HIGHWAY 3
CORRIDOR STUDY

FINAL REPORT
APRIL 2015

SANDERSON STEWART

Adopted by Policy Coordinating Committee on April 21, 2015

ACKNOWLEDGEMENTS

The Highway 3 Corridor Planning Study was conducted under the direction of the Project Oversight Committee, which included the members listed below. Along with the input of numerous community members, the guidance of the Project Oversight Committee has been essential to the success of this process and is very much appreciated.

Project Oversight Committee

Candi Millar, City-County Planning Division

Wyeth Friday, City-County Planning Division

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Kim Annin, Airport Engineering & Planning

Terry Smith, City Engineering

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INTRODUCTION

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The Billings Metropolitan Planning Organization (MPO) has identified the need to conduct a corridor planning study along the Highway 3 corridor in Billings and Yellowstone County. The extents of the study area are from the North 27th Street roundabout west to the Apache Trail intersection that accesses the Indian Cliffs Subdivision (approximately 5 miles). This study provides an access management plan for the corridor including bike and pedestrian amenities along the Rim face, a parking plan and a stormwater management plan. This study addresses current vehicle and non-motorized traffic circulation and access along the corridor, as well as plans for future changes to traffic patterns caused by the Inner Beltloop connection and development activity.

The Highway 3 Corridor Planning Study was generally broken into four key areas for the purposes of the public meeting presentations and for summary in this report. They include: Traffic & Safety, Parking, Trails & Open Space, and Stormwater. Highlights of the study area are illustrated in Figure 1 on the following page.

Study Area Description

Montana Highway 3 is a National Highway System (NHS) non-interstate route that extends from Billings to Great Falls. In the project vicinity, Highway 3 generally runs east to west providing access to several public streets and numerous residential driveways. Currently, the facility has a single travel lane in each direction with left-turn lanes at Rod & Gun Club Road (eastbound), Zimmerman Place (westbound), Zimmerman Trail (westbound) and Apache Trail (westbound). Highway 3 also has right-turn lanes at its intersections with Rod & Gun Club Road (westbound) and Zimmerman Trail (eastbound).

The existing Montana Department of Transportation (MDT) right-of-way varies throughout the length of the study corridor, but generally extends approximately 50 to 100 feet on either side of the existing centerline for a total right-of-way width of 100 to 200 feet. An access management agreement exists for the properties along Highway 3 west of Zimmerman Trail. It was established via a Limited Access Resolution in 1990 and many of the approaches were constructed by MDT at that time.

The posted speed limit varies from 45 miles-per-hour (mph) to 70 mph along the corridor. The speed limit is 45 mph from the east end of the corridor at milepost 3.0 to milepost 3.5, increasing to 50 mph from milepost 3.5 to 6.5, and then 70 mph from milepost 6.5 to the west end of the corridor. These speed limits are the result of a 2007 speed study conducted by MDT that recommended reductions from the previous speed limit of 60 mph from milepost 3.5 to the west. These speed limits and reference posts are shown in Figure 3 on page 10.

HIGHWAY 3 CORRIDOR STUDY

STUDY AREA HIGHLIGHTS

UTILIZE PUBLIC LAND TO VARY CONSISTENCY IN TRAIL AND CONNECT TO OTHER TRAILS IN VICINITY

CONSOLIDATE PARKING AREAS TO RELATE TO DEFINED TRAILHEADS AND SPUR CONNECTIONS

APPROXIMATE LIMITS OF EXISTING MDT LIMITED ACCESS CONTROL ( )

APACHE TRAIL

HIGHWAY 3

ZONE 3
RURAL

FUTURE INNER BELT LOOP CONNECTION

ROD & GUN CLUB RD

ZIMMERMAN TRAIL

ZONE 2
RESIDENTIAL

ZONE 1
SCENIC

LOGAN INTERNATIONAL AIRPORT

HIGHWAY 3

N 27TH ST

CREATE A CONSISTENT BUFFER FROM HIGHWAY 3 TRAFFIC FOR MULTI-USE TRAIL

ZONE 3: HIGHLIGHTS

- ~ 100' R.O.W. (50' FROM CENTERLINE OF HWY 3)
- ~ ACCESS TO ZIMMERMAN PARK
- ~ EXTENSION TO INDIAN CLIFFS (APACHE TRAIL) AND SECTION OF STATE LAND
- ~ LARGER HIGHWAY BUFFER POTENTIAL UTILIZING ZIMMERMAN PARK (COUNTY)
- ~ OPPORTUNITY TO CONNECT TO GREATER BILLINGS TRAIL NETWORK AND MARATHON LOOP

ZONE 2: HIGHLIGHTS

- ~ 100' R.O.W. (50' FROM CENTERLINE OF HWY 3)
- ~ CONNECTIVITY TO RIMRUNNER NATURE TRAIL
- ~ ACCESS POINT/CROSSING AT ROD & GUN CLUB ROAD
- ~ POTENTIAL FUTURE INTEGRATION WITH INNER BELT LOOP
- ~ ACCESS & SPACING CONSIDERATIONS
- ~ CENTER TURN LANES & ACCEL/DECEL BAYS
- ~ NORTH SIDE VS. SOUTH SIDE TRAIL ALIGNMENT

ZONE 1: HIGHLIGHTS

- ~ R.O.W. VARIES (PER 1936 R.O.W. MAP).
- ~ NEED FOR PARKING TO BE DEFINED (SCENIC VISTAS AND RECREATIONAL OPPORTUNITIES)
- ~ LARGER HIGHWAY BUFFER POTENTIAL FOR TRAIL UTILIZING ESTABLISHED COUNTY PARK
- ~ OPPORTUNITY FOR ENHANCED ENTRANCE AND WELCOME TO THE COMMUNITY
- ~ STORMWATER MANAGEMENT NEEDS
- ~ NEED TO PROVIDE SAFE ACCESS TO ENTER/EXIT HWY FROM RIM FRONT PARKING AREAS

BILLINGS - YELLOWSTONE COUNTY MPO METROPOLITAN PLANNING ORGANIZATION

SANDERSON STEWART

DESIGNWORKSHOP

FIGURE 1 – STUDY AREA HIGHLIGHTS – EXISTING CONDITIONS

Goals & Objectives

The Highway 3 Corridor Planning Study provides an access management and transportation circulation plan for the Highway 3 corridor and incorporates bike/pedestrian facilities, a parking plan and a stormwater management plan along the top of the Rims. The following objectives were outlined by the Project Oversight Committee at the onset of the study. asterisk

1. Maintain consistency with existing community plans.
2. Identify and engage all relevant stakeholders.
3. Appropriately consider all transportation modes.
4. Optimize transportation corridor functionality.
5. Mitigate impacts of highway on adjacent land uses.
6. Mitigate stormwater impacts to adjacent land.
7. Enhance corridor as a scenic entryway to the City.
8. Enhance recreational and aesthetic opportunities along the Rims.
9. Develop list of cost effective projects.
10. Address impacts of Inner Beltloop project.

Public Participation Process

A thorough public participation process was conducted for the Highway 3 Corridor Planning Study in conformance with the 2009 Yellowstone County Board of Planning Participation Plan.

The following meetings were conducted as part of the plan development:

- **Project Oversight Committee** meetings were held monthly to discuss the direction of the planning study.
- **Public Meeting No. 1** was held on June 25, 2014 to introduce the corridor planning study to the public. Input was requested on four key components including: Traffic & Safety, Parking, Trails & Open Space, and Stormwater.
- **Rimrock Neighborhoods Task Force** meeting was attended on July 16, 2014 and a project overview was provided.
- **Public Meeting No. 2** was held on October 15, 2014 in order to present preliminary recommendations and gather public input through key pad polling.

The following dates were scheduled for review and approval of the Highway 3 Corridor Planning Study:

- **Technical Advisory Committee** – Presentation and action on December 18, 2014
- **Yellowstone County Planning Board** – Presentation on January 13, 2015 and public hearing/action on January 27, 2015
- **Billings City Council** – Presentation on February 2, 2015 and public hearing/action on February 9, 2015
- **Yellowstone County Commission** – Discussion on February 2, 2015 and presentation/action on February 3, 2015
- **Policy Coordinating Committee** – Final action on February 17, 2015

A project website was developed as a location to post draft documents for review and as a tool to request additional public input. The web address is www.sandersonstewart.com/projects/highway3. The final document will be posted on the City of Billings website at http://ci.billings.mt.us/DocumentCenter/View/26772.

Related Projects

Inner Beltloop. The Inner Beltloop is a proposed rural bypass roadway project that will provide a new connection between the Heights and West End regions of Billings. The south terminus of the new road has been proposed at the existing intersection of Highway 3 and Zimmerman Trail, but other options are still being considered. Alignment alternatives and intersection improvements were evaluated in the 2006 Inner Beltloop Connection Planning Study and the 2010 Inner Beltloop Design Traffic Report.

Zimmerman Trail. MDT recently completed a rock fall mitigation project on Zimmerman Trail and they are currently outlining a budget and scope for additional improvements to the corridor. The extent of those improvements was unknown at the time of this study, but a project is underway. MDT has also recently nominated an intersection improvement project with safety funds at Zimmerman Trail and Highway 3.

Billings Urban Area Long Range Transportation Plan. The 2014 transportation plan identifies long-range transportation projects in the area. It identifies improvements along Zimmerman Trail and the proposed Inner Beltloop, as well as a future connection between Highway 3 and Molt Road. It was utilized as a resource for future land use and traffic volume projections.

Billings Area Bikeway & Trail Master Plan. This plan outlines a proposed short-range, on-street bike lane along Highway 3 east of Rod & Gun Club Road and a long-range bike lane west of this intersection. The plan also identifies proposed short-range bike lanes on N 27th Street, Airport Road and Zimmerman Trail, as well as long-range bike lanes on Rod & Gun Club Road and the Inner Beltloop.

Billings Logan International Airport Master Plan. This master plan document provides an inventory of existing airport facilities, projects future airport demand, and evaluates alternatives for future improvements to the airport and surrounding areas. The master plan recommends future expansion of the airport land use development to the west on Highway 3, including additional hangars, an expanded rental car center and potential commercial development.

EXISTING CONDITIONS

2

Traffic & Safety

A thorough evaluation of existing conditions relative to traffic and safety was conducted to establish a baseline for this study. It included a review of available historic traffic data from MDT, collection of new peak hour turning movement counts at major intersections, and review and analysis of crash data provided by MDT for the past 10 years.

Traffic Volumes

Historic traffic volumes on the corridor links were acquired from MDT's database in the form of average annual daily traffic (AADT) volumes. Sanderson Stewart conducted PM peak hour turning movement counts at the major intersections in June 2014 and those counts were compared to hourly data recorded by MDT in 2013. Marvin & Associates evaluated the traffic volume data to ensure conservative and accurate traffic volumes were used in the traffic analysis. The intersection counts were increased by approximately 20% when it was determined that the 24-hour counts more accurately reflected the typical PM peak hour period.

The resulting AADT volumes and design hour (PM peak) turning movements at the key intersections are shown in Figure 2. Detailed traffic count data is included in Appendix A.

HIGHWAY 3
CORRIDOR STUDY

2014 DESIGN HOUR TRAFFIC VOLUMES

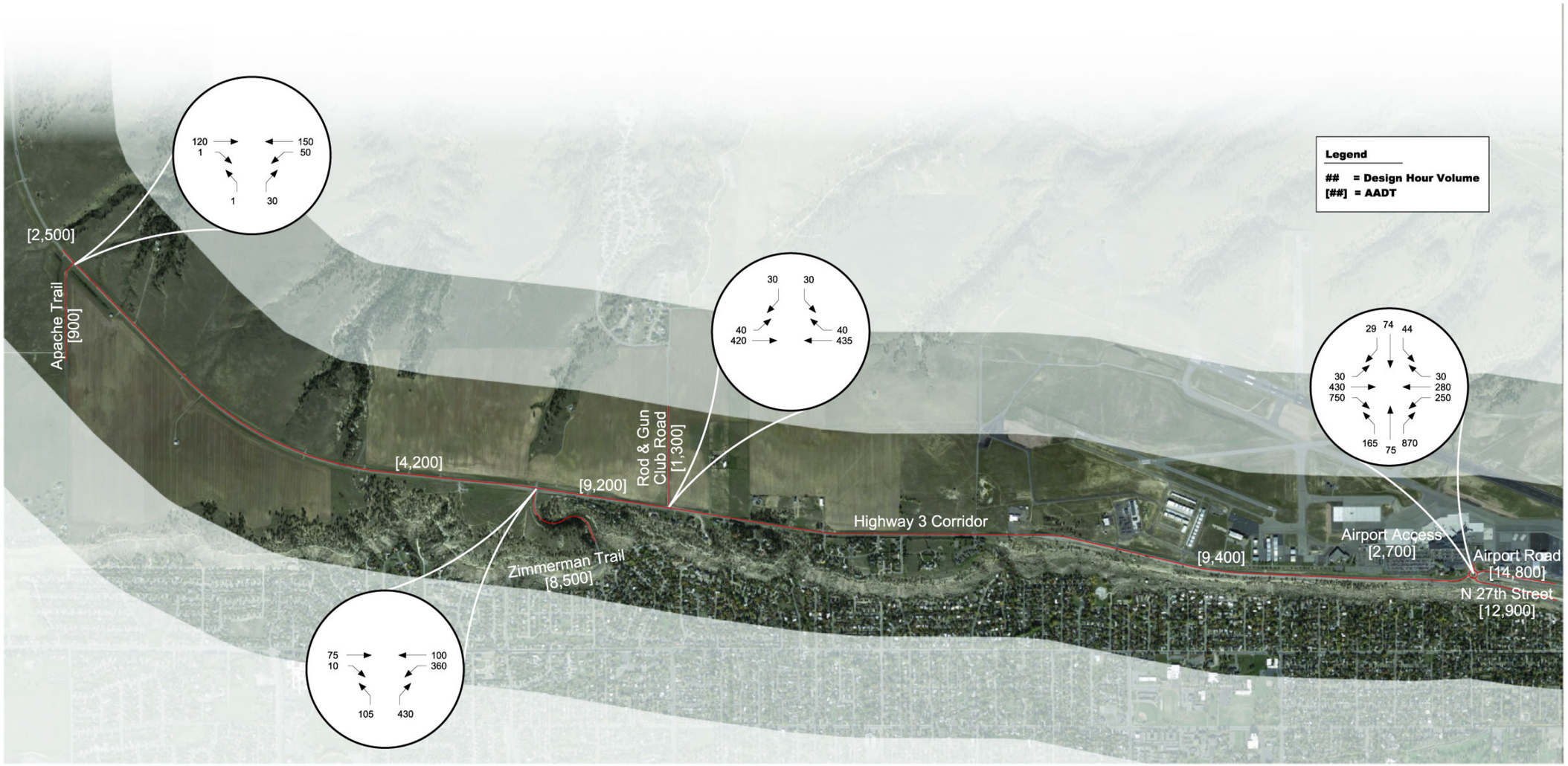

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FIGURE 2 – 2014 DESIGN HOUR TRAFFIC VOLUMES

Crash Data

A crash history analysis was conducted for Highway 3 from milepost 3.0 to milepost 8.2. Historical crash data was obtained from MDT for the ten-year period from January 1, 2004 through December 31, 2013. During this time period, 185 crashes were reported including 5 fatal crashes, 58 injury crashes, and 122 property damage only crashes.

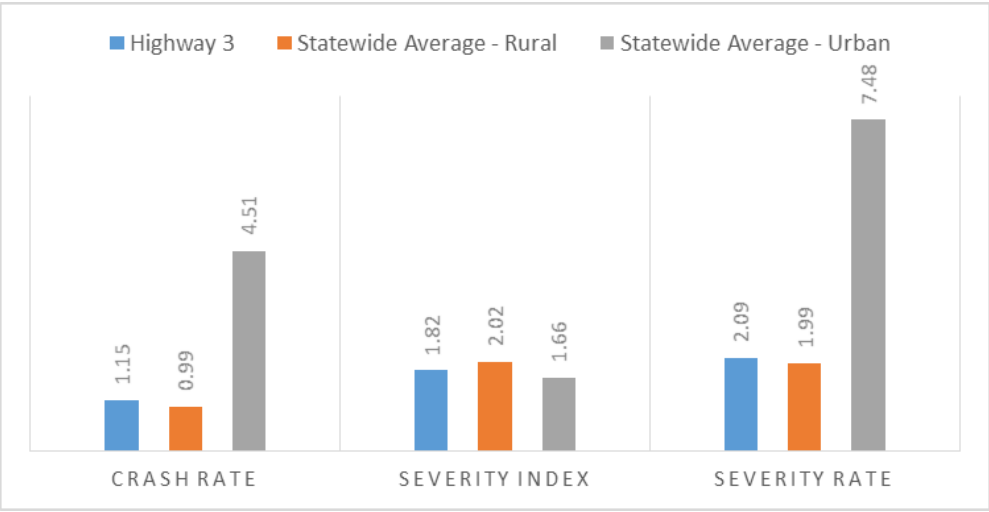
In general, the crashes along the study corridor do not appear to follow any trends associated with time of year, weather, lighting conditions, time of day, or horizontal roadway alignment. However, the location and number of crashes do appear to be influenced by intersections and access points along the corridor.

Three crash rate statistics were calculated to analyze the crash history: crash rate, severity index, and severity rate. The crash rate is defined as the number of crashes per million vehicle miles. The severity index is defined as the weighted average by crash severity, including fatal, injury, and property damage only crashes. Severity rate is defined as the crash rate multiplied by the severity index.

The crash rate statistics for the Highway 3 corridor are calculated based on AADT volumes measured during the ten-year period from 2004 through 2013. The crash rate for the 5.2-mile section of roadway was calculated at 1.15, the severity index at 1.82, and the severity rate at 2.09. As shown in Table 1, these numbers are compared to statewide average crash rates provided by MDT for the years 2008-2012. The average rates are used by MDT to help gauge the need for safety improvements for a roadway.

TABLE 1. CORRIDOR CRASH DATA STATISTICS

	Crash Rate	Severity Index	Severity Rate
Highway 3	1.15	1.82	2.09
Statewide Average – Rural	0.99	2.02	1.99
Statewide Average – Urban	4.51	1.66	7.48

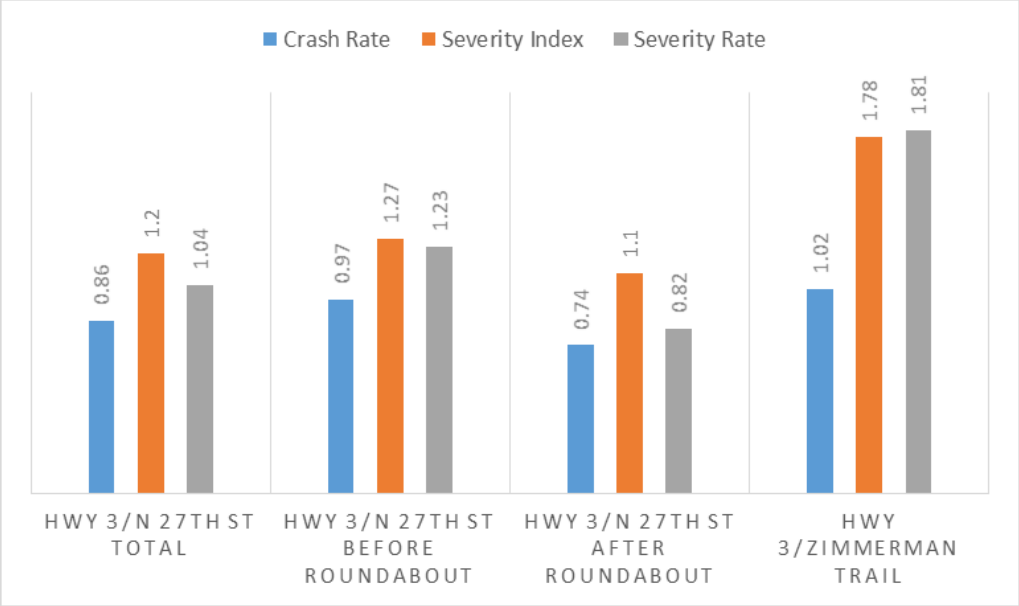


The calculated crash rate and severity rate for Highway 3 are slightly higher than the statewide average for rural roads, but lower than that for urban facilities. Conversely, the severity index for the study corridor is lower than the statewide average rate for a rural roadway, but higher than the average rate for an urban facility.

As a general rule, intersections with a crash rate greater than 1.0 crashes per million-entering-vehicles should be monitored further to determine if an inherent safety concern exists. For this study, crash rates were calculated for the intersections of Highway 3/North 27th Street and Highway 3/Zimmerman Trail. In addition, the crash data at the intersection of Highway 3 and North 27th Street was further analyzed before and after the construction of the roundabout in October 2009. These intersection crash data statistics are summarized in Table 2.

TABLE 2. INTERSECTION CRASH DATA STATISTICS

Intersection	Crash Rate	Severity Index	Severity Rate
Highway 3/N 27th St (2004-2013)	0.86	1.20	1.04
Before Roundabout (2004-2009)	0.97	1.27	1.23
After Roundabout (2009-2013)	0.74	1.10	0.82
Highway 3/Zimmerman Trail (2004-2013)	1.02	1.78	1.81



These calculations show that the crash rate improved significantly after the installation of the roundabout at Highway 3 and North 27th Street. The crash rate at the intersection of Highway 3 and Zimmerman Trail is slightly higher than the value suggested by MDT for monitoring (1.0) and may need to be improved in the future if the crash rate continues to increase.

Table 3 on the following page summarizes crash data for the corridor based on various characteristics such as location, weather and road conditions, crash type, and vehicle type. A majority of the crashes occurred at intersections along the corridor. Specifically, the highest number of crashes occurred at the intersections of Highway 3 with N 27th Street and Zimmerman Trail. The most prominent collision types (rear end, right angle and same-direction sideswipe) appear to be directly related to the high frequency of intersection crashes as opposed to crashes along areas with few access points. Figure 3 on page 10 provides a graphical representation of the same crash data.

During the ten-year analysis period, five (5) fatal crashes were reported. Two (2) of those crashes involved alcohol, two (2) crashes were head-on collisions, and two (2) involved a single vehicle. Through the course of analyzing the fatal crashes, no conclusive trends were identified that point toward specific traffic control improvements as an obvious mitigation measure.

There were 14 reported crashes involving a wild animal over the ten-year period. MDT Billings District Maintenance Division was contacted as well, and they reported 7 wildlife collisions during 2013 in which animals were removed from the roadway. The Maintenance Division also stated that this number is about average for the study corridor each year, and they do not feel the number of wildlife collisions is high relative to other area roadways. During 2013, only one crash involving a wild animal was listed in the crash history indicating that a low percentage of wild animal crashes are reported in the study area.

TABLE 3. CRASH DATA SUMMARY

Month	Crashes	%
January	12	6.5%
February	7	3.8%
March	22	11.9%
April	14	7.6%
May	10	5.4%
June	17	9.2%
July	14	7.6%
August	21	11.4%
September	19	10.3%
October	17	9.2%
November	17	9.2%
December	15	8.1%
Totals	185	100.0%

Day	Crashes	%
Sunday	29	15.7%
Monday	30	16.2%
Tuesday	24	13.0%
Wednesday	26	14.1%
Thursday	20	10.8%
Friday	30	16.2%
Saturday	26	14.1%
Totals	185	100.0%

Horiz. Align.	Crashes	%
Straight	115	62.2%
Curve	56	30.3%
Not Reported	14	7.6%
Totals	185	100.0%

Milepost	Crashes	%
3.0 - 3.4	73	39.5%
3.5 - 3.9	2	1.1%
4.0 - 4.4	7	3.8%
4.5 - 4.9	15	8.1%
5.0 - 5.4	17	9.2%
5.5 - 5.9	6	3.2%
6.0 - 6.4	51	27.6%
6.5 - 6.9	3	1.6%
7.0 - 7.4	3	1.6%
7.5 - 7.9	6	3.2%
8.0 - 8.4	2	1.1%
Totals	185	100.0%

Weather	Crashes	%
Clear	130	70.3%
Cloudy	31	16.8%
Snow	10	5.4%
Sleet	2	1.1%
Rain	4	2.2%
Fog	1	0.5%
Crosswinds	1	0.5%
Blowing Snow	6	3.2%
Totals	185	100.0%

Road Conditions	Crashes	%
Dry	148	80.0%
Wet	10	5.4%
Ice	9	4.9%
Snow/Slush	17	9.2%
Loose Gravel	1	0.5%
Totals	185	100.0%

Year	Crashes	%
2004	20	10.8%
2005	20	10.8%
2006	20	10.8%
2007	18	9.7%
2008	20	10.8%
2009	14	7.6%
2010	18	9.7%
2011	17	9.2%
2012	17	9.2%
2013	21	11.4%
Totals	185	100.0%

Crash Severity	Crashes	%
Fatal	5	2.7%
Injury Crash	59	31.9%
Prop. Damage Only	121	65.4%
Totals	185	100.0%

Note: Crash data summarized from 1/1/04 through 12/31/13

Collision Type	Crashes	%
Head On	6	3.2%
Rear End	63	34.1%
Right Angle	23	12.4%
Sideswipe SD	18	9.7%
Sideswipe OD	3	1.6%
Left Turn SD	2	1.1%
Left Turn OD	2	1.1%
Other/Unknown	68	36.8%
Totals	185	100.0%

Vehicle Type	Vehicles	%
Bicycle	1	0.3%
Motorcycle	6	1.9%
Passenger Car	101	32.3%
Mid-size Car	40	12.8%
Large Car	3	1.0%
SUV	52	16.6%
Van	12	3.8%
Pickup Truck	62	19.8%
Truck/Tractor	36	11.5%
Totals	313	100.0%

Light Conditions	Crashes	%
Dawn	2	1.1%
Daylight	124	67.0%
Dusk	2	1.1%
Dark-Lighted	15	8.1%
Dark-Not Lighted	41	22.2%
Unknown	1	0.5%
Totals	185	100.0%

Time of Day	Crashes	%
Before 6:00 am	18	9.7%
6:00 am - 9:00 am	27	14.6%
9:00 am- 12:00 pm	22	11.9%
12:00 pm - 3:00 pm	27	14.6%
3:00 pm - 6:00 pm	49	26.5%
6:00 pm - 9:00 pm	26	14.1%
After 9:00 pm	16	8.6%
Totals	185	100.0%

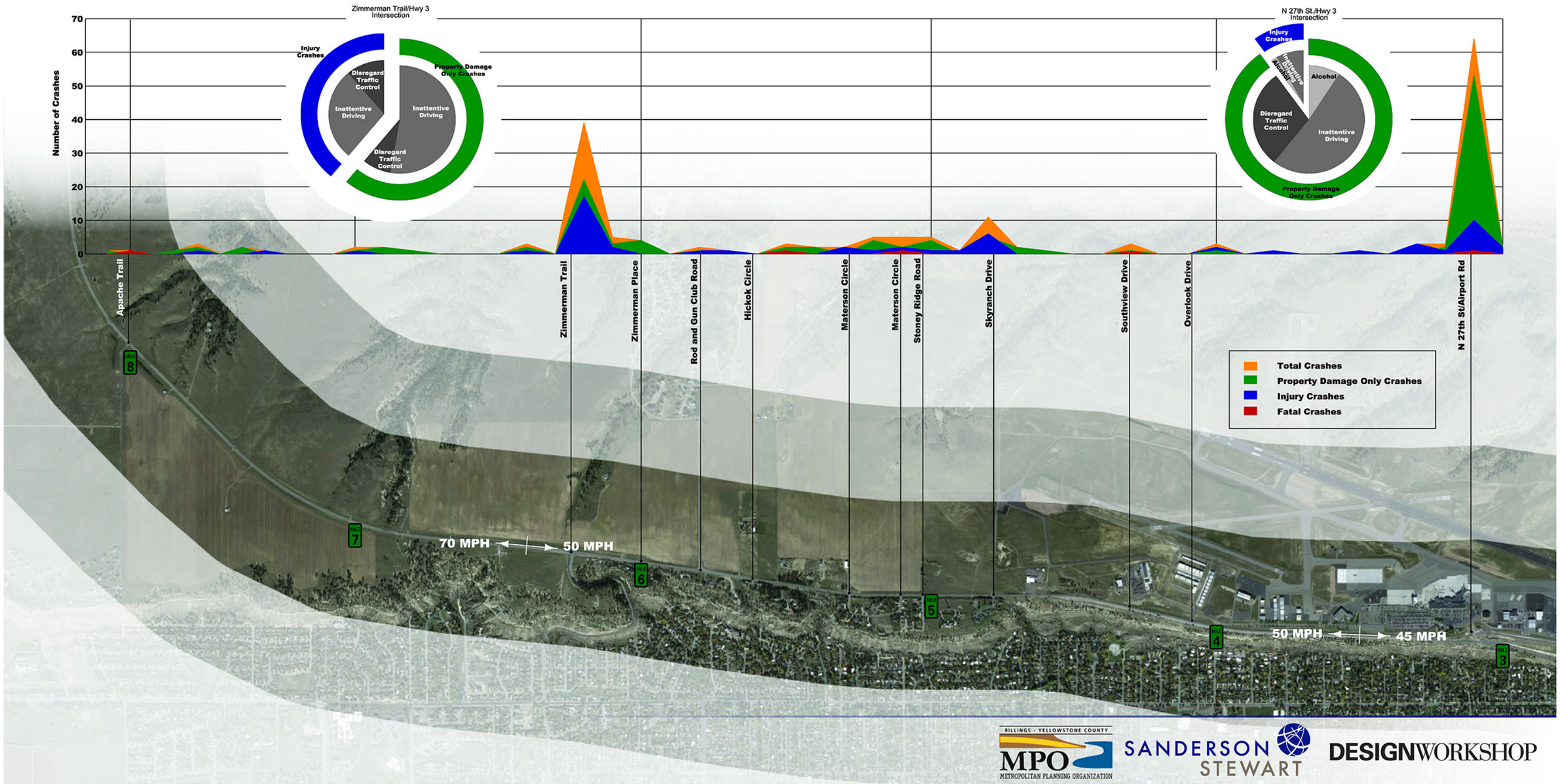


FIGURE 3 - CRASH DATA FIGURE

Parking

A parking inventory was conducted along the study corridor to evaluate the level of parking needed in the future. Counts were taken in May and August 2014 at the main Swords Park parking lot, the parking lot just east of the North 27th Street roundabout, the Zimmerman Park parking lot, and within the existing gravel parking area along Highway 3 west of North 27th Street, which was referred to as the Rimview Parking Area for the purposes of this report. These counts were then compared to the available parking capacity in each location, as summarized in Table 4 below. The results of this exercise show that the parking areas currently available provide adequate capacity relative to the demand.

TABLE 4. PARKING INVENTORY & CAPACITY

Parking Count/Date		Swords Park Parking Lot	Parking Lot East of N 27th St/Airport Rd Roundabout	Zimmerman Park Parking Lot	Rimview Parking Area
May 2014 Inventory[1]	Count 1	12	4	15	7
	Count 2	10	4	7	7
	Count 3	8	3	8	8
	Count 4	10	5	5	12
August 2014 Inventory[1]	Count 1	5	6	8	4
	Count 2	5	4	6	0
	Count 3	4	2	5	3
	Count 4	4	2	6	4
May Average Demand		10	4	9	9
August Average Demand		5	4	6	3
Maximum Observed Demand[2]		12	6	15	12
Estimated Capacity[3]		20	30	30	N/A[5]
Available Spots During Max Demand[4]		8	24	15	N/A[5]

[1] Parking counts were one-time observations taken throughout one day for each of the listed months.

[2]Maximum Observed Demand is the highest observed parking taken during the parking inventory.

[3]Parking capacity was estimated based on the size of the parking areas.

[4]Available Spots During Max Demand is calculated as the Estimated Capacity minus the Maximum Observed Demand.

[5] No existing defined parking lot. Counts taken for comparison purposes for parking lot design.

Trails & Open Space

Figure 4 illustrates the existing trails and open space along the Highway 3 corridor. Existing paved trails are shown in blue, existing natural trails in red and future trails as a dashed red line like the future trail planned along the inner belt loop.

Figure 4 also illustrates the extensive parkland that exists along the top of the Rims. There are 300 acres of parks and open space within one mile of the corridor, as well as 12 miles of existing trails. That is something very unique to this corridor that would not be seen anywhere else in Billings. This is why the multi-modal and recreational components of this study are so important.

Also worth noting is the smaller map in the bottom left corner of Figure 4 that illustrates the proposed Marathon Loop trail that will eventually provide a continuous off-street loop around the entire city. The potential multi-use trail along the Highway 3 corridor presents an opportunity to fill in a missing gap in the Marathon Loop.

Stormwater

Figure 5 on page 14 illustrates the existing stormwater drainage patterns for the Highway 3 corridor based on topography. The different colors represent different drainage areas. The white arrows show the direction of flow and the yellow lines represent existing culverts.

Drainage areas toward the west end of the Highway 3 corridor generally flow to the north, while areas on the east end flow to the south (toward the Rims). This information, along with some additional analysis, will be used to help identify potential areas for stormwater detention.

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EXISTING TRAILS + OPEN SPACE

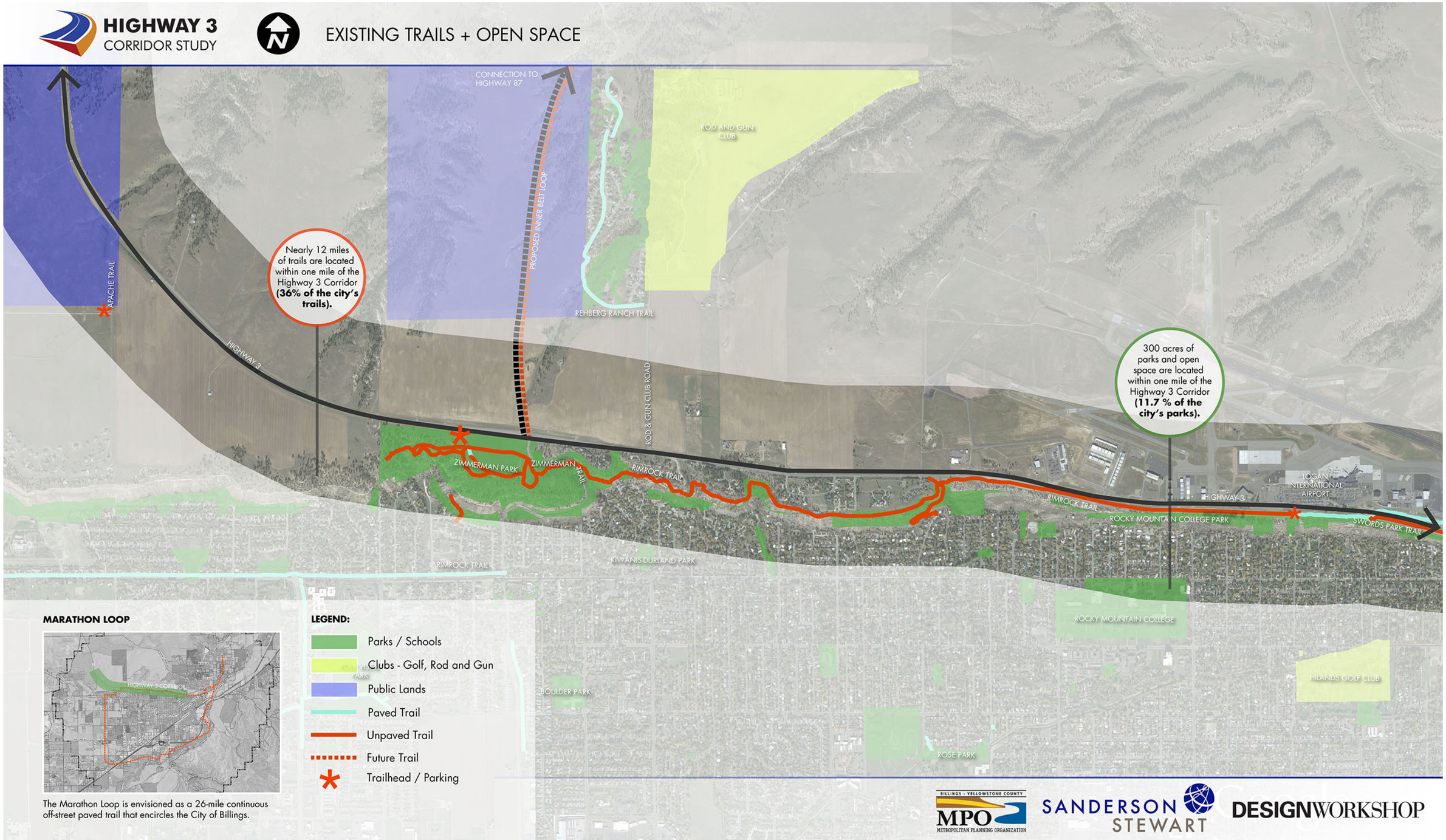

FIGURE 4 - CORRIDOR STUDY TRAILS

HIGHWAY 3
CORRIDOR STUDY

STORMWATER EXHIBIT

DRAINAGE AREA	AREA (ac)	CULVERT SIZE (in)
A1	6.06	24
A2	17.08	24
A3	23.61	24
A4	5.39	24
A5	6.81	24
A6	10.86	24
A7	57.54	24
A8	13.18	--
A9	24.66	24
A10	48.42	24
A11	15.30	36
A12	13.99	24
A13	28.09	30
A14	25.39	18
A15	105.28	48
A16	38.55	42

LEGEND

DRAINAGE FLOW

CULVERT
(SIZE VARIES)

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FIGURE 5 - STORMWATER DRAINAGE PATTERNS

CORRIDOR MODELING

3

Corridor traffic volumes were projected using a methodology based on existing traffic patterns at the four key corridor intersections, as described in greater detail in the following paragraphs. These volumes were then used to prepare a corridor model for the evaluation of traffic operations and ultimately, the evaluation of alternatives for improvement.

Traffic Volume Projections

Traffic patterns at the key intersections were converted to percentage distribution values to determine relative travel demand from and to separate corridor links. This resulted in an origin-destination trip table that was used to assign future travel patterns. The base trip table was reconfigured for future conditions involving the addition of the proposed Inner Beltloop connection link and anticipated demographic changes in the future design year 2035. These demographic projections were obtained from the 2014 Long Range Transportation Plan and are illustrated graphically in Figure 6. The model included substantial increases in population and employment in the areas just north of Highway 3. An extension of Apache Trail to the north was included to represent future access to development north of Highway 3 and west of the Inner Beltloop.

Ten years (2004-2013) of AADT data from MDT for the Highway 3 corridor was utilized to perform a historic growth analysis. The average annual growth rate was calculated for each link along the corridor and it was noted that all of the links had positive growth ranging from 0.2% to 5.5% annually. Multiplication factors were calculated using the annual percentage growth (compounded) to arrive at what is considered to be a conservatively high estimate of year 2035 volumes on the roadway links. In addition, a straight-line growth curve was calculated, which represented a low range estimate of year 2035 volumes. In order to add a measure of conservatism to this study, and for consistency with the Long Range Transportation Plan volumes, the high range volumes were used to predict year 2035 traffic volumes on the existing system.

Appendix A contains a series of calculations and trip tables that were used in the model's development. Model results for year 2035 traffic projections on the existing system are shown in Figure 7, which presents the AADT traffic on each roadway link and the design hour traffic at each of the key intersections. The highest Highway 3 AADT would be approximately 16,000 vehicles per day (vpd) between Zimmerman Trail and the Airport Road intersection.

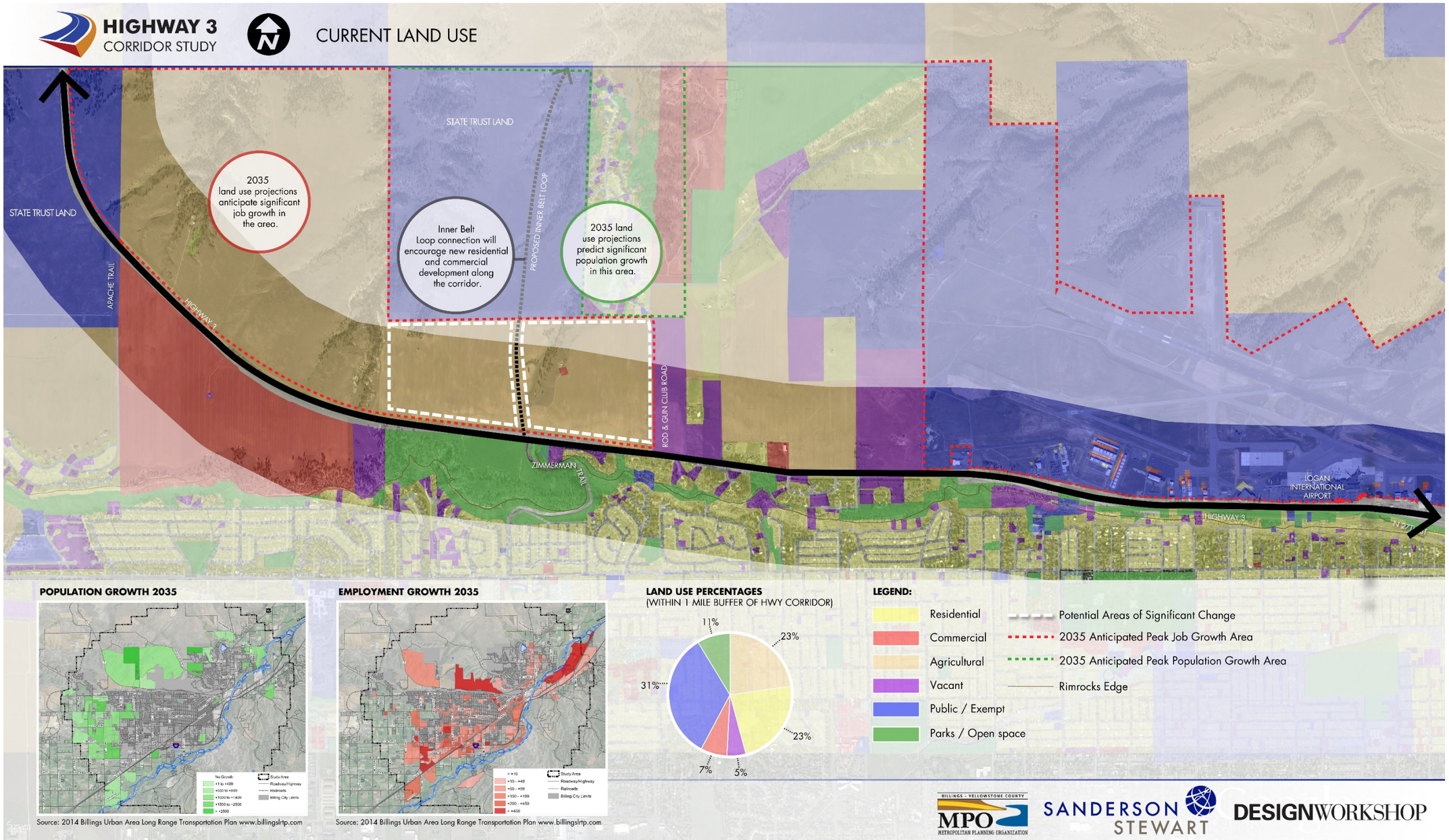

FIGURE 6 - EXISTING & PROJECTED LAND USE

2035 TRAFFIC VOLUME PROJECTIONS WITH INNER BELT LOOP & DEVELOPMENT BASED ON TRANSPORTATION PLAN HIGH LAND USE GROWTH SCENARIO

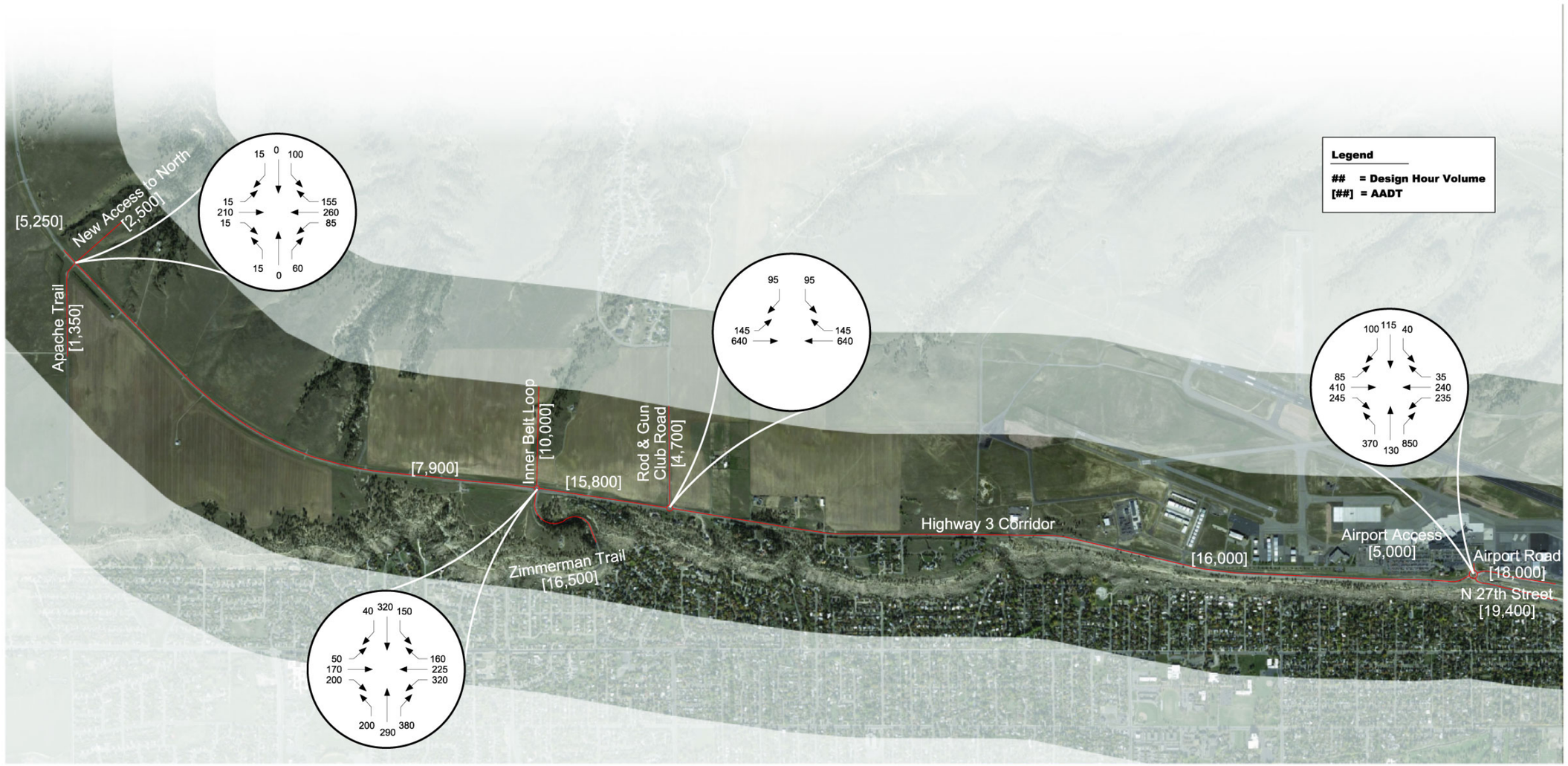

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FIGURE 7-2035 TRAFFIC VOLUME PROJECTIONS

Traffic Analysis

Capacity calculations were performed for existing and future conditions using Synchro 8, which is based on Highway Capacity Manual (HCM) methodologies. The HCM2000 defines level of service (LOS) as "a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, as well as comfort and convenience." LOS is a qualitative measure of the performance of an intersection. LOS values range from LOS A, indicating good operation and low vehicle delays, to LOS F, which indicates congestion and longer vehicle delays. A roundabout analysis program, Rodel Interactive, was also used to further evaluate conditions at intersections with existing and proposed roundabouts.

Both the City of Billings and MDT generally consider LOS C as the minimum standard for acceptable intersection operations. The existing capacity calculation results for this study show that all intersections and intersection approaches currently operate at an acceptable LOS, except for the north- and southbound (private drive) approaches at the Zimmerman Trail/Highway 3 intersection. LOS results for both existing and future conditions are presented in Table 5 and detailed Synchro reports are provided in Appendix B.

Three improvement alternatives were analyzed for the intersections within the project corridor as shown in Table 5. The first alternative is a no-build scenario in which the intersections at Zimmerman Trail and Rod & Gun Club Road would remain as two-way stop-controlled, as would the intermediate access intersections along the corridor. The second scenario (Alternative 1) proposes roundabouts at Zimmerman Trail and Rod & Gun Club Road, and stop control with three-quarter access at intermediate access intersections. The third scenario (Alternative 2) is similar to the second except signals were evaluated at the Zimmerman Trail and Rod & Gun Club Road intersections.

The capacity calculations conducted for 2035 traffic volumes show that many of the intersection approaches would not operate at an acceptable LOS for the no-build scenario. The results for both Alternative 1 and Alternative 2 indicate that intersections could be improved to acceptable levels with the installation of either signals or roundabouts at Zimmerman Trail and Rod & Gun Club Road. Both intersections project to operate well with single-lane roundabouts, but the signalized alternative for the Zimmerman Trail intersection would require left- and right-turn auxiliary lanes on all approaches and possibly even additional thru lanes in the northbound and southbound directions.

TABLE 5. CAPACITY CALCULATION RESULTS

Intersection	Approach	Existing (2014) PM Peak			2035 No-Build PM Peak			2035 Alternative 1 (Roundabouts) PM Peak			2035 Alternative 2 (Signals) PM Peak			Notes
		Avg Delay (s/veh)	LOS	Max Queue (veh)	Avg Delay (s/veh)	LOS	Max Queue (veh)	Avg Delay (s/veh)	LOS	Max Queue (veh)	Avg Delay (s/veh)	LOS	Max Queue (veh)	
Intersection Control		*One-way Stop Control*			*Two-way Stop Control*			*Two-way Stop Control*			*Two-way Stop Control*			
Apache Trail & Highway 3	EB	0.0	A	0	8.4	A	1	8.4	A	1	8.4	A	1	No Change in Traffic Control
	WB	7.6	A	1	1.4	A	1	1.4	A	1	1.4	A	1	
	NB	9.1	A	1	9.2	A	1	9.2	A	1	9.2	A	1	
	SB	--	--	--	25.7	D	2	25.7	D	2	25.7	D	2	
Intersection Control		*One-way Stop Control*			*Two-way Stop Control*			*Two-way Stop Control*			*Two-way Stop Control*			
Intermediate Access Intersection	EB	0.0	A	0	0.0	A	1	0.0	A	1	0.0	A	1	No Change in Traffic Control
	WB	0.2	A	1	0.1	A	1	0.1	A	1	0.1	A	1	
	NB	8.1	A	1	10.6	B	1	10.6	B	1	10.6	B	1	
	SB	--	--	--	21.4	C	1	21.4	C	1	21.4	C	1	
Intersection Control		*Two-way Stop Control*			*Two-way Stop Control*			*Roundabout*			*Signal*			
Zimmerman Trail & Highway 3	EB	0.0	A	0	1.0	A	1	16.8	C	1	45.1	D	7	Auxiliary Left and Right-turn Lanes all approaches, 2 NB/SB Thru Lanes
	WB	7.0	A	2	4.5	A	2	12.6	B	1	37.2	D	10	
	NB	21.5	C	6	1051.4	F	72	16.2	C	2	27.9	C	8	
	SB	25.1	D	1	1051.4	F	195	23.4	C	3	30.1	C	4	
Intersection Control		*One-way Stop Control*			*One-way Stop Control*			*Stop Control, 3/4 Access*			*Stop Control, 3/4 Access*			
Intermediate Access Intersection	EB	0.0	A	0	0.0	A	0	0.0	A	0	0.0	A	0	3/4 Access (NB/SB Right-Turn Only)
	WB	0.1	A	1	0.1	A	1	0.1	A	1	0.1	A	1	
	NB	9.9	A	1	13.9	B	1	13.9	B	1	13.9	B	1	
	SB	--	--	--	--	--	--	--	--	--	--	--	--	
Intersection Control		*Two-way Stop Control*			*Two-way Stop Control*			*Roundabout*			*Signal*			
Rod & Gun Club Road & Highway 3	EB	0.7	A	1	2.0	A	1	16.2	C	2	11.4	B	9	No Change in Lane Confirgurations for Signalized Option
	WB	0.0	A	0	0.0	A	0	16.8	C	3	24.8	C	16	
	NB	9.4	A	1	10.1	B	1	7.8	A	0	0.0	A	0	
	SB	14.2	B	1	99.0	F	8	12.6	B	0	21.9	C	3	
Intersection Control		*Two-way Stop Control*			*Two-way Stop Control*			*Stop Control, 3/4 Access*			*Stop Control, 3/4 Access*			
Intermediate Access Intersection	EB	0.4	A	1	0.4	A	1	0.4	A	1	0.4	A	1	3/4 Access (NB/SB Right-Turn Only)
	WB	0.1	A	1	0.2	A	1	0.2	A	1	0.2	A	1	
	NB	15.3	C	1	57.5	F	2	10.9	B	1	10.9	B	1	
	SB	15.7	C	1	113.9	F	4	11.7	B	1	11.7	B	1	
Intersection Control		*Roundabout*			*Roundabout*			*Roundabout*			*Roundabout*			
E Airport Road & Highway 3	EB	13.2	B	1	14.4	B	1	14.4	B	1	14.4	B	1	No Change in Traffic Control
	WB	10.8	B	1	11.4	B	1	11.4	B	1	11.4	B	1	
	NB	12.0	B	1	15.0	C	1	15.0	C	1	15.0	C	1	
	SB	12.0	B	1	14.4	B	1	14.4	B	1	14.4	B	1	

RECOMMENDED IMPROVEMENTS

4

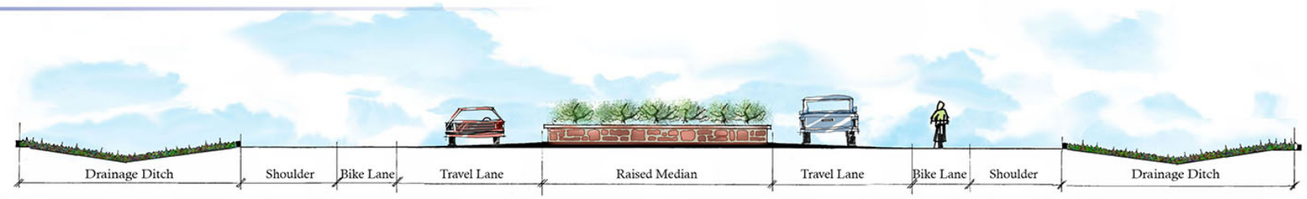
The preceding evaluation of existing conditions and analysis of projected future traffic operations, drainage and other study considerations resulted in many recommended improvements for the Highway 3 corridor. Those recommendations have again been organized by the four key project elements: Traffic & Safety, Parking, Trails & Open Space, and Stormwater. The overall improvements incorporating all of these elements are illustrated in Figure 8 on the following page.

It is important to note that these recommendations represent a vision for the corridor, but further engineering analysis will be required to confirm the feasibility and details of design.

Traffic & Safety

The proposed corridor improvements were based on the year 2035 traffic volume projections, the resulting capacity calculations, and other considerations previously discussed in the report. In general, all design elements for this project should be implemented with the ultimate goal of constructing a cohesive corridor that operates safely and efficiently for all modes of traffic. The recommended improvements should ultimately be designed to MDT, AASHTO, MUTCD, and other standards as appropriate.

PROPOSED CORRIDOR IMPROVEMENTS



TYPICAL SECTION

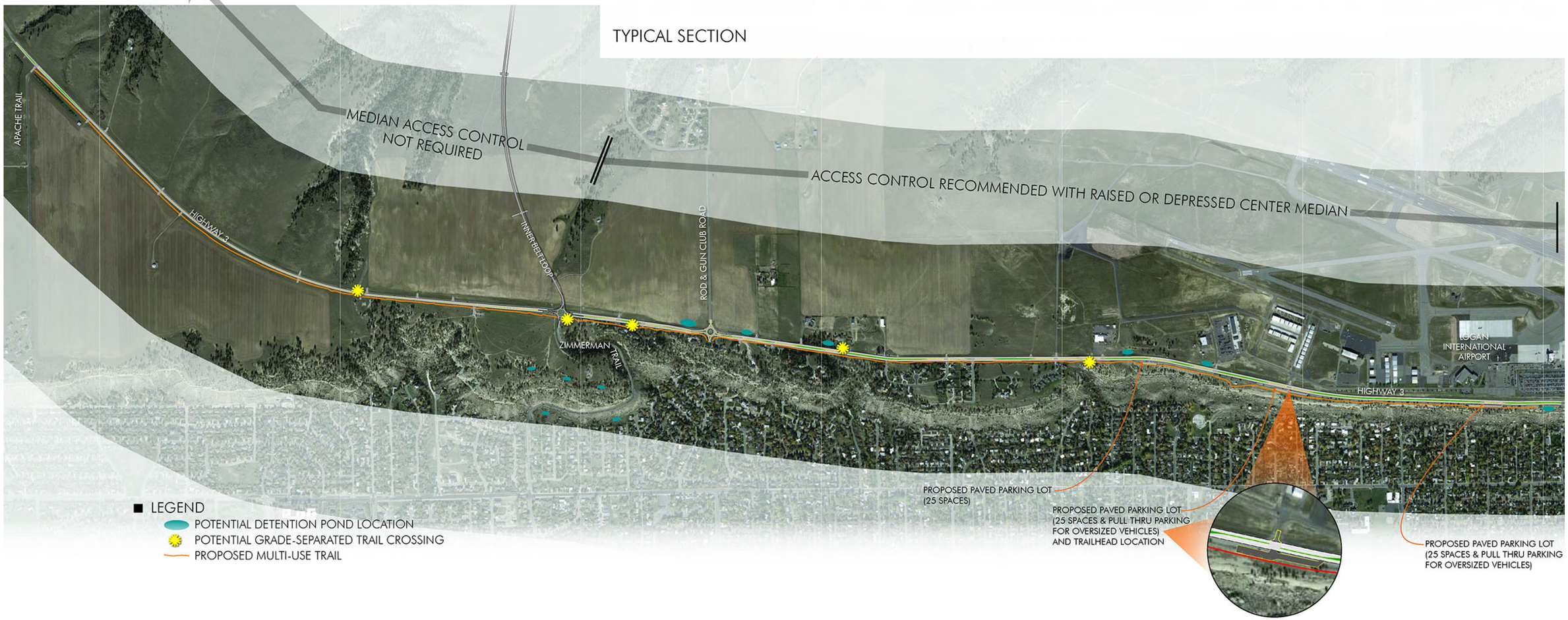


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FIGURE 8-PROPOSED CORRIDOR IMPROVEMENTS

Typical Section

A three-lane typical section is recommended from Zimmerman Trail to North 27th Street. Figure 9 on the following page shows the concept typical sections that were presented for public input. The recommended section consists of a single travel lane in each direction, bike lanes, left-turn lanes and some form of median to provide a level of access control needed for safety and to provide an acceptable level of service for traffic operations at minor intersections along the corridor. As a result, several of the intersections may be limited to three-quarter access, where both left and right turns are allowed onto the side street but access to Highway 3 from the side street would be limited to right-turn only. Vehicles wanting to make a left turn onto Highway 3 would need to make a right turn and then a u-turn at the next downstream intersection or median opening. The restriction on left-turn movements from the side streets provides for operations at LOS C or better, even with 2035 volumes.

West of Zimmerman Trail, a two lane section similar to the existing facility would be adequate for 2035 volume projections. There will be new accesses and turning traffic added with future development on both sides of the highway, but volumes are low enough that it should operate at an acceptable level without much modification. Future left-turn lanes should be evaluated at higher-volume accesses, similar to the existing left-turn lane at Apache Trail, but median control is not needed from a traffic operations standpoint. Many of the private approaches along this stretch have already been constructed by MDT based on the limited access resolution. These and other future approach locations will need to be further evaluated during the design process and as the area develops.

An acceleration lane was also considered relative to MDT guidelines for traffic turning right onto Highway 3 from Apache Trail. An acceleration lane is not recommended at this time because a considerable amount of reserve capacity would be available for design year traffic volumes, there is not a significant history of crashes associated with the right-turn movement, and intersection sight distance is adequate.

Intersections

There are two intersections along the corridor that will require a higher level of traffic control in the future: Zimmerman Trail and Rod & Gun Club Road. Traffic signals and roundabouts were both evaluated as mitigation alternatives for these intersections. It was determined that roundabouts would provide for better overall operations and efficiency at both locations.

For the purposes of this analysis, it was assumed that the Inner Beltloop would intersect Highway 3 at the Zimmerman Trail intersection. With the volumes that are projected for that connection, the signalized alternative would require auxiliary right and left turn lanes on all approaches and possibly an extra thru lane for both northbound and southbound traffic. In comparison, the traffic volumes could easily be accommodated via a single lane roundabout with an extra slip lane for northbound right-turning traffic.

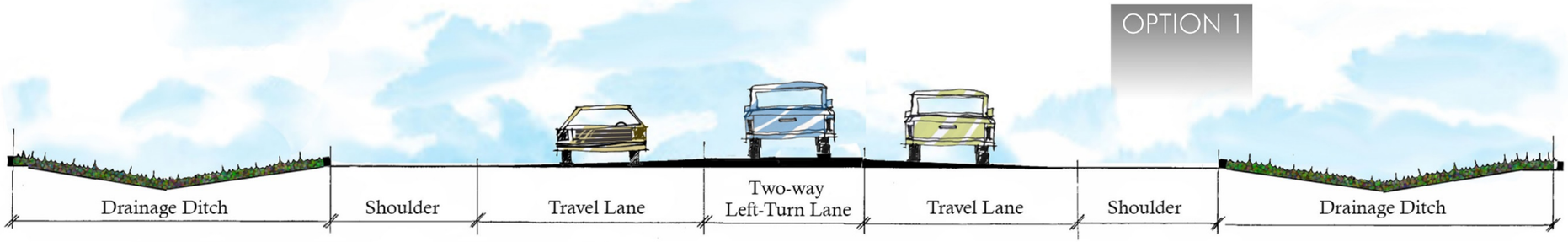
The Rod & Gun Club Road intersection would operate well with either a traffic signal and existing lane configurations or a single-lane roundabout. Because a roundabout is the preferred alternative at Zimmerman Trail, it is recommended that a roundabout be installed at Rod & Gun Club Road as well to maintain consistency along the corridor.

Overall, it is expected that roundabouts will provide greater safety benefits due to lower speeds and lower severity of crashes (as is typical at roundabout intersections). There will still be crashes, but the severity of those crashes should be considerably lower and fatal collisions at roundabouts are extremely rare.

MDT recently announced that they have nominated an intersection improvement project with safety funds based on the crash history at the Zimmerman Trail/Highway 3 intersection. These improvements will not be part of the Zimmerman Trail design project because of the funding source associated with the road project, but this project will be constructed at the same time as the Zimmerman Trail project. This study and other previous studies have recommended a roundabout in this location, but MDT will reevaluate both options before proceeding with design. Those improvements are anticipated to be programmed for construction in 2017, so they will likely be the first project constructed for the corridor and will set the stage for all future improvements.

The roundabout design in both locations will require specific accommodations for bicyclists and pedestrians in coordination with the design of the multi-use trail and bike lanes.

PROPOSED TYPICAL SECTIONS



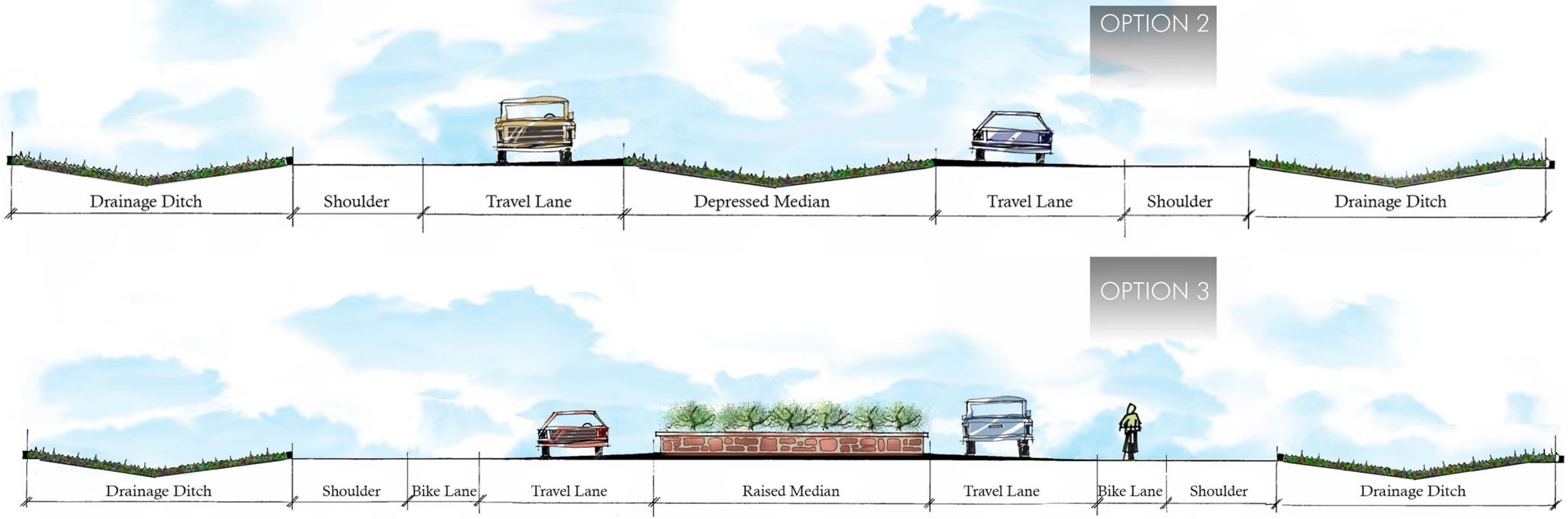


FIGURE 9 - PROPOSED TYPICAL SECTIONS

Parking

Another important aspect of this project addresses the existing gravel parking area along Highway 3 and adjacent to the Rims across from the airport. Based on the inventory and observations of this parking area and other parking areas at Swords Park and Zimmerman Park, it is recommended that three paved parking lots be constructed within this area: one at either end of the gravel area and one in the middle. Each parking lot should be large enough to accommodate approximately 25 vehicles. Areas between the new paved parking lots should be restored with native vegetation and drainage swales as illustrated in Figures 11 and 12.

In addition to the parking areas for passenger vehicles, it is recommended that two of the three lots be designed to accommodate pull-thru parking for oversized vehicles. Parking for oversized vehicles, including trucks, RV's and trailers, can be isolated using this type of parking configuration.

At the center parking lot, a more enhanced trailhead is recommended, including restrooms, a picnic shelter and other trailhead amenities, similar to what exists at Swords Park. This parking lot would be near the pump station building where the existing access road can be used to install a paved trail that would drop down below the Rim face and provide easy access to the existing natural trails. The ease of tying into the existing natural trail system is the primary reason why this is an ideal location for an enhanced trailhead.

Figures 10-12 illustrate the potential parking lot locations, how they would function in relation to the proposed trail location, and perhaps, most importantly, how these gravel areas can be restored with native landscaping to mimic the appearance of the existing Swords Park area.

Trails & Open Space

Through conversations and site visits with members of the Project Oversight Committee and the consultant team, a proposed multi-use trail alignment was developed with the goal of enhancing access to existing trails and highlighting the views from the top of the Rims. There is a strong desire to preserve the natural trails that exist along the Rims, so the proposed paved trail is not intended to replace them but rather to compliment them. As shown in Figure 8, the proposed trail would parallel Highway 3 and run along the south side of the highway through what is currently the expansive gravel parking area.

Through the stretch of residential development between the highway and the Rims, the proposed trail would remain within the highway right-of-way. The trail design at several proposed coulee crossings presents a challenge, but a safe and practical design is feasible. The trail will have to drop below the highway grade hugging the slope behind the guardrail and will require some support from retaining walls. These areas also present several good opportunities for grade separated crossings (pedestrian underpasses) since the trail will naturally be required to drop below the grade of the roadway. A cross-section of one of these underpass locations is illustrated in Figure 13.

Stormwater

Stormwater within the project vicinity generally flows to the north on the west end of the corridor and to the south (toward the Rims) on the east end of the corridor. Stormwater flowing over the Rims has presented a major problem in the past for the residential properties located below. In order to mitigate this problem, stormwater detention will be required. A concept for potential detention pond locations is illustrated in Figure 8. This figure is conceptual in nature only and a full hydraulic study will be required upon development to determine actual pond location, size and feasibility.

Standing water is a major concern for the airport because of its potential to attract waterfowl, so the detention ponds should only be installed if they can be designed to drain within 24-36 hours. Because of the soil conditions in this area, it may be necessary to incorporate some type of outfall with the detention pond design. The outfall would need to be designed so the stormwater does not consolidate to a point where the flow increases over the Rims in any particular location.

The goal is to slow the water down by way of the detention ponds and release it at a rate less than the pre-developed rate, but the City of Billings has expressed concerns about sending more water over the Rims. The ultimate design of these facilities will require a significant amount of input from the Airport and the City of Billings Engineering Division in order to balance these competing design challenges. The allowable release rate, the size of the ponds, and other elements will have to be determined through the design process. In order to fully address the issues with runoff over the Rims, some additional work will be required below the Rims as well.

A significant number of comments received at the first public meeting for this study were directed more toward the stormwater issues on Zimmerman Trail than Highway 3. Improvements to Zimmerman Trail are somewhat outside of the scope of this study, but they were considered nonetheless. Detention ponds located closer to the Rims within the Zimmerman Park area and on the south side of Zimmerman Trail would be needed to mitigate the issues associated with runoff. These locations are shown on the proposed improvements graphic in Figure 8, but they will need to be further evaluated as part of a separate project.

Key Pad Polling Results

During the second public meeting, a key pad polling system was utilized to gather public opinions regarding various proposed design alternatives. Approximately 30 people participated in the key pad polling, including representatives from the City, County and MDT that were in attendance at the public meeting. Following the public meeting, several public comments were received through the project website, primarily indicating the desire to include bike lanes along Highway 3 for the entire study length.

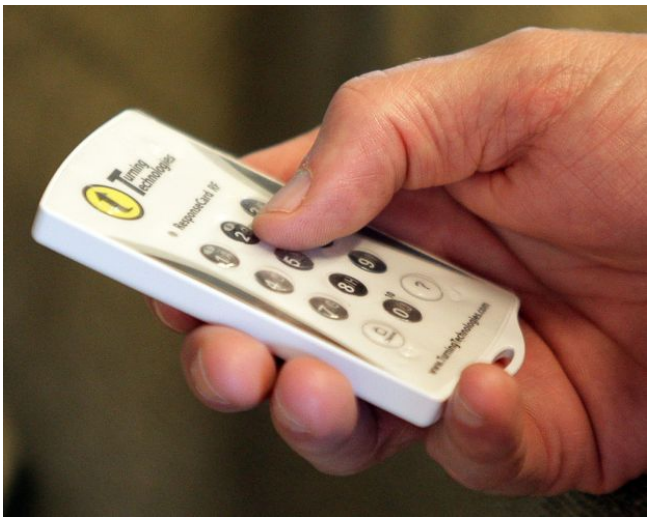


Table 6 on the following page provides a summary of the top-rated response(s) for each question presented. A complete compilation of the key pad polling results is provided in Appendix C. Many of the top-rated features are illustrated in the perspective views provided in Figures 10-13.

A complete summary of recommended projects for the Highway 3 corridor is provided in Table 7 on page 30. Although the projects are numbered, they are not listed in any particular order.

TABLE 6. KEY PAD POLLING SUMMARY

Question Summary [1]	Top-Rated Response [2]	
	Percent of Total Votes	Description
1. Roadway alternatives?	50%	2-lane with a center turn lane
	50%	2-lane with a center median
2. Median/access control alternatives?	41%	Raised median - with landscaping
3. Entry feature (Y/N and location)?	45%	Yes, located a Zimmerman Park
4. Bike lanes (Y/N and location)?	44%	Yes, along the entire corridor
5. New trail alternatives: East (Airport to Sky Ranch Drive)?	62%	Add a paved multi-use trail parallel to the roadway
6. Current trail alternatives: Central (Sky Ranch Drive to Zimmerman Park)?	42%	No change to the existing trail
7. New trail alternatives: Central (Sky Ranch Drive to Zimmerman Park)?	58%	Add a paved multi-use trail parallel to the roadway
8. New trail alternatives: West (Zimmerman Park to Apache Trail)?	58%	Add a paved multi-use trail parallel to the highway
9. New trail alternatives: North Side (location along north side of Highway 3)?	43%	Entire corridor
10. Grade-separated trail crossing locations? [3]	31%	Trail Crossing #3
11. Parking/trailhead locations? [4]	29%	Parking Area #1
12. Parking/trailhead vehicle accommodation?	52%	Provide parking for recreational vehicles and trailers only (no truck parking)
13. Parking/trailhead overnight parking allowed?	76%	No
14. Landscape character of corridor?	46%	A native restoration aesthetic that closely mimics the surrounding environment and uses only native plant materials
	46%	An enhanced native aesthetic that primarily uses native plant material and also incorporates ornamental elements at focused locations
15. Incorporate street trees (Y/N and location)?	39%	Yes, in specific areas only (parking areas, trailheads, etc.)
	39%	No
16. Incorporate pedestrian lighting (Y/N and location)?	61%	Yes, in specific areas only (parking areas, trailheads, etc.)
17. Addressing stormwater challenges?	52%	"Green infrastructure" solutions typically comprised of landscape and surface drainage facilities

[1] Complete question descriptions are shown in Appendix C.

[2] Remaining lower-rated responses and additional voting information are shown in Appendix C.

[3] See Figure 8 for potential grade-separated trail crossings locations.

[4] See Figure 8 for potential parking and trailhead locations.

HIGHWAY 3 CORRIDOR STUDY

PARKING AND TRAILHEAD AT OVERLOOK (OPTION 2)


EXISTING

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FIGURE 10-PERSPECTIVE VIEW OF PROPOSED CORRIDOR IMPROVEMENTS (1)

HIGHWAY 3 CORRIDOR STUDY

NATIVE REVEGETATION, PARKING AND TRAIL IMPROVEMENTS

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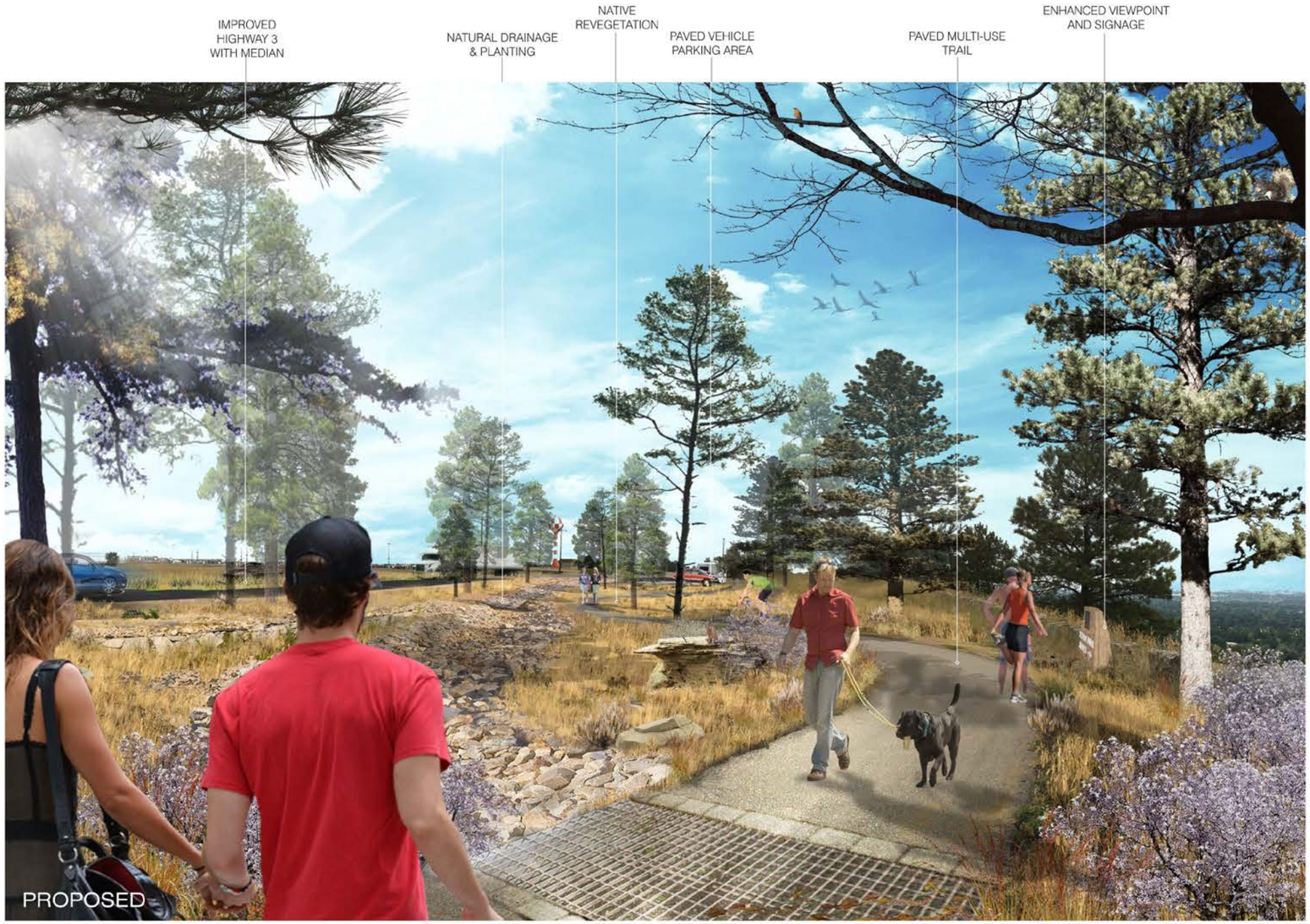
FIGURE 11-PERSPECTIVE VIEW OF PROPOSED CORRIDOR IMPROVEMENTS (2)

HIGHWAY 3 CORRIDOR STUDY

NATIVE REVEGETATION, PARKING AND TRAIL IMPROVEMENTS



EXISTING

SANDERSON STEWART DESIGNWORKSHOP

FIGURE 12-PERSPECTIVE VIEW OF PROPOSED CORRIDOR IMPROVEMENTS (3)

HIGHWAY 3 CORRIDOR STUDY

CORRIDOR IMPROVEMENTS AT GRADE-SEPARATED CROSSING

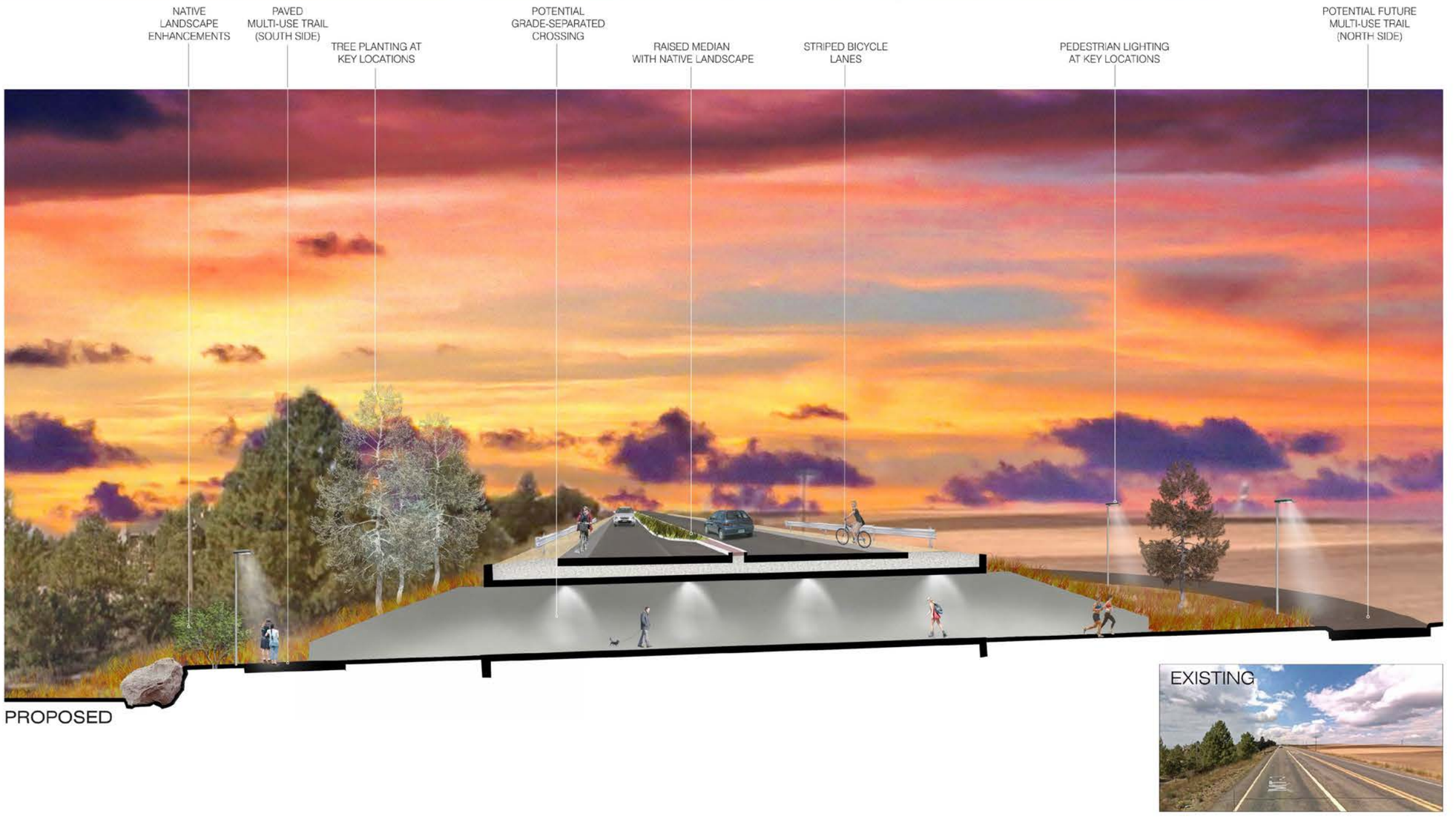


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FIGURE 13-PERSPECTIVE VIEW OF PROPOSED CORRIDOR IMPROVEMENTS (4)

TABLE 7. SUMMARY OF RECOMMENDED PROJECTS

Recommended Highway 3 Projects	Anticipated Cost
1. Install roundabout at Highway 3/Zimmerman Trail, including single circulating lane, northbound slip-lane for right-turning vehicles, bike and pedestrian accomodations.	$1.5 million
2. Install roundabout at Highway 3/Rod & Gun Club Road, including single circulating lane, single-lane approaches, and bike and pedestrian accomodations.	$1.5 million
3. Widen Highway 3 from N 27th Street to Zimmerman Trail (approximately 3 miles), including one thru lane each direction, bike lanes, center left-turn lanes and a median with native landscaping.	$4.5 million
4. Widen Highway 3 from Zimmerman Trail to Apache Trail (approximately 2 miles), including one thru lane each direction, bike lanes, and center turn lanes where needed for future development.	$2.6 million
5. Construct paved multi-use trail along south side of Highway 3 from N 27th Street to Apache Trail.	$2.25 million
6. Install bike/pedestrian underpasses as needed for multi-use trail connection across Zimmerman Trail, and north/south connections across Highway 3 for future development.	$500,000 each
7. Construct paved parking lot in central location across from the airport, including 25 parking spaces and pull-thru parking for oversized vehicles. Consider other trailhead amenities (restrooms, picnic shelter, etc.) in this location.	$350,000
8. Construct paved parking lot in east location (closest to N 27th Street), including 25 parking spaces and pull-thru parking for oversized vehicles.	$300,000
9. Construct paved parking lot in west location, including 25 parking spaces.	$250,000
10. Restore existing gravel area between new paved parking lots with native landscaping and natural drainage features.	$800,000
11. Install entryway feature along south side of Highway 3 near Zimmerman Park.	$50,000
12. Consider installation of proposed detention ponds along corridor, including a full hydraulic analysis to determine appropriate pond location, size and feasibility. The anticipated cost includes nine ponds designed to store the 100-year storm, outfall structures, and land acquisition.	$2.5 million
13. Consider future paved multi-use trail on the north side of the highway as area development occurs.	$2.0 million

APPENDIX A: TRAFFIC VOLUME DATA

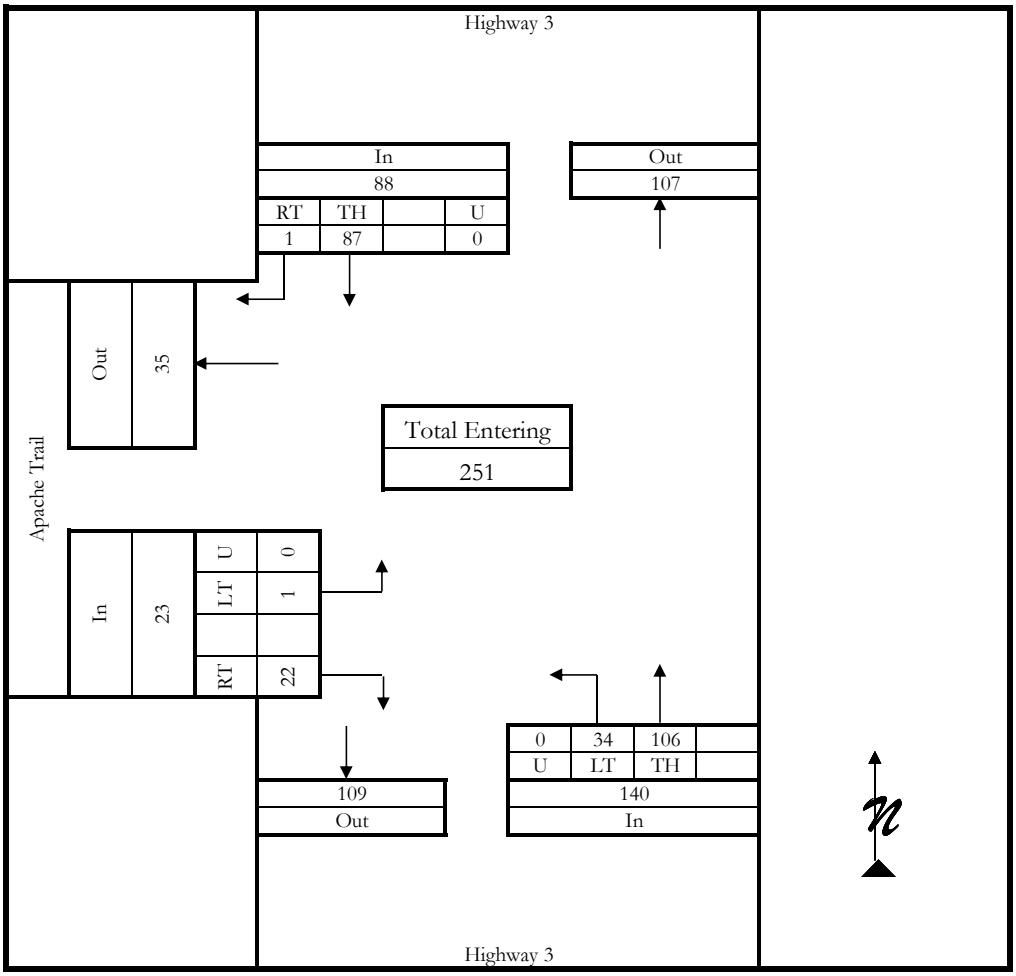
INTERSECTION TURNING MOVEMENT COUNT SUMMARY

General Information

Counted By:	V. Morasko	Intersection:	Highway 3/Apache Trail
Agency/Company:	Sanderson Stewart		
Date Performed:	Tuesday, June 24, 2014	Jurisdiction:	City of Billings / MDT
Count Time Period:	PM Peak Hour (4:45 - 5:45 PM)		
Project Number:	14027	Project Description:	Hwy 3 Corridor Planning Study
North/South Street:	Highway 3	East/West Street:	Apache Trail

Vehicle Volumes and Adjustments

	Highway 3 Southbound					Highway 3 Northbound					Apache Trail Eastbound					Westbound					Int.
Start Time	Right	Thru	Left	U-turn	Total	Right	Thru	Left	U-turn	Total	Right	Thru	Left	U-turn	Total	Right	Thru	Left	U-turn	Total	Total
Factor	0.89	0.89	0.89	0.89		0.89	0.89	0.89	0.89		0.90	0.90	0.90	0.90		0.00	0.00	0.00	0.00		
4:45 PM	0	28	0	0	28	0	28	7	0	35	6	0	1	0	7	0	0	0	0	0	70
5:00 PM	0	21	0	0	21	0	23	10	0	33	6	0	0	0	6	0	0	0	0	0	60
5:15 PM	1	18	0	0	19	0	19	12	0	31	5	0	0	0	5	0	0	0	0	0	55
5:30 PM	0	20	0	0	20	0	36	5	0	41	5	0	0	0	5	0	0	0	0	0	66
Grand Total	1	87	0	0	88	0	106	34	0	140	22	0	1	0	23	0	0	0	0	0	251
Medium Truck %	100.0	11.5	0.0	0.0	12.5	0.0	6.6	0.0	0.0	5.0	4.5	0.0	0.0	0.0	4.3	0.0	0.0	0.0	0.0	0.0	
Heavy Truck %	0.0	1.1	0.0	0.0	1.1	0.0	0.9	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Truck %	100.0	12.6	0.0	0.0	13.6	0.0	7.5	0.0	0.0	5.7	4.5	0.0	0.0	0.0	4.3	0.0	0.0	0.0	0.0	0.0	
Total %	0.4	34.7	0.0	0.0	35.1	0.0	42.2	13.5	0.0	55.8	8.8	0.0	0.4	0.0	9.2	0.0	0.0	0.0	0.0	0.0	100.0
PHF	0.79	0.79	0.79			0.85	0.85	0.85			0.82	0.82	0.82			0.00	0.00	0.00			0.90



INTERSECTION TURNING MOVEMENT COUNT SUMMARY

General Information

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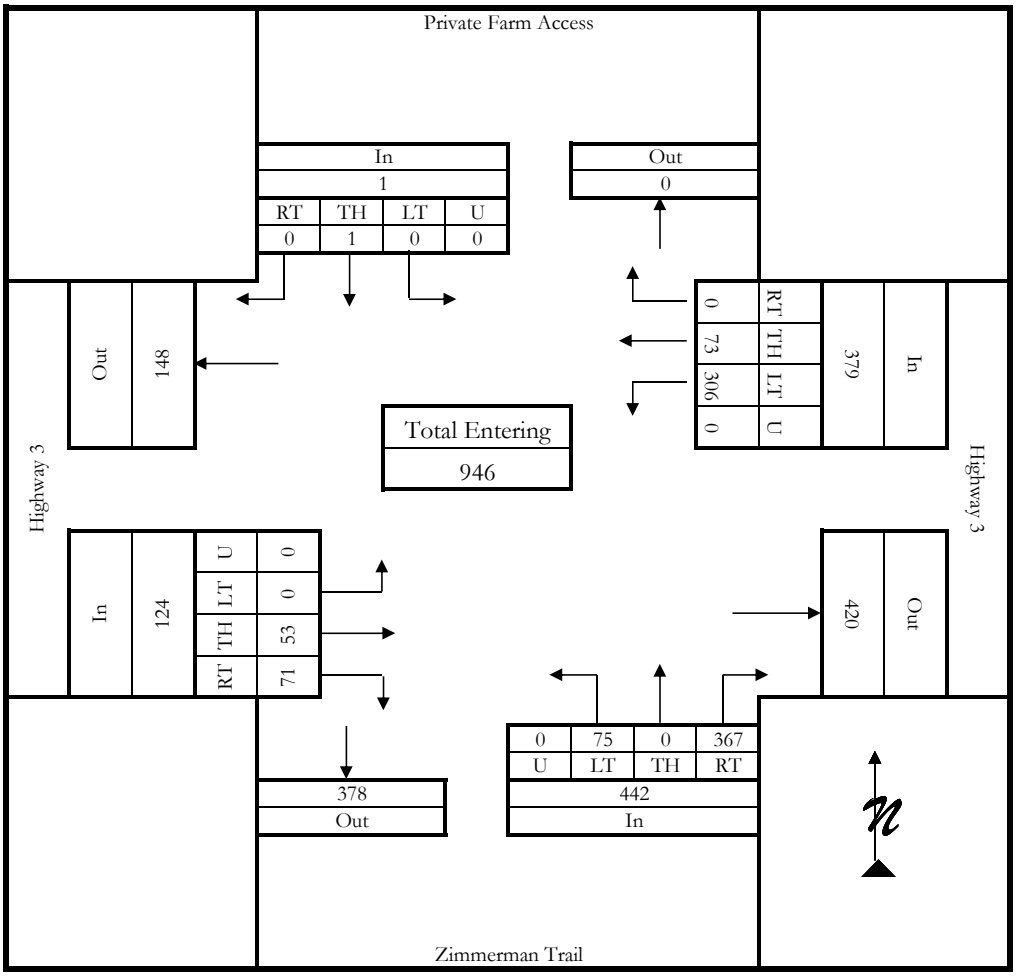
Count Time Period:	PM Peak Hour (4:45 - 5:45 PM)		
Project Number:	14027	Project Description:	Highway 3 Corridor Planning Study
North/South Street:	Zimmerman Trail	East/West Street:	Highway 3

Vehicle Volumes and Adjustments

	Private Farm Access Southbound					Zimmerman Trail Northbound					Highway 3 Eastbound					Highway 3 Westbound					Int.
Start Time	Right	Thru	Left	U-turn	Total	Right	Thru	Left	U-turn	Total	Right	Thru	Left	U-turn	Total	Right	Thru	Left	U-turn	Total	Total
Factor	0.89	0.89	0.89	0.89		0.89	0.89	0.89	0.89		0.89	0.89	0.89	0.89		0.89	0.89	0.89	0.89		
4:45 PM	0	0	0	0	0	82	0	18	0	100	22	16	0	0	38	0	12	66	0	78	216
5:00 PM	0	0	0	0	0	99	0	17	0	116	15	13	0	0	28	0	18	79	0	97	241
5:15 PM	0	0	0	0	0	97	0	19	0	116	18	12	0	0	30	0	24	92	0	116	262
5:30 PM	0	1	0	0	1	89	0	21	0	110	16	12	0	0	28	0	19	69	0	88	227
Grand Total	0	1	0	0	1	367	0	75	0	442	71	53	0	0	124	0	73	306	0	379	946
Medium Truck %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Heavy Truck %	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.3	0.0	1.1	5.6	17.0	0.0	0.0	10.5	0.0	9.6	1.0	0.0	2.6	
Total Truck %	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.3	0.0	1.1	5.6	17.0	0.0	0.0	10.5	0.0	9.6	1.0	0.0	2.6	
Total %	0.0	0.1	0.0	0.0	0.1	38.8	0.0	7.9	0.0	46.7	7.5	5.6	0.0	0.0	13.1	0.0	7.7	32.3	0.0	40.1	100.0
PHF	0.25	0.25	0.25			0.95	0.95	0.95			0.82	0.82	0.82			0.82	0.82	0.82			0.90



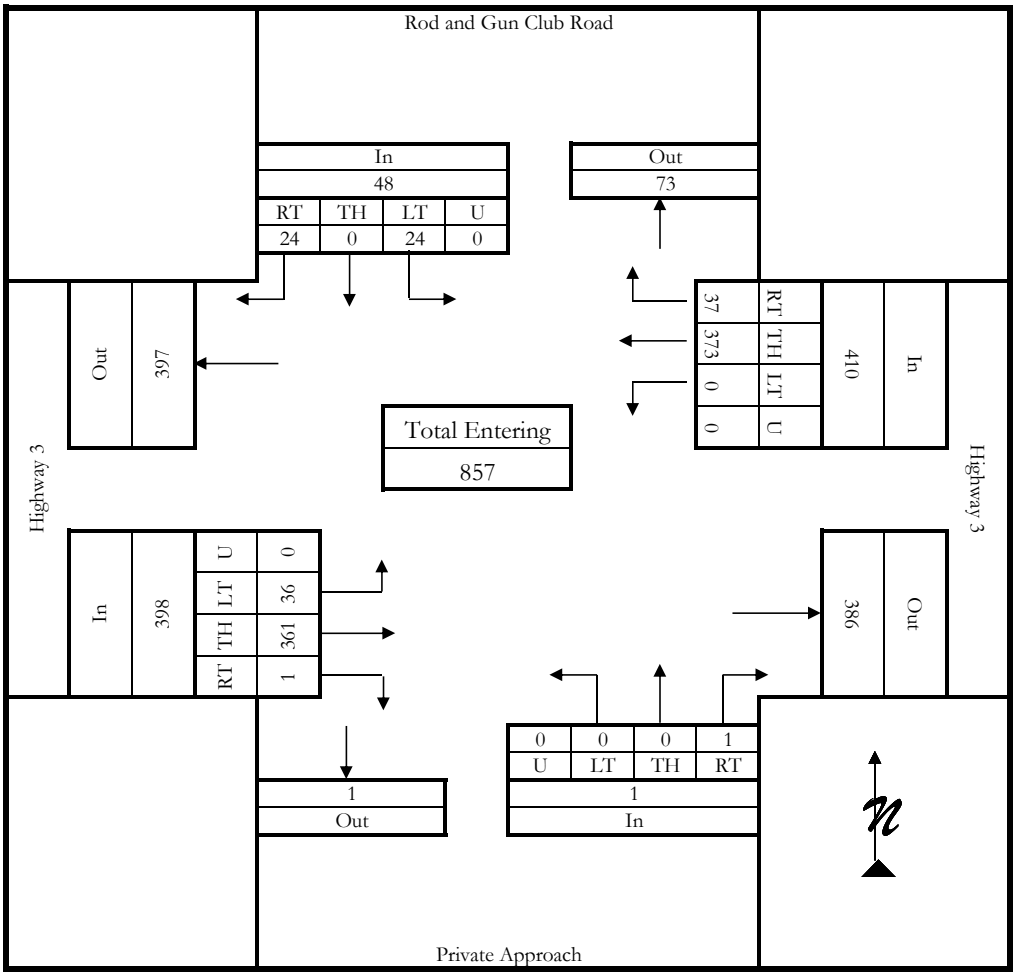
INTERSECTION TURNING MOVEMENT COUNT SUMMARY

General Information

Counted By:	V. Morasko	Intersection:	Highway 3/Rod and Gun Club Road
Agency/Company:	Sanderson Stewart		
Date Performed:	Wednesday, June 25, 2014	Jurisdiction:	City of Billings / MDT
Count Time Period:	PM Peak Hour (4:45 - 5:45 PM)		
Project Number:	14027	Project Description:	Highway 3 Corridor Planning Study
North/South Street:	Rod and Gun Club Road	East/West Street:	Highway 3

Vehicle Volumes and Adjustments

	Rod and Gun Club Road Southbound					Private Approach Northbound					Highway 3 Eastbound					Highway 3 Westbound					Int.
Start Time	Right	Thru	Left	U-turn	Total	Right	Thru	Left	U-turn	Total	Right	Thru	Left	U-turn	Total	Right	Thru	Left	U-turn	Total	Total
Factor	0.90	0.90	0.90	0.90		1.00	1.00	1.00	1.00		0.89	0.89	0.89	0.89		0.89	0.89	0.89	0.89		
4:45 PM	8	0	6	0	14	1	0	0	0	1	1	93	5	0	99	6	94	0	0	100	214
5:00 PM	4	0	2	0	6	0	0	0	0	0	0	94	11	0	105	11	93	0	0	104	215
5:15 PM	7	0	9	0	16	0	0	0	0	0	0	91	10	0	101	8	104	0	0	112	229
5:30 PM	5	0	7	0	12	0	0	0	0	0	0	83	10	0	93	12	82	0	0	94	199
Grand Total	24	0	24	0	48	1	0	0	0	1	1	361	36	0	398	37	373	0	0	410	857
Medium Truck %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Heavy Truck %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	2.3	0.0	4.6	0.0	0.0	4.1	
Total Truck %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	2.3	0.0	4.6	0.0	0.0	4.1	
Total %	2.8	0.0	2.8	0.0	5.6	0.1	0.0	0.0	0.0	0.1	0.1	42.1	4.2	0.0	46.4	4.3	43.5	0.0	0.0	47.8	100.0
PHF	0.75	0.75	0.75			0.25	0.25	0.25			0.95	0.95	0.95			0.92	0.92	0.92			0.94



SANDERSON STEWART

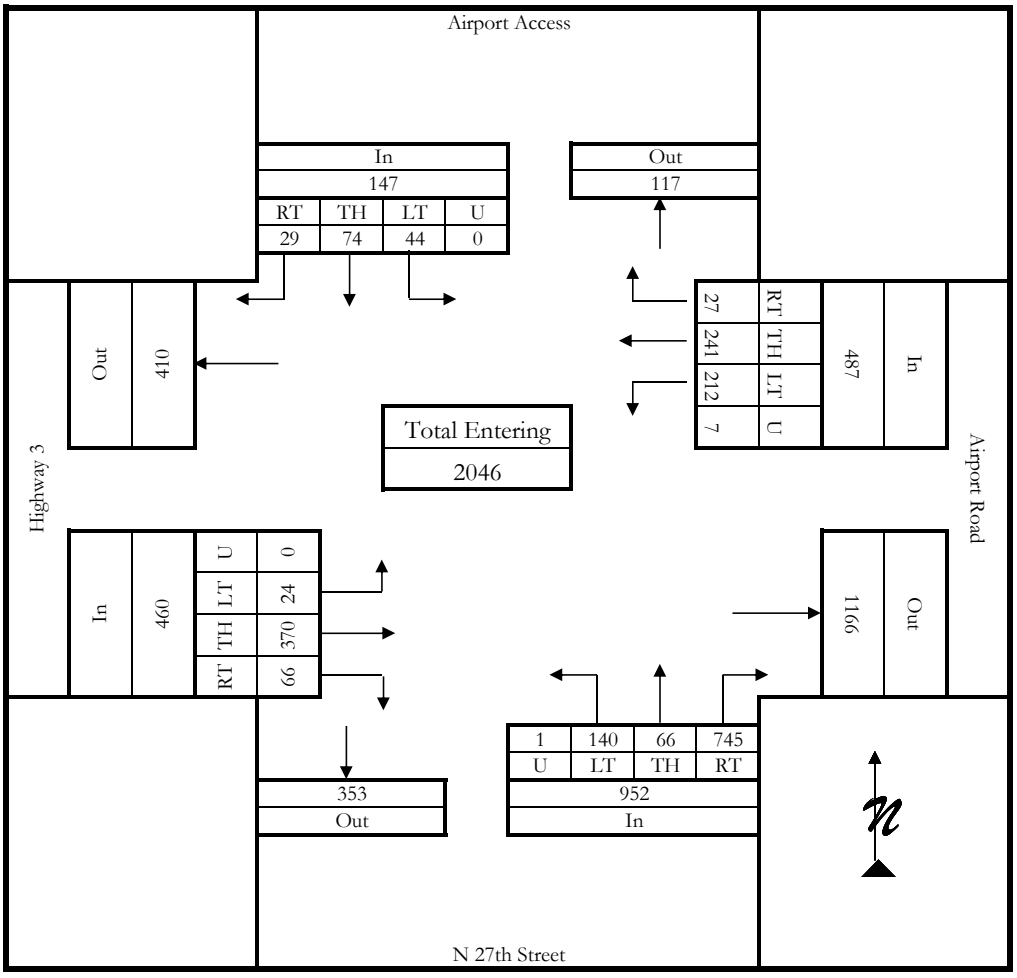
INTERSECTION TURNING MOVEMENT COUNT SUMMARY

General Information

Counted By:	V. Morasko	Intersection:	Highway 3/N 27th Street
Agency/Company:	Sanderson Stewart		
Date Performed:	Tuesday, June 24, 2014	Jurisdiction:	City of Billings / MDT
Count Time Period:	PM Peak Hour (4:45 - 5:45 PM)		
Project Number:	14027	Project Description:	Highway 3 Corridor Planning Study
North/South Street:	N 27th Street	East/West Street:	Highway 3

Vehicle Volumes and Adjustments

	Airport Access Southbound					N 27th Street Northbound					Highway 3 Eastbound					Airport Road Westbound					Int.
Start Time	Right	Thru	Left	U-turn	Total	Right	Thru	Left	U-turn	Total	Right	Thru	Left	U-turn	Total	Right	Thru	Left	U-turn	Total	Total
Factor	1.00	1.00	1.00	1.00		0.97	0.97	0.97	0.97		0.95	0.95	0.95	0.95		0.97	0.97	0.97	0.97		
4:45 PM	4	9	11	0	24	162	17	23	1	203	15	91	7	0	113	6	53	42	2	103	443
5:00 PM	3	18	6	0	27	247	13	48	0	308	17	91	2	0	110	3	68	62	3	136	581
5:15 PM	12	21	9	0	42	187	20	40	0	247	24	101	15	0	140	8	63	47	0	118	547
5:30 PM	10	26	18	0	54	149	16	29	0	194	10	87	0	0	97	10	57	61	2	130	475
Grand Total	29	74	44	0	147	745	66	140	1	952	66	370	24	0	460	27	241	212	7	487	2046
Medium Truck %	3.4	0.0	0.0	0.0	0.7	0.0	1.5	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.6	0.4	
Heavy Truck %	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.4	6.1	4.1	0.0	0.0	4.1	0.0	5.8	0.0	28.6	3.3	
Total Truck %	3.4	0.0	0.0	0.0	0.7	0.5	1.5	0.0	0.0	0.5	6.1	4.1	0.0	0.0	4.1	0.0	5.8	0.0	57.1	3.7	
Total %	1.4	3.6	2.2	0.0	7.2	36.4	3.2	6.8	0.0	46.5	3.2	18.1	1.2	0.0	22.5	1.3	11.8	10.4	0.3	23.8	100.0
PHF	0.68	0.68	0.68			0.77	0.77	0.77			0.82	0.82	0.82			0.90	0.90	0.90			0.88



HIGHWAY 3 CORRIDOR STUDY TRAFFIC PROJECTIONS

Methodology

Corridor traffic projection methodology was based on existing traffic patterns at the four key corridor intersections. Traffic patterns at the key intersections were converted to percentage distribution values to determine relative travel demand from and to separate corridor links. This resulted in an origin-destination trip table that was used to assign future travel patterns. The base trip table was reconfigured for future conditions involving the addition of the proposed Inner Belt Loop connection link using anticipated demographic changes in the future design year 2035.

2035 Existing System Traffic Projections

Historic traffic volume on the corridor links were acquired from the Montana Department of Transportation's (MDT) data base. Existing average annual daily traffic (AADT) volumes as well as peak pm hour turning movements at the key intersections are shown in Figure 1. Sanderson Stewart counted the intersections in June 2014 and those counts were compared to hourly counts taken by MDT in 2013. The intersection counts closely matched the 24 hours counts except at the intersection of Apache Trail and Highway 3. The intersection counts were increased by approximately 20% when it was determined that the 24 hour counts more accurately reflected the typical peak pm hour period.

The past ten years (2003-2013) of MDT AADT data along the corridor was selected for inclusion in historic growth analysis. Seven roadway links are shown in Table1 along with traffic volumes for each of the ten years. The average annual growth rate for each link was calculated and it is noted that all of the links had positive growth ranging from 0.2% to 5.5% annually. Multiplication factors were calculated using the annual percentage growth (compounded) to arrive at what is considered to be a high estimate of year 2035 volumes on the roadway links. In addition, a straight-line growth curve was calculated, which represented a low range estimate of year 2035 volumes. For this study, the average of the high and low factors was used to predict year 2035 traffic volumes on the existing system.

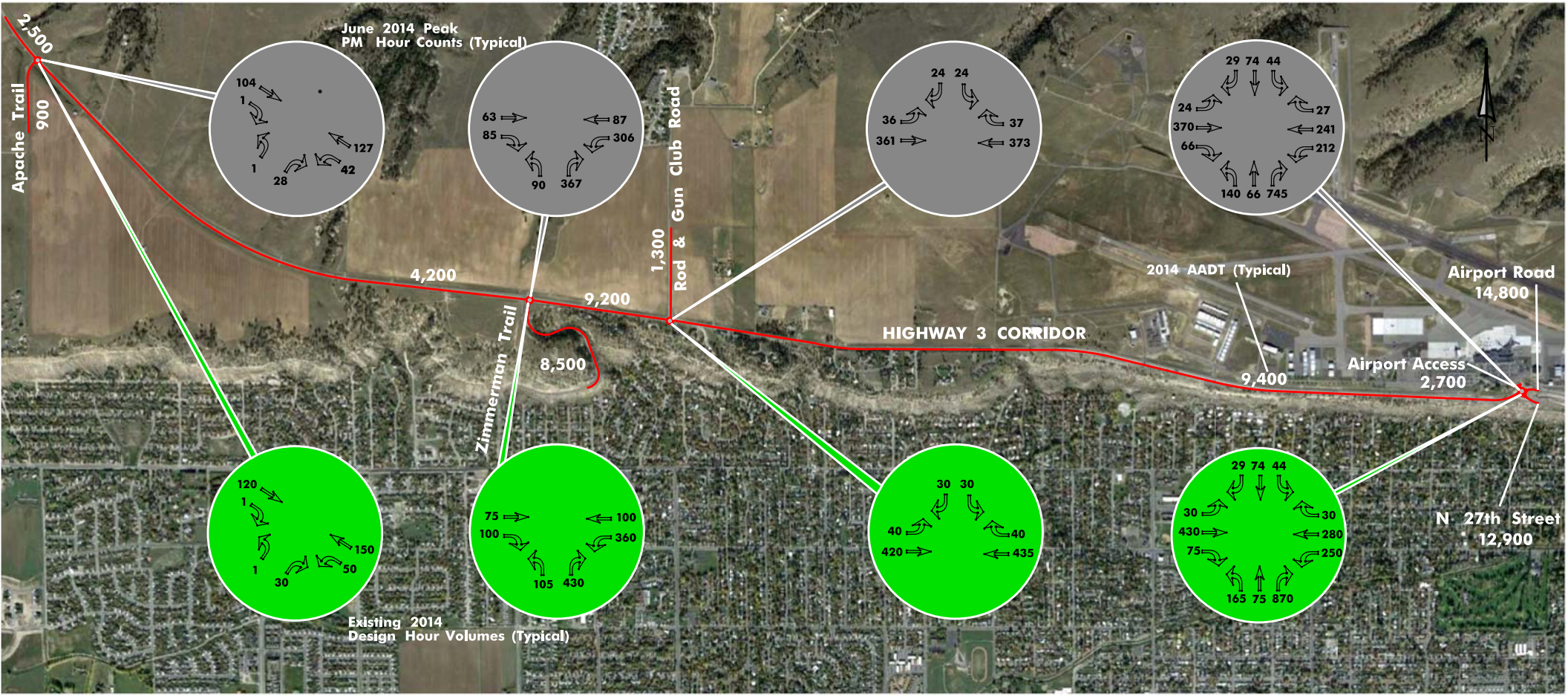
The appendix contains calculations and trip tables that were used in the models development. Single direction trip percentages and annual average daily traffic (AADT) volumes were calculated both from west to east and from east to west along the corridor using the year 2035 historic volume projections. Model results for year 2035 traffic projections on the existing system are shown in Figure 2. Figure 2 presents the AADT

traffic on each roadway link and the design hour traffic at each of the key intersections. The highest Highway 3 AADT would be approximately 12,700 between Zimmerman Trail and the Airport Road intersection. The highway volume model link would be Airport Road, east of the Airport at 20,700. Zimmerman Trail would have an AADT of 13,100 using the existing system scenario.

Year 2035 Traffic Projections with the Inner Belt Loop

Land use patterns using the 2014 Billings Urban Area Transportation Plan Update demographic projections were included in a revised traffic model that included the Inner Belt Loop connection between Highway 3 and Alkali Creek Road in Billings Heights. The revised model also included substantial increases in population and employment in the areas just north of Highway 3. An extension of Apache Trail to the north was included to represent future access to development north of Highway 3 and west of the Inner Belt Loop.

The model's traffic distribution tables were developed using existing traffic patterns modified by redistribution of traffic to and from the new Inner Belt Loop link. Trips generated by the projected land uses north of Highway 3 were calculated and included in the 2035 traffic projections. In addition, historic increases on connecting links were added and adjusted to account for traffic redistribution attributable to the Inner Belt Loop. A number of iterations involving peak hour balancing routines at individual intersections were made to calibrate the model for 2035 traffic conditions. Figure 3 presents the final results for year 2035 Highway 3 Corridor traffic projections. For this scenario Highway 3 between Zimmerman Trail and the Airport intersection and Zimmerman Trail itself would have AADT in excess of 14,000. The Inner Belt Loop AADT would be close to 9,000, while Airport Road, east of the Airport would only be 2,000 AADT higher than currently exists (14,800). West of Zimmerman Trail, Highway 3 would have an AADT of approximately 7,300. Mid-range growth projections were used in this analysis, but there is always the possibility that high range growth could occur and planning activities should consider the possibility that highway 3 Corridor AADT could range up to 20,000 AADT in the year 2035.



* Counts Factored to Match 2013 Electronic Count Data

Sources: Sanderson Stewart Turning Movement Counts June 2014
MDT Electronic Counters September 2013
MDT Permanent Count Station Monthly Variations & Design Hour Factors

Figure 1. 2014 Traffic Volumes – AADT & Key Intersection Movements

Sources: MDT Traffic by Section Reports 2003 to 2013
Marvin & Associates Traffic Model

Figure 2. 2035 Traffic Volumes Based on Historic Growth Factors

Sources: MDT Traffic by Section Reports 2003 to 2013
2014 Billings Urba Area Transportation Plan
Marvin & Associates Traffic Model

Figure 3. 2035 Traffic Volume Projections With Inner Belt Loop and Development Based On Transportation Plan Land Use Growth

Table 1. Historic Annual Average Daily Traffic on Highway 3 Corridor

Year	W of Apache Tr	W of Zimmerman Tr	Zimmerman Trail	E of Zimmerman Tr	W of Airport Intersection	E of Airport Intersection	South of Airport
2003	2370	3830	6590	6215	6340	12170	10200
2004	2780	3570	7310	6340	6750	10940	10340
2005	2780	3570	5910	6340	6520	10750	11130
2006	2400	3560	6520	6340	6990	11400	8660
2007	3650	4110	6310	8600	9020	11020	12200
2008	2520	3760	6110	8000	8350	10680	11300
2009	2400	3830	7140	6700	8500	10890	9450
2010	2430	3990	7980	8300	9240	12500	11460
2011	2540	4160	8530	9310	9910	13280	10890
2012	2830	4100	9130	9020	9150	14610	12710
2013	2420	4130	8420	9120	9330	14770	12840
% Annual Growth	**0.2%**	**0.7%**	**2.5%**	**3.9%**	**5.5%**	**2.0%**	**2.3%**
	Year 2035 High, Low & Mid-Range Growth Factors						
High % Annual Growth	1.04	1.15	1.64	2.15	2.92	1.49	1.36
Low Straight Line	1.04	1.15	1.43	1.64	1.64	1.18	1.41
Mid-Range Average	1.04	1.15	1.54	1.90	2.28	1.34	1.39

Highway 3 Hourly Traffic Variations - September 4 - 6, 2013 Averages

Begin Hour	West of Apache Tr.		West of Zimmerman		Zimmerman Trail		East of Zimmerman		West of Airport		East of Airport				South of Airport			
	Volume	% of Day	Volume	% of Day	Volume	% of Day	Volume	% of Day	Volume	% of Day	EB Vol.	WB Vol.	Total Vol.	% of Day	EB Vol.	WB Vol.	Total Vol.	% of Day
0:00	17	0.5%	31	0.7%	41	0.4%	47	0.5%	56	0.6%	58	36	94	0.6%	47	50	97	0.7%
1:00	25	0.8%	33	0.7%	31	0.3%	51	0.5%	54	0.5%	37	32	69	0.4%	37	32	69	0.5%
2:00	17	0.5%	18	0.4%	20	0.2%	29	0.3%	33	0.3%	22	18	40	0.2%	11	16	27	0.2%
3:00	14	0.4%	18	0.4%	22	0.2%	31	0.3%	36	0.4%	18	19	37	0.2%	11	29	40	0.3%
4:00	30	0.9%	37	0.8%	55	0.6%	63	0.6%	57	0.6%	27	49	76	0.5%	44	71	115	0.8%
5:00	49	1.5%	71	1.6%	170	1.8%	191	1.9%	183	1.8%	107	133	240	1.5%	106	156	262	1.9%
6:00	128	3.8%	184	4.1%	359	3.9%	396	4.0%	439	4.4%	213	314	527	3.3%	268	161	429	3.1%
7:00	201	6.0%	288	6.5%	742	8.0%	774	7.9%	822	8.2%	462	668	1130	7.0%	577	327	904	6.5%
8:00	180	5.4%	277	6.2%	613	6.6%	640	6.5%	643	6.4%	366	631	997	6.2%	501	290	791	5.7%
9:00	185	5.6%	261	5.9%	437	4.7%	488	5.0%	502	5.0%	362	385	747	4.6%	333	318	651	4.7%
10:00	203	6.1%	240	5.4%	439	4.7%	478	4.9%	489	4.9%	440	387	827	5.1%	307	424	731	5.3%
11:00	197	5.9%	263	5.9%	556	6.0%	590	6.0%	583	5.8%	555	401	956	5.9%	357	507	864	6.3%
12:00	212	6.4%	279	6.3%	532	5.8%	570	5.8%	578	5.8%	574	403	977	6.0%	416	533	949	6.9%
13:00	220	6.6%	274	6.2%	501	5.4%	554	5.7%	560	5.6%	546	372	918	5.7%	377	433	810	5.9%
14:00	202	6.1%	275	6.2%	545	5.9%	575	5.9%	589	5.9%	674	335	1009	6.2%	275	521	796	5.8%
15:00	216	6.5%	271	6.1%	613	6.6%	636	6.5%	648	6.5%	733	409	1142	7.0%	274	620	894	6.5%
16:00	303	9.1%	347	7.8%	778	8.4%	802	8.2%	782	7.8%	898	452	1350	8.3%	362	784	1146	8.3%
17:00	258	7.8%	324	7.3%	819	8.9%	822	8.4%	855	8.5%	1142	493	1635	10.1%	345	1024	1369	9.9%
18:00	240	7.2%	308	6.9%	623	6.7%	627	6.4%	632	6.3%	649	399	1048	6.5%	315	520	835	6.0%
19:00	142	4.3%	219	4.9%	457	4.9%	458	4.7%	458	4.6%	478	274	752	4.6%	238	385	623	4.5%
20:00	114	3.4%	194	4.4%	401	4.3%	403	4.1%	415	4.1%	437	206	643	4.0%	187	336	523	3.8%
21:00	77	2.3%	95	2.1%	246	2.7%	267	2.7%	274	2.7%	279	160	439	2.7%	110	218	328	2.4%
22:00	56	1.7%	75	1.7%	145	1.6%	182	1.9%	202	2.0%	220	118	338	2.1%	92	205	297	2.2%
23:00	42	1.3%	60	1.4%	99	1.1%	129	1.3%	141	1.4%	135	78	213	1.3%	129	126	255	1.8%
Totals =	**3328**	**100.0%**	**4442**	**100.0%**	**9244**	**100.0%**	**9803**	**100.0%**	**10031**	**100.0%**	**9432**	**6772**	**16204**	**100.0%**	**5719**	**8086**	**13805**	**100.0%**

Year 2014 Peak PM Hour Traffic Distribution

Apache Trail - HWY 3				
	LT	TH	RT	TOT
NB	1		28	29
EB		104	1	105
WB	42	127		169
Percentages				
NB	3.4%	0.0%	96.6%	
EB	0.0%	99.0%	1.0%	
WB	24.9%	75.1%	0.0%	

Zimmerman Trail - HWY 3				
	LT	TH	RT	TOT
NB	90		367	457
EB		63	85	148
WB	306	87		393
Percentages				
NB	19.7%	0.0%	80.3%	
EB	0.0%	42.6%	57.4%	
WB	77.9%	22.1%	0.0%	

Rod & Gun Club - HWY 3				
	LT	TH	RT	TOT
SB	24		24	48
EB	36	361		397
WB		373	37	410
Percentages				
SB	50.0%	0.0%	50.0%	
EB	9.1%	90.9%	0.0%	
WB	0.0%	91.0%	9.0%	

Airport - HWY 3 (N 27th)				
	LT	TH	RT	TOT
NB	140	66	745	951
SB	44	74	29	147
EB	24	370	66	460
WB	212	241	27	480
Percentages				
NB	14.7%	6.9%	78.3%	
SB	29.9%	50.3%	19.7%	
EB	5.2%	80.4%	14.3%	
WB	44.2%	50.2%	5.6%	

West To East Distribution

	HWY 3		Apache Trail - HWY 3				Zimmerman Trail - HWY 3				Rod & Gun Club - HWY 3				Airport - HWY 3 (N 27th)			
			LT	TH	RT	TOT	LT	TH	RT	TOT	LT	TH	RT	TOT	LT	TH	RT	TOT
HWY 3 West of Apache to Airport	EB Vol =	105		104	1	105		44	60	104	4	40		44	2	32	6	40
Apache Trail to Airport	EB Vol =	28						12	16	28	3	9		12	0	7	1	8
Zimmerman Trail to Airport	EB Vol =	367									33	334		367	17	269	48	334
Rod & Gun Club to Airport	EB Vol =	24													1	19	3	23
	Totals			104	1	105		56	76	132	40	383		423	20	327	58	405

East to West Distribution

N 27th South of Airport to Apache	WB Vol =	140	7	21		28	99	28		127		127	13	140	140			140
Airport Road East of Airport- Appache	WB Vol =	241	12	36		48	171	48		219		219	22	241		241		241
Airport Access to Apache	WB Vol =	29	1	5		6	20	6		26		26	3	29			29	29
Rod & Gun Club to Apache	WB Vol =	24	1	4		5	19	5		24								
Zimmerman to Apache	WB Vol =	90	22	68		90												
	Totals		43	134		177	309	87		396		372	38	410	140	241	29	410

Single Direction Volumes

	HWY 3 West	Apache Trail	Zimmerman	Rod & Gun Club	Airport Access	Airport Road	N. 27th Street	
HWY 3 West		1	60	4	2	32	6	105
Apache Trail	1		16	3	0	7	1	28
Zimmerman	68	22		33	17	269	48	457
Rod & Gun Club	4	1	19		1	19	3	47
Airport Access	5	1	20	3		44	74	147
Airport Road	36	12	171	22	27		212	480
N. 27th Street	21	7	99	13	66	745		951
	135	44	385	78	113	1116	344	2215

Bi-directional Volumes

	HWY 3 West	Apache Trail	Zimmerman	Rod & Gun Club	Airport Access	Airport Road	N. 27th Street	
HWY 3 West								240
Apache Trail	2							116
Zimmerman	128	82						886
Rod & Gun Club	8	4	52					125
Airport Access	7	1	37	4				260
Airport Road	68	19	440	41	71			1596
N. 27th Street	27	8	147	16	140	957		1295
	240	114	676	61	211	957	0	4518

Table 2014 Traffic Distribution on Highway 3 Corridor Origin-Destination Links

		% of AADT Traffic on O-D Links To and From Complimentary Links						
O-D Links	**2014 AADT**	**HWY 3 West**	**Apache Trail**	**Zimmerman**	**Rod & Gun Club**	**Airport Access**	**Airport Road**	**N. 27th Street**
HWY 3 West	2500		1%	53%	3%	3%	28%	11%
Apache Trail	900	2%		71%	3%	1%	16%	7%
Zimmerman	8500	14%	9%		6%	4%	50%	17%
Rod & Gun Club	1300	6%	3%	42%		3%	33%	13%
Airport Access	2700	3%	0%	14%	2%		27%	54%
Airport Road	14800	4%	1%	28%	3%	4%		60%
N. 27th Street	12900	2%	1%	11%	1%	11%	74%	

Table 2014 AADT Volumes on Highway 3 Corridor Betewen Origin-Destination Links

		AADT Between O-D Links						
O-D Links	**2014 AADT**	**HWY 3 West**	**Apache Trail**	**Zimmerman**	**Rod & Gun Club**	**Airport Access**	**Airport Road**	**N. 27th Street**
HWY 3 West	2500		10	667	42	36	354	141
Apache Trail	900	16		318	16	4	74	31
Zimmerman	8500	614	393		249	177	2111	705
Rod & Gun Club	1300	42	21	270		21	213	83
Airport Access	2700	36	5	192	21		369	727
Airport Road	14800	315	88	2040	190	329		4437
N. 27th Street	12900	134	40	732	80	697	4767	
		1157	558	4220	597	1265	7887	6124

Table 2035 Traffic Projections O-D Links Based on Mid Range Growth Factors

		AADT Between O-D Links						
O-D Links	**2035 AADT**	**HWY 3 West**	**Apache Trail**	**Zimmerman**	**Rod & Gun Club**	**Airport Access**	**Airport Road**	**N. 27th Street**
HWY 3 West	2625		11	700	44	38	372	148
Apache Trail	1350	12		477	23	6	111	47
Zimmerman	13090	946	606		384	273	3250	1086
Rod & Gun Club	2470	79	40	514		40	405	158
Airport Access	4050	55	8	288	31		553	1090
Airport Road	20720	441	123	2856	266	461		6212
N. 27th Street	17931	187	55	1018	111	969	6625	

HWY 3 AADT PROJECTIONS	**Model**	**Adjusted**
West of Apache Trail	**3032**	**2625**
Appache Trail	**1518**	**1350**
West of Zimmerman	**4527**	**4500**
Zimmerman Trail	**12398**	**13090**
East of Zimmerman	**11445**	**12700**
Rod & Gun Club Road	**2094**	**2470**
West of Airport	**11372**	**12700**
East of Airport	**20720**	**20720**
Airport Access	**4050**	**4050**
N. 27th Street	**17931**	**17930**

Year 2014 Peak PM Hour Traffic Distribution with Inner Belt Loop

Apache Trail - HWY 3				
	LT	TH	RT	TOT
NB	1		28	29
EB		104	1	105
WB	42	127		169

Zimmerman Trail - HWY 3				
	LT	TH	RT	TOT
NB	104	150	203	457
SB	41	88	6	135
EB	16	60	72	148
WB	122	84	61	268

Rod & Gun Club - HWY 3				
	LT	TH	RT	TOT
SB	24		24	48
EB	36	361		397
WB		376	37	413

Airport - HWY 3 (N 27th)				
	LT	TH	RT	TOT
NB	140	66	745	951
SB	44	74	29	147
EB	24	295	66	385
WB	212	190	27	429

Percentages			
NB	3.4%	0.0%	96.6%
EB	0.0%	99.0%	1.0%
WB	24.9%	75.1%	0.0%

Percentages			
NB	22.7%	32.9%	44.4%
SB	30.2%	65.1%	4.7%
EB	10.8%	40.5%	48.7%
WB	45.6%	31.5%	22.9%

Percentages			
SB	50.0%	0.0%	50.0%
EB	9.1%	90.9%	0.0%
WB	0.0%	91.0%	9.0%

Percentages			
NB	14.7%	6.9%	78.3%
SB	29.9%	50.3%	19.7%
EB	6.2%	76.6%	17.1%
WB	49.4%	44.3%	6.3%

West To East Distribution

	HWY 3		LT	TH	RT	TOT	LT	TH	RT	TOT	LT	TH	RT	TOT	LT	TH	RT	TOT
HWY 3 West of Apache to Airport	EB Vol =	105		104	1	105	11	42	51	104	4	38		42	2	29	7	38
Apache Trail to Airport	EB Vol =	28					3	11	14	28	3	8		11	0	6	1	7
Zimmerman Trail to Airport	EB Vol =	243.7									22	221.7		243.7	14	170	38	222
Rod & Gun Club to Airport	EB Vol =	24													1	18	4	23
			Totals	104	1	105	14	53	65		29	267.7		296.7	17	223	50	290

East to West Distribution

N 27th South of Airport to Apache	WB Vol =	140	10	30		40	58	40	29	127		127	13	140	140			140
Airport Road East of Airport- Appache	WB Vol =	190	13	41		54	79	54	40	173		173	17	190		190		190
Airport Access to Apache	WB Vol =	29	3	11		14	12	14	6	32		26	3	29			29	29
Rod & Gun Club to Apache	WB Vol =	24	2	6		8	11	8	5	24								
Zimmerman to Apache	WB Vol =	110.1	27	83.08		110.1												
		Totals	55	171.1		226.1	160	116	80	356		326	33	359	140	190	29	359

Single Direction Volumes

	HWY 3 West	Apache Trail	Zimmer/Inner	Rod & Gun Club	Airport Access	Airport Road	N. 27th Street
HWY 3 West		1	62	4	2	29	7
Apache Trail	1		17	3	0	6	1
Zimmer/Inner	83.084	27		22	14	170	38
Rod & Gun Club	6	2	16		1	18	4
Airport Access	11	3	18	3		44	74
Airport Road	41	13	119	17	27		212
N. 27th Street	30	10	87	13	66	745	
	172.084	56	319	62	110	1012	336

Bi-directional Volumes

	HWY 3 West	Apache Trail	Zimmer/Inner	Rod & Gun Club	Airport Access	Airport Road	N. 27th Street
HWY 3 West							
Apache Trail	2						
Zimmer/Inner	145.084	89					
Rod & Gun Club	10	5	38				
Airport Access	13	3	32	4			
Airport Road	70	19	289	35	71		
N. 27th Street	37	11	125	17	140	957	
	277.084	127	484	56	211	957	0

Table 2014 Traffic Distribution on Highway 3 Corridor Origin-Destination Links

		% of AADT Traffic on O-D Links To and From Complimentary Links						
O-D Links	**2014 AADT**	**HWY 3 West**	**Apache Trail**	**Zimmer/Inner**	**Rod & Gun Club**	**Airport Access**	**Airport Road**	**N. 27th Street**
HWY 3 West	2500		1%	52%	4%	5%	25%	13%
Apache Trail	900	2%		69%	4%	2%	15%	9%
Zimmer/Inner	8500	20%	12%		5%	4%	40%	17%
Rod & Gun Club	1300	9%	5%	35%		4%	32%	16%
Airport Access	2700	5%	1%	12%	2%		27%	53%
Airport Road	14800	5%	1%	20%	2%	5%		66%
N. 27th Street	12900	3%	1%	10%	1%	11%	74%	

Table 2014 Traffic Volumes on Highway 3 Corridor Between Origin-Destination Links

		AADT Between O-D Links						
O-D Links	**2014 AADT**	**HWY 3 West**	**Apache Trail**	**Zimmer/Inner**	**Rod & Gun Club**	**Airport Access**	**Airport Road**	**N. 27th Street**
HWY 3 West	2500		9	655	45	59	316	167
Apache Trail	900	7		310	17	10	66	38
Zimmer/Inner	12500	1263	775		331	279	2515	1088
Rod & Gun Club	1300	60	30	227		24	209	101
Airport Access	2700	133	31	329	41		729	1437
Airport Road	14800	359	98	1484	180	365		4915
N. 27th Street	12900	185	55	626	85	702	4796	

Table 2035 Traffic Projections O-D Links Based on Land Use Projections

		AADT Between O-D Links						
O-D Links	**2035 AADT**	**HWY 3 West**	**Apache Trail**	**Zimmer/Inner**	**Rod & Gun Club**	**Airport Access**	**Airport Road**	**N. 27th Street**
HWY 3 West	2950		11	772	53	69	373	197
Apache Trail*	3650	28		1259	71	42	269	156
Zimmer/Inner*	24150	2440	1497		639	538	4860	2102
Rod & Gun Club	4300	197	99	750		79	690	335
Airport Access	4050	100	23	246	31		547	1078
Airport Road	16720	406	110	1677	203			5552
N. 27th Street	17931	258	77	871	118		6667	

*** Sum of North & South Approaches**

HWY 3 AADT PROJECTIONS	**Model**	**Adjusted**
West of Apache Trail	**4904**	**4000**
Appache Trail*	**1100**	**1350**
Apache Tr North	**1870**	**2300**
West of Zimmerman	**7248**	**7250**
Zimmerman Trail	**14940**	**14900**
Inner Beltloop	**8750**	**8800**
East of Zimmerman	**14181**	**14200**
Rod & Gun Club Road	**4300**	**4300**
West of Airport	**14593**	**14500**
East of Airport	**16720**	**16750**
Airport Access	**4050**	**4050**
N. 27th Street	**17931**	**17900**

APPENDIX B: CAPACITY CALCULATION RESULTS

Intersection	
Intersection Delay (sec/veh):	1.9

Movement	SET	SER	NWL	NWT	NEL	NER
Volume (vph)	120	1	50	150	1	30
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length		0	375		0	0
Median Width	12			12	12	
Grade (%)	0%			0%	0%	
Peak Hour Factor	0.79	0.79	0.85	0.85	0.82	0.82
Heavy Vehicles(%)	13	100	0	8	0	5
Movement Flow Rate	152	1	59	176	1	37
Number of Lanes	1	0	1	1	1	0

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	0	0	153	0	358	153
Stage 1	-	-	-	-	153	-
Stage 2	-	-	-	-	205	-
Follow-up Headway	-	-	2.2	-	3.5	3.345
Pot Capacity-1 Maneuver	-	-	1440	-	644	885
Stage 1	-	-	-	-	880	-
Stage 2	-	-	-	-	834	-
Time blocked-Platoon(%)	-	-	0	-	0	0
Mov Capacity-1 Maneuver	-	-	1440	-	644	885
Mov Capacity-2 Maneuver	-	-	-	-	644	-
Stage 1	-	-	-	-	880	-
Stage 2	-	-	-	-	834	-

Approach	SE	NW	NE
HCM Control Delay (s)	0	1.9	9.1
HCM LOS	A	A	A

Lane	NELn1	NWL	NWT	SET	SER
Capacity (vph)	915				
HCM Control Delay (s)	9.1	7.606	-	-	-
HCM Lane VC Ratio	0.041	0.041	-	-	-
HCM Lane LOS	A	A	-	-	-
HCM 95th Percentile Queue (veh)	0.129	0.128	-	-	-

Intersection	
Intersection Delay (sec/veh):	12

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	0	75	100	360	100	0	105	0	430	0	1	0
Conflicting Peds.(#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		400	550		0	200		0	0		0
Median Width		12			12			12			12	
Grade (%)		0%			0%			0%			0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82	0.95	0.95	0.95	0.25	0.25	0.25
Heavy Vehicles(%)	0	17	6	1	10	0	2	0	1	0	0	0
Movement Flow Rate	0	91	122	439	122	0	111	0	453	0	4	0
Number of Lanes	0	1	1	1	1	0	1	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow Rate - All	-	0	0	213	0	-	1093	1152	107	1046	1213	61
Stage 1	-	-	-	-	-	-	152	152	-	1000	1000	-
Stage 2	-	-	-	-	-	-	941	1000	-	46	213	-
Follow-up Headway	0	-	-	2.209	-	0	3.518	4	3.309	3.5	4	3.3
Pot Capacity-1 Maneuver	0	-	-	1363	-	0	192	199	950	208	183	1010
Stage 1	0	-	-	-	-	0	850	775	-	295	324	-
Stage 2	0	-	-	-	-	0	316	324	-	973	730	-
Time blocked-Platoon(%)	0	-	-	0	-	0	0	0	0	0	0	0
Mov Capacity-1 Maneuver	-	-	-	1363	-	-	189	199	950	109	183	1010
Mov Capacity-2 Maneuver	-	-	-	-	-	-	189	199	-	109	183	-
Stage 1	-	-	-	-	-	-	-	775	-	-	324	-
Stage 2	-	-	-	-	-	-	312	324	-	509	730	-

Approach	EB	WB	NB	SB
HCM Control Delay (s)	0	7	21.5	25.1
HCM LOS	A	A	C	D

Lane	NBLn1	NBLn2	EBT	EBR	WBL	WBT	SBLn1
Capacity (vph)	189	729					183
HCM Control Delay (s)	35.7	19.4	-	-	8.891	0	25.1
HCM Lane VC Ratio	0.39	0.671	-	-	0.322	-	0.022
HCM Lane LOS	E	C	-	-	A	A	D
HCM 95th Percentile Queue (veh)	1.713	5.22	-	-	1.408	-	0.067

Intersection	
Intersection Delay (sec/veh):	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	40	420	1	0	435	40	0	0	1	30	0	30
Conflicting Peds.(#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	575		0	0		125	0		0	250		250
Median Width		12			12			12			12	
Grade (%)		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.92	0.92	0.92	0.25	0.25	0.25	0.75	0.75	0.75
Heavy Vehicles(%)	0	3	0	0	5	0	0	0	0	0	0	0
Movement Flow Rate	42	442	1	0	473	43	0	0	4	40	0	40
Number of Lanes	1	1	0	0	1	1	0	1	0	1	0	1

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow Rate - All	516	0	0	-	0	0	764	1043	222	800	~	259
Stage 1	-	-	-	-	-	-	527	527	-	495	-	-
Stage 2	-	-	-	-	-	-	237	516	-	305	-	-
Follow-up Headway	2.2	-	-	0	-	-	3.5	4	3.3	3.5	0	3.3
Pot Capacity-1 Maneuver	1060	-	-	0	-	-	323	231	823	306	0	785
Stage 1	-	-	-	0	-	-	538	532	-	560	0	-
Stage 2	-	-	-	0	-	-	771	538	-	709	0	-
Time blocked-Platoon(%)	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1060	-	-	-	-	-	307	231	823	305	-	785
Mov Capacity-2 Maneuver	-	-	-	-	-	-	307	231	-	305	-	-
Stage 1	-	-	-	-	-	-	538	532	-	560	-	-
Stage 2	-	-	-	-	-	-	732	538	-	706	-	-

Approach	EB	WB	NB	SB
HCM Control Delay (s)	0.7	0	9.4	14.2
HCM LOS	A	A	A	B

Lane	NBLn1	EBL	EBT	EBR	WBT	WBR	SBLn1	SBLn2
Capacity (vph)	823						305	785
HCM Control Delay (s)	9.4	8.537	0	-	-	-	18.6	9.8
HCM Lane VC Ratio	0.005	0.04	-	-	-	-	0.131	0.051
HCM Lane LOS	A	A	A	-	-	-	C	A
HCM 95th Percentile Queue (veh)	0.015	0.124	-	-	-	-	0.447	0.161

Intersection	
Intersection Delay (sec/veh):	0.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	1	450	5	5	475	1	5	0	5	1	0	1
Conflicting Peds.(#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade (%)		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2	2	2	2	2	2	2
Movement Flow Rate	1	489	5	5	516	1	5	0	5	1	0	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow Rate - All	517	0	0	494	0	0	1021	1021	492	1023	1023	517
Stage 1	-	-	-	-	-	-	494	494	-	527	527	-
Stage 2	-	-	-	-	-	-	527	527	-	496	496	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1049	-	-	1070	-	-	215	236	577	214	236	558
Stage 1	-	-	-	-	-	-	557	547	-	535	529	-
Stage 2	-	-	-	-	-	-	535	528	-	556	545	-
Time blocked-Platoon(%)	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1049	-	-	1070	-	-	213	234	577	211	234	558
Mov Capacity-2 Maneuver	-	-	-	-	-	-	213	234	-	211	234	-
Stage 1	-	-	-	-	-	-	556	546	-	534	525	-
Stage 2	-	-	-	-	-	-	533	524	-	547	544	-

Approach	EB	WB	NB	SB
HCM Control Delay (s)	0	0.1	13.7	13.6
HCM LOS	A	A	B	B

Lane	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (vph)	426							422
HCM Control Delay (s)	13.7	8.435	0	-	8.382	0	-	13.6
HCM Lane VC Ratio	0.026	0.001	-	-	0.005	-	-	0.005
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th Percentile Queue (veh)	0.078	0.003	-	-	0.015	-	-	0.016

Intersection	
Intersection Delay (sec/veh):	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	20	450	5	5	475	20	5	0	5	20	0	20
Conflicting Peds.(#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade (%)		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2	2	2	2	2	2	2
Movement Flow Rate	22	489	5	5	516	22	5	0	5	22	0	22
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow Rate - All	538	0	0	494	0	0	1084	1084	492	1075	1075	527
Stage 1	-	-	-	-	-	-	536	536	-	537	537	-
Stage 2	-	-	-	-	-	-	548	548	-	538	538	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1030	-	-	1070	-	-	194	217	577	197	220	551
Stage 1	-	-	-	-	-	-	529	524	-	528	523	-
Stage 2	-	-	-	-	-	-	521	517	-	527	522	-
Time blocked-Platoon(%)	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1030	-	-	1070	-	-	181	209	577	190	212	551
Mov Capacity-2 Maneuver	-	-	-	-	-	-	181	209	-	190	212	-
Stage 1	-	-	-	-	-	-	514	509	-	513	519	-
Stage 2	-	-	-	-	-	-	486	513	-	518	507	-

Approach	EB	WB	NB	SB
HCM Control Delay (s)	0.4	0.1	15.3	15.7
HCM LOS	A	A	C	C

Lane	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (vph)	362							380
HCM Control Delay (s)	15.3	8.57	0	-	8.382	0	-	15.7
HCM Lane VC Ratio	0.03	0.021	-	-	0.005	-	-	0.114
HCM Lane LOS	C	A	A	-	A	A	-	C
HCM 95th Percentile Queue (veh)	0.093	0.065	-	-	0.015	-	-	0.384

Intersection	
Intersection Delay (sec/veh):	0.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	20	535	475	20	20	20
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length	0			0	0	0
Median Width		0	0		12	
Grade (%)		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2
Movement Flow Rate	22	582	516	22	22	22
Number of Lanes	0	1	1	0	1	0

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	538	0	0	0	1152	527
Stage 1	-	-	-	-	527	-
Stage 2	-	-	-	-	625	-
Follow-up Headway	2.218	-	-	-	3.518	3.318
Pot Capacity-1 Maneuver	1030	-	-	-	219	551
Stage 1	-	-	-	-	592	-
Stage 2	-	-	-	-	534	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	1030	-	-	-	212	551
Mov Capacity-2 Maneuver	-	-	-	-	212	-
Stage 1	-	-	-	-	592	-
Stage 2	-	-	-	-	517	-

Approach	EB	WB	SB
HCM Control Delay (s)	0.3	0	14.5
HCM LOS	A	A	B

Lane	EBL	EBT	WBT	WBR	SBLn1
Capacity (vph)					424
HCM Control Delay (s)	8.57	-	-	-	14.5
HCM Lane VC Ratio	0.021	-	-	-	0.103
HCM Lane LOS	A	-	-	-	B
HCM 95th Percentile Queue (veh)	0.065	-	-	-	0.34

Intersection	
Intersection Delay (sec/veh):	0.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	20	535	475	20	20	20
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length	0			0	0	0
Median Width		0	0		12	
Grade (%)		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2
Movement Flow Rate	22	582	516	22	22	22
Number of Lanes	0	1	1	0	1	0

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	538	0	0	0	1152	527
Stage 1	-	-	-	-	527	-
Stage 2	-	-	-	-	625	-
Follow-up Headway	2.218	-	-	-	3.518	3.318
Pot Capacity-1 Maneuver	1030	-	-	-	219	551
Stage 1	-	-	-	-	592	-
Stage 2	-	-	-	-	534	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	1030	-	-	-	212	551
Mov Capacity-2 Maneuver	-	-	-	-	212	-
Stage 1	-	-	-	-	592	-
Stage 2	-	-	-	-	517	-

Approach	EB	WB	SB
HCM Control Delay (s)	0.3	0	14.5
HCM LOS	A	A	B

Lane	EBL	EBT	WBT	WBR	SBLn1
Capacity (vph)					424
HCM Control Delay (s)	8.57	-	-	-	14.5
HCM Lane VC Ratio	0.021	-	-	-	0.103
HCM Lane LOS	A	-	-	-	B
HCM 95th Percentile Queue (veh)	0.065	-	-	-	0.34

Intersection	
Intersection Delay (sec/veh):	0.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	20	535	475	20	20	20
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length	0			0	0	0
Median Width		0	0		12	
Grade (%)		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2
Movement Flow Rate	22	582	516	22	22	22
Number of Lanes	0	1	1	0	1	1

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	538	0	0	0	1152	527
Stage 1	-	-	-	-	527	-
Stage 2	-	-	-	-	625	-
Follow-up Headway	2.218	-	-	-	3.518	3.318
Pot Capacity-1 Maneuver	1030	-	-	-	219	551
Stage 1	-	-	-	-	592	-
Stage 2	-	-	-	-	534	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	1030	-	-	-	212	551
Mov Capacity-2 Maneuver	-	-	-	-	212	-
Stage 1	-	-	-	-	592	-
Stage 2	-	-	-	-	517	-

Approach	EB	WB	SB
HCM Control Delay (s)	0.3	0	17.8
HCM LOS	A	A	C

Lane	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (vph)					212	551
HCM Control Delay (s)	8.57	-	-	-	23.9	11.8
HCM Lane VC Ratio	0.021	-	-	-	0.103	0.039
HCM Lane LOS	A	-	-	-	C	B
HCM 95th Percentile Queue (veh)	0.065	-	-	-	0.338	0.123

Intersection	
Intersection Delay (sec/veh):	0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Volume (vph)	450	5	5	475	5	5
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length		0	0		0	0
Median Width	0			0	12	
Grade (%)	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2
Movement Flow Rate	489	5	5	516	5	5
Number of Lanes	1	0	0	1	1	0

Major/Minor	Major 1			Major 2		
Conflicting Flow Rate - All	0	0	494	0	1017	492
Stage 1	-	-	-	-	492	-
Stage 2	-	-	-	-	525	-
Follow-up Headway	-	-	2.218	-	3.518	3.318
Pot Capacity-1 Maneuver	-	-	1070	-	263	577
Stage 1	-	-	-	-	615	-
Stage 2	-	-	-	-	593	-
Time blocked-Platoon(%)	-	-	0	-	0	0
Mov Capacity-1 Maneuver	-	-	1070	-	261	577
Mov Capacity-2 Maneuver	-	-	-	-	261	-
Stage 1	-	-	-	-	615	-
Stage 2	-	-	-	-	589	-

Approach	EB	WB	NB
HCM Control Delay (s)	0	0.1	12
HCM LOS	A	A	B

Lane	NBLn1	EBT	EBR	WBL	WBT
Capacity (vph)	522				
HCM Control Delay (s)	12	-	-	8.382	-
HCM Lane VC Ratio	0.021	-	-	0.005	-
HCM Lane LOS	B	-	-	A	-
HCM 95th Percentile Queue (veh)	0.064	-	-	0.015	-

Intersection	
Intersection Delay (sec/veh):	0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Volume (vph)	450	5	5	475	5	5
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length		0	0		0	0
Median Width	0			0	12	
Grade (%)	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2
Movement Flow Rate	489	5	5	516	5	5
Number of Lanes	1	0	0	1	1	0

Major/Minor	Major 1			Major 2		
Conflicting Flow Rate - All	0	0	494	0	1017	492
Stage 1	-	-	-	-	492	-
Stage 2	-	-	-	-	525	-
Follow-up Headway	-	-	2.218	-	3.518	3.318
Pot Capacity-1 Maneuver	-	-	1070	-	263	577
Stage 1	-	-	-	-	615	-
Stage 2	-	-	-	-	593	-
Time blocked-Platoon(%)	-	-	0	-	0	0
Mov Capacity-1 Maneuver	-	-	1070	-	261	577
Mov Capacity-2 Maneuver	-	-	-	-	261	-
Stage 1	-	-	-	-	615	-
Stage 2	-	-	-	-	589	-

Approach	EB	WB	NB
HCM Control Delay (s)	0	0.1	12
HCM LOS	A	A	B

Lane	NBLn1	EBT	EBR	WBL	WBT
Capacity (vph)	522				
HCM Control Delay (s)	12	-	-	8.382	-
HCM Lane VC Ratio	0.021	-	-	0.005	-
HCM Lane LOS	B	-	-	A	-
HCM 95th Percentile Queue (veh)	0.064	-	-	0.015	-

Intersection	
Intersection Delay (sec/veh):	0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Volume (vph)	450	5	5	475	5	5
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length		0	0		0	0
Median Width	0			0	12	
Grade (%)	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2
Movement Flow Rate	489	5	5	516	5	5
Number of Lanes	1	0	0	1	1	0

Major/Minor	Major 1			Major 2		
Conflicting Flow Rate - All	0	0	554	0	1077	552
Stage 1	-	-	-	-	552	-
Stage 2	-	-	-	-	525	-
Follow-up Headway	-	-	2.218	-	3.518	3.318
Pot Capacity-1 Maneuver	-	-	1016	-	242	533
Stage 1	-	-	-	-	577	-
Stage 2	-	-	-	-	593	-
Time blocked-Platoon(%)	-	-	0	-	0	0
Mov Capacity-1 Maneuver	-	-	1016	-	228	506
Mov Capacity-2 Maneuver	-	-	-	-	228	-
Stage 1	-	-	-	-	548	-
Stage 2	-	-	-	-	589	-

Approach	EB	WB	NB
HCM Control Delay (s)	0	0.1	13.1
HCM LOS	A	A	B

Lane	NBLn1	EBT	EBR	WBL	WBT
Capacity (vph)	456				
HCM Control Delay (s)	13.1	-	-	8.562	-
HCM Lane VC Ratio	0.024	-	-	0.005	-
HCM Lane LOS	B	-	-	A	-
HCM 95th Percentile Queue (veh)	0.073	-	-	0.016	-

Intersection	
Intersection Delay (sec/veh):	-

Movement	SET	SER	NWL	NWT	NEL	NER
Volume (vph)	0	0	0	0	0	0
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length		0	0		0	0
Median Width	12			12	12	
Grade (%)	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2
Movement Flow Rate	0	0	0	0	0	0
Number of Lanes	1	0	0	1	1	0

Major/Minor	Major 1			Major 2		
Conflicting Flow Rate - All	0	-	-	0	-	-
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	-	-	-
Follow-up Headway	-	0	0	-	3.518	0
Pot Capacity-1 Maneuver	-	0	0	-	-	0
Stage 1	-	0	0	-	-	0
Stage 2	-	0	0	-	-	0
Time blocked-Platoon(%)	-	0	0	-	0	0
Mov Capacity-1 Maneuver	-	-	-	-	-	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	SE	NW	NE
HCM Control Delay (s)	0	0	0
HCM LOS	A	A	A

Lane	NELn1	NWT	SET
Capacity (vph)	0		
HCM Control Delay (s)	0	-	-
HCM Lane VC Ratio	-	-	-
HCM Lane LOS	A	-	-
HCM 95th Percentile Queue (veh)	-	-	-

Intersection	
Intersection Delay (sec/veh):	0.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Volume (vph)	175	5	5	205	5	5
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length		0	0		0	0
Median Width	0			0	12	
Grade (%)	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2
Movement Flow Rate	190	5	5	223	5	5
Number of Lanes	1	0	0	1	1	0

Major/Minor	Major 1			Major 2		
Conflicting Flow Rate - All	0	0	195	0	425	193
Stage 1	-	-	-	-	193	-
Stage 2	-	-	-	-	232	-
Follow-up Headway	-	-	2.218	-	3.518	3.318
Pot Capacity-1 Maneuver	-	-	1378	-	586	849
Stage 1	-	-	-	-	840	-
Stage 2	-	-	-	-	807	-
Time blocked-Platoon(%)	-	-	0	-	0	0
Mov Capacity-1 Maneuver	-	-	1378	-	584	849
Mov Capacity-2 Maneuver	-	-	-	-	584	-
Stage 1	-	-	-	-	840	-
Stage 2	-	-	-	-	804	-

Approach	EB	WB	NB
HCM Control Delay (s)	0	0.2	8.1
HCM LOS	A	A	A

Lane	NBLn1	EBT	EBR	WBL	WBT
Capacity (vph)	1168				
HCM Control Delay (s)	8.1	-	-	7.623	-
HCM Lane VC Ratio	0.009	-	-	0.004	-
HCM Lane LOS	A	-	-	A	-
HCM 95th Percentile Queue (veh)	0.028	-	-	0.012	-

Intersection	
Intersection Delay (sec/veh):	0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Volume (vph)	450	5	5	475	5	5
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length		0	200		0	0
Median Width	12			12	12	
Grade (%)	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2
Movement Flow Rate	489	5	5	516	5	5
Number of Lanes	1	0	1	1	1	0

Major/Minor	Major 1			Major 2		
Conflicting Flow Rate - All	0	0	494	0	759	492
Stage 1	-	-	-	-	492	-
Stage 2	-	-	-	-	267	-
Follow-up Headway	-	-	2.218	-	3.518	3.318
Pot Capacity-1 Maneuver	-	-	1070	-	374	577
Stage 1	-	-	-	-	615	-
Stage 2	-	-	-	-	778	-
Time blocked-Platoon(%)	-	-	0	-	0	0
Mov Capacity-1 Maneuver	-	-	1070	-	374	577
Mov Capacity-2 Maneuver	-	-	-	-	374	-
Stage 1	-	-	-	-	615	-
Stage 2	-	-	-	-	778	-

Approach	EB	WB	NB
HCM Control Delay (s)	0	0.1	9.9
HCM LOS	A	A	A

Lane	NBLn1	EBT	EBR	WBL	WBT
Capacity (vph)	748				
HCM Control Delay (s)	9.9	-	-	8.382	-
HCM Lane VC Ratio	0.015	-	-	0.005	-
HCM Lane LOS	A	-	-	A	-
HCM 95th Percentile Queue (veh)	0.044	-	-	0.015	-


11:12:14
HWY3+AIRPORT 2014
221
E (m) 4.3 4.3 4.3 8.0
L' (m) 15.0 15.0 15.0 30.0
V (m) 4.00 4.0 4.0 4.0
RAD (m) 25.00 25.0 25.0 25.0
PHI (d) 20.00 20.00 20.00 20.00
DIA (m) 45.00 41.00 41.00 41.00
GRAD SEP 0 0 0 0
TIME PERIOD min 90
TIME SLICE min 15
RESULTS PERIOD min 15 75
TIME COST $/hr 15.00
FLOW PERIOD min 15 75
FLOW TYPE pcu/veh VEH
FLOW PEAK am/op/pm PM
LEG NAME PCU VEH TURNS (1st exit, 2nd..U) FLOF CL FLOW RATIO FLOW TIME
NORTH 1.02 29 74 44 0 1.00 50 0.75 1.125 0.75 15 45 75
WEST 1.05 0 370 24 0 1.00 50 0.75 1.125 0.75 15 45 75
SOUTH 1.02 0 66 165 0 1.00 50 0.75 1.125 0.75 15 45 75
EAST 1.05 27 241 212 0 1.00 50 0.75 1.125 0.75 15 45 75
MODE 2
FLOW veh 147 394 231 480
CAPACITY veh 966 1100 1066 1866
AVE DELAY mins 0.20 0.22 0.20 0.18
MAX DELAY mins 0.23 0.25 0.23 0.19
AVE QUEUE veh 0 1 0 0
MAX QUEUE veh 0 1 0 0
AVEDEL s 11.8
LOS SIG B
LOS UNSIG B
VEHIC HRS 4.1
COST $ 62
F1mode F2direct F3peak Ctrl F3rev F4fact F6stats F8econ F9prnt F10run Esc

Intersection	
Intersection Delay (sec/veh):	4.6

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Volume (vph)	15	210	15	85	260	155	15	0	60	100	0	15
Conflicting Peds.(#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	375		0	0		0	0		0
Median Width		12			12			12			12	
Grade (%)		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.79	0.79	0.85	0.85	0.92	0.82	0.92	0.82	0.92	0.92	0.92
Heavy Vehicles(%)	2	13	100	0	8	2	0	2	5	2	2	2
Movement Flow Rate	16	266	19	100	306	168	18	0	73	109	0	16
Number of Lanes	0	1	0	1	1	0	0	1	0	1	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow Rate - All	474	0	0	285	0	0	661	982	276	934	907	237
Stage 1	-	-	-	-	-	-	308	308	-	590	590	-
Stage 2	-	-	-	-	-	-	353	674	-	344	317	-
Follow-up Headway	2.218	-	-	2.2	-	-	3.5	4.018	3.345	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1088	-	-	1289	-	-	379	249	756	246	276	802
Stage 1	-	-	-	-	-	-	706	661	-	494	495	-
Stage 2	-	-	-	-	-	-	668	454	-	671	654	-
Time blocked-Platoon(%)	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1088	-	-	1289	-	-	366	245	756	219	271	802
Mov Capacity-2 Maneuver	-	-	-	-	-	-	366	245	-	219	271	-
Stage 1	-	-	-	-	-	-	693	649	-	485	495	-
Stage 2	-	-	-	-	-	-	643	454	-	606	642	-

Approach	SE	NW	NE	SW
HCM Control Delay (s)	0.5	1.4	9.2	25.7
HCM LOS	A	A	A	D

Lane	NELn1	NWL	NWT	NWR	SEL	SET	SER	SWLn1	SWLn2
Capacity (vph)	945							219	283
HCM Control Delay (s)	9.2	8.028	0	-	8.359	0	-	29.4	20.6
HCM Lane VC Ratio	0.097	0.078	-	-	0.015	-	-	0.331	0.186
HCM Lane LOS	A	A	A	-	A	A	-	D	C
HCM 95th Percentile Queue (veh)	0.321	0.252	-	-	0.046	-	-	1.38	0.668

Intersection	
Intersection Delay (sec/veh):	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	50	170	200	320	225	160	200	290	380	150	320	40
Conflicting Peds.(#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		400	550		0	200		0	200		0
Median Width		12			12			12			12	
Grade (%)		0%			0%			0%			0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82	0.95	0.95	0.95	0.25	0.25	0.25
Heavy Vehicles(%)	0	17	6	1	10	0	2	0	1	0	0	0
Movement Flow Rate	61	207	244	390	274	195	211	305	400	600	1280	160
Number of Lanes	0	1	1	1	1	0	1	1	0	1	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow Rate - All	469	0	0	451	0	0	2008	1700	226	1530	1725	235
Stage 1	-	-	-	-	-	-	451	451	-	1152	1152	-
Stage 2	-	-	-	-	-	-	1557	1249	-	378	573	-
Follow-up Headway	2.2	-	-	2.209	-	-	3.518	4	3.309	3.5	4	3.3
Pot Capacity-1 Maneuver	1103	-	-	1115	-	-	# 44	# 93	816	# 97	# 90	809
Stage 1	-	-	-	-	-	-	588	574	-	# 243	# 275	-
Stage 2	-	-	-	-	-	-	# 141	# 247	-	648	# 507	-
Time blocked-Platoon(%)	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1103	-	-	1115	-	-	-	# 86	816	-	# 83	809
Mov Capacity-2 Maneuver	-	-	-	-	-	-	-	# 86	-	-	# 83	-
Stage 1	-	-	-	-	-	-	543	530	-	# 224	# 275	-
Stage 2	-	-	-	-	-	-	-	# 247	-	# 140	# 468	-

Approach	EB	WB	NB	SB
HCM Control Delay (s)	1	4.5	-	-
HCM LOS	A	A	-	-

Lane	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (vph)	-	239							-	112
HCM Control Delay (s)	-	$ 1051.4	8.455	-	-	9.957	0	-	-	$ 1051.4
HCM Lane VC Ratio	-	3.245	0.055	-	-	0.35	-	-	-	14.643
HCM Lane LOS	-	F	A	-	-	A	A	-	-	F
HCM 95th Percentile Queue (veh)	-	71.142	0.175	-	-	1.588	-	-	-	194.167

Intersection	
Intersection Delay (sec/veh):	13.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	145	640	1	0	640	145	0	0	1	95	0	95
Conflicting Peds.(#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	575		0	0		125	0		0	250		250
Median Width		12			12			12			12	
Grade (%)		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.92	0.92	0.92	0.25	0.25	0.25	0.75	0.75	0.75
Heavy Vehicles(%)	0	3	0	0	5	0	0	0	0	0	0	0
Movement Flow Rate	153	674	1	0	696	158	0	0	4	127	0	127
Number of Lanes	1	1	0	0	1	1	0	1	0	1	0	1

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow Rate - All	854	0	0	-	0	0	1329	1835	338	1418	~	427
Stage 1	-	-	-	-	-	-	981	981	-	775	-	-
Stage 2	-	-	-	-	-	-	348	854	-	643	-	-
Follow-up Headway	2.2	-	-	0	-	-	3.5	4	3.3	3.5	0	3.3
Pot Capacity-1 Maneuver	794	-	-	0	-	-	133	77	709	# 116	0	632
Stage 1	-	-	-	0	-	-	303	330	-	394	0	-
Stage 2	-	-	-	0	-	-	672	378	-	465	0	-
Time blocked-Platoon(%)	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	794	-	-	-	-	-	106	77	709	# 115	-	632
Mov Capacity-2 Maneuver	-	-	-	-	-	-	106	77	-	# 115	-	-
Stage 1	-	-	-	-	-	-	303	330	-	394	-	-
Stage 2	-	-	-	-	-	-	537	378	-	462	-	-

Approach	EB	WB	NB	SB
HCM Control Delay (s)	2	0	10.1	99
HCM LOS	A	A	B	F

Lane	NBLn1	EBL	EBT	EBR	WBT	WBR	SBLn1	SBLn2
Capacity (vph)	709						115	632
HCM Control Delay (s)	10.1	10.61	0	-	-	-	185.8	12.1
HCM Lane VC Ratio	0.006	0.192	-	-	-	-	1.101	0.2
HCM Lane LOS	B	B	A	-	-	-	F	B
HCM 95th Percentile Queue (veh)	0.017	0.708	-	-	-	-	7.66	0.743

Intersection	
Intersection Delay (sec/veh):	5.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	33	735	15	15	785	33	15	0	15	33	0	33
Conflicting Peds.(#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade (%)		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2	2	2	2	2	2	2
Movement Flow Rate	36	799	16	16	853	36	16	0	16	36	0	36
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow Rate - All	889	0	0	815	0	0	1800	1800	807	1790	1790	871
Stage 1	-	-	-	-	-	-	879	879	-	903	903	-
Stage 2	-	-	-	-	-	-	921	921	-	887	887	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	762	-	-	812	-	-	62	80	381	63	81	350
Stage 1	-	-	-	-	-	-	342	365	-	332	356	-
Stage 2	-	-	-	-	-	-	324	349	-	339	362	-
Time blocked-Platoon(%)	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	762	-	-	812	-	-	50	70	381	55	71	350
Mov Capacity-2 Maneuver	-	-	-	-	-	-	50	70	-	55	71	-
Stage 1	-	-	-	-	-	-	312	333	-	303	342	-
Stage 2	-	-	-	-	-	-	265	335	-	312	331	-

Approach	EB	WB	NB	SB
HCM Control Delay (s)	0.4	0.2	57.5	113.9
HCM LOS	A	A	F	F

Lane	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (vph)	100							95
HCM Control Delay (s)	57.5	9.958	0	-	9.524	0	-	113.9
HCM Lane VC Ratio	0.326	0.047	-	-	0.02	-	-	0.755
HCM Lane LOS	F	A	A	-	A	A	-	F
HCM 95th Percentile Queue (veh)	1.262	0.148	-	-	0.061	-	-	3.933

Intersection	
Intersection Delay (sec/veh):	1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	15	735	15	15	785	15	15	0	15	15	0	15
Conflicting Peds.(#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade (%)		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2	2	2	2	2	2	2
Movement Flow Rate	16	799	16	16	853	16	16	0	16	16	0	16
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow Rate - All	869	0	0	815	0	0	1740	1740	807	1740	1740	861
Stage 1	-	-	-	-	-	-	839	839	-	893	893	-
Stage 2	-	-	-	-	-	-	901	901	-	847	847	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	775	-	-	812	-	-	68	87	381	68	87	355
Stage 1	-	-	-	-	-	-	360	381	-	336	360	-
Stage 2	-	-	-	-	-	-	333	357	-	357	378	-
Time blocked-Platoon(%)	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	775	-	-	812	-	-	61	81	381	61	81	355
Mov Capacity-2 Maneuver	-	-	-	-	-	-	61	81	-	61	81	-
Stage 1	-	-	-	-	-	-	346	367	-	323	346	-
Stage 2	-	-	-	-	-	-	306	343	-	329	364	-

Approach	EB	WB	NB	SB
HCM Control Delay (s)	0.2	0.2	44.9	44.9
HCM LOS	A	A	E	E

Lane	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (vph)	122							122
HCM Control Delay (s)	44.9	9.745	0	-	9.524	0	-	44.9
HCM Lane VC Ratio	0.267	0.021	-	-	0.02	-	-	0.267
HCM Lane LOS	E	A	A	-	A	A	-	E
HCM 95th Percentile Queue (veh)	1.004	0.064	-	-	0.061	-	-	1.004

Intersection	
Intersection Delay (sec/veh):	0.5

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Volume (vph)	2	370	0	5	500	27	0	0	4	18	0	1
Conflicting Peds.(#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		12			12			0			0	
Grade (%)		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2	2	2	2	2	2	2
Movement Flow Rate	2	402	0	5	543	29	0	0	4	20	0	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow Rate - All	572	0	0	402	0	0	974	988	402	976	974	558
Stage 1	-	-	-	-	-	-	406	406	-	568	568	-
Stage 2	-	-	-	-	-	-	568	582	-	408	406	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1001	-	-	1157	-	-	231	247	648	230	252	529
Stage 1	-	-	-	-	-	-	622	598	-	508	507	-
Stage 2	-	-	-	-	-	-	508	499	-	620	598	-
Time blocked-Platoon(%)	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1001	-	-	1157	-	-	229	245	648	227	250	529
Mov Capacity-2 Maneuver	-	-	-	-	-	-	229	245	-	227	250	-
Stage 1	-	-	-	-	-	-	620	596	-	506	504	-
Stage 2	-	-	-	-	-	-	505	496	-	612	596	-

Approach	SE	NW	NE	SW
HCM Control Delay (s)	0	0.1	10.6	21.4
HCM LOS	A	A	B	C

Lane	NELn1	NWL	NWT	NWR	SEL	SET	SER	SWLn1
Capacity (vph)	648							240
HCM Control Delay (s)	10.6	8.126	0	-	8.604	0	-	21.4
HCM Lane VC Ratio	0.007	0.005	-	-	0.002	-	-	0.086
HCM Lane LOS	B	A	A	-	A	A	-	C
HCM 95th Percentile Queue (veh)	0.02	0.014	-	-	0.007	-	-	0.28

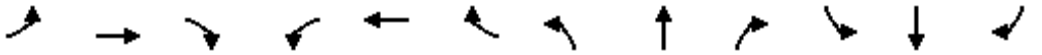
Intersection	
Intersection Delay (sec/veh):	0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Volume (vph)	700	10	10	705	10	10
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length		0	200		0	0
Median Width	12			12	12	
Grade (%)	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2
Movement Flow Rate	761	11	11	766	11	11
Number of Lanes	1	0	1	1	1	0

Major/Minor	Major 1			Major 2		
Conflicting Flow Rate - All	0	0	772	0	1171	767
Stage 1	-	-	-	-	767	-
Stage 2	-	-	-	-	404	-
Follow-up Headway	-	-	2.218	-	3.518	3.318
Pot Capacity-1 Maneuver	-	-	843	-	213	402
Stage 1	-	-	-	-	458	-
Stage 2	-	-	-	-	674	-
Time blocked-Platoon(%)	-	-	0	-	0	0
Mov Capacity-1 Maneuver	-	-	843	-	213	402
Mov Capacity-2 Maneuver	-	-	-	-	213	-
Stage 1	-	-	-	-	458	-
Stage 2	-	-	-	-	674	-

Approach	EB	WB	NB
HCM Control Delay (s)	0	0.1	13.9
HCM LOS	A	A	B

Lane	NBLn1	EBT	EBR	WBL	WBT
Capacity (vph)	426				
HCM Control Delay (s)	13.9	-	-	9.326	-
HCM Lane VC Ratio	0.051	-	-	0.013	-
HCM Lane LOS	B	-	-	A	-
HCM 95th Percentile Queue (veh)	0.161	-	-	0.039	-



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	170	200	320	225	160	200	290	380	150	320	40
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Queue, veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking, Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow Rate	1900	1624	1792	1881	1727	1900	1863	1900	1881	1900	1900	1900
Lanes	1	1	1	1	1	1	1	2	1	1	2	1
Capacity, veh/h	323	253	237	424	493	461	289	968	429	704	1396	625
Arriving On Green	0.04	0.16	0.00	0.17	0.29	0.00	0.10	0.27	0.00	0.22	0.39	0.00
Sat Flow, veh/h	1809.5	1523.6	1523.6	1791.6	1615.0	1615.0	1774.0	1599.0	1599.0	1809.5	1615.0	1615.0
Grp Volume(v), veh/h	61.0	207.3	0.0	390.2	274.4	0.0	210.5	305.3	0.0	600.0	1280.0	0.0
Grp Sat Flow(s),veh/h/ln	1809.5	1623.9	1523.6	1791.6	1727.3	1615.0	1774.0	1805.0	1599.0	1809.5	1805.0	1615.0
Q Serve(g_s), s	2.4	10.7	0.0	12.6	11.7	0.0	7.3	5.9	0.0	15.8	29.2	0.0
Cycle Q Clear(g_c), s	2.4	10.7	0.0	12.6	11.7	0.0	7.3	5.9	0.0	15.8	29.2	0.0
Proportion In Lane	1.000		1.000	1.000		1.000	1.000		1.000	1.000		1.000
Lane Grp Cap(c), veh/h	323.3	252.6	237.0	424.1	492.6	460.6	288.8	967.8	428.7	704.4	1396.0	624.5
V/C Ratio(X)	0.189	0.821	0.000	0.920	0.557	0.000	0.729	0.315	0.000	0.852	0.917	0.000
Avail Cap(c_a), veh/h	418.7	299.9	281.3	431.0	492.6	460.6	288.8	967.8	428.7	844.8	1416.5	633.7
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.000	1.000	0.000	1.000	1.000	0.000	1.000	1.000	0.000	1.000	1.000	0.000
Uniform Delay (d), s/veh	29.0	35.4	0.0	19.1	26.3	0.0	22.3	25.4	0.0	12.9	25.2	0.0
Incr Delay (d2), s/veh	0.3	14.3	0.0	24.7	1.4	0.0	9.0	0.2	0.0	7.2	9.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	29.3	49.7	0.0	43.8	27.7	0.0	31.3	25.5	0.0	20.1	34.9	0.0
Movement LOS	C	D		D	C		C	C		C	C	
Approach Volume, veh/h		268			665			516			1880	
Approach Delay, s/veh		45.1			37.2			27.9			30.1	
Approach LOS		D			D			C			C	

Timer												
Assigned Phase	7	4		3	8		5	2		1	6	
Phase Duration (G+Y+Rc), s	7.43	17.48		18.66	28.71		13.00	27.23		23.28	37.51	
Change Period (Y+Rc), s	4.00	4.00		4.00	4.00		4.00	4.00		4.00	4.00	
Max Green Setting (Gmax), s	8.00	16.00		15.00	23.00		9.00	17.00		26.00	34.00	
Max Q Clear Time (g_c+I1), s	4.43	12.71		14.61	13.70		9.33	7.86		17.81	31.19	
Green Extension Time (p_c)	0.03	0.77		0.06	1.62		0.00	6.67		1.47	2.31	

Intersection Summary	
HCM 2010 Control Delay	32.4
HCM 2010 Level of Service	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	145	640	1	0	640	145	0	0	1	95	0	95
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Queue, veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking, Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow Rate	1900	1845	1845	0	1810	1900	0	0	1900	1900	0	1900
Lanes	1	1	0	0	1	1	0	1	0	1	1	0
Capacity, veh/h	301	1045	2	0	789	705	0	0	0	192	0	0
Arriving On Green	0.07	0.57	0.57	0.00	0.44	0.44	0.00	0.00	0.12	0.13	0.00	0.13
Sat Flow, veh/h	1809.5	1841.4	2.9	0.0	1809.5	1615.0	0.0	0.0	0.0	1434.8	0.0	0.0
Grp Volume(v), veh/h	152.6	0.0	674.7	0.0	695.7	157.6	0.0	0.0	4.0	126.7	0.0	126.7
Grp Sat Flow(s),veh/h/ln	1809.5	0.0	1844.2	0.0	1809.5	1615.0	0.0	0.0	0.0	1434.8	0.0	0.0
Q Serve(g_s), s	2.9	0.0	16.7	0.0	23.6	4.1	0.0	0.0	8.0	5.6	0.0	9.0
Cycle Q Clear(g_c), s	2.9	0.0	16.7	0.0	23.6	4.1	0.0	0.0	8.0	5.6	0.0	9.0
Proportion In Lane	1.000		0.002	0.000		1.000	0.000		1.000	1.000		1.000
Lane Grp Cap(c), veh/h	301.4	0.0	1047.0	0.0	789.4	704.6	0.0	0.0	0.0	192.5	0.0	0.0
V/C Ratio(X)	0.506	0.000	0.644	0.000	0.881	0.224	0.000	0.000	0.000	0.658	0.000	0.000
Avail Cap(c_a), veh/h	603.0	0.0	1402.0	0.0	836.2	746.3	0.0	0.0	0.0	192.5	0.0	0.0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.000	0.000	1.000	0.000	1.000	1.000	0.000	0.000	1.000	1.000	0.000	1.000
Uniform Delay (d), s/veh	13.9	0.0	9.9	0.0	17.3	11.8	0.0	0.0	0.0	27.6	0.0	0.0
Incr Delay (d2), s/veh	1.3	0.0	0.7	0.0	10.4	0.2	0.0	0.0	0.0	16.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	15.2	0.0	10.6	0.0	27.7	12.0	0.0	0.0	0.0	43.9	0.0	0.0
Movement LOS	B		B		C	B				D		
Approach Volume, veh/h		827			853			4			253	
Approach Delay, s/veh		11.4			24.8			0.0			21.9	
Approach LOS		B			C			A			C	

Timer												
Assigned Phase	7	4			8			2			6	
Phase Duration (G+Y+Rc), s	8.82	42.08			33.27			12.00			13.00	
Change Period (Y+Rc), s	4.00	4.00			4.00			4.00			4.00	
Max Green Setting (Gmax), s	16.00	51.00			31.00			8.00			9.00	
Max Q Clear Time (g_c+I1), s	4.86	18.73			25.62			10.00			11.00	
Green Extension Time (p_c)	0.26	11.02			3.65			0.00			0.00	

Intersection Summary	
HCM 2010 Control Delay	18.7
HCM 2010 Level of Service	B

Intersection	
Intersection Delay (sec/veh):	4.6

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Volume (vph)	15	210	15	85	260	155	15	0	60	100	0	15
Conflicting Peds.(#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	375		0	0		0	0		0
Median Width		12			12			12			12	
Grade (%)		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.79	0.79	0.85	0.85	0.92	0.82	0.92	0.82	0.92	0.92	0.92
Heavy Vehicles(%)	2	13	100	0	8	2	0	2	5	2	2	2
Movement Flow Rate	16	266	19	100	306	168	18	0	73	109	0	16
Number of Lanes	0	1	0	1	1	0	0	1	0	1	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow Rate - All	474	0	0	285	0	0	661	982	276	934	907	237
Stage 1	-	-	-	-	-	-	308	308	-	590	590	-
Stage 2	-	-	-	-	-	-	353	674	-	344	317	-
Follow-up Headway	2.218	-	-	2.2	-	-	3.5	4.018	3.345	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1088	-	-	1289	-	-	379	249	756	246	276	802
Stage 1	-	-	-	-	-	-	706	661	-	494	495	-
Stage 2	-	-	-	-	-	-	668	454	-	671	654	-
Time blocked-Platoon(%)	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1088	-	-	1289	-	-	366	245	756	219	271	802
Mov Capacity-2 Maneuver	-	-	-	-	-	-	366	245	-	219	271	-
Stage 1	-	-	-	-	-	-	693	649	-	485	495	-
Stage 2	-	-	-	-	-	-	643	454	-	606	642	-

Approach	SE	NW	NE	SW
HCM Control Delay (s)	0.5	1.4	9.2	25.7
HCM LOS	A	A	A	D

Lane	NELn1	NWL	NWT	NWR	SEL	SET	SER	SWLn1	SWLn2
Capacity (vph)	945							219	283
HCM Control Delay (s)	9.2	8.028	0	-	8.359	0	-	29.4	20.6
HCM Lane VC Ratio	0.097	0.078	-	-	0.015	-	-	0.331	0.186
HCM Lane LOS	A	A	A	-	A	A	-	D	C
HCM 95th Percentile Queue (veh)	0.321	0.252	-	-	0.046	-	-	1.38	0.668

Intersection	
Intersection Delay (sec/veh):	0.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	15	735	15	15	785	15	0	0	30	0	0	30
Conflicting Peds.(#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	200		0	200		0	0		0	0		0
Median Width		12			12			0			0	
Grade (%)		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2	2	2	2	2	2	2
Movement Flow Rate	16	799	16	16	853	16	0	0	33	0	0	33
Number of Lanes	1	1	0	1	1	0	0	0	1	0	0	1

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow Rate - All	869	0	0	815	0	0	~	~	408	~	~	435
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Headway	2.218	-	-	2.218	-	-	0	0	3.318	0	0	3.318
Pot Capacity-1 Maneuver	775	-	-	812	-	-	0	0	643	0	0	621
Stage 1	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	0	0	-	0	0	-
Time blocked-Platoon(%)	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	775	-	-	812	-	-	0	-	643	0	-	621
Mov Capacity-2 Maneuver	-	-	-	-	-	-	0	-	-	0	-	-
Stage 1	-	-	-	-	-	-	0	-	-	0	-	-
Stage 2	-	-	-	-	-	-	0	-	-	0	-	-

Approach	EB	WB	NB	SB
HCM Control Delay (s)	0.2	0.2	10.9	11.1
HCM LOS	A	A	B	B

Lane	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (vph)	643							621
HCM Control Delay (s)	10.9	9.745	0	-	9.524	0	-	11.1
HCM Lane VC Ratio	0.051	0.021	-	-	0.02	-	-	0.053
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th Percentile Queue (veh)	0.16	0.064	-	-	0.061	-	-	0.166

Intersection	
Intersection Delay (sec/veh):	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	33	735	15	15	785	33	0	0	30	0	0	66
Conflicting Peds.(#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	200		0	200		0	0		0	0		0
Median Width		12			12			0			0	
Grade (%)		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2	2	2	2	2	2	2
Movement Flow Rate	36	799	16	16	853	36	0	0	33	0	0	72
Number of Lanes	1	1	0	1	1	0	0	0	1	0	0	1

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow Rate - All	889	0	0	815	0	0	~	~	408	~	~	445
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Headway	2.218	-	-	2.218	-	-	0	0	3.318	0	0	3.318
Pot Capacity-1 Maneuver	762	-	-	812	-	-	0	0	643	0	0	613
Stage 1	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	0	0	-	0	0	-
Time blocked-Platoon(%)	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	762	-	-	812	-	-	0	-	643	0	-	613
Mov Capacity-2 Maneuver	-	-	-	-	-	-	0	-	-	0	-	-
Stage 1	-	-	-	-	-	-	0	-	-	0	-	-
Stage 2	-	-	-	-	-	-	0	-	-	0	-	-

Approach	EB	WB	NB	SB
HCM Control Delay (s)	0.4	0.2	10.9	11.7
HCM LOS	A	A	B	B

Lane	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (vph)	643							613
HCM Control Delay (s)	10.9	9.958	0	-	9.524	0	-	11.7
HCM Lane VC Ratio	0.051	0.047	-	-	0.02	-	-	0.117
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th Percentile Queue (veh)	0.16	0.148	-	-	0.061	-	-	0.395

Intersection	
Intersection Delay (sec/veh):	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	33	740	710	33	0	66
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length	200			0	0	0
Median Width		12	12		0	
Grade (%)		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2
Movement Flow Rate	36	804	772	36	0	72
Number of Lanes	1	1	1	0	0	1

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	808	0	0	0	~	790
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Follow-up Headway	2.218	-	-	-	0	3.318
Pot Capacity-1 Maneuver	817	-	-	-	0	390
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	-	0	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	817	-	-	-	-	390
Mov Capacity-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay (s)	0.4	0	16.3
HCM LOS	A	A	C

Lane	EBL	EBT	WBT	WBR	SBLn1
Capacity (vph)					390
HCM Control Delay (s)	9.609	-	-	-	16.3
HCM Lane VC Ratio	0.044	-	-	-	0.184
HCM Lane LOS	A	-	-	-	C
HCM 95th Percentile Queue (veh)	0.138	-	-	-	0.665

Intersection	
Intersection Delay (sec/veh):	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	33	740	710	33	0	66
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length	200			0	0	0
Median Width		12	12		0	
Grade (%)		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2
Movement Flow Rate	36	804	772	36	0	72
Number of Lanes	1	1	1	0	0	1

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	808	0	0	0	~	790
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Follow-up Headway	2.218	-	-	-	0	3.318
Pot Capacity-1 Maneuver	817	-	-	-	0	390
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	-	0	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	817	-	-	-	-	390
Mov Capacity-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay (s)	0.4	0	16.3
HCM LOS	A	A	C

Lane	EBL	EBT	WBT	WBR	SBLn1
Capacity (vph)					390
HCM Control Delay (s)	9.609	-	-	-	16.3
HCM Lane VC Ratio	0.044	-	-	-	0.184
HCM Lane LOS	A	-	-	-	C
HCM 95th Percentile Queue (veh)	0.138	-	-	-	0.665

Intersection	
Intersection Delay (sec/veh):	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	33	740	710	33	0	66
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length	200			0	100	0
Median Width		12	12		0	
Grade (%)		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2
Movement Flow Rate	36	804	772	36	0	72
Number of Lanes	1	1	1	0	0	1

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	808	0	0	0	~	790
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Follow-up Headway	2.218	-	-	-	0	3.318
Pot Capacity-1 Maneuver	817	-	-	-	0	390
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	-	0	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	817	-	-	-	-	390
Mov Capacity-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay (s)	0.4	0	16.3
HCM LOS	A	A	C

Lane	EBL	EBT	WBT	WBR	SBLn1
Capacity (vph)					390
HCM Control Delay (s)	9.609	-	-	-	16.3
HCM Lane VC Ratio	0.044	-	-	-	0.184
HCM Lane LOS	A	-	-	-	C
HCM 95th Percentile Queue (veh)	0.138	-	-	-	0.665

Intersection	
Intersection Delay (sec/veh):	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Volume (vph)	735	15	15	785	0	30
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length		0	200		0	0
Median Width	12			12	0	
Grade (%)	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2
Movement Flow Rate	799	16	16	853	0	33
Number of Lanes	1	0	1	1	0	1

Major/Minor	Major 1			Major 2		
Conflicting Flow Rate - All	0	0	815	0	~	807
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Follow-up Headway	-	-	2.218	-	0	3.318
Pot Capacity-1 Maneuver	-	-	812	-	0	381
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	-	0	-
Time blocked-Platoon(%)	-	-	0	-	0	0
Mov Capacity-1 Maneuver	-	-	812	-	-	381
Mov Capacity-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay (s)	0	0.2	15.3
HCM LOS	A	A	C

Lane	NBLn1	EBT	EBR	WBL	WBT
Capacity (vph)	381				
HCM Control Delay (s)	15.3	-	-	9.524	-
HCM Lane VC Ratio	0.086	-	-	0.02	-
HCM Lane LOS	C	-	-	A	-
HCM 95th Percentile Queue (veh)	0.279	-	-	0.061	-

Intersection	
Intersection Delay (sec/veh):	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Volume (vph)	735	15	15	785	0	30
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length		0	200		0	0
Median Width	12			12	0	
Grade (%)	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2
Movement Flow Rate	799	16	16	853	0	33
Number of Lanes	1	0	1	1	0	1

Major/Minor	Major 1			Major 2		
Conflicting Flow Rate - All	0	0	815	0	~	807
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Follow-up Headway	-	-	2.218	-	0	3.318
Pot Capacity-1 Maneuver	-	-	812	-	0	381
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	-	0	-
Time blocked-Platoon(%)	-	-	0	-	0	0
Mov Capacity-1 Maneuver	-	-	812	-	-	381
Mov Capacity-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay (s)	0	0.2	15.3
HCM LOS	A	A	C

Lane	NBLn1	EBT	EBR	WBL	WBT
Capacity (vph)	381				
HCM Control Delay (s)	15.3	-	-	9.524	-
HCM Lane VC Ratio	0.086	-	-	0.02	-
HCM Lane LOS	C	-	-	A	-
HCM 95th Percentile Queue (veh)	0.279	-	-	0.061	-

Intersection	
Intersection Delay (sec/veh):	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Volume (vph)	735	15	15	785	0	30
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length		0	200		0	0
Median Width	12			12	0	
Grade (%)	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2
Movement Flow Rate	799	16	16	853	0	33
Number of Lanes	1	0	1	1	0	1

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	0	0	815	0	~	807
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Follow-up Headway	-	-	2.218	-	0	3.318
Pot Capacity-1 Maneuver	-	-	812	-	0	381
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	-	0	-
Time blocked-Platoon(%)	-	-	0	-	0	0
Mov Capacity-1 Maneuver	-	-	812	-	-	381
Mov Capacity-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay (s)	0	0.2	15.3
HCM LOS	A	A	C

Lane	NBLn1	EBT	EBR	WBL	WBT
Capacity (vph)	381				
HCM Control Delay (s)	15.3	-	-	9.524	-
HCM Lane VC Ratio	0.086	-	-	0.02	-
HCM Lane LOS	C	-	-	A	-
HCM 95th Percentile Queue (veh)	0.279	-	-	0.061	-

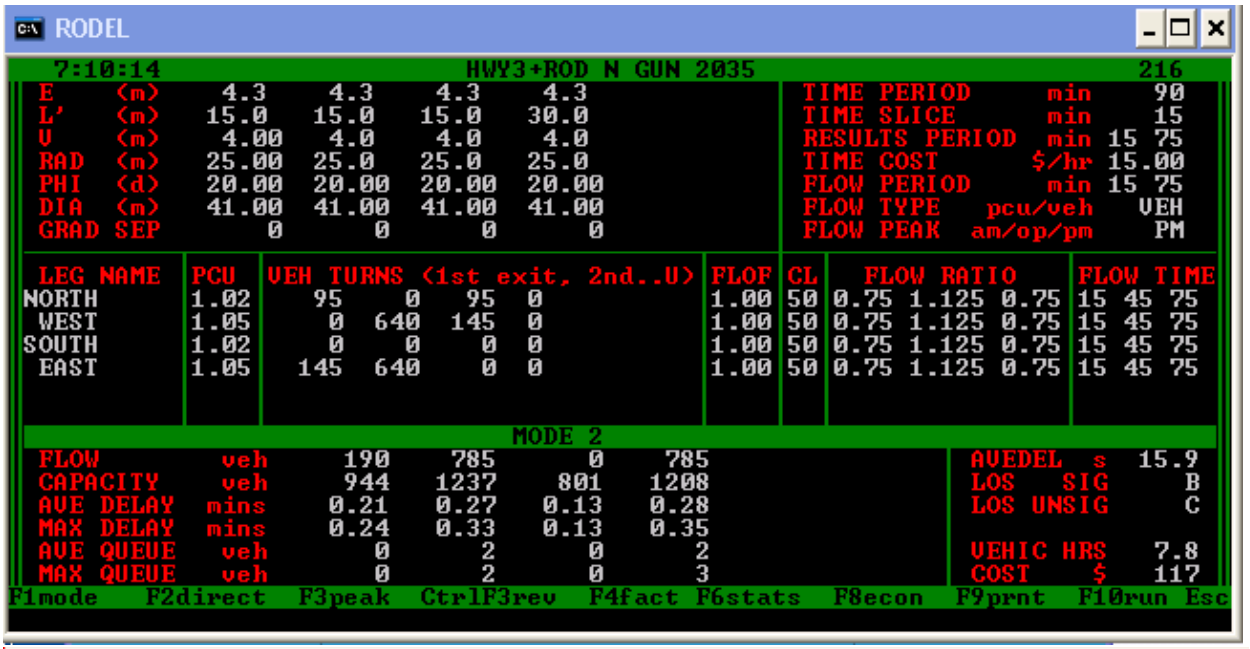
Intersection	
Intersection Delay (sec/veh):	0.5

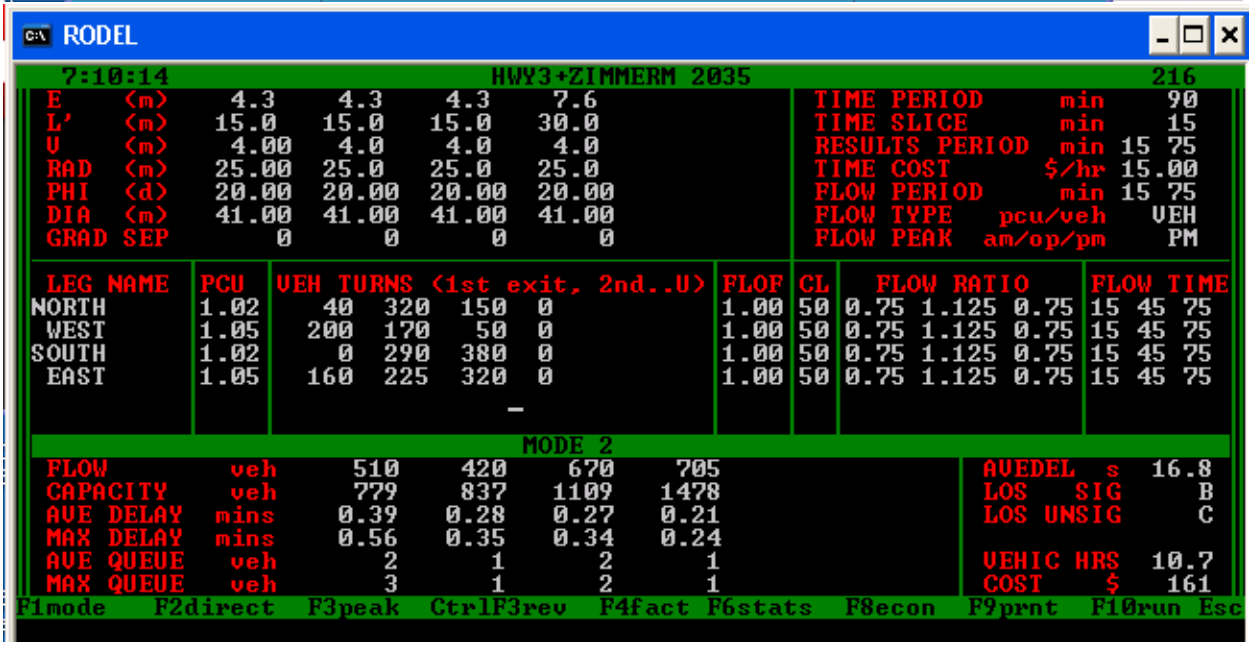
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Volume (vph)	2	370	0	5	500	27	0	0	4	18	0	1
Conflicting Peds.(#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		12			12			0			0	
Grade (%)		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles(%)	2	2	2	2	2	2	2	2	2	2	2	2
Movement Flow Rate	2	402	0	5	543	29	0	0	4	20	0	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow Rate - All	572	0	0	402	0	0	974	988	402	976	974	558
Stage 1	-	-	-	-	-	-	406	406	-	568	568	-
Stage 2	-	-	-	-	-	-	568	582	-	408	406	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1001	-	-	1157	-	-	231	247	648	230	252	529
Stage 1	-	-	-	-	-	-	622	598	-	508	507	-
Stage 2	-	-	-	-	-	-	508	499	-	620	598	-
Time blocked-Platoon(%)	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1001	-	-	1157	-	-	229	245	648	227	250	529
Mov Capacity-2 Maneuver	-	-	-	-	-	-	229	245	-	227	250	-
Stage 1	-	-	-	-	-	-	620	596	-	506	504	-
Stage 2	-	-	-	-	-	-	505	496	-	612	596	-

Approach	SE	NW	NE	SW
HCM Control Delay (s)	0	0.1	10.6	21.4
HCM LOS	A	A	B	C

Lane	NELn1	NWL	NWT	NWR	SEL	SET	SER	SWLn1
Capacity (vph)	648							240
HCM Control Delay (s)	10.6	8.126	0	-	8.604	0	-	21.4
HCM Lane VC Ratio	0.007	0.005	-	-	0.002	-	-	0.086
HCM Lane LOS	B	A	A	-	A	A	-	C
HCM 95th Percentile Queue (veh)	0.02	0.014	-	-	0.007	-	-	0.28


RODEL
7:10:14
HWY3+ROD N GUN 2035
216
E (m) 4.3 4.3 4.3 4.3
L' (m) 15.0 15.0 15.0 30.0
V (m) 4.00 4.0 4.0 4.0
RAD (m) 25.00 25.0 25.0 25.0
PHI (d) 20.00 20.00 20.00 20.00
DIA (m) 41.00 41.00 41.00 41.00
GRAD SEP 0 0 0 0
TIME PERIOD min 90
TIME SLICE min 15
RESULTS PERIOD min 15 75
TIME COST $/hr 15.00
FLOW PERIOD min 15 75
FLOW TYPE pcu/veh VEH
FLOW PEAK am/op/pm PM
LEG NAME PCU VEH TURNS (1st exit, 2nd..U) FLOF CL FLOW RATIO FLOW TIME
NORTH 1.02 95 0 95 0 1.00 50 0.75 1.125 0.75 15 45 75
WEST 1.05 0 640 145 0 1.00 50 0.75 1.125 0.75 15 45 75
SOUTH 1.02 0 0 0 0 1.00 50 0.75 1.125 0.75 15 45 75
EAST 1.05 145 640 0 0 1.00 50 0.75 1.125 0.75 15 45 75
MODE 2
FLOW veh 190 785 0 785
CAPACITY veh 944 1237 801 1208
AVE DELAY mins 0.21 0.27 0.13 0.28
MAX DELAY mins 0.24 0.33 0.13 0.35
AVE QUEUE veh 0 2 0 2
MAX QUEUE veh 0 2 0 3
AVEDEL s 15.9
LOS SIG B
LOS UNSIG C
VEHIC HRS 7.8
COST $ 117
F1mode F2direct F3peak CtrlF3rev F4fact F6stats F8econ F9prnt F10run Esc


RODEL
7:10:14
HWY3+ZIMMERM 2035
216
E (m) 4.3 4.3 4.3 7.6
L' (m) 15.0 15.0 15.0 30.0
V (m) 4.00 4.0 4.0 4.0
RAD (m) 25.00 25.0 25.0 25.0
PHI (d) 20.00 20.00 20.00 20.00
DIA (m) 41.00 41.00 41.00 41.00
GRAD SEP 0 0 0 0
TIME PERIOD min 90
TIME SLICE min 15
RESULTS PERIOD min 15 75
TIME COST $/hr 15.00
FLOW PERIOD min 15 75
FLOW TYPE pcu/veh VEH
FLOW PEAK am/op/pm PM
LEG NAME PCU VEH TURNS (1st exit, 2nd..U) FLOF CL FLOW RATIO FLOW TIME
NORTH 1.02 40 320 150 0 1.00 50 0.75 1.125 0.75 15 45 75
WEST 1.05 200 170 50 0 1.00 50 0.75 1.125 0.75 15 45 75
SOUTH 1.02 0 290 380 0 1.00 50 0.75 1.125 0.75 15 45 75
EAST 1.05 160 225 320 0 1.00 50 0.75 1.125 0.75 15 45 75
MODE 2
FLOW veh 510 420 670 705
CAPACITY veh 779 837 1109 1478
AVE DELAY mins 0.39 0.28 0.27 0.21
MAX DELAY mins 0.56 0.35 0.34 0.24
AVE QUEUE veh 2 1 2 1
MAX QUEUE veh 3 1 2 1
AVEDEL s 16.8
LOS SIG B
LOS UNSIG C
VEHIC HRS 10.7
COST $ 161
F1mode F2direct F3peak CtrlF3rev F4fact F6stats F8econ F9prnt F10run Esc

APPENDIX C: PUBLIC MEETING KEY PAD POLLING RESULTS

Highway 3 - Keypad Polling

Session Name
Billings Public Meeting - October 15, 2014

Date Created
10/15/2014 4:17:10 PM

Active Participants
32

Questions
17

Total Participants
32

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1. Roadway Alternatives: To accommodate future traffic volumes and level of service requirements, adjustments to the roadway configuration and access control will be necessary. Which of the following options would you prefer? (Select 1)

	Responses	
	Percent	**Count**
2-lane with a center turn lane	50%	16
2-lane with a center median	50%	16
No preference	0%	0
Totals	**100%**	**32**

2. Median /Access Control Alternatives: If a median is required to help control and limit access points on the corridor, what is your preferred design option for a median along parts of the Highway 3 corridor? (Select 1)

	Responses	
	Percent	**Count**
Striped median on asphalt paving	3%	1
Depressed median – with landscaping	34%	10
Raised median – paved	7%	2
Raised median – with landscaping	41%	12
I don’t think a median is appropriate	14%	4
No opinion	0%	0
Totals	**100%**	**29**

3. Entry Feature: Do you think there should be a community entry feature welcoming travelers to Billings along the Highway 3 corridor? (Select 1)

	Responses	
	Percent	Count
Yes, located east of Zimmerman Trail	19%	6
Yes, located at Zimmerman Trail	16%	5
Yes, located at Zimmerman Park	45%	14
No	16%	5
No opinion	3%	1
Totals	**100%**	**31**

4. Bike Lanes: In addition to a trail parallel to the roadway, should bike lanes be accommodated within the roadway section? (Select 1)

	Responses	
	Percent	Count
Yes, along the entire corridor	44%	14
Yes, from the Billings Airport roundabout to Zimmerman Park	25%	8
Yes, from Zimmerman Park to Apache Trail	9%	3
No	19%	6
No opinion	3%	1
Totals	**100%**	**32**

5. Trail Alternatives (EAST): Please choose the option which best describes your preference about a potential NEW trail alignment along the eastern section of the Highway 3 corridor (Airport to Sky Ranch Drive): (Select 1)

	Responses	
	Percent	Count
Add a paved multi-use trail parallel to the roadway	62%	18
Add a natural surface trail parallel to the roadway	10%	3
Add a dual-surface trail parallel to the roadway	24%	7
Do not add a trail parallel to the roadway	3%	1
Totals	**100%**	**29**

6. Trail Alternatives (CENTRAL) Following the Rim: Along the central section of the Highway 3 corridor (Sky Ranch Drive to Zimmerman Park) the existing natural trail moves away from Highway 3 and generally follows the edge of the Rim. Please choose the option which best describes your preference regarding the CURRENT trail alignment: (Select 1)

	Responses	
	Percent	Count
Pave a portion of the trail	26%	8
Improve the natural surface trail	23%	7
Create a dual-surface trail	10%	3
No change to the existing trail	42%	13
Totals	**100%**	**31**

7. Trail Alternatives (CENTRAL) Parallel to the Highway: Please choose the option which best describes your preference about a potential NEW trail alignment along the central section of the Highway 3 corridor (Sky Ranch Drive to Zimmerman Park): (Select 1)

	Responses	
	Percent	Count
Add a paved multi-use trail parallel to the roadway	58%	18
Add a natural surface trail parallel to the roadway	10%	3
Add a dual-surface trail parallel to the roadway	19%	6
Do not add an additional trail parallel to the roadway	13%	4
Totals	**100%**	**31**

8. Trail Alternatives (WEST): Currently, no trail alignment exists along the western section of the Highway 3 corridor (Zimmerman Park to Apache Trail). Please choose the option which best describes your preference about a potential NEW trail alignment: (Select 1)

	Responses	
	Percent	Count
Add a paved multi-use trail parallel to the highway	58%	18
Add a natural surface trail parallel to the highway	13%	4
A dual-surface trail parallel to the highway	13%	4
Do not add a new trail parallel to the highway	16%	5
Totals	**100%**	**31**

9. Trail Alternatives (North Side):Currently, no trail alignment exists on the north side of Highway 3. Please select your preference about the creation of a new pedestrian path on the north side of the corridor as a potential long-term recommendation: (Select 1)

	Responses	
	Percent	Count
Add a trail from the Airport to Sky Ranch Drive (EAST)	3%	1
Add a trail from Sky Ranch Drive to Zimmerman Park (CENTRAL)	3%	1
Add a trail from Zimmerman Park to Apache Trail (WEST)	3%	1
Entire Corridor	43%	13
Options 1 & 2 only (EAST and CENTRAL)	10%	3
None of the above	37%	11
Totals	**100%**	**30**

10. Trail Crossings:At-grade crossings will be included in future improvements at Zimmerman Trail and Rod and Gun Club Road (yellow stars). What locations would you prioritize for additional GRADE-SEPARATED pedestrian connections along the corridor? (Select up to 2)

	Responses	
	Percent	Count
Trail Crossing #1	26%	14
Trail Crossing #2	20%	11
Trail Crossing #3	31%	17
Trail Crossing #4	17%	9
None of these locations	6%	3
Totals	**100%**	**54**

11. Parking/Trailheads:What locations would you prioritize for parking/trailhead improvements? (Select up to 2)

	Responses	
	Percent	Count
Parking Area #1	29%	15
Parking Area #2	10%	5
Parking Area #3	25%	13
Parking Area #4	16%	8
All of these locations are important	18%	9
No opinion	2%	1
Totals	**100%**	**51**

12. Parking/Trailheads:What types of oversized vehicle parking should be accommodated along the Highway 3 corridor? (Select 1)

	Responses	
	Percent	Count
Provide parking for ALL oversized vehicles (including commercial trucks)	24%	7
Provide parking for recreational vehicles and trailers only (no truck parking)	52%	15
Do NOT provide parking for oversized vehicles or trucks	21%	6
No opinion	3%	1
Totals	**100%**	**29**

13. Parking/Trailheads:Should overnight parking along the Highway 3 corridor be allowed? (Select 1)

	Responses	
	Percent	Count
Yes	17%	5
No	76%	22
No opinion	7%	2
Totals	**100%**	**29**

14. Landscape Character:The Highway 3 corridor serves as an important entry point into the community of Billings. In general, do you believe the landscape character of this corridor should be … (Select 1)

	Responses	
	Percent	Count
A native restoration aesthetic that closely mimics the surrounding environment and uses only native plant materials	46%	13
An enhanced native aesthetic that primarily uses native plant material and also incorporates ornamental elements at focused locations	46%	13
A formalized aesthetic that uses ornamental plant material and landscape elements	0%	0
No opinion	7%	2
Totals	**100%**	**28**

15. Landscape Character:As an element of future improvements, are street trees appropriate along the Highway 3 corridor ? (Select 1)

	Responses	
	Percent	Count
Yes, along the entire corridor	21%	6
Yes, in specific areas only (parking areas, trailheads, etc.)	39%	11
No	39%	11
No opinion	0%	0
Totals	**100%**	**28**

16. Landscape Character:As an element of future improvements, is pedestrian lighting appropriate along the Highway 3 corridor? (Select 1)

	Responses	
	Percent	Count
Yes, along the entire corridor	14%	4
Yes, in specific areas only (parking areas, trailheads, etc.)	61%	17
No	25%	7
No opinion	0%	0
Totals	**100%**	**28**

17. Landscape Character:Stormwater control and treatment is an important aspect of future improvements on the Highway 3 corridor. In general, how do you feel stormwater challenges should be addressed along Highway 3? (Select 1)

	Responses	
	Percent	Count
“Green infrastructure” solutions typically comprised of landscape and surface drainage facilities	52%	14
Combination of landscape and structured solutions based on site conditions and space requirements	44%	12
Structured infrastructure solutions typically comprised of hard-surfaced drainage facilities	4%	1
No opinion	0%	0
Totals	**100%**	**27**

SANDERSON STEWART

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