEVARD

- » No Build: TWSC This alternative includes the intersection remain a stop controlled on the Liberty Boulevard approaches for the time being with the addition of a dedicated left-turn lane for the westbound approach.
- » Alternative 1: Signalized Intersection This alternative includes the implementation of a traffic signal at the intersection, as well as the addition of dedicated left-turn lanes to all approaches. Additional signal timing optimization may be needed should this alternative be ultimately selected.
- » Alternative 2: Single-Lane Roundabout This alternative includes the implementation of a single-lane roundabout.

HIGHWAY 1416 AND S ELLSWORTH ROAD

S Ellsworth Road is the intersection where Highway 1416 is proposed to transition from a three-lane to a five-lane urban corridor. All alternatives analyzed have a single-lane approach in each direction on the

east side of the intersection, and a two-lane approach in each direction on the west side of the intersection.

- » Alternative 1: Signalized Intersection This alternative includes the implementation of a traffic signal at the intersection, as well as the addition of dedicated left-turn lanes to all approaches, as well as dual eastbound left-turn lanes and a single eastbound through lane.
- » Alternative 2: Single-Lane Roundabout This alternative includes the implementation of a single-lane roundabout.
- » Alternative 3: Hybrid Roundabout This alternative includes the implementation of a hybrid 2x1 roundabout. The roundabout has an additional dedicated eastbound left-turn lane to accommodate for high volumes, with two circulating lanes at the eastbound and northbound approaches. This design also includes a yield-controlled channelized southbound right-turn lane.
- » Alternative 4: Displaced Eastbound Left This alternative includes the implementation of a displaced eastbound left-turn movement. This alternative design includes the eastbound left-turn lane crossing the westbound through traffic at a signalized location west of the intersection with S Ellsworth Road. The eastbound left-turning traffic would then make the left-turning movement at another signal located at S Ellsworth Road.

HIGHWAY 1416 AND RADAR HILL ROAD

- » Alternative 1: Signalized Intersection This alternative includes the implementation of a traffic signal at the intersection, as well as the addition of dedicated left-turn lanes to all approaches.
- » Alternative 2: 2x1 Roundabout This alternative includes the implementation of a 2x1 roundabout, with two lanes in the eastbound and westbound directions, and one lane in the northbound and southbound directions.
- » Alternative 3: 2x1 Roundabout with Channelized NBR This alternative includes the implementation of a 2x1 roundabout with two lanes in the eastbound and westbound directions. The northbound approach includes a single lane for through and left-turning traffic, and a channelized right turn lane to accommodate high volumes. The southbound approach at Gumbo Drive is closed allowing for safer movement on Box Elder Road.
- » Alternative 4: Hybrid Roundabout This alternative includes the implementation of a roundabout with two lanes in westbound direction, and a single lane in the eastbound direction. The northbound approach includes a single lane for through and left-turning traffic, and a channelized right turn lane to accommodate high volumes. The southbound approach at Gumbo Drive is closed allowing for safer movement on Box Elder Road.

Crash Modification Factors

Crash modification factors (CMFs) are an effective tool for analyzing alternative designs and estimating their respective safety benefit. CMFs are a multiplicative factor that indicates the proportion of crashes that would be expected after implementing a countermeasure. CMFs with a value less than 1.0 indicate a decrease in expected crashes, and CMFs greater than 1.0 indicate an increase in expected crashes. The Federal Highway Administration (FHWA)'s CMF Clearinghouse provides a toolbox of CMF values determined through extensive research based on crash data. The CMF Clearinghouse presents each CMF, along with the quality (a measure of research reliability, rated on a scale of one (worst) to five (best)), as well as crash types, crash severities, and area types that the CMF can reasonably be applied to.

CMFs for each of the proposed intersection alternatives are shown in Table 4-2.

Countermeasure	CMF	Crash Type	Crash Severity	Area Type	Quality
Signalized Intersection	0.95 (CMF ID: 322)	All	All	Urban	3/5
Install a traffic signal (major road speed limit at least 40	0.33 (CMF ID: 323)	Angle	All	Urban	4/5
mph)	2.43 (CMF ID: 324)	Rear-End	All	Urban	4/5
	0.28 (CMF ID: 206)	All	All	Urban	4/5
Single-Lane Roundabout Conversion of stop-controlled	0.42 (CMF ID: 207)	All	All	Rural	4/5
intersection into single-lane roundabout	0.12 (CMF ID: 210)	All	А, В, С	Urban	4/5
	0.18 (CMF ID: 211)	All	А, В, С	Rural	4/5
	0.95 (CMF ID: 208)	All	All	Urban	4/5
2x1 Roundabout <i>Conversion of stop-controlled</i>	0.004 (CMF ID: 6159)	All	К, А, В, С	Not specified	2/5
intersection into multi-lane roundabout	2.073 (CMF ID: 6158)	All	All	Not specified	2/5
	6.016 (CMF ID: 6160)	All	0	Not specified	2/5
Channelined Dickt Turn Long	0.734 (CMF ID: 11154)	All	All	Not specified	3/5
Provide Right Turn	0.616 (CMF ID: 11152)	All	К, А, В, С	Not specified	3/5
Channelization	0.786 (CMF ID: 11153)	All	0	Not specified	2/5
Displaced Left	1.112 (CMF ID: 10889)	All	All	Urban and suburban	2/5

Table 4-2 – Highway 1416 Crash Modification Factors

Countermeasure	CMF	Crash Type	Crash Severity	Area Type	Quality	
Convert intersection to a	1.224	All	KARC	Urban and	2/5	
displaced left turn intersection	(CMF ID: 10890)		к, А, Б, С	suburban		
	1.069	All	0	Urban and	2 /F	
	(CMF ID: 10891)	All	0	suburban	2/5	
	1.244	Anglo	A 11	Urban and	2 /F	
	(CMF ID: 10894)	Angle	All	suburban	2/5	
	0.946	Boor and	A 11	Urban and	2/5	
	(CMF ID: 10895)	Rear-enu	All	suburban		
	0.713		A 11	Urban and	2/5	
	(CMF ID: 10896)	nead-on	All	suburban	2/5	
	1.519	Cingle vehicle	A 11	Urban and	2/5	
	(CMF ID: 10892)	Single vehicle	All	suburban	2/5	
	0.612	Othor	A 11	Urban and	2/5	
	(CMF ID: 10893)	other	All	suburban	2/5	

Crash Severity: K – Fatality; A – Serious injury; B – Minor injury; C – Possible injury; O – Property damage only

Capacity Analysis and Demand

Intersection Capacity Analysis

Intersection capacity analysis was conducted using HCS 2023 software for each of the alternatives described previously, using both AM and PM peak vehicular volumes under 2030 and 2050 scenarios. Intersection performance was measured based on delay and Level of Service (LOS). The methodology for vehicular LOS is described in the following section.

VEHICULAR LEVEL OF SERVICE (VLOS)

Vehicular Level of Service (VLOS) is a function of average delay per vehicle. LOS "A" represents free-flow traffic, whereas LOS "F" represents unacceptable delay. LOS "D" or better is considered acceptable for Minor Arterials and Collectors, in accordance with SDDOT standards. LOS delay thresholds are presented in Table 4-3.

	Average Delay / Vehicle								
Level of Service	Stop, Yield, and Roundabout	Signalized							
	Intersections	Intersections							
А	< 10 seconds	< 10 seconds							
В	10 to 15 seconds	10 to 20 seconds							
С	15 to 25 seconds	20 to 35 seconds							
D	25 to 35 seconds	35 to 55 seconds							
E	35 to 50 seconds	55 to 80 seconds							
F	> 50 seconds	> 80 seconds							

Vehicular LOS results for each intersection are presented and discussed in the following section. The intersection delay is presented based on methodology described above. The corresponding LOS value for the intersection delay is shown, as well as the LOS value for the worst approach. Detailed Vehicular Level of Service results can be found in **Appendix G**.

Highway 1416 and Liberty Boulevard

The LOS results for alternatives at Highway 1416 and Liberty Boulevard, under 2030 and 2050 conditions, are presented in **Table 4-4**.

		30	2050					
AM Peak		PM Peak		AM Pea	ak	PM Peak		
Alternative	Delay (s/veh)	LOS*	Delay (s/veh)	LOS*	Delay (s/veh)	LOS*	Delay (s/veh)	LOS*
No-Build: TWSC	116.5	F/F	12.7	B/C	152.5	F/F	13.1	B/C
Alt 1: Signal	17.0	В	8.8	A	17.4	В	9.8	A
Alt 2: 1x1 RAB	8.2	А	5.3	А	8.4	А	5.4	А

Table 4-4 – Highway 1416 and Liberty Boulevard Alternatives Analysis Results

*[Intersection LOS] / [Worst approach LOS] (for TWSC)

ALTERNATIVE 1

Delay and LOS results for Alternative 1: Signalized Intersection show that the implementation of a traffic signal at the intersection of Highway 1416 and Liberty Boulevard is expected to mitigate delay and LOS deficiencies expected during the AM and PM peaks, under both 2030 and 2050 scenarios. The intersection is expected to operate at LOS C during the AM and PM peaks in 2030 and 2050 with the implementation of a traffic signal. Additional traffic timing optimization could further improve LOS results.

ALTERNATIVE 2

Delay and LOS results for Alternative 2: Single-Lane Roundabout show that the implementation of a singlelane roundabout at the intersection of Highway 1416 and Liberty Boulevard is expected to mitigate delay and LOS deficiencies expected during the AM and PM peaks, under both 2030 and 2050 scenarios. The intersection is expected to operate at LOS A during the AM and PM peaks in 2030 and 2050 with the implementation of a single-lane roundabout.

Highway 1416 and S Ellsworth Road

The LOS results for alternatives at Highway 1416 and S Ellsworth Road, under 2030 and 2050 conditions, are presented in **Table 4-5**.

		20	30		2050				
	AM Peak		PM Pe	ak	AM Pe	ak	PM Peak		
Alternative	Delay (s/veh)	LOS*	Delay (s/veh)	LOS*	Delay (s/veh)	LOS*	Delay (s/veh)	LOS*	
No-Build: TWSC	4493.0	F/F	90.6	F/F	15432.5	F/F	166.1	F/F	
Alt 1: Signal, dual EBL	19.9	В	17.5	В	39.4	D	20.1	C	
Alt 2: 1x1 RAB	133.3	F	9.0	A	287.3	F	11.0	В	
Alt 3: Hybrid RAB	11.8	В	5.7	A	15.8	С	6.4	A	
Alt 4: Displaced EBL	13.6	В	7.4	А	12.0	В	7.9	Α	

Table 4-5 – Highway 1416 and S Ellsworth Road Alternatives Analysis Results

*[Intersection LOS] / [Worst approach LOS] (for TWSC)

ALTERNATIVE 1

Delay and LOS results for Alternative 1: Signalized Intersection show that the implementation of a traffic signal at the intersection of Highway 1416 and S Ellsworth Road is expected to mitigate delay and LOS deficiencies expected during the AM and PM peaks, under both 2030 and 2050 scenarios. The intersection is expected to operate at LOS C during the AM and PM peaks in 2030 and the AM peak of 2050, and it is expected to operate at LOS D during the PM Peak in 2050, with the implementation of a traffic signal. Additional traffic timing optimization could further improve LOS results.

ALTERNATIVE 2

Delay and LOS results for Alternative 2: Single-Lane Roundabout show that the implementation of a singlelane roundabout at the intersection of Highway 1416 and S Ellsworth Road is not expected to mitigate delay and LOS deficiencies expected during the AM and PM peaks, under 2030 and 2050 scenarios. The intersection is expected to operate at LOS F during the AM peak in 2030 and 2050 with the implementation of a single-lane roundabout. Based on this analysis, it was determined that a single-lane roundabout is not expected to have the capacity to support the high volumes traveling to and from the Ellsworth Air Force Base.

ALTERNATIVE 3

Delay and LOS results for Alternative 3: Hybrid Roundabout show that the implementation of a hybrid roundabout at the intersection of Highway 1416 and S Ellsworth Road, with additional capacity supporting eastbound left-turning volumes, is expected to mitigate delay and LOS deficiencies expected during the AM and PM peaks, under 2030 and 2050 scenarios. The intersection is expected to operate at LOS B during the AM peak in 2030 and 2050, and LOS A during the PM peak in 2030 and 2050 with the implementation of a hybrid roundabout.

ALTERNATIVE 4

Delay and LOS results for Alternative 4: Displaced Eastbound Left show that the implementation of a signalized displaced left-turn in the eastbound approach of Highway 1416 and S Ellsworth Road is expected to mitigate delay and LOS deficiencies expected during the AM and PM peaks, under 2030 and 2050 scenarios. The intersection is expected to operate at LOS B during the AM peaks and LOS A during the PM peaks in both 2030 and 2050 with the implementation of a displaced eastbound left-turn lane.

Highway 1416 and Radar Hill Road

The LOS results for alternatives at Highway 1416 and Radar Hill Road, under 2030 and 2050 conditions, are presented in **Table 4-6**.

		203	30	2050				
	AM Peak		PM Peak		AM Pe	ak	PM Peak	
Alternative	Delay (s/veh)	LOS*	Delay (s/veh)	LOS*	Delay (s/veh)	LOS*	Delay (s/veh)	LOS*
No-Build: TWSC	66.5	F/F	68.7	F/F	202.5	F/F	359.3	F/F
Alt 1: Signal	20.9	С	18.8	В	26.2	С	19.9	В
Alt 2: 2x1 RAB	16.4	С	7.0	А	63.8	F	8.1	А
Alt 3: 2x1 RAB (ch. NBR)	9.2	А	6.7	А	13.1	В	7.7	А
Alt 4: Hybrid RAB	14.0	В	10.4	В	24.2	С	16.1	С

Table 4-6 – Highway 1416 and Radar Hill Road Alternatives Analysis Results

*[Intersection LOS] / [Worst approach LOS] (for TWSC)

ALTERNATIVE 1

Delay and LOS results for Alternative 1: Signalized Intersection show that the implementation of a traffic signal at the intersection of Highway 1416 and Radar Hill Road is expected to mitigate delay and LOS deficiencies expected during the AM and PM peaks, under 2030 and 2050 scenarios. The intersection is expected to operate at LOS C during the AM peaks and LOS B during the PM peaks in both 2030 and 2050 with the implementation of a traffic signal. Additional traffic timing optimization could further improve LOS results.

ALTERNATIVE 2

Delay and LOS results for Alternative 2: 2x1 Roundabout show that the implementation of a 2x1 roundabout at the intersection of Highway 1416 and Radar Hill Road, with two lanes in the eastbound and westbound directions, is expected to mitigate delay and LOS deficiencies during the AM and PM peaks under 2030 scenarios, but the intersection is expected to remain at LOS F during the AM peak in 2050. High northbound left and right volumes contribute significantly to this deficiency.

ALTERNATIVE 3

Delay and LOS results for Alternative 3: 2x1 Roundabout with Channelized NBR show that the implementation of a 2x1 roundabout, along with a channelized northbound right-turn lane at the intersection of Highway 1416 and Radar Hill Road is expected to mitigate delay and LOS deficiencies during the AM and PM peaks under 2030 and 2050 scenarios. The intersection is expected to operate at LOS A during the AM and PM peaks in 2030, at LOS B during the AM peak in 2050, and LOS A during the PM peak in 2050.

ALTERNATIVE 4

Delay and LOS results for Alternative 4: Hybrid Roundabout show that the implementation of a hybrid roundabout, with single lanes in the eastbound and southbound approaches, two lanes in the westbound approach, and a channelized northbound right-turn lane at the intersection of Highway 1416 and Radar Hill Road is expected to mitigate delay and LOS deficiencies during the AM and PM peaks, under 2030 and 2050 scenarios. The intersection is expected to operate at LOS B during the AM and PM peaks in 2030, and LOS C during the AM and PM peaks in 2050.

Design

Right-of-Way Impacts

Right-of-way was evaluated based on GIS data provided by the city of Rapid City and Pennington County. Based on this data, it is anticipated that this project would have minimal impact on the ROW. However, the data provided is not official, and land survey of property lines would need to be completed to confirm this.

Currently, the Radar Hill Road 3 lane alternative shows minimal property impacts at maximum of 4' based on available data. If those impacts are still present in preliminary design after a property survey is done, alignment tapering can be done to avoid the impacts to the properties if desired by the governing jurisdiction.

Anticipated Cost

An anticipated preliminary cost comparison analysis was completed. The results are shown in **Table 4-7**. The cost estimates assumed 3% annual inflation, a 20% contingency, and an asphalt concrete depth of 8 inches on 14 inches of aggregate base. The city cost estimates shown on the Highway 1416 corridor stem from improvements to approaches on city owned roadways at study intersections. As shown, the cheapest alternative for Highway 1416 is Alternative 3 with roundabouts at the Radar Hill Road and Ellsworth Road intersections. Situationally, signals can be more expensive than roundabouts. In this situation, the signal alternatives have an increased pavement area with turn lanes and a large, paved intersection. Additionally, in this case both a signal and roundabout will require significant grading since the existing intersection does not match the area needed for a signal, which is not common when comparing a signal to roundabout for cost analysis. With there not being existing signal facilities at the location it will require new systems and finding sources of power, fiber for the signal controls, and other misc. items that are required for the signals to function properly. These items all increase the signal system costs.

	Preliminary Cost Estimate S	ummary		
Highway 1416 / Radar Hill Road Alternatives	Alternative Costs (Const. Engineering + Const.)	Est. County Cost	Est. City Cost	Total Cost
Highw	av 1416			
Alternative 1 –	ay 1410			
Signalized Intersections at Radar	2023 Construction Costs	\$16,537,466	\$2,993,825	\$19,531,291
Hill & Ellsworth, ¾ at Commercial Gate, TWSC at Liberty	2030 Construction Costs	\$21,002,582	\$3,802,158	\$24,804,740
Alternative 2 – Signalized Intersections at Radar	2023 Construction Costs	\$17,936,716	\$2,793,684	\$20,730,400
at Commercial Gate, TWSC at Liberty	2030 Construction Costs	\$22,779,630	\$3,547,978	\$26,327,608
Alternative 3 – Roundabouts at Radar Hill &	2023 Construction Costs	\$16,128,683	\$2,871,958	\$19,000,641
Ellsworth, ¾ at Commercial Gate, TWSC at Liberty	2030 Construction Costs	\$20,483,427	\$3,647,387	\$24,130,814
Cost At Liberty to Add a Signal	2023 Construction Costs	\$315,000	\$105,000	\$420,000
(When Warrants are Met)	2030 Construction Costs	\$400,050	\$133,350	\$533,400
Radar I	Hill Road			
Alternative 1 –	2023 Construction Costs	\$7,351,400	\$5,253,409	\$12,604,809
2 Lane Urban with Walk	2030 Construction Costs	\$9,336,278	\$6,671,830	\$16,008,108
Alternative 2 –	2023 Construction Costs	\$7,365,795	\$5,849,960	\$13,215,755
3 Lane Urban with Walk	2030 Construction Costs	\$9,354,559	\$7,429,450	\$16,784,009
Alternative 3 –	2023 Construction Costs	\$6,091,419	\$2,220,414	\$8,311,833
Pavement Reconstruction	2030 Construction Costs	\$7,736,102	\$2,819,926	\$10,556,028

Table 4-7 - Preliminary Cost Estimates

Recommendations

Based on the capacity results discussed in this report, safety considerations analyzed for the Existing Conditions chapter, and preliminary cost estimates, the following recommendations were developed for each of the study intersections that require improvement:

- » Safety and capacity issues are present now, and they are expected to become worse as traffic increases. Efforts to correct these deficiencies should be undertaken as soon as adequate funding can be found.
- » Highway 1416 and Liberty Boulevard once warranted, the implementation of a traffic signal is recommended at this intersection, due to significant improvements in delay and LOS. Spatial constraints due to the proximity to the BNSF railroad, utilities, and wetlands made it difficult to implement the single-lane roundabout alternative.
- » Highway 1416 and S Ellsworth Road the implementation of a hybrid roundabout is recommended at this intersection, due to significant improvements in delay and LOS. High cost, spatial constraints, public opinion, and construction impacts made the displaced eastbound left-turn alternative a less desirable option. The hybrid roundabout alternative was also shown to be more cost effective and expected to be more efficient and safer than the signalized alternative.

» Highway 1416 and Radar Hill Road – the implementation of a 2x1 roundabout with a channelized northbound right-turn lane is recommended at this intersection, due to significant improvements in delay and LOS. The roundabout alternative was also shown to be more cost effective and expected to be safer than the signalized alternative.

Summary

Interim Alternatives

» All-way stop control is recommended (and has been implemented) as a short-term solution for the intersections of Highway 1416 and S Ellsworth Road, and Highway 1416 and Radar Hill Drive, while more permanent and effective alternatives are analyzed, funded, and implemented.

Alternatives

- » Alternatives developed and analyzed at Highway 1416 and Liberty Boulevard included the following:
 - Alternative 1 signalized intersection, with left-turn lanes at each approach
 - Alternative 2 single-lane roundabout
- » Alternatives developed and analyzed at **Highway 1416 and S Ellsworth Road** included the following:
 - Alternative 1 signalized intersection, with left-turn lanes at each approach, and a dual leftturn at the eastbound approach
 - Alternative 2 single-lane roundabout
 - Alternative 3 hybrid roundabout, with a dedicated eastbound left-turn lane
 - Alternative 4 displaced eastbound left, with signalization at the intersection, as well as the eastbound left crossing
- » Alternatives developed and analyzed at **Highway 1416 and Radar Hill Road** included the following:
 - Alternative 1 signalized intersection, with left-turn lanes at each approach
 - $\circ~$ Alternative 2 2x1 roundabout, with two travel lanes at the eastbound and westbound approaches
 - Alternative 3 2x1 roundabout, with two travel lanes at the eastbound and westbound approaches, and a channelized northbound right-turn lane
 - Alternative 4 hybrid roundabout, with a single-lane at the eastbound approach, two travel lanes in the westbound approach, and a channelized northbound right-turn lane
- » No alternatives were proposed or analyzed at the intersections of Highway 1416 and 151st Avenue, Radar Hill Road and Long View Drive, or Radar Hill Road and Highway 44, as these intersections are expected to operate under acceptable conditions in 2050 with no geometric improvements.

Capacity Analysis

- » The following alternatives are expected to operate under unacceptable delay and LOS in the projected scenarios:
 - Highway 1416 and S Ellsworth Road Alternative 2: 1x1 Roundabout is expected to operate at LOS F during the AM peaks in 2030 and 2050.

- Highway 1416 and Radar Hill Road Alternative 2: 2x1 Roundabout is expected to operate at LOS F during the AM peak in 2050.
- » All other alternatives presented in this report are expected to operate under acceptable delay and LOS and are expected to improve delay and LOS conditions as compared to the no-build scenarios.

Recommendations

» Recommended alternatives for each intersection are shown below in **Table 4-8**.

Table 4-8 – Recommended Alternatives

Intersection	Recommended Alternative
Hwy 1416 and Liberty Blvd	Alternative 1: Signalized Intersection (once warranted)
Hwy 1416 and S Ellsworth Rd	Alternative 3: Hybrid Roundabout
Hwy 1416 and Radar Hill Rd	Alternative 3: 2x1 Roundabout with Channelized NBR

Appendices

Appendix A: Raw Traffic Counts

Radar Hill - 1416 Corridor Study

Time	NB Utm	NB Left	NB Thru	NB Right	EB Ped & Bikes	WB Ped & Bikes	SB Utrn	SB Left	SB Thru	SB Right	EB Ped & Bikes	WB Ped & Bikes	EB Utrn	EB Left	EB Thru	EB Right	NB Ped & Bikes	SB Ped & Bikes	WB Utrn	WB Left	WB Thru	WB Right	NB Ped & Bikes	SB Ped & Bikes
		NBL	NBT	NBR				SBL	SBT	SBR				EBL	EBT	EBR				WBL	WBT	WBR		
00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	0	0	0	0	0	0	0	1	0	11	0	0	0	4	4	0	0	0	0	0	12	0	0	0
06:00	0	0	0	0	0	0	0	5	0	22	0	0	0	4	8	0	0	0	0	0	56	1	0	0
07:00	0	0	0	0	0	0	0	5	0	34	0	0	0	7	38	0	0	0	0	0	94	8	0	0
08:00	0	0	0	0	0	0	0	2	0	16	0	0	0	15	30	0	0	0	0	0	40	3	0	0
09:00	0	0	0	0	0	0	0	2	0	16	0	0	0	7	21	0	0	0	0	0	41	3	0	0
10:00	0	0	0	0	0	0	0	3	0	13	0	0	0	12	35	0	0	0	1	0	30	1	0	0
11:00	0	0	0	0	0	0	0	2	0	16	0	0	0	13	36	0	0	0	0	0	34	2	0	0
12:00	0	0	0	0	0	0	0	3	0	23	0	0	0	24	41	0	0	0	0	0	31	2	0	0
13:00	0	0	0	0	0	0	0	4	0	13	0	0	0	16	32	0	0	0	1	0	31	3	0	0
14:00	0	0	0	0	0	0	0	4	0	12	0	0	0	19	45	0	0	0	0	0	33	4	0	0
15:00	0	0	0	0	0	0	0	2	0	10	0	0	0	12	59	0	0	0	0	0	27	3	0	0
16:00	0	0	0	0	0	0	0	3	0	14	0	0	1	33	82	0	0	0	0	0	34	1	0	0
17:00	0	0	0	0	0	0	0	2	0	19	0	0	0	30	75	0	0	0	0	0	55	2	0	0
18:00	0	0	0	0	0	0	0	3	0	8	0	0	0	15	24	0	0	0	0	0	16	2	0	0
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Time	NB Utm	NB Left	NB Thru	NB Right	EB Ped & Bikes	WB Ped & Bikes	SB Utrn	SB Left	SB Thru	SB Right	EB Ped & Bikes	WB Ped & Bikes	EB Utrn	EB Left	EB Thru	EB Right	NB Ped & Bikes	SB Ped & Bikes	WB Utrn	WB Left	WB Thru	WB Right	NB Ped & Bikes	SB Ped & Bikes
		NBL	NBT	NBR				SBL	SBT	SBR				EBL	EBT	EBR				WBL	WBT	WBR		
00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	0	1	7	0	0	0	0	10	1	5	0	0	0	13	3	1	0	0	0	0	3	23	0	0
06:00	0	1	18	0	0	0	0	21	6	19	0	0	0	61	10	2	0	0	0	0	8	100	0	0
07:00	0	5	33	3	0	0	1	23	9	39	0	0	0	124	21	1	0	0	0	2	15	126	0	0
08:00	0	2	13	1	0	0	0	20	8	26	0	0	0	26	13	1	0	0	0	2	16	59	0	0
09:00	0	4	14	0	0	0	0	25	10	23	0	0	0	35	11	4	0	0	0	0	9	39	0	0
10:00	0	2	9	0	0	0	2	17	6	17	0	0	0	14	8	4	0	0	0	1	1	22	0	0
11:00	0	3	10	1	0	0	1	27	9	27	0	0	0	28	22	7	0	0	0	3	12	35	0	0
12:00	0	3	7	0	0	0	0	33	7	28	0	0	0	46	23	2	0	0	0	1	11	39	0	0
13:00	0	4	14	2	0	0	0	54	12	35	0	0	0	37	25	3	0	1	0	0	16	37	0	0
14:00	0	6	16	0	0	0	0	39	15	30	0	0	0	37	19	6	1	0	0	1	16	35	0	0
15:00	0	4	18	3	0	0	1	71	20	65	0	0	0	46	33	2	0	0	0	1	14	51	0	0
16:00	0	0	15	1	0	0	0	82	22	49	0	0	0	44	42	12	0	0	0	3	19	47	0	0
17:00	0	8	15	1	0	0	2	92	24	51	0	0	0	39	46	9	0	2	0	4	25	51	0	0
18:00	0	0	11	1	0	0	0	26	8	13	0	0	0	13	18	3	2	0	0	1	4	17	0	0
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Time	NB Utrn	NB Left	NB Thru	NB Right	EB Ped & Bikes	WB Ped & Bikes	SB Utrn	SB Left	SB Thru	SB Right	EB Ped & Bikes	WB Ped & Bikes	EB Utrn	EB Left	EB Thru	EB Right	NB Ped & Bikes	SB Ped & Bikes	WB Utrn	WB Left	WB Thru	WB Right	NB Ped & Bikes	SB Ped & Bikes
		NBL	NBT	NBR				SBL	SBT	SBR				EBL	EBT	EBR				WBL	WBT	WBR		
00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	0	16	7	2	0	0	0	1	1	31	0	0	0	154	15	2	0	0	0	0	10	0	0	0
06:00	0	46	35	7	0	0	0	3	3	85	0	0	0	621	66	8	0	0	0	2	16	7	0	0
07:00	0	86	56	7	0	0	0	10	16	194	0	0	0	618	115	15	0	0	0	0	44	13	0	0
08:00	0	36	15	5	0	0	0	4	9	130	0	0	1	263	29	10	0	0	0	4	33	7	0	0
09:00	0	24	18	2	0	0	0	8	14	134	0	0	0	212	39	16	0	0	0	2	24	8	0	0
10:00	0	21	11	4	0	0	0	10	14	138	0	0	0	197	42	15	0	0	0	6	36	6	0	0
11:00	0	23	9	2	0	0	0	5	18	156	0	0	0	217	50	26	0	0	0	0	37	3	0	0
12:00	0	22	15	7	0	0	0	13	25	175	0	0	0	279	55	35	0	0	0	3	38	10	0	0
13:00	0	27	19	7	0	0	0	3	10	150	0	0	0	252	62	18	0	0	0	5	40	7	1	0
14:00	0	23	20	3	0	0	0	4	23	170	0	0	0	280	58	32	0	0	0	1	49	13	0	0
15:00	0	28	21	7	0	0	0	9	47	334	0	0	0	263	61	48	0	0	0	6	62	13	0	0
16:00	0	30	26	6	0	0	0	9	45	300	0	0	0	286	78	75	0	1	0	6	63	7	1	1
17:00	0	42	32	4	0	0	0	7	72	237	0	0	1	257	82	152	0	1	0	17	65	3	0	0
18:00	0	25	8	0	0	0	0	0	13	111	0	0	0	85	31	43	0	0	0	2	14	1	0	0
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Time	NB Utm	NB Left	NB Thru	NB Right	EB Ped & Bikes	WB Ped & Bikes	SB Utrn	SB Left	SB Thru	SB Right	EB Ped & Bikes	WB Ped & Bikes	EB Utrn	EB Left	EB Thru	EB Right	NB Ped & Bikes	SB Ped & Bikes	WB Utrn	WB Left	WB Thru	WB Right	NB Ped & Bikes	SB Ped & Bikes
		NBL	NBT	NBR				SBL	SBT	SBR				EBL	EBT	EBR				WBL	WBT	WBR		
00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	0	47	1	36	0	0	0	1	2	8	0	0	0	1	143	11	0	0	0	13	48	1	0	0
06:00	0	116	0	170	0	0	0	2	2	14	0	0	0	2	524	32	0	0	0	32	137	5	0	0
07:00	0	167	1	236	0	0	0	8	9	16	0	0	0	4	527	55	0	0	0	79	334	5	0	0
08:00	0	81	7	56	0	0	0	3	9	26	0	0	2	7	243	49	0	0	0	51	202	7	0	0
09:00	0	68	8	59	0	0	0	6	4	10	0	0	1	15	223	46	0	0	0	46	196	2	0	0
10:00	0	64	3	62	0	0	0	3	2	9	0	0	1	9	201	55	0	0	0	55	234	3	0	0
11:00	0	57	3	50	0	0	0	2	3	12	0	0	0	16	250	69	0	0	0	76	295	3	0	0
12:00	0	56	9	88	0	0	0	5	5	20	0	0	0	12	294	75	0	0	0	66	227	2	0	0
13:00	0	68	6	61	0	0	0	1	8	18	0	0	1	16	288	73	0	0	0	65	230	4	0	0
14:00	0	66	2	87	0	0	0	5	9	16	0	0	0	23	292	87	0	0	0	74	316	8	0	0
15:00	0	69	7	82	0	0	0	3	3	10	0	0	0	17	291	104	0	0	0	195	509	5	0	0
16:00	0	89	9	101	0	0	0	5	5	11	0	0	0	19	357	162	0	0	0	182	627	7	0	0
17:00	0	117	8	125	0	0	0	3	8	9	0	0	0	25	377	185	0	0	0	136	437	2	0	0
18:00	0	31	3	26	0	0	0	1	4	6	0	0	0	7	131	70	0	0	0	29	124	4	0	0
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Time	NB Utm	NB Left	NB Thru	NB Right	EB Ped & Bikes	WB Ped & Bikes	SB Utrn	SB Left	SB Thru	SB Right	EB Ped & Bikes	WB Ped & Bikes	EB Utrn	EB Left	EB Thru	EB Right	NB Ped & Bikes	SB Ped & Bikes	WB Utrn	WB Left	WB Thru	WB Right	NB Ped & Bikes	SB Ped & Bikes
		NBL	NBT	NBR				SBL	SBT	SBR				EBL	EBT	EBR				WBL	WBT	WBR		
00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	0	0	11	3	0	0	0	0	12	21	0	0	0	14	0	1	0	0	0	0	1	1	0	0
06:00	0	0	32	2	0	0	0	3	30	73	0	0	0	64	2	2	0	0	0	3	8	6	0	0
07:00	0	1	16	3	0	0	0	4	42	105	0	0	0	65	5	0	0	0	0	3	16	8	0	0
08:00	0	0	11	6	0	0	0	7	27	55	0	0	0	46	7	1	0	0	0	7	8	8	0	0
09:00	0	2	23	7	0	0	0	6	27	49	0	0	0	40	11	4	0	0	0	8	10	6	0	0
10:00	0	1	27	5	0	0	0	6	26	53	0	0	0	32	7	0	0	0	0	4	9	7	0	0
11:00	0	1	23	5	0	0	0	8	32	48	0	0	0	50	6	3	0	0	0	6	7	6	0	0
12:00	1	1	30	6	0	0	0	6	23	47	0	0	0	57	5	4	0	0	0	5	5	8	0	0
13:00	0	0	20	4	0	0	0	7	20	59	0	0	0	49	4	0	0	0	0	6	9	8	0	0
14:00	0	0	26	6	0	0	0	9	29	72	0	0	0	47	3	1	0	0	0	7	4	6	0	0
15:00	0	2	34	7	0	0	0	4	40	87	0	0	0	80	8	0	0	0	0	4	5	8	0	0
16:00	0	1	44	7	0	0	0	8	40	94	0	0	0	118	8	1	0	0	0	4	9	5	0	0
17:00	0	3	43	2	0	0	0	6	36	93	0	0	0	102	9	1	0	0	0	1	4	3	0	0
18:00	0	2	13	1	0	0	0	3	14	22	0	0	0	43	3	2	0	0	0	1	1	1	0	0
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Time	NB Utm	NB Left	NB Thru	NB Right	EB Ped & Bikes	WB Ped & Bikes	SB Utrn	SB Left	SB Thru	SB Right	EB Ped & Bikes	WB Ped & Bikes	EB Utrn	EB Left	EB Thru	EB Right	NB Ped & Bikes	SB Ped & Bikes	WB Utrn	WB Left	WB Thru	WB Right	NB Ped & Bikes	SB Ped & Bikes
		NBL	NBT	NBR				SBL	SBT	SBR				EBL	EBT	EBR				WBL	WBT	WBR		
00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	0	1	1	1	0	0	0	7	3	3	0	0	0	7	60	0	0	0	0	0	42	6	0	0
06:00	0	5	6	3	0	0	0	11	5	17	0	0	0	12	159	3	0	0	0	0	107	12	0	0
07:00	0	11	1	2	0	0	0	9	5	25	0	0	0	15	170	4	0	0	0	2	150	4	0	0
08:00	0	6	4	3	0	0	0	16	0	20	0	0	0	15	147	3	0	0	0	3	103	2	0	0
09:00	0	2	2	1	0	0	0	17	3	23	0	0	0	17	177	5	0	0	0	5	135	16	0	0
10:00	0	4	0	3	0	0	0	20	2	10	0	0	0	15	202	8	0	0	0	2	228	15	0	0
11:00	0	7	0	2	0	0	0	21	2	17	0	0	0	24	164	2	0	0	0	4	192	10	0	0
12:00	0	5	3	2	0	0	0	15	6	21	0	0	0	21	168	7	0	0	0	3	253	14	0	0
13:00	0	1	2	5	0	0	0	6	4	14	0	0	0	20	121	4	0	0	0	0	155	6	0	0
14:00	0	8	2	1	0	0	0	10	8	22	0	0	0	18	145	3	0	0	0	1	138	11	0	0
15:00	0	5	1	3	0	0	0	15	6	24	0	0	0	32	170	7	0	0	0	0	193	12	0	0
16:00	0	7	2	0	0	0	0	19	6	24	0	0	0	38	127	11	0	0	0	2	179	18	0	0
17:00	0	7	4	2	0	0	0	12	3	25	0	0	0	29	153	7	0	0	0	2	171	13	0	0
18:00	0	1	1	0	0	0	0	3	4	5	0	0	0	7	68	4	0	0	0	0	62	5	0	0
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Appendix B: Vehicular Level of Service (VLOS) Results – Existing

Radar Hill - 1416 Corridor Study

	HCS Two-Way															
General Information							Site	Inforr	natio	n						
Analyst	Emm	a Myers-	Verhage				Inters	section			High	way 1416	5 and 15	1st Ave		
Agency/Co.							Juriso	diction			Box E	lder SD				
Date Performed	6/2/2	023					East/	West Stre	eet		High	way 1416	5			
Analysis Year	2023						North	n/South :	Street		151st	Ave				
Time Analyzed	AM p	eak					Peak	Hour Fac	ctor		0.76					
Intersection Orientation	East-	West					Analy	sis Time	Period	(hrs)	1.00					
Project Description	Rada	r Hill 141	6 Corrid	or Study	,											
Lanes																
					_											
					Maie	or Street: Ea	st-West									
Vehicle Volumes and Adiu	ictmo	ntc			,											
Assures	Easthound Westbound								1	N la utila			1	Cauth	ام م ، بم ما	
Approach		Easic		р		vest		р		North		р		South		D
Driority	111	L 1	2	к 2	411	L		ĸ	0		0	ĸ	0	L 10	11	к 12
Number of Laner	0	0	2	0	40	4	1	0		0	0	9		0	1	0
	0			0	0	0	-	ТР		0	0	0				0
		7	28	<u> </u>			94	8						5		34
Porcont Hoavy Vahiclos (%)		γ 0	- 50	<u> </u>			54	0						16		16
Proportion Time Blocked		9		<u> </u>										10		
Percent Grade (%)															0	
Right Turn Channelized															0	
Median Type Storage				Undi	vided											
Critical and Follow up Ha				ona	viaca				<u> </u>							
	auwa	ys	1												1	
Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.19												6.56		6.36
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.28												3.64		3.44
Delay, Queue Length, and	l Leve	l of Se	ervice													
Flow Rate, v (veh/h)		9													51	
Capacity, c (veh/h)		1409													866	
v/c Ratio		0.01													0.06	
95% Queue Length, Q ₉₅ (veh)		0.0													0.2	
Control Delay (s/veh)		7.6	0.1												9.4	
Level of Service (LOS)		A	A												A	
Approach Delay (s/veh)		1	.2											9	.4	
Approach LOS			Ą												Ą	

	HCS Two-Way															
General Information							Site	Inforr	natio	n						
Analyst	Emm	a Myers-	Verhage				Inters	section			High	way 1416	6 and 15	1st Ave		
Agency/Co.							Juriso	diction			Box E	lder SD				
Date Performed	6/2/2	023					East/	West Stre	eet		High	way 1416	5			
Analysis Year	2023						North	n/South :	Street		151st	Ave				
Time Analyzed	PM P	eak					Peak	Hour Fac	ctor		0.83					
Intersection Orientation	East-	West					Analy	sis Time	Period	(hrs)	1.00					
Project Description	Rada	r Hill 141	6 Corrid	or Study	,											
Lanes																
					_											
								_								
					Mair	or Street: Fa	st-West									
Vahiela Valumas and Adiu	ictmo	ntc														
	Stments								1				1	<u> </u>		
Approach		Eastb	ound			West	bound			North	bound			South	bound	
Movement	U	L		R	0	L		R	U			R	U	L	1	R
Priority	10	1	2	3	40	4	5	6		/	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
			0.1				50	IR							LR	45
Volume (ven/n)		36	84				50							3		15
Percent Heavy Vehicles (%)		9												16		16
Proportion Time Blocked																
Percent Grade (%)															5	
Right Turn Channelized																
Median Type Storage				Undi	vided											
Critical and Follow-up He	adwa	ys														
Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.19												6.56		6.36
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.28												3.64		3.44
Delay, Queue Length, and	l Leve	l of Se	ervice													
Flow Rate, v (veh/h)		43													22	
Capacity, c (veh/h)		1498													905	
v/c Ratio		0.03													0.02	
95% Queue Length, Q ₉₅ (veh)		0.1													0.1	
Control Delay (s/veh)		7.5	0.2												9.1	
Level of Service (LOS)		A	A												Α	
Approach Delay (s/veh)		2	.4											9	.1	
Approach LOS		/	Ą											,	4	

		ŀ	ICS 1	Гwo-'	Way	Stop	ntrol	Repo	ort							
General Information							Site	Inforr	natio	n						
Analyst	Emm	a Myers-	Verhage				Inters	ection			Highv	vay 1416	and Lib	erty Blvo	b	
Agency/Co.							Jurisc	liction			Box E	lder SD		,		
Date Performed	6/2/2	023					East/	Nest Stre	eet		Highv	vay 1416	5			
Analysis Year	2023						North	/South S	Street		Libert	y Blvd				
Time Analyzed	AM P	eak					Peak	Hour Fac	ctor		0.84	-				
Intersection Orientation	East-	West					Analy	sis Time	Period (hrs)	1.00					
Project Description	Rada	r Hill 141	6 Corrid	or Study	,						1					
Lanes																
					Maj	or Street: Ea	st-West									
Vehicle Volumes and Adju	ıstme	nts														
Approach		Eastbound Westbound								North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	0	1	0		0	1	0		0	1	1
Configuration		L		TR			LTR				LTR			LT		R
Volume (veh/h)		134	23	2		1	15	139		3	32	2		20	8	28
Percent Heavy Vehicles (%)		8				7				2	2	2		9	9	9
Proportion Time Blocked																
Percent Grade (%)											0			(C	
Right Turn Channelized														Y	es	
Median Type Storage				Undi	vided											
Critical and Follow-up He	adwa	ys														
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.18				4.17				7.12	6.52	6.22		7.19	6.59	6.29
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.27				2.26				3.52	4.02	3.32		3.58	4.08	3.38
Delay, Queue Length, and	l Leve	l of Se	ervice													
Flow Rate, v (veh/h)		160				1					44			33		33
Capacity, c (veh/h)		1356				1551					414			406		936
v/c Ratio		0.12				0.00					0.11			0.08		0.04
95% Queue Length, Q ₉₅ (veh)		0.4				0.0					0.4			0.3		0.1
Control Delay (s/veh)		8.0	0.1	0.1		7.3	0.0	0.0			14.7			14.7		9.0
Level of Service (LOS)		A	А	А		А	А	А			В			В		А
Approach Delay (s/veh)		. 6	.8			. 0	.1			- 14	4.7			1'	.8	
Approach LOS		/	4				٩				В			I	3	

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		ŀ	ICS 1	Гwo-'	Way	Stop	-Cor	ntrol	Repo	ort						
General Information							Site	Inforr	natio	n						
Analyst	Emm	a Myers-	Verhage				Inters	ection			Highv	way 1416	and Lib	erty Blvo	d	
Agency/Co.							Jurisc	liction			Box E	lder SD		,		
Date Performed	6/2/2	023					East/	Nest Stre	eet		Highv	way 1416	5			
Analysis Year	2023						North	/South S	Street		Libert	ty Blvd				
Time Analyzed	PM P	eak					Peak	Hour Fac	ctor		0.84	-				
Intersection Orientation	East-	West					Analy	sis Time	Period ((hrs)	1.00					
Project Description	Rada	r Hill 141	6 Corrid	or Study	,											
Lanes																
					Maj	or Street: Ea	st-West									
Vehicle Volumes and Adju	istme	nts														
Approach		Eastb	ound			West	oound			North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	0	1	0		0	1	0		0	1	1
Configuration		L		TR			LTR				LTR			LT		R
Volume (veh/h)		37	42	12		3	27	54		7	10	0		110	20	54
Percent Heavy Vehicles (%)		8				7				2	2	2		9	9	9
Proportion Time Blocked																
Percent Grade (%)											0				0	
Right Turn Channelized														Y	es	
Median Type Storage				Undi	vided											
Critical and Follow-up He	adwa	ys														
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.18				4.17				7.12	6.52	6.22		7.19	6.59	6.29
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.27				2.26				3.52	4.02	3.32		3.58	4.08	3.38
Delay, Queue Length, and	l Leve	l of Se	ervice													
Flow Rate, v (veh/h)		44				4					20			155		64
Capacity, c (veh/h)		1460				1507					620			676		981
v/c Ratio		0.03				0.00					0.03			0.23		0.07
95% Queue Length, Q ₉₅ (veh)		0.1				0.0					0.1			0.9		0.2
Control Delay (s/veh)		7.5	0.1	0.1		7.4	0.0	0.0			11.0			11.9		8.9
Level of Service (LOS)		A	А	A		A	A	A			В			В		А
Approach Delay (s/veh)		3	.1			0	.3	-		- 1'	1.0	_		1'	1.0	-
Approach LOS			4				4				В			I	В	

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	HCS Two-Way Stop-Con															
General Information							Site	Inforr	natio	n						
Analyst	Emm	a Myers	Verhage	<u>.</u>			Inters	ection			WB H	lighway	1416 an	d S Ellsw	orth Rd	
Agency/Co.							Jurisc	liction			Box E	ilder SD				
Date Performed	6/12/	2023					East/	West Stre	eet		WB H	lighway	1416			
Analysis Year	2023						North	n/South S	Street		S Ells	worth Ro	ł			
Time Analyzed	AM P	eak					Peak	Hour Fac	ctor		0.84					
Intersection Orientation	North	n-South					Analy	sis Time	Period ((hrs)	1.00					
Project Description	Rada	r Hill 14'	6 Corric	lor Study	/											
Lanes																
					_			1								
								J								
					Majo	r Street: No	rth-South									
Vehicle Volumes and Adju	ustme	nts														
Approach	Eastbound Westbo									North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority		10	11	12		7	8	9	10	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	2	0	0	0	1	0	0	0	1	1
Configuration						LT		TR		LT					Т	R
Volume (veh/h)						0	44	13		86	674				26	194
Percent Heavy Vehicles (%)						10	10	10		1						
Proportion Time Blocked																
Percent Grade (%)							0									
Right Turn Channelized														Ŷ	'es	
Median Type Storage				Undi	vided				İ							
Critical and Follow-up He	adwa	ys														
Base Critical Headway (sec)						7.1	6.5	6.2		4.1						
Critical Headway (sec)						7.20	6.60	6.30		4.11						
Base Follow-Up Headway (sec)						3.5	4.0	3.3		2.2						
Follow-Up Headway (sec)						3.59	4.09	3.39		2.21						
Delay, Queue Length, and	l Leve	l of S	ervice													
Flow Rate, v (veh/h)	T					26	<u> </u>	42		102						
Capacity, c (veh/h)	<u> </u>					197		239		1588					<u> </u>	<u> </u>
v/c Ratio	<u> </u>					0.13		0.17		0.06						<u> </u>
95% Queue Length, Q ₉₅ (veh)						0.5		0.6		0.2						
Control Delay (s/veh)						26.1		23.3		7.4	0.9					
Level of Service (LOS)						D		С		A	A					
Approach Delay (s/veh)			1			24	4.4			1	.6			1		1
Approach LOS						-	С				Ą					
1 P																

		ŀ	HCS [Two-	ntrol	Repo	ort									
General Information							Site	Inforr	natio	n						
Analyst	Emm	a Myers	-Verhage	9			Inters	ection			WB H	lighway	1416 an	d S Ellsw	orth Rd	
Agency/Co.		,					Jurisc	liction			Box E	ilder SD				
Date Performed	6/12/	/2023					East/	West Stre	eet		WB H	lighway	1416			
Analysis Year	2023						North	n/South S	Street		S Ells	worth Ro	ł			
Time Analyzed	PM P	eak					Peak	Hour Fac	ctor		0.90					
Intersection Orientation	North	n-South					Analy	sis Time	Period ((hrs)	1.00					
Project Description	Rada	r Hill 14 [.]	16 Corric	lor Study	/											
Lanes	_															
					_			1								
								I								
					Majo	r Street: No	rth-South									
Vehicle Volumes and Ad	justme	nts														
Approach	Τ	Eastbound West								North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority		10	11	12		7	8	9	10	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	2	0	0	0	1	0	0	0	1	1
Configuration						LT		TR		LT					Т	R
Volume (veh/h)						14	71	6		36	328				65	256
Percent Heavy Vehicles (%)						10	10	10		1						
Proportion Time Blocked																
Percent Grade (%)						-	0	-			-	-				-
Right Turn Channelized														Y	'es	
Median Type Storage				Undi	vided											
Critical and Follow-up H	eadwa	ys														
Base Critical Headway (sec)	Τ					7.1	6.5	6.2		4.1						
Critical Headway (sec)						7.20	6.60	6.30		4.11						
Base Follow-Up Headway (sec)						3.5	4.0	3.3		2.2						
Follow-Up Headway (sec)						3.59	4.09	3.39		2.21						
Delay, Queue Length, an	d Leve	l of S	ervice	•	<u>.</u>		<u> </u>	<u>.</u>	<u>.</u>	<u> </u>	<u>.</u>		<u>.</u>			
Flow Rate, v (veh/h)	T					55		46		40						
Capacity, c (veh/h)						438		459		1534						
v/c Ratio						0.13		0.10		0.03						
95% Queue Length, Q ₉₅ (veh)						0.4		0.3		0.1						
Control Delay (s/veh)						14.4		13.7		7.4	0.2					
Level of Service (LOS)						В		В		A	A					
Approach Delay (s/veh)						14	4.1			- 1	.0					
Approach LOS							В				A					
Approach LOS							В				A					

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	HCS Two-Way Stop-Contro															
General Information							Site	Infor	matio	n						
Analyst	Emm	a Myers-	Verhage	<u>.</u>			Inter	section			EB Hi	ghway 1	416 and	S Ellswo	orth Rd	
Agency/Co.		,					Juriso	diction			Box E	Ider SD				
Date Performed	6/4/2	023					East/	West Str	eet		EB Hi	ghway 1	416			
Analysis Year	2023						Nort	h/South	Street		S Ells	worth Ro	1			
Time Analyzed	AM P	eak					Peak	Hour Fa	ctor		0.84					
Intersection Orientation	East-	West					Analy	/sis Time	Period	(hrs)	1.00					
Project Description	Rada	r Hill 141	6 Corrid	lor Study	/					. ,						
Lanes																
					_											
					Maj	or Street: Ea	ast-west									
Vehicle Volumes and Adju	Eacthound Westhound															
Approach		Eastb	ound			West	bound			North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	10	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	0	0	0		0	1	0		0	1	0
Configuration		LT		TR								TR		LT		
Volume (veh/h)		618	115	15							142	7		10	16	
Percent Heavy Vehicles (%)		4									1	1		5	5	
Proportion Time Blocked																
Percent Grade (%)											0				0	
Right Turn Channelized																
Median Type Storage				Undi	vided											
Critical and Follow-up He	adwa	ys														
Base Critical Headway (sec)		5.3									6.5	6.9		7.5	6.5	
Critical Headway (sec)		5.38									6.52	6.92		7.60	6.60	
Base Follow-Up Headway (sec)		3.1									4.0	3.3		3.5	4.0	
Follow-Up Headway (sec)		3.14									4.01	3.31		3.55	4.05	
Delay, Queue Length, and	l Leve	l of Se	ervice													
Flow Rate, v (veh/h)		736										177		31		
Capacity, c (veh/h)		1146										36		34		
v/c Ratio		0.64										4.98		0.92		
95% Queue Length, Q ₉₅ (veh)		5.2										74.4		6.2		
Control Delay (s/veh)		13.7	0.8									7390.1		468.7		
Level of Service (LOS)		В	A									F		F		
Approach Delay (s/veh)		11	1.5							73	90.1			46	8.7	
Approach LOS	11.5 B										F			l	F	

	HCS Two-Way Stop-Cont															
General Information							Site	Infor	natio	n						
Analyst	Emm	a Myers-	Verhage	2	_	_	Inter	section	_	_	EB Hi	ghway 1	416 and	S Ellswo	orth Rd	
Agency/Co.							Juriso	diction			Box E	ilder SD				
Date Performed	6/4/2	023					East/	West Str	eet		EB Hi	ghway 1	416			
Analysis Year	2023						Nort	h/South	Street		S Ells	worth Ro	b			
Time Analyzed	PM P	eak					Peak	Hour Fa	ctor		0.90					
Intersection Orientation	East-	West					Analy	/sis Time	Period	(hrs)	1.00					
Project Description	Rada	r Hill 141	6 Corrid	lor Study	/		-									
Lanes				-												
					Maj	or Street: Ea	ast-West									
Vehicle Volumes and Adj	ustme	nts														
Approach	Eastbound Westbound								<u> </u>	North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	0	0	0		0	1	0		0	1	0
Configuration		LT		TR								TR		LT		
Volume (veh/h)		291	79	143							73	6		6	73	
Percent Heavy Vehicles (%)		4									1	1		5	5	
Proportion Time Blocked																
Percent Grade (%)											0	1			0	
Right Turn Channelized																
Median Type Storage				Undi	vided											
Critical and Follow-up He	adwa	ys														
Base Critical Headway (sec)		5.3									6.5	6.9		7.5	6.5	
Critical Headway (sec)		5.38									6.52	6.92		7.60	6.60	
Base Follow-Up Headway (sec)		3.1									4.0	3.3		3.5	4.0	
Follow-Up Headway (sec)		3.14									4.01	3.31		3.55	4.05	
Delay, Queue Length, and	d Leve	l of Se	ervice													
Flow Rate, v (veh/h)		323										88		88		
Capacity, c (veh/h)		1146										231		184		
v/c Ratio		0.28						1				0.38		0.48		
95% Queue Length, Q ₉₅ (veh)		1.2										1.8		2.6		
Control Delay (s/veh)		1.2 1.8 9.4 0.3												42.0		
Level of Service (LOS)		A	А									D		E		
Approach Delay (s/veh)	A A 5.4									3	0.0			42	2.0	
Approach LOS	5.4 A										D				E	

	HCS Two-Way Stop-Contr															
General Information							Site	Inforr	natio	n						
Analyst	Emma	a Myers-	-Verhage	9			Inters	ection			WB H	lighway	1416 an	d Radar	Hill Rd	
Agency/Co.		,					Jurisc	liction			Box E	ilder SD				
Date Performed	6/4/2	023					East/	Nest Stre	eet		WB H	lighway	1416			
Analysis Year	2023						North	/South S	Street		Rada	r Hill Rd				
Time Analyzed	AM P	eak					Peak	Hour Fac	ctor		0.88					
Intersection Orientation	East-	West					Analy	sis Time	Period (hrs)	1.00					
Project Description	Rada	r Hill 141	16 Corric	lor Study	,											
Lanes																
															_	_
					Maj	or Street: Ea	st-West									
Vehicle Volumes and Adj	ustme	Sethound Westhound														
Approach		Eastbound Westbound								North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	10	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	0	0	0	0	2	0		0	1	0		0	1	0
Configuration						LT		TR		LT						TR
Volume (veh/h)						79	334	5		167	5				17	16
Percent Heavy Vehicles (%)						5				4	4				3	3
Proportion Time Blocked																
Percent Grade (%)											0				0	
Right Turn Channelized																
Median Type Storage				Undi	vided											
Critical and Follow-up H	eadwa	ys														
Base Critical Headway (sec)	Τ					5.3				7.5	6.5				6.5	6.9
Critical Headway (sec)						5.40				7.58	6.58				6.56	6.96
Base Follow-Up Headway (sec)						3.1				3.5	4.0				4.0	3.3
Follow-Up Headway (sec)						3.15				3.54	4.04				4.03	3.33
Delay, Queue Length, and	d Leve	l of S	ervice													
Flow Rate, v (veh/h)	<u> </u>					90				195						38
Capacity, c (veh/h)						1143				462						525
v/c Ratio						0.08				0.42						0.07
95% Queue Length, Q ₉₅ (veh)						0.3				2.2						0.2
Control Delay (s/veh)						8.4	0.5			18.5						12.4
Level of Service (LOS)						А	A			С						В
Approach Delay (s/veh)						2	0			18	8.5			1	2.4	
Approach LOS							A				с				В	
1																

	HCS Two-Way Stop-Contr															
General Information							Site	Inforr	natio	n						
Analyst	Emma	a Myers-	Verhage	<u>.</u>			Inters	ection			WB H	lighway	1416 an	d Radar	Hill Rd	
Agency/Co.		,					Jurisc	liction			Box E	lder SD				
Date Performed	6/4/2	023					East/	West Stre	eet		WB H	lighway	1416			
Analysis Year	2023						North	n/South S	Street		Rada	r Hill Rd				
Time Analyzed	PM P	eak					Peak	Hour Fac	ctor		0.94					
Intersection Orientation	East-	West					Analy	sis Time	Period (hrs)	1.00					
Project Description	Rada	r Hill 141	6 Corric	lor Study	,											
Lanes																
																_
					Maj	or Street: Ea	st-West									
Vehicle Volumes and Adj	ustme	ments														
Approach		Eastbound Westbound								North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	0	0	0	0	2	0		0	1	0		0	1	0
Configuration						LT		TR		LT						TR
Volume (veh/h)						184	531	3		112	28				13	10
Percent Heavy Vehicles (%)						5				4	4				3	3
Proportion Time Blocked																
Percent Grade (%)											0				0	
Right Turn Channelized																
Median Type Storage				Undi	vided											
Critical and Follow-up He	eadwa	ys														
Base Critical Headway (sec)						5.3				7.5	6.5				6.5	6.9
Critical Headway (sec)						5.40				7.58	6.58				6.56	6.96
Base Follow-Up Headway (sec)						3.1				3.5	4.0				4.0	3.3
Follow-Up Headway (sec)						3.15				3.54	4.04				4.03	3.33
Delay, Queue Length, and	d Leve	l of S	ervice	•												
Flow Rate, v (veh/h)						196				149						24
Capacity, c (veh/h)						1143				235						293
v/c Ratio						0.17				0.63						0.08
95% Queue Length, Q ₉₅ (veh)						0.6				4.7						0.3
Control Delay (s/veh)						8.8	1.1			45.8						18.4
Level of Service (LOS)						A	A			E						С
Approach Delay (s/veh)						3	8.0			4	5.8			18	3.4	
Approach LOS							A				E				С	

		HCS	All-W	ay Sto	p Con	trol Re	eport					
General and Site Informatio	n				Lanes							
Analyst	Emma N	Ayers-Verh	age				_					
Agency/Co.					1							
Date Performed	6/4/202	3			1							
Analysis Year	2023				1							
Analysis Time Period (hrs)	1.00				1							
Time Analyzed	AM Pea	k			1							
Project Description	Radar H	lill 1416 Co	rridor Stud	у	1							
Intersection	EB High	way 1416 a	and Radar I	Hill Rd	1							
Jurisdiction	Box Elde	er SD			1							
East/West Street	EB High	way 1416			1							
North/South Street	Radar H	ill Rd			1							
Peak Hour Factor	0.88				1							
Turning Movement Demand	l Volum	nes										
Approach		Eastbound	l		Westbound	b	I I	Northboun	d	9	Southboun	d
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	4	527	55					168	236	8	88	
% Thrus in Shared Lane	50		50									
Lane Flow Rate and Adjustn	nents											
Approach		Eastbound			Westbound	b	1	Northboun	d	9	Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	304	362					459			109		
Percent Heavy Vehicles	4	4					4			3		
Initial Departure Headway, hd (s)	3.20	3.20					3.20			3.20		
Initial Degree of Utilization, x	0.270	0.322					0.408			0.097		
Final Departure Headway, hd (s)	6.19	6.06					5.39			6.36		
Final Degree of Utilization, x	0.523	0.609					0.688			0.193		
Move-Up Time, m (s)	2.3	2.3					2.0			2.0		
Service Time, t _s (s)	3.89	3.76					3.39			4.36		
Capacity, Delay and Level of	Servic	e										
Approach		Eastbound	1		Westbound	b	, I	Northboun	d		Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	304	362					459			109		
Capacity (veh/h)	582	594					667			566		
95% Queue Length, Q95 (veh)	3.2	4.5					6.2			0.7		
Control Delay (s/veh)	15.6	18.1					20.0			10.9		
Level of Service, LOS	С	С					С			В		
Approach Delay (s/veh) LOS	17.0		С		<u> </u>		20.0		С	10.9		В
Intersection Delay (s/veh) LOS			17	7.6					(С		

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		HCS	All-W	ay Sto	p Con	trol Re	eport					
General and Site Informatio	n				Lanes							
Analyst	Emma N	Ayers-Verh	age									
Agency/Co.					1							
Date Performed	6/4/202	3			1	_					_	
Analysis Year	2023				1							
Analysis Time Period (hrs)	1.00				1							
Time Analyzed	PM Pea	k			1							
Project Description	Radar H	lill 1416 Co	rridor Stud	у	1							
Intersection	EB High	way 1416 a	and Radar I	Hill Rd	1							
Jurisdiction	Box Elde	er SD			1							
East/West Street	EB High	way 1416			1							
North/South Street	Radar H	lill Rd			1							
Peak Hour Factor	0.94				1							
Turning Movement Demand	d Volum	nes										
Approach		Eastbound			Westbound	b	1	Northboun	d	9	Southboun	d
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	19	401	193					121	116	4	193	
% Thrus in Shared Lane	50		50									
Lane Flow Rate and Adjustn	nents											
Approach		Eastbound			Westbound	d	1	Northboun	d	9	Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	234	419					252			210		
Percent Heavy Vehicles	4	4					4			3		
Initial Departure Headway, hd (s)	3.20	3.20					3.20			3.20		
Initial Degree of Utilization, x	0.208	0.372					0.224			0.186		
Final Departure Headway, hd (s)	5.94	5.55					5.57			5.91		
Final Degree of Utilization, x	0.385	0.645					0.390			0.344		
Move-Up Time, m (s)	2.3	2.3					2.0			2.0		
Service Time, ts (s)	3.64	3.25					3.57			3.91		
Capacity, Delay and Level of	F Servic	e										
Approach		Eastbound			Westbound	b	1	Northboun	d		Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	234	419					252			210		
Capacity (veh/h)	606	649					646			609		
95% Queue Length, Q ₉₅ (veh)	1.9	5.2					1.9			1.6		
Control Delay (s/veh)	12.3	18.2					12.1			12.0		
Level of Service, LOS	В	С					В			В		
Approach Delay (s/veh) LOS	16.1		С				12.1		В	12.0		В
Intersection Delay (s/veh) LOS			14	1.4					I	- B		

HCS All-Way Stop Control Report												
General and Site Informatio	n				Lanes							
Analyst	Emma N	/lyers-Verh	age				_					
Agency/Co.												
Date Performed	6/4/202	6/4/2023										
Analysis Year	2023											
Analysis Time Period (hrs)	1.00				1							
Time Analyzed	AM Pea	k										
Project Description	Radar H	lill 1416 Co	rridor Stud	у								
Intersection	Radar H	lill Rd and I	ong View	Rd								
Jurisdiction	Box Elde	er SD			1							
East/West Street	Long Vi	ew Rd										
North/South Street	Radar H	iill Rd			1							
Peak Hour Factor	0.90											
Turning Movement Demand	d Volum	nes										
Approach		Eastbound			Westbound	b	1	Northboun	d	9	Southboun	d
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	70	6	1	5	16	9	1	24	3	3	38	102
% Thrus in Shared Lane												
Lane Flow Rate and Adjustments												
Approach		Eastbound	1		Westbound	b	, I	Northboun	d	9	Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	L	TR		L	TR		L	TR		L	TR	
Flow Rate, v (veh/h)	78	8		6	28		1	30		3	156	
Percent Heavy Vehicles	3	3		49	49		14	14		5	5	
Initial Departure Headway, hd (s)	3.20	3.20		3.20	3.20		3.20	3.20		3.20	3.20	
Initial Degree of Utilization, x	0.069	0.007		0.005	0.025		0.001	0.027		0.003	0.138	
Final Departure Headway, hd (s)	5.52	4.92		6.35	5.60		5.69	5.11		5.44	4.43	
Final Degree of Utilization, x	0.119	0.011		0.010	0.043		0.002	0.043		0.005	0.191	
Move-Up Time, m (s)	2.3	2.3		2.3	2.3		2.3	2.3		2.3	2.3	
Service Time, t _s (s)	3.22	2.62		4.05	3.30		3.39	2.81		3.14	2.13	
Capacity, Delay and Level of	f Servic	e										
Approach		Eastbound			Westbound	ł	l I	Northboun	d	9	Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	L	TR		L	TR		L	TR		L	TR	
Flow Rate, v (veh/h)	78	8		6	28		1	30		3	156	
Capacity (veh/h)	652	732		567	643		633	705		662	812	
95% Queue Length, Q ₉₅ (veh)	0.4	0.0		0.0	0.1		0.0	0.1		0.0	0.7	
Control Delay (s/veh)	9.0	7.7		9.1	8.6		8.4	8.0		8.2	8.2	
Level of Service, LOS	А	А		А	А		А	А		А	А	
Approach Delay (s/veh) LOS	8.8		A	8.6		A	8.0		A	8.2		A
Intersection Delay (s/veh) LOS			8	.4					,	4		

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HCS All-Way Stop Control Report												
General and Site Informatio	n				Lanes							
Analyst	Emma N	/lyers-Verh	age									
Agency/Co.												
Date Performed	6/4/202	3			1							
Analysis Year	2023											
Analysis Time Period (hrs)	1.00				1							
Time Analyzed	PM Pea	k										
Project Description	Radar H	lill 1416 Co	rridor Stud	у	1							
Intersection	Radar H	lill Rd and I	ong View	Rd								
Jurisdiction	Box Elde	er SD			1							
East/West Street	Long Vi	ew Rd										
North/South Street	Radar H	lill Rd			1							
Peak Hour Factor	0.95				1							
Turning Movement Demand	d Volum	nes										
Approach		Eastbound	l		Westbound	b	l I	Northboun	d	9	Southboun	d
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	127	10	1	2	6	4	1	46	4	7	37	107
% Thrus in Shared Lane												
Lane Flow Rate and Adjustments												
Approach	Eastbound				Westbound	b	I I	Northboun	d	9	Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	L	TR		L	TR		L	TR		L	TR	
Flow Rate, v (veh/h)	134	12		2	11		1	53		7	152	
Percent Heavy Vehicles	3	3		49	49		14	14		5	5	
Initial Departure Headway, hd (s)	3.20	3.20		3.20	3.20		3.20	3.20		3.20	3.20	
Initial Degree of Utilization, x	0.119	0.010		0.002	0.009		0.001	0.047		0.007	0.135	
Final Departure Headway, hd (s)	5.57	5.00		6.48	5.70		5.81	5.25		5.57	4.55	
Final Degree of Utilization, x	0.207	0.016		0.004	0.017		0.002	0.077		0.011	0.192	
Move-Up Time, m (s)	2.3	2.3		2.3	2.3		2.3	2.3		2.3	2.3	
Service Time, t _s (s)	3.27	2.70		4.18	3.40		3.51	2.95		3.27	2.25	
Capacity, Delay and Level of	f Servic	e										
Approach		Eastbound	1		Westbound	ł	1	Northboun	d	9	Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	L	TR		L	TR		L	TR		L	TR	
Flow Rate, v (veh/h)	134	12		2	11		1	53		7	152	
Capacity (veh/h)	647	719		555	631		620	686		646	790	
95% Queue Length, Q ₉₅ (veh)	0.8	0.0		0.0	0.1		0.0	0.2		0.0	0.7	
Control Delay (s/veh)	9.7	7.8		9.2	8.5		8.5	8.4		8.3	8.3	
Level of Service, LOS	A	A		A	A		A	A		A	A	
Approach Delay (s/veh) LOS	9.6		A	8.6		A	8.4		A	8.3		A
Intersection Delay (s/veh) LOS			8	.8					1	Ą		

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		ŀ	ICS 1	Гwo-'	Way	Stop	-Cor	ntrol	Repo	ort						
General Information							Site Information									
Analyst	Emm	a Myers-	Verhage				Intersection Radar Hill Rd			r Hill Rd	and Highway 44					
Agency/Co.						Jurisc	liction			Box E	Box Elder SD					
Date Performed	6/4/2	023					East/	Nest Stre	eet		High	way 44				
Analysis Year	2023						North	/South S	Street		Rada	r Hill Rd				
Time Analyzed	AM P	eak					Peak	Hour Fac	ctor		0.86					
Intersection Orientation	East-	West					Analy	sis Time	Period (hrs)	1.00					
Project Description	Rada	r Hill 141	6 Corrid	or Study	,											
Lanes																
					_											
		_			Maj	or Street: Ea	st-West									
Vehicle Volumes and Adju	olumes and Adjustments															
Approach		Eastb	ound			West	oound			North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	1	2	0		0	1	0		0	1	0
Configuration		L	Т	TR		L	Т	TR			LTR				LTR	
Volume (veh/h)	0	15	217	5	0	2	207	17		4	0	1		19	2	10
Percent Heavy Vehicles (%)	5	5			3	3				6	6	6		10	10	10
Proportion Time Blocked																
Percent Grade (%)											0				0	
Right Turn Channelized																
Median Type Storage				Undi	vided											
Critical and Follow-up He	adwa	ys														
Base Critical Headway (sec)		4.1				4.1				7.5	6.5	6.9		7.5	6.5	6.9
Critical Headway (sec)		4.20				4.16				7.62	6.62	7.02		7.70	6.70	7.10
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.25				2.23				3.56	4.06	3.36		3.60	4.10	3.40
Delay, Queue Length, and	l Leve	l of Se	ervice					<u> </u>			<u>.</u>		<u>.</u>	<u>.</u>		
Flow Rate, v (veh/h)		17				2					6				36	
Capacity, c (veh/h)		1279				1296					534				564	
v/c Ratio		0.01				0.00					0.01				0.06	
95% Queue Length, Q ₉₅ (veh)		0.0				0.0					0.0				0.2	
Control Delay (s/veh)		7.9				7.8					11.8				11.8	
Level of Service (LOS)		A				A					В				В	
Approach Delay (s/veh)		0	.5			0	.1			1 ⁻	1.8			1 ⁻	1.8	
Approach LOS		A A			4		В				В					

		ŀ	ICS 1	ſwo-'	Way	Stop	-Cor	ntrol	Repo	ort						
General Information							Site Information									
Analyst	Emm	a Myers-	Verhage				Intersection Rac			Radar	adar Hill Rd and Highway 44					
Agency/Co.							Jurisd	liction			Box E	Box Elder SD				
Date Performed	6/4/2	023					East/\	Nest Stre	eet		Highv	vay 44	ay 44			
Analysis Year	2023						North	/South S	Street		Radar	· Hill Rd				
Time Analyzed	PM P	eak					Peak	Hour Fac	tor		0.85					
Intersection Orientation	East-	West					Analy	sis Time	Period (hrs)	1.00					
Project Description	Rada	r Hill 141	6 Corrid	or Study	,						1					
Lanes																
	_	_	_	_				_	_	_	_	_	_	_	_	_
Major Street: East-West																
Vehicle Volumes and Adju	ustme	nts														
Approach		Eastb	ound			West	oound			North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	1	2	0		0	1	0		0	1	0
Configuration		L	Т	TR		L	Т	TR			LTR				LTR	
Volume (veh/h)	0	39	132	12	0	1	221	24		6	1	0		23	7	24
Percent Heavy Vehicles (%)	5	5			3	3				6	6	6		10	10	10
Proportion Time Blocked																
Percent Grade (%)							I	I			0		0			
Right Turn Channelized																
Median Type Storage				Undi	vided								<u> </u>			
Critical and Follow-up He	adwa	ys														
Base Critical Headway (sec)		4.1				4.1				7.5	6.5	6.9		7.5	6.5	6.9
Critical Headway (sec)		4.20				4.16				7.62	6.62	7.02		7.70	6.70	7.10
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.25				2.23				3.56	4.06	3.36		3.60	4.10	3.40
Delay, Queue Length, and	l Leve	l of Se	ervice			,								,		
Flow Rate, v (veh/h)		46				1					8				64	
Capacity, c (veh/h)		1249				1398					467				564	
v/c Ratio		0.04				0.00					0.02				0.11	
95% Queue Length, Q ₉₅ (veh)		0.1				0.0					0.1				0.4	
Control Delay (s/veh)		8.0				7.6					12.9				12.2	
Level of Service (LOS)		A				А					В				В	
Approach Delay (s/veh)		1	.7			0	.0			12	2.9			12	2.2	
Approach LOS		1	4			1	٩		B B			3				

Appendix C: Pedestrian Level of Service (PLOS) and Bicycle Level of Service (BLOS) Results

Lanes per direction:	2		
Outside lane width:	12 ft		
Paved shoulder/bike lane/marked parking width:	0 ft		
Bidirectional ADT traffic volume:	3943 (veh/day)		
Posted speed limit:	65 mph		
Heavy vehicle percentage:	3%		
FHWA's pavement condition rating:	3		
% of segment with occupied parking:	0%		
% of segment with sidewalks:	0%		

	Score	Level-of-service	Compatibility Level
BLOS:	4.2	D (3.51-4.50)	Moderately Low
PLOS:	4.92	E (4.51-5.50)	Very Low

Highway 1416 151st Avenue to Liberty Blvd

Lanes per direction:	2
Outside lane width:	12 ft
Paved shoulder/bike lane/marked parking width:	0 ft
Bidirectional ADT traffic volume:	1469 (veh/day)
Posted speed limit:	50 mph
Heavy vehicle percentage:	5%
FHWA's pavement condition rating:	3
% of segment with occupied parking:	0%
% of segment with sidewalks:	0%

	Score	Level-of-service	Compatibility Level
BLOS:	4.08	D (3.51-4.50)	Moderately Low
PLOS:	4.08	D (3.51-4.50)	Moderately Low

WB Highway 1416 Liberty Blvd to S Ellsworth Rd

Lanes per direction:	2
Outside lane width:	12 ft
Paved shoulder/bike lane/marked parking width:	0 ft
Bidirectional ADT traffic volume:	5878 (veh/day)
Posted speed limit:	55 mph
Heavy vehicle percentage:	5%
FHWA's pavement condition rating:	3
% of segment with occupied parking:	0%
% of segment with sidewalks:	0%

	Score	Level-of-service	Compatibility Level
BLOS:	4.87	E (4.51-5.50)	Very Low
PLOS:	4.55	E (4.51-5.50)	Very Low

WB Highway 1416 S Ellsworth Rd to W Gate Rd

Lanes per direction:	2
Outside lane width:	12 ft
Paved shoulder/bike lane/marked parking width:	0 ft
Bidirectional ADT traffic volume:	1080 (veh/day)
Posted speed limit:	50 mph
Heavy vehicle percentage:	8%
FHWA's pavement condition rating:	3
% of segment with occupied parking:	0%
% of segment with sidewalks:	0%

	Score	Level-of-service	Compatibility Level
BLOS:	4.89	E (4.51-5.50)	Very Low
PLOS:	4.06	D (3.51-4.50)	Moderately Low

<u>EB Highway 1416</u> Liberty Blvd to S Ellsworth Rd

Lanes per direction:	2
Outside lane width:	12 ft
Paved shoulder/bike lane/marked parking width:	0 ft
Bidirectional ADT traffic volume:	6290 (veh/day)
Posted speed limit:	55 mph
Heavy vehicle percentage:	5%
FHWA's pavement condition rating:	3
% of segment with occupied parking:	0%
% of segment with sidewalks:	0%

	Score	Level-of-service	Compatibility Level
BLOS:	4.9	E (4.51-5.50)	Very Low
PLOS:	4.57	E (4.51-5.50)	Very Low

EB Highway 1416 S Ellsworth Rd to W Gate Rd

Lanes per direction:	2
Outside lane width:	13 ft
Paved shoulder/bike lane/marked parking width:	0 ft
Bidirectional ADT traffic volume:	5385 (veh/day)
Posted speed limit:	45 mph
Heavy vehicle percentage:	4%
FHWA's pavement condition rating:	3
% of segment with occupied parking:	0%
% of segment with sidewalks:	0%

	Score	Level-of-service	Compatibility Level
BLOS:	4.26	D (3.51-4.50)	Moderately Low
PLOS:	4.02	D (3.51-4.50)	Moderately Low

<u>Radar Hill Rd</u> Highway 1416 to 228th St

Lanes per direction:	2		
Outside lane width:	13 ft		
Paved shoulder/bike lane/marked parking width:	10 ft		
Bidirectional ADT traffic volume:	1052 (veh/day)		
Posted speed limit:	45 mph		
Heavy vehicle percentage:	12%		
FHWA's pavement condition rating:	3		
% of segment with occupied parking:	0%		
% of segment with sidewalks:	0%		

	Score	Level-of-service	Compatibility Level
BLOS:	1.5	A (below 1.50)	Extremely High
PLOS:	3.07	C (2.51-3.50)	Moderately High

Radar Hill Rd 228th St to 229th St

Lanes per direction:		2
Outside lane width:	13 ft	
Paved shoulder/bike lane/marked parking width:	0 ft	
Bidirectional ADT traffic volume:	320 (veh/day)	
Posted speed limit:	50 mph	
Heavy vehicle percentage:		7%
FHWA's pavement condition rating:		3
% of segment with occupied parking:		0%
% of segment with sidewalks:	0%	
Score Level-of-service	Compatibility Leve	el

	Score	Level-of-service	Compatibility Le
BLOS:	3.81	D (3.51-4.50)	Moderately Low
PLOS:	3.92	D (3.51-4.50)	Moderately Low

Radar Hill Rd 229th St to Highway 44

Appendix D: Vehicular Level of Service (VLOS) Results - Future No-Build

	HCS Two-Way Stop-Control Report															
General Information							Site Information									
Analyst	Emma	Myers-	Verhage				Inters	ection			Highv	way 1416	and 15	1st Ave		
Agency/Co.							Jurisd	liction			Box E	lder, SD				
Date Performed	7/28/	2023					East/\	Nest Stre	et		Highv	way 1416	5			
Analysis Year	2030						North	/South S	Street		151st	Ave				
Time Analyzed	AM P	eak					Peak I	Hour Fac	tor		0.76					
Intersection Orientation	East-V	Vest					Analy	sis Time	Period (l	hrs)	1.00					
Project Description	Radar	Hill 141	6 Corrid	or Study	/											
Lanes																
	Image: Additional and the second s															
venicie volumes and Adju	istme	nts			1				_				_			
Approach		Eastb	ound			West	bound			North	bound	-		South	bound	
Movement	U	L		R	U	L	-	R	U	L	1	R	U	L		R
Priority	10	1	2	3	40	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	I	0	0	0				0	0	0		0		0
								IR 10						- 11	LK	146
Volume (veh/h)		179	41				99	19						11		146
Percent Heavy Vehicles (%)		9										<u> </u>		16		16
Proportion Time Blocked																
Percent Grade (%)														()	
Right Turn Channelized																
Median Type Storage		Undivided														

Critical and Follow-up Headways														
Base Critical Headway (sec)		4.1										7.1		6.2
Critical Headway (sec)		4.19										6.56		6.36
Base Follow-Up Headway (sec)		2.2										3.5		3.3
Follow-Up Headway (sec)		2.28										3.64		3.44
Delay, Queue Length, and Level of Service														
Flow Rate, v (veh/h)		236											207	
Capacity, c (veh/h)		1383											780	
v/c Ratio		0.17											0.26	
95% Queue Length, Q ₉₅ (veh)		0.6											1.1	
Control Delay (s/veh)		8.1	1.4										11.3	
Level of Service (LOS)		A	A										В	
Approach Delay (s/veh)		6	.9									1	1.3	
Approach LOS			Ą								 		В	

HCS Two-Way Stop-Control Report																
General Information						Site Information										
Analyst	Emma Myers-Verhage							Intersection Highway 141				5 and 151st Ave				
Agency/Co.	1	,					Jurisc	diction			Box E	lder, SD	D			
Date Performed	7/28/	2023					East/	West Str	eet		High	way 141	6			
Analysis Year	2030						North	n/South	Street		151st	: Ave				
Time Analyzed	PM P	eak					Peak	Hour Fa	ctor		0.83					
Intersection Orientation	East-	West					Analy	/sis Time	e Period	(hrs)	1.00					
Project Description	Rada	r Hill 141	16 Corric	lor Study	/						4					
lanes	-															
A A A A A A A A A A A A A A A A A A A																
Vehicle Volumes and Adj	ustme	nts														
Approach		Eastb	ound		İ 🗌	West	bound			North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	10	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration	1	LT						TR							LR	
Volume (veh/h)	1	92	87				52	5						6		65
Percent Heavy Vehicles (%)	1	9							<u> </u>					16		16
Proportion Time Blocked		-														
Percent Grade (%)																
Right Turn Channelized	1								-							
Median Type Storage				Undi	vided											
Critical and Follow-up He	- adwa	vs			viaca –											
Base Critical Headway (sec)	1	41		<u> </u>		1	1	1	<u> </u>			1	1	71		62
Critical Headway (sec)		л.1 Л 10												6.56		6.36
Pase Follow Up Headway (sec)		4.13												0.50		0.30
Eallow Up Headway (sec)		2.2												2.5		2.3
	<u> </u>	2.20	<u> </u>											5.04		5.44
Delay, Queue Length, and	d Leve	l of Se	ervice													
Flow Rate, v (veh/h)	1	111													86	
Capacity, c (veh/h)		1489													901	
v/c Ratio		0.07													0.09	
95% Queue Length, Q ₉₅ (veh)		0.2													0.3	
Control Delay (s/veh)	1	7.6	0.6												9.4	
Level of Service (LOS)	1	A	A												А	
Approach Delay (s/veh)	1	. 4	.2											9	.4	
Approach LOS	A												A			

HCS Two-Way Stop-Control Report								
General Information		Site Information						
Analyst	Emma Myers-Verhage	Intersection	Highway 1416 and Liberty Blvd					
Agency/Co.		Jurisdiction	Box Elder, SD					
Date Performed	7/28/2023	East/West Street	Highway 1416					
Analysis Year	2030	North/South Street	Liberty Blvd					
Time Analyzed	AM Peak	Peak Hour Factor	0.84					
Intersection Orientation	East-West	Analysis Time Period (hrs)	1.00					
Project Description	Radar Hill 1416 Corridor Study							
Lanes								



Vehicle Volumes and Adjustments

Approach		Eastb	ound			West	ound			North	bound			South	oound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	0	1	0		0	1	0		0	1	1
Configuration		L		TR			LTR				LTR			LT		R
Volume (veh/h)		326	150	3		7	90	171		4	51	10		60	19	141
Percent Heavy Vehicles (%)		8				7				2	2	2		9	9	9
Proportion Time Blocked																
Percent Grade (%)		!!								()			C)	
Right Turn Channelized														Ye	es	
Median Type Storage				Undiv	vided											
Critical and Follow-up He	adways															
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.18				4.17				7.12	6.52	6.22		7.19	6.59	6.29
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.27				2.26				3.52	4.02	3.32		3.58	4.08	3.38
Delay, Queue Length, and	Leve	of Se	ervice													
Flow Rate, v (veh/h)		388				8					77			94		168
Capacity, c (veh/h)		1216				1363					123			65		814
v/c Ratio		0.32				0.01					0.63			1.46		0.21
95% Queue Length, Q ₉₅ (veh)		1.4				0.0					4.3			21.3		0.8
Control Delay (s/veh)		9.3				7.7	0.1	0.1			81.0			1032.9		10.6
Level of Service (LOS)		А				А	А	А			F			F		В
Approach Delay (s/veh)		6.	4		0.3				81.0				377.7			
Approach LOS		ŀ	4			ļ	4		F				F			

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	HCS Two-Way Stop-Control Report												
General Information		Site Information											
Analyst	Emma Myers-Verhage	Intersection	Highway 1416 and Liberty Blvd										
Agency/Co.		Jurisdiction	Box Elder, SD										
Date Performed	7/28/2023	East/West Street	Highway 1416										
Analysis Year	2030	North/South Street	Liberty Blvd										
Time Analyzed	PM Peak	Peak Hour Factor	0.84										
Intersection Orientation	East-West	Analysis Time Period (hrs)	1.00										
Project Description	Radar Hill 1416 Corridor Study												
Lanes													



Vehicle Volumes and Adjustments

Approach		Eastb	ound			West	bound			North	bound			South	bound		
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R	
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12	
Number of Lanes	0	1	1	0	0	0	1	0		0	1	0		0	1	1	
Configuration		L		TR			LTR				LTR			LT		R	
Volume (veh/h)		97	83	13		7	64	66		8	16	2		125	26	107	
Percent Heavy Vehicles (%)		8				7				2	2	2		9	9	9	
Proportion Time Blocked																	
Percent Grade (%)										()			()		
Right Turn Channelized														Ye	es		
Median Type Storage	Undivided																
Critical and Follow-up He	leadways																
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2	
Critical Headway (sec)		4.18				4.17				7.12	6.52	6.22		7.19	6.59	6.29	
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3	
Follow-Up Headway (sec)		2.27				2.26				3.52	4.02	3.32		3.58	4.08	3.38	
Delay, Queue Length, and	Leve	l of Se	ervice														
Flow Rate, v (veh/h)		115				8					31			180		127	
Capacity, c (veh/h)		1390				1444					405			424		918	
v/c Ratio		0.08				0.01					0.08			0.42		0.14	
95% Queue Length, Q ₉₅ (veh)		0.3				0.0					0.2			2.2		0.5	
Control Delay (s/veh)		7.8				7.5	0.0	0.0			14.6			19.7		9.6	
Level of Service (LOS)		А				А	А	А			В			С		А	
Approach Delay (s/veh)		3	.9			0	.4			14.6				15.5			
Approach LOS		A	4				4			I	3		С				

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HCS Two-Way Stop-Control Report

General Information		Site Information										
Analyst	Emma Myers-Verhage	Intersection	WB Highway 1416 and S Ellsworth Rd									
Agency/Co.		Jurisdiction	Box Elder, SD									
Date Performed	7/28/2023	East/West Street	WB Highway 1416									
Analysis Year	2030	North/South Street	S Ellsworth Rd									
Time Analyzed	AM Peak	Peak Hour Factor	0.84									
Intersection Orientation	North-South	Analysis Time Period (hrs)	1.00									
Project Description	Radar Hill 1416 Corridor Study											

Lanes



Vehicle Volumes and Adjustments Approach Eastbound Westbound Northbound Southbound U R U U L Т L т R U L Т R L т R Movement 12 7 1U 2 4U Priority 10 11 8 9 1 3 4 5 6 Number of Lanes 0 0 0 0 2 0 0 0 1 0 0 0 1 1 TR Configuration LT LT Т R 90 128 207 Volume (veh/h) 30 173 44 752 Percent Heavy Vehicles (%) 10 10 10 1 **Proportion Time Blocked** 0 Percent Grade (%) **Right Turn Channelized** Yes Median Type | Storage Undivided **Critical and Follow-up Headways** Base Critical Headway (sec) 7.1 6.5 6.2 4.1 Critical Headway (sec) 7.20 6.60 6.30 4.11 3.5 4.0 3.3 2.2 Base Follow-Up Headway (sec) Follow-Up Headway (sec) 3.59 4.09 3.39 2.21 Delay, Queue Length, and Level of Service Flow Rate, v (veh/h) 139 155 107 Capacity, c (veh/h) 133 172 1434 v/c Ratio 1.04 0.90 0.07 15.8 11.6 0.2 95% Queue Length, Q₉₅ (veh) Control Delay (s/veh) 295.8 141.5 1.2 7.7 F F Level of Service (LOS) А А Approach Delay (s/veh) 214.3 1.9 Approach LOS F А

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HCS Two-Way Stop-Control Report

General Information		Site Information										
Analyst	Emma Myers-Verhage	Intersection	WB Highway 1416 and S Ellsworth Rd									
Agency/Co.		Jurisdiction	Box Elder, SD									
Date Performed	7/28/2023	East/West Street	WB Highway 1416									
Analysis Year	2030	North/South Street	S Ellsworth Rd									
Time Analyzed	PM Peak	Peak Hour Factor	0.84									
Intersection Orientation	North-South	Analysis Time Period (hrs)	1.00									
Project Description	Radar Hill 1416 Corridor Study											

Lanes



Vehicle Volumes and Adjustments Approach Eastbound Westbound Northbound Southbound U R U U L Т L т R U L Т R L т R Movement 12 7 1U 2 4U Priority 10 11 8 9 1 3 4 5 6 Number of Lanes 0 0 0 0 2 0 0 0 1 0 0 0 1 1 TR Configuration LT LT Т R 93 273 Volume (veh/h) 29 135 21 38 356 Percent Heavy Vehicles (%) 10 10 10 1 **Proportion Time Blocked** 0 Percent Grade (%) **Right Turn Channelized** Yes Median Type | Storage Undivided **Critical and Follow-up Headways** Base Critical Headway (sec) 7.1 6.5 6.2 4.1 Critical Headway (sec) 7.20 6.60 6.30 4.11 3.5 4.0 3.3 2.2 Base Follow-Up Headway (sec) Follow-Up Headway (sec) 3.59 4.09 3.39 2.21 Delay, Queue Length, and Level of Service Flow Rate, v (veh/h) 105 115 45 Capacity, c (veh/h) 374 413 1486 0.25 v/c Ratio 0.31 0.03 1.3 1.0 0.1 95% Queue Length, Q₉₅ (veh) Control Delay (s/veh) 18.9 16.7 7.5 0.3 С С Level of Service (LOS) А А Approach Delay (s/veh) 17.8 1.0 Approach LOS С А

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	HCS Two-Way Stop	-Control Report										
General Information		Site Information										
Analyst	Emma Myers-Verhage	Intersection	EB Highway 1416 and S Ellsworth Rd									
Agency/Co.		Jurisdiction	Box Elder, SD									
Date Performed	7/28/2023	East/West Street	EB Highway 1416									
Analysis Year	2030	North/South Street	S Ellsworth Rd									
Time Analyzed	AM Peak	Peak Hour Factor	0.84									
Intersection Orientation	East-West	Analysis Time Period (hrs)	1.00									
Project Description	Radar Hill 1416 Corridor Study											
Lanes												



Vehicle Volumes and Adjustments

Approach		Eastb	ound			West	oound			North	bound			South	bound			
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R		
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12		
Number of Lanes	0	0	2	0	0	0	0	0		0	1	0		0	1	0		
Configuration		LT		TR								TR		LT				
Volume (veh/h)		650	335	16							190	59		62	96			
Percent Heavy Vehicles (%)		4									1	1		5	5			
Proportion Time Blocked																		
Percent Grade (%)										()		0					
Right Turn Channelized																		
Median Type Storage				Undi	vided				· · · · · · · · · · · · · · · · · · ·									
Critical and Follow-up He	adwa	ys																
Base Critical Headway (sec)		5.3									6.5	6.9		7.5	6.5			
Critical Headway (sec)		5.38									6.52	6.92		7.60	6.60			
Base Follow-Up Headway (sec)		3.1									4.0	3.3		3.5	4.0			
Follow-Up Headway (sec)		3.14									4.01	3.31		3.55	4.05			
Delay, Queue Length, and	Leve	l of Se	ervice															
Flow Rate, v (veh/h)		774										296		188				
Capacity, c (veh/h)		1146										19		13				
v/c Ratio		0.67										15.26		14.20				
95% Queue Length, Q ₉₅ (veh)		6.0										141.6		90.5				
Control Delay (s/veh)		14.6	2.3									26052. 6		24320. 7				
Level of Service (LOS)		В	А									F		F				
Approach Delay (s/veh)		10).2						26052.6				24320.7					
Approach LOS		E	3								F		F					

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		ŀ	HCS ⁻	Two-	Way	Stop	o-Coi	ntrol	Repo	ort								
General Information							Site	Infor	matio	n								
Analyst	Emm	a Myers-	Verhage	9			Inter	section			EB Hi	ghway 1	416 and	S Ellswo	orth Rd			
Agency/Co.	1	-					Juriso	diction			Box E	lder, SD						
Date Performed	7/28/	2023					East/	West Str	eet		EB Highway 1416							
Analysis Year	2030						Nort	n/South	Street		S Ellsworth Rd							
Time Analyzed	PM P	eak					Peak	Hour Fa	ctor		0.84							
Intersection Orientation	East-	West					Analy	/sis Time	Period	(hrs)								
Project Description	Rada	r Hill 141	16 Corric	lor Study	/													
Lanes	-			-														
A A A A A A A A A A A A A A A A A A A																		
Vehicle Volumes and Adj																		
Approach		Eastb	ound			West	bound			North	bound			South	bound			
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R		
Priority	10	1	2	3	4U	4	5	6		7	8	9		10	11	12		
Number of Lanes	0	0	2	0	0	0	0	0		0	1	0		0	1	0		
Configuration		LT		TR								TR		LT				
Volume (veh/h)	1	306	150	152							87	22		22	100			
Percent Heavy Vehicles (%)	1	4									1	1		5	5			
Proportion Time Blocked	1																	
Percent Grade (%)													0					
Right Turn Channelized																		
Median Type Storage				Undi	vided													
Critical and Follow-up He	adwa	ys																
Base Critical Headway (sec)	1	5.3									6.5	6.9		7.5	6.5			
Critical Headway (sec)		5.38					-		<u> </u>		6.52	6.92		7.60	6.60			
Base Follow-Up Headway (sec)		3.1									4.0	3.3		3.5	4.0			
Follow-Up Headway (sec)		3.14									4.01	3.31		3.55	4.05			
Delay, Queue Length, and	d Leve	l of Se	ervice				<u> </u>											
Elow Bate y (yeb/b)	1	364			1	1	1		1		1	130		145				
Flow Rate, V (Vell/II)		1146							<u> </u>			190		143	<u> </u>			
	-	0.22										0.60		1.09				
		0.32										0.69		1.55				
Control Dolou (s (uch)	-	1.4	0.7				-					5.0		20.4				
		9.6	0.7									5.5 -		141.2				
		A	A								2.5	F			7.2			
Approach Delay (s/veh)		5	0.0						63.5				747.2					
Approach LOS	4		A								F				F			

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HCS Two-Way Stop-Control Report											
General Information		Site Information									
Analyst	Emma Myers-Verhage	Intersection	WB Highway 1416 and Radar Hill Rd								
Agency/Co.		Jurisdiction	Box Elder, SD								
Date Performed	7/28/2023	East/West Street	WB Highway 1416								
Analysis Year	2030	North/South Street	Radar Hill Rd								
Time Analyzed	AM Peak	Peak Hour Factor	0.88								
Intersection Orientation	East-West	Analysis Time Period (hrs)	1.00								
Project Description Radar Hill 1416 Corridor Study											

Lanes



Vehicle Volumes and Adjustments Approach Eastbound

Approach		Eastb	ound			West	bound			North	bound			South	bound		
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R	
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12	
Number of Lanes	0	0	0	0	0	0	2	0		0	1	0		0	1	0	
Configuration						LT		TR		LT						TR	
Volume (veh/h)						107	454	7		179	28				37	17	
Percent Heavy Vehicles (%)						5				4	4				3	3	
Proportion Time Blocked																	
Percent Grade (%)										()		0				
Right Turn Channelized																	
Median Type Storage				Undi	vided												
Critical and Follow-up He	adways																
Base Critical Headway (sec)						5.3				7.5	6.5				6.5	6.9	
Critical Headway (sec)						5.40				7.58	6.58				6.56	6.96	
Base Follow-Up Headway (sec)						3.1				3.5	4.0				4.0	3.3	
Follow-Up Headway (sec)						3.15				3.54	4.04				4.03	3.33	
Delay, Queue Length, and	l Leve	l of Se	ervice														
Flow Rate, v (veh/h)						122				235						61	
Capacity, c (veh/h)						1143				314						358	
v/c Ratio						0.11				0.75						0.17	
95% Queue Length, Q ₉₅ (veh)						0.4				7.5						0.6	
Control Delay (s/veh)						8.5	0.7			48.4						17.2	
Level of Service (LOS)						А	А			E						С	
Approach Delay (s/veh)					2.2			48.4				17.2					
Approach LOS					A				E				С				

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HCS TM TWSC Version 2023 WBHwy1416-RadarHillRd_AMPeak2030.xtw
		ł	HCS -	Two-	Way	Stop	-Cor	ntrol	Repo	ort						
General Information							Site	Inforr	natio	n						
Analyst	Emma	a Myers-	-Verhage	9			Inters	ection			WB H	lighway	1416 an	d Radar	Hill Rd	
Agency/Co.							Jurisc	liction			Box E	lder, SD			-	
Date Performed	7/28/	2023					East/	West Stre	eet		WB H	lighway	1416			
Analysis Year	2030						North	n/South S	Street		Rada	r Hill Rd				
Time Analyzed	PM P	eak					Peak	Hour Fac	ctor		0.94					
Intersection Orientation	East-\	West					Analy	sis Time	Period ((hrs)	1.00					
Project Description	Radai	r Hill 14'	16 Corric	lor Study	/						1					
Lanes	-															
				144444		1 		1 1 1 4 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1								
Vehicle Volumes and Adj	Vehicle Volumes and Adjustments															
Approach		Eastb	oound			West	oound			North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	T	R
Priority	10	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	0	0	0	0	2	0		0	1	0		0	1	0
Configuration						LT		TR		LT						TR
Volume (veh/h)						209	605	4		118	34				18	11
Percent Heavy Vehicles (%)						5				4	4				3	3
Proportion Time Blocked																
Percent Grade (%)											0				0	
Right Turn Channelized																
Median Type Storage				Undi	vided											
Critical and Follow-up He	eadwa	ys														
Base Critical Headway (sec)						5.3				7.5	6.5				6.5	6.9
Critical Headway (sec)						5.40				7.58	6.58				6.56	6.96
Base Follow-Up Headway (sec)						3.1				3.5	4.0				4.0	3.3
Follow-Up Headway (sec)						3.15				3.54	4.04				4.03	3.33
Delay, Queue Length, and	d Leve	l of S	ervice	<u> </u>	<u> </u>			, <u> </u>			<u> </u>		<u> </u>	<u> </u>		, <u> </u>
Flow Rate, v (veh/h)	1		<u> </u>	<u> </u>		222			<u> </u>	162		<u> </u>				31
Capacity, c (veh/h)						1143				184						227
v/c Ratio						0.19				0.88						0.14
95% Queue Lenath, Qas (veh)	1					0.7				11.0						0.5
Control Delay (s/veh)	1					8.9	1.3			123.8						23.4
Level of Service (LOS)	1					A	A			F						
Approach Delay (s/veh)	1					3	.2			12	3.8			2	3.4	Ŭ
Approach LOS	1						4				F			<u> </u>	C	
	-															

HCS TM TWSC Version 2023 WBHwy1416-RadarHillRd_PMPeak2030.xtw

		HCS	All-W	ay Sto	op Con	itrol Re	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Myers-Verh	age				-					
Agency/Co.					1			<u>*</u>		د ل <u>ہ</u>		
Date Performed	7/28/20)23			1							
Analysis Year	2030				1	_*					K	
Analysis Time Period (hrs)	1.00				1	4					<u> </u>	
Time Analyzed	AM Pea	k			1	*	4				←	
Project Description	Radar H	lill 1416 Co	rridor Stud	ly	1		7					
Intersection	EB High	way 1416 a	and Radar I	Hill Rd	1						¥ ←	
Jurisdiction	Box Eld	er, SD			1	× ~						
East/West Street	EB High	way 1416			1	٩			•			
North/South Street	Radar H	lill Rd			1		5	<u></u> ×	∣ ╱╴ ↑ ↑			
Peak Hour Factor	0.88				1							
Turning Movement Demai	nd Volum	nes										
Approach		Eastbound	1		Westboun	d	1	Northboun	d		Southboun	ıd
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	5	702	64					197	314	12	111	
% Thrus in Shared Lane	50		50		1							
Lane Flow Rate and Adjust	tments											
Approach		Eastbound	1		Westboun	d	1	Northboun	d		Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	405	472			1		581			140		
Percent Heavy Vehicles	4	4					4			3		
Initial Departure Headway, hd (s)	3.20	3.20					3.20			3.20		
Initial Degree of Utilization, x	0.360	0.419					0.516			0.124		
Final Departure Headway, hd (s)	6.73	6.61					5.79			7.02		
Final Degree of Utilization, x	0.756	0.866					0.934			0.273		
Move-Up Time, m (s)	2.3	2.3			1		2.0			2.0		
Service Time, ts (s)	4.43	4.31					3.79			5.02		
Capacity, Delay and Level	of Servic	е		<u> </u>			-				<u> </u>	
Approach		Eastbound	1		Westboun	d	1	Northboun	d		Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	405	472					581			140		
Capacity (veh/h)	535	544					622			513		
95% Queue Length, Q ₉₅ (veh)	8.3	14.0					20.9			1.1		
Control Delay (s/veh)	29.4	46.4					64.3			12.7		
Level of Service, LOS	D	E					F			В		
Approach Delay (s/veh) LOS	38.6	_	E		·		64.3		F	12.7		В
Intersection Delay (s/veh) LOS			4	5.7						E		

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		HCS	All-W	ay Sto	op Con	trol Re	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Myers-Verh	age				-					
Agency/Co.					1			* + *		L.		
Date Performed	7/28/20)23			1							
Analysis Year	2030				1	_*					K	
Analysis Time Period (hrs)	1.00				1	*					<u> </u>	
Time Analyzed	PM Pea	k			1	*	4				←	
Project Description	Radar H	lill 1416 Co	rridor Stud	ly	1		7					
Intersection	EB High	way 1416 a	and Radar I	Hill Rd	1							
Jurisdiction	Box Eld	er, SD			1	* ~						
East/West Street	EB High	way 1416			1	٩			•			
North/South Street	Radar H	lill Rd			1		ሻ	<u>भी भीन भ</u>	∣ ╱┤╋│╊	<u>م</u> م		
Peak Hour Factor	0.94				1							
Turning Movement Dema	nd Volun	nes										
Approach		Eastbound	1		Westbound	d	1	Northboun	d		Southboun	d
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	20	475	205					132	138	5	206	
% Thrus in Shared Lane	50		50									
Lane Flow Rate and Adjust	tments											
Approach		Eastbound	1		Westbound	d	1	Northboun	d		Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	274	471			1		287			224		
Percent Heavy Vehicles	4	4					4			3		
Initial Departure Headway, hd (s)	3.20	3.20					3.20			3.20		
Initial Degree of Utilization, x	0.243	0.418					0.255			0.200		
Final Departure Headway, hd (s)	6.12	5.75					5.79			6.18		
Final Degree of Utilization, x	0.466	0.752					0.462			0.385		
Move-Up Time, m (s)	2.3	2.3					2.0			2.0		
Service Time, t _s (s)	3.82	3.45					3.79			4.18		
Capacity, Delay and Level	of Servic	е		<u> </u>			-			<u> </u>	<u> </u>	
Approach		Eastbound	1		Westbound	d	1	Northboun	d		Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	274	471					287			224		
Capacity (veh/h)	588	626					622			582		
95% Queue Length, Q ₉₅ (veh)	2.6	8.2					2.5			1.9		
Control Delay (s/veh)	14.1	25.3					13.7			13.0		
Level of Service, LOS	В	D					В			В		
Approach Delay (s/veh) LOS	21.2		С		<u> </u>		13.7		В	13.0		В
Intersection Delay (s/veh) LOS			18	8.0						С		

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		HCS	All-W	'ay Sto	p Con	trol Re	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Myers-Verh	age									
Agency/Co.					1		<u>_</u>	≠↓ ↓ ×	14 h	د ل <u>ـ</u>		
Date Performed	7/28/20)23			1			×	Ļ			
Analysis Year	2030				1	_*					K	
Analysis Time Period (hrs)	1.00				1	4					<u>*</u>	
Time Analyzed	AM Pea	k				*	_			4	←	
Project Description	Radar H	lill 1416 Co	rridor Stud	ly	1	<u> </u>	7			¥		
Intersection	Radar H	lill Rd and I	ong View	Dr	1							
Jurisdiction	Box Eld	er, SD			1	* ~						
East/West Street	Radar H	lill Rd				•		5	t.			
North/South Street	Long Vi	ew Dr			1		ሻ	মা মাদ ম	∕* ↑ ∱	<u>م</u> ،		
Peak Hour Factor	0.90				1							
Turning Movement Demai	nd Volun	nes										
Approach		Eastbound	l		Westbound	d		Northboun	d		Southboun	ıd
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	80	7	2	6	18	10	2	26	4	4	41	116
% Thrus in Shared Lane												
Lane Flow Rate and Adjust	tments											
Approach	T	Eastbound	1		Westbound	d		Northboun	d		Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	L	TR		L	TR		L	TR		L	TR	
Flow Rate, v (veh/h)	89	10		7	31		2	33		4	174	
Percent Heavy Vehicles	3	3		49	49		14	14		5	5	
Initial Departure Headway, hd (s)	3.20	3.20		3.20	3.20		3.20	3.20		3.20	3.20	
Initial Degree of Utilization, x	0.079	0.009		0.006	0.028		0.002	0.030		0.004	0.155	
Final Departure Headway, hd (s)	5.59	4.93		6.43	5.68		5.76	5.16		5.50	4.48	
Final Degree of Utilization, x	0.138	0.014		0.012	0.049		0.004	0.048		0.007	0.217	
Move-Up Time, m (s)	2.3	2.3		2.3	2.3		2.3	2.3		2.3	2.3	
Service Time, t _s (s)	3.29	2.63		4.13	3.38		3.46	2.86		3.20	2.18	
Capacity, Delay and Level	of Servic	e	,			,			,			
Approach	T	Eastbound	1		Westbound	d		Northboun	d		Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	L	TR		L	TR		L	TR		L	TR	
Flow Rate, v (veh/h)	89	10		7	31		2	33		4	174	
Capacity (veh/h)	644	730		560	634		625	697		655	803	
95% Queue Length, Q ₉₅ (veh)	0.5 0.0 0.0			0.0	0.2		0.0	0.2		0.0	0.8	
Control Delay (s/veh)	9.2	7.7		9.2	8.7		8.5	8.1		8.2	8.4	
Level of Service, LOS	А	A		A	A		A	A		A	A	
Approach Delay (s/veh) LOS	9.0	8.8		A	8.1		A	8.4		A		
Intersection Delay (s/veh) LOS			8	3.6						A		

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		HCS	All-W	ay Sto	p Con	trol Re	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Myers-Verh	age									
Agency/Co.					1		<u>_</u>			L.		
Date Performed	7/28/20)23			1			4	L.			
Analysis Year	2030				1	_*					K	
Analysis Time Period (hrs)	1.00				1						<u> </u>	
Time Analyzed	PM Pea	k			1	*	_*			A	←	
Project Description	Radar H	lill 1416 Co	rridor Stud	ly	1	<u> </u>	7			~		
Intersection	Radar H	lill Rd and I	ong View	Dr	1							
Jurisdiction	Box Eld	er, SD			1							
East/West Street	Radar H	lill Rd			1	•		5				
North/South Street	Long Vi	ew Dr			1		ካ	∗† •⊄≉ ™	╱│╋│╊	, <u>r</u>		
Peak Hour Factor	0.95				1							
Turning Movement Demai	nd Volum	nes			-							
Approach		Eastbound	1		Westbound	d		Northboun	d		Southboun	d
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	145	12	2	3	7	5	2	50	5	8	40	122
% Thrus in Shared Lane												
Lane Flow Rate and Adjust	tments											
Approach		Eastbound	1		Westbound	d		Northboun	d		Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	L	TR		L	TR		L	TR		L	TR	
Flow Rate, v (veh/h)	153	15		3	13		2	58		8	171	
Percent Heavy Vehicles	3	3		49	49		14	14		5	5	
Initial Departure Headway, hd (s)	3.20	3.20		3.20	3.20		3.20	3.20		3.20	3.20	
Initial Degree of Utilization, x	0.136	0.013		0.003	0.011		0.002	0.051		0.007	0.152	
Final Departure Headway, hd (s)	5.64	5.04		6.58	5.79		5.91	5.34		5.66	4.63	
Final Degree of Utilization, x	0.239	0.021		0.006	0.020		0.003	0.086		0.013	0.219	
Move-Up Time, m (s)	2.3	2.3		2.3	2.3		2.3	2.3		2.3	2.3	
Service Time, ts (s)	3.34	2.74		4.28	3.49		3.61	3.04		3.36	2.33	
Capacity, Delay and Level	of Servic	e										
Approach		Eastbound	1		Westbound	d		Northboun	d		Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	L	TR		L	TR		L	TR		L	TR	
Flow Rate, v (veh/h)	153	15		3	13		2	58		8	171	
Capacity (veh/h)	638	714		547	622		610	674		636	777	
95% Queue Length, Q ₉₅ (veh)	0.9 0.1 0.0				0.1		0.0	0.3		0.0	0.8	
Control Delay (s/veh)	10.1	7.8		9.3	8.6		8.6	8.5		8.4	8.6	
Level of Service, LOS	В	A		A	A		A	A		A	A	
Approach Delay (s/veh) LOS	9.9	_	A	8.8	_	A	8.5		A	8.6		A
Intersection Delay (s/veh) LOS			g	.1						Ą		

HCS M AWSC Version 2023 RadarHillRd-LongViewDr_PMPeak2030.xaw Generated: 7/28/2023 4:29:21 PM

	HCS Two-Way Stop-Control Report													
General Information		Site Information												
Analyst	Emma Myers-Verhage	Intersection	Radar Hill Rd and Highway 44											
Agency/Co.		Jurisdiction	Box Elder, SD											
Date Performed	7/28/2023	East/West Street	Highway 44											
Analysis Year	2030	North/South Street	Radar Hill Rd											
Time Analyzed	AM Peak	Peak Hour Factor	0.86											
Intersection Orientation	East-West	Analysis Time Period (hrs)	1.00											
Project Description	Radar Hill 1416 Corridor Study													
Lanes														

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Maior Street: East-West	

Vehicle Volumes and Adjustments

Approach		Eastb	ound			West	ound			North	oound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	1	2	0		0	1	0		0	1	0
Configuration		L	Т	TR		L	Т	TR			LTR				LTR	
Volume (veh/h)	0	16	232	6	0	3	221	19		5	2	2		21	3	11
Percent Heavy Vehicles (%)	5	5			3	3				6	6	6		10	10	10
Proportion Time Blocked																
Percent Grade (%)										()			()	
Right Turn Channelized																
Median Type Storage				Undiv	vided											
Critical and Follow-up He	adwa	ys														
Base Critical Headway (sec)		4.1				4.1				7.5	6.5	6.9		7.5	6.5	6.9
Critical Headway (sec)		4.20				4.16				7.62	6.62	7.02		7.70	6.70	7.10
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.25				2.23				3.56	4.06	3.36		3.60	4.10	3.40
Delay, Queue Length, and	Leve	of Se	ervice													
Flow Rate, v (veh/h)		19				3					10				41	
Capacity, c (veh/h)		1259				1276					494				531	
v/c Ratio		0.01				0.00					0.02				0.08	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.1				0.2	
Control Delay (s/veh)		7.9				7.8					12.5				12.3	
Level of Service (LOS)		А				А					В				В	
Approach Delay (s/veh)	0.5 0.1									12	5			12	3	
Approach LOS		ŀ	4			ŀ	4			E	3			E	3	

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HCS Two-Way Stop-Control Report													
General Information		Site Information											
Analyst	Emma Myers-Verhage	Intersection	Radar Hill Rd and Highway 44										
Agency/Co.		Jurisdiction	Box Elder, SD										
Date Performed	7/28/2023	East/West Street	Highway 44										
Analysis Year	2030	North/South Street	Radar Hill Rd										
Time Analyzed	PM Peak	Peak Hour Factor	0.85										
Intersection Orientation	East-West	Analysis Time Period (hrs)	1.00										
Project Description	Radar Hill 1416 Corridor Study												
Lanes													



Vehicle Volumes and Adju	ıstme	nts														
Approach		Eastb	ound			West	oound			North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	1	2	0		0	1	0		0	1	0
Configuration		L	Т	TR		L	Т	TR			LTR				LTR	
Volume (veh/h)	0	42	141	13	0	2	236	26		7	2	2		25	8	26
Percent Heavy Vehicles (%)	5	5			3	3				6	6	6		10	10	10
Proportion Time Blocked																
Percent Grade (%)											0				0	
Right Turn Channelized																
Median Type Storage		Undivided														
Critical and Follow-up He	adways															
Base Critical Headway (sec)		4.1				4.1				7.5	6.5	6.9		7.5	6.5	6.9
Critical Headway (sec)		4.20				4.16				7.62	6.62	7.02		7.70	6.70	7.10
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.25				2.23				3.56	4.06	3.36		3.60	4.10	3.40
Delay, Queue Length, and	l Leve	l of Se	ervice													
Flow Rate, v (veh/h)		49				2					13				69	
Capacity, c (veh/h)		1228				1384					481				534	
v/c Ratio		0.04				0.00					0.03				0.13	
95% Queue Length, Q ₉₅ (veh)		0.1				0.0					0.1				0.4	
Control Delay (s/veh)		8.1				7.6					12.7				12.8	
Level of Service (LOS)		A				A					В				В	
Approach Delay (s/veh)		1	.7			0	.1			12	2.7			12	2.8	
Approach LOS	A A									В				В		

		H	ICS 1	ſwo-'	Way	Stop	-Cor	ntrol	Repc	ort						
General Information							Site	Inform	natio	ı						
Analyst	Emma	a Myers-	Verhage				Inters	ection			Highv	vay 1416	and 15	1st Ave		
Agency/Co.							Jurisd	liction			Box E	lder, SD				
Date Performed	7/30/	2023					East/\	Nest Stre	eet		Highv	vay 1416	;			
Analysis Year	2050						North	/South S	Street		151st	Ave				
Time Analyzed	AM P	eak					Peak	Hour Fac	ctor		0.76					
Intersection Orientation	East-	Nest					Analy	sis Time	Period (hrs)	1.00					
Project Description	Rada	· Hill 141	6 Corrid	or Study	/											
anes																
				J 4 1 7 4 1 7	n ti Maju	۲۰۰۰ r Street: Ea	st-West	7 4 4 7 4 4 7 G								
Vehicle Volumes and Adju	istme	nts														
Approach		Eastb	ound			West	oound			North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		180	44				108	20						11		151
															4	

5					1	1			1			1		
Volume (veh/h)		180	44				108	20				11		151
Percent Heavy Vehicles (%)		9										16		16
Proportion Time Blocked														
Percent Grade (%)													0	
Right Turn Channelized														
Median Type Storage				Undi	vided									
Critical and Follow-up He	adwa	ys												
Base Critical Headway (sec)		4.1										7.1		6.2
Critical Headway (sec)		4.19										6.56		6.36
Base Follow-Up Headway (sec)		2.2										3.5		3.3
Follow-Up Headway (sec)		2.28										3.64		3.44
Delay, Queue Length, and	l Leve	l of Se	ervice	ļ										
Flow Rate, v (veh/h)		237											213	
Capacity, c (veh/h)		1368											769	
v/c Ratio		0.17											0.28	
95% Queue Length, Q ₉₅ (veh)		0.6											1.1	
Control Delay (s/veh)		8.2	1.5										11.5	
Level of Service (LOS)		A	А										В	
Approach Delay (s/veh)		6	.9									1'	1.5	
Approach LOS			Ą											

		ŀ	ICS 1	Гwo-'	Way	Stop	-Cor	ntrol	Repo	ort						
General Information							Site	Inforr	natio	n						
Analyst	Emma	a Myers-	Verhage	!			Inters	ection			High	way 1416	and 15	1st Ave		
Agency/Co.							Jurisd	liction			Box E	lder, SD				
Date Performed	7/30/	2023					East/\	Nest Stre	eet		Highv	way 1416	5			
Analysis Year	2050						North	/South S	Street		151st	Ave				
Time Analyzed	PM P	eak					Peak	Hour Fac	ctor		0.83					
Intersection Orientation	East-\	Nest					Analy	sis Time	Period (hrs)	1.00					
Project Description	Radar	· Hill 141	6 Corrid	or Study	/											
Lanes																
Vehicle Volumes and Adjustments																
Approach		Eastb	ound			West	oound			North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		97	95				57	5						6		67
Percent Heavy Vehicles (%)		9												16		16
Proportion Time Blocked																
Percent Grade (%)														()	
Right Turn Channelized	ed															
Median Type Storage				Undi	vided											
Critical and Follow-up He																
Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.19												6.56		6.36
Base Follow-Up Headway (sec)		2.2												3.5		3.3

Delay, Queue Length, and Level of Service

Follow-Up Headway (sec)

2.28

Flow Rate, v (veh/h)	117								88	
Capacity, c (veh/h)	1481								891	
v/c Ratio	0.08								0.10	
95% Queue Length, Q ₉₅ (veh)	0.3								0.3	
Control Delay (s/veh)	7.6	0.6							9.5	
Level of Service (LOS)	А	А							А	
Approach Delay (s/veh)	4	.2						9.	.5	
Approach LOS		4		 				ļ	4	

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3.44

	HCS Two-Way Stop	-Control Report												
eneral Information		Site Information												
Analyst	Emma Myers-Verhage	Intersection	Highway 1416 and Liberty Blvd											
Agency/Co.		Jurisdiction	Box Elder, SD											
Date Performed	7/30/2023	East/West Street	Highway 1416											
Analysis Year	2050	North/South Street	Liberty Blvd											
Time Analyzed	AM Peak	Peak Hour Factor	0.84											
ntersection Orientation	East-West	Analysis Time Period (hrs)	1.00											
Project Description	Radar Hill 1416 Corridor Study													
anes														
	nes J 4 J L 4 J L													



Vehicle Volumes and Adjustments

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I I L

Approach		Eastb	ound			West	ound			North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	0	1	0		0	1	0		0	1	1
Configuration		L		TR			LTR				LTR			LT		R
Volume (veh/h)		333	151	3		7	91	178		4	52	10		61	19	142
Percent Heavy Vehicles (%)		8				7				2	2	2		9	9	9
Proportion Time Blocked																
Percent Grade (%)										()			()	
Right Turn Channelized														Ye	es	
Median Type Storage	Und				vided											
Critical and Follow-up He	adwa	ys														
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.18				4.17				7.12	6.52	6.22		7.19	6.59	6.29
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.27				2.26				3.52	4.02	3.32		3.58	4.08	3.38
Delay, Queue Length, and	Leve	l of Se	ervice													
Flow Rate, v (veh/h)		396				8					79			95		169
Capacity, c (veh/h)		1207				1362					116			58		808
v/c Ratio		0.33				0.01					0.67			1.65		0.21
95% Queue Length, Q ₉₅ (veh)		1.5				0.0					4.9			24.6		0.8
Control Delay (s/veh)		9.4				7.7	0.1	0.1			94.3			1387.3		10.6
Level of Service (LOS)	A					А	А	А			F			F		В
Approach Delay (s/veh)	6.5					0	.3			94	l.3			50	6.7	
Approach LOS		ŀ	4				4				=			F		

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	HCS Two-Way Stop-Control Report														
General Information		Site Information													
Analyst	Emma Myers-Verhage	Intersection	Highway 1416 and Liberty Blvd												
Agency/Co.		Jurisdiction	Box Elder, SD												
Date Performed	7/30/2023	East/West Street	Highway 1416												
Analysis Year	2050	North/South Street	Liberty Blvd												
Time Analyzed	PM Peak	Peak Hour Factor	0.84												
Intersection Orientation	East-West	Analysis Time Period (hrs)	1.00												
Project Description	Radar Hill 1416 Corridor Study														
Lanes															
	××↓ ⊱ L ↓ L ⊂														



Vehicle Volumes and Adjustments

Approach		Eastb	ound			West	ound			North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	0	1	0		0	1	0		0	1	1
Configuration		L		TR			LTR				LTR			LT		R
Volume (veh/h)		99	86	13		7	66	69		8	16	2		131	27	110
Percent Heavy Vehicles (%)		8				7				2	2	2		9	9	9
Proportion Time Blocked																
Percent Grade (%)										()			()	
Right Turn Channelized														Ye	es	
Median Type Storage	Unc				vided											
Critical and Follow-up He	eadways															
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.18				4.17				7.12	6.52	6.22		7.19	6.59	6.29
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.27				2.26				3.52	4.02	3.32		3.58	4.08	3.38
Delay, Queue Length, and	Leve	of Se	ervice													
Flow Rate, v (veh/h)		118				8					31			188		131
Capacity, c (veh/h)		1383				1440					395			415		913
v/c Ratio		0.09				0.01					0.08			0.45		0.14
95% Queue Length, Q ₉₅ (veh)		0.3				0.0					0.3			2.4		0.5
Control Delay (s/veh)		7.8				7.5	0.0	0.0			14.9			20.8		9.6
Level of Service (LOS)	A					А	А	А			В			С		А
Approach Delay (s/veh)	3.9					0	.4			14	1.9			16	5.2	
Approach LOS		A	4				Ą			E	3			(2	

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HCS Two-Way Stop-Control Report

		controport	
General Information		Site Information	
Analyst	Emma Myers-Verhage	Intersection	WB Highway 1416 and S Ellsworth Rd
Agency/Co.		Jurisdiction	Box Elder, SD
Date Performed	7/30/2023	East/West Street	WB Highway 1416
Analysis Year	2050	North/South Street	S Ellsworth Rd
Time Analyzed	AM Peak	Peak Hour Factor	0.84
Intersection Orientation	North-South	Analysis Time Period (hrs)	1.00
Project Description	Radar Hill 1416 Corridor Study		

Lanes



Vehicle Volumes and Adjustments Approach Eastbound Westbound Northbound Southbound U U U L Т R L т R U L Т R L т R Movement 7 1U 2 Priority 10 11 12 8 9 1 3 4U 4 5 6 Number of Lanes 0 0 0 0 2 0 0 0 1 0 0 0 1 1 TR Configuration LT LT Т R 102 132 248 Volume (veh/h) 30 182 47 868 Percent Heavy Vehicles (%) 10 10 10 1 **Proportion Time Blocked** 0 Percent Grade (%) **Right Turn Channelized** Yes Median Type | Storage Undivided **Critical and Follow-up Headways** Base Critical Headway (sec) 7.1 6.5 6.2 4.1 Critical Headway (sec) 7.20 6.60 6.30 4.11 3.5 4.0 3.3 2.2 Base Follow-Up Headway (sec) Follow-Up Headway (sec) 3.59 4.09 3.39 2.21 Delay, Queue Length, and Level of Service Flow Rate, v (veh/h) 144 164 121 Capacity, c (veh/h) 97 130 1429 v/c Ratio 1.48 1.27 0.08 30.5 26.6 0.3 95% Queue Length, Q₉₅ (veh) Control Delay (s/veh) 1010.7 620.4 7.8 1.6 F F Level of Service (LOS) А А Approach Delay (s/veh) 802.8 2.3 Approach LOS F А

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		ŀ	ICS ⁻	Гwo-	Way	Stop	-Cor	ntrol	Repo	ort						
General Information							Site	Inforr	natio	n						
Analyst	Emma	a Mvers-	Verhage				Inters	ection			WB H	lighway	1416 and	d S Ellsw	orth Rd	
Agency/Co.	1	,					Jurisd	liction			Box E	lder, SD				
Date Performed	7/30/	2023					East/	Nest Stre	eet		WB H	lighway	1416			
Analysis Year	2050						North	/South S	Street		S Ellsv	worth Rc	ł			
Time Analyzed	PM P	eak					Peak	Hour Fac	ctor		0.90					
Intersection Orientation	North	-South					Analy	sis Time	Period (hrs)	1.00					
Project Description	Rada	· Hill 141	6 Corrid	lor Study	,						1					
Lanes	1															
	A A A A A A A A A A A A A A A A A A A															
Vehicle Volumes and Adju	ıstme	nts														
Approach		Eastb	ound			West	oound			North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	T	R	U	L	Т	R
Priority	1	10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes	1	0	0	0		0	2	0	0	0	1	0	0	0	1	1
Configuration	1					LT		TR		LT					Т	R
Volume (veh/h)	1					32	150	22		43	413				104	327
Percent Heavy Vehicles (%)						10	10	10		1						
Proportion Time Blocked																
Percent Grade (%)							0									
Right Turn Channelized														Y	es	
Median Type Storage	1			Undi	vided											
Critical and Follow-up He	adwa	ys														
Base Critical Headway (sec)	1					7.1	6.5	6.2		4.1						
Critical Headway (sec)	i					7.20	6.60	6.30		4.11						
Base Follow-Up Headway (sec)	i					3.5	4.0	3.3		2.2						
Follow-Up Headway (sec)	1					3.59	4.09	3.39		2.21						
Delay, Queue Length, and	l Leve	l of Se	ervice	-					-			-				
Flow Rate, v (veh/h)	1					119		108		48						
Capacity, c (veh/h)	1					350		387		1480						
v/c Ratio	i					0.34		0.28		0.03						
95% Queue Length, Q ₉₅ (veh)	İ					1.5		1.1		0.1						
Control Delay (s/veh)	i					20.6		17.9		7.5	0.3					

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Level of Service (LOS)

Approach LOS

Approach Delay (s/veh)

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С

		ŀ	ICS -	Гwo-	Way	Stop	-Cor	ntrol	Repo	ort						
General Information							Site	Inforr	natio	n						
Analyst	Emm	a Myers-	Verhage				Inters	ection			EB Hi	ghway 1	416 and	S Ellswo	rth Rd	
Agency/Co.							Jurisc	liction			Box E	lder, SD				
Date Performed	7/30/	2023					East/	West Stre	eet		EB Hi	ghway 1	416			
Analysis Year	2050						North	n/South S	Street		S Ells	worth Rc	1			
Time Analyzed	AM P	eak					Peak	Hour Fac	ctor		0.84					
Intersection Orientation	East-	West					Analy	sis Time	Period (hrs)	1.00					
Project Description	Rada	r Hill 141	6 Corrid	or Study	/						1					
Lanes	-															
				$ \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow$	h f	t t t t t t t t t t t t t t t t t t t	t tr	1447460								
Vehicle Volumes and Adj	ustme	nts														
Approach		Eastb	ound			West	bound			North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	0	0	0		0	1	0		0	1	0
Configuration	1	LT		TR								TR		LT		
Volume (veh/h)	1	748	356	19							209	60		63	98	
Percent Heavy Vehicles (%)	1	4									1	1		5	5	
Proportion Time Blocked	1															
Percent Grade (%)	1										0			()	
Right Turn Channelized	1															
Median Type Storage	1			Undi	vided											
Critical and Follow-up He	adwa	ys														
Base Critical Headway (sec)	1	5.3									6.5	6.9		7.5	6.5	
Critical Headway (sec)		5.38									6.52	6.92		7.60	6.60	
Base Follow-Up Headway (sec)		3.1									4.0	3.3		3.5	4.0	
Follow-Up Headway (sec)		3.14									4.01	3.31		3.55	4.05	
Delay, Queue Length, and	l Leve	l of Se	ervice													
Flow Rate, v (veh/h)	1	890					<u> </u>					320		192		
Capacity, c (yeh/h)		1146										6		4		
v/c Ratio		0.78										51 91		50.64		
95% Queue Length, Q _{es} (veh)	1	9.7										160.0		96.9		
Control Delay (s/veh)	1	18.8	3.2									92815. 6		91259. 1		
Level of Service (LOS)	C A											F		F		
Approach Delay (s/veh)	13.5									928	15.6			912	59.1	
Approach LOS		l	В								F			I	-	

		ŀ	HCS ⁻	Two-	Way	Stop	o-Cor	ntrol	Repo	ort						
General Information							Site	Infor	natio	n						
Analyst	Emm	a Myers-	Verhage	9			Inter	section			EB Hi	ghway 1	416 and	S Ellswo	rth Rd	
Agency/Co.	1	,					Juriso	diction			Box E	lder, SD				
Date Performed	7/30/	2023					East/	West Str	eet		EB Hi	ghway 1	416			
Analysis Year	2050						Nort	n/South	Street		S Ells	worth Ro	ł			
Time Analyzed	PM P	eak					Peak	Hour Fa	ctor		0.90					
Intersection Orientation	East-	West					Analy	/sis Time	Period ((hrs)	1.00					
Project Description	Rada	r Hill 141	l6 Corric	lor Study	/						1					
Lanes																
				$J \neq J \neq A \neq F \downarrow J$	h i		1 1 1 1 1 1 1 1 1 1 1 1 1 1	14 1 7 4 1 C G								
Vehicle Volumes and Adj	ustme	nts			IVIAJ											
Approach		Eastb	ound			West	bound			North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	10	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	0	0	0		0	1	0		0	1	0
Configuration		LT		TR								TR		LT		
Volume (veh/h)		352	165	178							96	23		23	109	
Percent Heavy Vehicles (%)	1	4									1	1		5	5	
Proportion Time Blocked	1															
Percent Grade (%)											0			. ()	
Right Turn Channelized																
Median Type Storage				Undi	vided											
Critical and Follow-up He	eadwa	ys														
Base Critical Headway (sec)	1	5.3									6.5	6.9		7.5	6.5	
Critical Headway (sec)	1	5.38									6.52	6.92		7.60	6.60	
Base Follow-Up Headway (sec)		3.1									4.0	3.3		3.5	4.0	
Follow-Up Headway (sec)	1	3.14									4.01	3.31		3.55	4.05	
Delay, Queue Length, and	d Leve	l of Se	ervice		<u> </u>	<u> </u>	<u> </u>		<u> </u>			<u> </u>	<u> </u>	<u> </u>		
Elow Bate y (yeh/h)	1	391			1	1	<u> </u>		1		1	132		147		
Capacity c (veh/h)		1146										164		83		
v/c Ratio		0.34										0.81		176		
95% Queue Length, Osc (veh)		15										82		37.6		
Control Delay (s/veh)	-	9.8	07									102.1		1513.9	_	
level of Service (LOS)		Δ	Δ									F		F		
Approach Delay (s/yeb)	-	5	1							10)2 1			151	3.9	
Approach LOS	-		Δ								F			1.5	F	
hppioacii 203	-															

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HCS Two-Way Stop-Control Report													
General Information		Site Information											
Analyst	Emma Myers-Verhage	Intersection	WB Highway 1416 and Radar Hill Rd										
Agency/Co.		Jurisdiction	Box Elder, SD										
Date Performed	7/30/2023	East/West Street	WB Highway 1416										
Analysis Year	2050	North/South Street	Radar Hill Rd										
Time Analyzed	AM Peak	Peak Hour Factor	0.88										
Intersection Orientation	East-West	Analysis Time Period (hrs)	1.00										

Lanes

Approach

Project Description

Vehicle Volumes and Adjustments

Genera Analyst



Westbound

Northbound

U т R U R U Т R L L т L Movement 1U 2 3 4U 4 7 8 9 Priority 1 5 6 0 1 Number of Lanes 0 0 0 0 0 2 0 0 0 LT TR LT Configuration Volume (veh/h) 120 512 8 202 28 5 Percent Heavy Vehicles (%) 4 4 **Proportion Time Blocked** Percent Grade (%) 0 **Right Turn Channelized** Undivided Median Type | Storage **Critical and Follow-up Headways**

Radar Hill 1416 Corridor Study

Eastbound

Base Critical Headway (sec)					5.3			7.5	6.5			6.5	6.9
Critical Headway (sec)					5.40			7.58	6.58			6.56	6.96
Base Follow-Up Headway (sec)					3.1			3.5	4.0			4.0	3.3
Follow-Up Headway (sec)					3.15			3.54	4.04			4.03	3.33
Delay, Queue Length, and	l Leve	l of Se	ervice										
Flow Rate, v (veh/h)					136			261					67
Capacity, c (veh/h)					1143			266					314
v/c Ratio					0.12			0.98					0.21
95% Queue Length, Q ₉₅ (veh)					0.4			18.6					0.8
Control Delay (s/veh)					8.6	0.8		158.0					19.6
Level of Service (LOS)					А	А		F					С
Approach Delay (s/veh)					2	.3		15	8.0		19	9.6	
Approach LOS						4			F		(C	

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HCSTM TWSC Version 2023 WBHwy1416-RadarHillRd_AMPeak2050.xtw Southbound

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HCS Two-Way Stop-Control Report												
General Information		Site Information										
Analyst	Emma Myers-Verhage	Intersection	WB Highway 1416 and Radar Hill Rd									
Agency/Co.		Jurisdiction	Box Elder, SD									
Date Performed	7/30/2023	East/West Street	WB Highway 1416									
Analysis Year	2050	North/South Street	Radar Hill Rd									
Time Analyzed	PM Peak	Peak Hour Factor	0.94									
Intersection Orientation	East-West	Analysis Time Period (hrs)	1.00									
Project Description	Radar Hill 1416 Corridor Study											

Lanes



Vehicle Volumes and Adjustments Approach Eastbound Westbound Northbound Southbound U U U L т R L т R U L Т R L т R Movement 1U 7 9 10 12 Priority 1 2 3 4U 4 5 6 8 11 Number of Lanes 0 0 0 0 0 0 2 0 0 1 0 0 1 0 TR Configuration LT LT TR 237 134 20 Volume (veh/h) 697 4 38 12 3 Percent Heavy Vehicles (%) 5 4 4 3 **Proportion Time Blocked** 0 0 Percent Grade (%) **Right Turn Channelized** Median Type | Storage Undivided Critical and Follow-up Headways Base Critical Headway (sec) 5.3 7.5 6.5 6.5 6.9 Critical Headway (sec) 5.40 7.58 6.58 6.56 6.96 3.1 3.5 4.0 4.0 3.3 Base Follow-Up Headway (sec) Follow-Up Headway (sec) 3.15 3.54 4.04 4.03 3.33 Delay, Queue Length, and Level of Service Flow Rate, v (veh/h) 252 183 34 Capacity, c (veh/h) 1143 138 176 v/c Ratio 0.22 1.32 0.19 0.8 31.1 0.7 95% Queue Length, Q_{95} (veh) 9.0 1.5 703.8 30.4 Control Delay (s/veh) Level of Service (LOS) А А F D Approach Delay (s/veh) 703.8 30.4 3.4

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Approach LOS

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А

F

		HCS	All-W	ay Sto	op Con	trol R	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Myers-Verh	age				-					
Agency/Co.					1			× + + ×		د ل <u>ہ</u>		
Date Performed	7/30/20)23			1							
Analysis Year	2050				1	_*					K	
Analysis Time Period (hrs)	1.00				1	4					<u> </u>	
Time Analyzed	AM Pea	k			1	*	_≯_				← x	
Project Description	Radar H	lill 1416 Co	rridor Stud	ly	1		7					
Intersection	EB High	way 1416 a	and Radar I	Hill Rd	1						¥ +	
Jurisdiction	Box Eld	er, SD			1	<u>*</u>						
East/West Street	EB High	way 1416			1				•			
North/South Street	Radar H	lill Rd			1		ሻ	<u>भ</u> ी भीज ¹	╷ ╱╵ ↑ │Ѣ			
Peak Hour Factor	0.86				1							
Turning Movement Dema	nd Volun	nes										
Approach		Eastbound	1		Westboun	d	1	Northboun	d		Southboun	ıd
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	5	794	73					220	356	13	123	
% Thrus in Shared Lane	50		50									
Lane Flow Rate and Adjus	tments											
Approach		Eastbound	1		Westboun	d		Northboun	d		Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	467	547					670			158		
Percent Heavy Vehicles	3	3					4			3		
Initial Departure Headway, hd (s)	3.20	3.20					3.20			3.20		
Initial Degree of Utilization, x	0.416	0.486					0.595			0.141		
Final Departure Headway, hd (s)	6.81	6.69			1		5.83			7.04		
Final Degree of Utilization, x	0.884	1.016			1		1.084			0.309		
Move-Up Time, m (s)	2.3	2.3					2.0			2.0		
Service Time, ts (s)	4.51	4.39					3.83			5.04		
Capacity, Delay and Level	of Servic	e										
Approach		Eastbound	1		Westboun	d	1	Northboun	d		Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	467	547					670			158		
Capacity (veh/h)	529	538					618			511		
95% Queue Length, Q ₉₅ (veh)	15.2	30.8					47.3			1.3		
Control Delay (s/veh)	52.4	135.1					215.6			13.2		
Level of Service, LOS	F	F					F			В		
Approach Delay (s/veh) LOS	97.0		F				215.6	;	F	13.2		В
Intersection Delay (s/veh) LOS			13	2.9						F		

HCS M AWSC Version 2023 EBHwy1416-RadarHillRd_AMPeak2050.xaw

		HCS	All-W	ay Sto	op Con	itrol Re	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Ayers-Verh	age				-					
Agency/Co.					1			<u>*</u>		د ل <u>ہ</u>		
Date Performed	7/30/20	23			1							
Analysis Year	2050				1	_*					×	
Analysis Time Period (hrs)	1.00				1	*					<u> </u>	
Time Analyzed	PM Pea	k			1	*	4				←	
Project Description	Radar H	lill 1416 Co	rridor Stud	ly	1		7				$\frac{2}{3}$	
Intersection	EB High	way 1416 a	and Radar	Hill Rd	1							
Jurisdiction	Box Eld	er, SD			1	× ~						
East/West Street	EB High	way 1416			1	٩			•			
North/South Street	Radar H	lill Rd			1		ሻ	भी भी <i>न</i> ¹⁴	╷ ╱┤╋│╊	<u>م</u> ،		
Peak Hour Factor	0.85				1							
Turning Movement Demai	nd Volun	nes										
Approach		Eastbound	1		Westboun	d	1	Northboun	d		Southboun	ıd
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	23	545	239					148	158	5	232	
% Thrus in Shared Lane	50		50		1							
Lane Flow Rate and Adjust	tments											
Approach	T	Eastbound	1		Westboun	d	1	Northboun	d		Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	348	602					360			279		
Percent Heavy Vehicles	3	3					4			3		
Initial Departure Headway, hd (s)	3.20	3.20					3.20			3.20		
Initial Degree of Utilization, x	0.309	0.535					0.320			0.248		
Final Departure Headway, hd (s)	6.58	6.21					6.14			6.57		
Final Degree of Utilization, x	0.636	1.038					0.614			0.509		
Move-Up Time, m (s)	2.3	2.3					2.0			2.0		
Service Time, ts (s)	4.28	3.91			1		4.14			4.57		
Capacity, Delay and Level	of Servic	e										
Approach		Eastbound	1		Westboun	d	1	Northboun	d		Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	348	602					360			279		
Capacity (veh/h)	547	579					586			548		
95% Queue Length, Q ₉₅ (veh)	5.0	36.1					4.6			3.0		
Control Delay (s/veh)	20.6	156.7					18.8			16.3		
Level of Service, LOS	С	F					С			С		
Approach Delay (s/veh) LOS	106.9)	F				18.8		С	16.3		С
Intersection Delay (s/veh) LOS			7	1.0						F		

HCS M AWSC Version 2023 EBHwy1416-RadarHillRd_PMPeak2050.xaw Generated: 8/22/2023 2:53:19 PM

		HCS	All-W	ay Sto	p Con	trol Re	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Myers-Verh	age									
Agency/Co.					1			× + + ×	└▖♠▖╞	د ل <u>ہ</u>		
Date Performed	7/30/20)23			1			4	Ļ			
Analysis Year	2050				1	_*					K	
Analysis Time Period (hrs)	1.00				1						<u> </u>	
Time Analyzed	AM Pea	k			1	*	_*			X	←	
Project Description	Radar H	lill 1416 Co	rridor Stud	ly	1	<u> </u>	7			x		
Intersection	Radar H	lill Rd and I	ong View	Dr	1							
Jurisdiction	Box Eld	er, SD			1							
East/West Street	Long Vi	ew Dr			1	•		5	1			
North/South Street	Radar H	lill Rd			1		ሻ	⊾ কা শ	╱│ ↑ │Ѣ			
Peak Hour Factor	0.90				1							
Turning Movement Demai	nd Volun	nes			<u>.</u>							
Approach		Eastbound	1		Westbound	d		Northboun	d		Southboun	d
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	114	10	2	7	25	12	2	32	4	4	50	166
% Thrus in Shared Lane												
Lane Flow Rate and Adjust	ments											
Approach		Eastbound	1		Westbound	d		Northboun	d		Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	L	TR		L	TR		L	TR		L	TR	
Flow Rate, v (veh/h)	127	13		8	41		2	40		4	240	
Percent Heavy Vehicles	3	3		49	49		14	14		5	5	
Initial Departure Headway, hd (s)	3.20	3.20		3.20	3.20		3.20	3.20		3.20	3.20	
Initial Degree of Utilization, x	0.113	0.012		0.007	0.037		0.002	0.036		0.004	0.213	
Final Departure Headway, hd (s)	5.79	5.17		6.67	5.94		5.99	5.41		5.67	4.63	
Final Degree of Utilization, x	0.204	0.019		0.014	0.068		0.004	0.060		0.007	0.309	
Move-Up Time, m (s)	2.3	2.3		2.3	2.3		2.3	2.3		2.3	2.3	
Service Time, ts (s)	3.49	2.87		4.37	3.64		3.69	3.11		3.37	2.33	
Capacity, Delay and Level	of Servic	e										
Approach		Eastbound	1		Westbound	b		Northboun	d		Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	L	TR		L	TR		L	TR		L	TR	
Flow Rate, v (veh/h)	127	13		8	41		2	40		4	240	
Capacity (veh/h)	622	696		540	606		601	665		635	778	
95% Queue Length, Q ₉₅ (veh)	0.8	0.1		0.0	0.2		0.0	0.2		0.0	1.3	
Control Delay (s/veh)	10.0	8.0		9.5	9.1		8.7	8.5		8.4	9.4	
Level of Service, LOS	А	A		A	A		A	A		A	A	
Approach Delay (s/veh) LOS	9.8		A	9.1		A	8.5		A	9.4		A
Intersection Delay (s/veh) LOS			g	.4	A							

HCS M AWSC Version 2023 RadarHillRd-LongViewDr_AMPeak2050.xaw Generated: 7/30/2023 3:37:01 PM

		HCS	All-W	ay Sto	p Con	trol Re	eport							
General and Site Information	on				Lanes									
Analyst	Emma N	Ayers-Verh	age				-							
Agency/Co.					1			* + *	L	L.				
Date Performed	7/30/20	23			1			*	Ļ					
Analysis Year	2050				1	_*					K			
Analysis Time Period (hrs)	1.00				1	4					<u> </u>			
Time Analyzed	PM Pea	k			1	*	_			4	←			
Project Description	Radar H	lill 1416 Co	rridor Stud	ly	1		7			v -				
Intersection	Radar H	lill Rd and I	Long View	Dr	1						¥ •			
Jurisdiction	Box Eld	er, SD			1	* 								
East/West Street	Long Vi	ew Dr			1	•		5	1					
North/South Street	Radar H	lill Rd			1		ሻ	। মা মাদ ™	╱│╀│╊	- - -				
Peak Hour Factor	0.85				1									
Turning Movement Deman	d Volun	nes												
Approach		Eastbound	1		Westbound	d	, I	Northboun	d	9	Southboun	d		
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R		
Volume (veh/h)	50	169	16	2	283	31	8	2	2	30	9	31		
% Thrus in Shared Lane														
Lane Flow Rate and Adjust	ments													
Approach		Eastbound	1		Westbound	d	· ·	Northboun	d	9	Southboun	d		
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3		
Configuration	L	TR		L	TR		L	TR		L	TR			
Flow Rate, v (veh/h)	59	218		2	369		9	5		35	47			
Percent Heavy Vehicles	3	3		49	49		14	14		5	5			
Initial Departure Headway, hd (s)	3.20	3.20		3.20	3.20		3.20	3.20		3.20	3.20			
Initial Degree of Utilization, x	0.052	0.193		0.002	0.328		0.008	0.004		0.031	0.042			
Final Departure Headway, hd (s)	5.70	5.14		6.38	5.81		7.01	6.16		6.74	5.70			
Final Degree of Utilization, x	0.093	0.311		0.004	0.596		0.018	0.008		0.066	0.074			
Move-Up Time, m (s)	2.3	2.3		2.3	2.3		2.3	2.3		2.3	2.3			
Service Time, t₅ (s)	3.40	2.84		4.08	3.51		4.71	3.86		4.44	3.40			
Capacity, Delay and Level o	f Servic	e												
Approach		Eastbound	1		Westbound	d	1	Northboun	d	9	Southboun	d		
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3		
Configuration	L	TR		L	TR		L	TR		L	TR			
Flow Rate, v (veh/h)	59	218		2	369		9	5		35	47			
Capacity (veh/h)	632	701		565	620		513	584		534	632			
95% Queue Length, Q₅5 (veh)	0.3	1.3		0.0	4.3		0.1	0.0		0.2	0.2			
Control Delay (s/veh)	9.0	10.1		9.1	17.0		9.8	8.9		9.9	8.9			
Level of Service, LOS	A	В		A	С		A	А		A	A			
Approach Delay (s/veh) LOS	9.9		A	16.9		С	9.5		A	9.3		A		
Intersection Delay (s/veh) LOS			1:	3.3	B					B				

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	HCS Two-Way Stop-Control Report											
General Information		Site Information										
Analyst	Emma Myers-Verhage	Intersection	Radar Hill Rd and Highway 44									
Agency/Co.		Jurisdiction	Box Elder, SD									
Date Performed	7/30/2023	East/West Street	Highway 44									
Analysis Year	2050	North/South Street	Radar Hill Rd									
Time Analyzed	AM Peak	Peak Hour Factor	0.86									
Intersection Orientation	East-West	Analysis Time Period (hrs)	1.00									
Project Description	Radar Hill 1416 Corridor Study											
Lanes												
		<u>*</u>										

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Vehicle Volumes and Adjustments

Approach	Eastbound Westbo				Westbound Northbound						Southbound					
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	1	2	0		0	1	0		0	1	0
Configuration		L	Т	TR		L	Т	TR			LTR				LTR	
Volume (veh/h)	0	20	278	7	0	3	265	22		6	2	2		25	3	13
Percent Heavy Vehicles (%)	5	5			3	3				6	6	6		10	10	10
Proportion Time Blocked																
Percent Grade (%)										()			()	
Right Turn Channelized																
Median Type Storage				Undiv	vided											
Critical and Follow-up He	adwa	ys														
Base Critical Headway (sec)		4.1				4.1				7.5	6.5	6.9		7.5	6.5	6.9
Critical Headway (sec)		4.20				4.16				7.62	6.62	7.02		7.70	6.70	7.10
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.25				2.23				3.56	4.06	3.36		3.60	4.10	3.40
Delay, Queue Length, and	Leve	l of Se	ervice													
Flow Rate, v (veh/h)		23				3					12				48	
Capacity, c (veh/h)		1201				1218					422				465	
v/c Ratio		0.02				0.00					0.03				0.10	
95% Queue Length, Q ₉₅ (veh)		0.1				0.0					0.1				0.3	
Control Delay (s/veh)		8.1				8.0					13.8				13.6	
Level of Service (LOS)		А				А					В				В	
Approach Delay (s/veh)		0	.5			0	.1			13	3.8			13	8.6	
Approach LOS		ļ	4				4			E	3			E	3	

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HCS 11 TWSC Version 2023 RadarHillRd-Hwy44_AMPeak2050.xtw

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HCS Two-Way Stop-Control Report												
General Information		Site Information										
Analyst	Emma Myers-Verhage	Intersection	Radar Hill Rd and Highway 44									
Agency/Co.		Jurisdiction	Box Elder, SD									
Date Performed	7/30/2023	East/West Street	Highway 44									
Analysis Year	2050	North/South Street	Radar Hill Rd									
Time Analyzed	PM Peak	Peak Hour Factor	0.85									
Intersection Orientation	East-West	Analysis Time Period (hrs)	1.00									
Project Description	Radar Hill 1416 Corridor Study											
Lanes												



Vehicle Volumes and Adju	istme	nts														
Approach		Eastb	ound			West	oound			North	bound			South	bound	
Movement	U	L	Т	R	U	L	Т	R	U	L	T	R	U	L	Т	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	1	2	0		0	1	0		0	1	0
Configuration		L	Т	TR		L	Т	TR			LTR				LTR	
Volume (veh/h)	0	50	169	16	0	2	283	31		8	2	2		30	9	31
Percent Heavy Vehicles (%)	5	5			3	3				6	6	6		10	10	10
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type Storage				Undi	vided											
Critical and Follow-up He	adwa	ys														
Base Critical Headway (sec)		4.1				4.1				7.5	6.5	6.9		7.5	6.5	6.9
Critical Headway (sec)		4.20				4.16				7.62	6.62	7.02		7.70	6.70	7.10
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.25				2.23				3.56	4.06	3.36		3.60	4.10	3.40
Delay, Queue Length, and	Leve	l of Se	ervice													
Flow Rate, v (veh/h)		59				2					14				82	
Capacity, c (veh/h)		1164				1342					409				466	
v/c Ratio		0.05				0.00					0.03				0.18	
95% Queue Length, Q ₉₅ (veh)		0.2				0.0					0.1				0.6	
Control Delay (s/veh)		8.3				7.7					14.1				14.4	
Level of Service (LOS)		А				А					В				В	
Approach Delay (s/veh)		1.8 0.0 14.1									14.4					
Approach LOS		1	4			/	4			I	3			I	3	

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Appendix E: Signal Warrant Analysis Results

Radar Hill - 1416 Corridor Study



City/County: Box Elder, SD Intersection: Hwy 1416 and Liberty Blvd

ta	Date:	8/25/2023	Approach	Speed	Lanes	RT %
Dai	Population < 10,000:	No	Major 1: EB Highway 1416	50	2	100%
١٨I	Existing Signal:	No	Major 3: WB Highway 1416	50	2	100%
pn	0.70 Factor Used:	Yes	Minor 2: NB Liberty Blvd	25	1	100%
St	0.80 Factor Used:	No	Minor 4: SB Liberty Blvd	45	2	100%

		1	1	L		1	I					· · · · · · · · · · · · · · · · · · ·
	Time of Day	Major #1	Major #3	Total 1+3	Major 1A/1B 420/630	Minor #2	Minor #2 1A/1B 140/070	Minor #4	Minor #4 1A/1B 140/070	Both Met 1A/1B	Crash Warrant	MWSA Warrant
	6:00 - 7:00	89	117	206	/	20	/	50	/	1		
	7:00 - 8:00	485	247	732	X/X	68	/	213	X/X	X/X	х	х
	8:00 - 9:00	66	89	155	/	17	/	60	/	/		
sis	9:00 - 10:00	70	57	127	/	19	/	63	/	1		
a l	10:00 - 11:00	46	33	79	/	12	/	47	/	1		
An A	11:00 - 12:00	82	62	144	/	15	/	70	/	1		
LS I	12:00 - 1:00	100	64	164	/	12	/	74	/X	1		
a	1:00 - 2:00	91	65	156	/	21	/	108	/X	/		
L L	2:00 - 3:00	94	66	160	/	24	/	92	/X	1		
Š	3:00 - 4:00	177	119	296	/	31	/	217	X/X	1		х
-	4:00 - 5:00	134	85	219	/	18	/	163	X/X	1		х
	5:00 - 6:00	132	96	228	/	26	/	179	X/X	1		х
	6:00 - 7:00	63	34	97	/	14	/	53	/	1		
	7:00 - 8:00	66	52	118	/	14	/	60	/	1		
	8:00 - 9:00	48	37	85	/	10	/	43	/	1		
	9.00 - 10.00	31	24	55	/	7	/	28	/	/		

	Criteria	Hours Met	Hours Required	Warrants Met	
s s	Warrant 1a: Minimum Vehicular Volume	1	8	Not Met	
esult	Warrant 1b: Interruption of Continuous Traffic	1	8	Not Met	
	Warrant 2: Four-Hour Vehicular Volume	1	4	Not Met	
<u>~</u>	Warrant 7: Crash Experience	1	8	Not Met	
	Multi-way Stop Applications (MWSA)	Multi-way Stop Applications (MWSA) 4 8			
Radar Hill 1	416 Corridor Study			No-Build (2030)	
Cit	y/County: Box Elder, SD				
Int	errortion, Hun, 1416 and Liberty Rhyd				

Radar Hill 1416 Corridor Study

City/County: Box Elder, SD Intersection: Hwy 1416 and Liberty Blvd

a	Date:	8/25/2023	Approach	Speed	Lanes	RT %
Dat	Population < 10,000:	No	Major 1: EB Highway 1416	50	2	100%
l <u>≻</u>	Existing Signal:	No	Major 3: WB Highway 1416	50	2	100%
pn:	0.70 Factor Used:	Yes	Minor 2: NB Liberty Blvd	25	1	100%
5 J	0.80 Factor Used:	No	Minor 4: SB Liberty Blvd	45	2	100%



	Criteria	Hours Met	Hours Required	Warrants Met
Results	Warrant 2: Four-Hour Vehicular Volume	1	4	Not Met
	Warrant 3: Peak Hour	0	1	Not Met



City/County: Box Elder, SD Intersection: Hwy 1416 and Liberty Blvd

	Data	8/25/2023	Approach	Croad	lanos	DT 0/
até	Date.	0/25/2025	Approach	speed	Lanes	KI 70
Dš	Population < 10,000:	No	Major 1: EB Highway 1416	50	2	100%
۲,	Existing Signal:	No	Major 3: WB Highway 1416	50	2	100%
on	0.70 Factor Used:	Yes	Minor 2: NB Liberty Blvd	25	1	100%
St	0.80 Factor Used:	No	Minor 4: SB Liberty Blvd	45	2	100%

	Time of Day	Major #1	Major #3	Total 1+3	Major 1A/1B 420/630	Minor #2	Minor #2 1A/1B 140/070	Minor #4	Minor #4 1A/1B 140/070	Both Met 1A/1B	Crash Warrant	MWSA Warrant
	6:00 - 7:00	93	123	216	/	21	/	52	/	1		
	7:00 - 8:00	493	254	747	X/X	70	/	217	X/X	X/X	х	х
	8:00 - 9:00	68	94	162	/	18	/	63	/	/		
sis	9:00 - 10:00	73	59	132	/	20	/	66	/	1		
a l	10:00 - 11:00	48	35	83	/	13	/	49	/	1		
An	11:00 - 12:00	85	65	150	/	16	/	74	/X	/		
ts	12:00 - 1:00	104	67	171	/	13	/	78	/X	1		
a	1:00 - 2:00	95	68	163	/	22	/	113	/X	/		
L L	2:00 - 3:00	97	69	166	/	26	/	96	/X	1		
Š	3:00 - 4:00	182	123	305	/	33	/	225	X/X	1		х
	4:00 - 5:00	139	89	228	/	19	/	171	X/X	/		х
	5:00 - 6:00	137	101	238	/	28	/	188	X/X	1		х
	6:00 - 7:00	64	36	100	/	15	/	55	/	/		
	7:00 - 8:00	68	55	123	/	14	/	63	/	/		
	8:00 - 9:00	49	39	88	/	11	/	45	/	/		
	9:00 - 10:00	33	25	58	1	7	/	30	/	1		

	Criteria	Hours Met	Hours Required	Warrants Met	
s	Warrant 1a: Minimum Vehicular Volume	1	8	Not Met	
Result	Warrant 1b: Interruption of Continuous Traffic	1	8	Not Met	
	Warrant 2: Four-Hour Vehicular Volume	1	4	Not Met	
	Warrant 7: Crash Experience	1	8	Not Met	
	Multi-way Stop Applications (MWSA)	Multi-way Stop Applications (MWSA) 4 8			
Radar Hill 141	6 Corridor Study			No-Build (2050)	
City/C	County: Box Elder, SD				
Interc	ection: Hwy 1416 and Liberty Blvd				

Radar Hill 1416 Corridor Study

City/County: Box Elder, SD Intersection: Hwy 1416 and Liberty Blvd

ta	Date:	8/25/2023	Approach	Speed	Lanes	RT %
Dat	Population < 10,000:	No	Major 1: EB Highway 1416	50	2	100%
l <u>≻</u>	Existing Signal:	No	Major 3: WB Highway 1416	50	2	100%
on	0.70 Factor Used:	Yes	Minor 2: NB Liberty Blvd	25	1	100%
st	0.80 Factor Used:	No	Minor 4: SB Liberty Blvd	45	2	100%



	Criteria	Hours Met	Hours Required	Warrants Met
Results	Warrant 2: Four-Hour Vehicular Volume	1	4	Not Met
	Warrant 3: Peak Hour	0	1	Not Met



City/County: Box Elder, SD Intersection: Hwy 1416 and S Ellsworth Rd

ta	Date:	8/25/2023	Approach	Speed	Lanes	RT %
Dai	Population < 10,000:	No	Major 1: EB Highway 1416	55	2	100%
_×	Existing Signal:	No	Major 3: WB Highway 1416	50	2	100%
pn	0.70 Factor Used:	Yes	Minor 2: NB S Ellsworth Rd	25	1	100%
St	0.80 Factor Used:	No	Minor 4: SB S Ellsworth Rd	35	1	100%

	Time of Day	Major #1	Major #3	Total 1+3	Major	Minor #2	Minor #2	Minor #4	Minor #4	Both Met	Crash	MWSA
	Time of Day	Iviajoi #1	Iviajui #3	10(a) 1+5	420/630	1011101 #2	105/053	1011101 #4	105/053	1A/1B	Warrant	Warrant
	6:00 - 7:00	741	39	780	X/X	93	/X	101	/X	/X	Х	х
	7:00 - 8:00	1013	236	1249	X/X	247	X/X	364	X/X	X/X	х	х
	8:00 - 9:00	336	67	403	/	59	/X	158	X/X	1		х
sis	9:00 - 10:00	294	52	346	/	46	/	170	X/X	1		х
	10:00 - 11:00	281	67	348	/	38	/	177	X/X	1		х
Ϋ́Α̈́	11:00 - 12:00	324	62	386	/	36	/	196	X/X	1		х
ts [12:00 - 1:00	407	78	485	X/	46	/	233	X/X	X/	х	х
an	1:00 - 2:00	366	76	442	X/	56	/X	179	X/X	X/		х
Ľ.	2:00 - 3:00	410	92	502	X/	48	/	217	X/X	X/	х	х
N N	3:00 - 4:00	454	178	632	X/X	78	/X	450	X/X	X/X	х	х
	4:00 - 5:00	484	109	593	X/	65	/X	383	X/X	X/	х	х
	5:00 - 6:00	541	119	660	X/X	82	/X	343	X/X	X/X	х	х
	6:00 - 7:00	186	41	227	/	35	/	139	X/X	1		х
	7:00 - 8:00	285	52	337	/	41	/	148	X/X	1		х
	8:00 - 9:00	204	37	241	/	30	/	106	X/X	1		
	9:00 - 10:00	134	25	159	/	19	/	69	/X	/		

	Criteria	Hours Met	Hours Required	Warrants Met	
s	Warrant 1a: Minimum Vehicular Volume	7	8	Not Met	
et l	Warrant 1b: Interruption of Continuous Traffic	4	8	Not Met	
esi	Warrant 2: Four-Hour Vehicular Volume	7	4	Met	
~	Warrant 7: Crash Experience	7	8	Not Met	
	Multi-way Stop Applications (MWSA)	Multi-way Stop Applications (MWSA) 14 8			
Radar Hill 14	16 Corridor Study			No-Build (2030)	
City	/County: Box Elder, SD				
Inte	rsection: Hwy 1416 and S Ellsworth Rd				

Radar Hill 1416 Corridor Study

City/County: Box Elder, SD Intersection: Hwy 1416 and S Ellsworth Rd

ta	Date:	8/25/2023	Approach	Speed	Lanes	RT %
Dai	Population < 10,000:	No	Major 1: EB Highway 1416	55	2	100%
_ <u>></u>	Existing Signal:	No	Major 3: WB Highway 1416	50	2	100%
n	0.70 Factor Used:	Yes	Minor 2: NB S Ellsworth Rd	25	1	100%
st	0.80 Factor Used:	No	Minor 4: SB S Ellsworth Rd	35	1	100%



Criteria	Criteria	Hours Met	Hours Required	Warrants Met
Results	Warrant 2: Four-Hour Vehicular Volume	7	4	Met
	Warrant 3: Peak Hour	4	1	Met



City/County: Box Elder, SD Intersection: Hwy 1416 and S Ellsworth Rd

ta	Date:	8/25/2023	Approach	Speed	Lanes	RT %
Dai	Population < 10,000:	No	Major 1: EB Highway 1416	55	2	100%
Γ	Existing Signal:	No	Major 3: WB Highway 1416	50	2	100%
pn	0.70 Factor Used:	Yes	Minor 2: NB S Ellsworth Rd	25	1	100%
St	0.80 Factor Used:	No	Minor 4: SB S Ellsworth Rd	35	1	100%

	Time of Day	Maior #1	Maior #3	Total 1+3	Major	Minor #2	Minor #2	Minor #4	Minor #4	Both Met	Crash	MWSA
	Time of Duy	iviajor #1	iviajor #3	10101115	420/630	1411101 112	105/053	1411101 114	105/053	1A/1B	Warrant	Warrant
	6:00 - 7:00	853	43	896	X/X	107	X/X	115	X/X	X/X	х	х
	7:00 - 8:00	1134	245	1379	X/X	271	X/X	400	X/X	X/X	х	х
	8:00 - 9:00	384	74	458	X/	68	/X	181	X/X	X/		х
sis	9:00 - 10:00	337	57	394	/	53	/	195	X/X	1		х
al	10:00 - 11:00	322	75	397	/	44	/	203	X/X	1		х
An A	11:00 - 12:00	371	68	439	X/	41	/	225	X/X	X/		х
ts	12:00 - 1:00	466	86	552	X/	53	/	267	X/X	X/	х	х
a	1:00 - 2:00	419	84	503	X/	64	/X	206	X/X	X/	х	х
L L	2:00 - 3:00	470	102	572	X/	56	/X	249	X/X	X/	х	х
Š	3:00 - 4:00	514	191	705	X/X	87	/X	513	X/X	X/X	х	х
	4:00 - 5:00	555	121	676	X/X	75	/X	440	X/X	X/X	х	х
	5:00 - 6:00	620	133	753	X/X	95	/X	394	X/X	X/X	х	х
	6:00 - 7:00	212	44	256	/	40	/	159	X/X	/		х
	7:00 - 8:00	327	58	385	/	48	/	170	X/X	1		х
	8:00 - 9:00	233	41	274	/	34	/	121	X/X	1		X
	9:00 - 10:00	154	27	181	/	22	/	79	/X	1		

	Criteria	Hours Met	Hours Required	Warrants Met
s	Warrant 1a: Minimum Vehicular Volume	10	8	Met
님	Warrant 1b: Interruption of Continuous Traffic	5	8	Not Met
Resi	Warrant 2: Four-Hour Vehicular Volume	9	4	Met
	Warrant 7: Crash Experience	8	8	Met - Check Crash Rate
	Multi-way Stop Applications (MWSA)	15	8	Met
Radar Hill 1416	corridor Study			No-Build (2050)
City/C	ounty: Box Elder, SD			
Interse	ection: Hwy 1416 and S Ellsworth Rd			

Radar Hill 1416 Corridor Study

City/County: Box Elder, SD Intersection: Hwy 1416 and S Ellsworth Rd

ta	Date:	8/25/2023	Approach	Speed	Lanes	RT %
Dat	Population < 10,000:	No	Major 1: EB Highway 1416	55	2	100%
_ <u>∧</u>	Existing Signal:	No	Major 3: WB Highway 1416	50	2	100%
pn	0.70 Factor Used:	Yes	Minor 2: NB S Ellsworth Rd	25	1	100%
st	0.80 Factor Used:	No	Minor 4: SB S Ellsworth Rd	35	1	100%



	Criteria	Hours Met	Hours Required	Warrants Met
Results	Warrant 2: Four-Hour Vehicular Volume	9	4	Met
	Warrant 3: Peak Hour	5	1	Met



City/County: Box Elder, SD Intersection: Hwy 1416 and Radar Hill Rd

ta	Date:	8/25/2023	Approach	Speed	Lanes	RT %
Da	Population < 10,000:	No	Major 1: EB Highway 1416	55	2	100%
١٨	Existing Signal:	No	Major 3: WB Highway 1416	55	2	100%
pn	0.70 Factor Used:	Yes	Minor 2: NB Radar Hill Rd	45	1	100%
St	0.80 Factor Used:	No	Minor 4: SB Gumbo Dr	25	1	100%

	Time of Day	Major #1	Major #3	Total 1+3	Major 1A/1B 420/630	Minor #2	Minor #2 1A/1B 105/053	Minor #4	Minor #4 1A/1B 105/053	Both Met 1A/1B	Crash Warrant	MWSA Warrant	
		6:00 - 7:00	591	192	783	X/X	299	X/X	19	/	X/X	х	х
I		7:00 - 8:00	774	560	1334	X/X	512	X/X	56	/X	X/X	х	х
I		8:00 - 9:00	328	289	617	X/	151	X/X	40	/	X/		х
I	sis	9:00 - 10:00	307	268	575	X/	141	X/X	21	/	X/		
I	a	10:00 - 11:00	288	320	608	X/	135	X/X	15	/	X/		
I	An	11:00 - 12:00	363	407	770	X/X	115	X/X	18	/	X/X	х	
I	ts /	12:00 - 1:00	413	328	741	X/X	160	X/X	31	/	X/X	х	
I	u au	1:00 - 2:00	408	330	738	X/X	141	X/X	28	/	X/X	х	
I	arra	2:00 - 3:00	436	438	874	X/X	162	X/X	31	/	X/X	х	
I	Š	3:00 - 4:00	480	809	1289	X/X	179	X/X	21	/	X/X	х	х
_	-	4:00 - 5:00	580	877	1457	X/X	208	X/X	22	/	X/X	х	х
	5:00 - 6:00	631	626	1257	X/X	262	X/X	21	/	X/X	х	х	
I		6:00 - 7:00	232	183	415	/	63	/X	12	/	1		
	7:00 - 8:00	287	274	561	X/	123	X/X	16	/	X/			
	8:00 - 9:00	205	196	401	/	88	/X	11	/	1			
I		9.00 - 10.00	135	128	263	/	58	/x	7	/	1		

	Criteria	Hours Met	Hours Required	Warrants Met
s	Warrant 1a: Minimum Vehicular Volume	13	8	Met
불	Warrant 1b: Interruption of Continuous Traffic	9	8	Met
Resi	Warrant 2: Four-Hour Vehicular Volume	11	4	Met
	Warrant 7: Crash Experience	9	8	Met - Check Crash Rate
	Multi-way Stop Applications (MWSA)	6	8	Not Met
Radar Hill 1416	Corridor Study			No-Build (2030)
City/Co	ounty: Box Elder, SD			
Interse	ction: Hwy 1416 and Radar Hill Rd			

Radar Hill 1416 Corridor Study

City/County: Box Elder, SD Intersection: Hwy 1416 and Radar Hill Rd

ta ta	Date:	8/25/2023	Approach	Speed	Lanes	RT %
Dat	Population < 10,000:	No	Major 1: EB Highway 1416	55	2	100%
l _>	Existing Signal:	No	Major 3: WB Highway 1416	55	2	100%
pn:	0.70 Factor Used:	Yes	Minor 2: NB Radar Hill Rd	45	1	100%
s l	0.80 Factor Used:	No	Minor 4: SB Gumbo Dr	25	1	100%



Criteri Results Warra Warra	Criteria	Hours Met	Hours Required	Warrants Met
	Warrant 2: Four-Hour Vehicular Volume	11	4	Met
	Warrant 3: Peak Hour	6	1	Met



City/County: Box Elder, SD Intersection: Hwy 1416 and Radar Hill Rd

ta	Date:	8/25/2023	Approach	Speed	Lanes	RT %
Dai	Population < 10,000:	No	Major 1: EB Highway 1416	55	2	100%
ΙΛ	Existing Signal:	No	Major 3: WB Highway 1416	55	2	100%
pn	0.70 Factor Used:	Yes	Minor 2: NB Radar Hill Rd	45	1	100%
St	0.80 Factor Used:	No	Minor 4: SB Gumbo Dr	25	1	100%

sis	Time of Day	Major #1	Major #3	Total 1+3	Major 1A/1B 420/630	Minor #2	Minor #2 1A/1B 105/053	Minor #4	Minor #4 1A/1B 105/053	Both Met 1A/1B	Crash Warrant	MWSA Warrant
	6:00 - 7:00	672	217	889	X/X	341	X/X	21	/	X/X	Х	Х
	7:00 - 8:00	860	620	1480	X/X	571	X/X	60	/X	X/X	х	х
	8:00 - 9:00	372	327	699	X/X	172	X/X	45	/	X/X	х	х
	9:00 - 10:00	349	304	653	X/X	161	X/X	24	/	X/X	х	
ar	10:00 - 11:00	327	362	689	X/X	154	X/X	17	/	X/X		
Warrants An	11:00 - 12:00	411	462	873	X/X	131	X/X	20	/	X/X	х	
	12:00 - 1:00	468	371	839	X/X	182	X/X	36	/	X/X	х	х
	1:00 - 2:00	463	374	837	X/X	161	X/X	32	/	X/X	х	
	2:00 - 3:00	494	496	990	X/X	185	X/X	36	/	X/X	х	х
	3:00 - 4:00	540	912	1452	X/X	202	X/X	23	/	X/X	х	х
	4:00 - 5:00	658	996	1654	X/X	237	X/X	25	/	X/X	х	х
	5:00 - 6:00	717	710	1427	X/X	298	X/X	24	/	X/X	х	х
	6:00 - 7:00	262	206	468	X/	72	/X	13	/	1		
	7:00 - 8:00	325	310	635	X/X	140	X/X	18	/	X/X		х
	8:00 - 9:00	232	222	454	X/	100	/X	13	/	1		
	9.00 - 10.00	153	145	298	/	66	/X	8	/	1		

Results	Criteria	Hours Met	Hours Required	Warrants Met	
	Warrant 1a: Minimum Vehicular Volume	13	8	Met	
	Warrant 1b: Interruption of Continuous Traffic	13	8	Met	
	Warrant 2: Four-Hour Vehicular Volume	13	4	Met	
	Warrant 7: Crash Experience	11 8		Met - Check Crash Rate	
	Multi-way Stop Applications (MWSA)	9 8		Met	
Radar Hill 1416	Corridor Study			No-Build (2050)	
City/Co	ounty: Box Elder, SD				
Interse	ction: Hwy 1416 and Radar Hill Rd				

Radar Hill 1416 Corridor Study

City/County: Box Elder, SD Intersection: Hwy 1416 and Radar Hill Rd

ta ta	Date:	8/25/2023	Approach	Speed	Lanes	RT %
Dat	Population < 10,000:	No	Major 1: EB Highway 1416	55	2	100%
l _>	Existing Signal:	No	Major 3: WB Highway 1416	55	2	100%
pn:	0.70 Factor Used:	Yes	Minor 2: NB Radar Hill Rd	45	1	100%
s l	0.80 Factor Used:	No	Minor 4: SB Gumbo Dr	25	1	100%



	Criteria	Hours Met	Hours Required	Warrants Met	
Results	Warrant 2: Four-Hour Vehicular Volume	13	4	Met	
	Warrant 3: Peak Hour	8	1	Met	

Appendix F: Alternative Concepts

Radar Hill - 1416 Corridor Study


















Appendix G: Vehicular Level of Service (VLOS) Results – Alternatives

Radar Hill - 1416 Corridor Study

		HCS	All-W	'ay Sto	p Con	trol Re	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Ayers-Verh	age									
Agency/Co.					1			≠↓↓×	└┓┢	L.		
Date Performed	6/26/20	23			1			Į	Ļ			
Analysis Year	2023					_*					×	
Analysis Time Period (hrs)	1.00				1	4					*	
Time Analyzed	AM Pea	k			1	*				.∡	←	
Project Description	Radar H	lill 1416 Co	rridor Stud	ly - Interim	1	\prec				*		
Intersection	WB Hig	hway 1416	and S Ellsv	worth Road							*	
Jurisdiction	Box Eld	er, SD			1	*						
East/West Street	WB Hig	hway 1416			1	٩						
North/South Street	S Ellswo	orth Rd			1		ሻ	भी भीत्र ¹⁴	▎ ↗ ₳ ৳	<u>م</u> ا		
Peak Hour Factor	0.84				1							
Turning Movement Dema	nd Volum	nes										
Approach		Eastbound	1		Westbound	d		Northboun	d	9	Southboun	nd
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)				0	44	13	86	674			26	194
% Thrus in Shared Lane				50		50						
Lane Flow Rate and Adjus	tments		,			,	,					
Approach		Eastbound	ł		Westbound	d		Northboun	d	9	Southboun	nd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration				LT	TR		LT			Т	R	
Flow Rate, v (veh/h)				26	42		905			31	231	
Percent Heavy Vehicles				10	10		1			5	5	
Initial Departure Headway, hd (s)				3.20	3.20		3.20			3.20	3.20	
Initial Degree of Utilization, x				0.023	0.037		0.804			0.028	0.205	
Final Departure Headway, hd (s)				6.94	6.68		4.86			5.39	4.69	
Final Degree of Utilization, x				0.050	0.077		1.222			0.046	0.301	
Move-Up Time, m (s)				2.3	2.3		2.0			2.3	2.3	
Service Time, t _s (s)				4.64	4.38		2.86			3.09	2.39	
Capacity, Delay and Level	of Servic	e	,			,	,					
Approach	T	Eastbound	1		Westbound	d		Northboun	d	9	Southboun	nd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration				LT	TR		LT			Т	R	
Flow Rate, v (veh/h)				26	42		905			31	231	
Capacity (veh/h)				519	539		740			668	767	
95% Queue Length, Q ₉₅ (veh)				0.2	0.3		96.3			0.1	1.3	
Control Delay (s/veh)				10.0	9.9		432.7			8.4	9.4	
Level of Service, LOS				В	A		F			A	A	
Approach Delay (s/veh) LOS				10.0		A	432.7	7	F	9.3		A
Intersection Delay (s/veh) LOS			31	9.7						F		

HCS M AWSC Version 2023 WB1416-Ellsworth_Interim_AMPeak2023.xaw Generated: 8/23/2023 10:51:50 AM

		HCS	All-W	'ay Sto	p Con	trol R	eport					
General and Site Informat	tion				Lanes							
Analyst	Emma N	Myers-Verh	age				-					
Agency/Co.					1			* + *		L.		
Date Performed	6/26/20)23			1			Į	Ų			
Analysis Year	2023				1	_*					K	
Analysis Time Period (hrs)	1.00				1	4					*	
Time Analyzed	PM Pea	k			1	*				4	←	
Project Description	Radar H	lill 1416 Co	rridor Stuc	ly - Interim	1	<u> </u>				*	\mathbf{x}	
Intersection	WB Hig	hway 1416	and S Ellsv	worth Rd	1						¥ ←	
Jurisdiction	Box Eld	er, SD			1	× ~						
East/West Street	WB Hig	hway 1416			1	•						
North/South Street	S Ellswo	orth Rd			1		ካ	भी भीज ¹⁴	╱╴╋╴╊	<u>م</u> م		
Peak Hour Factor	0.90				1							
Turning Movement Dema	nd Volum	nes										
Approach		Eastbound	l		Westbound	d		Northboun	d	9	Southboun	ıd
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)				14	71	6	36	328			65	256
% Thrus in Shared Lane				50		50						
Lane Flow Rate and Adjus	tments											
Approach		Eastbound	1		Westbound	d		Northboun	d	9	Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration				LT	TR		LT			Т	R	
Flow Rate, v (veh/h)				55	46		404			72	284	
Percent Heavy Vehicles				10	10		1			5	5	
Initial Departure Headway, hd (s)				3.20	3.20		3.20			3.20	3.20	
Initial Degree of Utilization, x				0.049	0.041		0.360			0.064	0.253	
Final Departure Headway, hd (s)				6.55	6.30		5.04			5.29	4.58	
Final Degree of Utilization, x				0.100	0.081		0.566			0.106	0.362	
Move-Up Time, m (s)				2.3	2.3		2.0			2.3	2.3	
Service Time, t _s (s)				4.25	4.00		3.04			2.99	2.28	
Capacity, Delay and Level	of Servic	е				<u>.</u>	<u>.</u>	<u>.</u>		<u>.</u>		
Approach		Eastbound	1		Westbound	d		Northboun	d	9	Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration				LT	TR		LT			Т	R	
Flow Rate, v (veh/h)				55	46		404			72	284	
Capacity (veh/h)				550	571		714			681	785	
95% Queue Length, Q95 (veh)				0.3	0.3		3.8			0.4	1.7	
Control Delay (s/veh)				10.0	9.6		14.6			8.6	9.9	
Level of Service, LOS				А	А		В			A	А	
Approach Delay (s/veh) LOS				9.8		A	14.6		В	9.6	<u> </u>	A
Intersection Delay (s/veh) LOS			1	2.0						В		

HCS M AWSC Version 2023 WB1416-Ellsworth_Interim_PMPeak2023.xaw Generated: 8/23/2023 10:53:22 AM

		HCS	All-W	'ay Sto	p Con	trol R	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Nyers-Verh	age				-					
Agency/Co.					1			* + *		L.		
Date Performed	6/26/20)23			1			Į	Ļ			
Analysis Year	2030				1	_*					K	
Analysis Time Period (hrs)	1.00				1						<u> </u>	
Time Analyzed	AM Pea	k			1	*				4	← x	
Project Description	Radar H	lill 1416 Cc	orridor Stuc	ly - Interim	1					×		
Intersection	WB Hig	hway 1416	and S Ells	worth Road							<u>₩</u> +	
Jurisdiction	Box Eld	er, SD			1							
East/West Street	WB Hig	hway 1416			1							
North/South Street	S Ellswo	orth Rd			1		ካ	<u>र्</u> र र र	╵ ╱╹ ↑ ╊	· ~		
Peak Hour Factor	0.84				1							
Turning Movement Dema	nd Volun	nes			<u> </u>							
Approach		Eastbound	ł		Westbound	d	1	Northboun	d	9	Southboun	ıd
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)				30	173	44	90	752			128	207
% Thrus in Shared Lane				50		50						
Lane Flow Rate and Adjus	tments			-	<u> </u>	<u> </u>	-			<u> </u>		
Approach		Eastbound	ł		Westbound	d	1	Northboun	d	9	Southboun	nd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration				LT	TR		LT			Т	R	
Flow Rate, v (veh/h)				139	155		1002			152	246	
Percent Heavy Vehicles				10	10		1			5	5	
Initial Departure Headway, hd (s)				3.20	3.20		3.20			3.20	3.20	
Initial Degree of Utilization, x				0.123	0.138		0.891			0.135	0.219	
Final Departure Headway, hd (s)				7.34	6.98		5.87			6.37	5.67	
Final Degree of Utilization, x				0.283	0.301		1.633			0.270	0.388	
Move-Up Time, m (s)				2.3	2.3		2.0			2.3	2.3	
Service Time, ts (s)				5.04	4.68		3.87			4.07	3.37	
Capacity, Delay and Level	of Servic	e										
Approach		Eastbound	ł		Westboun	d	1	Northboun	d	9	Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration				LT	TR		LT			Т	R	
Flow Rate, v (veh/h)				139	155		1002			152	246	
Capacity (veh/h)				490	516		614			565	635	
95% Queue Length, Q ₉₅ (veh)				1.2	1.3		201.8			1.1	1.9	
Control Delay (s/veh)				12.9	12.7		1163.9			11.4	12.0	
Level of Service, LOS				В	В		F			В	В	
Approach Delay (s/veh) LOS				12.8		В	1163.	9	F	11.8		В
Intersection Delay (s/veh) LOS			69	- 93.2						F		

HCS TM AWSC Version 2023 WB1416-Ellsworth_Interim_AMPeak2030.xaw Generated: 8/23/2023 11:18:36 AM

		HCS	All-W	ay Sto	p Con	trol R	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Myers-Verh	age									
Agency/Co.					1			≠ ↓ ↓ ×		د ل <u>ہ</u>		
Date Performed	6/26/20)23			1			Į	Ļ			
Analysis Year	2030				1	_*					K	
Analysis Time Period (hrs)	1.00				1	4					<u> </u>	
Time Analyzed	PM Pea	k			1	*				*	←	
Project Description	Radar H	lill 1416 Cc	orridor Stuc	ly - Interim	1	<u> </u>						
Intersection	WB Hig	hway 1416	and S Ellsv	worth Rd	1							
Jurisdiction	Box Eld	er, SD			1	× ~						
East/West Street	WB Hig	hway 1416	i		1	4						
North/South Street	S Ellswo	orth Rd			1		5	भी भौत ¹⁰	▎ ╱╴ ╀ ╶╊			
Peak Hour Factor	0.90				1				III			
Turning Movement Dema	nd Volum	ıes										
Approach	T	Eastbound	ł		Westbound	d		Northboun	d		Southboun	ıd
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)				29	135	21	38	356			93	273
% Thrus in Shared Lane				50		50						
Lane Flow Rate and Adjus	tments								,			
Approach		Eastbound	ł		Westbound	d		Northboun	d		Southboun	ıd
Lane	L1	Eastbound We			L2	L3	L1	L2	L3	L1	L2	L3
Configuration	1			LT	TR		LT			Т	R	
Flow Rate, v (veh/h)				107	98		438			103	303	
Percent Heavy Vehicles	1			10	10		1			5	5	
Initial Departure Headway, hd (s)				3.20	3.20		3.20			3.20	3.20	
Initial Degree of Utilization, x				0.095	0.087		0.389			0.092	0.270	
Final Departure Headway, hd (s)				6.90	6.58		5.51			5.80	5.09	
Final Degree of Utilization, x				0.205	0.180		0.670			0.167	0.429	
Move-Up Time, m (s)				2.3	2.3		2.0			2.3	2.3	
Service Time, t _s (s)				4.60	4.28		3.51			3.50	2.79	
Capacity, Delay and Level	of Servic	e										
Approach		Eastbound	ł		Westbound	d		Northboun	d		Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration				LT	TR		LT			Т	R	
Flow Rate, v (veh/h)				107	98		438			103	303	
Capacity (veh/h)				522	547		653			620	707	
95% Queue Length, Q ₉₅ (veh)				0.8	0.7		5.8			0.6	2.2	
Control Delay (s/veh)		11.4					19.5			9.7	11.6	
Level of Service, LOS		B					С			A	В	
Approach Delay (s/veh) LOS		·		11.1		В	19.5		С	11.1		В
Intersection Delay (s/veh) LOS	1		1.	4.6						В		

HCS M AWSC Version 2023 WB1416-Ellsworth_Interim_PMPeak2030.xaw Generated: 8/23/2023 11:20:50 AM

		HCS	All-W	ay Stc	op Con	itrol Re	eport					
General and Site Information	on				Lanes							
Analyst	Emma N	Myers-Verh	age				-					
Agency/Co.					1			× + + ×	L da b	د ل <u>ہ</u>		
Date Performed	6/26/20)23			1							
Analysis Year	2023				1	_*					×	
Analysis Time Period (hrs)	1.00				1	*					<u> </u>	
Time Analyzed	AM Pea	k			1	*	4				←	
Project Description	Radar H	lill 1416 Co	rridor Stud	ly - Interim	ו		7					
Intersection	EB High	way 1416 a	and S Ellsw	orth Rd	1							
Jurisdiction	Box Eld	er, SD			1	* ~						
East/West Street	EB High	way 1416			1	•			t r			
North/South Street	S Ellswo	orth Rd			1		ሻ	মা কাৰ ম	। ⋎र∕↑↑↑↑			
Peak Hour Factor	0.84				1							
Turning Movement Deman	d Volun	nes										
Approach		Eastbound	1		Westbound	d	1	Northboun	d		Southboun	ıd
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	618	115	15					142	7	10	16	
% Thrus in Shared Lane	50		50									
Lane Flow Rate and Adjust	ments											
Approach		Eastbound	l		Westbound	d	1	Northboun	d		Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	804	86					177			31		
Percent Heavy Vehicles	4	4					1			5		
Initial Departure Headway, hd (s)	3.20	3.20					3.20			3.20		
Initial Degree of Utilization, x	0.715	0.077					0.158			0.028		
Final Departure Headway, hd (s)	5.67	5.07					5.80			6.26		
Final Degree of Utilization, x	1.267	0.121					0.286			0.054		
Move-Up Time, m (s)	2.3	2.3					2.0			2.0		
Service Time, ts (s)	3.37	2.77					3.80			4.26		
Capacity, Delay and Level o	of Servic	e										
Approach		Eastbound	1		Westbound	d	1	Northboun	d		Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	804	86					177			31		
Capacity (veh/h)	635	711					621			575		
95% Queue Length, Q ₉₅ (veh)	97.1	0.4					1.2			0.2		
Control Delay (s/veh)	514.0	8.5					11.1			9.6		
Level of Service, LOS	F	A					В			A		
Approach Delay (s/veh) LOS	465.0		F		<u> </u>		11.1		В	9.6		A
Intersection Delay (s/veh) LOS			37	78.9						F		

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		HCS	All-W	ay Stc	op Con	itrol Re	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Ayers-Verh	age				-					
Agency/Co.					1			× + + ×		د ل <u>ه</u>		
Date Performed	6/26/20	23			1							
Analysis Year	2023				1	_*					K	
Analysis Time Period (hrs)	1.00				1	*					<u> </u>	
Time Analyzed	PM Pea	k			1	*	4				←	
Project Description	Radar H	lill 1416 Co	rridor Stud	ly - Interim	ו		7					
Intersection	EB High	way 1416 a	and S Ellsw	orth Rd	1							
Jurisdiction	Box Eld	er, SD			1	× ~						
East/West Street	EB High	way 1416			1	٩			•			
North/South Street	S Ellswo	orth Rd			1		ሻ	भी भीत्र ¹⁴	╷ ╱╸╋╶╏╋	<u>م</u> ،		
Peak Hour Factor	0.90				1							
Turning Movement Demai	nd Volum	nes										
Approach		Eastbound	1		Westbound	d	1	Northboun	d		Southboun	ıd
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	291	79	143					73	6	6	73	
% Thrus in Shared Lane	50		50		1							
Lane Flow Rate and Adjust	tments											
Approach		Eastbound	1		Westbound	d	1	Northboun	d	9	Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	367	203			1		88			88		
Percent Heavy Vehicles	4	4					1			5		
Initial Departure Headway, hd (s)	3.20	3.20					3.20			3.20		
Initial Degree of Utilization, x	0.326	0.180					0.078			0.078		
Final Departure Headway, hd (s)	5.50	4.51					5.30			5.42		
Final Degree of Utilization, x	0.561	0.254					0.129			0.132		
Move-Up Time, m (s)	2.3	2.3					2.0			2.0		
Service Time, ts (s)	3.20	2.21					3.30			3.42		
Capacity, Delay and Level	of Servic	e										
Approach		Eastbound	1		Westbound	d	1	Northboun	d	9	Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR			1		TR			LT		
Flow Rate, v (veh/h)	367	203					88			88		<u> </u>
Capacity (veh/h)	655	799					680			664		
95% Queue Length, Q ₉₅ (veh)	3.7	1.0					0.4			0.5		
Control Delay (s/veh)	15.2	8.7					9.1			9.2		
Level of Service, LOS	С	A					A			A		
Approach Delay (s/veh) LOS	12.9		В				9.1		A	9.2		A
Intersection Delay (s/veh) LOS			12	2.0						В		

HCS M AWSC Version 2023 EB1416-Ellsworth_Interim_PMPeak2023.xaw

		HCS	All-W	ay Sto	op Con	trol R	eport					
General and Site Informati	ion				Lanes							
Analyst	Emma N	Ayers-Verh	age									
Agency/Co.					1			* + *		د ل <u>ہ</u>		
Date Performed	6/26/20	23			1							
Analysis Year	2030				1	<u>_</u> *					K	
Analysis Time Period (hrs)	1.00				1	<u>_</u>					<u> </u>	
Time Analyzed	AM Pea	k			1	*	4				←	
Project Description	Radar H	lill 1416 Co	rridor Stud	ly - Interin	ו	<u> </u>	7					
Intersection	EB High	way 1416 a	and S Ellsw	orth Rd	1							
Jurisdiction	Box Eld	er, SD			1	<u>*</u>						
East/West Street	EB High	way 1416			1	•			h			
North/South Street	S Ellswo	orth Rd			1		ሻ	*	╷ ╱│╋│╊			
Peak Hour Factor	0.84				1							
Turning Movement Demar	nd Volum	nes										
Approach		Eastbound	1		Westbound	d	1	Northboun	d		Southboun	ıd
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	650	335	16					190	59	62	96	
% Thrus in Shared Lane	50		50									
Lane Flow Rate and Adjust	ments											
Approach		Eastbound	1		Westbound	d	1	Northboun	d		Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	973	218					296			188		
Percent Heavy Vehicles	4	4					1			5		
Initial Departure Headway, hd (s)	3.20	3.20					3.20			3.20		
Initial Degree of Utilization, x	0.865	0.194					0.263			0.167		
Final Departure Headway, hd (s)	6.47	6.01					6.04			6.52		
Final Degree of Utilization, x	1.750	0.365					0.497			0.341		
Move-Up Time, m (s)	2.3	2.3					2.0			2.0		
Service Time, ts (s)	4.17	3.71					4.04			4.52		
Capacity, Delay and Level	of Servic	e										
Approach		Eastbound	1		Westbound	d	1	Northboun	d		Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	973	218					296			188		
Capacity (veh/h)	556	599			1		596			552		
95% Queue Length, Q95 (veh)	215.4	1.7					2.9			1.5		
Control Delay (s/veh)	1374.5	12.2					15.0			12.9		
Level of Service, LOS	F	F B					В			В		
Approach Delay (s/veh) LOS	1124.	8	F				15.0		В	12.9		B
Intersection Delay (s/veh) LOS	1		80)3.7						F		

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		HCS	All-W	ay Stc	p Con	trol Re	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Myers-Verh	age									
Agency/Co.					1			* + *		د ل <u>ہ</u>		
Date Performed	6/26/20)23			1							
Analysis Year	2030				1	_*					K	
Analysis Time Period (hrs)	1.00				1	*					<u> </u>	
Time Analyzed	PM Pea	k				*	_≯				← x	
Project Description	Radar H	lill 1416 Co	rridor Stud	ly - Interim	1		7					
Intersection	EB High	way 1416 a	and S Ellsw	orth Rd							¥ +	
Jurisdiction	Box Eld	er, SD			1	* 						
East/West Street	EB High	way 1416			1				h			
North/South Street	S Ellswo	orth Rd			1		ሻ	1 1 1 1	╷ ╱│╋│╊	~		
Peak Hour Factor	0.90											
Turning Movement Dema	nd Volum	nes										
Approach		Eastbound	1		Westbound	d	· ·	Northboun	d	9	Southboun	ıd
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	306	150	152					87	22	22	100	
% Thrus in Shared Lane	50		50									
Lane Flow Rate and Adjus	tments											
Approach		Eastbound	ł		Westboun	d	· ·	Northboun	d	9	Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	423	252					121			136		
Percent Heavy Vehicles	4	4					1			5		
Initial Departure Headway, hd (s)	3.20	3.20					3.20			3.20		
Initial Degree of Utilization, x	0.376	0.224					0.108			0.120		
Final Departure Headway, hd (s)	5.71	4.84					5.53			5.72		
Final Degree of Utilization, x	0.672	0.339					0.186			0.216		
Move-Up Time, m (s)	2.3	2.3					2.0			2.0		
Service Time, t _s (s)	3.41	2.54					3.53			3.72		
Capacity, Delay and Level	of Servic	e										
Approach		Eastbound	1		Westbound	d	1	Northboun	d	9	Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	423	252					121			136		
Capacity (veh/h)	630	744					651			629		
95% Queue Length, Q ₉₅ (veh)	5.8	1.5					0.7			0.8		
Control Delay (s/veh)	19.9	10.0					9.8			10.3		
Level of Service, LOS	С	В					A			В		
Approach Delay (s/veh) LOS	16.2		C				9.8		A	10.3		В
Intersection Delay (s/veh) LOS			14	4.5			Ì			B		

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		HCS	All-W	'ay Sto	p Con	trol R	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Myers-Verh	age									
Agency/Co.							<u>_</u>		L + +	م ل <u>م</u>		
Date Performed	6/26/20)23			1			×				
Analysis Year	2023				1	_*					K	
Analysis Time Period (hrs)	1.00				1	4					<u> </u>	
Time Analyzed	AM Pea	k			1	*				.∡	←	
Project Description	Radar H	lill 1416 Cc	orridor Stuc	ly - Interim	1	<u> </u>				*		
Intersection	WB Hig	hway 1416	and Radar	· Hill Rd	1							
Jurisdiction	Box Eld	er, SD			1	× ~						
East/West Street	WB Hig	hway 1416			1	•						
North/South Street	Radar H	lill Rd			1		ሻ	1 1 1 ×	▎ ↗│₳│₺	~		
Peak Hour Factor	0.88				1							
Turning Movement Dema	nd Volun	nes			<u>.</u>							
Approach		Eastbound	ł		Westboun	d	1	Northboun	d	9	Southboun	ıd
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)				79	334	5	167	5			17	16
% Thrus in Shared Lane				50		50						
Lane Flow Rate and Adjus	tments											
Approach		Eastbound	ł		Westboun	d	1	Northboun	d	9	Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration				LT	TR		LT			TR		
Flow Rate, v (veh/h)				280	195		195			38		
Percent Heavy Vehicles				5	5		4			3		
Initial Departure Headway, hd (s)				3.20	3.20		3.20			3.20		
Initial Degree of Utilization, x				0.248	0.174		0.174			0.033		
Final Departure Headway, h₄ (s)				5.39	5.21		5.33			5.08		
Final Degree of Utilization, x				0.419	0.283		0.289			0.053		
Move-Up Time, m (s)				2.3	2.3		2.0			2.0		
Service Time, ts (s)				3.09	2.91		3.33			3.08		
Capacity, Delay and Level	of Servic	е										
Approach		Eastbound	k		Westboun	d	1	Northboun	d	9	Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	1			LT	TR		LT			TR		
Flow Rate, v (veh/h)				280	195		195			38		
Capacity (veh/h)				668	691		676			709		
95% Queue Length, Q ₉₅ (veh)				2.1	1.2		1.2			0.2		
Control Delay (s/veh)				12.0	10.0		10.5			8.4		
Level of Service, LOS				В	A		В			A		
Approach Delay (s/veh) LOS			-	11.1		B	10.5		В	8.4		A
Intersection Delay (s/veh) LOS			1	0.8						В		

HCS TM AWSC Version 2023 WB1416-RadarHill_Interim_AMPeak2023.xaw Generated: 8/23/2023 10:55:00 AM

		HCS	All-W	ay Sto	p Con	trol Re	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma I	Myers-Verh	age									
Agency/Co.					1		<u>_</u>	<u></u>	┶┶╞	د ل <u>ہ</u>		
Date Performed	6/26/20)23			1							
Analysis Year	2023				1	_*					×	
Analysis Time Period (hrs)	1.00				1	4					<u> </u>	
Time Analyzed	PM Pea	k			1	*				A	←	
Project Description	Radar H	lill 1416 Co	rridor Stud	ly - Interim	1					*		
Intersection	WB Hig	hway 1416	and Radar	Hill Rd	1							
Jurisdiction	Box Eld	er, SD			1	* ~						
East/West Street	WB Hig	hway 1416			1	•						
North/South Street	Radar H	lill Rd			1		ሻ	মা মাদ ™	। γ ∕ ↑ ∱			
Peak Hour Factor	0.94				1							
Turning Movement Dema	nd Volun	nes										
Approach		Eastbound	1		Westbound	d		Northboun	d	9	Southboun	ıd
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)				184	531	3	112	28			13	10
% Thrus in Shared Lane				50		50						
Lane Flow Rate and Adjus	tments											
Approach		Eastbound V				d	1	Northboun	d		Southboun	ıd
Lane	L1	L1 L2 L3 L1			L2	L3	L1	L2	L3	L1	L2	L3
Configuration				LT	TR		LT			TR		
Flow Rate, v (veh/h)				478	286		149			24		
Percent Heavy Vehicles				5	5		4			3		
Initial Departure Headway, hd (s)				3.20	3.20		3.20			3.20		
Initial Degree of Utilization, x				0.425	0.254		0.132			0.022		
Final Departure Headway, hd (s)				5.31	5.10		5.74			5.54		
Final Degree of Utilization, x				0.705	0.404		0.237			0.038		
Move-Up Time, m (s)				2.3	2.3		2.0			2.0		
Service Time, t _s (s)				3.01	2.80		3.74			3.54		
Capacity, Delay and Level	of Servic	е	<u> </u>	<u> </u>	<u> </u>		-		<u> </u>			
Approach		Eastbound	1		Westboun	d	1	Northboun	d	9	Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration				LT	TR		LT			TR		
Flow Rate, v (veh/h)				478	286		149			24		
Capacity (veh/h)				678	706		627			650		
95% Queue Length, Q ₉₅ (veh)		6.7					0.9			0.1		
Control Delay (s/veh)		20.4					10.5			8.8		
Level of Service, LOS		C					В			A		
Approach Delay (s/veh) LOS				17.0		С	10.5		В	8.8		A
Intersection Delay (s/veh) LOS			1	5.8						С		

HCS M AWSC Version 2023 WB1416-RadarHill_Interim_PMPeak2023.xaw

		HCS	All-W	'ay Sto	p Con	trol Re	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Myers-Verh	age									
Agency/Co.					1			× + + ×	L da b	د ل <u>ه</u>		
Date Performed	6/26/20)23			1							
Analysis Year	2030				1	_*					K	
Analysis Time Period (hrs)	1.00				1	<u>~</u>					<u> </u>	
Time Analyzed	AM Pea	k			1	*				*	← x	
Project Description	Radar H	lill 1416 Co	orridor Stuc	ly - Interim	1					T		
Intersection	WB Hig	hway 1416	and Radar	Hill Rd	1						¥ +	
Jurisdiction	Box Eld	er, SD			1	~						
East/West Street	WB Hig	hway 1416			1							
North/South Street	Radar H	lill Rd			1		ሻ	মা মাদ ™	▎ ╱┦ <mark>╀</mark> ▕╊	<u>م</u>		
Peak Hour Factor	0.88				1							
Turning Movement Dema	nd Volum	nes			<u>.</u>							
Approach		Eastbound	ł		Westboun	d	, I	Northboun	d	9	Southboun	d
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)				107	454	7	179	28			37	17
% Thrus in Shared Lane				50		50						
Lane Flow Rate and Adjust	tments											
Approach		Eastbound	ł		Westboun	d		Northboun	d	9	Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration				LT	TR		LT			TR		
Flow Rate, v (veh/h)				380	266		235			61		
Percent Heavy Vehicles				5	5		4			3		
Initial Departure Headway, hd (s)				3.20	3.20		3.20			3.20		
Initial Degree of Utilization, x				0.337	0.236		0.209			0.055		
Final Departure Headway, hd (s)				5.61	5.43		5.68			5.63		
Final Degree of Utilization, x				0.592	0.401		0.371			0.096		
Move-Up Time, m (s)				2.3	2.3		2.0			2.0		
Service Time, t _s (s)				3.31	3.13		3.68			3.63		
Capacity, Delay and Level	of Servic	e										
Approach		Eastbound	ł		Westboun	d	· ·	Northboun	d	9	Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration				LT	TR		LT			TR		
Flow Rate, v (veh/h)				380	266		235			61		
Capacity (veh/h)				641	663		633			640		
95% Queue Length, Q ₉₅ (veh)				4.2	2.0		1.8			0.3		
Control Delay (s/veh)		16.4					12.0			9.2		
Level of Service, LOS				С	В		В			A		
Approach Delay (s/veh) LOS				14.5		В	12.0		В	9.2		А
Intersection Delay (s/veh) LOS			1	3.5						В		

HCS TM AWSC Version 2023 WB1416-RadarHill_Interim_AMPeak2030.xaw Generated: 8/23/2023 12:32:19 PM

		HCS	All-W	'ay Sto	p Con	trol Re	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Nyers-Verh	age									
Agency/Co.					1			*{	L da b	د ل <u>ه</u>		
Date Performed	6/26/20)23			1							
Analysis Year	2030				1	_*					K	
Analysis Time Period (hrs)	1.00				1	<u>~</u>					<u> </u>	
Time Analyzed	PM Pea	k			1	*				*	← k	
Project Description	Radar H	lill 1416 Co	orridor Stuc	ly - Interim	1					4	x X	
Intersection	WB Hig	hway 1416	and Radar	Hill Rd							¥ +	
Jurisdiction	Box Eld	er, SD										
East/West Street	WB Hig	hway 1416										
North/South Street	Radar H	lill Rd					ካ	*	╵ ⋎ ┦ ┣┣	• ~		
Peak Hour Factor	0.94											
Turning Movement Dema	nd Volun	nes										
Approach		Eastbound	ł		Westbound	d		Northboun	d		Southboun	ıd
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)				209	605	4	118	34			18	11
% Thrus in Shared Lane				50		50						
Lane Flow Rate and Adjust	tments											
Approach		Eastbound	ł		Westboun	d		Northboun	d		Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration				LT	TR		LT			TR		
Flow Rate, v (veh/h)				544	326		162			31		
Percent Heavy Vehicles				5	5		4			3		
Initial Departure Headway, hd (s)				3.20	3.20		3.20			3.20		
Initial Degree of Utilization, x				0.484	0.290		0.144			0.027		
Final Departure Headway, hd (s)				5.38	5.17		5.90			5.76		
Final Degree of Utilization, x				0.814	0.468		0.265			0.049		
Move-Up Time, m (s)				2.3	2.3		2.0			2.0		
Service Time, ts (s)				3.08	2.87		3.90			3.76		
Capacity, Delay and Level	of Servic	e										
Approach		Eastbound	ł		Westboun	d		Northboun	d		Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration				LT	TR		LT			TR		
Flow Rate, v (veh/h)				544	326		162			31		
Capacity (veh/h)		669					611			625		
95% Queue Length, Q ₉₅ (veh)				11.1	2.6		1.1			0.2		
Control Delay (s/veh)		30.1					11.0			9.1		
Level of Service, LOS				D	В		В			A		
Approach Delay (s/veh) LOS				23.5		С	11.0		В	9.1		A
Intersection Delay (s/veh) LOS			2	1.2						С		

HCS M AWSC Version 2023 WB1416-RadarHill_Interim_PMPeak2030.xaw

		HCS	All-W	ay Sto	p Con	trol R	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Ayers-Verh	age				-					
Agency/Co.					1			× + + ×	L 🛧 🖡	د ل <u>ہ</u>		
Date Performed	6/26/20	23			1							
Analysis Year	2023				1	۲					K	
Analysis Time Period (hrs)	1.00				1	<u>~</u>					<u> </u>	
Time Analyzed	AM Pea	k			1	*	_≯_				← x	
Project Description	Radar H	lill 1416 Co	rridor Stud	ly -Interim	1		7					
Intersection	EB High	way 1416 a	and Radar	Hill Rd	1							
Jurisdiction	Box Eld	er, SD			1	× ~						
East/West Street	EB High	way 1416			1	•			•			
North/South Street	Radar H	lill Rd			1		ኻ	भी भी <i>न</i> ¹⁴	╷ ╱╸╋╶╏╊	<u>م</u> ،		
Peak Hour Factor	0.88				1							
Turning Movement Dema	nd Volum	nes										
Approach		Eastbound	1		Westboun	d	1	Northboun	d	9	Southboun	ıd
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	4	527	55					168	236	8	88	
% Thrus in Shared Lane	50		50									
Lane Flow Rate and Adjus	tments											
Approach		Eastbound	1		Westboun	d	1	Northboun	d	9	Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	304	362					459			109		
Percent Heavy Vehicles	4	4					4			3		
Initial Departure Headway, hd (s)	3.20	3.20					3.20			3.20		
Initial Degree of Utilization, x	0.270	0.322					0.408			0.097		
Final Departure Headway, hd (s)	6.19	6.06					5.39			6.36		
Final Degree of Utilization, x	0.523	0.609					0.688			0.193		
Move-Up Time, m (s)	2.3	2.3					2.0			2.0		
Service Time, t _s (s)	3.89	3.76					3.39			4.36		
Capacity, Delay and Level	of Servic	e										
Approach		Eastbound	1		Westboun	d	1	Northboun	d	9	Southboun	ıd
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	304	362					459			109		
Capacity (veh/h)	582	594					667			566		
95% Queue Length, Q95 (veh)	3.2	4.5					6.2			0.7		
Control Delay (s/veh)	15.6	18.1					20.0			10.9		
Level of Service, LOS	С	С					С			В		
Approach Delay (s/veh) LOS	17.0		С				20.0		С	10.9		В
Intersection Delay (s/veh) LOS			1	7.6						C		

HCS M AWSC Version 2023 EB1416-RadarHill_Interim_AMPeak2023.xaw

		HCS	All-W	ay Sto	op Con	trol R	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Myers-Verh	age									
Agency/Co.					1		<u>_</u>	<u></u>		د ل <u>ہ</u>		
Date Performed	6/26/20)23			1							
Analysis Year	2023				1	_*					K	
Analysis Time Period (hrs)	1.00				1	4					<u> </u>	
Time Analyzed	PM Pea	k			1	*	4				←	
Project Description	Radar H	lill 1416 Co	rridor Stud	ly - Interin	n	<u> </u>	7					
Intersection	EB High	way 1416 a	and Radar	Hill Rd	1							
Jurisdiction	Box Eld	er, SD			1	× ~						
East/West Street	EB High	way 1416			1	4			★			
North/South Street	Radar H	lill Rd			1		ሻ	भी भी <i>न</i> ¹⁴	╷ ╱╸╋╶╏╊	<u>م</u> ،		
Peak Hour Factor	0.94				1							
Turning Movement Dema	nd Volun	nes										
Approach		Eastbound	1		Westboun	d	1	Northboun	d		Southboun	d
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	19	401	193					121	116	4	193	
% Thrus in Shared Lane	50		50									
Lane Flow Rate and Adjus	tments											
Approach	T	Eastbound	1		Westboun	d	1	Northboun	d		Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	234	419					252			210		
Percent Heavy Vehicles	4	4					4			3		
Initial Departure Headway, hd (s)	3.20	3.20					3.20			3.20		
Initial Degree of Utilization, x	0.208	0.372					0.224			0.186		
Final Departure Headway, hd (s)	5.94	5.55					5.57			5.91		
Final Degree of Utilization, x	0.385	0.645					0.390			0.344		
Move-Up Time, m (s)	2.3	2.3					2.0			2.0		
Service Time, ts (s)	3.64	3.25					3.57			3.91		
Capacity, Delay and Level	of Servic	e										
Approach	T	Eastbound	1		Westboun	d		Northboun	d		Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	234	419					252			210		
Capacity (veh/h)	606	649					646			609		
95% Queue Length, Q ₉₅ (veh)	1.9	5.2					1.9			1.6		
Control Delay (s/veh)	12.3	18.2					12.1			12.0		
Level of Service, LOS	В	С					В			В		
Approach Delay (s/veh) LOS	16.1		С				12.1		В	12.0		В
Intersection Delay (s/veh) LOS			14	4.4						В		

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		HCS	All-W	ay Sto	op Con	trol R	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Myers-Verh	age									
Agency/Co.					1		<u>_</u>	* + *		د ل <u>ه</u>		
Date Performed	6/26/20)23			1							
Analysis Year	2030				1	_*					K	
Analysis Time Period (hrs)	1.00				1	4					<u> </u>	
Time Analyzed	AM Pea	k			1	*	4				←	
Project Description	Radar H	lill 1416 Co	rridor Stud	ly - Interin	n	<u> </u>	7					
Intersection	EB High	way 1416 a	and Radar	Hill Rd	1						¥ ←	
Jurisdiction	Box Eld	er, SD			1	× ~						
East/West Street	EB High	way 1416			1	4			•			
North/South Street	Radar H	lill Rd			1		ሻ	<u>भी भीन भ</u>	∣ ╱┤╋│╊	<u>م</u> .		
Peak Hour Factor	0.88				1							
Turning Movement Dema	nd Volun	nes										
Approach		Eastbound	1		Westboun	d	1	Northboun	d		Southboun	d
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	5	702	64					197	314	12	111	
% Thrus in Shared Lane	50		50		1							
Lane Flow Rate and Adjus	tments											
Approach		Eastbound	1		Westboun	d	1	Northboun	d		Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	405	472					581			140		
Percent Heavy Vehicles	4	4					4			3		
Initial Departure Headway, hd (s)	3.20	3.20			1		3.20			3.20		
Initial Degree of Utilization, x	0.360	0.419					0.516			0.124		
Final Departure Headway, hd (s)	6.73	6.61			1		5.79			7.02		
Final Degree of Utilization, x	0.756	0.866					0.934			0.273		
Move-Up Time, m (s)	2.3	2.3					2.0			2.0		
Service Time, t _s (s)	4.43	4.31					3.79			5.02		
Capacity, Delay and Level	of Servic	e										
Approach		Eastbound	1		Westboun	d	1	Northboun	d		Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	405	472					581			140		
Capacity (veh/h)	535	544					622			513		
95% Queue Length, Q ₉₅ (veh)	8.3	14.0					20.9			1.1		
Control Delay (s/veh)	29.4	46.4					64.3			12.7		
Level of Service, LOS	D	E					F			В		
Approach Delay (s/veh) LOS	38.6		E				64.3		F	12.7		В
Intersection Delay (s/veh) LOS			4	5.7						E		

HCSTM AWSC Version 2023 EB1416-RadarHill_Interim_AMPeak2030.xaw Generated: 8/23/2023 11:12:43 AM

		HCS	All-W	ay Stc	op Con	trol R	eport					
General and Site Informat	ion				Lanes							
Analyst	Emma N	Myers-Verh	age									
Agency/Co.					1			* + *		د ل <u>ہ</u>		
Date Performed	6/26/20)23			1							
Analysis Year	2030				1	۲					K	
Analysis Time Period (hrs)	1.00				1	<u>~</u>					<u> </u>	
Time Analyzed	PM Pea	k			1	*	_≯_				← x	
Project Description	Radar H	lill 1416 Co	rridor Stud	ly - Interim	ו	<u> </u>	7					
Intersection	EB High	way 1416 a	and Radar	Hill Rd	1							
Jurisdiction	Box Eld	er, SD			1							
East/West Street	EB High	way 1416			1	•						
North/South Street	Radar H	lill Rd			1		ሻ	*	╷ ╱│╋│╊			
Peak Hour Factor	0.94				1							
Turning Movement Dema	nd Volun	nes										
Approach		Eastbound	l		Westbound	d	1	Northboun	d		Southboun	d
Movement	L	Т	R	L	Т	R	L	Т	R	L	Т	R
Volume (veh/h)	20	475	205					132	138	5	206	
% Thrus in Shared Lane	50		50		1							
Lane Flow Rate and Adjus	tments											
Approach		Eastbound	1		Westbound	d	1	Northboun	d		Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	274	471			1		287			224		
Percent Heavy Vehicles	4	4					4			3		
Initial Departure Headway, hd (s)	3.20	3.20					3.20			3.20		
Initial Degree of Utilization, x	0.243	0.418					0.255			0.200		
Final Departure Headway, hd (s)	6.12	5.75					5.79			6.18		
Final Degree of Utilization, x	0.466	0.752					0.462			0.385		
Move-Up Time, m (s)	2.3	2.3					2.0			2.0		
Service Time, t _s (s)	3.82	3.45					3.79			4.18		
Capacity, Delay and Level	of Servic	е		<u> </u>			-				<u> </u>	
Approach		Eastbound	1		Westbound	d	1	Northboun	d		Southboun	d
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	TR					TR			LT		
Flow Rate, v (veh/h)	274	471					287			224		
Capacity (veh/h)	588	626					622			582		
95% Queue Length, Q95 (veh)	2.6	8.2					2.5			1.9		
Control Delay (s/veh)	14.1	25.3					13.7			13.0		
Level of Service, LOS	В	D					В			В		
Approach Delay (s/veh) LOS	21.2	·	С				13.7		В	13.0		В
Intersection Delay (s/veh) LOS			18	8.0						C		

HCS M AWSC Version 2023 EB1416-RadarHill_Interim_PMPeak2030.xaw

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General Inform	nation								Int	ersecti	on Inf	ormati	on	2		
Agency									Du	ration,	h	1.000)		₽ Þ	21-
Analyst		Emma Myers-Verha	age	Analys	is Date	Aug 8	, 2023		Are	еа Туре	;	Othe	r			
Jurisdiction		Box Elder, Sd		Time F	Period	AM Pe	eak		PH	IF		1.00			w ∯ L	÷
Urban Street		Alternative 1		Analys	is Year	2030			An	alysis F	Period	1> 7:	00			185
Intersection		Hwy 1416 and Libe	rty Blvd	File Na	ame	Hwy14	416-Libe	erty_/	Alt1_	AMPe	ak2030).xus			tr	
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy		N								5	C BIO A d	11個
				1			r				r					
Demand Inform	nation				EB			N	/B			NB			SB	
Approach Move	ement			L	Т	R			Г	R	L	Т	R	L	Т	R
Demand (v), v	eh/h			326	150	3	7	9	90	171	4	51	10	60	19	141
Signal Informa	tion					5								1		
	58.0	Reference Phase	2	-	La -									X		stz.
Offset s	0	Reference Point	End		F-	- F3 -		2					1	Y 2	3	4
	Ves	Simult Gap F/W	On	Green	9.5	12.5	22.5	0.0	0	0.0	0.0	_		Ð−		\mathbf{k}
Force Mode	Fixed	Simult. Gap N/S	On	Red	3.5	3.5	3.5	0.	0	0.0	0.0		5	6	7	×↓ ×
1 orde mode	TIXCU	oindit. Oup N/O	011	Incu	1.0	1.0	1.0	0.	0	0.0	0.0		-			
Timer Results	_			EBL	_	EBT	WB		W	/BT	NBI	_	NBT	SBI	_	SBT
Assigned Phase	e			5		2	1		(6			4			8
Case Number				1.1		4.0	0.0		14	4.0			8.0			7.0
Phase Duration	, S			14.0		31.0	0.0		17	7.0			27.0			27.0
Change Period,	(Y+R	c), S		4.5		4.5	3.5		4	.5			4.5			4.5
Max Allow Head	dway (<i>N</i>	MAH), s		3.0		3.0	0.0		3	.0			3.2			3.2
Queue Clearan	ce Time	e (gs), s		10.6	;	5.1			11	1.8			3.5			5.8
Green Extensio	n Time	(ge), s		0.0		0.7	0.0		0	.7			0.5			0.5
Phase Call Prol	bability			0.99)	1.00			1.	.00			1.00			1.00
Max Out Proba	bility			1.00)	0.00			0.	.00			0.00			0.00
Movement Gro	oup Res	sults			EB			W	B	_		NB			SB	
Approach Move	ement			L	T	R	L	T	+	R	L	Т	R	L	T	R
Assigned Move	ment	<u> </u>		5	2	12	1	6		16	1	4	14	3	8	18
Adjusted Flow I), veh/h		326	153			268	8			65		<u> </u>	79	141
Adjusted Satura		bw Rate (s), veh/h/l	n	1615	1689			150	8	_		1643		<u> </u>	1414	1448
Queue Service	Time (g	g s), S T ())		8.6	3.1			5.0		-		0.0			0.5	3.8
Cycle Queue C		e Time (<i>g c</i>), s		8.6	3.1			9.8	3	-		1.5			2.0	3.8
Green Ralio (g	/C)			0.41	0.40			0.2	2	-		0.39			0.39	0.39
Capacity (c), v	en/n	tic (X)		440	112			420	0			703			058	0.054
Volume-to-Capa	$\frac{1}{(0)}$	$\frac{100}{100}$		0.742	20.1			127	29	-		0.092		<u> </u>	0.120	0.251
Back of Queue	$(Q), \Pi$	ph/lp (95 th percentile	ilo)	55	1.5			57	.3 2	-		25		<u> </u>	27.3	2.1
	Q), Ve	PO(95 th percent)	tilo)	0.00	0.00			0.0	0	-		0.00			0.00	2.1
Uniform Delay (1/ 1	0.00			21	7			11.3			11 /	12.0
Incremental De	(u +), s			6.1	0.0			21.	:	-		0.3			0.4	12.0
Initial Queue De	emental Delay (<i>d</i> ₂), s/veh al Queue Delay (<i>d</i> ₃), s/veh							0.0	, ,			0.0			0.4	0.0
Control Delay (ntal Queue Delay (d 3), s/ven							22	3			11.6			11 8	13.1
Level of Service	evel of Service (LOS)							<u> </u>	-			B			R	B
Approach Delay	pproach Delay, s/veh / LOS					B	22.3			C I	11 F		B	12 7		B
Intersection Del	ntersection Delay, s/veh / LOS					17	7.0			-			-	B		-
						. /								-		
Multimodal Re	sults				EB			W	В			NB			SB	
Pedestrian LOS	Score	/LOS		1.66		В	1.91		E	В	1.67	7	В	1.89		В
Bicycle LOS Sc	ore / LC	DS		1.28		А	0.93	3		A	0.59)	А	0.85	5	А

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General Inforn	nation								Inte	ersecti	ion Inf	ormati	on			4 12
Agency									Du	ration.	h	1.00	0		,	
Analvst		Emma Mvers-Verha	ade	Analys	sis Date	e Aua 8	. 2023		Are	a Type	;	Othe	er			2323
Jurisdiction		Box Elder, SD	<u> </u>	Time F	Period	AM P	eak		PH	F		1.00			w‡u	\leftrightarrow
Urban Street		Alternative 1		Analvs	sis Yea	r 2050			Ana	alvsis F	Period	1> 7	:00			
Intersection		Hwy 1416 and Libe	rtv Blvd	File Na	ame	Hwv1	416-Lib	ertv	Alt1	AMPe	ak2050).xus			vtr	
Project Descrip	tion	Radar Hill 1416 Co	ridor St	udy			-			-						新派
, ,				,												
Demand Inform	nation				EB			V	٧B			NE	3		SB	
Approach Move	ement			L	Т	R	L	-	Т	R	L	Т	R	L	Т	R
Demand (v), v	eh/h			326	146	3	6	7	76	173	4	51	10	59	17	119
				li.												
Signal Informa	tion			-	La		125								₹	$\mathbf{\lambda}$
Cycle, s	60.9	Reference Phase	2		R	R	<u></u>	2					1		3	4
Offset, s	0	Reference Point	End	Green	9.9	18.1	19.4	0.	0	0.0	0.0			<u> </u>	1	
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	3.5	3.5	3.5	0.	0	0.0	0.0	_	∕ ∣			∇
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.0	1.0	0.	0	0.0	0.0		5	6	7	8
T . D K			_	EDI	1	EDT							NDT	0.0		ODT
Assigned Dhee	•			EBL	-	EBI	VVB			BI		-	NBI	5B 7		SBI
Assigned Phase	e			5 1 1	_	2			1 /	0	11.0		0	14		4
Phase Duration	I, S			14.4		37.0	0.0	+	22	+.0 2.6	0.0	' -	23.9	0.0		23.9
Change Period	, (Y+R (c), S		4.5		4.5	4.0		4	.5	4.0		4.5	4.5		4.5
Max Allow Hea	dway(<i>N</i>	<i>MAH</i>), s		3.0		3.0	0.0		3	.0	0.0		3.2	0.0		3.2
Queue Clearan	ce Time	(g s), s		9.5		4.7			20).1			3.7			8.2
Green Extensio	n Time	(ge), s		0.4		0.6	0.0		0	.0	0.0		0.1	0.0		0.3
Phase Call Pro	bability			1.00)	1.00			1.0	00			1.00			1.00
Max Out Proba	bility			0.00)	0.00			1.0	00			0.00			0.00
Movement Gro	oup Res	ults			EB			W	В			NB			SB	
Approach Move	ement			L	Т	R	L	Т		R	L	Т	R	L	Т	R
Assigned Move	ment			5	2	12	1	6		16	3	8	18	7	4	14
Adjusted Flow I	Rate (v), veh/h		326	149			25	5			65			76	119
Adjusted Satura	ation Flo	w Rate (<i>s</i>), veh/h/l	n	1667	1744			75	7			1698			508	
Queue Service	Time (g	y s), S		7.5	2.7			5.0)			1.7			0.0	
Cycle Queue C	learance	e Time (<i>g c</i>), s		7.5	2.7			18.	1			1.7			6.2	
Green Ratio (g	/C)	i		0.49	0.53			0.3	0			0.32	1		0.32	
Capacity (c), v	/eh/h			389	931			31	3			615			267	
Volume-to-Cap	acity Ra	tio(X)		0.837	0.160			0.81	16			0.106	;		0.285	
Back of Queue	(Q), ft	/In (95 th percentile)	96	30.3			173	.8			29.4			39.9	
Back of Queue	(Q), ve	eh/In (95 th percenti	le)	3.8	1.2			7.0	ו			1.2			1.6	
Queue Storage	Ratio (RQ) (95 th percent	ile)	0.00	0.00			0.0	0			0.00			0.00	
Uniform Delay	(d 1), si	/veh		13.1	7.2			18.	7			14.7			15.8	
Incremental De	lay (<i>d</i> 2), s/veh		1.9	0.0			16.	1			0.3			2.7	
Initial Queue D	elay (<i>d</i>	3), s/veh		0.0	0.0			0.0)			0.0			0.0	
Control Delay (d), s/ve	eh		15.0	7.3			34.	8			15.0			18.5	0.0
Level of Service	f Service (LOS)							C				В			В	Α
Approach Dela	proach Delay, s/veh / LOS					В	34.8	3	0	0	15.0)	В	7.2		А
Intersection De	section Delay, s/veh / LOS					17	′.4							В		
Multimodal Re	modal Results							\/\/	B			NR			SB	
Pedestrian I OS	S Score	/ LOS		1.65	;]	В	1.91		F	в	1.71		В	1.9		В
Bicycle LOS Sc	ore / LC)S		1.27	,	А	0.91		Ā	Ą	0.59)	А	0.8	1	А
,																

			Ŭ								Í					
General Inform	nation								Inte	ersect	ion Inf	ormati	on			
Agency									Dur	ration,	h	1.000)		↓ ×	
Analyst		Emma Myers-Verha	age	Analys	is Date	Aug 8	, 2023		Are	a Type	Э	Othe	r			
Jurisdiction		Box Elder, SD	0	Time F	Period	PM Pe	eak		PH	F		1.00			w ‡ u	÷
Urban Street		Alternative 1		Analys	is Year	2030			Ana	alysis I	Period	1> 16	6:30			
Intersection		Hwy 1416 and Libe	rtv Blvd	File Na	ame	Hwv14	416-Libe	ertv /	Alt1	PMPe	ak2030).xus			xte	
Project Descrip	tion	Radar Hill 1416 Co	ridor St	udy			-		_	-				3	T Series and	111
, ,																
Demand Inform	nation				EB			N	/B			NB			SB	
Approach Move	ement			L	Т	R	L	-	Г	R	L	Т	R	L	Т	R
Demand (v), v	eh/h			38	43	13	4	2	8	55	8	11	2	112	21	55
				h	1						-					
Signal Informa	tion		-	-	a	3	205								x	\mathbf{A}
Cycle, s	37.5	Reference Phase	2		R	R	- SA	2					1	Q 2	3	4
Offset, s	0	Reference Point	End	Green	1.6	3.9	18.5	0.0	0	0.0	0.0			<u> </u>	1	
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	3.5	3.5	3.5	0.0	0	0.0	0.0					~ V *
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.0	1.0	0.0	0	0.0	0.0	_	5	6	7	8
			_	EDI		EDT				D.T.		_	NET		_	0.5.7
Timer Results				EBL	-	EBI	WB		VV	RI	NBI	-	NBI	SB		SBT
Assigned Phase)			5	_	2	1	\rightarrow	6		3		8	/		4
Case Number				1.1		4.0	0.0	\rightarrow	14	4.0	11.0		14.2	14.0)	13.3
Phase Duration	, S) -		6.1		14.5	0.0	\rightarrow	8.	.4	0.0	+	23.0	0.0	_	23.0
Change Period,	(Y+R)	c), S		4.5		4.5	4.5	\rightarrow	4.	.5	4.5	\rightarrow	4.5	4.5	_	4.5
Max Allow Head	away(∧ ⊶ Time e	//AH), S		3.0		3.1	0.0	\rightarrow	3.	.1	0.0	+	3.2	0.0		3.0
Queue Clearan	ce nime	$(g_s), s$		2.7		2.9	0.0	\rightarrow	4.	.0	0.0		2.2	0.0	_	5.2
Green Extensio	n lime	(ge), s		0.0		0.2	0.0	\rightarrow	0.	.2	0.0	+	0.0	0.0	_	0.2
Phase Call Pro				0.33		0.85	<u> </u>	\rightarrow	0.1	//		_	1.00		_	1.00
Max Out Proba	ollity			1.00		0.00			0.0	00			0.00			0.00
Movement Gro	up Res	ults			EB			WE	3			NB			SB	
Approach Move	ment			L	Т	R	L	Т	Т	R	L	Т	R	L	Т	R
Assigned Move	ment			5	2	12	1	6	+	16	3	8	18	7	4	14
Adjusted Flow F	Rate (v), veh/h		38	56			87				21			133	55
Adjusted Satura	tion Flc	w Rate (s), veh/h/l	n	1667	1680			157	1			1605	<u> </u>		831	
Queue Service	Time (d	(s), S		0.7	0.9			2.0)			0.2			0.0	
Cycle Queue C	learance	e Time (g c), s		0.7	0.9			2.0	,			0.2			3.2	
Green Ratio (g	/C)			0.20	0.27			0.1	0			0.49	1		0.49	
Capacity (c), v	eh/h			333	448			28′	1			926			587	
Volume-to-Capa	acity Ra	tio(X)		0.114	0.125			0.31	0			0.023	1		0.227	
Back of Queue	(Q), ft	/In (95 th percentile)	8.1	10.3			23.	6			3			18.2	
Back of Queue	(Q), ve	eh/In (95 th percenti	le)	0.3	0.4			0.9	,			0.1	1		0.7	
Queue Storage	Ratio (RQ) (95 th percent	ile)	0.00	0.00			0.0	0			0.00	1		0.00	
Uniform Delay (d 1), s/	/veh		12.5	10.4			16.	0			4.9			5.5	
Incremental De	lay (d 2), s/veh		0.1	0.0			0.2	2			0.0	1		0.9	
Initial Queue De	elay (d	3), s/veh		0.0	0.0			0.0)			0.0	1		0.0	
Control Delay (d), s/ve	eh		12.5	10.5			16.	2			4.9	1		6.4	0.0
Level of Service	e (LOS)			В	В			В				Α			Α	Α
Approach Delay	, s/veh	/LOS		11.3		В	16.2	2	E	3	4.9		А	4.6		А
Intersection De	ersection Delay, s/veh / LOS					8	.8							A		
Multimodal Re	sults				EB			WE	3			NB			SB	
Pedestrian LOS	Score	/LOS		1.66		В	1.91	1	E	3	1.69)	В	1.86	3	В
Bicycle LOS Sc	ore / LC	DS		0.64		A	0.63	3	A	4	0.52	2	A	0.80)	A

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General Inform	nation								Inte	ersecti	ion Inf	ormati	on	E C		
Agency									Dur	ration.	h	1.000)		↓ *	
Analvst		Emma Mvers-Verha	ae	Analys	is Date	e Aua 8	. 2023	_	Are	a Type	3	Othe	r			2323
Jurisdiction		Box Elder, SD	<u> </u>	Time F	Period	PM Pe	eak		PHI	F		1.00			w t	\leftrightarrow
Urban Street		Alternative 1		Analys	is Yea	2050		_	Ana	alvsis F	Period	1> 7:	00			88
Intersection		Hwy 1416 and Libe	rtv Blvd	File Na	ame	Hwv14	416-Libe	ertv A	Alt1	PMPe	ak2050).xus			nte	
Project Descrip	tion	Radar Hill 1416 Co	ridor St	udy			-		_	-				3	i Natanatan	新作
, ,																
Demand Inform	nation				EB			W	/B			NB			SB	
Approach Move	ement			L	Т	R	L		Г	R	L	Т	R	L	Т	R
Demand (v), v	eh/h			40	46	13	4	3	0	58	8	11	2	118	22	58
				h							-					
Signal Informa	ation		-		La		126								₹	\mathbf{A}
Cycle, s	42.5	Reference Phase	2		R	B	<u></u>	2					1	Q 2	3	4
Offset, s	0	Reference Point	End	Green	1.9	4.2	23.0	0.0)	0.0	0.0			<u> </u>		
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	3.5	3.5	3.5	0.0)	0.0	0.0	_				$-\Psi$
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.0	1.0	0.0)	0.0	0.0		5	6	7	8
Timer Deculto			_		_	EDT			\\\/	рт			NDT			ODT
Assigned Dhose				EDL	-	2			001					30	-	
Case Number	e			1 1		2		+	14	,	11.0		0	/		4
Case Number				6.4	-	4.0	0.0	-+-	14 Q	7	0.0		27.5	0.0		27.5
Change Period	(V+P)			4.5		15.0	0.0	-+	0. 1	5	1.5		ZT.5	0.0		21.J 4.5
Max Allow Hear	$\frac{1}{2}$	(), S (AAH) e		4.0		4.5	4.5	-	4. 3	.5	4.5		3.2	4.5	_	4.0
Queue Clearan	ce Time	$(a_s)_s$		2.8		3.2	0.0	+	<u>J</u> .	4	0.0		2.2	0.0		5.7
Green Extensio	n Time	(gs), s	_	0.0	-	0.2	0.0	-	۰. ۱	2	0.0		0.0	0.0		0.7
Phase Call Pro	hability	(9, 9, 5		0.38		0.90	0.0	-	0.	83	0.0		1.00	0.0		1.00
Max Out Proba	bility			1.00		0.00		-	0.0	00			0.00			0.00
Max Out 1 1054	onity			1.00		0.00			0.0	00			0.00			0.00
Movement Gro	oup Res	ults			EB			WE	3			NB			SB	
Approach Move	ement			L	Т	R	L	Т		R	L	Т	R	L	Т	R
Assigned Move	ment			5	2	12	1	6		16	3	8	18	7	4	14
Adjusted Flow I	Rate(<i>v</i>), veh/h		40	59			92				21			140	58
Adjusted Satura	ation Flo	ow Rate (<i>s</i>), veh/h/l	n	1667	1683			157	2			1600			794	
Queue Service	Time (g	gs), s		0.8	1.2			2.4				0.2			0.0	
Cycle Queue C	learance	e Time (<i>g c</i>), s		0.8	1.2			2.4				0.2			3.7	
Green Ratio (g	/C)			0.19	0.25			0.10	5			0.54			0.54	
Capacity (c), v	/eh/h			299	417			259)			984			585	
Volume-to-Capa	acity Ra	tio(X)		0.134	0.141			0.35	5			0.021			0.239	
Back of Queue	(Q), ft	/In (95 th percentile)	10.9	14.3			31				3.1			20.2	
Back of Queue	(Q), ve	eh/In (95 th percenti	le)	0.4	0.6			1.2	2			0.1	<u> </u>		0.8	
Queue Storage	Ratio (RQ) (95 th percent	ile)	0.00	0.00			0.0	0			0.00	<u> </u>		0.00	
Uniform Delay ((d 1), s/	/veh		14.6	12.5			18.4	4			4.5	<u> </u>		5.2	
Incremental De	lay (<i>d</i> 2), s/veh	0.1	0.1			0.3				0.0	<u> </u>		1.0		
Initial Queue De	elay (d	3), s/veh		0.0	0.0			0.0				0.0	<u> </u>		0.0	
Control Delay (d), s/ve	eh		14.6	12.5			18.	7			4.6			6.2	0.0
Level of Service	e (LOS)			В	В			B				A	<u> </u>		A	Α
Approach Delay	proach Delay, s/veh / LOS					В	18.7		E	3	4.6		A	4.4		A
Intersection De	ersection Delay, s/veh / LOS					9	.8				_			A	_	
Multimedal De	nodal Results							10/5	2						00	
Redestrian LOS	Suits	/1.05		1 67	EB	P	1.04	VVE) Г	2	1 60	INB	P	1.0/	38	P
Rievelo LOS So				1.0/		Δ	1.9				0.50	,		1.00		Δ
BICYCIE LOS SC	JUIE / LC			0.65		А	0.64		P	٦	0.52	-	А	0.8		А

				ł	ЧC	S Rou	nda	ibοι	uts Re	ep	ort								
General Information					_		_	Site	e Info	rm	natio	ı			_		_		
Analyst	Emma	a Myers	-Verhag	je			*		1		Inters	ection			Hi	ghway	1416	5 and L	iberty Bl
Agency or Co.										Ī	E/W S	Street Na	ime		Hi	ghway	1416	5	
Date Performed	8/3/2	023				$\left[\right]$		N		÷	N/S S	treet Na	me		Lik	berty B	lvd		
Analysis Year	2030						W	†Ε S) † }		Analy	sis Time	Period, h	rs	1.0	00			
Time Analyzed	AM P	eak									Peak	Hour Fac	tor		0.8	84			
Project Description	Alterr	native 1						→ ▼ *	1		Jurisd	liction			Bc	ox Elde	r, SD		
Volume Adjustments	and S	ite Cl	harac	teris	stic	s													
Approach			EB				V	VB		Τ		Ν	IB				S	БB	
Movement	U	L	Т	F	R	U	L	Т	R		U	L	Т	R	U	J	L	Т	R
Number of Lanes (N)	0	0	1	(0	0	0	1	0		0	0	1	0	0		0	1	0
Lane Assignment				LTR					LTR				LT	R					LTR
Volume (V), veh/h	0	326	150	3	3	0	7	90	17	1	0	4	51	10	0		60	19	141
Percent Heavy Vehicles, %	8	8	8	8	8	7	7	7	7		2	2	2	2	9	,	9	9	9
Flow Rate (VPCE), pc/h	0	419	193	4	4	0	9	115	5 218	3	0	5	62	12	0		78	25	183
Right-Turn Bypass		N	one				N	one				No	one				No	one	
Conflicting Lanes			1					1					1					1	
Pedestrians Crossing, p/h			0					0					0					0	
Proportion of CAVs										0)								
Critical and Follow-U	p Hea	dway	Adju	ıstm	nen	t													
Approach		1	EB				V	VB		Т		Ν	IB				S	В	
Lane	Left	Ri	ght	Вура	iss	Left	Ri	ght	Bypas	s	Left	Ri	ght B	ypass	L	.eft	Ri	ght	Bypass
Critical Headway, s		4.9	9763				4.9	9763				4.9	763				4.9	763	
Follow-Up Headway, s		2.6	5087				2.6	5087				2.6	087				2.6	087	
Flow Computations,	Capaci	ity an	d v/e	: Rat	tios	5													
Approach		I	EB				V	VB				Ν	IB				5	В	
Lane	Left	Ri	ght	Вура	iss	Left	Ri	ght	Bypas	s	Left	Rig	ght B	ypass	L	.eft	Ri	ght	Bypass
Entry Flow (v _e), pc/h		6	16				3	42				7	'9				2	86	
Entry Volume, veh/h		5	70				3	20				7	7				2	62	
Circulating Flow (vc), pc/h		1	12				4	86				6	90				1	29	
Exiting Flow (vex), pc/h		2	83				3	03				6	99				3	8	
Capacity (c _{pce}), pc/h		12	231				8	41				6	83				12	10	
Capacity (c), veh/h		1	140				7	86				6	69				11	10	
v/c Ratio (x)		0	.50				0	.41				0.	12				0.	24	
Delay and Level of Se	rvice	rvice																	
Approach		EB		Т		WB				NB		Т			SB				
Lane	Left Right					Bypass	L	eft	Right	В	Bypass	Left	Right	Вур	ass	Left		Right	Bypass
Lane Control Delay (d), s/veh	8.8								9.8	T			6.7				T	5.4	
Lane LOS	A								А	T			А					А	
95% Queue, veh	3.0								2.0	T			0.4				T	0.9	
Approach Delay, s/veh LOS	proach Delay, s/veh LOS 8.8							9.8		A	Ą	6.7	,	A		5.	4		A
Intersection Delay, s/veh LOS	LOS 8.8						8.2								A				

HCS TM Roundabouts Version 2023 Hwy1416-Liberty_Alt2_AMPeak2030.xro

					HC	S Rou	nd	abo	uts	Rep	oort								
General Information				_			_	Sit	e In	forr	matio	n			_		_		
Analyst	Emma	a Myers	-Verha	ge			4				Inters	ection			F	lighwa	ay 14	16 and L	iberty Bl
Agency or Co.								+			E/W S	Street N	ame		F	lighwa	ay 14	16	
Date Performed	8/3/2	023				$\left[\right]$				+	N/S S	treet N	ame		L	iberty	Blvd		
Analysis Year	2050					₹ ↓		W + E S		↑ ≻	Analy	sis Time	e Period, l	nrs	1	.00			
Time Analyzed	AM P	eak									Peak	Hour Fa	ctor		0	.84			
Project Description	Alterr	native 1					\sim		1		Jurisc	liction			В	lox Eld	ler, S	D	
Volume Adjustments	and S	ite C	hara	cter	ristic	s													
Approach			EB					WB					NB		Τ			SB	
Movement	U	L	Т		R	U	L	Т		R	U	L	Т	R		U	L	Т	R
Number of Lanes (N)	0	0	1		0	0	0	1		0	0	0	1	0		0	0	1	0
Lane Assignment				LTR					LTR				Ľ	R					LTR
Volume (V), veh/h	0	333	151		3	0	7	91	1	178	0	4	52	10		0	61	19	142
Percent Heavy Vehicles, %	8	8	8		8	7	7	7		7	2	2	2	2		9	9	9	9
Flow Rate (VPCE), pc/h	0	428	194		4	0	9	11	6	227	0	5	63	12		0	79	25	184
Right-Turn Bypass		N	one				I	None				N	one		Ť		I	None	-
Conflicting Lanes			1					1					1					1	
Pedestrians Crossing, p/h			0					0					0					0	
Proportion of CAVs										0									
Critical and Follow-U	p Hea	dway	v Adj	ust	men	t													
Approach			EB					WB					NB		Т			SB	
Lane	Left	R	ight	Ву	pass	Left		Right	Ву	pass	Left	R	ght I	Bypass	Τ	Left	Τ	Right	Bypass
Critical Headway, s		4.9	9763				4	1.9763				4.9	9763		Τ		4	.9763	
Follow-Up Headway, s		2.0	6087				2	2.6087				2.	5087				2	.6087	
Flow Computations,	Capaci	ity ar	nd v/	c R	atio	5													
Approach			EB					WB				l	NB		Τ			SB	
Lane	Left	R	ight	Ву	pass	Left		Right	Ву	pass	Left	R	ght I	Bypass	Τ	Left	Τ	Right	Bypass
Entry Flow (v _e), pc/h		6	526				Τ	352					80		Τ		Τ	288	
Entry Volume, veh/h		5	580				Τ	329					78		Τ		Τ	264	
Circulating Flow (v _c), pc/h		1	13					496				7	01		Τ			130	
Exiting Flow (v _{ex}), pc/h		2	285					305				7	'18		Τ			38	
Capacity (c _{pce}), pc/h		1	230					832				6	575					1209	
Capacity (c), veh/h		1	139					778				6	62					1109	
v/c Ratio (x)		C).51					0.42				C	.12					0.24	
Delay and Level of Se	rvice																		
Approach	EB						Τ		W	'B			NB					SB	
Lane	Left Right					Bypas	s	Left	Rig	jht	Bypass	Left	Righ	: By	pass	Lef	ft	Right	Bypass
Lane Control Delay (d), s/veh		9.0							10	.1			6.8					5.5	
Lane LOS	A								В	3			A					А	
95% Queue, veh	3.1								2.	2			0.4					0.9	
Approach Delay, s/veh LOS	LOS 9.0							10.1			В	6.	8	A			5.5		A
Intersection Delay, s/veh LOS	DS 9.0						8.4									Ą			

					HC	S Rou	nda	aboı	uts F	Rep	ort								
General Information				_	_		_	Sit	e Inf	forr	natio	n			_		_		
Analyst	Emma	a Myers	-Verha	ge			*		L		Inters	ection			Hi	ghway	1416	5 and L	iberty Bl
Agency or Co.								+			E/W S	Street Na	ame		Hi	ghway	1416	5	
Date Performed	8/3/2	023								\$	N/S S	treet Na	me		Lik	oerty B	lvd		
Analysis Year	2030					≺ + ∣	(τ τ τ ε ε) †	\geq	Analy	rsis Time	Period, h	rs	1.0	00			
Time Analyzed	PM Pe	eak				Ê					Peak	Hour Fa	ctor		0.8	34			
Project Description	Alterr	native 1					\sim	→ ▼*	1		Jurisc	liction			Bo	ox Elde	r, SD		
Volume Adjustments	and S	ite C	harad	teri	istic	s													
Approach			EB					WB				٦	IB				S	ЗB	
Movement	U	L	Т		R	U	L	Т		R	U	L	Т	R	U		L	Т	R
Number of Lanes (N)	0	0	1		0	0	0	1		0	0	0	1	0	0		0	1	0
Lane Assignment				LTR					LTR				LT	R					LTR
Volume (V), veh/h	0	97	83	•	13	0	7	64	L I	66	0	8	16	2	0	1	125	26	107
Percent Heavy Vehicles, %	8	8	8		8	7	7	7		7	2	2	2	2	9		9	9	9
Flow Rate (VPCE), pc/h	0	125	107	·	17	0	9	82	2	84	0	10	19	2	0	1	162	34	139
Right-Turn Bypass		N	one				Ν	lone				N	one				No	one	-
Conflicting Lanes			1					1					1					1	
Pedestrians Crossing, p/h			0					0					0					0	
Proportion of CAVs											0								
Critical and Follow-U	p Hea	dway	v Adju	ustn	nen	t													
Approach			EB					WB				١	1B				S	SB	
Lane	Left	R	ight	Вура	ass	Left	F	Right	Вур	ass	Left	Ri	ght B	ypass	L	eft	Ri	ght	Bypass
Critical Headway, s		4.9	9763				4.	9763				4.9	763				4.9	763	
Follow-Up Headway, s		2.0	5087				2.	6087				2.6	087				2.6	087	
Flow Computations,	Capaci	ity ar	nd v/	c Ra	tios	5													
Approach			EB					WB				١	IB				S	БB	
Lane	Left	R	ight	Вура	ass	Left	F	Right	Вур	ass	Left	Ri	ght B	ypass	L	eft	Ri	ght	Bypass
Entry Flow (ve), pc/h		2	49				Γ	175				3	31				3	35	
Entry Volume, veh/h		2	231				T	164				3	80				3	07	
Circulating Flow (v _c), pc/h		2	205					154				3	94				1	01	
Exiting Flow (v _{ex}), pc/h		2	271					231				2	28				6	50	
Capacity (c _{pce}), pc/h		1	120				1	179				9	23				12	45	
Capacity (c), veh/h		1	037				1	102				9	05				11	42	
v/c Ratio (x)		C	.22					0.15				0	03				0.	27	
Delay and Level of Se	vrvice																		
Approach	EB						Τ		WB	;			NB					SB	
Lane	Left Right				Bypass	5	Left	Righ	nt	Bypass	Left	Right	Вур	ass	Left	Τ	Right	Bypass	
Lane Control Delay (d), s/veh		5.6							4.6				4.3					5.7	
Lane LOS		A							A				А					А	
95% Queue, veh	0.9								0.5				0.1					1.1	
Approach Delay, s/veh LOS			5	.6		A		4.6			A	4.3	3	A		5.	.7		А
Intersection Delay, s/veh LOS	OS 5.6						5.3								A				

					HC	S Roi	Ind	aboı	uts	Rep	oort								
General Information				_			_	Sit	e In	nforr	matio	n			_	_	_		
Analyst	Emma	a Myers	-Verha	ge			4		L		Inters	section			F	lighwa	ay 14	16 and L	iberty Bl
Agency or Co.								4			E/W S	Street N	ame		F	lighwa	ay 14	16	
Date Performed	8/3/2	023				$\left[\right]$				+	N/S S	Street Na	ime		L	iberty	Blvd		
Analysis Year	2050					K +		W + E S		↑ ≻	Analy	vsis Time	Period, I	nrs	1	.00			
Time Analyzed	PM Pe	eak								1	Peak	Hour Fa	ctor		0	.84			
Project Description	Alterr	native 1					$\begin{picture}{c} \hline \end{picture} \end{picture}$	→ ▼**	1		Jurisc	liction			В	lox Elc	der, Sl)	
Volume Adjustments	and S	ite C	hara	cter	ristic	s													
Approach			EB					WB				1	١B					SB	
Movement	U	L	Т	Τ	R	U	L	Т		R	U	L	Т	R		U	L	Т	R
Number of Lanes (N)	0	0	1		0	0	0	1		0	0	0	1	0		0	0	1	0
Lane Assignment				LTR					LTR	ł			1	R					LTR
Volume (V), veh/h	0	99	86	Τ	13	0	7	66	5	69	0	8	16	2		0	131	27	110
Percent Heavy Vehicles, %	8	8	8	Τ	8	7	7	7		7	2	2	2	2		9	9	9	9
Flow Rate (VPCE), pc/h	0	127	111	Τ	17	0	9	84	1	88	0	10	19	2		0	170	35	143
Right-Turn Bypass		N	one					None				N	one				١	lone	
Conflicting Lanes			1					1					1					1	
Pedestrians Crossing, p/h			0					0					0					0	
Proportion of CAVs											0								
Critical and Follow-U	p Hea	dway	, Adj	ustr	men	t													
Approach			EB					WB				1	NB					SB	
Lane	Left	R	ight	Вур	pass	Left		Right	Ву	pass	Left	Ri	ght I	Bypass		Left	F	Right	Bypass
Critical Headway, s		4.9	9763				4	.9763				4.9	763				4	9763	
Follow-Up Headway, s		2.0	5087				2	.6087				2.6	087				2	6087	
Flow Computations,	Capaci	ity ar	nd v/	c Ra	atios	5													
Approach			EB					WB				1	١B					SB	
Lane	Left	R	ight	Вур	pass	Left		Right	Ву	pass	Left	Ri	ght I	Bypass		Left	F	Right	Bypass
Entry Flow (v _e), pc/h		2	255					181				:	31					348	
Entry Volume, veh/h		2	236					169				:	30					319	
Circulating Flow (v _c), pc/h		2	214					156				4	08					103	
Exiting Flow (v _{ex}), pc/h		2	283					237				2	34					61	
Capacity (c _{pce}), pc/h		1	109				Τ	1177				g	10				· -	242	
Capacity (c), veh/h		1	027					1100				8	92				•	140	
v/c Ratio (x)		C	.23					0.15				0	.03					0.28	
Delay and Level of Se	rvice																		
Approach			Т		W	/B			NB					SB					
Lane	Left Right					Bypas	s	Left	Rig	ght	Bypass	Left	Right	Ву	pass	Le	ft	Right	Bypass
Lane Control Delay (d), s/veh	5.7								4.	.6			4.3					5.8	
Lane LOS	A								A	4			A					А	
95% Queue, veh	0.9								0.	.5			0.1					1.2	
Approach Delay, s/veh LOS	ich Delay, s/veh LOS 5.7						T	4.6			А	4.	3	A			5.8		А
Intersection Delay, s/veh LOS	S 5.7 OS						5.4								/	Ą			

General Inform	nation								Int	ersect	ion Infe	ormatio	on	2		制料
Agency									Du	ration,	h	1.000			44	
Analyst		Emma Myers-Verha	age	Analys	is Date	Aug 8	, 2023		Are	еа Туре	e	Other				
Jurisdiction				Time F	Period	AM P	eak		PH	IF		1.00			w ↓ u	
Urban Street		Alternative 1		Analys	is Year	2030			An	alysis l	Period	1> 7:	00			181
Intersection		Hwy 1416 and S El	lswor	File Na	ame	Hwy1	416-Ells	wortl	hRd	Alt1	AMPeal	(2030.)	us		5 \$	
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy		8								1	i di na da da	
				-							V					
Demand Inform	nation				EB		\\		WB			NB			SB	
Approach Move	ement			L	Т	R	<u> </u>		Т	R	L	Т	R	L	Т	R
Demand (v), v	eh/h			650	327	16	24	1	47	38	90	100	57	60	66	207
O'me al la famma	4!			1	1											
Signal Informa			0		La .,				2	245	245			*	₹ .	ሐ
Cycle, s	61.1	Reference Phase	Z End			R	R'	R'''			- N	17 T	1	2	3	4
Offset, s	0		Ena	Green	1.7	4.3	9.1	9.1 3.9		1.1	18.5	5	_	<u> </u>		
	Yes	Simult. Gap E/W	On	Yellow	3.5	3.5	3.5	3.	5	0.0	3.5			Y		Ψ.
Force Mode	Fixed	Simult. Gap N/S	Red	1.0	1.0	1.0	1.0 1.0		0.0	1.0		5	6	7	8	
Timer Deculto			ГРІ		ГРТ			14		NDI		NDT	CDI	_	ODT	
Assigned Dhose				EDL		2			~ ~ ~	/D1 6		-		301	-	4
Case Number	e			11		2		\rightarrow	1		1 1		0	/		4
Case Number				15.0		4.0	1.1	-+	4	4.U 2.6	1.1 Q /		4.0	1.1		4.0
Change Duration	, s (V+D			15.0		4 5	0.2	-+	1	5.0	0.4		25.0	9.5		4.1
	$(1+\Lambda)$			4.5		4.5	4.5	-+	4	2.0	4.5		4.J	4.5	_	4.5
	co Timo	$(a_{\lambda}) \in \mathcal{A}$		2.9	2.9		2.9	-	2.9		2.9		5.1 6.5	2.9		3. I 10 Q
Groop Extensio	n Timo	$(g_s), s$		11.9		0.7	2.7		0.7		4.2		0.3	0.0	_	0.5
Bhase Call Pro	hability	(<i>g</i> e), s		1.00 1		1.00	0.0		1.00		0.0	2	1.00	1.00		1.00
Max Out Broba	bility			1.00		0.01	1.00	2	1.	.00	1.00) \	0.00	1.00		1.00
	DIIILY			1.00 0		0.01	1.00	,	0.	.01	1.00		0.00	1.00	, , ,	J.05
Movement Gro	oup Res	ults			EB	_		W	В			NB			SB	
Approach Move	ement			L	Т	R	L	Т		R	L	Т	R	L	Т	R
Assigned Move	ment			5	2	12	1	6		16	3	8	18	7	4	14
Adjusted Flow I	Rate (v), veh/h		650	343		24	18	5		90	157		60	273	
Adjusted Satura	ation Flo	w Rate (<i>s</i>), veh/h/l	In	1618	1735		1667	168	88		1667	1643		1667	1540	
Queue Service	Time (g	g s), S		9.9	10.6		0.7	6.4	1		2.2	4.5		1.4	8.9	
Cycle Queue C	learance	e Time (<i>g c</i>), s		9.9	10.6	1	0.7	6.4	1		2.2	4.5		1.4	8.9	
Green Ratio (g	/C)	i		0.35	0.29	1	0.18	0.1	5		0.37	0.30		0.38	0.32	
Capacity (c), v	/eh/h			899	509		255	25	1		384	498		541	494	
Volume-to-Cap	acity Ra	itio(X)		0.723	0.674		0.094	0.73	37		0.235	0.316		0.111	0.553	
Back of Queue	(Q), ft	/In (95 th percentile	e)	141.1	158		11.1	102	.4		29.2	71.2		20.7	139.6	
Back of Queue	(Q), ve	eh/In (95 th percenti	ile)	5.6	6.3		0.4	4.1	1		1.2	2.8		0.8	5.6	
Queue Storage	Ratio (RQ) (95 th percent	tile)	0.00	0.00		0.00	0.0	0		0.00	0.00		0.00	0.00	
Uniform Delay	(d 1), si	/veh		16.8	19.0		21.2	24.	9		13.8	16.4		12.2	17.1	
Incremental Delay (<i>d</i> ₂), s/veh					0.8		0.1	1.6	3		0.1	1.7		0.4	4.5	
Initial Queue Delay (<i>d</i> ₃), s/veh					0.0		0.0	0.0)		0.0	0.0		0.0	0.0	
Control Delay (<i>d</i>), s/veh					19.8	1	21.2	26.	5		13.9	18.1		12.6	21.6	
Level of Service (LOS)					В		С	С			В	В		В	С	
Approach Delay, s/veh / LOS						В	25.9)		С	16.6	;	В	20.0		В
Intersection Delay, s/veh / LOS						19	9.9							В		
Multimodal Results					EB			WE				NB			SB	
Pedestrian LOS	S Score	/LOS		1.91		В	2.11		В		1.91		В	2.09		В
Bicycle LOS Sc	ore / LC	DS		2.13		В	0.83	3		A	0.90		А	1.04		А

General Inform	nation								Inte	ersect	ion Inf	ormatio	on	2		
Agency									Dur	ration,	h	1.000			45	and and
Analyst		Emma Myers-Verha	age	Analys	is Dat	e Aug 8	3, 2023		Are	a Type	e	Other		, see 1		
Jurisdiction		Box Elder, SD		Time F	Period	AM P	eak		PH	F		1.00			W T	
Urban Street		Alternative 1		Analys	is Yea	r 2050			Ana	alysis I	Period	1> 7:(00			188
Intersection		Hwy 1416 and S El	lswor	File Na	ame	Hwy1	416-Ells	worth	nRd_	Alt1_A	AMPeal	k2050.x	us		ግ ቱ	
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy												行行
				-												
Demand Inform	nation				EB			W	/B			NB			SB	
Approach Move	ement			L	Т	R	L		Г	R	L	Т	R	L	Т	R
Demand (v), v	eh/h			748	348	19	24	15	56	41	102	107	58	61	69	248
O'me al la famma	4!			1	1	-										
Signal Informa			0		Lz,			<u> </u>	2	245				~	ς Ι,	\mathbf{A}
Cycle, s	83.4	Reference Phase	2 End			R	R '	· ·	S S1		2		1	\$ 2	3	4
Offset, s	0	Reference Point	End	Green	2.1	11.1	11.7	18	3.0 18.0		0.0		_	<u> </u>		•
	Yes	Simult. Gap E/W	On	Yellow	3.5	3.5	3.5	3.5	5	3.5	0.0			Y		Ψ.
Force Mode	Fixed	Simult. Gap N/S	Rea	1.0	1.0	1.0	1.0	1.0 1.0		0.0		5	6	7	8	
Timer Deculto				ГРІ		ГРТ			10/	рт				<u>SDI</u>		CDT
Assigned Dhose				EDL		2								301		
Case Number	e		11	-	2	1 1	+	4	0	1 1		0	1 1		4	
Case Number				1.1	,	4.0 21.9	1.1	-	4.	.0 3.2	22.5		4.0 22.5	1.1 22 F		4.0
Change Duration	(V+D			22.2	-	1.0	0.0	-	10	5	22.0)	4.5	22.0	,	22.5
	$\frac{1}{2}$	c), S		4.5		4.5	4.5	-	4.5		4.5		4.0	4.5		4.0
	co Timo	$(a_{\lambda}) \in \mathcal{A}$		2.9		2.9	2.9	-	2.9		2.9		0.3	2.9		10.0
Groop Extensio	n Timo	$(g_s), s$		17.6		0.1	3.0	-	0.2		0.1		9.5	0.1		0.0
Bhase Call Bro	hability	(<i>g</i> e), s		1.00		1.00	0.0	2	1.0	.2	1.00		1.00	1.00		1.00
Max Out Proba	bility			1.00		1.00	0.4	י ר	0.1	10	0.00	,	0.02	0.00	,	1.00
	Dinty			1.00		1.00	0.00	,	0.	10	0.00)	0.03	0.00	,	1.00
Movement Gro	oup Res	ults			EB			WE	3		_	NB			SB	
Approach Move	ement			L	Т	R	L	Т	Т	R	L	Т	R	L	Т	R
Assigned Move	ment			5	2	12	1	6	+	16	3	8	18	7	4	14
Adjusted Flow I	Rate (v), veh/h		748	367		24	197	7		102	165		61	317	
Adjusted Satura	ation Flo	w Rate (<i>s</i>), veh/h/l	In	1618	1734	1	1667	168	7		1667	1646		1667	1534	
Queue Service	Time (g	g s), s		15.6	15.1		1.0	9.5	;		3.1	7.3		1.8	17.0	
Cycle Queue C	learance	e Time (<i>g c</i>), s		15.6	15.1	1	1.0	9.5	;		3.1	7.3		1.8	17.0	
Green Ratio (g	/C)	i		0.38	0.33	1	0.17	0.14	4		0.43	0.22		0.43	0.22	
Capacity (c), v	/eh/h			924	567		255	236	3		446	355		575	331	
Volume-to-Cap	acity Ra	itio(X)		0.809	0.647	·	0.094	0.83	3		0.229	0.465		0.106	0.958	
Back of Queue	(Q), ft	/In (95 th percentile	e)	241	240.8	;	17	176.	.8		51.4	136.2		28.7	433.7	
Back of Queue	(Q), ve	eh/In (95 th percenti	ile)	9.6	9.6		0.7	7.1			2.1	5.4		1.1	17.3	
Queue Storage	Ratio (RQ) (95 th percent	tile)	0.00	0.00		0.00	0.00	0		0.00	0.00		0.00	0.00	
Uniform Delay	(d1), s/	/veh		22.1	24.0		29.5	34.9	9		16.3	28.5		14.5	32.3	
Incremental De	5.1	2.0		0.1	5.8	;		1.2	4.4		0.4	66.0				
Initial Queue Delay (<i>d</i> ₃), s/veh					0.0		0.0	0.0)		0.0	0.0		0.0	0.0	
Control Delay (d), s/veh					26.0		29.5	40.7	7		17.5	32.9		14.9	98.4	
Level of Service (LOS)					С		С	D			В	С		В	F	
Approach Delay, s/veh / LOS						С	39.5	5	C)	27.0)	С	84.9)	F
Intersection Delay, s/veh / LOS						3	9.4							D		
Multimodal Results					EB			WE	WB			NB	NB		SB	
Pedestrian LOS	Score	/LOS		1.92		В	2.13		В		1.93	3	В	2.12	2	В
Bicycle LOS Sc	ore / LC	DS	2.33		В	0.85	5	A	4	0.93	3	А	1.11		А	

General Inform	nation								Int	tersect	ion Infe	ormatio	on	2		制度
Agency									Du	iration,	h	1.000)		4 5	and a set
Analyst		Emma Myers-Verha	age	Analys	is Date	e Aug 8	, 2023		Are	еа Тур	е	Other	-			
Jurisdiction		Box Elder, SD		Time P	eriod	PM P	eak		PH	١F		1.00			w 🖥 u	
Urban Street		Alternative 1		Analys	is Yea	· 2030			An	alysis	Period	1> 16	6:45			181
Intersection		Hwy 1416 and S El	lswor…	File Na	me	Hwy1	416-Ells	worth	hRd	_Alt1_I	PMPeal	k2030.>	kus		ግ ቱ	
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy										1	L HINT AND	派
				I			1				T					
Demand Inform	nation				EB			N	WB			NB			SB	
Approach Move	ement			L	Т	R	L		Т	R	L	Т	R	L	Т	R
Demand (v), v	eh/h			306	84	152	15	7	' 6	7	38	39	7	7	62	273
O'me al la famma	4!			li -						1 111						
Signal Informa	tion		0		La "			<u> </u>	2	245	245	a 🖌 🗸		~	<	\mathbf{A}
Cycle, s	52.4	Reference Phase	2			R	R.	· ·	5		5	17 T	1	\$ 2	3	4
Offset, s	0	Reference Point	End	Green	1.0	4.1	5.8	2.	1 2.9		18.5	5	_	<u> </u>		•
	Yes	Simult. Gap E/W	On	Yellow	3.5	0.0	3.5	3.	5	0.0	3.5			Y		Ψ.
Force Mode	Fixed	Simult. Gap N/S	Red	1.0	0.0	1.0	1.0	0	0.0	1.0		5	6	7	8	
Timer Deculto			ГРІ		ГРТ			10		NDI		NDT	CDI		орт	
Assigned Dhose			EDL	-	2			V\					301		4	
Case Number	e			1 1		2	1 1	\rightarrow	/	1.0	J 1 1		0	/	_	4
Case Number				1.1		4.0	5.5	\rightarrow	4	+.U	1.1		4.0	0.5		4.0
Change Duration	(V+D			9.0		14.4	5.5	\rightarrow		0.5	0.0		23.0	9.5		25.9
	$\frac{1}{2}$	c), S		4.5		4.5		\rightarrow	4.5		4.0		4.0	4.5	_	4.5
	co Timo	$(a_{\lambda}) \in \mathcal{A}$		2.9		9.5	3.0		3.0		2.5		2.4	2.1		3. 4 10.7
Groop Extensio	n Timo	$(g_s), s$		0.0		9.5	2.4		4.4		2.7		2.9	2.1		0.6
Bhase Call Bro	hability	(<i>g</i> e), s		0.99		1.00	0.0		0	00	0.0	,	1.00	1.00		0.0
Max Out Proba	bility			0.99		0.01	1.00	, ,	0	.99	1.00	-	0.00	1.00		1.00
	Dinty			1.00		0.01	1.00		0.	.00	1.00	,	0.00	1.00		5.07
Movement Gro	oup Res	ults			EB			WE	В			NB			SB	
Approach Move	ement			L	Т	R	L	Т	Т	R	L	Т	R	L	Т	R
Assigned Move	ment			5	2	12	1	6	\uparrow	16	3	8	18	7	4	14
Adjusted Flow I	Rate (v), veh/h		306	236		15	83	;		38	46		7	335	
Adjusted Satura	ation Flo	w Rate (<i>s</i>), veh/h/l	n	1618	1568	1	1667	172	24		1667	1703		1667	1526	
Queue Service	Time (g	g s), S		4.2	7.5		0.4	2.4	1		0.7	0.9		0.1	8.7	
Cycle Queue C	learance	e Time (<i>g c</i>), s		4.2	7.5	1	0.4	2.4	1		0.7	0.9		0.1	8.7	
Green Ratio (g	/C)	i		0.24	0.19	1	0.13	0.1	1		0.39	0.35		0.46	0.41	
Capacity (c), v	/eh/h			766	297		178	191	1		421	601		759	622	
Volume-to-Cap	acity Ra	tio(X)		0.399	0.795	1	0.084	0.43	34		0.090	0.077		0.009	0.538	
Back of Queue	(Q), ft	/In (95 th percentile	e)	54.2	104		6.2	37.	3		10.9	16.2		1.9	141.3	
Back of Queue	(Q), ve	eh/In (95 th percenti	ile)	2.2	4.2		0.2	1.5	5		0.4	0.6		0.1	5.7	
Queue Storage	Ratio (RQ) (95 th percent	tile)	0.00	0.00		0.00	0.0	0		0.00	0.00		0.00	0.00	
Uniform Delay (<i>d</i> 1), s/veh					20.3		20.3	21.	8		10.5	11.3		7.8	11.8	
Incremental Delay (<i>d</i> ₂), s/veh					1.9		0.1	0.6	3		0.0	0.2		0.0	3.4	
Initial Queue Delay (d 3), s/veh					0.0		0.0	0.0)		0.0	0.0		0.0	0.0	
Control Delay (d), s/veh					22.1		20.4	22.3	3		10.5	11.5		7.8	15.1	
Level of Service (LOS)					С		С	С	T		В	В		Α	В	
Approach Delay, s/veh / LOS						В	22.0)		С	11.1		В	15.0		В
Intersection Delay, s/veh / LOS						17	7.5							В		
								-								
Multimodal Results					EB		V		WB				NB		SB	
Pedestrian LOS	S Score	/LOS		1.91		В	2.11		В		1.89		В	2.08	;	В
Bicycle LOS Sc	1.38		А	0.65	5		A	0.63	3	А	1.05	5	А			

General Inform	nation								Int	tersect	ion Infe	ormatio	on	3		
Agency									Du	iration,	h	1.000)		4 5	
Analyst		Emma Myers-Verha	age	Analys	is Dat	e Aug 1	0, 2023		Are	еа Тур	е	Other	-	, I		
Jurisdiction		Box Elder, SD		Time F	Period	PM P	eak		PH	łF		1.00			พ 🛔 แ	
Urban Street		Alternative 1		Analys	is Yea	r 2050			An	alysis	Period	1> 16	6:45			188
Intersection		Highway 1416 and	S Ell	File Na	ame	Hwy1	416-Ells	worth	hRd	Alt1	PMPeal	k2050.>	kus		5 Þ	
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy												
				-			W				T			v		
Demand Inform	nation				EB			N	WB			NB			SB	
Approach Move	ement			L	Т	R	L		Т	R	L	Т	R	L	Т	R
Demand (v), v	eh/h			352	99	178	18	9)1	8	43	43	8	8	72	327
O'me al la famma	4!			1	1					1 111						
Signal Informa	tion		0		La .				2	245	245	a 🖌		~	κ.	\mathbf{A}
Cycle, s	54.6	Reference Phase	2		ľ		R'		5		5	17 T	1	\$ 2	3	4
Offset, s	0	Reference Point	Ena	Green	1.2	3.9	8.0	2.4	4	2.6	18.5	5	_	<u> </u>	1	•
	Yes	Simult. Gap E/W	On	Yellow	3.5	0.0	3.5	3.	5	0.0	3.5			Y		Ψ.
Force Mode	Fixed	Simult. Gap N/S	Rea	1.0	0.0	1.0	11.	.0 0.0		1.0		5	6	7	8	
Timer Deculto				ГРІ		ГРТ		1	14		NDI		NDT	<u>CDI</u>		CDT
Assigned Dhose				EDL		2								301	-	
Case Number	e		11		2		-	1		J 1 1		0	11		4	
Case Number				1.1		4.0	5.7	-	4	+.U 2.5	1.1 6.0		4.0	1.1		4.0
Change Duration	(V+D			9.0		10.5	5.7	-	4	2.5	0.9		23.0	9.5	-	25.0
	$\frac{1}{2}$	c), S		4.5		4.5		-	4.5		4.0		4.0	4.0		4.5
	co Timo	$(a_{\lambda}) \in \mathcal{A}$		2.9		11 5	2.5	-	3.0		2.0		3.4	2.3		5.4 1/ 5
Groop Extensio	n Timo	$(g_s), s$		0.0		0.4	2.5		0.6		2.9		1.0	2.2		0.5
Bhase Call Bro	hability	(<i>g</i> e), s		1.00		1.00	0.0	1	1	00	0.0	2	1.0	1.00		0.5
Max Out Proba	bility			1.00		0.05	1.00	+ \	1.	.00	1.00))	0.00	1.00	,	0.75
	Dinty			1.00		0.05	1.00	,	0.	.00	1.00	,	0.00	1.00		0.75
Movement Gro	oup Res	ults			EB			W	В			NB			SB	
Approach Move	ement			L	Т	R	L	Т		R	L	Т	R	L	Т	R
Assigned Move	ment			5	2	12	1	6	+	16	3	8	18	7	4	14
Adjusted Flow I	Rate (v), veh/h		352	277		18	99	,		43	51		8	399	
Adjusted Satura	ation Flo	w Rate (<i>s</i>), veh/h/l	n	1568	1520		1537	159	0		1654	1689		1602	1466	
Queue Service	Time (g	g s), S		5.1	9.5		0.5	3.1	1		0.9	1.1		0.2	12.5	
Cycle Queue C	learance	e Time (<i>g c</i>), s		5.1	9.5		0.5	3.1	1		0.9	1.1		0.2	12.5	
Green Ratio (g	/C)	i		0.27	0.22		0.17	0.1	5		0.38	0.34		0.43	0.39	
Capacity (c), v	/eh/h			788	332		174	234	4		323	572		698	566	
Volume-to-Cap	acity Ra	tio(X)		0.447	0.833		0.104	0.42	23		0.133	0.089		0.011	0.705	
Back of Queue	(Q), ft	/In (95 th percentile	e)	66.1	140.6		8	48.	3		13.7	19.8		2.5	219.1	
Back of Queue	(Q), ve	eh/In (95 th percenti	ile)	2.6	5.4		0.3	1.8	3		0.5	0.8		0.1	8.4	
Queue Storage	Ratio (RQ) (95 th percent	tile)	0.00	0.00		0.00	0.0	0		0.00	0.00		0.00	0.00	
Uniform Delay (<i>d</i> 1), s/veh					20.4		19.6	21.	2		12.1	12.3		8.9	14.1	
Incremental Delay (<i>d</i> ₂), s/veh					4.0		0.1	0.5	5		0.1	0.3		0.0	7.5	
Initial Queue Delay (d 3), s/veh					0.0		0.0	0.0)		0.0	0.0		0.0	0.0	
Control Delay (<i>d</i>), s/veh					24.4		19.7	21.	6		12.1	12.6		8.9	21.6	
Level of Service (LOS)					С		В	С			В	В		Α	С	
Approach Delay, s/veh / LOS						С	21.3	3		С	12.4		В	21.4		С
Intersection Delay, s/veh / LOS						2).1							С		
Multimodal Results					EB			W	WB			NB			SB	
Pedestrian LOS	Score	/LOS		1.91		В	2.11		В		1.90)	В	2.08	3	В
Bicycle LOS Sc		1.53		В	0.68	3		A	0.64		А	1.16	6	А		

				Н	CS	Rour	ndak	oou	its Re	po	rt											
General Information	_			Site	e Info	rma	atior	ı			_		_	_								
Analyst	Emma	a Myers	-Verhag	e	Т		*				Inters	ection			Hig	ghway	1416	and S	Ellswor			
Agency or Co.							+	-			e/w s	street Na	ime		Hig	ghway	1416					
Date Performed	8/7/2	023				1				2	N/S S	treet Na	me		S E	llswort	h Rd					
Analysis Year	2030					$\triangleleft \downarrow$	w † s	Ð	↑		Analy	sis Time	Period, h	rs	1.00							
Time Analyzed	AM P	eak			Ĩ						Peak I	Hour Fac	tor		0.8	0.84						
Project Description	Alterr	native 2					-				Jurisd	iction			Bo	Box Elder, SD						
Volume Adjustments	and S	ite C	harac	terist	ics																	
Approach			EB		Т		В		Т		N	IB				3						
Movement	U	L	Т	R	T	U L T			R		U	L	Т	R	U		L	Т	R			
Number of Lanes (N)	0	0	1	0		0	0	1	0		0	0	1	0	0		0	1	0			
Lane Assignment				LTR					LTR				LT	R					LTR			
Volume (V), veh/h	0	650	335	16		0	30	173	44		0	90	100	59	0	6	52	66	207			
Percent Heavy Vehicles, %	4	4 4 4 4					10	10	10		1	1	1	1	5		5	5	5			
Flow Rate (VPCE), pc/h	0	0 805 415 20					0 39 227 58					108	120	71	0	7	78	82	259			
Right-Turn Bypass		N	one				Nor	ne				No	one				No	ne				
Conflicting Lanes						1						1			1							
Pedestrians Crossing, p/h			0				0					(0			0						
Proportion of CAVs										0												
Critical and Follow-U	p Hea	dway	, Adjı	ıstme	ent																	
Approach			EB		Т	WB						NB					S	3				
Lane	Left	Ri	ight	Bypass	5	Left	Right		Bypass		Left	Rig	ght B	ypass	Le	eft	Rig	ht	Bypass			
Critical Headway, s		4.9	9763		Τ		4.97	63		Τ		4.9	763				4.97	763				
Follow-Up Headway, s		2.6	5087		Τ		2.60	87		Τ		2.6	087			2.6087						
Flow Computations,	Capaci	ity an	d v/o	: Rati	os																	
Approach			EB				W	В		Т		Ν	IB				S	3				
Lane	Left	Ri	ight	Bypass	5	Left	Rig	ht	Bypass		Left	Rig	ght B	ypass	Le	eft	Rig	ht	Bypass			
Entry Flow (ve), pc/h		1	240			32			324			2	99				41	9				
Entry Volume, veh/h		1	192				29	5				2	96				39	9				
Circulating Flow (v _c), pc/h		1	99				103	33				12	.98				37	4				
Exiting Flow (v _{ex}), pc/h		5	64				59	4				9	83				14	1				
Capacity (c _{pce}), pc/h		1	126				48	1				3	67				94	2				
Capacity (c), veh/h		1	083				43	7				3	64				89	7				
v/c Ratio (x)		1	.10				0.6	7				0.	81				0.4	14				
Delay and Level of Se	ervice																					
Approach		В				WB				NB		Т			SB							
Lane	Left Righ					Bypass	Let	ft	Right	Вур	oass	Left	Right	Вура	ass	Left	R	ight	Bypass			
Lane Control Delay (d), s/veh	rol Delay (d), s/veh 220.								28.1				52.9				T	9.4				
Lane LOS F									D				F					А				
95% Queue, veh 77.0					.6				5.7				10.1					2.4				
Approach Delay, s/veh LOS 220.7						F	Ĩ	28.1		D	D 52.9 F				9.4				A			
Intersection Delay, s/veh LOS		133.3											F									

				H	ICS	S Rou	nda	bou	ıts R	ep	ort											
General Information		_	_	_		Site Information												_				
Analyst	Emma	a Myers	-Verhag	e	Т		-				Inters	ection			н	ighway	1416	5 and S	Ellswor			
Agency or Co.								÷			E/W S	Street Na	ame		н	ighway	1416	5				
Date Performed	8/7/2	023								*	N/S S	treet Na	me		S	Ellswor	th Ro	ł				
Analysis Year	2050					∢ ↓	W	† E S) †	\geq	Analy	sis Time	Period, h	rs	1.	1.00						
Time Analyzed	AM P	eak				\$			1		Peak	Hour Fa	ctor		0.	0.84						
Project Description	Alterr	native 2						→ ▼ *	1		Jurisd	liction			В	Box Elder, SD						
Volume Adjustments	and S	ite Cl	narac	teris	tics	5																
Approach			EB		Т	WB						٩	IB		Γ	SB						
Movement	U	L	Т	R	1	UL				र	U	L	Т	R	ι	J	L	Т	R			
Number of Lanes (N)	0	0	0	0	1	()	0	0	1	0	()	0	1	0						
Lane Assignment				LTR	1				LTR				LT	R					LTR			
Volume (V), veh/h	0	748	356	19	,	0	30	182	2 4	7	0	102	107	60	(63	69	248			
Percent Heavy Vehicles, %	4	4 4 4 4					10	10	1	0	1	1	1	1	5	5	5	5	5			
Flow Rate (VPCE), pc/h	0	0 926 441 24					0 39 238 62					123	129	72) .	79	86	310			
Right-Turn Bypass		None					N	one				No	one		\square	_	No	one				
Conflicting Lanes					1					1			1									
Pedestrians Crossing, p/h			0					0					0			0						
Proportion of CAVs										(0											
Critical and Follow-U	p Hea	dway	Adju	istm	ent	:																
Approach		[EB		Т	WB					NB						5	SB				
Lane	Left	Ri	ght	Bypas	s	Left	ight	Bypass		Left	Ri	ght B	ypass	L	Left		ght	Bypass				
Critical Headway, s		4.9	763				4.9	9763				4.9	763				4.9	763				
Follow-Up Headway, s		2.6	6087				2.6	5087				2.6	087		2.6087							
Flow Computations,	Capaci	ity an	d v/c	: Rati	ios																	
Approach		[EB		Τ		V	NB				Ν	IB				ç	SB				
Lane	Left	Ri	ght	Bypas	s	Left	Ri	ight	Вура	ss	Left	Ri	ght B	ypass	L	_eft	Ri	ght	Bypass			
Entry Flow (ve), pc/h		13	391		T		39				3	24				4	75					
Entry Volume, veh/h		13	338				3	808				3	21				4	52				
Circulating Flow (v _c), pc/h		2	04		T		1	178				14	46				4	00				
Exiting Flow (vex), pc/h		5	92				6	571				1 1	17				1	49				
Capacity (तृत्व), pc/h		1.	121		T		4	15				3	16				9	18				
Capacity (c), veh/h		1(078				3	77				3	13				8	74				
v/c Ratio (x)		1	.24				0	.82				1.	03				0.	.52				
Delay and Level of Se	ervice																					
Approach	EB						Т		WB				NB					SB				
Lane	Left Right					Bypass	L	.eft	Right		Bypass	Left	Right	Вур	ass	Left	Т	Right	Bypass			
Lane Control Delay (d), s/veh	rol Delay (d), s/veh 458								51.8				187.8					11.1				
Lane LOS					F				F				F					В				
95% Queue, veh					3.9				10.3	T			24.1				T	3.2				
Approach Delay, s/veh LOS	458.9 F 51.8 F					F 187.8 F				11.1 B												
Intersection Delay, s/veh LOS		287.3									F	F										

				Н	ICS	S Rour	nda	bou	its Re	ер	ort											
General Information		_	_	_	_	Site Information																
Analyst	Emma	a Myers	-Verhag	je	Т		*				Inters	ection			н	lighway	, 141	6 and S	Ellswor			
Agency or Co.				-			•	- ^			E/W S	Street Na	ime		н	lighway	[,] 141	6				
Date Performed	8/7/2	023				7				÷	N/S S	treet Na	me		S	Ellswo	rth R	d				
Analysis Year	2030					┥ ↓ (W	Ť E S) †)		Analy	sis Time	Period, h	rs	1.	1.00						
Time Analyzed	PM P	eak			Ī	÷					Peak	Hour Fac	tor		0	0.90						
Project Description	Alterr	native 2					-	→ ↓			Jurisd	liction			В	Box Elder, SD						
Volume Adjustments	and S	ite C	harac	terist	tics	;																
Approach			EB		Т	WB						N	IB		Γ							
Movement	U	L	Т	R		U	L	Т	R		U	L	Т	R	l	J	L	Т	R			
Number of Lanes (N)	0	0	1	0	0	0	1	0		0	0	1	0	(0	0	1	0				
Lane Assignment				LTR	Ť				LTR				LT	R					LTR			
Volume (V), veh/h	0	306	150	152	2	0	29	135	21		0	38	49	22	1	0	22	71	273			
Percent Heavy Vehicles, %	4	4	4	10	10	10	10		1	1	1	1	!	5	5	5	5					
Flow Rate (VPCE), pc/h	0	354	173	176	0 35 165 26					0	43	55	25	(0	26	83	318				
Right-Turn Bypass		N	one	_		No	one				No	one				N	one					
Conflicting Lanes						1					1			1								
Pedestrians Crossing, p/h			0				(0					C			0						
Proportion of CAVs										0)											
Critical and Follow-U	p Hea	dway	, Adju	ıstme	ent																	
Approach			EB		Т	WB					NB							SB				
Lane	Left	Ri	ight	Bypas	s	Left	Rig	ght Bypass			Left	Rig	ght B	ypass		Left		ight	Bypass			
Critical Headway, s		4.9	9763		T		4.9	763				4.9	763				4.9	9763				
Follow-Up Headway, s		2.6	5087				2.6	087				2.6	087				2.0	5087				
Flow Computations,	Capac	ity an	nd v/o	: Rati	os		-															
Approach			EB		Т		W	VB				Ν	IB		Γ			SB				
Lane	Left	Ri	ight	Bypas	s	Left	Rig	ght	Bypas	s	Left	Rig	ght B	ypass		Left	R	ight	Bypass			
Entry Flow (ve), pc/h		7	03		T		22	26				1	23				4	27				
Entry Volume, veh/h		6	576				20	05				1	22				4	07				
Circulating Flow (v _c), pc/h		1	44		Ť		4	52				5	53				2	43				
Exiting Flow (vex), pc/h		2	24				52	26				4	35				ź	94				
Capacity (c _{pce}), pc/h		1	191		T		8	70				7	85				1	077				
Capacity (c), veh/h		1	146				79	91				7	77				1	026				
v/c Ratio (x)		0	.59		T		0.	26				0.	16				C	.40				
Delay and Level of Se	ervice																					
Approach		В		Γ		WB				NB					SB							
Lane	Left Rigl					Bypass	Le	eft	Right	B	Bypass	Left	Right	Вур	ass	Left		Right	Bypass			
Lane Control Delay (d), s/veh	e Control Delay (d), s/veh 10.								7.4	Γ			6.3					7.8				
Lane LOS B					3				А				А					А				
95% Queue, veh 4.2					.2				1.0	Γ			0.6					2.0				
Approach Delay, s/veh LOS 10.						В 7.4 А					A 6.3 A				7.8				А			
Intersection Delay, s/veh LOS		9.0							A													
				Н	CS	Rour	ndak	oou	its Re	epo	ort											
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General Information					_			Site	e Info	rm	natior	ı			_		_					
Analyst	Emma	a Myers	-Verhag	ge	Т		*			Т	Inters	ection			Ні	ighway	141	5 and S	Ellswor			
Agency or Co.							•	-		ľ	E/W S	Street Na	ime		Hi	ighway	141	ô				
Date Performed	8/7/2	023				1			\sum	÷	N/S S	treet Na	me		S	Ellswor	th Ro	ł				
Analysis Year	2050					$\prec \downarrow$	w †	9	†		Analy	sis Time	Period, h	rs	1.0	00						
Time Analyzed	PM P	eak			Í						Peak I	Hour Fac	tor		0.	90						
Project Description	Alterr	native 2					-	•	1		Jurisd	liction			Bo	ox Elde	r, SD					
Volume Adjustments	and S	ite C	harac	terist	tics																	
Approach			EB		Т		W	В		Т		N	IB		Γ		ç	SB				
Movement	U	L	Т	R		U	L	Т	R	1	U	L	Т	R	ι	J	L	Т	R			
Number of Lanes (N)	0	0	1	0	T	0	0	1	0	T	0	0	1	0	C)	0	1	0			
Lane Assignment				LTR	1				LTR	Ť			LT	R					LTR			
Volume (V), veh/h	0	352	165	178	3	0	32	150	22	T	0	43	53	23	C)	23	81	327			
Percent Heavy Vehicles, %	4	4	4	4		10	10	10	10	Ť	1	1	1	1	5	5	5	5	5			
Flow Rate (VPCE), pc/h	0	407	191	206	;	0	39	183	27	Ť	0	48	59	26	C)	27	94	382			
Right-Turn Bypass		N	one				No	ne				No	one				N	one	-			
Conflicting Lanes			1		Τ		1			Т			1					1				
Pedestrians Crossing, p/h			0		Τ		0)		T		(0					0				
Proportion of CAVs										0												
Critical and Follow-U	p Headway Adjustme																					
Approach			EB				W	В				Ν	IB				Ş	SB				
Lane	Left	Ri	ight	Bypas	s	Left	Rig	ht	Bypass	;	Left	Rig	ght B	ypass	L	_eft	Ri	ght	Bypass			
Critical Headway, s		4.9	9763		Τ		4.97	763		Т		4.9	763				4.9	763				
Follow-Up Headway, s		2.6	5087		Τ		2.60	087		Т		2.6	087				2.6	087				
Flow Computations,	Capac	ity an	d v/	c Rati	os																	
Approach			EB		Τ		W	B		Т		Ν	IB				9	SB				
Lane	Left	Ri	ight	Bypas	s	Left	Rig	Iht	Bypass	;	Left	Rig	ght B	ypass	L	_eft	Ri	ght	Bypass			
Entry Flow (ve), pc/h		8	804				24	9		T		1	33				5	03				
Entry Volume, veh/h		7	73				22	6				1	32				4	79				
Circulating Flow (v _c), pc/h		1	60				51	4		T		6	25				2	70				
Exiting Flow (v _{ex}), pc/h		2	44		Τ		61	3		Τ		4	93				3	39				
Capacity (c _{pce}), pc/h		1	172		Τ		81	7		Τ		7	29				1()48				
Capacity (c), veh/h		1	127				74	3				7.	22				9	98				
v/c Ratio (x)		0	.69				0.3	30				0.	18				0	.48				
Delay and Level of Se	ervice																					
Approach	EB								WB				NB					SB				
Lane	Left Right				jht	Bypass	Le	ft	Right	By	ypass	Left	Right	Вур	ass	Left		Right	Bypass			
Lane Control Delay (d), s/veh	13.5				.5				8.5				7.0					9.3				
Lane LOS	B				3				А				А					А				
95% Queue, veh	6.3				3				1.3				0.7					2.7				
Approach Delay, s/veh LOS	proach Delay, s/veh LOS 13.5					В		8.5		A	4	7.0		А		9	.3		A			
Intersection Delay, s/veh LOS	.OS 13.5						1.0								В	;						

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				ł	ЧC	S Rou	nda	abou	uts	Rep	oort								
General Information		_	_	_	_		_	Sit	e In	forr	natio	n		_	_	_	_	_	
Analyst	Emma	a Myers	-Verhag	ge	_		k		A		Inters	ection			н	wy 141	6 an	d S Ellsv	worth Rd
Agency or Co.								+		_	E/W S	Street Na	ame		Н	ighway	141	5	
Date Performed	8/4/2	023				/				+	N/S S	treet Na	me		S	Ellswor	th Ro	ł	
Analysis Year	2030					≤ (+)	W	τ τ S) †	↑≻	Analy	sis Time	Period, ł	rs	1.	.00			
Time Analyzed	AM P	eak				*					Peak	Hour Fa	ctor		0.	.84			
Project Description	Alterr	native 3					-	→ → ▼∳	1		Jurisc	liction			B	ox Elde	r, SD		
Volume Adjustments	and S	ite Cl	harac	teri	stic	s													
Approach		1	EB				١	WB				٩	IB		Γ		9	SB	
Movement	U	L	Т	F	२	U	L	Т		R	U	L	Т	R	ι	J	L	Т	R
Number of Lanes (N)	0	1	1	()	0	0	1		0	0	0	1	0	(о —	0	1	0
Lane Assignment		L		LTR				\square	LTR				LT	R					LT
Volume (V), veh/h	0	650	335	1	6	0	30	173	3	44	0	90	100	59	(D C	62	66	207
Percent Heavy Vehicles, %	4	4	4	4	4	10	10	10		10	1	1	1	1	5	5	5	5	5
Flow Rate (VPCE), pc/h	0	805	415	2	0	0	39	227	7	58	0	108	120	71	(о ^г	78	82	259
Right-Turn Bypass		N	one				N	lone				No	one				Yie	ding	
Conflicting Lanes			1					2					2					1	
Pedestrians Crossing, p/h			0					0					0					0	
Proportion of CAVs											1								
Critical and Follow-U	p Hea	dway	, Adju	ustm	nen	t													
Approach			EB				١	WB				٦	1B		Γ		9	SB	
Lane	Left	Ri	ght	Вура	ISS	Left	R	ight	Вур	pass	Left	Ri	ght E	ypass		Left	Ri	ght	Bypass
Critical Headway, s	4.5436	6 4.5	5436				4.3	3276				4.3	276				4.9	763	4.9763
Follow-Up Headway, s	2.5352	2 2.5	5352				2.5	5352				2.5	352				2.6	087	2.6087
Flow Computations,	Capaci	ity an	d v/o	c Rat	tios	5													
Approach		I	EB				١	WB				Ν	IB				9	SB	
Lane	Left	Ri	ght	Вура	ISS	Left	R	ight	Вур	pass	Left	Ri	ght E	ypass		Left	Ri	ght	Bypass
Entry Flow (v _e), pc/h	657	5	83				3	324				2	99				1	60	259
Entry Volume, veh/h	632	5	60				2	295				2	96				1	52	247
Circulating Flow (v _c), pc/h		1	99				1	033				12	298				3	74	
Exiting Flow (v _{ex}), pc/h		5	64				Э	335				9	83				1	41	
Capacity (c _{adj,pce}), pc/h	1187	1	187				5	591				4	72				9	44	981
Capacity (c), veh/h	1142	1	142				5	537				4	67				8	99	934
v/c Ratio (x)	0.55	0	.49				0).55				0.	63				0	.17	0.26
Delay and Level of Se	ervice																		
Approach		EB					Τ		WE	В			NB					SB	
Lane		Left Right					; L	.eft	Rigl	ht	Bypass	Left	Right	Вур	ass	Left	Τ	Right	Bypass
Lane Control Delay (d), s/veh		9.8 8.6							17.	.5			23.9				Т	5.7	6.6
Lane LOS	A A								C				С				T	А	A
95% Queue, veh	3.7 2.9								3.5	5			4.9					0.6	1.1
Approach Delay, s/veh LOS	.OS 9.3					A		17.5			С	23.	9	С		6.	2		А
Intersection Delay, s/veh LOS	5		11.8								E	3							

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				ŀ	НC	S Rou	Ind	aboı	uts	Rer	oort_								
General Information	_	_	_					Sit	e Ir	nforr	matio	n	_	_	_	_	_	_	_
Analyst	Emma	a Mvers	-Verhad	ae			/ .				Inters	ection			Тн	lwv 141	l6 an	d S Ellsv	worth Rd
Agency or Co.								+		i.	E/W S	Street Na	ime		н	lighway	/ 141	6	
Date Performed	8/4/2	023				/				÷	N/S S	itreet Na	me		S	Ellswo	rth R	d	
Analysis Year	2050					K ↓		W + E) †		Analy	sis Time	Period, h	irs	1	.00			
Time Analyzed	AM P	eak				*				1	Peak	Hour Fac	tor		0	.84			
Project Description	Alterr	native 3					\sim	$\overrightarrow{\bullet}$	1		Jurisc	liction			В	ox Elde	er, SD	I	
Volume Adjustments	and S	ite Cl	harac	teris	stic	s													
Approach			EB					WB				Ν	IB		Г			SB	
Movement	U	L	Т	F	२	U	L	Т	Т	R	U	L	Т	R		J	L	Т	R
Number of Lanes (N)	0	1	1	()	0	0	1	T	0	0	0	1	0		0	0	1	0
Lane Assignment		L		LTR					LTR	ł			LT	R					LT
Volume (V), veh/h	0	748	356	1	9	0	30	18	2	47	0	102	107	60		0	63	69	248
Percent Heavy Vehicles, %	4	4	4	4	4	10	10	10)	10	1	1	1	1	1	5	5	5	5
Flow Rate (VPCE), pc/h	0	926	441	2	4	0	39	23	8	62	0	123	129	72		0	79	86	310
Right-Turn Bypass		N	one					None				No	one				Yie	lding	
Conflicting Lanes			1					2					2		\square			1	
Pedestrians Crossing, p/h			0					0					0					0	
Proportion of CAVs											1								
Critical and Follow-U	p Headway Adjustme					t													
Approach		I	EB					WB				Ν	IB		Γ			SB	
Lane	Left	Ri	ght	Вура	ISS	Left		Right	By	pass	Left	Ri	ght E	ypass		Left	R	ight	Bypass
Critical Headway, s	4.5436	6 4.5	5436				4	1.3276				4.3	276				4.9	9763	4.9763
Follow-Up Headway, s	2.5352	2 2.5	352				2	2.5352				2.5	352				2.6	5087	2.6087
Flow Computations,	Capaci	ity an	d v/	c Rat	tios	5													
Approach			EB					WB				Ν	IB		Γ			SB	
Lane	Left	Ri	ght	Вура	ISS	Left		Right	By	pass	Left	Ri	ght E	ypass		Left	R	ight	Bypass
Entry Flow (v _e), pc/h	737	6	54					339				3	24				1	65	310
Entry Volume, veh/h	709	6	29					308				3	21				1	57	295
Circulating Flow (v _c), pc/h		2	.04					1178				14	46					100	
Exiting Flow (vex), pc/h		5	92					361				11	17				1	49	
Capacity (Cadj,pce), pc/h	1182	1'	182					523				4	16		Γ		9	20	955
Capacity (c), veh/h	1137	1'	137					475				4	12				8	376	909
v/c Ratio (x)	0.62	0	.55					0.65				0.	78		Γ		C	.18	0.32
Delay and Level of Se	ervice																		
Approach	EB						Т		W	/B			NB					SB	
Lane	Left Right					Bypas	s	Left	Rig	ght	Bypass	Left	Right	Вур	bass	Left		Right	Bypass
Lane Control Delay (d), s/veh	11.5 9.8							24	1.5			41.3					5.9	7.5	
Lane LOS	B A							C	2			E					А	A	
95% Queue, veh	4.9 3.7								5.	.2			8.8					0.7	1.4
Approach Delay, s/veh LOS		В		24.5			С	41.	3	E		6	5.9		А				
Intersection Delay, s/veh LOS	5		15.8								(2							

					НC	S Rou	Ind	labou	uts	Rep	oort								
General Information				_	_		_	Sit	e Ir	nforr	natio	n			_		_		
Analyst	Emma	a Myers	-Verha	ge	_	L L	/ }		L		Inters	ection			н	wy 14	16 an	d S Ellsv	worth Rd
Agency or Co.								+			E/W S	Street Na	ame		н	lighwa	y 141	6	
Date Performed	8/4/2	023				-/	1			+	N/S S	treet Na	me		S	Ellswo	rth R	d	
Analysis Year	2030					Ľ{ +		W + E S) ↑	↑≻	Analy	rsis Time	Period, h	rs	1.	.00			
Time Analyzed	PM Pe	eak				*					Peak	Hour Fa	ctor		0.	.90			
Project Description	Altern	ative 3					\backslash	$\overrightarrow{\mathbf{v}}$	1	r	Jurisc	liction			B	ox Elde	er, SD	,	
Volume Adjustments	and S	ite C	harad	teri	istic	:s													
Approach			EB					WB				1	1B		Τ			SB	
Movement	U	L	Т		R	U	L	Т		R	U	L	Т	R	ι	J	L	Т	R
Number of Lanes (N)	0	1	1		0	0	0	1		0	0	0	1	0	(0	0	1	0
Lane Assignment	i	_		LTR					LTR	ł			LT	R	\square				LT
Volume (V), veh/h	0	306	150	1	52	0	29	13	5	21	0	38	49	22	(0	22	71	273
Percent Heavy Vehicles, %	4	4	4		4	10	10	10)	10	1	1	1	1	:	5	5	5	5
Flow Rate (VPCE), pc/h	0	354	173	1	76	0	35	16	5	26	0	43	55	25	(0	26	83	318
Right-Turn Bypass		N	one					None				N	one		\square		Yie	lding	
Conflicting Lanes			1					2					2					1	
Pedestrians Crossing, p/h			0					0					0		\square			0	
Proportion of CAVs										1									
Critical and Follow-U	p Hea	dway	, Adj	ustn	nen	t													
Approach			EB					WB				1	IВ					SB	
Lane	Left	Ri	ight	Вура	ass	Left	Т	Right	Ву	pass	Left	Ri	ght B	ypass		Left	R	ight	Bypass
Critical Headway, s	4.5436	5 4.5	5436				4	4.3276				4.3	276		Γ		4.9	9763	4.9763
Follow-Up Headway, s	2.5352	2 2.5	5352				2	2.5352				2.5	352		Γ		2.6	5087	2.6087
Flow Computations,	Capaci	ity an	d v/	c Ra	tio	s													
Approach			EB					WB				1	١B					SB	
Lane	Left	Ri	ight	Вура	ass	Left	Τ	Right	By	pass	Left	Ri	ght B	ypass		Left	R	ight	Bypass
Entry Flow (ve), pc/h	373	3	30				Τ	226				1	23				1	09	318
Entry Volume, veh/h	358	3	18				T	205				1	22				1	04	303
Circulating Flow (v _c), pc/h		1	44				_	452				5	53				2	43	
Exiting Flow (v _{ex}), pc/h		2	24					208				4	35				2	294	
Capacity (Cadj,pce), pc/h	1248	1	248				Т	968				8	89		\square		1	079	1116
Capacity (c), veh/h	1200	1	200				T	880				8	80				1	028	1063
v/c Ratio (x)	0.30	0	.26				T	0.23				0	.14				C	.10	0.28
Delay and Level of Se	0.30 0.26 ervice														1				
Approach	EB						Т		W	/B			NB					SB	
Lane	Left Righ					Bypas	s	Left	Rig	ght	Bypass	Left	Right	Вур	ass	Left	:	Right	Bypass
Lane Control Delay (d), s/veh	5.8 5.4							6.	.5			5.4					4.4	6.2	
Lane LOS	A A								A	4			A				T	А	A
95% Queue, veh	1.3 1.1								0.	.9			0.5					0.3	1.2
Approach Delay, s/veh LOS	ach Delay, s/veh LOS 5.6					A		6.5			А	5.4	1	A		Ę	5.7		А
Intersection Delay, s/veh LO	S		5.7								A	4							

				H	CS Ro	oun	ndab	out	ts Rej	port								
General Information							5	Site	Infor	matio	n							
Analyst	Emma	Myers	-Verhag	ge		J /	•			Inter	section				Hwy ²	1416 a	and S Ells	worth Rd
Agency or Co.						Y	-			E/W	Street N	ame			Highv	way 14	416	
Date Performed	8/4/2	023				1				N/S	Street N	ame			S Ellsv	worth	Rd	
Analysis Year	2050				5,↓		w + I s		↑ † >	Anal	/sis Tim	e Period,	hrs		1.00			
Time Analyzed	PM Pe	eak			4					Peak	Hour Fa	ictor			0.90			
Project Description	Altern	ative 3					$\overrightarrow{\mathbf{v}}$	*		Juris	diction				Box E	lder, S	SD	
Volume Adjustments	and S	ite Cl	harac	terist	cs													
Approach			EB				WB					NB		Т			SB	
Movement	U	L	Т	R	U		L	т	R	U	L	Т		R	U	L	Т	R
Number of Lanes (N)	0	1	1	0	0	T	0	1	0	0	0	1		0	0	0	1	0
Lane Assignment	1	_		LTR				l	TR			Ľ	TR	1				LT
Volume (V), veh/h	0	352	165	178	0	:	32	150	22	0	43	53	2	23	0	23	81	327
Percent Heavy Vehicles, %	4	4	4	4	10	·	10	10	10	1	1	1		1	5	5	5	5
Flow Rate (VPCE), pc/h	0	407	191	206	0	:	39	183	27	0	48	59	2	26	0	27	[,] 94	382
Right-Turn Bypass		N	one				None	e			N	one				Y	'ielding	
Conflicting Lanes			1				2					2					1	
Pedestrians Crossing, p/h			0				0					0					0	
Proportion of CAVs							1											
Critical and Follow-U	p Hea	dway	Adju	ustme	nt													
Approach			EB				WB			Τ		NB		Т			SB	
Lane	Left	Ri	ght	Bypass	Left	t	Righ	t	Bypass	Left	R	ight	Вура	ass	Left		Right	Bypass
Critical Headway, s	4.5436	5 4.5	5436				4.327	6			4.	3276					4.9763	4.9763
Follow-Up Headway, s	2.5352	2 2.5	5352				2.535	2			2.	5352					2.6087	2.6087
Flow Computations,	Capaci	ity an	d v/o	c Ratio	os													
Approach		1	EB				WB					NB					SB	
Lane	Left	Ri	ght	Bypass	Left	t	Righ	t	Bypass	Left	R	ight	Вура	ass	Left	Τ	Right	Bypass
Entry Flow (v _e), pc/h	426	3	78				249					133					121	382
Entry Volume, veh/h	410	3	63				226					132					115	364
Circulating Flow (vc), pc/h		1	60				514					525					270	
Exiting Flow (v _{ex}), pc/h		2	44				231					193					339	
Capacity (Cadj,pce), pc/h	1230	12	230				919					336					1050	1090
Capacity (c), veh/h	1183	1	183				835					328					1000	1038
v/c Ratio (x)	0.35	0	.31				0.27				(0.16					0.12	0.35
Delay and Level of Se	ervice																	
Approach						WB			NB					SB				
Lane		nt Byp	ass	Left	Τ	Right	Bypass	Left	Righ	t	Bypas	s L	eft	Right	Bypass			
Lane Control Delay (d), s/veh	6.4 5.9								7.3			6.0					4.6	7.1
Lane LOS	A A								А			A					А	А
95% Queue, veh	1.6 1.3								1.1			0.6					0.4	1.6
Approach Delay, s/veh LOS	•h LOS 6.2						7	.3 .3		А	6	0		А		6.5		А
Intersection Delay, s/veh LOS	5			6.	.4								A					

HCS T Roundabouts Version 2023 Hwy1416-EllsworthRd_Alt3_PMPeak2050.xro

General Inform	nation								Inte	ersecti	on Info	rmati	on	2	n an sait	器键
Agency									Du	ration,	h	1.000)			
Analyst		Emma Myers-Verha	age	Analys	is Dat	e 8/16/2	2023		Are	ea Type	;	Othe	r			
Jurisdiction		Box Elder, SD	<u> </u>	Time F	Period	AM P	eak		PH	F		1.00			w I L	
Urban Street		Alternative 4.1 - no	EBL	Analys	is Yea	r 2030			Ana	alysis F	Period	1> 7:	00	推到		
Intersection		Hwy 1416 Displace	d EBL	File Na	ame	Hwy1	416-Ells	wortł	nRd	Alt4.1	AMPea	ak2030	0.xus			
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy										3		B IR
				-							v					
Demand Inform	nation				EB			Ν	/B			NB			SB	
Approach Move	ement			L	Т	R	L		Г	R	L	Т	R	L	Т	R
Demand (v), v	eh/h			650	343			23	37							
0	1			1			-			1					_	
Signal Informa	tion				La	€	-									
Cycle, s	30.5	Reference Phase	2		P	\rightarrow							1	→ 2	3	4
Offiset, s	0		End	Green	14.2	7.4	0.0	0.	0	0.0	0.0		_			
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	3.5	3.5	0.0	0.0	0	0.0	0.0					
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.0	0.0	0.0	0	0.0	0.0		5	6	7	8
Timer Deculto				ГРІ		ГРТ			10/		NDI		NDT	CDI		ODT
Assigned Dhose				EDL		2					INDL	+	INDI			301
Case Number	e			20		2		\rightarrow	0	2		+			+	
Case Number				2.0		4.0		+	0.	.3		-			+	
Change Deriod	(V+D			10.7		4.5		\rightarrow	1	5		-			+	
Max Allow Hear	$\frac{1}{2}$	(), S (A(H)) s		4.5		2.8		-		.J 8		-				
	ce Time	Time (g s), s				2.0		\rightarrow	5	.0 Q		-			+	
Green Extensio	n Time	e Time (·	1.6	-	-	1	.5 1		-		-		
Phase Call Pro	hahility	īme (ge), s bilitv				1.0		\rightarrow	1	.4		-		<u> </u>	+	
Max Out Proba	bility			0.00		0.00		-	0.0	00		-		<u> </u>		
	onity			0.00	·	0.00			0.	00					a de la composición de la composición de la composición de la composición de la composición de la composición d	
Movement Gro	oup Res	ults			EB			W	3			NB			SB	
Approach Move	ement			L	Т	R	L	Т		R	L	Т	R	L	Т	R
Assigned Move	ment			5	2			6								
Adjusted Flow F	Rate(<i>v</i>), veh/h		650	343			444	4							
Adjusted Satura	ation Flo	w Rate (<i>s</i>), veh/h/l	n	1615	1614			153	6							
Queue Service	Time (g	gs), s		11.0	0.5			3.9)							
Cycle Queue C	learance	e Time (<i>g c</i>), s		11.0	0.5			3.9)							
Green Ratio (g	/C)			0.46	0.85			0.2	4							
Capacity (c), v	/eh/h			750	2753			74(2							
Volume-to-Capa	acity Ra	tio(X)		0.866	0.125			0.60	00							
Back of Queue	(Q), ft	/In (95 th percentile	e)	38.8	0.1			32.	3							
Back of Queue	(Q), ve	eh/In (95 th percenti	ile)	1.5	0.0			1.2	2							
Queue Storage	Ratio (RQ) (95 th percent	tile)	0.00	0.00			0.0	0							
Uniform Delay ((d 1), s/	/veh		7.3	0.4			10.	3							
Incremental De	lay (<i>d</i> 2), s/veh		1.2	0.0			0.3	3							
Initial Queue De	elay (d	3), s/veh		0.0	0.0			0.0								\square
Control Delay (d), s/ve	eh		8.6	0.4			10.	6							
Level of Service	e (LOS)			A	Α			В								
Approach Delay	y, s/veh	/LOS		5.7		A	10.6	5	E	3	0.0			0.0		
Intersection De	lay, s/ve	h / LOS				7	.2							A		
								1.4.17	-			ND			0.0	
Nultimodal Re	Results			0.00	ER	Λ	4.07	, VVE	5	^	0.40	NR	P	0.07	SB	P
Peuestrian LOS	score	100		0.60	<u> </u>	A	1.3/		F	→	2.10	_	D	2.27		D
DICYCLE LOS SC	ore / LC	13		1.31		А	0.68		ŀ	4						

			-								_					
General Inform	nation								Inte	ersecti	on Info	rmatio	on	2	P IP IP SEL	
Agency									Dura	ation, I	h	1.000)			
Analyst		Emma Myers-Verha	age	Analys	is Date	e 8/16/2	2023		Area	а Туре	;	Other	-			
Jurisdiction		Box Elder, SD		Time F	Period	AM P	eak		PHF	=		1.00			W T	
Urban Street		Alternative 4.1 - no	EBL	Analys	is Yea	r 2050			Ana	Iysis F	Period	1> 7:	00			
Intersection		Hwy 1416 Displace	d EBL	File Na	ame	Hwy1	416-Ells	worth	nRd_	Alt4.1	AMPea	ak2050).xus			
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy										3	计计计计计	新派
Demand Inform	nation				EB			W	/B	_		NB			SB	
Approach Move	ement			<u> </u>	Т	R	L		Г	R	L	Т	R		T	R
Demand (<i>v</i>), v	eh/h			748	367			2	58							
Signal Informa	tion															
	25.6	Reference Dhase	2	e	La -	€	-									
Offect s	0	Reference Priase	Z End		\square								1	2	3	4
Unseed s	Voo	Simult Con E/W	On	Green	18.4	8.2	0.0	0.0	0	0.0	0.0		_	←		
Earco Modo	Fixed	Simult Cap N/S	On	Yellow	3.5	3.5	0.0	0.0	0	0.0	0.0		5	6	7	0
Force wode	Fixed	Simult. Gap N/S	Oli	Reu	1.0	1.0	0.0	0.0	0	0.0	0.0		5	0	1	0
Timor Posults			_	EBI		EBT	W/B		\//E	эт	NRI		NBT	SBI	<u> </u>	SBT
Assigned Phase	۵			5		2		-+-	6							
Case Number				2.0		4.0		\rightarrow	8	3					+	
Phase Duration	s			2.0		35.6		-+	12	7					+	
Change Period	(V+R	a) e		4.5		1.5			12	. <i>1</i> 5					+	
Max Allow Hear	, (7 · /) dway (/	ν/ΔΗ) s		- 1 .5		2.8	-	-+	2 9	8						
Queue Clearan	Clearance Time ($g s$), s					2.0		\rightarrow	6	7					+	
Green Extensio	Clearance Time (g s), s Extension Time (g e), s			15		1.7		-+	1	5						
Phase Call Pro	Extension Time ($g \in$), s Call Probability			1.0		1.00		\rightarrow	1.0	0				<u> </u>	-	
Max Out Proba	bility			0.00		0.00		-+-	0.0)1						
Max Out 1 1054	onity			0.00		0.00			0.0	,						
Movement Gro	oup Res	sults			EB			WE	3			NB			SB	
Approach Move	ement			L	Т	R	L	Т		R	L	Т	R	L	Т	R
Assigned Move	ment			5	2			6								
Adjusted Flow I	Rate (<i>v</i>), veh/h		748	367			453	3							
Adjusted Satura	ation Flo	ow Rate (<i>s</i>), veh/h/l	In	1615	1614			153	6							
Queue Service	Time (g s), s		14.9	0.6			4.7	7							
Cycle Queue C	learanc	e Time (<i>g c</i>), s		14.9	0.6			4.7	7							
Green Ratio (g	/C)			0.52	0.87			0.2	3							
Capacity (c), v	/eh/h			834	2821			710)							
Volume-to-Cap	acity Ra	itio(X)		0.897	0.130			0.63	38							
Back of Queue	(Q), f	/In (95 th percentile	e)	68	0.1			48.4	4							
Back of Queue	(Q), ve	eh/In (95 th percenti	ile)	2.6	0.0			1.8	3							
Queue Storage	Ratio (RQ) (95 th percent	tile)	0.00	0.00			0.0	0							
Uniform Delay	(d 1), s	/veh		7.8	0.3			12.4	4							
Incremental De	lay (<i>d</i> 2), s/veh		1.5	0.0			0.3	3							
Initial Queue De	elay(d	з), s/veh		0.0	0.0			0.0)							
Control Delay (d), s/ve	eh		9.3	0.3			12.	7							
Level of Service	l of Service (LOS)			Α	Α			В								
Approach Dela	proach Delay, s/veh / LOS					А	12.7	7	В	5	0.0			0.0		
Intersection De	lay, s/ve	eh / LOS				8	.2							A		
Multimodal Re	ultimodal Results				EB			WE	3			NB	_		SB	
Pedestrian LOS	Score	/LOS		0.60		A	1.38	3	A	`	2.10		В	2.27	\rightarrow	В
Bicycle LOS Sc	ore / LC	DS		1.41		А	0.70)	A	۱.						

Image: Inderection of the section the section of the	
AgencyAgencyAnalysisDate $Uration, h$ 1.00 $I.00$ AnalysisEmma Myers-VerhageAnalysis $Nalysis$ $Nete$ $Nete$ $Nete$ $Other$ $Other$ $I.00$ <t< td=""></t<>	
$ \begin{array}{ $	
Project Description Radar Hill 1416 Corridor Study Image: State	
Demand InformationImage: Set of the se	
Demand InformationIDEMAND <th co<="" td=""></th>	
Approach Movement L I R L I I I I I I I I I I I I I I	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	
Signal Information Cycle, s18.5Reference Phase2Offset, s0Reference PointEndUncoordinatedYesSimult. Gap E/WOnForce ModeFixedSimult. Gap N/SOnReference PointEndVellow3.53.50.00.00.0Force ModeFixedSimult. Gap N/SOnRed1.01.00.00.00.0Force ModeFixedSimult. Gap N/SOnRed1.01.00.00.00.0Force ModeFixedSimult. Gap N/SOnRed1.01.00.00.00.0Red1.01.00.00.00.0Signed Phase526Image: Signed Signed PhaseCase Number2.04.08.3Image: Signed Si	
Organ interviewentCycle, s18.5Reference Phase2Offset, s0Reference PointEndUncoordinatedYesSimult. Gap E/WOnForce ModeFixedSimult. Gap N/SOnRefForce ModeFixedSimult. Gap N/SOnRefTimer ResultsEBLEBLEBTWBLWBTNBLNBTSBLSBTAssigned Phase 5 2.04.0 2 6 -1 2 -1 </td	
Order No.0 Reference Point End Green 4.5 5.1 0.0	
Origonal of the reference Form Lind Green 4.5 5.1 0.0	
Force Mode Fixed Simult. Gap N/S On Red 1.0 1.0 0.0	
Timer Results EBL EBL EBT WBL WBT NBL NBT SBL SBT Assigned Phase 5 2 6 <t< td=""></t<>	
Timer Results EBL EBT WBL WBT NBL NBT SBL SBT Assigned Phase 5 2 6 6 100	
Assigned Phase 5 2 6	
Case Number 2.0 4.0 8.3 <th< th=""></th<>	
Phase Duration, s 9.0 18.5 9.6 6 6 6 6 Change Period, (Y+R c), s 4.5 4.5 4.5 4.5 6 </td	
Change Period, (Y+R c), s 4.5 4.5 4.5 4.5 6 7 <th7< th=""> 7 7</th7<>	
Max Allow Headway (MAH), s 2.9 2.8 2.8	
Queue Clearance Time (g s), s 5.3 2.4 3.9	
Green Extension Time (g e), s 0.3 1.2 1.1	
Phase Call Probability 0.79 1.00 1.00	
Max Out Probability 0.02 0.00 0.00	
Movement Group Results EB WB NB SB	
Approach Movement L T R L T R L T R L T R L T R	
Assigned Movement 5 2 6 C	
Adjusted Flow Rate (v), veh/h 306 236 387	
Adjusted Saturation Flow Rate (s), veh/h/ln 1615 1614 1536	
Queue Service Time (g s), s 3.3 0.4 1.9	
Cycle Queue Clearance Time (g c), s 3.3 0.4 1.9	
Green Ratio (g/C) 0.24 0.76 0.27	
Capacity (c), ven/n 389 2445 842 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	
Volume-to-Capacity Ratio (X) 0.786 0.097 0.460	
Back of Queue (Q), Ivin (95 th percentile) 6.8 0.1 0.8 0.8	
Back of Queue (Q), ven/in (95 th percentile) 0.3 0.0 0.0 0.0	
$\frac{1}{1} = \frac{1}{1} = \frac{1}$	
Incremental Delay (<i>d</i> 2), siven 0.0 0.0 0.1 0.1	
Control Doloy (d) olyopha 20 0.6 57	
Operation Delay (10), s/ven OU OU <t< td=""></t<>	
Approach Delay, s/yeh / LOS	
Intersection Delay, s/veh / LOS 52	
Multimodal Results EB WB NB SB	
Pedestrian LOS Score / LOS 0.60 A 1.34 A 2.08 B 2.25 B	
Bicycle LOS Score / LOS 0.93 A 0.58 A	

			-									-					
General Inform	nation									Inte	ersecti	on Info	ormati	on	3	an pangangan an	
Agency										Du	ration,	h	1.000	C			
Analyst		Emma Myers-Verha	age	Analys	is Dat	e 8/1	6/2	023		Are	еа Туре	;	Othe	r			
Jurisdiction		Box Elder, SD		Time F	Period	PM	l Pe	ak		PH	IF		1.00			w ‡ u	
Urban Street		Alternative 4.1 - no	EBL	Analys	is Yea	r 205	50			Ana	alysis F	Period	1> 16	6:45			
Intersection		Hwy 1416 Displace	d EBL	File Na	ame	Hw	y14	16-Ells	wortł	hRd_	_Alt4.1	_PMPea	ak205	0.xus			
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy											5		195117
		•						r				r					
Demand Inform	nation				EB				N	/B			NB			SB	
Approach Move	ement			L	Т	F	R	L	<u> </u>	Т	R	L	Т	R	L	Т	R
Demand (v), v	eh/h			352	277				1:	34							
	4!			li								-					
Signal Informa		Defense Dhara	0				\leftarrow	-									
Cycle, s	20.7	Reference Phase	2		\vdash									1	→ ₂	3	4
Oπset, s	0		End	Green	5.8	5.9)	0.0	0.	0	0.0	0.0		_			
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	3.5	3.5	5	0.0	0.0	0	0.0	0.0	_				
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.0)	0.0	0.0	0	0.0	0.0		5	6	7	8
Timer Deculto			_			CDT			1	10/				NDT			ODT
Assigned Dhose				EDL		2	-	VVDL	-			INDL	· · ·		301		301
Assigned Phase	e			5		2	_		\rightarrow	0	0					\rightarrow	
Case Number				2.0		4.0	-		\rightarrow	0							
Change Duration				10.3	,	20.7	_		+	1	J.4				<u> </u>	\rightarrow	
Max Allow Hoo	(Y+R)	c), S		4.5		4.5	-		+	4	.5		_			-+-	
	adway (<i>MAH</i>), s ince Time (<i>g</i> s), s			2.9		2.0	_		+	2	.0		-		<u> </u>	+	
Queue Clearan	ance Time (g s), s sion Time (g e), s			0.2		2.4	-		+	4	.0		_		<u> </u>		
Bhase Cell Bro	sion Time ($g \in $), s			0.5	,	1.0	_		+	0	.4		_		<u> </u>	+	
Max Out Broba	bility			0.07		0.00	_		-	0.	99		-			\rightarrow	
	Dinty			0.00	,	0.00				0.	00						
Movement Gro	oup Res	ults			EB				W	В			NB			SB	
Approach Move	ement			L	Т	R		L	Т	Т	R	L	Т	R	L	Т	R
Assigned Move	ment			5	2				6	+							
Adjusted Flow I	Rate (v), veh/h		352	277				46	1				<u> </u>			
Adjusted Satura	ation Flo	w Rate (s), veh/h/l	n	1615	1614				153	6							
Queue Service	Time (g	g s), s		4.2	0.4				2.6	3				1			
Cycle Queue C	learanc	e Time (g c), s		4.2	0.4				2.6	3							
Green Ratio (g	/C)			0.28	0.78				0.2	9							
Capacity (c), v	/eh/h			451	2525				876	6							
Volume-to-Cap	acity Ra	tio(X)		0.780	0.110				0.52	26							
Back of Queue	(Q), ft	/In (95 th percentile	e)	8.9	0.1				1.9)							
Back of Queue	(Q), ve	eh/In (95 th percenti	ile)	0.3	0.0				0.1	1							
Queue Storage	Ratio (RQ) (95 th percent	tile)	0.00	0.00				0.0	0							
Uniform Delay ((d1), s	/veh		6.9	0.5				6.2	2							
Incremental De	lay (d 2), s/veh		1.1	0.0				0.2	2							
Initial Queue De	elay (<i>d</i>	з), s/veh		0.0	0.0				0.0)							
Control Delay (d), s/ve	eh		8.0	0.5				6.4	1							
Level of Service	e (LOS)			Α	Α				Α								
Approach Delay	y, s/veh	/ LOS		4.7		A		6.4			A	0.0			0.0		-
Intersection De	lay, s/ve	h / LOS					5.	4							A		
Multimodal Re	imodal Results				EB				W	В			NB			SB	
Pedestrian LOS	Score	/LOS		0.60		Α		1.35		/	A	2.08		В	2.25	;	В
Bicycle LOS So	ore / LC	DS		1.01		Α		0.60		1	A						

General Inform	nation								Interse	ction Ir	forma	tion	2		制的
Agency									Duratio	n, h	1.0	00			201
Analyst		Emma Myers-Verha	age	Analys	is Dat	e 8/16/2	023		Area Ty	/pe	Oth	er			∼ _
Jurisdiction		Box Elder, SD	0	Time F	Period	AM P	eak		PHF	•	1.0	0		w 1 L	
Urban Street		Alternative 4.1 - no	EBL	Analys	is Yea	r 2030			Analysi	s Perioo	1 1>	7:00			
Intersection		Hwy 1416 and S El	lswor…	File Na	ame	Hwv1	416-Ells	worth	nRd Alt4	.1 AMF	eak20	30.xus		xtr	<u>#77.</u>
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy			-			_				T Bendan i Janub	摘
, ,				, 											
Demand Inform	nation				EB			W	/B		N	В		SB	
Approach Move	ement			L	Т	R	L		T R	L		R	L	Т	R
Demand (v), v	eh/h				327	16	24	14	47 38	90) 10	0 57	60	66	207
				1			li li								
Signal Informa	tion	Y	1	-	6 €	일시되									\mathbf{k}
Cycle, s	19.5	Reference Phase	2		₿"	ിടുപ	7					1	$\mathbf{\nabla}_{2}$	3	4
Offset, s	0	Reference Point	End	Green	5.0	5.5	0.0	0.0	0 0.0) 0.0)		<u> </u>		
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	3.5	3.5	0.0	0.0	0.0) 0.0)		7		- N
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.0	0.0	0.0	0.0) 0.0)	5	6	7	8
							1			_					
Timer Results				EBL	-	EBT	WB	L	WBT	N	3L	NBT	SBI	-	SBT
Assigned Phase	Э					2		\rightarrow	6			8			4
Case Number						7.0			5.0			8.0			7.0
Phase Duration	, S					9.5			9.5			10.0			10.0
Change Period	(Y+R	c), S				4.5			4.5			4.5			4.5
Max Allow Head	dway(A	<i>MAH</i>), s				2.9			2.9			3.3			3.3
Queue Clearan	e Clearance Time (g_s) , s					3.6			4.0			4.6			4.4
Green Extensio	Extension Time ($g e$), s					1.0			1.0			1.1			1.1
Phase Call Pro	bability					1.00			1.00			0.96			0.96
Max Out Proba	bility					0.00			0.00			0.01			0.01
Movement Gro		ulte			EB			\٨/٢	3		NE	2		SB	
Approach Move	mont	Suits			Т	R	1		, B			, R		т	R
Assigned Move	ment				2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow F	Rate (v) veh/h			327	16	24	147	7 38		247	7	<u> </u>	126	207
Adjusted Satura	ation Flo	y, ven/n w Rate (s) veh/h/l	n		161/	1/137	086	153	6 1367	-	15/	6		1/05	201
	Time ((16	0.2	0.4	0.7	7 04	-	1.4			0.0	
	learance	$g \in J, S$			1.0	0.2	2.0	0.7	7 0.4	-	2.6			1.1	
Green Ratio (\sqrt{C}	c mile (<i>g c</i>), 3			0.26	0.2	0.26	0.7	6 0. 4	-	0.2	2		0.28	
Capacity (c)	/o/) /eh/h				833	371	541	793	3 353		685	5		691	
Volume-to-Cap	acity Ra	tio (X)			0.392	0.043	0.044	0.18	35 0.108	3	0.36	1		0.182	
Back of Queue	(Q), ft	In (195 th percentile	e)		0.8	0.1	0.9	1.1	0.7	-	5.7			8.3	
Back of Queue	(Q), ve	eh/In (95 th percenti	, ile)		0.0	0.0	0.0	0.0) 0.0		0.2			0.3	
Queue Storage	Ratio (RQ) (95 th percent	, tile)		0.00	0.00	0.00	0.0	0 0.00		0.0	2		0.00	
Uniform Delay	(d1), s	/veh			6.0	5.4	6.8	5.6	3 5.5		6.0			5.5	
Incremental De	lay (d 2), s/veh			0.1	0.0	0.0	0.0	0.0		0.1			0.0	
Initial Queue De	elay (d	3), s/veh			0.0	0.0	0.0	0.0) 0.0		0.0			0.0	
Control Delay (d), s/ve	eh			6.1	5.4	6.8	5.7	7 5.6		6.1			5.5	0.0
Level of Service	e (LOS)				А	Α	Α	A	A		A			A	A
Approach Dela	, s/veh	/ LOS		6.0		A	5.8		A	6.	1	A	2.1		A
Intersection De	lay, s/ve	h / LOS				4	.8						A		
	lersection Delay, siven / LOS														
Multimodal Re	sults				EB			WE	3		NE	3		SB	
Pedestrian LOS	Score	/LOS		1.64		В	1.86	6	В	2.3	38	В	2.22	2	В
Bicycle LOS Sc	ore / LC	DS		0.77		А	0.66	6	А	0.9	90	А	1.04	1	А

General Information								Interse	ectior	n Info	ormatio	n	2		
Agency								Duratic	on, h		1.000			1 k	
Analyst	Emma Myers-Verha	age	Analys	is Date	e 8/16/2	023		Area T	уре		Other				~_
Jurisdiction	Box Elder, SD		Time F	Period	AM Pe	eak		PHF			1.00			w ‡ u	
Urban Street	Alternative 4.1 - no	EBL	Analys	is Yea	r 2050			Analys	is Per	riod	1> 7:0	0			
Intersection	Hwy 1416 and S El	lswor	File Na	ame	Hwy1	416-Ells	worth	Rd_Alt4	1.1_A	MPea	ak2050	.xus		**	
Project Description	Radar Hill 1416 Co	rridor St	udy										1		额
			_			1			r						
Demand Information				EB	- I		W	В	\rightarrow		NB			SB	
Approach Movement			L	Т	R	L			2	L	Т	R	L	Т	R
Demand (v), veh/h				348	19	24	15	56 4 ⁻	1	90	100	57	60	66	207
Signal Information				5											1
	Poforonco Phaso	2	-		<u> </u>										
Offect s	Reference Point	Z End		F, '		71						1	2 2	3	4
Unservice Vos		On	Green	5.3	5.5	0.0	0.0) 0.0	0	0.0	_		A-		
Force Mode Fixed	Simult Gap N/S	On	Ped	3.5	3.5	0.0	0.0			0.0	-	5	× 6	7	Y
	Sinut. Gap N/S	OII	Reu	1.0	1.0	0.0	0.0	0.0	5	0.0		3	0	I	10
Timer Results			FBI		FBT	WB		WBT		NBI		NBT	SBI		SBT
Assigned Phase					2		-	6				8			4
Case Number					7.0		-	5.0	+			8.0			7.0
Phase Duration, s					9.8			9.8			-	10.0			10.0
Change Period, (Y+R	c), S				4.5			4.5				4.5			4.5
Max Allow Headway (<i>MAH</i>), s				2.9			2.9				3.3			3.3
Queue Clearance Tim	Le Clearance Time (g_s), s				3.8		\rightarrow	4.2				4.6			4.4
Green Extension Time	ue Clearance Time ($g s$), s In Extension Time ($g e$), s				1.1			1.1				1.1			1.1
Phase Call Probability	n Extension Time (g e), s e Call Probability				1.00		-	1.00				0.96			0.96
Max Out Probability					0.00			0.00			(0.01			0.01
Movement Group Re	sults		<u> </u>	EB		<u> </u>	WE	3	+-		NB	_		SB	_
Approach Movement				1	R			R	+-	L		R		1	R
Assigned Movement				2	12	1	6	16	+-	3	8	18	1	4	14
Adjusted Flow Rate (/), ven/n			348	19	24	150	6 41 6 400	+		247			126	207
Adjusted Saturation Fi	ow Rate (s), ven/n/l	In		1614	1437	967	153	6 136		\rightarrow	1546			1495	
Queue Service Time (gs), s			1.8	0.2	0.4	0.8	0.4	+	\rightarrow	1.5			0.0	
Cycle Queue Clearand	ce Time (<i>g c</i>), s			1.8	0.2	2.2	0.8	0.4 7 0.27	,		2.0			1.2	
Green Rallo (g/C)				0.27	0.27	0.27	0.2	0.27	-		670			0.28	
Volume to Conseity P	atia (X)			0.405	0.050	0.045	010	1 0 11	2	-	079			000	
Back of Oueue (O)	$\frac{10}{10}$ ($\frac{1}{25}$ th percentile			0.405	0.050	0.045	1.19	0.11	5	-	6			0.104 8.6	
Back of Queue (Q),	eh/ln (95 th percent	;) ile)		0.9	0.1	0.9	0.0	0.7	+-	-	02			0.0	
Oueue Storage Ratio	(RO) (95 th percent	tila)		0.0	0.0	0.0	0.0				0.2			0.0	
Uniform Delay (d_1)	(//@/)(35 th percen			6.0	5.4	6.9	5.6	5 5 5	-	-	6.1			5.6	
Incremental Delay (d /),				0.0	0.4	0.0	0.0	0.0	+	\rightarrow	0.1			0.0	
Initial Queue Delay (C	2), 3/veh			0.1	0.0	0.0	0.0	0.1	+-	-	0.1			0.0	
Control Delay (d) sh	reh			6.1	5.0	6.9	5.6	5.5	-	\rightarrow	6.2			5.6	0.0
Level of Service (LOS)			Δ	<u>А</u>	A	<u>о.</u> о	Δ			Α			A	A
Approach Delay s/vet	, 		6.0		A	5.8		A		6.2		А	21		A
Intersection Delay s/v	eh / LOS		0.0		4	.9				5.2			A 2.1		
	ersection Delay, s/ven / LOS														
Multimodal Results				EB			WE	3			NB			SB	
Pedestrian LOS Score	e / LOS		1.64		В	1.86	3	В		2.38		В	2.22	2	В
Bicycle LOS Score / L	OS		0.79		А	0.67	7	А		0.90		A	1.04		A

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			-								-					
General Inform	nation								Interse	ction	Infor	rmatio	n	2		
Agency									Duratio	n, h		1.000			₽ Þ	
Analyst		Emma Myers-Verha	age	Analys	is Dat	e 8/16/2	023		Area Ty	/pe		Other				~_
Jurisdiction		Box Elder, SD	-	Time F	eriod	PM P	eak		PHF	-		1.00			w tu	
Urban Street		Alternative 4.1 - no	EBL	Analys	is Yea	r 2030			Analysi	s Perio	bd	1> 16	:45			
Intersection		Hwy 1416 and S El	lswor	File Na	me	Hwy1	416-Ells	worth	Rd_Alt4	.1_PM	1Pea	k2030	.xus		nț#	
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy												
							1									
Demand Inform	nation				EB		<u> </u>	W	B		.	NB		<u> </u>	SB	
Approach Move	ement			L		R	L		R		L		R			R
Demand (v), v	eh/h				84	152	15	7	6 7		38	39	7	7	62	273
Signal Informa	tion				5											1
Cycle s	19.5	Reference Phase	2	-	Li											Φ
Offset, s	0	Reference Point	- End		ГÝ.	<u>`</u>]]	~						1	Y 2	3	4
Uncoordinated	Yes	Simult, Gap F/W	On	Green	5.0	5.5	0.0	0.0	0.0		0.0	-		$\overline{\mathbf{A}}$		
Force Mode	Fixed	Simult, Gap N/S	On	Red	1.0	1.0	0.0	0.0	0.0		0.0	-	5	6	7	Y
	1 mod		•													
Timer Results				EBL		EBT	WB	L	WBT	1	NBL		NBT	SBI	-	SBT
Assigned Phase	e					2			6				8			4
Case Number						7.0			5.0				8.0			7.0
Phase Duration	, S					9.5			9.5			-	10.0			10.0
Change Period	, (Y+R)	c), S				4.5			4.5				4.5			4.5
Max Allow Head	dway (<i>N</i>	/АН), s				3.0			3.0				3.4			3.4
Queue Clearan	ue Clearance Time (g_s), s					3.7			2.6				2.7			5.3
Green Extensio	en Extension Time ($g \in $), s					0.6			0.6				0.9			0.8
Phase Call Pro	e Extension Time (<i>g</i> e), s Call Probability					1.00			1.00			(0.90			0.90
Max Out Proba	bility					0.00			0.00			(0.00			0.00
Movement Gre		ulte			EB			\\/E	2			NR			SB.	
Approach Move	mont	Juits			<u>ЕВ</u> Т	R	1		, R			T	R	1	Т	R
Assigned Move	ment				2	12	1	6	16	3	+	8	18	7	4	14
Adjusted Flow F	Rate (v) veh/h			84	152	15	76	7		+	84	10	<u> </u>	69	273
Adjusted Satura	ation Flo), ven/n w Rate (s) veh/h/l	n		161/	1/137	1231	153	6 1367		+	1586			1662	215
Queue Service	Time (($\tau_{\rm s}$) s			0.4	1 7	0.2	0.4	0 1		+	0.0		<u> </u>	0.0	
	learance	$a = Time(a_c) s$			0.1	1.7	0.6	0.4	0.1		+	0.7			0.6	
Green Ratio (a	/C)	5 mile (g t), 6			0.26	0.26	0.26	0.26	6. I	-	+	0.28			0.28	
Capacity (c), y	/eh/h				826	368	659	786	350 ³	+	+	717			674	
Volume-to-Cap	acity Ra	tio(X)			0.102	0.413	0.023	0.09	7 0.02)	(0.117			0.102	
Back of Queue	(Q), ft	/In (95 th percentile	e)		0.2	1.5	0.3	0.6	0.1		\uparrow	1.5			4.3	
Back of Queue	(Q), ve	eh/In (95 th percenti	ile)		0.0	0.1	0.0	0.0	0.0			0.1			0.2	
Queue Storage	Ratio (RQ) (95 th percent	tile)		0.00	0.00	0.00	0.00	0.00			0.00			0.00	
Uniform Delay ((d1), s	/veh			5.6	6.0	5.8	5.5	5.4			5.3			5.2	
Incremental De	lay (<i>d</i> 2), s/veh			0.0	0.3	0.0	0.0	0.0			0.0			0.0	
Initial Queue De	elay (<i>d</i>	3), s/veh			0.0	0.0	0.0	0.0	0.0			0.0			0.0	
Control Delay (d), s/ve	eh			5.6	6.3	5.8	5.6	5.4			5.3			5.3	0.0
Level of Service	e (LOS)				Α	Α	Α	Α	A			Α			А	Α
Approach Delay	y, s/veh	/LOS		6.1		А	5.6		А		5.3		А	1.1		А
Intersection De	lay, s/ve	h / LOS				3	.7							A		
Multimodal Re	sults				EB			WE	3 _			NB	_		SB	_
Pedestrian LOS	Score	LOS		1.64		В	1.87		В		.37	_	В	2.22	2	В
BICYCLE LOS SC	ore / LC	15		0.68		A	0.57		A	0	0.63		A	1.05)	A

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											-					
General Inform	nation								Inters	ectic	on Info	ormatic	on			
Agency									Duratio	on, h	1	1.000			₩ ₩	
Analyst		Emma Myers-Verha	age	Analys	is Dat	e 8/16/2	2023		Area T	уре		Other				~_
Jurisdiction		Box Elder, SD		Time F	Period	PM P	eak		PHF			1.00			w 1 ∎	
Urban Street		Alternative 4.1 - no	EBL	Analys	is Yea	r 2050			Analys	sis Pe	eriod	1> 16	:45			
Intersection		Hwy 1416 and S El	lswor…	File Na	ame	Hwy1	416-Ells	worth	Rd_Alt	4.1_	PMPe	ak2050	.xus		**	
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy										5		额
										r						
Demand Inform	nation				EB	- I		W	'B			NB			SB	
Approach Move	ement			L	Т	R	L			२	L	Т	R	L	Т	R
Demand (v), v	eh/h				99	178	18	9	1 8	3	43	43	8	8	72	327
Signal Informa	tion															
		Poforonao Dhaga	2			글새의										Φ
Cycle, s	20.0	Reference Priase	Z End		F.		2						1	S 2	3	4
Unseerdingtod	Vee	Simult Can E/M	Ellu	Green	5.0	6.8	0.0	0.0) 0.	0	0.0			<u>A</u>		
Earoo Mada	Fixed	Simult Cop N/S	On	Yellow	3.5	3.5	0.0	0.0	$\frac{0}{0}$	0	0.0	_	E	× I	7	Ψ.
Force Mode	Fixeu	Simult. Gap N/S	OII	Reu	1.0	1.0	0.0	0.0	J [0.	0	0.0		5	0	Ĩ	
Timor Results			_	EBI		EBT	WB	1	W/BT	T	NBI		NBT	SBI		SBT
Assigned Phase	<u></u>					2			6	÷			8		-	4
Case Number	<u> </u>			<u> </u>		7.0		-	5.0	+			8.0			7.0
Phase Duration	S			<u> </u>		9.5	<u> </u>	-	9.5	÷			11.3			11.3
Change Period	(V+R)	-) s		<u> </u>	-	4.5		-	4 5	╈			4.5			4.5
Max Allow Hear	$\frac{1}{2}$	/ΔΗ) s		<u> </u>	-	3.0	<u> </u>	-	3.0	÷			34			34
Queue Clearan	ce Time	$(a_s)_s$				4.2		-	2.7	╈			2.8			6.2
Green Extensio	n Time	(q_e) s				0.7			0.7				11			1.0
Phase Call Pro	bability	(90),0			-	1.00	<u> </u>	-	1 00	╈			0.94			0.94
Max Out Proba	bility					0.00			0.00				0.00			0.01
						0.00			0.00							
Movement Gro	oup Res	ults			EB			WE	3			NB			SB	
Approach Move	ement			L	Т	R	L	Т	R		L	Т	R	L	Т	R
Assigned Move	ment				2	12	1	6	16		3	8	18	7	4	14
Adjusted Flow I	Rate(<i>v</i>), veh/h			99	178	18	91	8			94			80	327
Adjusted Satura	ation Flo	ow Rate (<i>s</i>), veh/h/l	n		1614	1437	1214	153	6 136	7		1570			1664	
Queue Service	Time (g	g s), S			0.5	2.2	0.2	0.5	0.1			0.0			0.0	
Cycle Queue C	learance	e Time (<i>g c</i>), s			0.5	2.2	0.7	0.5	0.1			0.8			0.7	
Green Ratio (g	/C)				0.24	0.24	0.24	0.24	4 0.24	4		0.33			0.33	
Capacity (<i>c</i>), v	/eh/h				778	346	611	740) 329)		764			733	
Volume-to-Cap	acity Ra	tio (X)			0.127	0.514	0.029	0.12	3 0.02	24		0.123			0.109	
Back of Queue	(Q), ft	/In (95 th percentile	e)		1	5.2	0.7	1.4	0.3	;		1.7			5.1	
Back of Queue	(Q), ve	eh/In (95 th percenti	ile)		0.0	0.2	0.0	0.1	0.0			0.1			0.2	
Queue Storage	Ratio (RQ) (95 th percent	tile)		0.00	0.00	0.00	0.00	0.0	0		0.00			0.00	
Uniform Delay ((d 1), s/	/veh			6.2	6.8	6.5	6.2	6.0			5.0			5.0	
Incremental De	lay (<i>d</i> 2), s/veh			0.0	0.4	0.0	0.0	0.0			0.0			0.0	
Initial Queue De			0.0	0.0	0.0	0.0	0.0			0.0			0.0			
Control Delay (6.2	7.3	6.5	6.2	6.0			5.0			5.0	0.0		
Level of Service			Α	A	A	A	Α			A			A	A		
Approach Delay	Approach Delay, s/veh / LOS					A	6.2		A		5.0		A	1.0		A
Intersection De	lay, s/ve	h / LOS				3	.9							Α		
Multimedal De	Multimodal Results							۱۸/۲	>						CD	
Pedestrian L OS		1 64	EB	P	1 0	7		+	0 07	ND .	B	2.00		B		
Riovela LOS So	edestrian LOS Score / LOS					Δ	1.07	2	^	╋	2.37		Δ	2.22	-	Δ
				0.72		А	0.50	,	A		0.04		A	1.10	,	A

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General Inform	nation								Inte	ersecti	on Inf	ormatio	on	8		識
Agency									Du	ration,	h	1.000			₽ Þ	
Analyst		Emma Myers-Verha	age	Analys	is Date	e 8/16/2	023		Are	ea Type	;	Other		.		15 S
Jurisdiction		Box Elder, SD	-	Time F	Period	AM P	eak		PH	F		1.00			w tu	
Urban Street		Alternative 4.2 - no	WBT	Analys	is Yea	r 2030			Ana	alysis F	Period	1> 7:(00			1898
Intersection		Hwy 1416 and S El	lswor	File Na	ame	Hwy1	416-Ells	wort	hRd	Alt4.2	AMPe	ak2030	.xus		**	
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy										1	E dans Jaco	
				-			12				v					
Demand Inform	nation				EB			٧	VB			NB			SB	
Approach Move	ement			L	Т	R	L		Т	R	L	Т	R	L	Т	R
Demand (v), v	eh/h			650	327	16	24			38	90	100	57	60	66	207
0	41			1												
Signal Informa	tion				3	<u> </u>								~		\mathbf{A}
Cycle, s	49.8	Reference Phase	2		R'	` §∩	7						1	\$ 2	3	4
Offset, s	0	Reference Point	End	Green	22.3	18.5	0.0	0.	0	0.0	0.0			<u>~</u>		
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	3.5	3.5	0.0	0.	0	0.0	0.0	_				∇
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.0	0.0	0.	0	0.0	0.0		5	6	7	8
Timer Deculto			_			FDT			10/						_	ODT
Assigned Dhose				EDL		2		-				-		301		
Assigned Phase	e			<u> </u>		2	<u> </u>	\rightarrow		0			0			4
Case Number				<u> </u>		26.8		-	26	.0 3.8			0.0			7.0
Change Duration	(V+D				+	20.0		-	20	5			4.5			25.0
	$\frac{1}{1}$	(), S				4.5		-	4	.5			4.0			4.5
	ce Time	(a_{α}) s				20.5		-	2	.9			7.7			73
Green Extensio	n Time	$(g_s), s$				1.8		-	2	.9			1.0			1.0
Phase Call Pro	hability	(ge), s		<u> </u>		1.0		-	1	.0		_	1.0	<u> </u>		1.0
Max Out Proba	bility					0.03		-	0	00		_	0.02	-		0.02
Max Out 1 10ba	onity					0.00			0.	00			0.02			0.02
Movement Gro	oup Res	ults			EB			W	В			NB			SB	
Approach Move	ement			L	Т	R	L	Т		R	L	Т	R	L	Т	R
Assigned Move	ment			5	2	12	1			16	3	8	18	7	4	14
Adjusted Flow I	Rate (v), veh/h		650	327	16	24			38		247			126	207
Adjusted Satura	ation Flo	w Rate (<i>s</i>), veh/h/l	n	1615	1614	1437	986		·	1367		1542			1444	
Queue Service	Time (g	g s), S		18.5	3.1	0.3	0.8			0.8		2.3			0.0	
Cycle Queue C	learance	e Time (<i>g c</i>), s		18.5	3.1	0.3	3.9			0.8		5.7			2.6	
Green Ratio (g	/C)			0.45	0.45	0.45	0.45			0.45		0.37			0.37	
Capacity (c), v	/eh/h			868	1446	644	525			613		671			643	
Volume-to-Cap	acity Ra	tio(X)		0.749	0.226	0.025	0.046		C	0.062		0.368			0.196	
Back of Queue	(Q), ft	/In (95 th percentile	e)	193.8	30.6	2.8	5.7			7.4		80.7			44.2	
Back of Queue	(Q), ve	eh/In (95 th percenti	ile)	7.5	1.2	0.1	0.2			0.3		3.2			1.7	
Queue Storage	Ratio (RQ) (95 th percent	tile)	0.00	0.00	0.00	0.00			0.00		0.00			0.00	
Uniform Delay	(d 1), si	/veh		12.7	8.4	7.7	9.6			7.8		11.6			10.6	
Incremental De	niform Delay (d 1), s/veh cremental Delay (d 2), s/veh					0.0	0.0			0.0		1.6			0.7	
Initial Queue De	itial Queue Delay (<i>d s</i>), s/veh					0.0	0.0			0.0		0.0			0.0	
Control Delay (ontrol Delay (<i>d</i>), s/veh					7.7	9.6			7.8		13.1			11.3	0.0
Level of Service	e (LOS)			В	А	Α	Α			А		В			В	Α
Approach Delay	pproach Delay, s/veh / LOS					В	8.5		ŀ	4	13.1		В	4.3		А
Intersection De	ntersection Delay, s/veh / LOS					1().4							В		
Multimodal Re			EB			W	В			NB	_		SB	_		
Pedestrian LOS		1.65		В	1.88	;	E	В	2.08	3	В	2.25	5	В		
Bicycle LOS Sc	ore / LC	DS		1.31		А			F	F	0.90)	А	1.04		A

General Inform	nation								Inte	ersecti	ion Inf	ormatic	on	2	NIR STREET	<u></u>
Agency									Dur	ration,	h	1.000			1 k	
Analyst		Emma Myers-Verha	age	Analys	is Dat	e 8/16/2	2023		Are	a Type	;	Other		<u> </u>		15 A
Jurisdiction		Box Elder, SD	-	Time F	Period	AM P	eak		PH	F		1.00			w I L	
Urban Street		Alternative 4.2 - no	WBT	Analys	is Yea	r 2050			Ana	alysis F	Period	1> 7:(00			180
Intersection		Hwy 1416 and S El	lswor	File Na	ame	Hwy1	416-Ells	wort	hRd_	Alt4.2	AMPe	ak2050	.xus		**	
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy							_			1	E HINE SHOP	
				I							11			Ļ.		
Demand Inform	nation				EB			٧	VB			NB			SB	
Approach Move	ement			L	Т	R	L		Т	R	L	Т	R	L	Т	R
Demand (v), v	eh/h			748	348	19	27			41	102	107	58	61	69	248
O'read he former	4'			li												
Signal Informa		Defense Dhara	0	-	.3	7212								~		ሐ
Cycle, s	38.9	Reference Phase	Z Eval		F,	` §∩	7						1	2	3	4
Offset, s	0		End	Green	20.4	9.5	0.0	0.	0	0.0	0.0			<u>~</u>		
	Yes	Simult. Gap E/W	On	Yellow	3.5	3.5	0.0	0.	0	0.0	0.0	_				Ψ.
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.0	0.0	0.	0	0.0	0.0		5	6	7	8
Timor Populto				EDI	_	EDT	\\/D	1	10/	рт	NDI	_		CDI	_	CDT
Assigned Phase	0			EDL		2	VD		00		INDL	-		301	-	4
Case Number	e				+	5.0		-	5	0			80			4
Phase Duration					-	24.0		-	24	.0			0.0 14 0			14.0
Change Duration	, s (V+D				+	24.9		-	Z4 1	5			14.0			4.0
	(1 + 1)	(), S			-	4.5		-	4. 2	.5			4.J 2.2		_	4.5
	co Timo	$(a_{\lambda}) \in$			-	18.0		-	Z.	.9			9.5 8.1			3.3 8.2
Groop Extonsio	n Timo	$(g_s), s$			-	2.2	-	-	4. 2	.1			0.1		_	0.2
Phase Call Pro	hability	(ge), s			-	2.5		-	2.				1.0			1.0
Max Out Proba	bility					0.00	-		0.0	00			0.01			0.01
	Dinty					0.00			0.0	00			0.01			0.01
Movement Gro	oup Res	ults			EB			W	В			NB			SB	
Approach Move	ement			L	Т	R	L	Т		R	L	Т	R	L	Т	R
Assigned Move	ment			5	2	12	1			16	3	8	18	7	4	14
Adjusted Flow I	Rate(<i>v</i>), veh/h		748	348	19	27			41		267			130	248
Adjusted Satura	ation Flo	w Rate (<i>s</i>), veh/h/l	n	1615	1614	1437	967		1	1367		1543			1471	
Queue Service	Time (g	g s), S		16.0	2.2	0.2	0.6			0.6		3.6			0.0	
Cycle Queue C	learance	e Time (<i>g c</i>), s		16.0	2.2	0.2	2.7			0.6		6.1			2.5	
Green Ratio (g	/C)			0.52	0.52	0.52	0.52		(0.52		0.24			0.24	
Capacity (c), v	/eh/h			1031	1693	753	640			717		505			496	
Volume-to-Cap	acity Ra	tio(X)		0.725	0.206	0.025	0.042		0	0.057		0.528			0.262	
Back of Queue	(Q), ft	/In (95 th percentile	e)	79.2	10.6	1.1	2.7			2.9		69.3			37	
Back of Queue	(Q), ve	eh/In (95 th percenti	ile)	3.1	0.4	0.0	0.1			0.1		2.7			1.4	
Queue Storage	Ratio (RQ) (95 th percent	tile)	0.00	0.00	0.00	0.00		(0.00		0.00			0.00	
Uniform Delay	(d 1), s/	/veh		8.2	4.9	4.5	5.6			4.5		13.3			12.1	
Incremental De	lay (<i>d</i> 2), s/veh		0.4	0.0	0.0	0.0			0.0		0.3			0.1	
Initial Queue De	elay (<i>d</i>	₃), s/veh		0.0	0.0	0.0	0.0			0.0		0.0			0.0	
Control Delay (ontrol Delay (<i>d</i>), s/veh					4.5	5.6			4.6		13.7			12.2	0.0
Level of Service	evel of Service (LOS)					Α	А			А		В			В	Α
Approach Delay	pproach Delay, s/veh / LOS					Α	5.0		A	4	13.7		В	4.2		А
Intersection De	lay, s/ve	h / LOS				7	.6							A		
	Aultimedial Deputto															
Multimodal Re	sults				EB	_		W	B 			NB	_		SB	_
Pedestrian LOS	Score	LOS		1.63	5	В	1.86	;	E	5	2.08	5	В	2.25		В
Bicycle LOS Sc	ore / LC)S		1.41		А			F	-	0.93	5	A	1.11		A

General Inform	nation								Inte	ersecti	on Inf	ormatio	on	8		
Agency									Du	ration,	h	1.000			₽ Þ	
Analyst		Emma Myers-Verha	age	Analys	is Dat	e 8/16/2	2023		Are	ea Type	;	Other				
Jurisdiction		Box Elder, SD	-	Time F	Period	PM P	eak		PH	IF		1.00			w tu	
Urban Street		Alternative 4.2 - no	WBT	Analys	is Yea	ar 2030			Ana	alysis F	Period	1> 16	:45			188
Intersection		Hwy 1416 and S El	lswor	File Na	ame	Hwy1	416-Ells	wort	hRd	Alt4.2	PMPe	ak2030	.xus		**	
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy					_					1	C Hand Jacob	
							L.				v					
Demand Inform	nation				EB			۷	VB			NB			SB	
Approach Move	ement			L	Т	R	L		Т	R	L	Т	R	L	Т	R
Demand (<i>v</i>), v	eh/h			306	84	142	15			7	38	39	7	7	62	273
O'read he former	4!			li			-									
Signal Informa	tion		0			<u>H</u> 215								~		\mathbf{A}
Cycle, s	21.3	Reference Phase	2		R'	í - SA	7						1	\$ 2	3	4
Oπset, s	0		End	Green	6.3	5.9	0.0	0.	0	0.0	0.0			<u>~</u>		
	Yes	Simult. Gap E/W	On	Yellow	3.5	3.5	0.0	0.	0	0.0	0.0					Ψ.
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.0	0.0	0.	0	0.0	0.0		5	6	7	8
Timor Populto				EDI	_	EDT	\//D		۱۸/		NDI			SDI	_	CDT
Assigned Phase	0			EDL		2		-	00					301		4
Coso Number	e			<u> </u>	+	5.0	<u> </u>	\rightarrow	5				0		_	4
Case Number					+	10.9	<u> </u>	+	10	1.0 1.9			0.0			10.4
Change Duration	, s (V+D	-) c			+	10.0	<u> </u>	-	4	5			4.5			10.4
	(1 + 1)	(), S			-	4.5		-	4.				4.5			4.5
	co Timo	$(a_{\lambda}) \in \mathcal{A}$			+	2.9		\rightarrow	2	.9			2.8			5.6
Green Extensio	n Time	$(g_{s}), s$			-	0.8		-	2.	 Q			0.0	-		0.8
Phase Call Pro	hability	(ge), s			+	1.00		\rightarrow	1	00			0.9	<u> </u>		0.0 n 92
Max Out Proba	hility				-	0.00	<u> </u>	-	0.0	00			0.02	<u> </u>		0.02
Max Out 1105a	onity					0.00			0.	00			0.00			0.00
Movement Gro	oup Res	ults			EB			W	В			NB			SB	
Approach Move	ement			L	Т	R	L	Т		R	L	Т	R	L	Т	R
Assigned Move	ment			5	2	12	1			16	3	8	18	7	4	14
Adjusted Flow I	Rate(<i>v</i>), veh/h		306	84	142	15			7		84			69	273
Adjusted Satura	ation Flo	ow Rate (<i>s</i>), veh/h/l	n	1615	1614	1437	1231			1231		1583			1663	
Queue Service	Time (g	g s), s		3.5	0.4	1.6	0.2			0.1		0.0			0.0	
Cycle Queue C	learance	e Time (<i>g c</i>), s		3.5	0.4	1.6	0.6			0.1		0.8			0.7	
Green Ratio (g	/C)			0.30	0.30	0.30	0.30			0.30		0.28			0.28	
Capacity (c), v	/eh/h			820	963	428	683			367		688			651	
Volume-to-Cap	acity Ra	tio(X)		0.373	0.087	7 0.331	0.022		0	0.019		0.122			0.106	
Back of Queue	(Q), ft	/In (95 th percentile	e)	3.5	0.4	1.8	0.4			0.2		3			5.6	
Back of Queue	(Q), ve	eh/In (95 th percenti	ile)	0.1	0.0	0.1	0.0			0.0		0.1			0.2	
Queue Storage	Ratio (RQ) (95 th percent	tile)	0.00	0.00	0.00	0.00			0.00		0.00			0.00	
Uniform Delay	(d 1), si	/veh		6.5	5.4	5.8	5.6			5.3		5.8			5.8	
Incremental De	lay (<i>d</i> 2), s/veh		0.1	0.0	0.2	0.0			0.0		0.0			0.0	
Initial Queue De	itial Queue Delay (<i>d</i> ₃), s/veh					0.0	0.0			0.0		0.0			0.0	
Control Delay (ontrol Delay (<i>d</i>), s/veh					6.0	5.6			5.3		5.8			5.8	0.0
Level of Service	evel of Service (LOS)					A	Α			А		A			A	Α
Approach Delay	pproach Delay, s/veh / LOS					А	5.5		ŀ	A	5.8		Α	1.2		А
Intersection De	lay, s/ve	h / LOS				4	.4							A		
	Multimodal Posulta															
Multimodal Re	Aultimodal Results					_	4.00	W	В –		0.00	NB	D	0.00	SB	
Pedestrian LOS	edestrian LOS Score / LOS					В	1.86)	E		2.06		В	2.23		В
BICYCIE LOS SC	ore / LC	15		0.93		A			ŀ		0.63	>	A	1.05		A

General Inform	nation								Inte	ersecti	on Infe	ormatio	on			
Agency									Dur	ration, l	h	1.000)		₽ Þ	
Analyst		Emma Myers-Verha	age	Analys	is Dat	e 8/16/2	2023		Are	ea Type	;	Other		.		
Jurisdiction		Box Elder, SD		Time F	Period	PM P	eak		PH	F		1.00			w I L	
Urban Street		Alternative 4.2 - no	WBT	Analys	is Yea	r 2050			Ana	alysis F	Period	1> 7:	00			188
Intersection		Hwy 1416 and S El	lswor	File Na	ame	Hwy1	416-Ells	wort	hRd	Alt4.2	PMPe	ak2050).xus		**	
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy										5	E dans Jaco	
							V				V					
Demand Inform	nation				EB			٧	VB			NB			SB	
Approach Move	ement			L	Т	R	L		т	R	L	Т	R	L	Т	R
Demand (v), v	eh/h			352	99	178	18			8	43	43	8	8	72	327
0	4			1						1						
Signal Informa	tion		0			1242								*		\mathbf{A}
Cycle, s	24.3	Reference Phase	2		F,	` _ ≦≏∩	7						1	\$ 2	3	4
Oπset, s	0		End	Green	7.7	7.7	0.0	0.	0	0.0	0.0			~		
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	3.5	3.5	0.0	0.	0	0.0	0.0	_				∇
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.0	0.0	0.	0	0.0	0.0		5	6	7	8
Timer Deculto			_			FDT			10/				NDT		_	ODT
Assigned Dhose				EDL		2		-	C		INDL			301		
Assigned Phase	e			<u> </u>		2		-	5	0			0	<u> </u>		4
Case Number						12.0		+	10	.0			0.0	<u> </u>		12.2
Change Duration	(V+D				-	12.2		\rightarrow	12	5			12.2	<u> </u>		12.2
	$\frac{1}{1}$	(), S				4.5		-	4.	.5			4.5			4.5
	ce Time	(a_{α}) s				6.6		\rightarrow	2	.0			3.4			7.0
Green Extensio	n Time	$(g_s), s$				1.0		-		.0			1.1			1.0
Phase Call Pro	hability	(ge), s				1.0		\rightarrow	1 (. 1			0.97	<u> </u>		1.0 n 07
Max Out Proba	bility					0.01	-	-	0.0	00			0.01			0.07
Max Out 1 10ba	onity					0.01			0.0	00			0.00			0.02
Movement Gro	oup Res	ults			EB			W	В			NB			SB	
Approach Move	ement			L	Т	R	L	Т		R	L	Т	R	L	Т	R
Assigned Move	ment			5	2	12	1			16	3	8	18	7	4	14
Adjusted Flow I	Rate (v), veh/h		352	99	178	18			8		94			80	327
Adjusted Satura	ation Flo	w Rate (<i>s</i>), veh/h/l	n	1615	1614	1437	1214		1	1367		1565			1666	
Queue Service	Time (g	g s), S		4.6	0.5	2.4	0.3			0.1		0.0			0.0	
Cycle Queue C	learance	e Time (<i>g c</i>), s		4.6	0.5	2.4	0.8			0.1		1.0			0.8	
Green Ratio (g	/C)			0.31	0.31	0.31	0.31		(0.31		0.31			0.31	
Capacity (c), v	/eh/h			805	1017	453	653			431		709			688	
Volume-to-Cap	acity Ra	tio(X)		0.438	0.097	0.393	0.028		0	0.019		0.133			0.116	
Back of Queue	(Q), ft	/In (95 th percentile	e)	14.2	1.5	6.9	0.9			0.4		5			7.9	
Back of Queue	(Q), ve	eh/In (95 th percenti	ile)	0.5	0.1	0.3	0.0			0.0		0.2			0.3	
Queue Storage	Ratio (RQ) (95 th percent	tile)	0.00	0.00	0.00	0.00		(0.00		0.00			0.00	
Uniform Delay	(d 1), si	/veh		7.3	5.9	6.5	6.1			5.7		6.0			6.0	
Incremental De	niform Delay (d 1), s/veh cremental Delay (d 2), s/veh					0.2	0.0			0.0		0.0			0.0	
Initial Queue De	itial Queue Delay (d 3), s/veh					0.0	0.0			0.0		0.0			0.0	
Control Delay (ontrol Delay (<i>d</i>), s/veh					6.7	6.2			5.7		6.1			6.0	0.0
Level of Service	evel of Service (LOS)					Α	Α			A		Α			А	А
Approach Dela	pproach Delay, s/veh / LOS					А	6.0		F	4	6.1		А	1.2		А
Intersection De	ntersection Delay, s/veh / LOS					4	.9							A		
Multimodal Re			EB			W	В		-	NB			SB	_		
Pedestrian LOS	Pedestrian LOS Score / LOS					В	1.87	'	E	В	2.06	5	В	2.23		В
Bicycle LOS Sc	ore / LC	DS		1.01		А			F	F	0.64	-	А	1.16	5	A

											j					
General Inform	nation								Inters	secti	ion Inf	ormatio	on	2	ETEROSEKE	
Agency									Durat	tion,	h	1.000			44	
Analyst		Emma Myers-Verha	age	Analys	is Dat	e 8/14/2	2023		Area	Туре	Э	Other		<u> </u>		- -
Jurisdiction		Box Elder, SD	-	Time F	Period	AM P	eak		PHF			1.00			w I u	
Urban Street		Alternative 1		Analys	is Yea	ar 2030			Analy	/sis F	Period	1> 7:(00			
Intersection		Hwy 1416 and Rad	ar Hil	File Na	ame	Hwy1	416-Rad	darHi	II_Alt1	AM	Peak20)30.xus			5 10	
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy										1		術
		*									Y					
Demand Inform	nation				EB			N	/B			NB			SB	
Approach Move	ement			L	Т	R	L		Г	R	L	Т	R	L	Т	R
Demand (v), v	eh/h			5	697	64	102	43	33	7	179	18	312	11	26	17
	41a.m			I	1											
Signal Informa		Defense Dhara	0	-		_ ÷	1.2 8		2		245	a 🛛		*	<	ሐ
Cycle, s	61.1	Reference Phase	Z				F		5	51	2 5	17 T	1	\$ 2	3	4
Offset, s	0	Reference Point	End	Green	0.4	3.7	15.0	0.9	9 4	4.2	18.9)	_	<u> </u>		•
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	3.5	0.0	3.5	3.	5 0	0.0	3.5			Y		Ψ.
Force Mode	Fixed	Simult. Gap N/S	On	Rea	1.0	0.0	1.0	11.	0 [[J.U	1.0		5	6	7	8
Timor Populto			_	EDI	_	EDT	\//D	1		г	NDI		NDT	<u>SDI</u>		CDT
Assigned Phase				EDL		2	1		6	-		-		361	-	4
Caso Number	5			11	+	2 0		-	3.0	-	1 1		4.0	11		4
Phase Duration	6			1.1	-	10 5	8.6	-	23.0	,	9.6	_	4.0 27.6	5.4	-	4.0 23 /
Change Period	, 3 (V+R	a) e		4.5	-	4.5	4.5		4.5	-	1.5		15	4.5		15
Max Allow Hear	way (A	MAH)s		2.9	-	2.9	2.0	-	29		3.0		33			33
Queue Clearan	ce Time	(a_s) s		2.0	+	14.2	47	-	8.3		6.3		12.8	2.3		3.1
Green Extensio	n Time	(q_{e}) s		0.0	-	0.8	0.0		2.1		0.0		0.5	0.0		0.7
Phase Call Pro	bability	(90),0		0.08	;	1.00	0.82	>	1.00)	0.95	5	1.00	0.17		1.00
Max Out Proba	bility			1.00		0.70	1 00	-)	0.08	, }	1 00)	0.14	1.00		00
						0.110			0.00				••••			
Movement Gro	oup Res	sults			EB			W	3			NB			SB	
Approach Move	ement			L	Т	R	L	Т	F	२	L	Т	R	L	Т	R
Assigned Move	ment			5	2	12	1	6	1	6	3	8	18	7	4	14
Adjusted Flow I	Rate(<i>v</i>), veh/h		5	697	64	102	433	3 7	7	179	330		11	43	
Adjusted Satura	ation Flo	ow Rate (<i>s</i>), veh/h/l	n	1667	1666	6 1483	1667	166	6 14	83	1667	1495		1667	1634	
Queue Service	Time (g	g s), S		0.1	12.2	2.1	2.7	6.3	3 0.	.2	4.3	10.8		0.3	1.1	
Cycle Queue C	learance	e Time (<i>g c</i>), s		0.1	12.2	2.1	2.7	6.3	3 0.	.2	4.3	10.8		0.3	1.1	
Green Ratio (g	/C)			0.25	0.25	0.25	0.33	0.3	1 0.3	31	0.42	0.38		0.32	0.31	
Capacity (c), v	eh/h			294	819	365	265	102	1 45	55	659	566		322	505	
Volume-to-Cap	acity Ra	itio(X)		0.017	0.85	1 0.176	0.385	0.42	24 0.0)15	0.272	0.583		0.034	0.085	
Back of Queue	(Q), ft	/In (95 th percentile)	2	200.7	7 26.8	36.8	87.	52.	.5	57.1	164.5		4.5	20.1	
Back of Queue	(Q), ve	eh/In (95 th percenti	le)	0.1	8.0	1.1	1.5	3.5	5 0.	.1	2.3	6.6		0.2	0.8	
Queue Storage	Ratio (RQ) (95 th percent	tile)	0.00	0.00	0.00	0.00	0.0	0 0.0	00	0.00	0.00		0.00	0.00	
Uniform Delay	(d 1), s	/veh		17.3	22.0	18.2	16.2	16.	9 14	.8	11.6	15.2		14.7	15.0	
Incremental De	mental Delay (<i>d</i> ₂), s/veh					0.1	0.3	0.1	I 0.	.0	0.1	4.4		0.0	0.3	
Initial Queue De	tial Queue Delay (d 3), s/veh					0.0	0.0	0.0) 0.	.0	0.0	0.0		0.0	0.0	
Control Delay (ntrol Delay (d), s/veh					18.3	16.5	17.	0 14	.8	11.6	19.6		14.7	15.3	
Level of Service	el of Service (LOS)					B	В	B	E	3	В	В		В	В	
Approach Delay	proach Delay, s/veh / LOS					С	16.9	9	В		16.8	3	В	15.2		В
Intersection De	lay, s/ve	eh / LOS				20).9							С		
	lultimodal Results								_						0.5	
Nultimodal Re	ultimodal Results						4.04		5		0.44	NB	P	0.40	SB	
Pedestrian LOS	score	/ LUS		1.91		B	1.91		В		2.41		Б	2.42		Б
BICYCIE LOS SC	ore / LC	10		1.12		A	0.93	ן כ	A		1.33		А	0.58		А

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											-					
General Inform	nation								Inte	ersect	ion Inf	ormatio	on	2		
Agency									Du	ration,	h	1.000)		44	
Analyst		Emma Myers-Verha	age	Analys	is Dat	e 8/17/2	2023		Are	еа Туре	Э	Other		.		~_ ~ _
Jurisdiction		Box Elder, SD		Time F	Period	AM P	eak		PH	IF		1.00			₩ 	
Urban Street		Alternative 1		Analys	is Yea	ar 2050			Ana	alysis l	Period	1> 7:	00			
Intersection		Hwy 1416 and Rad	ar Hil…	File Na	ame	Hwy1	416-Ra	darHi	II_Alt	t1_AM	Peak20)50.xus			ካ ቱ	
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy		<u> </u>								5	E dana Jané	
							1				1			1		
Demand Inform	nation			<u> </u>	EB		<u> </u>	N	/B	_	<u> </u>	NB			SB	
Approach Move	ement				T	R			T	R		T	R	L	T	R
Demand (<i>v</i>), v	eh/h			5	789	9 73	115	49	91	8	202	18	354	12	28	19
Signal Informa	tion					5	: N	:								1
Cycle s	66.6	Reference Phase	2	-	2	<u> </u>	FLA &		7	243	_			Z	5	Φ
Offset s	0	Reference Point	End				- N		<u>}</u>	<u> </u>	<u> </u>		1	2	3	4
Uncoordinated	Yes	Simult Gap E/W	On	Green	0.4	4.2	18.5	5.	1	20.4	0.0	_		$\overline{\mathbf{A}}$	ιI	
Force Mode	Fixed	Simult. Gap N/S	On	Red	3.5	0.0	3.5	3.	5 0	3.5	0.0		5	6	Y 7	$\mathbf{Y}_{\mathbf{s}}$
T cree mode	T INCO	Cirrian: Cap 11/C	U II	Tieu	1.0	10.0	1.0		0	1.0	0.0					
Timer Results				EBL	.	EBT	WB	L	W	/BT	NBI	-	NBT	SBL		SBT
Assigned Phase	e			5		2	1		6	6	3		8	7		4
Case Number				1.1	+	3.0	1.1		3.	.0	1.1		4.0	1.1		4.0
Phase Duration	, S			4.9		23.0	9.1		27	7.2	9.6		25.0	9.5		24.9
Change Period,	, (Y+R	c), S		4.5		4.5	4.5		4	.5	4.5		4.5	4.5		4.5
Max Allow Head	dway (<i>I</i>	MAH), s		2.9		2.9	2.9		2	.9	3.0		3.3	3.3		3.3
Queue Clearan	ce Time	e (g s), s		2.1		17.6	5.2		10	0.0	7.1		17.9	2.3		3.4
Green Extensio	n Time	(g _e), s		0.0		0.9	0.0		2	.6	0.0		0.3	0.0		0.8
Phase Call Prol	bability			0.09		1.00	0.88	3	1.0	00	0.98	3	1.00	1.00		1.00
Max Out Proba	bility			1.00		0.71	1.00)	0.	06	1.00)	1.00	1.00		0.00
	_									_						
Movement Gro	oup Res	sults			EB			W	B	_		NB			SB	_
Approach Move	ement				I	R			_	R	L		R		1	R
Assigned Move	ment	<u> </u>		5	2	12	1	6		16	3	8	18	1	4	14
Adjusted Flow I	Rate (v), veh/h		5	789	73	115	49	1	8	202	372		12	47	
Adjusted Satura	ation Fig	bw Rate (<i>s</i>), ven/n/i	n	1615	1614	1437	1602	160		1425	1615	1447		1628	1593	
Queue Service	Time (g	() s), S - Times ()		0.1	15.6	2.6	3.2	8.0) \	0.2	5.1	15.9		0.3	1.4	
Cycle Queue C		e Time (<i>g c</i>), s		0.1	15.6	2.6	3.2	8.0)	0.2	5.1	15.9		0.3	1.4	
Green Ralio (g	/C)			0.28	0.28	0.28	0.37	100	4 (495	0.38	0.31		0.38	0.31	
Volume to Con		tio (X)		209	090	0 199	249	0.45	1 0	400	013	440		209	400	
Back of Oueue		$\frac{100}{100}$.)	2.017	253 (0.103	0.403 45.6	111	8	3.010	0.330 85.1	202.8		6	25.2	
Back of Oueuc	(0)	h/ln (95 th percenti	ile)	0.1	200.8 Q R	1 2	+J.0 1 Q	1 3	.0 2	0.1	33	292.0 11 2		02	2J.2	
	Ratio (RO (95 th percent	tila)	0.0	0.00	0.00	0.00	4.0	,	0.00	0.00	0.00		0.2	0.00	
Uniform Delay ((d_1) s			17 /	23.0	18.3	16.8	17	1	14.6	1/1 7	21.5		15.3	16.5	
Incremental De	lav (<i>d</i> 2) s/veh		0.0	7 9	0.1	0.5	0 1	1	0.0	0.1	19.2		0.3	0.4	
Initial Queue De	cremental Delay (d ₂), s/veh itial Queue Delay (d ₃), s/veh					0.1	0.0		<u>,</u>	0.0	0.1	0.0		0.0	0.4	
Control Delay (nitial Queue Delay (<i>d</i> ₃), s/veh control Delay (<i>d</i>), s/veh					18.4	17.3	17	2	14.6	14.8	40.7		15.6	16.9	
l evel of Service	evel of Service (LOS)					R	B	R	-	R	R	 D		R	R	
Approach Delay	pproach Delay, s/veh / LOS					C	17 3		F	B	31.6		С	16 6		B
Intersection Del	ntersection Delay, s/veh / LOS					2	6.2			-	01.0		-	C		-
														-		
Multimodal Re	sults				EB			W	В			NB			SB	
Pedestrian LOS	edestrian LOS Score / LOS					В	1.90)	E	В	2.42	2	В	2.42	2	В
Bicycle LOS Sc	ore / LC	DS		1.20		А	0.99)	ŀ	A	1.43	3	A	0.58		A

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General Inform	nation								Intersed	tion Inf	ormatio	on	2		<u>114</u>
Agency									Duration	. h	1.000	 		44	
Analvst		Emma Mvers-Verha	ade	Analys	is Dat	e 8/14/2	023	_	Area Tv	, De	Other		.		
Jurisdiction		Box Elder, SD	5	Time F	Period	AM P	eak		PHF		1.00			w‡u	
Urban Street		Alternative 1		Analys	is Yea	r 2030		_	Analysis	Period	1> 16	:45			✓
Intersection		Hwy 1416 and Rad	ar Hil	File Na	ame	Hwv1	416-Rad	darHil	II Alt1 PN	/Peak2)30.xus			54	
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udv					<u>_</u> ,, .		000.1140		5	l r Gentanio	行行
· · ·) · · · · · · · · · · ·				j									1		
Demand Inform	nation				EB			W	/B		NB			SB	
Approach Move	ement			L	Т	R	L		r R	L	Т	R	L	Т	R
Demand (v), v	eh/h			20	424	204	194	56	61 4	117	10	123	5	9	11
0	1			1		_									
Signal Informa	tion		0		La.	Дŝ	∃ ∂ §		5	243	a L		*	ς.	\mathbf{A}
Cycle, s	57.8	Reference Phase	2		Ι,		R'	<u> </u>	5 5	12 S	17	1	\$ 2	3	4
Offset, s	0	Reference Point	End	Green	1.4	4.1	11.6	0.4	4 3.9	18.5	5		<u> </u>	1	
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	3.5	0.0	3.5	3.5	5 0.0	3.5				>	∇
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	0.0	1.0	1.(0 0.0	1.0		5	6	7	8
Timer Desults			_			EDT					_	NDT	CDI		ODT
Assigned Deep			EBL	-	2	VVB 1		<u>корологи</u> С		-	NB I	5BL 7	-	381	
Assigned Phase	e		5		2	1 1	\rightarrow	2.0	J 1 1		0	/		4	
Phase Duration				5.0	-	3.0	1.1		20.2	1.1 8.7		4.0 26.0	1.1		4.0 23.0
Change Period	(Y+R)	c) S		4.5	-	4.5	4.5	_	4.5	4.5		4.5	4.5	-	4.5
Max Allow Head	dwav (<i>N</i>	иАН). s	_	2.9		2.9	2.9		2.9	3.0		3.3	3.3		3.3
Queue Clearan	ce Time	e (g s), s		2.6	-	9.7	7.4		10.9	4.6		5.6	2.1		2.5
Green Extensio	n Time	(ge),s		0.0		2.0	0.0		1.9	0.0		0.2	0.0		0.2
Phase Call Pro	bability			0.27	·	1.00	0.96	3	1.00	0.85	5	1.00	0.08		1.00
Max Out Proba	bility			1.00)	0.14	1.00)	0.18	1.00)	0.00	1.00		0.00
	_								_						
Movement Gro	oup Res	ults			EB			WE	3		NB		<u> </u>	SB	
Approach Move	ement			L	1	R			R	L	1	R		1	R
Assigned Wove)		5		12	1	6	16	3	8	18	1	4	14
Adjusted Flow I), ven/n		20	424	204	194	561	1 4	117	133	<u> </u>	5	20	
Adjusted Satura		w Rate (s), veh/h/l	n	1615	1614	1437	1602	160	1 1425	1615	1453		1628	1555	
Queue Service	Time (g	g s), S — ()		0.6	7.0	1.1	5.4	8.9	0.1	2.6	3.6		0.1	0.5	
Cycle Queue C	learance	e Time (<i>g c</i>), s		0.6	7.0	1.1	5.4	8.9	0.1	2.6	3.6		0.1	0.5	
Green Ratio (g	//C)			0.22	0.20	0.20	0.32	0.2	1 200	0.42	0.39		0.33	0.32	
Volume to Cap	en/n	tio (X)		232	040	200	352	07	1 300	009	200		497	497	
Back of Queue	(Q), ft	Vin (195 th percentile	•)	8.1	101.9	101.6	75.4	126	1 1.5	34.4	49.7		1.9	8.7	
Back of Queue	(Q), ve	eh/In (95 th percenti	ile)	0.3	3.9	3.9	2.9	4.8	3 0.1	1.3	1.9		0.1	0.3	
Queue Storage	Ratio (RQ) (95 th percent	, tile)	0.00	0.00	0.00	0.00	0.0	0 0.00	0.00	0.00		0.00	0.00	
Uniform Delay ((d1), s	/veh		18.0	21.3	21.5	15.9	18.0	6 15.4	10.7	12.0		13.2	13.6	
Incremental De	form Delay (d 1), s/veh remental Delay (d 2), s/veh					1.2	1.1	0.6	6 0.0	0.0	1.0		0.0	0.2	
Initial Queue De	tial Queue Delay (d_3), s/veh					0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (ontrol Delay (d), s/veh					22.7	17.0	19.2	2 15.4	10.7	13.0		13.2	13.7	
Level of Service	evel of Service (LOS)					С	В	В	В	В	В		В	В	
Approach Delay	pproach Delay, s/veh / LOS					С	18.6	3	В	11.9)	В	13.6		В
Intersection De	lay, s/ve	h / LOS				18	3.8						В		
Multimodel De	Multimodal Results							\^/	2		ND			CD	
Pedestrian LOS	Aultimodal Results Pedestrian LOS Score / LOS					B	1.04		P	2 / 4	INB	B	2 /1	38	B
Ricycle I OS So	edestrian LOS Score / LOS cvcle LOS Score / LOS					Δ	1.9		Δ	2.4		Δ	2.41		Δ
				1.02	-	А	1.1		~	0.90	,	Λ	0.55		Λ

			Ū												
General Inform	nation								Interse	ction Inf	ormatio	on	2		
Agency									Duration	ո, h	1.000)		44	
Analvst		Emma Mvers-Verha	ade	Analys	is Dat	e 8/17/2	023		Area Tv	pe	Othe	-	, .		
Jurisdiction		Box Elder, SD	0	Time F	Period	PM Pe	eak		PHF		1.00			w tu	
Urban Street		Alternative 1		Analys	is Yea	r 2050		_	Analysis	Period	1> 16	5:30			
Intersection		Hwy 1416 and Rad	ar Hil…	File Na	ame	Hwv1	416-Rad	darHil	I Alt1 P	MPeak2	050.xus	;		∽ tr	
Project Descrip	tion	Radar Hill 1416 Co	rridor St	udy									1	C Bill Jack	行行
, ,				,											
Demand Inform	nation				EB			W	/B		NB			SB	
Approach Move	ement			L	Т	R	L		Г R	L	Т	R	L	Т	R
Demand (v), v	eh/h			23	494	238	222	65	53 4	133	10	143	5	11	12
				i				_							
Signal Informa	tion				La .	_ 5	=		5	- 203	9			<	\mathbf{A}
Cycle, s	60.0	Reference Phase	2		Γ "		"R"	; t	5 5	12 S	17	1		3	4
Offset, s	0	Reference Point	End	Green	1.6	4.3	13.3	0.4	4 4.2	18.	1		<u> </u>		
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	3.5	0.0	3.5	3.5	5 0.0	3.5		~		>	∇
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	0.0	1.0	1.0	0.0	1.0		5	6	7	8
Timer Deculto			_			EDT						NDT		_	ODT
Assigned Deep				EBL	-	EBI	1 VVB		VVB1	INB 2		0 ND I	5BL 7	-	381
Case Number	e			1 1		20	1 1	+	2.0	1 1		0	/		4
Case Number				6.1		3.0 17.9	1.1	1	22.1	0.1		4.0	1.1		4.0
Change Duration	(V+D			0.1		17.0	10.4	+	4.5	9.1		20.0	4.9		4.5
Max Allow Hoa	$\frac{1}{1}$	(), S		4.3		4.5	4.5	-+-	4.5	4.5		4.5	4.5		4.5
	ce Time	(a_{2}) s		2.9		2.9	2.9	\rightarrow	12.9	5.0		5.5 6.4	2.1		2.6
Green Extensio	n Time	$(g_s), s$		2.7	-	2.1	1.9	-	2.0	0.0		0.4	2.1		0.3
Phase Call Pro	hahility	(ge), s		0.0	,	1.00	0.0	2	1.00	0.0	a 🗌	1.00	0.0		1.00
Max Out Proba	bility			1.00	-	0.31	1.00		0.38	1.00	י ר	0.00	1.00		0.00
Max Out 100a	onity			1.00		0.51	1.00	,	0.50	1.00	5	0.00	1.00		0.00
Movement Gro	oup Res	ults			EB			WE	3		NB			SB	
Approach Move	ement			L	Т	R	L	Т	R	L	Т	R	L	Т	R
Assigned Move	ment			5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow F	Rate (v), veh/h		23	494	238	222	653	3 4	133	153		5	23	
Adjusted Satura	ation Flo	w Rate (<i>s</i>), veh/h/l	n	1615	1614	1437	1602	160	1 1425	1615	1451		1628	1562	
Queue Service	Time (g	g s), S		0.7	8.4	9.3	5.9	10.8	8 0.1	3.2	4.4		0.1	0.6	
Cycle Queue C	learance	e Time (<i>g c</i>), s		0.7	8.4	9.3	5.9	10.8	8 0.1	3.2	4.4		0.1	0.6	
Green Ratio (g	/C)			0.25	0.22	0.22	0.35	0.2	9 0.29	0.41	0.37		0.31	0.30	
Capacity (<i>c</i>), v	/eh/h			224	718	320	350	942	2 419	643	540		455	472	
Volume-to-Capa	acity Ra	tio(X)		0.102	0.688	0.745	0.634	0.69	0.010	0.207	0.283		0.011	0.049	
Back of Queue	(Q), ft	/In (95 th percentile	•)	9.4	123.6	129.7	94.9	157.	.8 1.5	42.7	63.8		2.1	10.8	
Back of Queue	(Q), ve	eh/In (95 th percenti	ile)	0.4	4.8	5.0	3.7	6.1	0.1	1.7	2.5		0.1	0.4	
Queue Storage	Ratio (RQ) (95 th percent	tile)	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00		0.00	0.00	
Uniform Delay ((d 1), s	/veh		17.8	21.4	21.7	16.3	18.8	8 15.0	11.5	13.2		14.4	14.8	
Incremental De	lay (<i>d</i> 2), s/veh		0.1	0.5	2.9	2.9	1.5	5 0.0	0.1	1.3		0.0	0.2	
Initial Queue De	nitial Queue Delay (d 3), s/veh					0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (17.9	21.9	24.6	19.3	20.3	3 15.0	11.6	14.5		14.4	15.0			
Level of Service	evel of Service (LOS)					С	В	C	В	В	B		В	В	
Approach Delay	Approach Delay, s/veh / LOS					С	20.0)	В	13.1	1	В	14.9		В
Intersection De	ntersection Delay, s/veh / LOS					19	9.9						В		
	Multimodal Posulto														
Multimodal Re			EB	F	1.0	WE	3		NB	_	- · ·	SB			
Pedestrian LOS	Pedestrian LOS Score / LOS					В	1.91		В	2.4	1	В	2.42		В
BICYCIE LOS SC	ore / LC	5		1.11		A	1.21		A	0.96	D I	A	0.53		A

					HC	S Rou	nda	bοι	its R	ep	ort								
General Information								Sit	e Inf	orn	natio	n							
Analyst	Emma	Myers	Verha	ge			*				Inters	section			н	lighwa	ay 14	16 and F	Radar Hil
Agency or Co.											E/W S	Street N	ame		н	lighwa	ay 14	16	
Date Performed	8/17/2	023						N		₹ •	N/S S	Street Na	me		R	adar H	Hill Ro	k	
Analysis Year	2030					≰ ↓	W	†Ε S) †	×	Analy	vsis Time	Period, h	rs	1	.00			
Time Analyzed	AM Pe	ak				T			1		Peak	Hour Fa	ctor		0	.88			
Project Description	Radar Study	Hill 14'	16 Corr	ridor					1		Jurisc	liction			В	ox Eld	ler, Sl	D	
Volume Adjustments	and Si	te Cl	narao	cteri	istic	s													
Approach		I	EB				V	VB				1	1B		Т			SB	
Movement	U	L	Т	Τ	R	U	L	Т		२	U	L	Т	R		U	L	Т	R
Number of Lanes (N)	0	0	2		0	0	0	2)	0	0	1	0		0	0	1	0
Lane Assignment		-		TR		LT			TR				LT	R	\top				LTR
Volume (V), veh/h	0	5	702	2 6	64	0	107	454	1 ·	7	0	179	18	314		0	12	25	17
Percent Heavy Vehicles, %	4	4	4		4	5	5	5		5	4	4	4	4		3	3	3	3
Flow Rate (VPCE), pc/h	0	6	830	, ,	76	0	128	542	2	3	0	212	21	371		0	14	29	20
Right-Turn Bypass		N	one				N	one				N	one		T		١	None	
Conflicting Lanes			1					1					2					2	
Pedestrians Crossing, p/h		0						0					0					0	
Proportion of CAVs										(0								
Critical and Follow-U	p Head	lway	Adj	ustn	nen	t													
Approach		[EB				V	VB				1	۱B		Τ			SB	
Lane	Left	Ri	ght	Вура	ass	Left	Ri	ght	Вура	ss	Left	Ri	ght E	ypass		Left	F	Right	Bypass
Critical Headway, s	4.5436	4.5	436			4.5436	4.5	436				4.3	276				4	.3276	
Follow-Up Headway, s	2.5352	2.5	352			2.5352	2.5	352				2.5	352				2	.5352	
Flow Computations, (Capaci	ty an	d v/	c Ra	tios	5													
Approach		I	EB				v	VB				1	١B		Г			SB	
Lane	Left	Ri	ght	Вура	ass	Left	Ri	ght	Вура	SS	Left	Ri	ght E	ypass		Left	F	Right	Bypass
Entry Flow (v _e), pc/h	429	4	83			319	3	59				6	04					63	
Entry Volume, veh/h	412	4	65			303	3	42				5	81		Τ			61	
Circulating Flow (vc), pc/h		1	71				2	39				8	50		Τ			882	
Exiting Flow (vex), pc/h		12	215				7	74				:	35		Τ			233	
Capacity (c _{pce}), pc/h	1215	12	215			1142	1.	142				6	89		Τ			671	
Capacity (c), veh/h	2/h 1215 1215 'h 1169 1169					1088	1(088				6	63		Τ			651	
v/c Ratio (x)	0.35	0.35 0.40					0	.31				0	88		Τ			0.09	
Delay and Level of Se	rvice																		
Approach					EB				WB				NB					SB	
Lane			Left	F	Right	Bypas	5 L	eft	Right	: F	Bypass	Left	Right	Вур	bass	Lef	ťt	Right	Bypass
Lane Control Delay (d), s/veh			6.5		7.1		6	5.0	6.4				43.2					6.6	
Lane LOS			А		А			A	А				E					А	
95% Queue, veh			1.6		2.0		1	.2	1.4				15.4					0.3	
Approach Delay, s/veh LOS 6.8				5.8		А		6.2			A	43	2	E			6.6		А
Intersection Delay, s/veh LOS					16.4								(c					

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				HC	CS Rou	ında	ιbοι	uts Re	ер	ort								
General Information							Sit	e Info	orn	natio	n							
Analyst	Emma	Myers-	Verhag	je		*		1		Inters	ection			Hi	ghway	1416	and R	adar Hil
Agency or Co.										E/W S	Street Na	ime		Hi	ghway	1416		
Date Performed	8/17/2	023					N			N/S S	itreet Na	me		Ra	ıdar Hil	l Rd		
Analysis Year	2050				₹ +	W	† E S		Þ	Analy	sis Time	Period, h	rs	1.0	00			
Time Analyzed	AM Pe	ak			×			1		Peak	Hour Fac	ctor		0.8	38			
Project Description	Radar Study	Hill 141	l6 Corr	idor				1		Jurisc	liction			Во	x Eldei	, SD		
Volume Adjustments	and Si	te Cl	narac	teristi	cs													
Approach		E	B			٧	VB				٩	IB				S	В	
Movement	U	L	Т	R	U	L	Т	R		U	L	Т	R	U		L	Т	R
Number of Lanes (N)	0	0	2	0	0	0	2	0		0	0	1	0	0		0	1	0
Lane Assignment	LI	-		TR	L1			TR				LT	२					LTR
Volume (V), veh/h	0	5	794	73	0	120	512	2 8		0	202	18	356	0		13	27	19
Percent Heavy Vehicles, %	4	4	4	4	5	5	5	5		4	4	4	4	3		3	3	3
Flow Rate (VPCE), pc/h	0	6	938	86	0	143	611	1 10)	0	239	21	421	0		15	32	22
Right-Turn Bypass	· · ·	No	one		<u> </u>	N	one				No	one				No	ne	
Conflicting Lanes	1						1					2				2	2	
Pedestrians Crossing, p/h	0						0					0				C)	
Proportion of CAVs									0)								
Critical and Follow-U	p Head	dway	Adju	ustmei	nt													
Approach		E	B			٧	VB				٩	IB				S	В	
Lane	Left	Ri	ght	Bypass	Left	Ri	ght	Bypas	s	Left	Ri	ght B	ypass	L	eft	Rig	jht	Bypass
Critical Headway, s	4.5436	4.5	436		4.5436	4.5	5436				4.3	276				4.32	276	
Follow-Up Headway, s	2.5352	2.5	352		2.5352	2.5	5352				2.5	352				2.53	352	
Flow Computations,	Capaci [.]	ty an	d v/e	c Ratio	s													
Approach		E	EB			V	VB				٩	IB				S	В	
Lane	Left	Ri	ght	Bypass	Left	Ri	ght	Вураз	s	Left	Ri	ght B	ypass	L	eft	Rig	jht	Bypass
Entry Flow (v _e), pc/h	484	5	46		359	4	05				6	81				6	9	
Entry Volume, veh/h	465	5	25		342	3	86				6	55				6	7	
Circulating Flow (v _c), pc/h		1	90			2	66				9	59				99	93	
Exiting Flow (vex), pc/h		13	374			8	72				3	57				26	51	
Capacity (c _{pce}), pc/h	1195	1	195		1115	1	115				6	28				61	1	
Capacity (c), veh/h	1149	1'	149		1062	1(062				6	04				59	93	
v/c Ratio (x)	0.41	0.32	0	.36				1.	08				0.1	11				
Delay and Level of Se	rvice																	
Approach				EB				WB				NB					SB	
Lane			Left	Righ	t Bypas	s L	eft	Right	E	Bypass	Left	Right	Вур	ass	Left	F	Right	Bypass
Lane Control Delay (d), s/veh			7.3	8.0		e	5.6	7.1	T			217.7					7.4	
Lane LOS			А	A			A	А				F					А	
95% Queue, veh			2.0	2.5			1.4	1.7	Τ			46.4					0.4	
Approach Delay, s/veh LOS				.7	А		6.9		ļ	A	217	.7	F		7.	4		А
Intersection Delay, s/veh LOS					63.8								F					

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				HC	CS Rou	ında	boı	uts Re	ep	ort								
General Information							Site	e Info	orm	natio	n							
Analyst	Emma	Myers-	Verhag	je		*		1		Inters	ection			Ні	ghway	1416	and R	adar Hil
Agency or Co.										E/W S	Street Na	me		Hi	ghway	1416		
Date Performed	8/17/2	023					N			N/S S	treet Na	me		Ra	adar Hil	l Rd		
Analysis Year	2030				∡ ∖ ↓	W	†Ε S) † }		Analy	rsis Time	Period, h	rs	1.0	00			
Time Analyzed	PM Pe	ak			T					Peak	Hour Fac	tor		0.9	94			
Project Description	Radar Study	Hill 141	l6 Corr	idor			- - - -	1		Jurisd	liction			Bo	ox Elder	, SD		
Volume Adjustments	and Si	ite Cł	narac	teristi	cs													
Approach		E	B			V	VB				N	B				S	В	
Movement	U	L	Т	R	U	L	Т	R		U	L	Т	R	U	J	L	Т	R
Number of Lanes (N)	0	0	2	0	0	0	2	0		0	0	1	0	0	,	0	1	0
Lane Assignment	LI	-		TR	L1			TR				LTI	र					LTR
Volume (V), veh/h	0	20	475	205	0	209	605	5 4		0	118	14	138	0		5	13	11
Percent Heavy Vehicles, %	4	4	4	4	5	5	5	5		4	4	4	4	3		3	3	3
Flow Rate (VPCE), pc/h	0	22	526	227	0	233	676	5 4		0	131	15	153	0	,	5	14	12
Right-Turn Bypass				N	one				No	one				No	ne			
Conflicting Lanes				1				:	2				2	2				
Pedestrians Crossing, p/h					0				()				C)			
Proportion of CAVs									0									
Critical and Follow-U	p Head	dway	Adju	ustmei	nt													
Approach		E	EB			V	VB				Ν	B				S	В	
Lane	Left	Ri	ght	Bypass	Left	Ri	ght	Bypas	s	Left	Rig	ght B	ypass	L	.eft	Rig	lht	Bypass
Critical Headway, s	4.5436	4.5	436		4.5436	4.5	436				4.3	276				4.32	276	
Follow-Up Headway, s	2.5352	2.5	352		2.5352	2.5	352				2.5	352				2.53	352	
Flow Computations,	Capaci	ty an	d v/o	c Ratio	S													
Approach		E	B			V	VB				Ν	B				S	В	
Lane	Left	Ri	ght	Bypass	Left	Ri	ght	Bypas	s	Left	Rig	ght B	ypass	L	.eft	Rig	ht	Bypass
Entry Flow (v _e), pc/h	364	4	11		429	4	84				2	99				3	1	
Entry Volume, veh/h	350	3	95		409	4	61				2	38				3	0	
Circulating Flow (v _c), pc/h		2	52			1	68				5	53				10	40	
Exiting Flow (v _{ex}), pc/h		6	84			8	19				4	1				47	'4	
Capacity (c _{pce}), pc/h	1129	1'	129		1219	12	219				8	37				58	37	
Capacity (c), veh/h	ty (c _{pce}), pc/h 1129 1129 ty (c), veh/h 1086 1086					11	161				8	53				57	'0	
v/c Ratio (x)	0.32		0.35	0	.40				0.	34				0.0)5			
Delay and Level of Se	rvice																	
Approach				EB		Τ		WB				NB					SB	
Lane			Left	Righ	t Bypas	is Li	eft	Right	В	sypass	Left	Right	Вур	ass	Left	F	Right	Bypass
Lane Control Delay (d), s/veh			6.5	7.0		6	5.5	7.1	Γ			8.0					6.9	
Lane LOS			А	А			A	А				A					A	
95% Queue, veh			1.4	1.7		1	.6	2.0				1.5					0.2	
Approach Delay, s/veh LOS				.8	А		6.9		Д	Ą	8.0		А		6.	9		А
Intersection Delay, s/veh LOS						7.0								A				

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				Н	CS Ro	bur	ndab	ou	ts Re	port									
General Information							:	Site	Info	matic	on								
Analyst	Emma	Myers	Verhag	ge			*			Inte	rsect	tion			Hi	ighway	1416	5 and R	adar Hil
Agency or Co.							Ŧ			E/W	Stre	eet Na	me		Hi	ighway	1416	5	
Date Performed	8/17/2	023				1	N			N/S	Stre	eet Nar	ne		Ra	adar Hi	ll Rd		
Analysis Year	2050				X +		w + s		† 	Ana	lysis	s Time	Period, h	's	1.(00			
Time Analyzed	PM Pe	ak			*					Peal	k Ho	our Fac	tor		0.9	94			
Project Description	Radar Study	Hill 14'	l6 Corr	idor				*		Juris	sdicti	tion			Bo	ox Elde	r, SD		
Volume Adjustments	and Si	ite Cl	narac	terist	ics														
Approach		I	B				WB	3				N	В				S	SВ	
Movement	U	L	Т	R	U	Τ	L	Т	R	U	Τ	L	Т	R	U	J	L	Т	R
Number of Lanes (N)	0	0	2	0	0	Τ	0	2	0	0	T	0	1	0	0)	0	1	0
Lane Assignment		-		TR		LT			TR				LTF	ξ					LTR
Volume (V), veh/h	0	23	545	239	0	2	237	697	4	0	Τ	134	14	158	0)	5	15	12
Percent Heavy Vehicles, %	4	4	4	4	5	T	5	5	5	4	Ť	4	4	4	3	;	3	3	3
Flow Rate (VPCE), pc/h	0	25	603	264	0	2	265	779	4	0	T	148	15	175	0)	5	16	13
Right-Turn Bypass	<u> </u>	N	one				Non	ne				No	ne				No	one	
Conflicting Lanes			1				1					2	2					2	
Pedestrians Crossing, p/h			0				0					C)					0	
Proportion of CAVs										0									
Critical and Follow-U	p Head	dway	Adju	ustme	nt														
Approach		[B				WB	3		Τ		N	В				S	БВ	
Lane	Left	Ri	ght	Bypass	Lef	ť	Righ	nt	Bypass	Lef	ť	Rig	iht B	/pass	L	.eft	Ri	ght	Bypass
Critical Headway, s	4.5436	4.5	436		4.54	36	4.543	36				4.32	276				4.3	276	
Follow-Up Headway, s	2.5352	2.5	352		2.53	52	2.535	52				2.53	352				2.5	352	
Flow Computations,	Capaci	ty an	d v/e	c Rati	DS														
Approach		I	B				WB	3		Τ		N	В				S	БВ	
Lane	Left	Ri	ght	Bypass	Lef	ť	Righ	nt	Bypass	Lef	ť	Rig	iht B	/pass	L	.eft	Ri	ght	Bypass
Entry Flow (v _e), pc/h	419	4	73		493	3	555	5				33	8				3	34	
Entry Volume, veh/h	403	4	55		469	Э	529)				32	25				3	3	
Circulating Flow (v _c), pc/h		2	86				188	3				63	3				11	92	
Exiting Flow (v _{ex}), pc/h		7	83				940)				4	4				5	45	
Capacity (cpce), pc/h	1095	1()95		119	7	119	7				82	9				5	16	
Capacity (c), veh/h	1053	1()53		114	0	114	0				79	97				5	01	
v/c Ratio (x)	0.38	0	.43		0.4	1	0.46	6				0.4	11				0.	07	
Delay and Level of Se	rvice																		
Approach				EE					WB		Τ		NB		Т			SB	
Lane			Left	Rig	nt Byp	bass	Lef	t	Right	Bypass		Left	Right	Вура	ass	Left		Right	Bypass
Lane Control Delay (d), s/veh			7.5	8.2			7.4		8.2				9.7					8.0	
Lane LOS			А	A			A		А				А					А	
95% Queue, veh			1.9	2.3			2.1		2.6				2.0					0.2	
Approach Delay, s/veh LOS			7	.8	A			7.8		Α		9.7		Α		8	0		А
Intersection Delay, s/veh LOS						8	3.1								A				

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				HC	CS Rou	unda	abou	uts F	lep	ort								
General Information							Sit	e Inf	orn	natio	n							
Analyst	Emma	Myers	Verhag	ge		*				Inters	section			н	ighway	/ 141	6 and R	adar Hil
Agency or Co.							t de			E/W S	Street Na	ime		н	ighway	/ 141	<u>5</u>	
Date Performed	8/17/2	023						Υ '	, ↓ ↓	N/S S	Street Na	me		R	adar H	ill Rd		
Analysis Year	2030				≰ ∖ +	W	†Ε S) †	×	Analy	/sis Time	Period, h	rs	1.	.00			
Time Analyzed	AM Pe	ak						1.		Peak	Hour Fac	tor		0.	.88			
Project Description	Radar Study	Hill 14'	l6 Corr	idor			→ → ▼ √	1.		Jurisc	diction			B	ox Elde	er, SD		
Volume Adjustments	and Si	te Cl	narao	teristi	cs													
Approach		I	EB			١	NB				Ν	IB		Т		9	SB	
Movement	U	L	Т	R	U	L	Т		R	U	L	Т	R	ι	J	L	Т	R
Number of Lanes (N)	0	0	2	0	0	0	2		0	0	0	1	0	(C	0	1	0
Lane Assignment	LI	-		TR	1	-		TR				Ľ	Г					LTR
Volume (V), veh/h	0	5	702	64	0	107	454	4	7	0	179	18	314	(C	12	25	17
Percent Heavy Vehicles, %	4	4	4	4	5	5	5		5	4	4	4	4	:	3	3	3	3
Flow Rate (VPCE), pc/h	0	6	830	76	0	128	542	2	8	0	212	21	371	()	14	29	20
Right-Turn Bypass		N	one		<u> </u>	N	one				Yiel	ding				N	one	
Conflicting Lanes			1				1					2					2	
Pedestrians Crossing, p/h			0				0					C					0	
Proportion of CAVs									(0								
Critical and Follow-U	p Head	dway	Adju	ustme	nt													
Approach		[EB			١	NB				Ν	IB		Γ		9	SB	
Lane	Left	Ri	ght	Bypass	Left	R	ight	Вура	iss	Left	Ri	ght E	ypass		Left	Ri	ght	Bypass
Critical Headway, s	4.5436	4.5	436		4.5436	4.	5436				4.3	276 4	.9763			4.3	276	
Follow-Up Headway, s	2.5352	2.5	352		2.5352	2.	5352				2.5	352 2	.6087			2.5	352	
Flow Computations, (Capaci	ty an	d v/	c Ratio	S													
Approach		[B			١	NB				Ν	IB				9	SB	
Lane	Left	Ri	ght	Bypass	Left	R	ight	Вура	iss	Left	Ri	ght E	ypass		Left	Ri	ght	Bypass
Entry Flow (ve), pc/h	429	4	83		319	3	359				2	33	371			(53	
Entry Volume, veh/h	412	4	65		303	3	342				2	24	357			(51	
Circulating Flow (v _c), pc/h		1	71			ź	239				8	50				8	82	
Exiting Flow (v _{ex}), pc/h		8	44			7	774				3	5				2	33	
Capacity (c _{pce}), pc/h	1215	12	215		1142	1	142				6	39	583			6	71	
Capacity (c), veh/h	1169	1	169		1088	1	880				6	63	561			6	51	
v/c Ratio (x)	0.35	0	.40		0.28	C).31				0.	34	0.64			0	.09	
Delay and Level of Se	rvice																	
Approach				EB		Т		WB				NB					SB	
Lane			Left	Righ	t Bypas	is L	.eft	Righ	: E	Bypass	Left	Right	Вур	bass	Left	Τ	Right	Bypass
Lane Control Delay (d), s/veh			6.5	7.1			6.0	6.4				9.9	20).6		Т	6.6	
Lane LOS			А	A			А	А				А	(2			А	
95% Queue, veh			1.6	2.0			1.2	1.4				1.5	5.	.0			0.3	
Approach Delay, s/veh LOS			6	.8	А		6.2			A	16.	5	С		6	.6		А
Intersection Delay, s/veh LOS						9.2								A	4			

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General Information							Site	e Info	rma	atior	า						_	
Analyst	Emma	Myers-	-Verhag	ge		*			Τ	Inters	ection			Hig	ghway ²	1416 an	d Ra	ıdar Hil
Agency or Co.										E/W S	Street Na	me		Hig	ghway ⁻	1416		
Date Performed	8/17/2	023					N			N/S S	treet Na	me		Ra	dar Hill	Rd		
Analysis Year	2050				₹ ↓	W	† Ε S) † }		Analy	sis Time	Period, h	rs	1.0	00			
Time Analyzed	AM Pe	ak			R.			1		Peak I	Hour Fac	tor		0.8	38			
Project Description	Radar Study	Hill 141	16 Corr	idor				1-1		Jurisd	liction			Во	x Elder,	SD		
Volume Adjustments	and Si	te Cl	narao	teristi	cs													
Approach		E	EB			V	VB		Τ		N	В				SB		
Movement	U	L	Т	R	U	L	Т	R		U	L	Т	R	U	1	-	Т	R
Number of Lanes (N)	0	0	2	0	0	0	2	0		0	0	1	0	0	()	1	0
Lane Assignment	LT	-		TR	LT			TR				Ľ	Г				L	TR
Volume (V), veh/h	0	5	794	73	0	120	512	2 8		0	202	18	356	0	1	3	27	19
Percent Heavy Vehicles, %	4	4	4	4	5	5	5	5		4	4	4	4	3	3	3	3	3
Flow Rate (VPCE), pc/h	0	6	938	86	0	143	611	10		0	239	21	421	0	1	5	32	22
Right-Turn Bypass		No	one			N	one				Yield	ding				None		
Conflicting Lanes			1				1				ć	2				2		
Pedestrians Crossing, p/h			0				0				()				0		
Proportion of CAVs									0									
Critical and Follow-U	p Head	dway	Adju	ustmer	nt													
Approach		E	EB			٧	VB		Τ		N	В				SB		
Lane	Left	Ri	ght	Bypass	Left	Ri	ght	Bypas	5	Left	Rig	ght E	ypass	Le	eft	Right		Bypass
Critical Headway, s	4.5436	4.5	436		4.5436	4.5	5436				4.3	276 4	.9763			4.3276		
Follow-Up Headway, s	2.5352	2.5	352		2.5352	2.5	5352				2.5	352 2	.6087			2.5352		
Flow Computations,	Capaci	ty an	d v/	c Ratio	s													
Approach		E	EB			V	VB				N	В				SB		
Lane	Left	Ri	ght	Bypass	Left	Ri	ght	Bypas	5	Left	Rig	ght E	ypass	Le	eft	Right		Bypass
Entry Flow (v _e), pc/h	484	5	46		359	4	05				26	50	421			69		
Entry Volume, veh/h	465	5	25		342	3	86				25	50	405			67		
Circulating Flow (vc), pc/h		1	90			2	66				95	59				993		
Exiting Flow (vex), pc/h		9	53			8	72				3	7				261		
Capacity (c _{pce}), pc/h	1195	1	195		1115	1	115				62	28	522			611		
Capacity (c), veh/h	1149	1	149		1062	1(062				60)4	502			593		
v/c Ratio (x)	0.41	0.	.46		0.32	0	.36				0.4	41	0.81			0.11		
Delay and Level of Se	rvice																	
Approach				EB				WB				NB		Т		SB		
Lane			Left	Righ	t Bypas	s L	eft	Right	Ву	pass	Left	Right	Вура	ass	Left	Rigł	nt	Bypass
Lane Control Delay (d), s/veh			7.3	8.0		6	5.6	7.1				12.2	38.	9		7.4		
Lane LOS			А	Α			A	А				В	E			A		
95% Queue, veh			2.0	2.5			1.4	1.7				2.1	10.	3		0.4		
Approach Delay, s/veh LOS			7	.7	А		6.9		A		28.7	7	D		7.4			А
Intersection Delay, s/veh LOS						13.1								В				

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				H	CS Roi	unc	dabo	uts	s Rep	oort								
General Information						_	Sit	te l	nforr	natio	n		_			_		
Analyst	Emma	Myers	-Verhag	ge		-\$	•			Inters	ection			н	lighwa	/ 141	6 and F	Radar Hil
Agency or Co.							÷			E/W S	Street Na	ame		н	lighwa	/ 141	6	
Date Performed	8/17/2	2023							A V	N/S S	Street Na	me		R	adar H	ill Rd		
Analysis Year	2050				∡ ∖ +		W + E S		$\uparrow >$	Analy	vsis Time	Period, ł	nrs	1	.00			
Time Analyzed	PM Pe	ak			T				1	Peak	Hour Fa	ctor		0	.94			
Project Description	Radar Study	Hill 14	16 Corr	idor				1		Jurisc	liction			В	ox Elde	er, SD)	
Volume Adjustments	and S	ite Cl	harad	terist	ics													
Approach		1	EB				WB				١	IB					SB	
Movement	U	L	Т	R	U	L	Т	•	R	U	L	Т	R	2	U	L	Т	R
Number of Lanes (N)	0	0	2	0	0	0	2	2	0	0	0	1	0) (0	0	1	0
Lane Assignment	Ľ	Г		TR	Ľ	т		TF	र			Ľ	Т					LTR
Volume (V), veh/h	0	23	545	239	0	23	7 69	97	4	0	134	14	15	8	0	5	15	12
Percent Heavy Vehicles, %	4	4	4	4	5	5	5	;	5	4	4	4	4	L :	3	3	3	3
Flow Rate (VPCE), pc/h	0	25	603	264	0	26	5 77	'9	4	0	148	15	17	′5	0	5	16	13
Right-Turn Bypass		N	one				None				Yiel	ding				N	one	
Conflicting Lanes			1				1					2					2	
Pedestrians Crossing, p/h			0				0					0					0	
Proportion of CAVs										0								
Critical and Follow-U	p Hea	dway	Adj	ustme	nt													
Approach		l	EB				WB				١	IB					SB	
Lane	Left	Ri	ght	Bypass	Left		Right	В	ypass	Left	Ri	ght E	Bypas	ss	Left	R	ight	Bypass
Critical Headway, s	4.5436	6 4.5	5436		4.5436	5 .	4.5436	Γ			4.3	276	1.976	53		4.	3276	
Follow-Up Headway, s	2.5352	2.5	5352		2.5352	2	2.5352				2.5	352 2	2.608	37		2.	5352	
Flow Computations, (Capaci	ty an	d v/	c Ratio	os													
Approach		1	EB				WB				١	IB					SB	
Lane	Left	Ri	ght	Bypass	Left		Right	В	ypass	Left	Ri	ght E	Bypas	ss	Left	R	ight	Bypass
Entry Flow (v _e), pc/h	419	4	73		493		555	Γ			1	63	175				34	
Entry Volume, veh/h	403	4	55		469		529	Γ			1	57	168				33	
Circulating Flow (v _c), pc/h		2	86				188				6	33				1	192	
Exiting Flow (v _{ex}), pc/h		6	08				940				2	14				ļ	545	
Capacity (cpce), pc/h	1095	1(095		1197		1197				8	29	742			ļ	516	
Capacity (c), veh/h	1053	1(053		1140		1140				7	97	714			!	501	
v/c Ratio (x)	0.38	0	.43		0.41		0.46				0	20	0.24	t		().07	
Delay and Level of Se	rvice																	
Approach				EB				٧	VB			NB					SB	
Lane			Left	Rigl	nt Bypa	ss	Left	Ri	ght	Bypass	Left	Right	B	Bypass	Left		Right	Bypass
Lane Control Delay (d), s/veh	ontrol Delay (d), s/veh 7.5							8	3.2			6.6		7.8			8.0	
Lane LOS			А	А			А		A			А		А			А	
95% Queue, veh			1.9	2.3			2.1	2	2.6			0.7		0.9			0.2	
Approach Delay, s/veh LOS			7	.8	А		7.8			А	7.2	2	ŀ	A	8	3.0		А
Intersection Delay, s/veh LOS						7.7								4	4			

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General Information					_			Site	e Info	orn	natio	n		_					
Analyst	Emma	a Myers	Verha	ge	Т		*				Inters	ection		_	H	Highwa	ay 14	16 and F	Radar Hil
Agency or Co.							+	-		Ì	E/W S	Street Na	ame		H	Highwa	ay 14	16	
Date Performed	8/17/2	2023								₩ ₩	N/S S	treet Na	ime		F	Radar I	Hill R	d	
Analysis Year	2030					$\prec \downarrow$	W) †)		Analy	sis Time	Period,	nrs	1	1.00			
Time Analyzed	AM Pe	eak			ĺ				1		Peak	Hour Fa	ctor		().88			
Project Description	Radar Study	Hill 14	16 Cori	ridor					1 <u>r</u>		Jurisd	liction			E	Box Elc	ler, S	D	
Volume Adjustments	and S	ite Cl	nara	cteris	tics	;													
Approach			EB		Т		W	/B		Π		1	١B					SB	
Movement	U	L	Т	R	Ť	U	L	Т	R		U	L	Т	F	R	U	L	Т	R
Number of Lanes (N)	0	0	1	0		0	0	2	0		0	0	1	(0	0	0	1	0
Lane Assignment				LTR	Ť	LT			TR				ι	T					LTR
Volume (V), veh/h	0	5	702	64		0	107	454	l 7		0	179	18	31	14	0	12	25	17
Percent Heavy Vehicles, %	4	4	4	4	Ť	5	5	5	5		4	4	4	4	4	3	3	3	3
Flow Rate (VPCE), pc/h	0	6	830	76		0	128	542	. 8		0	212	21	37	71	0	14	29	20
Right-Turn Bypass		N	one		Τ		Nc	ne				Yie	ding				1	None	
Conflicting Lanes			1		Τ			1					2					2	
Pedestrians Crossing, p/h			0		Τ		()					0					0	
Proportion of CAVs										C)								
Critical and Follow-U	p Hea	dway	Adj	ustme	ent														
Approach		I	EB				W	/B				1	١B					SB	
Lane	Left	Ri	ght	Bypas	s	Left	Rig	ght	Bypas	s	Left	Ri	ght	Зура	iss	Left		Right	Bypass
Critical Headway, s		4.9	763		Τ	4.5436	4.5	436				4.3	276	4.976	63		4	.3276	
Follow-Up Headway, s		2.6	6087			2.5352	2.5	352				2.5	352	2.608	87		2	.5352	
Flow Computations, (Capaci	ity an	d v/	c Rati	os														
Approach		[EB		Т		W	/B				1	١B					SB	
Lane	Left	Ri	ght	Bypas	s	Left	Rig	ght	Bypas	s	Left	Ri	ght	Зура	iss	Left		Right	Bypass
Entry Flow (ve), pc/h		9	12			319	35	59				2	33	371	1			63	
Entry Volume, veh/h		8	77			303	34	42				2	24	357	7			61	
Circulating Flow (v _c), pc/h		1	71				23	39				8	50					882	
Exiting Flow (v _{ex}), pc/h		8	44				77	74				:	35					233	
Capacity (c _{pce}), pc/h		1.	159			1142	11	42				6	89	583	3			671	
Capacity (c), veh/h		1.	115			1088	10	88				6	63	561	1			651	
v/c Ratio (x)		0	.79			0.28	0.	31				0	.34	0.64	4			0.09	
Delay and Level of Se	rvice																		
Approach				E	В		Γ		WB				NB					SB	
Lane			Left	Rig	ght	Bypass	Le	eft	Right	E	Bypass	Left	Righ	t I	Bypass	Le	ft	Right	Bypass
Lane Control Delay (d), s/veh				18	8.7		6	.0	6.4				9.9		20.6			6.6	
Lane LOS				(2		A	Ą	А				Α		С			А	
95% Queue, veh				10).2		1	.2	1.4				1.5		5.0			0.3	
Approach Delay, s/veh LOS			18	8.7		С		6.2		,	Ą	16.	5		С		6.6		А
Intersection Delay, s/veh LOS						1	4.0									В			

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				H	CS Rc	oun	ndab	ou	ts Re	por	rt								
General Information						_		Site	Info	mat	tior	ı							
Analyst	Emma	Myers-	Verha	ge			*			li	nters	ection			н	lighwa	y 141	6 and F	Radar Hil
Agency or Co.							+ +			E	E/W S	street Na	me		н	lighwa	y 141	6	
Date Performed	8/17/2	2023				1	N				N/S S	treet Na	me		R	adar H	ill Rd		
Analysis Year	2050				_ ↓		w † s		†	A	Analy	sis Time	Period, ł	rs	1.	.00			
Time Analyzed	AM Pe	eak			Ë				1	Р	Peak I	Hour Fac	tor		0.	.88			
Project Description	Radar Study	Hill 141	l6 Cori	ridor				1	1.	Ji	urisd	iction			В	ox Eld	er, SD)	
Volume Adjustments	and S	ite Cł	narae	cterist	ics														
Approach		E	EB				WB			Т		N	B		Γ			SB	
Movement	U	L	Т	R	U	Τ	L	Т	R		U	L	Т	R	l	U	L	Т	R
Number of Lanes (N)	0	0	1	0	0		0	2	0		0	0	1	0		0	0	1	0
Lane Assignment				LTR		LT			TR				Ľ	Г				1	LTR
Volume (V), veh/h	0	5	794	73	0	1	120	512	8		0	202	18	356		0	13	27	19
Percent Heavy Vehicles, %	4	4	4	4	5	Γ	5	5	5		4	4	4	4	:	3	3	3	3
Flow Rate (VPCE), pc/h	0	6	938	86	0	1	43	611	10		0	239	21	421	(0	15	32	22
Right-Turn Bypass		No	one				Non	e				Yield	ding				N	lone	-
Conflicting Lanes			1				1					ź	2					2	
Pedestrians Crossing, p/h			0				0					()					0	
Proportion of CAVs					_					0									
Critical and Follow-U	p Hea	dway	Adj	ustme	nt														
Approach		E	B				WB					N	B					SB	
Lane	Left	Ri	ght	Bypass	Left	t	Righ	ıt	Bypass		Left	Rig	ght E	ypass		Left	R	ight	Bypass
Critical Headway, s		4.9	763		4.543	36	4.543	36		Τ		4.3	276 4	.9763			4.	3276	
Follow-Up Headway, s		2.6	087		2.535	52	2.535	52		Τ		2.5	352 2	.6087			2.	5352	
Flow Computations, (Capaci	ty an	d v/	c Ratio	os														
Approach		E	EB				WB			Τ		N	B		Γ			SB	
Lane	Left	Ri	ght	Bypass	Left	t	Righ	it	Bypass		Left	Rig	ght E	ypass		Left	R	ight	Bypass
Entry Flow (ve), pc/h		10	030		359)	405	;				26	50	421				69	
Entry Volume, veh/h		9	90		342	2	386	5				25	50	405				67	
Circulating Flow (vc), pc/h		1	90				266	5		Τ		95	59				Ģ	993	
Exiting Flow (vex), pc/h		9	53				872	2		Τ		3	7				Ĩ	261	
Capacity (c _{pce}), pc/h		11	137		111	5	111	5		Τ		62	28	522			(511	
Capacity (c), veh/h		10)93		106	2	1062	2		Τ		60)4	502			!	593	
v/c Ratio (x)		0.	.91		0.32	2	0.36	5				0.4	41	0.81			().11	
Delay and Level of Se	rvice																		
Approach				EB					WB				NB					SB	
Lane			Left	Rig	nt Byp	ass	Left	t	Right	Вура	ass	Left	Right	Вур	ass	Lef	:	Right	Bypass
Lane Control Delay (d), s/veh				35.	1		6.6		7.1				12.2	38	8.9			7.4	
Lane LOS				E			A		А				В	E				А	
95% Queue, veh				20.	6		1.4		1.7				2.1	10).3			0.4	
Approach Delay, s/veh LOS			3	5.1	E		e	5.9		А		28.	7	D			7.4		А
Intersection Delay, s/veh LOS						24	4.2								(2			

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					HC	S Rou	nda	bοι	uts R	ep	ort								
General Information								Site	e Inf	orn	natio	n							
Analyst	Emma	a Myers	Verha	ge			*		1		Inters	ection				High	way 1	416 and	Radar Hil
Agency or Co.								-			E/W S	Street N	ame			High	way 1	416	
Date Performed	8/17/2	2023				$\left[\right]$		N	/ /		N/S S	Street Na	ame			Rada	r Hill I	Rd	
Analysis Year	2030					₹ ↓	W	†Ε S) †	×	Analy	vsis Time	Period,	hrs	;	1.00			
Time Analyzed	PM Pe	eak							1.		Peak	Hour Fa	ctor			0.94			
Project Description	Radar Study	Hill 14	16 Cori	ridor					1.		Jurisc	liction				Box E	lder,	SD	
Volume Adjustments	and S	ite Cl	narae	cter	ristic	s													
Approach		[EB				٧	VB				l	١B					SB	
Movement	U	L	Т	Τ	R	U	L	Т		र	U	L	Т		R	U	L	Т	R
Number of Lanes (N)	0	0	1	Τ	0	0	0	2)	0	0	1	T	0	0	0	1	0
Lane Assignment				LTR		LT			TR					LT					LTR
Volume (V), veh/h	0	20	475	; ;	205	0	209	605	5 4	4	0	118	14	Τ	138	0	5	13	11
Percent Heavy Vehicles, %	4	4	4		4	5	5	5		5	4	4	4	Τ	4	3	3	3	3
Flow Rate (VPCE), pc/h	0	22	526	; ;	227	0	233	676	5 4	4	0	131	15	Т	153	0	5	14	12
Right-Turn Bypass		N	one				N	one	-			Yie	lding					None	
Conflicting Lanes			1					1					2					2	
Pedestrians Crossing, p/h			0					0					0					0	
Proportion of CAVs										(0								
Critical and Follow-U	p Hea	dway	Adj	usti	men	t													
Approach		[EB				٧	VB				l	١B					SB	
Lane	Left	Ri	ght	Вур	pass	Left	Ri	ght	Вура	SS	Left	R	ght	Ву	pass	Left		Right	Bypass
Critical Headway, s		4.9	763			4.5436	4.5	5436				4.3	3276	4.9	763			4.3276	
Follow-Up Headway, s		2.6	6087			2.5352	2.5	5352				2.5	352	2.6	087			2.5352	
Flow Computations, (Capaci	ity an	d v/	c Ra	atio	5													
Approach		1	EB				٧	VB					٨B					SB	
Lane	Left	Ri	ght	Byp	pass	Left	Ri	ght	Вура	SS	Left	R	ght	Ву	pass	Left		Right	Bypass
Entry Flow (ve), pc/h		7	75			429	4	84				1	46	1	53			31	
Entry Volume, veh/h		7	45			409	4	61				1	40	1	47			30	
Circulating Flow (vc), pc/h		2	52				1	68				5	53					1040	
Exiting Flow (vex), pc/h		5	31				8	19					41					474	
Capacity (c _{pce}), pc/h		1(067			1219	12	219				8	87	8	03			587	
Capacity (c), veh/h		1(026			1161	1	161				8	53	7	72			570	
v/c Ratio (x)		0	.73			0.35	0	.40				C	.16	0	.19			0.05	
Delay and Level of Se	rvice																		
Approach					EB		Τ		WB				NE	3		Τ		SB	
Lane			Left	:	Right	Bypas	s L	eft	Right		Bypass	Left	Rig	nt	Bypas	is l	.eft	Right	Bypass
Lane Control Delay (d), s/veh					16.3		6	6.5	7.1				5.9)	6.7			6.9	
Lane LOS					С			A	А				A		A			А	
95% Queue, veh					7.6		·	1.6	2.0				0.6	5	0.7			0.2	
Approach Delay, s/veh LOS			1	6.3		С		6.9			A	6.	3		А		6.9		А
Intersection Delay, s/veh LOS							10.4									В			

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					HC	S Rou	nda	bοι	ıts R	ер	ort								
General Information								Site	e Inf	orn	natio	n							
Analyst	Emma	Myers	Verha	ge			+				Inters	ection				Highv	vay 14	416 and	Radar Hil
Agency or Co.								-			E/W S	Street Na	ame			Highv	vay 14	416	
Date Performed	8/17/2	2023				$\left[\right]$		N		A F	N/S S	treet Na	me			Radar	Hill F	Rd	
Analysis Year	2050					₹ ↓	W	†Ε S) †	×	Analy	sis Time	Period,	hrs		1.00			
Time Analyzed	PM Pe	eak							1		Peak	Hour Fa	ctor			0.94			
Project Description	Radar Study	Hill 14	16 Cori	ridor				→ → ▼ √	1 <u>r</u>		Jurisc	liction				Box E	lder, S	SD	
Volume Adjustments	and S	ite Cl	nara	cter	ristic	s													
Approach			EB				V	VB				1	۱B					SB	
Movement	U	L	Т		R	U	L	Т	F	ł	U	L	Т	Γ	R	U	L	Т	R
Number of Lanes (N)	0	0	1		0	0	0	2	()	0	0	1	Γ	0	0	0	1	0
Lane Assignment				LTR		LT			TR					LT					LTR
Volume (V), veh/h	0	23	545	5 2	239	0	237	697	7 4	ļ	0	134	14		158	0	5	15	12
Percent Heavy Vehicles, %	4	4	4		4	5	5	5	ļ	5	4	4	4	Γ	4	3	3	3	3
Flow Rate (VPCE), pc/h	0	25	603	3 2	264	0	265	779) 4	ļ	0	148	15	Γ	175	0	5	16	13
Right-Turn Bypass		N	one				N	one				Yie	ding					None	
Conflicting Lanes			1					1					2					2	
Pedestrians Crossing, p/h			0					0					0					0	
Proportion of CAVs										(0								
Critical and Follow-U	p Hea	dway	Adj	ustr	men	t													
Approach			EB				V	VB				1	١B					SB	
Lane	Left	Ri	ght	Вур	oass	Left	Ri	ght	Вура	ss	Left	Ri	ght	Byp	bass	Left		Right	Bypass
Critical Headway, s		4.9	763			4.5436	4.5	5436				4.3	276	4.9	763			4.3276	
Follow-Up Headway, s		2.6	6087			2.5352	2.5	5352				2.5	352	2.6	087			2.5352	
Flow Computations, O	Capaci	ity an	d v/	c Ra	atios	5													
Approach		I	EB				V	VB				1	1B					SB	
Lane	Left	Ri	ght	Вур	oass	Left	Ri	ght	Вура	ss	Left	Ri	ght	Byp	bass	Left		Right	Bypass
Entry Flow (v _e), pc/h		8	92			493	5	55				1	63	1	75			34	
Entry Volume, veh/h		8	58			469	5	29				1	57	1(68			33	
Circulating Flow (vc), pc/h		2	86				1	88				6	33					1192	
Exiting Flow (vex), pc/h		6	08				9	40				4	14					545	
Capacity (c _{pce}), pc/h		1(031			1197	1	197				8	29	74	42			516	
Capacity (c), veh/h		9	91			1140	1	140				7	97	7	14			501	
v/c Ratio (x)		0	.87			0.41	0	.46				0	20	0.	24			0.07	
Delay and Level of Se	rvice																		
Approach					EB		Τ		WB				NB					SB	
Lane			Left	:	Right	Bypas	s L	eft	Right	I	Bypass	Left	Righ	t	Bypass	5 L	eft	Right	Bypass
Lane Control Delay (d), s/veh					29.4		7	7.4	8.2				6.6		7.8			8.0	
Lane LOS					D			A	А				A		А			А	
95% Queue, veh					15.6		Ĩ	2.1	2.6				0.7		0.9			0.2	
Approach Delay, s/veh LOS			2	9.4		D		7.8			A	7.2	2		А		8.0		А
Intersection Delay, s/veh LOS							16.1									С			

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