Noise

A noise analysis was not conducted for this study. Based on data collected during a windshield survey and review of aerial photographs, there are scattered residential receptors along the MT 78 corridor. Noise impacts to these receptors may require further study prior to the initiation of an improvement project in the corridor.

Regulatory and Study Requirements

Due to the number of potential impacts to water bodies, wetlands, wildlife, irrigation resources, and cultural resources, the following studies will likely be necessary before undertaking any project in the corridor:

- A Biological Resource Report (BRR) would be necessary to make recommendations regarding fish and wildlife movement in the corridor; assess potential fish and wildlife impacts from a specific project; determine the potential effect on threatened and endangered species or species of concern from any project; and to delineate wetlands. The likelihood for wetlands in the corridor is low, since only one area has hydric soils, but the number of water bodies and wet areas in the corridor indicates that a study would be necessary.
- A Cultural Resource Inventory (CRI) would be necessary to determine the eligibility and potential impacts to historic and cultural resources from any proposed project.
- An irrigation study may be necessary to gather information and assess potential impacts to numerous irrigation ditches in the corridor.

The following permits and notifications will likely be necessary in this corridor:

- A SPA 124 Notification
- A COE 404 Permit (if wetlands are identified)
- A Section 402/Montana Pollutant Discharge Elimination System (MPDES) authorization from the DEQ's Permitting & Compliance Division.

All work would need to be in accordance with the Water Quality Act of 1987 (P.L. 100-4), as amended.

Summary of Potential Environmental Impacts

Table 3-5 presents a qualitative summary of potential impacts to environmental resources within the MT 78 corridor.

Table 3-5 Summary of Potential Environmental Impacts

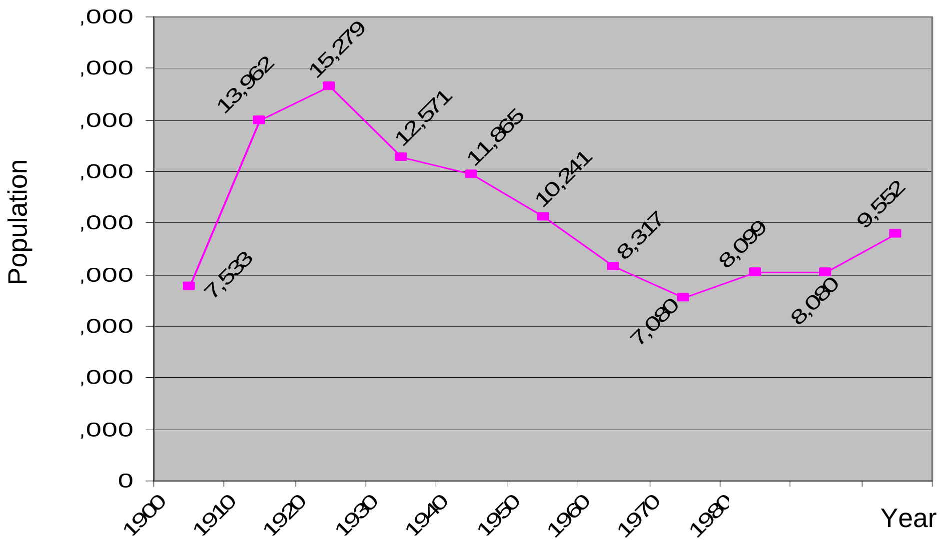
Resource	Potential Impact	Future Requirements
Land Ownership	None	None
Floodplains	None	None
Water Bodies	Potential for impacts	BRR; review stream crossings for specific project
Irrigation Systems	Potential for impacts	BRR; review irrigation ditch crossings for specific project
Wetlands	Some potential for impacts	BRR; field review for specific project
Air Quality	Little likelihood of impact	Cursory review of short-term effects for specific project
Water Quality	Little likelihood of impact	BRR; cursory review of short-term effects for specific project
Fish and Wildlife Resources	Potential for impacts	BRR; review potential impacts resulting from activities within or adjacent to West Red Lodge Creek and East Rosebud Creek for specific project
Wildlife Habitat	Little likelihood of impact	BRR; cursory review of short-term effects for specific project
Threatened and Endangered Species and Species of Concern	Potential for impacts	BRR; coordination with USFWS and MFWP for specific project
Hazardous Waste Sites	None	None
Visual Resources	None	None
Historic, Cultural, and Archaeological Resources	Potential for impacts	CRI; review for specific project
Public Parks and 6(f) Resources	None	None
Prime Farmland	Potential for impacts	Farmland Conversion Impact Rating Form
Noise	Little likelihood of impact	Cursory review of potential noise receptors for specific project

3.2 Community Demographics

Population

According to the U.S. Census Bureau, the population of Carbon County has fluctuated over the past hundred years from a high of over 15,000 in 1920 to a low of 7,080 in 1970 as shown in Figure 3.6. The county began growing again after 1970 to reach 8,080 residents in 1990. Between 1990 and 2000, the county gained nearly 1,500 residents to reach a population of 9,552, an increase of over 18 percent over the previous decade. The City of Red Lodge grew more slowly during this decade, from a population of 1,958 in 1990 to 2,177 in 2000, an increase of just over 11 percent.

Figure 3.6 Carbon County Population, 1900 – 2000



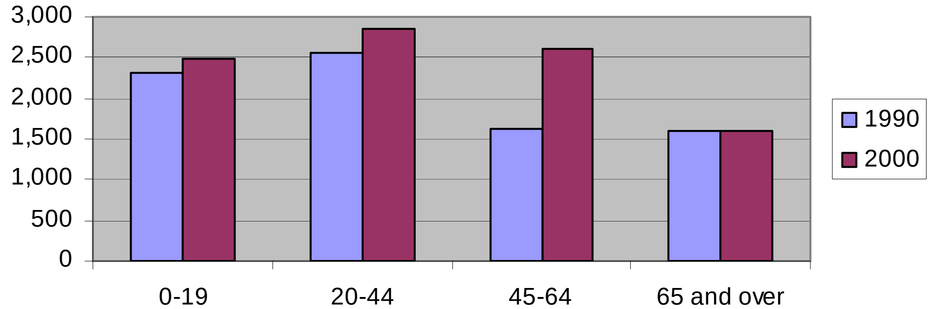
Source: US Census Bureau

More recent population estimates suggest that Carbon County had grown to 9,721 residents in 2002 and 9,770 in 2003, a yearly increase of 0.5 percent. Over the same period, Red Lodge grew from 2,252 residents in 2002 to 2,273 in 2003, a yearly gain of nearly one percent. No Census data are available for Roscoe.

Demographic Composition

As shown in Figure 3.6, the percentage of Carbon County residents in various age groups remained relatively constant between 1990 and 2000, with the exception of the 45 to 64 group.

Figure 3.7 Carbon County Population by Age, 1990 – 2000

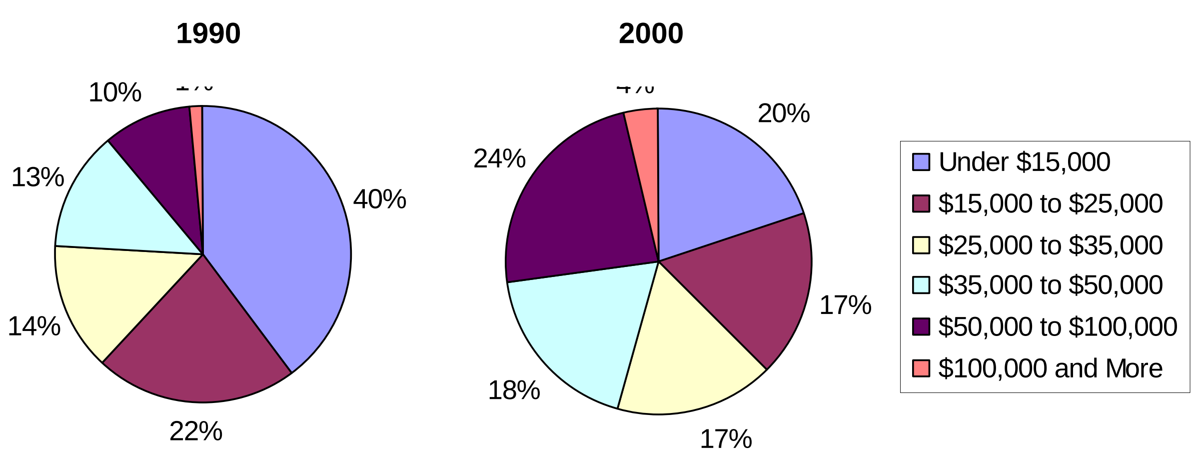


The majority of residents in Carbon County are categorized as “white” by the US Census Bureau. In 1990, over 99 percent of the county was categorized as “white” and the minority population was less than one percent. By 2000, the minority population grew to nearly three percent. Within the study area, Census data are only available at the county level. Therefore it is not possible to identify any existing minority populations located along the corridor.

Household Income

Between 1990 and 2000, Carbon County’s median household income increased from $19,042 in 1990 to $32,139 in 2000. As shown in Figure 3.7, nearly 40 percent of the households in Carbon County had incomes less than $15,000 in 1990, and by 2000 this group had shrunk to just under 20 percent of the households. Within the study area, Census data are only available at the county level. Therefore it is not possible to identify any existing low income populations located along the corridor.

Figure 3.8 Carbon County Household Income, 1990 – 2000

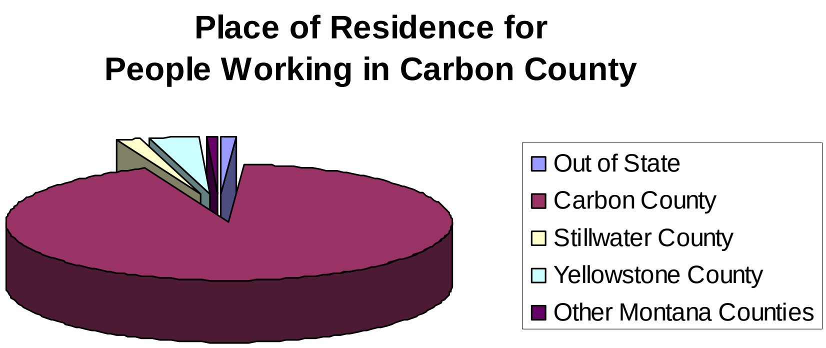


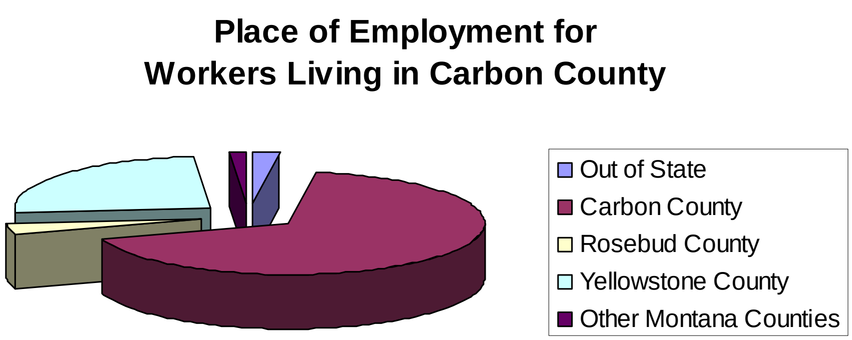
Commute

As shown in Figure 3.8, Carbon County does not experience a large influx of commuting workers. Of all workers in Carbon County in 2000, 93 percent lived in Carbon County, over three percent lived in Yellowstone County, nearly two percent lived in Stillwater County, and one percent lived out of state. The remaining workers lived in other Montana counties.

A substantial number of Carbon County residents work in other counties. Of those workers who live in Carbon County, almost 68 percent work in Carbon County, 25 percent work in Yellowstone County, nearly four percent work in Rosebud County, and just over two percent work out of state. The remaining Carbon County residents work in other Montana counties.

Figure 3.9 Place of Residence and Employment





3.3 Other Studies, Plans, and Regulations

This section summarizes relevant points from a number of local planning and regulatory documents.

Carbon County Growth Policy

The Carbon County Growth Policy sets forth a series of goals, objectives, and implementation measures that were developed by the Carbon County Planning Board in cooperation with the public under the Montana requirements for growth policies as set forth in Montana Code, Section 76-1-601.

The following three goals from the Growth Policy are pertinent to this study.

1. "Encourage land uses that are appropriate on the lands for which they are proposed." The County also seeks to retain lands in agricultural production. The Growth Policy stipulates that the County will request MDT to provide "information on how improvement options under consideration for state highway projects will affect existing residences and agricultural land." Carbon County officials will be kept apprised of plans relating to specific projects. The improvement options presented in Chapter 6 generally follow the existing alignment and thus do not discourage lands to stay in agricultural production.

2. "Ensure that proposed land uses consider and disclose known and/or potential impacts to ground and surface water quality and availability." Any project undertaken by MDT that would require NEPA compliance would also require consideration of water quality. As a pre-NEPA study, this document lists water resources in the corridor.

3. "Work cooperatively for the benefit of County residents with unincorporated communities, local governments in the County, and state and federal government agencies planning activities in the County that would affect Carbon County residents." The Growth Policy further stipulates that the County will "meet annually with MDOT [sic]… to discuss road projects, coordinate schedules, and look for efficiencies through working cooperatively." Any proposed projects will be undertaken in cooperation with County officials.

Carbon County Subdivision Regulations

The Carbon County Development Code provides comprehensive rules for the subdivision of land within Carbon County.

Chapter V, "Design and Improvement Standards," relates to this corridor study. A section on roads and streets provides guidelines for general design, improvements, improvements completion and certification, and a table of road design standards. The regulations explicitly state that "any vehicular access onto a state highway shall be approved by the MDOT [sic]."

Route Segment Plan

MDT maintains a Route Segment Plan, which aids in determining desired roadway widths. The desired width is based on a number of factors, including traffic projections and functional classification of the route. Based on the Route Segment Plan, MT 78 should be widened to a minimum of 28 feet under any reconstruction scenario. This would provide for two 12-foot travel lane widths and a minimum of two-foot shoulder widths.

Access Management Study

MDT completed an Access Management Study for MT 78 in 2004. This study reviewed all accesses along the highway. It recommended adoption of an access management plan, which would manage and administer accesses along the highway. Access management seeks to:

- Limit the number of conflict points;
- Separate basic conflict areas;
- Reduce interference with through traffic;
- Maintain progressive mainline speeds; and
- Practice controlled land development.

The recommendations in the Access Management Study for MP 5.0± to MP 20.0± are included in Appendix F. The majority of the accesses identified in the study corridor are farm field accesses; i.e., dirt roads used to access lands in agricultural use. The Study generally recommends realigning and combining these accesses. The Study and its recommendations were accepted for use in future planning efforts in Carbon and Stillwater counties.

Absarokee to Columbus Environmental Impact Statement

An Environmental Impact Statement (EIS) was prepared for the portion of MT 78 to the north of the study area between Absarokee and Columbus. The Preferred Alternative, approved in a Record of Decision (ROD) in 2002, included a 32-foot typical section and is currently being constructed. The portion of MT 78 between Absarokee and Columbus has higher traffic volumes than the portion of MT 78 between Roscoe and Red Lodge, necessitating the 32-foot width.

4.0 EXISTING TRANSPORTATION SYSTEM

The majority of location references throughout this document refer to and approximate the location of on-the-ground mile post markers within the corridor. The horizontal and vertical curve data included in Chapters 4 and 6 draw from as-built stationing, which has been converted to English mile post references for ease of comparison.

4.1 Highway Characteristics

The geometric, operational, and crash information contained in Sections 4.1 and 4.2 is presented in graphic form in Figure 4.2, located at the end of Section 4.2.

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 MT 78 corridor traverses mountainous terrain within the study area, and includes several areas with steep grades, which cause trucks to slow down to speeds below those of passenger cars. Based on public input, the area south of Roscoe is an example of a location where passenger vehicle travel is impeded by large trucks slowly climbing the steep grade.

Vertical Alignment

Vertical alignment is a measure of grade 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 vertical grades on rural arterials according to the type of terrain in the area. The maximum grade recommended for mountainous terrain is seven percent. There are currently several segments within the study area where the vertical grade exceeds the recommended grade for the local terrain, as shown in Table 4-1.

Table 4-1 Vertical Curves Exceeding Maximum Vertical Grade of Seven Percent

Mile Post	Existing Vertical Northbound
5.0	-
5.6	-10.81
5.7	-8.38
5.8	-10.62
5.9	-
6.3	-9.92
6.4	-
6.8	-8.55
7.0	-
8.0	7.27
8.2	-
8.4	-8.19
8.5	-10.71
8.6	-
9.1	-8.55
9.2	-
9.5	-8.33
9.6	-
10.7	-9.51
10.8	-
11.1	8.44
11.2	-
15.7	-8.5
16.0	-
18.2	7.83
18.6	-
19.0	-9.00
19.7	-

Figure 4.2 illustrates the northbound vertical curves within the corridor. A Good rating was provided for each segment of the corridor where vertical grades were less than four percent (the MDT standard for rolling terrain). Segments with grades ranging from four percent to seven

percent were considered Fair, and segments with grades above seven percent were classified as Poor. The analysis segment length was determined by the length of the curve and is centered on the point of intersection. Vertical curves with grades above seven percent make up approximately 13 percent of the length of the corridor. Vertical curves with grades between four and seven percent make up approximately 14 percent of the corridor length.

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 recommended degree of curvature on a highway is directly related to design speed. For a design speed of 60 miles per hour (mph), the MDT Road Design Manual recommends a minimum curve radius of 1,200 feet (ft). Nine horizontal curves do not meet the recommended minimum curve radius, as shown in Table 4-2. Horizontal curves that do not meet the recommended minimum curve radius make up approximately ten percent of the length of the corridor.

Table 4-2 Horizontal Curves Sharper Than Minimum Radius of 1,200 Feet

Mile Post	Existing Curve Radius (ft)
5.0	1,146
5.6	573
7.6	1,146
9.4	819
11.8	955
16.5	716
16.8	716
19.7	955
19.9	955

Figure 4.2 illustrates the horizontal curves within the corridor. A Good rating was provided for each segment of the corridor where the curve radius exceeded 1,200 ft. Segments with a radius less than 1,200 ft are considered Poor. The analysis segment length was determined by the length of the curve and is centered on the point of intersection.

Stopping Sight Distance (SSD)

Stopping Sight Distance 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. SSD in

Figure 4.2 is measured in terms of a variable, K. K is a measure of the rate of grade change on a hill or in a gully; i.e., a measure of curve length over grade. According to MDT standards for a 60 mph facility, the minimum K value for the crest of a hill is 151 and 136 for a gully between hills, also known as a sag curve. The K value for the crest of a hill is higher because visibility is more limited at the top of a hill than it is at a dip between hills.

Of the 81 vertical curves within the project limits, 59 fail to meet the respective minimum K values for crest hills and sag curves, as shown in Tables 4-3 and 4-4.

Table 4-3 Crest Hills Failing to Meet Minimum K Value of 151

Beginning Mile Post	K Value
5.0	54.6
5.2	54.4
5.4	133.3
5.6	86.3
6.3	70.6
6.8	47.4
7.3	63.9
7.6	81.7
7.8	69.9
7.9	66.7
8.2	134.5
8.4	68.2
9.1	56.9
9.3	103.8
9.5	129.9
9.9	87.5
10.2	110.9
10.4	96.4
10.7	52.6
10.9	56.3
11.2	81.8
13.6	88.9
13.9	125.2
15.7	120.5
16.1	140.4
16.9	114.6
18.1	120.5
18.6	106.4
19.0	116.4

Table 4-4 Sag Curves Failing to Meet Minimum K Value of 136

Beginning Mile Post	K Value
5.1	32.3
5.7	82.3
5.9	44.1
6.2	99.6
6.4	57.8
6.5	113.6
7.0	51.8
7.4	80.2
7.7	39.9
8.0	40.7
8.6	56.0
9.0	69.9
9.2	37.7
9.6	42.4
9.8	89.6
10.0	77.3
10.3	102.8
10.6	38.2
10.8	32.9
11.1	49.6
11.8	65.5
13.4	113.6
14.1	97.8
16.0	82.2
16.5	74.1
17.2	111.3
17.5	115.2
17.8	106.4
18.2	106.2
19.7	128.3

Figure 4.2 illustrates stopping sight distance within the corridor. SSD was calculated using a model and correlates to the stationing and profile provided on the as-built plans. A Good rating was provided for each segment of the corridor where K values for crest and sag curves were greater than 151 and 136, respectively. A Poor rating was assigned to segments having K values less than the respective minimum values for crests and sags. Analysis segments begin at the point identified for the hill or sag and extend until the point identified for the following hill or sag.

Passing Opportunities

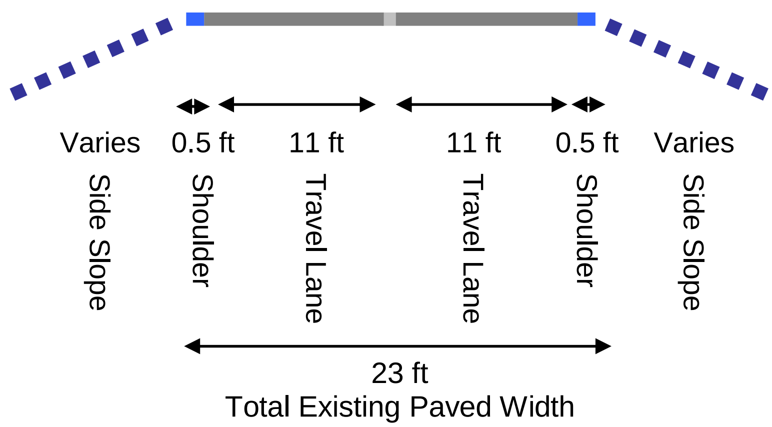
Passing Sight Distance (PSD) is a measure of motorists' ability to see oncoming vehicles and safely complete the passing maneuver of slower vehicles. According to the MDT Road Design Manual, a minimum PSD for a 60 mile-per-hour facility is 2,135 feet, or a little more than one-third of a mile. Passing zones are normally established based on field measurements of available sight distance, thus marked passing zones are a good indication of the adequacy of 60 mile-per-hour passing zones. A windshield survey of marked passing and no-passing zones was conducted to collect both northbound and southbound PSD data. PSD data correlate to the Mile Posts located along the existing roadway. These data are presented in Figure 4.2 and provide only an illustration of the northbound PSD due to the very similar nature in both directions.

A Good rating was provided for each segment of the corridor with a broken center line, and a Poor rating was assigned to segments marked with a solid center line. Approximately 27 percent of the corridor includes passing zones, thus 73 percent of the corridor is rated as Poor for passing opportunities.

Roadway Width and Widening Feasibility

Lane widths throughout the corridor are relatively narrow, averaging 11 feet wide. Shoulders throughout the entire corridor range from zero to one foot in width, averaging approximately six inches in width. A cross section of the existing roadway conditions, also known as a typical section, is shown in Figure 4.1. The existing side slopes vary in width and degree and are therefore depicted as discontinuous lines in Figure 4.1.

Figure 4.1 Existing Roadway Width



Widening through the southern half of the corridor would require a substantial amount of cut and fill due to steep side slopes, which would increase the cost of widening in this portion. In the northern half of the corridor, the side slopes are not as steep. This portion would require less earthwork, and would therefore be less expensive for a comparable length of roadway. New right-of-way would be required at several locations throughout the corridor.

Bridges

There are two bridges in the corridor: one at MP 12.9± over Red Lodge Creek and one at MP 19.8± over East Rosebud Creek. 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 time will be assessed by MDT.

4.2 Traffic Conditions

Average Daily Traffic Volumes

The weighted annual average daily traffic (AADT) is a total of all motorized vehicles traveling both directions on a highway on an average day. AADT for the MT 78 segment from MP 5.0 to MP 19.0 during the period January 1, 1995 to December 31, 2005 was 742 vehicles per day. AADT for the MT 78 segment from MP 4.0 to MP 20.0 during the period January 1, 2005 to December 31, 2005 was 994 vehicles per day.

Crashes

Crash rates in the corridor were compared to the average crash rate for similar facilities throughout the state of Montana. The data were collected by MDT for the period of January 1, 1995 through December 31, 2004. The average crash rate for all state primary roads for the period 1995 through 2004 is 1.502 crashes per million vehicle miles. Based on AADT for this portion of MT 78, the average statewide crash rate would be expected to equal 2.72 crashes per half-mile segment for the period 1995 to 2004. Appendix D provides a more detailed analysis of crash rates.

Segments of the roadway with a higher number of crashes than the expected statewide average are identified as crash concentrations in Table 4-5 and Figure 4.2. As depicted in the figure, crash concentrations generally coincide with areas exhibiting poor roadway geometry. Within these segments, there are three or more crashes per half-mile.

Table 4-5 Roadway Segments with Three or More Crashes per Half Mile

Segment (from MP to MP)	Total Crashes in Study Period
4.9-5.1	4
5.1-5.6	16
5.6-6.1	10
6.1-6.6	8
6.6-7.0	10
7.0-7.5	4
7.4-7.8	5
7.6-8.1	3
7.8-8.3	4
8.3-8.7	3
8.7-9.2	4
9.2-9.5	3
12.1-12.4	3
12.4-12.9	5
13.4-13.9	4
16.3-16.6	5
17.5-17.8	3
18.6-18.9	3
18.9-19.1	3
19.1-19.5	3
19.5-19.9	4
19.9-20.0	4