DEPARTMENT OF TRANSPORTATION

Railroad Separation at Highway 47 (Ferry St.) Feasibility Study

Anoka, Minnesota

December 2016

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Preferred Solution

It is recommended to construct a multi-span bridge on Trunk Highway (Hwy) 47 over the BNSF railway facility in its current location. This proposed bridge will accommodate two travel lanes, and a multi-use trail on the east side. It is recommended that the bridge is designed to allow for widening (up to two travel lanes) if Hwy 47 is expanded at some point in the future. The proposed roadway should be shifted east to allow for expansion on the west. Construction staging will allow BSNF operations and daily (or routine) rail traffic to be substantially maintained at all times. It is anticipated that the total project cost for this improvement is $17 to 21 million (2020 $) which includes right-of-way and estimated project risks. See **Figure 1** and **Figure 2** for the project layout and typical sections.

The primary need of this project is to address railroad crossing safety issues identified at Hwy 47 and the BNSF railway facility. Secondary needs include addressing the queuing and delays related to the railroad crossing, undesirable horizontal and vertical geometry at the railroad crossing, access management near the railroad crossing and capacity and safety issues along Hwy 47 within the project area. Secondary needs were only addressed if they did not substantially add costs or increase impacts when addressing the primary need.

Alternatives Considered

Two alternatives were considered for this feasibility study. These included constructing a bridge over the railroad (Over Alternative) and lowering the road below the railroad grade (Under Alternative). Both alternatives maintain the current crossing location. Although, both alternatives equally address the primary and some secondary needs for this project, the analysis clearly showed that the Over Alternative is the preferred solution compared to the Under Alternative. The Over Alternative had fewer impacts and cost substantially less when compared to Under Alternative. Advantages for the Over Alternative include:

- **Constructability:** Building the bridge over is accomplished by constructing a portion of the grade separation while keeping existing Hwy 47 open. The closure of Hwy 47 could likely be limited to a single construction season.
- **Railroad Impacts:** Constructing a bridge over the railroad is expected to have minimal disruption to rail services and provides reasonable railroad operational coordination opportunities for construction activities.
- **Contaminated Site Risk/Impacts:** Excavation is minimized by this alternative, reducing the potential of disturbing contaminated soils.
- **Water Table/Stormwater Impacts:** The water table will not be disturbed and there are generally suitable areas to temporarily retain stormwater.

Four bridge options were considered (three over and one under). The findings show advantages in the further development of Option 2, a seven span bridge, which provides an 80 feet horizontal span

opening and the minimum 23 feet 4 inch vertical clearance over the BNSF railway facility. The other spans replace very tall (17-30 feet) retaining walls and fill with additional bridge (Option 1).

Project Costs

The 2020 total project estimated cost for the Over Alternative is $17.4 to $21.2 million. These includes construction costs of approximately $13.8 million and the right of way cost of $3 million. The estimate also accounts for $2.8 million set aside for risk.

Project Risks and Impacts

Some project risks that have the potential to change the current proposed design and/or total project costs were identified and include a potentially historic well building, right-of-way impacts, access closures, construction timing, contamination, and traffic control at adjacent intersections. These include:

- **Martin Street closure:** Martin Street closed at Hwy 47 utilizing a cul-de-sac to the west of Hwy 47.
- **Residential impact:** A six foot retaining wall is proposed in front of the residential home located in the southwest quadrant of Hwy 47 and Martin Street.
- **A-1 Recycling:** Full acquisition of A-1 Recycling property needed for a stormwater treatment pond.
- **Alter Trading:** This property's two accesses along Hwy 47 are proposed to be closed due to the substantial grade change in this area. Closing these private accesses may require reconfiguring their site including relocating buildings.
- **Anoka-Hennepin Community Education Center:** The Hwy 47 access to the Anoka-Hennepin Community Education Center is proposed to be closed which will potentially result in the need to reconfigure their parking lot to allow for delivery truck (WB-62) circulation to and from their southern loading docks on the east side of the building. The property owner has a desire to use space under the proposed bridge for parking. A reconfiguration design has been proposed but still needs to be vetted with the property owner. Use of the space underneath the bridge should be investigated during Preliminary Design.
- **Municipal well building:** Access to the potentially historic well building can be maintained by moving the access to the north and constructing an access road along the east side of Hwy 47. To avoid impacts to this building the Over Alternative will utilize a 10 foot buffer between the building and the edge of bridge.
- **Pleasant Street signal:** Residents have voiced concerns about how the signal currently operates and whether eliminating the gaps provided by the at-grade railroad crossing would negatively impact their ability to turn at Pleasant Street and Martin Street to get into the neighborhood. The traffic analysis completed for this study shows improved operations at the Pleasant Street signal by eliminating the at-grade crossing as well as closing Martin Street. Further analysis at this location is suggested with further engagement with the neighborhood.
- **McKinley Street intersection:** Residents in the area have requested a signal at McKinley Street and Hwy 47 citing unavailable gaps for turning to/from Hwy 47. The analysis completed for this study did not show an operational problem at McKinley but did show that the delays experienced at Bunker Lake Boulevard and Hwy 47 would get slightly longer since traffic would no longer be impeded by the railroad crossing delay. It is recommended

that an intersection traffic control evaluation (ICE) occur at this intersection to determine if a signal would improve or make conditions worse. A signal, if recommended, may also be accompanied by a raised median at intersections between McKinley Street and Bunker Lake Boulevard (and possibly at driveways) to limit the corridor to right-in/right-out access.

- **Contaminated soils:** The project area has known contaminated soils both within the public right-of-way and on private properties. These known issues will increase costs for soil excavation and drainage improvements that are below grade. It has the potential to influence right-of-way costs (i.e. the reconfiguration of Alter Trading site). Costs have been included in the estimate to account for these but as the project further develops they have the potential to change based on the impact and/or change in design.
- **Congestion on Hwy 47:** As stakeholders (general public and elected officials) were engaged throughout the study it was often questioned why MnDOT was not adding lanes on Hwy 47. Stakeholders also questioned why the roadway was not being relocated to better accommodate more lanes. Suggestions included relocating it through the fairgrounds, relocating it through the Anoka/Hennepin Education Center site, or moving it to State Avenue on the east side of the Green Haven Golf Course & Event Center with a new connection to Hwy 10. Although it is understood that Hwy 47 is congested, addressing congestion is not the primary need to resolve for this study and MnDOT does not have the funds needed to expand and/or relocate Hwy 47. Furthermore, Hwy 10 congestion will not be addressed by this study beyond the operations of the westbound Hwy 10 off-ramp to Ferry Street. As a compromise, it is recommended to design the proposed bridge to allow for future expansion of two additional lanes. Costs of addressing this risk were not considered as part of estimated project costs since defining this cost far exceed the intended scope of this project.

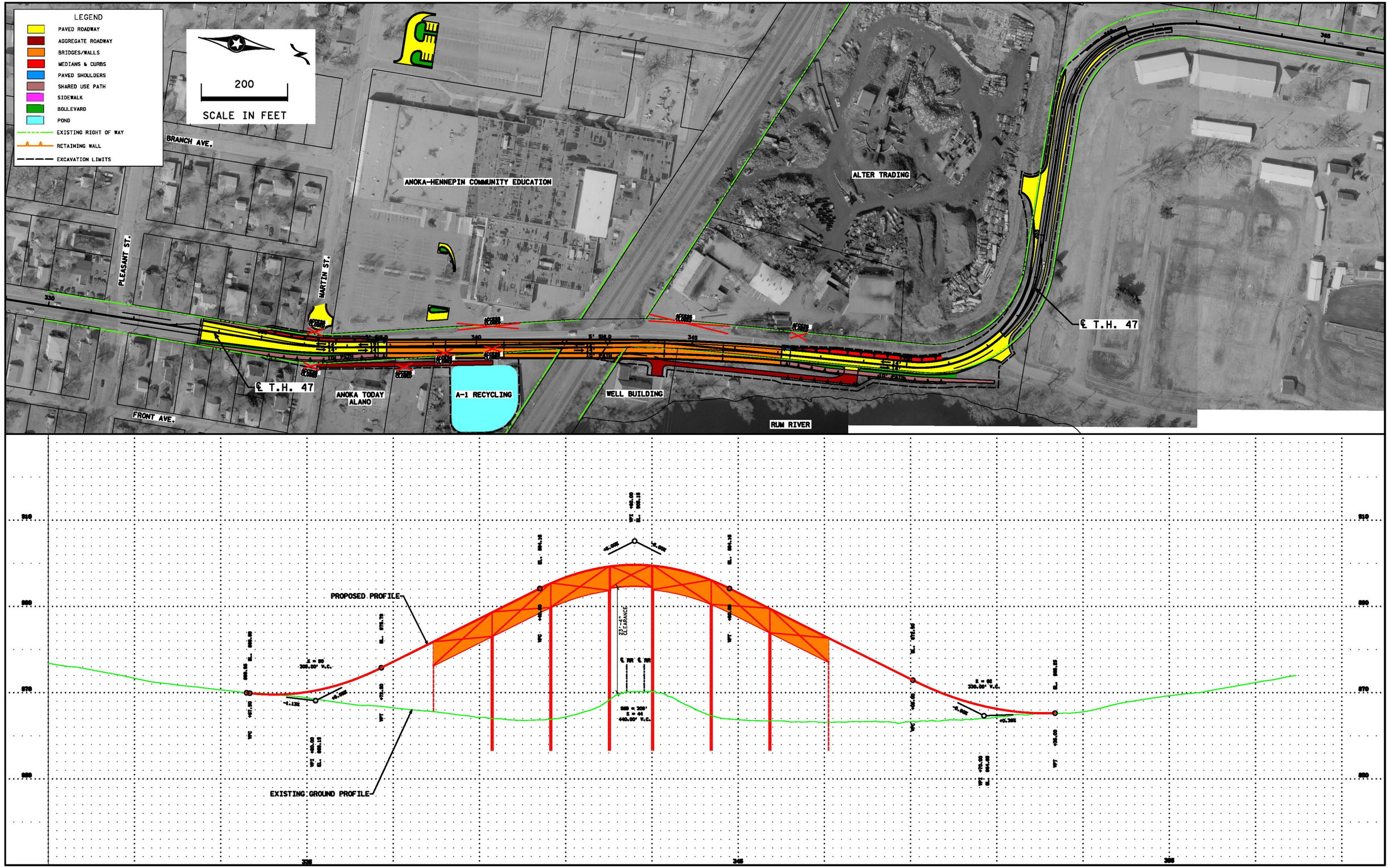
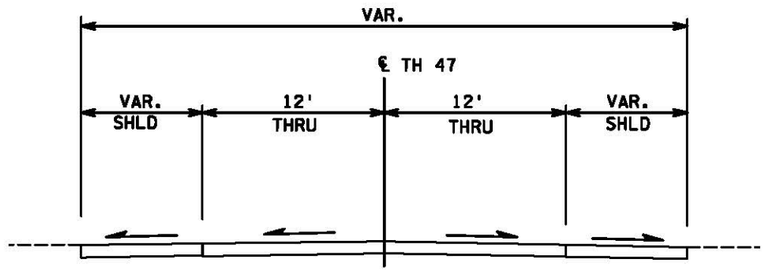


Figure 1: Preferred Alternative Layout



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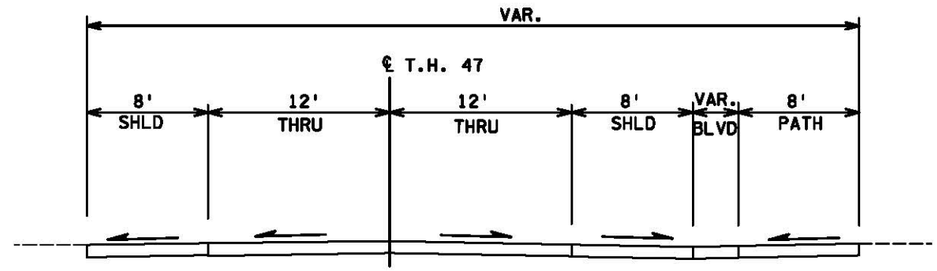

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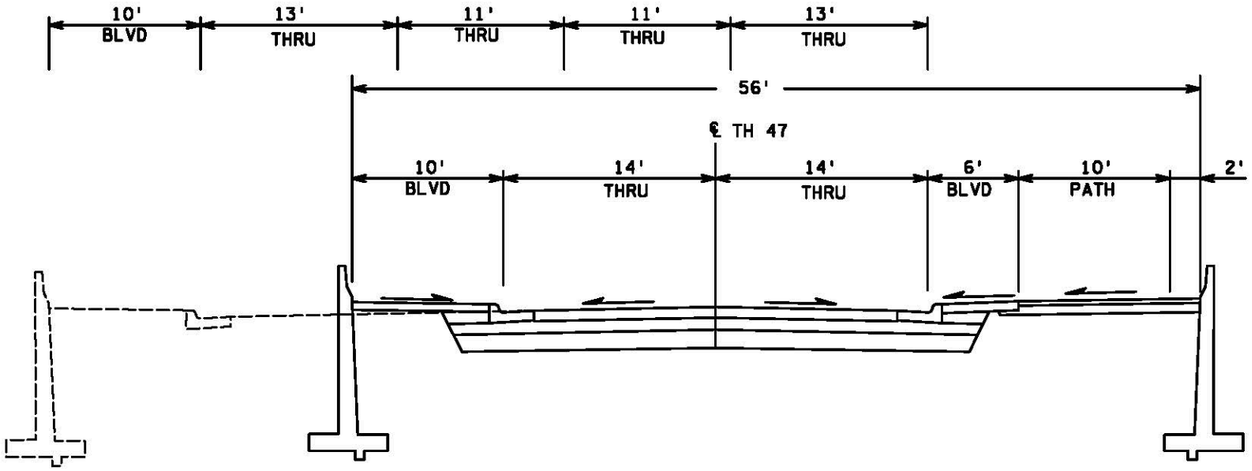
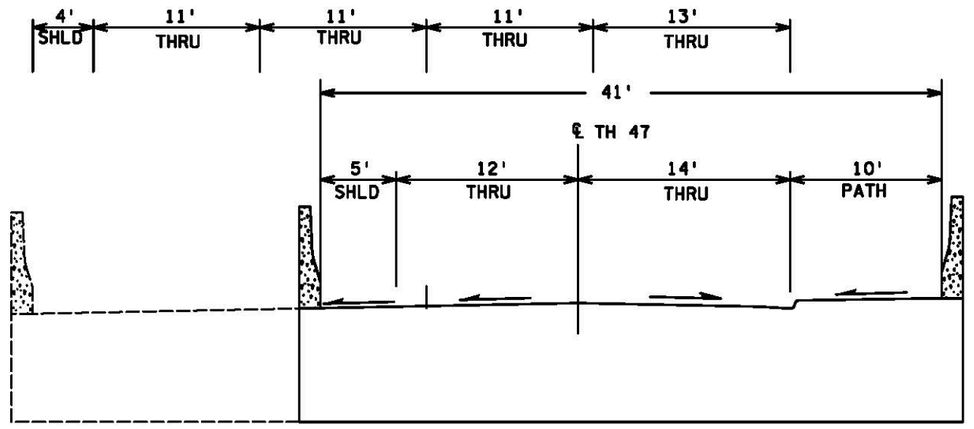


PROPOSED TH 47 OVER OPTION



PROPOSED TH 47 BRIDGE OVER OPTION

Figure 2: Typical Sections

1 Project Location

The project is located at the at-grade crossing of Hwy 47 (Ferry Street) and the BNSF Railway's two mainline tracks in the City of Anoka, Minnesota. The railroad crossing is approximately 0.3 miles north of Hwy 10 and 200 feet west of the Rum River. The existing roadway at the railroad crossing is two lanes (one lane in each direction) although the width varies from the south side to the north side of the railroad crossing. The traveled lanes are constant at 12 feet for each lane. The shoulders on the south side of the railroad crossing are 8 feet, and vary from 3 to 8 feet on the north side. Running near the east side of the roadway is an eight feet wide shared use path; generally this trail is separated from Hwy 47. However, at the railroad crossing the trail is adjacent to the roadway. The existing right-of-way is a consistent 66 feet through the project limits. Near the railroad crossing the roadway speed limit is 30 miles per hour (mph). The 2014 Average Annual Daily Traffic (AADT) at the railroad crossing was approximately 18,300 vehicles per day with significant heavy commercial, regional recreational, and County fair traffic. The project location map is found on **Figure 3.**

Figure 3: Project Location Map

Hwy 47 is functionally classified as an "A" Minor Arterial - Connector in the metro area's regional roadway system. Its purpose is to provide safe, direct connections between rural centers and to principal arterials in rural areas without adding continuous general purpose lane capacity.

BSNF Railway's two mainline tracks serve a mix of high speed freight, commuter, and passenger rail traffic. There are between 40 and 80 trains per day including 12 Northstar Commuter Rail trains (traveling during the peak periods) and two Amtrak trains. The train's timetable speeds are 75 mph for Northstar Commuter Rail and Amtrak trains and 60 mph for the freight trains. The Anoka Station for the Northstar Commuter Rail, operated by Metro Transit, is located 1,500 feet to the east of the railroad crossing on 4th Avenue.

2 Project Background

The Hwy 47 railroad crossing was identified as a public safety concern stemming from citizen complaints, credible reports of disregard of the railroad crossing gates observed by the Federal Rail Administration (FRA), MnDOT, and logged by BNSF crews.

In June of 2012, Campbell Technology Corporation (CTC) developed a Review of Ferry Street Highway-Rail Grade Crossing Report for MnDOT. The report summarized observations by CTC and citizens regarding the railroad crossing operations. These included extended gate down times sometimes without a train present, gates going down then coming up then going back down, excessive traffic queues, and poor sight lines at the railroad crossing. Moreover, there were complaints about not enough time to cross the tracks prior to a train arriving, drivers going around median and gates, and difficulty in awareness of potential second train events.

The report summarized short and long term improvements. Short term, it was recommended that MnDOT and BNSF review the railroad crossing activation system to see if improvements would minimize warning activation leading to long gate down times. The report stated that resolution of this issue could resolve the queuing problem in its entirety. Moreover, it was suggested to install enhanced LED blinking *Do Not Stop on Track* signs. Medium term, it was recommended that MnDOT improve access control near the railroad crossing due to limited site visibility and traffic safety. It was also recommended that MnDOT further study a queue cutter traffic signal which would prevent cars from queuing over the railroad tracks. Long term, it was recommended that MnDOT improve the grade geometry by removing the hump at the railroad crossing, widening the roadway, and increasing capacity.

In February of 2013, MnDOT proposed the installation of four-quadrant gates to facilitate a quiet zone, and to prohibit drivers from driving around the lowered gates. CTC assisted MnDOT in the development of the proper Exit Gate Clearance Time (EGCT), and developed another report, Ferry Street Exit Gate Clearance Time for Four-Quadrant Gate Report. After reviewing the location, CTC recommended not having EGCT for a four-quadrant gate warning system at this location. CTC concluded the operation of the four-quadrant gate warning system and EGCT will likely result in increased gate down times prior to train arrival at the railroad crossing for westbound commuter trains stopping at the Anoka Station. This will increase the traffic congestion and queuing on Ferry Street. The main concern is that drivers will stop on the track as a result of the traffic queues with no means for the driver to clear the track prior to the next train event. If MnDOT elects to implement a four-quadrant gate warning system, it was recommended in the report to include a queue cutter traffic signal, improve access control for local businesses adjacent to the crossing, and make roadway geometric improvements to mitigate traffic queuing concerns. Also, the report recommended eliminating the at-grade crossing with a grade separation.

3 Project Purpose and Need

The purpose of improving the Hwy 47 (Ferry Street) BNSF Railway crossing (railroad crossing) is to enhance safety and mobility for motorists, pedestrians, bicyclists and trains. The primary need of this project is to address railroad crossing safety issues identified at Hwy 47 and the BNSF Railway facility. Secondary needs include addressing the queuing and delays related to the railroad crossing, undesirable horizontal and vertical geometry at the railroad crossing, access management near the railroad crossing and safety issues along Hwy 47 within the project area. A summary of the primary and secondary needs are listed below. A technical memorandum providing more detail on these can be found in **Appendix A: Project Purpose and Need Technical Memorandum.**

3.1 Primary Need

The primary need is to improve safety at the crossing between Hwy 47 and the BNSF Railway. The following crash history and safety ratings were evaluated for this particular railroad crossing. Addressing the primary need will be the principal focus in determining the appropriate improvements for this project.

3.1.1 Railroad Crossing Crash History

Four property damage only (PDO) crashes occurred in 1972, 1973, 1976, and 1986. One fatal crash occurred in 2003 resulting in four fatalities where a teen driver appeared to drive around the gates. Between 2010 and 2014 there were 19 vehicle-vehicle related crashes within 150 feet of the railroad crossing on Hwy 47 of which 17 were rear end and likely due to queuing and delays related to the railroad crossing. None were fatal or serious injury crashes.

BNSF reports indicate that there are approximately two “near miss incidents” annually which are when trains narrowly miss hitting vehicles typically because a driver has ignored the warning devices. These incidents are reported by BNSF locomotive engineers as witnessed from the train.

3.1.2 Safety Evaluations Rankings

The ***Texas Priority Index*** score at this location is 10,330 ***making this railroad crossing the worst rated crossing in the state***.

The ***Risk Factor Based Analysis*** identifies eight out of ten risk factors are present at this railroad crossing. The Risk Factor Based Analysis looks for the presence of factors that are common among locations where crashes occurred.

The risk factors present at this railroad crossing include:

- Vehicle ADT
- Trains per Day
- Volume Cross Product
- Max Time Table Speed
- No. of Mainline Tracks
- Skew
- Distance to Nearest Crossing
- Clearing Sight Distance

3.2 Secondary Need

Secondary needs surround the project area. Some needs are directly related to railroad crossing while others are unique to Hwy 47. *Addressing secondary needs will be considered as improvements are proposed to address the primary need if the opportunity exists and the improvement doesn't substantially increase the project scope and impact.*

3.2.1 Railroad Crossing Operating Conditions

Traffic delays related to trains and extended gate down times result in driver frustration and impatience. Approximately 40-80 trains cross the tracks daily depending on market conditions. The majority of the trains are long freight trains traveling at speeds as high as 60 mph. There are 12 Northstar Commuter Rail trains (traveling during the peak periods) and two Amtrak trains daily traveling at speeds as high as 75 mph.

3.2.2 Gate Operations

The railroad crossing is 1,500 feet west of the Anoka Station for the Northstar Commuter Rail. The gates drop at the railroad crossing when detecting westbound trains traveling at a high speed from over 4,000 feet away even if the train stops at the station first. This has led to gates being down for over two minutes waiting for passenger boarding at the station. Although westbound Northstar train speeds were adjusted to avoid this trigger and BNSF has worked on software upgrades, it still occurs about 25% of the time. It occurs during Hwy 47 peak periods resulting in traffic queues that extend back onto the Hwy 10 ramps and onto Hwy 10 mainline. The long delay times result in driver frustration since they do not see a train passing through initially. Credible reports indicate that drivers, on occasion, drive around the gates and medians. It appears that drivers become conditioned to Northstar train station operations without realization that high speed freight operations are active on the second track.

3.2.3 Time Delay

Observed gate down times for freight trains ranged from less than one minute to over four minutes. The Northstar trains ranged from 37 to 90 seconds. In total, down times account for over an hour of delay throughout the day. During peak market conditions the BNSF train volumes can double further extending gate down times throughout the day.

3.2.4 Hwy 47 Operations

From Pleasant Street to Bunker Lake Boulevard, Hwy 47 is a two lane roadway carrying nearly 18,300 vehicles per day. Generally, a roadway with two lanes has the capacity to carry 11,000 to 15,000 vehicles per day. An operational analysis conducted in April 2016 identified the following deficiencies along the Hwy 47 corridor within the study area:

Hwy 47/Bunker Lake Boulevard Intersection: For the PM peak period all four intersection approaches have long delays resulting in LOS F, with overall intersection delay of 115 seconds. Several movements have queue lengths that exceed available storage including all of the left turn lanes and the westbound right turn lane. The congestion experienced at this intersection is primarily

a result of lane capacity and can sometimes be influenced by platoons of traffic coming from the railroad crossing.

Hwy 47/Pleasant St Intersection: For the PM peak period the westbound approach has a long delay of 132 seconds resulting in LOS F. This results in an overall intersection delay of 48 seconds resulting in LOS E. The southbound left turn lane has a queue length that exceeds available storage. The congestion experienced at this intersection is often influenced by delays related to the railroad crossing.

Hwy 47/Hwy 10 Westbound Ramps Intersection: For the PM peak period the westbound approach has a long delay of nearly 200 seconds resulting in LOS F. This results in an overall intersection delay of 78 seconds resulting in LOS E. The westbound movements all have long queue lengths that exceed available storage by as much as 2,600 feet causing traffic to back up onto Hwy 10 mainline. The congestion experienced at this intersection is often influenced by delays related to the railroad crossing.

3.2.5 Railroad Crossing Geometry

The skew angle combined with building sightline encroachment in two quadrants and the hump substantially limits the visibility of high speed approaching trains for drivers. Also the hump affects the visibility of vehicles using the driveways along Hwy 47 and forward sight distance to determine vehicle queuing space over and beyond the double track hazard zone. *Hidden Driveway* and *Do Not Stop On Tracks* signs have been installed approaching the railroad crossing for both directions on Hwy 47.

3.2.6 Access Management in the Project Area

In general, Hwy 47 has very limited access control. Numerous businesses have open access to their sites from the roadway with no defined driveways. These very wide driveways exist as close as 40 feet from the railroad crossing gates. As a result drivers can drive into and out of the site at any point near the railroad crossing. Left turning vehicles into and out of these driveways lack gaps to adequately make the maneuver which results in additional queuing extending onto the tracks.

3.2.7 Hwy 47 Corridor Safety

Crash data from 2012-2014 was evaluated along Hwy 47 from the westbound Hwy 10 ramps to Bunker Lake Boulevard. The data showed problematic intersections and roadway segments further described below.

3.2.8 Intersection Crashes

Hwy 47 at Martin Street – This intersection is located south of the railroad crossing. The crash rate at this unsignalized intersection is 0.62 crashes per Million Entering Vehicles (MEV), which exceeds the 0.37 critical crash rate. The typical pattern is rear end, low severity, during PM peak period which suggests congestion and queuing (related to the railroad crossing and overall delay on Hwy 47) contributes to the crash frequency.

Hwy 47 at McKinley Street – This intersection is located north of the railroad crossing. The crash rate at this unsignalized intersection is 0.98 crashes/MEV which exceeds the 0.37 critical crash rate. Fifteen of the 21 crashes are rear end crashes at this intersection. There was one serious injury right

angle crash that occurred at 10:22 PM. The typical pattern is rear end, low severity, during PM peak period which suggests congestion on Hwy 47 contributes to the crash frequency.

3.2.9 Roadway Segment Crashes

The roadway segments on Hwy 47 from the Hwy 10 ramps to Bunker Lake Blvd experiences a crash rate that exceeds the critical crash rate. The most common reported crashes are rear end (63 crashes, 52% of all crashes) and 42% of crashes occurred between 3:00 PM and 6:00 PM; therefore, many of the crashes are occurring during the PM peak period which is the most congested period along Hwy 47. There were no fatal crashes and one serious injury crash at the McKinley Street intersection also reported above. Fourteen of the crashes occurred along the curve at State Avenue/Garfield Street and seven of these crashes involved a vehicle that left its lane while five crashes were a rear end.

4 Traffic Forecasts, Operations and Safety

4.1 Traffic Forecasts

Initial traffic forecasts were prepared for the corridor using the Metropolitan Council travel demand model. The model does not account for at-grade crossing delay with a train penalty; therefore, the model could not be used to directly forecast traffic volumes for an at-grade and grade separated scenario. Instead, the model was used to understand the expected traffic growth in the corridor.

The model results showed limited growth along Hwy 47, which reflects that the corridor is already at or near capacity. However, the model forecasts did result in substantial growth along Bunker Lake Boulevard, which is essentially a parallel facility to Hwy 10. Draft 2040 peak hour turning movement forecasts were developed for the study intersections. The forecasted peak hour turning movements included substantial growth on the Bunker Lake Boulevard approaches. However, with no planned additional capacity for Hwy 47 at Bunker Lake Boulevard, green time would have to be taken from Hwy 47 and assigned to Bunker Lake Boulevard. The change would have resulted in delays on Hwy 47 that would mask the benefit of a grade separation. Therefore, the alternatives (at-grade and grade separated) were evaluated using existing volumes. This approach still provides an understanding of the impacts that would be expected at the time of opening, allowing MnDOT to assess Hwy 47 and implement improvements at a later time as the need arises.

4.2 Traffic Operations

A traffic operations analysis was completed for the study area using collected data on traffic volumes and train operations. The collected data was analyzed using VISSIM. Level of Service (LOS), max queue, and average travel speed was determined for two scenarios; at-grade (existing conditions) and grade separation at the crossing location. The grade separation provides substantial benefit at the south end of the corridor, especially in the PM peak hour where delay and queue lengths decrease. This includes reducing the Hwy 10 westbound off-ramp queue by 3,100 feet. Additionally, the Pleasant Street intersection improves despite reassigning vehicles from Martin Street to Pleasant Street. At the north end of the corridor, there is no change or a marginal decrease in operations. The grade separation moves the corridor bottleneck to the Bunker Lake Boulevard intersection. Overall, the grade separation meets a key secondary need of reducing the vehicle delay caused by train crossings. In the next phase of the project, turning movement volumes at Martin Street should be collected to aid in the determination of the volume reassignment to Pleasant Street. Also in the next phase of the project, an Intersection Control Evaluation (ICE) at McKinley Street should be performed, including Bunker Lake Boulevard in the analysis to capture the influence the intersection has on the corridor .

The following provides a summary of the at-grade and grade separated scenarios. The full analysis can be found in the Traffic Operations Technical Memorandum found in **Appendix B: Traffic Operations and Safety Technical Memorandum**.

4.2.1 At-Grade Traffic Operations

This scenario evaluates existing traffic conditions where Hwy 47 is at-grade with the BNSF railway.

AM Peak Hour LOS and Queue Length

In the AM peak hour, all studied intersections operate at LOS D or better as an overall performance measure. However, all intersections have either an approach or a specific movement that operates at LOS E or F in the at-grade crossing scenario. The measured delay at the railroad crossing is approximately 45 seconds per vehicle (s/veh). VISSIM only measures delay to the adjacent intersection, so this does not capture all delay related to the crossing.

PM Peak Hour LOS and Queue Length

In the PM peak hour, McKinley Street is the only intersection that operates better than LOS E. At the intersection, the eastbound approach has the largest delay (29 s/veh, LOS D). Pleasant Street operates at LOS E while both the Hwy 10 westbound ramp terminal and Bunker Lake Boulevard intersections operate at LOS F, which are considered unacceptable performance levels. The measured delay at the railroad crossing is approximately 23 seconds per vehicle (s/veh), which is less than the AM peak hour. However, most of PM travel direction is northbound and the close proximity of the Pleasant Street intersection restricts how well VISSIM can measure delay at the crossing.

4.2.2 Grade-Separated Traffic Operations

This scenario evaluates grade-separating Hwy 47 from the BNSF railway using existing traffic volumes.

AM Peak Hour LOS and Queue Length

Once the corridor was modeled with the grade separation, the average delay and queue lengths decreased for all intersections except Bunker Lake Boulevard. The morning traffic pattern is predominately southbound vehicles and the queue from the railroad grade crossing does not impact the Bunker Lake Boulevard intersection in the morning. Therefore, moderate delay and queue length increases at Bunker Lake Boulevard are likely due to model variation.

Specifically looking at the Pleasant Street intersection, shifting the vehicles from the Martin Street to Pleasant Street had no adverse impacts on the operations. The average delay for the northbound left turn dropped from 89 s/veh to 50 s/veh. In other words the LOS improved from F to D. To accommodate the increased turning traffic, five seconds of additional green time was assigned to the northbound movement. The VISSIM simulation was visually inspected to verify it was reasonable for the delay to decrease despite the increase in northbound left turns.

PM Peak Hour LOS and Queue Length

With grade separation at the train crossing, substantial improvements in average vehicle delay and queue lengths are seen at Hwy 10 westbound ramp and Pleasant Street intersections. One notable improvement is that the max queue length on the Hwy 10 westbound off-ramp decreased from in excess of 3,400 feet to less than 350 feet. At the northern end of the corridor, the grade separation resulted in a slight increase of queue lengths and average vehicle delay. The analysis reveals that the grade separation allows the vehicles to reach the northern end of the corridor with little impediment, which results in worse performance at Bunker Lake Boulevard – the downstream bottleneck – and McKinley Street. McKinley Street is a residential collector that provides access to

and from Hwy 47 and the adjacent neighborhoods. Because of the impact to the north end of the corridor, a full ICE study is recommended for McKinley Street. The ICE study needs to include the Bunker Lake Boulevard intersection because of the influence it has on the Hwy 47 corridor operations.

Specifically looking at the Pleasant Street intersection, shifting the vehicles from Martin Street to Pleasant Street had no adverse impacts on the operations. The average delay for the northbound left turn dropped from 43 s/veh to 22 s/veh. In other words, the LOS improved from D to C. To accommodate the increased turning traffic, five seconds of additional green time was assigned to the movement.

4.3 Traffic Safety

Overall, the grade separation meets the primary need of eliminating the potential for vehicle-train crashes by grade separating the crossing.

The current Hwy 47 access to Alter Trading has a bypass lane, which provides operational and safety benefit when trucks are turning left. A proposed access change is to relocate Alter Trading access to between the S-curves (see **Figure 1**). It is recommended that a left-turn lane be included.

5 Alternatives Evaluated

Two alternatives were considered to address the primary need for this feasibility study. These included constructing a bridge over the railroad (Over Alternative) and lowering the road below the railroad grade (Under Alternative). Both alternatives maintain the current crossing location. The following summarizes the alternatives considered and evaluated. The full evaluation can be found in **Appendix C: Alternatives Analysis Technical Memorandum**.

5.1 Concepts Considered

5.1.1 Over Alternative

The Over Alternative consists of building a two-lane bridge with a multi-purpose trail over the BNSF Railway. The change in grade is approximately 30 feet (see **Figure 2** in **Appendix C: Alternatives Analysis Technical Memorandum**). Highlights of the Over Alternative include:

- Eastern shift of Hwy 47's existing alignment to allow for future four-lane expansion (two additional lanes) to the west without substantial impacts to western pri\vate properties.
- Maximum 5% grades to allow for an ADA compliant Hwy 47 multi-purpose trail profile over the railroad.
- 35 mph design speed, except for at the first Hwy 47 curve
- Martin Street closed at Hwy 47
- Full acquisition of A-1 Recycling property
- Four access closures (Anoka-Hennepin Community Education Center, Alter Trading (two closures), Anoka Today Alano)

5.1.2 Under Alternative

The Under Alternative uses a similar shifted alignment as the Over Alternative to provide space for future four lane expansion and limit impacts to western private properties (see **Figure 3** in **Appendix C: Alternatives Analysis Technical Memorandum**). The Hwy 47 profile goes under the railroad. This alternative includes two sub options: the railroad profile remaining the same, and raising the railroad profile. Raising the railroad profile was considered to allow the roadway profile to be above the water table, lowering drainage costs and complications. Raising the railroad profile over the roadway presented many difficulties though, both with constructability and cost. Tying the railroad profile into the existing profile before the Northstar station east of the Rum River was not achievable, therefore the station would need to be modified to tie into the new track grades. Ultimately it was decided the sub option of leaving the existing railroad profile was more economical. Highlights of the Under Alternative include:

- Eastern shift of Hwy 47's existing alignment to allow for future four-lane expansion (two additional lanes) to the west without substantial impacts to western private properties.
- Maximum 5% grades to allow for an ADA compliant Hwy 47 multi-purpose trail profile under the railroad.
- 35 mph design speed, except for at the first Hwy 47 curve
- Maintains access to Martin Street
- Full acquisition of A-1 Recycling property

- Four access closures (Anoka-Hennepin Community Education Center, Alter Trading (two closures), Anoka Today Alano)

5.1.3 Geometric Design Criteria

The geometric design parameters used for this design utilized the thirteen critical design elements of primary importance to geometric design as defined by FHWA's "Federal Aid Policy Guide". These criteria and the associated values defined by the MnDOT Road Design Manual, MnDOT Technical Memoranda and LRFD Bridge Design Manual are the foundation of the design. The values used can be found in the table below:

Table 1: Hwy 47 Grade Separation Design Criteria

13 Critical Design Elements	Existing Condition	Proposed Design	Standard
Design Speed	30 MPH	35 MPH	TM 12-13-TS-07
Stopping Sight Distance	215'	237'	Figure 3-2.05D
Grades	5%	5%	Chapter 3 (MnDOT RDM)
Horizontal Alignment	852'/254'/224'	957'/4584'/279'/224 (last two curves do not meet 35 mph)'	TM 12-11-TS-05
Vertical Alignment	20 MPH	35 MPH	Figure 3-4.04A/3-4.04C (MnDOT RDM)
Cross Slopes	2%	2%	Chapter 4 (MnDOT RDM)
Superelevation	6%	6%	TM 12-11-TS-05
Lane Width	12'	12'	TM 13-18-TS-07
Shoulder Width	8'/~2'	Curb Reaction	TM 12-12-TS-06
Structural Capacity on Bridges	NA	HL-93/E80	MnDOT LRFD
Bridge Width	NA	41'	TM 12-14-B-03
Vertical Clearance	NA	23'4"	MnDOT LRFD
Horizontal Clearance to Obstruction	10'	TBD	Chapter 4 (MnDOT RDM)

In addition to these design criteria there were other design values, environmental, right-of-way and physical constraints considered during design:

- Cul-de-sac at Martin Street is 50 feet diameter.
- City parking standards used for parking lot modifications.
- Pavement sections:

  - Mainline = 8 inches Bituminous, 7 inches Aggregate Base, 12 inches Granular Embankment
  - Trail = 4 inches Bituminous, 6 inches Aggregate Base
  - Well Building Access Road = 3 inches Aggregate Surfacing, 12 inches Aggregate Base
- Snow Storage: 6 feet on south side, 10 feet on north side.
- BNSF requested ability to expand to third mainline track.
- BNSF agreed to 80 foot min portal. Design assumed third track would require reconfiguration of existing two tracks and Rum River Bridge. Expansion would happen to the south.
- Horizontal alignment was shifted to the east to accommodate future expansion to 4-lane section without requiring right-of-way from Alter Trading.
- A minimum offset of 10 feet was used from the well building.
- Design vehicle: WB-62 (Hwy 47, School, Alter) SU-40 (Well Building Access).
- Walls will be MnDOT standard Cast-in-Place walls.
- 35 MPH design speed will require design exceptions for both existing S-curves.

5.2 Approach and Evaluation Criteria

The alternatives analysis process was completed using the Value Benefit Assessment Process. Project team subject matter experts participated in the process and used the value matrix tool to build team consensus in prioritizing the evaluation criteria. The process was completed in the following four steps:

Step 1 - Evaluation Criteria

Project alternatives often have many attributes and requirements that determine and measure the success of the projects. At times the projects have some of these attributes which are competing or conflicting with each other. The project team selected and defined twelve attributes as the evaluation criteria which are identified in **Table 2**.

Step 2 - Criteria Weighting

To develop weighting for each criterion, a paired comparison method was used. By answering the question “Which criterion ‘A’ or ‘B’ will provide the greater improvement to the project relative to the Purpose and Need of the project?” The team subsequently compared each criterion. The letters were recorded in a matrix, and then the weight for each criterion was calculated.

Step 3 - Criteria Score Scale

To provide consistency and avoid bias, the team developed a criteria scoring scale and defined the bookends and mid-point for the scale. Scores range from a low of 1 to a high of 10, where 1 means Substantial Negative Impact, and 10 means Substantial Positive Impact.

Step 4 - Evaluation Matrix

Using the criteria score scale, the team evaluated and scored each alternative. Once the team completed scoring, the performance score was determined by the following equation.

$$Performance\ Score = \sum (Criteria\ Weight * Criteria\ Score)$$

Finally, the performance score was divided by the total estimated cost to determine the overall value of each alternative. Using this approach, higher values indicate the alternative better meets the project's evaluation criteria.

Table 2: Evaluation Criteria

	Evaluation Criteria	Description
A.	Right-of-Way Impacts	Avoid or minimize building removals/total property takes.
B.	Public / Private Access Closures	Avoid or minimize closing driveways and public streets, in the extreme case resulting in landlocked properties.
C.	Constructability	Avoid or minimize construction detours/full closures and length of construction.
D.	Railroad Impacts	Avoid or minimize disruption to rail service, i.e. utilize efficient construction methods and staging to construct project using minimal (and achievable) work windows that impact daily rail operations (which will be substantially maintained).
E.	Railroad Crossing Safety	**Primary Need:** Avoids or minimizes the potential for future vehicle-train collisions.
F.	Public Controversy	Avoid or minimize public controversy.
G.	Contaminated Site Risks/Impacts	Avoid or minimize disruption of contaminated soils.
H.	Floodplain Impacts	Avoid or minimize disruption of floodplain impacts.
I.	Water Table / Storm water Impacts	Avoid or minimize dewatering, pumping, or extensive storm water management.
J.	Historic Property Impacts	Avoid or minimize impacts to historic or potentially historic properties.
K.	Park / Fairground Impacts	Avoid or minimize impacts/property takes to the Rum River South County Park or Anoka County Fairgrounds.
L.	Vehicle Delay due to Train Crossings	**Secondary Need:** Avoid or minimize vehicle delays as a result of train crossings.

5.3 Alternative Comparison

Both alternatives address the primary need to improve the railroad crossing safety (safety for motorists, pedestrians, bicyclists, and trains). Both alternatives also equally addressed a key secondary need by improving traffic operations including reducing delays caused by trains. Although not in the evaluation matrix they also both address other secondary needs identified for this project including eliminating gate-down time and removing the poor line of sight at the crossing.

The Value Benefit Assessment Process described above was used to weight the twelve evaluation criteria, score each alternative, and compute a value score. Overall, the alternative with the bridge over the railroad had a better performance score, lower total estimated cost, and higher value (**Table** 3). Therefore, the Over Alternative is the preferred approach to separate the vehicles, pedestrians and bicycles from trains at the existing crossing.

Table 3: Alternative Evaluation Summary

Alternative	Performance Score	Total Estimated Cost	Value
Over	5.6	$21.7 Million	25.6
Under	4.7	$36.9 Million	12.6

The following summary addresses the evaluation criteria that contributed the most to the separation of the performance scores.

Over Alternative

- **Constructability:** Building the bridge over can initially be accomplished by constructing a portion of the grade separation while keeping the existing Hwy 47 open. The closure of Hwy 47 could likely be limited to a single construction season.
- **Railroad Impacts:** Constructing a bridge over the railroad is expected to have minimal disruption to rail services and utilizes efficient construction methods and staging with minimal impacts on daily rail operations.
- **Contaminated Site Risk/Impacts:** Excavation is minimized by this alternative, reducing the potential of disturbing contaminated soils.
- **Water Table/Stormwater Impacts:** The water table will not be disturbed and there is generally suitable areas to temporarily retain stormwater.

Under Alternative

- **Constructability:** More difficult to construct because of extensive coordination with the railroad. The construction will likely result in Hwy 47 being closed at least two years.
- **Railroad Impacts:** Construction of temporary lines and a temporary bridge over the Rum River could result in substantial project schedule risk due to rail operational coordination factors; i.e. rail traffic and BNSF operations must substantially be maintained as routine and daily during construction.
- **Contaminated Site Risk/Impacts:** Significant excavation is needed which has the possibility of disturbing contaminated soils. During construction, dewatering may be necessary, with the potential of the dewatering drawing the contaminated plume towards the project site and closer to the river.
- **Water Table/Stormwater Impacts:** A road under the railroad will require that stormwater (and possibly ground water) be pumped from the low point. This also requires underground storage chambers that must be design and constructed.

6 Preferred Concept Alternative

The preferred alternative was further refined based on input from project stakeholders such as adjacent properties owners, the general public, and City of Anoka staff.

6.1 Refined Concept Layout

The refined concept for the Over Alternative is shown in **Figure 1** and **Figure 2** and as described earlier the alignment it is shifted east, approximately 33 feet, to allow for up to two additional lanes on the west side if the Hwy 47 is expanded some point in the future. The alignment was set using four parameters:

1. Tying into the existing alignment to the south before the signal at Pleasant Street,
2. Tying into the existing alignment to the north without impacting Alter Trading or the Anoka County Fairgrounds,
3. Avoiding any impacts to the well building, and
4. Providing sufficient space to the west to allow for future expansion. To avoid impacts to the well building, a 10-foot buffer was used between the building and the edge of bridge.

The proposed Hwy 47 profile satisfies the BNSF desired clearance of 23 feet 4 inches. This clearance is maintained for the entire 80 foot wide portal that the BNSF agreed to (see BNSF Meeting in **Section 7 Stakeholder and Public Input**) and also allows for three tracks. The proposed grades on the Hwy 47 roadway/trail profile are no more than five percent which meets ADA requirements and allows for the shortest tie in to existing ground.

6.1.1 Project Design Parameters

The project is designed to meet a 35 mph design speed with the exception of the S-curves. The project extends through the first curve to the north and a left turn lane is proposed through the second curve. Neither horizontal curve meet 35 mph nor is it recommended to flatten the curves to meet the design speed due to the impacts to the Anoka County Fairgrounds and Alter Trading property. These curves are designed to meet 30 and 25 mph respectively.

6.1.2 Project Impacts and Design Issues

- **Martin Street closure:** It is currently proposed to close Martin Street at Hwy 47 and design a cul-de-sac on the west side of the roadway to accommodate local traffic. An evaluation of raising Martin Street to meet the proposed Hwy 47 elevation should be investigated in the next phase (Preliminary Design).
- **Residential impact:** A six-foot retaining wall is proposed in front of the residential home located in the southwest quadrant of Hwy 47 and Martin Street. The property owner's impacts should be evaluated in Preliminary Design.
- **A-1 Recycling:** Full acquisition of A-1 Recycling property is proposed to construct a stormwater treatment pond needed for this project. Space for a MnDOT access road is proposed along the east side of the proposed bridge/retaining walls. Investigating the most

desirable location (i.e. under proposed bridge and/or through adjacent parking lots) for this access road should be investigated during Preliminary Design.

- **Alter Trading:** This property's two accesses along Hwy 47 are proposed to be closed due to the substantial grade change in this area. One of the entrances is used as their main access to their truck scale and provides sufficient space for large trucks to easily enter and exit the site. Closing these private accesses may require reconfiguring their site including relocating buildings. A mid-block access is proposed between the two curves along Hwy 47. Left turns are also recommended into the proposed access and at the intersection with Garfield Street.
- **Anoka-Hennepin Community Education Center:** The Hwy 47 access to the Anoka-Hennepin Community Education Center is proposed to be closed which will potentially result in the need to reconfigure their parking lot to allow for delivery truck (WB-62) circulation to and from their southern loading docks on the east side of the building. The property owner has a desire to use space under the proposed bridge for parking. A parking lot reconfiguration design has been proposed but still needs to be vetted with the property owner. Use of the space underneath the bridge should be investigated during Preliminary Design.
- **Anoka Today ALANO:** The Hwy 47 access to this site is proposed to be closed. The owner was concerned about the ability to access Hwy 47 for pedestrians who pay to park at their site during the County Fair. This annual parking use is serves as an income generator for the property owner.
- **Municipal well building:** Access to the potentially historic well building can be maintained by moving the access to the north and constructing an access road along the east side of Hwy 47. An additional retaining wall is proposed on the eastern side of the access road to avoid encroaching into the Rum River. To avoid impacts to this building the Over Alternative will utilize a 10-foot buffer between the building and the edge of bridge.
- **Pleasant Street signal:** Residents have voiced concerns about how the signal currently operates and whether eliminating the gaps provided by the at-grade railroad crossing would negatively impact their ability to turn at Pleasant Street and Martin Street to get into the neighborhood. The traffic analysis completed for this study shows improved operations at the Pleasant Street signal by eliminating the at-grade crossing as well as closing Martin Street. Further analysis at this location is suggested with further engagement with the neighborhood.
- **McKinley Street intersection:** Residents in the area have requested a signal at McKinley Street and Hwy 47 citing unavailable gaps for turning to/from Hwy 47. The analysis completed for this study did not show an operational problem at McKinley but did show that the delays experienced at Bunker Lake Boulevard and Hwy 47 would get slightly longer since traffic would no longer be impeded by the railroad crossing delay. It is recommended that an intersection traffic control evaluation (ICE) occur at this intersection to determine if a signal would improve or make conditions worse. A signal, if recommended, may also be accompanied by a raised median at intersections between McKinley Street and Bunker Lake Boulevard (and possibly at driveways) to limit the corridor to right-in/right-out access.
- **Contaminated soils:** The project area has known contaminated soils both within the public right-of-way and on private properties. These known issues will increase costs for soil excavation and drainage improvements that are below grade. It has the potential to influence right-of-way costs (i.e. the reconfiguration of Alter Trading site). Costs have been included in the estimate to account for these but as the project further develops they have the potential to change based on the impact and/or change in design.

- **Anoka County Fairgrounds:** Access to the Anoka County Fairgrounds is maintained through the same entrance since the profile is tied into the existing road at this point. A strip taking may be necessary along the north side of Hwy 47 to provide space for the proposed left turn lane and to re-grade the north ditch.
- **Rum River impacts:** A new outlet to the Rum River is proposed east of the proposed stormwater treatment pond. The river is a State Wild and Scenic River. Coordination with the DNR during Preliminary Design will be necessary and Permits will be required.

6.2 Bridge Type Study

Four bridge alternatives were considered (three over and one under). The findings indicate Option 2 has lower overall costs (capital plus life cycle costs). Option 2 is a seven span bridge, which provides an 80 feet railroad portal, as agreed to by BNSF, and the minimum 23 feet 4 inch vertical clearance over the BNSF railway facility. A summary of the options are described below, for a more detailed analysis see **Appendix D: Structure Type Study Technical Memorandum**.

Option 1 – Single Pre-stressed Concrete Beam Span (Overpass)

Option 1 is a single span pre-stressed concrete beam bridge with high parapet abutments and retaining walls. The capital costs are approximately $2.7 million more than Option 2 (see **Table 4**) and $0.6 million more when considering a 75 year life cycle cost. This option is also less desirable since it places very high walls within close proximity (10 feet) to the potentially historic well building. The vibration caused by constructing the walls have the potential to negatively impact the well building. The walls would also likely need to be cast in-place since MSE walls are not ideal for a narrow section of roadway with very tall walls on both sides. MSE walls are also not desirable since it limits the ability to widen the roadway at some point in the future. It is also noted that BNSF would not allow MSE walls within their right-of-way.

Option 2 – Multiple Pre-stressed Concrete Beam Spans (Overpass)

A multiple span pre-stressed concrete beam bridge was considered as an alternative to the single span to evaluate replacing high retaining walls with more bridge. This option costs approximately $2.7 million less than Option 1 (see **Table 4**) and the construction of the pier near the well building is expected to have less impact than the proposed walls in Option 1 since the footprint would be smaller and the distance from the building would be greater. This option also allows for the utilization of space under the bridge.

Option 3 - Single Steel Girder Span (Overpass)

A single span steel superstructure was considered but not developed further since the preliminary section depth for a steel span of this length provides an insignificant amount of additional vertical clearance versus a prestressed concrete beam span, and is not worth the additional capital and maintenance costs for steel.

Option 4 – Single Thru-Plate Girder Span (Underpass)

A single thru-plate steel girder span was considered but not developed further since the geometry at the site required the adjustment of the profile for the railway tracks. This adjustment would impact

the adjacent railway bridges over the Rum River. The **Alternative Analysis (Appendix C**) documents the methodology and findings related to going under the BNSF crossing in this location. The findings show that going under has more project-related impacts and costs more than going over and therefore going over is the preferred solution. Because of this analysis, the under alternative was not further developed.

Table 4: Option 1 and Option 2 Cost Comparison (bridge vs wall spans)

LOCATION (50' segments or Main bridge span)			WALL/ROADWAY/ BRIDGE COSTS (Option 1)	BRIDGE COSTS (Option 2)
337+50	TO	338+00	$201,079	$290,000
338+00	TO	338+50	$239,102	$290,000
338+50	TO	339+00	$294,420	$290,000
339+00	TO	339+50	$336,141	$290,000
339+50	TO	340+00	$383,173	$290,000
340+00	TO	340+50	$416,618	$290,000
340+50	TO	341+00	$432,258	$290,000
341+00	TO	341+50	$445,753	$290,000
341+50	TO	342+00	$429,749	$290,000
Railway Span			$1,893,761	$520,800
343+00	TO	343+50	$445,753	$290,000
343+50	TO	344+00	$447,879	$290,000
344+00	TO	344+50	$437,303	$290,000
344+50	TO	345+00	$426,819	$290,000
345+00	TO	345+50	$399,418	$290,000
345+50	TO	346+00	$366,186	$290,000
346+00	TO	346+50	$332,390	$290,000
346+50	TO	347+00	$300,986	$290,000
347+00	TO	347+50	$268,846	$290,000
Totals			**$ 8.5M**	**$ 5.8M**
Totals (Includes LCCA)			**$ 9.4M**	**$ 8.8M**

NOTES:

- 2020 construction costs used (14% increase from 2015 prices)
- Does not include Life-Cycle Cost Analysis (LCCA).
- Station range is even 50 feet comparison and represents an approximate bridge length
- Option 1 includes: Bituminous, Retaining Wall, Barrier, Curb and Gutter, Class 5 Aggregate, Select Granular Material, Embankment-Common, Select Granular Modified 10%, Concrete Walk, and Bridge.

6.3 Drainage

The drainage analysis done for the feasibility is condensed to the primary area between Pleasant Street and Garfield Street. The drainage analysis considered the drainage needs for both the over and under options. High groundwater and historic contamination in the study area raised significant concerns about the constructability and costs associated with drainage for the underpass option. The overpass alternative avoids conflicts with groundwater and allows the drainage design to maintain existing drainage patterns north of the railroad. Both design alternatives propose a lined stormwater treatment pond in the current location of A1 Recycling, with a new outlet into Rum River to the east. Further detail and analysis can be found in **Appendix E: Drainage Technical Memorandum**.

6.4 Construction Staging

A constructability analysis of Bridge Options 1 and 2 was done to check feasibility of each option, possible construction phasing and possible detour routes. Because Options 1 and 2 have similar geometrics over the railroad, there is little to no difference in constructability over the active tracks.

6.4.1 Construction Phasing

The construction phasing developed as part of the feasibility study utilizes a three phase construction approach for both Options 1 and 2. Phasing for both options will follow these general steps:

- Phase 1 constructs the widening needed for the new Alter Trading entrance, the cul-de-sac on Martin Street and the Anoka/Hennepin School District parking lot modifications.
- Phase 2 will close access to Hwy 47, within the project limits, for A-1 Recycling, Alter Trading, Anoka/Hennepin School District, and Martin Street. Once access closures occur, temporary traffic control measures can be put in place, utilizing existing pavement, and construction on the eastern portion of both Options 1 and 2 can begin (See **Appendix F: Staging Concept** for more detail).
- Phase 3 will implement a full closure of Hwy 47 for completion of the structural and roadway work. Graphical representations of this phasing can be found **Appendix F: Staging Concept.** During phase 3 for both options, a possible detour route would utilize US 10, Thurston Avenue or CR 57 and Bunker Lake Boulevard.

6.4.2 Construction Duration

The current design estimates 155 working days based on MnDOT production rates to build the bridge. The bridge is the critical path for construction. Two scenarios for letting dates are being considered. The September letting is recommended since it allows for a longer construction if needed and the road isn't closed during the winter months when construction is dormant.

September Letting: Phase 1 – widen and close accesses and build railroad improvements needed for staging. Phase 2 – maintain two lanes of traffic during full shut down of construction operations from Dec to Feb. Build piers/columns and move subsurface utilities. Phase 3 – full closure of TH 47 from Feb to August with no access in the area. Open up by late fall early winter. Shut down during fair.

July letting: Phase 1 start construction in August would result in a closure of TH 47 during winter but could finish by July of the following year. The drawback is this scenario would have the road closed during winter with no construction activity. Since the fair is late July this has the potential to not impact the fair. However, it is cutting it close and there is no guarantee the contractor will be able to finish on time especially if there is a wet season.

6.5 Updated Cost

Specific bid items were calculated, percent of construction costs were assumed and project risk elements were assessed with a cost to develop the overall range of estimated project costs. The specific bid items used were the top fourteen bid items that were identified as being needed on this project. In addition to these bid items, lump sum items like bridge, drainage, traffic control, mobilization and a 15% other construction costs items were added. The estimate covers other project costs such as risk, project management, engineering, right-of-way and inflation (2020 construction). All of these individual elements roll up into an overall estimated project cost range of +/- 10%. The total project costs are expected to be in the range of $17 and 21 million (**Table 5**).

Table 5: Cost Estimate for the Preferred Alternative

TH 47 FEASIBILITY STUDY - COST ESTIMATE DRAFT							
						OVER OPTION	
	ITEM NUMBER	ITEM DESCRIPTION	UNITS	UNIT PRICE	NOTES		
1	2021.501/00010	MOBILIZATION	LUMP SUM	4.00%	1	1	$ 268,426
2	2105.607/00250	HAUL & DISPOSE OF CONTAMINATED MATERIAL	CU YD	$ 50.00		1000	$ 50,000
3	2106.607/00010	EXCAVATION - COMMON	CU YD	$ 4.75		2000	$ 9,500
4	2106.607/00060	COMMON EMBANKMENT (CV)	CU YD	$ 3.50		10000	$ 35,000
5	2106.607/00080	SELECT GRANULAR EMBANKMENT (CV)	CU YD	$ 13.00	4	2050	$ 26,650
6	2106.607/00110	SELECT GRANULAR EMBANKMENT MOD 10% (CV)	CU YD	$ 20.00		4500	$ 90,000
7	2118.607/00110	AGGREGATE SURFACING CLASS 1 (CV)	CU YD	$ 40.00	6	110	$ 4,400
8	2211.503/00050	AGGREGATE BASE (CV) CLASS 5	CU YD	$ 23.50	4,5,6	269	$ 6,333
9	2360.501/22200	TYPE SP 12.5 WEARING COURSE MIX (2,B)	TON	$ 60.00	4	2450	$ 147,000
10	2360.501/23300	TYPE SP 12.5 WEARING COURSE MIX (3,C)	TON	$ 67.00	5	260	$ 17,420
11	2401.513/01146	TYPE F (TL-4) BARRIER CONCRETE (3S52)	LIN FT	$ 85.00		1500	$ 127,500
12	2406.553/00010	BRIDGE APPROACH PANELS	SQ YD	$ 180.00		190	$ 34,200
13	2406.618/00010	CONCRETE RETAINING WALL	SQ FT	$ 80.00		13000	$ 1,901,275
14	2401	BRIDGE NO. XXXX - roadway bridge for over option	SQ FT	$ 123.00		41111	$ 5,056,653
17	2501 - 2512	DRAINAGE	LUMP SUM				$ 570,000
18	2521.501/00060	6" CONCRETE WALK	SQ FT	$ 5.00		4650	$ 23,250
19	2531.501/02320	CONCRETE CURB & GUTTER DESIGN B624	LIN FT	$ 20.00		3300	$ 66,000
20		RAIL	LUMP SUM	$ -			$ -
21		TEMPORARY DEWATERING	LUMP SUM	$ -			$ -
22	2565	TRAFFIC CONTROL	LUMP SUM	5.00%	2	1	$ 335,533
23	MISC.	OTHER CONSTRUCTION COSTS	LUMP SUM	15.00%	3	1	$ 248,100
24	MISC.	RISKS					$ 2,718,563
		CONSTRUCTION TOTALS					$ 11,735,803
		INFLATION (2020)		1.1357			
		2020 CONSTRUCTION TOTALS					**$ 13,328,352**
		PROJECT MANAGEMENT		9.00%			**$1,199,552**
		ENGINEERING		9.00%			**$1,199,552**
		RIGHT-OF-WAY					**$3,037,827**
		SUBTOTAL					**$18,765,282**
		HIGH		10.00%			**$20,641,810**
		LOW		-10.00%			**$16,888,754**

1.) Mobilization is calculated as 4% of items 2 thru 15 and 17

2.) Traffic control is calculated as 5% of items 2 thru 12 and 17

3.) Other Construction costs covers miscellaneous items for removals, signing, striping, turf establishment, landscaping, etc. Cost is calculated at 15% of items 2 thru 12 and 17

4.) TH 47 pavement section assumed to be 8" bit, 7" class 5 aggregate base, and 12" of select granular

5.) Trail along TH 47 assumed to be 4" bit and 6" class 5 aggregate base

6.) Access road to the well building assumed to be 3" class 1 aggregate surfacing and 12" of class 5 aggregate base

7 Stakeholder and Public Input

The Feasibility Study began in March of 2016 and concluded in September 2016. Throughout the study stakeholder and public input was gathered to inform design development and decisions. The following activities took place during this time. The following engagement strategy was developed based on input from staff from the City of Anoka, Anoka County and MnDOT. Meeting minutes for project core team meetings, local officials meeting, public open house and a meeting with BNSF are included in **Appendix G: Meeting Summaries**.

7.1 Project Core Team Meetings

Monthly meetings (eight total) were held with staff from MnDOT, City of Anoka, Anoka County and Consultant team members. This core team met to discuss project issues, public and stakeholder concerns and work through key design parameters and decisions. Members of the team include:

- Paul Jung, MnDOT Project Manager
- Brian Kelly, MnDOT Project Manager
- Jim Weatherhead, MnDOT Rail Administration
- Rick Dalton, MnDOT Metro Environmental Unit
- Brigid Gombold, MnDOT Metro Environmental Unit
- Gayle Gedstad, MnDOT Metro Traffic
- Jim Henricksen, MnDOT Metro Forecasting
- Brian Kelly, MnDOT Metro Water Resources
- Kent Barnard, MnDOT Communications
- Dan Prather, MnDOT Bridge Office
- Greg Lee, City of Anoka
- Mark Anderson, City of Anoka
- Ben Nelson, City of Anoka
- Andy Witter, Anoka County
- Brandi Popenhagen, HDR Project Manger
- Scott Burfeind, HDR Project Engineer
- Emily Hyland, HDR Strategic Communications
- Richard Storm, HDR Traffic Engineer
- Connor Fortune, HZ United Project Engineer

7.2 Local Officials Meeting - May 17, 2016

A meeting with elected officials was held early in the project (May 17, 2016) to discuss MnDOT's goals and objectives, define the primary and secondary project needs and show early concepts. The City of Anoka was generally supportive of the project. Anoka County officials expressed the desire to expand the project to accommodate four-lanes and relocate the crossing.

The following elected officials and Core Team staff attended the meeting:

- Matt Look, Anoka County Commissioner
- Doug Fischer, Anoka County Engineer
- Jeff Weaver, City of Anoka Council
- Carolyn Braun, City of Anoka Planner
- Steve Anderson, Anoka Hennepin Schools
- Greg Lee, City of Anoka Engineer/City Manager
- Carl Anderson, City of Anoka Council
- Amy McBeth, BNSF (via phone)
- Brian Kary, MnDOT
- Paul Jung, MnDOT
- Jim Weatherhead, MnDOT
- Kent Barnard, MnDOT
- Sheila Kauppi , MnDOT (via phone)
- Brandi Popenhagen, HDR
- Emily Hyland, HDR (via phone)

7.3 BNSF Meeting - May 16, 2016

A meeting was held between BNSF staff and Core Team members to coordinate the project's goals and objectives and share early design concepts. BNSF agreed to an 80-foot portal opening which allows for three tracks and 15-20 feet from piers to outside track centerlines. The vertical clearance of 23 feet 4 inches was agreed to between MnDOT and BNSF.

7.4 Property Owner One-on-One Meetings

One-on-one meetings were held with the following property owners to discuss MnDOT's goals, objectives and early design concepts. The property owners were selected based on their proximity to the grade crossing and level of impact anticipated. A meeting was requested with A1 Recycling but they did not want to meet with MnDOT at this time.

7.4.1 Anoka-Hennepin Community Education Center – June 23, 2016

Generally this property owner was in agreement with the project. They pointed out issues with removing their access and how it would impact internal circulation for large delivery trucks using the southern loading docks. They requested the need for more parking within their site and the desire to go under Hwy 47 to access city streets on the west side of Hwy 47 to reconnect to the highway. They asked for more one-on-one meetings as the design progressed.

7.4.2 Alter Trading Company – June 28, 2016

Generally this property owner was in agreement with the project. They also pointed out issues and concerns with removing their access to Hwy 47. They indicated that their buildings are located near the access to Hwy 47 and serve as a front door for customers. They pointed out the need to potentially relocate buildings within their site to situate closer to the relocated access. They indicated that they currently rent the facility and Schwartzman's is the owner. The project team later requested a meeting with Schwartzman's who declined until the design further progresses and the project becomes imminent. The property owner was concerned about the duration of a potential detour and the impacts it would have on their business operations.

7.4.3 Anoka Today ALANO – August 16, 2016

Generally this property owner was in agreement with the project. They expressed concerns with the use of their parking during the County Fair. Their lot is used during the fair and is a substantial income generator. They would prefer the design accommodates efficient access to their parking for walkers who would use their facility to go the fairgrounds north of the crossing.

7.5 Public Open House – June 21, 2016

An open house meeting was held from 5:00 p.m. – 7:00 p.m. on Tuesday, June 21, 2016 at the Anoka-Hennepin Educational Service Center in Anoka, MN.

MnDOT, City of Anoka, and HDR staff talked with local residents, commuters, and businesses at the open house to provide information about the study, discuss the pros and cons of each alternative, and project area issues. The team also asked open house attendees to provide input on corridor

plots displayed throughout the open house. Not including staff, the attendance at the open houses was approximately 124 people. Attendees were local residents, commuters, stakeholders, local business owners, and elected officials.

Several people felt the project needed to be expanded to include additional lanes on Hwy 47 and relocate the highway and crossing to address congestion. Many people agreed safety needed to be improved at the crossing. When asked about alternatives most people felt that going over the railroad was more feasible then going under.

Appendix A: Project Purpose and Need Technical Memorandum

Technical Memo

Date:	Tuesday, June 28, 2016
Project:	TH 47/BNSF Grade Separation Feasibility Study SP 0206-71 HDR No. 278053
To:	Brian Kary, PE, Acting North Area Engineer – MnDOT Metro District Jim Weatherhead, PMP, Metro Area Project Manager, MnDOT Rail Administration Office
From:	Brandi Popenhagen, PE, HDR Kathy Biesmann, PE, HDR
Subject:	Purpose and Need

The purpose of the technical memorandum is to document the purpose and need for improving the safety at the crossing of Trunk Highway (Hwy) 47 and the BNSF Railway's two mainline tracks in the City of Anoka, Minnesota.

Purpose and Need Statement

The purpose of improving the Hwy 47 (Ferry Street) BNSF Railway crossing (railroad crossing) is to enhance safety and mobility for motorists, pedestrians, bicyclists and trains.

The project is primarily needed to address railroad crossing safety issues identified at Hwy 47 and the BNSF Railway facility. Secondary needs include addressing the queuing and delays related to the railroad crossing, undesirable horizontal and vertical geometry at the railroad crossing, access management near the railroad crossing and safety issues along Hwy 47 within the project area.

The needs are further described in the Primary and Secondary Needs sections on the following pages.

Project Location

The project is located at the at-grade crossing of Hwy 47 (Ferry Street) and the BNSF Railway's two mainline tracks in the City of Anoka, Minnesota. The railroad crossing is approximately 0.3 miles north of Hwy 10 and 200 feet west of the Rum River. The existing roadway at the railroad crossing is two lanes (one lane in each direction) although the width varies from the south side to the north side of the railroad crossing. The traveled lanes are constant at 12 feet for each lane. The shoulders on the south side of the railroad crossing are 8 feet and vary from 3 feet to 8 feet on the north side. Running near the east side of the roadway is an eight foot wide shared use path; generally this trail is separated from Hwy 47. However, at the railroad crossing the trail is adjacent to the roadway. The existing right-of-way is a consistent 66 feet through the project limits. Near the railroad crossing the roadway speed limit is 30 miles per hour (mph). The Average Annual Daily Traffic (AADT) in 2014 at the railroad crossing is approximately 18,300

vehicles per day with significant heavy commercial, regional recreational, and County fair traffic. The project location map is found on **Figure 1**.

Hwy 47 is functionally classified as a Minor Connector Arterial in the metro area's regional roadway system. Its purpose is to provide safe, direct connections between rural centers and to principal arterials in rural areas without adding continuous general purpose lane capacity.

BSNF Railway's two mainline tracks serve a mix of high speed freight, commuter, and passenger rail traffic. There are between 40 and 80 trains per day including 12 Northstar Commuter Rail trains (traveling during the peak periods) and two Amtrak trains. The train's timetable speeds are 75 mph for Northstar Commuter Rail and Amtrak trains and 60 mph for the freight trains. The Anoka Station for the Northstar Commuter Rail, operated by Metro Transit, is located 1,500 feet to the east of the railroad crossing on 4th Street.

Figure 1: Project Location Map

Project Background

The Hwy 47 railroad crossing was identified as a public safety concern stemming from citizen complaints, credible reports of disregard of the railroad crossing gates observed by the Federal Rail Administration (FRA), MnDOT, and logged by BNSF crews. The following documents the recent events that have occurred based on the public safety concern.

Review of Ferry Street Highway-Rail Grade Crossing, June 1, 2012, Campbell Technology Corporation (CTC)

In June of 2012, CTC developed a Review of Ferry Street Highway-Rail Grade Crossing Report for MnDOT. The report summarized observations by CTC and citizens regarding the railroad crossing operations. These include:

- Extended gate down times sometimes without a train present
- Gates going down then coming up then going back down
- Drivers trying to beat the gates while they are in motion to come down and gates descending on vehicles
- Drivers complaining that it appears there is not enough time to cross the tracks prior to a train arriving
- Excessive traffic queues due to highway congestion that backs over the tracks and made worse by the downed gates
- Drivers going around median and gates
- Drivers not being aware of a potential second train event
- Poor sight lines at the railroad crossing

The report summarized short and long term improvements. Short term, it was recommended that MnDOT and BNSF review the railroad crossing activation system to see if improvements could be made to minimize warning activation leading to long gate down times. The report stated that resolution of this issue could resolve the queuing problem in its entirety. It was also recommended to install enhanced LED blinking *Do Not Stop on Track* signs. Medium term, it was recommended that MnDOT improve access control near the railroad crossing due to limited site visibility and traffic safety. It was also recommended that MnDOT further study a queue cutter traffic signal which would prevent cars from queuing over the railroad tracks. Long term, it was recommended that MnDOT improve the grade geometry by removing the hump at the railroad crossing, widening the roadway, and increasing capacity.

Ferry Street Exit Gate Clearance Time for Four-Quadrant Gate Report, February 6, 2013, Campbell Technology Corporation (CTC)

MnDOT proposed the installation of four-quadrant gates to facilitate a quiet zone, as well as, to prohibit drivers from driving around the lowered gates. CTC assisted MnDOT in the development of the proper Exit Gate Clearance Time (EGCT). After reviewing the location, CTC recommended not having EGCT for a four-quadrant gate warning system at this location. CTC

concluded the operation of the four-quadrant gate warning system and EGCT will likely result in increased gate down times prior to train arrival at the railroad crossing for westbound commuter trains stopping at the Anoka Station. This will increase the traffic congestion and queuing on Ferry Street. The main concern is that drivers will stop on the track as a result of the traffic queues with no means for the driver to clear the track prior to the next train event. It was recommended that any of the following be included to further mitigate traffic queuing concerns along with the implementation of four-quadrant gates.

- Implementation of a queue cutter traffic signal at the railroad crossing
- Improve access control for local businesses adjacent to the railroad crossing
- Improvements to roadway geometry

The report also recommended eliminating the at-grade crossing with a grade separation.

Recommendation Status

The following lists the status of the various recommendations identified above.

- Four-quadrant gates – Four-quadrant gates were not installed due to expected impacts to traffic flows on Hwy 47, instead geometry improvements, identified further below were constructed.
- Review the railroad crossing activation system - The westbound Northstar train was temporarily slowed to 45 mph approaching 3000 feet east and 30 mph at 1000 feet east of the Anoka Station as operational modifications were explored in an effort to eliminate the activation of the Hwy 47 gates as this train enters the Anoka Station. Ultimately the gate timing was modified so that the gates do not “time-out” and go up and down for short durations while passengers are loading and unloading at the Anoka station. Although westbound Northstar train speeds were adjusted to avoid this trigger and BNSF has worked on software upgrades, it still occurs about 25% of the time.
- Install enhanced LED blinking *Do Not Stop on Track* signs - This recommendation was rejected by the MnDOT traffic office but static ground mount regulatory signs were added in lieu of flashing LED signs.
- Improve access control near the railroad crossing - This recommendation has not occurred to date.
- Further study a queue cutter traffic signal - MnDOT performed a study and did not implement a queue cutter traffic signal due to impacts it would have on Hwy 47 traffic operations.
- Improve the grade geometry by removing the hump at the railroad crossing, widening the roadway, and increasing capacity - A southbound escape lane, northbound bypass lane, and minor median and curb modifications were completed during the summer of 2013. The City of Anoka train whistle ban (Quiet Zone) has also been granted by the FRA. The Quiet Zone was implemented as a night time (10 PM to 6 AM) only whistle ban. However Anoka has the option of requesting a 24 hour whistle ban is a possibility.
- Eliminate the at-grade crossing with a grade separation – Currently investigating this recommendation with this feasibility study.

Primary Need

Addressing the primary need will be the principal focus in determining the appropriate improvements for this project.

Railroad Crossing Safety

The primary need is to improve safety at the crossing between Hwy 47 and the BNSF Railway. The following crash history and safety ratings were evaluated for this particular railroad crossing.

Railroad Crossing Crash History

Four property damage only (PDO) crashes occurred in 1972, 1973, 1976, and 1986. One fatal crash occurred in 2003 resulting in four fatalities where a teen driver appeared to drive around gates. Between 2010 and 2014 there were 19 vehicle-vehicle related crashes within a 150 feet of the railroad crossing on Hwy 47 of which 17 were rear end and likely due to queuing and delays related to the railroad crossing. None of these crashes were fatal or serious injury crashes.

BNSF reports indicate that there are approximately two “near miss incidents” annually which are when trains narrowly miss hitting vehicles typically because a driver has ignored the warning devices. These incidents are reported by BNSF locomotive engineers as witnessed from the train.

Safety Evaluations Rankings

The ***Texas Priority Index*** score at this location is 10,330 ***making this railroad crossing the worst rated crossing in the state***. This score uses roadway average daily traffic, number of daily trains, train speed, in-place crossing protection (i.e. cross bucks, gates, etc.), and the number of crashes that occurred within the last five years to determine the score.

The ***Risk Factor Based Analysis*** identifies eight out of ten risk factors are present at this railroad crossing. The Risk Factor Based Analysis looks for the presence of factors that are common among locations where crashes occurred. The risk factors present at this railroad crossing include:

- Vehicle ADT
- Trains per Day
- Volume Cross Product
- Max Time Table Speed
- No of Mainline Tracks
- Skew
- Distance to Nearest Crossing
- Clearing Sight Distance

The risk factors that are missing at this railroad crossing include:

- Roadway Speed Limit
- Distance to Nearby Intersection

Secondary Needs

Secondary needs surround the project area. Some needs are directly related to railroad crossing while others are unique to Hwy 47. Addressing secondary needs will be considered as improvements are proposed to address the primary need if the opportunity exists and the improvement doesn't substantially increase the project scope and impact.

Railroad Crossing Operating Conditions

Traffic delays related to trains and extended gate down times result in driver frustration and impatience. Approximately 40-80 trains cross the tracks daily depending on market conditions. The majority of the trains are long freight trains traveling at speeds as high as 60 mph. There are 12 Northstar Commuter Rail trains (traveling during the peak periods) and two Amtrak trains daily traveling at speeds as high as 75 mph.

Gate Operations

The railroad crossing is 1,500 feet west of the Anoka Station for the Northstar Commuter Rail. The gates drop at the railroad crossing when detecting westbound trains traveling at a high speed from over 4,000 feet away even if the train stops at the station first. This has led to gates being down for over two minutes waiting for passenger boarding at the station. Although westbound Northstar train speeds were adjusted to avoid this trigger and BNSF has worked on software upgrades, it still occurs about 25% of the time. It occurs during Hwy 47 peak periods resulting in traffic queues that extend back onto the Hwy 10 ramps and onto Hwy 10 mainline. The long delay times result in driver frustration since they do not see a train passing through initially. Credible reports indicate that drivers, on occasion, drive around the gates and medians. It appears that drivers become conditioned to Northstar train station operations without realization that high speed freight operations are active on the second track.

Train Delay

Gate down times were collected for a 24 hour period in April, 2016. The results are shown in **Table 1**. These times were for a single day and it is important to note that the number of freight trains can change with market conditions, especially in the third and fourth quarters of the year. The gate down times for freight ranged from less than one minute to over four minutes. The Northstar trains ranged from 37 seconds to 1 ½ minutes. During peak market conditions the BNSF train volumes can double further extending gate down times throughout the day.

Table 1: Gate Down Times in April, 2016

Type and Number of Trains	Min Time (minute:second)	Max Time (minute:second)	Avg Time (minute:second)	Total Time (hour:minute:second)
Freight - 32	0:41	4:54	2:02	1:05:15
Northstar - 12	0:37	1:33	0:56	0:11:09
Amtrak - 1				0:00:43
Total - 45				**1:17:07**

Hwy 47 Operations

From Pleasant St to Bunker Lake Blvd, Hwy 47 is a two lane roadway carrying nearly 18,300 vehicles per day. Generally, a roadway with two lanes has the capacity to carry 11,000 to 15,000 vehicles per day. An operational analysis conducted in April 2016 identified the following deficiencies along the Hwy 47 corridor within the study area:

- **Hwy 47/Bunker Lake Blvd Intersection:** For the PM peak period all four intersection approaches have long delays resulting in LOS F. This results in an overall intersection delay of 115 seconds resulting in LOS F. Several movements have queue lengths that exceed available storage including all of the left turn lanes and the westbound right turn lane. The congestion experienced at this intersection is primarily a result of lane capacity and can sometimes be influenced by platoons of traffic coming from the railroad crossing.
- **Hwy 47/Pleasant St Intersection:** For the PM peak period the westbound approach has a long delay of 132 seconds resulting in LOS F. This results in an overall intersection delay of 48 seconds resulting in LOS E. The southbound left turn lane has a queue length that exceeds available storage. The congestion experienced at this intersection is often influenced by delays related to the railroad crossing.
- **Hwy 47/Hwy 10 Westbound Ramps Intersection:** For the PM peak period the westbound approach has a long delay of nearly 200 seconds resulting in LOS F. This results in an overall intersection delay of 78 seconds resulting in LOS E. The westbound movements all have long queue lengths that exceed available storage by as much as 2,600 feet causing traffic to back up onto Hwy 10 mainline. The congestion experienced at this intersection is often influenced by delays related to the railroad crossing.

Railroad Crossing Geometry

Several factors reduce the sight distance of drivers at the railroad crossing. The tracks and the roadway are at a 54 degree skew angle. The tracks are also higher than Hwy 47 creating a hump on the roadway. The skew angle combined with building sightline encroachment in two quadrants and the hump substantially limits the visibility of high speed approaching trains for drivers. Also the hump affects the visibility of vehicles using the driveways along Hwy 47 and forward sight distance to determine vehicle queueing space over and beyond the double track hazard zone. *Hidden Driveway* and *Do Not Stop On Tracks* signs have been installed approaching the railroad crossing for both directions on Hwy 47.

Access Management in the Project Area

In general, Hwy 47 has very limited access control. Numerous businesses have open access to their sites from the roadway with no defined driveways. These very wide driveways exist as close as 40 feet from the railroad crossing gates. As a result drivers can drive into and out of the site at any point near the railroad crossing. Left turning vehicles into and out of these driveways lack gaps to adequately make the maneuver which results in additional queuing extending onto the tracks.

Hwy 47 Corridor Safety

Crash data from 2012-2014 was evaluated along Hwy 47 from the westbound Hwy 10 ramps to Bunker Lake Blvd. The data showed problematic intersections and roadway segments further described below. The data was analyzed based on whether the crashes yielded a higher than normal crash rate and/or severity rate. A higher than normal rate exceeds what is called the critical rate. The critical rate is a statistically valid rate used to identify hazardous locations. The critical rate was calculated using a 99.5% confidence interval. Critical rates account for the type of roadway or intersection (number of lanes, traffic control, approach speed, environment), amount of vehicle exposure (measured as million vehicle miles - mvm) traveling through the roadway segment or intersection, and the random nature of crashes.

Intersection Crashes

Table 2 provides the calculated crash rates and comparable average and critical rates. Crashes above the critical crash rate are shaded in red in the table and crashes above the average crash rate are shaded in orange.

Table 2: Hwy 47 Intersection Crash Analysis

Intersection	Legs	AADT[1]	Traffic Control	Crash Rate[2]	Avg Crash Rate[4]	Crit Crash Rate[3]
TH 47 at WB TH 10 Ramps	4	25,400	Signalized	0.76	0.68	0.96
TH 47 at Pleasant St	4	21,625	Signalized	0.89	0.68	0.98
TH 47 at Martin Street	4	19,175	Unsignalized	0.62	0.19	0.37
TH 47 at Garfield St	3	18,363	Unsignalized	0.25	0.19	0.37
TH 47 at State St	3	18,363	Unsignalized	0.35	0.19	0.37
TH 47 at McKinley St	4	19,550	Unsignalized	0.98	0.19	0.37
TH 47 at Mccann Ave	4	18,550	Unsignalized	0.15	0.19	0.37
TH 47 at Dunham Dr	4	18,550	Unsignalized	0.05	0.19	0.37
TH 47 at Wilson St	4	18,550	Unsignalized	0.15	0.19	0.37
TH 47 at Mineral Pond Dr	4	18,550	Unsignalized	0.05	0.19	0.37
TH 47 at Bunker Lake Blvd	4	34,800	Signalized	0.71	0.68	0.91

1. 2014 Traffic volumes, taken from the MnDOT traffic data mapping application
2. From Minnesota Crash Mapping Analysis Tool, 2012-2014 data
3. Using 99.5% confidence levels
4. From MnDOT's 2014 Crash Tool Kit

- **Hwy 47 at Martin Street** – This intersection is located south of the railroad crossing. The crash rate at this unsignalized intersection is 0.62 crashes/mvm, which exceeds the 0.37 critical rate. Ten of the 13 crashes at this intersection are rear end (five) and sideswipe – passing (five). The typical pattern is rear end, low severity, during PM peak period which suggests congestion and queuing (related to the railroad crossing and overall delay on Hwy 47) contributes to the crash frequency.
- **Hwy 47 at McKinley Street** – This intersection is located north of the railroad crossing. The crash rate at this unsignalized intersection is 0.98 crashes/mvm which exceeds the 0.37 critical rate. Fifteen of the 21 crashes are rear end crashes at this intersection.

There was one serious injury right angle crash that occurred at 10:22 PM. The typical pattern is rear end, low severity, during PM peak period which suggests congestion on Hwy 47 contributes to the crash frequency.

Roadway Segment Crashes

Table 3 provides the calculated crash rates and comparable average and critical rates. Crash rates above the critical crash rate are shaded in red in the table. The entire corridor exceeds the critical crash rate. The most common reported crashes are: rear end (63 crashes, 52% of all crashes), right angle (14 crashes, 11%), sideswipe-passing (11 crashes, 9%) and left turn (8 crashes,7%). 42% of crashes occurred between 3:00 PM and 6:00 PM and therefore many of the crashes are occurring during the PM peak period the most congested period along Hwy 47. There were no fatal crashes and one serious injury crash at the McKinley St intersection also reported above. 14 of the crashes occurred along the curve at Garfield/State St and seven of these crashes involved a vehicle that left its lane while five crashes were a rear end.

Table 3: Hwy 47 Segment Crash Analysis

Section	Length (miles)	Design	ADT[1]	Crash Rate[2]	Avg Crash Rate[4]	Crit Crash Rate[3]
TH 47-WB TH 10 Ramps to Martin St	0.2	4-Lane	18,300	7.24	3.87	5.61
TH 47-Martin Street to Bunker Lake Blvd	1.3	2-Lane	18,300	3.48	2.31	2.81

1. 2014 Traffic volumes, taken from the MnDOT traffic data mapping application
2. From Minnesota Crash Mapping Analysis Tool, 2012-2014 data
3. Using 99.5% confidence levels
4. From MnDOT's 2014 Crash Tool Kit

Appendix B: Traffic Operations and Safety Technical Memorandum

Technical Memo

Date:	Tuesday, August 09, 2016
Project:	TH 47/BNSF Grade Separation Feasibility Study SP 0206-71 HDR No. 278053
To:	Paul Jung, MnDOT Brian Kary, MnDOT Jim Weatherhead, MnDOT
From:	Brandi Popenhagen, PE, HDR Richard Storm, PE, HDR Ellie Lee, EIT, HDR
Subject:	Traffic Operations and Safety

The purpose of the technical memorandum is to report the findings from traffic operation analysis and safety assessment at the crossing of Trunk Highway (TH) 47 and the BNSF Railway's two mainline tracks in the City of Anoka, Minnesota.

Summary of Findings and Recommendations

Traffic Operations

A traffic operations analysis was completed for the study area using collected data on traffic volumes and train operations. The collected data was analyzed using VISSIM. Level of Service (LOS), max queue, and average travel speed was determined for two improvement scenarios (**Table 1** and **Table 2**).

The grade separation provides substantial benefit at the south end of the corridor, especially in the PM peak hour where delay and queue lengths decrease. This includes reducing the TH 10 westbound off ramp queue by 3,100 ft. Additionally, the Pleasant Street intersection improves despite reassigning vehicles from Martin Street to Pleasant Street. At the north end of the corridor, there is no change or a marginal decrease in operations. The grade separation moves the corridor bottleneck to the Bunker Lake Blvd intersection. Overall, the grade separation meets a key secondary need of reducing the vehicle delay caused by train crossing.

Recommendations

- In the next phase of the project, collect turning movement volumes at Martin Street to more directly determine the volume reassignment to Pleasant Street.
- In the next phase of the project, perform an Intersection Control Evaluation (ICE) at McKinley Street. Include Bunker Lake Boulevard in the analysis to capture the influence the intersection has on the corridor.

Table 1: TH 47 Grade Separation Study Summary of Finding – AM Peak Hour

Intersection	At-Grade Crossing				Grade Separated Crossing				Traffic Operations Impact of Grade Separated Crossing
	Average Delay	LOS	Max Queue Length (ft)	Max Queue Direction	Average Delay	LOS	Max Queue Length (ft)	Max Queue Direction	
TH 47 at Bunker Lake Blvd	48.8	D	1,054	SB	49.5	D	1,135	SB	No substantial change.
TH 47 at McKinley St	12.7	B	515	NB	5.7	A	224	NB	Moderate decrease in average delay and max queue.
RR Grade Crossing	44.8	N/A	3,214	SB	----	----	----	----	Delay removed.
TH 47 at Pleasant St	34.4	C	479	SB	16.4	B	478	SB	Moderate decrease in average delay.
TH 47 at TH 10 WB Ramps	42.5	D	1,066	WB	25.9	C	563	WB	Moderate decrease in average delay and queue.

Table 2: TH 47 Grade Separation Study Summary of Finding – PM Peak Hour

Intersection	At-Grade Crossing				Grade Separated Crossing				Traffic Operations Impact of Grade Separated Crossing
	Average Delay	LOS	Max Queue Length (ft)	Max Queue Direction	Average Delay	LOS	Max Queue Length (ft)	Max Queue Direction	
TH 47 at Bunker Lake Blvd	102.8	F	1,750	NB & SB	120.3	F	2,023	NB	Moderate **increase** in average delay and max queue.
TH 47 at McKinley St	14.7	B	927	NB	24.0	C	1,331	NB	Moderate **increase** in average delay and max queue.
RR Grade Crossing	23.4	N/A	1,598	SB	----	----	----	----	Delay removed.
TH 47 at Pleasant St	65.1	E	1,910	WB	23.8	C	779	WB	Substantial decrease in average delay.
TH 47 at TH 10 WB Ramps	115.1	F	3,445	WB	22.4	C	393	SB	Substantial decrease in average delay and queue

Safety Assessment

The TH 47 BNSF Railway crossing in Anoka is ranked as the worst location statewide by the Texas Priority Index and one of the top 20 worst crossings in the Metro District based on FRA Crash Prediction index. Additionally, the crossing has eight of ten risk factors present for dynamic crossings, indicating a high potential for a future severe crash. Beyond the grade crossing, the corridor has a crash rate above the critical crash rate and two intersections (McKinley Street and Martin Street) have a crash rate above the critical crash rate. The crash severity tends to be low and the data reveals that a majority of the crashes occur during the PM peak hour. These are typical traits of congestion related crashes.

Overall, the grade separation meets the primary need of eliminating the potential for vehicle-train crashes by grade separating the crossing.

Recommendation

- The current TH 47 access to Alter Trading has a bypass lane, which provides operational and safety benefit when trucks are turning left. A proposed access change is to relocate Alter Trading access to State Street. Therefore, it is recommended that a northbound left-turn lane be added at the TH 47 intersection with State Street/Garfield Street.
- In the next phase of the project, further investigate (i.e., review officer narrative) the crashes at the State Street/Garfield Street intersection and the curve to determine if the crashes are due to corridor operations or related to turning vehicles.

Study Area and Background

The project is located at the railroad grade crossing of TH 47 (Ferry Street) and BNSF Railway's two mainline tracks (**Figure 1**). The study area extends from the TH 10 westbound ramps north to the TH 47 intersection with McKinley Street. However, the north terminus of the study area for the traffic analysis was moved to the Bunker Lake Boulevard intersection (**Figure 1**). In the afternoon peak hour, northbound queues at Bunker Lake Boulevard have been observed to extend south past the at-grade crossing. Therefore, for the traffic study it was important to extend the study area to include the Bunker Lake Boulevard intersection.

Intersections included in the traffic study included:

- TH 47 and TH 10 westbound ramps (signalized)
- TH 47 and Pleasant Street (signalized)
- TH 47 and McKinley Street (unsignalized)
- TH 47 and Bunker Lake Boulevard (signalized)

Train Operations

The BNSF railway carries a mix of freight rail and passenger rail. According to the January 2015 freight railroad map (Source: MnDOT), the corridor carries an average of 54 trains per day and has a maximum authorized speed of 79 miles per hour (mph). This includes two Amtrak trains, and up to 14 Northstar trains daily, with the remaining as freight trains.

The railroad crossing is approximately 0.3 miles north of TH 10 and 200 ft west of the Rum River. The Anoka Station for the Northstar Commuter Rail, operated by Metro Transit, is located 1,500 ft to the east of the railroad crossing on 4th Street. Due to the Anoka Station location, gate operations for westbound trains are complicated. In the past, while a westbound Northstar train was at the station, the gates may time out and go up briefly and then go back down before the Northstar train would cross TH 47. Because of this, there were several reports of vehicles being caught between the tracks after the Northstar train left the station. Currently the gates remain down while a commuter train is in the station. Therefore, the gates may be down up to two minutes before a westbound train actually crosses TH 47. During this delay motorists can get frustrated and attempt go around the gates. However, an eastbound train could be crossing during this time causing the vehicle to get caught between the two mainline tracks or worse. Recently, a median was added on the approach to reduce the likelihood of drivers going around the gates.

Figure 1: TH 47 Study Area for Traffic and Safety Analysis

Data Collection and Analysis

Vehicle and Train Volume Data

The project team performed a 13-hour observation at the four study intersections. The data collected include turning movement volumes for passenger vehicles and heavy vehicles from 6:00 AM to 7:00 PM. The data was collected on April 5th, 2016. The volumes were balanced and rounded to reflect a typical condition and are shown in **Figure** 2**.**

At the crossing of TH 47 and the BNSF Railway's two mainline tracks, the train crossing data was collected for a 24-hour period. This included the type of train, when the train crossed, and how long the gates were down. The number of trains counted on April 5th, 2016 was:

- Freight = 32
- Northstar = 15
- Amtrak = 1
- Total = 45

The counted train volume is below the volume reported by MnDOT. However, the count was conducted at the start of the second quarter of 2016. Historically, train volumes through Minnesota have a seasonal variation, with higher volumes in the third and fourth quarter of each year. In discussions with the project management team, it was decided to increase the train volumes used in the analysis to reflect the peak season. During each peak hour, two additional trains were included in each peak hour. The additional trains were assumed to be freight trains representative of the freight train that crossed during the AM peak hour.

Crash Data

Crash data was collected for 2012 through 2014. Crash data was collected using Minnesota Crash Mapping Analysis Tool (MnCMAT). However, crash data was selected to match the scan limits used to identify crashes for intersection analysis. Crash data was collected for 11 eleven intersections between and including the TH 10 WB ramps and Bunker Lake Boulevard, all of which are included in the MnDOT Interchange/Intersection (I/I) file for the TH 47 corridor.

Signal Timings

MnDOT provided AM and PM peak hour Synchro files (ver. 8) for the signals timings. To determine the green time, MnDOT used hourly volumes in the Synchro files that were inflated to equal the peak 15 minutes for each movement multiplied by four. MnDOT uses this practice to set the amount of green time for the splits based on the highest hourly volume seen on any given cycle.

The coordination for the TH 10 WB Ramp Terminal and Pleasant Street signals was installed in June 2007 with counts taken in April 2006. The coordination for TH 47 at Bunker Lake Blvd signal (with the three signals north of Bunker Lake Blvd) was also installed in June 2007 with counts taken in October 2006.

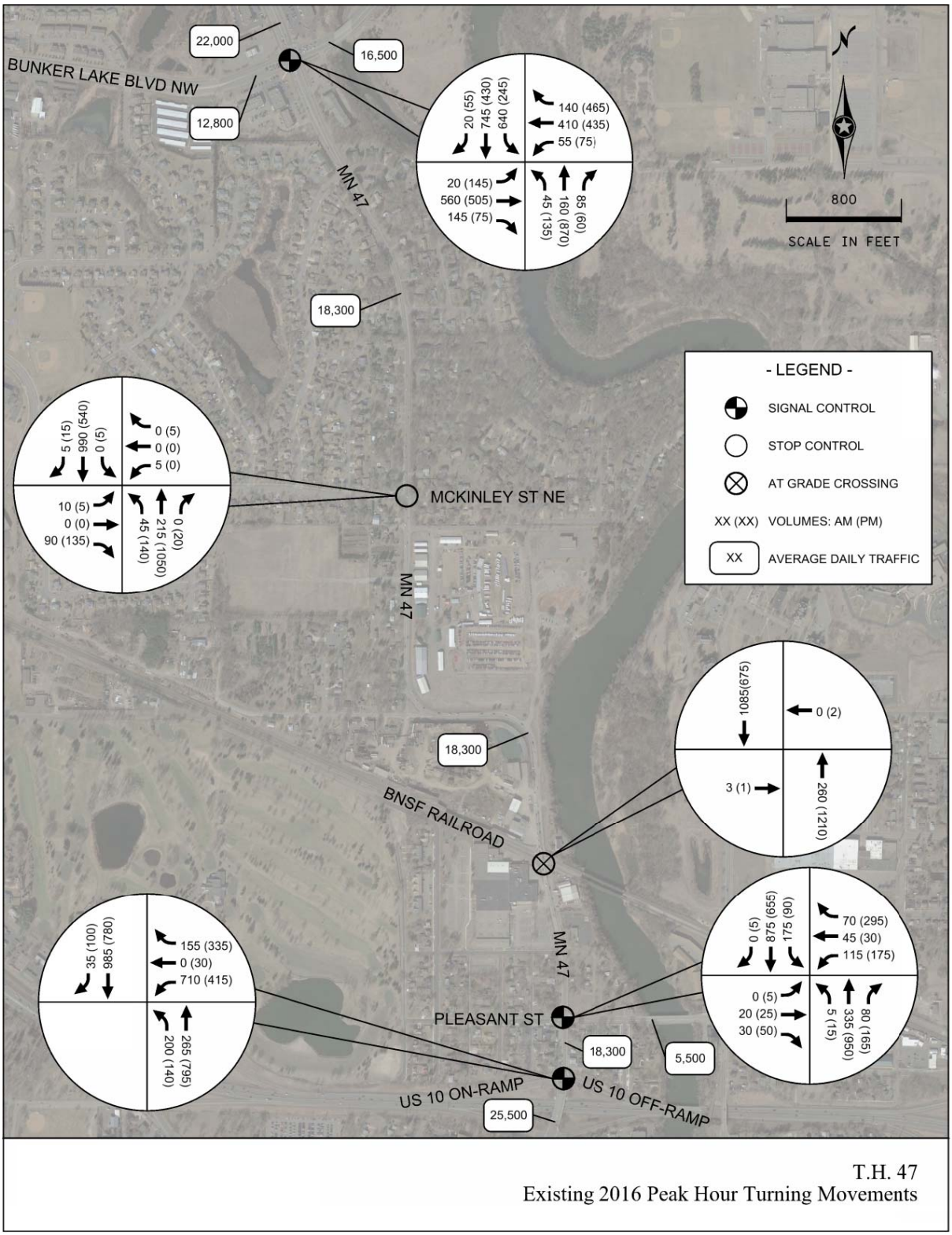


Figure 2: Existing 2016 Peak Hour Volumes

Scenarios

Two design alternatives are being considered; this includes an option to construct a bridge over the railroad (Over Alternative) and the option to lower the road below the railroad grade (Under Alternative). Both alternatives were evaluated using a single VISSIM model to test the benefit of grade separation.

The intent was to evaluate benefits in a forecast year (2040). However, substantial expected growth in the Bunker Lake Boulevard combined with no planned additional capacity for TH 47 at the intersection would have resulted in delays on TH 47 that would mask the benefit of grade separation. Therefore, it was agreed with the project management team to evaluate the alternatives (with and without trains) using existing volumes. Therefore the two scenarios were:

- 2016 Existing Condition with At-Grade Crossing
- 2016 Volumes with Grade Separated Crossing

From a modeling perspective, a major difference between the two grade separation scenarios is access at Martin Street. The Over Alternative likely closes Martin Street while the Under Alternative allows the access to remain open. From the collected turning movement counts, the volumes between Pleasant Street and McKinley Street are unbalanced. It was assumed that the imbalance is primarily the result of vehicles entering or exiting from the school district building. Therefore, turning volumes at Martin Street were added to address the volume imbalance[1]. Due to the possibility of a closure in the Over Alternative at Martin Street, the conservative modeling approach for the grade separated scenario was to move the estimated Martin Street turning volumes to the Pleasant Street intersection to determine if the intersection has capacity for additional turning vehicles.

[1] The turning movements at the Martin Street only correct for the imbalance between adjacent intersections. The movement volumes are an approximation of the Martin Street intersection and do not reflect the all turning movements at the intersection.

Traffic Operations

Method

To analyze the operations at-grade crossing of TH 47 (Ferry Street) and BNSF Railway's two mainline tracks, the system was modeled using VISSIM (Ver. 7) software. VISSIM is a micro simulation tool that can output various performance measures such as queue lengths, delay, and level of service.

The first step was to develop a base model which reflects existing conditions during AM and PM peak hours. This included incorporating the train volumes at the TH 47 grade crossing. Once a reasonable existing conditions model was developed, a copy was made with the trains removed to reflect the grade separated conditions. Reported results are the average of ten VISSIM simulations.

The AM and PM peak hour traffic volumes were analyzed along the network using traffic control (signals and stop signs), signal timing, and roadway geometry. The analysis measures the roadway's ability to move traffic along the corridor and accounts for delay experienced at intersections. This delay is then given a letter grade A-F, known as Level of Service (LOS). **Figure 3** is a graphical interpretation of the delay times that define level of service. The delay thresholds are lower for unsignalized intersections than signalized intersections due to the public's level of acceptance of delay for the two different types of traffic control. The max queue was also used to measure intersection performance. The max queue is defined to be the longest queue length (in feet) that was observed during the analysis time period. All uses of "queue" in this tech memo are references to the max queue.

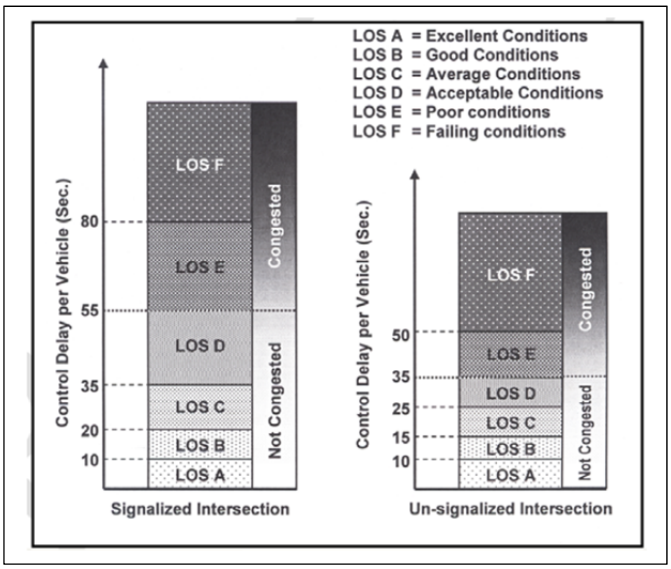


Figure 3: Intersection Level of Service Ranges

Analysis Results

The collected data was analyzed using VISSIM to determine LOS (average vehicle delay), max queue, and average travel speed.

AM Peak Hour LOS and Queue Length

In the AM peak hour, all studied intersections operate at LOS D or better as an overall performance measure (**Table 3**). However, all intersections have either an approach or a specific movement that operates at LOS E or F in the at-grade crossing scenario.

The measured delay at the railroad crossing is approximately 45 seconds per vehicle (s/veh). VISSIM only measures delay to the adjacent intersection, so this does not capture all delay related to the crossing.

Once the corridor was modeled with the grade separation, the average delay and queue lengths decreased for all intersections except Bunker Lake Boulevard (**Table 5**). The morning traffic pattern is predominately southbound vehicles and the railroad grade crossing does not impact the Bunker Lake Boulevard intersection in the morning. Therefore, moderate delay and queue length increases at Bunker Lake Boulevard are likely due to model variation.

Specifically looking at the Pleasant Street intersection, shifting the vehicles from Martin Street to Pleasant Street had no adverse impacts on the operations. The average delay for the northbound left turn dropped from 89 s/veh to 50 s/veh. In other words the LOS improved from F to D. To accommodate the increased turning traffic, five seconds of additional green time was assigned to the northbound movement. The VISSIM simulation was visually inspected to verify if it was reasonable for the delay to decrease despite the increase in northbound left turns. The visual inspection revealed two primary reasons for the shorter delay despite the higher turning volume:

1) North of Pleasant Street, northbound queues form in the at-grade scenario because of vehicles waiting to turn left at Martin Street or due to the gates down at the railroad crossing. Currently, there is no left turn lane for northbound TH 47 at Pleasant Street, so when northbound queues block the intersection, vehicles turning left are prevented from completing their turn by the vehicles stopped in front of them. Grade separating the railroad crossing and closing Martin Street eliminates the northbound queues at Pleasant Street that block turning vehicles.
2) Northbound left turn is permissive, meaning drivers have to select a gap in the approaching traffic. In the AM peak hour, the predominate southbound movement limits the number of acceptable gaps for a northbound left turn at Pleasant Street. Furthermore, after a train crosses TH 47, a steady stream of southbound vehicles is released, further limiting opportunities for a permitted northbound left turn. Grade separating the railroad crossing eliminated the steady platoon of southbound vehicles that forms after the gates go up.

While it is possible that a train crossing creates a gap for northbound left turners at Pleasant Street and Martin Street, it is the interaction of the two previous explanations that result in long delay for northbound left turn in the at-grade scenario. Specifically a left turning vehicle may not be in the right location (that is, sitting behind a stopped through vehicle) to actually make the turn. But once the through vehicle is no longer blocking the intersection, the platoon traveling in the opposite direction limits the number of suitable gaps.

The following provides a summary of results and comparison of the at-grade and grade separated scenarios by intersection.

- Bunker Lake Boulevard: In the at-grade scenario, the northbound, westbound and eastbound left turns operate at LOS F due to high delays (with a range of 89 to

105 s/veh) and the through movement for the same directions operation at LOS E or F (with a range of 60 to 94 s/veh). The northbound and eastbound approaches are at LOS E while the southbound and westbound operate at LOS D. Maximum left turn queues for westbound and southbound exceed the storage capacity by 105 and 70 ft respectively[2]. The high southbound volumes are given substantial green time; still, a single through lane with a single left-turn lane are insufficient to serve the volume, resulting in long southbound delays and queues. Additionally, the substantial southbound green time leaves insufficient green time to serve the demand on the other approaches. In the grade separated scenario, the intersection performs similar with no substantial change to the LOS and queue results.

- McKinley Street: In the at-grade scenario, the northbound and eastbound left turns operate at LOS E with approximately 38 seconds of delay per vehicle. These movements have to cross the southbound traffic stream, which is the primary travel direction in the AM peak hour. Overall, the eastbound approach operates at LOS E with over 40 seconds of delay. In the grade separated scenario, all movements and approaches improve to LOS C or better.
- Pleasant Street: In the at-grade scenario, the northbound left and through are at LOS F (delays of 85 to 89 s/veh) while the overall approach is at LOS E (78 s/veh). Additionally, the westbound right turn was at LOS F (96 s/veh) and the overall approach was LOS E (60 s/veh). Each approach had at least one movement where the maximum queue lengths exceeded the storage capacity by 88 to 280 ft. This included the northbound through, southbound left, westbound right, and eastbound right. As noted previously, queues from the at-grade crossing or Martin Street can block vehicles traveling north and was the primary reason identified for the unacceptable operations. In the grade separated scenario, the LOS improves to D or better for all movements and approaches. Furthermore, the maximum queue lengths are reduced, and no longer exceed the available storage capacity.
- TH 10 Westbound Ramps: The intersection's northbound and westbound movements, including the overall approach, operate at LOS E or F in the at-grade scenario with vehicle delays between 56 and 86 s/veh. The maximum queue lengths exceed the storage capacity for the northbound and southbound through movement by 701 and 58 ft. Also, for westbound left, right, and through movements, the maximum queue lengths exceed the storage capacity by 530, 900, and 530 ft respectively. The queues from Pleasant Street spilling back to this intersection cause the intersection congestion. In the grade separated scenario, the LOS improves to D or better for all movements and approaches. The queue lengths exceeding the available storage include the southbound through and the right turn for the TH 10 off-ramp. The max queue lengths are significantly decreased to 563 ft from 1066 ft, and the intersection is no longer congested.

[2] The values of maximum queue lengths exceed the storage capacity were computed by taking the difference between Max Queue and Storage from the Tables on page 16-19.

PM Peak Hour LOS and Queue Length

In the PM peak hour, McKinley Street is the only intersection that operates better than LOS E (**Table 4**). At the intersection, the eastbound approach has the largest delay (29 s/veh, LOS D). Pleasant Street operates at LOS E while both the TH 10 westbound ramp terminal and Bunker Lake Boulevard intersections operate at LOS F, which are considered unacceptable performance levels. The measured delay at the railroad crossing is approximately 23 seconds per vehicle (s/veh), which is less than the AM peak hour. However, most of PM travel direction is northbound and the close proximity of the Pleasant Street intersection restricts how well VISSIM can measure delay at the crossing.

With grade separation at the train crossing, substantial improvements in average vehicle delay and queue lengths are seen at TH 10 westbound ramp and Pleasant Street intersections (**Table 6**) One notable improvement is that the max queue length on the TH 10 WB off ramp decreased from in excess of 3,400 ft to less than 350 ft and no longer extends onto the TH 10 mainline. At the northern end of the corridor, the grade separation resulted in a slight increase of queue lengths and average vehicle delay. The analysis reveals that the grade separation allows the vehicles to reach the northern end of the corridor with little impediment, which results in worse performance at Bunker Lake Boulevard – the downstream bottleneck – and McKinley Street. McKinley Street is a residential collector that provides access to and from TH 47 and the adjacent neighborhoods. Because of the impact to the north end of the corridor, a full ICE study is recommended for McKinley Street. The ICE needs to include the Bunker Lake Boulevard intersection because of the influence it has on the TH 47 corridor operations.

Specifically looking at the Pleasant Street intersection, shifting the vehicles from the Martin Street to Pleasant Street had no adverse impacts on the operations. The average delay for the northbound left turn dropped from 43 s/veh to 22 s/veh. In other words the LOS improved from D to C. To accommodate the increased turning traffic, five seconds of additional green time was assigned to the movement.

The VISSIM simulation of the PM peak hour was also visually inspected to verify if it was reasonable for the delay to decrease despite the traffic reassignment. The visual inspection revealed the same contributing reasons noted in the AM peak hour, which is that grade separating the crossing and closing Martin Street will eliminate (1) northbound queues which block vehicles turning left at Pleasant Street and (2) southbound platoons after the gates go up that limit opportunities for turning left. As noted in the AM peak hour summary, these two factors can impede the northbound left turning vehicle.

In the PM peak hour, another factor that benefits the northbound left is the reassignment of 65 vehicles exiting Martin Street and continuing south through the Pleasant Street intersection. The vehicles were reassigned as an eastbound right at Pleasant Street. Therefore, the access change increases the number of gaps for northbound vehicles to turn left. Illustrations of the traffic before and after grade separating the TH 47 crossing and closing Martin Street are depicted in **Figure 4** and **Figure 5** (both figures represent the exact same time of day)**. Figure 4** shows the condition of TH 47 immediately after a train crosses the road during the PM peak

hour, which includes queues blocking the Pleasant Street intersection. As a comparison, **Figure 5** represents the PM peak hour with the grade crossing separated and Martin Street closed.

The following provides a summary of results and comparison of the at-grade and grade separated scenarios by intersection.

- Bunker Lake Boulevard: In the at-grade scenario, all left-turn movements, the westbound right turn movement, and all through movements except northbound operate at LOS E or F due to high delays (with a range of 58 to 228 s/veh). Additionally, all approaches are at LOS E or F and the overall intersection is LOS F (103 s/veh). The maximum queue lengths substantially (350 – 1200 ft) exceed the storage capacity for all left turns and the westbound right turn exceeds the available storage by 975 ft. The worst maximum queue occurs for the southbound left turn which exceeds storage by approximately 1200 ft. The westbound right turn average queue also exceeds the storage by 290 ft. The intersection congestion is a combination of high volumes, especially northbound with insufficient capacity at the intersection. In the grade separated scenario, the intersection performs similar, but the northbound through and right turn degrade from LOS D to LOS E. The overall intersection delay increases to 120 seconds resulting in longer maximum queue lengths than the at-grade scenario. By grade separating TH 47, vehicles are no longer blocked by crossing trains and a steady stream of vehicles reach the intersection, resulting in longer queues and delays.
- McKinley Street: In both scenarios all movements and approaches operate at LOS D or better. However, the northbound left and through decreased from LOS C [at-grade] to LOS D [grade separated]. Related, the queue lengths for northbound increased by approximately 400 ft, despite the substantial increase, the queue lengths do not exceed available storage. The decrease in the operations at McKinley Street is primarily due to the longer queues at Bunker Lake Boulevard having a greater impact on operations at the intersection.
- Pleasant Street: In the at-grade scenario, all westbound movements and the approach operate at LOS F (delay ranges from 190 to 220 s/veh) and the eastbound left turn is LOS E (62 s/veh). Overall, the intersection is LOS E (65 s/veh). Each approach had at least one movement where the maximum queue lengths (59 – 1795 ft) exceeded the storage capacity. The worst maximum occurs for the westbound right turn which exceeds the storage by 1795 ft. The westbound approach having the longest queues extending into the next intersection with 4th Avenue. Similar to the AM peak hour, train crossing combined with high northbound demand results in queues that block the intersection and lead to poor operations. In the grade separated scenario, the westbound left turn and through improve to LOS E (delays of 75 to 78 s/veh) and the westbound right turn and eastbound left turn improve to LOS D (delays of 38 to 45 s/veh). Furthermore, the maximum queue lengths decreased and no longer extend back to 4th Avenue, with only the westbound and eastbound right turn exceeding the available storage capacity by approximately 525 ft.
  TH 10 Westbound Ramps: The intersection's northbound and westbound movements, operate at LOS F (delays of 98 to 383 s/veh) in the at-grade scenario. Overall, the intersection has a LOS F (115 s/veh). The average and maximum queue lengths (3280 -

2918 ft) exceed the storage on the TH 10 off-ramp and for the northbound through movement. The high demand for northbound TH 47 and TH 10 off-ramp, when combined with the queues from the grade crossing, result in the congested conditions. In the grade separated scenario, the LOS improves to D or better for all movements and approaches except the westbound through which only improved to LOS E (56 s/veh). The maximum and average queue lengths decreased, with the only the right turn on the TH 10 off-ramp exceeding the available storage. Yet, the maximum queue length still decreased from 3,445 feet to 345 feet, nearly a 90 percent decrease. The congested conditions are improved as well.

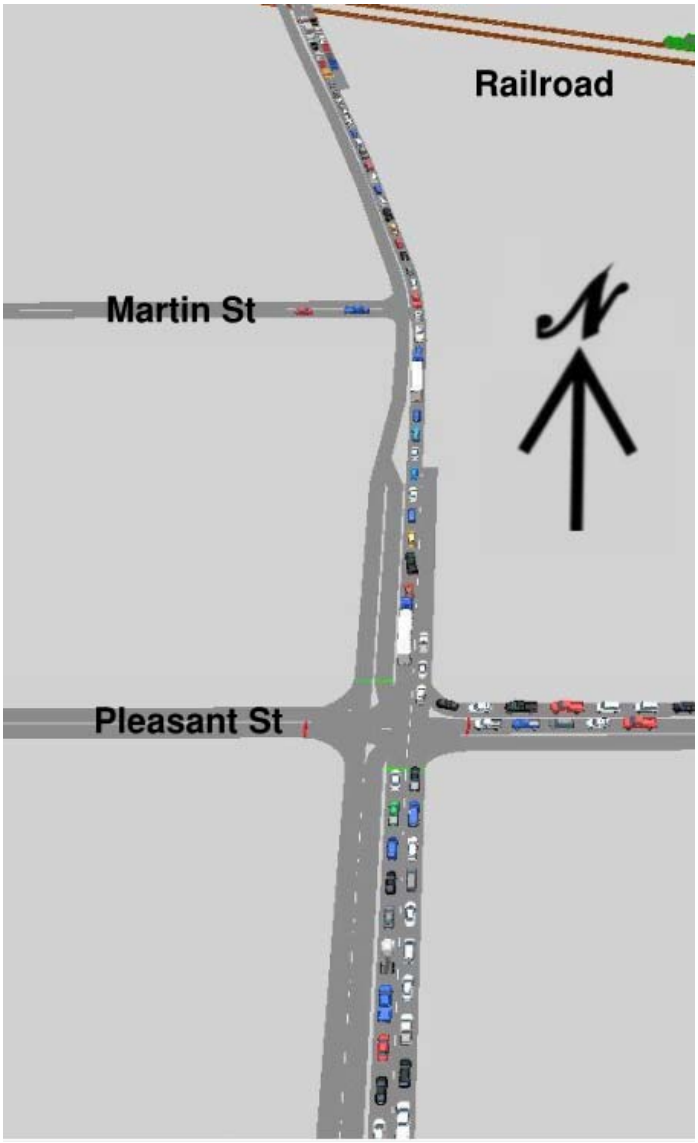


Figure 4: PM Peak Hour with At-Grade Crossing

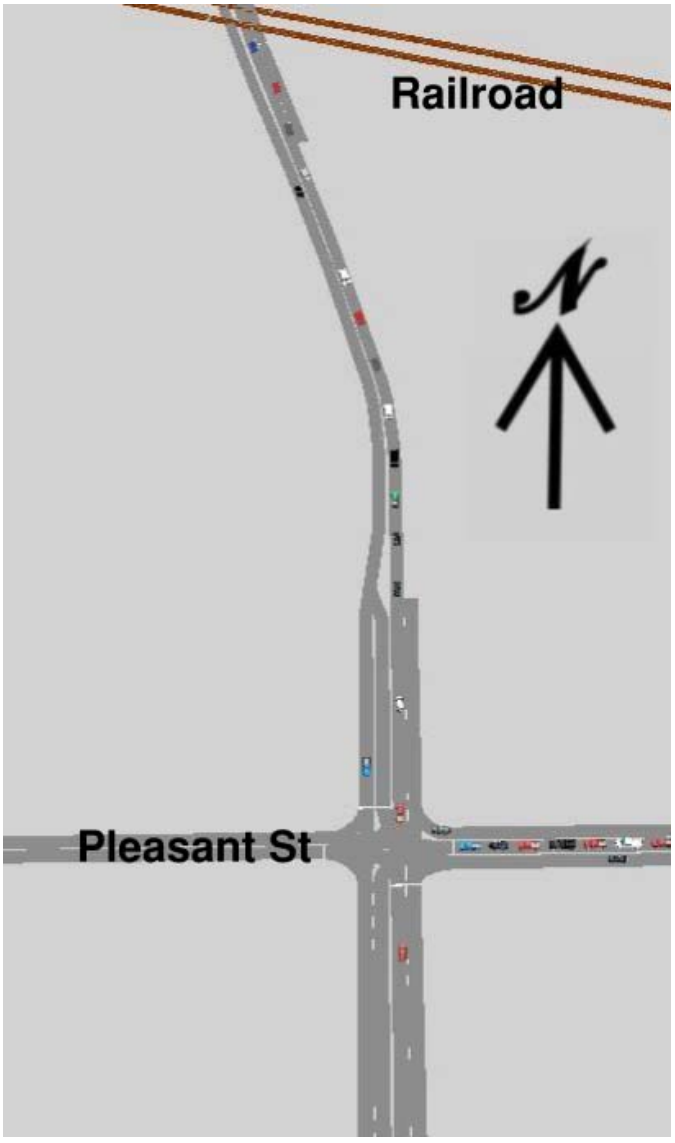


Figure 5: PM Peak Hour with Grade Separated Crossing

Table 3: At-Grade Train Crossing Operations Summary – AM Peak Hour

Intersection		Appr	Total Delay by Movement (Sec/Veh)			Level of Service by Movement			Delay & LOS by Approach (Sec/Veh)		Delay & LOS by Intersection (Sec/Veh)		Average & Maximum Traffic Queuing (feet)								
													Left Turn			Through			Right Turn		
Control	Location		L	T	R	L	T	R	Delay	LOS	Delay	LOS	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Signalized	TH 47 at Bunker Lake Boulevard	NB	96.7	94.1	18.2	F	F	B	73.2	E	48.8	D	23	134	220	90	495	-	4	113	500
		WB	105.4	60.1	8.2	F	E	A	52.0	D			37	256	150	94	416	-	3	87	210
		SB	37.2	36.7	22.1	D	D	C	36.7	D			84	610	540	131	1054	-	0	41	305
		EB	88.6	69.8	21.4	F	E	C	60.9	E			10	78	265	147	566	-	16	164	265
Unsignalized	TH 47 at McKinley Street	NB	38.1	24.9	0.0	E	C	A	27.3	D	12.7	B	30	515	-	15	374	-	4	286	285
		WB	17.5	0.0	0.0	C	A	A	17.5	C			0	30	-	0	32	525	0	32	-
		SB	0.0	6.9	4.0	A	A	A	6.9	A			6	385	-	4	314	-	4	314	-
		EB	39.1	0.0	40.5	E	A	E	40.3	E			22	199	-	22	199	1800	26	208	-
Signalized	TH 47 at Pleasant Street	NB	89.1	84.7	50.1	F	F	D	78.1	E	34.4	C	143	413	-	143	413	325	151	428	-
		WB	44.3	44.3	95.5	D	D	F	59.0	E			42	238	1725	42	238	1725	49	360	115
		SB	26.6	12.2	0.0	C	B	A	14.5	B			35	380	100	36	454	-	43	479	-
		EB	0.0	54.5	19.8	A	D	B	32.8	C			12	153	-	12	153	-	19	181	115
Signalized	TH 47 at TH 10 Westbound Ramps	NB	86.4	67.0	-	F	E	-	75.5	E	42.5	D	204	1004	-	204	1004	300	-	-	-
		WB	56.4	0.0	80.8	E	A	F	60.4	E			173	1066	535	173	1066	535	173	1066	165
		SB	-	14.6	13.8	-	B	B	14.6	B			-	-	-	55	383	325	39	420	-
Signalized	TH 47 at Railroad At-Grade Crossing	NB	-	-	-	-	-	-	17.9	-	44.8	-	-	-	-	211	531	-	-	-	-
		SB	-	-	-	-	-	-	50.2	-			-	-	-	1060	3214	-	-	-	-

Note: "L" = Left Turn; "T" = Through; "R" = Right Turn; "LOS" = Level of Service; "-" = Not Applicable

Table 4: At-Grade Train Crossing Operations Summary – PM Peak Hour

Intersection		Appr	Total Delay by Movement (Sec/Veh)			Level of Service by Movement			Delay & LOS by Approach (Sec/Veh)		Delay & LOS by Intersection (Sec/Veh)		Average & Maximum Traffic Queuing (feet)								
													Left Turn			Through			Right Turn		
Control	Location		L	T	R	L	T	R	Delay	LOS	Delay	LOS	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Signalized	TH 47 at Bunker Lake Boulevard	NB	129.7	54.3	38.4	F	D	D	62.6	E	102.8	F	90	712	220	313	1747	-	1	69	500
		WB	159.7	129.8	138.5	F	F	F	136.3	F			123	873	150	395	1101	-	503	1185	210
		SB	228.0	58.0	40.5	F	E	D	111.2	F			541	1750	540	60	536	-	1	79	305
		EB	216.7	85.0	14.7	F	F	B	102.3	F			219	632	265	168	601	-	4	84	265
Unsignalized	TH 47 at McKinley Street	NB	22.5	21.1	17.1	C	C	C	21.2	C	14.7	B	41	927	-	23	786	-	7	530	285
		WB	0.0	0.0	17.7	A	A	C	17.7	C			0	30	-	0	32	525	0	32	-
		SB	6.2	2.5	2.7	A	A	A	2.5	A			1	106	-	0	63	-	0	63	-
		EB	29.2	0.0	13.4	D	A	B	14.0	B			9	123	-	9	122	1800	12	132	-
Signalized	TH 47 at Pleasant Street	NB	42.7	40.8	28.1	D	D	C	38.9	D	65.1	E	277	455	-	277	455	325	289	470	-
		WB	199.8	189.6	219.8	F	F	F	210.7	F			585	1809	1725	585	1809	1725	698	1910	115
		SB	39.7	10.5	8.2	D	B	A	13.9	B			17	196	100	31	455	-	37	480	-
		EB	62.1	47.8	21.9	E	D	C	33.0	C			13	147	-	13	147	-	22	174	115
Signalized	TH 47 at TH 10 Westbound Ramps	NB	113.2	98.2	-	F	F	-	100.6	F	115.1	F	366	1357	-	366	1357	300	-	-	-
		WB	233.3	382.8	374.0	F	F	F	297.5	F			1497	3445	535	1497	3445	535	1497	3445	165
		SB	-	13.4	13.3	-	B	B	13.3	B			-	-	-	42	347	325	35	376	-
Signalized	TH 47 at Railroad At-Grade Crossing	NB	-	-	-	-	-	-	18.6	-	23.4	-	-	-	-	1085	691	-	-	-	-
		SB	-	-	-	-	-	-	31.1	-			-	-	-	678	1598	-	-	-	-

Note: "L" = Left Turn; "T" = Through; "R" = Right Turn; "LOS" = Level of Service; "-" = Not Applicable

Table 5: Grade Separated Train Crossing Operations Summary – AM Peak Hour

Intersection		Appr	Total Delay by Movement (Sec/Veh)			Level of Service by Movement			Delay & LOS by Approach (Sec/Veh)		Delay & LOS by Intersection (Sec/Veh)		Average & Maximum Traffic Queuing (feet)								
													Left Turn			Through			Right Turn		
Control	Location		L	T	R	L	T	R	Delay	LOS	Delay	LOS	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Signalized	TH 47 at Bunker Lake Boulevard	NB	89.0	88.0	12.4	F	F	B	67.0	E	49.5	D	24	123	220	92	415	-	4	98	500
		WB	104.4	62.8	8.6	F	E	A	53.8	D			36	252	150	98	449	-	3	88	210
		SB	37.6	38.0	22.2	D	D	C	37.6	D			84	646	540	137	1135	-	0	40	305
		EB	92.4	70.9	21.7	F	E	C	61.9	E			10	84	265	150	552	-	17	177	265
Unsignalized	TH 47 at McKinley Street	NB	17.1	6.9	0.0	C	A	A	8.6	A	5.7	A	8	224	-	0	83	-	0	48	285
		WB	12.5	0.0	0.0	B	A	A	12.5	B			0	30	-	0	32	525	0	32	-
		SB	0.0	3.5	2.8	A	A	A	3.5	A			0	22	-	0	39	-	0	39	-
		EB	19.4	0.0	19.9	C	A	C	19.8	C			8	111	-	8	111	1800	12	120	-
Signalized	TH 47 at Pleasant Street	NB	50.4	6.2	3.5	D	A	A	18.4	B	16.4	B	36	211	-	36	211	325	43	226	-
		WB	45.4	44.5	6.9	D	D	A	37.6	D			52	270	1725	52	270	1725	1	78	115
		SB	7.9	11.3	9.1	A	B	A	10.7	B			4	103	100	35	453	-	42	478	-
		EB	0.0	39.5	18.1	A	D	B	26.4	C			6	121	-	6	121	-	12	149	115
Signalized	TH 47 at TH 10 Westbound Ramps	NB	33.7	14.1	-	C	B	-	22.8	C	25.9	C	52	344	-	52	344	300	-	-	-
		WB	44.4	0.0	25.9	D	A	C	41.2	D			105	563	535	105	563	535	105	563	165
		SB	-	14.1	13.9	A	B	B	14.1	B			-	-	-	54	391	325	38	407	-

Note: “L” = Left Turn; “T” = Through; “R” = Right Turn; “LOS” = Level of Service; “-“ = Not Applicable

Table 6: Grade Separated Train Crossing Operations Summary – PM Peak Hour

Intersection		Appr	Total Delay by Movement (Sec/Veh)			Level of Service by Movement			Delay & LOS by Approach (Sec/Veh)		Delay & LOS by Intersection (Sec/Veh)		Average & Maximum Traffic Queuing (feet)								
													Left Turn			Through			Right Turn		
Control	Location		L	T	R	L	T	R	Delay	LOS	Delay	LOS	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Signalized	TH 47 at Bunker Lake Boulevard	NB	154.9	78.1	61.7	F	E	E	86.6	F	120.3	F	132	1433	220	543	2023	-	1	62	500
		WB	184.2	160.6	189.9	F	F	F	176.2	F			228	1167	150	561	1351	-	705	1434	210
		SB	233.7	62.1	43.5	F	E	D	115.4	F			557	1768	540	62	579	-	1	71	305
		EB	218.5	84.1	14.8	F	F	B	101.9	F			222	579	265	169	595	-	4	83	265
Unsignalized	TH 47 at McKinley Street	NB	34.8	34.9	24.0	D	D	C	34.7	D	24.0	C	66	1331	-	42	1190	-	16	740	285
		WB	0.0	0.0	24.3	A	A	C	24.3	C			0	30	-	0	32	525	1	32	-
		SB	17.0	3.3	4.8	C	A	A	3.5	A			4	193	-	2	100	-	2	100	-
		EB	34.0	0.0	14.2	D	A	B	15.0	C			10	123	-	10	123	1800	13	132	-
Signalized	TH 47 at Pleasant Street	NB	21.5	15.9	10.7	C	B	B	15.4	B	23.8	C	70	395	-	70	395	325	77	410	-
		WB	78.2	74.5	45.0	E	E	D	59.2	E			140	779	1725	140	779	1725	70	642	115
		SB	22.7	10.1	7.4	C	B	A	11.5	B			7	104	100	24	415	-	30	440	-
		EB	38.2	39.5	19.9	D	D	B	25.1	C			18	199	-	18	199	-	30	227	115
Signalized	TH 47 at TH 10 Westbound Ramps	NB	22.1	14.1	-	C	B	-	15.3	B	22.4	C	38	305	-	38	305	300	-	-	-
		WB	48.3	56.0	32.3	D	E	C	41.8	D			85	345	535	85	345	535	85	345	165
		SB	-	12.9	13.3	-	B	B	12.9	B			-	-	-	41	359	325	33	393	-

Note: “L” = Left Turn; “T” = Through; “R” = Right Turn; “LOS” = Level of Service; “-“ = Not Applicable

Travel Speeds

A grade separated crossing was generally found to improve operations in the corridor, with the Bunker Lake Boulevard and McKinley Street in the PM peak hour as the notable exceptions. Likewise, average travel speeds through the corridor (from just south of the TH 10 WB ramp terminal to just north of Bunker Lake Boulevard) are expected to improve (**Table 7**). In the AM peak hour, the travel speeds are expected to increase by just under 9 mph in the northbound direction and just over 5 mph in the southbound direction. The PM peak hour speed increases are more modest, which reflect the higher volumes and levels of congestion during the PM peak. The southbound increase is just over 3 mph while the northbound average speed increases by less than 1 mph. The minor increase in the northbound PM peak average travel speed illustrates how the improved operations at the south end of the corridor are nearly cancelled by the increase in delay and queue length in the north end of the corridor.

Table 7: Average Travel Speeds

Peak Hour	Travel Direction	Begin	End	Average Speed (mph)	Change in Average Speed
At-Grade Train Crossing					
AM	NB	South of TH 10 WB ramps	North of Bunker Lake Boulevard	12.5	
	SB	North of Bunker Lake Boulevard	South of TH 10 WB ramps	21.1	
PM	NB	South of TH 10 WB ramps	North of Bunker Lake Boulevard	16.6	
	SB	North of Bunker Lake Boulevard	South of TH 10 WB ramps	24.4	
Grade Separated Train Crossing					
AM	NB	South of TH 10 WB ramps	North of Bunker Lake Boulevard	21.2	↑ 8.7 mph
	SB	North of Bunker Lake Boulevard	South of TH 10 WB ramps	26.4	↑ 5.3 mph
PM	NB	South of TH 10 WB ramps	North of Bunker Lake Boulevard	17.3	↑ 0.7 mph
	SB	North of Bunker Lake Boulevard	South of TH 10 WB ramps	27.8	↑ 3.4 mph

Safety Assessment

At-Grade Crossing Safety Performance

The crash history at the TH 47 BSNF Railway crossing was evaluated. Between trains and vehicles, there were four Personal Damage Only (PDO) crashes reported occurring in 1972, 1973, 1976, and 1986. In 2003 there was a crash that had four total fatalities, where a teen driver appeared to driven around the gates. Since, BNSF reports indicate approximately two near miss incidents annually between trains and vehicles at this crossing.

Between the years of 2010 and 2014, there were 19 reported crashes involving only vehicles within a 150 foot radius of the crossing (Source: MnCMAT). Five crashes had possible injuries and 14 were PDO. Of those 19 crashes, 17 were rear end crashes with 11 in the southbound direction and six in the northbound direction. Two crashes were classified as something other than rear end. Five of the 19 crashes were noted to be at the railroad crossing, 13 were reported as not at an intersection, and one was noted to be at “Other”. The 2015 MnCMAT data is incomplete; however one crash was identified as a PDO, rear end crash in the southbound direction at the railroad crossing.

Current Safety Evaluations/Rankings of At-Grade Crossing

Currently, MnDOT evaluates three safety evaluation rankings for at-grade crossings. The methods used include the Texas Priority Index, the FRA Crash Prediction Model, and a Minnesota-based Risk Factor Analysis.

The ***Texas Priority Index*** score at this location is 10,330 ***making this railroad crossing the worst rated crossing in the state***. This score uses roadway average daily traffic, number of daily trains, train speed, in-place crossing protection (i.e. cross bucks, gates, etc.), and the number of crashes that occurred within the last five years to determine the score.

The ***FRA Crash Prediction*** index is 0.04890, ***placing this railroad crossing in the Metro District’s top 20 locations for expected crash frequency***. The FRA model relies on number of main tracks, train volume, vehicle volume, highway type and number of lanes, maximum train speed and whether the road is paved to estimate the future crash frequency.

The ***Risk Factor Based Analysis*** identifies eight out of ten risk factors are present at this railroad crossing. The Risk Factor Based Analysis looks for the presence of factors that are common among locations where crashes occurred. The risk factors present at this railroad crossing include:

- Vehicle ADT
- Trains per Day
- Volume Cross Product
- Max Time Table Speed
- No of Mainline Tracks
- Skew
- Distance to Nearest Crossing
- Clearing Sight Distance

The risk factors that are missing at this railroad crossing include:

- Roadway Speed Limit
- Distance to Nearby Intersection

TH 47 Corridor Safety Review

Crash data from 2012-2014 was evaluated along TH 47. The data showed problematic intersections and roadway segments further described below. The data was analyzed based on whether the crashes yielded a higher than normal crash rate. A higher than normal rate exceeds what is called the critical crash rate. The critical crash rate is a statistically valid rate used to identify hazardous locations. The critical crash rate was calculated using a 95% confidence interval. Critical crash rates account for the type of roadway or intersection (number of lanes, traffic control, approach speed, environment), amount of vehicle exposure (measured as million vehicle miles – mvm – for segments and million entering vehicles – mev – for intersections) traveling through the roadway segment or intersection, and the random nature of crashes.

Crash Data and History

Intersection Crashes

Table 8 provides the calculated crash rates and comparable average and critical rates. Locations with a rate above the critical crash rate are shaded in red and locations with a rate above the average rate but below the critical crash rate are shaded in orange. Two intersections in the corridor – McKinley Street and Martin Street – have a crash rate above the critical crash rate. The intersections in the south portion of the corridor and the Bunker Lake Boulevard intersection have a crash rate above the average rate but below the critical crash rate. This indicates that intersection crash frequency, especially in the south portion of the corridor, is generally higher than expected.

- **TH 47 at Martin Street** – This intersection is located south of the railroad crossing. The crash rate at this unsignalized intersection is 0.62 crashes/mev, which exceeds the 0.37 critical crash rate. Ten of the 13 crashes at this intersection are rear end (five) and sideswipe – passing (five). The typical pattern is rear end, low severity, during PM peak period which suggests congestion and queuing (related to the railroad crossing and overall delay on TH 47) contributes to the crash frequency.
- **TH 47 at McKinley Street** – This intersection is located north of the railroad crossing. The crash rate at this unsignalized intersection is 0.98 crashes/mvm which exceeds the 0.37 critical rate. Fifteen of the 21 crashes are rear end crashes at this intersection. There was one serious injury right angle crash that occurred at 10:22 PM. The typical pattern is rear end, low severity, during PM peak period which suggests congestion on TH 47 contributes to the crash frequency.

Table 8: TH 47 Intersection Crash Analysis Summary

Intersection	Legs	Entering ADT[1]	Traffic Control	Crash Rate[2]	Avg. Crash Rate[4]	Critical Crash Rate[3]
TH 47 at WB TH 10 Ramps	4	25,400	Signalized	0.76	0.68	0.96
TH 47 at Pleasant St	4	21,625	Signalized	0.89	0.68	0.98
TH 47 at Martin Street	4	19,175	Unsignalized	0.62	0.19	0.37
TH 47 at Garfield St	3	18,363	Unsignalized	0.25	0.19	0.37
TH 47 at State St	3	18,363	Unsignalized	0.35	0.19	0.37
TH 47 at McKinley St	4	19,550	Unsignalized	0.98	0.19	0.37
TH 47 at Mccann Ave	4	18,550	Unsignalized	0.15	0.19	0.37
TH 47 at Dunham Dr	4	18,550	Unsignalized	0.05	0.19	0.37
TH 47 at Wilson St	4	18,550	Unsignalized	0.15	0.19	0.37
TH 47 at Mineral Pond Dr	4	18,550	Unsignalized	0.05	0.19	0.37
TH 47 at Bunker Lake Blvd	4	34,800	Signalized	0.71	0.68	0.91

1. 2014 Traffic volumes, taken from the MnDOT traffic data mapping application
2. From Minnesota Crash Mapping Analysis Tool, 2012-2014 data
3. Using 95% confidence levels
4. From MnDOT's 2014 Crash Tool Kit

Roadway Segment Crashes

Table 9 provides the calculated crash rates and comparable average and critical crash rates. Crash rates above the critical crash rate are shaded in red in the table. The entire corridor exceeds the critical crash rate. The most common reported crashes are: rear end (63 crashes, 52% of all crashes), right angle (14 crashes, 11%), sideswipe-passing (11 crashes, 9%) and left turn (8 crashes, 7%). Forty-two percent of crashes occurred between 3:00 PM and 6:00 PM (**Figure 6**) and therefore many of the crashes are occurring during the PM peak period, which is the most congested period along TH 47. There were no fatal crashes and one serious injury crash at the McKinley Street intersection also reported above. Fourteen of the segment crashes occurred along the curve at Garfield/State St and seven of these crashes involved a vehicle that left its lane while five crashes were a rear end. The run off road crashes predominately happened between midnight and 3:00 AM with no consistent travel direction. The rear end crashes occurred during the day, but there was insufficient information to determine if the crash was due to vehicles stopped for a left-turning vehicle or instead involved the back of a standing queue for northbound traffic.

The proposed change in access for Alter Trading will increase turning movements at the State Street/Garfield Street intersection and the lack of a left-turn lane or bypass lane could not only result in delay, but also increase the potential for turning and rear end crashes. Therefore, the number of trucks entering Alter Trading was counted during the AM peak hours (7:00 – 8:00 AM) and the PM peak period (4:00 – 6:00 PM) using the recorded video from April 5th. The AM peak hour had 14 northbound trucks, half of which made a left turn to Alter Trading, with through vehicles using the bypass lane. Moreover, during PM peak period there were 24 northbound trucks and 30 percent entered Alter Trading. This information, along with the crash history in the vicinity of curve, suggests that the intersection is in need of a northbound left-turn lane or

bypass lane if the Alter Trading access is closed and vehicles are redirected to State Street/Garfield Street.

Table 9: TH 47 Segment Crash Analysis Summary

Section	Length (miles)	Design	ADT[1]	Crash Rate[2]	Avg. Crash Rate[4]	Critical Crash Rate[3]
TH 47-WB TH 10 Ramps to Martin St	0.2	4-Lane	18,300	7.24	3.87	5.61
TH 47-Martin Street to Bunker Lake Blvd	1.3	2-Lane	18,300	3.48	2.31	2.81

1. 2014 Traffic volumes, taken from the MnDOT traffic data mapping application
2. From Minnesota Crash Mapping Analysis Tool, 2012-2014 data
3. Using 99.5% confidence levels
4. From MnDOT's 2014 Crash Tool Kit

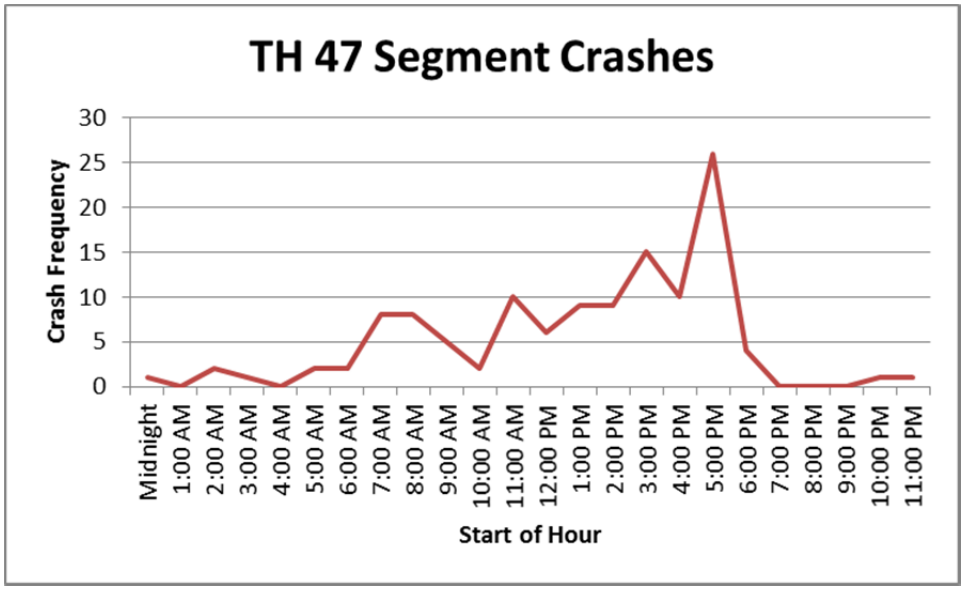


Figure 6: TH 47 Segment Crashes by Time of Day

Appendix C: Alternatives Analysis Technical Memorandum

Technical Memo

Date:	Thursday, July 14, 2016
Project:	TH 47/BNSF Grade Separation Feasibility Study SP 0206-71 HDR No. 278053
To:	Paul Jung, MnDOT Brian Kary, MnDOT Jim Weatherhead, MnDOT
From:	Brandi Popenhagen, PE Richard Storm, PE Ellie Lee, EIT
Subject:	Alternatives Analysis

The following describes the analysis and methodology used in determining the preferred grade separation alternative (over or under) at the crossing of Trunk Highway (Hwy) 47 and the BNSF Railway's two mainline tracks in the City of Anoka, Minnesota.

Summary of Findings

Two alternatives were considered for this feasibility study. These included constructing a bridge over the railroad (Over Alternative) and lowering the road below the railroad grade (Under Alternative). Both alternatives maintain the current crossing location.

Twelve evaluation criteria were identified and defined by the project advisory team. The Value Benefit Assessment Process was used to weight the evaluation criteria, score each alternative, and compute a value score. Overall, the alternative with the bridge over the railroad had a better performance score, lower total estimated cost, and higher value (**Table 1)**. Therefore, the Over Alternative is the preferred approach to separate the vehicles, pedestrians and bicycles from trains at the existing crossing.

Table 1: Alternative Evaluation Summary

Alternative	Performance Score	Total Estimated Cost	Value
Over	5.6	$21.7 Million	25.6
Under	4.7	$36.9 Million	12.6

Alternatives Analysis Process

The alternatives analysis process was completed using the Value Benefit Assessment Process. Project team subject matter experts participated in the process and used the value matrix tool to build team consensus in prioritizing the evaluation criteria. The process was completed in the following four steps:

Step 1 - Evaluation Criteria

Project alternatives often have many attributes and requirements that determine and measure the success of the projects. At times the projects have some of these attributes which are competing or conflicting with each other. The project team selected and defined twelve[1] attributes to build a common understanding among the team members. **Table 2** summarizes and describes the evaluation criteria applied for this project. The project's primary need, Railroad Crossing Safety and a secondary need, Vehicle Delay due to Train Crossing were included in the criteria. See Purpose and Need Technical Memorandum dated June 28, 2016.

Table 2: Explanation of Evaluation Criteria for the TH 47 Grade Separation Feasibility Study

	Evaluation Criteria	Description
A.	Right-of-Way Impacts	Avoid or minimize building removals/total property takes.
B.	Public / Private Access Closures	Avoid or minimize closing driveways and public streets, in the extreme case resulting in landlocked properties.
C.	Constructability	Avoid or minimize construction detours/full closures and length of construction.
D.	Railroad Impacts	Avoid or minimize disruption to rail service, i.e. utilize efficient construction methods and staging to construct project using minimal (and achievable) work windows that impact daily rail operations (which will be substantially maintained).
E.	Railroad Crossing Safety	**Primary Need:** Avoids or minimizes the potential for future vehicle-train collisions.
F.	Public Controversy	Avoid or minimize public controversy.
G.	Contaminated Site Risks/Impacts	Avoid or minimize disruption of contaminated soils.
H.	Floodplain Impacts	Avoid or minimize disruption of floodplain impacts.
I.	Water Table / Storm water Impacts	Avoid or minimize dewatering, pumping, or extensive storm water management.
J.	Historic Property Impacts	Avoid or minimize impacts to historic or potentially historic properties.
K.	Park / Fairground Impacts	Avoid or minimize impacts/property takes to the Rum River South County Park or Anoka County Fairgrounds.
L.	Vehicle Delay due to Train Crossings	**Secondary Need:** Avoid or minimize vehicle delays as a result of train crossings.

Step 2 - Criteria Weighting

To develop weighting for each criterion, a paired comparison method was used. By answering the question "Which criterion 'A' or 'B' will provide the greater improvement to the project relative to the Purpose and Need of the project?" The team subsequently compared each criterion. The letters were recorded in the matrix (spreadsheet), and then the weight for each criterion was calculated.

[1] During the development of the evaluation criteria, Pedestrian and Bicycle Connections was removed because the existing corridor and both alternatives provide a trail connection. Therefore, the criterion provides no differentiation between the alternatives and/or existing conditions. Well Impact and Visual Impact were removed because the evaluation criteria were not selected in any of the paired comparisons. In other words, the criteria were less important than all other criteria. Therefore, the two criteria provide no differentiation between the alternatives.

As shown on **Figure 1**, Railroad Crossing Safety (project's Primary Need) had the greatest weight compared to all other criteria. Railroad Impacts and Contaminated Site Risks/Impacts were the second and third highest weighted criteria.

Step 3 - Criteria Score Scale

To provide consistency and avoid bias, the team defined the bookends and mid-point for the scale used to score the alternatives. Scores range between a low of 1 and a high of 10. Criteria score guidance shown in **Table 3** was used.

Table 3: Guidance for Criteria Score

Scoring Scale	Description
1	Substantial Negative Impact
3	Moderate Negative Impact
5	No Anticipated Change
7	Moderate Positive Impact
10	Substantial Positive Impact

Step 4 - Evaluation Matrix

Using the criteria score scale, the team evaluated and scored each alternative. Once the team completed scoring, the performance score was determined by the following equation.

$$performance\ Score = \sum(Criteria\ Weight * Criteria\ Score)$$

Finally, the performance score was divided by the total estimated cost to determine the overall value of each alternative. Using this approach, higher values indicate the alternative better meets the project's evaluation criteria.

Table 4 shows how the two alternatives performed against each other using the evaluation matrix. The Over Alternative outperformed the Under Alternative in several categories yielding the higher performance score. The reasons for this outcome are further defined in the following section. The proposed designs for the alternatives are shown in **Figure 2** (Over Alternative) and **Figure 3** (Under Alternative).

Figure 1: Paired Comparison Method Matrix

	A. Right-of-Way Impacts	B. Public / Private Access Closures	C. Constructability	D. Railroad Impacts	E. Railroad Crossing Safety	F. Public Controversy	G. Contaminated Site Risks/Impacts	H. Floodplain Impacts	I. Water Table / Stormwater Impacts	J. Historic Property Impacts	K. Park / Fairground Impacts	L. Vehicle Delay due to Train Crossings	TOTAL	WEIGHT or Percent	
A. Right-of-Way Impacts	A	A	C	D	E	A/F	G	H	I	J	K	A	3.5	4%	4.49%
B. Public / Private Access Closures		B	B	D	E	F	B/G	H	B/I	B	K	L	4	5%	5.13%
C. Constructability			C	D	E	F	G	H	I	C	C	L	4	5%	5.13%
D. Railroad Impacts				D	E	D	D	D	D	D	D	D	11	14%	14.10%
E. Railroad Crossing Safety					E	E	E	E	E	E	E	E	12	15%	15.38%
F. Public Controversy						F	F	H	F	F/J	F/K	F	7.5	10%	9.62%
G. Contaminated Site Risks/Impacts							G	G/H	G/I	G	G	L	6.5	8%	8.33%
H. Floodplain Impacts								H	H	H	H/K	H	9	12%	11.54%
I. Water Table / Stormwater Impacts									I	I	I	L	6	8%	7.69%
J. Historic Property Impacts										J	J/K	L	3	4%	3.85%
K. Park / Fairground Impacts											K	L	4.5	6%	5.77%
L. Vehicle Delay due to Train Crossings												L	7	9%	8.97%
														78	

Note: **Primary needs**
Secondary needs

Table 4: TH 47 Railroad Grade Separation Feasibility Study-- Evaluation Matrix

	Evaluation Criteria													Cost Estimates			Value
Alternative	**Right-of-Way Impacts**	**Public / Private Access Closures**	**Constructability**	**Railroad Impacts**	**Railroad Crossing Safety**	**Public Controversy**	**Contaminated Site Risks/Impacts**	**Floodplain Impacts**	**Water Table / Stormwater Impacts**	**Historic Property Impacts**	**Park / Fairground Impacts**	**Vehicle Delay due to Train Crossings**	**Performance Score**	**Right-of-Way**	**Construction, Project Management, Engineering and Risk**	**Total Cost**	
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*					
Weight	*4%*	*5%*	*5%*	*14%*	*15%*	*10%*	*8%*	*12%*	*8%*	*4%*	*6%*	*9%*					
Grade Separation - Over	3	3	3	4	10	7	4	4	4	3	4	10	5.6	$ 3,000,000	$ 15,400,000	$ 21,700,000	25.6
Grade Separation - Under	4	4	1	1	10	7	1	4	1	3	4	10	4.7	$ 1,500,000	$ 32,300,000	$ 36,900,000	12.6

Guidance for Criteria Score:

1 - Substantial Negative Impact
3 - Moderate Negative Impact
5 - No Anticipated Change
7 - Moderate Positive Impact
10 - Substantial Positive Impact

Notes:

Performance Score = ∑ (Criteria Weight * Criteria Score)

Value = Performance Score ÷ Total Cost * 10^8

Primary needs
Secondary Needs

Alternative Comparison

The two alternatives were assessed to find the best solution to address the primary need for this project. According to the analysis, it was shown that both alternatives address the primary need to improve the railroad crossing safety (safety for motorists, pedestrians, bicyclists, and trains). Both alternatives also equally addressed a key secondary need by improving traffic operations including reducing delays caused by trains. Although not in the evaluation matrix they also both address other secondary needs identified for this project including eliminating gate-down time and removing the poor line of sight at the crossing.

Although, both alternatives equally address the primary and some secondary needs for this project, the analysis clearly showed that the Over Alternative is the preferred solution compared to the Under Alternative. The overall score for the Over Alternative was significantly higher at 30.5 compared to 13.8 for the Under Alternative and costs substantially less. The following summary addresses the evaluation criteria that contributed the most to the separation of the performance scores.

Over Alternative

- **Constructability:** Building the bridge over can initially be accomplished by constructing a portion of the grade separation while keeping the existing Hwy 47 open. The closure of Hwy 47 could likely be limited to a single construction season.
- **Railroad Impacts:** Constructing a bridge over the railroad is expected to have minimal disruption to rail services and no extended closures of the rail site.
- **Contaminated Site Risk/Impacts:** Excavation is minimized by the alternative, reducing the potential of disturbing contaminated soils.
- **Water Table/Stormwater Impacts:** The water table will not be disturbed and there is generally suitable areas to temporarily retain stormwater.

Under Alternative

- **Constructability:** More difficult to construct because of extensive coordination with the railroad. The construction will likely result in Hwy 47 being closed at least two years.
- **Railroad Impacts:** Construction of temporary lines and a temporary bridge over the Rum River could result in either extended closures or reduced capacity.
- **Contaminated Site Risk/Impacts:** Significant excavation is needed which has the possibility of disturbing contaminated soils. During construction, dewatering may be necessary, with the potential of the dewatering drawing the contaminated plume towards the project site and closer to the river.
- **Water Table/Stormwater Impacts:** A road under the railroad will require that stormwater (and possibly ground water) be pumped from the low point. This also requires underground storage chambers that must be design and constructed.

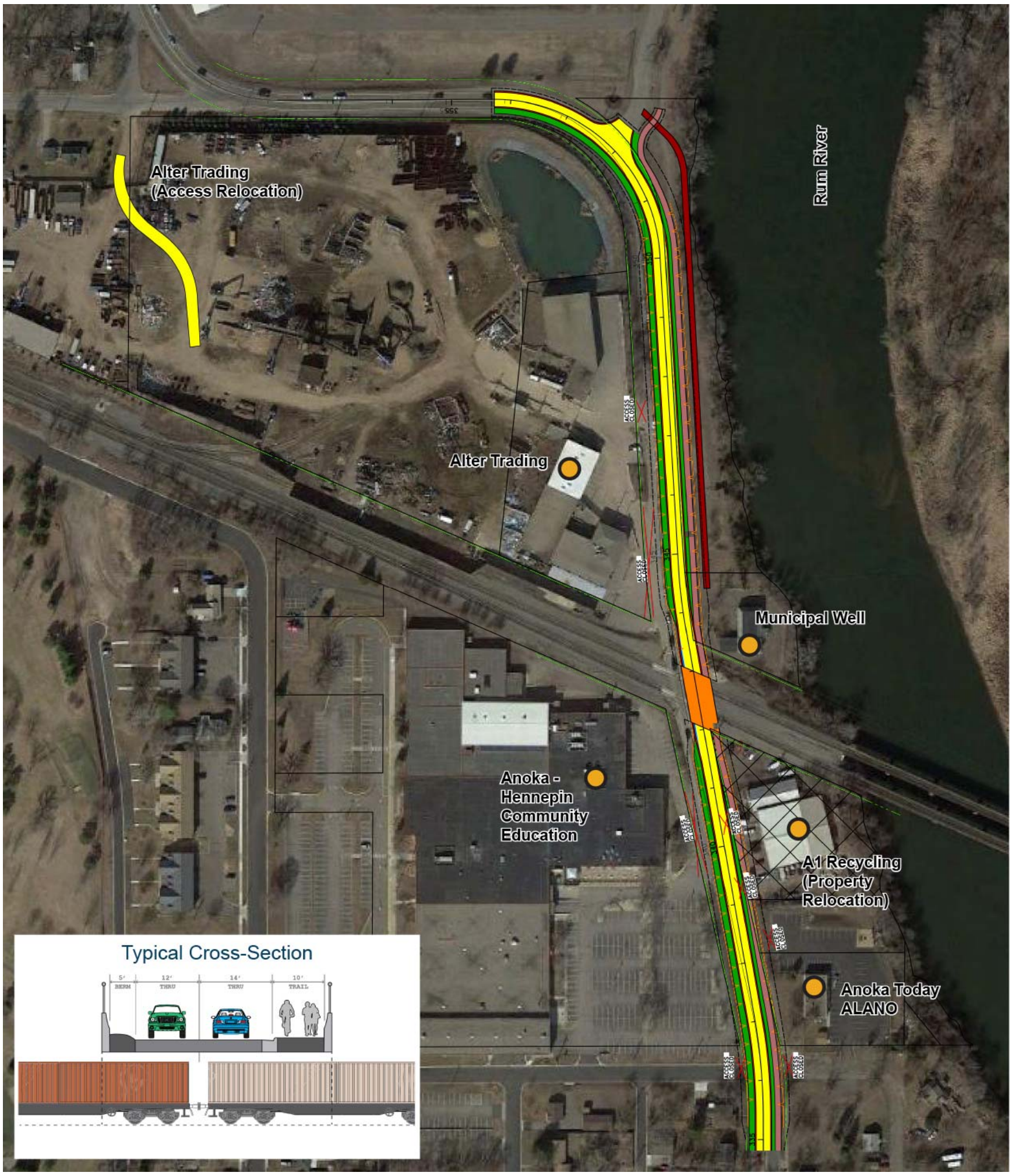


Figure 2: Concept for Alternative with Road Over the Railroad

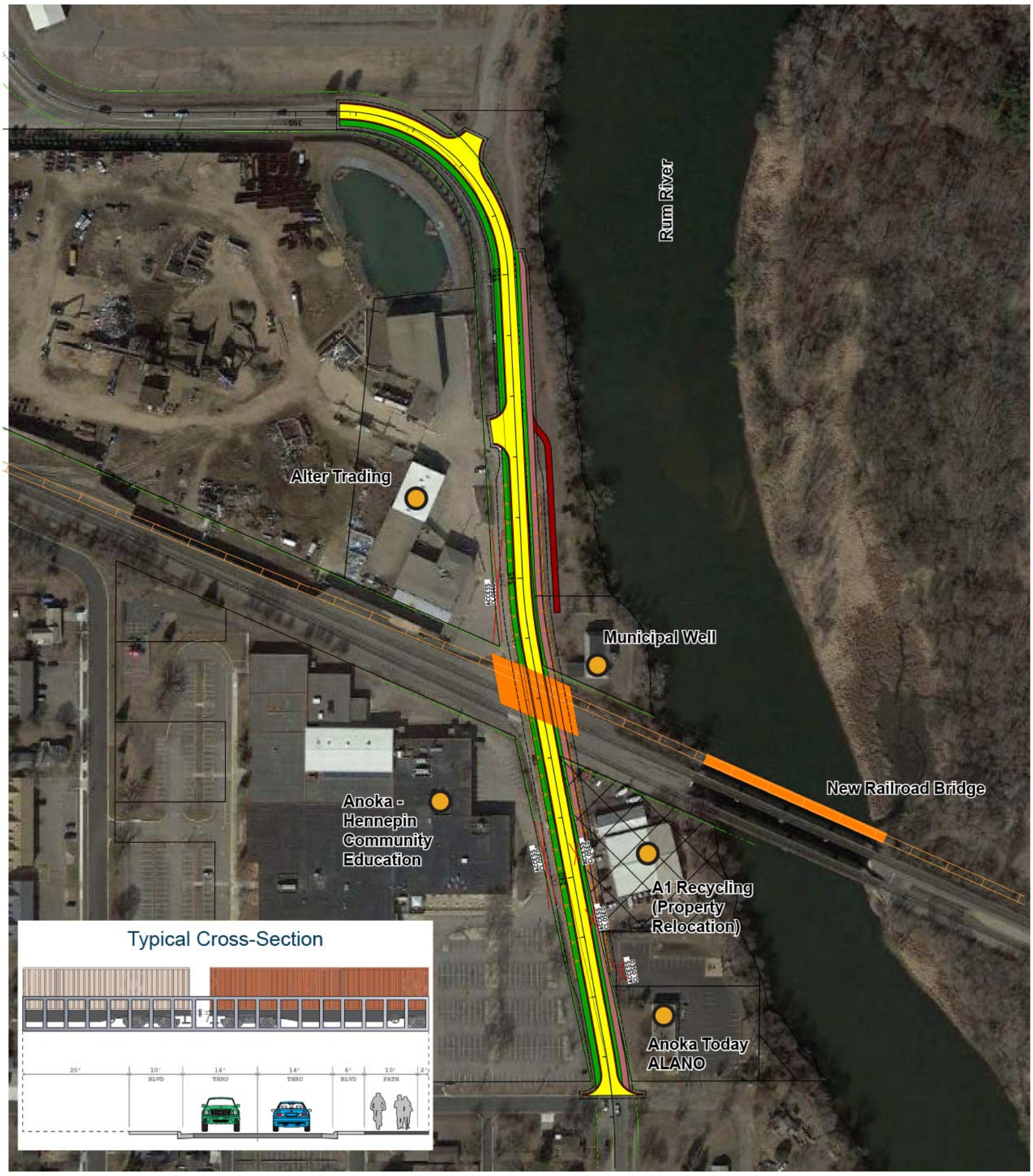


Figure 3: Concept for Alternative with Road Under the Railroad

Appendix D: Structure Type Study Technical Memorandum

Technical Memo

Date: Tuesday, December 13, 2016

Project: TH 47/BNSF Grade Separation Feasibility Study
SP 0206-71
HDR No. 278053

To: Paul Jung, MnDOT
Jim Weatherhead, MnDOT
Dan Prather, MnDOT

From: Andy Nordseth, PE
Scott Burfeind, PE
Brandi Popenhagen, PE

Subject: FINAL Structure Type Study

1 Introduction

The subject of this study is the crossing of Trunk Highway (TH) 47 (Ferry Street) and BNSF Railway's two mainline tracks in the City of Anoka, Minnesota. The crossing is approximately 0.3 miles north of TH 10 and 200 feet west of the Rum River. The purpose of this project is to evaluate the feasibility of grade separating TH 47 and the BNSF Railway and determining a preferred solution. The typical section of TH 47 on the bridge looking up station consists of:

Proposed

- 1'-8" concrete barrier and deck overhang
- 5'-0" shoulder
- 12'-0" thru lane
- 14'-0" thru lane
- 10'-0" path
- 1'-8" concrete barrier and deck overhang

Future Widening

- 1'-8" concrete barrier and deck overhang
- 4'-0" shoulder
- 11'-0" thru lane
- 11'-0" thru lane
- 11'-0" thru lane
- 13'-0" thru lane
- 10'-0" path
- 1'-8" concrete barrier and deck overhang

2 Findings

Four bridge alternatives are described in this report. After evaluating these options, our findings show advantages in the further development of Option 2; a multiple span bridge with precast concrete beams and parapet abutments. This option meets the horizontal and vertical clearance requirements for BNSF while being the most economical solution.

3 Bridge Type Analysis

3.1. Bridge Constraints/Objectives

The project site has many different constraints that influence the design. Some of the existing constraints include limited right-of-way (66'), known soil and ground water contamination adjacent to and within the right-of-way, proximity of the Rum River, and a potentially historic well building just northeast of the crossing. The proposed objectives for this site include designing with the ability for future expansion, limiting right-of-way impacts on sensitive properties (i.e. contaminated properties, Anoka/Hennepin School District, well building, and Anoka County Fairgrounds), avoid impact BNSF operations and limiting impacts to traffic during construction. All options considered are at the current crossing location. Designing a grade-separated crossing in a new location is not being considered at this time due to the substantial right-of-way impacts and lack of City of Anoka support for relocating TH 47 in this area and south of TH 10.

3.2. Design Criteria

The bridges will be designed in accordance with the American Association of State Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specifications, Customary U.S. Units, 7th Edition, with 2015 and 2016 Interim Revisions, the MnDOT LRFD Bridge Design Manual (BDM), and AREMA MRE.

The project will use a 35 (thirty-five) MPH design speed with the plan to request design exceptions for the horizontal curves on TH 47 north of the railroad crossing, to have those horizontal curves as 30 MPH curves.

3.1. Superstructure Selection

The selection of the superstructure options is based on roadway geometric requirements, and clearance constraints. This information is documented further in the base feasibility study report and the meeting minutes with BNSF on May 16, 2016.

The following four superstructure types were considered:

Option 1 – Single Pre-stressed Concrete Beam Span (Overpass)
Option 1 is a single span pre-stressed concrete beam bridge with high parapet abutments and retaining walls.

Option 2 – Multiple Pre-stressed Concrete Beam Spans (Overpass)
A multiple span pre-stressed concrete beam bridge was considered as an alternative to the single span to evaluate replacing high retaining walls with more bridge.

Option 3 - Single Steel Girder Span (Overpass)
A single span steel superstructure was considered but not developed further since the preliminary section depth for a steel span of this length provides an insignificant amount of additional vertical clearance versus a prestressed concrete beam span, and is not worth the additional capital and maintenance costs for steel.

Option 4 – Single Thru-Plate Girder Span (Underpass)
A single thru-plate steel girder span was considered but not developed further since the geometry at the site required the adjustment of the profile for the railway tracks. This adjustment would impact the adjacent railway bridges over the Rum River. The Alternative Analysis Technical Memorandum dated July 14, 2016 documents the methodology and findings related to going under the BNSF crossing in this location. The findings show that going under has more project related impacts and costs more than going over and therefore going over is the preferred solution. Because of this analysis, the under alternative was not further developed during this study.

3.2. Utilities

In place utilities at this time are preliminary in nature and subject to change when the project moves into preliminary design. Below is a current list of all known utilities.

UTILITY OWNER	UTILITY TYPE	LOCATION
Centerpoint Energy	Gas	West side of TH 47 with services to east side
Centurylink	Buried telephone	East side of TH 47
Centurylink	Buried fiber optic	West side of TH 47 with services to east side
City of Anoka	Buried power	East side of TH 47
City of Anoka	Water	Crosses TH 47 north of Railroad crossing. East side of TH 47 north of well building
City of Anoka	Sanitary sewer	East side of TH 47 south of Martin
Comcast	Buried fiber optic	West side of TH 47

At this time, it is anticipated that the only the utilities on the east side of the roadway will require relocation with all options.

3.3. Aesthetics

Aesthetics of the preferred alternatives will be developed during preliminary and final design.

3.4. Construction

A constructability analysis of Options 1 and 2 was done to check feasibility of each option, possible construction phasing and possible detour routes. Because options 1 and 2 have similar geometrics over the railroad, there is little to no difference in constructability over the active tracks.

The construction phasing developed as part of the feasibility study utilizes a three phase construction approach for both option 1 and 2. Phasing for both options will follow these general steps:

- Phase 1 constructs the widening needed for the new Alter Trading entrance, the cul-de-sac on Martin Street and the Anoka/Hennepin School District parking lot modifications.
- Phase 2 will close access to TH 47, within the project limits, for A-1 Recycling, Alter Trading, School District, and Martin Street. Once access closures occur, temporary

traffic control measures can be put in place, utilizing existing pavement, and construction on the eastern portion of both options 1 and 2 can begin(See Appendices C and E for more detail).

- Phase 3 will implement a full closure of TH 47 for completion of the structural and roadway work. Graphical representations of this phasing can be found in Appendices C and E.

During phase 3 for both options, a possible detour route would utilize US 10, Thurston Avenue or CR 57 and Bunker Lake Boulevard.

Approximate Construction Duration: It is anticipated that the construction duration for both options 1 and 2 would not exceed a construction season.

3.5. Typical Section

The typical section chosen for the proposed structures was chosen to be multimodal (Bike and pedestrian accommodations), able to accommodate future expansion and to meet current design standards. See appendix A for more detail.

3.6. Design Options

Conceptual bridge drawings and preliminary bridge cost estimates are attached to this report in Appendices B through E showing the elevation of each of the two options as well as a profile of the finished bridge deck for the recommended option. Plan views can be seen in the project layout as part of the base feasibility study report.

These general design features apply to all of the bridge options considered in this study:

- Provide the same skew angle for the substructures.
- Geotechnical considerations are not accounted for.
- Bridge design will be in accordance with MnDOT guidelines.
- Meets minimum vertical and horizontal clearances per project meeting dated May 16, 2016.
- Pier configuration is multi-column with a cap
- No pile bents

3.7. Life Cycle Cost Analysis (LCCA)

An LCCA was created to take into account future maintenance costs to compare options as opposed to only the initial capital investment. The full design life of 75 years is depicted to realize all of the potential maintenance items. They include; Bridge Deck & Seal and Snow Removal, Bridge Routine Inspection, Bridge Spot Repairs and Roadway Mill & Overlay, Replace Bridge Deck Joints, Bridge Deck Mill & Overlay, and Bridge Deck & Roadway Replacement. Another option for the LCCA is to show 15-20 years worth of maintenance items and credit the results with a salvage value since the bridge is still in service. This was ruled out, because of the activities that occur beyond 20 years. See Appendix F.

Option 1: Single Pre-stressed Concrete Beam, MN45, Span (Overpass)

Option 1 is a simple span bridge with MN45 prestressed concrete beams (PCB) and parapet abutments. This option provides the minimum 23'-4" vertical over 60'-0" and a 15'-0" to 20'-0" horizontal clearance (floating space based on final railway alignment, total portal is 80'-0" wide) over BNSF and also allows for three tracks. The following are the preliminary design assumptions for Option 1:

- Simple MN45 PCB span with a length of 100'-0"
- High parapet abutments
- Allows for 3 railway tracks (20'-0" track spacing) within an 80'-0" wide portal
- 23'-4" vertical clearance within 9' of the centerline of the outside tracks
- 15'-0" to 20'-0" horizontal clearance from centerline of outside track to the front face of the abutments Structure shown is feasibility level design and has not been optimized. Optimization will occur in preliminary design.

Option 2: Multiple Pre-stressed Concrete Beam Spans (Overpass)

Option 2 is a 7- span bridge with MN45 PCB's over the main span and MN54 PCB's over the approach spans This option provides the minimum 23'-4" vertical over 60'-0" and a 15'-0" to 20'-0" horizontal clearance (floating space based on final railway alignment, total portal is 80'-0" wide) over BNSF and also allows for three tracks, the same as Option 1. This Option replaces tall retaining walls and fill with more bridge. The following are the preliminary design assumptions for Option 2:

- MN45 PCB main span over the BNSF and MN54 PCB over the approach spans
- Parapet abutments
- Allows for 3 railway tracks (20'-0" track spacing) within an 80'-0" wide portal
- 23'-4" vertical clearance within 9' of the centerline of the outside tracks
- 15'-0" to 20'-0" horizontal clearance from centerline of outside track to the front face of the piers

Structure shown is feasibility level design and has not been optimized. Optimization will occur in preliminary design.

Table 1: Comparison Tables (Bridge spans only)

SINGLE SPAN VERSUS MULTISPAN		
	OPTION 1 (Single Span)	**OPTION 2 (Multiple Spans)**
Description	· 1-span MN45 PCB bridge	· 7-span PCB bridge
	· 100'-0" span length	· 100'-0" main span (MN45)
	· High parapet abutments	· 136'-0" approach spans (MN54)
		· Parapet abutments
Total Bridge Length	100'-0" +/-	916'-0" +/-
Total Bridge Width	44'-4"	44'-4"
Min. Vertical Clearance	23'-4"	23'-4" (Railway Portal)
Estimated Construction Cost (2020)	$1.9M	$5.8M
Cost/SF	$421/SF	$140/SF
Advantages	· Shorter construction schedule	· Potential for railway expansion
	· No piers or crash struts	· Open space allows for accessibility for utilities, roads, driveways and trails
	· Less maintenance	· Aesthetics
	· Shorter bridge	· Lower overall project cost
Disadvantages	· Tall abutments	· Longer construction schedule
	· Restricts accessibility	· More maintenance and inspection requirements
	· Large retaining walls	
	· Higher overall project cost	

Table 2: Cost Comparison Tables (Bridge vs Wall spans only)

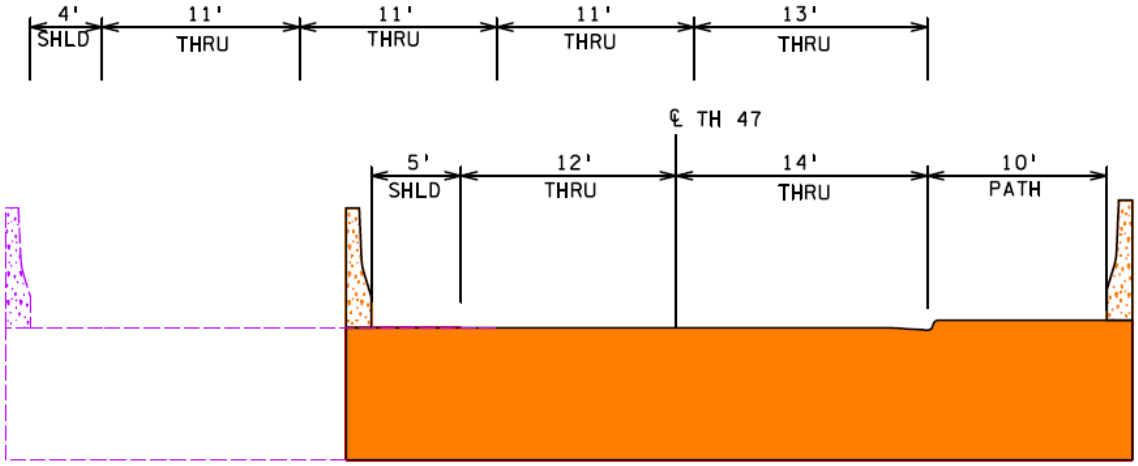
WALL VERSUS BRIDGE COST COMPARISION				
LOCATION (50' segments or Main bridge span)			WALL/ROADWAY/ BRIDGE COSTS (Option 1)	BRIDGE COSTS (Option 2)
337+50	TO	338+00	$201,079	$290,000
338+00	TO	338+50	$239,102	$290,000
338+50	TO	339+00	$294,420	$290,000
339+00	TO	339+50	$336,141	$290,000
339+50	TO	340+00	$383,173	$290,000
340+00	TO	340+50	$416,618	$290,000
340+50	TO	341+00	$432,258	$290,000
341+00	TO	341+50	$445,753	$290,000
341+50	TO	342+00	$429,749	$290,000
Railway Span			$1,893,761	$520,800
343+00	TO	343+50	$445,753	$290,000
343+50	TO	344+00	$447,879	$290,000
344+00	TO	344+50	$437,303	$290,000
344+50	TO	345+00	$426,819	$290,000
345+00	TO	345+50	$399,418	$290,000
345+50	TO	346+00	$366,186	$290,000
346+00	TO	346+50	$332,390	$290,000
346+50	TO	347+00	$300,986	$290,000
347+00	TO	347+50	$268,846	$290,000
Totals			$ 8.5M	$ 5.8M
Totals (Includes LCCA)			$ 9.4M	$ 8.8M

NOTES:

- 2020 construction costs used (14% increase from 2015 prices)
- Does not include Life-Cycle Cost Analysis (LCCA), See Appendix F for LCCA.
- Station range is even 50' comparison and represents an approximate bridge length
- Option 1 includes: Bituminous, Retaining Wall, Barrier, Curb and Gutter, Class 5 Aggregate, Select Granular Material, Embankment-Common, Select Granular Modified 10%, Concrete Walk, and Bridge estimate on page 4.
- Option 2 includes: Approach roadway, and bridge estimate on page 4.

APPENDIX A

Typical Section (with future expansion)



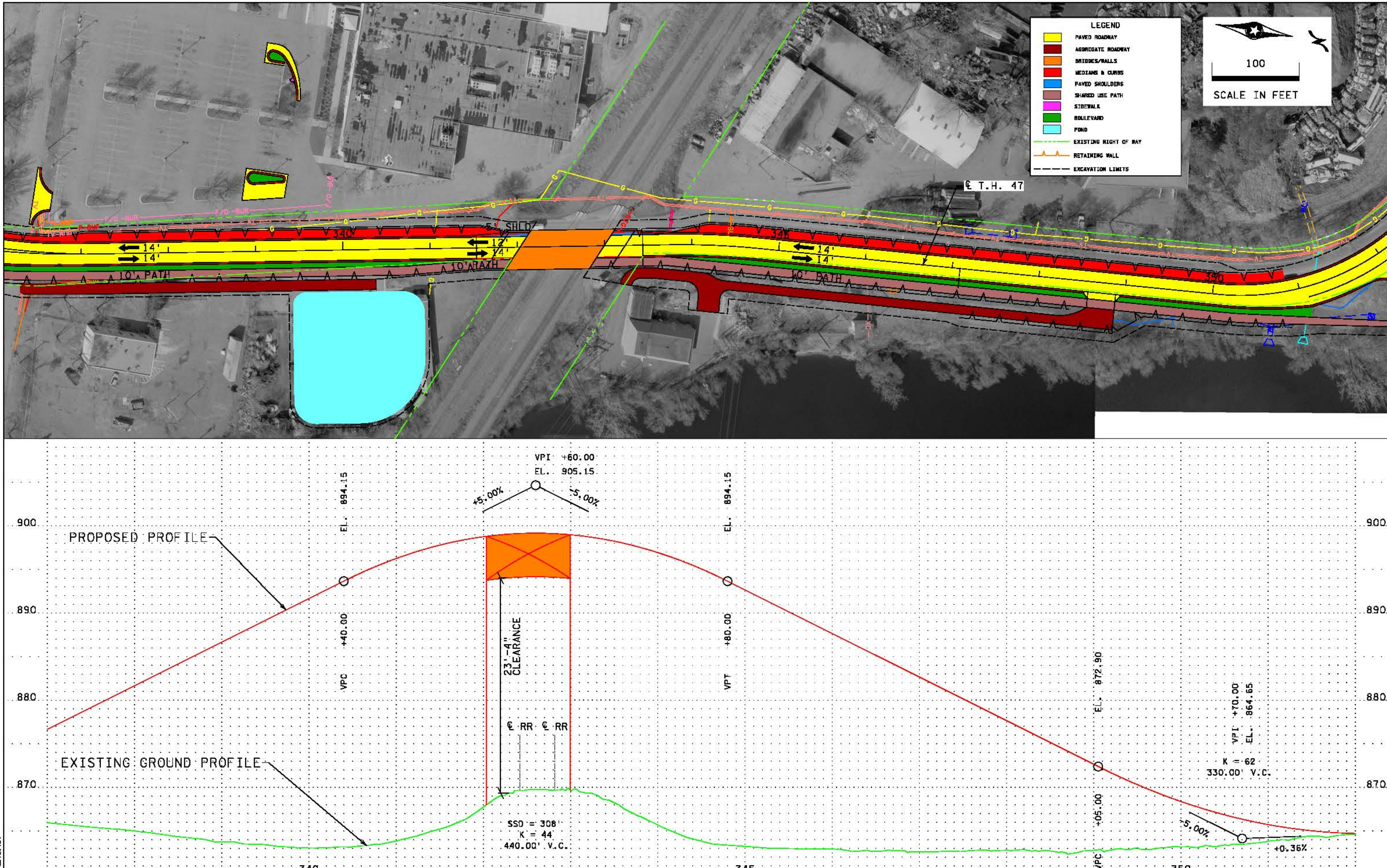
APPENDIX B

Preliminary Bridge Cost Estimate (Option 1)

ITEM NO	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
2406.553	Bridge Approach Panels	SQ. YD.	241	$165.00	$39,805
2401.501	Structural Concrete (1G52)	CU. YD.	383	$385.00	$147,369
2401.501	Structural Concrete (3B52)	CU. YD.	834	$590.00	$491,863
2401.618	Bridge Slab Concrete (3YHPC-S)	SQ. FT.	4500	$15.13	$68,063
2401.513	Type F (TL-4) Concrete (3S52)	LIN. FT.	280	$99.00	$27,720
2401.541	Reinforcement Bars	POUND	38278	$1.10	$42,106
2401.541	Reinforcement Bars (Epoxy Coated)	POUND	121713	$1.21	$147,273
2401.601	Structure Excavation	LUMP SUM	1	$7,333.33	$7,333
2402.595	Bearing Assembly	EACH	12	$1,100.00	$13,200
2404.501	Concrete Wearing Course (3U17A)	SQ. FT.	4166	$4.13	$17,185
2404.618	Blasting (Special)	SQ. FT.	4166	$0.55	$2,291
2405.502	Prestressed Concrete Beam (MN45)	LIN. FT.	600	$275.00	$165,000
2452.603	16" CIP Piling Delivered	LIN. FT.	3510	$62.70	$220,077
2502.502	Drainage System Type (B910)	LUMP SUM	1	$2,750.00	$2,750
2514.501	Concrete Slope Paving	SQ. YD.	129	$132.00	$17,013
				Bridge Subtotal:	$1,409,048
				7% for Aesthetics:	$98,633
				5% for Miscellaneous Items:	$70,452
				5% for Mobilization:	$83,060
				Total:	**$1,661,194**
				Total per SF:	**$369**
				2020 Construction (14%):	$1,893,761
				2020 Construction (14%):	$421

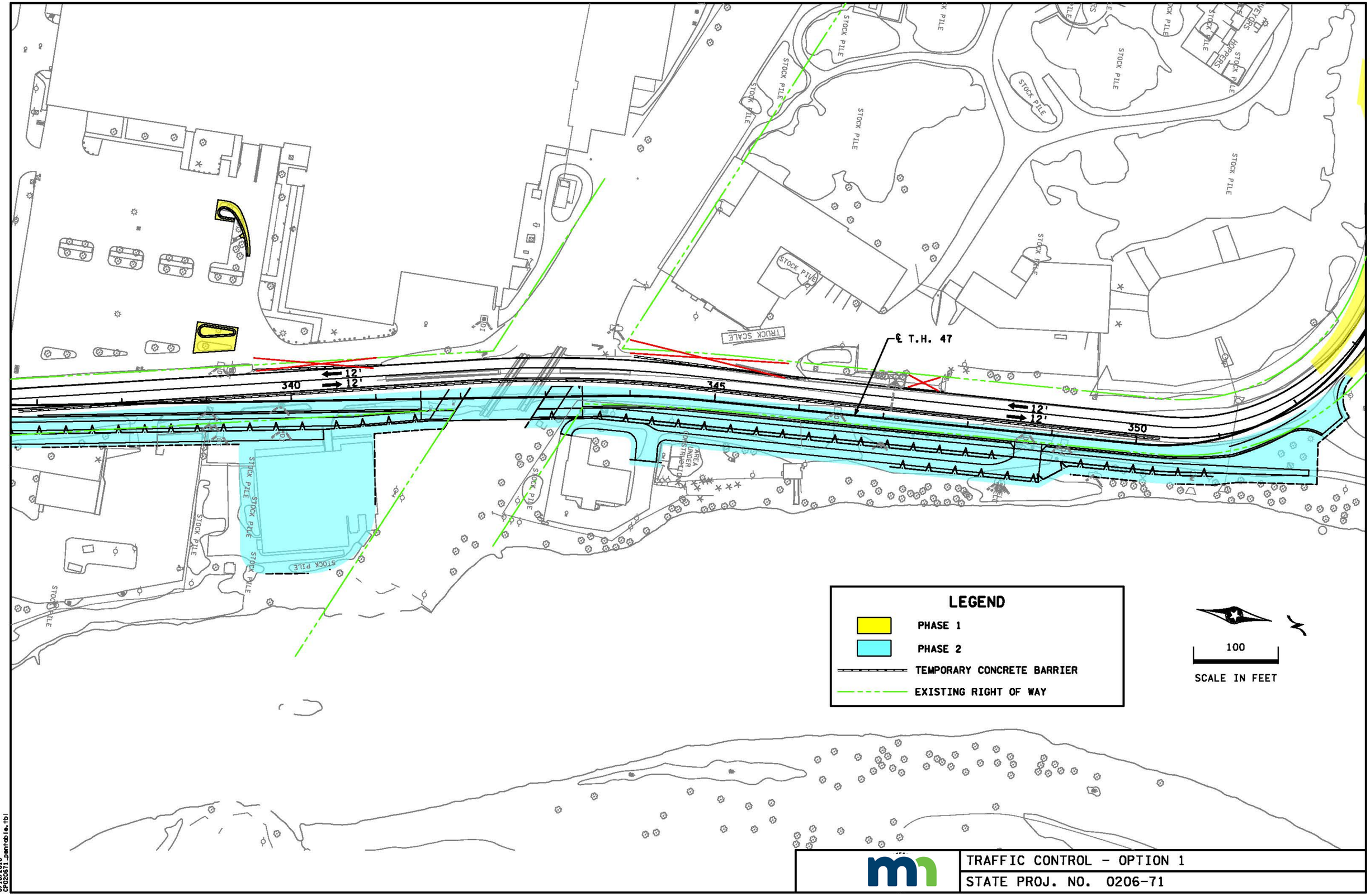
APPENDIX C

Preliminary Bridge Layout (Option 1)



OPTION 1 - SINGLE SPAN BRIDGE

STATE PROJ. NO. 0206-71



TRAFFIC CONTROL - OPTION 1

STATE PROJ. NO. 0206-71

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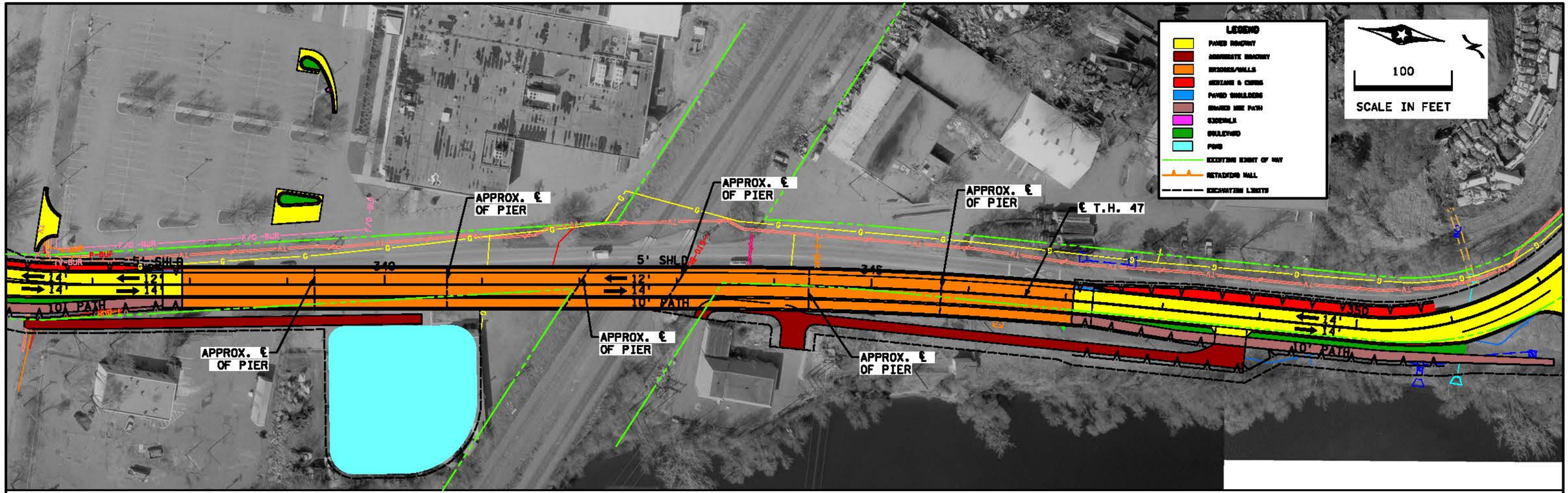
APPENDIX D

Preliminary Bridge Cost Estimate (Option 2)

ITEM NO	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
2406.553	Bridge Approach Panels	SQ. YD.	241	$165.00	$39,805
2401.501	Structural Concrete (1G52)	CU. YD.	497	$385.00	$191,388
2401.501	Structural Concrete (3B52)	CU. YD.	1156	$590.00	$682,040
2401.618	Bridge Slab Concrete (3YHPC-S)	SQ. FT.	41220	$15.13	$623,453
2401.513	Type F (TL-4) Concrete (3S52)	LIN. FT.	1912	$99.00	$189,288
2401.541	Reinforcement Bars	POUND	49711	$1.10	$54,682
2401.541	Reinforcement Bars (Epoxy Coated)	POUND	355480	$1.21	$430,131
2401.601	Structure Excavation	LUMP SUM	1	$7,333.33	$7,333
2402.595	Bearing Assembly	EACH	84	$1,100.00	$92,400
2404.501	Concrete Wearing Course (3U17A)	SQ. FT.	38161	$4.13	$157,412
2404.618	Blasting (Special)	SQ. FT.	38161	$0.55	$20,988
2405.502	Prestressed Concrete Beam (MN45)	LIN. FT.	600	$275.00	$165,000
2406.502	Prestressed Concrete Beam (MN54)	LIN. FT.	4896	$285.00	$1,395,360
2452.603	16" CIP Piling Delivered	LIN. FT.	3510	$62.70	$220,077
2502.502	Drainage System Type (B910)	LUMP SUM	1	$2,750.00	$2,750
2514.501	Concrete Slope Paving	SQ. YD.	129	$132.00	$17,013
				Bridge Subtotal:	$4,289,121
				7% for Aesthetics:	$300,238
				5% for Miscellaneous Items:	$214,456
				5% for Mobilization:	$252,832
				Total:	**$5,056,648**
				Total per SF:	**$123**
				2020 Construction (14%):	$5,764,579
				2020 Construction (14%):	$140

APPENDIX E

Preliminary Bridge Layout (Option 2)



OPTION 2 - MULTI SPAN BRIDGE

STATE PROJ. NO. 0206-71

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APPROX. ℄ OF PIER

APPROX. ℄ OF PIER

APPROX. ℄ OF PIER

APPROX. ℄ OF PIER

℄ T.H. 47

12'
12'

340

345

350

100

SCALE IN FEET

STOCK PILE

TRUCK SCALE

CONCRETE PAVEMENT

AREA UNDER CONSTRUCTION

LEGEND

- PHASE 1 ①
- PHASE 2
- PHASE 3
- TEMPORARY CONCRETE BARRIER
- EXISTING RIGHT OF WAY

SPECIFIC NOTES

① PHASE 1 INCLUDES PAVEMENT WIDENING FOR A TURN LANE INTO ALTER TRADING AND PAVEMENT WORK FOR ANOKA-HENNEPIN COMMUNITY EDUCATION PARKING LOT RECONFIGURATION.

APPROX. ℄ OF PIER

℄ T.H. 47

340

345

350

100

SCALE IN FEET

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TRAFFIC CONTROL - OPTION 2

STATE PROJ. NO. 0206-71

APPENDIX F

Life-Cycle Cost Analysis (LCCA)

FINAL - Bridge Life Cycle Cost Analysis
20161213
Originator: ATN Checker: JRG

TH 47 - Bridge Life Cycle Costs - Option 1 (Single Span Bridge with Retaining Walls) | Option 2 (7-Span Bridge)

Real Discount Rate*	1.6%	Event																	
		Option 1	Option 2	Option 1	Option 2	Option 1	Option 2	Option 1	Option 2	Option 1	Option 2	Option 1	Option 2	Option 1	Option 2	Option 1	Option 2	Option 1	Option 2
Design Life (Years)	75	2020 Initial Construction		Bridge Deck Flush & Seal, Snow Removal		Bridge Routine Inspection		Bridge Spot Repairs and Roadway Mill & OL		Replace Bridge Deck Joints		Bridge Deck Mill & OL		Br. Deck & Roadway Replacement		Yearly Total		Present Value of Yearly Total**	
Expected Life		N/A	N/A	1 Year	1 Year	2 Years	2 Years	20 Years	20 Years	20 Years	20 Years	30 Years	30 Years	50 Years	50 Years	N/A	N/A	N/A	N/A
Cost		N/A	N/A	$500	$10,000	$500	$1,000	$60,000	$230,000	$80,000	$80,000	$100,000	$480,000	$1,200,000	$4,000,000	N/A	N/A	N/A	N/A
Base Year																			
0		$8,497,634	$5,764,579															$8,497,634	$5,764,579
1				$500	$10,000											$500	$10,000	$492	$9,843
2				$500	$10,000	$500	$1,000									$1,000	$11,000	$969	$10,656
3				$500	$10,000											$500	$10,000	$477	$9,535
4				$500	$10,000	$500	$1,000									$1,000	$11,000	$938	$10,323
5				$500	$10,000											$500	$10,000	$462	$9,237
6				$500	$10,000	$500	$1,000									$1,000	$11,000	$909	$10,001
7				$500	$10,000											$500	$10,000	$447	$8,948
8				$500	$10,000	$500	$1,000									$1,000	$11,000	$881	$9,688
9				$500	$10,000											$500	$10,000	$433	$8,669
10				$500	$10,000	$500	$1,000									$1,000	$11,000	$853	$9,385
11				$500	$10,000											$500	$10,000	$420	$8,398
12				$500	$10,000	$500	$1,000									$1,000	$11,000	$827	$9,092
13				$500	$10,000											$500	$10,000	$407	$8,135
14				$500	$10,000	$500	$1,000									$1,000	$11,000	$801	$8,808
15				$500	$10,000											$500	$10,000	$394	$7,881
16				$500	$10,000	$500	$1,000									$1,000	$11,000	$776	$8,533
17				$500	$10,000											$500	$10,000	$382	$7,635
18				$500	$10,000	$500	$1,000									$1,000	$11,000	$751	$8,266
19				$500	$10,000											$500	$10,000	$370	$7,396
20					$8,500	$500	$1,000	$60,000	$230,000	$80,000	$80,000					$140,500	$319,500	$102,283	$232,593
21				$500	$10,000											$500	$10,000	$358	$7,165
22				$500	$10,000	$500	$1,000									$1,000	$11,000	$705	$7,758
23				$500	$10,000											$500	$10,000	$347	$6,941
24				$500	$10,000	$500	$1,000									$1,000	$11,000	$683	$7,515
25				$500	$10,000											$500	$10,000	$336	$6,724
26				$500	$10,000	$500	$1,000									$1,000	$11,000	$662	$7,280
27				$500	$10,000											$500	$10,000	$326	$6,514
28				$500	$10,000	$500	$1,000									$1,000	$11,000	$641	$7,053
29				$500	$10,000											$500	$10,000	$316	$6,311
30					$8,500	$500	$1,000	$35,000		$80,000	$240,000	$100,000	$480,000			$215,500	$729,500	$133,855	$453,121
31				$500	$10,000											$500	$10,000	$306	$6,114
32				$500	$10,000	$500	$1,000									$1,000	$11,000	$602	$6,619
33				$500	$10,000											$500	$10,000	$296	$5,923
34				$500	$10,000	$500	$1,000									$1,000	$11,000	$583	$6,412
35				$500	$10,000											$500	$10,000	$287	$5,737
36				$500	$10,000	$500	$1,000									$1,000	$11,000	$565	$6,212
37				$500	$10,000											$500	$10,000	$278	$5,558
38				$500	$10,000	$500	$1,000									$1,000	$11,000	$547	$6,018
39				$500	$10,000											$500	$10,000	$269	$5,385
40				$500	$10,000	$500	$1,000									$1,000	$11,000	$530	$5,830
41				$500	$10,000	$500	$1,000									$1,000	$11,000	$522	$5,738
42				$500	$10,000	$500	$1,000									$1,000	$11,000	$513	$5,648
43				$500	$10,000	$500	$1,000									$1,000	$11,000	$505	$5,559
44				$500	$10,000	$500	$1,000									$1,000	$11,000	$497	$5,471
45				$500	$10,000	$500	$1,000									$1,000	$11,000	$490	$5,385
46				$500	$10,000	$500	$1,000									$1,000	$11,000	$482	$5,300
47				$500	$10,000	$500	$1,000									$1,000	$11,000	$474	$5,217
48				$500	$10,000	$500	$1,000									$1,000	$11,000	$467	$5,134
49				$500	$10,000	$500	$1,000									$1,000	$11,000	$459	$5,054
50					$8,500					$80,000	$80,000			$1,200,000	$4,000,000	$1,280,000	$4,088,500	$578,795	$1,848,752
51				$500	$10,000											$500	$10,000	$223	$4,451
52				$500	$10,000	$500	$1,000									$1,000	$11,000	$438	$4,819
53				$500	$10,000											$500	$10,000	$216	$4,312
54				$500	$10,000	$500	$1,000									$1,000	$11,000	$424	$4,668
55				$500	$10,000											$500	$10,000	$209	$4,177
56				$500	$10,000	$500	$1,000									$1,000	$11,000	$411	$4,522
57				$500	$10,000											$500	$10,000	$202	$4,046
58				$500	$10,000	$500	$1,000									$1,000	$11,000	$398	$4,381
59				$500	$10,000											$500	$10,000	$196	$3,920
60				$500	$10,000	$500	$1,000									$1,000	$11,000	$386	$4,244
61				$500	$10,000											$500	$10,000	$190	$3,797
62				$500	$10,000	$500	$1,000									$1,000	$11,000	$374	$4,111
63				$500	$10,000											$500	$10,000	$184	$3,679
64				$500	$10,000	$500	$1,000									$1,000	$11,000	$362	$3,983
65				$500	$10,000											$500	$10,000	$178	$3,564
66				$500	$10,000	$500	$1,000									$1,000	$11,000	$351	$3,858
67				$500	$10,000											$500	$10,000	$173	$3,452
68				$500	$10,000	$500	$1,000									$1,000	$11,000	$340	$3,738
69				$500	$10,000											$500	$10,000	$167	$3,345
70					$8,500	$500	$1,000	$60,000	$230,000	$80,000	$80,000					$140,500	$319,500	$46,251	$105,175
71				$500	$10,000											$500	$10,000	$162	$3,240
72				$500	$10,000	$500	$1,000									$1,000	$11,000	$319	$3,508
73				$500	$10,000											$500	$10,000	$157	$3,139
74				$500	$10,000	$500	$1,000									$1,000	$11,000	$309	$3,398
75				$500	$10,000											$500	$10,000	$152	$3,041
																TOTALS		**$9,390,372**	**$8,839,615**

Notes:

1. Initial Construction Cost for the bridge estimate per feasibility study memo.

*MnDOT Office of Transportation System Management | Benefit-Cost Analysis Standard Value Tables - July 2016 | Table A.1

**

$PV = AC / (1 + r)^{(yi - yo)}$

Where:
PV = value in the year of analysis
AC = annual cost in the year of analysis dollars
r = the real discount rate
yi = the year in which the cost occurs
yo = the year of analysis (the year back to which the future dollars are discounted)

Assumptions:

Deck Flush and Seal: Opt. 1: 4 hrs ($38/hr)(2 staff) = $304 (Say **$500**) | Opt. 2: 16 hrs ($38/hr)(2 staff)=$1216 (Say **$1500**) Snow: **$8500**/year

Routine Inspection: Opt. 1: 2 hrs ($51*lead* +$37*assist* ./hr)=$176+$250*snooper* =$426 (Say **$500**) | Opt. 2: 8 hrs ($51*lead* +$37*assist* ./hr)=$704+$250*snooper* =$954 (Say **$1000**)

Spot Repairs (Assumes10% of deck requires repair):
Opt. 1: Remove and Patch Deck (Type A): 175 SF($26/SF)=$4550 Type B: 225 SF($38/SF)=$8550 Type C: 40 SF($100/SF)=$4000 Total=$17,100 (Say $20K)
Opt. 2: Remove and Patch Deck (Type A): 1,750 SF($26/SF)=$45.5K, Type B: 2250SF($38/SF)=$85.5K Type C: 400SF($100/SF)=$40.0K Total=$171K (Say $175K)
Total: Add 10%*mob* + 10%*misc* + 10%*risk* to options. Opt. 1 = **$25K** | Opt. 2 = **$230K**

Roadway Mill & Overlay (OL), 30 years: Opt. 1: $35K

Replace Expansion Joints: $750/LF(44.25')(2)=$66.4K + 10%mob + 10%risk = $79K (Say **$80K**) **Modular Joint:** $3000/LF (44.25') = $132.75K + 10%mob+10%risk = $159.3K (Say **$160K**) in Year 30 for 7 Span Bridge only

Bridge Deck Mill & Overlay: Opt. 1: **$100K** | Opt. 2: **$480K**

Roadway Reconst.: Opt. 1: $777.2K (**Say $800K**) Pavement Area: 21,600 sq ft - Match up with redeck in Year 50

Bridge Deck Replacement: Opt. 1: 4500 SF($82/SF)=$369K **(Say $400K)** | Opt. 2: 41,220 SF($82/SF)=$3.38M (**Say $4M**)

Inspection intervals increase from 2 years to annual 10 years prior to deck replacement

Appendix E: Drainage Technical Memorandum

Technical Memo

Project: TH 47/BNSF Grade Separation Feasibility Study
SP 0206-71
HDR No. 278053
To: Brandi Popenhagen, PE HDR
Scott Burfeind, PE HDR
From: Connor Fortune, EIT, Chris Erickson, EIT & Hugh Zeng, P.E. HZ United, LLC
Date: 08/31/2016
Subject: Hydraulics Analysis Summary

HZU has completed the requested preliminary drainage analysis for the TH 47 Grade Separation Feasibility Study. The primary purpose of the drainage analysis is to assist the greater study in the evaluation of grade separation design alternatives for TH 47 at the two BNSF mainline tracks in Anoka, MN.

Key Findings

HZU's hydraulic analysis recommends an overpass as the preferred design alternative. High groundwater and historic contamination in the area raised significant concerns about the constructability and costs associated with building an underpass. The overpass alternative avoids conflicts with groundwater and allows the design to maintain existing drainage patterns on the north side of the tracks. Both design alternatives propose a lined stormwater treatment pond in the current area of A1 Recycling south of the tracks, with a new outlet into Rum River to the east.

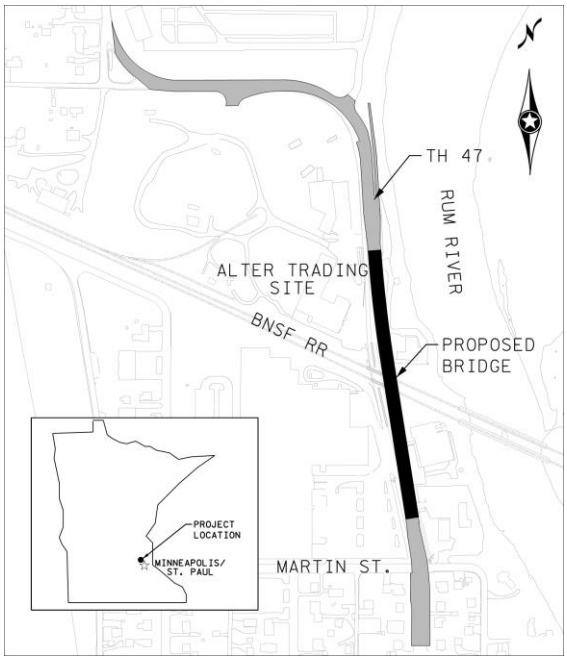


Figure 1: Project Location

Study Area and Project Background

There have been high crash rates and poor traffic performance at the TH 47 (Ferry St.) and the BNSF mainline railroad intersection and at nearby intersections. To improve safety and alleviate traffic congestion in this area, MnDOT has proposed the construction of an overpass or underpass on TH 47 at the BNSF tracks. The

aim of this memo is to provide feasibility analysis of the two design alternatives from a drainage perspective as well as lay out factors of hydraulic significance to the project. The study area extends from TH 10 from the south to the Bunker Lake Boulevard intersection to the north. The project is located in the City of Anoka, a municipality in Anoka County, MN (See figure 1).

Rum River

TH 47 (Ferry St.) runs along the Rum River, which is classified by the Minnesota DNR as a Recreational River and also a Minnesota Public Water. All design alternatives must mitigate impacts to the Rum river. In order to maintain the aesthetic nature of the river, it is recommended to furnish any constructed outlet to the Rum River with native seeding, shoreline protection and brick or colored concrete headwall. As a Minnesota Public Water, any work below the Ordinary High Water Level, found to be elevation 845.0, would require a DNR Public Waters permit. The project groundwater within the project area is at elevation 845.0. The 100-yr FEMA flood elevation for the Rum river was determined to be at elevation 850.0.

Contaminated Soil

The project study area contains heavy metal contamination within the soil northwest of the proposed bridge at the Alter Trading site. Although several remediation efforts have taken place resulting in the removal of over 71,000 tons of impacted soil, an investigation in 2009 and 2010 showed higher than allowable concentrations of Arsenic, Benzene, Chromium, and Vinyl Chloride in the site's groundwater. The resulting contamination plume (See figure 2) covers the north side of the project. This contamination directly affects the cost and feasibility of the drainage design options.

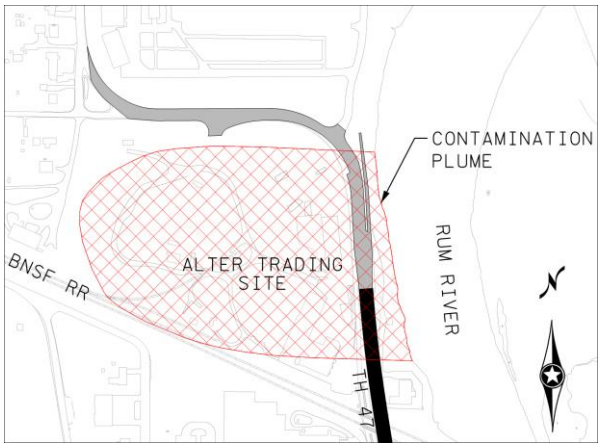


Figure 2: Contamination Limits

Existing Drainage Pattern

A 2009 drainage improvement project rebuilt the drainage system north of the railroad tracks. TH 47 and contributing area to the north of the Railroad tracks drains to a system which outlets directly to the Rum River. Runoff from Alter Trading is collected in a lined stormwater pond on the northeast corner of the property, where it connects to the system discussed above. This outlet is currently covered under a Municipal Stormwater (MS4) Permit. The preliminary drainage design concept is to replace-in-kind drainage systems north of the railroad and connect to this existing outlet.

Drainage on the south side of the railroad collects in a City of Anoka storm system and is directed west along Martin St. to a pond at the nearby Greenhaven Country Club. The City of Anoka Utility department has verbally expressed that there are no live storm sewer systems immediately south of the railroad tracks. For this reason the preliminary design objective south of the railroad is to create a new outlet to Rum River. The City of Anoka has expressed interest in utilizing a stormwater pond constructed in conjunction with this project in the future.

Stormwater Management

The project lies within the Lower Rum River Watershed Management Organization (LRRWMO). tracks Analysis indicates the following added impervious change for each alternative:

Table 1: Impervious Area Analysis

	Impervious Area (Acre)	Change (Acre)
Existing	4.93	
Overpass	4.81	-0.12
Underpass	4.39	-0.54

Although this analysis indicates a net reduction in impervious area, an alteration of the drainage patterns on the south side of the tracks will trigger LRRWMO permitting process and water quality rules thus a rate discharge and water quality BMP measures will be required in accordance with LRRWMO and Minnesota Pollution Control Agency (MPCA) rules. The soil type in the study area is predominantly loamy-sand (from USGS Soil Survey) which has a high infiltration rate (Hydraulic Soil Grade A), however due to local contamination it is necessary to use a lined settling basin as a BMP measure.

Underpass Alternative

The first design alternative analyzed was a divided two-lane underpass on TH 47 crossing the BNSF railroad, and a corresponding railroad bridge. The proposed drainage design for this alternative is to collect and drain the sag point runoff at the profile low point to an underground storage chamber which would be pumped through a force main to a surface stormwater treatment pond. An underground storage chamber would be used to reduce the required size of the pump. The pond would outlet, via an outlet control structure,

directly into the Rum River. The A1 Recycling lot (Southeast of the intersection) was located as a potential location for the stormwater pond.

Underpass Option 1

The first proposed option for the underpass design was to maintain the existing railroad grade. The underpass low point would be at elevation 845.0. See Exhibit 1 for the underpass drainage layout. There are several design challenges with this option, which are discussed below.

Challenges:

- A sag point at elevation 845.0 would require the underground storage and storm sewer systems to be built below ground water level (GWL at elevation 845.0).
- The contaminated groundwater would require steel casing for all stormwater pipes and a fully sealed underground storage chamber. This would be a major cost concern.
- The system would not be able to drain with gravity alone, and would require a lift station which must be watertight and consistently maintained into the future.
- Preliminary estimate for an 8 ft deep storage chamber requires 5.5 ft of backfill on top of the storage structure to counteract buoyancy forces, resulting in a minimum chamber bottom elevation of 830.0. This is 15 ft lower than Rum River.

Underpass Option 2

The second option proposes to raise BNSF railroad in order to accommodate an underpass low point of elevation 855.0. This would be done to limit the buoyancy forces of the groundwater on our storage structure and allow for a larger buffer between the contaminated groundwater and our drainage structures.

Challenges:

- Although the extra 10 ft would reduce contamination and constructability concerns, a portion of the storage chamber and lift station would still be constructed below the FEMA 100-year flood elevation of 850.0, which would still require waterproofing which would in turn affect cost.
- Due to the contaminated groundwater it is likely that the drainage pipes within the area will still need to be cased.
- The system would still require a lift station to move stormwater to a treatment pond.

The underpass design options raise serious concerns about constructability in an area with such significant historical contamination. Furthermore, the necessity of an underground storage chamber and a lift station would pose cost and maintenance concerns. A preliminary drainage cost for the underpass alternative was estimated to be $940,000.

Overpass Alternative

The second design alternative proposed is an overpass bridge taking the 2-lane roadway over the railroad. The preliminary drainage recommendation is to maintain existing drainage patterns by separating the drainage runoff north and south of the railroad. See Exhibit 2 for the overpass drainage layout. There were two design options considered for this option.

Overpass Option 1

The first overpass option considered is a retaining wall supported overpass with a 100 ft bridge over the railroad tracks. Option specific challenges are listed below.

Challenges:

- Storm sewer pipes within the retaining wall sections will need to be cased due to proximity to retaining walls.

Overpass Option 2

The second overpass option considered eliminated the retaining walls with a roughly 1,000 ft, 2-lane overpass bridge. Drainage analysis in Geopak Drainage indicates that no bridge drainage system is required and that the bridge contributing area can be collected at catch basins before the bridge approach panel.

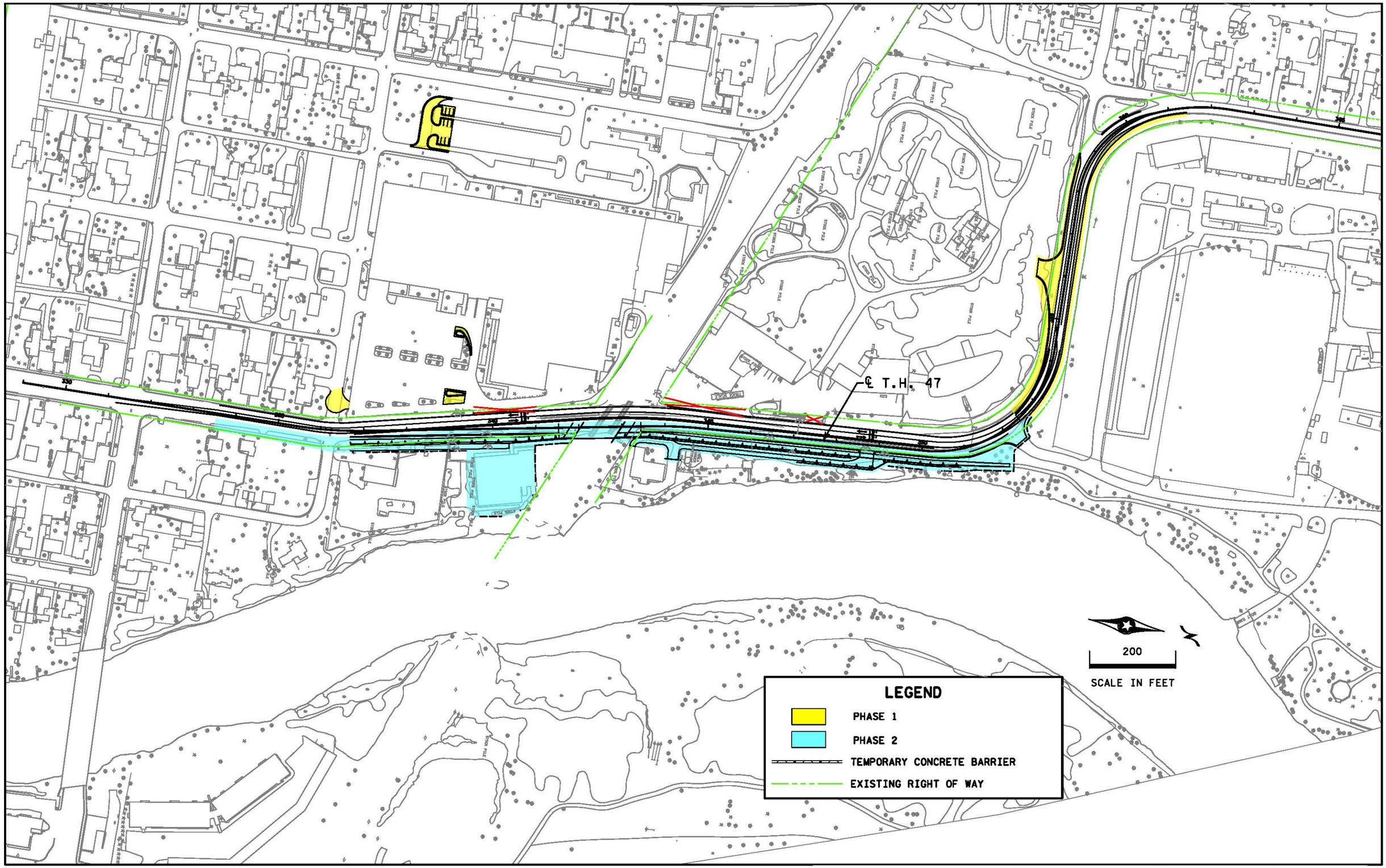
The northern half of the overpass will be drained to the existing system north of the railroad discussed earlier. The southern half of the overpass will be collected be captured and routed to a lined stormwater pond at the current site of A1 Recycling. The stormwater treatment pond will have an estimated depth of 6 ft and approximately 0.8 acre-ft of storage. A new outlet will be created from the stormwater pond to Rum River. This would provide for needed treatment requirements.

Overpass Challenges:

- The overpass and a new outlet will have an aesthetic impact on the Rum River.
- Stormwater pond will require a 6” clay liner to protect stormwater runoff from contaminated soils.

The overpass design alternative will allow for a gravity flow drainage system for the TH 47 area, straightforward capture and treatment of the water in a stormwater pond, and cost-effective drainage solutions. The maintenance requirements of this option will be significantly lower compared to the drainage systems required for the underpass alternative. A preliminary drainage cost for the retaining wall overpass was estimated at $590,000. A preliminary drainage cost for the 1,000 ft bridge option was estimated at $570,000.

Appendix F: Staging Concept



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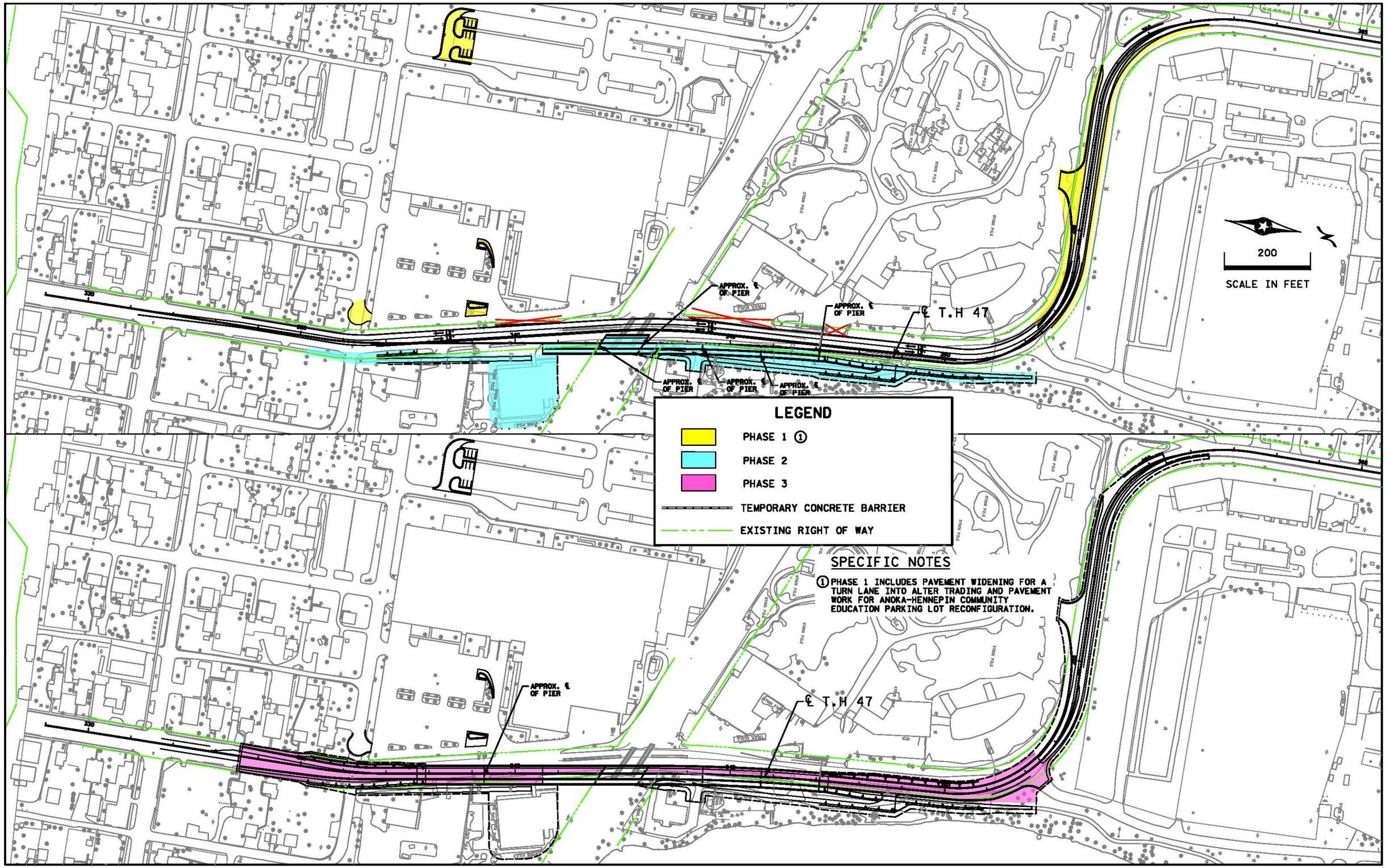
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LEGEND
PHASE 1 ①
PHASE 2
PHASE 3
TEMPORARY CONCRETE BARRIER
EXISTING RIGHT OF WAY
SPECIFIC NOTES
① PHASE 1 INCLUDES PAVEMENT WIDENING FOR A TURN LANE INTO ALTER TRADING AND PAVEMENT WORK FOR ANOKA-HENNEPIN COMMUNITY EDUCATION PARKING LOT RECONFIGURATION.
℄ T.H 47

Appendix G: Meeting Summaries

Meeting Minutes

Project:	TH 47/BNSF Grade Separation Feasibility Study
Subject:	Project Kick-Off Meeting
Date:	Wednesday, March 30, 2016
Location:	MnDOT Waters Edge RTMC 3rd Floor Touring Room

Attendees:

Brian Kary, MnDOT	Gayle Gedstad, MnDOT
Jim Weatherhead, MnDOT	Greg Lee, City of Anoka
Rick Dalton, MnDOT	Andrew Witter, Anoka County
Brigid Gombold, MnDOT	Brandi Popenhagen, HDR
Daniel Prather, MnDOT	Scott Burfeind, HDR
Kent Barnard, MnDOT	Emily Hyland, HDR
Brian Kelly, MnDOT	Richard Storm, HDR
Jim Henricksen, MDOT	Hugh Zeng, HZ United

	Topic
1	Project Welcome/Overview - Brian Kary welcomed everybody to start the meeting. Brian noted this is a high priority and if it is determined to be feasible then the next steps would be to develop preliminary designs. - Jim Weatherhead shared the background and history of the TH 47 grade crossing and identified some of the recognized issues. See item 2 for summary of issues.
2	Background of TH 47 Work to Date - Jim Weatherhead: The rail corridor includes high speed trains and a high volume of trains (60-80 daily freight trains, 2 Amtrak trains, and up to 14 Northstar trains). The location has had a total of five crashes; the last crash was in 2004 and resulted in 4 fatalities. BNSF near miss reports indicates up to two near misses annually. The location of the Anoka Station complicated the gate operations for westbound trains. Currently, the gates are down while the train is in the station. Therefore, the gates may be down up to 2 minutes before the train crosses TH 47. Prior, the gates may have gone up after the warning timed out. This led to vehicles getting caught between the two tracks while trains passed on both sides. Drivers have also driven around the gates when waiting. Problem can be that an EB train could cross at the same time. The corridor carries oil trains and there is a high population density and a river near the crossing. Difficult to move the track alignment because of the proximity to the Rum River. Also the crossing is a hump crossing which limits visibility. Prior problems with trespassing, especially with kids using the BNSF bridge for jumping into the Rum River. - Brian Kelly (MnDOT Water Resources): Rum River is a protected scenic river. The DNR will be concerned about maintaining water quality. Also, the area has poor drainage south of the rail; Martin Street intersection would pond during heavy rains. City shared they recently improved storm water drainage; directing storm water to the pond on the golf course (contact for more information is Ben Nelson at 763-576-2785). - Dan Prather (MnDOT Preliminary Bridge): Will want to know where utilities are located for placing the bridge structure. Will need to know if BNSF has plans to add a third track. Also, would like to know if BNSF will allow a pier between the tracks to minimize the structure depth. Also will need to determine if the soils along TH 47 can support the bridge or will piles have to be driven. - Andy Witter (Anoka Co Assistant Engineer): Anoka County receives many phone calls. The commissioners have a strong desire to remove the at-grade crossing. The County has some

history of grade separating crossing on this rail corridor and may be able to offer advice/assistance. Bunker Lake Blvd is a reliever to TH 10. So the County has an interest if this may address operational issues at TH 47 and Bunker Lake Blvd. There was a prior study completed 10 to 12 years ago that was a partnership between the County, City of Anoka, City of Ramsey and MnDOT. The study included looking at new corridors to cross the rail line. However, a new corridor would impact the neighborhoods and the City was not supportive. Suggested that coordination should include the Anoka County Fair Board and learn more about their special traffic control. If it helps, the County has a booth at the Fair. The project team could use the booth to share information with the public.

- Greg Lee (Anoka City Manager/Engineer): The Anoka City Council has identified this grade separation as a top priority. The City designated the area as a quiet zone in 2010. The City has two wells located at the old power plant. Currently not using the wells, but may need to in the future. The wells currently meet quality tests, but if the wells were turned on, it is uncertain if it may draw the contamination plum towards the wells and the Rum River (Wenck completed a prior study to locate the contamination plume). Three has been requests in the past for a traffic signal at McKinley Street. It has been mentioned that nearby streets would need to be converted to RI/RO or closed at TH 47. Could possibly test the scenario using barricades and a temporary signal.
- Rick Dalton (MnDOT Environmental): Would avoid buying right-of-way from a property that has contaminated soils. Any excavation or de-watering on the property would be expensive. The building at the well site has the potential to be historic. Fairground buildings could be historic and/or a 4(f) resource.
- Gayle Gedstad (MnDOT Traffic): A signal at McKinley is unlikely to meet warrants, but may be possible to address neighborhood issues, especially if nearby intersections are converted to RI/RO. Jim Abler (state Senator) has been a proponent to add a signal. Does anyone foresee a push to provide a 4-lane bridge over the rail? Some thought locals may question why MnDOT isn't building a four-lane bridge. Shared that on the Smith Avenue Bridge redecking, the bridge is being reconstructed with a separated bike path and that may be requested here too.
- Jim Henricksen (MnDOT Traffic Forecasting): Key is to use the new 2040 socio economic assumptions for travel demand modeling. There was a prior study on TH 10 a few years back. Used Airsage data for the TH 10 study, but also have INRIX data for the seven county area. Should be reviewed to determine how recommendation change conditions on Ferry Street. Will the corridor attract more trips once grade separated? Will need to review how well the model is calibrated for this area, the model may not have a penalty for the crossing. Will there be a benefit/cost analysis? There is a MnDOT project to widen the TH 10 bridge over the Rum River to provide deceleration lanes. Currently, the queues for the WB TH 47 off-ramp may extend to the mainline in the peak periods; vehicles have been reported to queue on the shoulder of TH 10. .
- Kent Barnard (MnDOT Communications): This has been a concern of the public for some time, so the project is likely a win-win for the residents. Will need to work with the businesses to communicate plans and impacts [e.g., it was shared that the recycling facility has a scale that trucks access directly from TH 47 and that grade separating may require the facility to move their scale.]
- Hugh Zeng (HZU/Drainage): The project is encroaching into the floodplain and the floodway. The project will need to find a place for storm water storage unless there is a regional facility. Andy shared there is a dam downstream at Anoka City Hall that may help. The pond on the recycling facility is lined and collects stormwater from TH 47 and then discharges to the Rum River.
- Other: It is unknown who owns the trail along TH 47. It may be owned by the City. MnDOT will require a limited use permit for any trail within the DOT's ROW.

3 Project Goals

- Brandi Popenhagen shared the project goals. Including that the current scope limits the study to a 2-lane grade separated option only. Will not be considering widening or alternative locations for the feasibility review. Study limits extend from the TH 10 WB ramp terminal to McKinley Street. Our traffic study area will continue to Bunker Lake Blvd because of the queues that develop in the afternoon.

4 Work Plan

- Scott Burfeind: Will want input into the cross-section [a possible over and under cross-section was shared]. It was suggested the cross-section of the bridge should best match the roadway leading up to the bridge. It will be important to provide shoulders for snow storage. A barrier separating the pedestrians/bicycles may also reduce vehicle speeds. Andy pointed out that ½ block to the south, TH 47 is a four-lane facility.
- Emily Hyland: Will be organizing a 2-hour workshop to develop a stakeholder engagement plan.
  - **ACTION ITEM:** Emily will use a doodle poll to schedule the workshop including Andy, Rick, Jim Weatherhead, BNSF, Kent and Brian Kary. May also engage school district (Keith Paulson is the school district's transportation director), DNR, County Fair Board, and Metro Transit.
- Richard Storm: Will be collecting traffic counts the following week. Count locations are highlighted on the attached map. There were no suggested changes to the count locations. Jim shared that it is important that no cameras are set-up on the railroad ROW.

5 Project Meetings

- Scheduled for 9:00 AM on the last Wednesday of the each month.
- Andy requested to include Doug Fisher on future correspondence.
- Jim will assist involving the RR as needed.
- Brian and Brandi will discuss involving MnDOT's bike/ped planners as needed.
- Next meeting will focus on traffic forecasting, existing conditions traffic modeling and initial grade-separation concepts.

Meeting Minutes

Project:	TH 47/BNSF Grade Separation Feasibility Study
Subject:	April Core Team Meeting
Date:	Wednesday, April 27, 2016
Location:	MnDOT Waters Edge Conference Room 403
Attendees:	Brian Kary, MnDOT Jim Weatherhead, MnDOT Paul Jung, MnDOT Brigid Gombold, MnDOT Carolyn Boben, MnDOT Daniel Prather, MnDOT Kent Barnard, MnDOT Kevin Schwartz, MnDOT Chad Casey, MnDOT Jim Henricksen, MDOT Gayle Gedstad, MnDOT Greg Lee, City of Anoka Brandi Popenhagen, HDR Scott Burfeind, HDR Emily Hyland, HDR Richard Storm, HDR Connor Fortune, HZ United

	Topic
1	Public and Stakeholder Engagement

- Emily provided an overview of the meeting notes from the Stakeholder Workshop.
  - Kent is working to getting a project website up and will be the media lead.
  - HDR will be working with Kent on the social media plan. The group spent much of their time on who needed to be engaged, what is the message, and how will they communicate to the audiences.
  - Four additional stakeholders were identified (4 property owners). The plan is to have one-on-one meetings with these four to discuss the issues of access.
  - Emily shared one of the big items from the meeting was if a bridge is to be built, will the project team say the plan is to build a 2-lane bridge with a possible for a 4-lane expansion. Brian is working within MnDOT to determine the message.
  - Brandi – When there is no construction coming soon, it is sometimes hard to get people to come to an open house, so HDR will be looking at how to effectively use social media.

- Emily provided an overview of the Draft Stakeholder Engagement Strategy.
  - Emily provided an overview of the communication schedule. One key item is a GoTo Meeting with elected officials to inform them of the project prior to an open house.

    ACTION ITEM: Greg will confirm best time with the City Council.

    ACTION ITEM: It was suggested to include Senator Abeler and Anoka County Commissioners. HDR will coordinate with MnDOT to send invitations.

    ACTION ITEM: Jim W. identified legislative affairs group to include in the GoTo Meeting. HDR will coordinate with MnDOT to send invitations.
  - Goal is to schedule the one-on-one in mid-May but after the open house because they may attend and have a one-on-one and address their questions.
- Brandi shared that at the open house, HDR would like to be very specific with explaining the purpose and need and that this study is focused on a specific location. Also share and

describe the concepts that are being considered.

- Emily shared an example project overview from Snelling Avenue study. HDR anticipates a similar overview for this project would be a good leave behind with elected officials.

  ACTION ITEM: HDR will prepare and circulate a draft before the next meeting.

- Greg Lee – If the under alternative is not feasible, would prefer to not show it, but instead say it was looked at it and clearly define the issues. It would be best to avoid getting into corridor discussions since that is a bigger issue.
- Jim – The Governor has hired a new Director of Rail. Jim will be making a point to meet with the Director to review this project.

2 Traffic Operations Analysis and Safety

- Richard provided an overview of the traffic and train volumes that were counted on April 5, 2016.
  - The AM peak hour was 7:00 AM to 8:00 AM, with one freight train crossing and two Northstar train crossings.
  - The PM peak hour was 4:30 PM to 5:30 PM, with 3 Northstar train crossings.
  - In the PM, the videos did not show a standing queue that reached from Bunker Lake Boulevard to the grade crossing.
  - Jim – Train volumes are typically lowest in the first quarter and peak in the third and fourth quarter. **Recommended** that two additional freight trains be added to each peak hour in the VISSIM model. The trains should be traveling the opposite direction of the predominant Northstar trains.

    ACTION ITEM: HDR to send email documenting the counted and proposed train volumes for MnDOT review and approval. Update the VISSIM model to reflect the approved train volumes.
- Richard provided an overview of the traffic forecasts developed using the regional travel demand model.
  - The travel demand model shows significant growth along Bunker Lake Boulevard and constrained growth along TH 47. The growth along Bunker Lake Boulevard will require more green time for east-west travel, which will likely result in substantial delay and queues even if with a grade separated.
  - Kevin asked if the travel demand model includes potential changes to TH 10, which may reduce the demand on Bunker Lake Boulevard. Jim shared it was unlikely the model include potential capacity improvements to TH 10, but the project is using the latest reviewed and approved model.
  - Richard shared that alternatives may be to add capacity at the TH 47 and Bunker Lake Boulevard intersection or to model the with and without grade separation in 2016. Brandi shared that HDR's **recommendation** is to model the grade separation in 2016 to avoid making the project about improvements to the TH 47 corridor. No one indicated a concern with the proposed change in VISSIM model scenarios.

    ACTION ITEM: HDR to document the change in an email to Brian for confirmation.
- Richard reviewed the safety analysis performed for the corridor.
  - The grade crossing has not had a collision since 2003. However, the BNSF near miss report indicates 1 to 2 near misses each year, MnDOT staff have witnessed near misses due to gate operations for the WB Northstar train, three separate analysis methods have rated the crossing as a top priority either in the region or within the state, and numerous rear end crashes have been identified in the area of the crossing.
  - The TH 47 corridor review identified several intersections with a crash rate above the critical crash rate and that the corridor segment crash rates is above the critical crash rate. The typical pattern is rear end, low severity, during the PM peak period; which

suggests congestion contributes to the crash frequency.

- Several lane departure and rear end curves were noted in the vicinity of the two horizontal curves north of the grade crossing. It was asked if the lane departure crashes could be drivers trying to avoid the back of queue.

  ACTION ITEM: HDR to review the time of day and direction of travel for lane departure crashes to determine if congestion may have contributed to the crashes instead of the tight horizontal radius.

3 Purpose and Need/Alternatives Evaluation

- Brandi explained the difference between the proposed Primary and Secondary needs. The current plan is to identify RR crossing safety as the only primary need with traffic delay related to the RR crossing, TH 47 corridor safety and pedestrian and bicycle accommodations as the secondary needs.
  - Kevin - A secondary need could be the train crossings create queues on TH 47 northbound, resulting in queues on the westbound off-ramp that back up onto the TH 10 mainline.
  - Jim – A secondary need could be access management along TH 47 to reduce some of the traffic turbulence near/adjacent to the grade crossing.
- Brandi provided an overview of the evaluation criteria and the process that will be used to give the evaluation criteria a weight. The proposed process will rate each alternative using a 1 o 5 scale. The scores are multiplied by the criteria weight and then summed to develop a Performance Score. The alternatives Value is determined by dividing the Performance Score by the Cost.
  - Several evaluation criteria were discussed to help Core Team members understand the intent of each.

    ACTION ITEM: HDR will develop and share a concise description of each evaluation alternative.
  - Bridgett – suggested Historical Property Impacts should be added.

    Dan – suggested including Ped/Bike Access should be added.

    ACTION ITEM: HDR to update the evaluation matrix to include the two new criteria and send to the group with a due date.

    ACTION ITEM: Core Team members complete the Performance Attribute Matrix and return to HDR by Friday, May 13th.
- Greg suggested talking to MPCA because they may say the under is a fatal flaw.

4 Concept Development

- Scott provided an overview of the cross-sections and alternatives (including two options for the under option…one keeps the rail line as-is and another raises the railroad grade 6 feet to keep the road profile above the ground water elevation.
  - Carolyn – shared that the contaminated area shown on the layout is likely Diesel Range Organics (DRO) groundwater and not contaminated soils. There is the possibility of contaminated soil south of the rail, but hasn't done an in-depth investigation.
  - Dan – The proposed existing with option to widen will not be cost effective. He offered several suggestions that may make expansion more economical in the future: (1) build a bridge wide enough to accommodate 4-lanes (52-feet wide) and if the road is expanded then put the trail on the outside of the bridge or (2) strategic design of the earth work and walls to accommodate future expansion.

    The group discussed the challenges of a 4-lane corridor, including that the TH 10/TH 47 interchange may be unable to accommodate the volume that a 4-lane cross-section would attract to the corridor. It was uncertain that MnDOT would widen

the corridor north of the railroad to a 4-lane cross section, and if any investments to accommodate a future 4-lane section is a justified investment.

- Greg – Shared that the City of Anoka is likely willing to accept the closure at Martin Street shown in the over alternative.

- Emily – Encouraged MnDOT to communicate with the home owners that may be impacted by the alternatives prior to an Open House.
- **ACTION ITEM:** Time did not permit a full discussion of both alternatives. Therefore, Scott will send a PDF of the alternatives to the core team for additional review and comment.

5 Upcoming Meetings

- GoTo Meeting with Elected Official – Date soon to be set
- BNSF Meeting – May 16, 2016
- May Core Team Meeting – May 25, 2016

Meeting Minutes

Project:	TH 47/BNSF Grade Separation Feasibility Study
Subject:	May Core Team Meeting
Date:	Wednesday, May 25, 2016
Location:	MnDOT Waters Edge Conference Room C
Attendees:	Brian Kary, MnDOT Jim Weatherhead, MnDOT Paul Jung, MnDOT Brigid Gombold, MnDOT Carolyn Boben, MnDOT Daniel Prather, MnDOT Chad Casey, MnDOT Jim Henricksen, MDOT Gayle Gedstad, MnDOT Greg Lee, City of Anoka Brandi Popenhagen, HDR Gina Beers, HDR Emily Hyland, HDR Richard Storm, HDR Connor Fortune, HZ United

	Topic
1	Concept Development - Gina and Brandi provided an overview of the each alternative's key aspects and impacts. o Carolyn – asked if the well is for drinking water, if the depth is known and if the well is open through aquifers. Greg shared that the City is going through a feasibility study to determine whether to reactivate the existing wells versus creating new wells. The feasibility included a test pumping and collection of other information, including that the well has casings and is not open to the aquifer. - General discussion of the Under alternative. o The alignment was shifted to the east as much as possible but still avoids impacting the well building. o The under option has a shorter footprint but requires railroad reconstruction and a temporary railroad river bridge. o Drainage Issues: Going under creates an isolated low point and HZU is looking at adding a storage chamber and a pump. Both under profiles involve putting in a pump and storage chamber, which increases cost. Underground storage has a buoyancy force concern that limits the size of the chamber and increases the depth of the construction. o Since access to A1 Recycling is severed, the location is shown as a total take. The parcel has the potential to be used as a pond site. - General discussion of the Over alternative. o The alignment was shifted to the east as much as possible but avoids impacting the well building. o At Martin Street, there would be a 6-feet vertical difference with TH 47. The drawings show closing Martin Street. There is the option to reconstruct Martin Street but this may impact the house in the SW quadrant. o The TH 47 access at the School District building is used by larger trucks that make deliveries. Closing the access require HDR to investigate how trucks will continue to make deliveries and circulate within the site. o Due to grade differences the current access to Alter Trading would be closed. The proposal is to provide new access from State Avenue. o Since access to A1 Recycling is severed, the location is shown as a total take. The

parcel has the potential to be used as a pond site.
  - Because the profile is so high, there is the possibility to add another span to the bridge on the south side of the crossing instead of using fill. This could potentially provide access to the school district building, a retention pond in the SE quadrant of the crossing, or provide parking for the school district.
  - Drainage issues are significantly less in this option. Factoring in placing a stormwater pond where A1 Recycling and Appliance Sales is located. On the north side, currently everything is outletting into the Rum River. Finding ROW on the north side for a pond would be helpful.
  - Jim – Shared that BNSF agreed to an 80-foot wide portal opening, even though the ROW is 125 feet. There may be the possibility to narrow the portal to 70 feet if necessary (for example, if it was known where a potential 3rd rail would be located).
  - Carolyn – Asked if the corridor was considered for a future 4-lane, would any of the properties need to be purchased for future need. Brandi – A prior study looked at the corridor and had no resolution on future plan. There is considerable cost and impacts to widen the road.

- Draft Cost Estimate
  - Over: The current estimate is approximately $16M. The embankment, walls, and bridge structure account for a majority of the cost.
  - Under: The current estimate is approximately $30M. Includes $7.7M for rail construction and $5.8M for new Rum River Bridge.
  - Dan – Asked if the rail construction cost includes temporary walls for the staging?
    - **ACTION ITEM:** HDR will review if the temporary wall was considered.
  - Jim – Asked if any consideration was given to the duration of the construction
    - For the Under option, TH 47 would close immediately and remained closed for 2 years. This would require a detour throughout construction.
    - For the Over option, TH 47 can likely remain open for much of the construction. At this point, it is estimated the TH 47 would be closed for one construction season.
  - Jim – Concerned that the rail costs might be low depending on how the construction plays out. There may be issues with bridge costs. There is the possibility that BNSF may cost share if constructed a new bridge that could accommodate a future 3rd rail.
  - Greg – Shared he was encouraged by the draft cost estimates. Similar cost to Hanson Blvd overpass but carrying higher volume.
    - Brandi – Reminded everyone that Hanson Blvd overpass is a 4-lane cross section and that constructing TH 47 for a 4-lane cross-section would increase the cost.
  - Jim – There is $100M in federal funding that is available.
  - Greg – With closing Martin Street, will need to accommodate the turning volumes for the school at Pleasant Street.
    - Topic was discussed during the traffic operations agenda item.
  - Carolyn – Have you looked at the cost of dewatering during construction?
    - **ACTION ITEM:** HDR will investigate the potential cost/impact.

2 Public and Stakeholder Engagement

- Emily provided an overview of the meeting with public officials.
  - At the meeting, there was considerable discussion about issues outside of the scope of the study area (fix the S-curves, place the overpass in the right spot for a future 4-lane, etc.). Several suggestions were made to re-align TH 47. The options shared during the meeting were either through the school district building, the fairgrounds, and/or Alter Trading. The City shared that extending the project was problematic because of the increased costs.
  - Brandi – It is evident that work needs to be done to have all groups on the same page. HDR will continue to remind stakeholders that the focus of this study is to determine if there is a feasible option at the existing location.

- **ACTION ITEM:** Meeting minutes will be drafted, reviewed and shared with all the attendees.

- Emily provided an overview of an overview handout prepared for the project.
  - Based on comments, HDR will narrow down the study area to avoid overlapping with buildings because people did not understand it was a general area graphic.
- Upcoming Meeting Planning
  - Looking at a series of 4 dates at the school building on either June 21/23 or June 28/30 for an open house.
    - Brian/Jim – 21st and 30th are best for their schedule.
    - Greg –Tuesday and Thursdays generally work well, but will coordinate with the Council.
  - Times proposed for the open house was from 5 PM to 7 PM. MnDOT and Greg thought the time should work well.
  - There is a minor cost to use the school district's building. MnDOT saw no problem with the cost.
  - **ACTION ITEM:** Kent was unable to attend the meeting, so Brian will confirm dates and times with him.
- Stakeholder Meetings
  - Prior to the open house, the project team will have meetings with key area businesses (Alter Trading, A1 Recycling and Appliance Sales, AA, school district).
  - **ACTION ITEM:** Emily will send a doodle pool for finding best time.

3 Traffic Operations Analysis and Safety

- Richard provided an overview of the traffic analysis approach, especially two key changes discussed and agreed to at the prior meeting.
  - Forecasts were prepared for the study area, which revealed significant growth on the Bunker Lake Boulevard corridor. With no planned improvements to TH 47 at the intersection, it was discussed and decided that the no build and build conditions will be evaluated using existing volumes. Using 2040 forecast volumes, benefits of the grade separation would have been masked by the need to add capacity on TH 47.
  - During the peak hours, two additional trains were added to better represent the higher train volumes during the fall.
  - To address Greg's question about turning volumes if Martin Street is closed, Richard explained that the counted volumes had an imbalance between Pleasant Street and McKinley Street and that a sink/source was added to represent the school district. In the build conditions, the volumes to the sink/source node were moved to Pleasant Street.
- Richard provided an overview of the traffic operations results.
  - AM Peak Hour: Moderate decrease in average intersection delay at Mckinley Street, Pleasant Street and TH 10 WB ramps. The average delay of 45 seconds at the crossing was removed. Travel speeds were found to increase by 5 to 9 mph.
  - PM Peak Hour: Substantial decrease in average intersection delay at Pleasant Street and TH 10 WB ramps, including substantial decrease in max queue length at both intersections. Moderate increase in average intersection delay and max queue at Bunker Lake Boulevard and McKinley Street. Average travel speed increased 1 to 3 mph. It was determined that removing the train crossing essentially benefits the intersections south of the crossing. But in the PM, the absence of train-related delay freely allows vehicles to reach the north portion of the corridor; resulting in greater delay and max queue lengths at Bunker Lake Blvd and McKinley St.
  - Brian/Jim W. – Asked if a signal or turn lane at McKinley would help the corridor. Brandi shared that there is a need to evaluate McKinley in the next phase with an ICE.
  - Jim H. – Asked if the analysis captured benefits to TH 10. Richard shared that other than the off-ramp, the TH 10 corridor was not modeled. The results do indicate shorter PM queues on the off-ramp.

- Greg – Shared he was encouraged by the results because it addresses safety and operations in the immediate vicinity.

4 Purpose and Need/Alternatives Evaluation

- Brandi provided an overview of the DRAFT statement and described how certain items were either identified as primary or secondary need.
- Jim confirmed that BNSF has stated that gate bounce has been fixed. If in the future there is still a potential for this to happen again, it may be appropriate to document as a primary need.
- Recommendation by group was to focus on the Texas Index for communicating with the public the safety assessment.
- **ACTION ITEM:** Check time of day for curve crashes.

5 Alternative Evaluation

- Brandi provided an overview of the performance attribute matrix and facilitated a discussion to finalize the matrix.
  - Because the current crossing provides pedestrian and bicycle connection as well as all alternatives, it was decided that the Pedestrian & Bicycle Connection would be removed.
  - In case the project has to go through a federal environmental process, it was decided to add Public Acceptance and Vehicle Traffic Operations as evaluation criteria.
  - Based on the voting for the performance matrix, the group discussed the criteria that were tied.
    - A/B – selected A
    - A/K – selected A
    - B/H – left as tie
    - B/J – left as tie
    - B/M – selected M
    - C/J – selected J
    - F/K – selected F
    - H/I – left as tie
    - I/M – left as time
    - J/M – selected J
    - K/M – selected M
    - L/M – left as tie
- Brandi provided an overview of the evaluation matrix, including the current scores assigned, and the results based on the draft cost estimate. The evaluation will need to be updated to reflect the changes discussed during the meeting and changes to the cost estimate.

Meeting Minutes

Project:	TH 47/BNSF Grade Separation Feasibility Study
Subject:	June Core Team Meeting
Date:	Wednesday, June 29, 2016
Location:	MnDOT Waters Edge Conference Room 176
Attendees:	Paul Jung, MnDOT Jim Weatherhead, MnDOT Sheila Kauppi, MnDOT Rick Dalton, MnDOT Carolyn Boben, MnDOT Kent Barnard, MnDOT Chad Casey, MnDOT Jim Henricksen, MDOT Greg Lee, City of Anoka Ben Nelson, City of Anoka Brandi Popenhagen, HDR Scott Burfeind, HDR Richard Storm, HDR Connor Fortune, HZ United

	Topic
1	Public and Stakeholder Engagement - **Open House:** Kent and Brandi provided an overview of the open house. o Project team members included Brian Kary, Kent Barnard, Greg Lee, Brandi Popenhagen and Scott Burfeind. o The public open house was a very well attended event; including Senator Abeler and Representative Whelan. The Facebook push had extensive outreach, seemed to increase the participation, and was a very reasonable cost. Kent shared that MnDOT will be looking into using again for other public open houses. o People generally bought into the project, but would like to see the project expanded. o Common questions and comments heard at the open house: ▪ Many questions centered on why the project wasn't converting the corridor to a 4-lane road. When the scope of the current feasibility study, as well as the problems encountered by previous corridor studies, people seemed to understand. ▪ Rep Whelan had many questions about why the project wasn't fixing the curve. The same question was raised by other participants. ▪ One resident raised a concern that the NBL arrow at Pleasant Street was disabled and it was difficult to turn left into her neighborhood. ▪ Several participants expressed concern about the roller coaster feel with the bridge over and the curves at the north end and wanted to know if it will be safe. ▪ Several participants expressed concern about trucks turning into Alter Trading currently have a bypass lane but saw no left-turn lane proposed at the relocated access. ▪ Many participants expressed a desire for a traffic signal at McKinley Street, but don't want the accesses north of McKinley Street closed. Greg clarified that many are OK with RI/RO. Brandi shared that RI/RO compliance without a center median will be challenging. Brandi noted that many of these concerns are not expressly covered in the cost estimates. However, risk has been added to the cost estimates to account for these and other similar items. o Greg –People had troubles visualizing the overpass, but he found it effective to use

Armstrong Boulevard overpass as an example. Many wanted to know the detour and how long will the crossing be closed. He heard concerns with turning left at Pleasant Street if Martin Street were closed. Residents seemed to understand the advantages of the Over alternative.
    - The family of one of the teens killed in a crash at the crossing attended the open house and offered to help if ever needed.
    - Boards presented at the open house are online.
    - **ACTION ITEM:** Working on a detailed synopsis of the meeting with comments.
    - **ACTION ITEM:** Kent will condense the meeting synopsis to content suitable for the project website.
    - Greg – For the feasibility report, he recommended it address how the project would address a future expansion.
- Meeting with School District (SD)
    - Much of the conversation focused on the delivery truck access and circulation. Also, the SD has insufficient parking so don't want to lose any parking to accommodate truck deliveries.
        - HDR is working to develop an option to accommodate deliveries and parking on the current property.
    - The SD would like to use the property across TH 47, but that was not promised.
        - Scott – regarding the property across from the School District, the current identified need is as an area for treatment of water. Need to have a consistent message with parties on the current intent of the property.
- Meeting with Alter Trading
    - The TH 47 access is the "front door" to the business and the lot is set-up for circulation off of TH 47.
    - Carolyn – Moving buildings could result in significant environmental costs. Brandi – we have increased the cost and added risk to make the site total $2M

2 Concept Development

- Scott described some of the key changes to the Current Concepts
    - After correcting the aerial images, identified there was insufficient room to bring the well access road up to the Rum River South County Park access road. Instead created an elevated driveway.
    - The design does not change the circulation at the well building. The access accommodates a SU-40 from either direction and a WB-50 can access the site from the north. Scott asked Greg what would be the largest vehicle. Greg – Likely a 2-ton truck. Changes to the wall/access had marginal impact on the cost.
    - A right turn lane was added for the Rum River South County Park/Fairgrounds.
    - Feedback at the public open house identified a need for a left-turn lane to access State Street/Garfield Street (100 foot long). The current proposed design is large enough to accommodate two WB-67 trucks meeting at the same time. Included $500K of risk to account for the expansion.
    - At the School District site, considering a center drive aisle to accommodate trucks. The team is identifying possible sites to replace parking that would be lost due to the change.
        - **ACTON ITEM:** At the next meeting, HDR will provide a revised concept for the school district site.
    - House in SW quad at Martin Street would require a strip taking. Would be looking at a 3-foot wall plus 2.8 feet barrier (nearly 6 feet) across from their house. A risk has been added to the cost for potential total take of this property.
    - Connor – Discussed that the pond site needed for treating water south of the railroad is about 100-ft x 100-ft for normal water level with a 25-ft buffer, giving a total area of approximately 150-ft x 150-ft. Brandi – the next drawings will include pond location and sewer. The plan is to make use of a Martin Street outlet that is not currently in use. City of Anoka – If the outfall is moved for the MnDOT pond, could the neighborhood

drain to the pond when it is redeveloped.
    - **ACTON ITEM:** Connor Fortune will talk with MnDOT drainage to determine if MnDOT would allow shared use of the pond if the City needed to use the pond because properties were improved.
  - Alter Trading said they must have a privacy fence because of their operations. Would MnDOT place a fence to the bridge that would act as a screen? Chad – The request seems reasonable but the idea would need to be discussed with ROW.

- Cost Estimate
  - Costs have increased since the open house, mainly due to the risks that have been added to account for the issues that arose at the open house (possible construction at Bunker Lake Boulevard, McKinley Street, State Street) and ROW costs for Alter Trading.
  - Scott provided an overview of the risks included in the cost analysis.
    - Rick – Asked if altering the view of the well building by raising the grade and constructing walls could result in damage and increase cost. No participant thought this might be a risk that needs to be accounted for in the cost estimate.
    - Carolyn – Shared that older water and sewer lines can include regulated materials that can increase cost.
  - Scott shared that the cost estimates assume a 2018 construction season but it may move to 2019 or 2020. The estimate already includes a 14% inflation for the 2 years, which is aggressive and might be sufficient for a 2020 construction season.
  - Jim W shared that based on past experience, going under the railroad there is a huge risk that accommodating the train operations could impact the length of the construction.
    - **ACTION ITEM:** HDR to have a meeting with Jim W. to discuss the risk level assigned for the railroad construction costs.

- Constructability
  - The Anoka County Fair Board mentioned that if a project is let in June, it would impact two years of the County Fair. Brandi mentioned that it may be possible for some activities to be started in late summer and completed in the fall to minimize impacts to the Anoka County Fair.
  - **ACTION ITEM:** HDR will develop a high level construction concept that will be presented at the next meeting. Goals for the concept are to maintain TH 47 open as long as possible.

3 Traffic Operations Analysis and Safety

- Richard provided an overview of the traffic operations and safety tech memo. Some of the key items discussed:
  - The Tech Memo summarizes previous results and discussions from past team meetings.
  - Based on input from the public open house, items investigated include:
    - NB left at Pleasant Street: Traffic from Martin Street sink/source node was reassigned to Pleasant Street. The NB left was evaluated and the intersection was found to have acceptable performance (based on 2016 volumes) after the crossing is grade separated.
    - The crashes at the curve at State Street were evaluated. Many of the ROR crashes occurred between Midnight and 3:00 AM. Rear end crashes were observed to be NB and during the afternoon peak. However, it wasn't clear if the crashes involved turning vehicle or back of queue.
  - Traffic recommendations for the next phase are to (1) count the Martin Street intersection and re-evaluate the Pleasant Street signal to determine if the intersection has capacity and (2) complete an ICE for McKinley Street (including Bunker Lake Boulevard).
  - Safety recommendations for the next phase are to (1) include a northbound left-turn lane to accommodate trucks turning at State Street and (2) review officer narrative to

identify if northbound rear end crashes in the afternoon are related to vehicles turning at State Street or involve the back of queue from Bunker Lake Boulevard and/or McKinley Street.
    - **ACTION ITEM:** Send comments on the Traffic Operations and Safety Tech Memo to Paul Jung by July 13, 2016.

4 Alternatives Analysis

- Brandi provided an overview of the Alternatives Analysis Tech Memo. Some of the key items discussed:
    - Eliminated Evaluation Criteria:
        - At the May meeting, it was decided to remove Pedestrian and Bicycle Accommodations because the current crossing and all proposed alternatives provide accommodations for ped/bikes to cross the tracks; therefore, the criteria does not distinguish between the existing and the alternatives.
        - Based on the results of the paired comparison, Well Impact and Visual Impact were removed because the criteria simply received a point for being on the list. Having additional criteria was diluting the weights of the other evaluation criteria.
    - Added Evaluation Criteria
        - HDR added two criteria (Public Controversy and Vehicle Delay due to Train Crossings). These criteria were added to help if the project was to receive federal funding and required a full evaluation that looked at other alternatives, such as do nothing, an enhanced at-grade or on a new alignment. HDR completed the paired comparison for the two new evaluation criteria.
- **ACTION ITEM:** It is important that team members review the eliminated evaluation criteria (footnote on page 2) and the results of the paired comparison for the two added criteria (Figure 1). Team members also need to review the evaluation scores given to the alternatives (Table 4). Comments or suggestions on the approach and/or results should be sent to Paul Jung by July 13, 2016.
- **ACTION ITEM:** Send comments on the Alternatives Analysis Tech Memo to Paul Jung by July 13, 2016.

5 Purpose and Need Statement

- Brandi shared that the final version was emailed to the Project Core Team. The revised statement focuses on the big issues. Any final comments should be sent to Paul in the next two weeks.
- **ACTION ITEM:** Send final comments on the Purpose and Need Statement to Paul Jung by July 13, 2016.

Meeting Summary

Project:	TH 47/BNSF Grade Separation Feasibility Study
Subject:	July Core Team Meeting
Date:	Wednesday, July 27, 2016
Location:	MnDOT Waters Edge
Attendees:	Paul Jung, MnDOT Jim Weatherhead, MnDOT Brigid Gombold, MnDOT Brian Kelly, MnDOT Gayle Gedstad, MnDOT Jim Henricksen, MnDOT Mark Anderson, City of Anoka Ben Nelson, City of Anoka Brandi Popenhagen, HDR Scott Burfeind, HDR Connor Fortune, HZ United

1. Introductions – since new members joined the meeting, everyone introduced themselves.
2. MnDOT updates
   - An internal MnDOT meeting is scheduled for August 2nd between top management from Metro District and the Office of Freight to make a go/no go decision on whether to proceed into the next phase of preliminary design. Metro District wants to be comfortable with moving forward considering the lack of funding they have to put towards this project. They want reassurance that the funding would come from elsewhere, like rail safety from the state legislature. Jim indicated that three funding streams are being considered. Primarily the idea is to approach the legislature for the funding dedicate to crude oil routes. It is a hot topic right now so it's important to stay on top of it. Jim said if the funding isn't available, worst case would be to have a project that is shovel ready and picked up at a later date. However, persistence is needed now with the legislature.
   - A question was asked if MnDOT is looking into state bonds? Jim indicated that it is preferred that it comes from the general fund. A question was asked if MnDOT is seeking state appropriated money vs federal like Tiger funds? Jim stated that realistically it could be some combination. The Rail Office really wants to see this happen and feels there is a strong case and it could happen, federal funds could be easier to capture since $100 million in FRA funding exists. MnDOT could also request BNSF to provide relief during construction (i.e.; contractor flagging, inspectors, etc.) which could mitigate some project costs.
   - Brigid indicated that if a potential for federal funding exists, MnDOT may want to talk with FHWA and give them a heads up. MnDOT wants to make sure the scope is clearly defined with them and determine whether more alternatives may need to be vetted out. We also need to strongly communicate with the locals regarding the purpose and need for this project.
3. Preferred Concept Development – the committee reviewed design revisions and further investigations related to the preferred concept (over alternative)
   - School Circulation – based on conversations with the school district, HDR developed designs to revise circulation so that delivery trucks could exit the site with the proposed new access location onto Martin St.
     - The design considers how a WB 62 design vehicle can navigate the parking lot to enter and exit the loading docks in the southeast quadrant of the building. The design shows new circulation within their site which would impact nine existing parking stalls. The lost stalls would be mitigated by adding nine stalls into the back parking lot where lawn currently exists.

- The City indicated that they would want a cul-de-sac at the end of Martin St. near TH 47 since the roadway will be terminated without direct access onto TH 47. This cul-de-sac would likely be located on the residential lot property located in the southwest quadrant of TH 47/Martin St. HDR included costs associated with the potential relocation of this residence in the risk category so it is accounted for in the current estimate. HDR will design the cul-de-sac and determine whether this cost will likely be realized.
- The design is not changing the way circulation works with the northern loading docks so we are not showing mitigation in that area.
- The north loading docks currently utilize MnDOT ROW to avoid impacting the existing parking stalls. **Action MnDOT:** will discuss this practice with the ROW group to see if that practice will still be allowed once that access is closed.
- The school officials did indicate the desire to use land on the east side of TH 47 for parking. This will be discussed further below.
- The City has looked at redeveloping the area near Front St. and potentially extending it north on the east side of TH 47. The developable area is substantially constrained due to setback requirements along the Rum River.

- <u>Proposed Pond</u>
  - The design includes a proposed pond located within the A1 Recycling property (assumed a total take). It is primarily used for rate control and sized for 0.8 acre ft with a six foot normal water level.
    - It will outlet directly to the east into the Rum River. HZU coordinated with Peter Leete, MnDOT. He believes that it will be accepted by the DNR but will need to think about how we design it to be aesthetically pleasing (i.e. plantings).
    - It is desirable to use the land located within the A1 Recycling property for a project pond. The city asked if the proposed pond could also accommodate city's stormwater runoff? It is possible, but the design team will need to know how much area it needs to accommodate and then determine whether it can be designed to accommodate the expanded area. The city indicated they are looking at the area north of Pleasant St and east of TH 47.
    - **Action HZU:** HZU will look at how to accommodate the city stormwater runoff.
    - The existing Rum River storm outlet at Martin is not going to be used since it is in very poor condition. The city indicated they tried to jet-rod it out but were not successful.
    - HZU indicated that the pond will have to be lined – soils in the area are poor (contaminated) and all pipes below existing ground will need to be cased which increases costs.
    - The city indicated that the school district was a clean up site (contaminated soils). Monitoring wells exist but they believe it has been closed as an active site.
- <u>Alter Access</u>
  - HDR looked into a mid-block access to Alter with a left turn lane (east-west section between TH 47 curves). The 66 foot R/W is a challenge for widening in this area.
    - The proposed design could include guard rail which would minimize the need to buy R/W. Guard rail typically isn't desired due to ongoing maintenance requirements.
    - Instead of guard rail, the ditches could be replaced with redesigned ditches to the north but it would require a strip taking of the fairgrounds property.

- The proposed roadway construction extends into the west curve which doesn't meet 30 mph in its existing condition. Maintaining the radius would require a design exception.
- The proposed design includes curb and gutter on the south side of the roadway.
- Any proposed storm sewer in the area will need to be cased which substantially increases the cost ($300,000 vs $100,000).
- **Action HDR:** send a copy to Gayle to evaluate the access point to Alter
- The proposed design allows access into Alter in two locations (mid-way between the curves and from Garfield.

o Bridges/Walls

o The proposed design currently has extremely tall walls – 30 to 32 feet at their highest near the RR crossing. The design team is considering replacing walls with bridges to develop a more cost effective design. They compared a single span bridge with tall walls to a multi-span bridge with shorter walls.

- *Single Span Option*
  - Requires very tall abutments
  - The tall walls would require a special design including piles since spread footings would be too large. This would result in pile driving near the well house. Vibration monitoring during driving operation would be needed to avoid impacting the well house which is old (built in 1889). The City indicated that the local historical society would like to preserve the building's historic integrity and/or restore it. Pile driving near this building is a project risk.
  - The design team indicated that toe of the wall would need to be about six feet long which gets you even closer to the well building
  - Another option is to construct MSE walls. MnDOT may not be in favor of this alternative since generally the length of the tie backs are 2/3 the wall height. If you are 30 feet high, the tie back would be 20 feet which past the centerline of the road. This would result in having to tie the MSE walls together on both sides. We don't know if MnDOT has done this before. Another issue is that BNSF would not likely allow MSE walls within their R/W. HDR indicated that we would have to do extended wing walls to get outside the R/W. If future expansion occurs, MSE walls are built from the bottom up and it may limit the ability to expand west without impacting the proposed east wall.
  - High walls tend to be visually intrusive.
- *Multi-Span Option*
  - Assumes the same structure over the RR as the single span option
  - Assumes 136 ft spans after the RR bridge
  - Unit bridge costs are about $123 per square foot vs $369 per square foot for the single span option. This is due to the savings related to economy of scale.
  - The multi-span option assumes a three column piers supported by piles.
  - Assumed pre-cast walls (vs MSE due to issues identified earlier) in the single option. They are substantially more expensive per ft of typical section construction then building the multi-span bridge. The multi-span option saves approximately $2 million.

- Drainage is still somewhat of a question and will need to have it on the bridge. Connor assumed it would be carried along the bridge until the bridge ends.
    a. MnDOT indicated that downspouts along the piers are preferred with storm sewer underneath the bridge. Connor indicated that the storm sewer would need to be cased which will increase costs.
- The long term maintenance costs of a multi-span bridge vs high retaining walls is higher which is less desirable.
- It would likely take longer to construct the multi-span bridge or consider building half at a time
- People discussed the idea of using the space under the bridge, potentially providing access from the well driveway to Alter and/or providing parking for the school.

4. <u>Constructability</u>
    - A full closure is needed to build the proposed grade separation, however it could be built in phases to minimize the duration of a full closure. The alignment is placed so that 2-12 foot lanes, plus a buffer can be maintained to build the entire east side including utilities. HDR asked if water/sewer is north of Martin – City indicated the watermain terminates at Martin and goes under the school building then under the tracks then east to the wells. They indicated a desire to move the system under this project and their consultant is currently looking into it. The gas lines are located on the west side.
    - Jim asked if the RR signal would need to be moved during this phase? The design team indicated it would.
        - Jim indicated that the existing quiet zone would not likely be in effect during this phase which could be an issue with the public. The phasing of the project would need to be coordinated with RR work (i.e., signal relocation).
        - This is a potential risk with getting the RR to do their work exactly when we need them to. We would need to give them the schedule early (like Nov before work start).
        - Deb also indicated that the RR will want to review preliminary and final bridge plans – it takes typically 30 days.
    - Construction of the east wall would be about a 60-day duration. Then the roadway would be shut down to build the west side for a duration of 90 days to construct plus 60 days to finalize all details. The total closure is estimated at 150 calendar days, about five months or a construction season. We would want to strategically let it to accomplish one season of closure. Seven to eight months of total construction duration is estimated. TH 47 would be fully closed for all the construction activities if an MSE wall system is proposed though.
5. Total Project Costs – still about $20 million
6. Environmental – The Rum River has wild and scenic regulations. There is a potential that bridges/walls could result in a visual impact. This will require coordination with the DNR and potentially the National Park Service. There will need to be a DNR permit to construct the proposed storm sewer outlet.
7. **Action HDR:** Let Jim know what we've spent in Phase I to see what can be used towards Phase II.

DEPARTMENT OF TRANSPORTATION

Meeting Summary

Project:	TH 47 BNSF Grade-Separation Feasibility Study
Subject:	August Core Team Meeting
Date:	Wednesday, August 31, 2016
Location:	MnDOT Waters Edge 1500 W. County Rd B-2, Roseville, MN
Attendees:	Mark Anderson, City of Anoka Ben Nelson, City of Anoka Paul Jung, MnDOT Jim Weatherhead, MnDOT Brandi Popenhagen, HDR Scott Burfeind, HDR Connor Fortune, HZU

	Topic
1	**Anoka Today ALANO Meeting**: MnDOT met with Board members who represent the ALANO treatment center located on the east side of Hwy 47. Brandi explained that the main concerns from the Board members was the ability to use their parking facility during the County Fair. They sell parking spaces during the event and it serves as a significant income/fundraiser for their treatment center. They requested that the design better accommodate how users travel by foot from their facility to the proposed trail. They suggested having access to it from Martin St instead of having to walk down to Pleasant St. We indicated that we would look into it.
2	**Concept Development:** Scott presented the updated concept with the multi-span bridge. • The proposed cul-de-sac at Martin St. west of Hwy 47 fits within the existing right of way. It was discussed that the wall in front of the home in the southwest quadrant of this intersection is six feet and although it is within right of way it is fairly close the house. The sidewalk would move closer to the house than where it exists today. Although it isn't identified as a full take it has been included in the costs in the risk category. • Martin St east of Hwy 47 could be designed as a right-in/right-out and provide better access to the proposed trail for this side of the highway. • Currently the design identifies storm sewer in front of the fairgrounds but the ditch could be rebuilt although it would require right of way. • The intersection of State/Garfield St and Hwy 47 is now being shown as is. It was decided to not change the configuration of this intersection since the current design better accommodates the trucks coming in and out of the Alter Trading site. • The updated cost estimate is $18.7 million which includes right of way, risk, engineering and project management. • The bridge office is still commenting on the multi-span bridge so it is not a certainty at this point.
3	**Construction Staging:** The current design assumes estimates 155 working days based on MnDOT production rates to build the bridge. The bridge is the critical path for construction. Two scenarios for letting dates are being considered. • September letting – Phase 1 – widen and close accesses and build railroad improvements needed for staging. Phase 2 – maintain two lanes of traffic during full shut down of construction operations from Dec to Feb. Build piers/columns and move subsurface utilities. Phase 3 – full closure of TH 47 from Feb to August with no access in the area. Open up by late fall early winter. Shut down during fair. • July letting – Phase 1 start construction in August would result in a closure of TH 47 during winter but could finish by July of the following year. The drawback is this scenario would have the road closed during winter with no construction activity. Since the fair is late July

this has the potential to not impact the fair. However, it is cutting it close and there is no guarantee the contractor will be able to finish on time especially if there is a wet season.
- The group generally preferred the September letting option.
- The group discussed the possibility of providing a shuttle during the fair.
- The city indicated that MnDOT has a standard detour for this route that they have used in the past.

4 **Drainage Technical Memorandum** – The contents of this memorandum was briefly discussed. The key design components include a lined treatment pond in the southeast quadrant of the railroad crossing with a new outlet to the river. Water north of the crossing will use either a cased storm sewer system or existing drainage ditches which outlet into the river near the County Park. Brandi asked that the memorandum be updated with a summary of findings at the beginning. **Action:** HZU will update the memorandum and distribute it to Brian Kelly for his review.

5 **Feasibility Study** – Brandi presented highlighted areas of the feasibility study. She pointed out key sections where key issues to be addressed in the next phase are identified
- Jim Hendrickson requested the study highlight the forecast that were developed but not used for the study and why.
- The construction section should be updated with the letting date scenario described at this meeting.
- The drainage section should be updated with a summary of findings.
- Others will review and provide their comments within two weeks.

6 **Next Steps:**
- The group was told that the next meeting would likely be postponed until the next phase begins. MnDOT has decided to go into the next phase which is Preliminary Design.
- The next phase should also include the development of a contractor style schedule with contractor estimates to nail down construction durations and costs.
- There was a question whether the next phase would look into bridge aesthetics. Paul Jung indicated he would look into who would do that.

DEPARTMENT OF TRANSPORTATION

Meeting Minutes

Project:	**MnDOT Railroad Separation at Highway 47 (Ferry St.) Feasibility Study**
Subject:	Local Officials Meeting
Date:	**Tuesday, May 17, 2016**
Location:	Anoka City Hall
Attendees:	Matt Look, Anoka County Commissioner Doug Fischer, Anoka County Engineer Jeff Weaver, City of Anoka Council Carolyn Braun, City of Anoka Planner Steve Anderson, Anoka Hennepin Schools Greg Lee, City of Anoka Engineer/City Manager Carl Anderson, City of Anoka Council Amy McBeth, BNSF Brian Kary, MnDOT Paul Jung, MnDOT Jim Weatherhead, MnDOT Kent Barnard, MnDOT Sheila Kauppi , MnDOT Brandi Popenhagen, HDR Emily Hyland, HDR

Project Overview

- Brian Kary provided an overview of the Feasibility Study:
  - The general study limits focus on the railroad crossing from south of the Anoka County fair grounds to Pleasant St.
  - MnDOT is not looking at a relocation of Ferry St. (Highway 47) rather focusing on separation at the grade crossing
  - The goal of this project is to identify feasible options at the grade separation
  - MnDOT is reviewing two options: Ferry St. (Highway 47) over or under the railroad
  - MnDOT is looking at maintaining 2-lanes at the railroad separation with the ability to expand to 4-lanes in the future if desired
  - Brian walked through the project schedule including outreach
  - Jim Weatherhead discussed safety issues at the crossing.
    - The Ferry St. and railroad crossing is ranked as one of the most dangerous crossings in Minnesota due to the mix of trains and the general volume of traffic (Average of 45 – 80 trains per day with about 20,000 cars per day).
    - Safety concerns were brought up by the public (getting stuck between tracks)
  - MnDOT is looking to identify a feasible option in order to secure funding

Open Discussion - Comments/Questions

  - Commissioner Look asked about the current cost estimate?
    - A cost estimate is currently under development and working toward having something next week
    - MnDOT indicated that this is a very complicated site including:
      - the need to maintain railroad operations
      - Tight, 66 foot right-of-way
      - Contaminated soils in the area
      - Rum River
      - Driveway accesses directly onto Highway 47
  - Someone asked if you can change the grade of the railroad?

        - Changing the grade requires reconstructing a substantial amount of tracks, increasing costs and we need to maintain railroad operations during the project construction.
- Councilman Weaver asked if this is one of the worst rail grade crossings in MN, why don't we hear about it?
    - It is according to a specific ranking, Texas Priority Index, which has become the more accepted measure than what was used in the past.
    - The crossing has more challenges related to how it is fixed than many, so the focus moved to other crossings
    - MnDOT has studied lower cost improvements and has been working with BNSF to incorporate them. The challenge is the mix of train traffic and its proximity to the Anoka Station
    - There was a tragic accident in 2003, but haven't had any recently
- MnDOT indicated that from what they've seen – going over the railroad tracks seems to be the best option
- MnDOT recognizes there are problems on Hwy 47 beyond the grade separation.
    - MnDOT has identified funding options to cover the costs of the railroad separation instead of a larger Hwy 47 fix
    - The Feasibility Study is focused on the railroad crossing
    - MnDOT is looking at what can be done at the existing railroad crossing in its current location
- The County asked if MnDOT is looking at building four-lanes and relocating the crossing to a location that would have less impacts for future widening to a four-lane.
    - MnDOT is looking at a two-lane bridge that could be expanded to a four-lane bridge in the future.
    - Funding for this study is from grade crossing safety funds dedicated as part of the State's Crude Oil Study and tied to the railroad separation. If MnDOT expands the project scope, funding would no longer be eligible for this project.
    - There are no plans for other improvements on Hwy 47, funding is limited and there are other higher priority projects in the area including Highway 10.
    - The County felt that improvements at the crossing should be consistent with long term needs on Hwy 47.
- Council member Anderson asked if MnDOT plans to flatten the curves just north of the crossing.
    - The curves at this location are consistent with the roadway low speed design and the safety analysis did not indicate that they would need to be flattened, although the intersection at Garfield may be looked into.
    - The focus is safety at the grade crossing.
- Commissioner Look indicated the project timeframe should be as soon as possible
    - CTIB funding may be available for up to 30% of the project since the project involves Northstar Commuter Rail
    - Dollars may become scarce soon with other projects like SWLRT in the near future
- Does BNSF plan to upgrade this track?
    - MnDOT had a meeting with BNSF on 5/16 and they do not have anything in their Capital Improvement Plans to expand in the next 5 years
    - If BNSF did expand it would go south of the existing tracks.
    - The bridge would be designed with an 80 foot portal to accommodate a future third rail in the future.

- Steve Anderson with Anoka Hennepin School District raised concerns about truck circulation within their property due to loss of access to Hwy 47. He also suggested meeting with the school prior to the public open house.

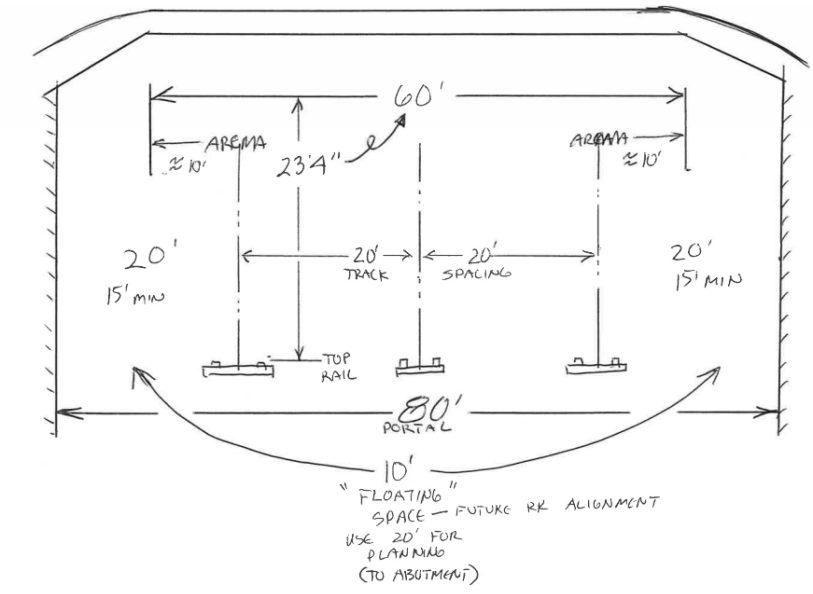
Next Steps

- Open House in anticipated for mid-June
  - Attendees identified the school building to be a great meeting location
- One-on-one stakeholder meetings with businesses adjacent to the Study Area will be scheduled for mid-June following the open house.
- Suggestion to update the graphic on the handout

Meeting Minutes

Project:	T.H. 47 Grade Separation Feasibility Study
Subject:	Initial BNSF Coordination Meeting
Date:	2:00-3:00 Monday, May 16, 2016
Location:	BNSF Conference Room @ 80 44th Ave NE, Fridley, MN
Attendees:	See attached Attendees Column 2 (Tab to add more rows)

- Chris gave BNSF overview of programed work
  - No major plans for major track improvement work in their long range plan
  - BNSF needs to preserve the ability to adding a third main in the future
  - The Rum river bridges are not obsolete and there are no known deficiencies that would require replacement in the near future.
- Discussion on center pier option
  - Center pier not desirable in current track spacing. Track spacing would need to be increased to provide crash protected pier +15' offset
- Discussion on Vertical Clearance
  - 23'4" between top of rail and bottom of structure over tracks was agreed to by MnDOT and BNSF
- Discussion on Portal
  - Chris indicated that there are many hurdles to achieve a third main in the corridor, including the existing Rum River bridges. Realignment of the tracks could be assumed to achieve the third track. Offsetting to the south makes the most sense at this time. 80 ft clear opening was agreed to and the following portal was to serve as an assumption at this time.



Minutes Prepared by: Scott C. Burfeind, P.E.

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Overview

An open house meeting was held from 5:00 p.m. – 7:00 p.m. on Tuesday, June 21, 2016 at the Anoka-Hennepin Educational Service Center in Anoka, MN.

MnDOT, City of Anoka, and HDR staff talked with local residents, commuters, and businesses at the open house to provide information about the study, discuss the pros and cons of each alternative, and project area issues. The team also asked open house attendees to provide input on corridor plots displayed throughout the open house.

Staffing

- MnDOT: Brian Kary, Kent Barnard, Jim Weatherhead
- City of Anoka: Greg Lee
- HDR: Brandi Popenhagen, Scott Burfeind, Tess Nejedlo

Open House Materials

Information Boards

The following information boards were plotted and displayed at the open house:

- Primary needs of the study
- Secondary needs of the study
- Alternative 1 – Build over railway
- Alternative 2 – Build under railway
- Project area issues
- We Value your Input!

Attendance

Not including staff, the attendance at the open houses was approximately 124 people. Attendees were local residents, commuters, stakeholders, local business owners, elected officials. Attendees that wanted further information about the project were signed up to receive GovDelivery alerts.

Key questions addressed:

The following outlines some of the major questions that were addressed at the meeting:

- Who is funding this project?
- Why can't you cut through _____ (Alter, Fairgrounds, Anoka Education Building, golf course)?
- Why wasn't this project done 30 years ago?
- Why is Hanson Blvd and Armstrong Blvd happening before this roadway?
- When will it be constructed?
- Why aren't you building four-lanes to Bunker Lake Blvd?

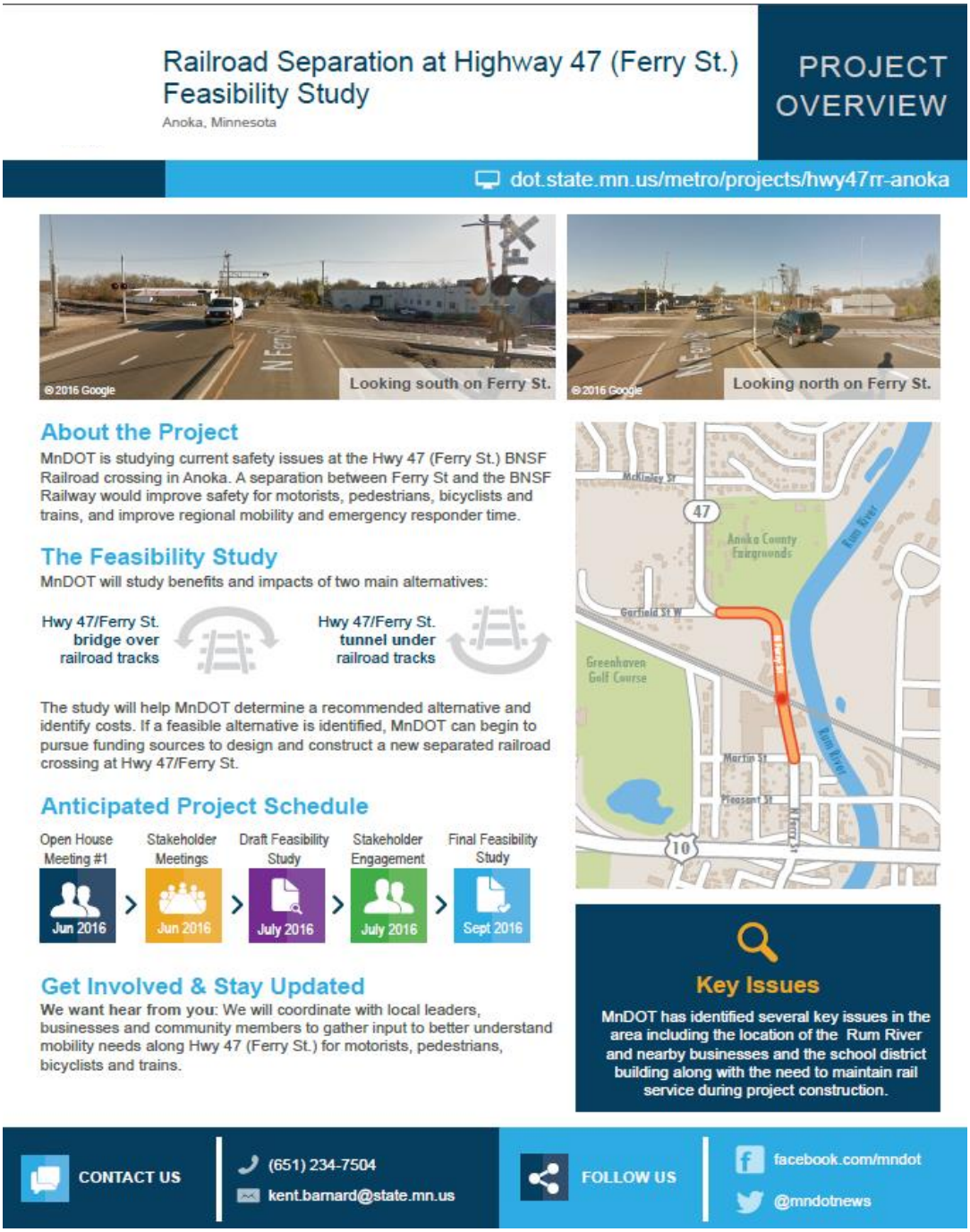
Some attendees filled out a comment form if they had a direct question or concern they wanted addressed. They are attached to this summary.

Key Themes:

- Preference towards alternative 1 – build over the railroad
- Put a signal at McKinley
- Don't close access on Hwy 47 north of McKinley but would settle for a right-in/right-out
- Make the road 4 lanes instead of 2 lanes
- A left turn lane or a bypass at Alter Trading is needed
- A northbound left turn arrow is needed at Pleasant St
- Flatten the curves
- Safety is an issues at this location
- Detour is a concern
- Construction will impact the County fair
- Realign Highway 47
- It is difficult to get onto Hwy 47 from side streets
- People going over the railroad won't see the curves ahead
- Closing Martin Street will not allow me to access my neighborhood due to the lack of gaps at Pleasant Street
- Concerns over the grade and esthetics of high bridge with alternative 1
- Concern of traffic using alley instead of Branch Ave. when traveling from Pleasant St. to Martin St.

Open House Materials

Handout



Railroad Separation at Highway 47 (Ferry St.) Feasibility Study

Anoka, Minnesota

PROJECT OVERVIEW

dot.state.mn.us/metro/projects/hwy47rr-anoka

About the Project

MnDOT is studying current safety issues at the Hwy 47 (Ferry St.) BNSF Railroad crossing in Anoka. A separation between Ferry St and the BNSF Railway would improve safety for motorists, pedestrians, bicyclists and trains, and improve regional mobility and emergency responder time.

The Feasibility Study

MnDOT will study benefits and impacts of two main alternatives:

Hwy 47/Ferry St. **bridge over** railroad tracks

Hwy 47/Ferry St. **tunnel under** railroad tracks

The study will help MnDOT determine a recommended alternative and identify costs. If a feasible alternative is identified, MnDOT can begin to pursue funding sources to design and construct a new separated railroad crossing at Hwy 47/Ferry St.

Anticipated Project Schedule

Open House Meeting #1	Stakeholder Meetings	Draft Feasibility Study	Stakeholder Engagement	Final Feasibility Study
Jun 2016	Jun 2016	July 2016	July 2016	Sept 2016

Get Involved & Stay Updated

We want hear from you: We will coordinate with local leaders, businesses and community members to gather input to better understand mobility needs along Hwy 47 (Ferry St.) for motorists, pedestrians, bicyclists and trains.

Key Issues

MnDOT has identified several key issues in the area including the location of the Rum River and nearby businesses and the school district building along with the need to maintain rail service during project construction.

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Railroad Separation at Highway 47 (Ferry St.) Feasibility Study

Anoka, Minnesota

FREQUENTLY ASKED QUESTIONS

dot.state.mn.us/metro/projects/hwy47rr-anoka

What is the purpose of this study?

- The focus of this Feasibility Study is to identify alternatives to separate the railroad and Highway 47 (Ferry St. crossing).
- MnDOT is reviewing recent traffic counts and previous crash data as part of the Feasibility Study.
- MnDOT currently does not have a preferred alternative and is using the Feasibility Study to review all available information and working with the design team to review alternatives.

Will the new alternative impact me?

- There is a possibility an alternative to separate the railroad and Highway 47 (Ferry St.) will result in access changes to local businesses. MnDOT will work with each local business and facility to discuss access options and needs.
- In order to build a bridge over the railroad tracks or a tunnel under the railroad tracks, MnDOT's alternatives will likely require MnDOT to expand their existing right-of-way. There may be a combination of temporary and permanent easements to the east and west of the railroad crossing.

What is the Study?

- We know this is an important project for the local community, especially, with the high traffic volume.
- The Feasibility Study is the first step to identifying and reviewing alternatives to address safety issues at the Hwy 47 (Ferry St.) railroad crossing in Anoka.
- The concept designs in the Feasibility Study will focus on a 2-lane bridge or tunnel over or under the railroad tracks. MnDOT is looking into the option of designing a bridge that allows for future 4-lane capacity.
- We understand there are additional congestion issues north and south of the Hwy 47 (Ferry St.) railroad crossing. This Feasibility Study is focused on separating Hwy 47 (Ferry St.) and the railroad crossing.
- This Feasibility Study is not looking at moving Hwy 47 (Ferry St.).
- This Feasibility Study will include a concept design, not a final design ready for construction. Additional engineering and design will be required prior to any construction.
- The intersection of Hwy 47 and McKinley will be analyzed to determine if removal of the at grade railroad crossing requires a signal at McKinley to allow residents access onto Hwy 47.

What is the project schedule?

- This Feasibility Study will wrap up in late summer. Should a feasible alternative be identified, MnDOT will continue into the preliminary design phase which would wrap up in summer of 2017.

How will the project be funded?

- Funding for this project has not been identified.
- The Feasibility Study will help MnDOT determine an estimated cost to make safety improvements. The costs are a requirement for MnDOT to begin pursuing funding options to design and construction the project.
- We currently do not have a timeframe for when funding would be secured for this project.

How can I stay involved?

- Information for upcoming input opportunities will be on the project website (dot.state.mn.us/metro/projects/hwy47rr-anoka), MnDOT's social media channels, and advertised in local newspapers.

facebook.com/mndot @mndotnews kent.barnard@state.mn.us (651) 234-7504

Boards

Why Study This Crossing?

PRIMARY NEED:

Safety

The intersection of Highway 47/Ferry Street and the BNSF Railway has safety issues. The proposed options would improve safety for motorists, pedestrians, bicyclists, and trains.

Major property damage crashes occurred in 1972, 1973, 1976, and 1986.

In 2003, a teen driver collided with a train, resulting in four fatalities.

8 of 10 Risk Factors Present

- vehicle traffic
- # of trains per day
- vehicles * trains
- max speed of trains
- # of tracks present
- crossing angle
- next nearest crossing
- line of sight

The Texas Priority Index classified this crossing as being **the worst crossing in the state** because of:

- High traffic volumes (18,300 vehicles/day) + high train volumes (40-80 trains/day)
- High train speed (as high as 75 mph)

Why Study This Crossing?

SECONDARY NEEDS:

Secondary needs within the project area will be considered if the opportunity exists while addressing the primary need as long as they don't substantially increase project cost and impact.

Line of Sight

The railroad tracks and the roadway are at a 55 degree skew angle. The railroad tracks are also higher than Ferry St., creating a hump in the roadway as it crosses the tracks.

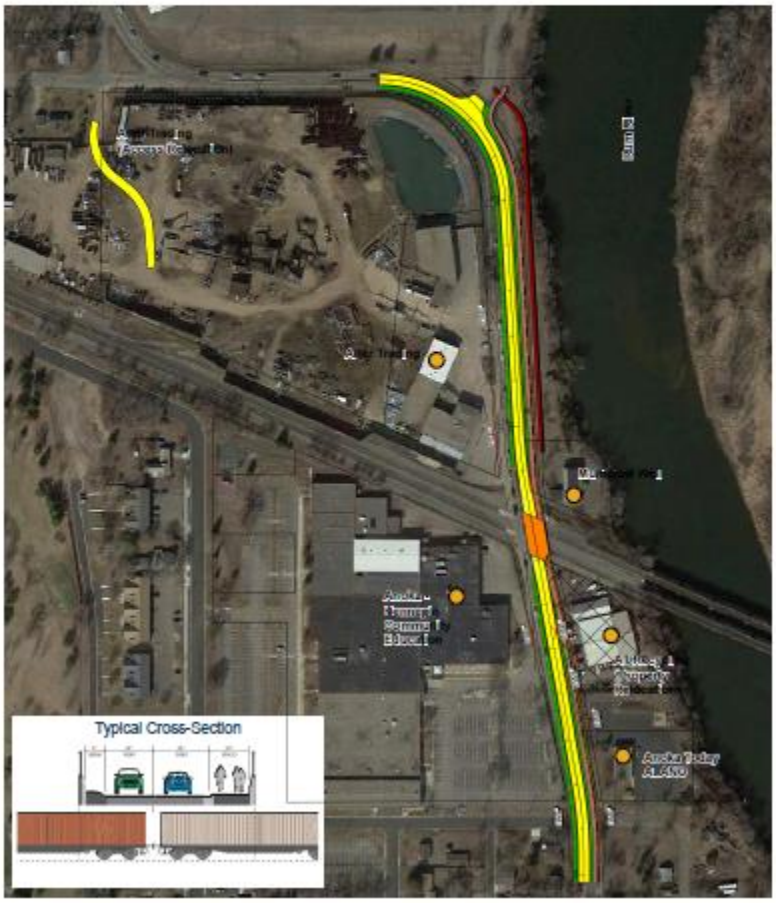
Crossing Conditions

- **Traffic delays** related to train lengths, mixture of trains (freight, Amtrak, and Northstar), volume, and frequent gate-down times result in back-ups onto Hwy 10, sometimes as far back as Bunker Lake Blvd.
- The nearby **Northstar Station** requires lowering gates when westbound trains approach the station. This results in lowered gates as long as two minutes.
- Frequent **lowered gates** occasionally leads drivers to drive around them which is a safety concern.

Access & Traffic Operations

- **Unmarked business driveways** near this intersection lead to driver confusion and difficult or unsafe turning maneuvers when trains are present or approaching.
- The **number of driveways** and roadways that access Ferry St. compromise safety and add to roadway congestion.
- **Roadway congestion** (due in insufficient capacity) results in high crash rates (mainly rear-ends).

Alternative 1: Build Over Railway



PROS:

- ✓ Removes conflicts between vehicles/pedestrians/ bicyclists and trains.
- ✓ Reduces likelihood of traffic back-ups onto Hwy 10.
- ✓ Eliminates gate-down times.
- ✓ Line of Sight no longer an issue.
- ✓ Eliminates access near crossing.

CONS:

- ✗ Closures: Martin St., one ALANO access, one Alter Trading access, and one school access.
- ✗ One property relocation; one access relocation.
- ✗ Visual impact of 30-foot-tall bridge.
- ✗ New stormwater outlet to Rum River.
- ✗ Construction detour for approximately one year.

COST: $15 - $19M

Alternative 2: Build Under Railway

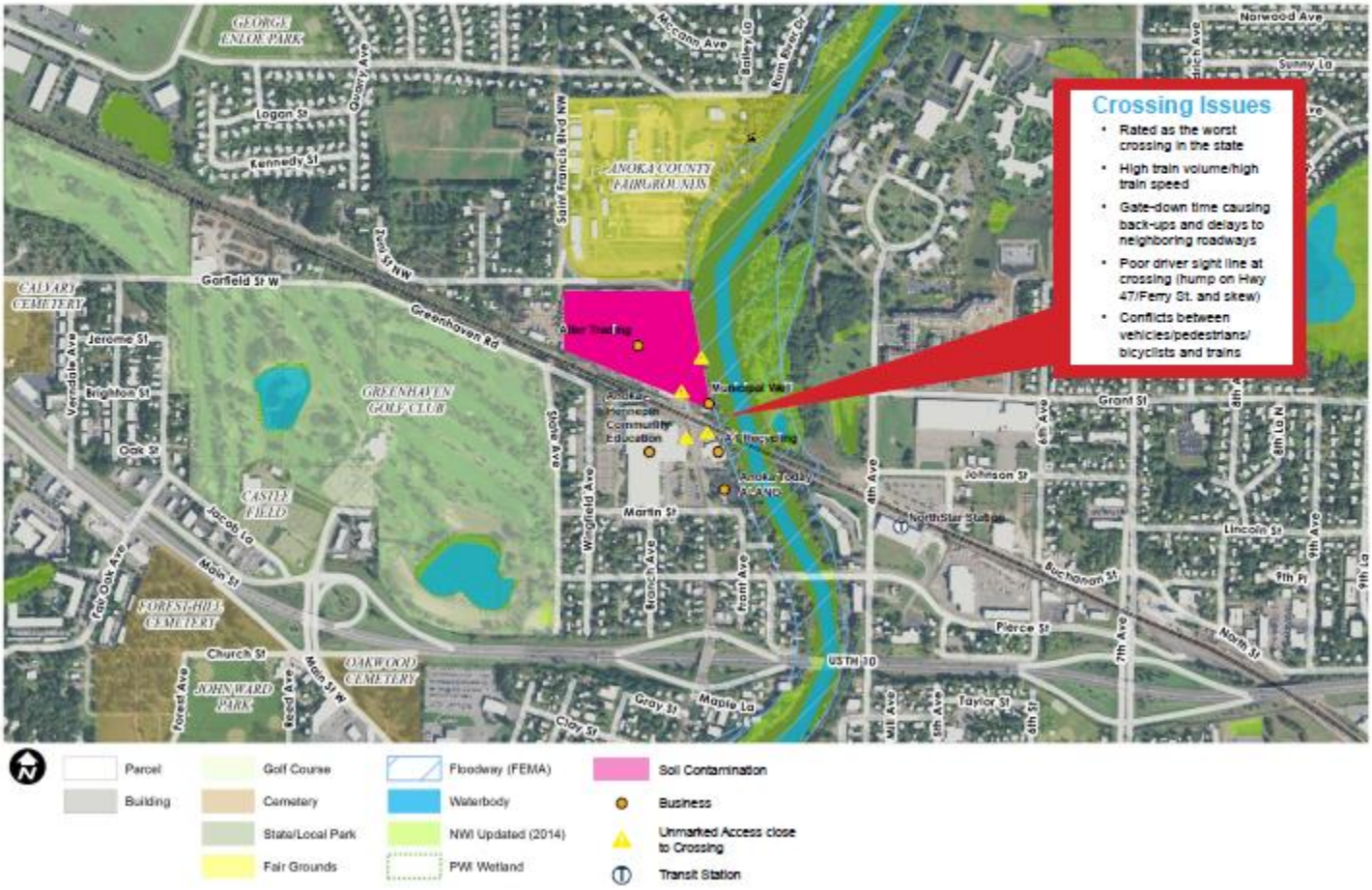
PROS:

- Removes conflicts between vehicles/pedestrians/ bicyclists and trains.
- Reduces likelihood of traffic back-ups onto Hwy 10.
- Eliminates gate-down times.
- Line of Sight no longer an issue.
- Eliminates access at crossing.

CONS:

- Closures: one ALANO access and one school access.
- One property relocation.
- A new railroad bridge over Rum River would be required.
- Substantial impact to train operations and track reconstruction.
- Substantial impacts to water table which would require a lift station and a new stormwater outlet to the river.
- Substantial impacts to contaminated soils.
- Construction detour for approximately two years.

Project Area Issues



Comments or Questions?

Let's Stay Connected:

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