CHAPTER 4

PROBLEM IDENTIFICATION

4.1 INTRODUCTION

This chapter identifies areas of the transportation system that do not meet the typical industry standards of traffic engineering and transportation planning, and also the expectations and/or perceptions of the community. In general, it is important to identify issues and problems before a series of mitigation strategies can be developed. The identification of "problems" is the result of intensive data collection, analysis, field observation, and public input. Over the development of this Transportation Plan Update, these tools have been used to assess all of the collected data to develop an understanding of the "problems" with the existing transportation system. This becomes a necessary step and forms the basis for developing mitigation strategies. The development of mitigation (i.e. preliminary recommendations) will be the follow-up step to plan for correction of the identified deficiencies. Identified deficiencies may fall into one or more of the following categories:

- Intersection levels of service
- Signal warrant analysis
- Corridor levels of service
- Safety (i.e. crash analyses)
- Pedestrian facilities
- Bicycle facilities
- Transit system

Each of these areas is expanded upon in this chapter.

4.2 INTERSECTION LEVELS OF SERVICE (MOTORIZED)

Urban road systems are ultimately controlled by the function of the major intersections. Intersection failure directly reduces the number of vehicles that can be accommodated during the peak hours that have the highest demand and the total daily capacity of a corridor. As a result of this strong impact on corridor function, intersection improvements can be a very cost-effective means of increasing a corridor's traffic volume capacity. In some circumstances, corridor expansion projects may be able to be delayed with correct intersection improvements. Due to the significant portion of total expense for road construction projects used for project design, construction, mobilization, and adjacent area rehabilitation, a careful analysis must be made of the expected service life from intersection-only improvements. If adequate design life can be achieved with only improvements to the intersection, then a corridor expansion may not be the most efficient solution. With that in mind, it is important to determine how well the major intersections are functioning by determining their Level of Service (LOS).

LOS is a qualitative measure developed by the transportation profession to quantify driver perception for such elements as travel time, number of stops, total amount of stopped delay, and impediments caused by other vehicles. It provides a scale that is intended to match the perception by motorists of the operation of the intersection. LOS provides a means for identifying intersections that are experiencing operational difficulties, as well as providing a scale to compare intersections with each other. The LOS scale represents the full range of operating conditions. The scale is based on the ability of an intersection or street segment to accommodate the amount of traffic using it. The scale ranges from "A" which indicates little, if any, vehicle delay, to "F" which indicates significant vehicle delay and traffic congestion. The LOS analysis was conducted according to the procedures outlined in the Transportation Research Board's ***Highway Capacity Manual – Special Report 209*** using the *Highway Capacity Software, version 4.1c.*

Of the 74 intersections that were studied as part of this project (41 signalized intersections and 33 unsignalized intersections), 22 had a level of service of D, E or F during the AM or PM peak hours of the day (6 signalized intersections as shown in **Table 4-1** and 16 unsignalized intersections as shown in **Table 4-2**).

It should be noted that the LOS shown in the following tables for the intersections along Rouse Avenue may not be identical to those shown in the recently published *Rouse Avenue Environmental Assessment*. Variations to the LOS at these intersections may be the result of variations in the peak hour factor, type of analysis software, the amount of truck traffic observed, construction activities in the area, or the time of year and day of the week that the intersection traffic counts were made.

Table 4-1
Existing (2007) Level of Service for Signalized Intersections

Intersection	AM Peak Hour					PM Peak Hour				
	EB	WB	NB	SB	INT	EB	WB	NB	SB	INT
Huffine Lane & Ferguson Road	B	B	-	C	**B**	F	B	-	C	**D**
Kagy Boulevard & South Willson Avenue	C	E	D	C	**D**	D	D	C	D	**D**
Main Street & South 19th Avenue	D	E	C	D	**D**	D	C	C	C	**D**
North 7th Avenue & Durston Road	D	D	C	D	**D**	B	B	D	C	**C**
North 7th Avenue & Oak Street	D	D	C	C	**C**	E	D	C	C	**D**
West College Street & South 19th Avenue	F	D	D	D	**D**	D	F	F	E	**F**

Table 4-2
Existing (2007) Level of Service for Unsignalized Intersections

Unsignalized Intersection	AM	PM	Unsignalized Intersection	AM	PM
8th Avenue & College Street	C	D	Jackrabbit Lane & Baxter Lane	C	D
College Street & Willson Avenue	E	F	Jackrabbit Lane & Durston Road	C	D
East Main Street & Haggerty Lane	C	E	Jackrabbit Lane & Ramshorn Drive	D	C
Frontage Road & Valley Center Road	C	E	Jackrabbit Lane & Forkhorn Trail	E	E
Highland Boulevard & Ellis Street	C	E	Jackrabbit Lane & Shedhorn Trail	C	E
Highland Boulevard & Kagy Boulevard	E	C	Kagy Boulevard & Sourdough Road	F	F
Jackrabbit Lane & Cameron Bridge Road	D	F	South 11th Avenue & College Street	D	F
Jackrabbit Lane & Hulbert Road	C	D	South 11th Avenue & Kagy Boulevard	D	F

Note that for the unsignalized intersections, it is more relevant to present operational characteristics of each individual turning movement associated with the individual intersection legs. This data is reflected in **Table 4-3** for all of the unsignalized intersections studied as part of this Transportation Plan.

Table 4-3
Existing (2007) Level of Service for Unsignalized Intersections
(Individual Turning Movements)

Unsignalized Intersection	AM Peak Hour			PM Peak Hour		
	Delay	LOS	V/C	Delay	LOS	V/C
Frontage Road & Nelson Road	17.2	C	-	18.3	C	-
Eastbound Left/Thru	7.8	A	0.02	9.3	A	0.02
Westbound Left/Thru/Right	17.2	C	0.2	18.3	C	0.16
Frontage Road & Valley Center Road	15.7	C	-	35.3	E	-
Westbound Left	9.1	A	0.06	8.5	A	0.14
Northbound Left/Right	15.7	C	0.33	35.3	E	0.59
Highland Boulevard & Ellis Street	20.75	C	-	31.15	E	-
Eastbound Left	24.1	C	0.09	43.7	E	0.52
Eastbound Thru/Right	20.4	C	0.01	14.9	B	0.02
Westbound Left/Thru/Right	17.6	C	0.18	21	C	0.35
Northbound Left	8.5	A	0	8.1	A	0
Southbound Left	8.1	A	0.05	8.6	A	0.02
Highland Boulevard & Kagy Boulevard	42.3	E	-	18.85	C	-
Eastbound Left	9.1	A	0.25	8	A	0.2
Westbound Left/Thru/Right	7.4	A	0	7.6	A	0
Northbound Left/Thru/Right	66.8	F	0.17	23.5	C	0.03
Southbound Left/Thru/Right	17.8	C	0.56	14.2	B	0.51
Main Street & Haggerty Lane	21.2	C	-	39.9	E	-
Westbound Left	8.4	A	0.06	9.7	A	0.04
Northbound Left/Right	21.2	C	0.32	39.9	E	0.67
Bozeman Trail Road & Haggerty Lane	9	A	-	8.7	A	-
Westbound Left/Right	9	A	0.07	8.7	A	0.05
Southbound Left/Thru/Right	7.3	A	0	7.3	A	0.03
Kagy Boulevard & Bozeman Trail Road	10.1	B	-	10.6	B	-
Eastbound Left/Thru/Right	7.6	A	0.01	7.4	A	0.02
Westbound Left/Thru/Right	7.3	A	0	7.5	A	0
Northbound Left/Thru/Right	10.7	B	0.04	10.7	B	0.01
Southbound Left/Thru/Right	9.5	A	0.06	10.5	B	0.1
Kagy Boulevard & Church Avenue	120.5	F	-	67.9	F	-
Eastbound Left	8.9	A	0.02	8.1	A	0.03
Westbound Left	8	A	0.02	8.8	A	0.06
Northbound Left/Thru/Right	210.9	F	1.29	81.5	F	0.75
Southbound Left/Thru/Right	30.1	D	0.42	54.3	F	0.77

Unsignalized Intersection	AM Peak Hour			PM Peak Hour		
	Delay	LOS	V/C	Delay	LOS	V/C
Main Street & I-90 Off-Ramp	16.5	C	-	12.3	B	-
Southbound Left/Thru	16.7	C	0.26	23.4	C	0.14
Southbound Right	16.5	C	0.63	10	A	0.17
Main Street & I-90 On-Ramp	10.5	B	-	10.7	B	-
Eastbound Left	8.2	A	0.15	8.6	A	0.28
Southbound Left/Right	10.5	B	0.21	10.7	B	0.15
Story Mill & Bridger Canyon	12.85	B	-	15.4	C	-
Eastbound Left/Thru/Right	7.9	A	0.06	7.9	A	0.11
Westbound Left/Thru/Right	7.5	A	0	7.7	A	0
Northbound Left/Thru/Right	14.6	B	0.09	18.6	C	0.21
Southbound Left/Thru/Right	11.1	B	0.17	12.2	B	0.2
N. Rouse Avenue & Peach Street	20.4	C	-	28.6	C	-
Eastbound Left/Thru/Right	25	C	0.34	35.9	E	0.45
Westbound Left/Thru/Right	15.4	C	0.2	21.3	C	0.41
Northbound Left/Thru/Right	8.3	A	0.02	8.4	A	0.04
Southbound Left/Thru/Right	8.2	A	0.08	8.3	A	0.07
11th Avenue & College Street	33.25	D	-	67.52	F	-
Eastbound Left/Thru/Right	39.12	E	-	67.92	F	-
Westbound Left/Thru/Right	35.69	E	-	83.5	F	-
Northbound Left/Thru/Right	21.01	C	-	67.91	F	-
Southbound Left/Thru/Right	32.14	D	-	46.12	E	-
College Street & Willson Avenue	44.6	E	-	74.5	F	-
Eastbound Left/Thru/Right	46.4	E	0.57	100.5	F	0.94
Westbound Left/Thru/Right	42.8	E	0.43	48.5	E	0.51
Northbound Left/Thru/Right	8.4	A	0.12	9	A	0.12
Southbound Left/Thru/Right	8.6	A	0.03	8.4	A	0.03
Kagy Boulevard & 11th Avenue	26.85	D	-	92.95	F	-
Eastbound Left	9.2	A	0.1	9.6	A	0.05
Westbound Left	8.6	A	0.01	8.6	A	0
Northbound Left	38.6	E	0.02	57.8	F	0.14
Northbound Thru/Right	11.7	B	0.01	19.5	C	0.1
Southbound Left	52.9	F	0.42	261.2	F	1.28
Southbound Thru/Right	15.6	C	0.13	16.9	C	0.25
19th Avenue & Goldenstein Road	10.9	B	-	11.1	B	-
Westbound Left/Right	10.9	B	0.13	11.1	B	0.11
Southbound Left/Thru	8	A	0.03	7.7	A	0.06
Jackrabbit Lane & Cameron Bridge Road	29.75	D	-	54	F	-
Eastbound Left/Thru/Right	38.1	E	0.66	72.3	F	0.63
Westbound Left/Thru/Right	21.4	C	0.12	35.7	E	0.2
Northbound Left	9.3	A	0.02	8.7	A	0.11
Southbound Left	8.1	A	0.01	9.7	A	0.02
Jackrabbit Lane & Hulbert	22.6	C	-	34.6	D	-

Unsignalized Intersection	AM Peak Hour			PM Peak Hour		
	Delay	LOS	V/C	Delay	LOS	V/C
Eastbound Left/Thru/Right	20.2	C	0.12	38.9	E	0.18
Westbound Left/Thru/Right	25	C	0.04	30.3	D	0.1
Northbound Left/Thru/Right	9.3	A	0	8.3	A	0
Southbound Left/Thru/Right	8.2	A	0.01	9.8	A	0.01
Jackrabbit Lane & Baxter Lane	23	C	-	34.95	D	-
Eastbound Left/Thru/Right	29.5	D	0.05	42.1	E	0.11
Westbound Left/Thru/Right	16.5	C	0.07	27.8	D	0.09
Northbound Left/Thru/Right	9.3	A	0	8.2	A	0
Southbound Left/Thru/Right	8.1	A	0.01	10	B	0.02
Jackrabbit Lane & Durston Road	23.15	C	-	29.45	D	-
Eastbound Left/Thru/Right	26.2	D	0.02	38	E	0.04
Westbound Left/Thru/Right	20.1	C	0.02	20.9	C	0.06
Northbound Left/Thru/Right	9.3	A	0	8.3	A	0
Southbound Left/Thru/Right	8.1	A	0.01	13	B	0
Jackrabbit Lane & Ramshorn Drive	28.9	D	-	22.3	C	-
Eastbound Left/Thru/Right	27.5	D	0.02	22.2	C	0.01
Westbound Left/Thru/Right	30.3	D	0.1	22.4	C	0.21
Northbound Left/Thru/Right	9.6	A	0	8.4	A	0
Southbound Left/Thru/Right	8	A	0.01	10.1	B	0.01
Jackrabbit Lane & Forkhorn Trail	40.7	E	-	38.25	E	-
Eastbound Left/Thru/Right	35.1	E	0.38	53.3	F	0.55
Westbound Left/Thru/Right	46.3	E	0.11	23.2	C	0.2
Northbound Left/Thru/Right	10.1	B	0.06	8.3	A	0.03
Southbound Left/Thru/Right	8.1	A	0.02	9.7	A	0.01
Jackrabbit Lane & Shedhorn Trail	19.7	C	-	49.15	E	-
Eastbound Left/Thru/Right	20.8	C	0.16	62.4	F	0.56
Westbound Left/Thru/Right	18.6	C	0.08	35.9	E	0.36
Northbound Left/Thru/Right	9.5	A	0.03	8.6	A	0.02
Southbound Left/Thru/Right	8.1	A	0.01	9.5	A	0.01
Jackrabbit Lane & Spanish Peak	17.8	C	-	24.9	C	-
Westbound Left/Right	17.8	C	0.05	24.9	C	0.23
Southbound Left/Thru	8.5	A	0.03	9.3	A	0.02
Huffine Lane & Monforton School Road	14.2	B	-	24.2	C	-
Eastbound Left	9.4	A	0.02	11.6	B	0.01
Southbound Left/Right	14.2	B	0.05	24.2	C	0.16
Huffine Lane & Love Lane	17.7	C	-	20.4	C	-
Eastbound Left	9.1	A	0.03	10.7	B	0.08
Southbound Left/Right	17.7	C	0.36	20.4	C	0.29
Huffine Lane & Gooch Hill Road	14.75	B	-	15.75	C	-
Eastbound Left	9.1	A	0	9.4	A	0.02
Westbound Left	9.6	A	0.05	10.3	B	0.14
Northbound Left/Thru	23.5	C	0.19	27.5	D	0.09

Unsignalized Intersection	AM Peak Hour			PM Peak Hour		
	Delay	LOS	V/C	Delay	LOS	V/C
Northbound Right	13.1	B	0.25	12.1	B	0.13
Southbound Left/Thru/Right	14	B	0.03	16.7	C	0.02
Valley Center Road & Harper Pucket	10.35	B	-	11.05	B	-
Eastbound Left/Thru/Right	7.4	A	0	7.7	A	0
Westbound Left/Thru/Right	7.7	A	0	7.5	A	0
Northbound Left/Thru/Right	10.1	B	0.01	11.1	B	0.03
Southbound Left/Thru/Right	10.6	B	0.05	11	B	0.02
College Street & 8th Avenue	17.31	C	-	25.6	D	-
Eastbound Left/Thru/Right	14.63	B	-	30.49	D	-
Westbound Left/Thru/Right	21.4	C	-	22.33	C	-
Northbound Left/Thru/Right	12.54	B	-	27.91	D	-
Southbound Left/Thru/Right	16.25	C	-	18.61	C	-
U.S. 191 & Gooch Hill	11.4	B	-	15.1	C	-
Westbound Left/Right	11.4	B	0.06	15.1	C	0.08
Southbound Left	7.7	A	0.01	8.6	A	0.02
U.S. 191 & Mill Street	15.9	C	-	19.85	C	-
Eastbound Left/Thru/Right	17.8	C	0.19	23.6	C	0.23
Westbound Left/Thru/Right	14	B	0.05	16.1	C	0.2
Northbound Left/Thru	8.1	A	0.01	7.8	A	0.02
Southbound Left/Thru	8.1	A	0.04	8.6	A	0.04
U.S. 191 & Cottonwood Road	12	B	-	18.85	C	-
Eastbound Left/Thru/Right	12.7	B	0.02	22.9	C	0.22
Westbound Left/Thru/Right	11.3	B	0.08	14.8	B	0.13
Northbound Left/Thru/Right	8	A	0	7.8	A	0
Southbound Left/Thru/Right	7.5	A	0.02	8.8	A	0.04

Signalized Intersections

- **Huffine Lane & Ferguson Road** – This intersection experiences poor LOS during the PM peak hour. The eastbound left-turn movement has a LOS of F and is the main cause for the intersection to fail. This intersection lacks a protected eastbound left-turn movement but does have a designated turn lane.

- **Kagy Boulevard & South Willson Avenue** – This intersection has a poor LOS for both the AM and PM peak hours. The westbound leg of the intersection has the lowest LOS during both peak hours. This intersection has protected left-turn phasing and dedicated left-turn lanes at all legs of the intersection.

- **Main Street & South 19th** – This intersection has a LOS of D for the AM and PM peak hours. Problems with this intersection are caused by the heavy amounts of traffic that pass through it. Additional lanes will be added to this intersection in the near future to accommodate additional traffic.

- **North 7th Avenue & Durston Road** – This intersection has a LOS of D during the AM peak hour. The signal timing and phasing of this intersection are not optimized to properly handle the amount of traffic passing through.

- **North 7th Avenue & Oak Street** – This intersection has a poor LOS during the PM peak hour. This failure is due to poor performance on the eastbound and westbound legs of the intersection. This intersection has designated and protected phasing for the left-turn movements at each leg.

- **West College Street & South 19th Avenue** – This intersection experiences poor LOS during the AM and PM peak hours. Every leg of the intersection during the AM and PM peak hours has a LOS of D or lower. This intersection is not equipped to handle the high amounts of traffic passing through. Additional lanes will be added to this intersection in the near future to accommodate additional traffic.

Unsignalized Intersections

The unsignalized intersections experiencing a LOS of D or lower for the AM or PM peak hours fail generally due to the inability of traffic on the minor approach to enter the intersection. High traffic volumes on the major approach make turning movements from the minor approach difficult. A signal warrant analysis was conducted for each of the unsignalized intersections that have a LOS of D or lower for either the AM or PM peak hours. The signal warrant analysis is found in the next section.

4.3 Signal Warrant Analysis (Motorized)

A signal warrant analysis was conducted to determine if any of the existing unsignalized intersections with unacceptable Levels of Service (LOS) met signal warrants. The subject intersections are listed in **Table 4-2** in the previous section.

According to the 2003 Edition of the *Manual on Uniform Traffic Control Devices (MUTCD)*, there are eight (8) signal warrants that must be analyzed for the installation of a traffic control signal. The MUTCD states that a traffic signal should not be installed unless one or more warrants are satisfied.

The eight (8) signal warrants that must be analyzed are as follows:

1. **Eight-Hour Vehicular Volume**
This warrant is intended for application at locations where a large volume of intersection traffic is the principal reason to consider the installation of a traffic signal (Condition A) or where the traffic volume on the major street is so heavy that traffic on the minor street experiences excessive delay or conflict in entering or crossing the major street (Condition B) during any eight (8) hours of an average day. The criteria for Warrant 1 may be met if either Condition A or Condition B is met. The combination of Condition A and B are not required. This warrant was not analyzed due to insufficient project data.

2. Four- Hour Vehicular Volume

This warrant is intended for locations where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal. This warrant requires that the combination of the major-street traffic (total of both approaches) and the higher-volume minor-street traffic (one direction only) reach the designated minimum volume during any four (4) hours of an average day. This warrant was based upon a combination of AM and PM peak hour volumes to account for the four-hour period. This warrant was met for six (6) of the intersections analyzed as shown in **Table 4-4**.

3. Peak Hour

This warrant is intended for use at a location where during any one (1) hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street. This warrant also requires that the combination of the major-street traffic (total of both approaches) and the higher-volume minor-street traffic (one direction only) reach the designated minimum volume. The peak hour warrant was conducted assuming that this peak hour would fall within the peak periods. This warrant was met for twelve (12) of the intersections analyzed as shown in **Table 4-4**.

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4. Pedestrian Volume

The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street. This warrant was not analyzed due to insufficient project data.

5. School Crossing

This warrant addresses the unique characteristics that a nearby school may have on the roadways. It requires that the major roadway be unsafe to cross and that there are no other feasible crossings in the area. This warrant was not analyzed due to insufficient project data.

6. Coordinated Signal System

Progressive movement in a coordinated signal system sometimes necessitates installing traffic control signals at intersections where they would not otherwise be needed in order to maintain proper platooning of vehicles. This warrant was not met for any of the intersections under consideration.

7. Crash Experience

The Crash Experience signal warrant conditions are intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal. This warrant was not analyzed due to insufficient project data.

8. Roadway Network

This warrant is intended for locations where the installation of a traffic signal may encourage concentration and organization of traffic flow on a roadway network. This warrant was not met for any of the intersections under consideration.

Table 4-4 shows which warrants are met for each intersection under existing traffic conditions.

Ideally, before considering a signal for traffic control at an intersection, it is desirable to meet more than one signal warrant. All of the intersections identified that meet one warrant (i.e. the Peak Hour warrant) will be further evaluated to determine if less restrictive traffic controls, or possible geometric modifications, will benefit the operational characteristics of the intersection. Intersections meeting two or three signal warrants are ideal candidates for signalization, but must be analyzed carefully to consider the major street traffic movements and volumes.

Table 4-4
Signal Warrant Analysis (Existing Unsignalized Intersections)

Intersection	LOS		Signal Warrant			
	AM	PM	#2	#3	#6	#8
Frontage Road & Valley Center Road	C	E	X	X		
Highland Boulevard & Ellis Street	C	E				
Highland Boulevard & Kagy Boulevard	E	C				
East Main Street & Haggerty Lane	C	E				
Kagy Boulevard & Sourdough Road	F	F		X		
South 11th Avenue & College Street	D	F	X	X		
College Street & Willson Avenue	E	F		X		
South 11th Avenue & Kagy Boulevard	D	F		X		
Jackrabbit Lane & Cameron Bridge Road	D	F	X	X		
Jackrabbit Lane & Hulbert Road	C	D				
Jackrabbit Lane & Baxter Lane	C	D				
Jackrabbit Lane & Durston Road	C	D				
Jackrabbit Lane & Ramshorn Drive	D	C				
Jackrabbit Lane & Forkhorn Trail	E	E		X		
Jackrabbit Lane & Shedhorn Trail	C	E		X		
8th Avenue & College Street	C	D		X		

Based upon the preliminary signal warrant analysis for this planning project, the following intersections appear to meet one or more traffic signal warrants and could be considered for traffic signal control going forward based on traffic volumes alone:

- Frontage Road & Valley Center Road
- Kagy Boulevard & Sourdough Road
- South 11th Avenue & College Street
- College Street & Willson Avenue
- South 11th Avenue & Kagy Boulevard
- Jackrabbit Lane & Cameron Bridge Road
- Jackrabbit Lane & Forkhorn Trail
- Jackrabbit Lane & Shedhorn Trail
- 8th Avenue & College Street

While the previously mentioned intersections may meet one or more traffic signal warrants, it may not be appropriate in every case to install a traffic signal. Alternatives to traffic signals, such as roundabouts, reduced access, revised intersection geometrics, etc, may be analyzed as other potential traffic control measures. **Chapter 9** provides a discussion on conceptual roundabout design while **Chapter 8** discusses roundabouts and other traffic calming measures.

In order to determine the optimal intersection control strategy, the overall design of the intersection must be considered. Some general objectives for good intersection design that should be considered are:

- Provide adequate sight distance
- Minimize points of conflict
- Simplify conflict areas
- Limit conflict frequency
- Minimize the severity of conflicts
- Minimize delay
- Provide acceptable capacity

4.4 Corridor Volumes, Capacity and Levels of Service (Motorized)

The corridors shown on **Figure 2-5** and **Figure 2-6** in **Chapter 2** were evaluated for volume to capacity (v/c) ratios under existing traffic conditions (year 2005 due to calibrated travel demand model) and future year traffic projections (year 2030). These variables are shown on **Figure 3-15** and **Figure 3-16** (existing year 2005 v/c ratios) and **Figure 3-17** and **Figure 3-18** (projected year 2030 v/c ratios) located in **Chapter 3**. The preparation and analysis of these figures assisted in determining potential capacity deficiencies under the future traffic conditions.

Roadway capacity is of critical importance when looking at the growth of a community. As traffic volume increases, the vehicle flow deteriorates. When traffic volumes approach and exceed the available capacity, the road begins to "fail". For this reason it is important to look at the size and configuration of the current roadways and determine if these roads need to be expanded to accommodate the existing or future traffic needs. The capacity of a road is a function of a number of factors including intersection function, land use adjacent to the road, access and intersection spacing, road alignment and grade, speed, turning movements, vehicle fleet mix, adequate road design, land use controls, street network management, and good planning and maintenance. Proper use of all of these tools will increase the number of vehicles that a specific lane segment may carry. However, the number of lanes is the primary factor in evaluating road capacity since any lane configuration has an upper volume limit regardless of how carefully it has been designed.

The size of a roadway is based upon the anticipated traffic demand. It is desirable to size the arterial network to comfortably accommodate the traffic demand that is anticipated to occur 20 years from the time it is constructed. The selection of a 20-year design period represents a desire to receive the most benefit from an individual construction project's service life within reasonable planning limits. The design, bidding, mobilization, and repair to affected adjacent properties can consume a significant portion of an individual project's budget. Frequent projects to make minor adjustments to a roadway can therefore be prohibitively expensive. As roadway capacity generally is provided in large increments, a long term horizon is necessary. The collector and local street network are often sized to meet the local needs of the adjacent properties.

There are two measurements of a street's capacity, Annual Average Daily Traffic (AADT) and Peak Hour. AADT measures the average number of vehicles a given street carries over a 24- hour period. Since traffic does not usually flow continuously at the maximum rate, AADT is not a statement of maximum capacity. Peak Hour measures the number of vehicles that a street can physically accommodate during the busiest hour of the day. It is therefore more of a maximum traffic flow rate measurement than AADT. When the Peak Hour is exceeded, the traveling public will often perceive the street as "broken" even though the street's AADT is within the expected volume. Therefore, it is important to consider both elements during design of corridors and intersections.

Street size of the roadway and the required right-of-way is a function of the land use that will occur along the street corridor. These uses will dictate the vehicular traffic characteristics, travel by pedestrians and bicyclists, and need for on-street parking. The right-of-way required should always be based upon the ultimate facility size.

The actual amount of traffic that can be handled by a roadway is dependent upon the presence of parking, number of driveways and intersections, intersection traffic control, and roadway alignment. The data presented in **Table 4-5** and **Table 4-6** indicates the approximate volumes that can be accommodated by a particular roadway. As indicated in the differences between the two tables, the actual traffic that a road can handle will vary based upon a variety of elements including: road grade; alignment; pavement condition; number of intersections and driveways; the amount of turning movements; and the vehicle fleet mix.

Roadway capacities can be increased under "ideal management conditions" (**Column 2** in **Table 4-5**) that take into account such factors as limiting direct access points to a facility, adequate roadway geometrics and improvements to sight distance. By implementing these control features, vehicles can be expected to operate under an improved Level of Service and potentially safer operating conditions.

Table 4-5
Approximate Volumes for Planning of Future Roadway Improvements

Road Segment	Volumes[1]	Volumes[2]
Two Lane Road	Up to 12,000 VPD	Up to 15,000 VPD*
Three Lane Road	Up to 18,000 VPD	Up to 22,500 VPD*
Four Lane Road	Up to 24,000 VPD	Up to 30,000 VPD*
Five Lane Road	Up to 35,000 VPD	Up to 43,750 VPD*

[1]Historical management conditions
[2]Ideal management conditions
*Additional volumes may be obtained in some locations with adequate road design, access control, and other capacity enhancing methods.

Table 4-5 shows capacity levels which are appropriate for planning purposes in developing areas within the study area. In newly developing areas, there are opportunities to achieve additional lane capacity improvements. The careful, appropriate, and consistent use of the capacity guidelines listed above can provide for long-term cost savings and help maintain roads at a scale comfortable to the community.

Two important factors to consider in achieving additional capacity are peak hour demand and access control. Traffic volumes shown in **Table 4-5** are 24-hour averages; however, traffic is not smoothly distributed during the day. The major street network shows significant peaks of demand, especially the work "rush" hour. These limited times create the greatest periods of stress on the transportation system. By concentrating large volumes in a brief period of time, a road's short-term capacity may be exceeded and a road user's perception of congestion is strongly influenced. The use of pedestrian and bicycle programs as discussed in **Chapter 6** and TDM measures can help to smooth out the peaks and thereby extend the adequate service life of a specific road configuration. The Transportation Plan strongly recommends the pursuit of such measures as low-cost means of meeting a portion of expected transportation demand.

Each time a roadway is intersected by a driveway or another street it raises the potential for conflicts between transportation users. The resulting conflicts can substantially reduce the roadway's ability to carry traffic if conflicts occur frequently. This basic principle is the design basis for the interstate highway system, which carefully restricts access to designated entrance and exit points. Arterial streets are intended to serve the longest trip distances in an urbanized area and the highest traffic volume corridors. Access control is therefore very important on the higher volume elements of a community's transportation system. Collector streets, and especially local streets, do provide higher levels of immediate property access required for transportation users to enter and exit the roadway network. In order to achieve volumes in excess of that shown in **Column 4** of **Table 4-5**, access controls should be put in place by the appropriate governing body. It is strongly recommended that access control standards appropriate to each classification of street be incorporated into the subdivision and zoning regulations of the City of Bozeman. Follow up monitoring of the effects of access control will aid in future transportation planning efforts.

Using the traffic model developed for this project, it was possible to project the traffic volumes on all major roads within the study area. These roads were analyzed for the current year (2005), and future year (2030) conditions to determine if the roads have an adequate number of lanes for the traffic volume. **Figure 3-16** and **Figure 3-17** presented in **Chapter 3** show the projected traffic volumes for the planning year horizon of year 2030 within the study area. The best tool generated by the traffic model for comparing the current traffic volumes to the existing number of travel lanes on the major corridors is the volume to capacity ratio (v/c ratio). By definition, the "v/c ratio" is the result of the flow rate of a roadway lane divided by the capacity of the roadway lane. **Table 4-6** shows "v/c ratios" and their corresponding roadway corridor "Level of Service" designations.

Table 4-6
V/C Ratios & LOS Designations

V/C Ratio	Description	Corridor LOS
< 0.59	Well Under Capacity	LOS A and B
> 0.60 – 0.79	Under Capacity	LOS C
> 0.80 – 0.99	Nearing Capacity	LOS D
> 1.00 – 1.19	At Capacity	LOS E
> 1.20	Over Capacity	LOS F

An examination of the "v/c ratios" computed by the traffic model, and as shown graphically on **Figures 3-18 thru 3-21**, shows the facilities that either over capacity or are at or nearing capacity, and consequently are roadways that may be currently undersized:

<u>Roadways at or above capacity for existing (2005) conditions</u>

- **Amsterdam Road** – Jackrabbit Lane to the study area boundary
- **Jackrabbit Lane** – Baxter Lane to 0.5 miles north
- **Gallatin Road** – Huffine Lane to 0.12 miles south
- **College Street** – Main Street to 11th Avenue
- **19th Avenue** – Lincoln Street to Main Street
- **North 7th Avenue** –Griffin Drive to Frontage Road
- **Frontage Road** – North 7th Avenue to Springhill Road
- **Willson Avenue** – Garfield to Main Street

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<u>Roadways at or above capacity for future (2030) conditions</u>

- **Amsterdam Road** – Jackrabbit Lane to the study area boundary
- **Jackrabbit Lane** – Huffine Lane to the study area boundary
- **Gallatin Road** – Huffine Lane to Axtell Anceney Road
- **Huffine Lane** – Jackrabbit Lane to Main Street
- **Norris Road** – Jackrabbit Lane to Zoot Way
- **Gooch Hill Road** – Huffine Lane to Blackwood Road
- **College Street** – Main Street to 8th Avenue
- **Main Street** – Babcock Street to 15th Avenue and 8th Avenue to Interstate 90
- **19th Avenue** – Patterson Road to Interstate 90
- **North 7th Avenue** – Aspen Street to Frontage Road
- **Frontage Road** – North 7th Avenue to Sacajawea Peak Drive and Airport Road to study area boundary
- **Springhill Road** – 19th Avenue to Sypes Canyon Road
- **Willson Avenue** – Main Street to Kagy Boulevard
- **South 3rd Street** – Kagy Boulevard to Henderson Street
- **Kagy Boulevard** – 19th Street to Highland Boulevard
- **Highland Boulevard** – Kagy Street to Main Street
- **Rouse Avenue** – Lamme Street to Griffin Drive
- **Bridger Drive** – Griffin Drive to Bucks Run Court
- **Griffin Drive** – Rouse Avenue to North 7th Avenue
- **Durston Road** – 19th Avenue to 25th Avenue and Hanson Lane to Yellowstone Avenue

4.4.1 Speed-Density-Flow Relationship

The following section discusses the relationship between speed, density, and flow rate as defined by the *Highway Capacity Manual (HCM) 2000*. These three basic variables can be used to describe traffic on a roadway, and can ultimately be used to determine the LOS and capacity of the facility.

Speed is defined as the average travel speed for purposes of this discussion. The average travel speed is computed by dividing the length of the roadway under consideration by the average travel time of the vehicles traversing it. For capacity analysis, speeds are best measured by observing travel times over a known length of highway. As measures of effectiveness, speed criteria must recognize driver expectations and roadway function.

Flow rate is defined as the equivalent hourly rate at which vehicles pass over a given point or section of a lane or roadway during a given time interval of less than one (1) hour. Flow rate represents the demand of a given facility during a specific time period. Congestion can influence demand, and observed volumes sometimes reflect capacity constraints rather than true demand.

Density is the number of vehicles occupying a given length of a lane or roadway at a particular instant. Measuring density in the field is difficult; it can, however, be calculated from the average travel speed and flow rate. Density is a critical parameter for uninterrupted-flow facilities because it characterizes the quality of traffic operations. It describes the proximity of vehicles to one another and reflects the freedom to maneuver within the traffic stream.

The equation found below shows the relationship between density, flow rate, and average travel speed:

$$D = \frac{v}{S}$$

where

v = flow rate (veh/h),
S = average travel speed (mi/h), and
D = density (veh/mi).

Figure 4-1 shows a generalized relationship between these three variables (as defined by the above equation). The form of these functions depends on the prevailing traffic and roadway conditions on the segment under study and on its length in determining density. Although these diagrams show continuous curves, it is unlikely that the full range of the functions would appear at any particular location.

From the curves shown in **Figure 4-1**, it can be seen that there are two points at which a zero flow rate is reached: 1) when there are no vehicles on the roadway, and 2) when the density becomes so high that all vehicles must stop.

Between these two points, the dynamics of traffic flow produce a maximizing effect. As flow increases from zero, density also increases, since more vehicles are on the roadway. When this happens, speed declines because of the interaction of vehicles. This decline is negligible at low and medium densities and flow rates. As density increases, these generalized curves suggest that speed decreases significantly before capacity is achieved. **Capacity** is reached when the product of density and speed results in the maximum flow rate. This condition is shown as optimum speed, optimum density, and maximum flow.

Any flow other than capacity can occur under two different conditions, one with a high speed and low density and the other with high density and low speed. LOS A through E are defined on the low-density, high-speed side of the curves, with the maximum-flow boundary of LOS E placed at capacity. LOS F describes oversaturated flow and is represented by the high-density, low-speed part of the functions.

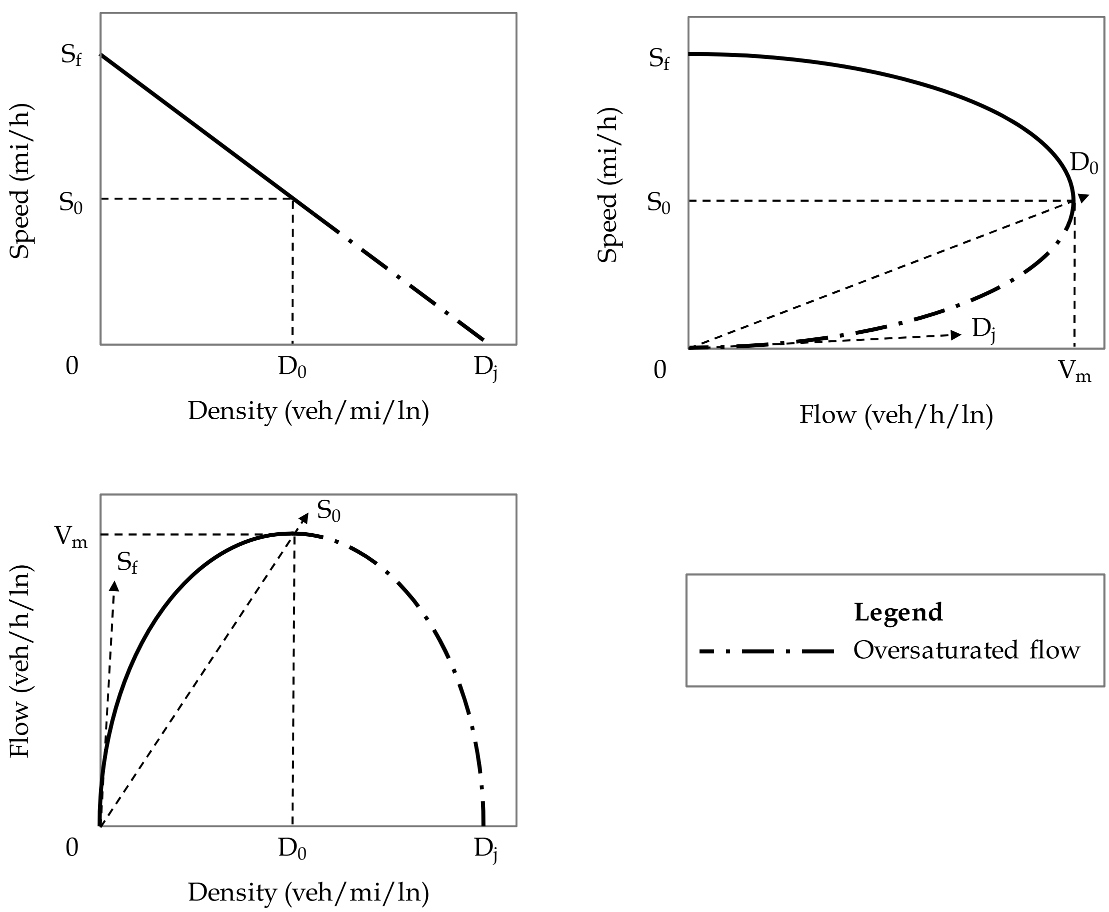

Figure 4-1
Fundamental Relationships between Speed-Density-Flow (May 1990)

4.5 VEHICLE CRASH ANALYSIS (MOTORIZED)

The MDT Traffic and Safety Bureau provided crash information and data for use in this Transportation Plan. The crash information was analyzed to find high crash locations. General crash characteristics were determined along with probable roadway deficiencies and solutions. The crash information covers the three-year time period from January 1st, 2004 to December 31st, 2006. **Section 2.1.5** in **Chapter 2** contains detailed information concerning the crash analysis prepared for this planning project.

Intersections that were identified through the composite rating score method, as described in **Chapter 2**, that warrant further study and may be in need of mitigation to specifically address crash trends. These intersections are as listed below. The locations of these intersections are shown on **Figure 2-11** and **Figure 2-12**.

- 7th Avenue & Oak Street
- 19th Avenue & Baxter Lane
- 18th Avenue & College Street
- 19th Avenue & Durston Road
- 19th Avenue & Oak Street
- Huffine Lane & Ferguson Road
- Huffine Lane & Fowler Road
- Huffine Lane & Jackrabbit Lane
- Jackrabbit Lane & Valley Center Road
- Main Street & 7th Avenue
- Main Street & 15th Avenue
- Main Street & 19th Avenue
- Main Street & College Street
- Willson Avenue & Babcock Street

Note that the fourteen intersections listed above are in alphabetical order, and there is no significance to the order of their listing. The identified intersections will be evaluated further to determine what type of mitigation measures may be possible to reduce specific crash trends (if any) and/or severity. These mitigation measures will be evaluated in the overall context of recommended improvements being evaluated via the *Greater Bozeman Area Transportation Plan – 2007 Update* development. It should be noted that several of the intersections have undergone significant reconstruction during the analysis period of January 1, 2004 to December 31, 2006 including the intersections of 7th Avenue & Oak Street, 19th Avenue & Baxter Lane, 19th Avenue & Durston Road, 19th Avenue & Oak Street, Huffine Lane & Ferguson Road, and Huffine Lane & Fowler Road that are listed above.

4.6 PEDESTRIAN SYSTEM

4.6.1 Problem Themes

Gallatin County residents within the study area face a largely undeveloped pedestrian system with major challenges including vast distances between homes and services, high vehicle speeds on rural roadways, low density development patterns, and roadways with no pedestrian facilities. See **Figure 2-17** *Study Area Pedestrian Facilities* to see existing pedestrian facilities in the study area.

Bozeman City residents have a much more developed pedestrian system, but there are still many problems that can be corrected. Through the existing conditions analysis and public involvement the main themes of pedestrian problems are summarized below:

- Lack of ADA compatible curb ramps throughout much of the city
- Old, deteriorating sections of sidewalk
- Lack of vegetation maintenance
- Lack of consistent snow removal in winter
- Longstanding gaps in the pedestrian network. See **Figure 2-18** *Bozeman Pedestrian Gaps*.
- Short-term gaps in the pedestrian network in new development areas.
- Difficult crossing locations of major streets.
- Large distances between legal crossings of major streets
- Lack of full integration with transit – sidewalk connections, shelters.

4.6.2 Pedestrian Collision Analysis

Crash data from January 2002 through June 2007 provided by the Bozeman Police Department were analyzed (see **Figure 2-19** and **Figure 2-20**). Fifteen crashes involving a pedestrian were reported in the greater Bozeman study area since 2002, all of which were within the Bozeman city limits. Seven of these crashes were on Main Street, two were on 7th Avenue, two were on Durston/Peach, one on North 19th, one on Mendenhall Street and one on Babcock Street. All reported crashes occurred on minor or principal arterials. These numbers, like the bicycle collision data, are likely underreported. The Bozeman Police Department reported that about half of the time the pedestrian was at fault, crossing mid block (jaywalking), or crossing against the signal. There were also several instances of riding on cars or jumping out into traffic.

4.6.3 Problem Areas

Few smaller, lower traffic streets including local streets and collectors present great difficulty for most pedestrians. Crossings are plentiful and short. Sidewalks are generally present with some needing maintenance. **Table 4-7** shown below focuses on major problems and barriers for pedestrian travel in Bozeman.

Table 4-7
Pedestrian Problem Identification

Street	From	To	Problem Description
Baxter Road	Fowler Avenue	N. 19th Avenue	Most of this roadway has no pedestrian facilities.
Cottonwood Road	Durston Road	Huffine Lane	No pedestrian facilities built.
Durston Road	Valley Drive	Flathead Avenue	No pedestrian facilities – This portion of the road has not been upgraded
Durston Road	Cottonwood Road	Westgate Avenue	No sidewalks on south side of roadway, south side is developed as soccer fields.
Griffin Drive	N. 7th Avenue	N. Rouse Avenue	No pedestrian facilities.
Kagy Boulevard	S. 19th Avenue	S. 11th Avenue	Several sections without pedestrian facilities. No pedestrian connection between housing and University.
Kagy Boulevard	Highland Boulevard	Bozeman Trail Road	No pedestrian facilities currently. The north side will be upgraded with development, but south side has been developed.
N. 7th Ave	Main Street	I-90	Sidewalk system is fragmented and generally of poor quality. Most sidewalks are curb-tight. Crossings occur at major intersections only. Jaywalking is prevalent.
N. Rouse Avenue	E. Lamme Street	Story Mill Road	Roadway is mostly lacking pedestrian facilities.
Oak Street	N. Rouse Avenue	Meagher Avenue	Some small sections near North 7th have no pedestrian facilities. Other problems stem from lack of pedestrian crossings combined with a wide street section.
S. 19th Avenue	W. Babcock Street	Stucky Road	Roadway has no pedestrian facilities.
S. 3rd Avenue / Graf Street	Kagy Boulevard	Teslow Drive	Sole pedestrian facility is a 4 foot paved shoulder with a rumble strip to buffer from traffic. Not adequate to connect large amount of housing to commercial area.
S. Church Avenue	Kagy Boulevard	E. Story Street	Most of route lacks pedestrian facilities. Where sidewalks exist they are poorly maintained and overgrown.
W. Main Street	S. 8th Avenue	Cottonwood Road	Long distances between crossing opportunities. Crossings themselves are very long with 6 or more lanes common for a pedestrian to cross.

4.7 Bicycle System

Bicyclists are a diverse group with widely varying needs and preferences. A solution for some will still leave others unserved. For example, the construction of bike lanes will be a boon to confident cyclists and those that prefer direct routes with few interruptions, however less confident cyclists will not feel comfortable next to vehicle traffic and will prefer a separated pathway or a parallel lower traffic route. Conversely, a shared-use path will encourage less confident cyclists and other recreational users, but if it is the sole bicycle facility confident cyclists will prefer to ride in the unimproved roadway, away from slow moving pedestrians and complicated crossings of roads and driveways. To meet the needs of all cyclists, a balanced approach to solving bicycle facility problems is required.

4.7.1 Problem Themes & Areas

With a few notable exceptions of shared use paths and undercrossings in Gallatin Gateway, Four Corners, and Huffine just east of Four Corners, Gallatin County lacks bicycle facilities. Many of the problems that exist for pedestrians also exist for cyclists. Long distances, high traffic speeds, narrow or non-existent shoulders, rumble strips, road debris, and even recently maintained roads which have been chip sealed become significant obstacles to cyclists.

The City of Bozeman has seen a rapid increase in bicycle facilities in recent years. Many of the east-west arterials to the north side of Main Street have undergone reconstruction with the addition of bicycle lanes including Durston Road, Oak Street, Babcock Street, Baxter Lane, and others. North-south corridors to see reconstruction, many of which are only half built through new development include, Ferguson Avenue, Fowler Avenue, Cottonwood Road, and North 27th Avenue. Shared use path corridors have also been developed and expanded including the North 19th Ave corridor, and the Highland Blvd corridor. In 2002 a series of bicycle routes were installed involving signage only within many of the older neighborhoods in the city.

Through the existing conditions analysis and public involvement the main themes of bicycle problems are summarized below:

- Continuous bike lanes not available on all arterial routes including:
    - North Rouse Avenue
    - Kagy Boulevard
    - Huffine/Main Street
    - North 7th Avenue
    - North & South 19th Avenue
    - Cottonwood Road
    - Davis Lane
    - Willson Avenue
    - College Street
    - South 8th Avenue
    - Valley Center Drive
- Existing bike lane network is fragmented with numerous gaps
- Many unimproved roadways have no shoulder
- Bike lanes and shoulders covered in debris
- Pavement quality including potholes and cracking on many bike routes
- Difficult crossings of major roadways at unsignalized intersections along high desire corridors including:
    - W Garfield St and S 19th Ave
    - W Kagy Blvd and S 11th Ave
    - W Koch St and S 19th Ave
    - W Koch St and S 11th Ave
    - W Lamme St and N 7th Ave
    - W Lamme St and N Rouse Ave
    - W College St and S Willson Ave

- Inadequate bicycle detection at signalized intersections
- If available, bike lanes not adequately plowed in winter;
- Inadequate or no bicycle parking at bicyclists' destination
- No bicycle parking at transit stops
- Lack of wayfinding signage on bicycle routes to major destinations
- Lack of bicycle lanes to Downtown Bozeman (Main Street, Mendenhall Street and Babcock Street)
- Lack of bicycle lanes to Montana State University
- Lack of shoulder bikeways on rural roadways
- Lack of dedicated bicycle facilities along high profile routes such as Bozeman-Belgrade, and Bozeman-Four Corners
- General perception of lack of safety for adults and children.
- General perception of lack of adequate bicycle connections from new residential areas to commercial areas.
- Need for better education for bicyclists and motorists

4.7.2 Bicycle Collision Analysis

Crash data from January 2002 through June 2007 provided by the Bozeman Police Department were analyzed (see Figure 2-15 and Figure 2-16). Since 2002, 83 bicycle/vehicle or bicycle/pedestrian accidents were reported in the greater Bozeman study area with 69 occurring within the Bozeman City limits. This number is actually lower than the actual number of collisions that likely have occurred, as many may have not been reported. In addition, the Police Department reports that accident tracking methods have improved in the last few years causing the years 2002-2005 likely being under represented in the number of collisions. Due to these factors trends between years cannot be ascertained. Data collected from the Bozeman Police Department does show that of the 69 recorded incidents 43 percent of the collisions were the fault of the bicycle, 14 percent were the fault of the vehicle and 42 percent undetermined.

Main reasons for bicycle rider fault involved riding on sidewalk or riding the wrong direction against traffic. Several accidents at night involved no lights or reflectors and in several cases the bicyclist lost control while braking. There were several instances where the bicycle rider ignored stop signs or red signals and swerving into or through traffic. A few cases involved intoxicated bicycle riders. Adequate and properly designed bicycle facilities can encourage proper behavior by cyclists and potentially reduce this category of accidents in the future. With vehicles at fault, there were several cases of opening doors on a rider and several cases of not yielding to the bicycle when turning or in a crosswalk.

Generally, rural crashes are concentrated on higher-order streets such as Huffine Lane, Valley Center Road, and Cameron Bridge Road. Within Bozeman, crashes are likewise clustered along principal arterials such as 7th Avenue, 19th Avenue, and Main Street. In addition, a smaller number of crashes were reported on minor arterials and collector streets as well, including College Street, Garfield Street, and 11th Avenue. One thing nearly all the crash locations have in common is that almost none had dedicated bicycle facilities.

4.8 TRANSIT SYSTEM

4.8.1 Needs Identified in the "Bozeman Area Transportation Coordination Plan"

The following were identified as needs in the *Bozeman Area Transportation Coordination Plan – FY 2009 (utilized as provided, with permission, from Lisa Ballard, P.E., Current Transportation Solutions)*. It is also stated that at this time, adequate resources are not available to meet all the needs identified in the plan.

Service Gaps

- Bus schedules do not facilitate commuter transportation from Bozeman to Belgrade
- Northeast trailer parks
- South of campus
- Business park southwest of campus hosting *RightNow Technologies*, one of the largest employers
- New growth areas in northwest
- Reach, Inc. Work Center
- Hospital – one-way loop
- Northwest Bozeman between Babcock and Durston
- East Main / new library is poorly connected to west side
- Higher service frequency
- Bridger Bowl
- Livingston-Bozeman commuter service
- Evening service
- Weekend service

Information Gaps

- Lack of coordinated communication between the service providers. Streamline and Skyline drivers communicate well. Schedules and web pages have been updated to provide adequate information regarding the other service. Coordination with Angel Line, Madison County, and West Yellowstone has been minimal in the last year.
- Lack of knowledge in the community regarding Streamline.
- Difficulty among some potential users in understanding time tables and planning trips.

Resource Gaps

- There exists no central place of storage and maintenance for vehicles
- There is no set standard for training of drivers and no specific place to train them. Sharing of drivers is thus not possible without universal requirements for training.
- Lack of benches and bus shelters

4.8.2 Additional Identified Needs

Below is a list of additional needs not identified in the *Bozeman Area Transportation Coordination Plan – FY 2009*.

Information and Resource Needs

- There is currently no 5-year plan or 10-year plan that considers the expected growth of the community and where bus routes should be to meet these needs.
- Work with Bozeman Planning Department to determine where bus bays need to be included in new development areas.
- Establish a relationship with the county planning department or with Belgrade planning.
- The standard street design of 3 lanes plus bike lanes requires a bus bay to avoid bus-bike conflicts. Responsibility for these bus bays needs to be determined.
- Determine a standard design for street furniture.

Infrastructure Needs

- **College** (the entire road) – The westbound location at 23rd street has no sidewalk and has a ditch right next to the road.
- **Highland (**at Ellis) – This location is at the bottom of a hill and there is no pull out away from traffic.
- **S. 19th Avenue** – The sidewalk is separated from the road by a ditch, and there are no pedestrian connections to the road, even at driveways.
- **Highland** – There is only a sidewalk on one side of the street and there is no connection between the sidewalk and the road.
- **Huffine** (out to Four Corners) – Inadequate pedestrian facilities
- **Jackrabbit** – Inadequate pedestrian facilities.
- **Oak Street** (eastbound just west of 7th) – There is no sidewalk
- **Oak Street** (at 15th right next to an accessible apartment complex) – Inadequate pedestrian facilities.
- **Durston and Babcock** – Have the bike lanes without a place to pull over. Durston lacks sidewalks in places.

City #7

4.9 EQUESTRIAN ISSUES

The planning boundary for the Update includes areas currently and historically used by equine riders and drivers. They and other non-motorized residents have used the unpaved roads as a trail system. As these roads are paved with no shoulder and no trail, and traffic volumes and speeds increase, these roads become less safe for both motorized and non-motorized users. Future improvements need to take into consideration all of these users.