4.0 EXISTING TRANSPORTATION SYSTEM

4.1 Highway Features and Characteristics

Roadway Function

US 93 is part of the National Highway System (NHS). The NHS includes highways Congress has determined to have the greatest national importance to transportation, commerce, and defense.

Functional classification is a process that groups public roads and highways in accordance with FHWA guidelines by the character of service they provide as part of the overall highway system and their corresponding level of travel mobility and access to property. US 93 is functionally classified as a rural principal arterial. Arterials provide the highest level of mobility, at the highest speed, for long uninterrupted travel. Arterials generally have higher design standards than other roads and many principal arterials have multiple lanes with some degree of access control.

US 93 is a major north/south thoroughfare in western Montana, running between Central Idaho and the Port of Roosville, Montana, into Canada. This corridor serves international commerce and travel, as well as regional and local commuter needs.

Terrain

The topography of the land traversed by a roadway influences the horizontal and vertical alignment of the facility. Topography is generally separated into three categories based on terrain: level, rolling, and mountainous. The US 93 corridor traverses level terrain between MP 74± to MP 83± (from Florence to Lolo) and rolling terrain between MP 83± and MP 91± (Lolo to Missoula). For a rural principal arterial, the design speed for level terrain is 70 miles per hour (mph), while the design speed for rolling terrain is 60 mph.

Roadway Width

The portion of the US 93 corridor between Florence and Lolo (MP 74± to MP 83±) has four 12-foot travel lanes, two shoulders, and turn lanes at some intersections. Shoulders in this portion of the corridor generally range from four feet up to 10 feet in width. The portion of the US 93 corridor between Lolo and Missoula (MP 83± to MP 91±) generally has two 12-foot outside travel lanes, two 14-foot inside travel lanes, a 16-foot center turn lane, and 8-foot shoulders for a total top width of 84 feet, although certain lengths of this portion also include an additional turning lane for a total top width of 94 feet.

Bridges

There are two bridges in the corridor located at MP 82.9± over Lolo Creek and at MP 90.11± over the Bitterroot River. MDT evaluates the current sufficiency of bridges in terms of structural adequacy and safety, serviceability and functional obsolescence, essentiality for public use, and special reductions. According to the MDT bridge sufficiency ratings database, neither of these bridges is deficient. The sufficiency of these bridges over the planning horizon will continue to be assessed by MDT.

4.2 Geometric Assessment

Horizontal Alignment

Horizontal alignment is a measure of the degree of turns and bends in the road. The primary element of horizontal alignment is horizontal curvature. The degree of curvature, or curve radius, is the main physical control on a vehicle rounding a horizontal curve. The curve radius describes how “sharp” the curve is. The maximum allowable degree of curvature on a highway is directly related to design speed. For a design speed of 70 mph, the MDT Road Design Manual recommends a minimum curve radius of 1,820 feet (ft), while a minimum curve radius of 1,200 ft is recommended for a design speed of 60 mph. Based on the design speeds for each type of terrain within the corridor, one horizontal curve does not meet the recommended minimum curve radius, as shown in Table 4.1.

Table 4.1 Horizontal Curve Sharper Than Recommended Minimum Radius

Point of Intersection (MP±)	Existing Curve Radius (ft)	Recommended Minimum Radius for Design Speed of 60 mph (ft)
86.1	1,146	1,200

Figure 4-1, located at the end of this section, illustrates the horizontal curves within the corridor. A rating of “Meets Standard” was provided for each segment of the corridor without horizontal curves or where the curve radius exceeds the minimum recommended for the design speed in that segment. Segments with a curve radius below the recommended minimum are described as

"Does Not Meet Standard." The analysis segment length was determined by the length of the curve and is centered on the point of intersection.

In addition to curve radius, horizontal curves are assessed in terms of their degree of superelevation. Superelevation is a measure of the amount of cross slope or "bank" provided on a horizontal curve to help counterbalance the outward pull of a vehicle transversing the curve. The recommended maximum rate of superelevation depends on several factors including overall climatic conditions, terrain conditions, type of facility, and the rural or urban nature of an area.

The required rate of superelevation for a curve is directly related to the horizontal curve radius. For design speeds of 60 and 70 mph, the MDT Road Design Manual recommends a horizontal curve radius within specified ranges associated with various rates of superelevation. These recommended radii relating to rates of superelevation are shown in Table 4.2.

Table 4.2 Required Range for Horizontal Radius and Rates of Superelevation for Design Speeds of 60 and 70 mph

Superelevation Rate (%)	Horizontal Radius Range for Design Speed of 60 mph (ft)	Horizontal Radius Range for Design Speed of 70 mph (ft)
Normal Crown (NC)	R ≥ 12,000	R ≥ 16,000
2.0	12,000 > R ≥ 8,440	16,000 > R ≥ 10,700
3.0	8,440 > R ≥ 5,420	10,700 > R ≥ 6,930
4.0	5,420 > R ≥ 3,890	6,930 > R ≥ 5,050
5.0	3,890 > R ≥ 2,960	5,050 > R ≥ 3,910
6.0	2,960 > R ≥ 2,320	3,910 > R ≥ 3,150
7.0	2,320 > R ≥ 1,820	3,150 > R ≥ 2,580
8.0	1,820 > R ≥ 1,200	2,580 > R ≥ 1,810

Nine horizontal curves within the US 93 corridor do not meet the recommended amount of superelevation given their respective curve radii, as shown in Table 4.3.

Table 4.3 Horizontal Curves Failing to Meet Required Amount of Superelevation

Design Speed	Point of Intersection (MP±)	Existing Horizontal Curve Radius (ft)	Superelevation Rate (%)
70 mph	76.4	4314.30	3.0
60 mph	83.7	11,460.0	NC
	86.1	1,145.9	7.0
	86.9	1,909.9	5.0
	87.3	1,909.9	5.0
	87.6	2,865.0	4.0
	88.3	1,637.0	6.0
	88.4	1,637.0	6.0
	89.0	1,909.9	5.0

Figure 4-1 illustrates the horizontal curves within the corridor. A rating of "Meets Standard" was provided for each segment of the corridor without horizontal curves or where the rate of superelevation exceeds the minimum recommended for the design speed in that segment. Segments with a rate of superelevation below the recommended minimum are described as "Does Not Meet Standard." The analysis segment length was determined by the length of the curve and is centered on the point of intersection.

Vertical Alignment

Vertical alignment is a measure of elevation change on a roadway. The length and steepness of grades directly affects the operational characteristics of the roadway. The MDT Road Design Manual lists recommendations for maximum grades on principal arterials according to the type of terrain in the area. The maximum grade recommended for level terrain is three percent and the maximum grade recommended for rolling terrain is four percent. There is currently one segment of the highway where the grade exceeds the recommended grade for the local terrain, as shown in Table 4.4. The existing grades are defined as either G_1 or G_2, which refers to the grades coming into or out of a vertical curve in a south to north direction.

Table 4.4 Grades Exceeding Maximum Vertical Grade Recommended for Terrain

Curve Type	Point of Intersection (MP±)	Existing Grade - G_1(%)	Existing Grade - G_2(%)	Maximum Grade for Rolling Terrain (%)
Sag	85.9	-0.070	4.117	4.0
Crest	86.2	4.117	-1.196	4.0

Figure 4-1 illustrates the existing grades within the corridor. A rating of "Meets Standard" was provided for each segment of the corridor where grades are below the maximum recommended for the terrain in that segment. The single segment with a grade above the recommended maximum is described as "Does Not Meet Standard." The analysis segment length was defined as the distance between the points of intersection for the sag and crest curves noted in Table 4.4.

Vertical curves are assessed in terms of their stopping sight distance (SSD). SSD is the distance required for a driver to perceive an obstacle in the roadway and brake to a stop. It is affected by the horizontal and vertical alignment, as well as visual obstructions such as berms, headwalls, and embankments. Other factors affecting SSD include the driver's perception-reaction time, the driver's eye height, the height of the object, pavement surface conditions, condition of the vehicle, and the vehicle operating speed. Crest curve SSD is based on an eye height of 3.5 feet and an object height of two feet; sag curve SSD is based on a headlight height of two feet. Given the SSD for a particular design speed, the recommended minimum length of a vertical curve is calculated taking into account the gradient in that location. All vertical curves within the study area meet the recommended standard for crest and sag curves.

Passing Opportunities

Passing Sight Distance (PSD) is a measure of motorists' ability to see oncoming vehicles and safely complete the passing maneuver of slower vehicles. According to the MDT Road Design Manual, the minimum PSD for a 70 mph facility is 2,480 ft, or nearly one-half mile, while the minimum PSD for a 60 mph design speed is 2,135 ft. Because the entire corridor includes two travel lanes in each direction, the entire corridor provides opportunities for passing.

Passing sight distance is not illustrated in Figure 4-1 because, as noted above, the entire corridor includes passing zones.

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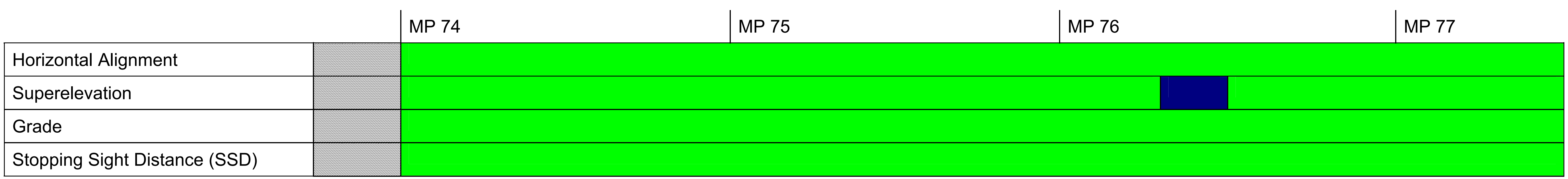
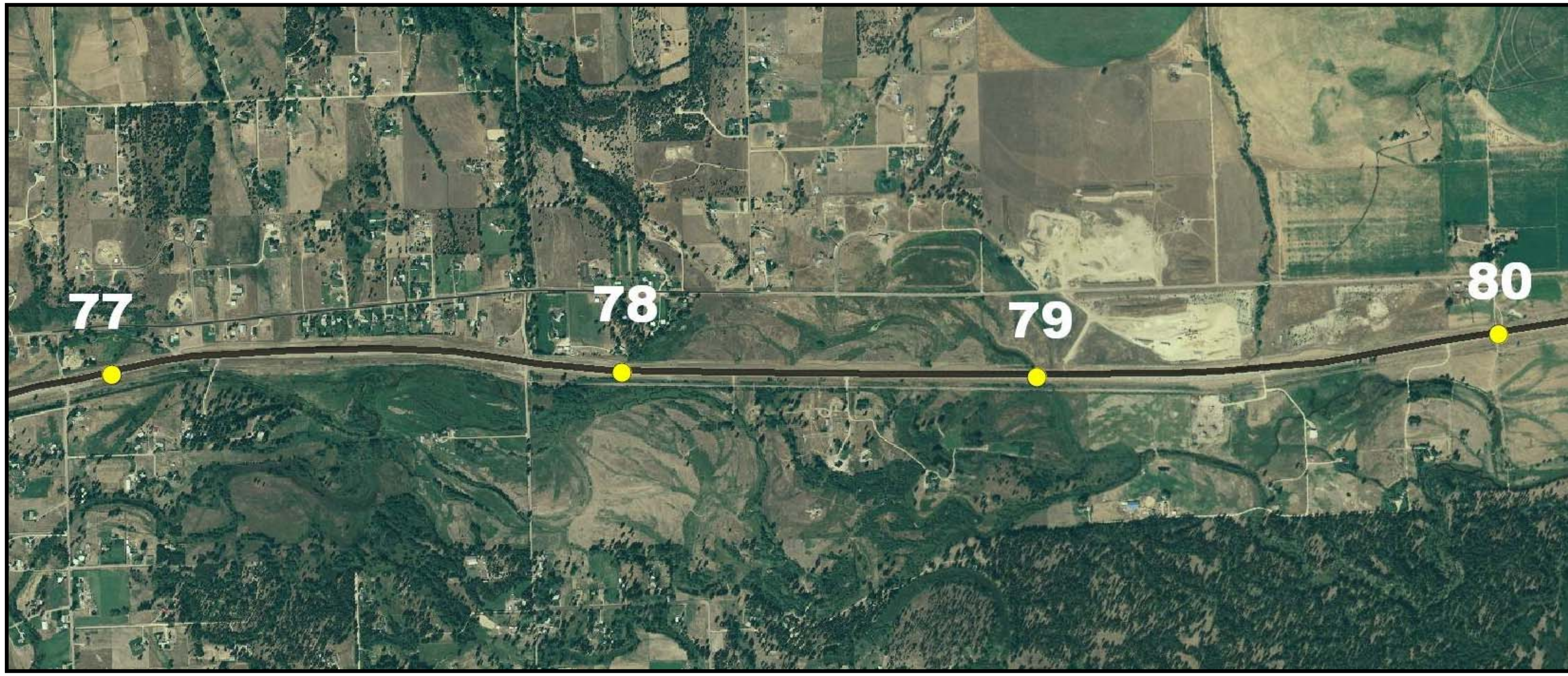
Figure 4-1 Geometric Characteristics of the US 93 Corridor

LEGEND	
(line)	US 93
(green)	Meets Standard
(blue)	Does Not Meet Standard
(hatched)	Not Measured



LEGEND	
US 93	
Meets Standard	
Does Not Meet Standard	
Not Measured	



	MP 77	MP 78	MP 79	MP 80
Horizontal Alignment				
Superelevation				
Grade				
Stopping Sight Distance (SSD)				

US 93 Corridor Study

Missoula to Florence

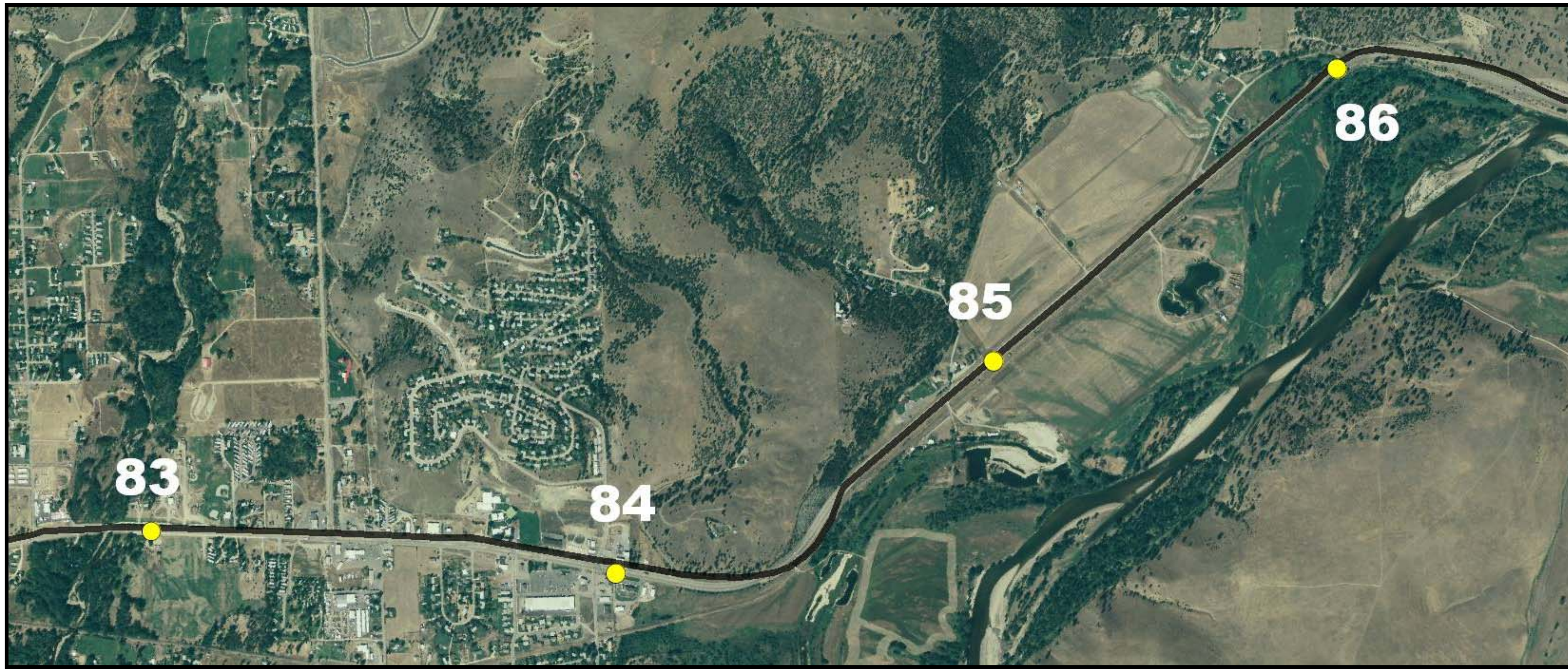
LEGEND	
▬	US 93
Green	Meets Standard
Blue	Does Not Meet Standard
Hatched	Not Measured

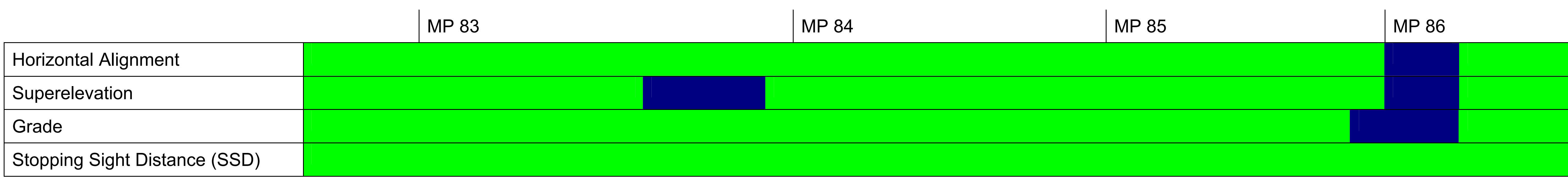
US 93 Corridor Study

Missoula to Florence

LEGEND

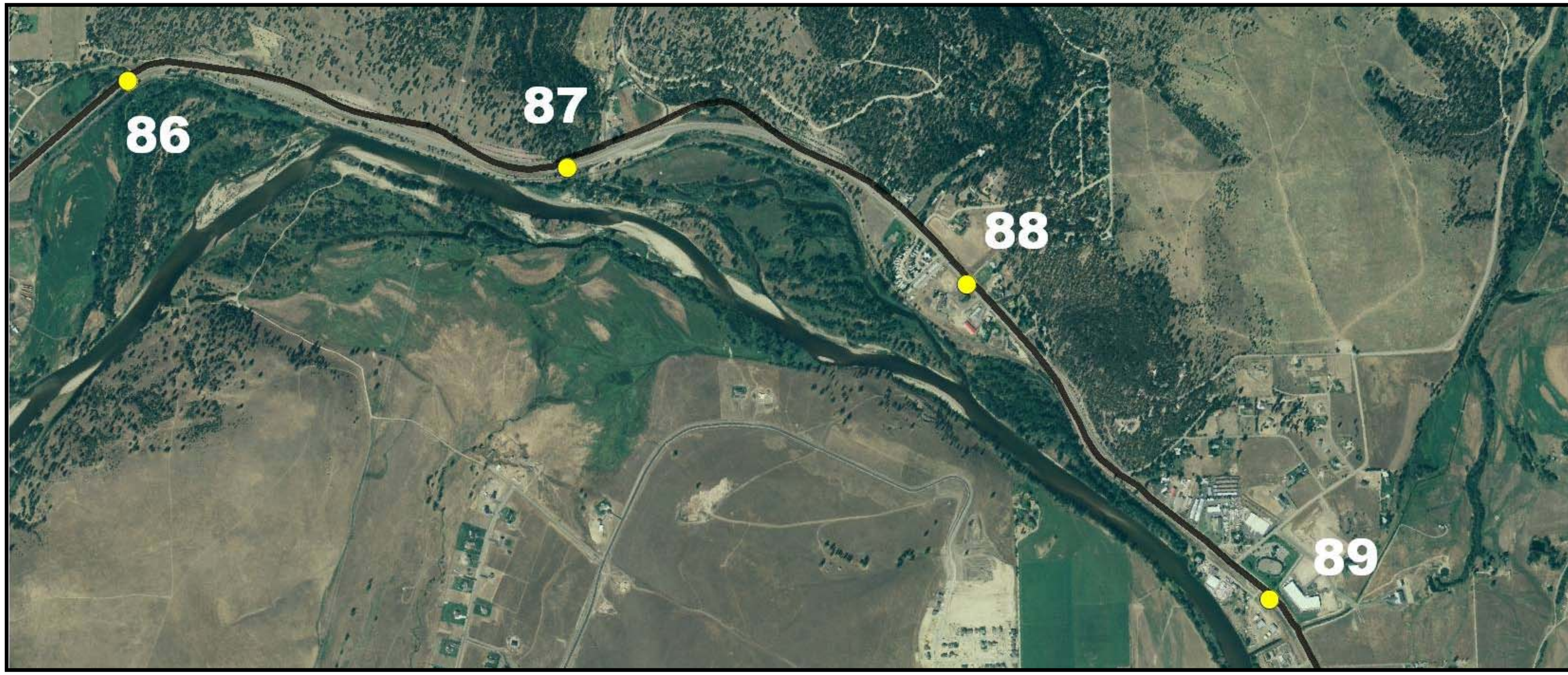
- US 93
- Meets Standard
- Does Not Meet Standard
- Not Measured

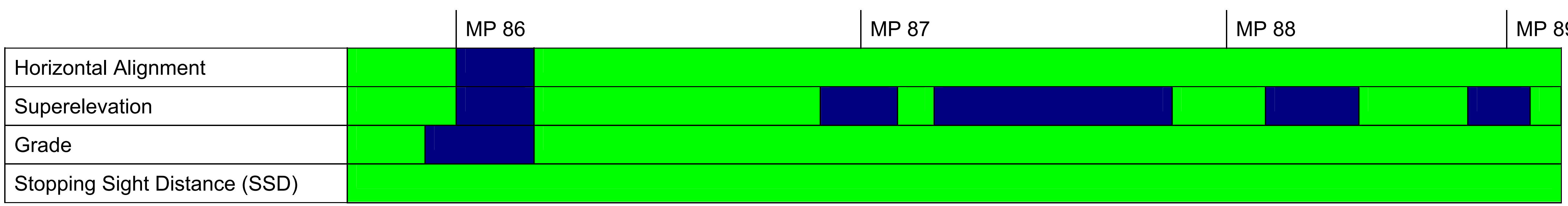




LEGEND

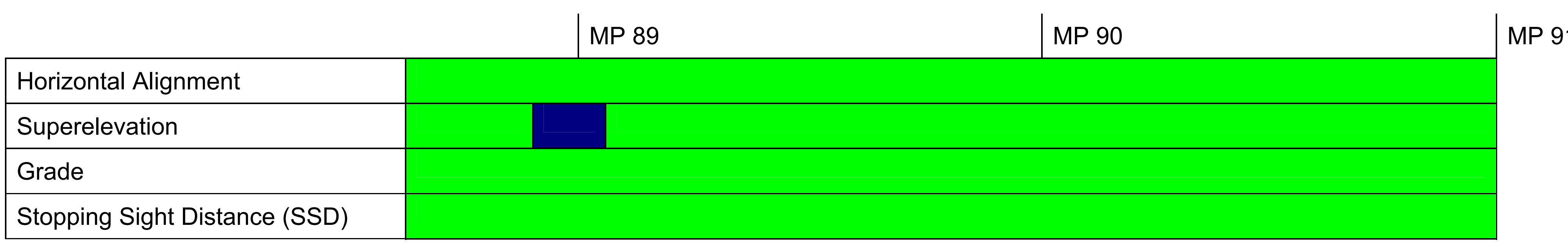
- US 93
- Meets Standard
- Does Not Meet Standard
- Not Measured





LEGEND

- US 93
- Meets Standard
- Does Not Meet Standard
- Not Measured



4.3 Crash Assessment

For this analysis, the number of crashes in the corridor was compared to the average crash rate for similar facilities throughout the state of Montana. The data were collected by the Montana Highway Patrol for the period of January 1, 2002 through December 31, 2006. The average crash rate for all rural non-interstate national highway system (NINHS) routes for the period 2002 through 2006 is 1.15 crashes per million vehicle miles. The average crash rate over the same period for all NINHS and state primary routes within the urban limits of cities with a population greater than 5,000 according to the 2000 Census is 5.66 crashes per million vehicle miles. These statewide average crash rates were converted to a corresponding projected number of crashes expected to occur in a half-mile segment using annual average daily traffic (AADT) values throughout the US 93 corridor. Table 4.5 presents statewide average crash rate conversions for MDT count locations. 2004 AADT data were utilized for these calculations as a mid-point estimate for the 2002 to 2006 period.

Table 4.5 Projected Number of Crashes Expected to Occur Based on Statewide Average Crash Rate

Classification	**Count Locations** (MP±)	**2004 AADT*** (Vehicles per day)	**Vehicle Miles****	**Million Vehicle Miles**	**Statewide Average Crash Rate** (Crashes per Million Vehicle Miles)	**Projected Number of Crashes Expected to Occur Based on Statewide Average Crash Rate*****
Rural	**74.7**	10,400	9,490,000	9.5	1.15	10.9
	83.4	19,500	17,793,750	17.8	1.15	20.5
	88.8	24,600	22,447,500	22.4	1.15	25.8
Urban	**90.1**	25,100	22,903,750	22.9	5.66	129.6
	90.6	32,200	29,382,500	29.4	5.66	166.3
	90.9	31,500	28,743,750	28.7	5.66	162.7

* Source: MDT Traffic Count Program, 2004.
**Vehicle Miles calculated as follows: (AADT)·(365 days/year)·(5 years)·(0.5 miles) = Vehicle Miles for 5-year period over half-mile segment
***Projected Number of Crashes Expected to Occur Based on Statewide Average Crash Rate calculated as follows: (Million Vehicle Miles)·(Statewide Average Crash Rate) = Projected Number of Crashes Expected to Occur Based on Statewide Average Crash Rate

The number of crashes corresponding to the statewide average crash rate can be used as a benchmark against which crashes on US 93 may be compared. Because AADT data are only available at certain locations throughout the corridor, linear regression methodology was used for this analysis to estimate AADT values between count locations. As depicted in Figure 4-2, there are scattered locations throughout the corridor with higher numbers of crashes per half-mile segment as compared to the projected number of crashes expected to occur based on the statewide average crash rate. These segments occur from MP 74.0± to MP 75.2±, MP 76.5± to MP 77.4±, MP 82.5± to MP 84.4±, and MP 85.6± to MP 89.3±, covering approximately 37 percent of the study area. Figure 4-2 shows these areas as blue peaks surpassing the pink line on the graph.

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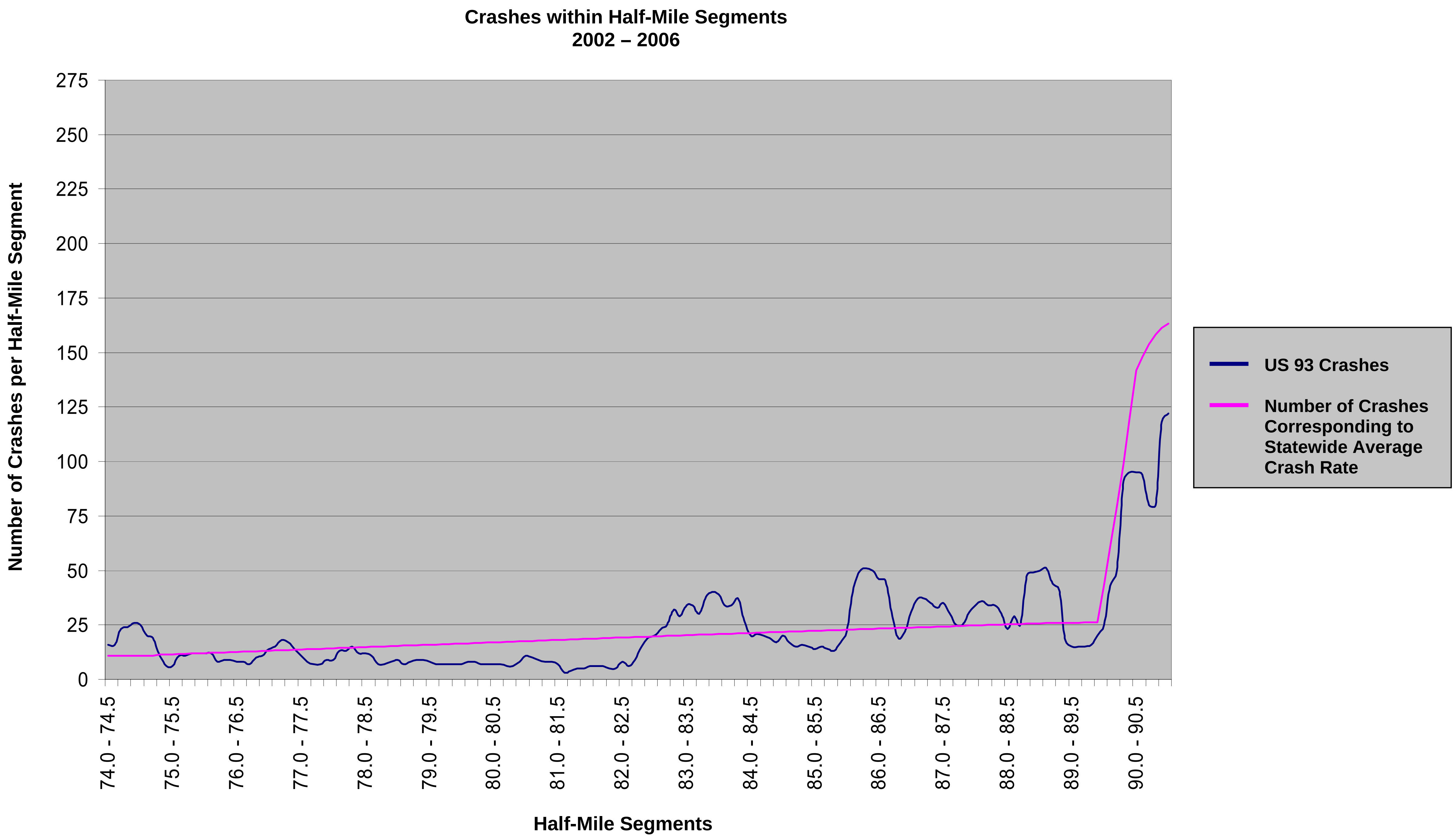
Figure 4-2 Comparison of US 93 Crashes with Number of Crashes Corresponding to Statewide Average Crash Rate for Similar Rural and Urban Facilities



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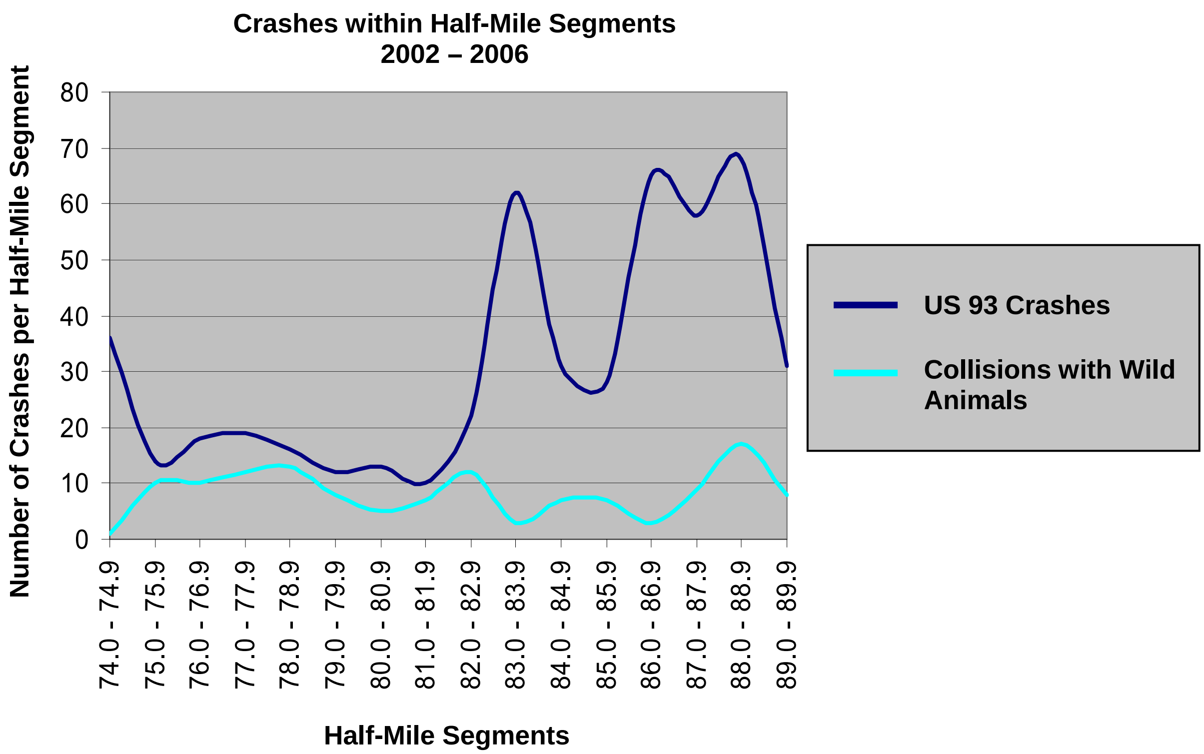
There are a number of factors contributing to the incidence of crashes in the US 93 corridor, including conflicts with wild animals. According to the crash data for the corridor over the period January 1, 2002 through December 31, 2006, higher numbers of collisions with wild animals occurred between MP 75± – 79±, MP 82± – 83±, and MP 87± – 90± as compared with the rest of the corridor, with the highest number occurring between MP 88± – 89±. Collisions with wild animals constituted the highest percentage of total crashes over the one-mile segments between MP 75± – 80± and between MP 81± – 83±, with the highest percentage occurring between MP 78± – 79±, as presented in Table 4.6 and in Figure 4-3.

Table 4.6 Collisions with Wild Animals (2002 – 2006)

Segment (MP± to MP±)	**Number of Collisions with Wild Animals**	**Collisions with Wild Animals as a Percentage of Total Collisions**
74.0 - 74.9	1	2.78%
75.0 - 75.9	10	71.43%
76.0 - 76.9	10	55.56%
77.0 - 77.9	12	63.16%
78.0 - 78.9	13	81.25%
79.0 - 79.9	8	66.67%
80.0 - 80.9	5	38.46%
81.0 - 81.9	7	70.00%
82.0 - 82.9	12	54.55%
83.0 - 83.9	3	4.84%
84.0 - 84.9	7	22.58%
85.0 - 85.9	7	25.00%
86.0 - 86.9	3	4.62%
87.0 - 87.9	9	15.52%
88.0 - 88.9	17	25.00%
89.0 - 89.9	8	25.81%
90.0 - 90.9	7	3.52%

Figure 4-3 Collisions with Wild Animals (2002 – 2006)



The segment with the highest number of collisions with wild animals (MP 88± – 89±) coincides with a stretch identified in Figure 4-2 as having a greater number of crashes than the projected number based on the statewide average crash rate. In this location, conflicts between vehicles and wild animals may contribute to the high incidence of crashes.

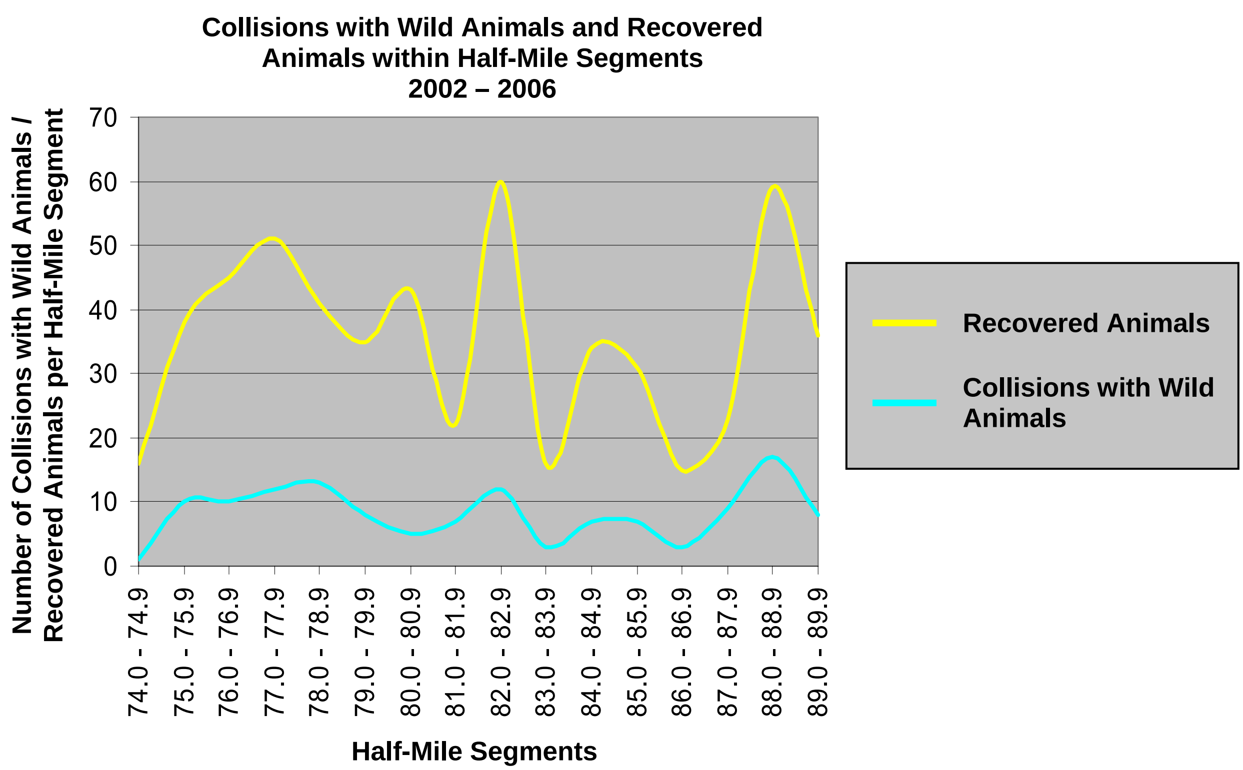
Roadkill data are another indicator of conflicts with wild animals, and may include collisions not reported to authorities or captured by crash data. As presented in Table 4.7, data obtained from MDT covering the period 2002 to 2006 show that the one-mile stretch between MP 82± – 83± contained the highest number of recovered animals. Other areas with high roadkill numbers include MP 76± – 79± and MP 88± – 89±.

Table 4.7 Roadkill Recovery (2002 – 2006)

Segment (MP± to MP±)	**Number of Recovered Animals**
74.0 - 74.99	16
75.0 - 75.99	38
76.0 - 76.99	45
77.0 - 77.99	51
78.0 - 78.99	41
79.0 - 79.99	35
80.0 - 80.99	43
81.0 - 81.99	22
82.0 - 82.99	60
83.0 - 83.99	16
84.0 - 84.99	34
85.0 - 85.99	31
86.0 - 86.99	15
87.0 - 87.99	23
88.0 - 88.99	59
89.0 - 89.99	36
90.0 – 91.0	35

As shown in Figure 4-4, the segment with the second highest number of recovered animals (MP 88± – 89±) coincides with the segment identified as having the highest number of collisions with wild animals. In this location, poor safety performance may relate to conflicts between vehicles and wild animals.

Figure 4-4 Roadkill Recovery as Compared to Collisions with Wild Animals (2002 – 2006)

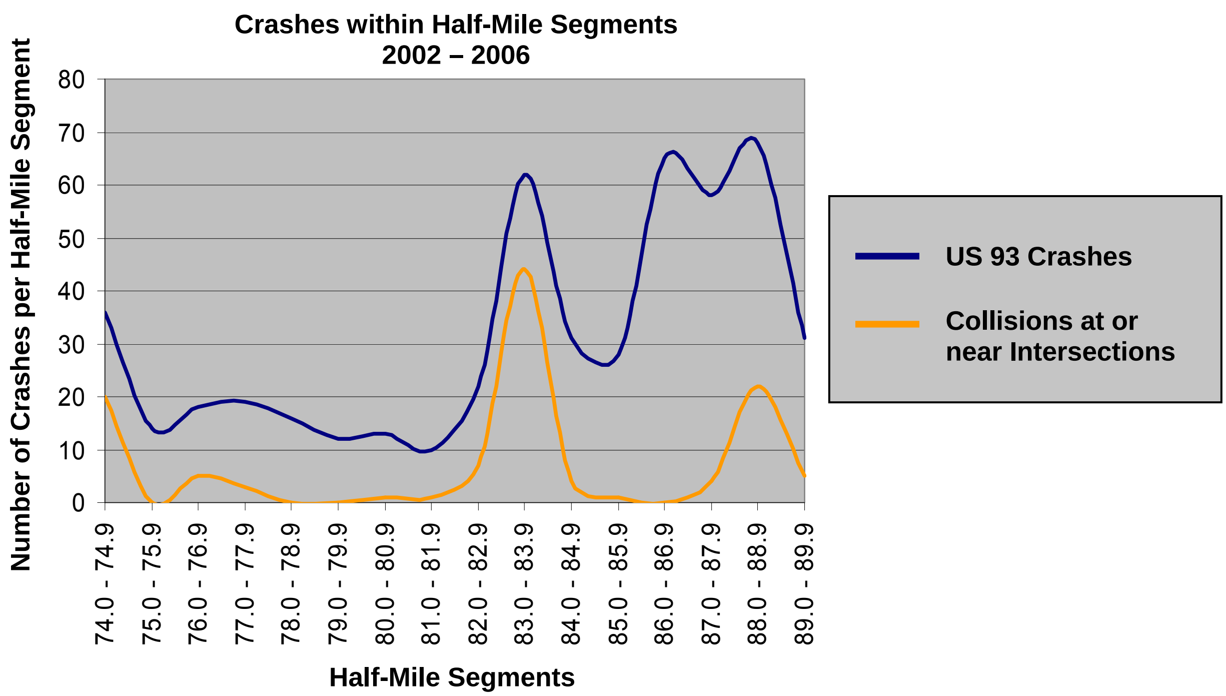


Intersection operation and design issues may also contribute to poor safety performance on US 93. According to the crash data for the corridor over the period January 1, 2002 through December 31, 2006, nearly 35 percent of all crashes occurred at or near intersections. This percentage was determined by counting the number of crashes coded as “In Intersection” or “Intersection Related” by the Montana Highway Patrol. As presented in Table 4.8 and Figure 4-5, higher numbers of collisions located at or near intersections occurred between MP 74± – 75±, MP 83± –84±, and MP 88± – 89± as compared with the rest of the corridor, with the highest concentration occurring between MP 90± – 91±. Collisions at or near intersections in these segments also constituted higher percentages of the total collisions in that segment, as compared to the rest of the corridor.

Table 4.8 Collisions at or near Intersections (2002 – 2006)

Segment (MP± to MP±)	**# Collisions at or near Intersections**	**Collisions at or near Intersections as a Percentage of Total Collisions**
74.0 - 74.9	20	55.56%
75.0 - 75.9	0	0.00%
76.0 - 76.9	5	27.78%
77.0 - 77.9	3	15.79%
78.0 - 78.9	0	0.00%
79.0 - 79.9	0	0.00%
80.0 - 80.9	1	7.69%
81.0 - 81.9	1	10.00%
82.0 - 82.9	7	31.82%
83.0 - 83.9	44	70.97%
84.0 - 84.9	4	12.90%
85.0 - 85.9	1	3.57%
86.0 - 86.9	0	0.00%
87.0 - 87.9	4	6.90%
88.0 - 88.9	22	32.35%
89.0 - 89.9	5	16.13%
90.0 - 90.9	132	66.33%

Figure 4-5 Collisions at or near Intersections (2002 – 2006)



The segments between MP 74± – 75±, MP 83± – 84±, and MP 88± – 89.0± coincide with stretches identified in Figure 4-2 as having a greater number of crashes than the projected number based on the statewide average crash rate. In these locations, the high incidence of crashes may relate to excessive delay or other intersection-related operational issues.

In addition to vehicle-animals conflicts and intersection design and operation, there may also be some correlation between poor safety performance and a single nonstandard horizontal curve located near MP 86.1±. Thirty-four crashes were concentrated at this horizontal curve between 2002 and 2006, which is identified in Figure 4-2 as having a greater number of crashes than the projected number based on the statewide average crash rate. In this location, the nonstandard horizontal curve may contribute to the high incidence of crashes.

4.4 Traffic Conditions

Annual Average Daily Traffic Volumes (2004)

Annual average daily traffic (AADT) is the total of all motorized vehicles traveling both directions on a highway on an average day. AADT values differ throughout the US 93 corridor. 2004 AADT values for various points throughout the corridor are listed in Table 4.9.

Table 4.9 Existing AADT (2004)

MP±	2004 AADT
90.9	31,500
90.6	32,200
90.1	25,100
88.8	24,600
83.4	19,500
74.7	10,400

Source: MDT Traffic Count Program, 2004.

Growth Rates

In order to project AADT and intersection turn movements into the future, a compound annual growth rate method was utilized. To maintain consistency with other projects in the area, the Miller Creek Road EIS, the Hamilton to Lolo EIS, and the Access Control Report: US 93 N & S; Lolo to Missoula were consulted. Figure 4-6 illustrates the coverage areas of these studies relative to the US 93 Corridor Study, and the growth rates used for the Corridor Study.

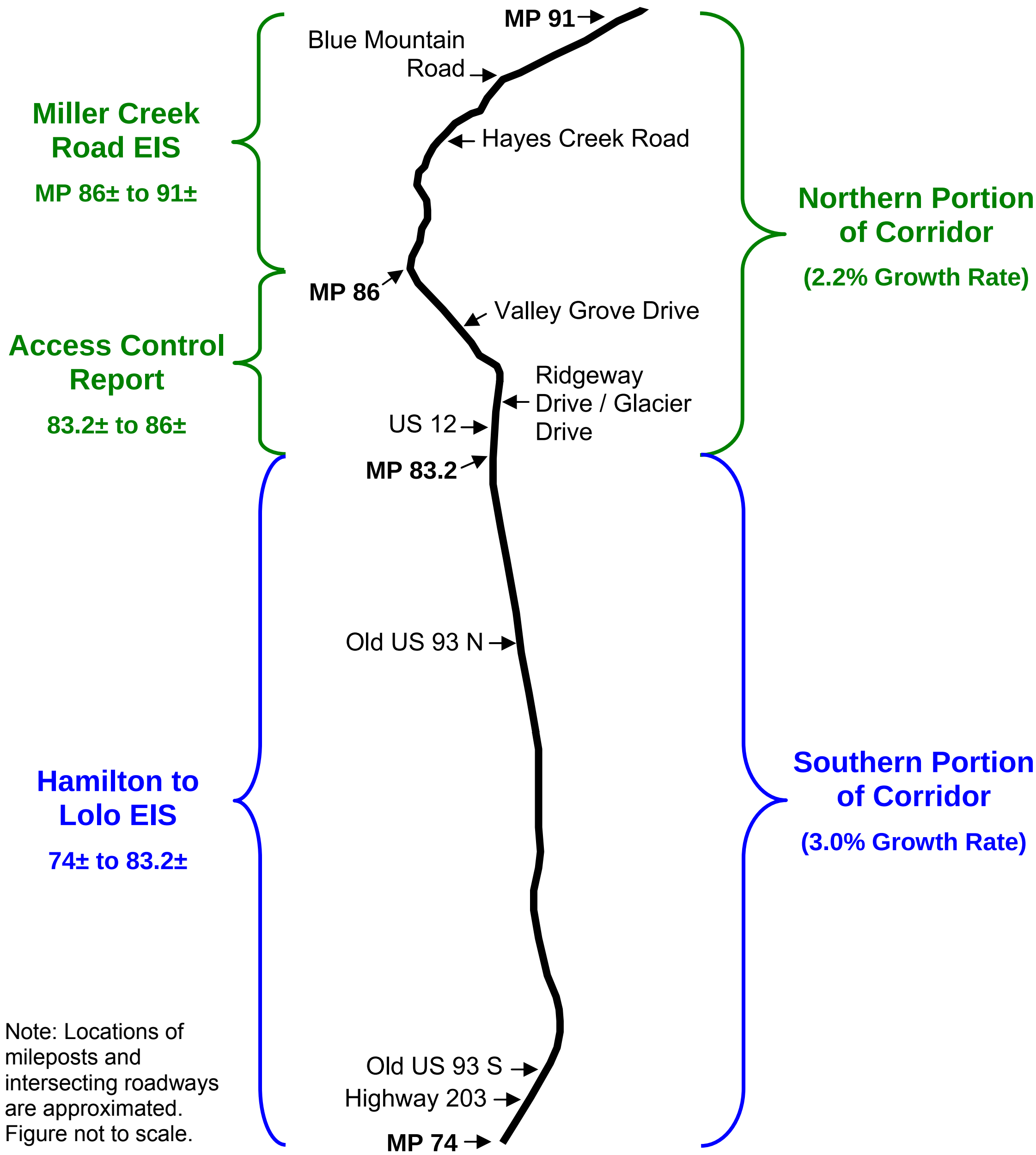
Northern Portion of Corridor

The Miller Creek Road EIS, which covers the portion of the corridor between MP 86± – 91±, utilized a growth rate of 2.22 percent based on 10 years of historic traffic data. This growth rate was rounded to 2.2 percent for the purpose of this study. The portion of the corridor between MP 83.2± – 86± is included in the Access Control Report. This report cited the Miller Creek Road EIS growth rate of 2.22 percent, which was rounded to 2.2 percent for the purpose of this study.

Southern Portion of Corridor

The Hamilton to Lolo EIS, which includes the portion of the corridor between MP 74± – 83.2±, noted that the previous ten years of historic traffic data showed a growth rate of "just under three percent." A growth rate of 3.0 percent was used for the purpose of this study.

Figure 4-6 Growth Rates in the US 93 Corridor



These growth rates were chosen for this Corridor Study to maintain consistency with published EIS documents and the adopted Access Control Report and to ensure that a uniform methodology was used in their calculation. Growth rates for both the northern and southern portions of the corridor were rounded to two significant digits to ensure a consistent level of analysis in traffic data projections.

Annual Average Daily Traffic Volumes (2007)

2007 AADT values were calculated using the growth rates described above. Table 4.10 presents 2007 AADT values for points corresponding with those in Table 4.9.

Table 4.10 Existing AADT (2007)

MP	2007 AADT
90.9	33,600
90.6	34,400
90.1	26,800
88.8	26,200
83.4	20,800
74.7	11,400

Source: HKM Engineering, 2007.

Level of Service

Traffic conditions on transportation facilities are commonly defined using the Level of Service (LOS) concept. The Highway Capacity Manual 2000 (HCM) defines LOS based on a variety of factors, including average travel speed, percent time delay, intersection delay, capacity utilization, and maximum density to provide a qualitative assessment of the driver's experience. Intersection analyses were conducted for this study using the procedures outlined in HCM and through the use of Syncho / SimTraffic simulation software.

The Syncho / SimTraffic simulation software uses a stochastic method to model the street network and estimate vehicle delay at each study intersection, thereby accounting for different mixes of driver behavior that might occur over a range of peak hours sampled in one location. Multiple runs were performed for each scenario to provide statistically sound results. The random nature of simulation, however, creates variation even when using identical input values for each simulation run. It is worth noting that the software methods do not quantify reduced delay of vehicles making a two staged left-turn into the two-way-left-turn-lane (TWLTL) median. Further, it should be noted that for each model run, there are differences in the percent of vehicles served at each intersection. Accordingly, the results of this analysis should be viewed as approximate.

Mainline LOS and Peak Hour Mainline Traffic Volumes

Mainline LOS is generally a measure of the degree of congestion on a roadway. For a mainline, six LOS categories ranging from A to F are used to describe traffic operations, with A representing the best conditions and F representing the worst. Table 4.11 presents LOS criteria for multi-lane highways as listed in HCM. A mainline LOS ranking of E indicates the roadway is at full capacity, and a ranking of F indicates that volumes have exceeded roadway capacity.

Table 4.11 LOS Criteria for Multilane Highways

Free-Flow Speed	Criteria	LOS				
		A	B	C	D	E
60 mi/h	Maximum density (pc/mi/ln)	11	18	26	35	40
	Average speed (mi/h)	60.0	60.0	59.4	56.7	55.0
	Maximum volume to capacity ratio (v/c)	0.30	0.49	0.70	0.90	1.00
	Maximum service flow rate (pc/h/ln)	660	1,080	1,550	1,980	2,200
55 mi/h	Maximum density (pc/mi/ln)	11	18	26	35	41
	Average speed (mi/h)	55.0	55.0	54.9	52.9	51.2
	Maximum volume to capacity ratio (v/c)	0.29	0.47	0.68	0.88	1.00
	Maximum service flow rate (pc/h/ln)	600	990	1,430	1,850	2,100
50 mi/h	Maximum density (pc/mi/ln)	11	18	26	35	43
	Average speed (mi/h)	50.0	50.0	50.0	48.9	47.5
	Maximum volume to capacity ratio (v/c)	0.28	0.45	0.65	0.86	1.00
	Maximum service flow rate (pc/h/ln)	550	900	1,300	1,710	2,000
45 mi/h	Maximum density (pc/mi/ln)	11	18	26	35	45
	Average speed (mi/h)	45.0	45.0	45.0	44.4	42.2
	Maximum volume to capacity ratio (v/c)	0.26	0.43	0.62	0.82	1.00
	Maximum service flow rate (pc/h/ln)	490	810	1,170	1,550	1,900

Source: HCM 2000, Exhibit 21-2 Level of Service Criteria for Multilane Highways.
(1) pc/mi/ln: Passenger Car per Mile per Lane
(2) v/c: Volume of the road per Capacity of the road
(3) pc/hr/ln: Passenger Car per Hour per Lane

According to HCM, two through lanes on a multilane highway can accommodate between approximately 2,300 and 2,600 vehicles per hour at LOS C and a free flow speed of 60 mph, as shown in Table 4.12. Fewer vehicles per hour can be accommodated at a higher LOS ranking, whereas a larger number of vehicles per hour can be accommodated at a lower LOS ranking. It should be noted that Table 4.12 contains approximate values and is only intended for illustrative purposes.

Table 4.12 Example Service Volumes for Multilane Highways

Free Flow Speed (mph)	Number of Lanes	Terrain	LOS Categories				
			A	B	C	D	E
			Service Volumes (vehicles per hour)				
60	2	Level	1,120	1,840	2,650	3,400	3,770
		Rolling	1,070	1,760	2,520	3,240	3,590
		Mountainous	980	1,610	2,310	2,960	3,290
	3	Level	1,690	2,770	3,970	5,100	5,660
		Rolling	1,610	2,640	3,790	4,860	5,390
		Mountainous	1,470	2,410	3,460	4,450	4,930
50	2	Level	940	1,540	2,220	2,910	3,430
		Rolling	890	1,460	2,120	2,780	3,260
		Mountainous	820	1,340	1,940	2,540	2,990
	3	Level	1,410	2,310	3,340	4,370	5,140
		Rolling	1,340	2,200	3,180	4,170	4,900
		Mountainous	1,230	2,010	2,910	3,810	4,480

Source: HCM 2000, Exhibit 12-5 Example Service Volumes for Multilane Highways.
Assumptions: Highway with 60-mph FFS has 8 access points/mile; highway with 50-mph FFS has 25 access points/mile; lane width = 12 ft; shoulder width > 6 ft; divided highway; PHF = 0.88; 5 percent trucks; and regular commuters.

Currently, the two northbound lanes of US 93 carry approximately 500 vehicles near the southern end of the corridor and approximately 2,100 vehicles at the northern end of the corridor during the AM peak hour, as illustrated in Figure 4-7. During the PM peak hour, the two southbound lanes of US 93 carry approximately 800 vehicles near the southern end of the corridor and approximately 1,800 vehicles at the northern end of the corridor, as illustrated in Figure 4-8. Considering the service volumes listed in Table 4.12, US 93 may currently be operating at LOS A in the southern portion of the corridor and LOS B or LOS C in the northern portion of the corridor during the peak hours, assuming level terrain and a free flow speed of 60 mph. Free flow speed (FFS) is the average speed of all vehicles on a given facility over a discrete segment, and includes the speed of vehicles entering and exiting the facility. In the absence of speed study data, HCM recommends a maximum base free flow speed of 60 mph for a rural or suburban multilane highway. Given the relative congestion on US 93 during peak hours of travel, as well as the number of access points over the corridor and the range of driver behaviors, it is reasonable to use a base free flow speed that is lower than the posted speed limit of 70 mph.

It should be noted that LOS rankings may be lower over portions of the US 93 corridor with rolling terrain and where the free flow speed may be closer to 50 mph.

Figure 4-7 AM Peak Hour Traffic Volumes in the US 93 Corridor (2007)

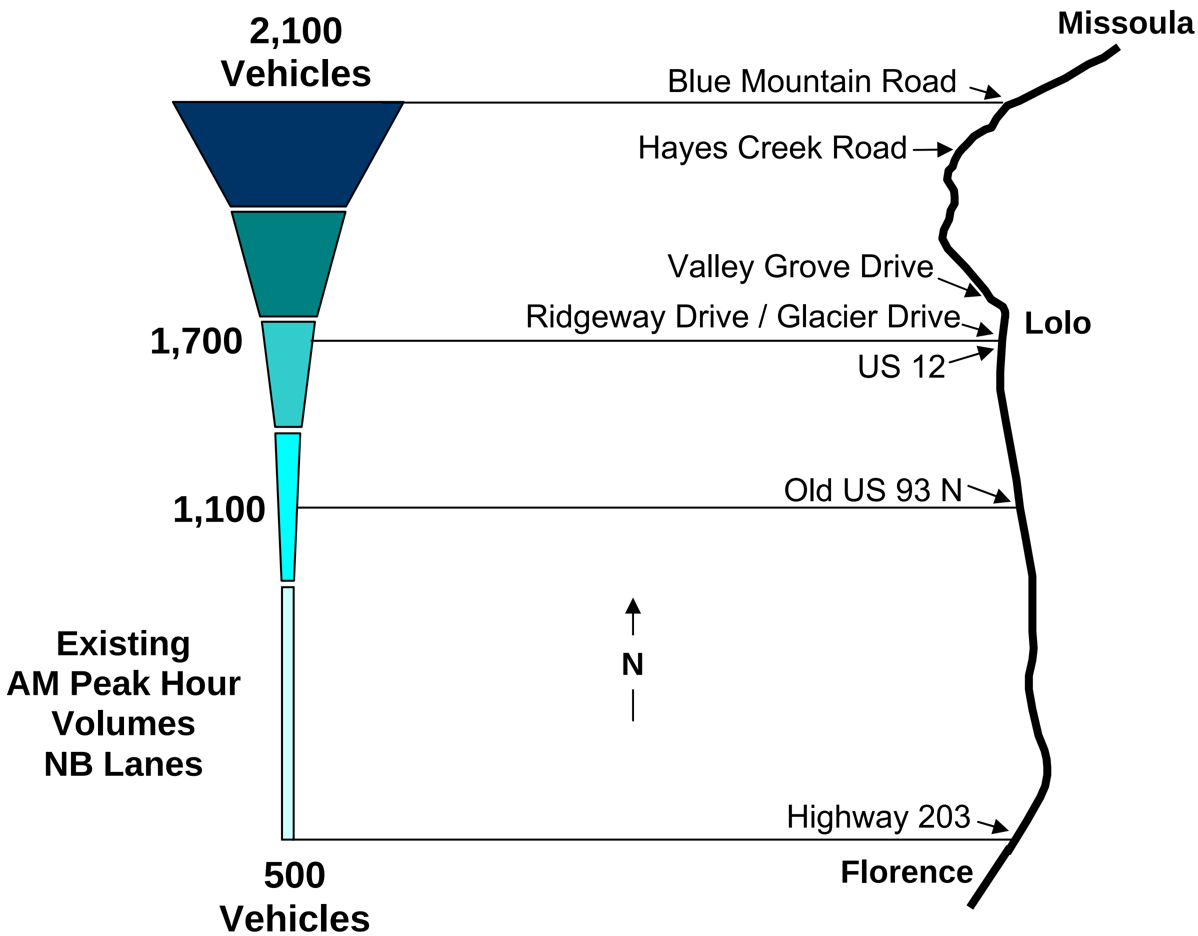
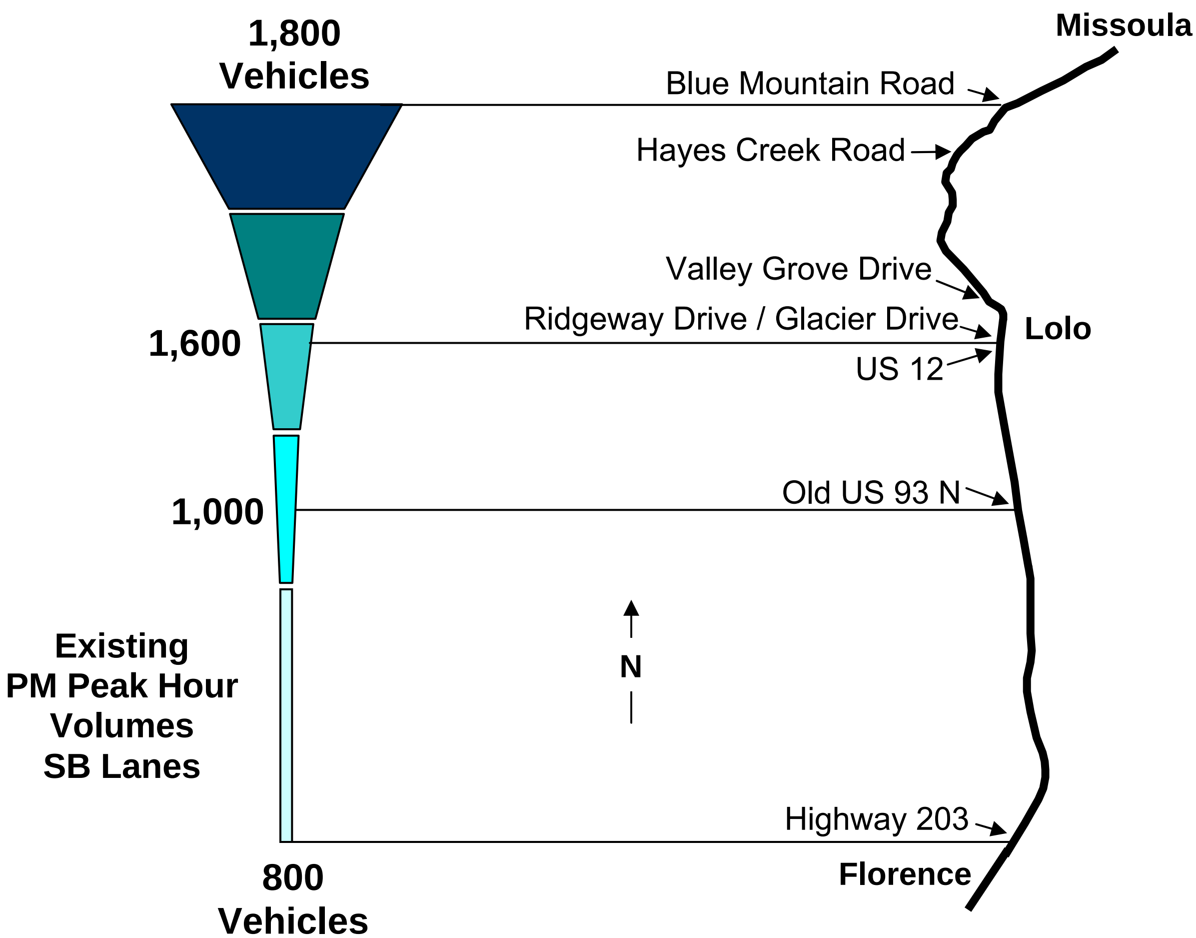


Figure 4-8 PM Peak Hour Traffic Volumes in the US 93 Corridor (2007)



Intersection LOS

For intersections, six LOS categories ranging from A to F are used to describe traffic operations. LOS A represents the best conditions and LOS F represents the worst. Delay times for each of these categories differ depending on the type of intersection control. Table 4.13 presents delay times for each category, as defined by HCM.

Table 4.13 Intersection LOS Criteria

LOS	Average Control Delay (seconds per vehicle)	
	Two-Way Stop Controlled Intersections	Signalized Intersections
A	0 – 10	≤ 10
B	> 10 – 15	> 10 – 20
C	> 15 – 25	> 20 – 35
D	> 25 – 35	> 35 – 55
E	> 35 – 50	> 55 – 80
F	> 50	> 80

Source: HCM 2000, Exhibit 16-2 Level of Service Criteria for Signalized Intersections and 17-2 Level of Service Criteria for TWSC Intersections.

Fourteen intersections were evaluated for this study during the AM and PM peak periods. The results of the LOS analyses are presented in Tables 4.14 and 4.15. The intersection of US 93 and Miller Creek, located at approximately MP 90±, was evaluated in the Miller Creek Road EIS. Improvements to this intersection are governed by the EIS document, and therefore this intersection was not evaluated in this Corridor Study.

Table 4.14 presents AM and PM peak hour overall intersection LOS for the fourteen intersections evaluated in this study. Overall intersection delay is calculated using a weighted average of the delay experienced at each leg of an intersection. Because mainline volumes are much larger than side street volumes throughout the US 93 corridor, the overall intersection LOS ranking is generally indicative of mainline delay at these intersections. Mainline volumes currently experience minimal delay at intersections throughout the corridor during both the AM and PM peak hours, as evidenced by the overall intersection LOS ratings of A and B. AM and PM overall intersection LOS is also illustrated in Figures 4-9 and 4-10.

Table 4.14 Existing (2007) Overall Intersection LOS

Intersection			AM Peak Hour Overall Intersection		PM Peak Hour Overall Intersection	
ID	Location	Control	Avg. Delay (Sec/Veh)	LOS	Avg. Delay (Sec/Veh)	LOS
1	Blue Mountain Rd./US-93	Signalized	5.3	A	12.9	B
2	Wornath Rd./US-93	EB Stop	<5.0	A	<5.0	A
3	Hayes Creek Rd./ US-93	EB/WB Stop	7.8	A	<5.0	A
4	Cochise Dr./US-93	EB Stop	7.5	A	<5.0	A
5	Bird Lane/US-93	EB Stop	<5.0	A	<5.0	A
6	Valley Grove Dr./ US-93	EB Stop	<5.0	A	<5.0	A
7	Ridgeway-Glacier Dr./US-93	Signalized	18.2	B	17.2	B
8	Tyler Way/US-93	Signalized	12.2	B	11.0	B
9	Lewis & Clark Dr./ US-93	EB/WB Stop	<5.0	A	<5.0	A
10	US-12/US-93	Signalized	18.9	B	10.0	A
11	Mormon Creek Rd./ US-93	EB Stop	<5.0	A	<5.0	A
12	Old US-93 N./US-93	EB Stop	<5.0	A	5.2	A
13	Old US-93 S./US-93	EB Stop	<5.0	A	5.6	A
14	Highway 203/US-93	Signalized	12.2	B	12.4	B

Source: Fehr & Peers, 2008.

Figure 4-9 Overall Intersection LOS – Existing Conditions AM Peak Hour

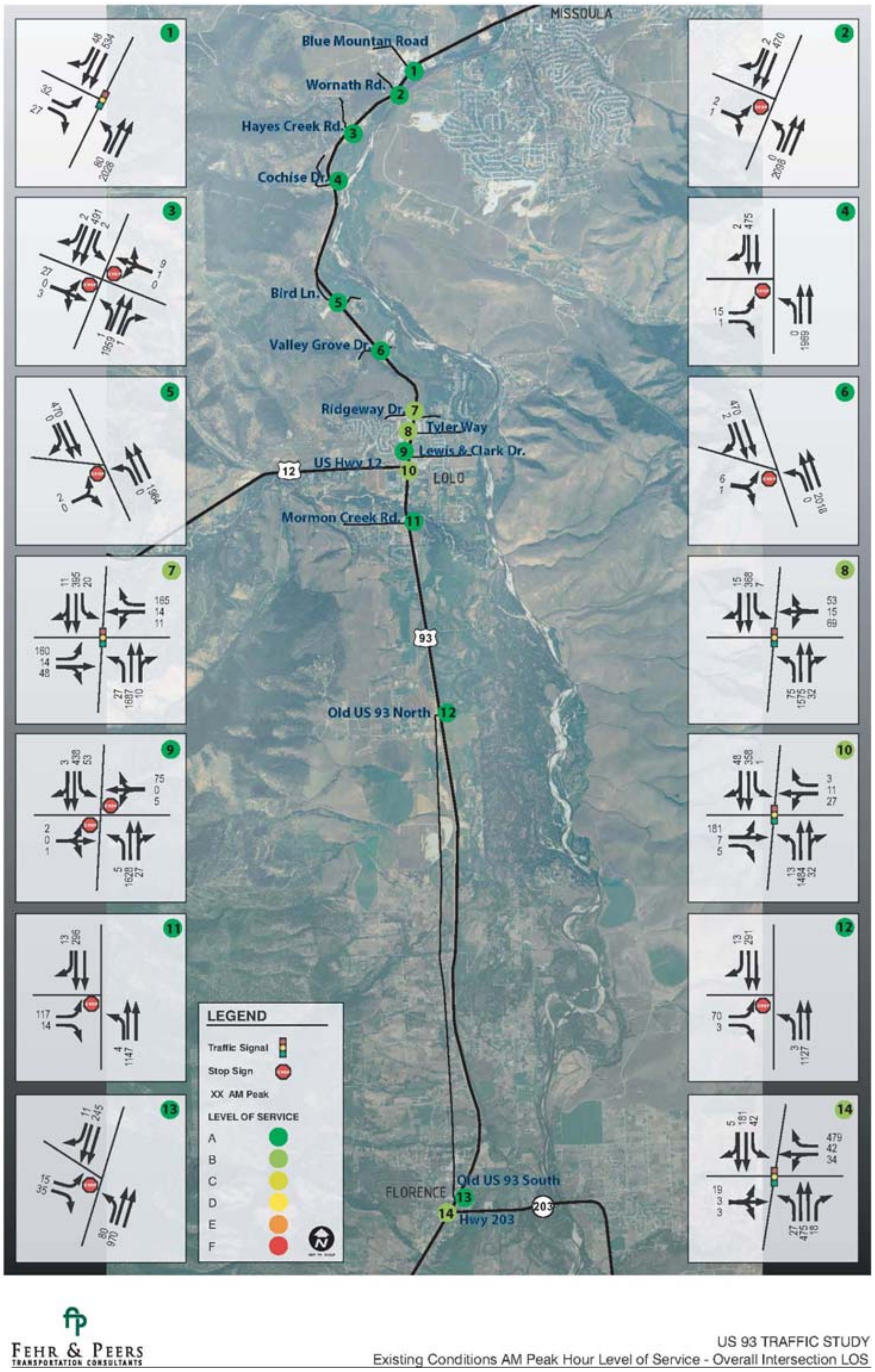


Figure 4-10 Overall Intersection LOS – Existing Conditions PM Peak Hour

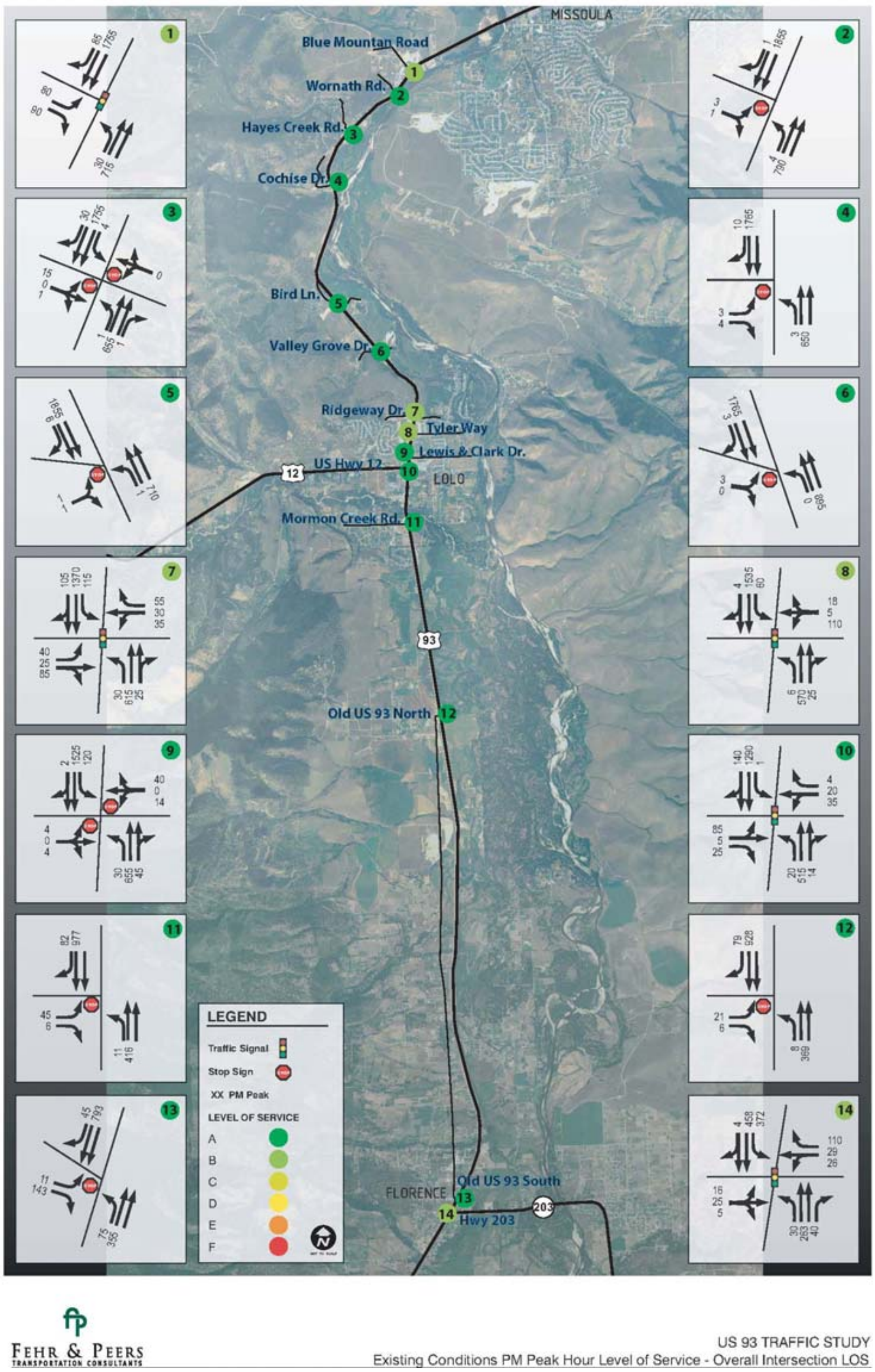


Table 4.15 presents LOS experienced at the worst approach of stop-controlled study intersections within the corridor. The worst approach of an intersection is defined as the intersection leg experiencing the longest delay as compared to other legs at that intersection. As indicated in Table 4.15, delay times on stop-controlled side streets range from nearly seven seconds (LOS A) to nearly 98 seconds (LOS F). LOS ratings of D, E, and F indicate that it is difficult to access US 93 from stop-controlled side streets during the AM and PM peak hours. AM and PM worst approach LOS is illustrated in Figures 4-11 and 4-12.

The worst approach LOS is based on a weighted average of delay times experienced by all vehicles at that approach, and therefore is not necessarily representative of all turn movements. Of note in this corridor, the intersection of US 93 and Old US 93 South is reported as experiencing LOS A during the AM peak hour. Vehicles attempting an eastbound to northbound left turn, however, experience greater delay (LOS C).

Table 4.15 Existing (2007) Worst Approach LOS

Intersection			AM Peak Hour Worst Approach			PM Peak Hour Worst Approach		
ID	**Location**	**Control**	**Approach**	**Avg. Delay** (Sec/Veh)	**LOS**	**Approach**	**Avg. Delay** (Sec/Veh)	**LOS**
1	Blue Mountain Rd./US-93	Signalized	N/A	N/A	N/A	N/A	N/A	N/A
2	Wornath Rd./US-93	EB Stop	EB	31.4	D	EB	28.1	D
3	Hayes Creek Rd./ US-93	EB/WB Stop	EB	52.5	F	EB	30.1	D
4	Cochise Dr./US-93	EB Stop	EB	32.4	D	EB	15.8	C
5	Bird Lane/US-93	EB Stop	EB	34.9	D	EB	9.2	A
6	Valley Grove Dr./ US-93	EB Stop	EB	33.4	D	EB	97.6	F
7	Ridgeway-Glacier Dr./ US-93	Signalized	N/A	N/A	N/A	N/A	N/A	N/A
8	Tyler Way/US-93	Signalized	N/A	N/A	N/A	N/A	N/A	N/A
9	Lewis & Clark Dr./ US-93	EB/WB Stop	WB	19.2	C	EB	48.5	E
10	US-12/US-93	Signalized	N/A	N/A	N/A	N/A	N/A	N/A
11	Mormon Creek Rd./ US-93	EB Stop	EB	18.2	C	EB	14.7	B
12	Old US-93 N./US-93	EB Stop	EB	15.3	C	EB	12.8	B
13	Old US-93 S./US-93	EB Stop	EB	6.5	A[1]	EB	13.9	B
14	Highway 203/US-93	Signalized	N/A	N/A	N/A	N/A	N/A	N/A

Source: Fehr & Peers, 2008.
[1] Vehicles attempting an EB to NB left turn at this intersection experience LOS C.

Figure 4-11 Worst Approach LOS – Existing Conditions AM Peak Hour

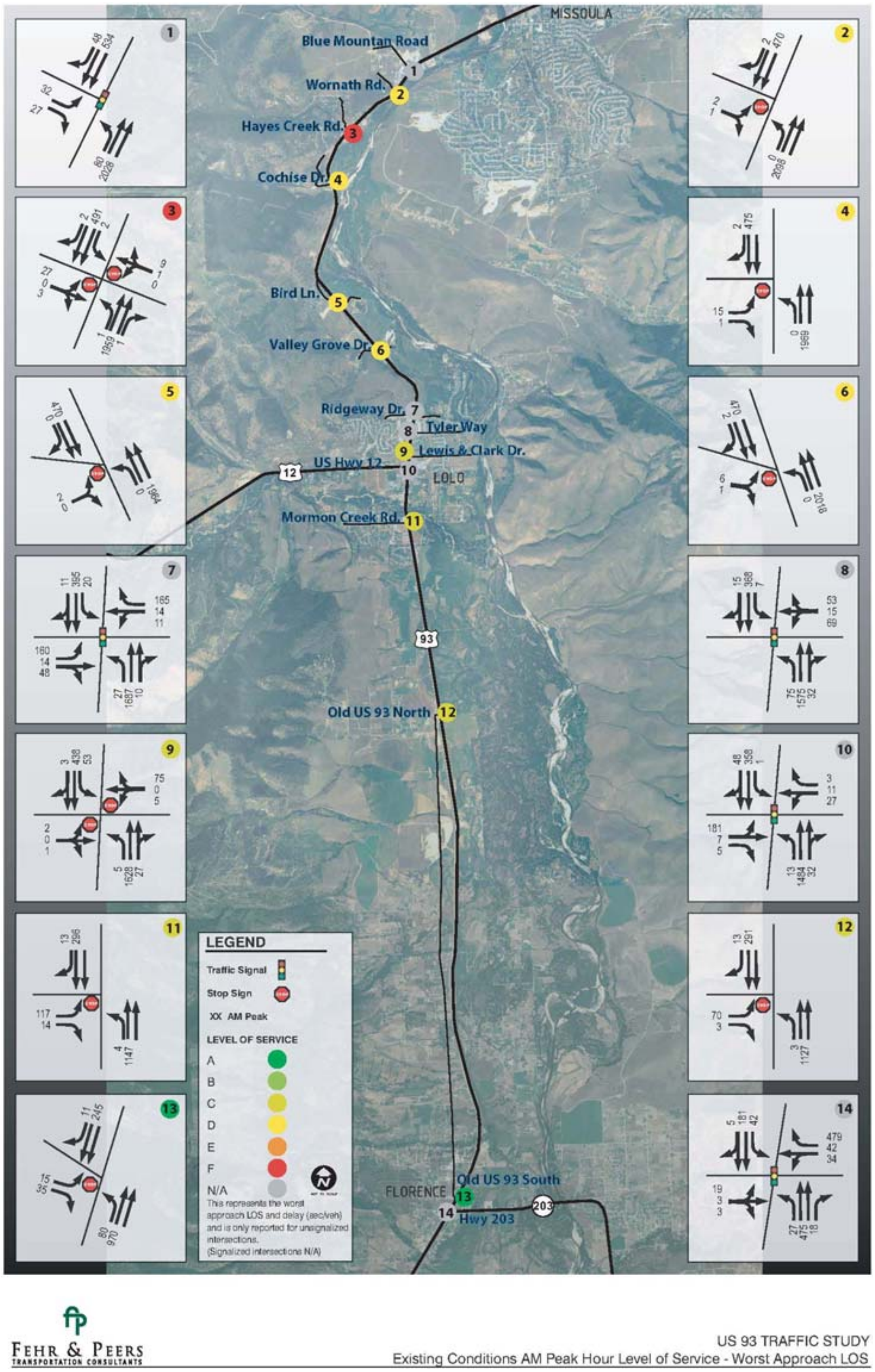
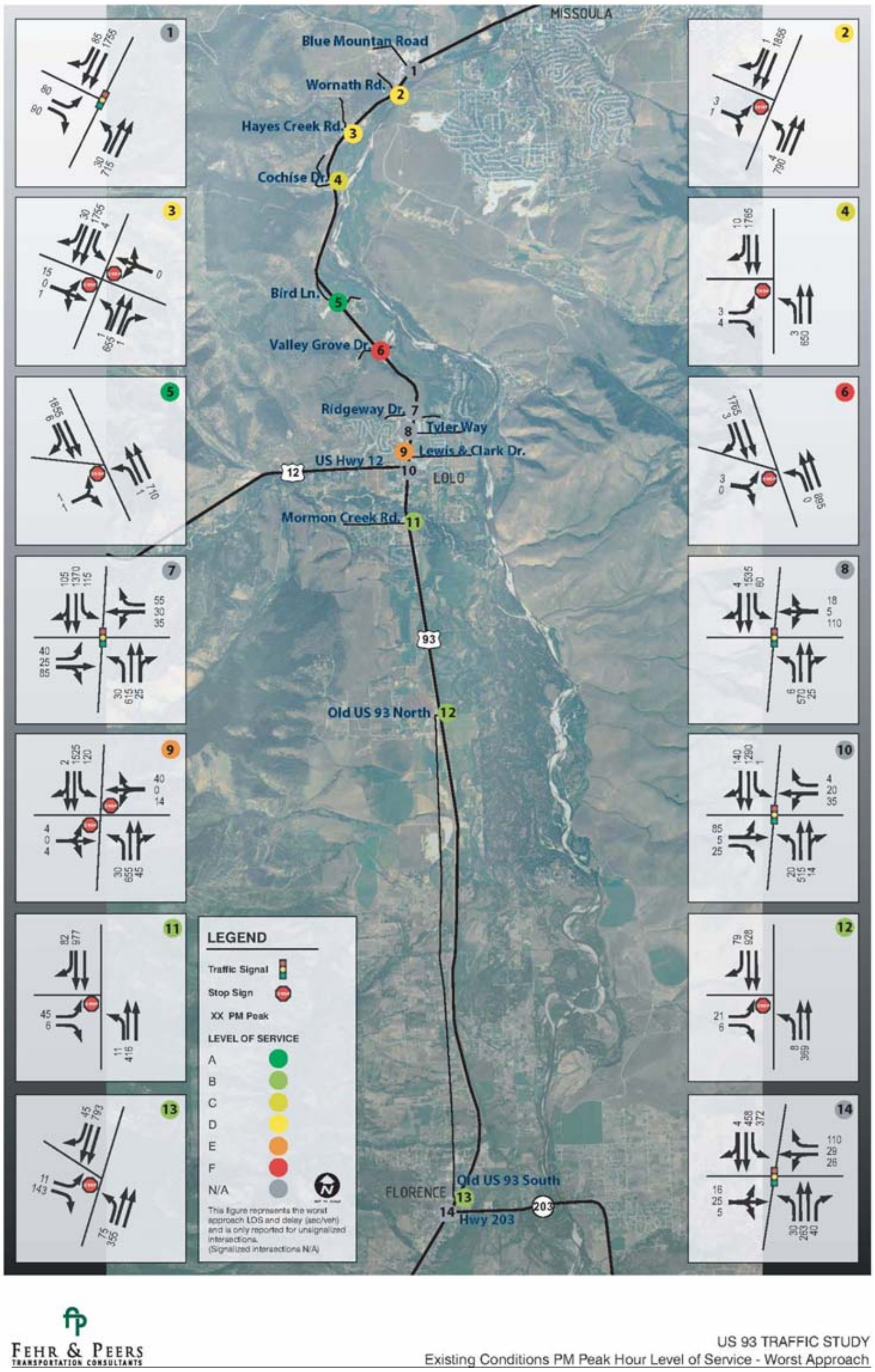


Figure 4-12 Worst Approach LOS – Existing Conditions PM Peak Hour



4.5 Summary of Existing Geometric and Operational Conditions

The investigation of existing conditions of the US 93 transportation system identified a number of issues to be considered in development of the Corridor Study. These issues are summarized in the following list.

1. A single sharp horizontal curve exists near MP 86.1±.

2. There are a number of scattered locations between MP 76± and MP 89± with nonstandard superelevation.

3. Grades over four percent, which is the maximum recommended grade for rolling terrain, are present near MP 86±.

4. Stopping sight distance meets minimum standards over the entire corridor.

5. According to the MDT bridge sufficiency ratings database, the two existing bridges within the corridor are not deficient.

6. Based on AM and PM peak hour volumes and HCM example service volumes for multilane highways, the northern portion of the corridor may be operating at LOS B or C. Accordingly, volumes are approaching roadway capacity during the peak hours of travel.

7. Mainline delay at intersections during the AM and PM peak hours is minimal, as evidenced by LOS ratings of A and B throughout the corridor.

8. Side-street delay at stop-controlled intersections during the AM and PM peak hours is substantial, as evidenced by LOS ratings of C, D, E, and F throughout the corridor. Accordingly, it is very difficult to access US 93 from side streets at stop-controlled intersections during the peak hours of travel.

9. There are scattered locations throughout the corridor with higher numbers of crashes per half-mile segment as compared to the projected number of crashes expected to occur based on the statewide average crash rate. These segments cover approximately 37 percent of the study area.

4.6 Multi-Modal Transportation

Railroad Facilities

Montana Rail Link is a freight service provider operating limited service in the Bitterroot Valley in the form of a branch line that runs in a north-south direction from Darby (located south of Florence) to Missoula. The current track condition allows a Federal Railroad Administration (FRA) Class 2 operating system, which can only accommodate speeds up to 25 mph. No signal systems are installed on this system. The track condition is considered "fair." There are continuous railroad tracks within the corridor that parallel US 93 to the east.

Air Facilities

The Missoula International Airport is located on the west end of Missoula. Several commercial airlines currently service the airport. The airport averages 158 flights daily. St. Patrick Hospital, DNRC, and the Community Medical Center operate private heliports in Missoula.

Ford's South Airport is a private facility located in Lolo.

The Stevensville Airport is a public facility located approximately ten miles south of Florence. The airport averages 31 operations daily. The Ckye Airport and Rosemont Airport are private facilities located in Stevensville.

The Ravalli County Airport is located in Hamilton, approximately 28 miles south of Florence. The airport averages 56 operations daily. The Garlick Heliport is a public facility located in Hamilton that averages 120 operations per year. The Kimp Airport, the Fox Field Airport, and the Stock Farm Heliport are private facilities located in Hamilton.

Bicycle and Pedestrian Facilities

There are no dedicated bicycle lanes within the study corridor. Shoulders throughout this portion of the corridor are greater than four feet in width and grades are less than five percent. Also of note, there are rumble strips located on the portion of US 93 between Florence and Lolo. Based on a field review, shoulders appear to range from four to ten feet in width.

There are separated bicycle and pedestrian paths within the corridor. There is a continuous path on the west side of US 93 between Florence and Lolo (MP 74± to MP 84±). There is also an intermittent path to the east of US 93 over this portion of the corridor and at least one under-crossing connecting the two paths. Based on a field review and anecdotal data, users of the paths primarily include school children, recreational users, and commuters.

There is no quantitative data available regarding bicycle or pedestrian use of the corridor. Therefore, anecdotal data from national and local sources was collected to measure usage.

The Adventure Cycling Association (ACA), a national bicycling organization, was contacted regarding their use of the corridor. ACA has two routes (the TransAmerica Trail and the Lewis and Clark Trail) that include the portion of US 93 between Florence and Missoula. ACA sold a total of 500 bicycle route maps for these two routes in 2006. ACA also conducted event rides in 2004, 2005, and 2006 that included the study corridor; a total of 417 cyclists participated in these events over the three-year period. Two other national bicycle touring companies were contacted for this study: Western Spirits and Bicycle Adventures. Neither of these companies conducts rides within the corridor.

Anecdotal data from ACA and a local bicycle shop in Missoula suggests that there is heavy bicycle and pedestrian usage of the separated bike path located between Florence and Lolo, mainly due to the perceived safety benefit of separation from vehicular traffic on US 93. Conversely, anecdotal data suggests that pedestrians rarely use the portion of the corridor between Lolo and Missoula and that bicyclists avoid this portion of the corridor due to high traffic volumes, roadway debris, and narrow shoulders over the portion of the roadway bordered by guardrails.

Transit Services and Interest Groups

Mountain Line

Mountain Line operates within a 36 square mile area serving Missoula, East Missoula, Bonner, Target Range, Rattlesnake, and Mullan Road.. The system has twelve weekday routes. Saturday service is provided on ten routes, with an additional bus serving the downtown area on Saturday mornings during Farmers Market season. Buses generally operate between 6:00 AM and 8:00 PM on weekdays and 10:00 AM and 6:00 PM on Saturdays. Routes typically run every 30 minutes during peak AM and PM hours and every 60 minutes during off-peak hours. Transit lines are located throughout the city, but are highly concentrated in the downtown area and the area east of Russell Street, south of the river. Key destinations served by the system include the University of Montana, the airport, hospitals, shopping centers, museums, and parks. Mountain Line also operates paratransit service for the handicapped.

In 2007, Mountain Line provided an average of 2,750 weekday trips and an average of 865 Saturday trips on its fixed route service, totaling over 735,000 rides for the year. Mountain Line ridership has increased 60 percent in the last 15 years. Eight paratransit buses carry an average of 2,100 passengers per month. Additionally, the Missoula Downtown Association (MDA) EZ Pass program averaged 2,882 rides per month in 2007, up from an average of 2,371 in 2006.

In 1994, Mountain Line operated a trial fixed bus service to Lolo. The service was only implemented on a trial basis, and was not continued because the decision to extend the service area of Mountain Line could not be agreed upon. Staff at Mountain Line considered the experiment a success and would be interested in providing service to Lolo again.

MR TMA

The Missoula Ravalli Transportation Management Association (MR TMA) is an organization that coordinates alternative transportation such as carpools and vanpools for Missoula and Ravalli counties. The goals of MR TMA are to reduce air pollution and congestion and to improve the environment. They provide free services to employers to establish ride-sharing programs and offer guaranteed rides home in cases of emergency. More information about the organization is provided on their web site at http://www.mrtma.org/

The vanpool program administered by MR TMA is a transportation service that picks groups of five to 15 people up at park and ride facilities throughout the US 93 corridor, delivers them to work in the morning, picks them up, and returns them to their cars at the park and ride locations at the end of the day. MR TMA operates park and ride lots in conjunction with the Montana Department of Transportation. In the Bitterroot Valley there are currently park and ride lots in Hamilton, Victor, Stevensville, Florence, south of Lolo, and Lolo. There are also two park and ride lots in Missoula. As of June 2008, 160 people from 78 different worksites used the vanpooling program, while 130 people were on a wait list. Currently, there are 14 vanpools with 11 operating along the US 93 Corridor south of Missoula. Vanpools operate from Stevensville to Missoula, Hamilton to Missoula, and Missoula to Hamilton.

The carpool program coordinated by MR TMA serves to connect commuters interested in sharing transportation to work. Commuters can access the MR TMA web site to be matched with others interested in carpooling. Carpooling groups can use existing park and ride facilities throughout the corridor as a meeting place, or may make different arrangements. The program currently has over 20 carpool destinations in Missoula and Hamilton. MR TMA also offers free presentations to students in Missoula and Ravalli County to provide education about transportation options and alternatives to driving alone.

Bitterroot Rail

Bitterroot Rail is a community interest group that promotes passenger rail transit. The goal of this group is to use the Montana Rail Link infrastructure to provide railbound public transport between Missoula and destinations south in the Bitterroot Valley. This group has solicited input from transit experts on the viability of passenger rail within the US 93 corridor.

Missoula In Motion (MIM)

Missoula In Motion is a community program designed to help local businesses, institutions, and individuals address transportation issues within the Missoula community. The program encourages alternative transportation and work options including carpooling, biking, walking, transit, vanpooling, telecommuting, and compressed work weeks in order to reduce traffic and improve air quality within the region.

Missoula Urban Transportation District (MUTD)

The Missoula Urban Transportation Board is responsible for the establishment, operation, improvement, maintenance, and administration of the Missoula Urban Transportation District. The Board is authorized by MCA § 7.14.212 and a 1993 interlocal agreement. There are currently seven board members, four of whom were appointed by the Board of County Commissioners and three appointed by the Mayor of Missoula. MUTD serves as Mountain Line's Board of Directors.

Associated Students of the University of Montana (ASUM) Office of Transportation

ASUM is a representative body of University of Montana students. The ASUM Office of Transportation is intended to increase transportation options and awareness for The University of Montana (UM) campus. The office is supported by a student initiated fee of $22.50 per semester. ASUM transportation programs include a late night shuttle service (UDASH); a free temporary bike loan program (ASUM Cruiser Co-op); a covered, secured bike parking area (The Bike Hub); no interest bike loans; and a UM-sponsored facebook application that facilitates ridesharing among UM students (GoLoco).

Utilities

There are a number of utilities within the corridor study area. Utilities found within the corridor include but are not limited to petroleum pipelines, power lines, public water supplies, and railroad infrastructure. Due to the large number of utilities within the study area, utility locations have not been mapped for this study. If utilities are impacted as a result of a future improvement project in the corridor, MDT will follow federal and state laws and regulations regarding utility relocations.

4.7 Area Projects

There are a number of recent, ongoing, and planned projects along US 93 between MP 74± and MP 91±. They are as follows:

- *2003 Signing N of Florence* is a roadway signing and striping project on Old US 93 N. of Florence from MP 0± – 1.5±. This project was completed in 2007.

- *Florence – Lolo* is a seal and cover project on US 93 between MP 74.2 – 83.2. This project was completed in 2007.

- *Lolo – Missoula* is a seal and cover project on US 93 between MP 83.2 – 90.9. This project is expected to be constructed in 2008.

- *Florence – East* is a full reconstruction project, including a bridge reconstruction, on Highway 203 between MP 11.96 (junction with US 93) to MP 9.86. This project is expected to be constructed in 2012 – 2013.