MOORHEAD DOWNTOWN GRADE SEPARATION STUDY: EXISTING AND FUTURE CONDITIONS REPORT

EXECUTIVE SUMMARY

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MINNESOTA DEPARTMENT OF TRANSPORTATION

EXECUTIVE SUMMARY

Two BNSF subdivisions pass through downtown Moorhead: the KO line and Prosper Lines. As illustrated in Table 1, downtown Moorhead is bustling with train activity. With current train activity and delays, the KO and Prosper lines are closed 16% and 19% of the day respectively, inducing substantial motorist delay.

Table 1 – Existing and Future Train Activity

Traffic Conditions	Rail Line	Train Movements	Through Trains	Local Movements	Total Blockages
2014	Prosper Subdivision	59	32	14	46
	KO Subdivision	67	53	7	60
2040	Prosper Subdivision	107	58	24	82
	KO Subdivision	118	93	12	105

The purpose of this memorandum is to describe the existing and future traffic conditions for at-grade railroad crossings in downtown Moorhead. Results from analyses described in this memorandum will be used to evaluate multiple grade separation alternatives from a traffic operations and safety perspective. Refer to Figure 1 for a map of the study area.

Previous Studies

Over the past ten years, the railroad crossings in downtown Moorhead have been studied numerous times, ranging from quiet zone projects to corridor studies. Although these studies are diverse in nature, they all included a similar recommendation: construct a railroad grade separation in downtown Moorhead. Need for the grade separation included improving safety by decreasing the number of train exposures in downtown Moorhead for vehicular and non-vehicular modes of travel, reducing delays to emergency response times and reducing traffic congestion and delays for vehicles traveling in downtown Moorhead.

Previous studies found that grade separation at 4th, 5th, 6th and 10th Streets have fatal flaws making them infeasible due to connectivity, land use and development and/or capacity constraints. These studies identified 8th, 11th and 14th Streets as corridors offering the greatest benefits when grade separated, with 11th and 14th showing more promise than 8th Street. Previous studies also discarded the option to only grade separate one of the rail crossings due to the high frequency of delays and conflicts at both the KO and Prosper lines.

The current Downtown Grade Separation study was designed to use the previous studies as a starting point. Thus, the emphasis of this report is at the KO and Prosper crossings of 8th, 11th and 14th Street where the last studies left off.

Justification of a Grade Separation

The Federal Highway Administration (FHWA) has published criteria for the consideration of vehicle-rail grade separations in the *Railroad-Highway Grade Crossing Handbook* (2007). The criteria includes two tiers of justification. The two tiers have the same criteria with differing thresholds. Tier 1 has increased thresholds to indicate a heightened need for a grade separation. There are 11 Tier 1 criteria and 12 Tier 2 criteria. Of the possible 12 criteria, three criteria are met to justify a grade separation in downtown Moorhead. Figure 2 and Figure 3 illustrate which criteria are met and which are not at each railroad line.

Figure 1 - Study Area

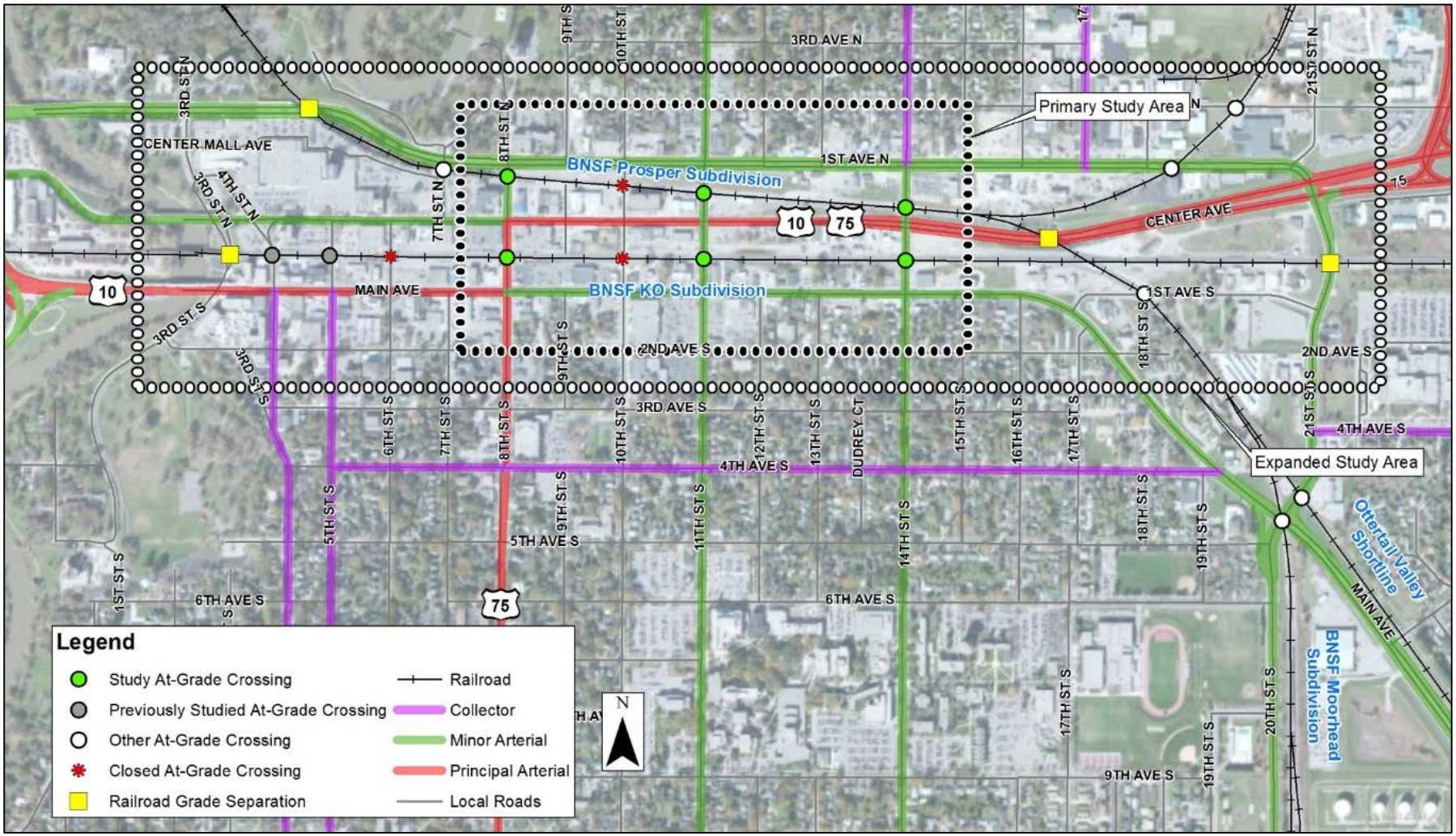
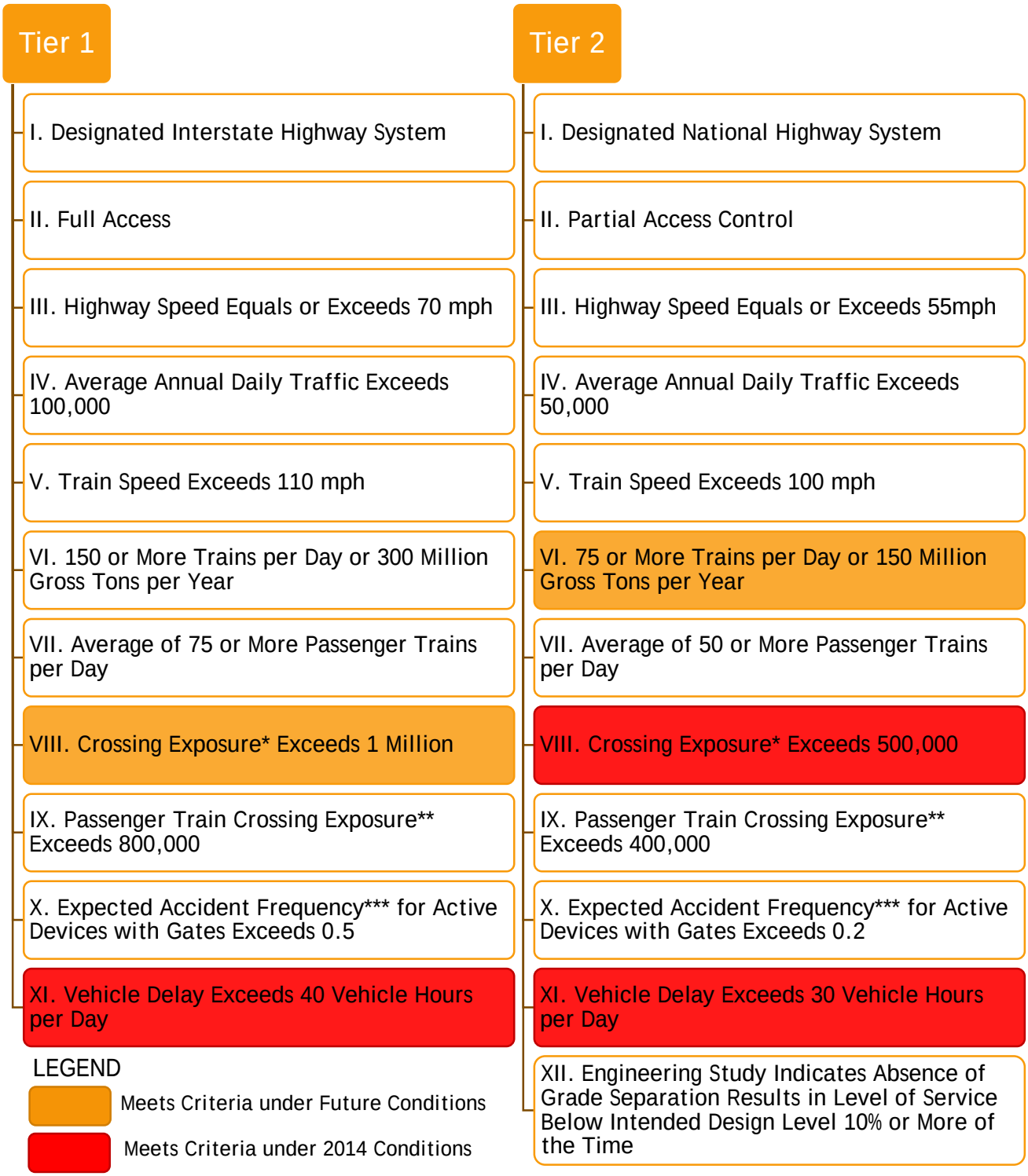


Figure 2 – Grade Separation Criteria Met For KO Line



*Crossing exposure is the product of the number of trains per day and Average Daily Traffic (ADT).
**Passenger train crossing exposure is the product of the number of passenger trains per day and ADT.
***Expected Accident Frequency is calculated using the U.S. DOT Accident Prediction Formula including Five-Year Accident History.

Figure 3 – Grade Separation Criteria Met For Prosper Line

*Crossing exposure is the product of the number of trains per day and Average Daily Traffic (ADT).
**Passenger train crossing exposure is the product of the number of passenger trains per day and ADT.
***Expected Accident Frequency is calculated using the U.S. DOT Accident Prediction Formula including Five-Year Accident History.

Critical Deficiencies

This report took a thorough look at transportation deficiencies within the downtown Moorhead study area. This includes train-induced deficiencies not quantified in the FHWA grade separation criteria as well as deficiencies not related to trains. The following deficiency areas were identified during this review.

Traffic Operations

Signal phasing, signal timing and turn lane improvements are planned for construction in 2015 within the study area to improve operations and traffic progression. Even with these improvements, traffic operations become deficient in scenarios when trains are present and a grade separation is not built. The lack of available right-of-way within the study makes additional capacity improvements impactful and costly.

Figure 4 - Train Induced Delay

Crash History

Between 1976 and 2006, one train related crash occurred every year on average. This included three fatalities. Since 2006, no train related crashes have been reported. This tremendous reduction in crash potential can be attributed to the effort to improve safety at rail crossing in downtown Moorhead over the past decade.

When evaluating vehicular, pedestrian and bicycle crash data, one primary trend arose; Forty-nine (49) of the crashes (44%) in the study area were right-angle crashes (does not include left-turn crashes). According to MnDOT data, this trend is more than 2.5 times the State average for urban signalized intersections, making this trend particularly alarming. According to NCHRP Report 500 *A Guide for Reducing Collisions at Signalized Intersections*, right-angle crashes produced 59% of fatalities at signalized intersections, even though the percentage of these crash types is low relative to other crash types.

Signals are designed to prevent right-angled crashes from conflicting directions. This means that the right-angled crash trend occurs when a motorist disobeys the traffic signal or the signal is operating in a fashion that the driver cannot meet the stopping requirements. Casual observations found that motorists often disobey traffic signals in the study area when train blockages occur to reroute and avoid delays. Thus it can be deduced that the motorist frustration caused by train delays is interrelated to risk taking behavior and an increase in crash potential.

Emergency Vehicles

The presence of trains on the Prosper and KO lines in downtown Moorhead create a barrier for emergency responders. Between April 23, 2014 and September 1, 2014 the Fire department had experienced nearly nine calls per month where the emergency response time was delayed due to train activity. This included ten calls for medical assistance and three fires.

The size of a fire is thought to double every 60 seconds (*Firetactics, July 4, 2007)*. When a heart stops, brain damage can occur within four to six minutes (American Heart Association,

2014). These statistics become particularly alarming considering the average train delay on the Prosper and KO lines are 5.9 and 3.9 minutes respectively and occur 60 and 46 times a day.

Transit

System reliability issues caused by railroad delays have resulted in the decision to have buses avoid at-grade crossings whenever possible. While the current transit route configuration avoids crossing the railroad tracks and thus is minimally affected by train activity, providing a grade separation would increase the flexibility of route design and potentially increase and/or improve the transit service area, frequency and reliability through downtown Moorhead.

Bicycles

According to the *2011 Fargo-Moorhead Metropolitan Bicycle and Pedestrian Plan*, downtown is one of the largest bicycle generators in Moorhead. However, downtown Moorhead is predominantly void of bicycle facilities. With downtown acting as the heart of the city, this creates a major connectivity gap for traffic throughout the city as well as for bicyclists destined specifically for downtown.

Pedestrians

Although downtown Moorhead has a very high degree of pedestrian connectivity, it is not devoid of deficiencies. Deficiencies within downtown include the railroad acting as a barrier for travel, missing sidewalk links in key railroad crossing areas, lack of buffer area from the adjacent street making walking less desirable and multiple accessibility deficiencies including deficient driveway side slopes and curb ramps located throughout the study area. Many areas of inaccessibility and pedestrian buffer will be addressed in a 2015 improvement project.

Grade Separation Alternatives Analysis

Using the Fargo-Moorhead regional travel demand model (TDM), trip retribution was estimated for each of the three KO and Prosper grade separation alternatives identified in the 2008 Feasibility Study; 8th, 11th and 14th. The traffic redistribution, exposure reduction and train induced delay reduction for each alternative is illustrated in Figure 5, Figure 6 and Figure 7.

This analysis was conducted solely on preexisting grade separation alternatives. Detailed alternative development, refinement and evaluation will be conducted once a purpose and need statement has been crafted and adopted.

During the modelling process, it was clear that the amount of traffic drawn to the 11th and 14th Street crossings were limited by the one-way roadway configurations south of the study area. Currently 11th Street is a southbound one way from 2nd Avenue to 12th Avenue South and 14th Street is a northbound one-way from 12th Avenue South to Main Avenue. This resulted in circuitous routes and increased travel times. This limited the potential benefit of these alternatives because the TDM is designed to direct traffic to the fastest route. It is recommended that elimination of the one-ways be studied to fully understand the potential benefits provided by grade separation at these locations.

The 8th, 11th and 14th Street alternatives were scored using the following criteria; Safety, Emergency Vehicle Access, Traffic Capacity/Mobility, Railroad Issues, Property Impacts, Constructability and Design, Environmental Impacts and Cost/Economics. Results from the alternatives ranking can be seen in Table 1. These are updated versions of alternative

comparison tables developed in the 2008 feasibility study with minor revisions to account for more detailed analysis. The items not covered in this report but included in the table were taken directly from the previous study and will be updated as this project progresses.

Figure 5 - Traffic Impacts from 8th Street Grade Separation

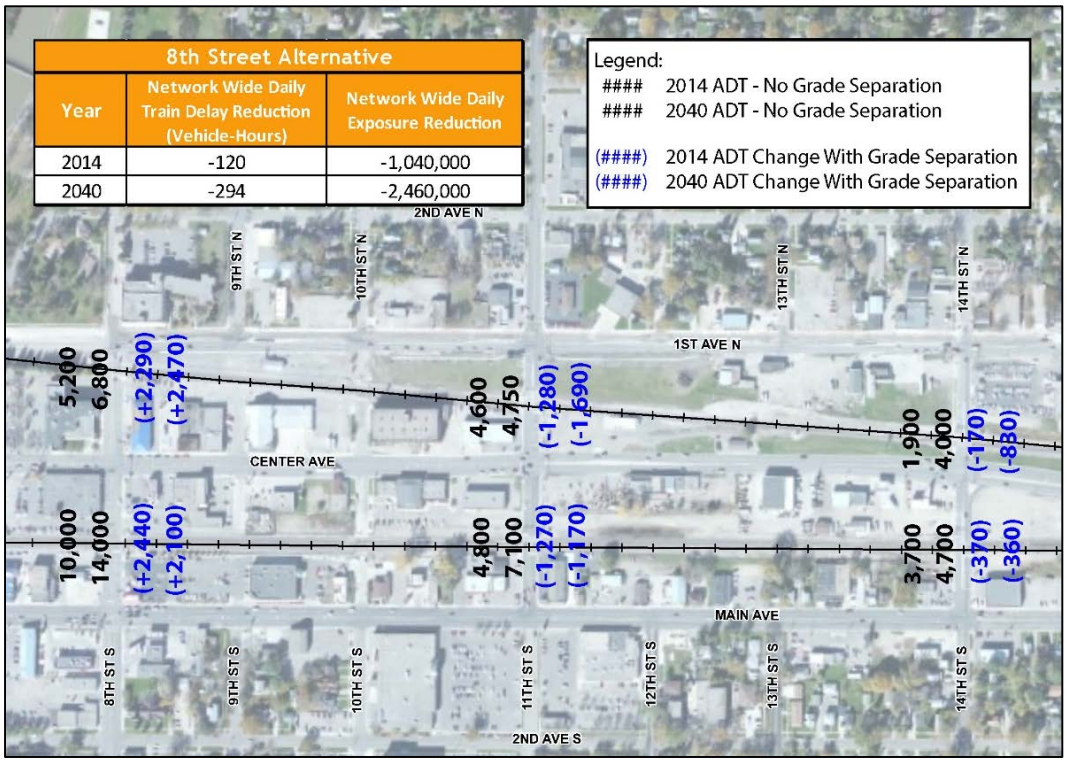


Figure 6 - Traffic Impacts from 11th Street Grade Separation

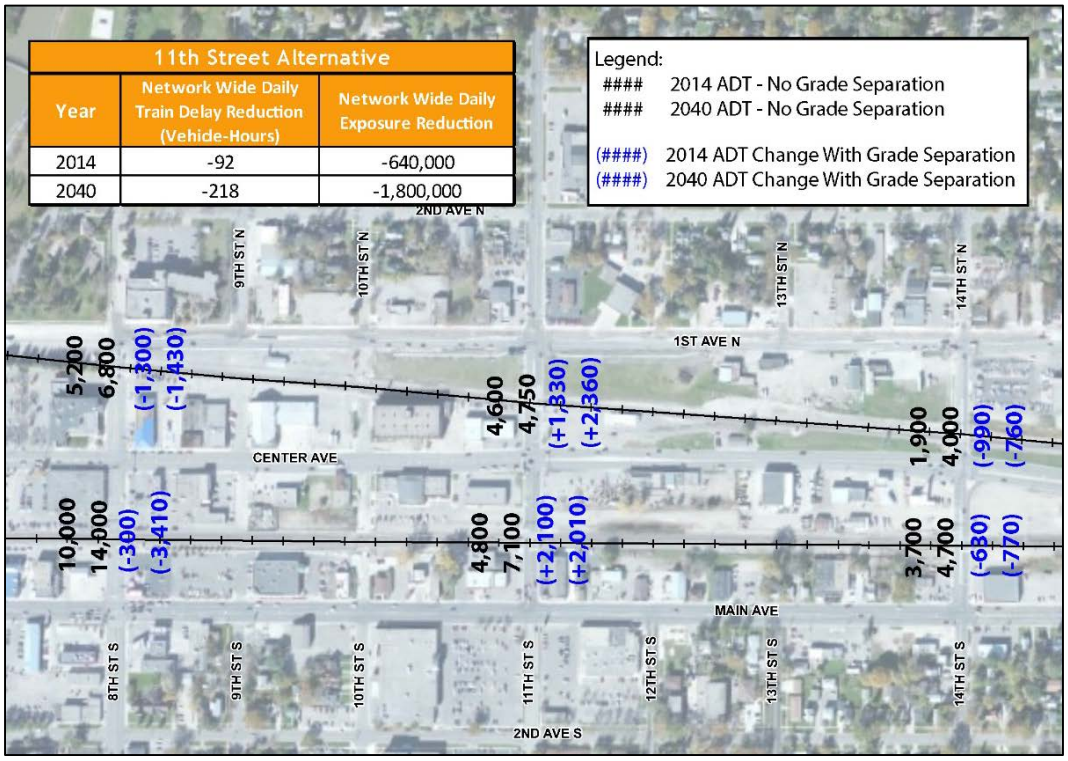


Figure 7 - Traffic Impacts from 14th Street Grade Separation

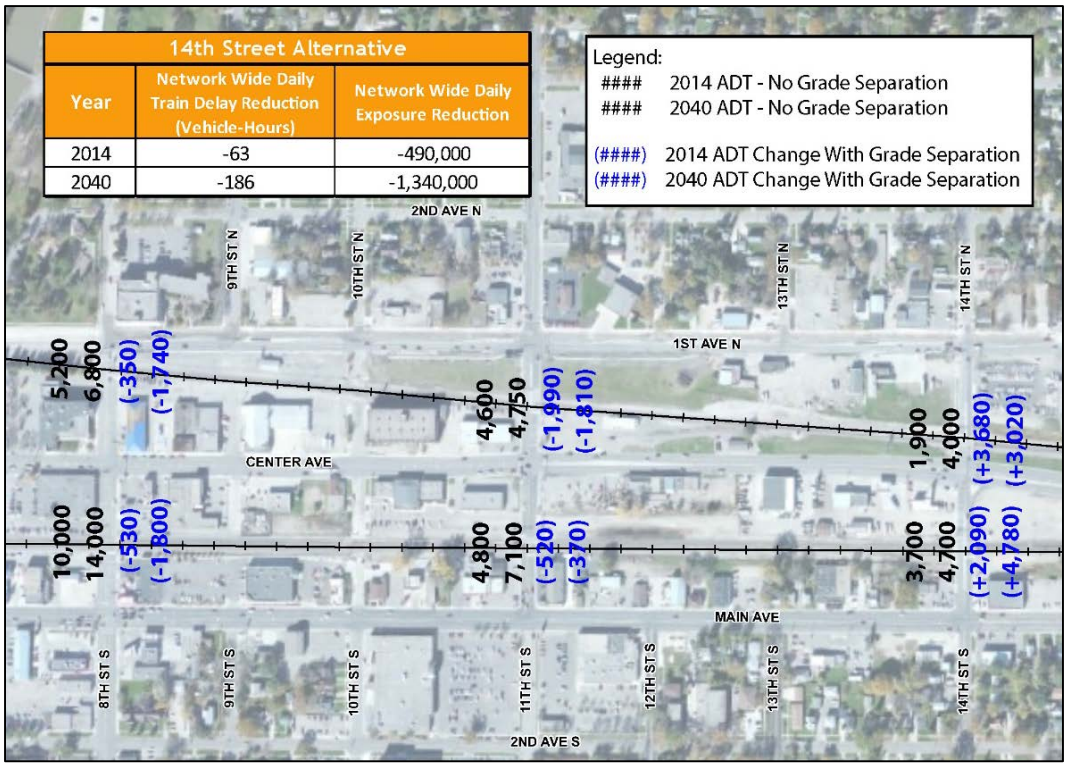


Table 2 - Alternatives Comparison

Screening Criteria	Grade Separation Alternatives		
	8th Street	11th Street	14th Street
Property Impacts			
Potential Property Impacts	●○○○○	●●●○○	●●○○○
Category Ranking	**1**	**3**	**2**
Safety			
Crash History (2008-2013)	●○○○○	●○○○○	●○○○○
Conflict Potential (Crossing Exposure)	●●●●●	●●●●○	●●●○○
Category Ranking	**3**	**2.5**	**2**
Emergency Vehicle Access			
Unrestricted Access and Optimized Routes	●●●○○	●●●●●	●●●●○
Category Ranking	**3**	**5**	**4**
Traffic Delay and Mobility			
Train Delay Reduction	●●●●●	●●●●○	●●●○○
Network-Wide Connectivity	●○○○○	●●●●●	●●●○○
Proximity to Downtown	●●●●●	●●●●○	●●○○○
Category Ranking	**3.5**	**4.5**	**2.5**
Constructability and Design			
Grade Separation	●○○○○	●●●○○	●●●○○
Utilities	●○○○○	●●●○○	●●●●○
Intersecting Streets	●○○○○	●●●●●	●●○○○
Category Ranking	**1**	**4**	**3**
Cost			
ROW Costs	●○○○○	●●●○○	●●●○○
Construction, Engineering and Admin Costs	●○○○○	●●●○○	●●○○○
Category Ranking	**1**	**3**	**2.5**
Railroad Issues			
Shoofly Construction	●○○○○	●●●●○	●●●○○
Category Ranking	**3**	**4**	**3**
Overall Ranking	**13.5**	**26**	**19**

Note: higher numbers are associated with greater benefits

In summary, 8th Street scored very poorly in constructability and design, property impacts and railroad issues which limit the feasibility to build this alternative. Cursory analysis indicates that this alternative does benefit the greatest volume of vehicles although this route has no connectivity to the north. It is anticipated that once two-way traffic conversion is considered on 11th and 14th Streets south of the study area, these traffic benefits will be reduced. As noted previously, the one-way configurations on 11th and 14th Streets creates circuitous routes and increases travel times for this movement and results and reduced modelled traffic forecasts on these routes.

14th Street is the furthest from the heart of the City where traffic demand is greatest and has limited connectivity to the north. These two factors combine to result in lowest benefits in terms overall reduction to motorist delay and global crossing exposure reduction. Additionally, construction of this alternative would be challenging considering the close proximity of Center Avenue and the Prosper Line on 14th Street. Finally this alternative would incur challenges constructing temporary shoofly tracks without impacting train operations due to the intersection of the KO Line and Moorhead Subdivision Line/Otter Tail Valley Railroad Spur just east of 14th Street.

Cursory analysis indicates that 11th Street is the optimal balance of constructability and traffic operational benefits. This alternative also has the greatest connectivity to the north, is closest to the fire station and has the fewest property and railroad impacts of the three alternatives. This alternative scored 67% and 36% higher than the 8th Street and 14th Street alternatives respectively.

Next Steps

This report is the first phase of the project, the following list is a brief summary of the next steps planned for this project:

- Purpose and Need and Environmental Review: development of the purpose and need statement, scoping, public involvement and alternatives development and analysis will all be completed to allow for a seamless transition into a NEPA documentation phase. The alternatives analysis will consider all feasible and prudent alternatives and screen the alternatives on their ability to meet the purpose and need and avoid or minimize impacts to the social, economic and natural environments. The team will develop design criteria and a methodology to screen the alternatives to ensure consistent application of the NEPA evaluation process.
- Alternative Refinement and Analysis: once alternatives have been screened through the purpose and need process, remaining alternatives will be refined through a planning level design process. This step will involve reviewing each alternative in the areas of roadway design, landowner impacts, utility impacts, costs, drainage, etc. A detailed cost benefit analysis will use this information to quantify these details into a dollar amount for comparison purposes.
- Studies to Surrounding Roadway System: the study area of the project is specific to the downtown Moorhead; however, traffic implications of a new grade separation would be felt throughout the entire city. The following two studies will be completed once alternatives are screened to ensure the remaining alternatives can be properly accommodated if a grade separation is constructed:

- One-Way Conversion Study: A one-way conversion analysis of 11th and 14th Street will be studied later in the project to fully understand potential benefits offered by a grade separation at these locations. Furthermore, this study will serve to identify the improvement needs and challenges faced from this conversion as this improvement will have widespread impacts to neighboring property owners, including MSUM.
- Multimodal Plan: A full downtown multimodal plan will be developed as part of this project once the optimal grade separation location has been identified. The new grade separation will include pedestrian and bicycle facilities. The multimodal plan will ensure that that these new facilities integrate harmoniously with the surrounding pedestrian and bicycle system and mitigate existing deficiencies in downtown Moorhead so that the new facilities can be easily accessed.

- Funding Assessment: finally funding strategies will be investigated for potential next steps. This will include a review and evaluation of standard federal, state and local funding sources typically utilized for implementation projects, competitive grant programs based on solicitation processes, federal and state programs that focus on safety and finally public/private partnership scenarios.