# Culbertson Corridor Planning Study

## ALTERNATE ROUTES REPORT

June 2012

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**Montana Department of Transportation**

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# Chapter 1 Alternate Truck Route Identification

The purpose of this Technical Memorandum is to provide an account of the methodology and analysis used to develop and refine proposed truck route regions and the identification of a preliminary preferred alternate route. Truck route regions were developed by taking a high-level examination of current truck traffic patterns through Culbertson and addressing the needs and objectives set up for this Study.

One key issue driving this whole process is the requirement that all large trucks on US 2 either eastbound or westbound are required to first proceed to the weigh scale. Large trucks on US 2 that are ultimately heading northbound or southbound on MT 16 are also required to stop first at the weigh scale. In other words, all large trucks entering the Study area either from the east or west are required to first check in at the weigh scale before proceeding to their destination. Additionally, all large trucks northbound on MT 16 (from Sidney or Richland County) must first proceed to the weigh scale. Southbound trucks approaching Culbertson from MT 16 (north) use a Weigh-In-Motion (WIM) System and a Variable message sign directs them to the weigh station if the WIM detects a violation of speed, axle weight, gross vehicle weight, or bridge weight. The WIM site detects a violation of approximately 15 percent of the southbound trucks on MT 16 and directs them to the weigh scale, regardless of their destination.

## 1.1 *Proposed Truck Route Regions*

In order to address the Town of Culbertson's concern regarding truck traffic traveling on Broadway Avenue and truck turning movements at the intersections of MT 16 with US 2, general regions on the east and west sides of Culbertson were developed. Regions on the east and west sides of Culbertson would eliminate the right-angle turning movements at the intersections of MT 16 to US 2. Regions north and south of US 2 were not developed because even if a region north or south of US 2 were available, trucks would not likely take a route that is longer than the current direct link through town along US 2. Figure 1 shows the two truck route regions developed for this Study.

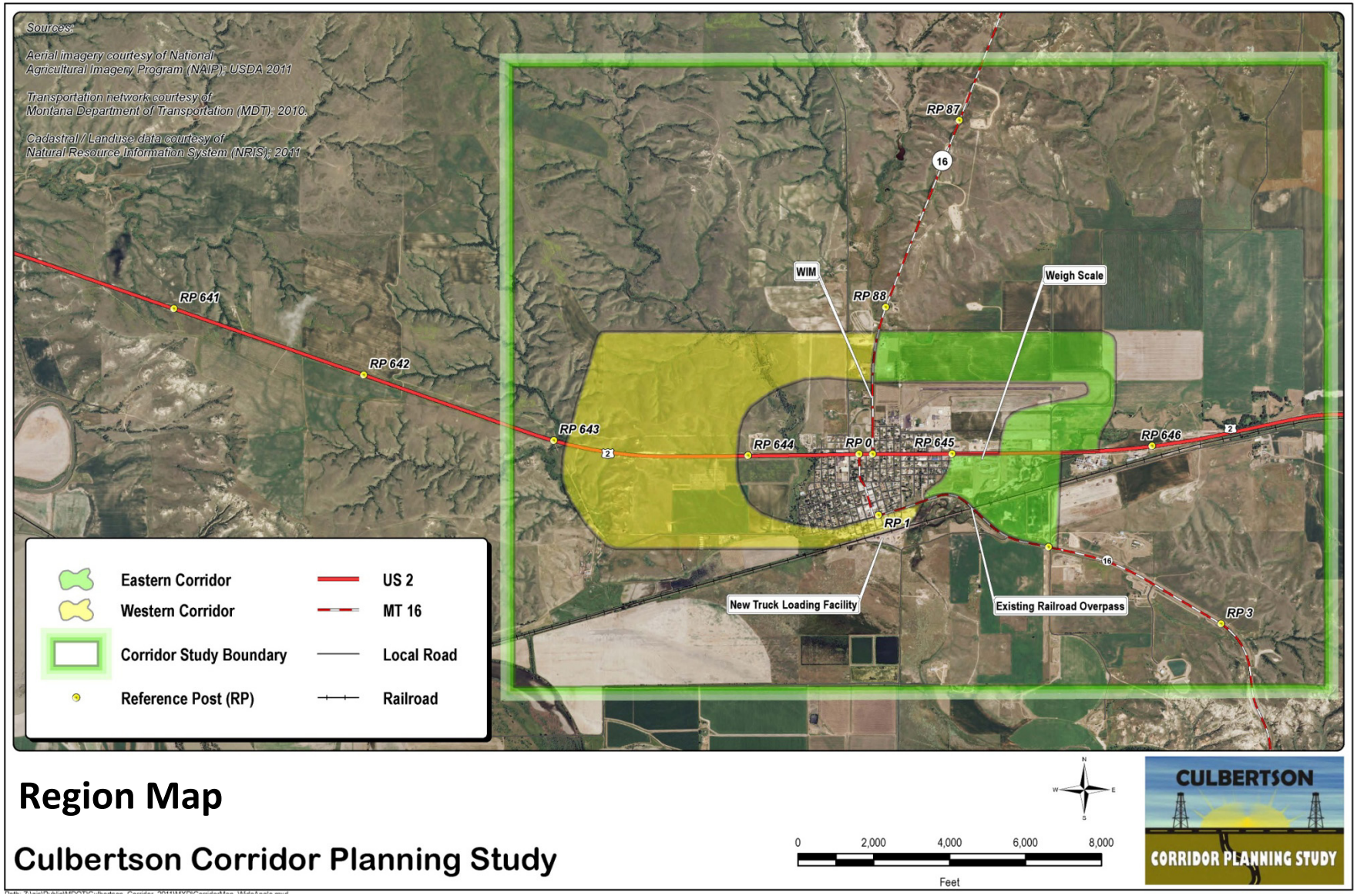



**Figure 1. Truck Route Regions**

### 1.1.1 Western Truck Route Area

The western truck route region contains the area west of MT 16 both north and south of US 2 and is located north of the BNSF railway. Major constraints in this region include the large elevation changes on the western most side of the Study area, the Hillside Cemetery, and the numerous residential and industrial areas within the Culbertson incorporated city limits. Diamond Creek travels though this region and a crossing of this creek would not be avoided. This region would not provide direct access to the weigh scale, and all trucks entering the Study area from the west and south would need to first proceed to the weigh scale before continuing on to their destination. Without implementation of additional traffic diversion features, a western truck route would not reduce truck traffic on Broadway Avenue or through Culbertson.

The only way to alleviate truck traffic through Culbertson would be to implement a WIM system on the various legs of MT 16 and US 2. The following paragraphs describe how implementation of a WIM system on a particular leg may or may not alleviate truck traffic through Culbertson.

#### *WIM System on MT 16 (North)*

Although there is currently a WIM system on MT 16 (north), the current location of the WIM system is located south of any western region connection with MT 16 (north) and therefore would not be effective in drawing traffic onto a western truck route. If the WIM system were moved north of its current location, the success of a western truck route region to draw traffic from Broadway Avenue and through Culbertson depends on the amount of traffic currently using MT 16 (north) that is heading west. A WIM system combined with a western route may be effective in alleviating southbound truck traffic, but with the added distance for trucks to travel around Culbertson, it is not clear whether the southbound trucks would take a western route or proceed through Culbertson.

#### *WIM System on US 2 West of Culbertson*

If a WIM system were added west of a western truck route connection on US 2, it could be successful in alleviating the volume of southbound and northbound trucks through town. Truck traffic traveling eastbound from US 2 would continue to travel the shortest route, which is US 2 straight through Culbertson.

#### *WIM System on MT 16 (South)*

If a WIM system were added to MT 16 south of a western truck route connection, it could be successful in alleviating westbound truck traffic through town. A WIM system combined with a western route may be effective in alleviating northbound truck traffic, but with the added distance for trucks to travel around Culbertson, it is not clear whether the northbound trucks would take a western route or proceed through Culbertson. Eastbound trucks would continue to traverse Broadway Avenue through Culbertson before proceeding east on US 2.

#### *Western Truck Route Region Summary*

Even if WIM systems were implemented on US 2 west of Culbertson, on MT 16 South of Culbertson, and the existing WIM system on MT 16 (north) was moved north of its current location, at least 15 percent

of truck traffic would still travel through town to head to the weigh scale. In addition, it is unclear whether trucks would utilize a western route due to the potential of an increase in truck travel distance.

### 1.1.2 Eastern Truck Route Area

The eastern region contains the area east of MT 16 both north and south of US 2and contains the area north of MT 16 (south). Major constraints in this region include the Big Sky Field airport, BNSF Railway, Clover Creek, and numerous residential and industrial areas. A north and south connection in this region would provide direct access to the weigh scale, which the majority of trucks need to proceed to before going to their destination and would address the issues with the increasing volumes of trucks through Culbertson as well as the issues with the turning movements of large trucks at the intersections of US 2 and MT 16 North and South. A truck route in this area would not require additional traffic diversion features due to the location of the weigh scale. To make an eastern truck route more effective, abstaining from implementation of a WIM system would force trucks to use the truck route to reach the weigh scale instead of proceeding through Culbertson to their destination. This may increase the truck traffic on US 2 through Culbertson for westbound trucks; but implementation of an eastern truck route would alleviate truck traffic through Culbertson if their destination through Culbertson is south, east, or north of Culbertson.

# Chapter 2 Screening of Proposed Truck Route Regions

Screening criteria were developed to assist in the evaluation of the two truck route regions in the Culbertson Corridor Study area and to provide a means of reducing the number of potential alternate truck routes for consideration by comparing them both quantitatively and qualitatively with a set of specific measures. The first level screening process described in this chapter illustrates each region's fulfillment of either meeting or not meeting Culbertson's ultimate goal to reduce truck traffic through Culbertson. The region that is best able to accomplish this goal will be moved forward for identification of individual alternate routes within the region. Figure 1 depicts the two general truck route regions under consideration.

## 2.1 *First Level Screening Criteria*

In order to evaluate which region is best able to meet Culbertson's goal of reduced truck traffic through Culbertson, screening criteria were developed. The first level of screening evaluates two truck route regions against the following criteria:

- Accessibility to Weigh Scale
- Truck Traffic Patterns

In order to determine whether a region met each screening criterion, rating factors were developed. "Yes" or "No" rating factors were assigned to each screening criterion for each region. Table 1 describes and shows the first level rating factors.

**Table 1. First Level Rating Factors**

| YES | NO |
|---|---|
| Best Able to Meet Screening Criterion | Least Able to Meet Screening Criterion |

A description of each screening criterion and a comparison of each truck route region to each screening criterion are described below. A matrix summary of the results of the first level screening is shown in Table 2.

### 2.1.1 Accessibility to Weigh Scale

Due to the requirement that trucks access the weigh scale before proceeding to their destination, the effectiveness of any truck route depends on its ability to reroute truck traffic away from Broadway Avenue before accessing the weigh scale. All trucks entering the Study area from the east, south, and west are required to check into the weigh scale before proceeding to their destination. Trucks approaching Culbertson from the north use a Weigh-In-Motion (WIM) System and a Variable message sign directs them to the weigh station if the WIM detects a violation of speed, axle weight, gross vehicle weight, or bridge weight. Approximately 15 percent of the southbound trucks on MT 16 are directed to the weigh scale, regardless of their destination through Culbertson. The effectiveness of a truck route region is a direct correlation to the location of the current weigh scale.

Accessibility to the weigh scale was measured in the following way:

| Rating Factor | Rating Factor Description |
|---|---|
| Yes | Route reduces the volume of truck traffic though Culbertson and provides access to weigh scale without need for trucks traversing Culbertson's interior street network. |
| No | Route does not provide a reasonable alternative route to weigh scale thus not reducing truck traffic volume through Culbertson. |

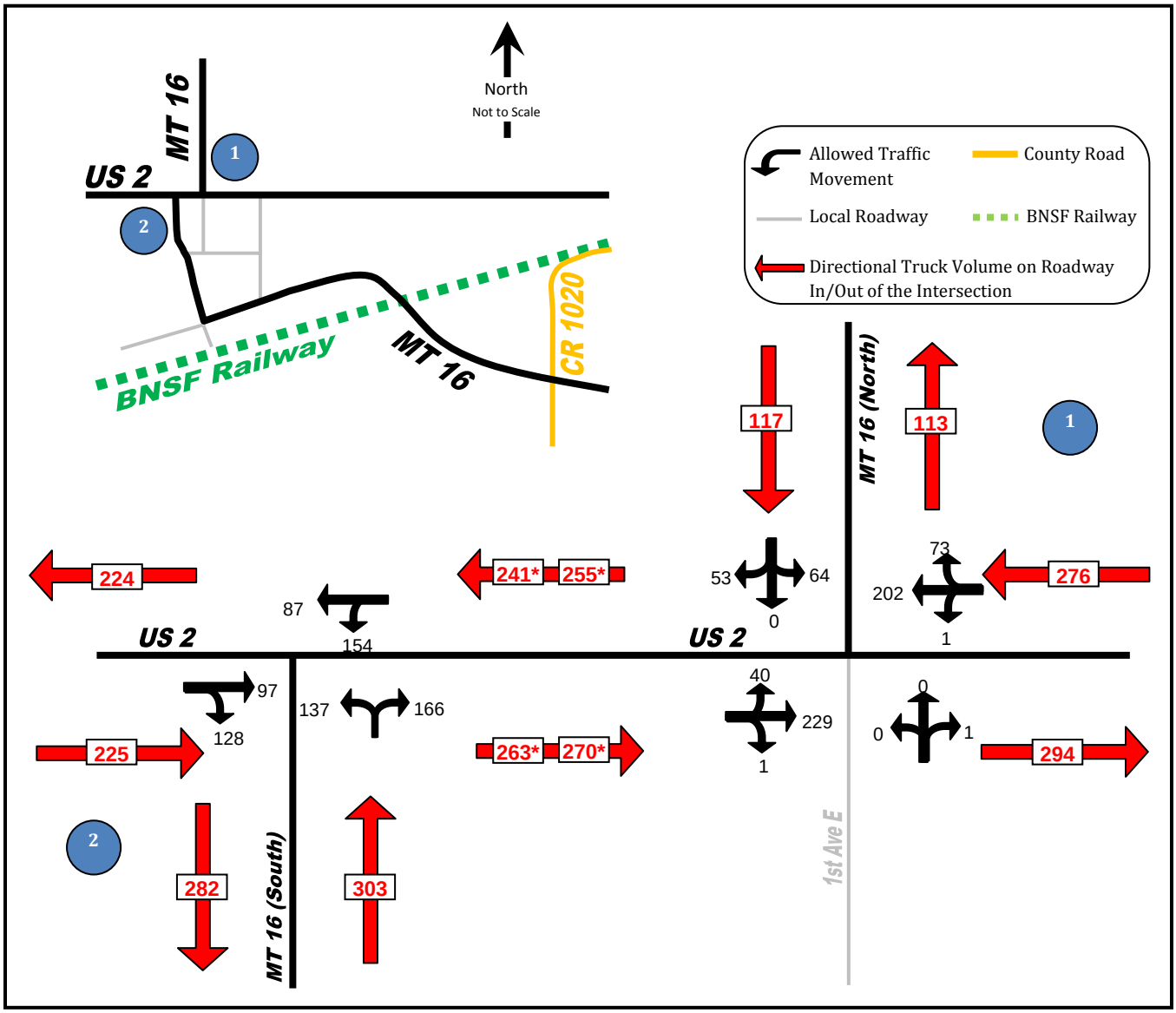
### 2.1.2 Truck Traffic Patterns

Truck traffic patterns would distinguish which region would help alleviate one of the Town of Culbertson's greatest concerns: truck traffic through Culbertson. Not only are there truck volume issues through Culbertson, but there are also a number of issues with trucks turning at both intersections of MT 16 with US 2. Truck turning issues include trucks using both lanes to make a turn, a delay in the ability to make the turn because of oncoming traffic and the truck drivers' need to use both lanes, and the increased queue of vehicles due to this delay. This screening criterion looks at which region has the highest potential to alleviate truck traffic volumes through Culbertson.

Turning movement counts were gathered at four locations within the Study area. Two of these turning movement counts were analyzed to gauge an overall picture of truck traffic patterns in the Study area.

The information in Figure 2 shows the highest volumes of trucks are entering / exiting US 2 east of MT 16 (north) and entering / exiting US 2 via MT 16 (South), essentially moving east and south.

**Figure 2. 24-hour Truck Traffic Patterns**




** Traffic counts were taken at different times for intersections 1 and 2 and therefore the combined volumes in and out of these intersections do not match.*

Truck traffic patterns were measured in the following manner:

| Rating Factor | Rating Factor Description |
|---|---|
| Yes | Has the highest potential to reduce both truck traffic through Culbertson and turning movements within Culbertson. |
| No | Has the lowest potential to reduce both truck traffic through Culbertson and turning movements within Culbertson. |

In looking at the truck traffic patterns shown in Figure 2, it appears that either as a leg volume or individual turning movements, all truck volumes entering/exiting the east are higher than those entering/exiting the west. By adding the volumes associated with an eastern or western region route, this screening criterion can determine which route would better reduce truck traffic through and turning movements within Culbertson. The western region route has the potential to divert 53 trucks from the north-to-west turning movement, 40 trucks from the west-to-north turning movement, 128 trucks from the west-to-south turning movement, and 137 trucks from the south-to-west turning movement, for a total of 358 trucks. The eastern region route has the potential to divert 73 trucks from the east-to-north turning movement, 64 trucks from the north-to-east turning movement, 166 trucks from the south-to-east turning movement, and 154 trucks from the east-to-south turning movement, for a total of 457 trucks. The eastern region has the potential to reduce the most trucks and their turning movements from Culbertson.

## 2.2 *First Level Screening Results*

The results of the first level of screening are shown in Table 2. This screening process helped identify which region would alleviate the most truck traffic through Culbertson and which region could be dropped from further consideration.

**Table 2. First Level Screening Results**

| Truck Route Region | Screening Criteria | | Advanced to Second Level Screening |
|---|---|---|---|
| | ***Accessibility to Weigh Scale*** | ***Truck Traffic Patterns*** | |
| Western Region | No | No | No |
| Eastern Region | Yes | Yes | Yes |

Because the Eastern Region has the highest potential to alleviate truck traffic through Culbertson, it has been forwarded to the next phase: Alternate Route Identification. It should be noted that even if the western truck route region was broken into northwest and southwest areas, trucks would still need to travel to the weigh scale and ultimately these routes would not be effective in alleviating truck traffic on Broadway Avenue.

# Chapter 3 Alternate Truck Route Identification

This chapter presents the process used to develop potential alternate truck routes to US 2 and MT 16 on the eastern side of Culbertson. Alternate routes within the eastern region were identified based on input from the local government, community members, and engineering constructability. The alternate routes identified within this Technical Memorandum will be included in the Corridor Study Report document and will be forwarded to the screening process. The identification of alternate routes is necessary to determine which route locations are most relevant to carry forward into the secondary screening process to determine whether a single, feasible alternate route is possible.

To reduce truck impacts through Culbertson the most significantly, it would appear that an eastern region route consisting of both a northern segment and a southern segment together would be the most beneficial. Although each alternate route on its own could reduce some amount of truck traffic, together they could provide the most benefit and eliminate turning movement issues at the current intersections of MT 16 with US 2. This chapter investigates the individual alternate truck routes and then investigates whether the benefits of a northern and southern route together would outweigh the environmental and financial cost to the community.

Planning level cost estimates were developed for each alternate truck route. These costs are for construction only and are shown in 2012 dollars. Planning-level cost estimates do not include right-of-way acquisition, utility relocation, preliminary or construction engineering. These estimates reflect roadway costs and a bridge construction cost to arrive at the planning level cost estimates for each alternate route. The calculations by which the planning level cost estimates were derived are shown in Appendix A of this Technical Memorandum.

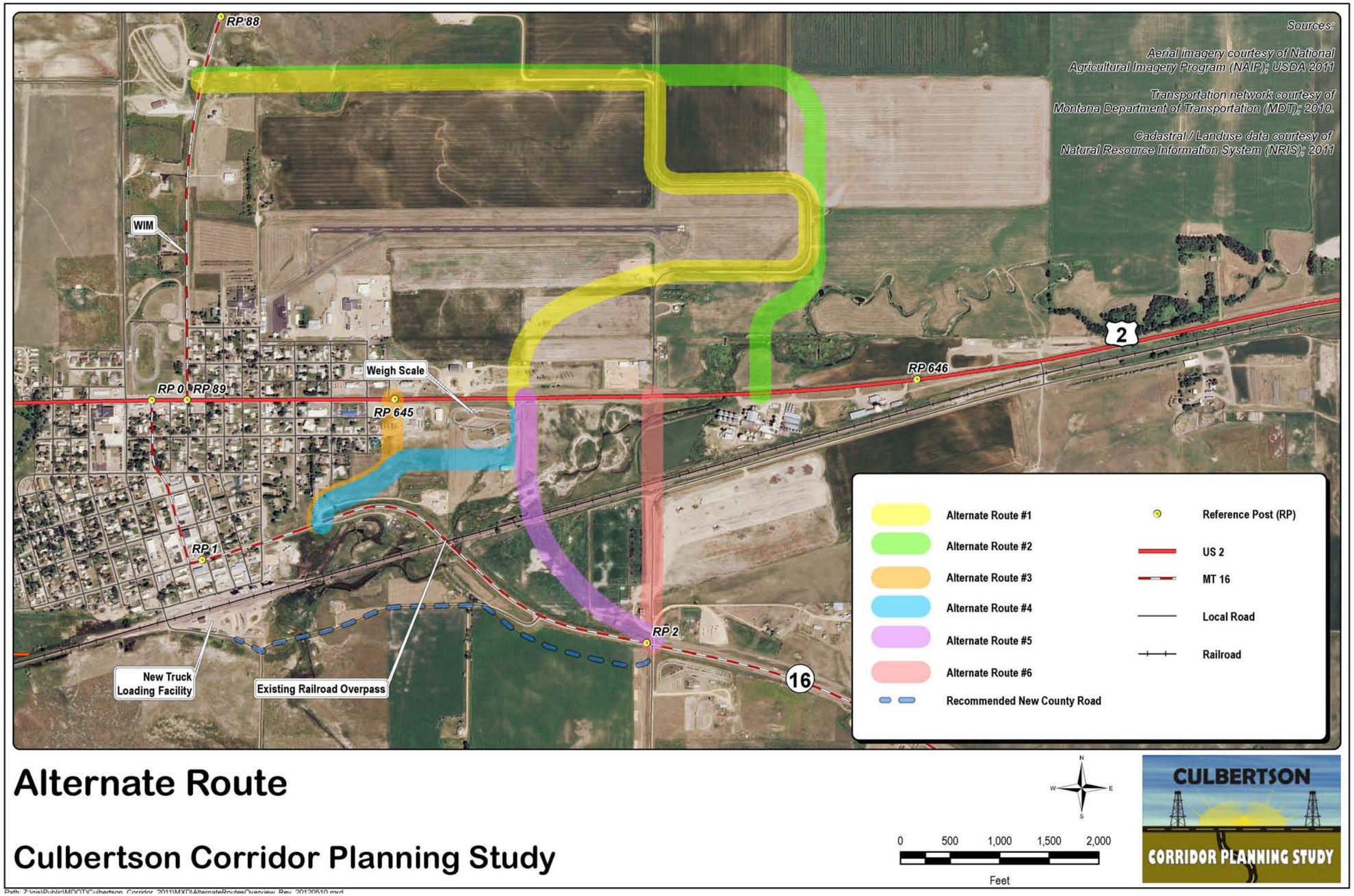



**Figure 3. Alternate Route Overview Map**

## 3.1 *Alternate Route #1*

This route starts on the north side of US 2 at the weigh scale entrance at approximate RP 645.2. This route heads northeast and follows County Road 1019 curving around the Big Sky Field property for approximately 1.33 miles where it turns west for approximately 0.87 miles until it intersected MT 16 (north) near RP 88.1. The total length for this alternate route would be approximately 2.2 miles. The estimated cost for this alternate route would range from $3.1 to $3.7 million dollars.

Alternate Route #1 was developed in order to avoid established, built facilities to the extent practicable and to use the existing County Road 1019 that has already been established. Because this route starts directly across from the weigh scale, it reduces the need for trucks to backtrack along US 2. This route would avoid wetlands, the airport, hazardous materials sites, and 4(f) and 6(f) sites. This route would not impact any residential or industrial structures but would require new right-of-way along its entirety. Bridges or large culverts would be necessary to cross two blue line intermittent streams and adjacent floodplains would be impacted. This route has the potential to encroach on habitat for the Whooping Crane and would impact farmland of statewide importance. This route has many sharp turns that would need to be lengthened during final design, possibly making this route longer.

## 3.2 *Alternate Route #2*

Starting on US 2 at approximate RP 645.7, Alternate Route #2 would curve northeast for approximately 0.31 miles where it would follow the existing County Road 1019 and head north for approximately 0.37 miles before turning west for approximately 1.11 miles until it intersects MT 16 (north) at approximate RP 88.1. The total length for this alternate route would be approximately 1.8 miles. The estimated cost for this alternate route would range from $2.8 to $3.3 million dollars.

Alternate Route #2 was developed in order to avoid impacts to the airport and minimize impacts to Clover Creek to the extent practicable. This route would avoid wetlands, hazardous material sites, and 4(f) and 6(f) sites. This route would not impact any residential or industrial structures but would require new right-of-way along its entirety. Bridges or large culverts may be necessary to cross two blue line intermittent streams and Clover Creek and adjacent floodplains would be impacted. This route has the potential to encroach on habitat for the Whooping Crane. This route would impact farmland of statewide importance, and the primary land use type along this route is agricultural rural. It should be noted that because this route does not line up with the weigh scale, trucks would need to backtrack along US 2 before proceeding to their destination.

## 3.3 *Alternate Route #3*

Starting on US 2 at approximate RP 645.0, Alternate Route #3 would head south for approximately 0.12 miles and arc southwest for approximately 0.20 miles until it intersects MT 16 (south) at a right angle at approximate RP 1.2. This connection with MT 16 (south) would allow for less cut and fill because this is the closest level point west of the current overpass structure. The total length for this alternate route would be approximately 0.32 miles. The estimated cost for this alternate route would range from $0.7 to $0.8 million dollars.

Alternate Route #3 was developed in order to avoid impacts to Clover Creek, BNSF Railway, residential and industrial areas, and based on public input. Although this route currently avoids residential and industrial areas, it has received recent interest in developing the area to include a potential motel and large RV park. This route would not impact wetlands, floodplains, waterways, hazardous material sites, 4(f) and 6(f) sites, or farmland. This route would provide the shortest distance to link US 2 and MT 16 and would utilize an existing approach along MT 16 and impact a portion of vacant rural land. There is currently an existing man camp located south of US 2, near RP 645, that should be minimized to the extent practicable. This route has the potential to encroach on the Western Hog-nosed Snake and habitat for the Whooping Crane. It should be noted that because this route does not line up with the weigh scale, trucks would need to backtrack along US 2 before proceeding to their destination. Addressing any sight distance issues with the connection to MT 16 (south) would be determined during final design if this alternate route is forwarded from this study.

## 3.4 *Alternate Route #4*

This route starts at the weigh scale entrance at approximate US 2 RP 645.2. This route would follow the existing weigh scale road for approximately 0.10 miles where it would skirt the rest area buildings and turn west approximately 0.23 miles and head southwest for approximately 0.21 miles where it intersects MT 16 (south) at a right angle at approximate RP 1.2. This connection with MT 16 (south) would allow for less cut and fill because this is the closest level point west of the current overpass structure. The total length for this alternate route would be approximately 0.54 miles. The estimated cost for this alternate route would range from $1.0 to $1.2 million dollars.

Alternate Route #4 was developed based on public input and would avoid impacts to Clover Creek, BNSF Railway, and residential and industrial areas. Although this route currently avoids residential and industrial areas, it has received recent interest in developing the area to include a potential motel and large RV park. In addition, this route would not impact wetlands, floodplains, waterways, hazardous material sites, 4(f) and 6(f) sites, or farmland. Alternate Route #4 would provide a direct connection to the weigh scale. Because this route starts directly across from the weigh scale, it reduces the need for trucks to backtrack along US 2. The route would utilize an existing approach along MT 16 and impact a portion of vacant rural land. The majority of this route exists on State of Montana land. This route has the potential to encroach on the Western Hog-nosed Snake and habitat for the Whooping Crane. Addressing any sight distance issues with the connection to MT 16 (south) would be determined during final design if this alternate route is forwarded from this study.

## 3.5 *Alternate Route #5*

This route is a north-south connection starting on US 2 at the weigh scale at approximate RP 645.2 and proceeds south and east to where a perpendicular overpass for the BNSF railway would be needed. The route would continue to travel southeast until it intersected MT 16 (south) at RP 2.0. The total length for this alternate route would be approximately 0.59 miles. A new railroad overpass is required for this alternate route in order to provide adequate vertical clearance of the railroad and Clover Creek. A floodplain is located along Clover Creek. The estimated cost for this alternate route would range from $2.9 to $3.5 million dollars.

Alternate Route #5 was originally developed based on public input and direct access to the weigh scale. Because this route starts directly across from the weigh scale, it reduces the need for trucks to backtrack along US 2. Alternate Route #5 was slightly modified to allow for a more constructible route that would avoid both a built-up elevation of and skewed intersection with the current overpass. A large portion of the land along this route is located on State of Montana property and the rest is on either agricultural rural or vacant rural land. This route would not impact wetlands, hazardous material sites, or farmland. This alignment has the potential to encroach on habitat for the Whooping Crane.

## 3.6 *Alternate Route #6*

This route is a straight north-south alignment between MT 16 (south) and US 2 that was recommended by the community. This route would start on US 2 at approximate RP 645.5 and head south where it would connect to and continue along County Road 1020 until it intersects US 2 at RP 2.0. An overpass would need to be constructed for this route over the BNSF Railway. The total length for this alternate route would be approximately 0.47 miles. The estimated cost for this alternate route would range from $4.6 to $5.5 million dollars.

Alternate Route #6 was developed based on public input and the use of existing County Road 1020. This route would utilize the existing County Road for approximately 0.25 miles and then require a new railroad overpass. This route would impact the wetland area and Clover Creek located between BNSF Railway and US 2. Consideration should be given to the design of the overpass and determine the level of impact the end of the structure may have on the wetland and/or Clover Creek as well as the proximity to US 2. This route is located approximately 0.15 miles east of the weigh scale. Alternate Route #6 does not impact farmland, floodplains, and 4(f) or 6(f) properties. The route has the potential of impacting a hazardous material site (Montola Growers Inc.). This alignment has the potential to encroach on habitat for the Whooping Crane. It should be noted that because this route does not line up with the weigh scale, trucks would need to backtrack along US 2 before proceeding to their destination.

## 3.7 *New SE County Road*

The new County Road alignment was brought forth by the local government officials as a necessity to address the projected truck traffic expected from the new loading facility located south of the railroad tracks and southwest of MT 16 (south). There are two current routes to the new loading facility: across the at-grade railroad crossing off 1st Street West or County Road 2059. County Road 2059 is not a preferred route for trucks because of the steep grade leading up to the intersection with MT 16 (south). In an attempt to avoid truck usage of the at-grade crossing located off 1st Avenue West, the local government officials recommended a new route.

Starting on MT 16 (south) at RP 2.0, the new County Road alignment would generally parallel MT 16 (south) for approximately 0.38 miles at which time it would meet and use the existing County Road 2059 for approximately 0.47 miles. This route would avoid to the extent practicable the steepest elevation changes associated with the adjacent overpass. The total length for this alternate route would be approximately 0.85 miles.

This new County Road alignment would impact a blue line intermittent stream, floodplain, and wetlands. There is a small potential for impacts to farmland of statewide importance near the intersection of MT 16. This alignment has the potential to encroach on the Eastern Red Bat and habitat for the Whooping Crane.

## 3.8 *Necessity of Improvement Options with Implementation of Alternate Route*

In order to determine if improvement options would still be necessary after an alternate route was implemented, each improvement option was analyzed against each alternate route. To determine if a combination of a northern and southern route would provide additional benefits, each improvement option was analyzed against a north/south alternate route combination. It should be noted that no specific north and south alignment were determined, but rather a conceptual analysis of any combination of north and south options was performed. Table 3 shows which improvement options would still be necessary if each respective alternate route was implemented.

**Table 3. Improvement Options Still Necessary with Implementation of Alternate Route**

| Improvement Options | Individual Alternate Routes | | | | | | Combination |
|---|---|---|---|---|---|---|---|
| | #1 | #2 | #3 | #4 | #5 | #6 | North and South |
| 1. Urban Amenities on MT 16 and US 2 | X | X | X | X | X | X | X |
| 2. Flashing Pedestrian Beacon | X | X | X | X | X | X | X |
| 3. Non-Motorized Transportation Plan | X | X | X | X | X | X | X |
| 4. "Share the Road" Signs | X | X | X | X | X | X | X |
| 5. Bulb-Out at MT 16 (South) & 2nd Street | | | | | | | |
| 6. Geometric Upgrade of MT 16 (north) / US 2 Intersection* | X | X | X | X | X | X | |
| 7. Upgrade MT 16 (south) / US 2 Intersection | X | X | | | | | |
| 8. MT 16 (North) Realignment | X | X | X | X | X | X | |
| 9. Sight Distance Improvements at Project Intersections | X | X | X | X | X | X | X |
| 10. Four Lane US 2** | X | X | X | X | X | X | X |
| 11. 7th Street Couplet** | X | X | X | X | X | X | X |
| 12. 8th Street Couplet** | X | X | X | X | X | X | X |
| 13. Weigh-in-Motion Systems* | X | X | | | | | X |
| 14. Access Management Plan | X | X | X | X | X | X | X |
| 15. US 2 Speed Study | X | X | X | X | X | X | X |

**Note: Because at least 15 percent of trucks currently proceed to the weigh scale before proceeding to their destination, it is likely that trucks would use the current MT 16 (north) through the current WIM system instead of directly to the weigh scale as this has the potential to shorten their trip.*

***Note: Only one of these 4-lane options would be implemented, not all three.*

It was determined that all pedestrian improvement options related to US 2 would still be necessary even if an alternate route was implemented because traffic, both heavy vehicles and other vehicles, would still use US 2. An access management plan would also be necessary due to the traffic on US 2, regardless of the alternate route. As noted by the double asterisk following Table 3, only one four-lane facility option would be recommended to address functional issues along US 2. As far as improvement options are concerned, the only benefit to combining a northern and southern alternate route would be to possibly eliminate intersection upgrades to the intersections of MT 16 with US 2 and to eliminate the realignment of MT 16 (north).

# Chapter 4 Second Level Screening

In order to determine the preferred alternate route(s), the six alternate routes developed in the eastern region were screened through a second level of criteria. The screening process relied on evaluating these alternate routes using three criteria. The three criteria are as follows:

Analysis No. 1 – Travel Time: Because drivers tend to take the shortest route to their destination, each alternate route was studied against the current route of trucks to see if the time between points would provide a benefit or add travel time.

Analysis No. 2 – Impacts: Each alternate route was assessed to determine if there was a substantial order of magnitude difference in impacts between various alignments.

Analysis No. 3 – Construction Cost Comparison (in 2012 dollars): This analysis is used to document the order of magnitude planning level costs for each alternate route. These costs reflect the planning level roadway costs assigned in the previous section.

For each criterion, the six alignments were given a numerical rating value of one to six, with one denoting the best option. The analysis of the three screening criteria is described in the following sections and presented in Table 8.

## 4.1 *Travel Time*

Because drivers tend to take the shortest route to their destination, each alternate route was studied against the current route of trucks to see if the travel time between points would provide a benefit or add time of travel. Since all trucks need to proceed to the weigh scale, all travel time was determined to be from the entrance of the weigh scale to the intersection along either US 2 or MT 16 at which the alternate route leaves the main thoroughfare.

The travel time for each route was computed based on the different posted speeds along each route and the length of travel at each speed variation. Approach delays were also considered. Figure 4 shows the locations at which approach delays were considered. It should be noted that approach delays were only calculated for four intersections through level of service analysis. Table 4 shows the approach delays calculated for these four intersections. All other approach delays were assumed based on the results of the four studied intersections. The assumptions for the intersections that were not calculated by traffic modeling include the following approach delays:

- 0 Seconds – Right turning movement from major leg to minor leg.
- 2 Seconds – Left turning movement from major leg to minor leg.
- 5 Seconds – Right turning movement from minor leg to major leg.
- 10 Seconds – Left turn from minor leg to major leg or thru movement across major leg from minor leg to minor leg.

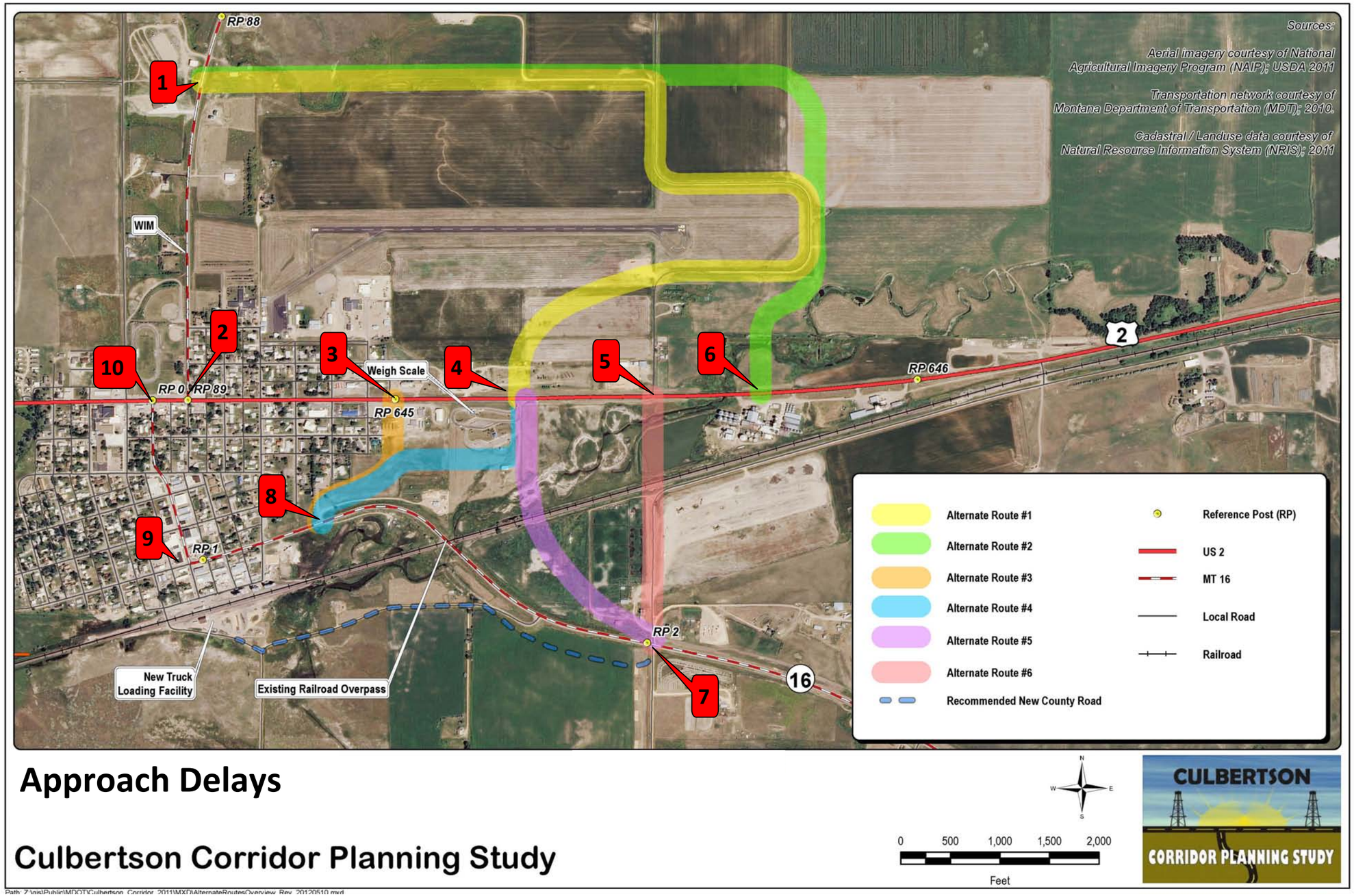



**Figure 4. Approaches with Delays**

**Table 4. Calculated Approach Delays**

| Approach No. (per Figure 4) | Intersection Description | Leg | Approach Delay* (seconds) |
|---|---|---|---|
| **2** | MT 16 (north) / US 2 | NB | 10.6 |
| | | SB | 10.5 |
| | | EB | 2.3 |
| | | WB | 0.3 |
| **7** | MT 16 (south) at RP 2.0 / County Road 1020 | NB | 9.3 |
| | | SB | 9.5 |
| | | EB | 0.6 |
| | | WB | 0 |
| **9** | MT 16 (south) / 1st Street / Broadway Avenue | NB | 7.6 |
| | | SB | 0 |
| | | EB | 10.9 |
| | | WB | 9.5 |
| **10** | MT 16 (south) / US 2 | NB | 10.6 |
| | | EB | 0 |
| | | WB | 3.5 |

**Note: The approach delays were calculated using HCS level of service modeling.*

In order to provide a comparative analysis of the alternate routes, the northern alternate routes were measured against the current northern route from RP 88.1 on MT 16(north) to the weigh scale along US 2 at RP 645.2. Similarly, the southern alternate routes were measured against the current southern route from RP 2.0 on MT 16 (south) to the weigh scale. Table 5 shows a breakdown of the distance, respective speed limit, and approach delay(s) equating to the total travel time of each alternate route and each current route. Each alternate route was compared to the current route to determine if the alternate route would add or reduce time of travel. A negative value in the difference column denotes the time saved by using the respective alternate route.

**Table 5. Travel Time Rating**

| Alternate Route | Route Distance (miles) | Associated Speed (MPH) | Average Approach Delay(s) (seconds)* | Total Time (seconds) | Time Difference (seconds | Rating** |
|---|---|---|---|---|---|---|
| **Current Northern Route** | 0.27 | 65 | 11 | 132 | 0 | N/A |
| | 0.32 | 45 | | | | |
| | 0.30 | 35 | | | | |
| | 0.35 | 25 | | | | |
| **Alternate Route #1** | 2.2 | 55 | 13 | 157 | +25 | 5 |
| **Alternate Route #2** | 2.25 | 55 | 13 | 160 | +28 | 6 |
| **Current Southern Route** | 0.25 | 65 | 17 | 228 | 0 | N/A |
| | 0.60 | 45 | | | | |
| | 0.40 | 35 | | | | |
| | 0.75 | 25 | | | | |
| **Alternate Route #3** | 0.25 | 65 | 16 | 137 | -91 | 3 |
| | 0.40 | 45 | | | | |
| | 0.28 | 35 | | | | |
| | 0.32 | 25 | | | | |
| **Alternate Route #4** | 0.25 | 65 | 5 | 137 | -91 | 3 |
| | 0.40 | 45 | | | | |
| | 0.08 | 35 | | | | |
| | 0.54 | 25 | | | | |
| **Alternate Route #5** | 0.59 | 55 | 5 | 43 | -185 | 1 |
| **Alternate Route #6** | 0.72 | 55 | 16 | 63 | -165 | 2 |

**Note: This analysis is the average of the delay experienced between the two directions of travel.*

***Note: This analysis was based on a numerical rating value of one to six, with one denoting the best option.*

## 4.2 *Impacts*

Impacted acreage for wetlands, floodplains, farmlands of statewide importance, and private right-of-way (ROW) were calculated for each alternate route. Acreage for each resource was determined based on the following equation:

**Formula 1:**

$$acres = \frac{length\ of\ roadway(mi) * 5280\,\frac{ft}{mi} * 80ft\ ROW\ from\ centerline * 2sides}{43{,}560\,\frac{ft^2}{acre}}$$

It should be noted that right-of-way calculations for alternate routes 1 and 2 did not include the locally-owned areas near the airport or near the rodeo grounds. Similarly, alternate routes 4 and 5 did not include the MDT-owned parcel surrounding the weigh scale.

All alternate routes have the potential to impact Whooping crane habitat; therefore, all alternate routes show at least one species of concern (SOC) impacted. In addition to the Whooping crane habitat, alternate routes 3 and 4 would also impact the hog-nosed snake. Any alternate route would need to clearly avoid the BNSF Railway via an overpass because the BNSF Railway is considered a 4(f) resource. No other 4(f) resources are located in the vicinity of the proposed alternate routes. Alternate Route #6 would impact the hazardous waste site previously owned by Montola Growers, Inc. For purposes of this study, ROW widths were based on 80 feet each side of centerline, which is the typical width for the type of roadway facility anticipated for each alternate route.

An alternate route's ability to reduce truck traffic was also computed. It should be noted that all northern alternate routes would reduce the same number of trucks and all southern alternate routes would reduce the same number of trucks. The number of trucks each alternate route has the potential to reduce was determined from the turning movement counts on Figure 2. For the northern routes, alternate routes #1 and #2, it was assumed that the added travel time and travel distance of a northern route would not entice all 117 southbound truck drivers on MT 16 (north) to use the route because they may rather use the current route. These alternate routes may only capture the 64 trucks heading east from MT 16 (north) and the 73 trucks heading north from the weigh scale. As such, these alternates route would draw only 137 trucks per day. Alternate routes 3-6 would have the potential to draw trucks heading east from MT 16 (south) (166 trucks per day), trucks heading south from US 2 (154 trucks per day), and trucks heading east through the MT 16 (south) / US 2 intersection if their reason for heading east was to access the weigh scale (97 trucks per day). Alternate routes 3-6 have the potential to draw up to 417 trucks per day off of MT 16 (south) and US 2. Table 6 shows the alternate route ratings and the comparative impact analysis.

**Table 6. Impacts Rating**

| Alternate Route | Wetland (acres) | Rating* | Floodplain (acres) | Rating* | Farmland (acres) | Rating* | Private ROW** (acres) | Rating* | Species of Concern Impacted | Rating* | Hazardous-Waste Sites | Rating* | Truck Traffic Reduction (trucks/day) | Rating* | Total Rating | Overall Rating* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Alternate Route #1** | 0 | **1** | 14.0 | **5** | 14.0 | **6** | 29.5 | **5** | 1 | **1** | 0 | **1** | 137 | **5** | 24 | **5** |
| **Alternate Route #2** | 0 | **1** | 14.0 | **5** | 12.4 | **5** | 34.3 | **6** | 1 | **1** | 0 | **1** | 137 | **5** | 24 | **5** |
| **Alternate Route #3** | 0 | **1** | 0 | **1** | 0 | **1** | 7.0 | **1** | 2 | **5** | 0 | **1** | 417 | **1** | 11 | **1** |
| **Alternate Route #4** | 0 | **1** | 0 | **1** | 0 | **1** | 7.0 | **1** | 2 | **5** | 0 | **1** | 417 | **1** | 11 | **1** |
| **Alternate Route #5** | 0 | **1** | 1.8 | **4** | 0 | **1** | 8.1 | **3** | 1 | **1** | 0 | **1** | 417 | **1** | 12 | **3** |
| **Alternate Route #6** | 2.2 | **6** | 0 | **1** | 0 | **1** | 10.3 | **4** | 1 | **1** | 1 | **6** | 417 | **1** | 20 | **4** |

**Note: This analysis was based on a numerical rating value of one to six, with one denoting the best option.*

***Note: Private right-of-way was calculated using Formula 1; however, for alternate routes 1, 2, 4, and 5, private right-of-way did not include the locally-owned areas near the airport or near the rodeo grounds, or the MDT-owned parcel surrounding the weigh scale.*

## 4.3 *Construction Cost Comparison*

As stated previously, planning level cost estimates were developed for each alternate route. These costs included construction costs only in 2012 dollars. The planning-level costs did not include right-of-way acquisition, utility relocation, preliminary or construction engineering. The costs reflect the planning level roadway costs and a planning level bridge construction cost to arrive at the planning level cost estimates for each alternate route. Each cost projection was inflated by a 20 percent contingency factor to account for preliminary engineering costs, construction engineering costs, and indirect cost accounting procedure costs. Table 7 shows the range of costs for the bridge, roadway, and combined costs.

**Table 7. Construction Cost Comparison Rating**

| Alternate Route | Bridge Cost | Roadway Cost | Total Cost | Rating* |
|---|---|---|---|---|
| **Alternate Route #1** | - | $3.1M to $3.7M | $3.1M to $3.7M | 5 |
| **Alternate Route #2** | - | $2.7M to $3.3M | $2.7M to $3.3M | 3 |
| **Alternate Route #3** | - | $0.7M to $0.8M | $0.7M to $0.8M | 1 |
| **Alternate Route #4** | - | $1.0M to $1.2M | $1.0M to $1.2M | 2 |
| **Alternate Route #5** | $2.1M to $2.5M | $0.8M to $1.0M | $2.9M to $3.5M | 4 |
| **Alternate Route #6** | $4.2M to $5.0M | $0.4M to $0.5M | $4.6M to $5.5M | 6 |

**Note: This analysis was based on a numerical rating value of one to six, with one denoting the best option.*

## 4.4 *Recommendation for Alternate Routes to Carry Forward*

After review and analysis of all the information, it is recommended to carry forward two individual alternate routes for further consideration as a project moves forward from this study. A summary of the second level of screening is shown in Table 8.

**Table 8. Second Screening Summary**

| Alternate Route | Travel Time Rating* | Impacts Rating* | Construction Cost Rating* | Total Rating |
|---|---|---|---|---|
| **Alternate Route #1** | **5** | **5** | **5** | 15 |
| **Alternate Route #2** | **6** | **5** | **3** | 14 |
| **Alternate Route #3** | **3** | **1** | **1** | 5 |
| **Alternate Route #4** | **3** | **1** | **2** | 6 |
| **Alternate Route #5** | **1** | **3** | **4** | 8 |
| **Alternate Route #6** | **2** | **4** | **6** | 12 |

**Note: This analysis was based on a numerical rating value of one to six, with one denoting the best option.*

The second level of screening showed Alternate Route #5 rating below alternate routes #3 and #4 due to cost. Although Alternate Route #5 has a higher construction cost, the option would provide trucks with a more direct connection to the weigh scale by eliminating curves and reducing travel time. Intersecting MT 16 (south) near RP 2, Alternate Route #5 provides trucks with convenient access to the new grain loading facility. For these reasons, the Town of Culbertson noted that Alternate Route #5 was their preferred alternate route. In terms of long-range planning, the Town of Culbertson noted that Alternate Route #5 provided for a route in line with their 50 year plan. Additionally, alternate routes #3 and #4 may not be viable options in the near future due to their location relative to the community and projected development in the area. For these reasons alternate routes #3 and #4 have been eliminated from further consideration at this time.

Because Alternate Route #5 is located south of US 2 and east/north of MT 16 (south), it has the potential to alleviate the most truck traffic through Culbertson. Alternate Route #5 is the most feasible route because of its close proximity to the weigh scale, its relatively low cost of construction, and its small number of impacts. For these reasons and those noted above, Alternate Route #5 was retained to be carried forward if a project moves forward from this study. Because there is a viable alternate route with fewer impacts, a lower cost, and better travel time located in the same area, Alternate Route #6 have been eliminated from further consideration at this time.

Although a northern and southern route combination would appear to minimize truck turning movements at the intersections of MT 16 and US 2 and would conceptually provide the most benefit, it was determined that since neither of the northern alternate routes would provide a benefit to travel time or to overall truck volumes, a northern/southern route combination would not provide an equitable benefit for the cost and impacts of construction. The option to pair a northern and southern route together is not recommended at this time. For these reasons and the analysis provided above, alternate routes #1 and #2 have been eliminated from further consideration at this time.

Appendix A:
Cost Estimating Spreadsheet

**Culbertson Corridor Planning Study**

**Second Level Screening Matrix - PLANNING LEVEL COST ESTIMATES**

**May 15, 2012**

***Roadway Construction Costs***

| | Total Route Length (mile) | Clover Creek/BNSF Bridge Length (mile) | Rural Route on Existing Alignment* (mile) | Rural Route on New Alignment (mile) | Urban Route(mile) | Cost of Actual Roadway | |
|---|---|---|---|---|---|---|---|
| Alternate Route #1 | 2.20 | 0 | 1.12 | 1.08 | | $3,072,000 | |
| Alternate Route #2 | 1.80 | 0 | 0.34 | 1.46 | | $2,744,000 | |
| Alternate Route #3 | 0.32 | 0 | | | 0.32 | $704,000 | |
| Alternate Route #4 | 0.54 | 0 | 0.06 | 0.21 | 0.27 | $1,002,000 | |
| Alternate Route #5 | 0.59 | 0.09 | 0.07 | 0.43 | | $773,576 | |
| Alternate Route #6 | 0.47 | 0.17 | 0.27 | 0.03 | | $368,242 | |

**Existing Alignment assumes route will follow an established roadway facility.*

***Bridge Construction Costs***

| | Clover Creek/BNSF Bridge Length (feet) | Total Bridge Area* ($ft^2$) | Cost per $Ft^2$ | Cost of Bridge | | |
|---|---|---|---|---|---|---|
| Alternate Route #5 | 470 | 18800 | 115 | $ | 2,162,000 | *Assumes continuous span over BNSF and Clover Creek.* |
| Alternate Route #6 | 910 | 36400 | 115 | $ | 4,186,000 | *Assumes continuous span over BNSF, Clover Creek, and Wetland.* |

**Bridge surface width is assumed to be 40 feet to match roadway top width. Location of bridge ends are assumed to be 100 feet from Clover Creek and/or BNSF railway centerline according to available satellite imagery.*

**Cost Estimate Assumptions *(provided by MDT Glendive District)*:**

*40' Top Width*
*5" Asphalt*
*22" of Gravel & Average Grading Amounts*

| | | |
|---|---|---|
| Rural Reconstruction on New Alignment = | $1,600,000 | mile |
| Rural Major Rehabilitation on Existing Alignment = | $1,200,000 | mile |
| Urban Major Rehabilitation on Existing Alignment = | $2,200,000 | mile |
| New Bridges = | $115 | $ft^2$ |

| | TOTAL COST | w/20% Cont. | RANGE OF PLANNING COSTS | | |
|---|---|---|---|---|---|
| Alternate Route #1 | $3,072,000 | $3,686,400 | $3.1 M | to | $3.7 M |
| Alternate Route #2 | $2,744,000 | $3,292,800 | $2.8 M | to | $3.3 M |
| Alternate Route #3 | $704,000 | $844,800 | $704 K | to | $845 K |
| Alternate Route #4 | $1,002,000 | $1,202,400 | $1.0 M | to | $1.2 M |
| Alternate Route #5 | $2,935,576 | $3,522,691 | $2.9 M | to | $3.5 M |
| Alternate Route #6 | $4,554,242 | $5,465,091 | $4.6 M | to | $5.5 M |