Appendix B: Existing and Future Conditions Report

Winifred to Big Sandy Corridor Study

Existing and Future Conditions Report

Prepared for

Chouteau County

Fergus County

Prepared by

DKS Associates
TRANSPORTATION SOLUTIONS

November 2010

Winifred to Big Sandy Corridor Plan

Existing and Future Conditions Report

November 2010

Prepared By:

***DKS** Associates, Inc.*

Contents

List of Figures

List of Tables

This report presents analysis of the existing and future conditions along the Secondary 236 corridor between Winifred and Big Sandy (Figure 1). The analysis includes an examination of both existing and future transportation conditions as well as existing environmental conditions.

1.0 Existing Conditions

1.1 Existing Transportation Conditions

Roadways

Within the study area (Figure 2), Secondary 236 is a two-lane roadway with no passing lanes or turn lanes. Along the narrower gravel segments of the roadway, however, the center of the roadway is used as a portion of the traveled area for both directions of traffic. This is because in these locations, drivers tend to “shy away” from the edge of the roadway where the gravel accumulates to greater depths and there are roadside obstructions and steep drop-offs.

Also in the gravel section, there are no shoulder areas, since the roadway consists of a continuous gravel surface. Within the paved section, there are no shoulders.

In the portion of the corridor between the Missouri River and Big Sandy, the curvature of the roadway is minimal, with generally large-radius horizontal curves and gradual vertical curves. In the southern end of the corridor, there are a number of steep vertical curves and sharp horizontal curves. The curvature of the roadway results in limited passing sight distance and/or stopping sight distance at many locations. MDT’s passing sight distance standard is not met along roughly 60% of the corridor.

The PN Bridge that crosses the Missouri River at reference post (R.P.) 48 is the only major structure. Culverts are also located at various points along the corridor.

In the paved segment of the corridor to the south of Big Sandy, the speed limit is signed as 70 mph for passenger vehicles and 60 mph for trucks. In the gravel segment of the corridor to the north of Winifred the speed limit is signed as 45 mph, with several of the sharp curves in this area having 25 mph warning signs.

Figure 1
Study Corridor Location

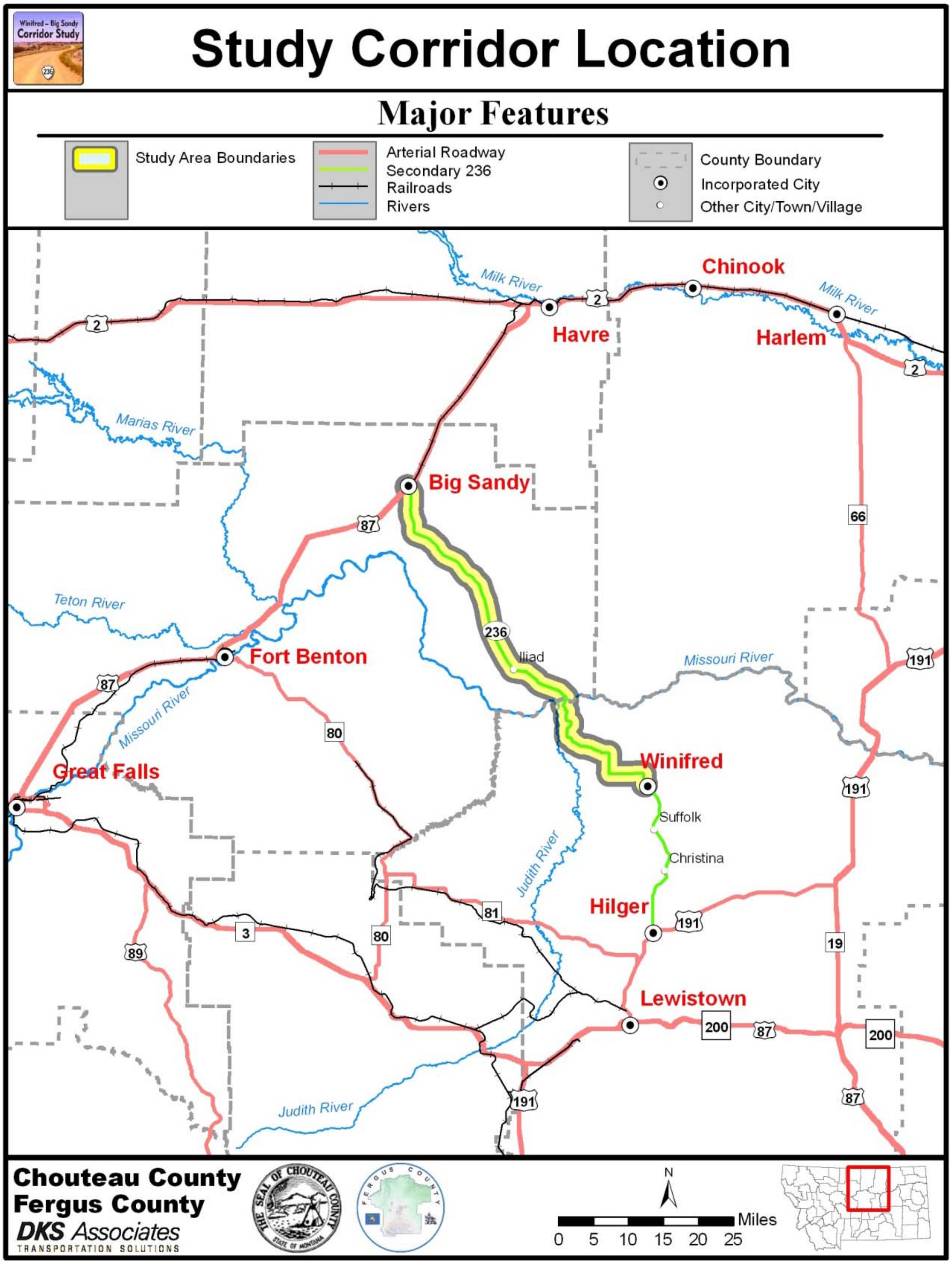
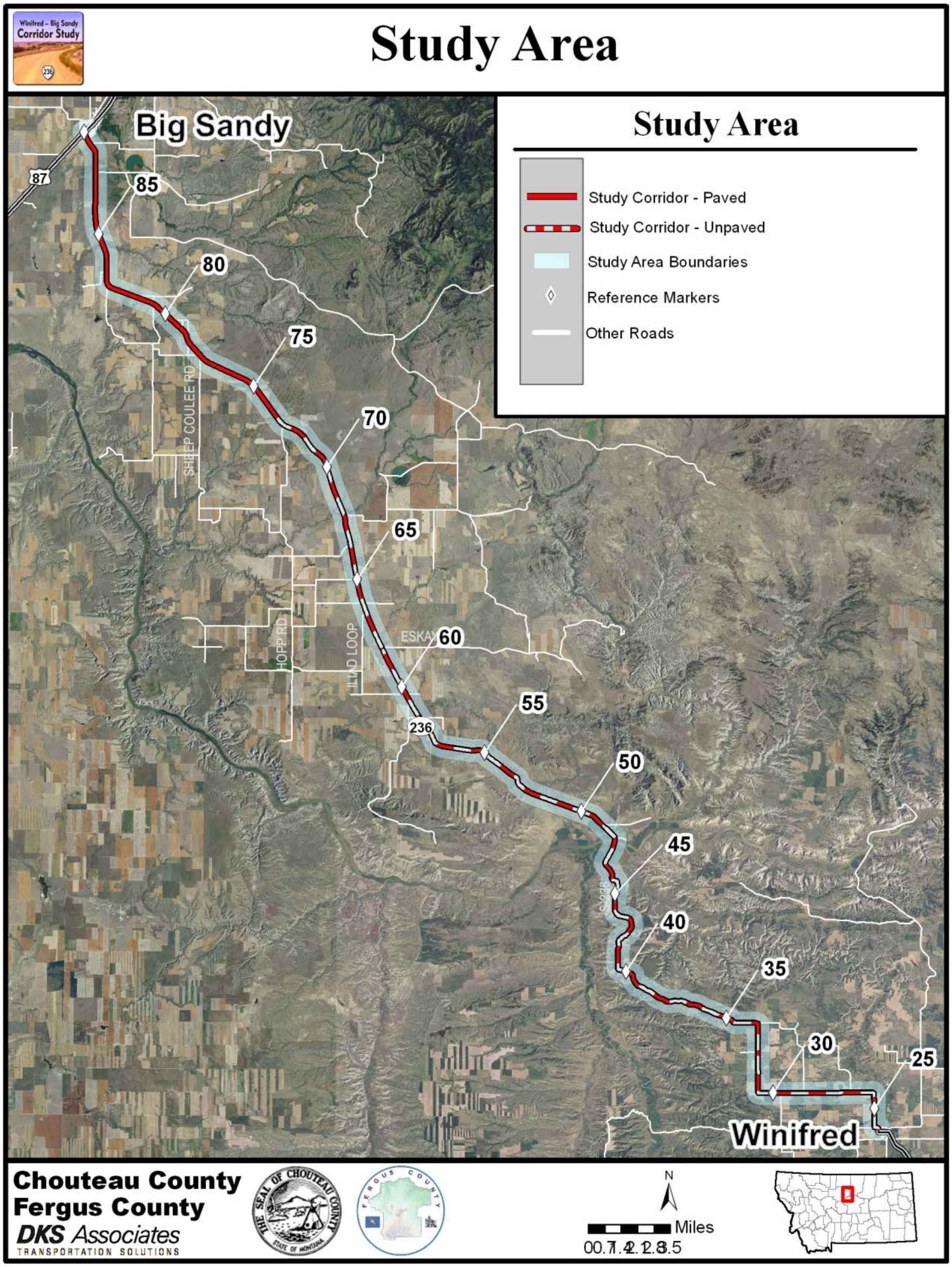


Figure 2
Study Area



There are 30 county road intersections along the corridor. All of these are two-lane gravel roads, with stop sign control on the county road approaches. The primary function of these roads is to provide access to local residences and carry agricultural-related goods to/from the farm fields and ranches surrounding the corridor.

Secondary 236 is classified as a major collector on Montana's secondary highway system (Figure 3). The major collector classification applies to roads in rural areas with the following characteristics:

- Service to travel of primarily intra-county importance.
- Serves important travel generators (i.e., county seats, consolidated schools, mining or logging areas).[1]

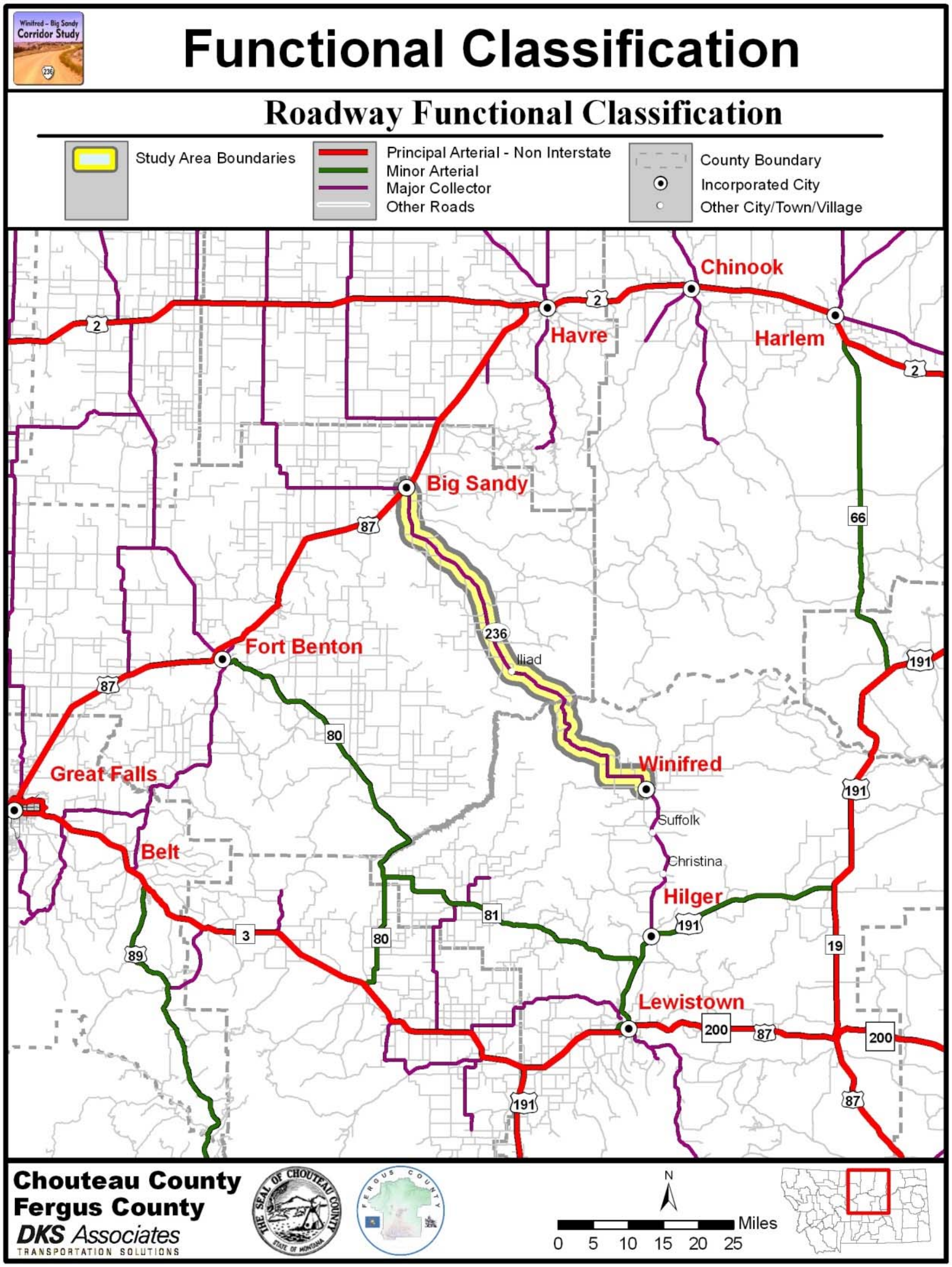
MDT's *Traffic Engineering Manual* further defines collector routes as "characterized by a fairly even distribution of their access and mobility functions. Traffic volumes will typically be somewhat lower than those of arterials. In rural areas, collectors serve intra-regional needs and provide connections to the arterial system. All cities and towns within a region will be connected".[2]

This function is reflected in the types of traffic that are carried along Secondary 236 within the study area. The primary trip types served are:

- Trips by local residents
- Truck trips related to the agricultural industry in the area
- Recreational trips by visitors to the Upper Missouri River Breaks National Monument

[1] Montana Department of Transportation, *A Guide to Functional Classification, Highway Systems, and Other Route Designations in Montana*, Helena, MT, January 2008.
[2] Montana Department of Transportation, *Traffic Engineering Manual*, Helena, MT, November 2007.

Figure 3
Functional Classification



The recreational component of travel has been growing over the past 20 years. Tourists use Secondary 236 to access the Missouri River at the Judith Landing recreation area, which is a popular take-out point for float trips along the river. Although there is the potential for a fairly large percentage of through trips on Secondary 236, the existing percentage of these trips is likely low because of the gravel surface.

Traffic Volumes

Existing annual average daily traffic (AADT) volumes are low (Figure 4), ranging from 200 – 300 vehicles per day (vpd) to the north of Winifred and to the south of Big Sandy to less than 200 vpd between Heggem Ln. (R.P. 34) and Eskay Rd. (R.P. 62). AADT is defined as the annual total two-way traffic volume along a particular segment, divided by the number of days in the year. The AADT volumes were derived from traffic volume data received from MDT's Traffic Data Collection Section. Although monthly traffic data was not available, it is likely that volumes are somewhat higher in the summer months due to increased agricultural traffic and recreational traffic destined for the Missouri River.

Safety Conditions

Existing safety conditions were analyzed using crash data obtained from MDT's Traffic and Safety Bureau. For the period 2004 – 2008, there were a total of 15 reported crashes. Summaries of the crashes by crash severity, crash type, and cause-of-crash are provided (Figure 5). Half the crashes involved an injury, with one fatality. All but one of the crashes was a single vehicle crash, with most of the vehicles leaving the road and overturning. Roughly half of the crashes were attributed to drivers going too fast for road conditions.

An overall crash rate for the corridor was calculated as well as crash rates for individual segments to provide a more comprehensive assessment of safety conditions along the corridor (Figure 6 and Table 1). The crash rate was calculated as the number of crashes per million vehicle miles traveled (MVMT). The overall crash rate for the corridor of 0.8 crashes per MVMT is below the statewide average of 1.53 crashes per MVMT for rural state secondary roads.

Figure 4
2008 AADT

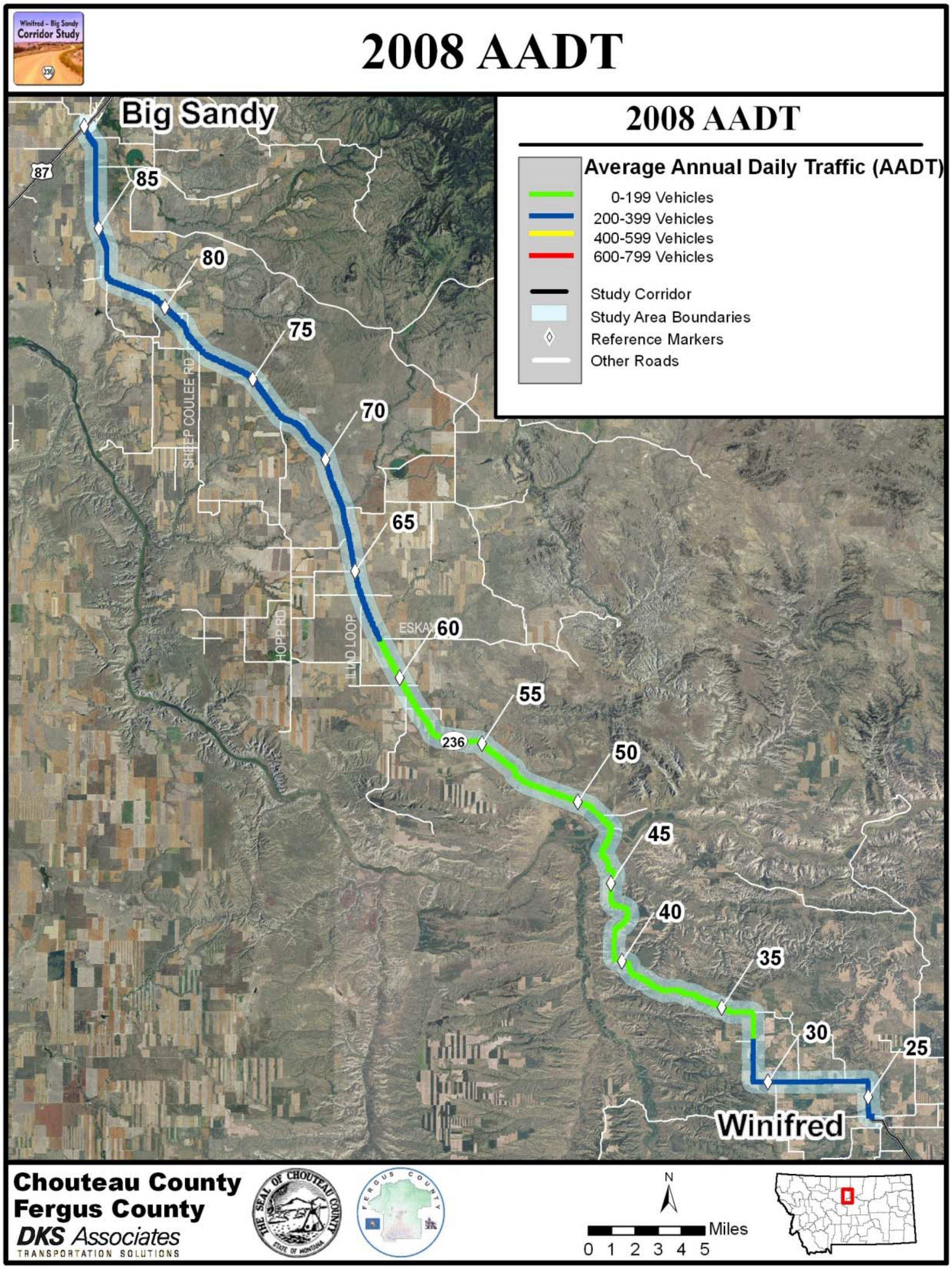


Figure 5
Crashes by Severity, Type, and Cause

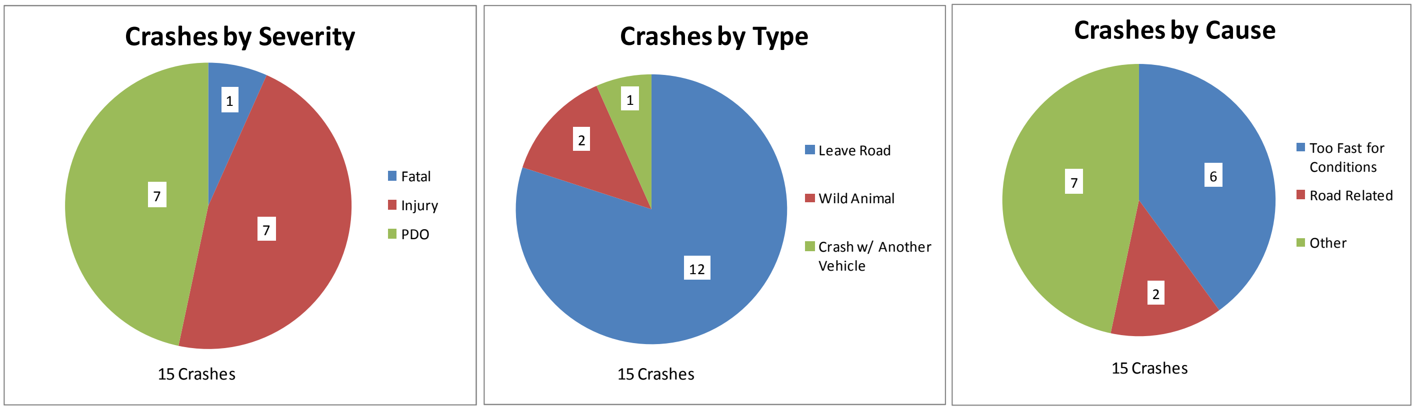


Table 1
Crash Rate Summary

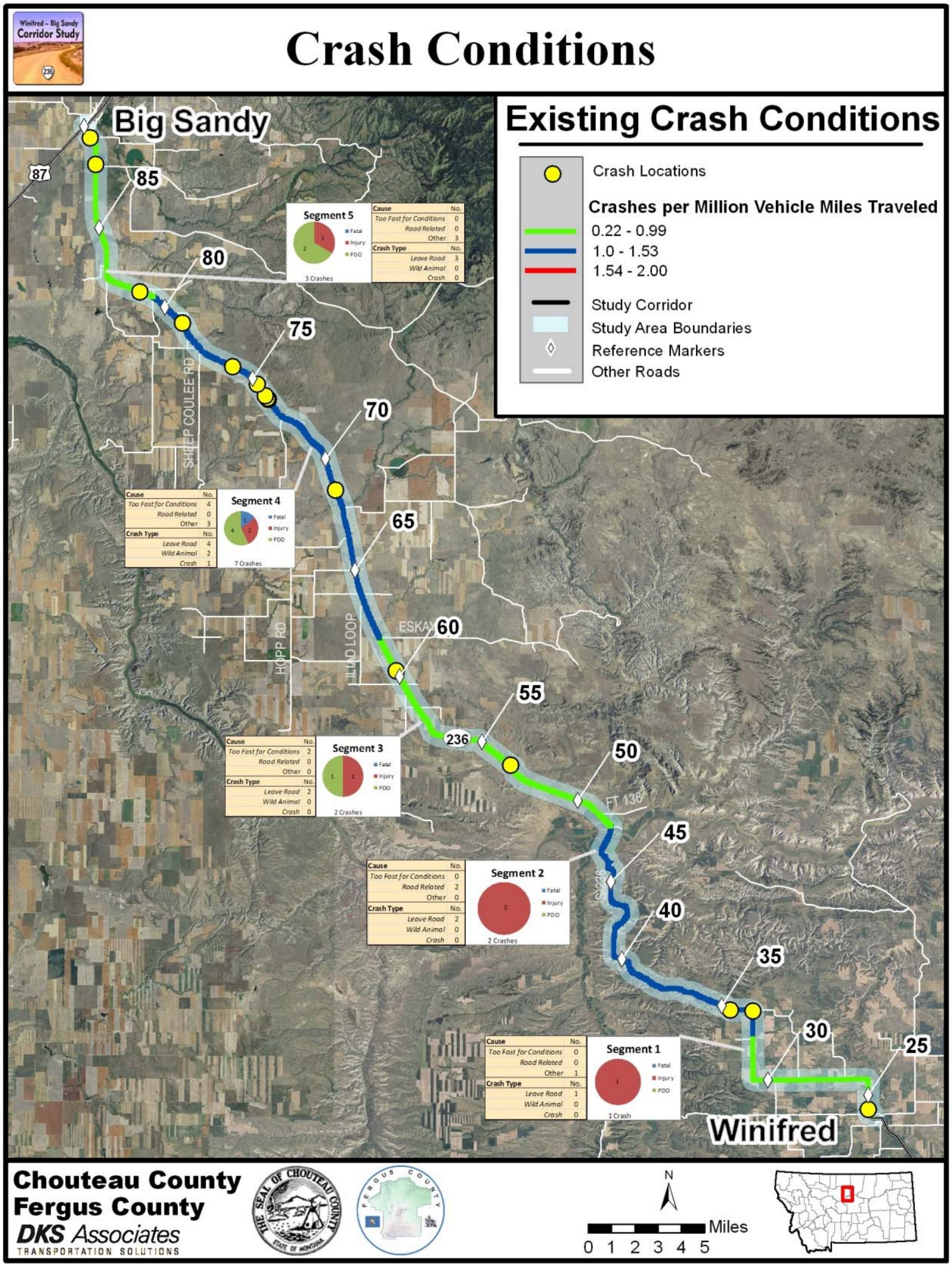
Segment			No. of Crashes	Crash Rate	Statewide Avg.	Above Avg.?
No.	From R.P.	To R.P.				
1	24.0	32.4	1	0.22	1.53	N
2	32.4	48.1	2	1.0	1.53	N
3	48.1	61.9	2	0.66	1.53	N
4	61.9	80.6	7	1.03	1.53	N
5	80.6	89.9	3	0.74	1.53	N

Crashes are distributed fairly evenly along the corridor (Figure 6), with a slight concentration near R.P. 75.

It should be noted that the crash data includes reported crashes only. County officials and members of the public have pointed out that there are more crashes than the total number reflected in the crash data. Part of the reason that a percentage of the crashes are unreported may be that most of the corridor is relatively remote.

Other comments received from the Counties and members of the public related to safety were that vehicle-generated dust causes reduced visibility and the numerous geometric problems contribute to unsafe conditions, such as tight corners (90-degree curves) and sight distance

Figure 6
Crash Conditions



restrictions (hills and corners along the roadway and roadside obstructions). It was also stressed that the road becomes difficult and dangerous to drive in wet or snowy conditions. Because of these problems, the local population is more adept at driving the road than tourists/non-locals. Representatives from the school districts mentioned that they try to avoid the road when traveling to events out of the area due to concerns about safety.

Geometric Conditions

The current characteristics of roadway segments along Secondary 236 were compared to MDT standards with regard to roadway width, stopping sight distance, passing sight distance, horizontal curve radius, vertical curvature, and maximum grade.

Roadway Width

The roadway width standards for rural collector roads vary by traffic volume (Table 2). The roadway width includes both travel lanes and shoulders. Within the gravel portion of the corridor, the roadway cross section is a continuous surface, with no delineation between travel lanes and shoulders. Within the paved portion, travel lanes are delineated, but there are no shoulders.

Table 2
MDT Roadway Width Standards[3]
Rural Collector Roads (Secondary System)

AADT	Roadway Width*
0 - 299	24’
300 – 999	28’
1,000 – 1,999	32’
2,000 – 3,000	36’
> 3,000	40’

*Travel lanes and shoulders

[3] Montana Department of Transportation, *Road Design Manual*, Helena, MT, August 2008.

For purposes of the roadway width analysis, segments were selected where changes in the width occur. MDT provided the roadway width data, which is a part of the road log data from MDT's Transportation Information System (TIS). The data was field-verified by measuring roadway widths at approximately one-half mile intervals.

The applicable roadway width standard is 24-feet because the existing AADT is less than 300 vpd along the entire corridor. This standard is met at nearly all locations (Figure 7). The only locations not meeting the standard are very short segments near R.P. 31, R.P. 35, and R.P. 50, where the roadway narrows to cross culverts.

In the middle portion of the corridor between R.P. 62 and R.P. 74, the roadway widths increase to greater than 28-feet. Within most of this section, widths range from 38 to 44-feet, with one location having a width of 50-feet.

It is interesting to note that because gravel does not form a fixed roadway surface, the width of the roadway varies over time as the gravel is redistributed by passing vehicles and road maintenance crews apply differing amounts of gravel from one maintenance cycle to the next.

On gravel surfaces, drivers tend to follow the wheel path of other vehicles, resulting in rutting. In most of the wider sections of the roadway, there are four ruts, two in each direction. In the narrower parts of the corridor, however, there are sometimes only three ruts, with the inside rut shared by drivers.

Within the paved section on the north end of the corridor between R.P. 74 and R.P. 90, the roadway width is consistently 24-feet. This comprises two 12-foot travel lanes, with no shoulders.

Roadway Alignment

MDT's standards for stopping sight distance, passing sight distance, horizontal curve radius, vertical curvature, and maximum grade are based on the design speed of the roadway (Table 3). These standards apply to both paved and gravel rural collector roads.

Figure 7
Roadway Width

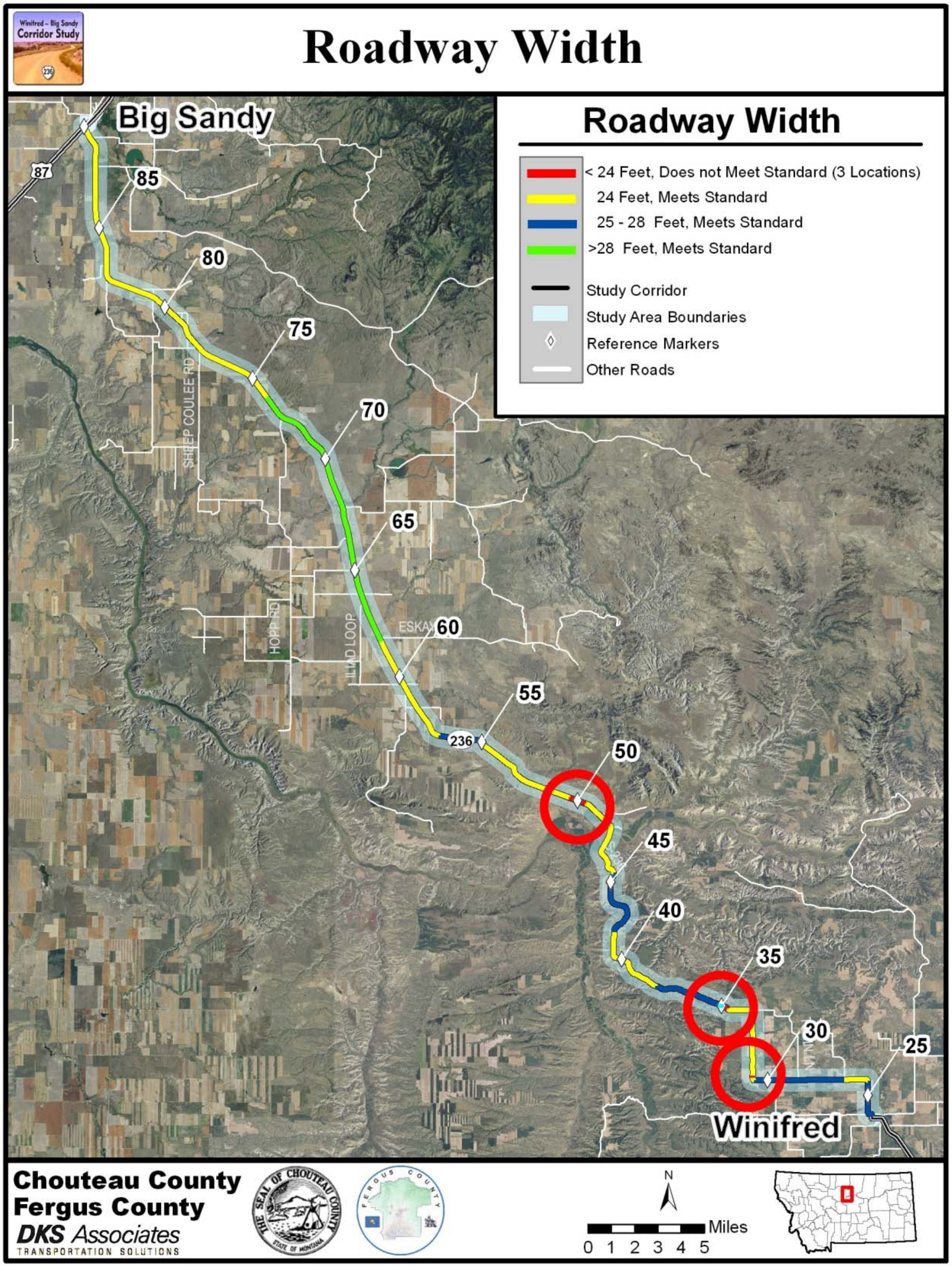


Table 3
MDT Roadway Alignment Standards[4]
Rural Collector Roads (Secondary System)

Geometric Element	Design Speed		
	45 mph	50 mph	60 mph
Stopping Sight Distance	360’	425’	570’
Passing Sight Distance	1,625’	1,835’	2,135’
Horizontal Curve Radius	590’	760’	1,200’
Vertical Curvature (K-value)			
Crest	61’	84’	151’
Sag	79’	96’	136’
Maximum Grade			
Level	5%		
Rolling	7%		
Mountainous	10%		

The design speed of the roadway, in turn, is based on the surrounding terrain type (level, rolling, or mountainous). MDT’s *Road Design Manual* contains the following definitions for each terrain type:

- Level Terrain: The available stopping sight distances are generally long or can be made to be so without construction difficulty or major expense.
- Rolling Terrain: The natural slopes consistently fall below and rise above the roadway and occasional steep slopes offer some restriction to horizontal and vertical alignment.
- Mountainous Terrain: Longitudinal and traverse changes in the elevation are abrupt and extensive grading is frequently needed to obtain acceptable alignments.

For rural collector roads, MDT’s design speed standards are 60-mph for level terrain, 50-mph for rolling terrain, and 45-mph for mountainous terrain.

[4] Montana Department of Transportation, *Road Design Manual*, Helena, MT, August 2008.

For the majority of the Secondary 236 corridor, the terrain is relatively level. The exceptions to this are on the south end of the corridor between R.P. 30.5 and R.P. 47 and R.P. 52 and R.P. 57, where the terrain is rolling (Figure 8). The terrain type determines the design speeds along Secondary 236 (Table 4).

Table 4
Design Speeds

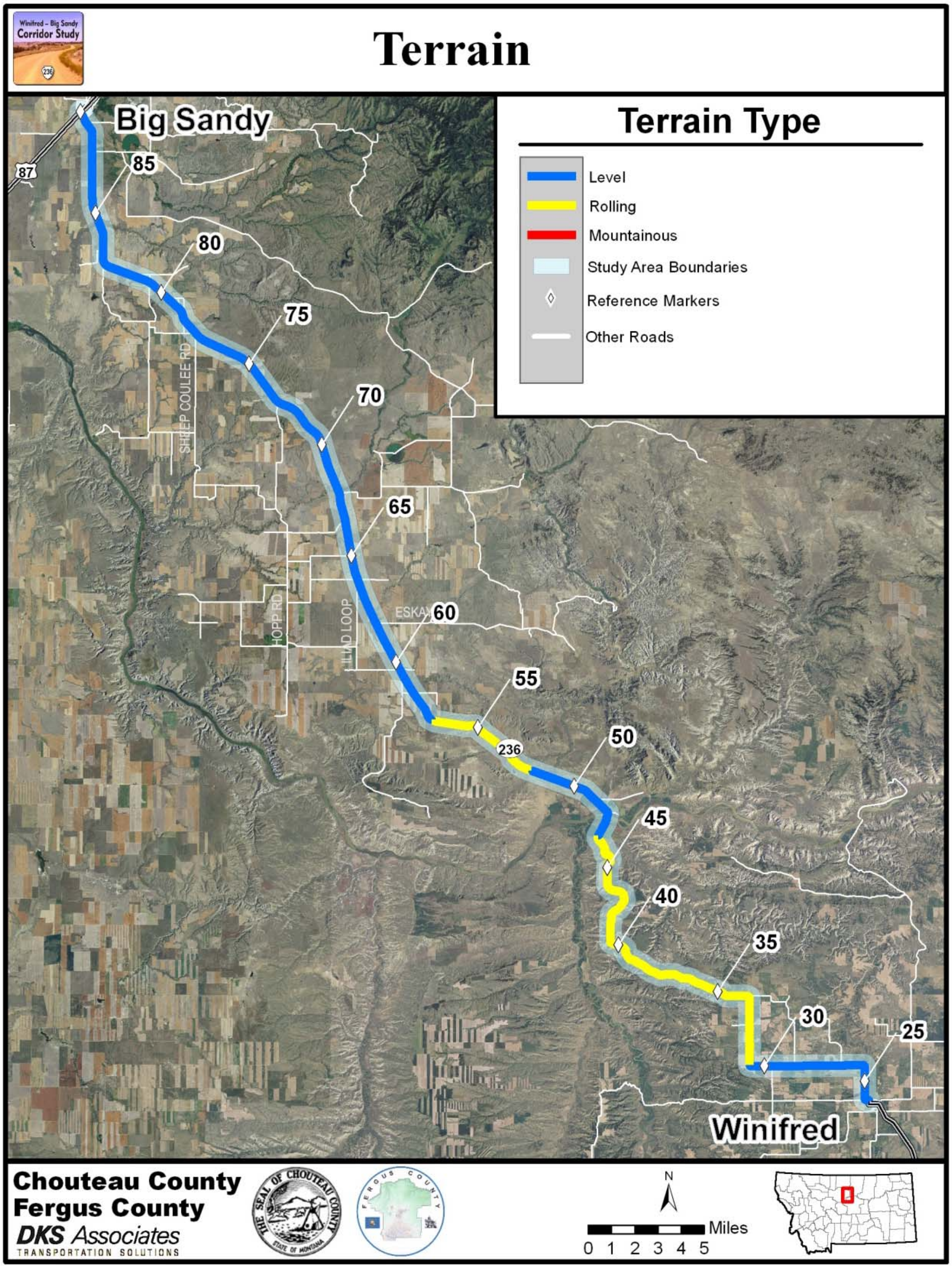
From R.P.	To R.P.	Terrain Type	Design Speed
24	30.5	Level	60-mph
30.5	47	Rolling	50-mph
47	52	Level	60-mph
52	57	Rolling	50-mph
57	90	Level	60-mph

Stopping Sight Distance

Stopping sight distance is the distance required for a driver to detect an object in the road, react, and bring the vehicle to a safe stop. The determining factors for stopping sight distance include vehicle speed, height of the object, roadway surface type and surface conditions, driver characteristics, driver eye height, and vehicle condition. For a 60-mph design speed, the stopping sight distance requirement is 570 feet; this decreases to 425 feet for a 50-mph design speed.

The available stopping sight distance along a roadway can be affected by the vertical curvature, horizontal curvature, and roadside obstructions. Vertical curvature refers to the hilliness of the roadway. There are two types of vertical curves: crest curves, which form the top of a hill, and sag curves, which are located at the bottom of a hill. If the degree of curvature is too steep for either a crest or sag vertical curve, the driver will not be able to see far enough ahead to come to a complete and safe stop. Vertical curvature is measured using a variable called the K-value. Minimum K-values are needed with each design speed to allow for adequate stopping sight distance (Table 3). The stopping sight distance associated with each K-value is shown in the

Figure 8
Terrain



first row of the table. Vertical curvature is the primary cause of limited sight distance along Secondary 236.

Horizontal curvature refers to curves that are used to change the horizontal direction of the roadway. If a horizontal curve is too sharp, the sight distance will be inadequate, because the driver will not be able to see far enough around the curve. Roadside obstructions include such features as slopes, berms, vegetation, and man-made objects located adjacent to the road that block the driver's line-of-sight.

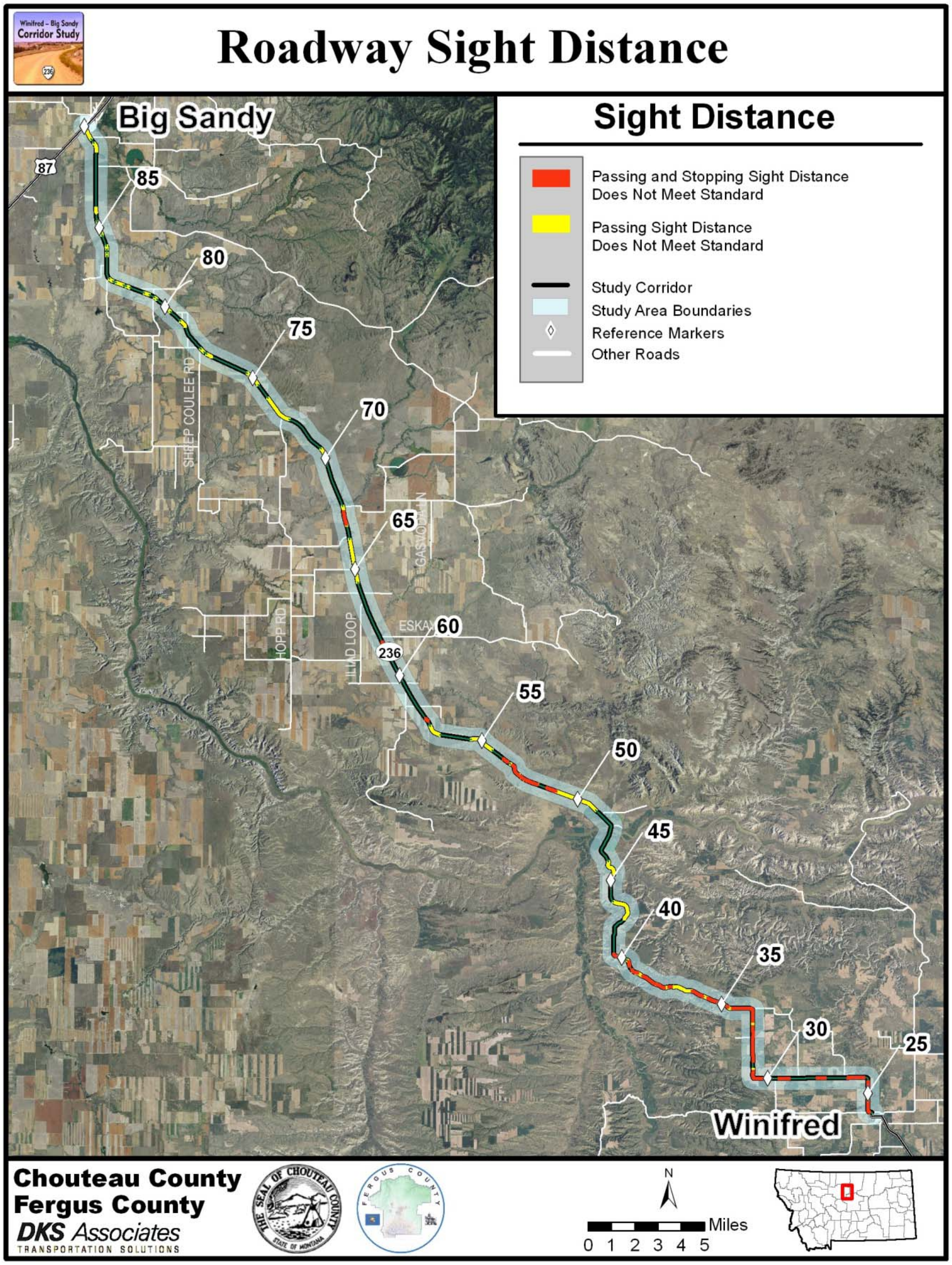
Stopping sight distances were estimated using geometric data from MDT's roadway videolog system, as well as through field survey. There are segments along Secondary 236 where the stopping sight distance does not meet MDT's standard (Figure 9, shown in orange). Most of these are located to the south of the Missouri River between R.P. 24 and R.P. 48. Within this area, there are over 50 vertical curves that do not meet MDT's current design standard. There are also several locations where the stopping sight distance is limited by roadside obstructions. Overall, MDT's current standard for stopping sight distance standard is not met over roughly 14 % of the corridor.

Passing Sight Distance

Passing sight distance is the distance required for a driver to detect an on-coming vehicle, decide whether there is adequate distance to pass, and then safely pass the slower-moving vehicle. The determining factors for passing sight distance include the speed of the vehicle to be passed, speed of the opposing vehicle, driving conditions, roadway surface conditions, driver characteristics, and vehicle condition. MDT's passing sight distance standard is 2,135 feet for a 60-mph design speed and 1,835 feet for a 50-mph design speed. The requirements for passing sight distance are significantly larger than those for stopping sight distance because the speed of the approaching vehicle must be accounted for.

Similar to stopping sight distance, the available passing sight distance along a roadway can be affected by vertical curvature, horizontal curvature, and roadside obstructions. For vertical

Figure 9
Roadway Sight Distance



curvature, the K-values shown (Table 3) are the minimum allowable values for achieving the passing sight distance standards.

Along paved highways, no-passing zones delineated by solid centerline striping define the areas where passing sight distance requirements are not met. This does not exist along the majority of the Secondary 236 corridor, however, because the surface type is gravel. Therefore, no-passing zones were estimated based on the location of vertical curves not meeting the K-value standard, horizontal curves that are too sharp, and roadside obstructions that block the driver's line of sight.

Passing sight distances were estimated using geometric data from MDT's roadway videolog system. The estimates were verified through field survey.

All segments that do not meet the stopping sight distance standard also do not meet the passing sight distance standard (Figure 9, shown in orange). This is because the distance needed for passing is significantly longer than that for stopping. Additional segments where the passing sight distance standard only is not met are shown in yellow.

Overall, the percentage of estimated no-passing zones along the entire corridor is 60%. On the south end of the corridor between R.P. 24 and R.P. 40, there are almost no areas for passing. Other concentrations of no-passing zones exist between R.P. 49 and R.P. 55 and R.P. 65 and R.P. 67. Along the remainder of the corridor, the no-passing zones are fairly evenly distributed.

Horizontal Curves

As described above, horizontal curves are curves which are used to change the horizontal direction of the roadway. MDT's standard for horizontal curves is defined in terms of the curve radius. The curve radius is distance from the center of a circle to any point on the circle, of which the curve is an arc or segment. As vehicle speeds increase, the radius must be longer to allow vehicles to stay on the road while traveling around the curve. Curves with radii less than the standard must be posted for speeds less than the design speed. MDT's standards are 760 feet for a 50-mph design speed and 1,200 feet for a 60-mph design speed.

The lengths of the horizontal curve radii were measured using aerial images of the corridor. As shown in Figure 10, there are 18 locations along the corridor where the horizontal curvature does not meet MDT's standards. Similar to the sight distance limitations, all of these are in the southern half of the corridor between R.P. 24 and R.P. 57. The highest concentration is in the area to the south of the Missouri River, where the roadway winds through hilly terrain. This includes three 90-degree curves just to the north of Winifred.

Grades

The maximum grades are 5% for level terrain, 7% for rolling terrain, and 10% for mountainous terrain (Table 3). The standards attempt to balance roadway construction costs with roadway user costs. It is for this reason that the maximum allowable grades increase with the severity of the terrain.

Grades along the corridor were calculated using data from MDT's roadway videolog system. Within the level segment between R.P. 24 and R.P. 30.5, the grades are ≤ 5%, so that the standard is met. Within the rolling segment between R.P. 30.5 and R.P. 47, there are multiple locations where the grade exceeds the standard of 7% (Figure 11, shown in orange). For this segment, videolog data was not available for the new section of roadway between R.P. 42.5 and R.P. 46.5, so the grades could not be calculated. The grade on the Claggett Hill portion of this section, however, is known to be 10%. Along the remainder of the corridor, there are only a few locations that do not meet the standard within the level segments (R.P. 47 to R.P. 52 and R.P. 57 to R.P. 90) and the rolling segment (R.P. 52 to 57).

Roadside Hazard Rating

The roadside clear zone is an important factor influencing the likelihood of errant vehicles being able to regain the roadway safely, or come to a stop on the roadside. The roadside is defined as the area between the outside shoulder edge and the right-of-way limits. The "clear zone" area along the roadside is defined as the total roadside border area, starting at the edge of the traveled way, available for safe use by errant vehicles. Elements of the clear zone include width, slope and surface type of the roadside, as well as roadside features such as signs, utility

Figure 10
Horizontal Curves

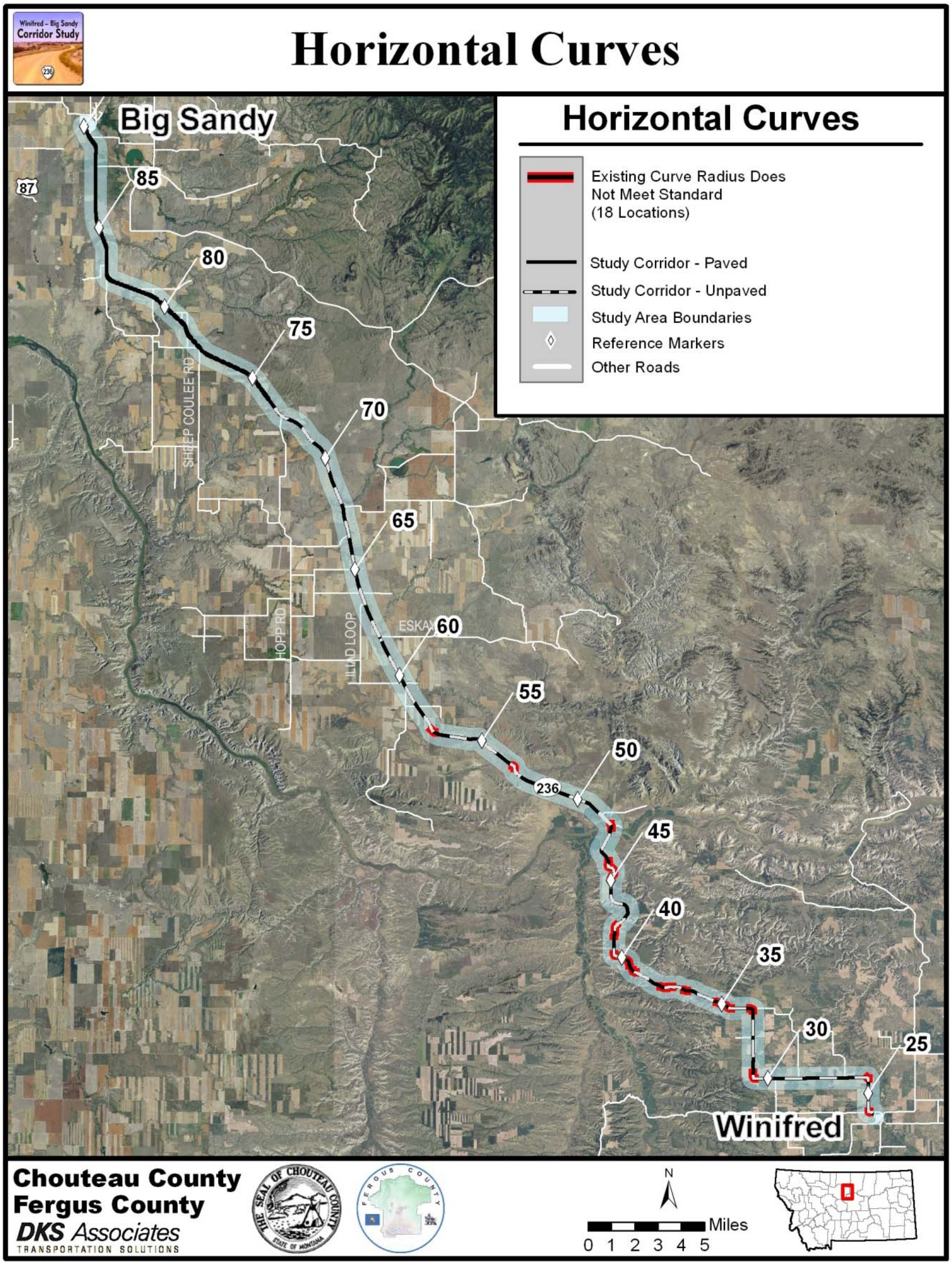
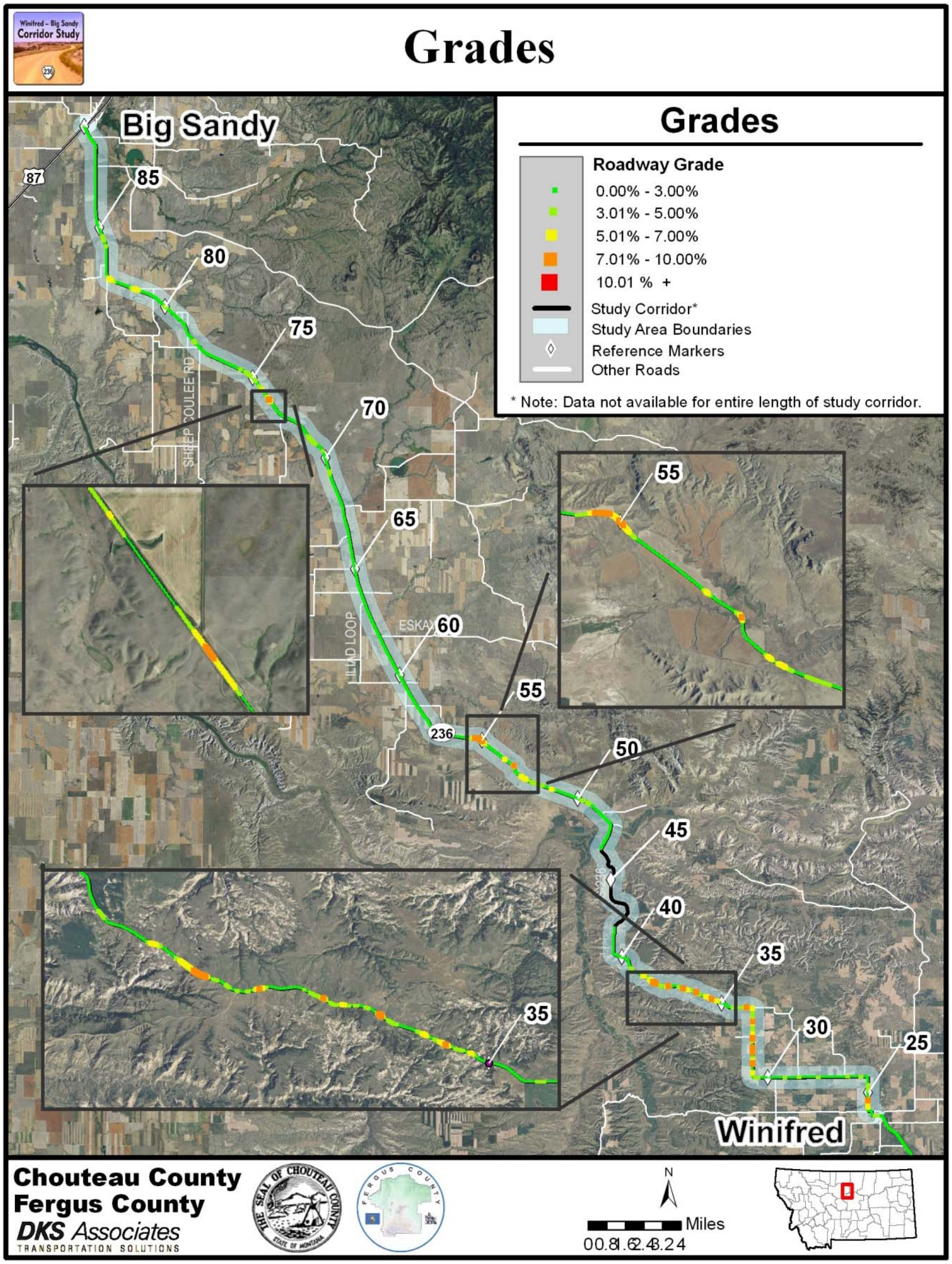


Figure 11
Grades



poles, trees, mailboxes, and other similar objects. Clear zones with stable, flattened slopes and relatively few fixed objects reduce the chance of serious consequences if a vehicle leaves the roadway.

There are many areas along Secondary 236 where the clear zone is limited or does not exist. This is due to factors such as ditches, steep drop-offs, irregular roadside surface conditions, and roadside obstructions.

The new *Highway Safety Manual*[5] contains a Roadside Hazard Rating system that considers the clear zone in conjunction with roadside slope, roadside surface roughness, recoverability of the roadside, and other elements beyond the clear zones such as barriers or trees. As the roadside hazard rating increases from one to seven, the crash risk for frequency and/or severity increases. A brief description of each rating is provided (Table 5).

Table 5
Roadside Hazard Ratings

Rating	Description
1	Clear zone width greater than or equal to 30 feet; side slope flatter than 4:1; vehicles can recover
2	Clear zone between 20 and 25 feet; side slope of about 4:1; vehicles can recover
3	Clear zone about 10 feet; side slope of about 3:1, vehicles have marginal chance of recovery
4	Clear zone between 5 and 10 feet; side slope between 4:1 and 3:1; vehicles have marginal chance of recovery; increased chance of reportable crash
5	Clear zone between 5 and 10 feet, side slope of about 3:1; vehicles have virtually no chance of recovery
6	Clear zone less than or equal to 5 feet; side slope of about 2:1; vehicles have no chance of recovery
7	Clear zone less than or equal to 5 feet; side slope of about 2:1 or steeper; vehicles have no chance of recovery; high likelihood of severe injuries from roadside crash

[5] American Association of State Highway and Transportation Officials (AASHTO), *Highway Safety Manual, First Edition*, September, 2010.

Roadside hazard ratings were assigned to homogenous segments of Secondary 236 by viewing the corridor through MDT's roadway videolog system and field survey. The ratings are mostly "3" or better to the north of the Missouri River between R.P. 47 and R.P. 90 (Figure 12), meaning that vehicles running off the road generally can recover. To the south of the river, however, most of the corridor has a rating of "4" or worse. In this section, vehicles generally have little or no chance recovery. This includes several segments with ratings of "6" or "7".

This condition is consistent with the findings for sight distance and horizontal curvature, reflecting the difficult terrain conditions in this portion of the corridor.

Intersections

In addition to roadway segments, existing roadway conditions were analyzed at all county road intersections along the corridor. It is important to consider intersection conditions because the configuration of the intersection on county road legs can affect traffic operations and safety conditions on Secondary 236.

Due to the sparse development within the study area, there are relatively few (30) county road intersections (Figure 13). These roads provide local access to the farms and ranches in the area. The traffic volumes are very low at all of the intersections; however the percentages of trucks and agricultural vehicles can be high as a result of the agricultural products and equipment that are hauled to and from the farms and ranches.

The intersections were analyzed with regard to the following characteristics:

- Intersection angle
- Intersection sight distance
- Minor road approach grade
- Intersection turn radius

Figure 12
Roadside Hazard Rating

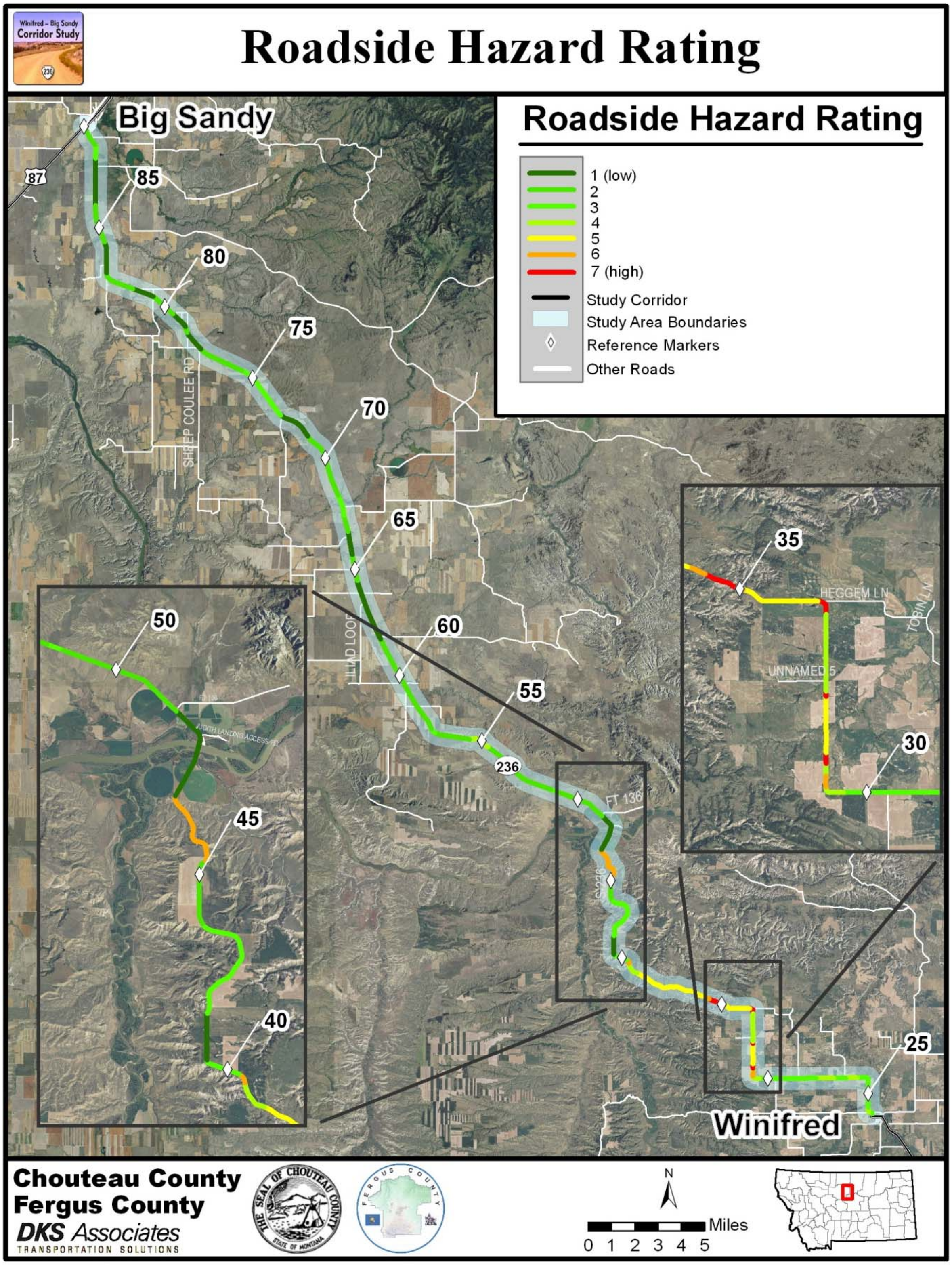
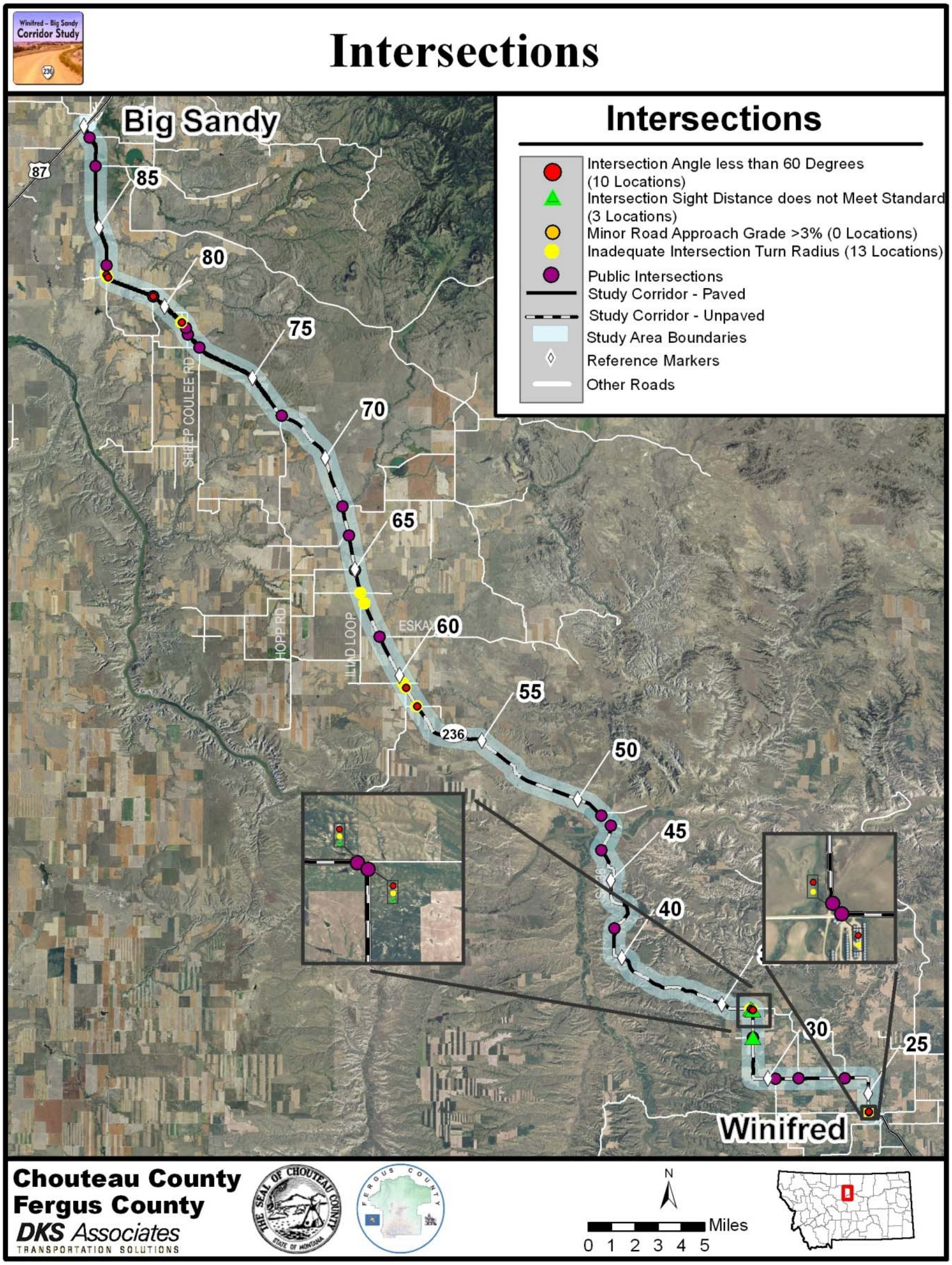


Figure 13
Intersections



Intersection Angle

Intersection angle is the angle at which the minor road intersects the major road. AASHTO recommends that the intersection angle should be at least 60-degrees.[6] If the intersection angle is too sharp, there can be negative consequences, including:

- Intersection sight distance from the minor road approach can be limited, as drivers on the minor road approach cannot turn their heads far enough to see approaching traffic on the major road.
- Vehicles turning from or on to the minor road must use the opposing travel lane to complete the turn because the sharp intersection angle results in a turning radius that is too short. This can be a particular problem for vehicles with larger turning radius requirements, such as trucks.
- Vehicles on the minor road approach may be less visible to drivers on the major road.

The intersection angles were estimated from aerial images of the corridor. There are 10 study area intersections where the angle is too sharp (Figure 13). These are clustered near R.P. 24, R.P. 34, R.P. 60, and R.P. 80.

Intersection Sight Distance

Intersection sight distance was estimated through field measurement at intersections where it appeared that the sight distance may not meet the standard. MDT's intersection sight distance standards (Table 6) are based on the design speed of the major road, the vehicle type for vehicles on the minor road intersection approach, and the approach grade of the minor road.

[6] AASHTO, *A Policy on the Geometric Design of Highways and Streets*, 2004.

Table 6
MDT Intersection Sight Distance Standards[7]

Design Speed	Passenger Cars*	Single-Unit Trucks	Tractor/ Semi-trailers
50 mph	555’	700’	850’
60 mph	665’	840’	1,015’

* Values assume a minor road approach grade of ≤ 3%.

Adequate intersection sight distance is required for drivers turning from the minor road to clearly see oncoming traffic, turn into the traffic stream, and safely accelerate. The largest sight distance requirements are for drivers turning left from the minor road. Longer sight distances are required for trucks than cars to account for the slower acceleration rate of trucks. Also, intersection sight distance requirements are larger than stopping sight distance requirements.

Three intersections were identified between R.P. 24 and R.P. 32.5 that did not meet the standards (Figure 13). Two of these intersections are located on the 90-degree curves. The sight distance at these locations is limited due to roadside obstructions (hills), vertical curves, or skewed intersection alignment.

Intersection Approach Grade

Minor road approach grades were visually inspected to verify that they were below AASHTO’s recommended maximum grade of ± 3%.[8] Approach grades that exceed this level can result in increased intersection sight distance requirements and can reduce the visibility of vehicles on the minor road approaches. No intersections were identified with minor road approach grades greater than ± 3%.

[7] Montana Department of Transportation, *Road Design Manual*, Helena, MT, August 2008.
[8] AASHTO, *A Policy on the Geometric Design of Highways and Streets*, 2004.

Intersection Turn Radius

As described earlier, intersection turn radii that are too short can potentially affect traffic operations and safety by limiting intersection sight distance, causing vehicles to/from the minor road to turn into the opposing travel lane, and reducing the visibility of vehicles on the minor road approaches. Thirteen intersections were identified along the corridor where the turning radius is too tight. It is interesting to note that because this can be highly correlated with a skewed intersection angle, both of these conditions occur at all but three of the 13 intersections.

Traffic Operations

Several comments were received from the public that there are frequent conflicts between agricultural and recreational traffic. This may be due to tourists traveling at speeds which are excessive for the roadway conditions. There was also concern that increased traffic on the highway could pose a danger to cattle operations, since Secondary 236 is used to move cattle.

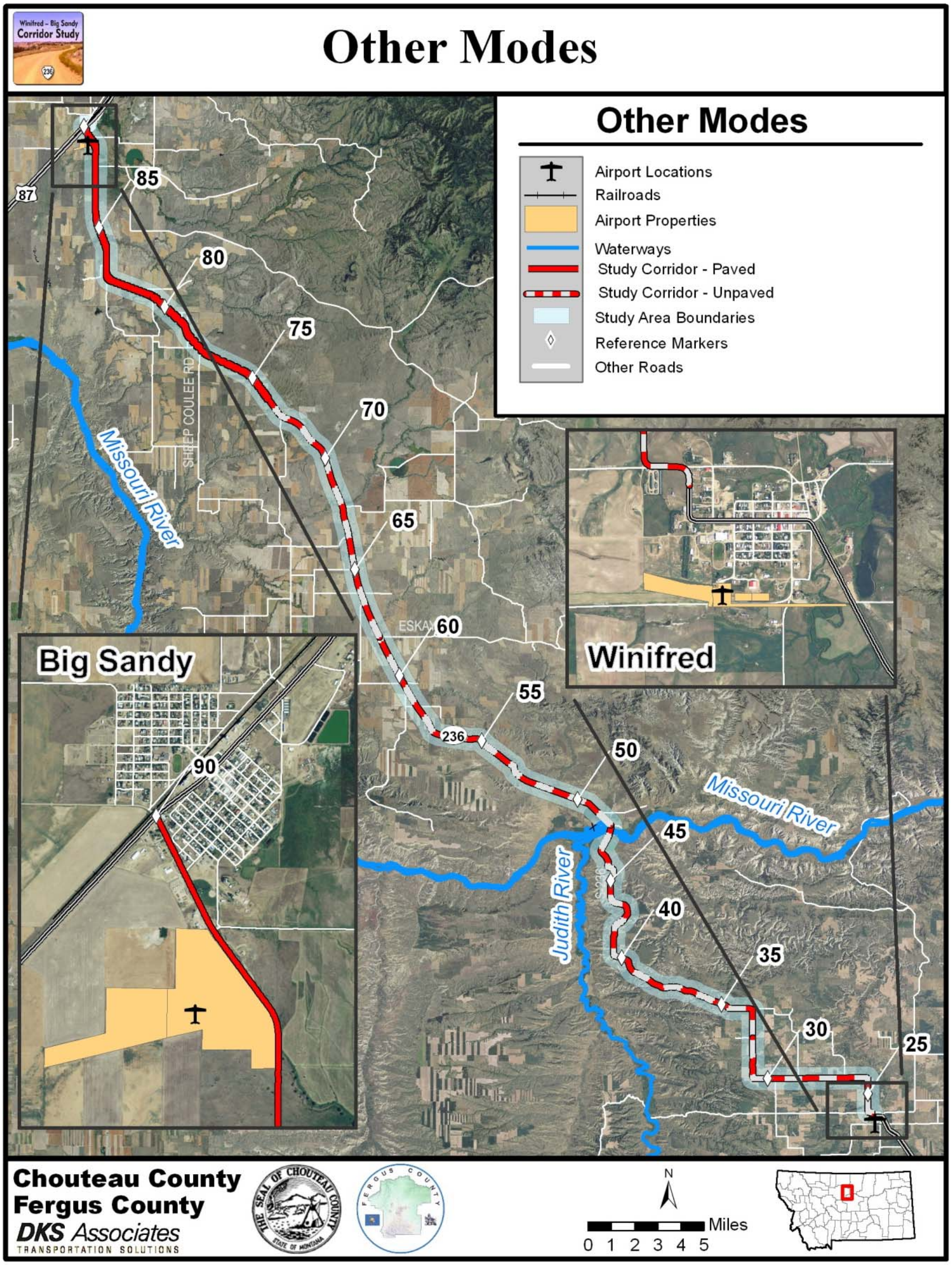
Roadway Surface Conditions

There were multiple comments from the public that the wider section of Secondary 236 on the north end of the corridor has the poorest surface conditions because there is too much gravel. Wash boarding was also mentioned as a problem. Between maintenance cycles the road condition often deteriorates. The condition of the road also increases the response time for first responders during emergency calls. There were a number of comments that the roadway should be paved.

Other Transportation Modes

The other transportation modes within the corridor study area are air, rail, water, and pipeline. There are two public airports located just outside of Winifred and Big Sandy (Figure 14). The Winifred/Fergus County Airport has one runway and serves an average of 24 aircraft

Figure 14
Other Modes



operations per week.[9] The Big Sandy airport has three runways and serves an average 103 aircraft operations per week.

The only rail line within the study area is the BNSF Big Sandy Subdivision, which runs between Havre and Big Sandy. Within Big Sandy, it parallels US 87 and terminates just to the south/east of Secondary 236. It serves an ADM/CHS grain facility in Big Sandy.[10] The line operates with a 10-mph maximum speed and a maximum gross car weight of 143 tons. There is no passenger rail service on this line.

The two rivers within the study area are the Missouri River and the Judith River and are used for recreational activity.

There is one gas pipeline that runs along the corridor. There are no major oil pipelines within the study area.

1.2 Environment

Geographic Setting

Secondary 236 is a major collector in MDT's Secondary Highway System located in Fergus and Chouteau Counties. It is surrounded primarily by agricultural and ranching land uses. Aside from the towns of Winifred and Big Sandy, the majority of the land is undeveloped. A section of the roadway is located within the Upper Missouri River Breaks National Monument.

Section 4(f)/Section 6(f)

Transportation projects that use Section 4(f) resources require the review and approval of the Federal Highway Administration (FHWA). Section 4(f) resources include park and recreational lands, wildlife and waterfowl refuges, and historic sites. Two Section 4(f) resources lie within the study area:

---

[9] AirNav, LLC, (2010), airport information, URL://airnav.com/airports/, visited September 23, 2010.
[10] Montana Department of Transportation, *2009 Montana State Rail Plan, Draft Report*, Helena, MT, July 2009.

- Judith Landing Historic District
- Upper Missouri River Breaks National Monument

Transportation projects that impact Section 6(f) resources require the approval of the Secretary of the Interior. Section 6(f) resources are recreational lands purchased or improved with land and water conservation funds. No Section 6(f) properties were identified within the corridor study area.

Soil Resources and Prime Farmland

Information was obtained on soils to determine the presence of prime farmland, farmland of statewide importance, and not prime farmland. Based on this information, it is likely that project activities within the corridor study area would create impacts to soil map units with "prime farmland with irrigation" and "farmland of statewide importance" status. This would require that a CPA-106 Farmland Conversion Impact Rating Form for Linear Projects be completed.

Geologic Resources

The study area is located within the Intermountain Seismic Belt, and several areas along the corridor are underlain by soils susceptible to liquefaction. In these areas, the roadway can sustain substantial damage during a large seismic event.

Water Resources

The study corridor travels through the Middle Missouri Watershed. Four water bodies within this watershed lie within the study corridor: the Missouri River, Judith River, Eagle Creek, and Dog Creek. If projects resulting from this study are identified, the water quality requirements set by the state and federal governments for these water bodies must be followed.

There are currently no Local Water Quality Districts within the study area. If one were to be formed, any road projects within the district would need to address local water quality requirements in addition to state and federal requirements.

Any project that may result from this study will need to avoid impacts to existing irrigation facilities. If an impact is unavoidable, reconstruction or relocation of the existing facility would be a potential mitigation measure. Additionally, any potentially impacted facilities would be examined to determine if they are considered waters of the U.S. and subject to jurisdiction by the U.S. Army Corps of Engineers.

Wetlands

Portions of the Missouri River and several other drainages have wetlands associated with them. Wetland impacts should be avoided to the greatest extent practicable. All unavoidable wetland impacts will be mitigated in accordance with all applicable rules, regulations and policies.

Wild and Scenic Rivers

The Missouri River is designated as a Wild and Scenic River within the study corridor area. If a project is forwarded from this study, coordination with the NPS will need to be conducted as necessary through the project development process.

Upper Missouri River Breaks National Monument

The Upper Missouri River Breaks National Monument is part of the Department of the Interior's National Landscape Monument System. Much of the land in this area is managed by the Bureau of Land Management. A portion of the study corridor is located within the monument.

Floodplains and Floodways

Within the study corridor, there are no 100-year floodplains delineated by the Federal Emergency Management Agency (FEMA). There are no FEMA-issued flood maps for Chouteau County. If a project is forwarded from this study, coordination with Fergus and Chouteau counties should be conducted during the project development process to verify no floodplain permits are necessary.

Hazardous Substances

Two petroleum release sites and several abandoned mines were identified in the general corridor area. If contaminated soils or groundwater is encountered during construction of a project forwarded from this study, handling and disposing of the contaminated material will be conducted in accordance with State, Federal, and local laws and rules.

Air Quality

The study corridor is not in or adjacent to a non-attainment area and is exempt from a Mobile Source Air Toxics Analysis under the Conformity exemption for planning studies.

Noise

A Preliminary Noise Screening Analyses may be needed if a project is forwarded from this study. The likely locations for this type of study would be in or near Winifred and Big Sandy and near residences along the corridor.

Visual Resources

The landscape throughout the study corridor is remote and contains an array of biological, scientific, historic, wildlife, ecological, and cultural resources. The remote nature of this segment of the Upper Missouri River has buffered the area from most human influence. This area has maintained the same vistas that awed the Lewis and Clark Expedition in 1805 and 1806.

Biological Resources

A preliminary review of the biological resources within the study area was completed. The specific topics covered for fish and wildlife included threatened and endangered species, species of concern, and wildlife and traffic concerns. The specific topics covered for vegetation included threatened and endangered species, species of concern, and noxious weeds.

Fish and Wildlife

If a project is selected for construction, encroachment into the wetted width and waterway (riparian and river, stream or creek habitats) should be avoided to the greatest extent practicable. It is recommended that a riparian corridor remain on both sides of waterways to facilitate wildlife movement.

A large bighorn sheep herd exists in the corridor study area. Paving the corridor and the subsequent use of de-icing materials in the winter could increase the potential for bighorn sheep/vehicle collisions due to the attractive nature of the de-icing salts. The appropriate resource agencies should be consulted for potential mitigation options if a project is selected for construction.

There are two endangered, threatened, proposed, or candidate animal species in the study corridor area; the Black-footed Ferret and the Pallid Sturgeon. If a project is selected for construction, an evaluation of potential impacts to all endangered, threatened, proposed, or candidate species will need to be completed during the project development process.

The scan lists several species of concern within the project site, including the Black-tailed Prairie Dog, Bald Eagle, and Sturgeon Chub. If a project is selected for construction, on-site surveys will need to be completed during the project development process.

For any corridor improvements, MDT should work with FWP Wildlife Biologists for the area to determine what measures, if any, are needed to address wildlife crossings. To facilitate wildlife movement and migrations through project areas, it is preferable to install wildlife-friendly fencing.

Vegetation

Native vegetation in the study area generally consists of wetland and riparian areas along waterways and forest/sagebrush/grasslands in the upland areas. The remaining vegetation consists of cultivated crop land. None of the vegetation is currently listed as endangered, threatened, proposed, or candidate plant species. A handful of plant species within the study area are listed as species of concern. If a project is selected for construction, on-site surveys will need to be completed during the project development process.

Noxious weeds degrade habitat, choke streams, crowd native plants, create fire hazards, poison and injure livestock and humans, and foul recreation sites. If a project is selected for construction, the study area will be surveyed for noxious weeds. To reduce the spread and establishment of noxious weeds and to re-establish permanent vegetation, disturbed areas will be seeded with desirable plant species.

Cultural and Archaeological Resources

The study corridor may contain a large number of cultural resources. Potential resources could include historic ranches and/or ranch buildings, historic bridges, tipi ring sites, lithic scatters, bison kill sites, and pre-contact buried campsites.

If a project is selected for construction, a cultural resource survey for unrecorded historic properties within the Area of Potential Effect will need to be completed during the project development process. Flexibility in design will be key to avoiding and/or minimizing impact to significant sites in the study corridor.

Social

The environmental scan revealed that the study area population has declined overall since 2000. Residents in the project area tend to be higher in age and lower in median household income compared to Montana as a whole. These differences can be generally attributed to the rural nature and relatively low population of the area. The ethnic makeup of the project area is primarily white, which is consistent with the state as a whole.

Environmental Justice

Title VI of the US Civil Rights Act of 1964, as amended (USC 2000(d)) and Executive Order (EO) 12898 require that no minority, or, by extension, low-income person shall be disproportionately adversely impacted by any project receiving federal funds. For transportation projects, this is also known as environmental justice. This means that no particular minority or low-income person may be disproportionately isolated, displaced, or otherwise subjected to adverse effects. If a project is selected for construction, Environmental Justice will need to be further evaluated during the project development process.

2.0 Future Transportation Conditions

Future transportation conditions were analyzed to determine how the traffic volumes and characteristics of the corridor may change compared to existing conditions. The analysis was based on a traffic forecast developed for the Year 2030.

2.1 Roadways

Committed and Planned Improvements

There are no improvements for Secondary 236 included in MDT's 2010-2014 State Transportation Improvement Program (STIP).[11] There are also no committed or planned improvements for county roads in either Fergus or Chouteau Counties.[12]

Traffic Projections

Based upon an assessment of potential future growth within the study area, a trendline forecasting method was used to estimate future volumes for Secondary 236. This method is appropriate when future growth rates are expected to be similar to the historical rate, and is most frequently used in areas with relatively low growth rates.

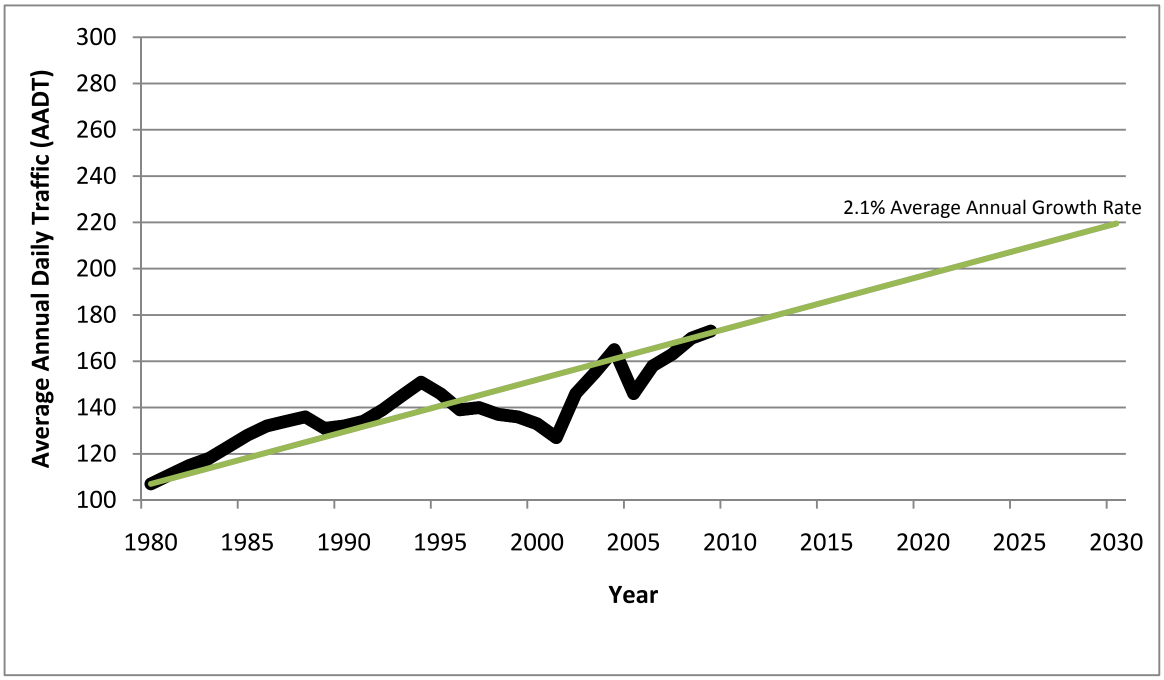
The traffic forecast was based on historic AADT traffic counts conducted by MDT at five locations along Secondary 236 between 1980 and 2009. The counts from the five locations

---

[11] Montana Department of Transportation, *2010-2014 State Transportation Improvement Program*, Helena, MT, July 2010.
[12] Information received from Carl Seilstad, Fergus County Commissioner on October 4th, 2010 and Daren Schuster, Chouteau County Commissioner on July 10, 2010.

were weighted based on the length of road segment and then averaged. Traffic levels have fluctuated from year-to-year, but in general, they have increased by an average of 2.1 percent per year over the last 30 years (Figure 15). This is equivalent to a growth of about 23 vehicles every 10 years. This growth increment is the basis for the 2030 AADT volumes (Figure 16).

Figure 15
Future Trendline Traffic Growth

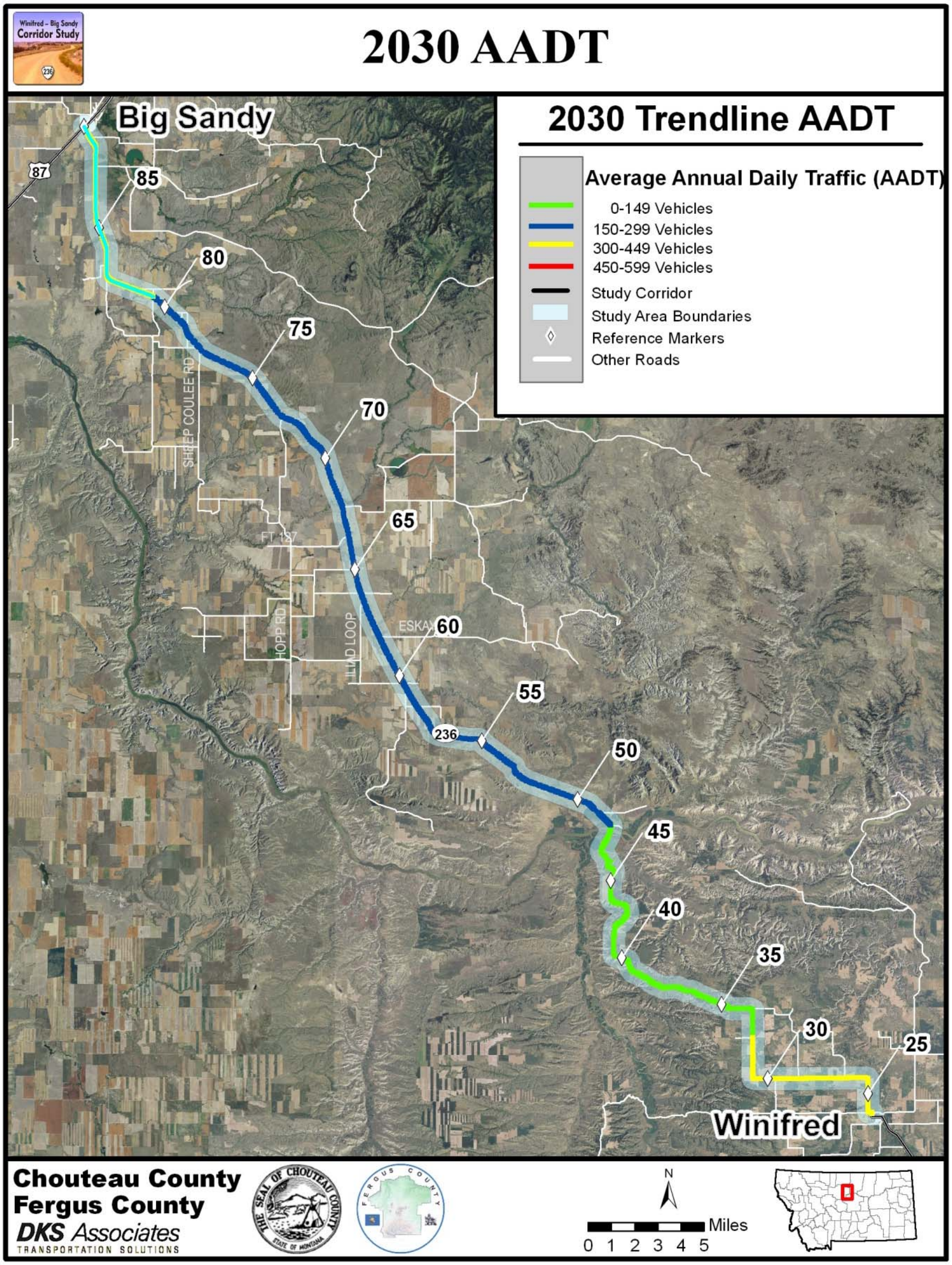


Traffic Diversion

Through the study's public involvement process, comments were received that if the corridor is improved, traffic from parallel routes may divert to Secondary 236. This may be particularly true if the roadway is paved at some point in the future. The diverted traffic would be in addition to the growth in existing Secondary 236 traffic reflected in the trendline forecast.

The parallel routes to Secondary 236 are MT 66 and MT 80. Both are paved routes that run in a primarily north-south direction. Current (2009) traffic levels on both roads are greater than on Secondary 236, with an average of 700 vpd on MT 66 and an average of 450 vpd on MT 80. Traffic volume growth over the last 30 years has been very different for the two routes.

Figure 16
2030 AADT



Historical growth on MT 80 is only about 0.6% per year, while over the same time period, the average annual increase in traffic volume along MT 66 is 3.5%.

As was done for Secondary 236, trendline growth forecasts were developed for MT 66 and MT 80 for the Year 2030. Trendline volume forecasts are compared for high and low-volume segments along each roadway, as well as the average volume (Table 7).

Table 7
MT 66 and MT 80 Trendline Forecast Volumes

Roadway	2030 Trendline AADT					
	High-Volume Segment		Low-Volume Segment		Average	
	2010	2030	2010	2030	2010	2030
Secondary 236	300	460	70	110	175	220
MT 66	860	1,200	280	660	900	1,250
MT 80	1,590	1780	170	190	480	510

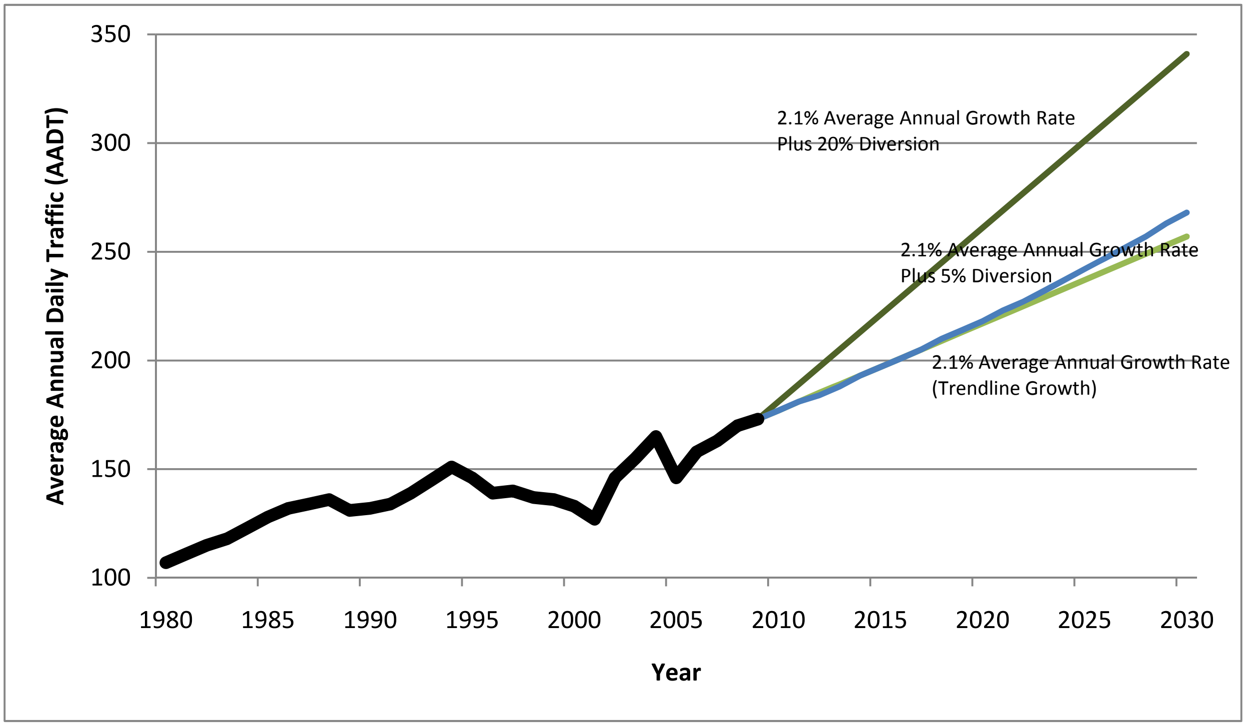
The potential diverted trips from MT 66 and MT 80 would be vehicles traveling the entire length of the route, i.e., through trips. These trips can be best estimated based on the smallest counted volume along the route, since all through trips would have to pass through this point.

Because no origin-destination data was available for MT 66 and MT 80, a specific through trip diversion rate could not be estimated. Therefore, a low diversion rate of 5% and a high diversion rate of 20% were tested to establish a reasonable range of diverted traffic volumes that could be expected with improvements to Secondary 236 (Figure 17).

Geometric Conditions

Of the MDT design standards used to assess existing transportation conditions in Section 3.1, the only one that varies by traffic volume level is the roadway width standard (Table 2). Comparison of the roadway width standards with the future traffic volume estimates (Table 8) reveals that the key volume threshold for Secondary 236 with regard to roadway width is 300 vpd. It is at this level that MDT's width standard increases from 24-feet to 28-feet. Thus, for

Figure 17
Future Traffic Growth With Diversion



the trendline growth-only scenario, the roadway would need to be 28-feet wide for Segment 1 (R.P. 24 – R.P. 32.4) and Segment 5 (R.P. 80.6 – R.P. 89.9) in order to meet the standard. The same width requirements would be true for low (5%) diversion scenario, with volumes

Table 8
Secondary 236
2030 AADT By Roadway Segment

Segment	Reference Post		2010	2030		
	From	To		Trendline Growth Only	Trendline PlusTraffic Diversion	
					Lower (5%)	Higher (20%)
1	24	32.4	302	380	410	500
2	32.4	48.1	72	91	120	210
3	48.1	61.9	126	159	190	280
4	61.9	80.6	208	262	290	380
5	80.6	89.9	250	315	345	435

exceeding 300 vpd for Segments 1 and 5, but less than 300 vpd for Segments 2-4. With the high (20%) diversion scenario, Segment 4, with a volume of 380 vpd, would need to be 28-feet wide, in addition to Segments 1 and 5.

A test was also made to determine the level of traffic diversion that would be required to push Segment 3 above the 300 vpd threshold. It was found that a diversion rate of 25% would be needed for this to occur, which was considered to be unreasonably high.

It was decided that a diversion rate of between 5% and 20% would be a reasonable assumption for the purpose of determining future roadway width requirements based on MDT's standard. Within this range, Secondary 236 would need to be 28-feet wide for Segments 1, 4, and 5. Because the current width of Segments 1 and 5 is less than 28-feet (Figure 7), these segments would not meet MDT's standard with the 2030 volumes. Segment 4 is greater than 28-feet in width between R.P. 61.9 and R.P. 74, so this portion of the segment would meet the standard. Between R.P. 74 and R.P. 80.6, however, Secondary 236 is only 24-feet wide, so here the standard would not be met.

2.2 Other Transportation Modes

Based on the relatively low amount of future development expected within the corridor, no major changes are anticipated in future conditions for the other modes compared to existing conditions.