TECHNICAL MEMORANDUM #1

Date: September 30, 2015

Project #: 18460

To: Wade Salyards, PE (Montana Department of Transportation)

From: Brett Korporaal and Andy Daleiden, PE

Project: Airport Rd/Main St – Billings, CM 1099(102), UPN 8718000

Subject: Existing and Future Transportation Conditions

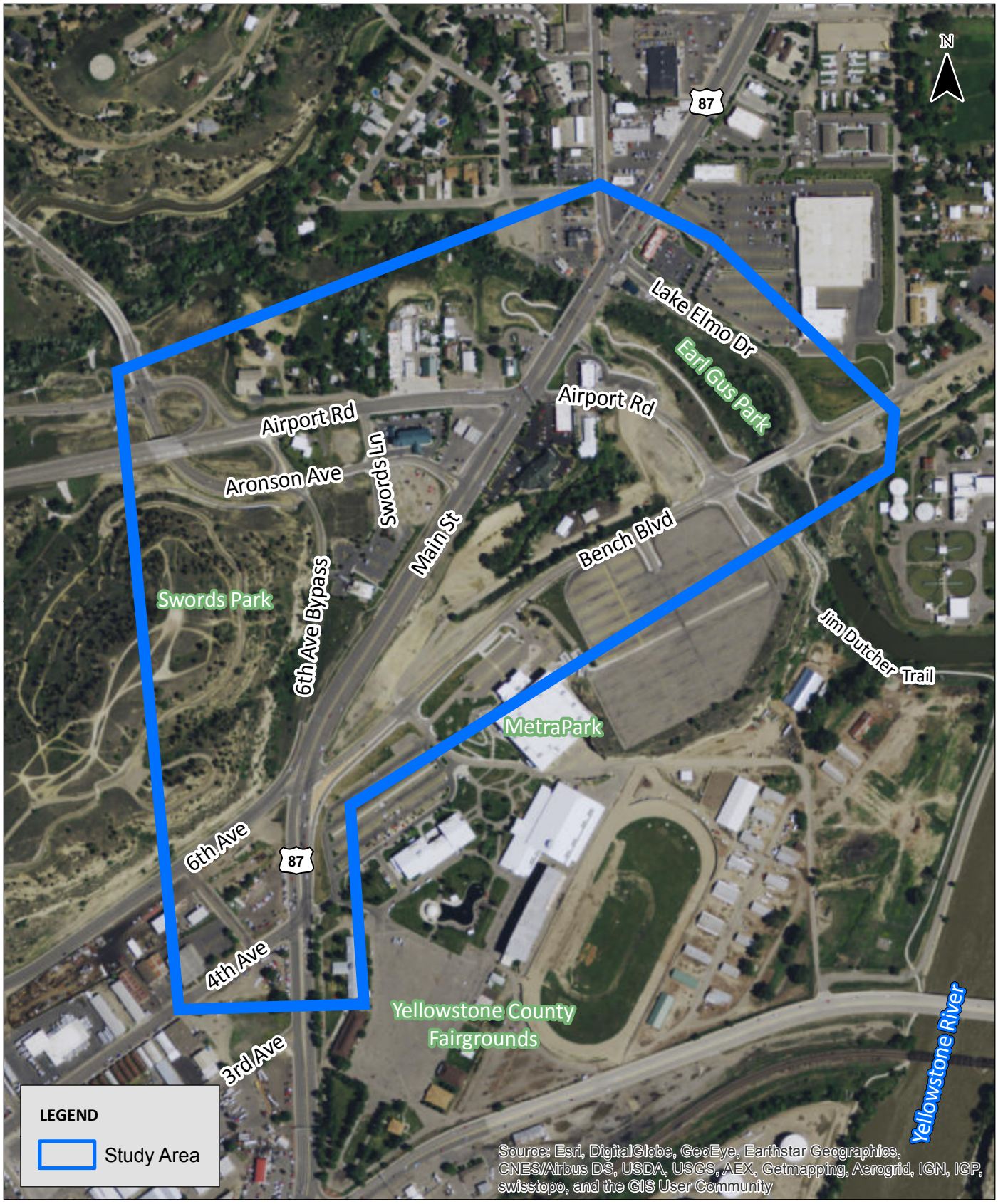
Introduction

This memorandum summarizes the existing and future transportation system conditions within the study area of the Airport Road and Main Street transportation study in Billings, MT. This memorandum documents the current facilities in place and their operational and safety performance of all travel modes within the study area. The existing conditions analysis establishes the baseline conditions of the current transportation system for comparison in the future conditions analysis. The future conditions analysis addresses programmed facility improvements, growth within the region, and the anticipated operational performance under year 2040 within the study area. The future conditions analysis provides a basis for comparing future alternatives in the next study phase. This memorandum includes the following items:

- Introduction - Pages 1 to 5
- Transportation system inventory – Pages 6 to 10
- Existing conditions – Pages 11 to 25
- Future conditions – Pages 25 to 30
- Summary – Pages 31 to 33

STUDY AREA

The Airport Road and Main Street intersection is located two miles northeast of downtown Billings, just north of MetraPark. The intersection's location is a critical junction for commuter, regional, and freight trips along the Airport Road and Main Street corridors. Designated as principal arterials, the two corridors connect recreational, residential neighborhoods (Heights West and East), low density commercial, and light industrial uses with downtown Billings and Interstate 90. The intersection is located on the Camino Real International Trade Corridor that connects Canada, United States, and Mexico. Figure 1 highlights the study area.



MONTANA MDT DEPARTMENT OF TRANSPORTATION

BILLINGS AIRPORT ROAD & MAIN STREET Concept

STUDY AREA
BILLINGS, MONTANA

SCALE: 1" = 600'

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FIGURE
1

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Coordinate System: NAD 1983 StatePlane Montana FIPS 2500 Feet

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PAST PLANS AND STUDIES

Several relevant past plans and studies were reviewed to understand the context of previous work completed in the study area, and to ensure that future intersection alternatives are consistent with any planned projects and the community's vision for the respective corridors. The key findings relevant to the study area from the five studies are outlined below:

MetraPark Egress Improvements Study (Reference 1)

This study was completed in April 2013 for the Yellowstone County Commission. The study identifies improvement recommendations to the overall circulation plan for the MetraPark, specifically ingress/egress changes to access on Main Street between the 4th Avenue and 6th Avenue and on Bench Boulevard along the MetraPark frontage.

Traffic Report 6th Ave N/Bench-Blgs, Phase 2 (Reference 2)

This study was completed in November 2012 for the MDT. The study evaluates several alternative intersection improvements at the 4th Avenue and 6th Avenue intersections with Bench Boulevard and Main Street. The study recommends the following improvements:

- **Main Street and 6th Avenue North/Bench Boulevard** – The short term recommendation is a no build option. The long term recommendation is the 4th Avenue North Flyover, but the timing of this improvement should be revisited once the Billings Bypass is constructed and more is known on the development potential within the EBURD and Hospitality Corridor.
- **Main Street and 1st Avenue North/US 87** – The short term recommendation is the no build option. The long term recommendation is a multilane roundabout, but the timing of this improvement should be revisited once the Billings Bypass is constructed and more is known on the development potential within the EBURD and Hospitality Corridor.
- **Airport Road and Main Avenue** – No specific improvements were recommended in the study. However, it was noted that capacity improvements would be needed in the future, as the intersection is projected to operate at a LOS F in 2020 without the Billings Bypass and at LOS F in 2033 with the Billings Bypass in place.

Hospitality Corridor Planning Study (Reference 3)

This study was completed in September 2013 for the City of Billings. The study provides a vision to integrate vehicular and non-vehicular needs within the Highway 87/Main Street/Exposition Drive corridor. The study includes recommendations for street cross-sections, intersection improvements, and pedestrian enhancements in the study area.

2014 Billings Urban Area Long Range Transportation Plan (Reference 4)

This plan was completed in August 2014 for the City of Billings / Yellowstone County Metropolitan Planning Organization. The plan identifies several transportation projects within the study area, including:

- **Roadway, Intersection, and Congestion Management:** Airport/Main improvements (illustrative), Main Street and 4th Avenue North pavement preservation (committed), Main Street signal timing (recommended)
- **Pedestrian:** Aronson Avenue sidewalks (illustrative), Main Street (US 87) pedestrian easement (recommended), MetraPark pedestrian overpass (recommended)
- **Bicycle:** Airport Road bike lanes (illustrative), Lake Elmo Drive bike lanes (illustrative), 4th Avenue bike lanes (illustrative), 6th Avenue bike lanes (illustrative)
- **Trails:** Swords Park/6th Avenue North Connector (committed), Alkali Creek Trail (committed)

East Billings Urban Renewal District (EBURD) Master Plan (Reference 5)

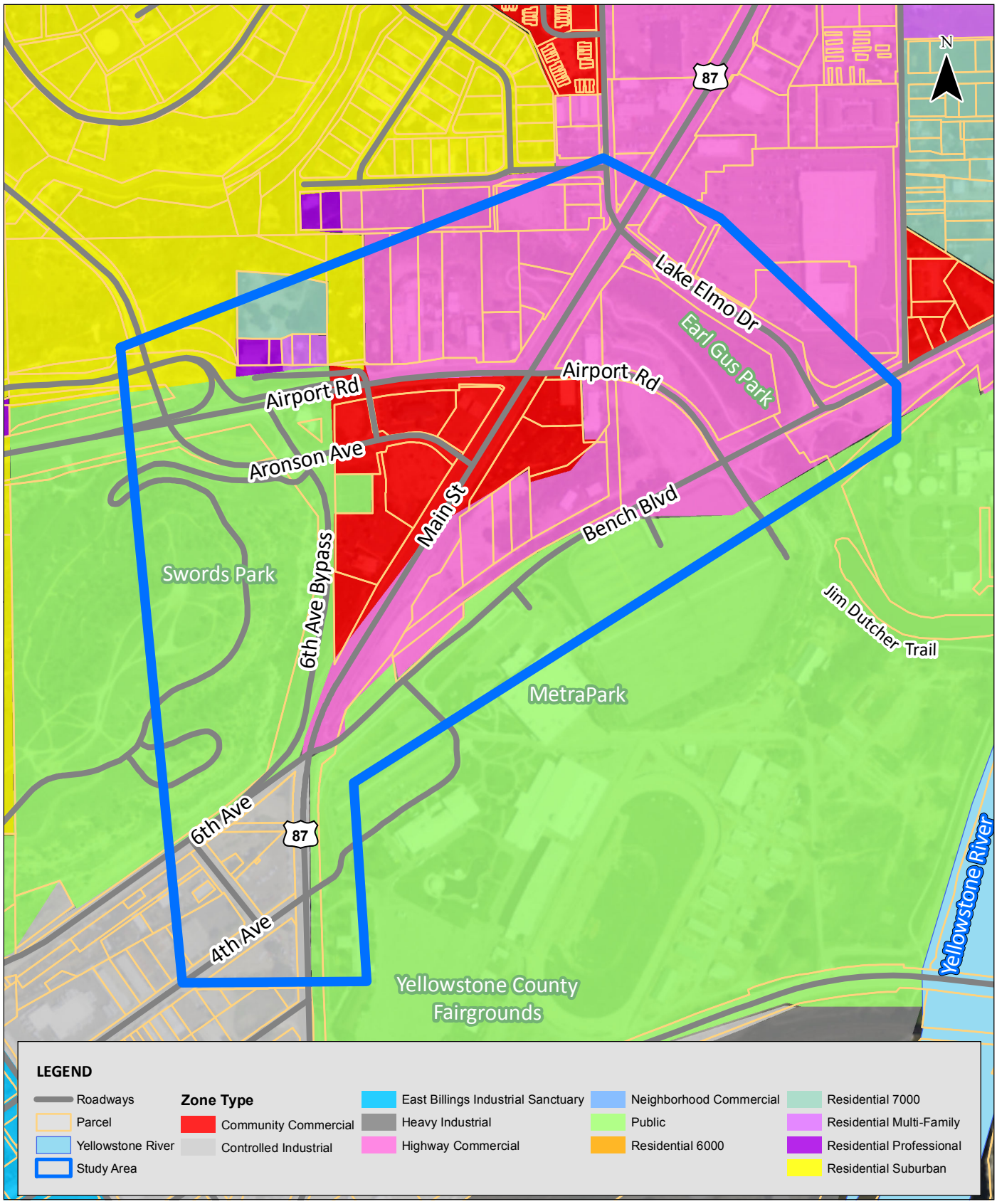
This plan was completed in July 2009 for the Big Sky Economic Development Authority. This plan defined some prototypical streetscape standards, including guidance on lane width, presence of street trees, and other modal facilities.

LAND USE AND ZONING

The project area is located mostly within the city limits of Billings, MT; however, the MetraPark area located south of Bench Boulevard and east of Main Street is owned by Yellowstone County. The existing zoning within the study area is a mix of industrial, public, highway and community commercial, and residential.

Figure 2 illustrates the existing zoning for the study area.

There are several restaurants, gas stations, and hotels near the intersection of Airport Road and Main Street. The southeast region of the study area is occupied by MetraPark and the Yellowstone County Fairgrounds. This entertainment and trade center facility hosts a wide variety of events (e.g. concerts, rodeos, sporting games, trade shows) throughout the year. The northern region of the study area is occupied by commercial and residential uses. The southwest region of the study area includes the Swords Rimrock Park, which has multiuse trails and points of interest. To the north of the study area, Main Street has several major commercial uses (e.g. Target, Walmart) that serve the Billings community.



MONTANA DEPARTMENT OF TRANSPORTATION MDT

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EXISTING ZONING
BILLINGS, MONTANA

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FIGURE
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Transportation System Inventory

The transportation system inventory identifies site conditions and the current geometric characteristics of roadways within the study area. The information presented herein is based on field visits and inventories of the area conducted in April 2015.

ROADWAY FACILITIES

Major roadways in the study area were identified and catalogued. Table 1 provides a summary of the roadway facilities being studied.

Table 1. Existing Roadway Characteristics within Study Area

Roadway	Functional Classification[1]	# of Travel Lanes	Posted Speed (mph)	Pedestrian Facilities	Bicycle Facilities[2]	Average Daily Traffic (ADT)[3]	AM Peak/PM Peak[4]
4th Avenue North	Principal Arterial	3 Lanes	35	Yes	No	14,000	535/1,675
6th Avenue Bypass	Principal Arterial	1 Lane	35	Partial	Primary Bike Route	4,800	760/200
6th Avenue North	Principal Arterial	4 Lanes	35	Yes	Arterial Bike Route	13,800	2,170/935
Alkali Creek Road	Principal Arterial	2 Lanes	25	Partial	Primary Bike Route	3,400	380/220
Airport Road	Principal Arterial	4 - 6 Lanes	45 - 50	Partial	Arterial Bike Route	11,800 - 13,000	1,015/1,610
Aronson Avenue	Principal Arterial	2 Lanes	25	Partial	No	3,100	310/645
Bench Boulevard	Principal Arterial	2 Lanes	35	Partial	Partial	6,500	960/1,110
Main Street	Principal Arterial	6 Lanes	35	Yes	No	38,000 - 49,300	3,060/4,090
Lake Elmo Drive	Collector / Principal Arterial	2 Lanes	25	Partial	Primary Bike Route	6,600	700/865
Swords Lane	Local Street	2 Lanes	25	Partial	No	800	45/75

Notes: [1] Roadway functional classification was derived from the *2014 Billings Urban Area Long Range Transportation Plan*; [2] There are no bike lanes on any roadways within the study area, bike routes were highlighted by the City of Billings Parks and Recreation; [3] ADT counts are from the *2014 Billings Urbanized Area Traffic Count Map* provided by the City of Billing or estimated based on the peak hour counts; and [4] AM and PM Peak hour counts are from turning movement counts collected in April 2015 and shown on Figures 6 and 7.

4th Avenue North is a one-way, principal arterial in the eastbound direction. The roadway provides a connection from Central Billings to Main Street. Bus routes 14P (Alkali), 16P (Main), 17P (Bench), and 18M (Heights) use 4th Avenue North to access communities to the east of downtown.

6th Avenue Bypass is a one lane, principal arterial that provides a one-way connection for vehicles traveling from Aronson Avenue and the Heights neighborhoods to 6th Avenue North. Bus Route 15P (Hilltop) uses the Bypass to connect with 6th Avenue.

6th Avenue North is a one-way, four lane, principal arterial in the westbound direction. The roadway begins at the Main Street/Bench Boulevard/6th Avenue intersection and provides westbound vehicles

a connection into Central Billings. Bus routes 14P (Alkali) and 15P (Hilltop) use 6th Avenue North to connect with downtown Billings.

Alkali Creek Road is a two-lane, principal arterial located to the northwest of the Airport Road/Main Street intersection. The roadway provides connections to local roads via Airport Road and Aronson Avenue within the Heights neighborhood north of Billings Logan International Airport.

Airport Road is a principal arterial that begins at the Airport Road/Main Street intersection and connects MetraPark and Main Street with the Billings Logan International Airport and Montana State Highway 3. No transit service is provided along Airport Road.

Aronson Avenue serves as a two-lane, principal arterial that connects Main Street to the Heights neighborhood located to the north of the study area.

Bench Boulevard is a two-lane, principal arterial that provides a north-south parallel route to Main Street. This roadway connects both commercial and residential uses in the north area of Billings, as well as serves as the main access to MetraPark and its parking facilities.

Main Street serves as a six-lane, principal arterial that provides a continuous, major north-south roadway outside the City limits into Central Billings. Bus routes 14P (Alakli), 15P (Hilltop), 16P (Main), 17P (Bench), and 18M (Heights) utilize Main Street to operate their route.

Lake Elmo Drive is a two-lane, collector and principal arterial that runs parallel to Main Street on the west side. This roadway provides a connection from the Heights neighborhood to Main Street. *Swords Lane* is a two-lane, local road that provides access to some residential parcels, commercial uses, and to Aronson Avenue.

Figure 3 illustrates the existing roadway's functional classification, pedestrian facilities, multi-use trails, and MET fixed-route bus stops within the study area.

PEDESTRIAN AND BICYCLE FACILITIES

Figure 3 highlights the location of sidewalks along the roadways. Main Street, 4th Avenue North, and 6th Avenue North were the only roadways with sidewalks on both sides of the road. An asphalt path was recently constructed along the 6th Avenue Bypass and Swords Lane. The remaining roadways maintain partial and/or intermittent sidewalks.

No bike lanes are provided on any of the roadways within the study area. However, the City of Billings has designated several roadways within the study area as "Arterial Bike Routes" or "Primary Bike Routes," identified in Table 1.

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EXISTING ROADWAY FACILITIES BILLINGS, MONTANA

SCALE: 1" = 600'

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FIGURE 3

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Coordinate System: NAD 1983 StatePlane Montana FIPS 2500 Feet

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Within the study area, Earl Gus Park and Swords Park provide multi-use paths for both pedestrians and bicyclists. These paths are separated and protected from nearby roadways. As shown on Figure 3, Earl Gus Park is located between Lake Elmo Drive, Airport Road, Main Street, and Bench Boulevard. The park includes grade separated facilities to access the Jim Dutcher Trail, which runs parallel to Bench Boulevard and the Yellowstone River. Swords Park is located west of the 6th Avenue Bypass and includes several trails for hiking and biking with views overlooking the Rimrocks and the City of Billings.

TRANSIT FACILITIES

Billings Metropolitan Transit (MET) is the public transportation agency providing fixed-route and paratransit bus services throughout Billings. There are five fixed-route bus routes providing service throughout the study area. These routes include: 14P (Alakli), 15P (Hiltop), 16P (Main), 17P (Bench), and 18M (Heights), all providing weekday service during the a.m. and p.m. peak periods with headways varying between 60 and 80 minutes. Weekend service is provided by bus route 18P (Heights) with headways varying between 60 and 80 minutes beginning at 8:40 a.m. This route runs on Saturday only, with no bus service provided on Sundays. The bus operations include a flag-down service, but there are a few common locations where buses stop in the study area, as shown in Figure 3.

PUBLIC AND PRIVATE ACCESSES

A field inventory of the existing residential and commercial accesses and public street connections was conducted within the study area. Figure 4 illustrates the location of each approach. There are a total of 68 accesses, of which 46 are commercial accesses, 18 public street connections, and 4 residential driveways within the study area. There are no residential driveways located on Main Street or Airport Road. All four residential driveways are located on Swords Lane, north of Airport Road.

The majority of accesses are in the vicinity of the Airport Road/Main Street intersection and the Lake Elmo Drive/Main Street intersection. Main Street has 10 commercial accesses between Aronson Avenue and Lake Elmo Drive. Airport Road has 12 commercial accesses between Bench Boulevard and 6th Avenue Bypass.

MONTANA MDT DEPARTMENT OF TRANSPORTATION

BILLINGS AIRPORT ROAD & MAIN STREET Concept

EXISTING APPROACHES
PUBLIC & PRIVATE
BILLINGS, MONTANA

SCALE: 1" = 600'
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FIGURE
4

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Existing Conditions

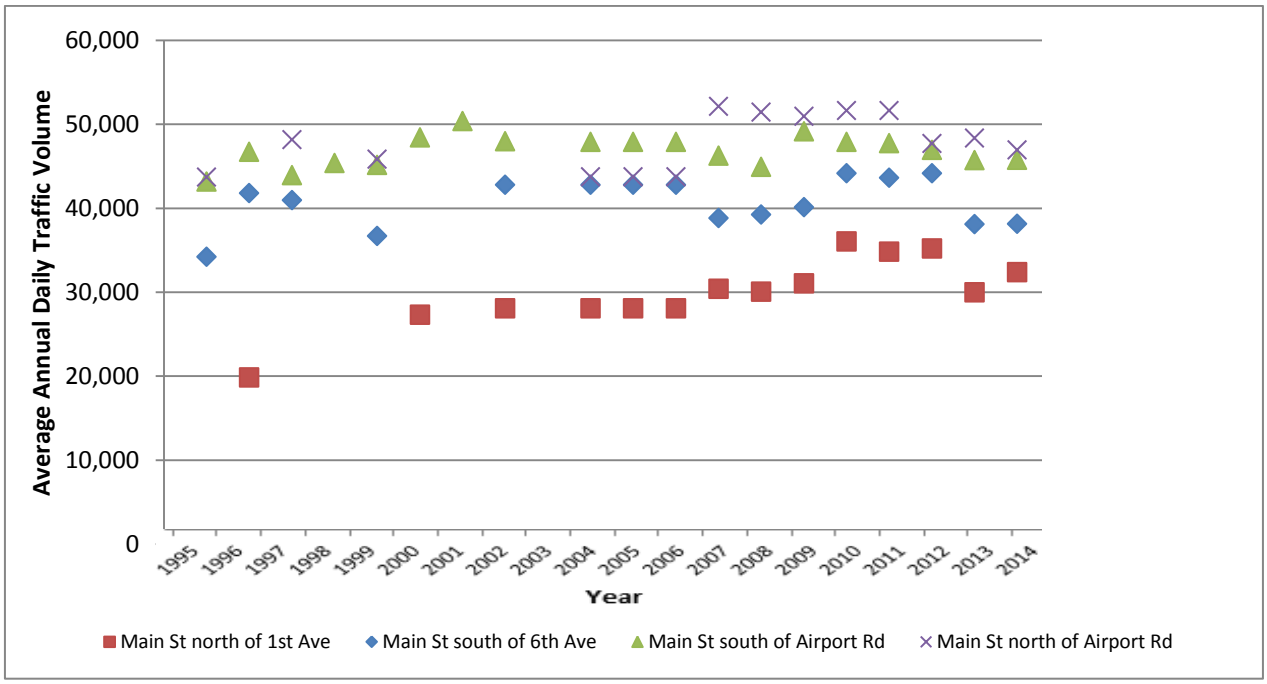
This section summarizes the existing traffic operations and safety analysis within the study area.

OPERATIONS ANALYSIS

Daily Traffic Volumes on Main Street

Montana Department of Transportation (MDT) provided average annual daily traffic (AADT) volumes along Main Street for the past 20 years (1995 - 2014). The AADT along Main Street includes two-way traffic volumes between 1st Avenue and Lake Elmo Drive. In 2014, AADT along Main Street varied from 46,900 north of Lake Elmo Drive to 38,100 north of 1st Avenue. Exhibit 1 presents a graphical representation of the range of AADT on Main Street for the past 20 years. When averaging the segment's AADT over 20 years, the annual growth rate is approximately 1%. *Attachment A includes the AADT worksheets provided by MDT along Main Street from 1995 – 2015.*

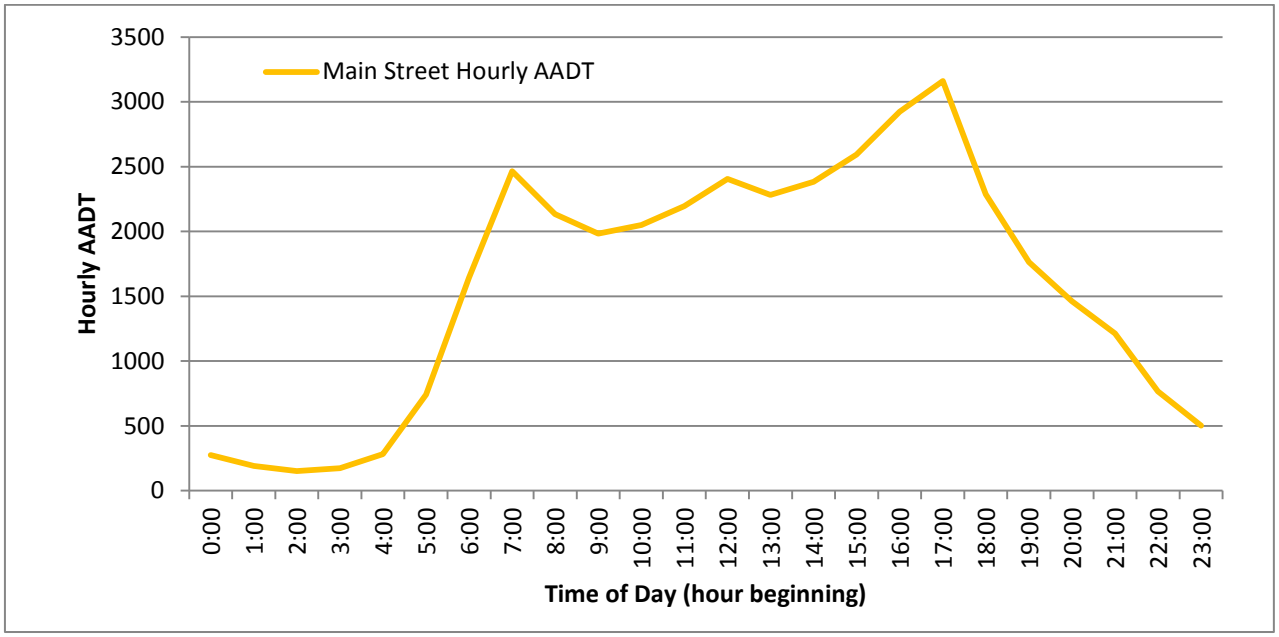
Exhibit 1. 20 Year AADT on Main Street



Notes: There was no AADT data recorded or estimated in 2003.

Exhibit 2 summarizes a weekday, 24-hour profile of the AADT volumes on Main Street just north of 1st Avenue. Main Street has a distinct a.m. peak that occurs between 7:00 a.m. and 8:00 a.m. and a p.m. peak that occurs between 5:00 p.m. and 6:00 p.m. The weekday p.m. peak hour is approximately 23 percent greater than the weekday a.m. peak hour.

Exhibit 2. Hourly AADT Profile at Main Street North of 1st Avenue



Heavy Vehicle Patterns and Activity

Airport Road and Main Street are located on the Camino Real International Trade Corridor that connects Canada, United States, and Mexico. Table 2 summarizes the heavy vehicle percentages by direction on Main Street and Airport Road during the weekday a.m. and p.m. peak hours. The weekday a.m. peak hour has the highest percentage of heavy vehicles in the study area.

Table 2. Heavy Vehicle Percentages along Study Roadways

Roadway	Peak Hour	Heavy Vehicle Percentages			
		Northbound	Southbound	Eastbound	Westbound
Airport Road (west of Main Street)	AM Peak	-	-	7.1%	6.8%
	PM Peak	-	-	3.6%	3.0%
Main Street (north of Airport Road)	AM Peak	8.3%	3.8%	-	-
	PM Peak	3.2%	3.8%	-	-
Main Street (between 6th Avenue and Airport Road)	AM Peak	12.7%	4.8%	-	-
	PM Peak	2.3%	5.2%	-	-

The Airport Road/Main Street intersection has the highest percentage of heavy vehicles among the study intersections, accounting for 5.6% and 3.5% of all vehicles during the weekday a.m. and p.m. peak hours, respectively. The northbound left (42%) from Main Street onto Airport Road and eastbound right (26%) from Airport Road onto Main Street are the movements with the highest heavy vehicle percentages at the intersection.

Pedestrian and Bicyclist Activity

Turning movement counts and pedestrian/bicyclist counts were collected at each study intersection in April 2015. The majority of pedestrian and bicyclist activity occurred at the Airport Road/Main Street intersection and along Bench Boulevard in the vicinity of Earl Gus Park. Table 3 provides directional pedestrian and bicycle activity where recorded at the study intersections.

There was relatively minimal bicycle activity throughout the study area. Many bicyclists utilize the multiuse trails within the study area, as they are separated and provide fairly good connectivity from the neighborhoods to downtown Billings.

Table 3. Pedestrian and Bicycle Activity

Intersection	Peak Hour	Northern Crossing		Southern Crossing		Eastern Crossing		Western Crossing		Total
		Ped	Bike	Ped	Bike	Ped	Bike	Ped	Bike	
Lake Elmo Dr/Main St	AM Peak	2	-	-	1	-	1	1	1	**6**
	PM Peak	-	-	-	-	1	1	1	-	**3**
Airport Rd/Main St	AM Peak	-	-	1	-	2	-	4	1	**8**
	PM Peak	-	-	5	1	-	1	4	-	**11**
Lake Elmo Dr/Bench Blvd	AM Peak	-	-	7	-	-	-	-	-	**7**
	PM Peak	2	-	12	-	1	-	-	-	**15**
Airport Rd/Bench Blvd	AM Peak	-	2	4	-	-	-	3	-	**9**
	PM Peak	1	-	1	-	1	-	-	1	**4**
Aronson Ave/6th Ave Bypass	AM Peak	-	-	2	-	-	-	-	-	**2**
	PM Peak	-	1	4	3	-	-	-	-	**8**
Aronson Ave/Main St	AM Peak	-	-	-	-	-	-	3	1	**4**
	PM Peak	-	-	-	-	-	-	6	-	**6**
6th Ave/Main St	AM Peak	-	-	-	-	-	1	1	-	**2**
	PM Peak	-	-	-	-	-	-	-	-	**0**
4th St/Main St	AM Peak	-	1	1	1	1	-	-	-	**4**
	PM Peak	-	-	3	-	-	-	1	-	**4**

Intersection Peak Hour Operations Analysis

Turning movement counts were collected on a typical mid-week day in April 2015 during the a.m. peak period (7:00 a.m. to 9:00 a.m.) and p.m. peak period (4:00 p.m. to 6:00 p.m.) at each of the study intersections. Additionally, turning movement counts were collected during an event at the Rimrock Auto Arena at MetraPark. The event was a Pro Bull Riding Rodeo on Friday, April 17, 2015. Turning movement counts were collected between 4:00 p.m. and 12:00 a.m. to identify event traffic patterns at nearby study intersections. *Attachment B includes the turning movement count data sheets at the study intersections for the weekday a.m. and p.m. peak time periods.*

The operational analysis was performed using the following assumptions:

- Synchro 8 was used to model the existing roadway network and analyze the weekday a.m. and p.m. peak hour traffic conditions.
- Weekday AM and PM turning movement counts (collected in April 2015)
- Pedestrian and bicycle counts (collected in April 2015)
- Lane geometry, posted speeds, and storage lengths (field collected in April 2015; used GoogleEarth to confirm some measurements)
- A 1700 passenger cars/per hour/per lane saturation flow rate was used based on field data collected on King Avenue in Billings, as part of the King Avenue Signal Timing project.
- Peak hour factor was calculated from the April 2015 turning movement counts
- Signal timing and phase diagrams were obtained from MDT for the traffic signals on Main Street and City of Billings for the Bench Boulevard/Airport Road intersection; The Main Street corridor operates in coordination with a cycle length of 130 and 150 seconds during the weekday a.m. and p.m. peak hours, respectively.
- The Highway Capacity Manual (HCM) 2000 (Reference 6) and Synchro 8's SIMTraffic methodology were used in the analysis. The HCM 2000 methodology was used for all of the signalized and stop-controlled intersections as it produced consistent results with our field observations in comparison to using the HCM 2010, except for the stop-controlled intersections of Aronson Avenue/6th Avenue Bypass and Aronson Avenue/Main Street. At the Aronson Avenue/6th Avenue Bypass intersection, the lane geometry and stop-controlled operations are not accommodated in the HCM. At the Aronson Avenue/Main Street intersection, the northbound left-turn movement was observed to maneuver when the northbound left-turn at the Airport Road/Main Street signalized intersection received the green arrow. The macroscopic nature of the HCM model is unable to capture this operational benefit from an upstream traffic signal. Therefore, Synchro 8's SimTraffic, a microsimulation tool was used to report the operational results at these two intersections. HCM 2010 was used to analyze the merge condition at the Airport Road/Alkali Creek Road on-ramp (Reference 7).
- Intersection performance measures reported in this study include, but are not limited to, level of service (LOS), volume-to-capacity ratio (V/C), delay, and 95th percentile queue lengths. MDT has adopted level-of-service standards for facilities, detailed in Chapter 3 of the MDT Road Design Manual. For a Principal Urban Arterial, the desirable LOS is LOS "B" or LOS "C" per the MDT Road Design Manual (Reference 8). In urban conditions, a LOS "D" or LOS "E" and a volume-to-capacity ratio of less than 0.90 are often acceptable. The LOS "B" and LOS "C" criteria are more pertinent for freeways and two-lane highways versus the urban arterial conditions within the study area.

Figure 5 presents the existing lane configuration and traffic control devices at the study intersections. Figure 6 and Figure 7 summarize the operational analysis at the study intersections during the weekday a.m. and p.m. peak hours. *Attachment C includes the existing conditions operational results from Synchro 8 during the weekday a.m. and p.m. peak hours.*

As shown in Figures 6 and 7, most of the study intersections currently operate at a level of service C or better during the weekday a.m. and p.m. peak hours. However, the following intersections are identified as either not meeting the LOS C criteria or have a volume-to-capacity ratio of greater than 0.90:

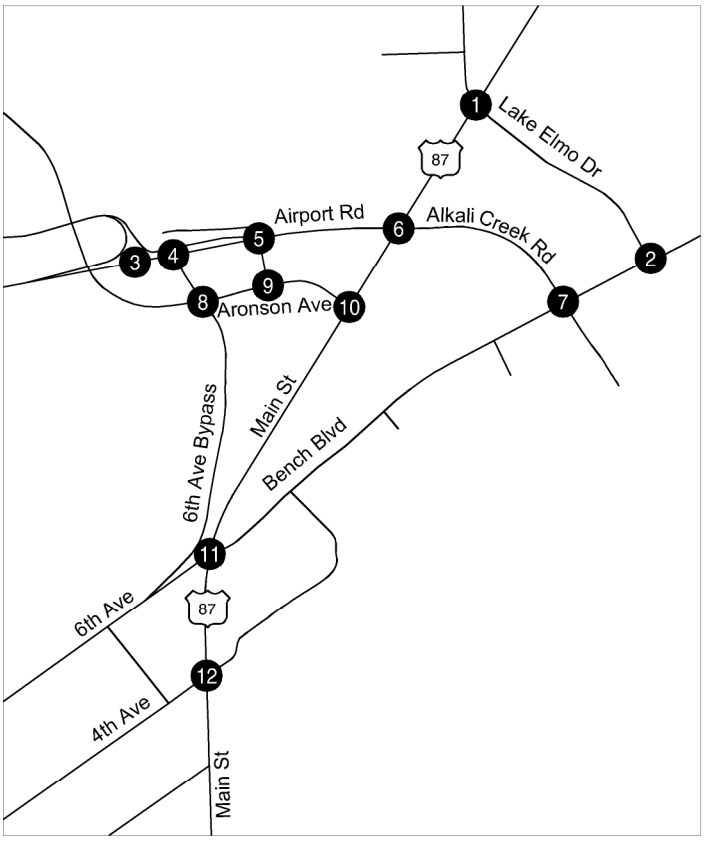
- Main Street/Lake Elmo Drive (AM v/c = 0.97)
- Main Street/Airport Road (AM v/c = 0.92, PM LOS D and v/c = 0.92)
- Main Street/Aronson Avenue (PM LOS = D for northbound left-turn)
- Main Street/6th Avenue (AM v/c = 1.00, PM v/c = 0.97)
- Main Street/4th Avenue (PM LOS D and v/c = 0.96)

As observed in the field, the main Street corridor between 4th Avenue and Lake Elmo Drive is operating near capacity during the weekday a.m. and p.m. peak hour.

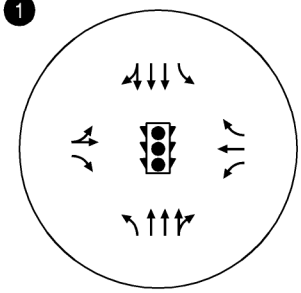
Queue lengths were evaluated at the signalized intersections along the Main Street corridor to identify if any deficiencies in queue spillback occur during the weekday a.m. and p.m. peak hours. The 95th percentile queue lengths are calculated using Synchro 8 and represents the worst-case queue that occurs 5% of the time.

Figure 8 illustrates the 95th percentile critical queue lengths at the study intersections during the weekday a.m. and p.m. peak hours. The following are results from the analysis and observations from the field visit:

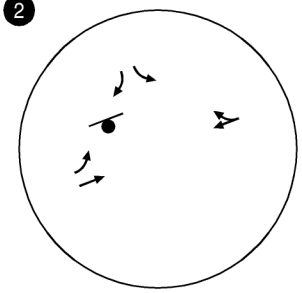
- **Lake Elmo Drive/Main Street** – The 95th percentile queue length for the eastbound right exceeds the storage length during the weekday a.m. and p.m. peak hours. There is currently an exclusive right-turn lane with a storage length of 100 feet, which is inadequate to accommodate the right-turn traffic volume. Additionally, during the weekday a.m. peak period, vehicles making that right-turn have limited opportunity to make a right-turn on red due to the heavy throughput on Main Street. Vehicle queues for the southbound through movement reach their maximum length during the weekday a.m. peak period, extending roughly 500 feet from the intersection.
- **Airport Road/Main Street** - The eastbound left turn experiences high delay and at times long vehicle queues during the weekday p.m. peak hour. The split-phasing for the eastbound and westbound movements limits the green time for the eastbound left turn. During the weekday a.m. peak hour, vehicle queues in the southbound through direction were observed to spill back to the Lake Elmo Drive intersection.



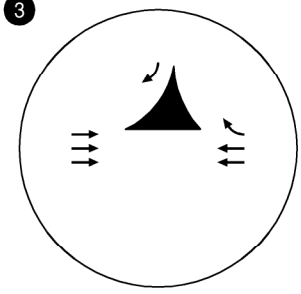
1 Lake Elmo Drive & Main Street



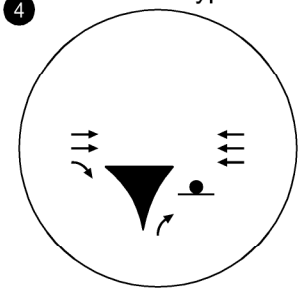
2 Lake Elmo Drive & Bench Boulevard



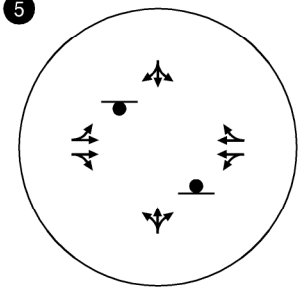
3 Airport Road & Alkali Creek Road



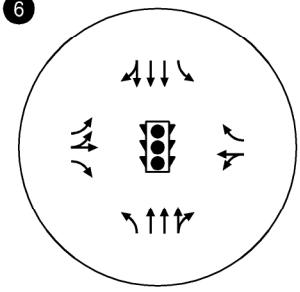
4 Airport Road & 6th Avenue Bypass*



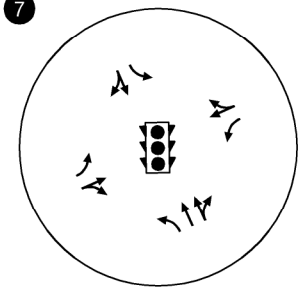
5 Airport Road & Swords Lane



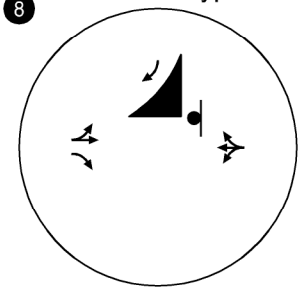
6 Airport Road & Main Street



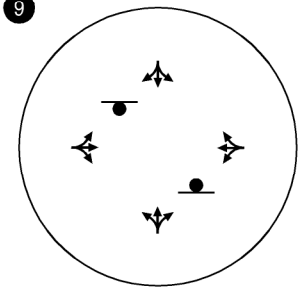
7 Alkali Creek Road & Bench Boulevard



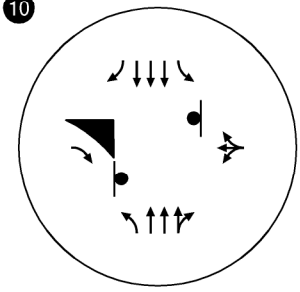
8 Aronson Avenue & 6th Avenue Bypass



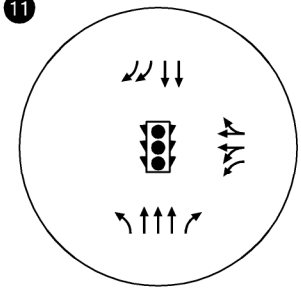
9 Aronson Avenue & Swords Lane



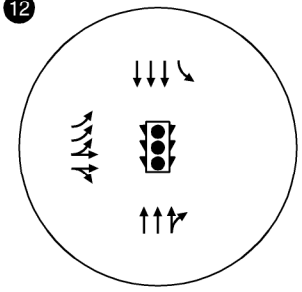
10 Aronson Avenue & Main Street



11 6th Avenue & Main Street



12 4th Avenue & Main Street



* The third westbound through lane serves as a right-turn lane at the downstream intersection.

MONTANA MDT DEPARTMENT OF TRANSPORTATION

BILLINGS AIRPORT ROAD MAIN STREET Concept

EXISTING LANE CONFIGURATIONS AND TRAFFIC CONTROL DEVICES BILLINGS, MONTANA

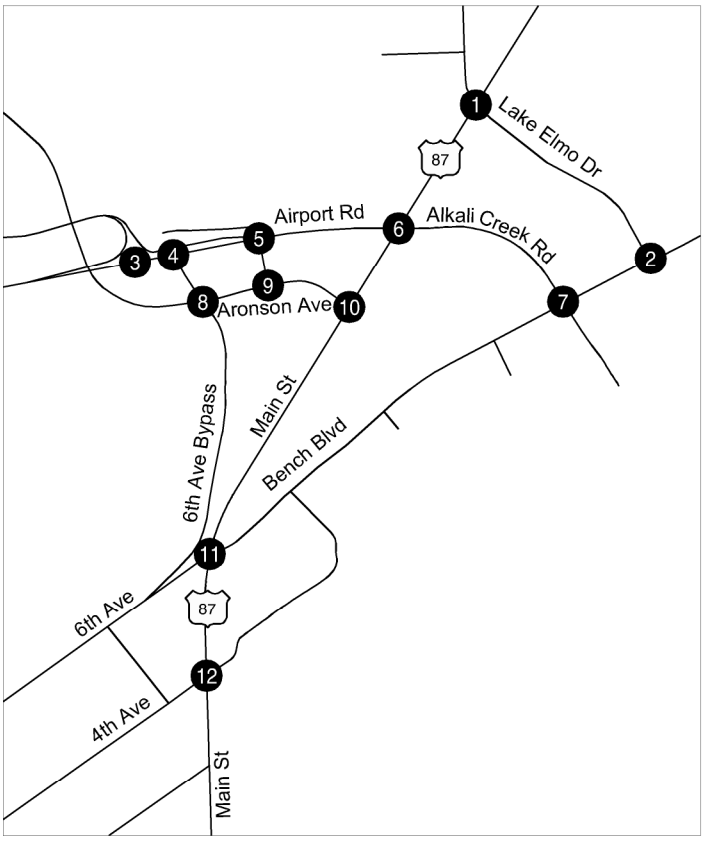
LEGEND

- STOP SIGN
- TRAFFIC SIGNAL

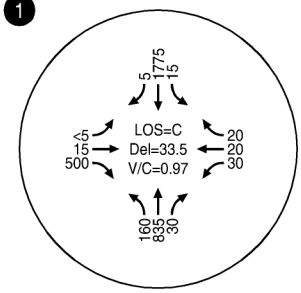
FIGURE 5

KITTELSON & ASSOCIATES, INC. TRANSPORTATION ENGINEERING/PLANNING

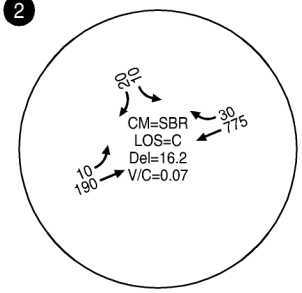
H:\projfils\18460 - Airport Road & Main Street - Billings\dwgs\figs\18460_FinalFigures.dwg Sep 09, 2015 - 8:55am - bkorpooraal Layout Tab: LaneCo nfiguration



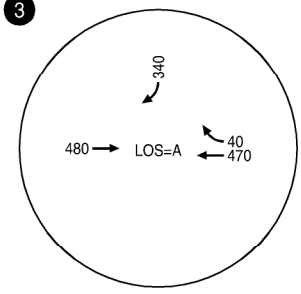
1 Lake Elmo Drive & Main Street



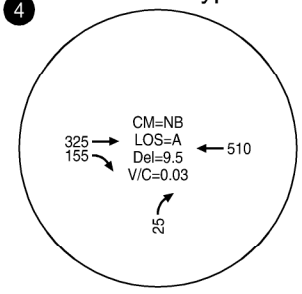
2 Lake Elmo Drive & Bench Boulevard



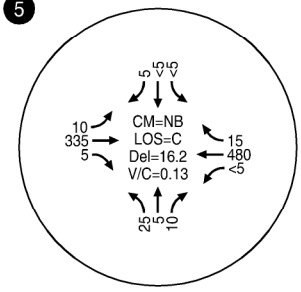
3 Airport Road & Alkali Creek Road*



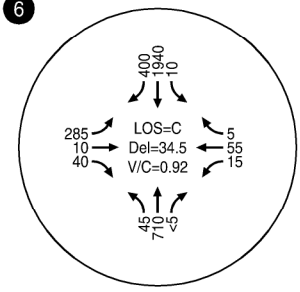
4 Airport Road & 6th Avenue Bypass



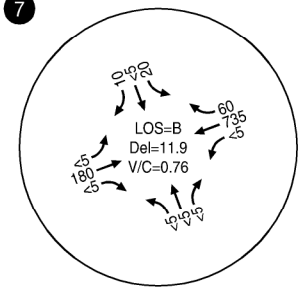
5 Airport Road & Swords Lane



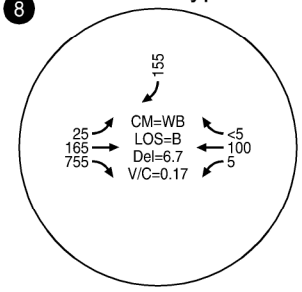
6 Airport Road & Main Street



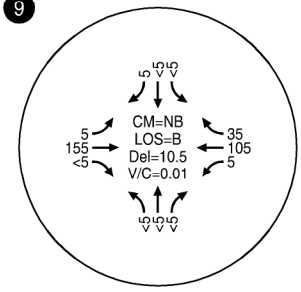
7 Alkali Creek Road & Bench Boulevard



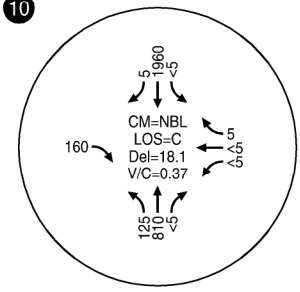
8 Aronson Avenue & 6th Avenue Bypass**



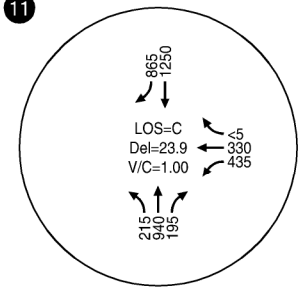
9 Aronson Avenue & Swords Lane



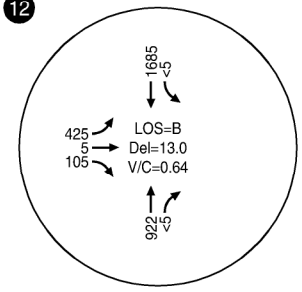
10 Aronson Avenue & Main Street**



11 6th Avenue & Main Street



12 4th Avenue & Main Street



* HCM 2000 Methodology does not support intersection's traffic control device. Operation results were determined using HCS 2010 Merge Segment Methodology.
** HCM 2000 Methodology does not support intersection's lane configuration. Operation results were determined using Synchro's SimTraffic analysis.

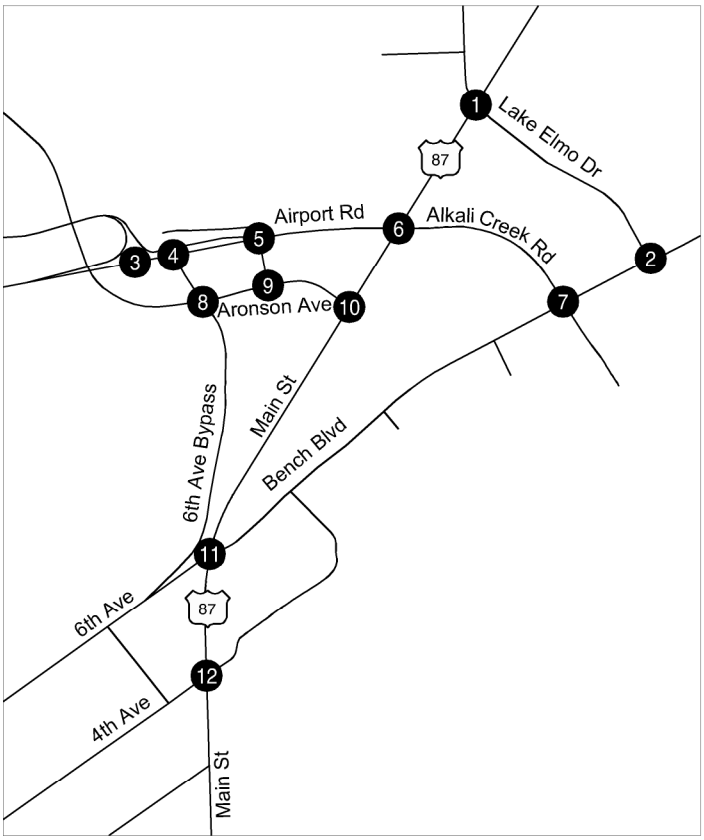
MONTANA DEPARTMENT OF TRANSPORTATION MDT
BILLINGS AIRPORT ROAD MAIN STREET Concept

EXISTING CONDITIONS
AM PEAK HOUR
BILLINGS, MONTANA

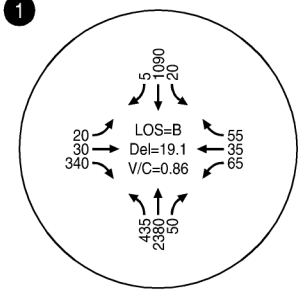
LEGEND
CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE /CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY/ CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

FIGURE
6

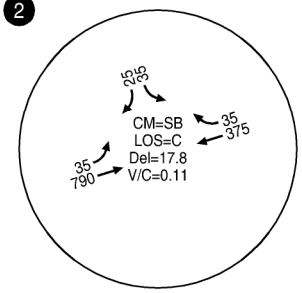
KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING



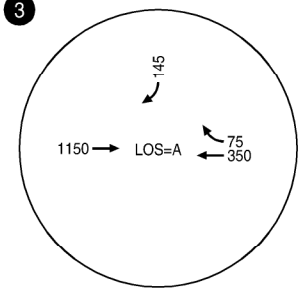
1 Lake Elmo Drive & Main Street



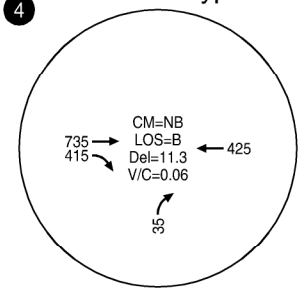
2 Lake Elmo Drive & Bench Boulevard



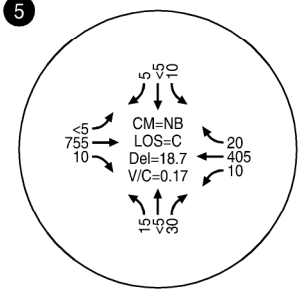
3 Airport Road & Alkali Creek Road*



4 Airport Road & 6th Avenue Bypass



5 Airport Road & Swords Lane



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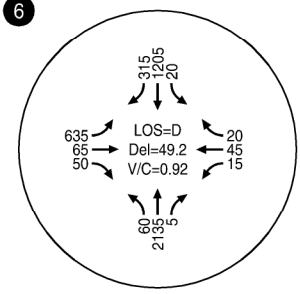
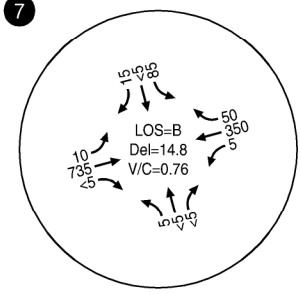
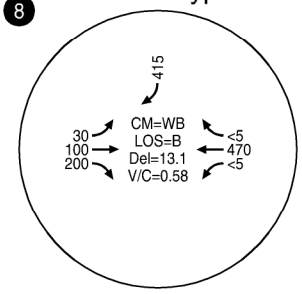


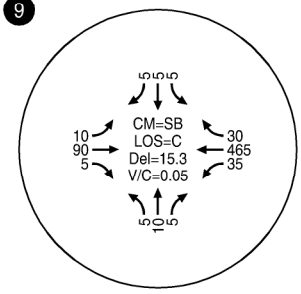
7 Alkali Creek Road & Bench Boulevard



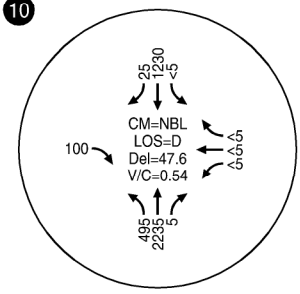
8 Aronson Avenue & 6th Avenue Bypass**



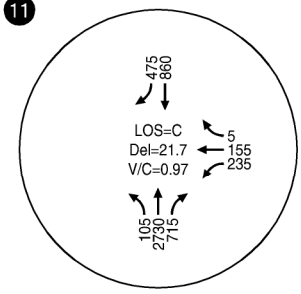
9 Aronson Avenue & Swords Lane



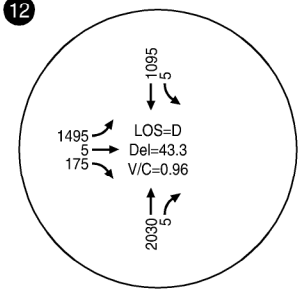
10 Aronson Avenue & Main Street**



11 6th Avenue & Main Street



12 4th Avenue & Main Street



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** HCM 2000 Methodology does not support intersection's lane configuration. Operation results were determined using Synchro's SimTraffic analysis.

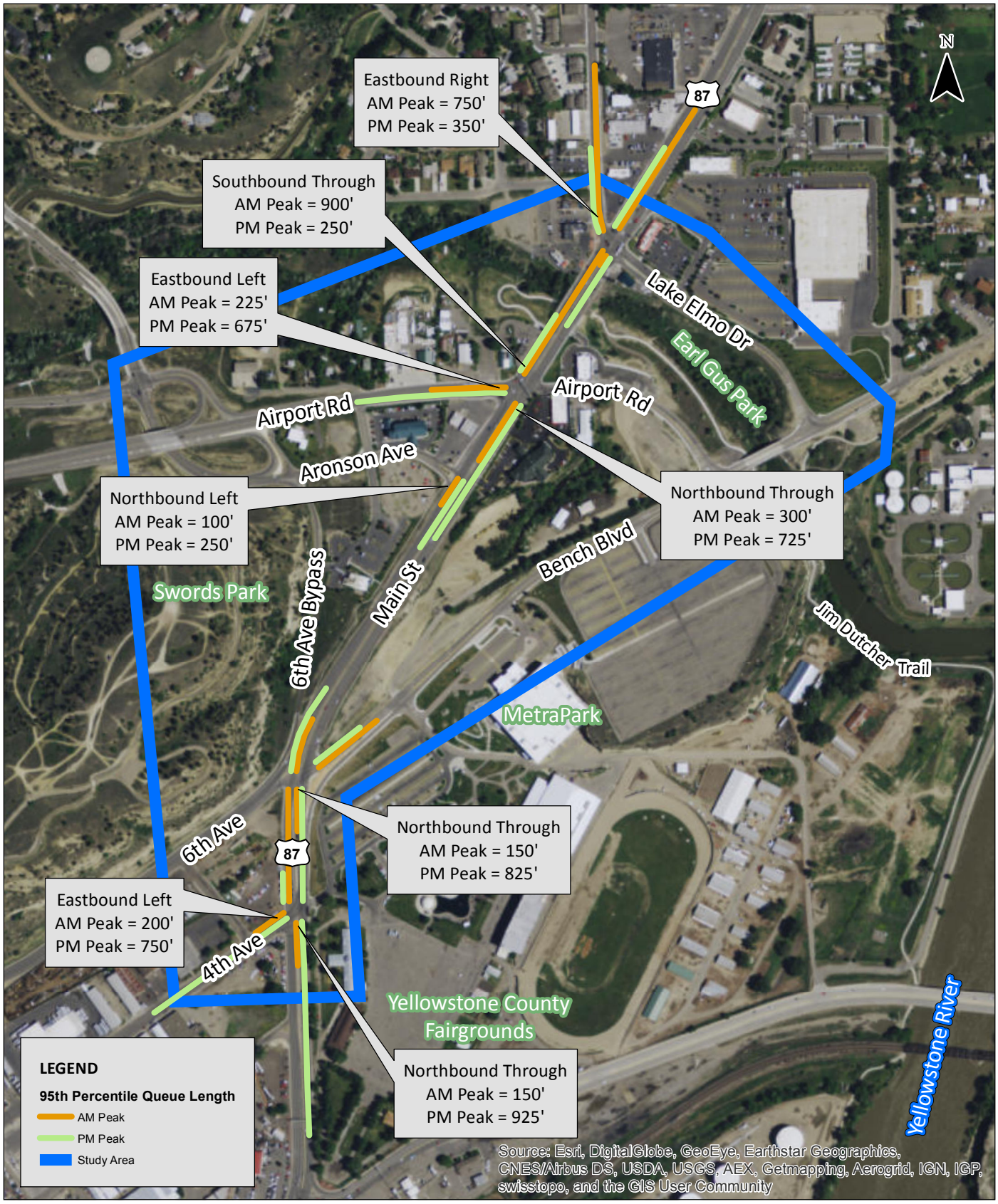
MONTANA DEPARTMENT OF TRANSPORTATION MDT
BILLINGS AIRPORT ROAD MAIN STREET Concept

EXISTING CONDITIONS
PM PEAK HOUR
BILLINGS, MONTANA

LEGEND
CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE /CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY/ CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

FIGURE
7

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING



MONTANA MDT DEPARTMENT OF TRANSPORTATION

BILLINGS AIRPORT ROAD & MAIN STREET Concept

95th PERCENTILE CRITICAL QUEUE LENGTHS BILLINGS, MONTANA

SCALE: 1" = 600'

0 300 600 Feet

FIGURE 8

H:\profile\18460 - Airport Road & Main Street - Billings\gis\base\tech memo 1\95th%Queues.mxd - bkorporal - 9:34 AM 10/27/2015

KITTELSON & ASSOCIATES, INC. TRANSPORTATION ENGINEERING/PLANNING

Coordinate System: NAD 1983 StatePlane Montana FIPS 2500 Feet

There is currently no southbound right-turn lane, so vehicles making the right-turn on to Airport Road must wait until the southbound through movement gets a green indication. Vehicle queues in the northbound direction varied based on time of day, but were longest during the weekday p.m. peak hour. The northbound vehicle queues were observed to spillback to or past the Aronson Drive/Main Street intersection. Vehicle queues for the northbound left movement never exceeded the storage length provided in either of the peak periods as the majority of vehicles making a left off of Main Street in the northbound direction use Aronson Avenue as an alternate route.

- **Aronson Avenue/Main Street** – The unsignalized intersection of Aronson Avenue/Main Street experiences a high volume of northbound left turns (495 in the p.m. peak hour). This movement was observed to fill the storage length turn lane and on occasion, spill back into the through lanes on Main Street.
- **6th Avenue/Main Street/Bench Boulevard** - The northbound left turn is at capacity during the weekday a.m. peak hour, which results in queues exceeding the storage lane. During the weekday p.m. peak hour, the queue length of the northbound through movement was observed to spillback past the 4th Avenue/Main Street intersection, resulting in a lack of progression for vehicles trying to make a left from 4th Avenue onto Main Street.
- **4th Avenue/Main Street** - The eastbound left turn experiences long delays and queues during the weekday p.m. peak hour. This movement often slows or stops during its phase to join the platoon of vehicles headed in the northbound direction along Main Street. When the eastbound left turn's phase turns green, vehicles must wait for the northbound through queue on Main Street to clear before entering the intersection, resulting in an underutilized phase at the 4th Avenue/Main Street intersection. In addition, the southbound through queue length reaches storage capacity during the weekday a.m. peak hour. Spillback into the 6th Avenue intersection was not observed; however, at times southbound through queues at 4th Avenue did inhibit westbound left turns from Bench Boulevard from being able to turn onto Main Street and head south.

Event Traffic Conditions

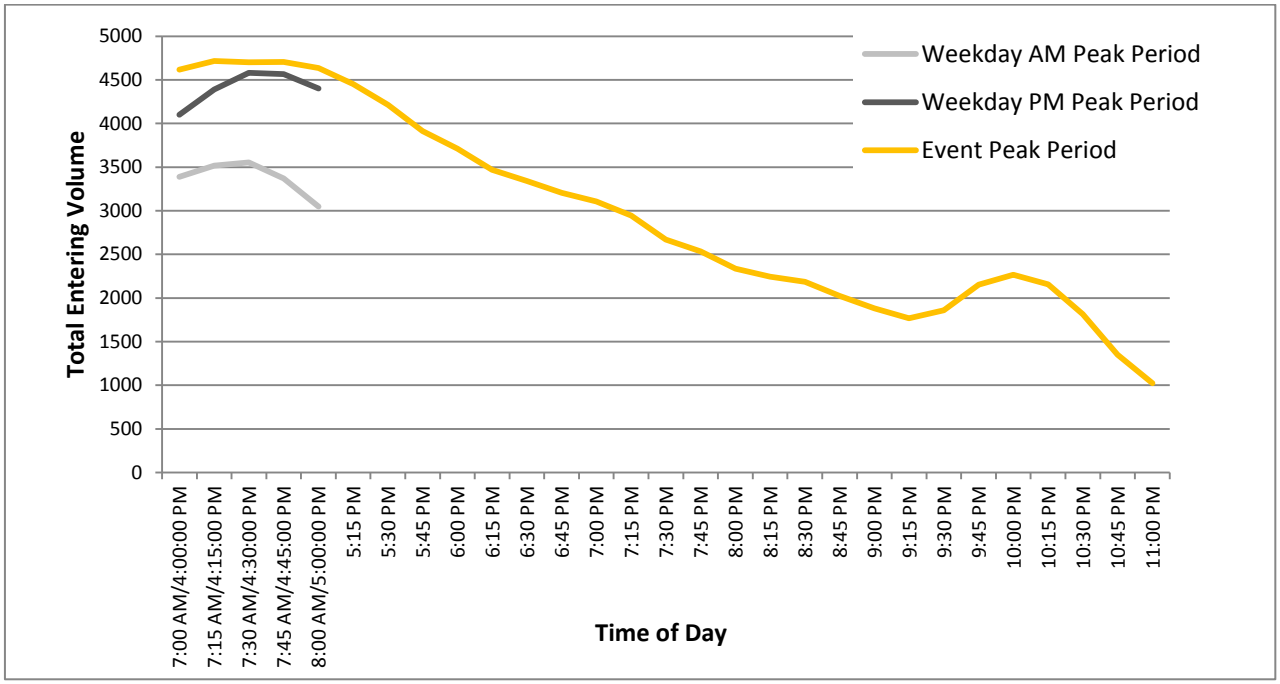
Turning movement counts were collected at each of the study intersections on Friday, April 17, 2015 from 4:00 p.m. to 12:00 a.m. Counts were collected to analyze the impact of event traffic on roadways and intersections within the study area. The Rimrock Auto Area at MetraPark has a capacity of 12,000 seats and was host to the Professional Bull Riding Rodeo from 8:00 p.m. to 10:00 p.m. on that evening.

Event counts during the Friday p.m. peak period were higher than the non-event weekday p.m. peak hour conditions. At the Airport Road/Main Street intersection, the total entering volume was approximately 3.3% higher during the event than the non-event condition, which is not a significant change. However, event counts indicate turning movement counts onto Airport Road in the

eastbound direction increased 61% during the Friday p.m. peak hour. Other than the Friday p.m. peak hour containing a higher percentage of vehicles turning onto eastbound Airport Road, peak characteristics under event conditions were generally the same as the non-event, weekday p.m. peak hour conditions.

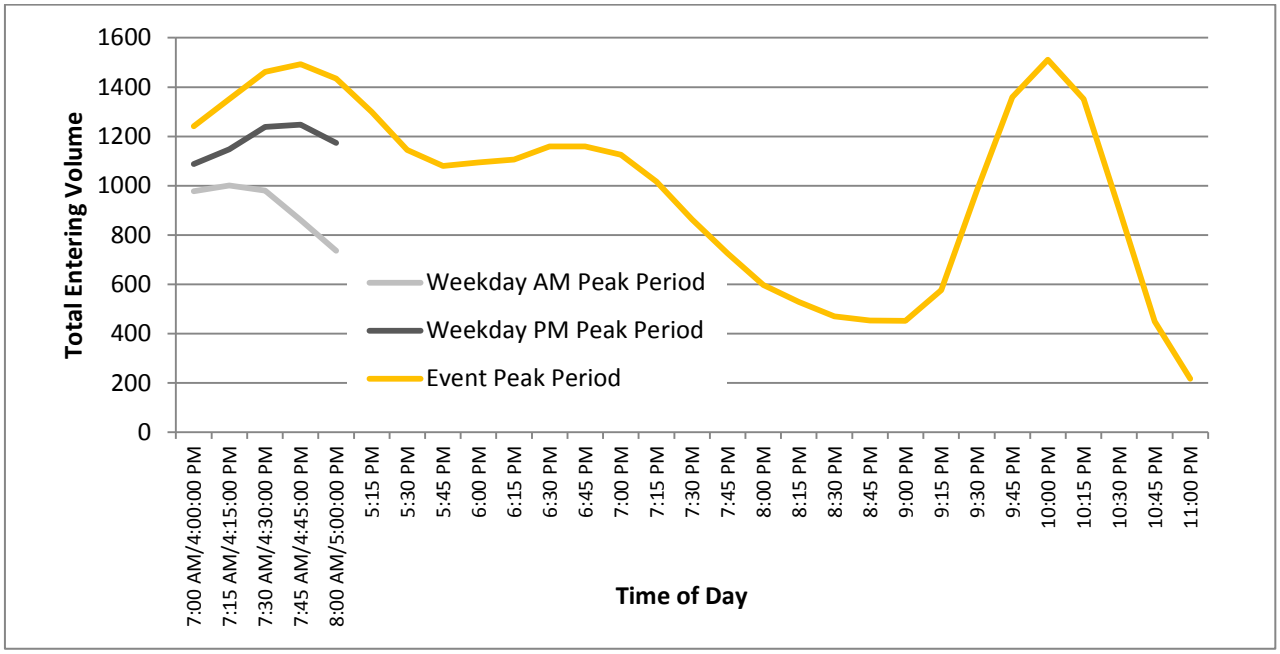
After the event completed, traffic increased at the intersections between 10:00 p.m. and 11:00 p.m. The eastbound approach at the Airport Road/Main Street intersection accounted for approximately 28% of the total entering volume at the intersection, in comparison to 2% during non-event conditions. Exhibit 3 compares the total entering volumes between event and non-event conditions at Airport Road/Main Street.

Exhibit 3. Total Entering Volume Comparison of Event and Non-Event Traffic at the Airport Road/Main Street Intersection



The Bench Boulevard/Airport Road intersection serves as the main exit for vehicles leaving the arena. Exhibit 4 compares the total entering volumes between event and non-event conditions at Bench Boulevard/Airport Road. After the event completed, traffic increased by approximately 21% at the intersection between 10:00 p.m. and 11:00 p.m. The westbound approach accounted for approximately 64% of the total entering volume at the intersection, in comparison to less than 1% during non-event conditions.

Exhibit 4. Total Entering Volume Comparison of Event and Non-Event Traffic at the Bench Boulevard/Airport Road Intersection



Overall, the peak hour totals of event traffic were within the range of the traffic volumes counted during the midweek p.m. peak hour. However, specific approaches at the intersections experience a significant increase in volume when the event lets out. At this time, no additional traffic operations analysis was completed at the study intersections under an event condition. However, a sensitivity check and discussion about event conditions is planned for the different alternatives, as the study moves into the development and evaluation of the alternatives. *Attachment D contains the turning movement counts collected during the event peak period.*

CRASH HISTORY

Crash data from the previous five years (2010 – 2014) was obtained from MDT and was used to evaluate crash trends within the study area. Crash data was summarized at each of the study intersections. Overall, there were 383 crashes, including 1 fatality over a 5-year period in the study area. Injury related crashes accounted for 36% of all reported crashes. There were no crashes reported at the unsignalized intersection of Aronson Avenue/Swords Lane or the signalized intersection of Bench Boulevard/Airport Road. Table 4 presents the severity of total reported crashes, as well as a crash rate for each intersection which is the ratio of crashes per million entering vehicles at each of the study intersections.

The crash rate is a useful tool to measure the relative safety at a particular intersection, as well as how it compares to the average intersection along a specific corridor or roadway network. Oftentimes, a crash rate is used to prioritize locations for safety improvements. An intersection or

roadway crash rate greater than 1.00 is an indication that a particular crash type may warrant additional analysis to potentially implement a mitigation to improve safety at the intersection or along the roadway.

Table 4. Crash Summary (2010 - 2014) at the Study Intersections

Int. ID	Study Intersection	PDO	Injury	Fatal	Total	Crashes per Million Vehicles Entering
1	Lake Elmo Drive/Main Street	96	51	0	147	**1.78**
2	Lake Elmo Drive/Bench Boulevard	1	0	0	1	**0.04**
3	Airport Road/Alkali Creek Road	1	1	0	2	**0.06**
4	Airport Road/6th Avenue Bypass	0	2	0	2	**0.07**
5	Airport Road/Swords Lane	4	1	0	5	**0.22**
6	Airport Road/Main Street	67	44	0	111	**1.33**
7	Airport Road/Bench Boulevard	0	0	0	0	**0.00**
8	Aronson Avenue/6th Avenue Bypass	2	0	0	2	**0.09**
9	Aronson Avenue/Swords Lane	0	0	0	0	**0.00**
10	Aronson Avenue/Main Street	5	3	0	8	**0.40**
11	6th Avenue/Main Street	34	15	1	50	**0.58**
12	4th Avenue/Main Street	34	21	0	55	**0.62**
-	**Total**	**244**	**138**	**1**	**383**	-

Notes: Crash data provided by Montana Department of Transportation for years 2010 – 2014.

The Lake Elmo Drive/Main Street and Airport Road/Main Street intersections have crash rates greater than 1.00. Both intersections have the two highest totals of reported crashes. Rear-end crashes accounted for approximately two-thirds of the reported crashes at both intersections, which is a common crash type at signalized intersections.

The highest crash types among all study intersections were rear-end crashes and right angle crashes, accounting for 61% and 14% of total crashes, respectively. Exhibit 5 presents the percentage of crash types among all reported crashes. Nearly 25% of crashes occurred during the weekday p.m. peak period (4:00 p.m. – 6:00 p.m.). No crash trends were identified within specific months of the year. However, 21% of crashes occurred on wet/snowy/icy pavement.

Exhibit 5. Crash Types of Reported Crashes at All Study Intersections

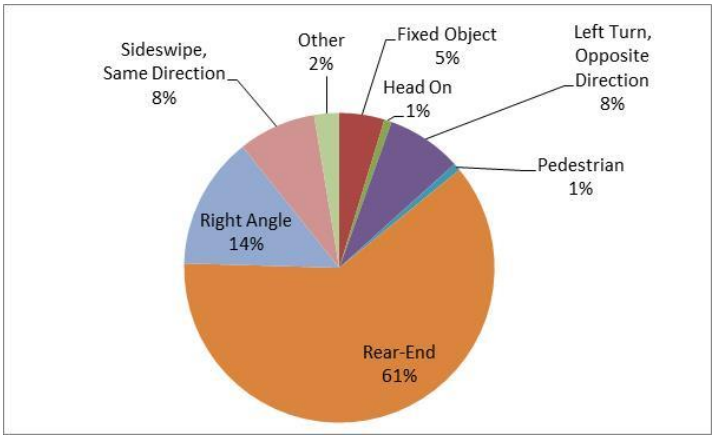


Table 5 summarizes the crash type by year at the two highest crash rate intersections. Similar to the other study intersections, rear-end crashes exceeded 60% at both of these intersections.

Table 5. Airport Road/Main Street and Lake Elmo Drive/Main Street Crash Summary

Crash Type	Year					Total	Percentage
	2010	2011	2012	2013	2014		
Airport Road & Main Street Intersection							
Fixed Object	2	1	1	1	1	**6**	**5%**
Head On	0	0	1	0	1	**2**	**2%**
Left Turn, Opposite Direction	2	2	2	0	4	**10**	**9%**
Pedestrian	0	0	0	1	0	**1**	**2%**
Rear-End	16	20	13	10	11	**70**	**63%**
Right Angle	2	4	3	4	0	**13**	**12%**
Sideswipe, Same Direction	1	2	2	3	1	**9**	**8%**
Totals	23	29	22	19	18	**111**	**100%**
Lake Elmo Drive & Main Street Intersection							
Fixed Object	1	1	0	1	0	**3**	**2%**
Left Turn, Opposite Direction	0	7	2	4	4	**17**	**12%**
Other	0	0	0	1	1	**2**	**1%**
Pedestrian	0	0	0	0	1	**1**	**1%**
Rear-End	27	18	9	26	22	**102**	**69%**
Right Angle	0	3	5	2	4	**14**	**10%**
Right Turn, Same Direction	0	0	0	0	1	**1**	**1%**
Sideswipe, Opposite Direction	2	1	1	1	2	**7**	**5%**
Totals	30	30	17	35	35	**147**	**100%**

In addition to the intersection crashes, there were a total of 44 reported crashes that occurred on the individual segments on Main Street between 4th Street and Lake Elmo Drive. The highest crash types were rear-end and side-swipe. *Historical crash data is available through MDT and is included within the project file.*

ENVIRONMENTAL SCAN

The purpose of the environmental scan was to identify potential environmental constraints within the study area to inform the development and evaluation of alternatives during the concept phase, and for future insights as this project moves into final design. **This environmental scan is not meant to be used as or substituted for a comprehensive environmental investigation.** If improvement options are forwarded from this study into project development, an analysis for compliance with the National and Montana Environmental Policy Acts (NEPA and MEPA) will be completed as part of the Montana Department of Transportation (MDT) project development process. Information provided in this

study may be forwarded into the NEPA/MEPA process at that time. *Attachment E includes the complete environmental scan document.*

ACCESS MANAGEMENT

This section describes existing access spacing along the Main Street and Airport Road corridors in comparison to MDT access control spacing guidelines from the MDT Road Design Manual and Montana Right-of-Way Operations Manual (Reference 9).

MDT's access spacing guidelines for roadways classified as National Highway System (NHS), undivided and divided, and in a developed area are:

- Undivided (Airport Road – 45 mph): Signal spacing is ¼ mile. Minimum unsignalized access spacing is 325 to 375 feet.
- Divided (Main Street – 35 mph): Signal spacing is ¼ mile. Median opening spacing is ¼ mile for full movement and 1/8 mile for directional only. Minimum unsignalized access spacing is 250 feet.

Attachment F includes the Recommended Montana Access Guidelines figure from the Montana Right-of-Way Operations Manual.

As shown in Figure 4, there are several commercial accesses located near the Airport Road and Main Street intersection. In general, the roadway segments near the Airport Road and Main Street intersection do not currently meet the MDT access control spacing guidelines presented above.

As this study moves forward into the next phase, additional research will be conducted regarding access control and the access deeds in place for the parcels near the Airport Road and Main Street intersection. Additionally, access consideration will be included in the evaluation and assessment of the different intersection alternatives in the next phase of the study.

Year 2040 Future Conditions

Future conditions reflect traffic conditions in year 2040, which documents programmed facility improvements, growth within the region, and the anticipated operational performance within the study area. This section provides a basis for comparing to future alternatives in the next study phase.

PROGRAMMED TRANSPORTATION IMPROVEMENTS

Several facility improvements in the study area, listed below are identified in the Billings Urban-Area LRTP as committed and/or recommended within the fiscally-constrained plan.

- **Roadway, Intersection, and Congestion Management:** Airport/Main improvements (illustrative), Main Street and 4th Avenue North pavement preservation (committed), Main Street-Billings pavement preservation (committed), Main Street signal timing (recommended)
- **Pedestrian:** Aronson Avenue sidewalks (illustrative), Main Street (US 87) pedestrian easement (recommended), MetraPark pedestrian overpass (recommended)
- **Bicycle:** Airport Road bike lanes (illustrative), Lake Elmo Drive bike lanes (illustrative), 4th Avenue bike lanes (illustrative), 6th Avenue bike lanes (illustrative)
- **Trails:** Swords Park/6th Avenue North Connector (committed), Alkali Creek Trail (committed)

There are no design plans for these improvements. Most of the improvements are focused on improving the pedestrian and bicycle connectivity in the area. These improvements are not included in the analysis for the purposes of establishing a base future year 2040 condition.

However, there are two committed projects that have a significant impact on the projected traffic volumes on Main Street and in the study area.

- The **Billings Bypass Arterial project,** located to the northeast of the study area is a committed project that will be moving into the design phase in 2015. This project provides a new 3-lane connection between Old Highway 312 and Highway 87 (Main Street) in Billings to the Johnson Lane interchange in Lockwood.
- The **Inner Belt Loop project**, located to the northwest of the study area is a committed project that will provide a new 2-lane connection between Wicks Lane/Skyview Drive to Zimmerman Trail.

These two projects, along with several other regional transportation improvement projects are included in the regional travel demand model.

YEAR 2040 TRAFFIC VOLUMES

The MDT travel demand model for the Billings Urban Area/Yellowstone County was used to develop year 2040 traffic volume forecasts on the roadway links and intersections within the study area. The methodology included the following steps:

- **Verify model input** - The 2035 travel demand model inputs were reviewed to identify any potential changes to roadway connections, number of travel lanes, and speed. The recommended changes to the 2035 travel demand model were coordinated with MDT Planning to update and rerun the travel demand model output.
- **Check reasonableness of model output** - The year 2035 daily traffic volumes from the travel demand model were reviewed and compared with the year 2035 daily traffic

volumes included in the 2035 Billings Urban-Area LRTP model run. Additionally, the directional daily volumes were obtained from MDT for each of the roadway segments in the study area. Once the data looked reasonable, the year 2035 daily traffic volumes were used to develop year 2040 turning movement counts at the study intersections during the weekday a.m. and p.m. peak hours.

- **Develop future year 2040 turning movement counts** – MDT provided year 2010 and 2035 daily, directional traffic volumes from the travel demand model for the roadway links within the study area. The year 2010 daily volumes, year 2035 daily volumes, and year 2015 turning movement counts (actual count data) were used to estimate year 2040 turning movement counts.
    - The year 2010 and 2035 daily, directional link volumes were adjusted to obtain weekday a.m. and p.m. peak hour link, directional volumes.
    - The incremental annual change between year 2010 and year 2035 directional link volumes was calculated and added for 25 years to the actual year 2015 traffic count, peak hour, directional link volumes to obtain year 2040 directional link volumes. *Note: Using the actual peak hour count data along with the incremental change from the two model year link volumes provides a more accurate representation of the year 2040 link volumes when compared to just using the model output.*
    - The year 2010 peak hour, directional link volumes, year 2040 peak hour, directional link volumes, and year 2015 turning movement counts (actual count data) were used to estimate year 2040 turning movement counts during the weekday a.m. and p.m. peak hours. The ratio and difference methodology from *NCHRP Report 765 – Analytical Travel Forecasting Approaches for Project-Level Planning and Design (incorporates the methodology from NCHRP 255)* was applied using these three data sets to estimate the year 2040 turning movement counts at the study intersections (Reference 10). *Attachment G includes the travel demand model output and analysis worksheets.*
- The year 2040 turning movement counts and years 2035 and 2040 peak hour link volumes were reviewed for consistency and reasonableness, and compared with recent studies and plans for this area, including Billings Urban Area LRTP, Billings Bypass EIS, and Traffic Report 6th Ave N/Bench-Blgs, Phase 2. Once confirmed, the year 2040 turning movement counts were added to the traffic operational model in Synchro to perform an operations analysis during the year 2040 traffic conditions, weekday a.m. and p.m. peak hours.

Table 6 summarizes the link volumes within study area and percent change between the year 2015 and 2040 daily traffic volumes.

Table 6. Year 2015 and Year 2040 Daily Traffic Volumes and Growth Change

Roadway Segment	Location on Roadway	Year 2015 Daily Volume	Year 2040 Daily Volume	Annual Growth
Main Street	North of Lake Elmo Drive	43,000	56,200	1.1%
Main Street	North of Airport Road	52,200	66,800	1.0%
Main Street	South of Airport Road	49,300	70,600	1.4%
Main Street	South of 6th Avenue	56,000	81,300	1.5%
Main Street	South of 4th Avenue	39,800	63,000	1.9%
Airport Road	West of Main Street	14,100	21,900	1.8%
Airport Road	West of Aronson Avenue	19,800	35,200	2.3%
Airport Road	East of Main Street	2,000	6,100	4.5%
Lake Elmo Drive	West of Main Street	10,400	15,200	1.5%
Lake Elmo Drive	East of Main Street	3,100	6,000	2.7%
Bench Boulevard	South of Airport Road	13,400	21,300	1.9%
Bench Boulevard	North of Airport Road	14,800	26,300	2.3%
6th Avenue	West of Main Street	11,300	15,400	1.2%
4th Avenue	West of Main Street	20,200	33,600	2.1%

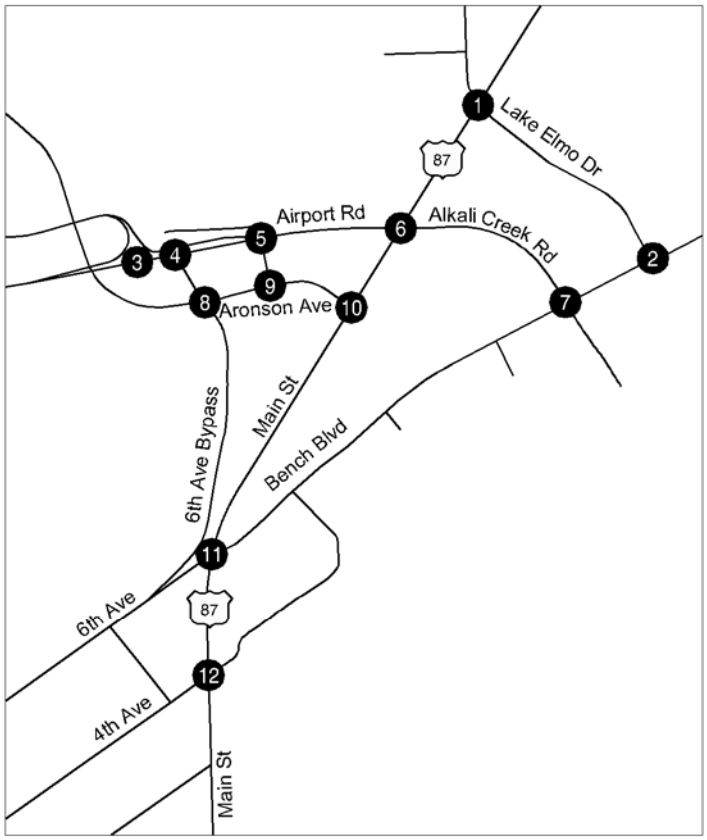
As shown in Table 6 the average annual growth is approximately 1.4% percent on Main Street and 2.1% percent on Airport Road. Main Street is projected to carry approximately 56,000 to 81,000 daily traffic volumes with the Billings Bypass Arterial in place. Airport Road is projected to carry approximately 22,000 to 35,000 daily traffic volumes with the Billings Bypass Arterial in place. Figures 9 and 10 illustrate the year 2040 traffic volumes during the weekday a.m. and p.m. peak hours, respectively.

OPERATIONAL ANALYSIS

An operational analysis was performed at the study intersections using the same methodology and assumptions under existing conditions with the exception of the following:

- At the signalized intersections, the phase splits were optimized to account for the change in traffic volumes. Cycle lengths were not adjusted at this time, but will be optimized as part of the alternatives analysis in the next phase of the study.
- Future year 2040 traffic volumes were used for the weekday a.m. and p.m. peak hours.
- A peak hour factor of 1.0 was used for this planning-level analysis.

The operational analysis results are shown in Figures 9 and 10. As shown in the operational analysis, all of the signalized intersections and most of the unsignalized intersections are projected to operate at LOS E or worse and a volume-to-capacity ratio of greater than 1.0 under year 2040 weekday a.m. and p.m. peak hour traffic conditions. The operational analysis is consistent with the findings from the Billings Urban Area LRTP and Traffic Report 6th Ave N/Bench-Blgs, Phase 2. *Attachment H includes the Year 2040 Weekday AM and PM Peak Hour Level of Service Worksheets*.



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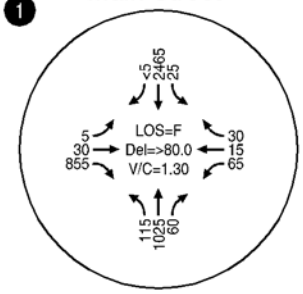
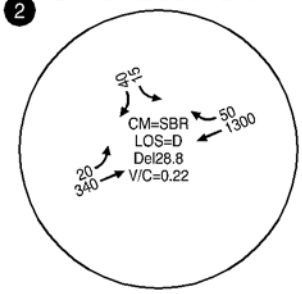
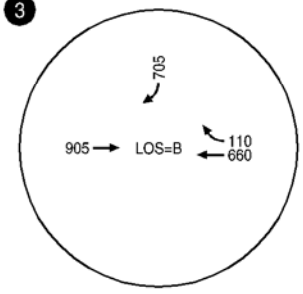


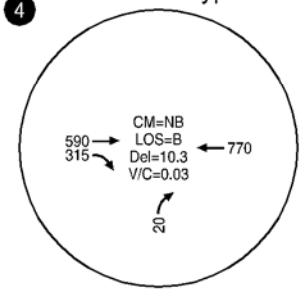
2 Lake Elmo Drive & Bench Boulevard



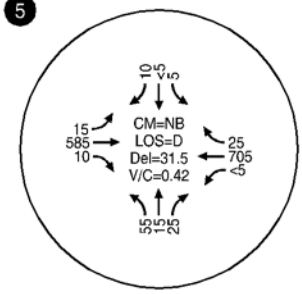
3 Airport Road & Alkali Creek Road*



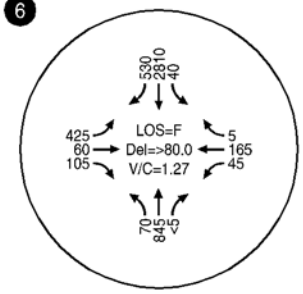
4 Airport Road & 6th Avenue Bypass



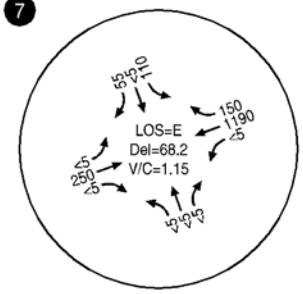
5 Airport Road & Swords Lane



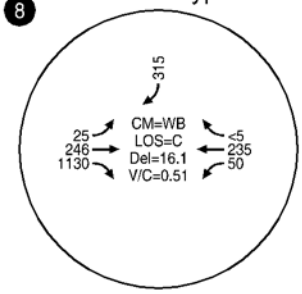
6 Airport Road & Main Street



7 Alkali Creek Road & Bench Boulevard



8 Aronson Avenue & 6th Avenue Bypass**



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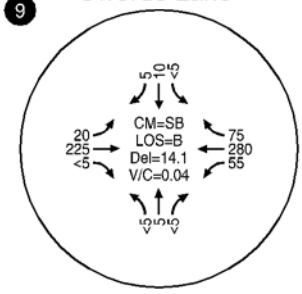

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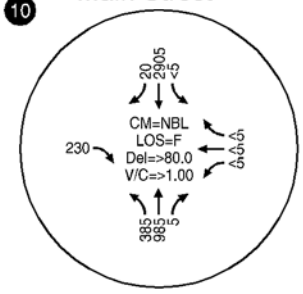
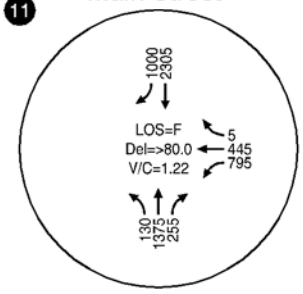
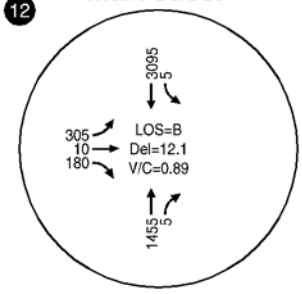


11 6th Avenue & Main Street



12 4th Avenue & Main Street



* HCM 2000 Methodology does not support intersection's traffic control device. Operation results were determined using HCS 2010 Merge Segment Methodology.
** Synchro's SimTraffic analysis could not properly determine delay at the intersection because of queue spillback. Intersection has reached or is exceeding vehicle capacity.

MONTANA DEPARTMENT OF TRANSPORTATION MDT
BILLINGS AIRPORT ROAD MAIN STREET Concept

FUTURE CONDITIONS
YEAR 2040 AM PEAK HOUR
BILLINGS, MONTANA

LEGEND
CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE /CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY/ CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

FIGURE
9

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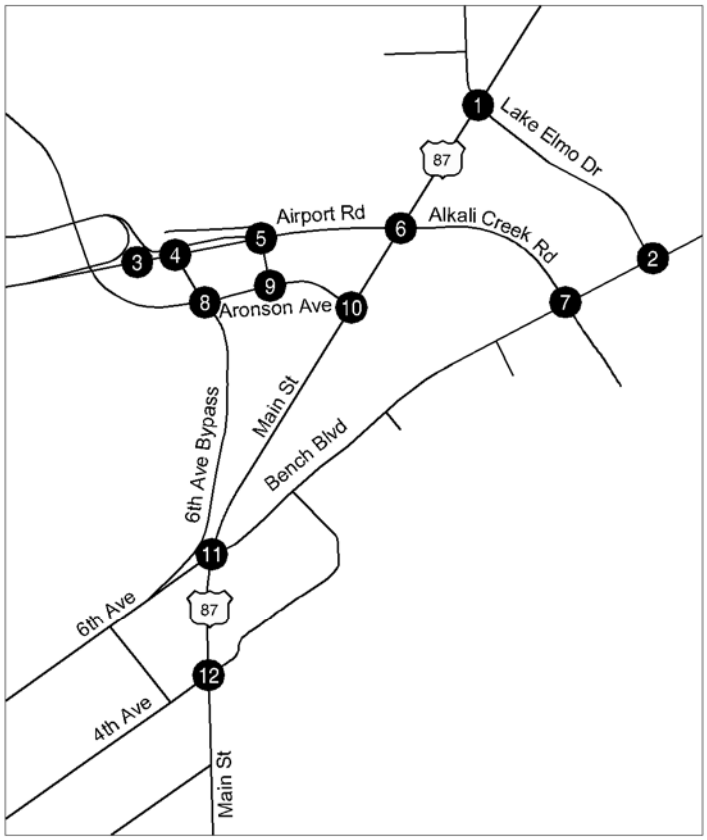
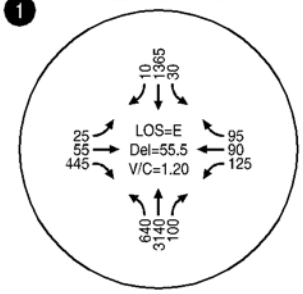
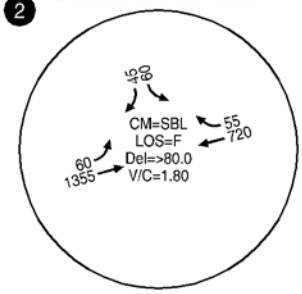
TRANSPORTATION ENGINEERING/PLANNING



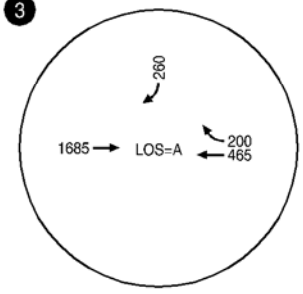
1 Lake Elmo Drive & Main Street



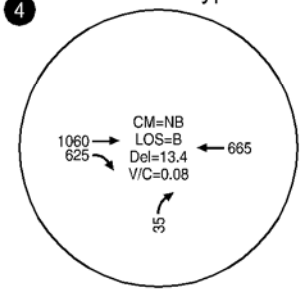
2 Lake Elmo Drive & Bench Boulevard



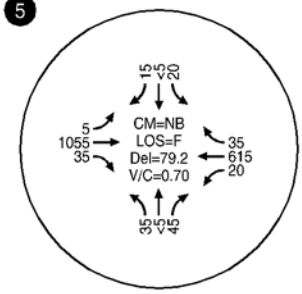
3 Airport Road & Alkali Creek Road*



4 Airport Road & 6th Avenue Bypass



5 Airport Road & Swords Lane



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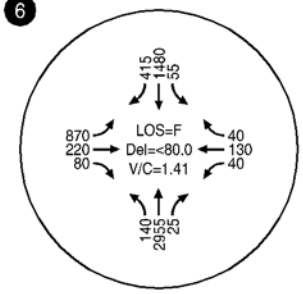
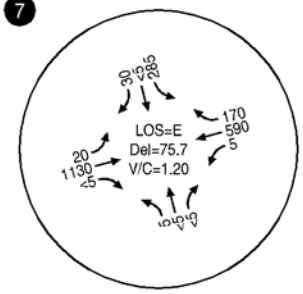
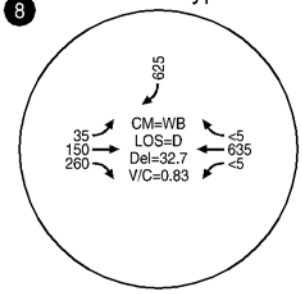


7 Alkali Creek Road & Bench Boulevard



8 Aronson Avenue & 6th Avenue Bypass**



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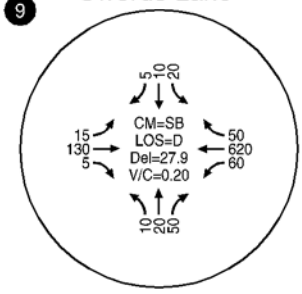
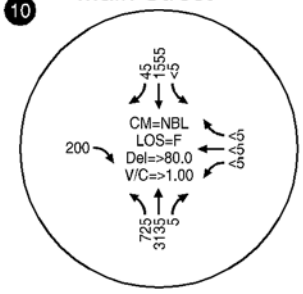
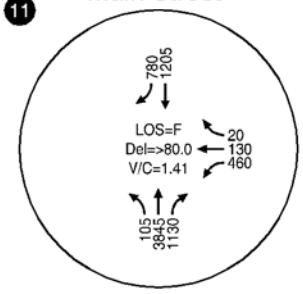


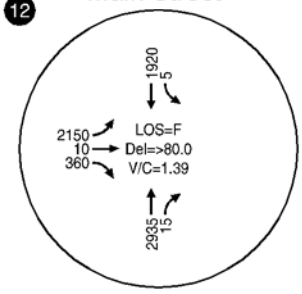
10 Aronson Avenue & Main Street**



11 6th Avenue & Main Street



12 4th Avenue & Main Street



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MONTANA DEPARTMENT OF TRANSPORTATION MDT
BILLINGS AIRPORT ROAD MAIN STREET Concept

FUTURE CONDITIONS
YEAR 2040 PM PEAK HOUR
BILLINGS, MONTANA

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FIGURE
10

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Summary

The key findings from the existing and future conditions analysis are highlighted below.

EXISTING CONDITIONS

- The AADT on Main Street ranges from 38,000 to the north of 1st Avenue to 48,000 to the north of Lake Elmo Drive.
- The Airport Road/Main Street intersection has a total entering volume of 4,570 vehicles during the weekday p.m. peak hour, which is approaching the threshold between large signalized intersections and alternative intersection forms (e.g., displaced let-turns, quadrants, median u-turns). The critical movements are the eastbound left turn (285 AM, 635 PM), southbound right-turn (400 AM, 315 PM), northbound through (710 AM, 2,135 PM), and southbound through (1,940 AM, 1,205 PM) during the weekday a.m. and p.m. peak hours.
- The Airport Road and Main Street corridors are located on a major freight route, El Camino Real Trade Corridor. The Airport Road/Main Street intersection has the highest percentage of heavy vehicles in the study area, ranging between 3.5% and 5.6% during the weekday a.m. and p.m. peak hours, respectively. The northbound left (42%) from Main Street onto Airport Road and eastbound right (26%) from Airport Road onto Main Street are the movements with the highest heavy vehicle percentages.
- Most of the study intersections currently operate at a level of service C or better during the weekday a.m. and p.m. peak hours. However, the following intersections exceed the the LOS C criteria or have a volume-to-capacity ratio of greater than 0.90:
    - Main Street/Lake Elmo Drive (AM v/c = 0.97)
    - Main Street/Airport Road (AM v/c = 0.93, PM LOS D and v/c = 0.93)
    - Main Street/Aronson Avenue (PM LOS = D for northbound left-turn)
    - Main Street/6th Avenue (AM v/c = 1.00, PM v/c = 0.97)
    - Main Street/4th Avenue (PM LOS D and v/c = 0.96)
- As observed in the field and presented in the operations analysis, the Main Street corridor between 4th Avenue and Lake Elmo Drive is operating near capacity during the weekday a.m. and p.m. peak hours.
- The MetraPark is a major activity center that is host to a variety of concerts, sports events, and other event types during the year. Overall, the total intersection peak hour event traffic volumes are within the range of the non-event traffic volumes. However, specific approaches at the study intersections experience a significant increase in volume when an

event lets out. A sensitivity check and discussion about event conditions is planned as the study moves into the development and evaluation of the alternatives.

- Over the past five years (2010 – 2014), there were 383 reported crashes, including 1 fatality at the study area intersections and roadway segments. The highest crash types at the study intersections were rear-end crashes and right angle crashes, accounting for 61% and 14% of total crashes, respectively.
- The Lake Elmo Drive/Main Street and Airport Road/Main Street intersections have crash rates greater than 1.00. Both intersections have the two highest totals of reported crashes. Rear-end crashes accounted for approximately two-thirds of the reported crashes at both intersections.
- Based on the environmental scan, the study area includes the following key items for further assessment with the alternatives development and evaluation phase of the study and future design phase: three Section 4(f) properties: Swords Park, Earl Guss Park, and MetraPark; three historical properties: Black Otter Trail, Boothill Cemetery, and Larry's Overlook; two inactive and three active hazardous materials sites; three listed endangered species and two candidate species; and a classified surface water with Alkali Creek.
- There are a total of 68 accesses, of which 46 are commercial accesses, 18 public street connections, and 4 residential driveways within the study area. The majority of accesses are in the vicinity of the Airport Road/Main Street intersection and the Lake Elmo Drive/Main Street intersection. Main Street has 10 commercial accesses between Aronson Avenue and Lake Elmo Drive. Airport Road has 12 commercial accesses between Bench Boulevard and 6th Avenue Bypass. The MDT access spacing guidelines for Airport Road and Main Street are not met in the vicinity of the Airport Road and Main Street intersection.

FUTURE CONDITIONS

- The Billings Bypass Arterial and Inner Belt Loop are committed projects with a significant impact on the projected year 2040 traffic volumes on Main Street and Airport Road.
- The annual growth between year 2015 and 2040 is approximately 1.4% percent along Main Street and approximately 2.1% percent along Airport Road.
- Main Street is projected to carry approximately 56,000 to 81,000 daily traffic volumes with the Billings Bypass Arterial in place. Airport Road is projected to carry approximately 22,000 to 35,000 daily traffic volumes with the Billings Bypass Arterial in place
- All of the signalized intersections and most of the unsignalized intersections are projected to operate at LOS E or worse and a volume-to-capacity ratio of greater than 1.0 under year 2040 traffic conditions, weekday a.m. and p.m. peak hour conditions. The operational analysis is consistent with the findings from the Billings Urban Area LRTP and Traffic Report 6th Ave N/Bench-Blgs, Phase 2.

If you have any questions, please contact Andy Daleiden via email at adaleiden@kittelson.com or by phone at 208.338.2683.

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Attachment A AADT Worksheets (Main St.)

Attachment B Weekday A.M. and P.M.
Turning Movement Counts

Attachment C Existing Conditions Synchro LOS Worksheets

Attachment D Event Turning Movement Counts

Attachment E Environmental Scan

Attachment F Montana Access Guideline Figure

Attachment G Travel Demand Model Output and Analysis Worksheets

Attachment H Year 2040 Future Conditions
Synchro LOS Worksheets