

Appendix D

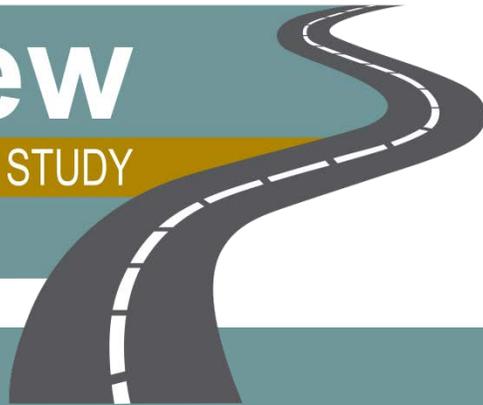
Improvement Options Report



February 2016

Fairview

CORRIDOR PLANNING STUDY



Improvement Options Report

Prepared for:



Prepared by:



Contents

1.0	Introduction	1
2.0	Needs and Objectives	3
3.0	New Alignments	3
3.1	Quantm Modeling	3
3.2	Alternative Scenarios	8
3.3	Screening Parameters and Alternatives Analysis.....	13
3.4	Screening Parameters Considered But Not Forwarded	19
3.5	Alternative Screening	22
4.0	Existing Routes	24
4.1	Potential Improvement Options	24
4.2	Options Considered But Not Forwarded.....	25
4.3	Summary of Improvement Options for Existing Routes.....	26
5.0	References.....	27

Tables

Table 1.	Geometric Design Criteria - Rural Principal Arterials (NHS – Non Interstate) .	5
Table 2.	Cost Parameters	6
Table 3.	Avoid Zones.....	6
Table 4.	Special Zones	8
Table 5.	Route Length and Travel Time.....	14
Table 6.	At-grade Rail Crossings	14
Table 7.	Parcel Impacts and Right-of-Way Acquisition.....	15
Table 8.	NWI Wetland Impacts	15
Table 9.	Farmland Impacts	16
Table 10.	Irrigation Impacts	16
Table 11.	Access Point Density	17
Table 12.	Estimated Construction Costs	17
Table 13.	Total Intersection Treatment Costs	18
Table 14.	Total Project Development Costs.....	19
Table 15.	Impact, Cost, and Screening Summary.....	23
Table 16.	Summary of Improvements for Existing Routes	27

Figures

Figure 1. Study Area	1
Figure 2. Start/End Points	4
Figure 3. Avoid Zones	7
Figure 4. Routing Trends	9
Figure 5. Optimized Routing	12
Figure 6. RP 61.8 to RP 62.3 Potential Roadway Widening	24

Attachments

Attachment 1	Segment Analysis Worksheets
Attachment 2	Cost Estimate Spreadsheets
Attachment 3	AC Screening Survey

Abbreviations and Acronyms

ADA	Americans with Disabilities Act
CWA	Clean Water Act
DTM	Digital Terrain Model
FHWA	Federal Highway Administration
FPPA	Farmland Protection Policy Act
GIS	Geographic Information System
LOS	Level of Service
MDT	Montana Department of Transportation
MEPA	Montana Environmental Policy Act
NDDOT	North Dakota Department of Transportation
NEPA	National Environmental Policy Act
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
RP	Reference Post
Section 4(f)	Section 4(f) of the 1966 Department of Transportation Act
TRB	Transportation Research Board
USFWS	United States Fish and Wildlife Service

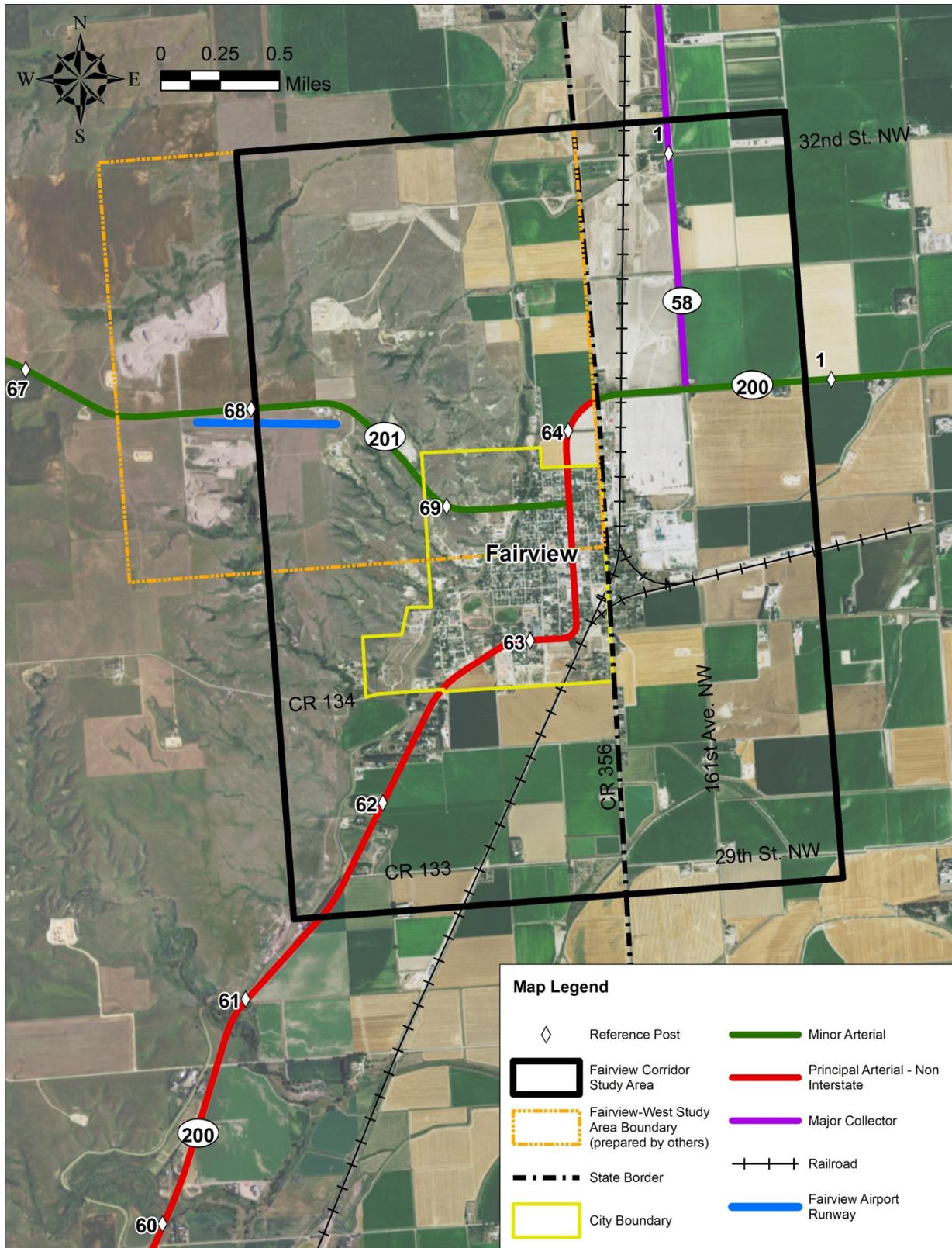
1.0 Introduction

The Montana Department of Transportation (MDT), in cooperation with the North Dakota Department of Transportation (NDDOT), City of Fairview, Richland County, Montana, McKenzie County, North Dakota, and the Federal Highway Administration (FHWA), initiated a corridor planning study to investigate options to alleviate truck traffic in the Fairview area. At the time the study was initiated, the increase in truck traffic in Fairview had been generated by development in the Bakken oil field in both Montana and North Dakota. The study area is illustrated in Figure 1 and includes MT 200, ND 200, ND 58, and the area immediately surrounding Fairview. MT 201 is being evaluated separately as part of another MDT study conducted by others (Fairview-West).

A corridor study is a planning-level assessment of a study area occurring before project-level environmental compliance activities under the National and Montana Environmental Policy Acts (NEPA/MEPA). There is no equivalent state-level environmental policy act in North Dakota. The planning study process is designed to identify potential transportation improvements and to facilitate a smooth and efficient transition from transportation planning to environmental review and potential project development. The process involves conducting a planning-level review of safety, operational, and environmental conditions to identify needs and constraints. It also allows early coordination with members of the public, resource agencies, and other interested stakeholders. This process is separate from the NEPA/MEPA environmental compliance documentation, design, right-of-way acquisition, and construction phases of an individual project. Depending on needs and funding availability, an improvement option may be forwarded from this planning-level study and developed into a project at a later date.

This improvement options report identifies potential alternative routes around the community of Fairview, as well as improvements to existing routes within the study area. Figure 1 outlines the study area boundary, roadways within the boundary, and their associated reference post (RP) numbers.

Figure 1. Study Area



Source: DOWL 2015.

2.0 Needs and Objectives

Needs and objectives for the Fairview Corridor Planning Study were developed based on existing and projected conditions within the corridor (including planned projects), input from the public and resource agencies, and coordination with the study advisory committee. Needs, objectives, and considerations are not listed in order of priority.

Need 1: Accommodate existing and projected transportation demands within the study area.

Objectives:

To the extent practicable:

- Meet desirable levels of service on roadway segments and at intersections through the 2035 planning horizon.
- Consider regional and local travel patterns.

Need 2: Provide transportation facilities that safely support travel for all modes.

Objectives:

To the extent practicable:

- Improve roadway and bridge elements to meet current design criteria.
- Improve continuity for pedestrian facilities on MT 200 within Fairview.
- Consider methods to reduce conflicts between local vehicular traffic and regional truck traffic.

Other Considerations

- Local planning efforts, planned projects, and potential future development in the study area.
- Potential impacts to railroad, utility, irrigation, and mining features.
- Potential adverse impacts to environmental resources that may result from improvement options.
- Funding availability.
- Temporary construction impacts.
- Construction feasibility and physical constraints.
- Seasonal variations in truck traffic.

3.0 New Alignments

3.1 Quantm Modeling

Trimble Quantm Alignment Planning System (referred to as Quantm in this report) is a software tool that generates planning-level alignments satisfying geometric, social, environmental, and terrain constraints. The Quantm system considers millions of route options before delivering a range of options that best meet planning needs and objectives, while balancing social and environmental impacts against cost scenarios. Route optimization is an iterative process allowing users to refine alignments to minimize impacts and reduce costs, in consideration of public and stakeholder feedback. To build the Quantm model, all available data was synthesized into a Geographic Information System (GIS) format. The available data included linear features, special zones, structure sizes, geometric standards, and the Digital Terrain Model (DTM).

Based on results of the origin-destination analysis conducted for the Fairview Corridor Planning Study, the alignment starting point was defined as the intersection of MT 200

and CR 133. The end point was defined as the intersection of ND 200 and ND 58. These locations are illustrated in Figure 2.

Figure 2. Start/End Points



Source: DOWL 2015.

Geometric Parameters

Engineering design parameters are used to specify elements such as roadway width, design speed, vertical grades, and horizontal curvature for new roadway alignments modeled in Quantm. For the Fairview Corridor Planning Study, new alignments were required to conform to criteria for rural principal arterials (National Highway System – Non Interstate) as defined in the MDT Road Design Manual. An undivided facility with two travel lanes and 8-foot shoulders, level terrain type, and 70 mile-per-hour (mph) design speed was specified for this effort. Design criteria are outlined in Table 1 below.

Table 1. Geometric Design Criteria - Rural Principal Arterials (NHS – Non Interstate)

Design Element		Design Criteria	
Design Controls	Design Forecast Year (Geometrics)	20 Years	
	Design Speed	Level Terrain 70 mph	
	Level of Service (LOS)	B	
Roadway Elements	Travel Lane Width	12 ft (<i>two travel lanes for this study</i>)	
	Shoulder Width	<i>Varies (8 ft for this study)</i>	
	Cross Slope	Travel Lane	2%
		Shoulder	2%
	Median Width	<i>Varies (none for this study)</i>	
Earth Cut Sections	Ditch	Inslope	6:1 (Width: 10 ft)
		Width	10 ft Minimum
		Slope	20:1 towards back slope
	Backslope; Cut Depth at Slope Stake for Level Terrain	0 to 5 ft	5:1
		5 ft to 10 ft	4:1
		10 ft to 15 ft	3:1
		15 ft to 20 ft	2:1
		> 20 ft	1.5:1
Earth Fill Slopes	Fill Height at Slope Stake	0 to 10 ft	6:1
		10 ft to 20 ft	4:1
		20 ft to 30 ft	3:1
		> 30 ft	2:1
Alignment Elements	Stopping Sight Distance		730 ft
	Passing Sight Distance		2480 ft
	Minimum Horizontal Curve Radius (e = 8%)		1810 ft
	Superelevation Rate		$e_{max} = 8.0\%$
	Vertical Curvature (K-Value) (for 70 mph design speed)	Crest Vertical Curve	247
		Sag Vertical Curve	181
	Maximum Grade	Level Terrain	3%
	Minimum Vertical Clearance		17 ft

Source: MDT RDM Chapter 12, Figure 12-3.

The selected design criteria for new alignments provide continuity with the existing MT 200 roadway, which is classified as a non-interstate principal arterial.

Cost Parameters

Quantm incorporates cost parameters for road construction features and right-of-way acquisition. Depending on the parameter, costs may be assigned by volume, area, linear unit, or by feature. For consistency, cost values generated for the Fairview-West project were used in the Fairview Corridor Planning Study, as presented in Table 2.

Table 2. Cost Parameters

Cost Parameter	Assigned Cost
Global Cost Zones	Pavement (Template Section): \$92/sf
	Earth movement:\$0.50/cy/mi for haul and \$3.50/cy for dump
	Fill: \$2/cy
	Cut: \$1.50/cy
	Bridge: \$150/sf
Area Cost Zones	Agricultural land: \$3,500/ac
	Commercial land: \$15,000/ac
	Residential land: \$1.50/sf plus an additional \$200,000 per parcel for total acquisition if a residence is affected.

Source: Fairview-West Alternative Alignment Analysis, 2015, and MDT Quantm output data files, provided October 2015. sf: square foot, cy: cubic yard, ac: acre, mi: mile.

A global cost zone covers the entire study area. An area cost zone increases the cost of construction to account for land acquisition within a specifically defined area.

Quantm Constraint Inputs

Quantm allows users to define specific constraints that limit or increase the cost of potential new alignments. Constraints such as socially- and environmentally-sensitive areas can be protected by defining these areas as avoid zones, or modeled by incorporating associated costs for purchase or mitigation.

Avoid Zones

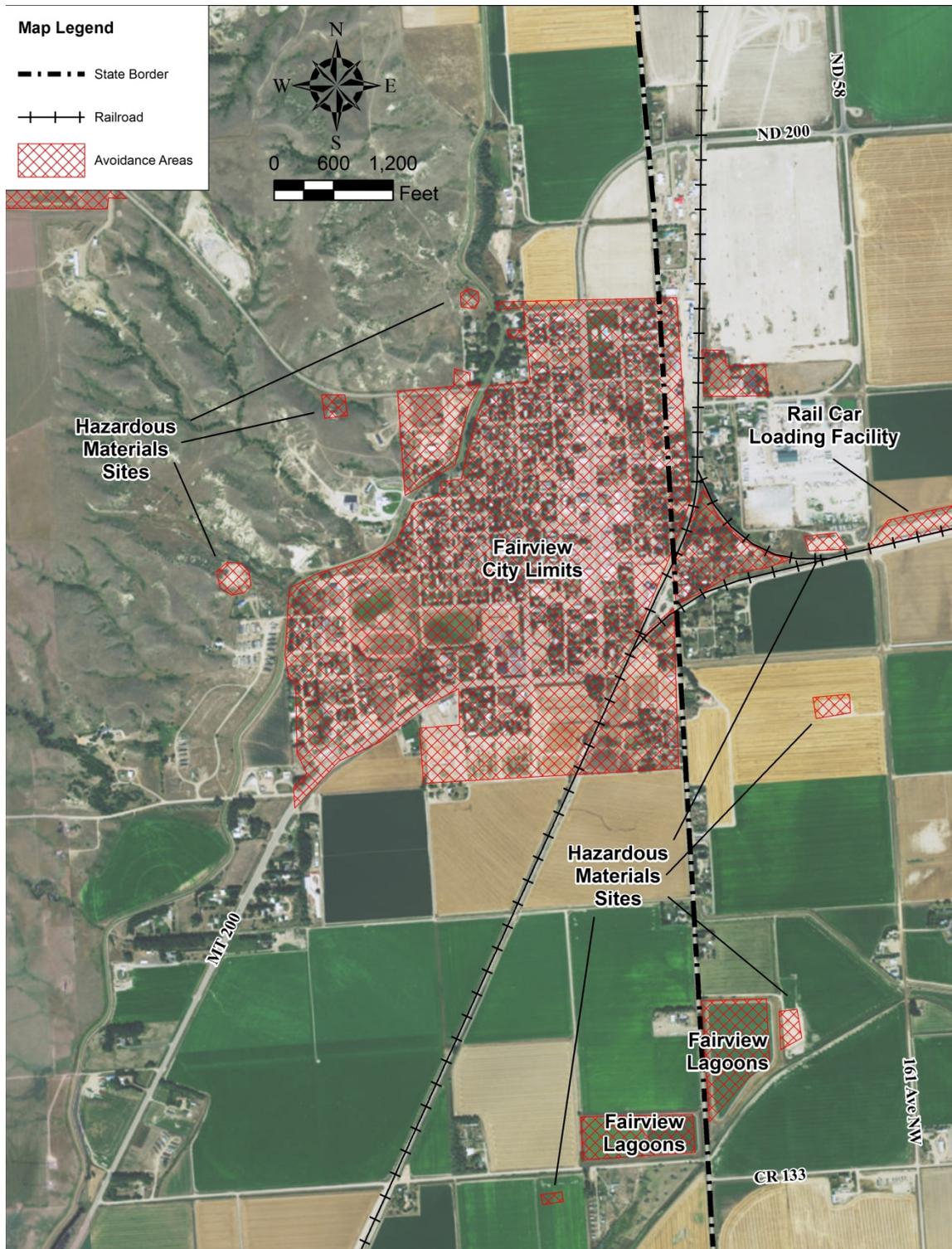
Avoid zones are assigned to areas of environmental and social importance that would be particularly difficult or costly to mitigate. Depending on the priority level assigned in Quantm, alignments will generally avoid entering these zones, which may result in increased alignment length and/or cost. Table 3 and Figure 3 present avoid zones defined for this study.

Table 3. Avoid Zones

Avoid Zone	Description
Fairview Limits	The intent of a new alignment is to provide an alternative to the existing MT 200 alignment within Fairview. By defining the area within the limits of Fairview as an avoid zone, new alignments are forced around the town.
Fairview Lagoons	The Fairview sewer lagoons are located just north of CR 133 at the intersection with CR 356.
Hazardous Materials Sites	A number of oils wells, injection disposal wells, and abandoned mines have been identified within the study area boundary. These features were modeled as avoid zones.
Rail Car Loading Facility	A railroad spur line and large material loading facility are located within the study area to the east of Fairview. This area was modeled as an avoid zone.

Source: MDT Quantm output data files provided October 2015.

Figure 3. Avoid Zones



Source: MDT Quantm output data files, provided October 2015.

Special Zones

A special zone is assigned to locations that would be more costly to mitigate compared to the default settings within the study area. Designation of a special zone increases the cost of construction within the zone boundary. Table 4 lists special zones defined for this study.

Table 4. Special Zones

Special Zone	Description
Irrigation Structures	Multiple irrigation structures including center pivots are located outside Fairview.
Wetlands	No large emergent, shrub-scrub, or forested wetlands were observed during the February 25, 2015, field review; however, dead wetland vegetation, including sedge, horsetail, and cattail, was observed along the edges of several irrigation ditches/canals within the study area.
At-grade Railroad Crossings	At-grade railroad crossings occur along the proposed eastern alignments. These crossings are located on County Road 133 and 161 Ave NW.

Source: MDT Quantm output data files provided October 2015.

Other Inputs

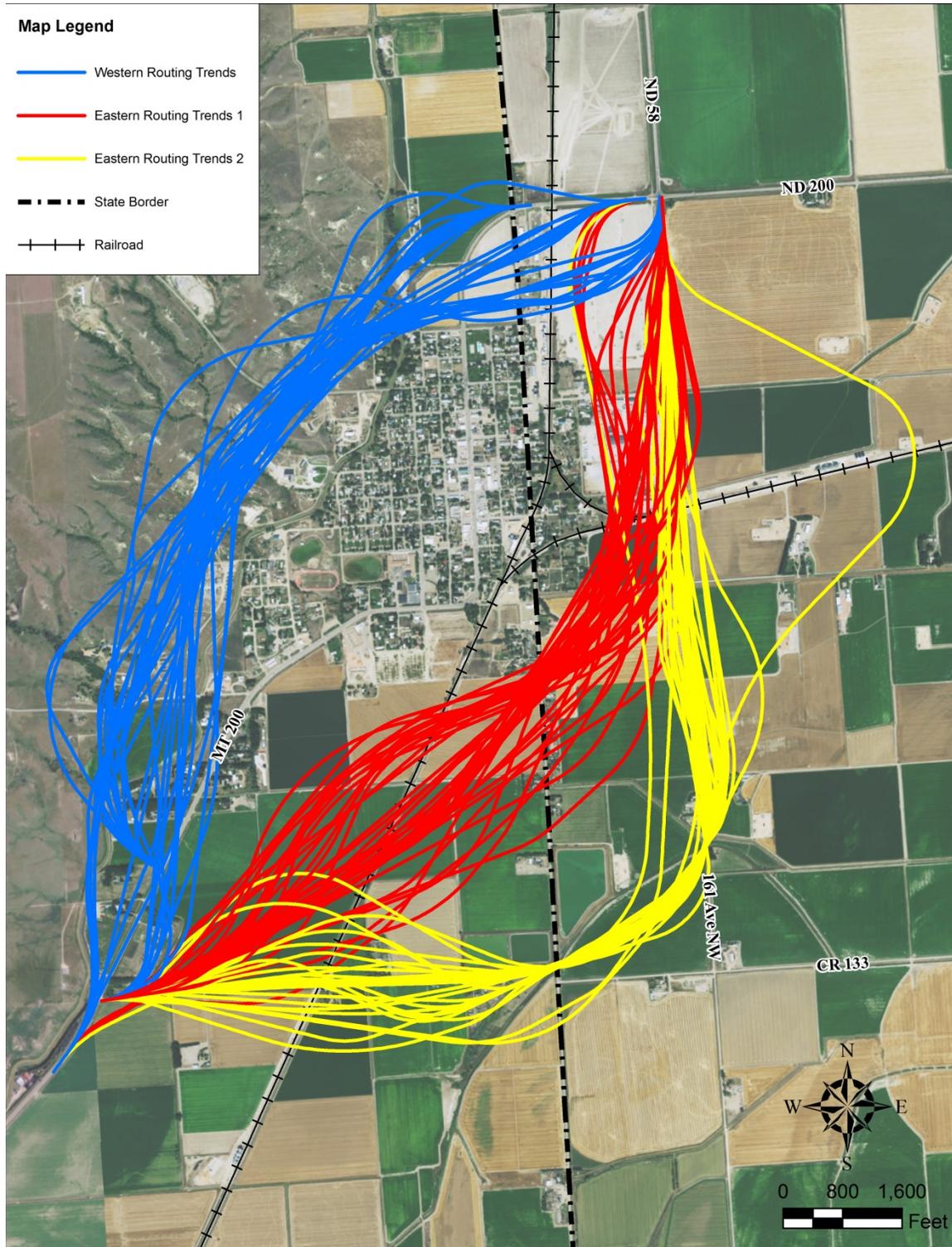
Quantm also considers other specific resource information gathered from publically-available data sources. The following data for both Montana and North Dakota was utilized to support the modeling effort.

- Airports and Railroads
- Cadastral
- Cultural Resources
- Floodplains
- Geology
- Groundwater Wells
- Hazardous Materials
- Irrigation
- Land Cover
- Land Use
- Riparian Areas
- Prime and Unique Farmland
- Recreational Section 4(f) Resources
- Roads
- Surface Waters and Wetlands

3.2 Alternative Scenarios

Based on the start/end points, cost parameters, constraints, and geometric inputs outlined in Section 3.1, initial development of alternative alignments with Quantm revealed several common routing trends. The alternatives generally include a pattern of alignments west of Fairview and two variations of alignments east of Fairview. To minimize right-of-way impacts, one group of eastern alignments closely follows the existing county roads while the other eastern alignment pattern minimizes overall project impacts and costs. Initial alignment trends developed for the study through Quantm are shown in Figure 4.

Figure 4. Routing Trends



Source: MDT 2015 and DOWL 2015.

In consideration of impacts, convenience, functionality in reducing truck traffic in Fairview, and anticipated costs, six alignments were identified as a result of the initial Quantm analysis to explore for further consideration. Quantm was used to generate, refine, and optimize several iterations of these six alignments to identify the most appropriate route. Initial alignments were manipulated through the use of waypoints and

horizontal alignment adjustments to either avoid features such as residential properties and irrigation structures or to improve and simplify the alignment geometrics. The alignments were manipulated to minimize grade changes to allow for unhampered traffic flow at the desired design speed. To allow for further refinement during a future design phase for a selected alternative, a 400-foot wide swath centered on each Quantum alignment was used to identify the potential limits of a new corridor. It is anticipated that additional flexibility will be needed to accommodate design considerations when detailed survey and investigation is conducted if a design project is pursued. The alignments forwarded for consideration with this study are illustrated in Figure 5 and defined below.

- Western Alignment: This Quantum-generated alignment is located west of Fairview. The alignment comes close to residential property northwest of the presumed intersection point with MT 200. It has the greatest grade change of the six alignments and would require two bridge crossings over an irrigation ditch (the Main Canal). The crossings would be located on the southern and northern portions of the alignment and are shown on Figure 5. It also includes an at-grade crossing at the existing railroad mainline at the northern end of the study area. This location is not appropriate for a grade-separated structure due to its proximity to the existing ND200/ND 58 intersection. The alignment is approximately 2.9 miles in length (including portions of the existing MT 200 route before start and end points at the CR 133 and ND 58 intersections).
- Eastern Alignment 1A: This alignment is located immediately east of Fairview. To minimize travel interruptions, this alignment would include a railroad overpass structure located on farmland south of the town of Fairview. The alignment is approximately 2.8 miles in length and includes one new grade-separated railroad crossing and one existing at-grade spur crossing.
- Eastern Alignment 1B: This alignment is located immediately east of Fairview and follows the same corridor as eastern alignment 1A. To minimize interruptions, this alignment would include a railroad overpass structure located on farmland south of the town of Fairview and an additional railroad overpass structure located east of the town of Fairview. The alignment is approximately 2.8 miles in length.
- Eastern Alignment 2A: This alignment is located east of Fairview and generally follows existing county roads (CR 133 and 161 Ave NW). It is the longest alignment at approximately 3.3 miles in length and includes two at-grade railroad crossings at existing mainline and existing railroad spur crossing locations.
- Eastern Alignment 2B: This alignment generally follows eastern alignment 2A, but includes a grade-separated structure at the existing mainline crossing location. Like eastern alignment 2A, this alignment is approximately 3.3 miles in length, follows CR 133 and 161 Ave NW, and would maintain the existing at-grade spur crossing east of Fairview.
- Eastern Alignment 2C: This alignment generally follows eastern alignments 2A and 2B but includes a grade-separated rail spur crossing in addition to a grade-separated structure at the existing mainline crossing location. Like

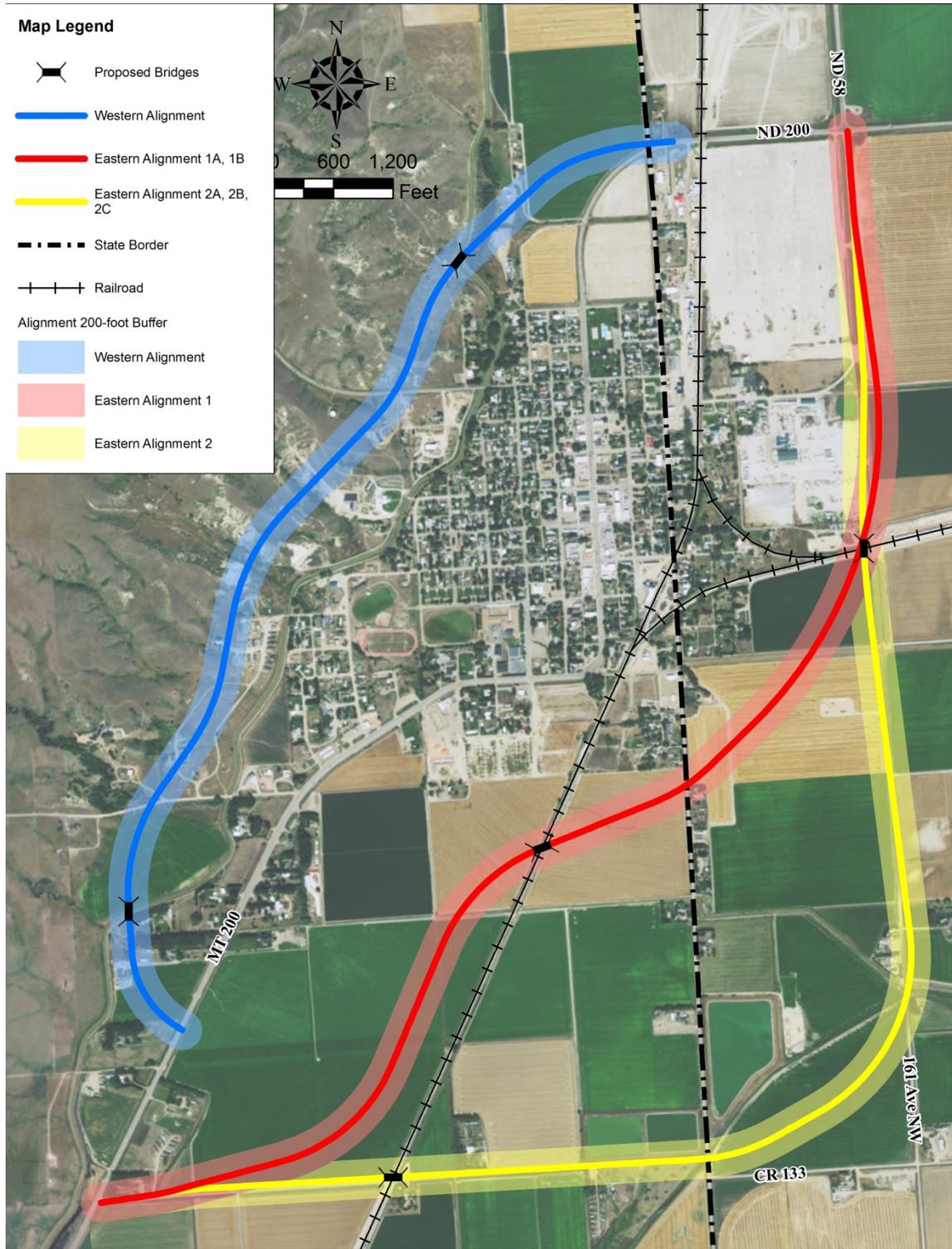
eastern alignments 2A and 2B, this alignment is approximately 3.3 miles in length and follows CR 133 and 161 Ave NW.

NDDOT uses the terms *truck reliever route* and *truck bypass route* to clarify the function of a new route and its relationship to an existing route. A truck reliever route provides an alternative alignment to relieve truck traffic traveling through an existing town. Vehicles must turn off of the primary through route to travel along the new truck reliever route. A truck bypass route is intended to divert the majority of traffic around an existing town, allowing traffic to directly flow onto the route. It serves as the primary through route, replacing the function of the existing route. Depending on future design considerations and public/stakeholder feedback, a future alignment could be configured as a truck reliever or a truck bypass route.

The Montana Code Annotated, Section 60-2-211, states that MDT “may not construct highway bypasses or highway relocation projects without prior consent of the governing body of an incorporated municipality when the bypasses or projects: (a) are not part of the national system of interstate highways built under the National Defense Highway Act; and (b) divert motor vehicles from an existing highway route through a municipality incorporated prior to January 1, 1965.” It also requires that MDT notify the governing body of an affected municipality by certified mail and provide 60 days to consent or object to the bypass. MDT would follow these regulations and communicate with community members and local officials in advance of any future project to construct a new alignment in the study area.

New alignments are referred to as alternative routes for the remainder of the report.

Figure 5. Optimized Routing



Source: MDT 2015 and DOWL 2015.

3.3 Screening Parameters and Alternatives Analysis

An analysis was performed for the six alternative routes to assess anticipated functionality, relative impacts, and costs. The geometric standards presented in Table 1 were used in Quantm to determine approximate construction limits, area impacts, and their associated costs.

The following parameters were used to evaluate the six alternative routes.

- Route Length and Travel Time
- At-grade Rail Crossings
- Parcel Impacts and Right-of-Way Acquisition
- Wetland Impacts
- Farmland Impacts
- Irrigation Impacts
- Access Point Density
- Cost

Route Length and Travel Time

Roadway and bridge lengths affect travel time on each alternative route as well as future maintenance requirements and costs. Maintenance of a longer length of roadway can be considerably more time and cost intensive than a shorter and more direct route. Bridge length and bridge skew are additional concerns that should be considered when selecting an alternative. Design and construction of skewed bridges can be much more challenging than a non-skewed bridge design.

Topography of each alternative route was incorporated into the travel time analysis to reflect changes in elevation that may affect travel speed. The proposed western route has multiple grade changes that may require trucks to travel at slower speeds when compared to the proposed eastern routes. Additionally, the varying topography of the western route would likely reduce sight distance and provide less opportunity for trucks and passenger vehicles to pass slower motorists.

Travel times for the six alternative routes were analyzed using SimTraffic 9 software. Each analysis consisted of three simulation runs, and the median value of the three runs was reported. The simulations included the stop-controlled intersection at MT 200 and the roundabout at ND 58 so that these interrupted flows are included in the travel time. The following assumptions were incorporated into the analysis.

- It was assumed that 100% of truck traffic and 50% of passenger vehicle traffic would use a new truck reliever route.
- The travel speed of the roadway was modeled at 70 mph, with 1,000 feet of 35-mph travel modeled where the roadway approaches either a stop-controlled intersection or a roundabout.
- For all at-grade mainline and spur railroad crossings, it was assumed one train crossing would occur during the peak hour for a duration of ten minutes.
- The western alignment intersection with MT 201 was modeled with two-way stop control on the minor legs of MT 201, and uncontrolled through movement on the western alignment.
- At their southern junctions with MT 200, the eastern and western alignments were modeled with stop control and the existing MT 200 route was modeled as the through movement.
- At their northern junctions with MT 200, the eastern alignments were modeled as connecting into the single-lane roundabout at the ND 200/ND 58 intersection.

At its northern junctions with MT 200, the western alignment was modeled as a through movement connecting with ND 200.

Table 5 provides the road and bridge lengths and calculated travel times for the six alternative routes generated by Quantm. Estimated values for route length, and travel time on the existing MT 200 route (with build and no build scenarios) are provided for comparison purposes.

Table 5. Route Length and Travel Time

Criteria	MT 200		Western	Eastern 1A	Eastern 1B	Eastern 2A	Eastern 2B	Eastern 2C	
	No Build	Build							
Route Length (feet)	15,500	15,500	15,150	15,000	15,000	17,600	17,600	17,600	
Travel Time (minutes/seconds)	2025	6.4/ 385.2	6.3/ 380.0	5.4/ 320.9	8.1/ 488.1	4.1/ 247.8	8.7/ 523.9	8.0/ 481.8	5.7/ 342.2
	2035	5.9/ 355.3	6.0/ 356.9	5.0/ 297.0	4.5/ 266.9	3.5/ 207.1	5.6/ 334.8	4.9/ 294.6	3.8/ 225.1

Source: MDT Quantm output data files provided October 2015, and DOWL 2015.

The No Build scenario assumes a new route is not constructed. The Build scenario assumes construction of a new rural principal arterial serving as a truck reliever route outside the town of Fairview.

At-grade Rail Crossings

The number of at-grade rail crossings for each alternative is a consideration for determining the overall functionality of the route. The main disadvantage of at-grade rail crossings is that they are likely to adversely affect travel time, which was addressed in the discussion above. Additional factors are more difficult to quantify. Users may be less likely to use alternative route with at-grade rail crossings based on perceived inconvenience and the probability for increased delay time. Additionally, emergency response vehicles may be less likely to use a route with at-grade rail crossings because the crossings could impose delay that would slow emergency response time. The Transportation Research Board (TRB) has released guidance on the impact of at-grade rail crossings titled *Quantifying the Public Impacts of Highway-Rail Grade Crossings on Surface Mobility*. Before selecting an alternative route with an at-grade rail crossing, additional research should be conducted to quantify the resulting impact.

In the event an alternative containing an at-grade rail crossing is selected, installation of variable message signs (VMS) at each end could be utilized to alert traffic to potential delays associated with using the route. The VMS would be activated in conjunction with existing rail crossing warning signs.

Table 6. At-grade Rail Crossings

Criteria	Western	Eastern 1A	Eastern 1B	Eastern 2A	Eastern 2B	Eastern 2C
Number of At-grade Rail Crossings	1	1	0	2	1	0

Source: MDT Quantm output data files provided October 2015, and DOWL 2015.

Parcel Impacts and Right-of-Way Acquisition

The estimated right-of-way acquisition needed for each alternative route is determined based on the existing topography and current land use. Construction limits define the

area impacted by each alternative. The total construction limits of each route were calculated using the following methodology: Quantm-generated impact width, plus 10-foot buffer on each side of Quantm impact width, minus 60 feet of width for any portion of the proposed route that would follow an existing County Road easement. The total construction area needed to construct each route was generated by Quantm based on the input parameters and the existing surface. It is anticipated that there will be additional impacted areas after additional design work is completed for the potential routes.

Additionally, Quantm calculated the number of parcels that will likely be impacted by each alternative. A larger number of parcel impacts could lead to increased coordination and cost associated with right-of-way acquisition. Table 7 shows the number of parcels and the acreage impacted by each alternative.

Table 7. Parcel Impacts and Right-of-Way Acquisition

Criteria	Western	Eastern 1A	Eastern 1B	Eastern 2A	Eastern 2B	Eastern 2C
Number of Parcel Impacts	24	12	17	29	29	31
Right-of-way Acquisition (acres)	48.3	45.4	50.9	32.9	40.7	45.5

Source: MDT Quantm output data files provided October 2015, and DOWL 2015.

Wetland Impacts

Section 404 of the federal Clean Water Act (CWA) governs wetland impacts for all new construction areas. After an alternative route is selected, additional design work will be completed to reduce impacts to wetlands. It is desirable to avoid and minimize impacts to wetlands as much as practicable when constructing a new route. A field wetland delineation was not completed for this analysis. Quantm uses the United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) mapping database to determine potential wetland impacts. Table 8 provides the NWI wetland impact areas for the six alternative routes.

Table 8. NWI Wetland Impacts

Criteria	Western	Eastern 1A	Eastern 1B	Eastern 2A	Eastern 2B	Eastern 2C
Wetland Impacts (acres)	0.4	0.2	0.3	0.1	0.2	0.1

Source: MDT Quantm output data files provided October 2015, and DOWL 2015.

With wetland impacts less than 0.5 acre, all alternative routes are anticipated to qualify for a CWA Nationwide Permit 14 for Linear Transportation Projects from the United States Army Corps of Engineers.

Farmland Impacts

Special consideration must be given to impacted areas with soils that are considered prime farmland, unique farmland, or farmland of statewide or local importance by the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) in accordance with the Farmland Policy Protection Act (FPPA) (7 U.S.C. 4201 et. seq.) Prime farmland soils are defined as those that have a favorable combination of physical and chemical characteristics for producing food, feed, and forage. The areas with these attributes must be available for farming to be considered prime

farmland. Prime farmland can include areas that are currently non-irrigated, but would be considered prime if irrigated. Farmland of statewide importance is land that has been designated essential for the production of food, feed, forage, and oilseed crops by the NRCS.

Farmland impacts were estimated for the six alternative routes using the preliminary construction area impacts within the construction limits. Table 9 presents the farmland impact areas for both prime farmland and farmland of statewide importance. The total farmland impact that exists within the current county road easement was subtracted from the Quantm output to provide an accurate impact estimate.

Table 9. Farmland Impacts

Criteria	Western	Eastern 1A	Eastern 1B	Eastern 2A	Eastern 2B	Eastern 2C
Farmland of Statewide Importance (acres)	4.3	15.5	23.0	21.6	18.6	23.6
Prime Farmland if Irrigated (acres)	17.2	30.1	27.9	8.7	20.1	18.8
Total Farmland Impacts (acres)	21.4	45.7	50.9	30.2	38.7	42.4

Source: MDT Quantm output data files provided October 2015, and DOWL 2015.

Irrigation Impacts

To measure potential irrigation impacts associated with each alternative route, three categories were considered. First, the need to replace, relocate, or modify an existing pivot was assessed. Secondly, bridges utilized by Quantm to cross major irrigation facilities are also considered an impact because they are a source of future maintenance costs. Lastly, any crossing of major existing canals and laterals that may potentially require a culvert or siphon are considered an irrigation impact. Table 10 presents the number of irrigation impacts by category.

Table 10. Irrigation Impacts

Criteria	Western	Eastern 1A	Eastern 1B	Eastern 2A	Eastern 2B	Eastern 2C
Pivot Impact/Bridge/Major Ditch Crossing (number)	1/2/0	1/0/1	1/0/1	1/0/0	1/0/0	1/0/0

Source: MDT Quantm output data files provided October 2015, and DOWL 2015.

Access Point Density

Access point density for each alternative route was determined by examining each route and determining the potential number of access points that would need to be perpetuated during construction of a new route. For each alternative, access points were classified as public (e.g., existing intersections with county or city streets) and private (e.g., driveways and subdivision access points). Access point density was considered as a screening criterion due to the fact that more access points along a route may slow traffic, create additional conflict points and potential safety issues, and generally make the route less desirable for motorists trying to bypass traffic congestion

by choosing to use the alternative route. Table 11 presents the number of access points occurring on each alternative route.

Table 11. Access Point Density

Criteria	Western	Eastern 1A	Eastern 1B	Eastern 2A	Eastern 2B	Eastern 2C
Access Point Density (Total/Public/Private)	6/2/4	8/5/3	8/5/3	20/4/16	20/4/16	20/4/16

Source: MDT Quantum output data files provided October 2015, and DOWL 2015.

Planning-level Costs

Planning-level cost estimates were prepared for the six alternative routes. Cost estimates presented in Table 12 primarily include costs associated with construction (and do not include project development costs, utility relocation costs, inflation, or indirect costs). Specific adjustments to the individual alternative route cost estimates were made to reflect irrigation impacts, at-grade railroad crossings and bridge lengths. Recent bid history was applied to the irrigation and railroad crossing assumptions. The structure lengths associated with the railway crossings would accommodate three total tracks and a service road.

Table 12. Estimated Construction Costs

Criteria	Western	Eastern 1A	Eastern 1B	Eastern 2A	Eastern 2B	Eastern 2C
Cut	\$752,000	\$121,000	\$126,000	\$204,000	\$181,000	\$165,000
Borrow	\$0	\$887,000	\$1,500,000	\$0	\$933,000	\$1,630,000
Fill	\$474,000	\$937,000	\$1,550,000	\$99,100	\$1,040,000	\$1,700,000
Dump	\$744,000	\$81,800	\$91,900	\$179,000	\$98,100	\$108,000
Road Template	\$2,920,000	\$3,840,000	\$3,800,000	\$4,580,000	\$4,500,000	\$4,540,000
Mass Haul	\$135,000	\$219,000	\$314,000	\$28,800	\$144,000	\$248,000
Retaining Wall	\$201,000	\$8,220	\$0	\$0	\$8,270	\$325,000
Culvert	\$76,000	\$1,060,000	\$1,240,000	\$586,000	\$668,000	\$1,070,000
Bridge	\$1,580,000	\$1,350,000	\$2,430,000	\$0	\$1,200,000	\$2,250,000
Footprint Area (Irrigation Pivot)	\$0	\$112,500	\$150,000	\$55,500	\$112,500	\$150,000
Footprint Area (Wetlands) ¹	\$15,000	\$5,220	\$12,200	\$2,000	\$9,200	\$5,200
Cadastral	\$190,000	\$113,000	\$118,000	\$219,000	\$237,000	\$244,000
At-Grade Railroad Crossing	\$0	\$350,000	\$0	\$700,000	\$350,000	\$0
Total Estimated Construction Cost²	\$7,087,000	\$9,064,740	\$11,332,100	\$6,712,500	\$9,481,070	\$12,435,200

Source: MDT Quantum output data files provided October 2015, and DOWL 2015.

¹ Wetland criterion includes mitigation cost (calculated at \$1 per square foot of impacted wetland).

² Anticipated right-of-way and indirect costs (IDC) are included in the Total Quantum Construction Cost.

To capture the comprehensive financial impact of a potential future project, it was desirable to incorporate additional costs associated with the six alternative routes. Table 13 presents the costs of multiple intersection treatments for the junction of the new route with MT 200 south of Fairview. All four intersection treatment options are viable options for any of the six alternatives. Table 14 presents the total project development cost

associated with each alternative. Four potential intersection configurations were analyzed including a bypass configuration as well as stop controlled, signalized, and roundabout (which could be used with a truck reliever configuration). The total estimated project cost range listed in the final row of Table 14 includes both the route cost and the cost for intersection treatment. This cost range is based on the lowest and highest total based on the assumed contingencies (20% and 30%) and the potential intersection alternatives.

Table 13. Total Intersection Treatment Costs

Intersection Alternatives	Stop-Controlled	Signalized	Roundabout	Bypass with Tee Intersection
Total Intersection Cost	\$303,636	\$396,696	\$588,510	\$719,636
Miscellaneous (20%)	\$60,727	\$79,339	\$117,702	\$143,927
Subtotal	\$364,363	\$476,035	\$706,212	\$863,563
Mobilization (10%)	\$30,364	\$39,670	\$58,851	\$71,964
Subtotal	\$394,700	\$515,705	\$765,063	\$935,527
Preliminary Engineering (12%)	\$47,364	\$61,885	\$91,808	\$112,263
Construction Engineering (10%)	\$39,470	\$51,570	\$76,506	\$93,553
Inflation (5 years at 3.16%)	\$66,430	\$86,796	\$128,765	\$157,455
IDC (10.37%)	\$40,930	\$53,479	\$79,337	\$97,014
Subtotal	\$588,895	\$769,435	\$1,141,479	\$1,395,812
Intersection Cost (20% Contingency)	\$700,000	\$900,000	\$1,400,000	\$1,700,000
Intersection Cost (30% Contingency)	\$800,000	\$1,100,000	\$1,500,000	\$1,900,000

Source: MDT Quantum output data files provided October 2015, and DOWL 2015.

Table 14. Total Project Development Costs

Alternative Routes	Western	Eastern 1A	Eastern 1B	Eastern 2A	Eastern 2B	Eastern 2C
Total Quantm Construction Cost ¹¹	\$7,087,000	\$9,064,740	\$11,332,100	\$6,712,500	\$9,481,070	\$12,435,200
Miscellaneous (20%)	\$1,417,400	\$1,812,948	\$2,266,420	\$1,342,500	\$1,896,214	\$2,487,040
Subtotal	\$8,504,400	\$10,877,688	\$13,598,520	\$8,055,000	\$11,377,284	\$14,922,240
Mobilization (10%)	\$708,700	\$906,474	\$1,133,210	\$671,250	\$948,107	\$1,243,520
Subtotal	\$9,213,100	\$11,784,162	\$14,731,730	\$8,726,250	\$12,325,391	\$16,165,760
Preliminary Engineering (12%)	\$1,105,572	\$1,414,099	\$1,767,808	\$1,047,150	\$1,479,047	\$1,939,891
Construction Engineering (10%)	\$921,310	\$1,178,416	\$1,473,173	\$872,625	\$1,232,539	\$1,616,576
Inflation (5 years at 3.16%)	\$1,550,620	\$1,983,345	\$2,479,439	\$1,468,680	\$2,074,437	\$2,720,794
IDC (10.37%)	\$955,398	\$1,222,018	\$1,527,680	\$904,912	\$1,278,143	\$1,676,389
Subtotal	\$13,746,000	\$17,582,040	\$21,979,830	\$13,019,617	\$18,389,557	\$24,119,411
Route Cost (20% Contingency)	\$16,500,000	\$21,100,000	\$26,400,000	\$15,600,000	\$22,100,000	\$28,900,000
Route Cost (30% Contingency)	\$17,900,000	\$22,900,000	\$28,600,000	\$17,000,000	\$24,000,000	\$31,400,000
Total Estimated Project Development Cost (Including Range of Intersection Costs)	\$17,200,000 to \$19,800,000	\$21,800,000 to \$24,800,000	\$27,100,000 to \$30,500,000	\$16,300,000 to \$18,900,000	\$22,800,000 to \$25,900,000	\$29,600,000 to \$33,300,000

Source: MDT Quantm output data files provided October 2015, and DOWL 2015.

¹ Anticipated right-of-way and indirect costs (IDC) are included in the Total Quantm Construction Cost.

3.4 Screening Parameters Considered But Not Forwarded

The following parameters were considered as options to evaluate the six alternative routes, but ultimately were not included in the final alternative screening. Reasons for excluding these parameters included inability to objectively quantify results, relative level of importance (i.e., low probability that the parameter would materially affect route selection), and the attempt to avoid double counting the same concept through multiple parameters.

- Level of Service (LOS)
- Section 4(f) Impacts
- Public Perception
- Safety (as a stand-alone parameter)
- Local Planning Efforts and Future Developments
- Utility Impacts
- Wildlife Connectivity
- Potential Hazard to Fairview Residents
- Noise
- Visual Impacts
- Value to Roadway Network
- Maintenance
- Topography
- Financial Participation and NDDOT Coordination
- Project Development Schedule

Level of Service (LOS)

All alternative routes are anticipated to accommodate existing and projected demand within the study area. A new route would increase capacity and address regional and local traffic patterns. In coordination with the study advisory committee (AC), the level of service (LOS) criterion was removed due to the difficulty in assessing interrupted flow

conditions for at-grade rail crossings. Differences in the ability to meet demand are reflected in the travel time criterion.

Section 4(f) Impacts

Section 4(f) of the U.S. Department of Transportation Act of 1966, which was enacted to protect publically-owned parks, recreation areas, wildlife and waterfowl refuges, and public and private historic sites of local, state, and national significance. Federally-funded transportation projects cannot “use” Section 4(f) properties unless there are no feasible and prudent avoidance alternatives and all possible planning to minimize harm has occurred. Resources in proximity to the alternative routes that may qualify for Section 4(f) protection are limited due to the extent of privately-owned property. Identified recreational resources include Sharbano Park (corner of MT 200 and 1st Street), the playground and sports field at the East Fairview Elementary School (301 2nd Street), and the sports fields and track at the Fairview High School (713 S. Western Avenue). There are no state or federal public lands within or immediately surrounding the study area. None of the six optimized Quantm routes are anticipated to impact potential Section 4(f) sites.

Public Perception

The AC discussed the possibility of assessing public perception as a measure of demand. The AC decided not to include public preference as a screening criterion because it would be difficult to objectively measure without conducting a direct survey of the public that will likely use the alternative route. The AC did not feel that it was worthwhile to conduct such a survey at this time and the public perception criterion was not carried forward.

Safety (as a stand-alone parameter)

All alternative routes would be designed and constructed to meet current MDT/NDDOT design criteria, including curve radii and sight distance. Quantm modeling included requirements for alternative routes to conform to criteria for rural principal arterials (National Highway System – Non Interstate) as defined in the MDT Road Design Manual.

Safety is also considered in the access point density criterion. Public and major private access roadways create points of conflict with the mainline route. Routes with a higher number of access points were scored accordingly.

In some cases, safety performance can be associated with the occurrence of structures and guardrail. For example, bridges typically experience increased icing issues and guardrail is regarded as a roadside hazard. These potential concerns do not always result in a higher number or severity of crash occurrences, and cannot be used to reliably predict safety performance. Accordingly, the occurrence of structures and guardrail was not included as a screening criterion.

Another aspect of safety performance is animal/vehicle conflicts. MDT data from 2004 to 2012 indicate five white-tailed deer carcasses were recorded. The relative potential occurrence of animal/vehicle conflicts on new routes is unknown, and was not included as a screening criterion.

Local Planning Efforts and Future Development

Quantm modeling was conducted to avoid existing developments and adjacent areas that may be developed in the future. Due to uncertainty associated with future areas of development, this was not included as a screening parameter.

Utility Impacts

Public and private utility impacts were not calculated specific to the alternative routes. With limited mapping available for the Quantm analysis to determine these impacts, the cost to relocate or adjust utilities is included in the contingency for each alignment, and was not included as a separate screening parameter.

Wildlife Connectivity

A screening criterion to rate the wildlife connectivity of each alternative alignment was considered during the alternative screening. Drainage corridors west of Fairview still possess specimens of the native vegetation that was likely present in this area prior to its conversion to agriculture. These corridors are important wildlife corridors for mammals moving from the upper badlands down to the Yellowstone River valley. The eastern alignments traverse lands that have already been developed for agriculture. Ultimately this criterion proved difficult to measure quantitatively and was not included in the final alternative screening.

Potential Hazard to Fairview Residents

A member of the AC suggested rating alternative routes based upon potential risk to Fairview residents resulting from a hazardous materials spill. All of the new routes travel in close proximity to some developed areas. This parameter was not carried forward as a screening criterion because it likely would not be a deciding factor in selecting an alternative route.

Noise

A screening criterion addressing potential noise impacts to surrounding areas was considered during the alternative screening. Noise generated from the western alignment may be greater than eastern alignments due to its elevation and proximity to residential areas. A noise study would be needed to quantify potential impacts to sensitive receptors. After further consideration the AC elected not to include this as a screening criterion.

Visual Impacts

The western alignment may result in greater visual impacts compared to eastern alignments due to its elevation. This parameter was not carried forward as a screening criterion because it likely would not be a deciding factor in selecting an alternative route.

Value to Roadway Network

A member of the AC suggested evaluating alternative routes based upon their added value to the roadway network. All new routes would create additional capacity, and serve as a new principal arterial to service travel demand. This parameter was not carried forward as a screening criterion because it likely would not be a deciding factor in selecting an alternative route.

Maintenance

Maintenance requirements for each alternative route may vary based on the total roadway and structure lengths, number of culverts, guardrail lengths, and other design criteria. It was determined that maintenance requirements could be captured in the roadway length screening criterion, and therefore the maintenance criterion was not carried forward as an individual screening parameter.

Topography

The AC discussed the possibility of assessing the associated topography of each alternative route. Quantm modeling limited the maximum grade to 4% to provide

minimal disruption to truck traffic. All new routes achieved a maximum of approximately 2%, which is not anticipated to substantially affect travel times. Public perception of topography is not measureable without additional supporting data. Accordingly, the AC elected not to include topography as a stand-alone screening criterion.

Financial Participation and NDDOT Coordination

The need for MDT and NDDOT financial participation would vary depending on the location of a new route. A western alignment occurring entirely within Montana would require a funding package through MDT, whereas an eastern alignment would require funding in coordination with MDT and NDDOT. This issue can be viewed from multiple perspectives. NDDOT funding participation could reduce the financial burden placed on MDT for a new route. However, NDDOT has not committed to a financial partnership for a new route, and the need for NDDOT participation would likely increase project development complexity and timeframe, requiring additional MDT staff time and effort.

Screening results are presented from the perspective of the combined MDT/NDDOT responsibility for a new route and the route's ability to meet study needs and objectives (as opposed to exclusive benefits that may accrue for MDT or NDDOT). Therefore, a screening criterion addressing NDDOT financial participation and coordination was not included.

Project Development Schedule

The timeframe to construct a new route around Fairview would depend on funding cooperation, complexity of the design, and potential right-of-way negotiations. Potential delivery of a new route could be estimated for each alternative route based on estimated project development activities. Given multiple unknown factors, project development schedule was not carried forward as a screening criterion.

3.5 Alternative Screening

A weighted screening process was applied to the screening criteria based on input provided by the study AC. Points were initially assigned according to the performance under each criterion, with the lowest score (1) indicating the best performance and the highest score (6) indicating the worst performance in each category. A tied score was allotted for two or more routes that performed equally for a particular category.

Based on survey responses from the AC, a weighting system was developed to reflect the perceived relative importance or risk associated with each criterion. Fourteen survey responses were received, of which three were disqualified due to improper value allocation. Attachment 3 includes the survey instrument and survey responses.

Qualifying survey responses were averaged, grouped, and assigned a weight ranging from 50 to 200. Initial scores were multiplied by the criterion weight. The total score listed in Table 15 indicates the relative level of impact and cost, with the lowest score potentially indicating the least impactful and most cost-effective alternative route according to the criteria assessed.

Table 15 summarizes impacts and costs estimated for the six alternative routes. Estimated values for route length and travel time on the existing MT 200 route (with and without construction of a new route) are provided for comparison purposes.

Table 15. Impact, Cost, and Screening Summary

Criteria	Weight	MT 200 No Build	MT 200 Build	Western			Eastern 1A			Eastern 1B			Eastern 2A			Eastern 2B			Eastern 2C		
				Value	Rank	Weighted Score															
Route Length (feet) ¹	150	15,500	15,500	15,150	1	150	15,000	1	150	15,000	1	150	17,600	2	300	17,600	2	300	17,600	2	300
Travel Time WB (minutes/seconds) ²	200	2025: 6.4/385.2 2035: 5.9/355.3	2025: 6.3/380.0 2035: 6.0/356.9	2025: 5.4/320.9 2035: 5.0/297.0	2	400	2025: 8.1/488.1 2035: 4.5/266.9	4	800	2025: 4.1/247.8 2035: 3.5/207.1	1	200	2025: 8.7/523.9 2035: 5.6/334.8	5	1000	2025: 8.0/481.8 2035: 4.9/294.6	4	800	2025: 5.7/342.2 2035: 3.8/225.1	3	600
At-grade Rail Crossings	150	1	1	1	2	300	1	2	300	0	1	150	2	3	450	1	2	300	0	1	150
Parcel Impacts	100	0	0	24	3	300	14	1	100	17	2	200	29	4	400	29	4	400	31	5	500
Right-of-way Acquisition (acres) ³	150	0	0	48.3	4	600	45.4	3	450	50.9	5	750	32.9	1	150	40.7	2	300	45.5	3	450
Wetland Impacts (acres)	100	0	0	0.4	4	400	0.2	2	200	0.3	3	300	0.1	1	100	0.2	2	200	0.1	1	100
Total Farmland Impacts (acres) ³	50	0	0	21.4	1	50	45.7	5	250	50.9	6	300	30.2	2	100	38.7	3	150	42.4	4	200
Irrigation Impacts (Pivot/Bridge/Major Ditch) ³	100	0	0	1/2/0	3	300	1/0/1	2	200	1/0/1	2	200	1/0/0	1	100	1/0/0	1	100	1/0/0	1	100
Access Point Density (Total/Public/Private) ⁴	150	NA	NA	6/2/4	1	150	8/5/3	2	300	8/5/3	2	300	20/4/16	3	450	20/4/16	3	450	20/4/16	3	450
Total Estimated Project Development Cost	200	0	0	\$17,200,000 to \$19,800,000	2	400	\$21,800,000 to \$24,800,000	3	600	\$27,100,000 to \$30,500,000	5	1000	\$16,300,000 to \$18,900,000	1	200	\$22,800,000 to \$25,900,000	4	800	\$29,600,000 to \$33,300,000	6	1200
Total Point Score				3050			3350			3550			3250			3800			4050		

Source: MDT Quantm output data files provided October 2015, and DOWL 2015.

¹ Equal scores allotted for values within 500 feet.

² Travel time calculated using the PM peak hour and truck reliever configuration. Travel time screening based on 2025 (worst case scenario) minutes, with equal scores allotted for values within 0.1 minute.

³ Irrigation impacts screened based on total number of impacts. ⁴ Access point density screened according to the total number of access points per mile.

The results of the screening process indicate that the best performing alternative is the western alignment, followed by eastern alignment 2A. If impediments to a western alignment are discovered in the future and an eastern alignment is pursued, construction of eastern alignment 2 could be phased to initially provide at-grade crossings and construct grade-separated crossings as part of a future project phase.

4.0 Existing Routes

4.1 Potential Improvement Options

Option 1: Roadway Widening (Three Lanes)

This option considers widening MT 200 from the existing two-lane highway to a three-lane highway between County Road 133 and 0.2 miles south of County Road 134. This two-lane segment south of Fairview is anticipated to operate at LOS D in 2020 and 2025 during the peak hour assuming high-growth-scenario traffic volumes as documented in the Existing and Projected Conditions Report prepared for this study. The three-lane expansion would begin near the end of MDT's current Sidney to Fairview project (RP 52.6 to RP 62.3) (prior to its taper back to two lanes) and end at the intersection of the existing four-lane section of MT 200 traveling through Fairview. This lane expansion would provide continuity on MT 200 from the end of the Sidney to Fairview project to the existing four-lane section in Fairview and eliminate an unnecessary two-lane taper. Additionally, the three-lane section would provide improved functionality at all minor intersections along the proposed lane expansion section. Figure 6 shows the location of the potential lane expansion along MT 200 from RP 61.8 to RP 62.3.

Figure 6. RP 61.8 to RP 62.3 Potential Roadway Widening



Source: DOWL 2015.

Planning Cost Estimate

Unit Cost: \$700,000 to \$800,000 per 0.1 mile
 Total Cost: \$3,600,000 to \$4,000,000

Recommended Implementation Timeframe

Short-Term to Long-Term

Potentially-impacted Resources/Anticipated Right-of-Way

Potential impacts to farmlands, irrigation laterals, historic resources, right-of-way, and utilities may result from this option.

Option 2: Sidewalk/ADA Improvements

Fairview has existing sidewalk on both sides of MT 200 from RP 63.3 to 63.8. These facilities should be evaluated to ensure existing sidewalks and any new improvements are continuous and meet Public Rights-of-Way Accessibility Guidelines (PROWAG). As such, sidewalk intersections with existing approaches would be reconstructed with PROWAG-compliant curb ramps, and cross-slope and running-slope requirements would be met on all portions of newly-constructed sidewalk. The construction of additional sidewalk from RP 62.5 to RP 63.8 is recommended as needed to improve pedestrian safety and provide continuous pedestrian access.

Planning Cost Estimate

Unit cost: \$6,600 to 7,200 per 100 feet of newly-installed sidewalk and ADA curb ramps
 Total cost: Approximately \$470,000 to \$500,000 to install missing sidewalk and replace damaged/inaccessible sidewalk from RP 62.5 to 63.8.

This estimate is based on a cursory survey of the existing sidewalk within the defined limits. Additional investigation will be needed to develop a more accurate cost estimate.

Recommended Implementation Timeframe

Immediate to Short-term

Potentially-impacted Resources/Anticipated Right-of-Way

This project would occur within Fairview and within existing right-of-way. No environmental resource, utility, or right-of-way impacts are anticipated.

4.2 Options Considered But Not Forwarded**Bridge Repairs**

Data provided by the MDT Bridge Bureau indicated two bridges located one mile SW of Fairview at USBR Main Canal 093 and at the west edge of Fairview at USBR Main Canal 070 are in poor or fair condition, as identified in the Existing and Projected Conditions Report. These bridges are not located on MT 200/ND 200 within the study area, and therefore are not the focus of improvements proposed in this study.

MT 200/MT 201 and ND 58/ND 200 Intersections

Analysis of projected traffic volumes conducted for the Existing and Projected Conditions Report suggested that the intersections of MT 200/MT201 and ND58/ND 200 may operate below desirable levels in 2025 (assuming high-growth scenario conditions). The ND 58/ND 200 intersection is currently being reconstructed by NDDOT as a one-lane

roundabout and, therefore, is not addressed in this report. MDT is moving forward with the Fairview-West project, which could realign MT 201 and create a new junction with MT 200. With the Fairview-West project, traffic patterns on MT 201 could shift in the future and the current MT 200/MT 201 intersection would likely operate at a desirable LOS. No improvements are proposed at these two intersections.

Obstruction Shielding

The Existing and Projected Conditions Report identified multiple obstructions within the Fairview city limits (such as trees, fencing, signs, and utilities). In particular, two obstructions located at RP 62.2 (exposed culvert inlet) and RP 63.8 (power pole) were identified as potential hazards. Based on planning-level investigation, it was determined that the obstructions are located within the urban portion of MT 200 and obstruction shielding is not warranted due to lower travel speeds and urban constraints. No additional shielding options were explored.

Horizontal Curves

The Existing and Projected Conditions Report identified four horizontal curves within the study area that do not meet current MDT design criteria. The curves are located at RP 61.5, RP 62.5, RP 63.2, and RP 64.2. The curve at RP 61.5 occurs within the limits for MDT's Sidney to Fairview project and is being addressed through a design exception. The remaining three curves are located within the limits of MT 200-Fairview and will be addressed as part of that future MDT project.

Four-lane Roadway Widening

Analysis of projected traffic volumes conducted for the Existing and Projected Conditions Report suggested that the two-lane MT 200 segment from 2nd Street in Fairview to ND 58 may operate below desirable levels in all analysis years (assuming high-growth scenario conditions). This segment is relatively short (approximately 0.7 mile), includes an at-grade railroad crossing, and feeds into a single-lane roundabout at the intersection of ND 200/ND 58 (currently under construction). Review of the plans for the ND 200/ND 58 intersection project indicates the roundabout likely was not designed to be expanded to add an additional lane in the future. A widening project for this segment (to add an additional travel lane in each direction for a total of four travel lanes) was not pursued further for this study given these constraints. MDT could consider widening this segment of MT 200 in the future to provide widened shoulders matching the typical section for ND 58. A future improvement in this location would need to consider the potential of a new MT 201 alignment developed under the Fairview-West project connecting with the existing MT 200 alignment.

4.3 Summary of Improvement Options for Existing Routes

Table 16 summarizes potential improvement options for the existing MT 200 route within Fairview. These options are intended to address corridor needs and objectives, and may be pursued in addition to or independent from construction of an alternative route outside of Fairview.

Table 16. Summary of Improvements for Existing Routes

Improvement Options			Locations	Planning Cost Estimate ¹	Potential Timeframe ²	Potentially Impacted Resources and Anticipated ROW/ Permitting Requirements
Option Category	Option ID	Option Description				
Traffic Operations	Option 1	Roadway Widening (Three Lanes)	RP 61.8 to RP 62.3 (MT 200 South of Fairview)	\$3,600,000 to \$4,000,000 (\$700,000 to \$800,000 per 0.1 mile)	Short-term to Long-term	Yes
Pedestrian Improvements	Option 2	Sidewalk/ADA Improvements	MT 200 RP 62.5 to RP 63.8	\$470,000 to 500,000 (\$6,600 to \$7,200 per 100 feet)	Immediate to Short-term	No

¹ Cost estimates are provided in 2015 dollars and are rounded for planning purposes. Cost estimates reflect contingency ranges to account for the high degree of unknown factors at the planning level. Costs associated with right-of-way acquisition, utility relocation, preliminary engineering, and construction engineering/inspection, and other indirect costs are included where appropriate.

² Potential timeframe does not indicate when projects will be programmed or implemented. Project programming is based on available funding, the complexity and urgency of potential improvements, and other system priorities. Timeframes are defined as follows. Immediate: Implementation is currently ongoing or will be initiated in 2015; Short-term: Implementation could occur within a 1- to 3-year period; Mid-term: Implementation could occur within a 3- to 6-year period; Long-term: Implementation could occur within a 6- to 20-year period.

5.0 References

AASHTO. (2011). A Policy on Geometric Design of Highways and Streets. Section 4.4.2 Width of Shoulders; Table 7-1 Minimum Width of Traveled Way and Usable Shoulder for Rural Arterials; Figure 2-24 Acceleration of Passenger Cars, Level Conditions.

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Attachment 1

Segment Analysis Worksheets



Phone: Fax:
 E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst JSP
 Agency/Co. DOWL
 Date Performed 10/22/2015
 Analysis Time Period PM Peak Hour
 Highway (Red GS) Truck Reliever
 From/To MT 200 to ND 58 (WB)
 Jurisdiction MDT
 Analysis Year 2025
 Description Fairview Corridor Study

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.92	
Shoulder width	8.0	ft	% Trucks and buses	24	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.8	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	33	%
Up/down	-	%	Access point density	3	/mi

Analysis direction volume, Vd 421 veh/h
 Opposing direction volume, Vo 204 veh/h

Average Travel Speed

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.2	1.5
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adj. factor,(note-5) fHV	0.954	0.893
Grade adj. factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	480 pc/h	248 pc/h

Free-Flow Speed from Field Measurement:
 Field measured speed,(note-3) S FM - mi/h
 Observed total demand,(note-3) V - veh/h

Estimated Free-Flow Speed:
 Base free-flow speed,(note-3) BFFS 70.0 mi/h
 Adj. for lane and shoulder width,(note-3) fLS 0.0 mi/h
 Adj. for access point density,(note-3) fA 0.8 mi/h

Free-flow speed, FFSd 69.3 mi/h

Adjustment for no-passing zones, fnp 2.7 mi/h
 Average travel speed, ATSD 60.9 mi/h
 Percent Free Flow Speed, PFFS 87.9 %

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.0	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	1.000	0.977
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	458 pc/h	227 pc/h
Base percent time-spent-following,(note-4) BPTSFd	42.8	%
Adjustment for no-passing zones, fnp	33.1	
Percent time-spent-following, PTSFd	64.9	%

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.28	
Peak 15-min vehicle-miles of travel, VMT15	320	veh-mi
Peak-hour vehicle-miles of travel, VMT60	1179	veh-mi
Peak 15-min total travel time, TT15	5.3	veh-h
Capacity from ATS, CdATS	1518	veh/h
Capacity from PTSF, CdPTSF	1660	veh/h
Directional Capacity	1518	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.8	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSD (from above)	60.9	mi/h
Percent time-spent-following, PTSFd (from above)	64.9	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	E	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	457.6
Effective width of outside lane, We	28.00
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	11.70
Bicycle LOS	F

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i (v_d or v_o) $\geq 1,700$ pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for $v > 200$ veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Phone: Fax:
 E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst JSP
 Agency/Co. DOWL
 Date Performed 10/22/2015
 Analysis Time Period PM Peak Hour
 Highway (Yellow GS) Truck Reliever
 From/To MT 200 to ND 58 (WB)
 Jurisdiction MDT
 Analysis Year 2025
 Description Fairview Corridor Study

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.92	
Shoulder width	8.0	ft	% Trucks and buses	23	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.3	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	33	%
Up/down	-	%	Access point density	4	/mi

Analysis direction volume, Vd 421 veh/h
 Opposing direction volume, Vo 204 veh/h

Average Travel Speed

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.2	1.5
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adj. factor,(note-5) fHV	0.956	0.897
Grade adj. factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	479 pc/h	247 pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM - mi/h
 Observed total demand,(note-3) V - veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS 70.0 mi/h
 Adj. for lane and shoulder width,(note-3) fLS 0.0 mi/h
 Adj. for access point density,(note-3) fA 1.0 mi/h

Free-flow speed, FFSd 69.0 mi/h

Adjustment for no-passing zones, fnp 2.7 mi/h
 Average travel speed, ATSD 60.7 mi/h
 Percent Free Flow Speed, PFFS 87.9 %

-----Percent Time-Spent-Following-----

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.0	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	1.000	0.978
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	458 pc/h	227 pc/h
Base percent time-spent-following,(note-4) BPTSFD	42.8	%
Adjustment for no-passing zones, fnp	33.1	
Percent time-spent-following, PTSFD	64.9	%

-----Level of Service and Other Performance Measures-----

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.28	
Peak 15-min vehicle-miles of travel, VMT15	378	veh-mi
Peak-hour vehicle-miles of travel, VMT60	1389	veh-mi
Peak 15-min total travel time, TT15	6.2	veh-h
Capacity from ATS, CdATS	1525	veh/h
Capacity from PTSF, CdPTSF	1662	veh/h
Directional Capacity	1525	veh/h

-----Passing Lane Analysis-----

Total length of analysis segment, Lt	3.3	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSD (from above)	60.7	mi/h
Percent time-spent-following, PTSFD (from above)	64.9	
Level of service, LOSd (from above)	C	

-----Average Travel Speed with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

-----Percent Time-Spent-Following with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

-----Level of Service and Other Performance Measures with Passing Lane-----

Level of service including passing lane, LOSpl	E	
Peak 15-min total travel time, TT15	-	veh-h

-----Bicycle Level of Service-----

Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	457.6
Effective width of outside lane, We	28.00
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	11.02
Bicycle LOS	F

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i (v_d or v_o) $\geq 1,700$ pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for $v > 200$ veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Phone: Fax:
 E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst JSP
 Agency/Co. DOWL
 Date Performed 10/22/2015
 Analysis Time Period PM Peak Hour
 Highway (Red GS) Truck Reliever
 From/To MT 200 to ND 58 (WB)
 Jurisdiction MDT
 Analysis Year 2035
 Description Fairview Corridor Study

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.92	
Shoulder width	8.0	ft	% Trucks and buses	24	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.8	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	33	%
Up/down	-	%	Access point density	3	/mi

Analysis direction volume, Vd 204 veh/h
 Opposing direction volume, Vo 109 veh/h

Average Travel Speed

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.5	1.8
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adj. factor,(note-5) fHV	0.893	0.839
Grade adj. factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	248 pc/h	141 pc/h

Free-Flow Speed from Field Measurement:
 Field measured speed,(note-3) S FM - mi/h
 Observed total demand,(note-3) V - veh/h
 Estimated Free-Flow Speed:
 Base free-flow speed,(note-3) BFFS 70.0 mi/h
 Adj. for lane and shoulder width,(note-3) fLS 0.0 mi/h
 Adj. for access point density,(note-3) fA 0.8 mi/h
 Free-flow speed, FFSD 69.3 mi/h
 Adjustment for no-passing zones, fnp 2.3 mi/h
 Average travel speed, ATSD 64.0 mi/h
 Percent Free Flow Speed, PFFS 92.4 %

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.977	0.977
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	227 pc/h	121 pc/h
Base percent time-spent-following,(note-4) BPTSFD	24.0	%
Adjustment for no-passing zones, fnp	37.9	
Percent time-spent-following, PTSFD	48.7	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.15	
Peak 15-min vehicle-miles of travel, VMT15	155	veh-mi
Peak-hour vehicle-miles of travel, VMT60	571	veh-mi
Peak 15-min total travel time, TT15	2.4	veh-h
Capacity from ATS, CdATS	1426	veh/h
Capacity from PTSF, CdPTSF	1660	veh/h
Directional Capacity	1426	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.8	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSD (from above)	64.0	mi/h
Percent time-spent-following, PTSFD (from above)	48.7	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSp1	-	
Percent free flow speed including passing lane, PFFSp1	0.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	E	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	221.7
Effective width of outside lane, We	28.00
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	11.34
Bicycle LOS	F

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i (v_d or v_o) $\geq 1,700$ pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for $v > 200$ veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst JSP
Agency/Co. DOWL
Date Performed 10/22/2015
Analysis Time Period PM Peak Hour
Highway (Yellow GS) Truck Reliever
From/To MT 200 to ND 58 (WB)
Jurisdiction MDT
Analysis Year 2035
Description Fairview Corridor Study

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.92	
Shoulder width	8.0	ft	% Trucks and buses	23	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.3	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	33	%
Up/down	-	%	Access point density	4	/mi

Analysis direction volume, Vd 204 veh/h
Opposing direction volume, Vo 109 veh/h

Average Travel Speed

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.5	1.8
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adj. factor,(note-5) fHV	0.897	0.845
Grade adj. factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	247 pc/h	140 pc/h

Free-Flow Speed from Field Measurement:
Field measured speed,(note-3) S FM - mi/h
Observed total demand,(note-3) V - veh/h

Estimated Free-Flow Speed:
Base free-flow speed,(note-3) BFFS 70.0 mi/h
Adj. for lane and shoulder width,(note-3) fLS 0.0 mi/h
Adj. for access point density,(note-3) fA 1.0 mi/h

Free-flow speed, FFSd 69.0 mi/h

Adjustment for no-passing zones, fnp 2.3 mi/h
Average travel speed, ATSD 63.7 mi/h
Percent Free Flow Speed, PFFS 92.4 %

-----Percent Time-Spent-Following-----

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.978	0.978
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	227 pc/h	121 pc/h
Base percent time-spent-following,(note-4) BPTSFD	24.0	%
Adjustment for no-passing zones, fnp	37.9	
Percent time-spent-following, PTSFD	48.7	%

-----Level of Service and Other Performance Measures-----

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.15	
Peak 15-min vehicle-miles of travel, VMT15	183	veh-mi
Peak-hour vehicle-miles of travel, VMT60	673	veh-mi
Peak 15-min total travel time, TT15	2.9	veh-h
Capacity from ATS, CdATS	1437	veh/h
Capacity from PTSF, CdPTSF	1662	veh/h
Directional Capacity	1437	veh/h

-----Passing Lane Analysis-----

Total length of analysis segment, Lt	3.3	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSD (from above)	63.7	mi/h
Percent time-spent-following, PTSFD (from above)	48.7	
Level of service, LOSd (from above)	B	

-----Average Travel Speed with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSp1	-	
Percent free flow speed including passing lane, PFFSp1	0.0	%

-----Percent Time-Spent-Following with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

-----Level of Service and Other Performance Measures with Passing Lane-----

Level of service including passing lane, LOSpl	E	
Peak 15-min total travel time, TT15	-	veh-h

-----Bicycle Level of Service-----

Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	221.7
Effective width of outside lane, We	28.00
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	10.65
Bicycle LOS	F

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i (v_d or v_o) $\geq 1,700$ pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for $v > 200$ veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Phone: Fax:
E-Mail:

----- Directional Two-Lane Highway Segment Analysis -----

Analyst JSP
Agency/Co. DOWL
Date Performed 9/21/2015
Analysis Time Period
Highway Highway 200 Segment A WB
From/To HW133 to 0.2 mi S of HW134
Jurisdiction
Analysis Year 2025
Description PM Peak Hour

----- Input Data -----

Highway class	Class 1	Peak hour factor, PHF	0.90	
Shoulder width	8.0 ft	% Trucks and buses	30	%
Lane width	12.0 ft	% Trucks crawling	0.0	%
Segment length	0.7 mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level	% Recreational vehicles	0	%
Grade: Length	- mi	% No-passing zones	48	%
Up/down	- %	Access point density	18	/mi

Analysis direction volume, Vd 639 veh/h
Opposing direction volume, Vo 534 veh/h

----- Average Travel Speed -----

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adj. factor, (note-5) fHV	0.971	0.971
Grade adj. factor, (note-1) fg	1.00	1.00
Directional flow rate, (note-2) vi	731 pc/h	611 pc/h

Free-Flow Speed from Field Measurement:

Field measured speed, (note-3) S FM - mi/h
Observed total demand, (note-3) V - veh/h

Estimated Free-Flow Speed:

Base free-flow speed, (note-3) BFFS 70.0 mi/h
Adj. for lane and shoulder width, (note-3) fLS 0.0 mi/h
Adj. for access point density, (note-3) fA 4.5 mi/h

Free-flow speed, FFSd 65.5 mi/h

Adjustment for no-passing zones, fnp 1.6 mi/h
Average travel speed, ATSD 53.5 mi/h
Percent Free Flow Speed, PFFS 81.7 %

-----Percent Time-Spent-Following-----

Direction	Analysis(d)	Opposing (o)	
PCE for trucks, ET	1.0	1.0	
PCE for RVs, ER	1.0	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	1.000	
Grade adjustment factor,(note-1) fg	1.00	1.00	
Directional flow rate,(note-2) vi	710 pc/h	593 pc/h	
Base percent time-spent-following,(note-4) BPTSFD	63.6	%	
Adjustment for no-passing zones, fnp	26.6		
Percent time-spent-following, PTSFD	78.1	%	

-----Level of Service and Other Performance Measures-----

Level of service, LOS	D	
Volume to capacity ratio, v/c	0.43	
Peak 15-min vehicle-miles of travel, VMT15	124	veh-mi
Peak-hour vehicle-miles of travel, VMT60	447	veh-mi
Peak 15-min total travel time, TT15	2.3	veh-h
Capacity from ATS, CdATS	1651	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1651	veh/h

-----Passing Lane Analysis-----

Total length of analysis segment, Lt	0.7	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSD (from above)	53.5	mi/h
Percent time-spent-following, PTSFD (from above)	78.1	
Level of service, LOSd (from above)	D	

-----Average Travel Speed with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

-----Percent Time-Spent-Following with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

-----Level of Service and Other Performance Measures with Passing Lane-----

Level of service including passing lane, LOSpl	E	
Peak 15-min total travel time, TT15	-	veh-h

-----Bicycle Level of Service-----

Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	710.0
Effective width of outside lane, We	28.00
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	16.46
Bicycle LOS	F

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i (v_d or v_o) $\geq 1,700$ pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for $v > 200$ veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst JSP
Agency/Co. DOWL
Date Performed 10/26/2015
Analysis Time Period PM Peak Hour (Build Condition)
Highway MT 200
From/To Segment A (WB)
Jurisdiction MDT
Analysis Year 2025
Description Fairview Corridor Study

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.90	
Shoulder width	8.0	ft	% Trucks and buses	0	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	0.7	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	48	%
Up/down	-	%	Access point density	18	/mi

Analysis direction volume, Vd 223 veh/h
Opposing direction volume, Vo 218 veh/h

Average Travel Speed

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.5	1.5
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adj. factor,(note-5) fHV	1.000	1.000
Grade adj. factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	248 pc/h	242 pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM - mi/h
Observed total demand,(note-3) V - veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS 70.0 mi/h
Adj. for lane and shoulder width,(note-3) fLS 0.0 mi/h
Adj. for access point density,(note-3) fA 4.5 mi/h

Free-flow speed, FFSD 65.5 mi/h

Adjustment for no-passing zones, fnp 3.3 mi/h
Average travel speed, ATSD 58.4 mi/h
Percent Free Flow Speed, PFFS 89.1 %

-----Percent Time-Spent-Following-----

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	1.000	1.000
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	248 pc/h	242 pc/h
Base percent time-spent-following,(note-4) BPTSFD	27.5	%
Adjustment for no-passing zones, fnp	53.6	
Percent time-spent-following, PTSFD	54.6	%

-----Level of Service and Other Performance Measures-----

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.15	
Peak 15-min vehicle-miles of travel, VMT15	42	veh-mi
Peak-hour vehicle-miles of travel, VMT60	149	veh-mi
Peak 15-min total travel time, TT15	0.7	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

-----Passing Lane Analysis-----

Total length of analysis segment, Lt	0.7	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSD (from above)	58.4	mi/h
Percent time-spent-following, PTSFD (from above)	54.6	
Level of service, LOSd (from above)	C	

-----Average Travel Speed with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSp1	-	
Percent free flow speed including passing lane, PFFSp1	0.0	%

-----Percent Time-Spent-Following with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

-----Level of Service and Other Performance Measures with Passing Lane-----

Level of service including passing lane, LOSpl	E	
Peak 15-min total travel time, TT15	-	veh-h

-----Bicycle Level of Service-----

Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	247.8
Effective width of outside lane, We	28.00
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	0.68
Bicycle LOS	A

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i (v_d or v_o) $\geq 1,700$ pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for $v > 200$ veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

MT 200

Direction	EB	WB	NB	SB	All
Average Speed (mph)	34	35	30	27	30
Total Travel Time (hr)	3	8	9	13	33
Distance Traveled (mi)	88	274	270	359	991
Performance Index	0.1	0.1	2.6	5.4	8.2

Zone 1 Totals

Number of Intersections	14
Average Speed (mph)	30
Total Travel Time (hr)	36
Distance Traveled (mi)	1050
Performance Index	9.7

MT 200

Direction	EB	WB	NB	SB	All
Average Speed (mph)	34	35	31	29	32
Total Travel Time (hr)	1	3	4	5	14
Distance Traveled (mi)	43	119	132	159	454
Performance Index	0.1	0.0	1.2	1.9	3.2

Phone: Fax:
E-Mail:

----- Directional Two-Lane Highway Segment Analysis -----

Analyst JSP
Agency/Co. DOWL
Date Performed 9/21/2015
Analysis Time Period
Highway Highway 200 Segment C WB
From/To 2nd St N to HW58
Jurisdiction
Analysis Year 2025
Description PM Peak Hour

----- Input Data -----

Highway class	Class 1	Peak hour factor, PHF	0.84	
Shoulder width	2.0 ft	% Trucks and buses	30	%
Lane width	12.0 ft	% Trucks crawling	0.0	%
Segment length	0.7 mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level	% Recreational vehicles	0	%
Grade: Length	- mi	% No-passing zones	100	%
Up/down	- %	Access point density	11	/mi

Analysis direction volume, Vd 710 veh/h
Opposing direction volume, Vo 660 veh/h

----- Average Travel Speed -----

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adj. factor, (note-5) fHV	0.971	0.971
Grade adj. factor, (note-1) fg	1.00	1.00
Directional flow rate, (note-2) vi	870 pc/h	809 pc/h

Free-Flow Speed from Field Measurement:

Field measured speed, (note-3) S FM	-	mi/h
Observed total demand, (note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, (note-3) BFFS	55.0	mi/h
Adj. for lane and shoulder width, (note-3) fLS	2.6	mi/h
Adj. for access point density, (note-3) fA	2.8	mi/h
Free-flow speed, FFSd	49.7	mi/h
Adjustment for no-passing zones, fnp	1.3	mi/h
Average travel speed, ATSD	35.3	mi/h
Percent Free Flow Speed, PFFS	71.2	%

-----Percent Time-Spent-Following-----

Direction	Analysis(d)	Opposing (o)	
PCE for trucks, ET	1.0	1.0	
PCE for RVs, ER	1.0	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	1.000	
Grade adjustment factor,(note-1) fg	1.00	1.00	
Directional flow rate,(note-2) vi	845 pc/h	786	pc/h
Base percent time-spent-following,(note-4) BPTSFD	70.8	%	
Adjustment for no-passing zones, fnp	24.6		
Percent time-spent-following, PTSFD	83.5	%	

-----Level of Service and Other Performance Measures-----

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.51	
Peak 15-min vehicle-miles of travel, VMT15	148	veh-mi
Peak-hour vehicle-miles of travel, VMT60	497	veh-mi
Peak 15-min total travel time, TT15	4.2	veh-h
Capacity from ATS, CdATS	1651	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1651	veh/h

-----Passing Lane Analysis-----

Total length of analysis segment, Lt	0.7	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSD (from above)	35.3	mi/h
Percent time-spent-following, PTSFD (from above)	83.5	
Level of service, LOSd (from above)	E	

-----Average Travel Speed with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

-----Percent Time-Spent-Following with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

-----Level of Service and Other Performance Measures with Passing Lane-----

Level of service including passing lane, LOSpl	E	
Peak 15-min total travel time, TT15	-	veh-h

-----Bicycle Level of Service-----

Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	845.2
Effective width of outside lane, We	14.00
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	19.49
Bicycle LOS	F

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i (v_d or v_o) $\geq 1,700$ pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for $v > 200$ veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst JSP
Agency/Co. DOWL
Date Performed 10/26/2015
Analysis Time Period PM Peak Hour (Build Condition)
Highway MT 200
From/To Segment C (WB)
Jurisdiction MDT
Analysis Year 2025
Description Fairview Corridor Study

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.84	
Shoulder width	2.0	ft	% Trucks and buses	0	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	0.7	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	100	%
Up/down	-	%	Access point density	11	/mi

Analysis direction volume, Vd 247 veh/h
Opposing direction volume, Vo 269 veh/h

Average Travel Speed

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.4	1.4
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adj. factor,(note-5) fHV	1.000	1.000
Grade adj. factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	294 pc/h	320 pc/h

Free-Flow Speed from Field Measurement:
Field measured speed,(note-3) S FM - mi/h
Observed total demand,(note-3) V - veh/h

Estimated Free-Flow Speed:
Base free-flow speed,(note-3) BFFS 55.0 mi/h
Adj. for lane and shoulder width,(note-3) fLS 2.6 mi/h
Adj. for access point density,(note-3) fA 2.8 mi/h

Free-flow speed, FFSd 49.7 mi/h

Adjustment for no-passing zones, fnp 3.2 mi/h
Average travel speed, ATSD 41.7 mi/h
Percent Free Flow Speed, PFFS 83.9 %

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	1.000	1.000
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	294 pc/h	320 pc/h
Base percent time-spent-following,(note-4) BPTSFD	33.2	%
Adjustment for no-passing zones, fnp	55.6	
Percent time-spent-following, PTSFD	59.8	%

Level of Service and Other Performance Measures

Level of service, LOS	D	
Volume to capacity ratio, v/c	0.17	
Peak 15-min vehicle-miles of travel, VMT15	54	veh-mi
Peak-hour vehicle-miles of travel, VMT60	180	veh-mi
Peak 15-min total travel time, TT15	1.3	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.7	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSD (from above)	41.7	mi/h
Percent time-spent-following, PTSFD (from above)	59.8	
Level of service, LOSd (from above)	D	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	E	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	294.0
Effective width of outside lane, We	14.00
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	3.70
Bicycle LOS	D

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i (v_d or v_o) $\geq 1,700$ pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for $v > 200$ veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Phone: Fax:
E-Mail:

----- Directional Two-Lane Highway Segment Analysis -----

Analyst JSP
Agency/Co. DOWL
Date Performed 9/21/2015
Analysis Time Period
Highway Highway 200 Segment D WB
From/To HW58 to Black Top Rd
Jurisdiction
Analysis Year 2025
Description PM Peak Hour

----- Input Data -----

Highway class	Class 1		Peak hour factor, PHF	0.84	
Shoulder width	4.0	ft	% Trucks and buses	37	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.8	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	7	%
Up/down	-	%	Access point density	8	/mi

Analysis direction volume, Vd 325 veh/h
Opposing direction volume, Vo 302 veh/h

----- Average Travel Speed -----

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.3	1.3
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adj. factor, (note-5) fHV	0.900	0.900
Grade adj. factor, (note-1) fg	1.00	1.00
Directional flow rate, (note-2) vi	430 pc/h	399 pc/h

Free-Flow Speed from Field Measurement:

Field measured speed, (note-3) S FM - mi/h
Observed total demand, (note-3) V - veh/h

Estimated Free-Flow Speed:

Base free-flow speed, (note-3) BFFS 65.0 mi/h
Adj. for lane and shoulder width, (note-3) fLS 1.3 mi/h
Adj. for access point density, (note-3) fA 2.0 mi/h

Free-flow speed, FFSd 61.7 mi/h

Adjustment for no-passing zones, fnp 1.5 mi/h
Average travel speed, ATSD 53.8 mi/h
Percent Free Flow Speed, PFFS 87.2 %

-----Percent Time-Spent-Following-----

Direction	Analysis(d)	Opposing (o)	
PCE for trucks, ET	1.1	1.1	
PCE for RVs, ER	1.0	1.0	
Heavy-vehicle adjustment factor, fHV	0.964	0.964	
Grade adjustment factor,(note-1) fg	1.00	1.00	
Directional flow rate,(note-2) vi	401 pc/h	373 pc/h	
Base percent time-spent-following,(note-4) BPTSFD	42.5	%	
Adjustment for no-passing zones, fnp	21.7		
Percent time-spent-following, PTSFD	53.7	%	

-----Level of Service and Other Performance Measures-----

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.25	
Peak 15-min vehicle-miles of travel, VMT15	271	veh-mi
Peak-hour vehicle-miles of travel, VMT60	910	veh-mi
Peak 15-min total travel time, TT15	5.0	veh-h
Capacity from ATS, CdATS	1530	veh/h
Capacity from PTSF, CdPTSF	1639	veh/h
Directional Capacity	1530	veh/h

-----Passing Lane Analysis-----

Total length of analysis segment, Lt	2.8	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSD (from above)	53.8	mi/h
Percent time-spent-following, PTSFD (from above)	53.7	
Level of service, LOSd (from above)	C	

-----Average Travel Speed with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

-----Percent Time-Spent-Following with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

-----Level of Service and Other Performance Measures with Passing Lane-----

Level of service including passing lane, LOSpl	E	
Peak 15-min total travel time, TT15	-	veh-h

-----Bicycle Level of Service-----

Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	386.9
Effective width of outside lane, We	16.00
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	25.03
Bicycle LOS	F

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i (v_d or v_o) $\geq 1,700$ pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for $v > 200$ veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Phone: Fax:
E-Mail:

----- Directional Two-Lane Highway Segment Analysis -----

Analyst JSP
Agency/Co. DOWL
Date Performed 9/21/2015
Analysis Time Period
Highway Highway 200 Segment A WB
From/To HW133 to 0.2 mi S of HW134
Jurisdiction
Analysis Year 2035
Description PM Peak Hour

----- Input Data -----

Highway class	Class 1	Peak hour factor, PHF	0.90	
Shoulder width	8.0 ft	% Trucks and buses	30	%
Lane width	12.0 ft	% Trucks crawling	0.0	%
Segment length	0.7 mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level	% Recreational vehicles	0	%
Grade: Length	- mi	% No-passing zones	48	%
Up/down	- %	Access point density	18	/mi

Analysis direction volume, Vd 309 veh/h
Opposing direction volume, Vo 259 veh/h

----- Average Travel Speed -----

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.4	1.4
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adj. factor, (note-5) fHV	0.893	0.893
Grade adj. factor, (note-1) fg	1.00	1.00
Directional flow rate, (note-2) vi	384 pc/h	322 pc/h

Free-Flow Speed from Field Measurement:

Field measured speed, (note-3) S FM - mi/h
Observed total demand, (note-3) V - veh/h

Estimated Free-Flow Speed:

Base free-flow speed, (note-3) BFFS 70.0 mi/h
Adj. for lane and shoulder width, (note-3) fLS 0.0 mi/h
Adj. for access point density, (note-3) fA 4.5 mi/h

Free-flow speed, FFSd 65.5 mi/h

Adjustment for no-passing zones, fnp 2.9 mi/h
Average travel speed, ATSD 57.1 mi/h
Percent Free Flow Speed, PFFS 87.2 %

-----Percent Time-Spent-Following-----

Direction	Analysis(d)	Opposing (o)	
PCE for trucks, ET	1.1	1.1	
PCE for RVs, ER	1.0	1.0	
Heavy-vehicle adjustment factor, fHV	0.971	0.971	
Grade adjustment factor,(note-1) fg	1.00	1.00	
Directional flow rate,(note-2) vi	354 pc/h	296 pc/h	
Base percent time-spent-following,(note-4) BPTSFD	37.6	%	
Adjustment for no-passing zones, fnp	46.2		
Percent time-spent-following, PTSFD	62.8	%	

-----Level of Service and Other Performance Measures-----

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.23	
Peak 15-min vehicle-miles of travel, VMT15	60	veh-mi
Peak-hour vehicle-miles of travel, VMT60	216	veh-mi
Peak 15-min total travel time, TT15	1.1	veh-h
Capacity from ATS, CdATS	1518	veh/h
Capacity from PTSF, CdPTSF	1650	veh/h
Directional Capacity	1518	veh/h

-----Passing Lane Analysis-----

Total length of analysis segment, Lt	0.7	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSD (from above)	57.1	mi/h
Percent time-spent-following, PTSFD (from above)	62.8	
Level of service, LOSd (from above)	C	

-----Average Travel Speed with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

-----Percent Time-Spent-Following with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

-----Level of Service and Other Performance Measures with Passing Lane-----

Level of service including passing lane, LOSpl	E	
Peak 15-min total travel time, TT15	-	veh-h

-----Bicycle Level of Service-----

Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	343.3
Effective width of outside lane, We	28.00
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	16.09
Bicycle LOS	F

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i (v_d or v_o) $\geq 1,700$ pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for $v > 200$ veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst JSP
Agency/Co. DOWL
Date Performed 10/26/2015
Analysis Time Period PM Peak Hour (Build Condition)
Highway MT 200
From/To Segment A (WB)
Jurisdiction MDT
Analysis Year 2035
Description Fairview Corridor Study

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.90	
Shoulder width	8.0	ft	% Trucks and buses	0	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	0.7	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	48	%
Up/down	-	%	Access point density	18	/mi

Analysis direction volume, Vd 108 veh/h
Opposing direction volume, Vo 105 veh/h

Average Travel Speed

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.8	1.8
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adj. factor,(note-5) fHV	1.000	1.000
Grade adj. factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	120 pc/h	117 pc/h

Free-Flow Speed from Field Measurement:
Field measured speed,(note-3) S FM - mi/h
Observed total demand,(note-3) V - veh/h

Estimated Free-Flow Speed:
Base free-flow speed,(note-3) BFFS 70.0 mi/h
Adj. for lane and shoulder width,(note-3) fLS 0.0 mi/h
Adj. for access point density,(note-3) fA 4.5 mi/h

Free-flow speed, FFSd 65.5 mi/h

Adjustment for no-passing zones, fnp 2.6 mi/h
Average travel speed, ATSD 61.0 mi/h
Percent Free Flow Speed, PFFS 93.2 %

-----Percent Time-Spent-Following-----

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	1.000	1.000
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	120 pc/h	117 pc/h
Base percent time-spent-following,(note-4) BPTSFD	13.7	%
Adjustment for no-passing zones, fnp	47.7	
Percent time-spent-following, PTSFD	37.9	%

-----Level of Service and Other Performance Measures-----

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.07	
Peak 15-min vehicle-miles of travel, VMT15	20	veh-mi
Peak-hour vehicle-miles of travel, VMT60	72	veh-mi
Peak 15-min total travel time, TT15	0.3	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

-----Passing Lane Analysis-----

Total length of analysis segment, Lt	0.7	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSD (from above)	61.0	mi/h
Percent time-spent-following, PTSFD (from above)	37.9	
Level of service, LOSd (from above)	B	

-----Average Travel Speed with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

-----Percent Time-Spent-Following with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

-----Level of Service and Other Performance Measures with Passing Lane-----

Level of service including passing lane, LOSpl	E	
Peak 15-min total travel time, TT15	-	veh-h

-----Bicycle Level of Service-----

Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	120.0
Effective width of outside lane, We	37.20
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	-2.69
Bicycle LOS	A

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i (v_d or v_o) $\geq 1,700$ pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for $v > 200$ veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

MT 200

Direction	EB	WB	NB	SB	All
Average Speed (mph)	34	35	31	29	32
Total Travel Time (hr)	1	4	4	6	15
Distance Traveled (mi)	43	134	132	176	484
Performance Index	0.1	0.0	1.2	2.0	3.4

MT 200

Direction	EB	WB	NB	SB	All
Average Speed (mph)	33	35	31	30	32
Total Travel Time (hr)	1	2	2	3	7
Distance Traveled (mi)	21	60	65	78	224
Performance Index	0.1	0.0	0.6	0.9	1.7

Phone: Fax:
E-Mail:

----- Directional Two-Lane Highway Segment Analysis -----

Analyst JSP
Agency/Co. DOWL
Date Performed 9/21/2015
Analysis Time Period
Highway Highway 200 Segment C WB
From/To 2nd St N to HW58
Jurisdiction
Analysis Year 2035
Description PM Peak Hour

----- Input Data -----

Highway class	Class 1		Peak hour factor, PHF	0.84	
Shoulder width	2.0	ft	% Trucks and buses	30	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	0.7	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	100	%
Up/down	-	%	Access point density	11	/mi

Analysis direction volume, Vd 343 veh/h
Opposing direction volume, Vo 319 veh/h

----- Average Travel Speed -----

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.3	1.3
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adj. factor, (note-5) fHV	0.917	0.917
Grade adj. factor, (note-1) fg	1.00	1.00
Directional flow rate, (note-2) vi	445 pc/h	414 pc/h

Free-Flow Speed from Field Measurement:

Field measured speed, (note-3) S FM	-	mi/h
Observed total demand, (note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, (note-3) BFFS	55.0	mi/h
Adj. for lane and shoulder width, (note-3) fLS	2.6	mi/h
Adj. for access point density, (note-3) fA	2.8	mi/h
Free-flow speed, FFSd	49.7	mi/h
Adjustment for no-passing zones, fnp	2.6	mi/h
Average travel speed, ATSD	40.3	mi/h
Percent Free Flow Speed, PFFS	81.3	%

-----Percent Time-Spent-Following-----

Direction	Analysis(d)	Opposing (o)	
PCE for trucks, ET	1.0	1.1	
PCE for RVs, ER	1.0	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	0.971	
Grade adjustment factor,(note-1) fg	1.00	1.00	
Directional flow rate,(note-2) vi	408 pc/h	391 pc/h	
Base percent time-spent-following,(note-4) BPTSFD	43.6	%	
Adjustment for no-passing zones, fnp	45.7		
Percent time-spent-following, PTSFD	66.9	%	

-----Level of Service and Other Performance Measures-----

Level of service, LOS	D	
Volume to capacity ratio, v/c	0.26	
Peak 15-min vehicle-miles of travel, VMT15	71	veh-mi
Peak-hour vehicle-miles of travel, VMT60	240	veh-mi
Peak 15-min total travel time, TT15	1.8	veh-h
Capacity from ATS, CdATS	1559	veh/h
Capacity from PTSF, CdPTSF	1650	veh/h
Directional Capacity	1559	veh/h

-----Passing Lane Analysis-----

Total length of analysis segment, Lt	0.7	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSD (from above)	40.3	mi/h
Percent time-spent-following, PTSFD (from above)	66.9	
Level of service, LOSd (from above)	D	

-----Average Travel Speed with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

-----Percent Time-Spent-Following with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

-----Level of Service and Other Performance Measures with Passing Lane-----

Level of service including passing lane, LOSpl	E	
Peak 15-min total travel time, TT15	-	veh-h

-----Bicycle Level of Service-----

Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	408.3
Effective width of outside lane, We	14.00
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	19.12
Bicycle LOS	F

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i (v_d or v_o) $\geq 1,700$ pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for $v > 200$ veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst JSP
Agency/Co. DOWL
Date Performed 10/26/2015
Analysis Time Period PM Peak Hour (Build Condition)
Highway MT 200
From/To Segment C (WB)
Jurisdiction MDT
Analysis Year 2035
Description Fairview Corridor Study

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.84	
Shoulder width	2.0	ft	% Trucks and buses	0	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	0.7	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	100	%
Up/down	-	%	Access point density	11	/mi

Analysis direction volume, Vd 120 veh/h
Opposing direction volume, Vo 130 veh/h

Average Travel Speed

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.7	1.7
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adj. factor,(note-5) fHV	1.000	1.000
Grade adj. factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	143 pc/h	155 pc/h

Free-Flow Speed from Field Measurement:
Field measured speed,(note-3) S FM - mi/h
Observed total demand,(note-3) V - veh/h

Estimated Free-Flow Speed:
Base free-flow speed,(note-3) BFFS 55.0 mi/h
Adj. for lane and shoulder width,(note-3) fLS 2.6 mi/h
Adj. for access point density,(note-3) fA 2.8 mi/h

Free-flow speed, FFSd 49.7 mi/h

Adjustment for no-passing zones, fnp 3.3 mi/h
Average travel speed, ATSD 44.0 mi/h
Percent Free Flow Speed, PFFS 88.7 %

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	1.000	1.000
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	143 pc/h	155 pc/h
Base percent time-spent-following,(note-4) BPTSFD	16.1 %	
Adjustment for no-passing zones, fnp	58.2	
Percent time-spent-following, PTSFD	44.0 %	

Level of Service and Other Performance Measures

Level of service, LOS	D	
Volume to capacity ratio, v/c	0.08	
Peak 15-min vehicle-miles of travel, VMT15	26	veh-mi
Peak-hour vehicle-miles of travel, VMT60	88	veh-mi
Peak 15-min total travel time, TT15	0.6	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.7	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSD (from above)	44.0	mi/h
Percent time-spent-following, PTSFD (from above)	44.0	
Level of service, LOSd (from above)	D	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	E	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	142.9
Effective width of outside lane, We	19.60
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	2.40
Bicycle LOS	B

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i (v_d or v_o) $\geq 1,700$ pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for $v > 200$ veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Phone: Fax:
E-Mail:

----- Directional Two-Lane Highway Segment Analysis -----

Analyst JSP
Agency/Co. DOWL
Date Performed 9/21/2015
Analysis Time Period
Highway Highway 200 Segment D WB
From/To HW58 to Black Top Rd
Jurisdiction
Analysis Year 2035
Description PM Peak Hour

----- Input Data -----

Highway class	Class 1	Peak hour factor, PHF	0.84	
Shoulder width	4.0 ft	% Trucks and buses	37	%
Lane width	12.0 ft	% Trucks crawling	0.0	%
Segment length	2.8 mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level	% Recreational vehicles	0	%
Grade: Length	- mi	% No-passing zones	7	%
Up/down	- %	Access point density	8	/mi

Analysis direction volume, Vd 157 veh/h
Opposing direction volume, Vo 146 veh/h

----- Average Travel Speed -----

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.6	1.6
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adj. factor, (note-5) fHV	0.818	0.818
Grade adj. factor, (note-1) fg	1.00	1.00
Directional flow rate, (note-2) vi	228 pc/h	212 pc/h

Free-Flow Speed from Field Measurement:

Field measured speed, (note-3) S FM	-	mi/h
Observed total demand, (note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, (note-3) BFFS	65.0	mi/h
Adj. for lane and shoulder width, (note-3) fLS	1.3	mi/h
Adj. for access point density, (note-3) fA	2.0	mi/h
Free-flow speed, FFSd	61.7	mi/h
Adjustment for no-passing zones, fnp	2.0	mi/h
Average travel speed, ATSD	56.3	mi/h
Percent Free Flow Speed, PFFS	91.3	%

-----Percent Time-Spent-Following-----

Direction	Analysis(d)	Opposing (o)	
PCE for trucks, ET	1.1	1.1	
PCE for RVs, ER	1.0	1.0	
Heavy-vehicle adjustment factor, fHV	0.964	0.964	
Grade adjustment factor,(note-1) fg	1.00	1.00	
Directional flow rate,(note-2) vi	194 pc/h	180 pc/h	
Base percent time-spent-following,(note-4) BPTSFD	21.0	%	
Adjustment for no-passing zones, fnp	23.3		
Percent time-spent-following, PTSFD	33.1	%	

-----Level of Service and Other Performance Measures-----

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.13	
Peak 15-min vehicle-miles of travel, VMT15	131	veh-mi
Peak-hour vehicle-miles of travel, VMT60	440	veh-mi
Peak 15-min total travel time, TT15	2.3	veh-h
Capacity from ATS, CdATS	1391	veh/h
Capacity from PTSF, CdPTSF	1639	veh/h
Directional Capacity	1391	veh/h

-----Passing Lane Analysis-----

Total length of analysis segment, Lt	2.8	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSD (from above)	56.3	mi/h
Percent time-spent-following, PTSFD (from above)	33.1	
Level of service, LOSd (from above)	A	

-----Average Travel Speed with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

-----Percent Time-Spent-Following with Passing Lane-----

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

-----Level of Service and Other Performance Measures with Passing Lane-----

Level of service including passing lane, LOSpl	E	
Peak 15-min total travel time, TT15	-	veh-h

-----Bicycle Level of Service-----

Posted speed limit, Sp	55
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	186.9
Effective width of outside lane, We	19.44
Effective speed factor, St	4.79
Bicycle LOS Score, BLOS	24.05
Bicycle LOS	F

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i (v_d or v_o) $\geq 1,700$ pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for $v > 200$ veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Arterial Level of Service: SB MT 200

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
ND 58	1	26.6	42.3	0.2	15
	82	30.9	58.9	0.2	12
Railroad	83	20.0	29.8	0.1	12
Interstate Ave	59	3.6	11.4	0.1	31
Private Dr	57	2.3	17.7	0.2	39
Taper	13	2.1	14.0	0.1	37
2nd St N	77	0.2	2.0	0.0	35
1st St N	56	1.0	8.1	0.1	31
MT 201	2	9.6	16.9	0.1	15
2nd St	52	3.4	10.4	0.1	24
3rd St	49	0.2	7.1	0.1	34
4th St	46	0.2	7.7	0.1	34
5th St	43	0.3	7.3	0.1	33
6th St	3	1.3	8.2	0.1	29
7th St	40	0.6	8.1	0.1	32
Central Ave	39	1.0	20.4	0.2	33
Western Ave	35	0.5	7.3	0.1	32
Pleasant Ave	32	0.5	7.8	0.1	32
Dawson Ave	8	0.4	7.6	0.1	33
Grand Ave	28	0.2	3.6	0.0	35
Private Dr	18	0.6	10.7	0.1	33
Ashland Ave	9	0.6	7.2	0.1	35
Dale Ave	31	0.6	8.6	0.1	42
CR 134	7	0.3	5.5	0.1	39
Taper	20	1.6	18.2	0.2	48
CR 133	19	5.1	38.5	0.6	59
Total		113.8	385.2	3.1	29

Arterial Level of Service: SB MT 200

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
ND 58	1	4.8	20.6	0.2	30
	82	23.4	52.0	0.2	13
Railroad	83	31.5	39.4	0.1	8
Interstate Ave	59	1.7	9.4	0.1	37
Private Dr	57	1.4	16.8	0.2	41
Taper	13	2.1	14.0	0.1	37
2nd St N	77	0.2	2.0	0.0	36
1st St N	56	0.8	7.8	0.1	32
MT 201	2	8.0	15.2	0.1	17
2nd St	52	3.4	10.3	0.1	24
3rd St	49	0.2	7.1	0.1	34
4th St	46	0.2	7.6	0.1	34
5th St	43	0.2	7.1	0.1	34
6th St	3	1.5	8.3	0.1	29
7th St	40	0.6	8.0	0.1	32
Central Ave	39	0.5	19.6	0.2	35
Western Ave	35	0.3	7.0	0.1	33
Pleasant Ave	32	0.3	7.6	0.1	34
Dawson Ave	8	0.2	7.3	0.1	34
Grand Ave	28	0.1	3.5	0.0	37
Private Dr	18	0.3	10.3	0.1	35
Ashland Ave	9	0.4	7.0	0.1	36
Dale Ave	31	0.3	8.3	0.1	43
CR 134	7	0.2	5.3	0.1	41
Taper	20	0.8	17.3	0.2	51
CR 133	19	2.5	36.3	0.6	62
Total		85.9	355.3	3.1	31

Arterial Level of Service: SB MT 200

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
ND 58	1	7.5	28.2	0.2	28
	82	22.5	50.2	0.2	13
Railroad	93	35.2	43.3	0.1	8
Interstate Ave	59	3.0	10.5	0.1	32
MT 200	83	4.8	19.2	0.1	26
Private Dr	57	0.5	13.6	0.1	31
Taper	13	0.8	12.8	0.1	41
2nd St N	77	0.1	1.8	0.0	38
1st St N	56	0.4	7.5	0.1	33
MT 201	2	7.3	14.4	0.1	18
2nd St	52	2.8	9.8	0.1	25
3rd St	49	0.1	7.1	0.1	34
4th St	46	0.1	7.6	0.1	34
5th St	43	0.1	7.2	0.1	34
6th St	3	0.8	7.7	0.1	31
7th St	40	0.3	7.7	0.1	33
Central Ave	39	0.3	19.5	0.2	35
Western Ave	35	0.1	7.0	0.1	34
Pleasant Ave	32	0.1	7.4	0.1	34
Dawson Ave	8	0.2	7.4	0.1	34
Grand Ave	28	0.1	3.5	0.0	36
Private Dr	18	0.2	10.3	0.1	35
Ashland Ave	9	0.2	6.8	0.1	37
Dale Ave	31	0.2	8.2	0.1	44
CR 134	7	0.2	5.4	0.1	40
Taper	20	0.5	17.1	0.2	51
Eastern 1B	23	5.1	38.8	0.6	58
Total		93.5	380.0	3.2	30

Arterial Level of Service: SB MT 200

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
ND 58	1	4.6	25.0	0.2	32
	82	0.5	28.2	0.2	24
Railroad	93	46.8	54.7	0.1	6
Interstate Ave	59	1.0	8.6	0.1	40
MT 200	83	2.3	16.4	0.1	30
Private Dr	57	0.3	13.3	0.1	32
Taper	13	0.7	12.6	0.1	42
2nd St N	77	0.1	1.8	0.0	38
1st St N	56	0.1	7.2	0.1	35
MT 201	2	6.6	13.5	0.1	19
2nd St	52	2.8	9.7	0.1	25
3rd St	49	0.1	7.0	0.1	34
4th St	46	0.2	7.6	0.1	34
5th St	43	0.1	7.1	0.1	35
6th St	3	0.8	7.7	0.1	31
7th St	40	0.3	7.8	0.1	33
Central Ave	39	0.2	19.6	0.2	35
Western Ave	35	0.1	6.9	0.1	34
Pleasant Ave	32	0.1	7.4	0.1	34
Dawson Ave	8	0.1	7.3	0.1	34
Grand Ave	28	0.1	3.5	0.0	37
Private Dr	18	0.2	10.4	0.1	34
Ashland Ave	9	0.3	6.9	0.1	36
Dale Ave	31	0.2	8.2	0.1	43
CR 134	7	0.1	5.2	0.1	41
Taper	20	0.3	17.0	0.2	52
Eastern 1B	23	2.9	36.4	0.6	62
Total		71.8	356.9	3.2	32

Arterial Level of Service: NE Western Alignment

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Western Alignment	91	6.7	36.6	0.5	44
	21	0.4	6.0	0.0	18
	92	0.1	5.4	0.0	31
CR 134	22	0.7	21.1	0.3	50
	89	0.4	10.2	0.2	63
	96	1.1	25.3	0.5	65
MT 201	58	1.0	12.3	0.2	64
	85	1.6	23.4	0.4	64
Private Drive	86	0.7	7.7	0.1	63
MT 200	82	5.7	11.6	0.1	37
Interstate Ave	59	27.1	34.7	0.1	15
Railroad	57	35.7	41.1	0.1	9
	6	3.7	8.0	0.1	36
2nd St	1	17.0	33.9	0.2	21
Total		102.1	277.5	2.9	37

Arterial Level of Service: SB Western Alignment

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	6	27.8	57.1	0.2	12
Railroad	57	13.8	20.5	0.1	14
Interstate Ave	59	3.3	9.5	0.1	37
FW MT 201	82	12.1	20.3	0.1	26
Private Drive	86	4.9	11.1	0.1	39
	85	2.2	9.5	0.1	52
MT 201	58	4.1	26.1	0.4	58
	96	1.8	13.4	0.2	59
	89	1.9	25.8	0.5	64
CR 134	22	3.7	13.0	0.2	49
	92	6.0	36.5	0.3	29
	21	14.7	19.5	0.0	9
Western Alignment	91	14.3	20.7	0.0	5
CR 133	19	2.5	37.9	0.5	43
Total		113.1	320.9	2.9	32

Arterial Level of Service: NE Western Alignment

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Western Alignment	91	3.1	31.8	0.5	51
	21	0.3	5.9	0.0	18
	92	0.1	5.5	0.0	30
CR 134	22	0.4	21.4	0.3	50
	89	0.2	10.3	0.2	62
	96	0.5	25.2	0.5	66
MT 201	58	0.5	12.1	0.2	65
	85	1.0	23.2	0.4	65
Private Drive	86	0.2	7.5	0.1	65
MT 200	82	0.8	6.5	0.1	66
Interstate Ave	59	16.8	24.4	0.1	21
Railroad	57	62.8	68.2	0.1	5
	6	3.2	7.5	0.1	38
2nd St	1	7.7	24.1	0.2	29
Total		97.4	273.6	2.9	38

Arterial Level of Service: SB Western Alignment

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	6	22.6	52.1	0.2	14
Railroad	57	32.0	38.6	0.1	7
Interstate Ave	59	4.2	10.3	0.1	34
FW MT 201	82	6.6	15.0	0.1	35
Private Drive	86	2.4	8.7	0.1	49
	85	1.0	8.5	0.1	58
MT 201	58	1.5	23.7	0.4	64
	96	0.8	12.4	0.2	64
	89	1.3	25.5	0.5	65
CR 134	22	3.3	12.7	0.2	51
	92	1.1	31.1	0.3	34
	21	2.7	7.5	0.0	22
Western Alignment	91	6.9	13.4	0.0	8
CR 133	19	2.4	37.7	0.5	43
Total		88.6	297.0	2.9	35

Arterial Level of Service: NB Eastern 1A

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
CR 133	24	0.3	31.8	0.3	32
	84	0.2	9.9	0.1	43
	85	0.2	14.7	0.2	60
	88	0.4	17.6	0.3	66
	87	0.4	14.4	0.3	67
Interstate Avenue	91	0.8	14.0	0.3	66
9th Street	86	2.3	18.9	0.3	61
Spur	93	62.8	74.3	0.2	11
Prospect Avenue	100	0.7	1.9	0.0	43
	4	2.3	11.4	0.2	55
Farm Driveway	101	0.9	7.1	0.1	59
2nd Street	104	0.8	5.7	0.1	60
	107	4.8	16.0	0.2	48
MT 200	1	18.5	35.3	0.2	19
Total		95.5	273.0	2.8	37

Arterial Level of Service: SB Eastern 1A

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	107	1.4	30.5	0.2	22
2nd Street	104	0.9	16.4	0.2	47
2nd Street S	101	2.6	7.8	0.1	44
	4	12.1	18.8	0.1	22
Prospect Avenue	100	39.1	48.2	0.2	13
Spur	93	2.2	3.4	0.0	24
9th Street	86	4.7	16.0	0.2	49
Interstate Avenue	91	3.8	20.4	0.3	56
	87	2.0	15.4	0.3	60
	88	1.4	15.2	0.3	63
	85	1.7	18.5	0.3	63
	84	3.8	16.6	0.2	53
CR 133	24	30.8	37.1	0.1	11
MT 200	23	194.7	223.9	0.3	5
Total		301.3	488.1	2.8	21

Arterial Level of Service: NB Eastern 1A

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
CR 133	24	0.1	30.8	0.3	33
	84	0.1	10.0	0.1	43
	85	0.2	14.9	0.2	59
	88	0.4	17.6	0.3	66
	87	0.4	14.4	0.3	66
Interstate Avenue	91	0.4	13.8	0.3	67
9th Street	86	0.6	17.4	0.3	66
Spur	93	49.3	60.7	0.2	13
Prospect Avenue	100	0.6	1.9	0.0	47
	4	1.7	10.7	0.2	58
Farm Driveway	101	1.4	7.6	0.1	55
2nd Street	104	1.0	5.9	0.1	58
	107	3.6	15.0	0.2	51
MT 200	1	6.0	23.2	0.2	29
Total		65.6	243.9	2.8	42

Arterial Level of Service: SB Eastern 1A

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	107	0.4	29.4	0.2	23
2nd Street	104	0.4	15.6	0.2	49
2nd Street S	101	0.3	5.5	0.1	62
	4	0.5	7.2	0.1	58
Prospect Avenue	100	40.2	49.3	0.2	13
Spur	93	9.4	10.7	0.0	8
9th Street	86	2.5	13.8	0.2	56
Interstate Avenue	91	2.0	18.6	0.3	62
	87	1.1	14.6	0.3	63
	88	0.8	14.6	0.3	66
	85	0.9	17.7	0.3	66
	84	1.5	14.3	0.2	62
CR 133	24	3.7	9.9	0.1	43
MT 200	23	14.6	45.6	0.3	23
Total		78.3	266.9	2.8	38

Arterial Level of Service: NB Eastern 1B

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
CR 133	24	0.4	32.6	0.3	32
	84	0.3	10.0	0.1	42
	85	0.5	15.1	0.2	59
	88	0.6	17.7	0.3	66
	87	0.5	14.6	0.3	66
Interstate Avenue	91	0.9	14.2	0.3	65
9th Street	86	1.1	18.0	0.3	64
Prospect Avenue	100	0.7	13.4	0.2	64
	4	0.4	9.5	0.2	65
Farm Driveway	101	0.4	6.6	0.1	63
2nd Street	104	0.3	5.3	0.1	64
	107	3.2	14.5	0.2	53
MT 200	1	5.8	22.9	0.2	30
Total		15.1	194.4	2.8	53

Arterial Level of Service: SB Eastern 1B

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	107	1.3	30.1	0.2	23
2nd Street	104	0.5	15.8	0.2	48
2nd Street S	101	0.4	5.7	0.1	60
	4	0.5	7.2	0.1	58
Prospect Avenue	100	0.6	9.8	0.2	64
9th Street	86	1.1	13.6	0.2	64
Interstate Avenue	91	1.7	18.3	0.3	63
	87	1.3	14.7	0.3	63
	88	1.1	14.9	0.3	64
	85	1.3	18.1	0.3	64
	84	1.5	14.2	0.2	62
CR 133	24	3.4	9.5	0.1	45
MT 200	23	45.5	75.9	0.3	14
Total		60.1	247.8	2.8	41

Arterial Level of Service: NB Eastern 1B

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
CR 133	24	0.1	30.9	0.3	33
	84	0.1	9.8	0.1	43
	85	0.1	14.7	0.2	60
	88	0.2	17.6	0.3	66
	87	0.2	14.3	0.3	67
Interstate Avenue	91	0.5	13.9	0.3	66
9th Street	86	0.8	17.8	0.3	64
Prospect Avenue	100	0.4	13.2	0.2	66
	4	0.2	9.5	0.2	66
Farm Driveway	101	0.3	6.5	0.1	65
2nd Street	104	0.2	5.2	0.1	65
	107	2.9	14.3	0.2	54
MT 200	1	3.9	21.5	0.2	32
Total		10.0	189.1	2.8	54

Arterial Level of Service: SB Eastern 1B

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	107	0.5	29.7	0.2	23
2nd Street	104	0.4	16.0	0.2	48
2nd Street S	101	0.3	5.6	0.1	61
	4	0.3	7.1	0.1	59
Prospect Avenue	100	0.5	9.6	0.2	65
9th Street	86	0.7	13.3	0.2	65
Interstate Avenue	91	0.9	17.6	0.3	65
	87	0.6	14.1	0.3	66
	88	0.5	14.5	0.3	66
	85	0.7	17.5	0.3	66
	84	0.8	13.6	0.2	65
CR 133	24	3.0	9.1	0.1	47
MT 200	23	8.2	39.4	0.3	26
Total		17.5	207.1	2.8	49

Arterial Level of Service: NB Eastern 2A

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	89	0.1	22.0	0.2	31
Railroad	105	65.1	89.0	0.4	15
Interstate Avenue	87	5.4	37.0	0.6	59
161st Avenue NW	111	2.8	20.6	0.4	61
Farm Driveway	88	1.1	11.7	0.2	63
Driveway	94	1.7	21.5	0.4	65
9th Street	98	7.8	20.2	0.2	42
Spur	116	30.9	40.9	0.2	17
Prospect Avenue	100	0.4	1.7	0.0	52
Farm Driveway	101	2.4	16.9	0.3	59
2nd Street	104	0.9	5.8	0.1	59
	107	4.0	15.1	0.2	51
MT 200	1	7.3	24.9	0.2	27
Total		129.9	327.2	3.3	37

Arterial Level of Service: SB Eastern 2A

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	107	1.3	30.7	0.2	22
2nd Street	104	1.2	16.6	0.2	46
2nd Street S	101	7.3	12.5	0.1	27
Prospect Avenue	100	61.4	76.7	0.3	13
Spur	116	5.3	6.6	0.0	13
9th Street	98	3.3	13.3	0.2	52
Driveway	94	3.2	15.7	0.2	55
Farm Driveway	88	3.7	23.8	0.4	59
161st Avenue NW	111	2.0	12.7	0.2	58
Interstate Avenue	87	2.9	20.9	0.4	60
Railroad	105	31.0	62.3	0.6	35
	89	63.0	81.9	0.4	16
MT 200	24	130.2	150.1	0.2	5
Total		315.7	523.9	3.3	23

Arterial Level of Service: NB Eastern 2A

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	89	0.0	21.2	0.2	32
Railroad	105	76.7	99.8	0.4	13
Interstate Avenue	87	4.1	34.5	0.6	64
161st Avenue NW	111	1.7	20.0	0.4	63
Farm Driveway	88	0.9	11.7	0.2	63
Driveway	94	0.9	21.0	0.4	66
9th Street	98	0.9	13.2	0.2	65
Spur	116	22.3	32.3	0.2	21
Prospect Avenue	100	0.2	1.5	0.0	56
Farm Driveway	101	1.2	15.7	0.3	64
2nd Street	104	0.4	5.3	0.1	64
	107	3.3	14.6	0.2	53
MT 200	1	5.2	22.4	0.2	31
Total		117.9	313.1	3.3	38

Arterial Level of Service: SB Eastern 2A

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	107	0.6	30.3	0.2	23
2nd Street	104	0.5	16.2	0.2	47
2nd Street S	101	0.4	5.7	0.1	60
Prospect Avenue	100	44.2	59.7	0.3	17
Spur	116	11.6	13.4	0.0	7
9th Street	98	3.7	13.9	0.2	49
Driveway	94	2.8	15.4	0.2	56
Farm Driveway	88	2.4	22.7	0.4	61
161st Avenue NW	111	1.7	12.4	0.2	59
Interstate Avenue	87	2.4	20.6	0.4	61
Railroad	105	28.0	59.1	0.6	37
	89	5.2	24.2	0.4	54
MT 200	24	20.0	41.1	0.2	17
Total		123.4	334.8	3.3	36

Arterial Level of Service: NB Eastern 2B

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	89	0.2	22.5	0.2	30
Interstate Avenue	87	1.1	56.5	1.0	62
161st Avenue NW	111	0.8	18.9	0.4	67
Farm Driveway	88	0.6	11.4	0.2	65
Driveway	94	1.0	20.8	0.4	67
9th Street	98	4.9	17.3	0.2	49
Spur	116	61.1	71.1	0.2	10
Prospect Avenue	100	0.7	2.0	0.0	43
Farm Driveway	101	3.4	18.0	0.3	56
2nd Street	104	1.1	6.0	0.1	57
	105	5.5	16.6	0.2	46
MT 200	1	21.4	38.6	0.2	18
Total		101.8	299.9	3.3	40

Arterial Level of Service: SB Eastern 2B

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	105	1.4	30.4	0.2	22
2nd Street	104	0.9	16.4	0.2	47
2nd Street S	101	1.9	7.1	0.1	48
Prospect Avenue	100	45.5	60.8	0.3	17
Spur	116	3.4	4.7	0.0	18
9th Street	98	3.5	13.6	0.2	51
Driveway	94	3.4	15.9	0.2	54
Farm Driveway	88	4.1	24.0	0.4	58
161st Avenue NW	111	1.9	12.6	0.2	58
Interstate Avenue	87	2.4	20.6	0.4	61
	89	61.4	111.5	1.0	31
MT 200	24	143.9	164.3	0.2	4
Total		273.6	481.8	3.3	25

Arterial Level of Service: NB Eastern 2B

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	89	0.1	21.6	0.2	31
Interstate Avenue	87	0.9	56.4	1.0	62
161st Avenue NW	111	0.6	18.9	0.4	67
Farm Driveway	88	0.3	11.2	0.2	66
Driveway	94	0.6	20.8	0.4	67
9th Street	98	0.8	13.4	0.2	64
Spur	116	52.4	62.3	0.2	11
Prospect Avenue	100	0.8	2.1	0.0	41
Farm Driveway	101	4.3	18.9	0.3	53
2nd Street	104	1.2	6.2	0.1	55
	105	3.9	15.0	0.2	51
MT 200	1	5.0	22.1	0.2	31
Total		70.8	269.1	3.3	45

Arterial Level of Service: SB Eastern 2B

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	105	0.5	29.8	0.2	23
2nd Street	104	0.3	15.9	0.2	48
2nd Street S	101	0.2	5.5	0.1	62
Prospect Avenue	100	38.8	54.1	0.3	19
Spur	116	9.5	10.8	0.0	8
9th Street	98	2.6	12.7	0.2	54
Driveway	94	2.0	14.5	0.2	59
Farm Driveway	88	2.2	22.3	0.4	62
161st Avenue NW	111	1.4	12.1	0.2	61
Interstate Avenue	87	1.7	19.9	0.4	63
	89	6.4	56.5	1.0	62
MT 200	24	18.8	40.2	0.2	17
Total		84.4	294.6	3.3	41

Arterial Level of Service: NB Eastern 2C

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	89	0.2	22.5	0.2	30
Interstate Avenue	87	1.3	57.0	1.0	61
161st Avenue NW	111	0.8	19.1	0.4	66
Farm Driveway	88	0.5	11.3	0.2	65
Driveway	94	0.8	20.9	0.4	67
9th Street	98	0.8	13.3	0.2	64
Prospect Avenue	100	0.7	12.0	0.2	65
Farm Driveway	101	0.9	15.3	0.3	66
2nd Street	104	0.4	5.3	0.1	64
	105	3.3	14.4	0.2	53
MT 200	1	5.7	22.9	0.2	30
Total		15.4	213.8	3.3	56

Arterial Level of Service: SB Eastern 2C

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	105	1.3	30.3	0.2	23
2nd Street	104	0.6	16.1	0.2	48
2nd Street S	101	0.4	5.7	0.1	60
Prospect Avenue	100	1.1	16.3	0.3	62
9th Street	98	1.0	12.3	0.2	63
Driveway	94	1.1	13.4	0.2	64
Farm Driveway	88	1.4	21.3	0.4	65
161st Avenue NW	111	0.9	11.5	0.2	64
Interstate Avenue	87	1.5	19.5	0.4	65
	89	8.9	59.3	1.0	59
MT 200	24	115.3	136.4	0.2	5
Total		133.4	342.2	3.3	35

Arterial Level of Service: NB Eastern 2C

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	105	0.1	21.6	0.2	32
Interstate Avenue	87	0.8	56.8	1.0	62
161st Avenue NW	111	0.8	19.1	0.4	66
Farm Driveway	88	0.3	11.1	0.2	66
Driveway	94	0.5	20.3	0.4	69
9th Street	98	0.5	13.0	0.2	66
Prospect Avenue	100	0.4	11.8	0.2	66
Farm Driveway	101	0.5	15.2	0.3	66
2nd Street	104	0.2	5.2	0.1	65
	89	2.8	14.1	0.2	55
MT 200	1	4.4	22.0	0.2	31
Total		11.2	210.1	3.3	57

Arterial Level of Service: SB Eastern 2C

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
	89	0.4	29.1	0.2	23
2nd Street	104	0.4	15.8	0.2	49
2nd Street S	101	0.3	5.5	0.1	62
Prospect Avenue	100	0.6	15.8	0.3	64
9th Street	98	0.6	11.9	0.2	65
Driveway	94	0.5	12.9	0.2	66
Farm Driveway	88	0.8	20.9	0.4	67
161st Avenue NW	111	0.5	11.2	0.2	66
Interstate Avenue	87	1.0	19.0	0.4	66
	105	5.1	54.2	1.0	65
MT 200	24	7.5	28.9	0.2	24
Total		17.6	225.1	3.3	53

Attachment 2

Cost Estimate Spreadsheets





WEST ALIGNMENT
Planning-level Estimate of Costs

Item Description	Approx. Quantity	Unit	Amount
CUT	472,000	CUYD	\$752,000.00
FILL	238,000	CUYD	\$474,000.00
DUMP	214,000	CUYD	\$744,000.00
TEMPLATE MATERIALS (SURFACING)			\$2,920,000.00
MASS HAUL	271,000	CUYD MI	\$135,000.00
RETAINING WALL	4,140	SQFT	\$201,000.00
CULVERT	148	FT	\$76,000.00
BRIDGE	9,720	FT	\$1,580,000.00
FOOTPRINT AREA (WETLANDS)	0.35	ACRES	\$15,000.00
CADASTRAL	24	PARCELS	\$190,000.00
QUANTM SUBTOTAL			\$7,087,000
MISCELLANEOUS ITEMS SUBTOTAL ⁶		20%	\$1,417,400
MOBILIZATION @ 10% OF SUBTOTAL ⁷		10%	\$708,700
SUBTOTAL			\$9,213,100
PRELIMINARY ENGINEERING		12%	\$1,105,572
CONSTRUCTION ENGINEERING		10%	\$921,310
INFLATION (5 YEARS AT 3.16%) OF SUBTOTAL		3.16%	\$1,550,620
INDIRECT COST (IDC) - CONSTRUCTION @ 10.37% OF SUBTOTAL ⁸		10.37%	\$955,398
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{9,10}			\$16,500,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{9,10}			\$17,900,000

¹ 0.1 mile is 528 ft.

² Average MDT bid prices provided for the period September 2014 to September 2015.

³ Cost estimates are provided in 2015 dollars. All dollar amounts are rounded for planning purposes.

⁴ Paved road typical section includes a top width of 40 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow.

⁵ 4 ft average cut depth is assumed.

⁶ The Miscellaneous category is estimated at 20 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁷ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁸ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁹ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

¹⁰ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.

¹¹ Right of way costs estimated from anticipated impacted area.



EAST ALIGNMENT 1A
Planning-level Estimate of Costs

Item Description	Approx. Quantity	Unit	Amount
CUT	49,000	CUYD	\$121,000.00
BORROW	444,000	CUYD	\$887,000.00
FILL	468,000	CUYD	\$937,000.00
DUMP	23,400	CUYD	\$81,800.00
TEMPLATE MATERIALS (SURFACING)			\$3,840,000.00
MASS HAUL	439,000	CUYD MI	\$219,000.00
RETAINING WALL	164	SQFT	\$8,220.00
CULVERT	2,130	FT	\$1,040,000.00
BRIDGE	225	FT	\$1,350,000.00
FOOTPRINT AREA (IRRIGATION PIVOT)	75	ACRES	\$112,500.00
FOOTPRINT AREA (WETLANDS)	0.23	ACRES	\$5,220.00
CADASTRAL	12	PARCELS	\$113,000.00
AT-GRADE RAILROAD CROSSING	1	EACH	\$350,000.00
QUANTM SUBTOTAL			\$9,064,740
MISCELLANEOUS ITEMS SUBTOTAL ⁶		20%	\$1,812,948
MOBILIZATION @ 10% OF SUBTOTAL ⁷		10%	\$906,474
SUBTOTAL			\$11,784,200
PRELIMINARY ENGINEERING		12%	\$1,414,104
CONSTRUCTION ENGINEERING		10%	\$1,178,420
INFLATION (5 YEARS AT 3.16%) OF SUBTOTAL		3.16%	\$1,983,352
INDIRECT COST (IDC) - CONSTRUCTION @ 10.37% OF SUBTOTAL ⁸		10.37%	\$1,222,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{9,10}			\$21,100,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{9,10}			\$22,900,000

¹ 0.1 mile is 528 ft.

² Average MDT bid prices provided for the period September 2014 to September 2015.

³ Cost estimates are provided in 2015 dollars. All dollar amounts are rounded for planning purposes.

⁴ Paved road typical section includes a top width of 40 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow.

⁵ 4 ft average cut depth is assumed.

⁶ The Miscellaneous category is estimated at 20 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁷ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁸ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁹ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

¹⁰ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.

¹¹ Right of way costs estimated from anticipated impacted area.



EAST ALIGNMENT 1B
Planning-level Estimate of Costs

Item Description	Approx. Quantity	Unit	Amount
CUT	49,200	CUYD	\$126,000.00
BORROW	751,000	CUYD	\$1,500,000.00
FILL	773,000	CUYD	\$1,550,000.00
DUMP	26,200	CUYD	\$91,900.00
TEMPLATE MATERIALS (SURFACING)			\$3,800,000.00
MASS HAUL	628,000	CUYD MI	\$314,000.00
CULVERT	2,530	FT	\$1,240,000.00
BRIDGE	405	FT	\$2,430,000.00
FOOTPRINT AREA (IRRIGATION PIVOT)	100	ACRES	\$150,000.00
FOOTPRINT AREA (WETLANDS)	0.28	ACRES	\$12,200.00
CADASTRAL	17	PARCELS	\$118,000.00
QUANTM SUBTOTAL			\$11,332,100
MISCELLANEOUS ITEMS SUBTOTAL ⁶		20%	\$2,266,420
MOBILIZATION @ 10% OF SUBTOTAL ⁷		10%	\$1,133,210
SUBTOTAL			\$14,731,700
PRELIMINARY ENGINEERING		12%	\$1,767,804
CONSTRUCTION ENGINEERING		10%	\$1,473,170
INFLATION (5 YEARS AT 3.16%) OF SUBTOTAL		3.16%	\$2,479,434
INDIRECT COST (IDC) - CONSTRUCTION @ 10.37% OF SUBTOTAL ⁸		10.37%	\$1,528,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{9,10}			\$26,400,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{9,10}			\$28,600,000

¹ 0.1 mile is 528 ft.

² Average MDT bid prices provided for the period September 2014 to September 2015.

³ Cost estimates are provided in 2015 dollars. All dollar amounts are rounded for planning purposes.

⁴ Paved road typical section includes a top width of 40 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow.

⁵ 4 ft average cut depth is assumed.

⁶ The Miscellaneous category is estimated at 20 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁷ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁸ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁹ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

¹⁰ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.

¹¹ Right of way costs estimated from anticipated impacted area.



EAST ALIGNMENT 2A
Planning-level Estimate of Costs

Item Description	Approx. Quantity	Unit	Amount
CUT	104,000	CUYD	\$204,000.00
FILL	48,900	CUYD	\$99,100.00
DUMP	51,100	CUYD	\$179,000.00
TEMPLATE MATERIALS (SURFACING)			\$4,580,000.00
MASS HAUL	57,700	CUYD MI	\$28,900.00
CULVERT	1,300	FT	\$645,000.00
FOOTPRINT AREA (IRRIGATION PIVOT)	37	ACRES	\$55,500.00
FOOTPRINT AREA (WETLANDS)	0.07	ACRES	\$2,000.00
CADASTRAL	29	PARCELS	\$219,000.00
AT-GRADE RAILROAD CROSSING	2	EACH	\$700,000.00
QUANTM SUBTOTAL			\$6,712,500
MISCELLANEOUS ITEMS SUBTOTAL ⁶		20%	\$1,342,500
MOBILIZATION @ 10% OF SUBTOTAL ⁷		10%	\$671,250
SUBTOTAL			\$8,726,300
PRELIMINARY ENGINEERING		12%	\$1,047,156
CONSTRUCTION ENGINEERING		10%	\$872,630
INFLATION (5 YEARS AT 3.16%) OF SUBTOTAL		3.16%	\$1,468,689
INDIRECT COST (IDC) - CONSTRUCTION @ 10.37% OF SUBTOTAL ⁸		10.37%	\$905,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{9,10}			\$15,600,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{9,10}			\$17,000,000

¹ 0.1 mile is 528 ft.

² Average MDT bid prices provided for the period September 2014 to September 2015.

³ Cost estimates are provided in 2015 dollars. All dollar amounts are rounded for planning purposes.

⁴ Paved road typical section includes a top width of 40 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow.

⁵ 4 ft average cut depth is assumed.

⁶ The Miscellaneous category is estimated at 20 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁷ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁸ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁹ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

¹⁰ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.

¹¹ Right of way costs estimated from anticipated impacted area.



EAST ALIGNMENT 2B
Planning-level Estimate of Costs

Item Description	Approx. Quantity	Unit	Amount
CUT	83,600	CUYD	\$181,000.00
BORROW	466,000	CUYD	\$933,000.00
FILL	519,000	CUYD	\$1,040,000.00
DUMP	28,000	CUYD	\$98,100.00
TEMPLATE MATERIALS (SURFACING)			\$4,500,000.00
MASS HAUL	288,000	CUYD MI	\$144,000.00
RETAINING WALL	165	SQFT	\$8,270.00
CULVERT	1,390	FT	\$668,000.00
BRIDGE	200	FT	\$1,200,000.00
FOOTPRINT AREA (IRRIGATION PIVOT)	75	ACRES	\$112,500.00
FOOTPRINT AREA (WETLANDS)	0.21	ACRES	\$9,200.00
CADASTRAL	29	PARCELS	\$237,000.00
AT-GRADE RAILROAD CROSSING	1	EACH	\$350,000.00
QUANTM SUBTOTAL			\$9,481,070
MISCELLANEOUS ITEMS SUBTOTAL ⁶		20%	\$1,896,214
MOBILIZATION @ 10% OF SUBTOTAL ⁷		10%	\$948,107
SUBTOTAL			\$12,325,400
PRELIMINARY ENGINEERING		12%	\$1,479,048
CONSTRUCTION ENGINEERING		10%	\$1,232,540
INFLATION (5 YEARS AT 3.16%) OF SUBTOTAL		3.16%	\$2,074,439
INDIRECT COST (IDC) - CONSTRUCTION @ 10.37% OF SUBTOTAL ⁸		10.37%	\$1,278,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{9,10}			\$22,100,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{9,10}			\$24,000,000

¹ 0.1 mile is 528 ft.

² Average MDT bid prices provided for the period September 2014 to September 2015.

³ Cost estimates are provided in 2015 dollars. All dollar amounts are rounded for planning purposes.

⁴ Paved road typical section includes a top width of 40 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow.

⁵ 4 ft average cut depth is assumed.

⁶ The Miscellaneous category is estimated at 20 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁷ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁸ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁹ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

¹⁰ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.

¹¹ Right of way costs estimated from anticipated impacted area.



EAST ALIGNMENT 2C
Planning-level Estimate of Costs

Item Description	Approx. Quantity	Unit	Amount
CUT	68,700	CUYD	\$165,000.00
BORROW	813,000	CUYD	\$1,630,000.00
FILL	848,000	CUYD	\$1,700,000.00
DUMP	30,900	CUYD	\$108,000.00
TEMPLATE MATERIALS (SURFACING)			\$4,540,000.00
MASS HAUL	496,000	CUYD MI	\$248,000.00
RETAINING WALL	6,500	SQFT	\$325,000.00
CULVERT	2,200	FT	\$1,070,000.00
BRIDGE	375	FT	\$2,250,000.00
FOOTPRINT AREA (IRRIGATION PIVOT)	100	ACRES	\$150,000.00
FOOTPRINT AREA (WETLANDS)	0.12	ACRES	\$5,200.00
CADASTRAL	31	PARCELS	\$244,000.00
QUANTM SUBTOTAL			\$12,435,200
MISCELLANEOUS ITEMS SUBTOTAL ⁶		20%	\$2,487,040
MOBILIZATION @ 10% OF SUBTOTAL ⁷		10%	\$1,243,520
SUBTOTAL			\$16,165,800
PRELIMINARY ENGINEERING		12%	\$1,939,896
CONSTRUCTION ENGINEERING		10%	\$1,616,580
INFLATION (5 YEARS AT 3.16%) OF SUBTOTAL		3.16%	\$2,720,801
INDIRECT COST (IDC) - CONSTRUCTION @ 10.37% OF SUBTOTAL ⁸		10.37%	\$1,676,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{9,10}			\$28,900,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{9,10}			\$31,400,000

¹ 0.1 mile is 528 ft.

² Average MDT bid prices provided for the period September 2014 to September 2015.

³ Cost estimates are provided in 2015 dollars. All dollar amounts are rounded for planning purposes.

⁴ Paved road typical section includes a top width of 40 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow.

⁵ 4 ft average cut depth is assumed.

⁶ The Miscellaneous category is estimated at 20 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁷ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁸ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁹ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

¹⁰ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.

¹¹ Right of way costs estimated from anticipated impacted area.



**Option 1 STOP CONTROLLED INTERSECTION
Planning-level Estimate of Costs**

Item Description	Approx. Quantity	Unit	Average MDT Bid Prices ¹		Adjusted Unit Prices	
			Unit Price	Amount	Unit Price	Amount ²
			Dollars	Dollars	Dollars	Dollars
MT 200/BYPASS INTERSECTION						
COMMERCIAL MIX-PG 70-28 ³	771	TON	\$104.99	\$114,439.00	\$105.00	\$114,450.00
EMULSIFIED ASPHALT CRS-2P	0.7	TON	\$579.90	\$575.00	\$580.00	\$575.00
COVER-TYPE 1	3,000	SQYD	\$0.61	\$2,577.00	\$1.00	\$4,224.00
BASE-CEMENT TREATED	600	CUYD	\$37.81	\$31,942.00	\$40.00	\$33,792.00
CRUSHED AGGREGATE COURSE ³	600	CUYD	\$22.12	\$18,687.00	\$25.00	\$21,120.00
SPECIAL BORROW ³	1,000	CUYD		\$0.00	\$20.00	\$28,160.00
EXCAVATION - UNCLASSIFIED ⁴	2,000	CUYD	\$4.69	\$13,207.00	\$5.00	\$14,080.00
STRIPING-WHITE PAINT	4	GAL	\$34.31	\$103.00	\$1,000.00	\$3,000.00
STRIPING-WHITE PLASTIC 24 IN	80	LNFT		\$0.00	\$110.00	\$7,370.00
STRIPING-YELLOW PAINT	4	GAL	\$39.70	\$79.00	\$1,000.00	\$2,000.00
PHOTO ELECTRIC CONTROL	1	EACH			\$200.00	\$200.00
LUMINAIRE ASSEMBLY - 400 W S.V.	4	EACH	\$354.00	\$1,416.00	\$150.00	\$600.00
SERV ASSEMB-60 AMP	1	EACH	\$1,787.50	\$1,788.00	\$2,000.00	\$2,000.00
SIG STANDARD TYPE 3-A-500-3	4	EACH	\$1,331.25	\$5,325.00	\$10,000.00	\$40,000.00
REMOVE AND RESET EXISTING POLE	4	EACH	\$350.00	\$1,400.00	\$350.00	\$1,400.00
FOUNDATION CONCRETE	2	CUYD	\$832.52	\$1,665.00		\$1,665.00
TRAFFIC CONTROL	1	LS	\$15,285.16	\$15,285.00	\$25,000.00	\$25,000.00
SIGNS	8	EACH		\$0.00	\$500.00	\$4,000.00
MT 200/BYPASS INTERSECTION SUBTOTAL						\$303,636
AVERAGE COST - SUBTOTAL 1					\$303,636	
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁵					20%	\$60,700
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁶					10%	\$30,400
SUBTOTAL 2						\$394,700
PRELIMINARY ENGINEERING					12%	\$47,364
CONSTRUCTION ENGINEERING					10%	\$39,470
INFLATION (5 YEARS @ 3.16%) OF SUBTOTAL					3.16%	\$66,430
INDIRECT COST (IDC) - CONSTRUCTION @ 10.37% OF SUBTOTAL 2 ⁷					10.37%	\$41,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{8,9}						\$710,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{8,9}						\$800,000

¹ Average MDT bid prices provided for the period September 2014 to September 2015.

² Cost estimates are provided in 2015 dollars. All dollar amounts are rounded for planning purposes.

³ Paved road typical section includes a top width of 40 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow.

⁴ 2ft average cut depth is assumed.

⁵ The Miscellaneous category is estimated at 20 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁶ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁷ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁸ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

⁹ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.



**Option 2 - SIGNAL CONTROLLED INTERSECTION
Planning-level Estimate of Costs**

Item Description	Approx. Quantity	Unit	Average MDT Bid Prices ¹		Adjusted Unit Prices	
			Unit Price	Amount	Unit Price	Amount ²
			Dollars	Dollars	Dollars	Dollars
MT 200/BYPASS INTERSECTION						
COMMERCIAL MIX-PG 70-28 ³	771	TON	\$104.99	\$114,439.00	\$105.00	\$114,450.00
EMULSIFIED ASPHALT CRS-2P	0.7	TON	\$579.90	\$575.00	\$580.00	\$575.00
COVER-TYPE 1	3,000	SQYD	\$0.61	\$2,577.00	\$1.00	\$4,224.00
BASE-CEMENT TREATED	600	CUYD	\$37.81	\$31,942.00	\$40.00	\$33,792.00
CRUSHED AGGREGATE COURSE ³	600	CUYD	\$22.12	\$18,687.00	\$25.00	\$21,120.00
SPECIAL BORROW ³	1,000	CUYD		\$0.00	\$20.00	\$28,160.00
EXCAVATION - UNCLASSIFIED ⁴	2,000	CUYD	\$4.69	\$13,207.00	\$5.00	\$14,080.00
STRIPING-WHITE PAINT	4	GAL	\$34.31	\$103.00	\$1,000.00	\$3,000.00
STRIPING-WHITE PLASTIC 24 IN	80	LNFT		\$0.00	\$110.00	\$7,370.00
STRIPING-YELLOW PAINT	4	GAL	\$39.70	\$79.00	\$1,000.00	\$2,000.00
CONDUIT-PLASTIC 2 IN	400	LNFT	\$8.69	\$3,476.00	\$10.00	\$4,000.00
CONDUIT-PLASTIC 2 1/2 IN	75	LNFT	\$6.76	\$507.00	\$7.00	\$525.00
CONDUIT-PLASTIC 4 IN	75	LNFT			\$25.00	\$1,875.00
PULL BOX-COMPOSITE TYPE 3	5	EACH	\$528.78	\$2,644.00	\$600.00	\$3,000.00
FOUNDATION-CONCRETE	10	CUYD	\$859.53	\$8,595.00	\$900.00	\$9,000.00
CABLE-COPPER 3AWG14-600V	50	LNFT	\$1.05	\$53.00	\$1.00	\$50.00
CABLE-COPPER 7AWG14-600V	800	LNFT	\$1.72	\$1,376.00	\$2.00	\$1,600.00
CABLE-COPPER 16AWG14-600V	600	LNFT	\$4.50	\$2,700.00	\$4.50	\$2,700.00
CABLE-COPPER COAXIAL-VIDEO	600	LNFT		\$0.00	\$3.00	\$1,800.00
CABLE-COPPER COAXIAL 50 OHM 3/8 IN	50	LNFT	\$1.95	\$98.00	\$2.00	\$100.00
CONDUCTOR-COPPER AWG6-600V	600	LNFT	\$1.05	\$630.00	\$1.00	\$600.00
CONDUCTOR-COPPER AWG8-600V	800	LNFT	\$0.80	\$640.00	\$1.00	\$800.00
CONDUCTOR-COPPER AWG10-600V	600	LNFT	\$0.57	\$342.00	\$1.00	\$600.00
PHOTO ELECTRIC CONTROL	1	EACH			\$200.00	\$200.00
LUMINAIRE ASSEMBLY - 400 W S.V.	4	EACH	\$354.00	\$1,416.00	\$150.00	\$600.00
CONTROLLER-CAB PEDESTAL TYPE P	1	EACH	\$980.00	\$980.00	\$1,000.00	\$1,000.00
SERV ASSEMB-60 AMP	1	EACH	\$1,787.50	\$1,788.00	\$2,000.00	\$2,000.00
SIG-TRAF 3 COL-1 WAY 12-12-12	12	EACH	\$838.85	\$10,066.00	\$1,000.00	\$12,000.00
SIG-TRAF-BACKPLATE-REFLECTIVE	12	EACH	\$75.00	\$900.00	\$75.00	\$900.00
SIG-PEDESTRIAN TYPE 2	8	EACH	\$885.55	\$7,084.00	\$900.00	\$7,200.00
CONTRLR/TRAF-ACTUAT TYPE 8-A	1	EACH	\$788.00	\$788.00	\$35,000.00	\$35,000.00
SIG STANDARD TYPE 3-A-500-3	4	EACH	\$1,331.25	\$5,325.00	\$10,000.00	\$40,000.00
REMOVE AND RESET EXISTING POLE	4	EACH	\$350.00	\$1,400.00	\$350.00	\$1,400.00
REMOVE AND SALVAGE MISC ELECTRICAL	1	LS	\$2,594.17	\$2,594.00	\$10,000.00	\$10,000.00
PUSH BUTTON/PEDESTRIAN	8	EACH	\$1,041.67	\$8,333.00	\$1,050.00	\$8,400.00
YAGI ANTENNA-TYPE D	1	EACH	\$1,075.00	\$1,075.00	\$1,075.00	\$1,075.00
GE/MDS SD9 RADIO	1	EACH			\$2,000.00	\$2,000.00
TRAFFIC CONTROL	1	LS	\$15,285.16	\$15,285.00	\$15,500.00	\$15,500.00
SIGNS	8	EACH		\$0.00	\$500.00	\$4,000.00
MT 200/BYPASS INTERSECTION SUBTOTAL						\$396,696
CATEGORY	QUANTITY					
	1.00					\$396,696
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁵					20%	\$79,000
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁶					10%	\$40,000
SUBTOTAL 2						\$520,000
PRELIMINARY ENGINEERING					12%	\$62,400
CONSTRUCTION ENGINEERING					10%	\$52,000
INFLATION (5 YEARS @ 3.16%) OF SUBTOTAL					3.16%	\$87,519
INDIRECT COST (IDC) - CONSTRUCTION @ 10.37% OF SUBTOTAL 2 ⁷					10.37%	\$54,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{8,9}						\$900,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{8,9}						\$1,100,000

¹ Average MDT bid prices provided for the period September 2014 to September 2015.

² Cost estimates are provided in 2015 dollars. All dollar amounts are rounded for planning purposes.

³ Paved road typical section includes a top width of 40 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow.

⁴ 2ft average cut depth is assumed.

⁵ The Miscellaneous category is estimated at 20 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.



**Option 2 - SIGNAL CONTROLLED INTERSECTION
Planning-level Estimate of Costs**

Item Description	Approx. Quantity	Unit	Average MDT Bid Prices ¹		Adjusted Unit Prices	
			Unit Price	Amount	Unit Price	Amount ²
			Dollars	Dollars	Dollars	Dollars

⁶ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁷ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁸ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

⁹ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.



**Option 3 ROUNDABOUT INTERSECTION
Planning-level Estimate of Costs**

Item Description	Approx. Quantity	Unit	Average MDT Bid Prices ¹		Adjusted Unit Prices	
			Unit Price	Amount	Unit Price	Amount ²
			Dollars	Dollars	Dollars	Dollars
EXCAVATION-UNCLASSIFIED ⁴	500	CUYD	\$4.69	\$2,345.00	\$6.00	\$3,000.00
EXCAVATION-UNCLASS BORROW ⁴	2000	CUYD	\$3.76	\$54,423.00	\$5.00	\$10,000.00
CRUSHED AGGREGATE COURSE ³	700	CUYD	\$22.12	\$97,512.00	\$25.00	\$17,500.00
PORT CEM CONC PAVE 9 IN	2200	SQYD	\$145.22	\$685,293.00	\$150.00	\$330,000.00
COMMERCIAL MIX PG 64-28 ³	50	TON	\$103.45	\$152,002.00	\$125.00	\$6,250.00
DECORATIVE CONCRETE	500	SQYD	\$95.24	\$89,684.00	\$100.00	\$50,000.00
CURB-CONC MEDIAN TYPE A	800	LNFT	\$26.66	\$53,267.00	\$22.00	\$17,600.00
CURB AND GUTTER-CONC	1200	LNFT	\$22.16	\$51,367.00	\$25.00	\$30,000.00
TOPSOIL	200	CUYD	\$26.40	\$21,296.00	\$30.00	\$6,000.00
SEEDING AREA NO 1	1	ACRE	\$379.87	\$570.00	\$400.00	\$400.00
CONDITION SEEDBED SURFACE	1	ACRE	\$61.48	\$92.00	\$70.00	\$70.00
LANDSCAPE ROCK	90	CUYD	\$88.70	\$14,547.00	\$50.00	\$4,500.00
TRAFFIC CONTROL	1	LS	\$15,285.16	\$15,285.00	\$40,000.00	\$40,000.00
SIGNS	20	EACH		\$0.00	\$500.00	\$10,000.00
CURB MARKING-YELLOW PAINT	8	GAL		\$0.00	\$70.00	\$560.00
CURB MARKING-YELLOW EPOXY	8	GAL	\$240.94	\$3,614.00	\$250.00	\$2,000.00
WORDS AND SYMBOLS-WHITE PAINT	8	GAL	\$135.06	\$2,026.00	\$150.00	\$1,200.00
WORDS AND SYMBOLS-WHITE EPOXY	8	GAL	\$321.55	\$4,823.00	\$325.00	\$2,600.00
STRIPING-WHITE PAINT	63	GAL	\$24.82	\$3,103.00	\$30.00	\$1,890.00
REMOVE PAVEMENT MARKINGS	100	LNFT	\$1.71	\$610.00	\$2.00	\$200.00
STRIPING-WHITE EPOXY	8	GAL	\$59.54	\$7,443.00	\$60.00	\$480.00
STRIPING-YELLOW PAINT	8	GAL	\$25.57	\$2,046.00	\$30.00	\$240.00
STRIPING-YELLOW EPOXY	8	GAL	\$60.09	\$4,807.00	\$65.00	\$520.00
SEPARATION GEOTEXTILE - MOD	500	SQYD	\$3.31	\$3,254.00	\$3.00	\$1,500.00
RIGHT OF WAY ¹⁰	1	ACRE		\$0.00	\$52,000.00	\$52,000.00
MT 200/BYPASS INTERSECTION SUBTOTAL						\$588,510
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁵					20%	\$117,700
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁶					10%	\$58,900
SUBTOTAL 2						\$765,100
PRELIMINARY ENGINEERING					12%	\$91,812
CONSTRUCTION ENGINEERING					10%	\$76,510
INFLATION (5 YEARS @ 3.16%) OF SUBTOTAL					3.16%	\$128,771
INDIRECT COST (IDC) - CONSTRUCTION @ 10.37% OF SUBTOTAL 2 ⁷					10.37%	\$79,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{8,9}						\$1,400,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{8,9}						\$1,500,000

¹ Average MDT bid prices provided for the period September 2014 to September 2015.

² Cost estimates are provided in 2015 dollars. All dollar amounts are rounded for planning purposes.

³ Paved road typical section includes a top width of 40 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow.

⁴ 2 ft average cut depth is assumed.

⁵ The Miscellaneous category is estimated at 20 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁶ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁷ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁸ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

⁹ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.

¹⁰ Right of way costs estimated from anticipated impacted area.



Option 4 BYPASS WITH TEE INTERSECTION
Planning-level Estimate of Costs

Item Description	Approx. Quantity	Unit	Average MDT Bid Prices ¹		Adjusted Unit Prices		
			Unit Price	Amount	Unit Price	Amount ²	
			Dollars	Dollars	Dollars	Dollars	
COMMERCIAL MIX-PG 70-28 ³	10,251	TON	\$104.99	\$114,439.00	\$105.00	\$114,450.00	
EMULSIFIED ASPHALT CRS-2P	9.3	TON	\$579.90	\$575.00	\$580.00	\$575.00	
COVER-TYPE 1	21,444	SQYD	\$0.61	\$2,577.00	\$1.00	\$4,224.00	
BASE-CEMENT TREATED	4,289	CUYD	\$37.81	\$31,942.00	\$40.00	\$33,792.00	
CRUSHED AGGREGATE COURSE ³	4,289	CUYD	\$22.12	\$18,687.00	\$25.00	\$21,120.00	
SPECIAL BORROW ³	7,148	CUYD		\$0.00	\$20.00	\$28,160.00	
EXCAVATION - UNCLASSIFIED ⁴	14,296	CUYD	\$4.69	\$13,207.00	\$5.00	\$14,080.00	
STRIPING-WHITE PAINT	4	GAL	\$34.31	\$103.00	\$1,000.00	\$3,000.00	
STRIPING-WHITE PLASTIC 24 IN	80	LNFT		\$0.00	\$110.00	\$7,370.00	
STRIPING-YELLOW PAINT	4	GAL	\$39.70	\$79.00	\$1,000.00	\$2,000.00	
PHOTO ELECTRIC CONTROL	1	EACH			\$200.00	\$200.00	
LUMINAIRE ASSEMBLY - 400 W S.V.	4	EACH	\$354.00	\$1,416.00	\$150.00	\$600.00	
SERV ASSEMB-60 AMP	1	EACH	\$1,787.50	\$1,788.00	\$2,000.00	\$2,000.00	
SIG STANDARD TYPE 3-A-500-3	4	EACH	\$1,331.25	\$5,325.00	\$10,000.00	\$40,000.00	
REMOVE AND RESET EXISTING POLE	4	EACH	\$350.00	\$1,400.00	\$350.00	\$1,400.00	
FOUNDATION CONCRETE	2	CUYD	\$832.52	\$1,665.00		\$1,665.00	
TRAFFIC CONTROL	1	LS	\$15,285.16	\$15,285.00	\$25,000.00	\$25,000.00	
SIGNS	8	EACH		\$0.00	\$500.00	\$4,000.00	
RIGHT OF WAY ¹⁰	8	ACRE		\$0.00	\$52,000.00	\$416,000.00	
MT 200/BYPASS INTERSECTION SUBTOTAL							\$719,636
CATEGORY	QUANTITY				SUBTOTAL		
	1.00				\$719,636		
ADDITIONAL COSTS							
	MISCELLANEOUS ITEMS SUBTOTAL 1 ⁵		20%		\$143,900		
	MOBILIZATION @ 10% OF SUBTOTAL 1 ⁶		10%		\$72,000		
	SUBTOTAL 2				\$935,500		
	PRELIMINARY ENGINEERING		12%		\$112,260		
	CONSTRUCTION ENGINEERING		10%		\$93,550		
	INFLATION (5 YEARS @ 3.16%) OF SUBTOTAL		3.16%		\$157,450		
	INDIRECT COST (IDC) - CONSTRUCTION @ 10.37% OF SUBTOTAL 2 ⁷		10.37%		\$97,000		
	TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{8,9}				\$1,700,000		
	TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{8,9}				\$1,900,000		

¹ Average MDT bid prices provided for the period September 2014 to September 2015.

² Cost estimates are provided in 2015 dollars. All dollar amounts are rounded for planning purposes.

³ Paved road typical section includes a top width of 40 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow.

⁴ 2ft average cut depth is assumed.

⁵ The Miscellaneous category is estimated at 20 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁶ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁷ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁸ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

⁹ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.

¹⁰ Right of way costs estimated from anticipated impacted area.



**Option 1 - ROADWAY WIDENING (Three Lanes)
Planning-Level Estimate of Costs**

Item Description	Approx. Quantity	Unit	Average MDT Bid Prices ²		Adjusted Unit Prices	
			Unit Price	Amount	Unit Price	Amount ³
			Dollars	Dollars	Dollars	Dollars
ROADWAY WIDENING (RP 61.8 TO 62.3)						
COMMERCIAL MIX-PG 70-28 ⁴	5,090	TON	\$104.99	\$534,399.00	\$105.00	\$534,450.00
EMULSIFIED ASPHALT CRS-2P	4.6	TON	\$579.90	\$2,683.00	\$580.00	\$2,684.00
COVER-TYPE 1	15,840	SQYD	\$0.61	\$9,662.00	\$61.00	\$966,240.00
BASE-CEMENT TREATED	1,613	CUYD	\$37.81	\$61,000.00	\$40.00	\$64,533.00
CRUSHED AGGREGATE COURSE ⁴	1,613	CUYD	\$22.12	\$35,687.00	\$25.00	\$40,333.00
SPECIAL BORROW ⁴	2,151	CUYD		\$0.00	\$20.00	\$43,022.00
ROADWAY OBLITERATION	26.4	STA	\$858.58	\$22,667.00	\$860.00	\$22,704.00
EXCAVATION - UNCLASSIFIED ⁵	3,911	CUYD	\$4.69	\$18,343.00	\$5.00	\$19,556.00
EXCAVATION-UNCLASSIFIED BORROW ⁵	8,604	CUYD	\$3.76	\$32,353.00	\$4.00	\$34,418.00
STRIPING - WHITE EPOXY	10	GAL	\$59.54	\$595.00	\$60.00	\$600.00
STRIPING - YELLOW EPOXY	10	GAL	\$60.09	\$601.00	\$60.00	\$600.00
RIGHT OF WAY ¹¹	2.4	ACRE		\$0.00	\$50,000.00	\$120,000.00
ROADWAY WIDENING (RP 61.8 TO 62.3) SUBTOTAL						\$1,849,140
CATEGORY	LENGTH (MILE)		COST PER 0.1 MILE¹			
RP 61.8 TO 62.3	0.50		\$369,828			
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁶					15%	\$55,500
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁷					10%	\$37,000
SUBTOTAL 2						\$462,300
PRELIMINARY ENGINEERING					10%	\$46,230
CONSTRUCTION ENGINEERING					10%	\$46,230
INDIRECT COST (IDC) - CONSTRUCTION @ 10.37% OF SUBTOTAL 2 ⁸					10.37%	\$48,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{9,10}						\$700,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{9,10}						\$800,000
TOTAL PROJECT COST						\$1,849,140
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁶					15%	\$277,400
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁷					10%	\$184,900
SUBTOTAL 2						\$2,311,400
PRELIMINARY ENGINEERING					10%	\$231,140
CONSTRUCTION ENGINEERING					10%	\$231,140
INDIRECT COST (IDC) - CONSTRUCTION @ 10.37% OF SUBTOTAL 2 ⁸					10.37%	\$240,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{9,10}						\$3,600,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{9,10}						\$4,000,000

¹ 0.1 mile is 528 ft.

² Average MDT bid prices provided for the period September 2014 to September 2015.

³ Cost estimates are provided in 2015 dollars. All dollar amounts are rounded for planning purposes.

⁴ Paved road typical section includes a top width of 40 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow.

⁵ 2 ft average cut depth is assumed.

⁶ The Miscellaneous category is estimated at 15 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁷ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁸ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁹ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

¹⁰ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.

¹¹ Right of way costs estimated from anticipated impacted area.



Option 2 - SIDEWALK IMPROVEMENTS
Planning-Level Estimate of Costs

Item Description	Approx. Quantity	Unit	Average MDT Bid Prices ¹		Adjusted Unit Prices	
			Unit Price	Amount	Unit Price	Amount ²
			Dollars	Dollars	Dollars	Dollars
RP 62.5 TO 63.8						
EXCAVATION-UNCLASSIFIED ³	185	CUYD	\$4.69	\$869.00	\$5.00	\$926.00
SIDEWALK-CONCRETE 4 IN	556	SQYD	\$63.99	\$35,550.00	\$70.00	\$38,889.00
SIDEWALK-CONCRETE 6 IN	56	SQYD	\$70.28	\$3,904.00	\$75.00	\$4,167.00
COMMERCIAL MIX-PG 58-28	129	TON	\$140.30	\$18,029.00	\$150.00	\$19,275.00
REMOVE SIDEWALK	389	SQYD		\$0.00	\$10.00	\$3,889.00
DETEC WARNING DEVICES-TYPE 1	90	SQYD	\$289.14	\$26,023.00	\$300.00	\$27,000.00
CURB AND GUTTER-CONC	1,000	LNFT	\$22.16	\$22,160.00	\$25.00	\$25,000.00
REMOVE CURB AND GUTTER	700	LNFT		\$0.00	\$12.00	\$8,400.00
TRAFFIC CONTROL	1	LS	\$15,285.16	\$15,285.00	\$20,000.00	\$20,000.00
CURB MARKING-YELLOW EPOXY	5	GAL	\$240.94	\$1,205.00	\$150.00	\$750.00
RIGHT OF WAY ⁹	0.5	ACRE		\$0.00	\$180,000.00	\$90,000.00
RP 62.5 TO 63.8 SUBTOTAL				\$869.00		\$238,296
						COST PER 100 feet¹
						\$3,453.57
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁴					15%	\$500
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁵					10%	\$300
SUBTOTAL 2						\$4,254
PRELIMINARY ENGINEERING					10%	\$425
CONSTRUCTION ENGINEERING					10%	\$425
INDIRECT COST (IDC) - CONSTRUCTION @ 10.37% OF SUBTOTAL 2 ⁶					10.37%	\$400
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{7,8}						\$6,600
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{7,8}						\$7,200
TOTAL PROJECT COST						\$238,296
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁴					15%	\$35,700
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁵					10%	\$23,800
SUBTOTAL 2						\$297,796
PRELIMINARY ENGINEERING					10%	\$29,780
CONSTRUCTION ENGINEERING					10%	\$29,780
INDIRECT COST (IDC) - CONSTRUCTION @ 10.37% OF SUBTOTAL 2 ⁶					10.37%	\$30,900
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{7,8}						\$470,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{7,8}						\$500,000

¹ Average MDT bid prices provided for the period September 2014 to September 2015.

² Cost estimates are provided in 2015 dollars. All dollar amounts are rounded for planning purposes.

³ Assume an excavation depth of 1 ft under sidewalk locations.

⁴ The Miscellaneous category is estimated at 15 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁵ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁶ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁷ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

⁸ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.

Attachment 3

AC Screening Survey



Fairview Screening Criteria

Advisory Committee Survey

The Fairview screening process is intended to evaluate potential alternative routes according to their ability to satisfy study needs and objectives based on available information.

Needs, Objectives, and Other Considerations

Need 1: Accommodate existing and projected transportation demands within the study area.

Objectives:

To the extent practicable:

- Meet desirable levels of service on roadway segments and at intersections through the 2035 planning horizon.
- Consider regional and local travel patterns.

Need 2: Provide transportation facilities that safely support travel for all modes.

Objectives:

To the extent practicable:

- Improve roadway and bridge elements to meet current design criteria.
- Improve continuity for pedestrian facilities on MT 200 within the city limits of Fairview.
- Consider methods to reduce conflicts between local vehicular traffic and regional truck traffic.

Other Considerations

- Local planning efforts, planned projects, and potential future development in the study area.
- Potential impacts to railroad, utility, irrigation, and mining features.
- Potential adverse impacts to environmental resources that may result from improvement options.
- Funding availability.
- Temporary construction impacts.
- Construction feasibility and physical constraints.
- Seasonal variations in truck traffic.

In consideration of study needs, objectives, and other considerations, please order the importance or level of risk for the following ten screening criteria, with 10 assigned to the criterion that is most important or involves the most risk, and 1 indicating the criterion that is least important or involves the least risk.

Screening Criteria	Order of Importance
Route Length (Feet)	
Travel Time (Minutes/Seconds)	
At-grade Rail Crossings (Total Number)	
Parcel Impacts (Total Number)	
Right-of-way Acquisition (Acres)	
Wetland Impacts (Acres)	
Total Farmland Impacts (Acres)	
Irrigation Impacts (Total Number of Features)	
Access Point Density (Total Number of Public/Private)	
Total Estimated Project Development Cost	

Order: 10 = Most Important/Most Risk; 1 = Least Important/Least Risk.

In consideration of study needs, objectives, and other considerations, please order the importance or level of risk for the following ten screening criteria, with 10 assigned to the criterion that is most important or involves the most risk, and 1 indicating the criterion that is least important or involves the least risk.

Screening Criteria	Order of Importance
Route Length (Feet)	5
Travel Time (Minutes/Seconds)	4
At-grade Rail Crossings (Total Number)	9
Parcel Impacts (Total Number)	7
Right-of-way Acquisition (Acres)	8
Wetland Impacts (Acres)	2
Total Farmland Impacts (Acres)	1
Irrigation Impacts (Total Number of Features)	3
Access Point Density (Total Number of Public/Private)	6
Total Estimated Project Development Cost	10

Order: 10 = Most Important/Most Risk; 1 = Least Important/Least Risk.

In consideration of study needs, objectives, and other considerations, please order the importance or level of risk for the following ten screening criteria, with 10 assigned to the criterion that is most important or involves the most risk, and 1 indicating the criterion that is least important or involves the least risk.

Screening Criteria	Order of Importance
Route Length (Feet)	2
Travel Time (Minutes/Seconds)	5
At-grade Rail Crossings (Total Number)	10
Parcel Impacts (Total Number)	1
Right-of-way Acquisition (Acres)	4
Wetland Impacts (Acres)	7
Total Farmland Impacts (Acres)	3
Irrigation Impacts (Total Number of Features)	6
Access Point Density (Total Number of Public/Private)	9
Total Estimated Project Development Cost	8

Order: 10 = Most Important/Most Risk; 1 = Least Important/Least Risk.

In consideration of study needs, objectives, and other considerations, please order the importance or level of risk for the following ten screening criteria, with 10 assigned to the criterion that is most important or involves the most risk, and 1 indicating the criterion that is least important or involves the least risk.

Screening Criteria	Order of Importance
Route Length (Feet)	9
Travel Time (Minutes/Seconds)	10
At-grade Rail Crossings (Total Number)	8
Parcel Impacts (Total Number)	1
Right-of-way Acquisition (Acres)	6
Wetland Impacts (Acres)	2
Total Farmland Impacts (Acres)	3
Irrigation Impacts (Total Number of Features)	4
Access Point Density (Total Number of Public/Private)	5
Total Estimated Project Development Cost	7

Order: 10 = Most Important/Most Risk; 1 = Least Important/Least Risk.

In consideration of study needs, objectives, and other considerations, please order the importance or level of risk for the following ten screening criteria, with 10 assigned to the criterion that is most important or involves the most risk, and 1 indicating the criterion that is least important or involves the least risk.

Screening Criteria	Order of Importance
Route Length (Feet)	6
Travel Time (Minutes/Seconds)	5
At-grade Rail Crossings (Total Number)	10
Parcel Impacts (Total Number)	7
Right-of-way Acquisition (Acres)	10
Wetland Impacts (Acres)	3
Total Farmland Impacts (Acres)	10
Irrigation Impacts (Total Number of Features)	10
Access Point Density (Total Number of Public/Private)	7
Total Estimated Project Development Cost	8

Order: 10 = Most Important/Most Risk; 1 = Least Important/Least Risk.

In consideration of study needs, objectives, and other considerations, please order the importance or level of risk for the following ten screening criteria, with 10 assigned to the criterion that is most important or involves the most risk, and 1 indicating the criterion that is least important or involves the least risk.

Screening Criteria	Order of Importance
Route Length (Feet)	3
Travel Time (Minutes/Seconds)	10
At-grade Rail Crossings (Total Number)	7
Parcel Impacts (Total Number)	2
Right-of-way Acquisition (Acres)	4
Wetland Impacts (Acres)	6
Total Farmland Impacts (Acres)	1
Irrigation Impacts (Total Number of Features)	5
Access Point Density (Total Number of Public/Private)	8
Total Estimated Project Development Cost	9

Order: 10 = Most Important/Most Risk; 1 = Least Important/Least Risk.

In consideration of study needs, objectives, and other considerations, please order the importance or level of risk for the following ten screening criteria, with 10 assigned to the criterion that is most important or involves the most risk, and 1 indicating the criterion that is least important or involves the least risk.

Screening Criteria	Order of Importance
Route Length (Feet)	2
Travel Time (Minutes/Seconds)	9
At-grade Rail Crossings (Total Number)	3
Parcel Impacts (Total Number)	4
Right-of-way Acquisition (Acres)	7
Wetland Impacts (Acres)	8
Total Farmland Impacts (Acres)	1
Irrigation Impacts (Total Number of Features)	6
Access Point Density (Total Number of Public/Private)	5
Total Estimated Project Development Cost	10

Order: 10 = Most Important/Most Risk; 1 = Least Important/Least Risk.

when At grade crossing have increased time the could be considered as double country. The At grade should be new so that was the case I would have put it at a higher level.

In consideration of study needs, objectives, and other considerations, please order the importance or level of risk for the following ten screening criteria, with 10 assigned to the criterion that is most important or involves the most risk, and 1 indicating the criterion that is least important or involves the least risk.

Screening Criteria	Order of Importance
Route Length (Feet)	9
Travel Time (Minutes/Seconds)	7
At-grade Rail Crossings (Total Number)	8
Parcel Impacts (Total Number)	3
Right-of-way Acquisition (Acres)	6
Wetland Impacts (Acres)	2
Total Farmland Impacts (Acres)	1
Irrigation Impacts (Total Number of Features)	4
Access Point Density (Total Number of Public/Private)	5
Total Estimated Project Development Cost	10

Order: 10 = Most Important/Most Risk; 1 = Least Important/Least Risk.

AND:

- Spill/toxic/flamable Hazard to city residents
- Vertical Rise - Trucks won't climb hill if given choice - it is a Bus Hill west 6
- Community Value as Collector (Natural extension of streets)

In consideration of study needs, objectives, and other considerations, please order the importance or level of risk for the following ten screening criteria, with 10 assigned to the criterion that is most important or involves the most risk, and 1 indicating the criterion that is least important or involves the least risk.

Screening Criteria	Order of Importance
Route Length (Feet)	9
Travel Time (Minutes/Seconds)	9
At-grade Rail Crossings (Total Number)	9
Parcel Impacts (Total Number)	2
Right-of-way Acquisition (Acres)	2
Wetland Impacts (Acres)	7
Total Farmland Impacts (Acres)	7
Irrigation Impacts (Total Number of Features)	9
Access Point Density (Total Number of Public/Private)	7
Total Estimated Project Development Cost	5

Order: 10 = Most Important/Most Risk; 1 = Least Important/Least Risk.

In consideration of study needs, objectives, and other considerations, please order the importance or level of risk for the following ten screening criteria, with 10 assigned to the criterion that is most important or involves the most risk, and 1 indicating the criterion that is least important or involves the least risk.

Screening Criteria	Order of Importance
Route Length (Feet)	8
Travel Time (Minutes/Seconds)	8
At-grade Rail Crossings (Total Number)	9
Parcel Impacts (Total Number)	6
Right-of-way Acquisition (Acres)	6
Wetland Impacts (Acres)	7
Total Farmland Impacts (Acres)	5
Irrigation Impacts (Total Number of Features)	5
Access Point Density (Total Number of Public/Private)	8
Total Estimated Project Development Cost	9

Order: 10 = Most Important/Most Risk; 1 = Least Important/Least Risk.

In consideration of study needs, objectives, and other considerations, please order the importance or level of risk for the following ten screening criteria, with 10 assigned to the criterion that is most important or involves the most risk, and 1 indicating the criterion that is least important or involves the least risk.

Screening Criteria	Order of Importance
Route Length (Feet)	10
Travel Time (Minutes/Seconds)	9
At-grade Rail Crossings (Total Number)	4
Parcel Impacts (Total Number)	8
Right-of-way Acquisition (Acres)	5
Wetland Impacts (Acres)	1
Total Farmland Impacts (Acres)	3
Irrigation Impacts (Total Number of Features)	2
Access Point Density (Total Number of Public/Private)	6
Total Estimated Project Development Cost	7

Order: 10 = Most Important/Most Risk; 1 = Least Important/Least Risk.

In consideration of study needs, objectives, and other considerations, please order the importance or level of risk for the following ten screening criteria, with 10 assigned to the criterion that is most important or involves the most risk, and 1 indicating the criterion that is least important or involves the least risk.

Screening Criteria	Order of Importance
Route Length (Feet)	9
Travel Time (Minutes/Seconds)	8
At-grade Rail Crossings (Total Number)	6
Parcel Impacts (Total Number)	3
Right-of-way Acquisition (Acres)	7
Wetland Impacts (Acres)	1
Total Farmland Impacts (Acres)	2
Irrigation Impacts (Total Number of Features)	5
Access Point Density (Total Number of Public/Private)	4
Total Estimated Project Development Cost	10

Order: 10 = Most Important/Most Risk; 1 = Least Important/Least Risk.

In consideration of study needs, objectives, and other considerations, please order the importance or level of risk for the following ten screening criteria, with 10 assigned to the criterion that is most important or involves the most risk, and 1 indicating the criterion that is least important or involves the least risk.

Screening Criteria	Order of Importance
Route Length (Feet)	8
Travel Time (Minutes/Seconds)	10
At-grade Rail Crossings (Total Number)	4
Parcel Impacts (Total Number)	2
Right-of-way Acquisition (Acres)	7
Wetland Impacts (Acres)	6
Total Farmland Impacts (Acres)	1
Irrigation Impacts (Total Number of Features)	3
Access Point Density (Total Number of Public/Private)	5
Total Estimated Project Development Cost	9

Order: 10 = Most Important/Most Risk; 1 = Least Important/Least Risk.

In consideration of study needs, objectives, and other considerations, please order the importance or level of risk for the following ten screening criteria, with 10 assigned to the criterion that is most important or involves the most risk, and 1 indicating the criterion that is least important or involves the least risk.

Screening Criteria	Order of Importance
Route Length (Feet)	8
Travel Time (Minutes/Seconds)	9
At-grade Rail Crossings (Total Number)	5
Parcel Impacts (Total Number)	1
Right-of-way Acquisition (Acres)	10
Wetland Impacts (Acres)	2
Total Farmland Impacts (Acres)	4
Irrigation Impacts (Total Number of Features)	6
Access Point Density (Total Number of Public/Private)	3
Total Estimated Project Development Cost	7

Order: 10 = Most Important/Most Risk; 1 = Least Important/Least Risk.

In consideration of study needs, objectives, and other considerations, please order the importance or level of risk for the following ten screening criteria, with 10 assigned to the criterion that is most important or involves the most risk, and 1 indicating the criterion that is least important or involves the least risk.

Screening Criteria	Order of Importance
Route Length (Feet)	10
Travel Time (Minutes/Seconds)	9
At-grade Rail Crossings (Total Number)	7
Parcel Impacts (Total Number)	4
Right-of-way Acquisition (Acres)	2
Wetland Impacts (Acres)	3
Total Farmland Impacts (Acres)	1
Irrigation Impacts (Total Number of Features)	5
Access Point Density (Total Number of Public/Private)	6
Total Estimated Project Development Cost	8

Order: 10 = Most Important/Most Risk; 1 = Least Important/Least Risk.

**Fairview Corridor Study
Advisory Committee Survey Results
February 2016**

Screening Criteria	Responses											Response Average	Tier	Disqualified Responses *		
Route Length (Feet)	5	2	9	3	2	9	10	9	8	8	10	6.8	3	6	9	8
Travel Time (Minutes/Seconds)	4	5	10	10	9	7	9	8	10	9	9	8.2	4	5	9	8
At-grade Rail Crossings (Total Number)	9	10	8	7	3	8	4	6	4	5	7	6.5	3	10	9	9
Parcel Impacts (Total Number)	7	1	1	2	4	3	8	3	2	1	4	3.3	2	7	2	6
Right-of-way Acquisition (Acres)	8	4	6	4	7	6	5	7	7	10	2	6.0	3	10	2	6
Wetland Impacts (Acres)	2	7	2	6	8	2	1	1	6	2	3	3.6	2	3	7	7
Total Farmland Impacts (Acres)	1	3	3	1	1	1	3	2	1	4	1	1.9	1	10	7	5
Irrigation Impacts (Total Number of Features)	3	6	4	5	6	4	2	5	3	6	5	4.5	2	10	9	5
Access Point Density (Total Number of Public/Private)	6	9	5	8	5	5	6	4	5	3	6	5.6	3	7	7	8
Total Estimated Project Development Cost	10	8	7	9	10	10	7	10	9	7	8	8.6	4	8	5	9

*Disqualified responses are not included in response average.

- Tier 4 = Weight of 200
- Tier 3 = Weight of 150
- Tier 2 = Weight of 100
- Tier 1 = Weight of 50