

GLENDIVE TRAFFIC STUDY

STPX 5099(4)
UPN 8934000



MERRILL AVENUE – DOUGLAS
STREET TO OREGON LANE



Prepared for:




MAY 2016

CERTIFICATION

I hereby certify that this traffic study for Merrill Avenue in Glendive, Montana was prepared by me or under my direct supervision and that I am a duly registered professional engineer under the laws of the State of Montana.




Steve A. Grabill P.E., PTOE

5/31/16
Date

EXECUTIVE SUMMARY

The City of Glendive has approached MDT with a desire to have a traffic study conducted along Merrill Avenue. A recently completed plan recommended converting Towne Street from a four lane street to a three lane street equipped with a center two-way left turn lane (TWLTL) and enhanced pedestrian and bike facilities. The City believes that similar changes to the Merrill Avenue corridor may be beneficial. It is with this request in mind that MDT has undertaken this study.

RECOMMENDATIONS

Based on a review of Merrill Avenue corridor alternatives, the following recommendations were made to maintain existing traffic operations and accommodate bike and pedestrian travel in the existing roadway section while minimizing impacts to on-street parking.

MERRILL AVENUE TYPICAL SECTION

Merrill Avenue will function well through the year 2035 regardless of whether a 3 or 4 lane section is implemented. However, the 3 lane section offers a number of benefits over the 4 lane section and is therefore recommended. Namely, it provides space for the development of bike lanes. It also provides a good location for bulb-outs and pedestrian refuge islands in key locations to improve pedestrian crossing safety.

Almost half of the crashes along the corridor are rear-end or sideswipe, same direction crashes. Both of these crash types may be reduced with the 3 lane section. Rear end crashes may be reduced because left turning traffic is removed from the through traffic. Some of the sideswipe crashes may be occurring from traffic trying to weave around left turning vehicles. The continuous left turn bay would significantly reduce this activity as well.

Based on review of the crash data, a reduction of slightly more than 25% of all rear end and sideswipe same direction crashes, or a 12.6% reduction in all crashes are estimated to result from installation of the proposed 3 lane section.

ON-STREET PARKING

Through the Merrill Avenue corridor there is sufficient room to preserve on-street parking while implementing a three lane section with bike lanes. Therefore, it is recommended that on-street parking be allowed to remain in areas where it already exists, with the possible exceptions of three parking spots along the northwest side of Merrill Avenue near Douglas Street and the southeast side of Merrill Avenue between Douglas Street and Towne Street. Where parking currently is prohibited, those locations should remain prohibited for on-street parking.

Based on completed parking use counts, it was observed that use of parking spaces is generally low along the southeast side of Merrill Avenue. In these locations, removal of on-street parking could be considered in favor of additional width for traffic and bike lanes and shoulders.



PEDESTRIAN CROSSING FACILITIES

It is recommended that bike lanes be installed from the Douglas Street east crosswalk to Oregon Street. From Griswold Street to Oregon Street a separated sidewalk is also recommended.

Significant pedestrian crossing activity has been observed at Slocum Street in the vicinity of the High School. There were 20 pedestrians that crossed Merrill Avenue during the noon peak hour. This is enough to warrant signalization based on the School Crossing Warrant if gaps are insufficient. However, a gap study would be difficult to conduct given the proposed change in lane configuration. No other warrants were met at this location. A Rectangular Rapid Flashing Beacon is a better solution than a signal because it increases pedestrian safety without impairing traffic operations and it is therefore recommended.

It is recommended that the Glendive community pursue a Hillcrest to Allen Street Multi-use Path connection. It is further recommended that Allen Street/Subway Pedestrian Safety Alternative 2 be implemented at this location.

DOUGLAS STREET INTERSECTION IMPROVEMENTS

Given the number of crashes that have occurred at the Douglas Street intersection and the substandard placement of approach stop signs, it is recommended that Alternative 1 - Improvements Without Signalization be implemented as soon as is practical. Alternative 2 - Minor Improvements could be an acceptable interim alternative if changes in traffic control are desired prior to implementation of Alternative 1.

These alternatives were reviewed by MDT and feedback from the City of Glendive was obtained. This recommendation follows the desires of MDT District Staff and the City of Glendive as an ultimate solution to safety concerns at the intersection.

TRAFFIC SIGNALIZATION

It is recommended that traffic signals be maintained at the Towne Street intersection. Although Griswold Street meets Warrant 9 (Intersection near a grade crossing), no safety issues were identified for the intersection. The low level of vehicular traffic indicated that traffic signals would impair traffic operations at this intersection. Therefore traffic signals are neither justified nor recommended at this location.

Douglas Street met warrants for signalization by the year 2020. However, if Alternative 1 is implemented as recommended, signalization of the intersection in the future should not be necessary.



STREET LIGHTING

As was stated in the review of existing conditions, with the exception of street lighting present at the I-94 Interchange there is no street lighting along Merrill Avenue north of Sigmund Street. Only 2 of 95 reported crashes along the Merrill Avenue corridor occurred under dark-not lighted conditions over a 5 year period.

In unlighted sections of Merrill Avenue, the greatest need for future street lighting appears to be along the segment north of I-94, where substantial hotel and restaurant/business traffic may merit a future lighting project. It is recommended lighting be considered along this segment.



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CHAPTER 1 - INTRODUCTION

The City of Glendive approached MDT with a desire to have a traffic study conducted along Merrill Avenue. A recently completed plan recommended converting Towne Street from a four lane street to a three lane street equipped with a center two-way left turn lane (TWLTL) and enhanced pedestrian and bike facilities. The City believes that similar changes to the Merrill Avenue corridor may be beneficial.

Provision of enhanced pedestrian and bike facilities is also consistent with the City's Bike/Pedestrian Master Plan. Building Active Glendive (BAG) has a vision for Glendive to have a fully integrated multi-modal transportation network. It is with the City's request in mind that MDT has undertaken this study.

PLAN PURPOSE

The purpose of the report is to provide an evaluation of the Merrill Avenue corridor to identify opportunities to improve safety and operations on Merrill Avenue by providing appropriate lane configuration, traffic control and pedestrian/bike features to address current and anticipated traffic conditions. This effort was undertaken with consideration of current on-street parking utilization and available street pavement widths.

This traffic engineering report documents traffic operational and safety issues related to the four lane typical section of Merrill Avenue, as well as benefits and tradeoffs of revising the four-lane section to a three-lane typical section on Merrill Avenue between Douglas Street and the north side of Oregon Lane, north of the I-94 interchange.

The study also examines use of on-street parking in order to assess possible removal of on-street parking in favor of bike lanes. The study further identifies feasible pedestrian/bike features for the corridor, and traffic control recommendations for the Merrill Avenue intersections with Douglas Street and Ames Avenue located in the City of Glendive.

STUDY AREA

The study area is shown in **Figure 1-1**. It includes the Merrill Avenue corridor between Douglas Street and Oregon Lane, north of the I-94 interchange. Key land uses within the study area include Eastern Plains Event Center and Dawson County High School.

The Burlington Northern Santa Fe (BNSF) Railroad parallels the east side of Merrill Avenue south of I-94. Within the Study area, only I-94, Griswold Street (at-grade), Allen Street and Douglas Street cross the railroad tracks.



FIGURE 1-1 - Study Area



CHAPTER 2 - EXISTING AND PROJECTED CONDITIONS

An evaluation was conducted to determine the existing transportation network and traffic conditions, as well as the extent of transportation deficiencies and improvement opportunities within the study area.

ROADWAY FACILITIES INVENTORY

An inventory of existing road conditions was undertaken to identify issues and opportunities to improve motorized and non-motorized traffic flow and safety.

FUNCTIONAL CLASSIFICATION AND POSTED SPEED

Functional classification refers to a hierarchy of roads. It supports the concept that roads are designed for different purposes. Primary and secondary state highways or arterials, for example, are designed to serve higher volumes of traffic at high speeds and over greater distances, while collectors are designed to facilitate some land access at the expense of higher speeds or high traffic volume.

Merrill Avenue is designated as a non-Interstate principal arterial road between I-94 and Towne Street. South of Towne Street it becomes a major collector route. North of I-94 it is designated as a local roadway. Intersecting roads that are functionally classified include I-94 (Interstate Principal Arterial), Towne Street (Non-Interstate Principal Arterial), Griswold and Douglas Streets (Major Collectors). All other roads are classified as local streets.

The posted speed limit along Merrill Avenue is 35 mph south of Douglas Street and between the north side of the High School and north of Idaho Street. Elsewhere along Merrill Avenue the posted speed limit is 25 mph.

ROADWAY GEOMETRICS

The existing geometrics along Merrill Avenue were obtained from as-built road plans provided by MDT. Merrill Avenue consists of a four lane, undivided roadway without turn lanes between Douglas Street and the south I-94 Interchange ramps, and as a two lane undivided roadway without turn lanes between the south I-94 Interchange ramps and Oregon Lane to the north.

Representative examples of Merrill Avenue existing lane use and geometrics are shown in **Figures 2-1, 2-2 and 2-3**. Actual dimensions for these typical sections vary minimally along the corridor. More detailed typical sections are provided in the alternatives section of this report.

In addition to these examples, it is notable that the typical section on Merrill Avenue between Douglas and Towne Street is similar to that shown in Figure 2-2, except having an overall dimension of 61 feet. North of the High School to Oregon to I-94 Merrill Avenue transitions to a rural four lane highway with no parking and with varying shoulder and overall dimensions.



FIGURE 2-1 - Existing Two Lane Typical Section North of I-94

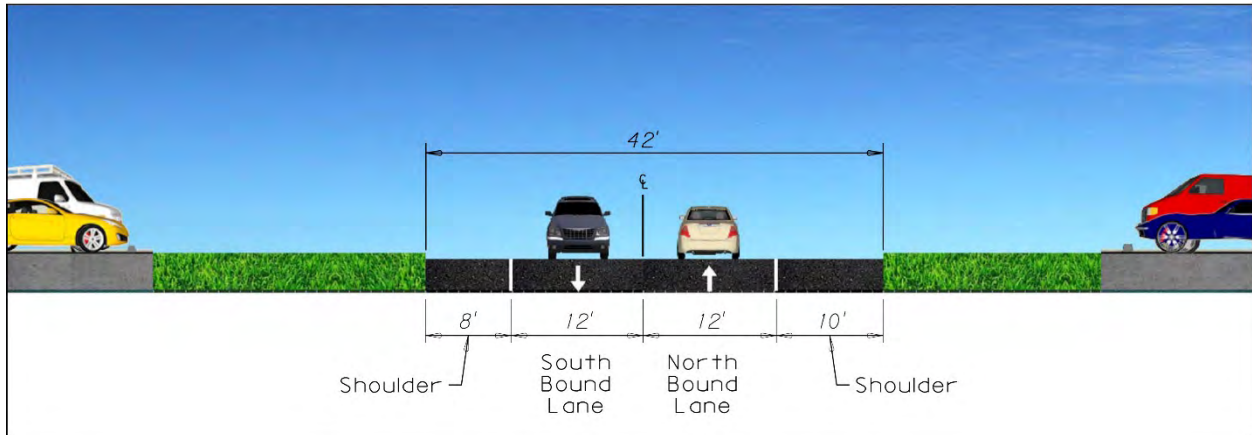


FIGURE 2-2 - Existing Four Lane Typical Section (Towne to Borden)

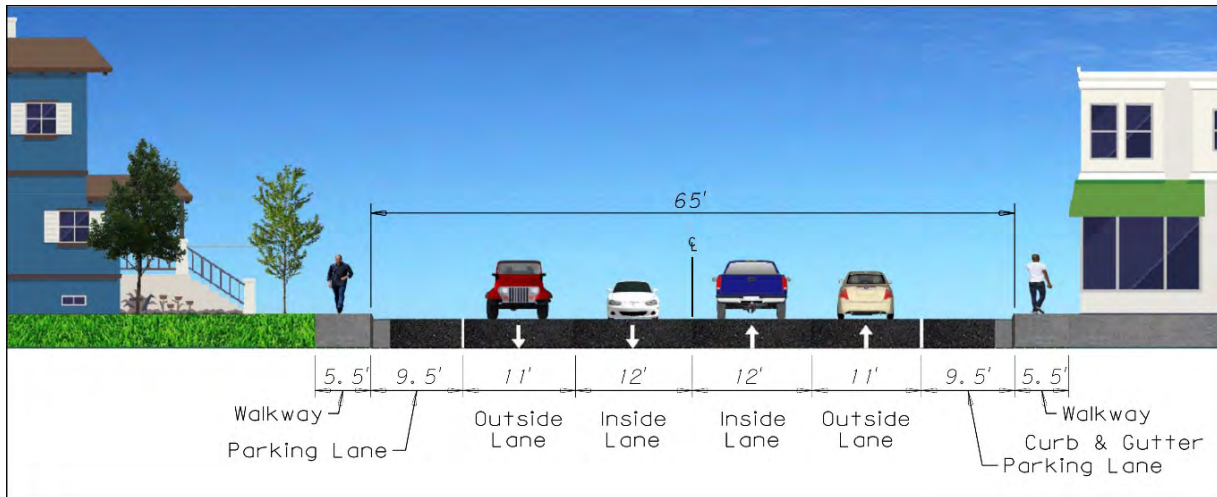
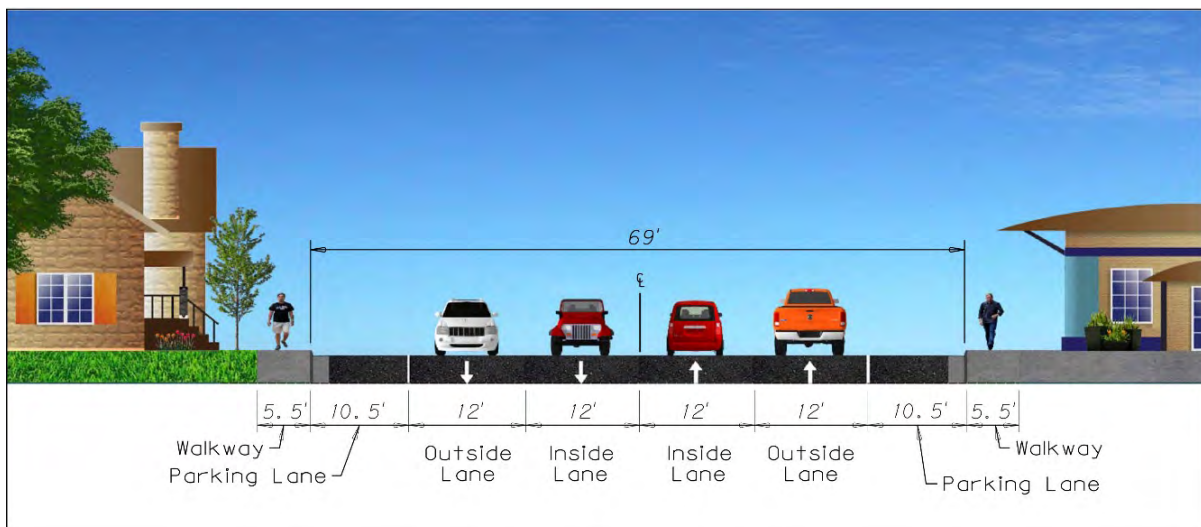


FIGURE 2-3 - Existing Four Lane Typical Section (Borden to North of High School)



ON-STREET PARKING INVENTORY

On-street parking was inventoried during am, pm and evening (after 5:00 p.m.) periods from September 4-6, 2015. Available and utilized parking spaces from the inventory are shown in Figure 2-4. Additional parking inventory information is provided in Appendix A.

The heaviest observed utilization of on-street parking was observed along the northwest side of Merrill Avenue from Ames Street to Slocum Street and from Clement Street to Power Street. With the exception of the High School vicinity, parking utilization was generally under 50% utilization regardless of time of day. However, it should be noted that during Eastern Plains Event Center events, and during events at the park and during other city activities, parking use in those vicinities can be significantly higher than what was observed.

FIGURE 2-4 - Merrill Avenue Parking Use Inventory

North Cross Street along Merrill	South Cross Street along Merrill	Side	Available Spaces	Parking Spaces Used					
				AM 1	AM 2	PM 1	PM 2	Eve 1	Eve 2
Ames	HS X-Walk	SE	7	2	4	2	2	0	0
		NW	16	9	7	8	1	0	0
HS X-Walk	Slocum	SE	6	2	4	2	0	0	0
		NW	9	9	9	6	6	0	0
Slocum	Relf	SE	6	4	0	3	1	0	1
		NW	4	1	3	2	1	3	4
Relf	Brennan	SE	10	1	0	1	0	2	0
		NW	7	2	2	3	2	2	2
Brennan	Dodge	SE	11	0	0	0	0	0	0
		NW	8	2	0	1	1	0	2
Dodge	Borden	SE	12	0	0	0	0	0	0
		NW	8	1	0	0	0	0	0
Borden	Clement	SE	11	0	0	0	0	0	0
		NW	5	0	0	0	0	0	0
Clement	Benham	SE	10	2	2	3	3	2	2
		NW	9	1	7	0	2	0	6
Benham	Towne	SE	9	0	0	0	0	0	0
		NW	7	1	4	1	4	1	5
Towne	Bell	SE	8	1	0	2	1	0	1
		NW	10	4	4	5	5	3	8
Bell	Valentine	SE	8	2	0	2	3	2	0
		NW	10	1	6	5	3	2	0
Valentine	Power	SE	10	0	0	2	0	0	0
		NW	9	2	5	3	5	4	7
Power	Douglas	SE	8	1	0	0	0	0	0
		NW	9	0	0	3	1	2	0

ROADWAY SURFACE CONDITIONS

Road surface conditions are generally in very good condition along Merrill Avenue. The Merrill Avenue roadway has an asphalt surface.



STREET LIGHTING CONDITIONS

Street lighting exists along the west side of Merrill Avenue between Sigmund Street and Towne Street. Overhead lighting is provided on both sides of Merrill Avenue between Towne Street and Douglas Street. With the exception of street lighting present at the I-94 Interchange, there is no street lighting along Merrill Avenue north of Sigmund Street.

PEDESTRIAN AND BIKE FACILITIES INVENTORY

Walking and biking is an important component of the transportation system. Enhancing the ability of travelers to walk or bike involves not only providing the infrastructure but also linking design, streetscapes and land use to encourage walking and biking. Safety is also critical when developing an appealing pedestrian and bike network. According to national studies, pedestrians represent a disproportionate percentage of road-related fatalities, and thus, special focus should be given to addressing these safety concerns.

In regard to pedestrian facility needs, a survey of Americans with Disabilities Act/Public Right of Way Accessibility Guidelines (ADA/PROWAG) requirements was not within the scope of this study. However, it was within the scope of this study to consider the general requirements that apply and suggest alternatives to address them. Specific to ADA/PROWAG requirements is the removal of barriers to access. Along the Merrill Avenue corridor, current barriers include ADA curb ramps that do not meet current standards and lack of available sidewalks.

Regarding the needs for bicyclists, the condition of curbs and the use of non-bicycle friendly drainage grates influence the functionality of the traveling way for bicyclists. The current drainage grates are not bike friendly and would need to be replaced where bike lanes are proposed adjacent to curbing. There are no designated on-street or off-street bike facilities along Merrill Avenue.

SOUTHEAST SIDE FACILITIES

Sidewalks exist along the southeast side of Merrill Avenue between Douglas Street and almost across from the school track and field. No facilities exist further north along Merrill Avenue.

NORTHWEST SIDE FACILITIES

Pedestrian facilities exist along the northwest side of Merrill Avenue between Douglas Street and Griswold Street. Between Griswold and I-94 there are no facilities along Merrill Avenue. There is a pedestrian overpass across I-94 along the northwest side of the interchange bridge, though no pedestrian facilities connect to the overpass. There are no pedestrian facilities along Merrill Avenue north of I-94.



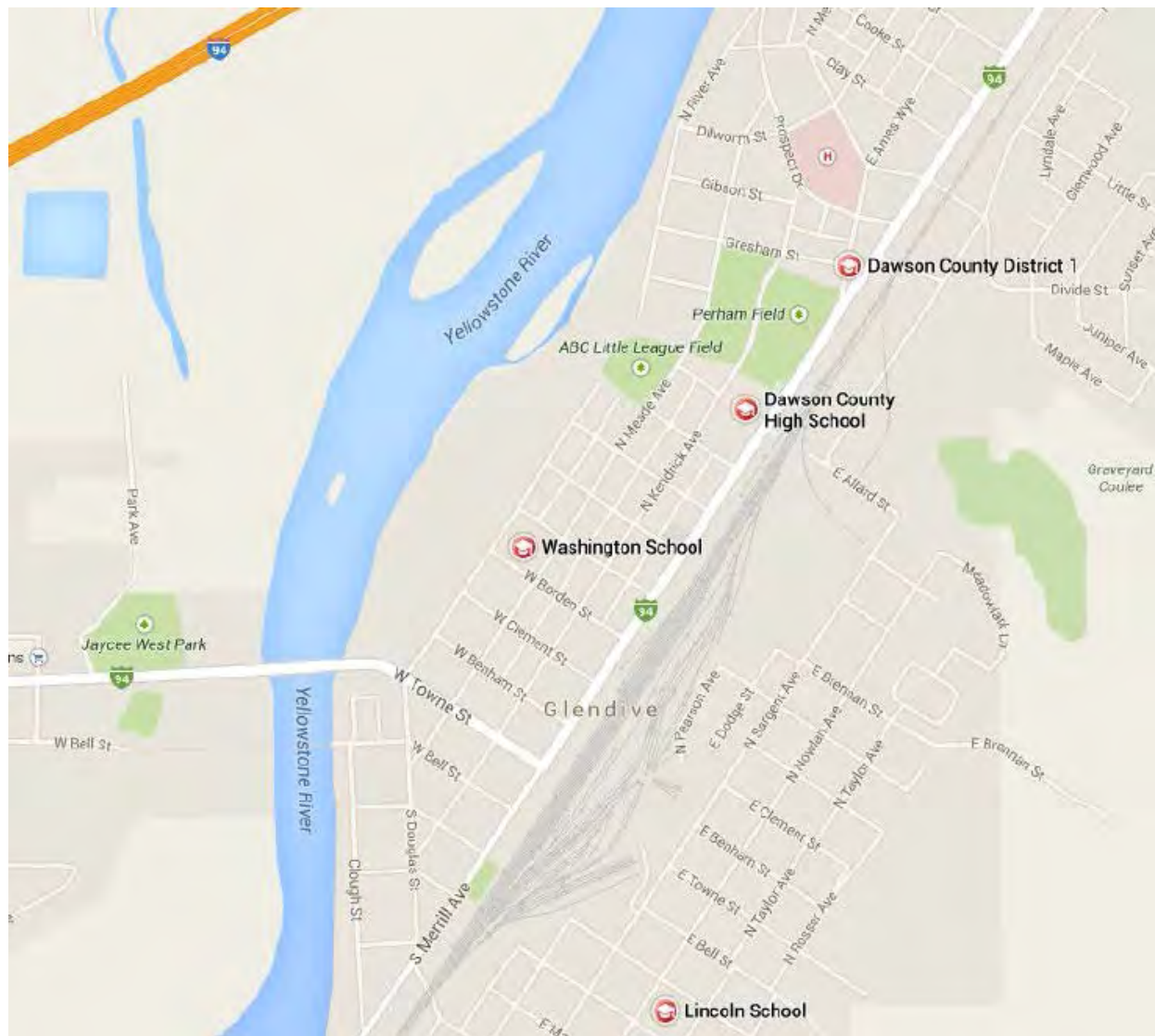
MERRILL AVENUE CROSSINGS

Most of the marked crosswalks across Merrill Avenue are located at the downtown intersections between Allard Street and Douglas Street. The only other marked crosswalk is located at Allen Street. In all cases, there are no refuge islands present.

HIGH PEDESTRIAN AND BIKE TRAFFIC GENERATORS

Schools and parks are typically high generators of pedestrian and bike traffic. Locations of schools and parks in the vicinity of Merrill Avenue are shown in Figure 2-5. Additionally, the Eastern Plains Event Center and some restaurants such as the Subway at Allen Street can be high traffic generators.

Figure 2-5 - Merrill Avenue Vicinity Schools and Parks



TRANSIT CONDITIONS

Transit service for the Glendive area is currently provided using a dial-a-ride system by Urban Transportation District of Dawson County. Transit service is provided by a fleet of 4-12 passenger buses that operate Monday through Friday from 7:30 a.m. to 5:00 p.m. There are no fixed routes serving Glendive.

TRAFFIC CONDITIONS

Many factors influence the traffic conditions of a transportation system. These include the levels of existing and projected traffic, roadway capacity and intersection control, roadway geometrics, traffic operations, access management and on-street parking among others.

EXISTING AND PROJECTED TRAFFIC

Existing a.m., noon and p.m. turning movement counts were collected at 6 intersections along the studied corridor. The results of those counts are shown in **Figure 2-6** and provided in **Appendix A**. Historical traffic data for the Merrill Avenue corridor was provided by MDT. Growth for the years 2010 through 2014 was calculated and averaged across the Merrill Avenue corridor to determine an average annual growth rate.

Based on growth over the last five years, it was estimated that traffic on Merrill Avenue will grow at a rate of 3.4% per year and that a 1.0% per year growth rate will occur on minor street approaches. The annual growth rate was applied to existing traffic for a build year 2020 projection and a 20 year projection to the year 2035. Projected year 2035 turning movements are shown in **Figure 2-7**. Existing and projected Average Daily Traffic (ADT) volumes are shown in **Figure 2-8**. Existing ADT's range from 6500 vpd in the northern corridor and the highest volumes near Douglas/Towne Street with 9000 vpd. Projected ADT's range from 12,700 to 17,500 vpd at the same locations.

Existing pedestrian and bike crossing volumes are shown in **Figure 2-9**. Only two bicyclists were observed during the studied time intervals at the five studied locations. Pedestrian activity was much more common along the corridor, with highest peak hourly volumes in the range of 20-30 pedestrians near Slocum Street in the vicinity of the school.



FIGURE 2-6 - Existing Peak Hour Traffic Data

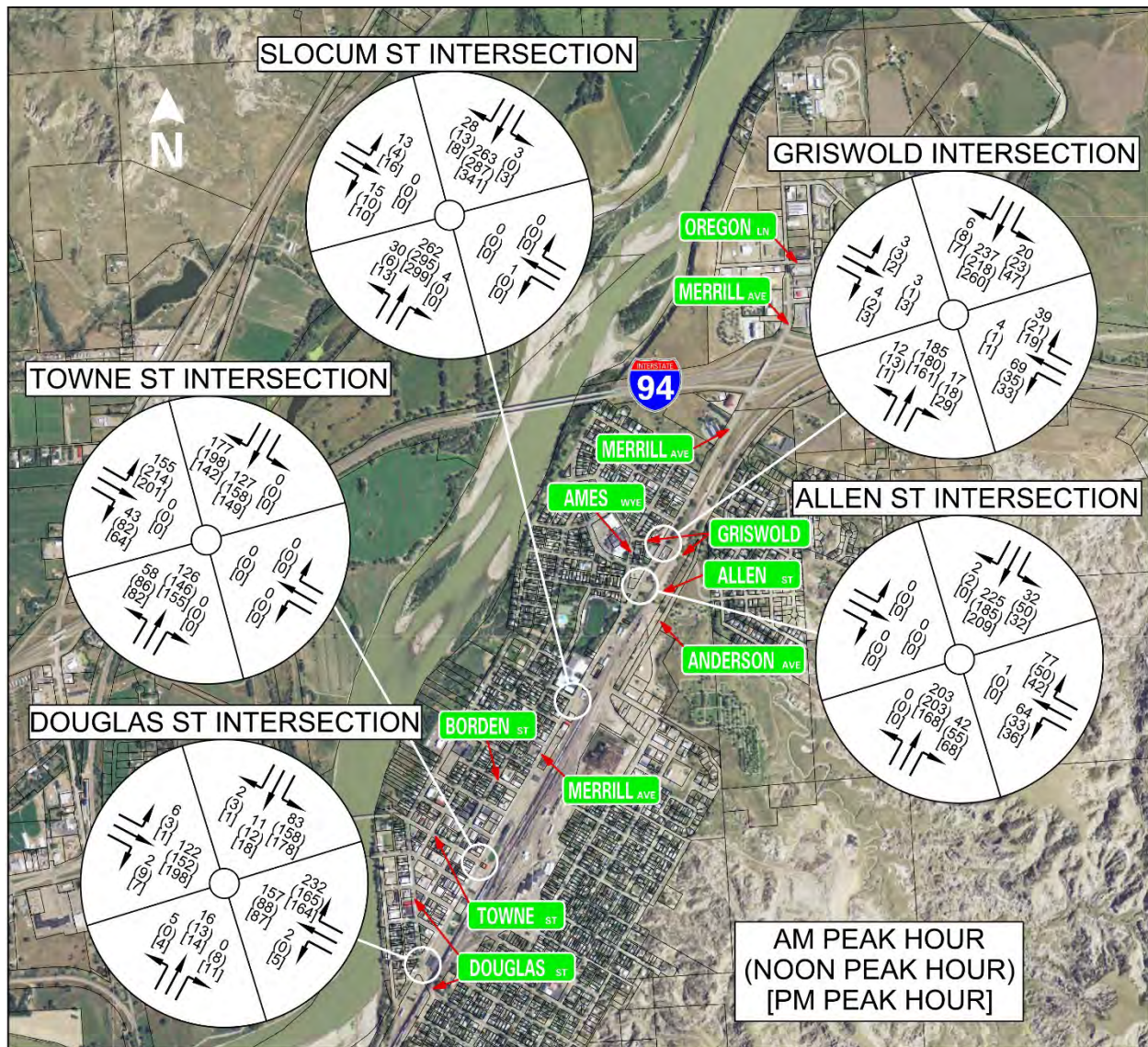


FIGURE 2-7 - Projected Year 2035 Peak Hour Traffic Data

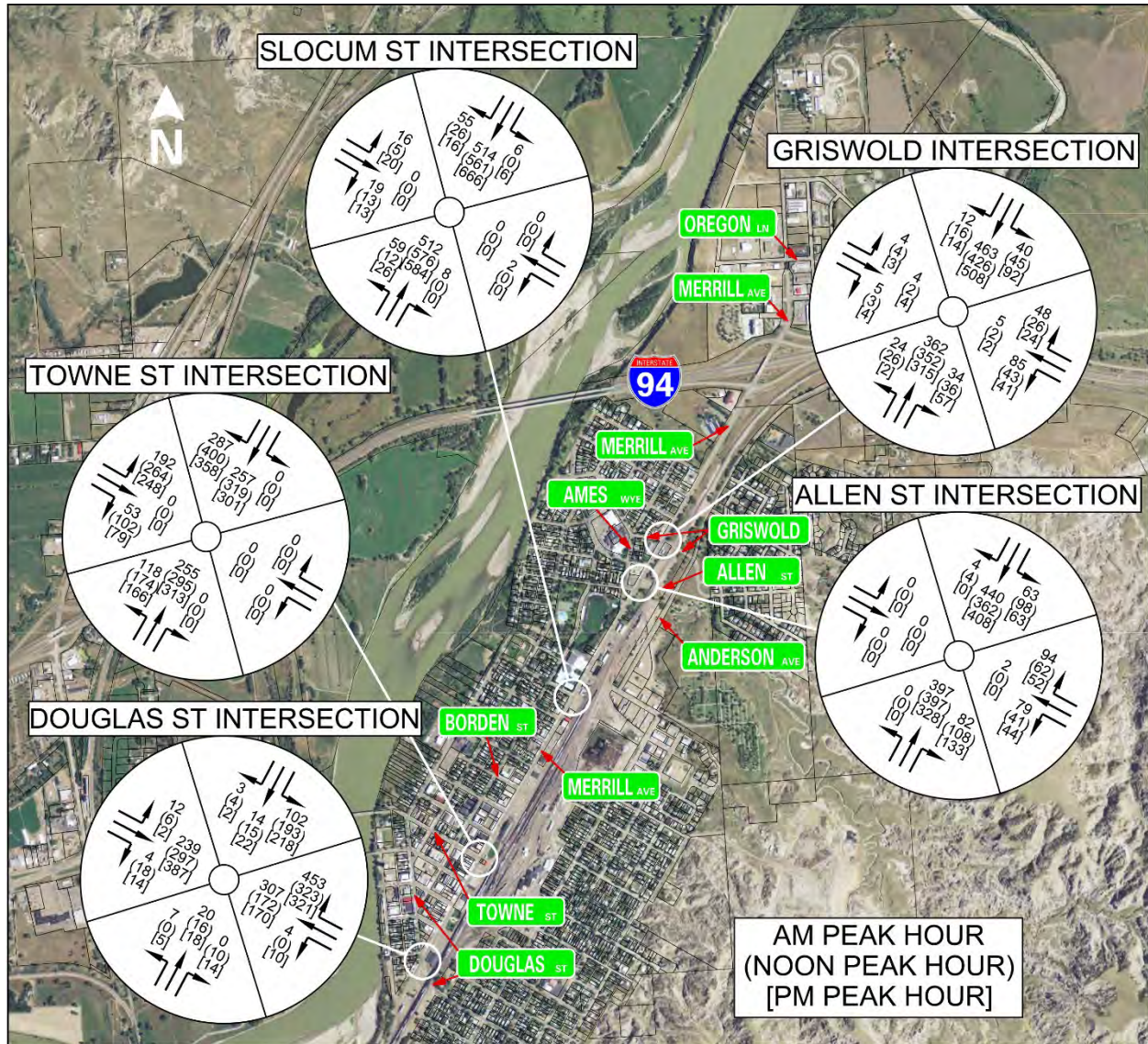


FIGURE 2-8 - Existing and Projected Average Daily Traffic

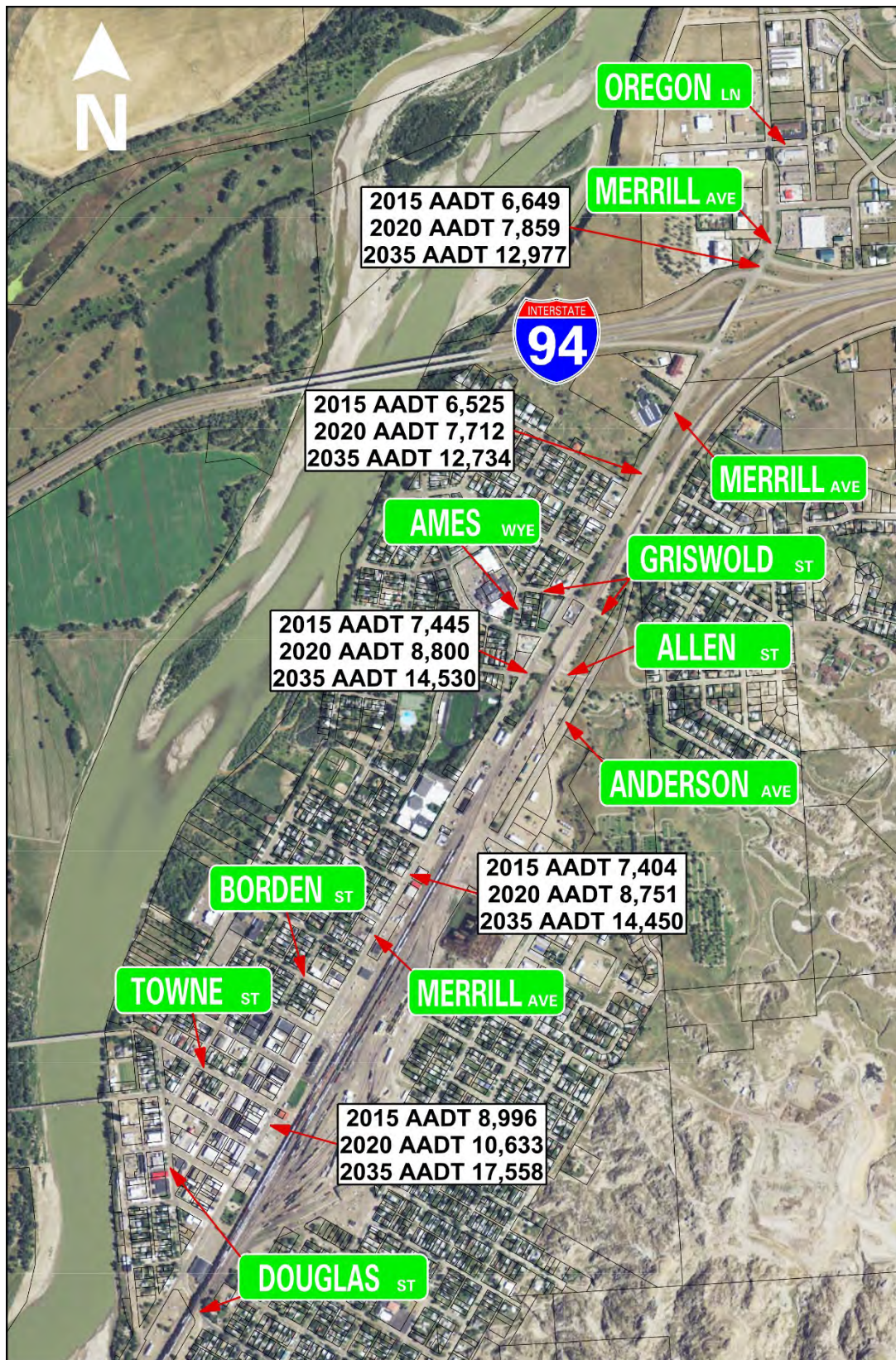
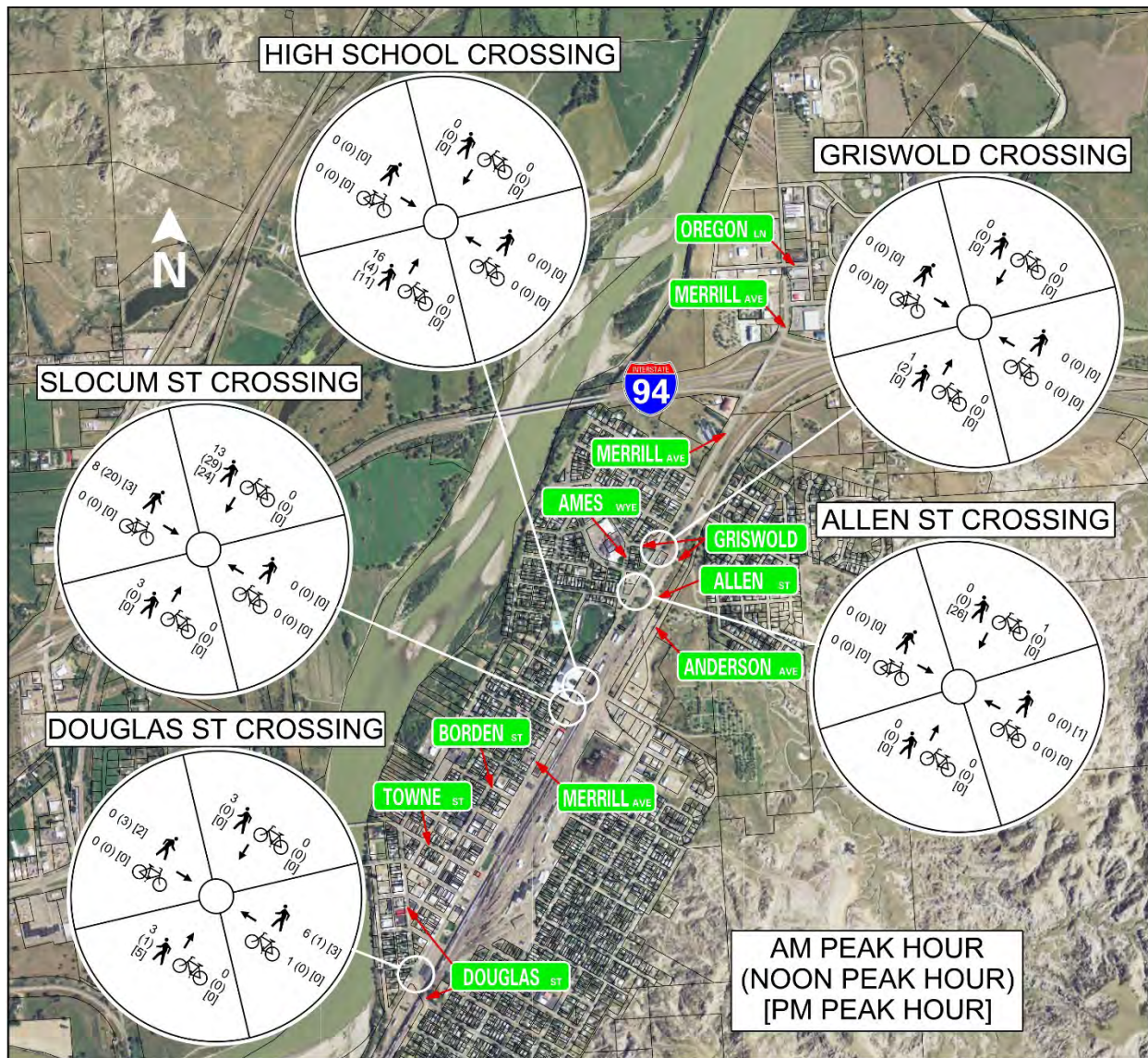


FIGURE 2-9 - Existing Pedestrian and Bike Peak Hourly Crossing Volumes



CRASH ANALYSIS

Crash data for the Merrill Avenue corridor was provided by MDT for the time interval between 1/1/2010 through 12/31/2014. Crash data is included in **Appendix B**. **Figures 2-10 and 2-11** provide a summary of crash data analysis results for the entire corridor.

None of the crashes listed in the crash database involved pedestrians or bicyclists. Almost half of the crashes along the corridor are rear-end or sideswipe, same direction crashes. Both of these crash types may be reduced with the 3 lane section. Rear end crashes may be reduced because left turning traffic is removed from the through traffic. Some of the sideswipe crashes may be occurring from traffic trying to weave around left turning vehicles. The continuous left turn bay could significantly reduce this activity as well.



Based on review of the crash data, a reduction of slightly more than 25% of all rear end and sideswipe same direction crashes, or a 12.6% reduction in all crashes are estimated to result from installation of the proposed 3 lane section.

FIGURE 2-10 - Crash Data Summary Tables

Collision Type	# of Crashes	Percentage
Rear-End	31	32.6%
Sideswipe, Same Direction	14	14.7%
Fixed Object	11	11.6%
Right Angle	10	10.5%
Wild Animal	10	10.5%
Head On	3	3.2%
Left Turn, Opposite Direction	2	2.1%
Other	2	2.1%
Rear To Side	2	2.1%
Right Turn, Opposite Direction	2	2.1%
Domestic Animal	1	1.1%
Left Turn, Same Direction	1	1.1%
Parked Vehicle	1	1.1%
Rear To Front	1	1.1%
Rear To Rear	1	1.1%
Right Turn, Same Direction	1	1.1%
Roll Over	1	1.1%
Sideswipe, Opposite Direction	1	1.1%
Total	95	100.0%

Light Condition	# of Crashes	Percentage
DAYLIGHT	64	67.4%
DARK-LIGHTED	21	22.1%
DUSK	5	5.3%
DARK-NOT LIGHTED	2	2.1%
DAWN	2	2.1%
Unknown	1	1.1%
Total	95	100.0%

Road Surface Condition	# of Crashes	Percentage
DRY	60	63.2%
SNOW	16	16.8%
ICE/FROST	13	13.7%
WET	4	4.2%
SLUSH	1	1.1%
Unknown	1	1.1%
Total	95	100.0%

Road Geometry	# of Crashes	Percentage
Road curves: grade	4	4.2%
Road curves: level	3	3.2%
Road is straight: grade	23	24.2%
Road is straight: level	65	68.4%
Total	95	100.0%

	Merrill	State Average
Crash Rate	3.57	4.51
Severity Index	1.21	1.66
Severity Rate	4.33	7.48

FIGURE 2-11 - Crash Severity Summary

Crash Injury Severity	# of Crashes	Percentage
Fatal	0	0.0%
Incapacitating Injury	0	0.0%
Non-injury accident (property- damage-only accident)	83	87.4%
Non-incapacitating evident injury accident	5	5.3%
Possible injury accident	5	5.3%
Unknown	2	2.1%
Total	95	100.0%

Figure 2-12 provides a summary of crash data results for the Merrill Avenue corridor by location. As can be seen in the figure, crashes are spread fairly evenly south of Griswold Street and Douglas Street, though the highest concentration of crashes occurred between Griswold Street and Ames Wye. There was also a higher concentration of crashes near Douglas Street.



FIGURE 2-12 - Summary of Crash Events



TRAFFIC CONTROL EVALUATION

Traffic control analysis is based upon standards outlined in the 2009 *Manual on Uniform Traffic Control Devices* (MUTCD) published by the Federal Highway Administration. The MUTCD includes standards and guidance for all-way stop control, traffic control signals and pedestrian hybrid beacons.

Traffic Signals

The only existing traffic signal along Merrill Avenue is located at the Towne Street intersection. The MUTCD traffic signal standards include warrants for varying data thresholds ranging from pedestrian and vehicular volumes to crash frequency. Detailed signal warrant analysis results are provided in **Appendix C**.

A summary of traffic signal warrants analysis results is provided in **Figure 2-13**. Currently, only the Towne Street, Slocum Street and Griswold Street intersections meet traffic signal warrants. Although Griswold Street meets Warrant 9 (Intersection near a grade crossing), no safety issues were identified for the intersection. The low level of vehicular traffic indicated that traffic signals would impair traffic operations at this intersection. Therefore traffic signals are neither justified nor recommended at this location.

By the year 2020, Douglas Street is projected to meet warrants for signalization and should be monitored for possible future signalization. There were 20 pedestrians observed crossing Merrill Avenue at the high school/Slocum Street crosswalk during the noon peak hour. This would be enough to warrant signalization based on the School Crossing Warrant 5 if vehicle gaps are insufficient. However, a gap study would be difficult to conduct given the proposed change in lane configuration. No other warrants were met at this location. A Rectangular Rapid Flashing Beacon is a better solution than a signal because it increases pedestrian safety without impairing traffic operations and it is therefore recommended.

Figure 2-13 - Merrill Avenue Signal Warrants Analysis Results

Merrill Avenue Intersection	2015 Warrants Status	2020 Warrants Status	2035 Warrants Status
Douglas Street	Not Warranted	Warrants 3 Met (3-Lane)	Warrants 1 (Possible), 2&3 Met
Towne Street	Warrants 2&3 Met	Warrants 1, 2&3 Met	Warrants 1, 2&3 Met
Slocum Street	Warrant 5 Met*	Warrant 5 Met*	Warrant 5 Met*
Allen Street	Not Warranted	Not Warranted	Not Warranted
Griswold Street	Warrant 9 Met	Warrant 9 Met	Warrant 9 Met

* Warrant 5, School Crossing Warrant met based on pedestrian volumes only. Gaps were not measured.

INTERSECTION CAPACITY ANALYSIS

Intersection capacity analysis was conducted to determine delay and level of service (LOS). LOS is a term used to describe operational performance of transportation infrastructure elements. Refer to **Figure 2-14 - Highway Capacity Manual Level of Service Thresholds** for signalized and unsignalized LOS ranges according to the *Highway Capacity Manual*.



Figure 2-14 - Highway Capacity Manual Level of Service Thresholds

Control Delay (sec/veh)		Volume < Capacity	Volume > Capacity
Unsignalized	Signalized		
≤ 10	≤ 10	A	F
> 10-15	> 10-20	B	F
> 15-25	> 20-35	C	F
> 25-35	> 35-55	D	F
> 35-50	> 55-80	E	F
> 50	> 80	F	F

Intersection delay and LOS were based upon Synchro model outputs. Synchro is a macroscopic traffic software program based on capacity analysis specified in the Highway Capacity Manual (HCM). Capacity analysis outputs are found in **Appendix D** and are summarized in **Appendix E**.

Traffic operations and capacity analysis were conducted under existing 2015, build year 2020 and 2035 horizon year a.m., noon and p.m. peak-hour traffic conditions. **Figure 2-15** shows the existing and projected levels of service at each of the studied intersections.

With minor exceptions discussed in the next paragraph, all intersections exhibit a LOS C or better for all analysis years, assuming the proposed three lane section along Merrill Avenue is implemented and traffic signals are installed when warranted.

A future level of service F was observed from the Slocum Street and Griswold approaches onto Merrill Avenue. Since these are low volume approaches under two-way stop conditions, this was not identified as an area of concern. A similar condition likely exists for other stop controlled, minor street approaches not evaluated by this study. More details regarding level of service and delays at individual intersections can be observed in **Appendix D** and **Appendix E**.

Figure 2-15 - Merrill Avenue Intersection Levels of Service

Cross Street on Merrill	Scenario	2015			2020			2035		
		AM	Noon	PM	AM	Noon	PM	AM	Noon	PM
Douglas St	4-Lane	C	C	C	C	C	D	F/B	F/B	F/B
	3-Lane	B	C	C	C/B	C/C	D/C	E/B	F/B	F/C
	+3-Lane	C	C	C	C/B	C/C	D/B	F/B	F/B	F/B
Towne St	4-Lane	B	B	B	B	B	B	B	B	C
	3-Lane	B	B	B	B	B	B	B	C	C
Slocum St	4-Lane	C	B	B	C	B	C	F	C	E
	3-Lane	B	B	C	C	B	C	F	C	F
Allen St	4-Lane	B	B	B	B	B	B	D	C	C
	3-Lane	B	B	B	B	B	B	C	C	C
Griswold	4-Lane	C/C	B/C	B/C	C/C	C/C	C/C	F/B	D/B	E/B
	3-Lane	C/C	C/C	C/C	D/C	C/C	C/C	F/C	F/B	F/C

*Two Way Stop Control: Lowest LOS for Minor Approach

**Signal: Lowest LOS for Minor Approach

+ 1 lane for Southbound Approach on Merrill Avenue



CHAPTER 3 - CORRIDOR ALTERNATIVES

Alternatives for Merrill Avenue were made following analysis of existing and future projected traffic conditions. In line with the plan purpose to explore the merits of a 3 lane section, the primary alternative developed in this chapter is the 3 lane typical section. With some exceptions noted, the 3 lane alternative covers seven different existing typical sections

ALTERNATIVE 1 – MAINTAIN EXISTING 4 LANE SECTION

This alternative consists of maintaining the existing 4 lane section along Merrill Avenue. With this alternative, there would be no space to provide bike lanes without removal of on-street parking along both sides of Merrill Avenue. Enhancements and benefits associated with the three lane section would not be received.

ALTERNATIVE 2 – IMPLEMENT 3 LANE SECTION

This alternative would convert the existing 4 lane Merrill Avenue corridor into a 3 lane corridor with bike lanes. Given that the width of Merrill Avenue varies from one end of the study area to the other, eight typical sections were prepared to show how the 3 lane section would fit within the available roadway widths along Merrill Avenue. These typical Sections are shown in Figures 3-1 through 3-9. Alternative 2 plan views are shown in Figures 3-10 through 3-17.

Figures 3-1 and 3-2 show two options for the segment between Douglas and Towne Street. The difference between the two options is Option 1 maintains parking on the southwest side of Merrill Avenue whereas Option 2 eliminates that parking. The elimination of parking was considered given the low utilization observed during the study. Option 2 also provides optimum traveled lane widths, whereas Option 1 provided narrower lane widths than were desired. If Option 2 is selected, transitions in alignment will need to be addressed during design. MDT will discuss these options with the city before a decision is made on which option to implement.

The three lane section provides adequate room for bike lanes while preserving on-street parking throughout the corridor (except for Option 2, Douglas to Towne Street). It maintains adequate projected roadway capacity (LOS C or better) for mainline traffic. It also exhibits improved safety over the 4 lane section as was discussed earlier in the report.



Figure 3-1 - Douglas to Towne - Typical Section (Option 1)

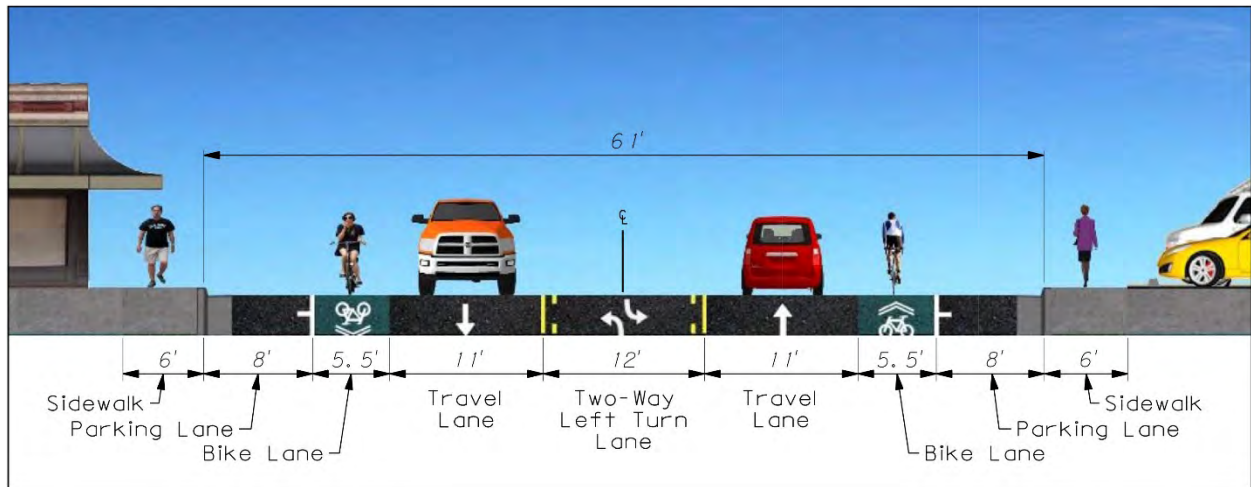


Figure 3-2 - Douglas to Towne - Typical Section (Option 2)

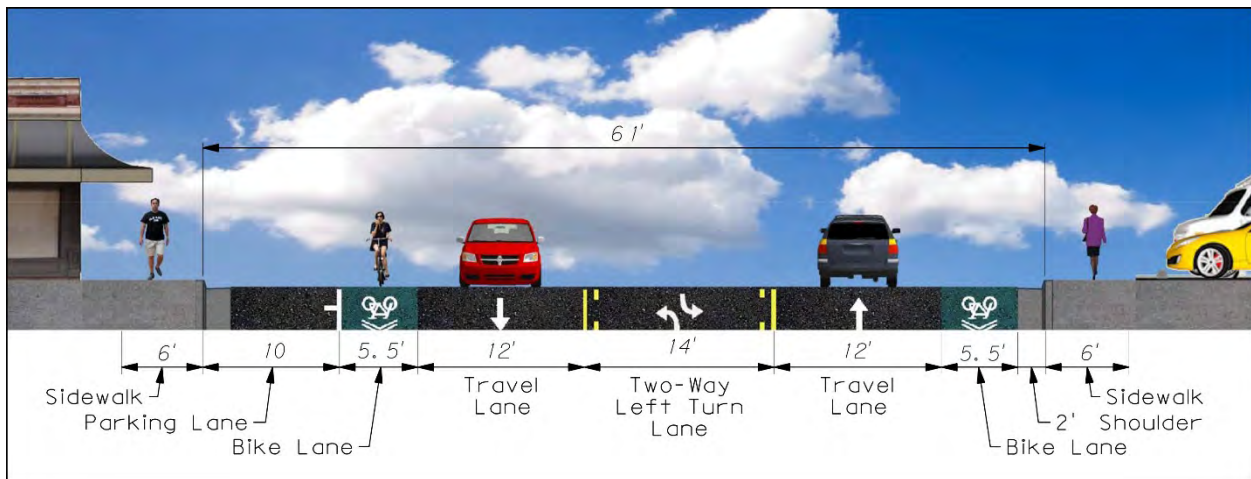


Figure 3-3 - Towne to Borden - Typical Section

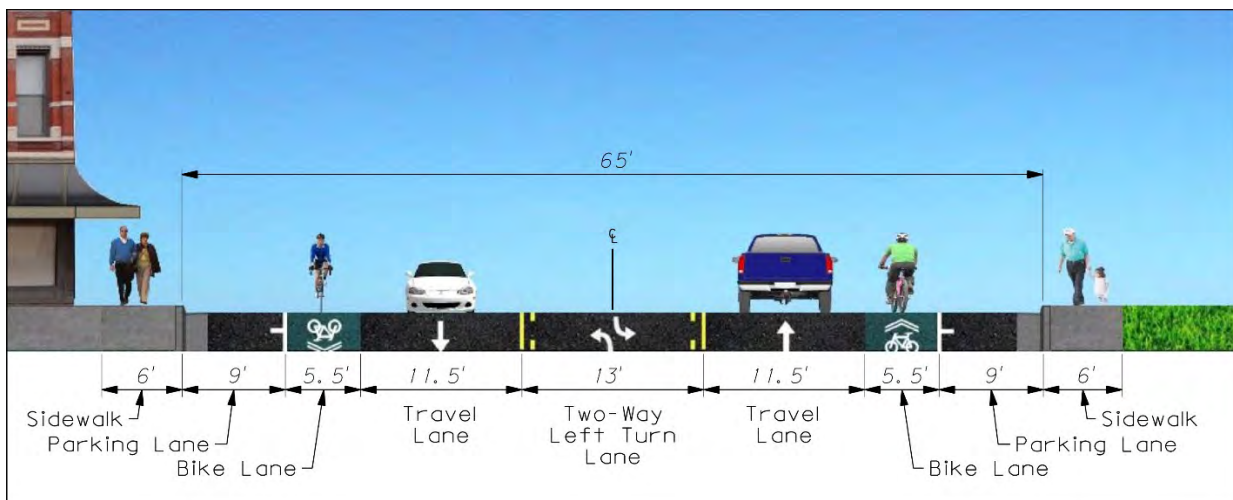


Figure 3-4 - Borden to North of High School - Typical Section

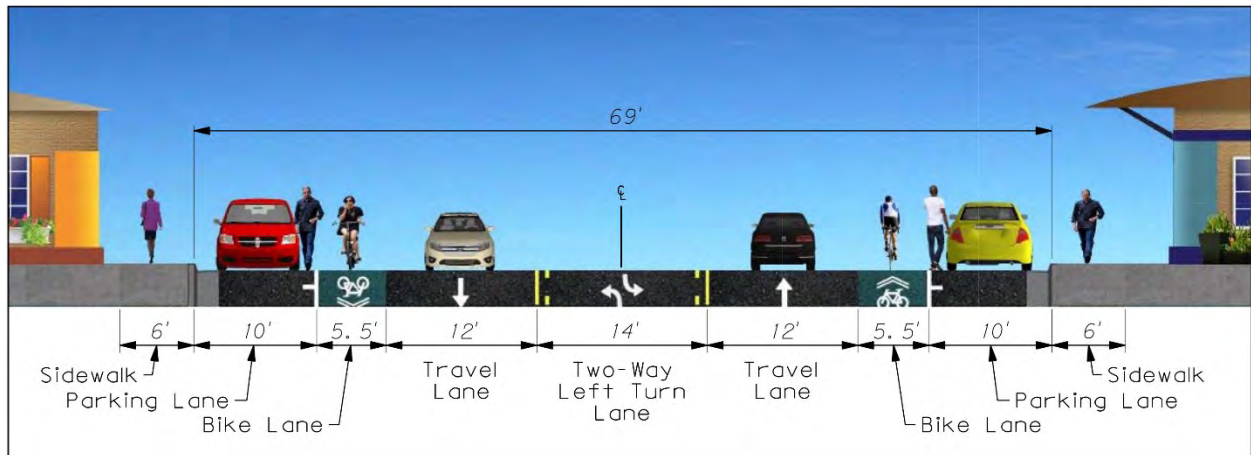


Figure 3-5 - North of High School to Griswold - Typical Section

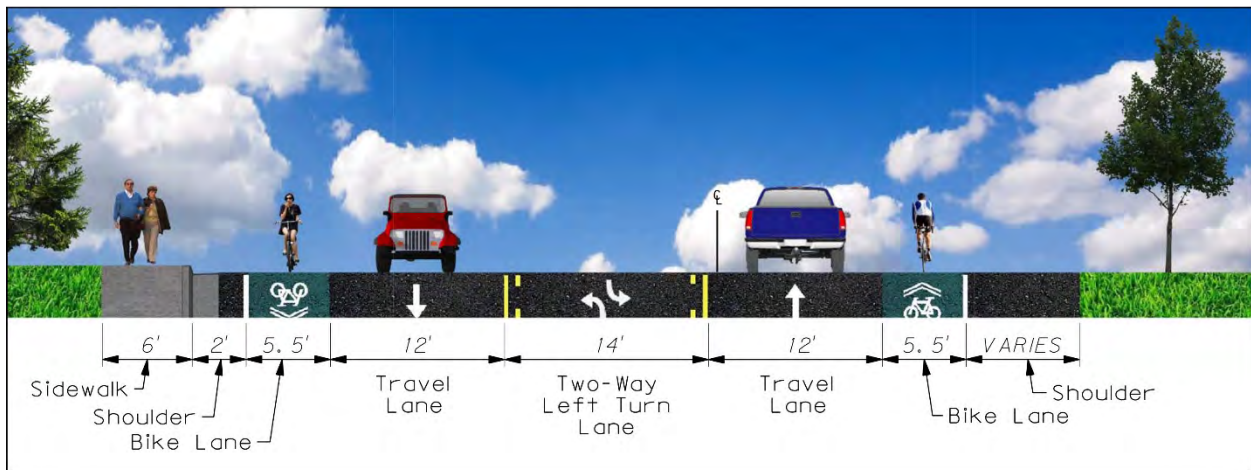


Figure 3-6 - Griswold to North of Cooke - Typical Section

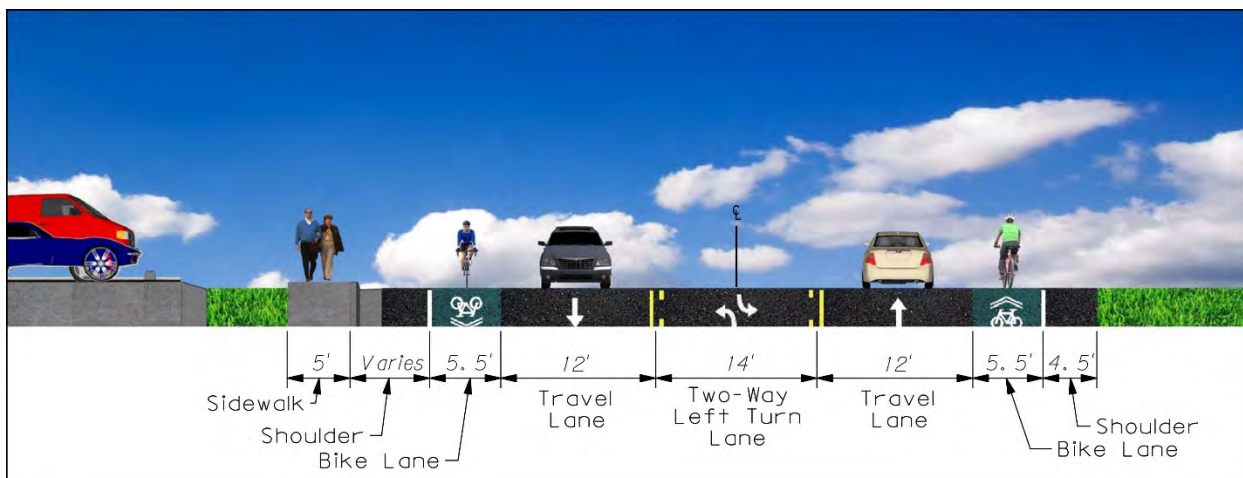


Figure 3-7 - North of Cooke to I-94 Bridge - Typical Section

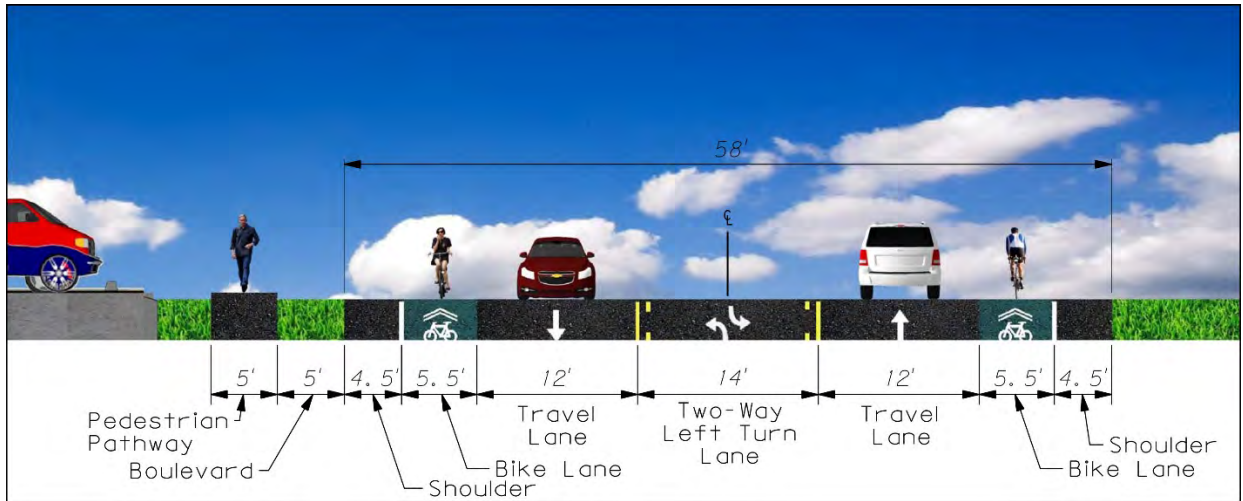


Figure 3-8 - I-94 Bridge - Typical Section

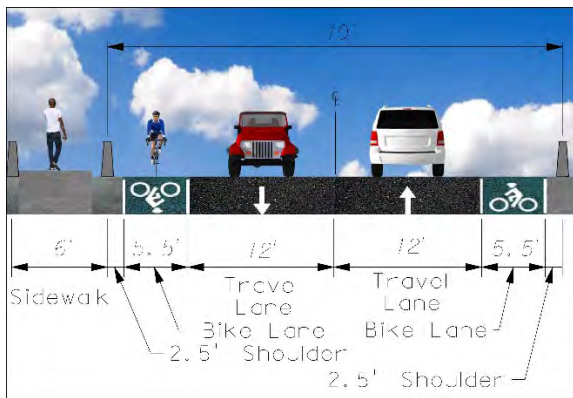


Figure 3-9 - I-94 Bridge to Oregon - Typical Section

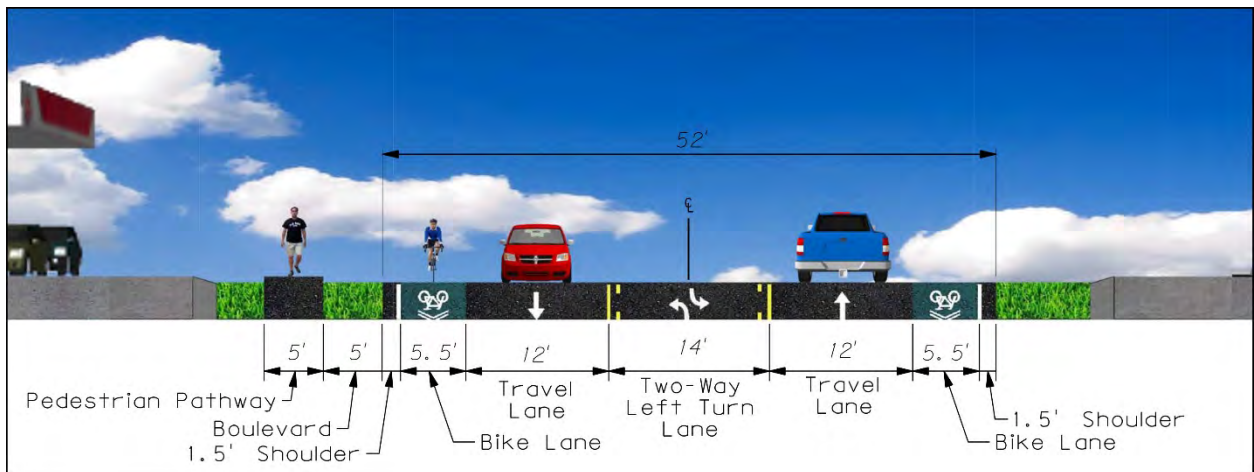


Figure 3-10 - Douglas to Towne (Option 1) - Plan View

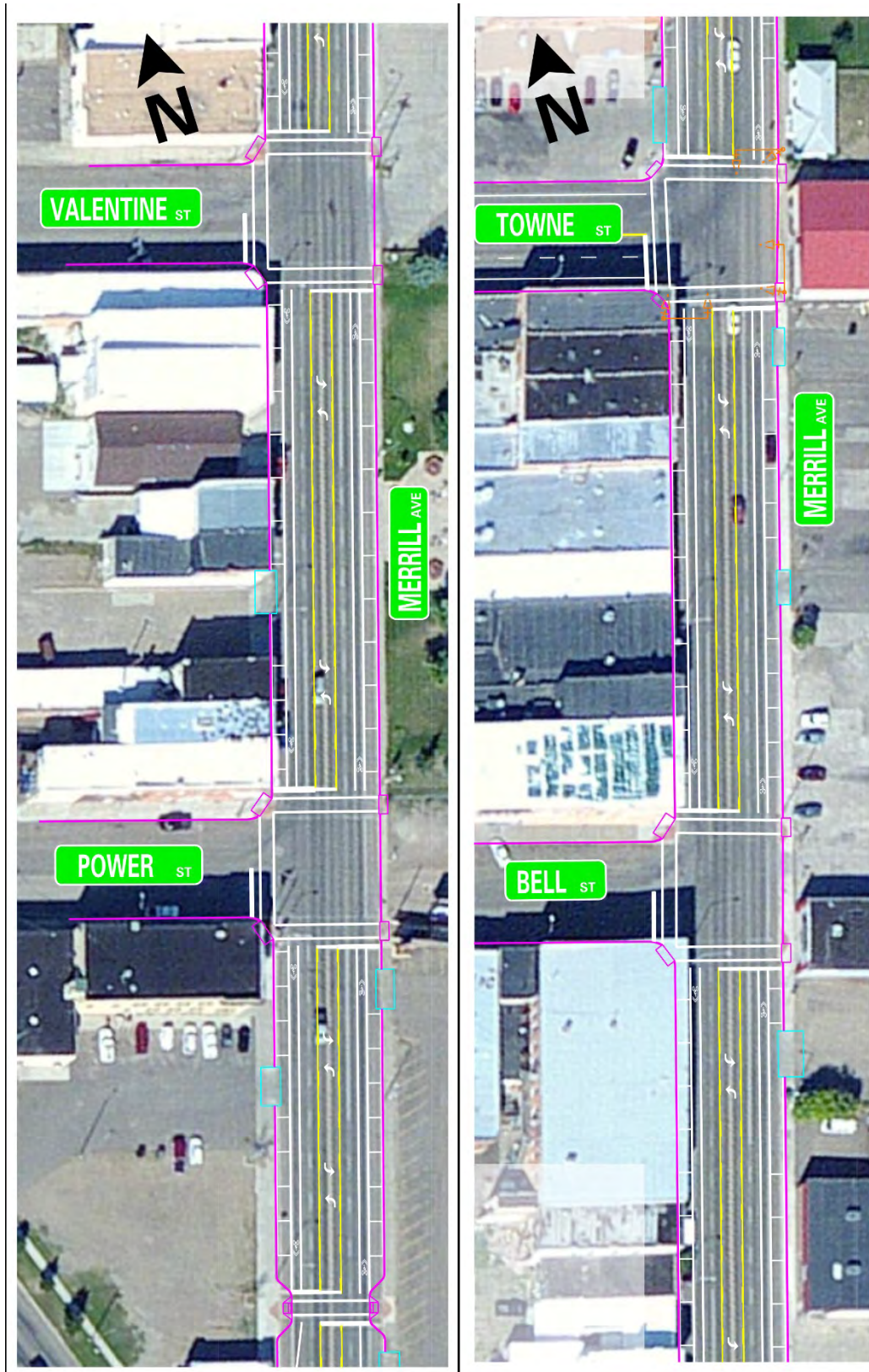


Figure 3-11 - Towne to Borden - Plan View

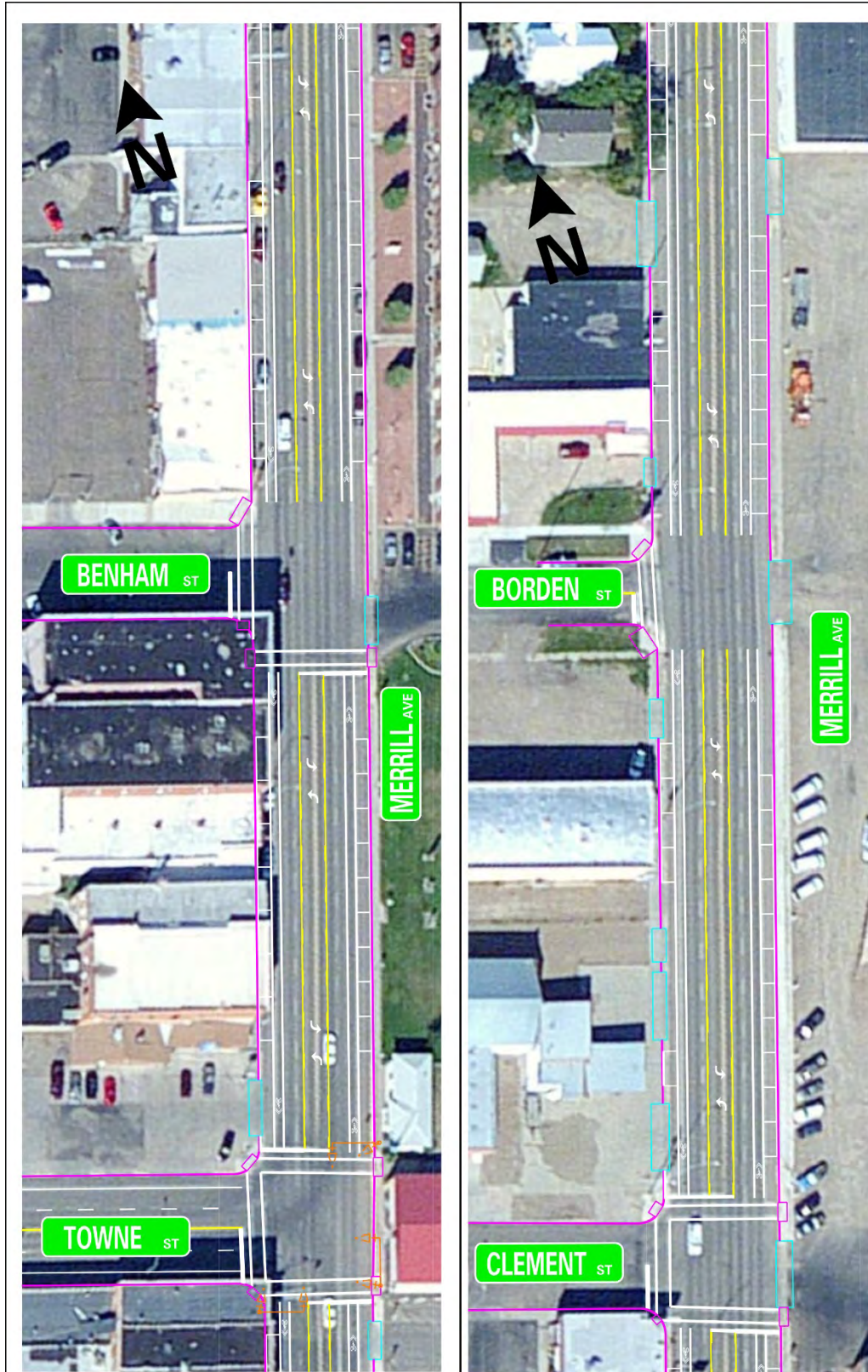


Figure 3-12 - Borden to North of High School - Plan View 1



Figure 3-13 - Borden to North of High School - Plan View 2

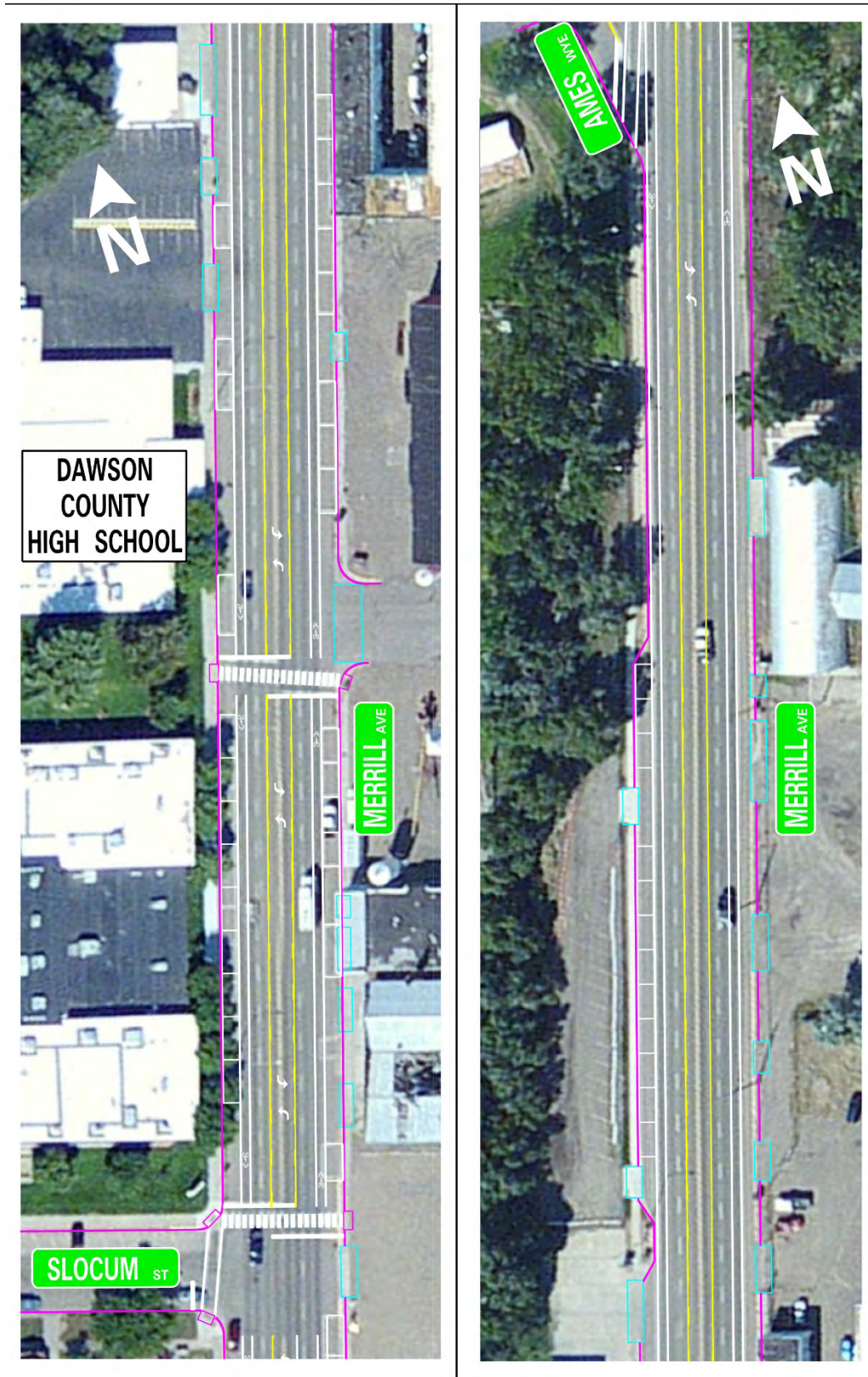


Figure 3-14 - North of High School to Griswold - Plan View

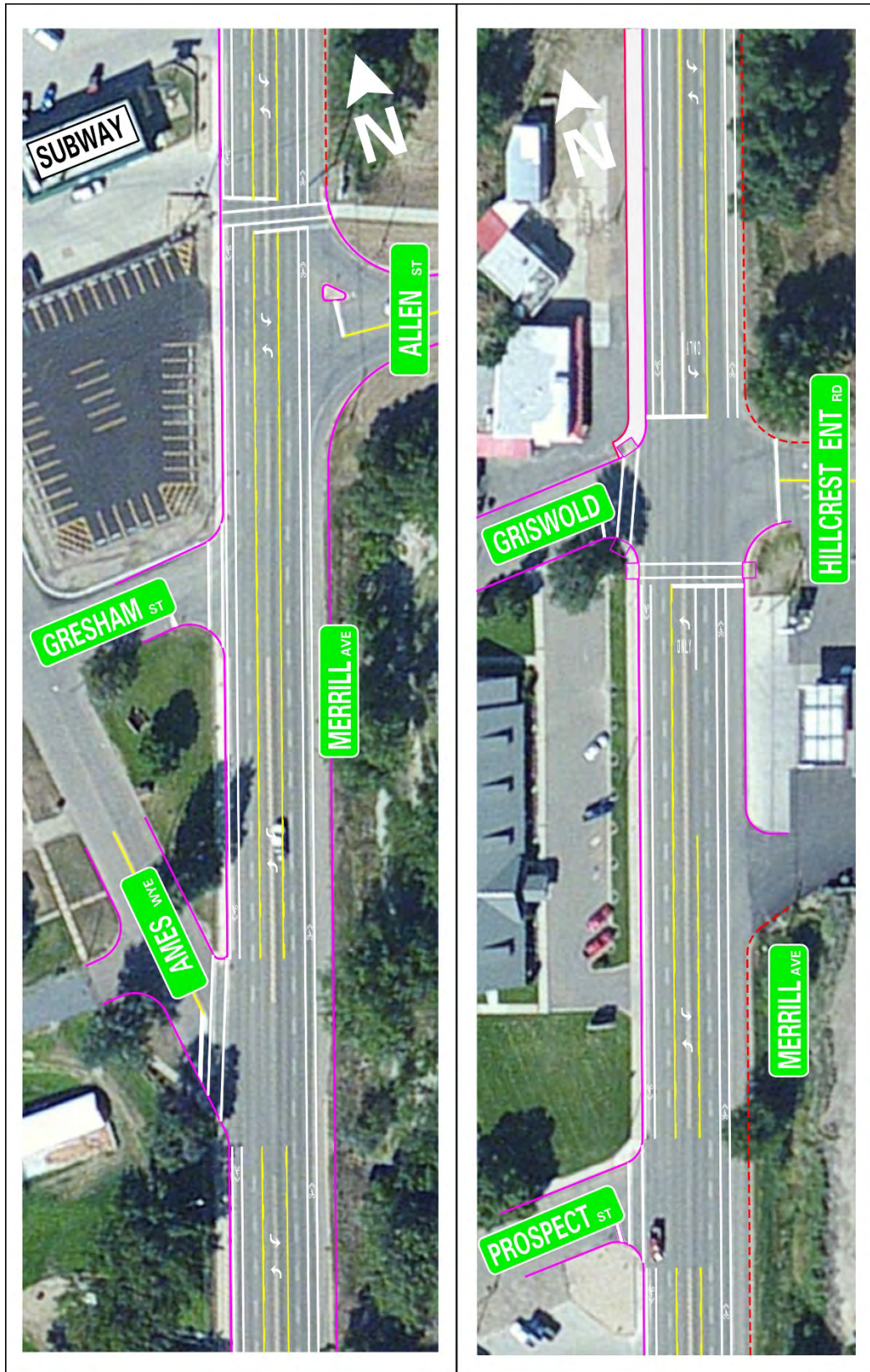


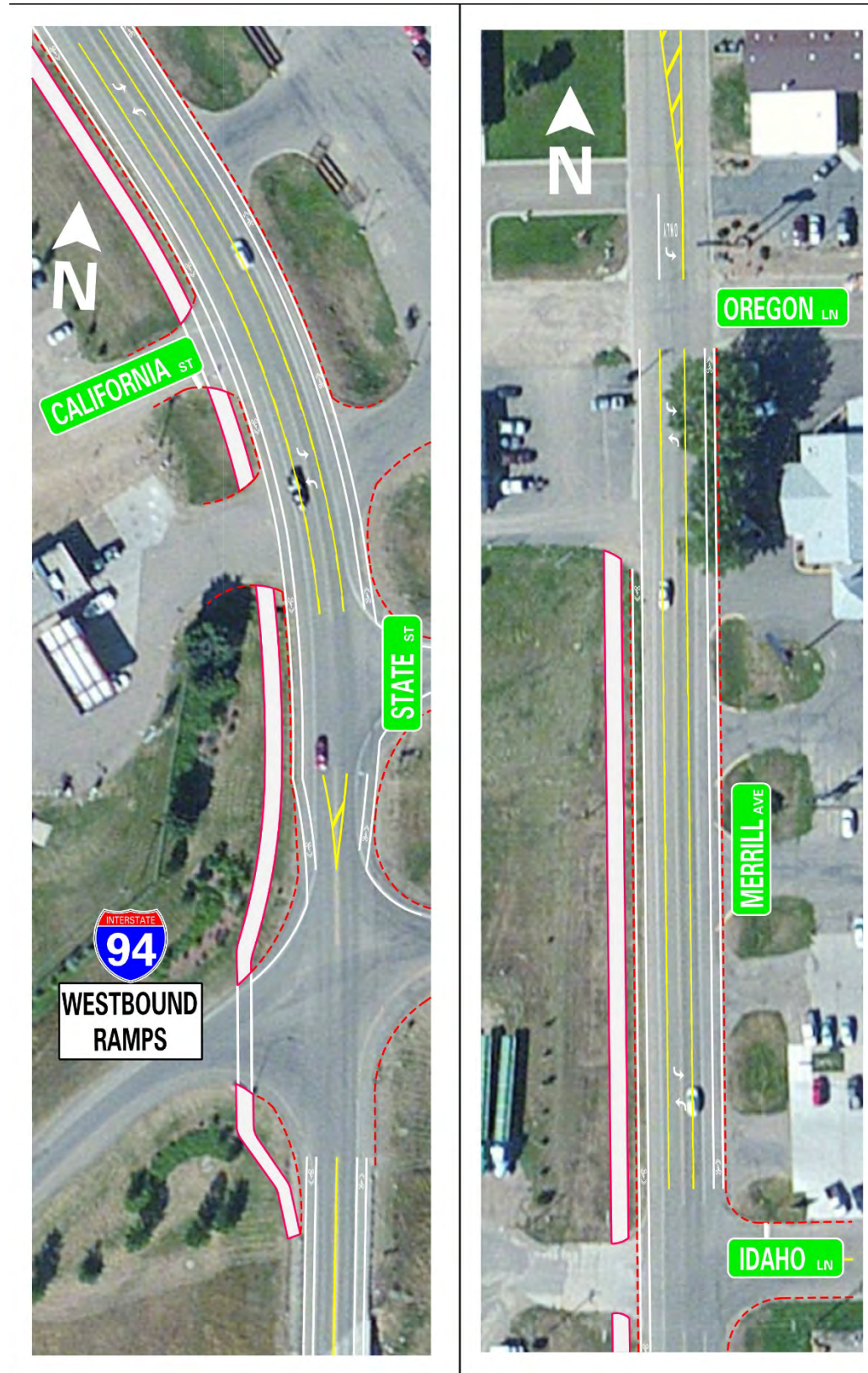
Figure 3-15 - Griswold to North of Cooke - Plan View



Figure 3-16 - North of Cooke to I-94 - Plan View



Figure 3-17 - I-94 to Oregon - Plan View



ON-STREET PARKING IMPACTS

Parking is an essential complement to transportation systems and land development. Although many businesses and residents have off-street parking, some of them rely on abutting on-street parking. Wherever on-street parking is underutilized, consideration may be given to phasing it out. However, from the standpoint of alternatives development, on-street parking was preserved if sufficient room was available.

In developing the alternatives, efforts were made to limit the locations where on-street parking would be removed. As a result, there were no locations where on-street parking was proposed to be eliminated with one exception. Alternatives near Douglas Street show three parking stalls being eliminated on the northwest side of Douglas Street. These parking stalls would be eliminated to make room for a new right turn lane on Merrill Avenue for vehicles on southbound Merrill Avenue wanting to turn right onto Douglas Street.

PEDESTRIAN CROSSING IMPROVEMENT ALTERNATIVES

Use of a 3 lane section along Merrill Avenue provides new opportunities for raised pedestrian refuge islands at locations where there are large numbers of pedestrians who cross. Curb bulb-outs can also be developed where desired by extending through parking spaces without blocking proposed bike lanes. Bulb-out design should accommodate WB-40 trucks wherever applicable.

At the High School crosswalk by Allard Street, median refuge islands are proposed to improve safety. Here, curb bulb-outs are also proposed to reduce the crossing distance for pedestrians and bikes. See **Figure 3-18**.

At the Slocum Street crosswalk, median refuge islands were not proposed because of anticipated conflicts with southbound vehicles turning left into a parking lot. Curb bulb-outs are proposed to reduce the crossing distance for pedestrians and bikes. See **Figure 3-18**.

There was very little pedestrian or bike activity observed at the Allen Street crossing. This may be because there is no direct connection between Hillcrest and Allen Street. An alternative was prepared to provide a separated multi-use path providing a more direct connection between Allen Street and the neighborhood southeast of the railroad tracks. This alternative is shown in **Figure 3-19**. We believe this would benefit the overall community but it is not an alternative that MDT would be funding.

Two alternatives are proposed to improve the safety for pedestrians and bikes crossing Merrill Avenue at Allen Street and Subway. Alternative 1 provides refuge islands at the existing crosswalk, whereas Alternative 2 moves the crosswalk to the north side of Subway to separate crossing activity from the heavy left turning movements onto Allen Street. These alternatives are shown in **Figures 3-20** and **3-21**.



Figure 3-18 - High School/Slocum Street Pedestrian Safety Alternative



Figure 3-19 - Hillcrest to Allen Street Connection Alternative



Figure 3-20 - Allen Street/Subway Pedestrian Safety Alternative 1



Figure 3-21 - Allen Street/Subway Pedestrian Safety Alternative 2



DOUGLAS STREET INTERSECTION ALTERNATIVES

Three alternatives were prepared to address traffic operational and safety issues at the Douglas Street intersection. This intersection has substandard geometrics due to the skewed approaches and the presence of private driveways and a public street approach in the operational influence of the intersection. Use of traffic control signs is also substandard, as stop signs control the north and west approaches as shown in **Figure 3-22**. This results in conflicts between concurrent northbound through traffic and westbound through and left turning traffic.

Alternatives were prepared to address current and anticipated future traffic conditions. These are shown in **Figures 3-23 through 3-25**.

DOUGLAS STREET EXISTING CONDITIONS

Existing conditions at Douglas Street are shown in **Figure 3-22**. The blue shading represents the sight triangle on Douglas Street for northbound traffic.

Figure 3-22 - Douglas Street Existing Conditions

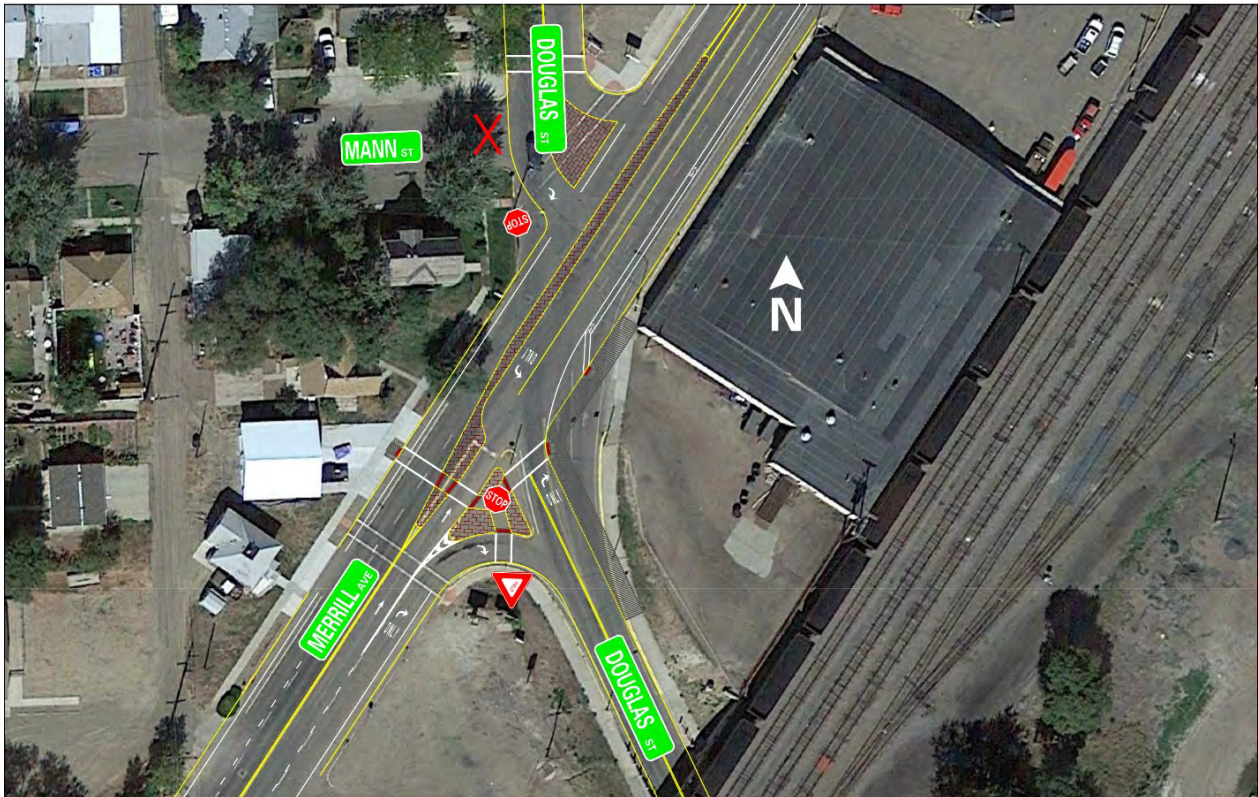


ALTERNATIVE 1 -IMPROVEMENTS WITHOUT SIGNALIZATION

This alternative provides a long-term solution to traffic movements at Douglas Street without implementation of traffic signals. A median would be installed to limit movements on Douglas Street to right in and right out movements only. See Figure 3-23. This solution reduced the impact of the skewed approaches and provides significant safety benefits to the intersection. However, it would stop the major movement of traffic and would likely back up traffic on the underpass.

Since through traffic on Douglas would be eliminated, additional left turns would be introduced onto Merrill Avenue at intersections to the northeast to facilitate north-south traffic flow.

Figure 3-23 - Douglas Street Improvements Without Signalization



ALTERNATIVE 2 - MINOR IMPROVEMENTS

Given that traffic signals are not warranted yet (projected to be warranted in 2020) and that placement of existing stop signs is substandard, this alternative was prepared as a low cost, measure to provide standard stop control. The MDT District and City of Glendive have discussed the potential to eliminate the southwest bound left turn lane on Merrill Avenue in favor of a raised median. This option was analyzed and the change in level of service was negligible. It is anticipated that the decision of whether to use a left turn lane as shown or a raised median will be made during the design process. The blue shading in Figure 3-24 represents the sight triangle for southbound traffic on Merrill Avenue.

Figure 3-24 - Douglas Street Minor Improvements



ALTERNATIVE 2B - SIGNALIZATION IMPROVEMENTS

Traffic signals are projected to be warranted by the year 2020. Once warranted, the proposed minor improvements seem to work well once the intersection is signalized. See **Figure 3-25**. The MDT District and City of Glendive have discussed the potential to eliminate the southwest bound left turn lane on Merrill Avenue in favor of a raised median. This option was analyzed and the change in level of service was negligible. It is anticipated that the decision of whether to use a left turn lane as shown or a raised median will be made during the design process.

Figure 3-25 - Douglas Street Signalization Improvements



CHAPTER 4 - ROADWAY RECOMMENDATIONS

Based on a review of Merrill Avenue corridor alternatives, the following recommendations were made to address deficient corridor conditions while minimizing impacts to on-street parking.

MERRILL AVENUE TYPICAL SECTION

Merrill Avenue will function well through the year 2035 regardless of whether a 3 or 4 lane section is implemented. However, the 3 lane section offers a number of benefits over the 4 lane section and is therefore recommended. Namely, it provides space for the development of bike lanes. It also provides a good location for pedestrian refuge islands in key locations to improve pedestrian crossing safety.

Almost half of the crashes along the corridor are rear-end or sideswipe, same direction crashes. Both of these crash types may be reduced with the 3 lane section. Rear end crashes may be reduced because left turning traffic is removed from the through traffic. Some of the sideswipe crashes may be occurring from traffic trying to weave around left turning vehicles. The continuous left turn bay would significantly reduce this activity as well.

Based on review of the crash data, a reduction of slightly more than 25% of all rear end and sideswipe same direction crashes, or a 12.6% reduction in all crashes are estimated to result from installation of the proposed 3 lane section.

ON-STREET PARKING

Throughout the Merrill Avenue corridor there is sufficient room to preserve on-street parking while implementing a three lane section with bike lanes. Therefore, it is recommended that on-street parking be allowed to remain in areas where it already exists, with the possible exceptions of three parking spots along the northwest side of Merrill Avenue near Douglas Street and parking along the southeast side between Douglas and Towne Street. Where parking currently is prohibited, those locations should remain prohibited for on-street parking.

Based on completed parking use counts, it was observed that use of parking spaces is generally low along the southeast side of Merrill Avenue. In these locations, removal of on-street parking could be considered in favor of additional width for traffic and bike lanes and shoulders.

PEDESTRIAN CROSSING FACILITIES

It is recommended that bike lanes be installed from the Douglas Street east crosswalk to Oregon Street. From Griswold Street to Oregon Street a separated sidewalk is also recommended.

Significant pedestrian crossing activity has been observed at Slocum Street in the vicinity of the High School. There were 20 pedestrians that crossed Merrill Avenue during the noon peak hour. This is enough to warrant signalization based on the School Crossing Warrant if gaps are insufficient. However, a gap study would be difficult to conduct given the proposed change in



lane configuration. No other warrants were met at this location. A Rectangular Rapid Flashing Beacon is a better solution than a signal because it increases pedestrian safety without impairing traffic operations and it is therefore recommended.

It is recommended that the Glendive community pursue a Hillcrest to Allen Street Multi-use Path connection. It is further recommended that Allen Street/Subway Pedestrian Safety Alternative 2 be implemented at this location.

DOUGLAS STREET INTERSECTION IMPROVEMENTS

Given the number of crashes that have occurred at the Douglas Street intersection and the substandard placement of approach stop signs, it is recommended that Alternative 1 - Improvements Without Signalization be implemented as soon as is practical. Alternative 2 - Minor Improvements could be an acceptable interim alternative if changes in traffic control are desired prior to implementation of Alternative 1.

These alternatives were reviewed by MDT and feedback from the City of Glendive was obtained. This recommendation follows the desires of MDT District Staff and the City of Glendive as an ultimate solution to safety concerns at the intersection.

TRAFFIC SIGNALIZATION

It is recommended that traffic signals be maintained at the Towne Street intersection. Although Griswold met Warrant 9 for Intersection near a Grade Crossing, no safety issues were identified for the intersection. The low level of vehicular traffic indicated that traffic signals would impair traffic operations at this intersection. Therefore traffic signals are neither justified nor recommended at this location.

Douglas Street met warrants for signalization by the year 2020. However, if Alternative 1 is implemented as recommended, signalization of the intersection in the future should not be necessary.

STREET LIGHTING

As was stated in the review of existing conditions, with the exception of street lighting present at the I-94 Interchange there is no street lighting along Merrill Avenue north of Sigmund Street. Only 2 of 95 reported crashes along the Merrill Avenue corridor occurred under dark-not lighted conditions over a 5 year period.

In unlighted sections of Merrill Avenue, the greatest need for future street lighting appears to be along the segment north of I-94, where substantial hotel and restaurant/business traffic may merit a future lighting project. It is recommended lighting be considered along this segment.

