TH 77 Corridor Managed Lanes Study

Final Report

140th Street in the City of Apple Valley to
Old Shakopee Road in the City of Bloomington

Mn/DOT No. SP 1925-48

SEH No. MNTMD 107598

Prepared for the Minnesota Department of Transportation

August 6, 2010

SEH

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Dated June 2, 2010

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Dated June 21, 2010

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1.0 Introduction

Mn/DOT has led the effort to study congestion on freeway corridors in the Twin Cities Metropolitan area and develop alternatives that take advantage of underutilized capacity on freeways and arterials, as well as adding lanes to relieve congestion and other remedial measures. Many studies looked at the duration of congestion and established corridor "planning" capacities, reviewed hourly volumes by direction on critical segments, and identified time periods where an "extra" lane would help reduce congestion. Providing access to the Central Business District (CBD) of Minneapolis, as well as to businesses on the I-494 corridor including the Mall of America, the Trunk Highway (TH) 77 corridor in southern suburban area is a critical link in the Metro Freeway System. In the Congestion Management Planning (CMP) study completed in May 2007, the TH 77 corridor between 140th Street in the City of Apple Valley and Old Shakopee Road in the City of Bloomington was identified as one of the 19 low-cost, high-benefit projects for reducing congestion on freeways in the Twin Cities. However, the actual benefit of the project was in question and the costs were very preliminary. Given the importance of addressing the ongoing congestion, further study was warranted.

Following the CMP study, the TH 77 Corridor Managed Lanes Study was undertaken to further identify operational deficiencies and to evaluate various options to improve the capacity of the corridor. This study addresses broader and regional impacts on the transportation system and modes of travel. The budget for the study is $688,834, and it was funded by a federal value pricing grant with Mn/DOT match. The goals and criteria for evaluation of any proposed options in this study are:

1. Better utilize existing infrastructure investments
2. Preserve or enhance advantages for transit and carpoolers
3. Preserve or enhance advantages for general traffic
4. Provide a congestion-free choice for single occupant vehicles
5. Preserve or enhance corridor safety

1.1 Metropolitan Highway System Investment Study

As the TH 77 Study progressed, the Metropolitan Highway System Investment Study (MHSIS) became a significant influence. The following is some background regarding the MHSIS.

The Metropolitan Highway System Investment Study (MHSIS) is a joint effort between the Metropolitan Council and the Minnesota Department of Transportation (Mn/DOT) to create short-term and long-term visions for the highway system in the Twin Cities region. The goal of the study is to identify methods and improvements to achieve the greatest efficiency out of the region's highway system, and manage congestion from a system-wide perspective.

The study, referenced in the Council's 2030 Transportation Policy Plan, will result in proposed amendments to the plan to be considered by the Council later in 2010. The Mn/DOT Metro District will also update its Highway Investment Plan as a result of this study.

Rationale for the MHSIS

The 2030 Transportation Policy Plan, adopted by the Metropolitan Council in January 2009, highlights the extensive highway system in place in the seven-county metropolitan area, which was built over the past 50 years and now requires the commitment of significant resources to maintain. The plan notes the need to refocus highway investment on preserving the existing system and improving its performance – maximizing efficiency by managing all elements of the system.

As a result, improvements should be focused on the need to enhance system performance including managing and optimizing the effectiveness of the existing system, and implementing strategic and affordable capacity expansion. Key principles for these improvements include safety, preservation, and congestion management.

The plan also acknowledges the need to reassess the projects defined as "major expansions." Several of these projects have been carried over from plan to plan, because they were unable to be constructed within existing resources. Each project will be reassessed with the intent to reduce the scope and cost while still achieving substantial benefit.

Mn/DOT and Council staff estimate the revenue needed to address congestion over the next 20 years tops $40 billion, and even the most optimistic revenue projections show that a fraction of that amount will be available in that timeframe. A majority of existing funding will have to be dedicated to bridges, and preservation and maintenance projects.

That leaves approximately $900 million in total for congestion mitigation projects through 2030, or about $55 million annually.

This reality requires a new approach to managing congestion in the metropolitan highway system, which is what the MHSIS will begin to address.

A new strategy for highway investment

The challenges of managing the metropolitan highway system call for a 21st century solution that is technology-based, multi-modal, and problem-focused with an emphasis on system-wide management.

Rather than focusing on building capacity alone, the new strategy will focus on improvements that build on existing management strategies and provide relief to identified problem areas throughout the system.

Managed lanes (either conversion or expansion), such as the Mn/DOT MnPASS lanes, where rush-hour traffic is limited to high-occupancy vehicles (carpools and buses), motorcycles, and single-occupant vehicles willing to pay a toll to use the lane.

- Additional active traffic management techniques, such as the existing ramp meter, sign-messaging, traffic volume detection, traffic camera system, and new technologies.
- Strategic capacity enhancement projects, including projects to extend lanes or otherwise add capacity in specific locations to ease bottlenecks. Includes lower-cost, high-benefit projects where a smaller scale, more affordable project to remove bottlenecks or improve traffic flow can help congestion.
- Access management for Interregional Corridors (IRCs), which involves limiting private access and managing public access to these highways. (IRCs provide significant connections between regions of the state, particularly for freight traffic.) The state, working with county and local governments, will manage access to optimize the performance of the existing routes. New public access, or new/reconstructed interchanges to expand capacity to meet safety concerns, will only be considered if they are consistent with Mn/DOT's criteria and adopted regional priorities.
- In addition, staff is examining other types of projects on the system, including resurfacing and replacement projects. Potential congestion relief strategies will also be examined as part of preservation projects to assure the greatest benefit for the resources expended.
- Specifically, the MHSIS will produce potential solutions that may provide improvements for system-wide benefit. These solutions will be ranked according to defined principles, including specific methods for measuring performance and will provide a reservoir of projects to draw from, if additional financial resources become available.

Following this introductory section, this report is organized as follows:

- Section 2.0 analyzes the existing conditions and operational deficiencies along the TH 77 corridor in the study area. The analysis was primarily based on actual data collected and field observation.
- Section 3.0 presents the various conceptual alternatives and their subalternatives, and how they were narrowed to three primary alternatives based on the discussion and evaluation from the project management team and various project committees.
- Section 4.0 presents geometry design standards for the three primary alternatives and design exceptions to better utilize existing infrastructure investments. The concept layouts are developed based on the standards and design exceptions.
- Section 5.0 summarizes the technical evaluation methodologies and results for the primary alternatives and their subalternatives based on a detailed regional model travel demand forecast analysis and the state-of-the-art microsimulation CORSIM analysis.
- Section 6.0 summarizes the project team committees' structure and public community involvement.
- Lastly, Section 7.0 summarizes the findings and advantages and disadvantages for each alternative based on the previous analysis.

2.0 Existing Conditions

TH 77 in the study area is a principal arterial in the metro freeway system. The northbound direction of this corridor consists of three lanes at the southern connection to Dakota County Road 23 (140th Street in Apple Valley), which immediately tapers down to two lanes once the freeway section of TH 77 begins. At Diffley Road, the highway widens again to a three--lane freeway to the north with a lane being added on the left. The southbound direction of the corridor in the study area consists of three lanes from the on-ramp from I-494 collector

distributor ramp to the southern terminus where the roadway changes to Dakota County Road 23, a signalized arterial.

The traffic characteristics of the TH 77 corridor in the study area is highly directional during peak hours with a heavy northbound predominance in the AM peak period and southbound predominance in the PM peak period (Figure 1). Based on the detector data on the Minnesota River Bridge in 2007, the directional flow is nearly 80% northbound and 20% southbound during the AM peak period while it is nearly 30% northbound and 70% southbound during PM peak.

Figure 1 – Project Area and CORSIM Model Limits

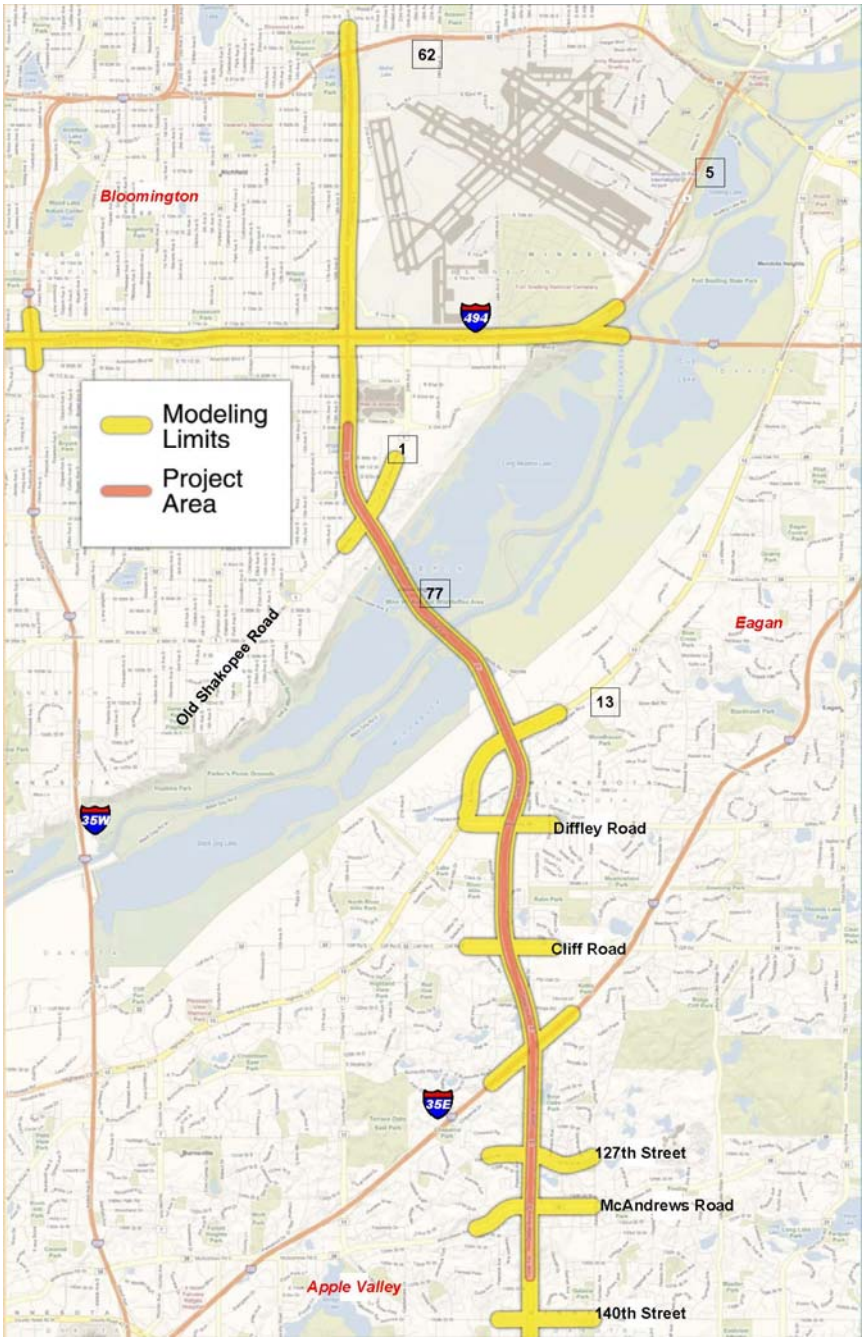


Figure 2 – TH 77 Facing South during AM Peak Hour

Currently, there are operational deficiencies due to above-mentioned geometric and traffic characteristics along the corridor. The operational problems along the corridor are described as follows.

2.1 AM Peak Period

During AM peak period, the northbound direction of TH 77 experiences major congestion for most of the project area. Figure 2.1 illustrates speed contours for both directions of TH 77 during the AM peak period while the map on the left in Figure 2.3 shows the duration of freeway congestion on the TH 77 corridor and adjacent freeways. Major northbound hot spots in the study can be identified as follows:

- The two-lane segment between 138th Street and Diffley Road
- Insufficient capacity of the Minnesota River Bridge and Old Shakopee Road exit ramp.

The two-lane segment between 138th Street and Diffley Road is the biggest bottleneck in the study area. With TH 77 north of I-35E already operating at capacity, the heavy entering traffic from Cliff Road (750 veh/h), coupled with vehicles weaving to get into the left lane to enter the added 3rd lane at Diffley Road, creates a stop and go condition that extends back along TH 77 from Diffley Road all the way to 140th Street.

The demand on the River Bridge is currently also over its capacity during the AM peak hour. With the heavy exiting volume at Old Shakopee Road, congestion on the bridge can extend back into the TH 13 interchange area and sometimes even further south into the Diffley interchange area. This congestion is exacerbated by the heavy entering volume at TH 13. The exiting peak hour volume at Old Shakopee is about 1,500 vehicles. That volume creates a forced flow to the exit ramp that essentially consumes the outside through lane over the Minnesota River Bridge, creating less capacity than normal and extending the period of congestion by one to two hours.

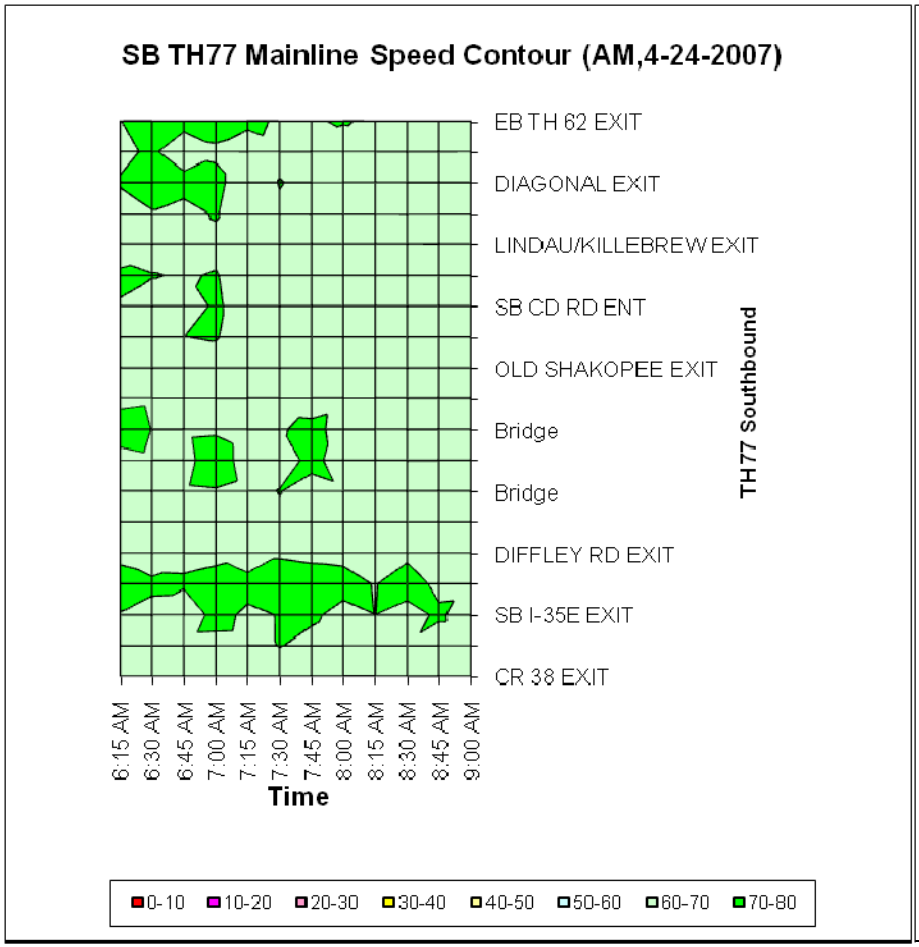
Both Figures 2.1 and 2.3 shows that southbound TH 77 operates at or above the speed limit during the AM peak period.

2.2 PM Peak Period

Figure 2.2 illustrates the speed contours for both directions of TH 77 during the PM peak period. It can be seen that the southbound TH 77 experiences congestion in the Old Shakopee Road interchange area. High entering traffic from Old Shakopee Road increases the downstream mainline volume above the capacity of the three-lane bridge. The map on the right in Figure 2.3 shows no congestion in the area. Knowledge of freeway operations along this corridor suggests that congestion occurs periodically. The southbound traffic congestion during the PM peak period is far less severe than northbound during the AM peak period.

Figure 2.2 shows that northbound TH 77 operates at posted speeds or above for the entire corridor during the PM peak period.

Figure 2.1 – TH 77 Speed Contours During AM Peak Period



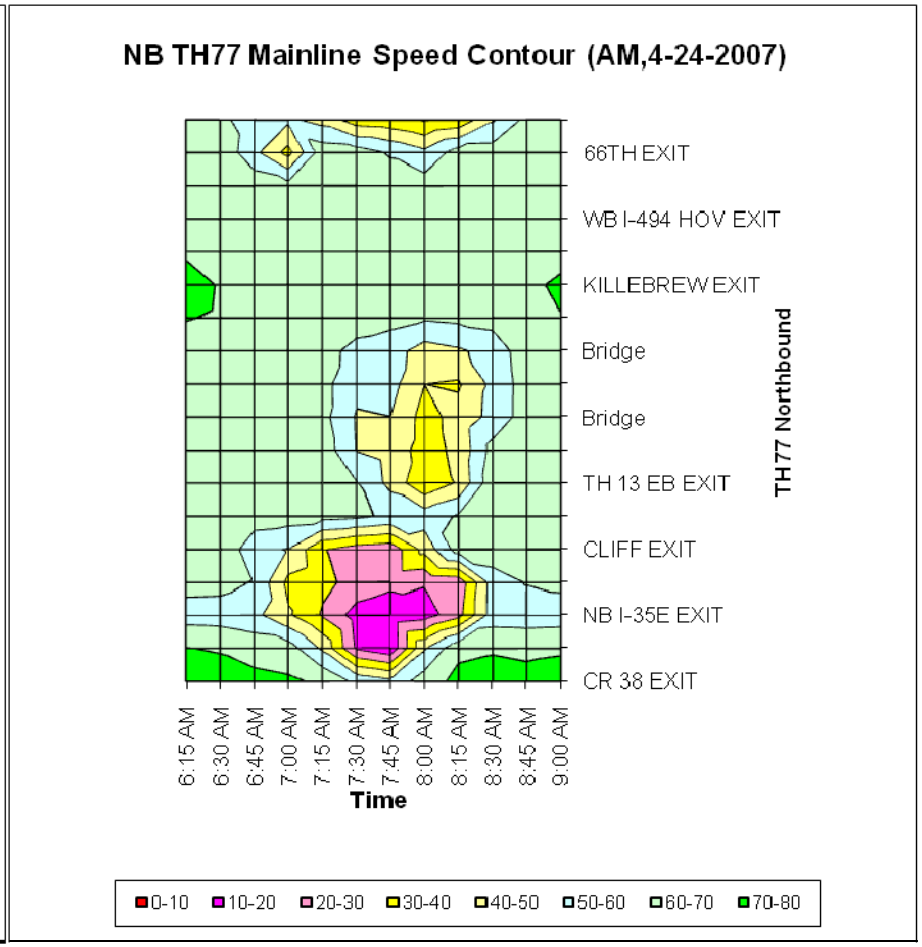
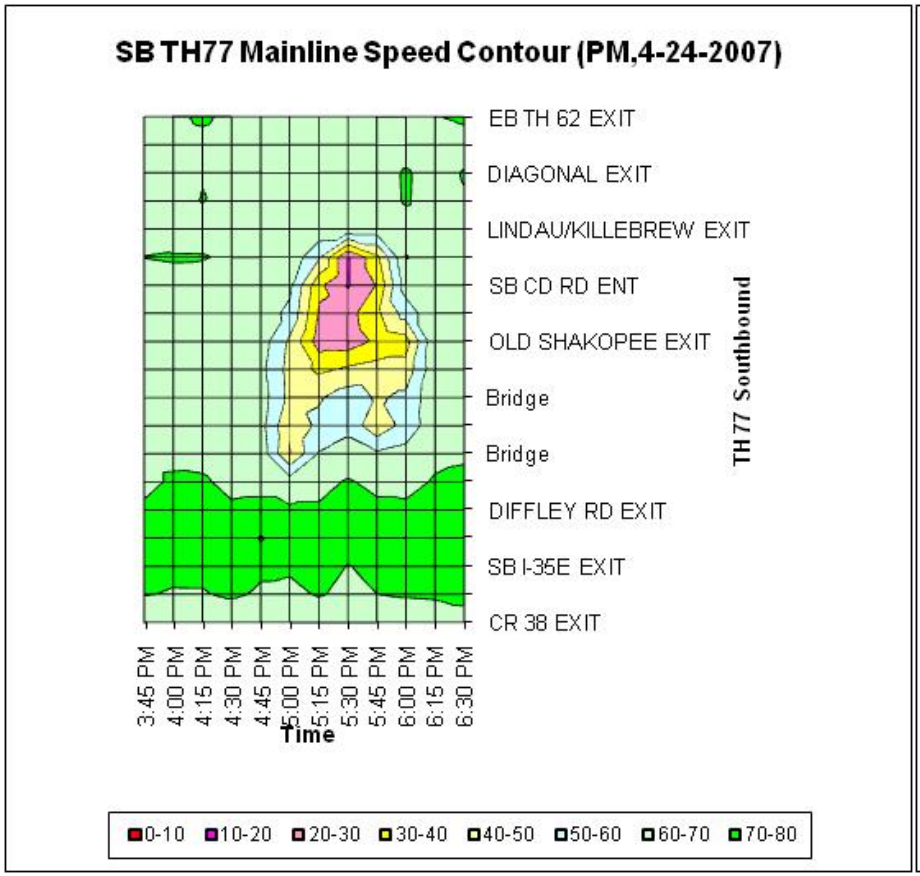


Figure 2.2 – TH 77 Speed Contours during PM Peak Period



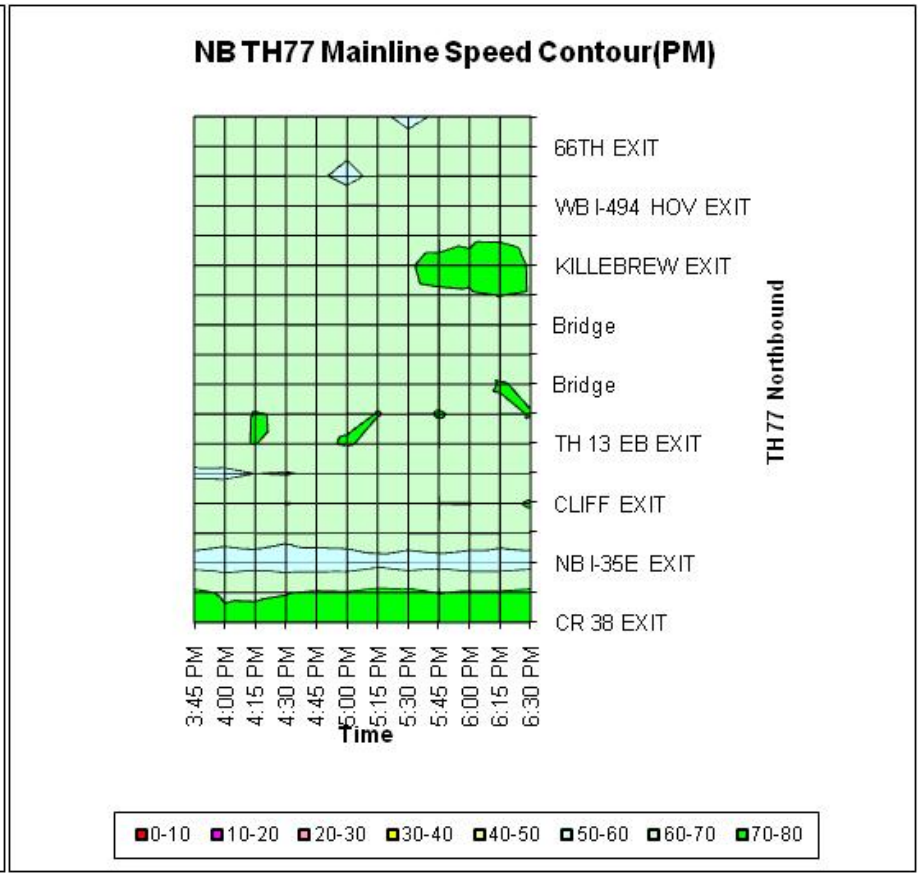
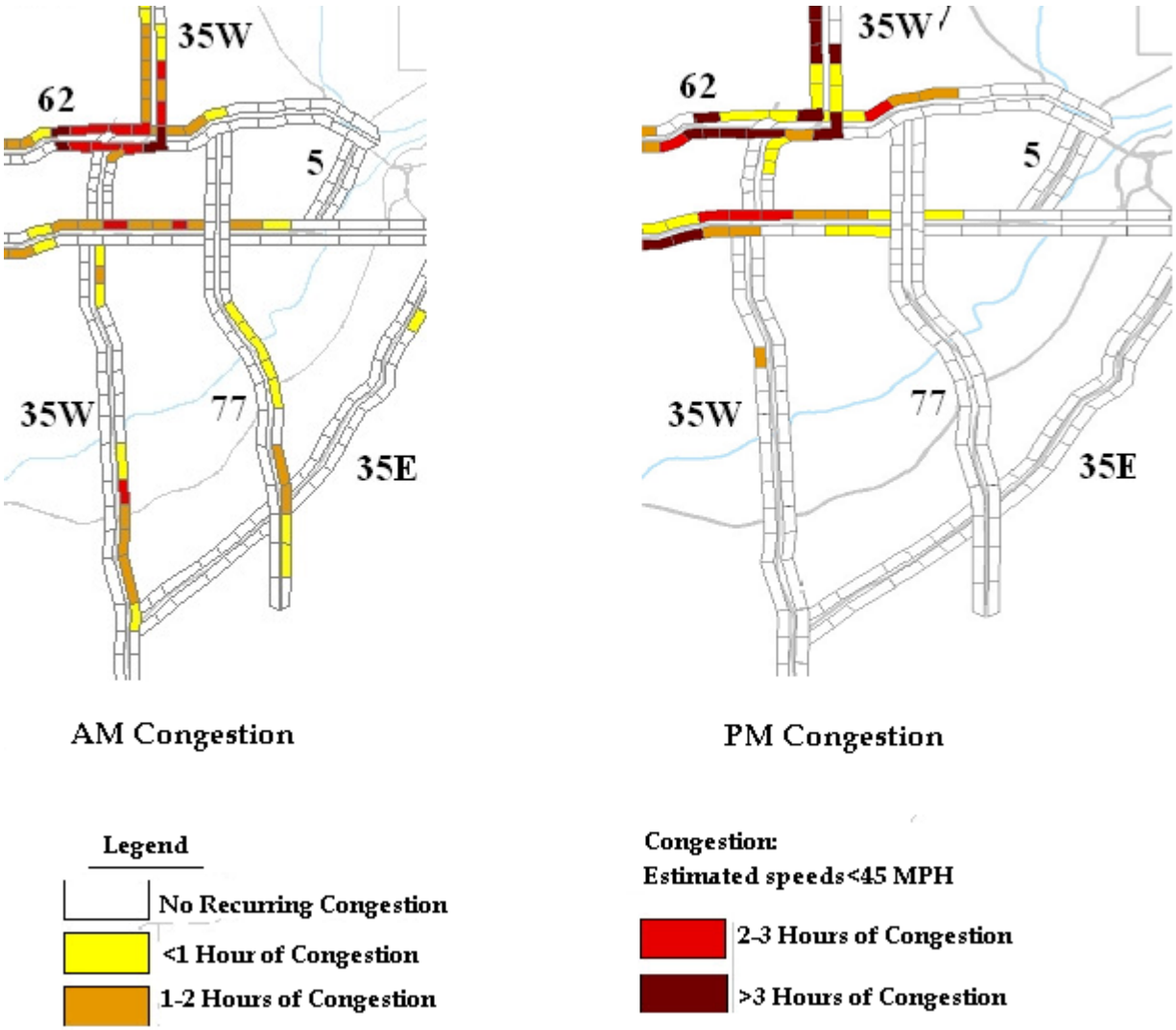


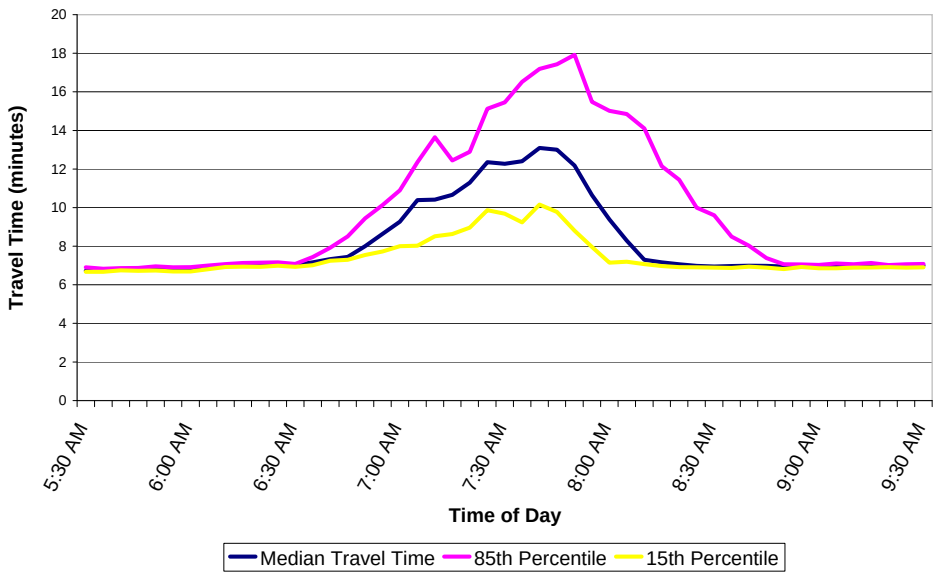
Figure 2.3 – Duration of Freeway Congestion (October 2009)



2.3 Corridor Travel Time Reliability

Northbound TH 77 from Dakota County Road 38 (McAndrews Road) to I-494 in the study area is a 7-mile long freeway. Figure 3 illustrates the travel time for the segment. Travel times are calculated based on the detector speed data for the month of October 2008. It can be seen from the figure that the segment experiences an average travel time of 13 minutes during the AM peak period. This average trip travel time is 85% greater than the free-flow travel time of 7 minutes. Additionally, the travel time during the peak hour may fluctuate from 10 to 18 minutes due to incidents, weather, or other special events that may change traffic congestion levels. Poor travel time reliability increases motorist's frustration with congestion as the travel time to their destination becomes less predictable.

Figure 3 – Northbound TH 77 AM Peak Travel Time Reliability



2.4 Transit Advantages – Bus Only Shoulders (BOS)

TH 77 corridor in the study area is served by multiple park-and-ride facilities, as well as major transit centers in the southern suburbs.

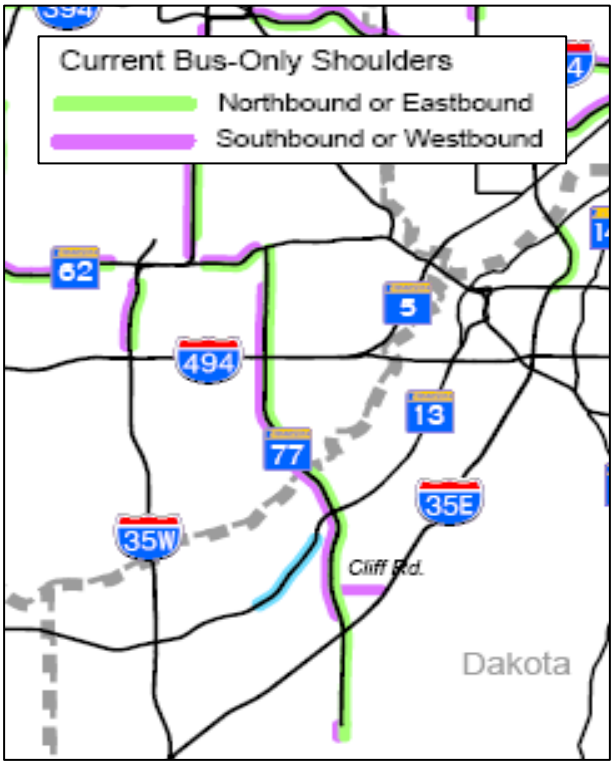
Transit vehicles are permitted to drive on shoulders of TH 77 for most of the segments (as well as most freeways in the seven-county metropolitan area) provided that the transit vehicles do not travel more than 15 mph faster than the general purpose lanes and that the transit vehicles do not exceed the speed limit of 35 mph while traveling on the shoulder.

Figure 4 shows current TH 77 Bus-Only-Shoulders in the study area with additional details below.

- Cedar Avenue Transitway –Bus Rapid Transit (BRT) on the Cedar Avenue Transitway (TH77) currently under development with runningway construction beginning in 2010 on County Road 23. BRT as envisioned for this corridor will provide high-capacity transit improvements that offer faster travel speeds and an improved customer experience over regular bus services. Bus Rapid Transit on the TH 77 portion of the Cedar Avenue Transitway will most likely operate on the outside shoulder of the roadway.

- Urban Partnership Agreement – The Cedar Avenue corridor is a significant element of the Twin Cities Urban Partnership Agreement (UPA) with the United States Department of Transportation (USDOT). The UPA grant will expedite elements of the planned BRT service on Cedar Avenue by providing funding for transit stations, park and ride lots, and transit vehicles. Some elements of the Urban Partnership Agreement were completed in 2010.

Figure 4 – Current TH 77 Bus-Only-Shoulders



3.0 Conceptual Alternatives Development And Evaluation

This section describes all the alternatives considered in the onset of the study and the reasons in italic for those alternatives that were removed from further consideration in the subsequent technical evaluation phase. The conceptual alternatives for the study were developed and evaluated in an iterative process with inputs from both the Technical Advisory Committee (TAC) and Steering Advisory Committee (SAC). In addition to the Baseline (No build) Alternative, four primary alternatives, and a number of sub-alternatives were proposed and evaluated. Appendix 1-1 through 1-4 illustrates the lane diagrams for all those alternatives and subalternatives. They are described as follows.

3.1 Alternative 1 and Subalternatives

As previously noted, the Congestion Management Planning (CMP) study completed in May 2007 identified several projects for reducing congestion on Metro Area freeways. An addition of a third lane on northbound TH 77 from 138th Street to Diffley Road was identified as a recommended improvement. This lane addition was believed to have the potential to make a significant improvement in reducing congestion on the south end of the TH 77 corridor; however, there continues to be concern that the project would only push the congestion north.

This study analyzed the effectiveness of the third lane and looked at additional concepts to help relieve congestion on northbound TH 77. The construction of the third lane between 138th Street and Diffley Road was considered a high-priority alternative and was designated as "Primary" Alternative 1A. A similar concept of adding the third lane but starting at I-35E was considered as Alternative 1B because it was believed to have comparable congestion relief at a lower cost.

The two subalternatives are described as follows:

- Alternative 1A
  - This alternative consists of a new northbound through lane constructed in the existing median from 138th Street to Diffley Road, filling in the area between the existing northbound third lane drop and add. This alternative would not add a fourth lane on the Minnesota River Bridge

- Alternative 1B
  - This is a shorter version of Alternative 1A, wherein the new third lane would only be constructed from I-35E to Diffley Road
  - *This alternative was removed from further consideration due to lack of lane continuity on the TH 77 mainline between the I-35E interchange and 138th Street and therefore would be locally unacceptable.*

Alternative 1A: Proposed Visualization

3.2 Alternative 2 and Subalternatives

At the present time, the current Minnesota River Bridge carries three lanes of traffic in both the northbound and southbound directions. It was determined that the bridge is structurally and geometrically capable of accommodating the addition of a fourth lane by striping and narrowing lanes and shoulders. However, it is noted that the proposed changes on the Minnesota River Bridge will negatively impact its overall appraisal rating, reducing the bridge's sufficiency rating. This could affect federal funding. It was also determined that a

fourth-lane alternative was feasible and they were evaluated as an additional means of relieving congestion. In an effort to address the concerns raised with Alternate 1 and its alternatives, an option to expand to four lanes between Diffley Road and Old Shakopee Road was proposed as Alternative 2 for this study. Depending on how the fourth lane begins at the Diffley Road, there are two subalternatives. They are described as follows:

- Alternative 2A
  - This alternative includes the improvements that comprise Alternative 1A, but would also add a new northbound inside HOV/HOT lane from Diffley Road to north of Old Shakopee Road through construction and re-striping on the Minnesota River Bridge.
  - *This alternative was removed from further consideration due to poor lane continuity at Diffley Road especially with the MnPASS lane alternative.*

- Alternative 2B
  - This alternative varies from Alternative 2A only in that the additional fourth lane north of Diffley Road would be achieved by widening to the outside with some lane re-striping. The outside lane would continue until Old Shakopee Road where it would be dropped as an exit lane.
  - Depending on the management strategies for the left lane between 138th Street and Old Shakopee Road, there are two subalternatives:
    a. Alternative 2B_GP: A regular general purpose lane
    b. Alternative 2B_MnPASS: A managed MnPASS lane on the left with open access at multiple locations.

Alternative 2B – Proposed Visualization

3.3 Alternative 3 ("Contraflow") and Subalternatives

The concept of a movable barrier contraflow lane uses an established technology that uses existing capacity of under-utilized lanes and could advance the Bus Rapid Transit (BRT) concept for center running express service, if implemented. It incorporates a movable barrier that allows traffic to use an existing lane in the off-peak direction of travel for peak direction traffic. As previously discussed, the TH 77 northbound lanes are heavily congested while the southbound lanes have very little traffic. For TH 77, a southbound lane could be borrowed for northbound traffic during the morning peak period. Preliminary 2030 traffic projections indicate that this pattern will not change so that southbound traffic on the remaining two lanes will be free-flowing during the morning commute times. To control the number of vehicles entering the contraflow lane, managed lane tools including eligibility restrictions, such as a High Occupancy Vehicle (HOV) lane or pricing use as a High Occupancy Toll (HOT) lane was considered. Access control would also be a tool employed since vehicles would only be able to enter the contraflow lane at a specific median crossover.

The concept under consideration proposed developing a contraflow lane using the inside (left) lane on the southbound side for northbound morning traffic. This option called for the deployment of a movable barrier to provide an additional northbound lane during the morning peak period. Several alternatives were proposed relative to deploying contraflow. They are described as follows.

- Alternative 3A
  - This alternative uses the existing inside southbound lane and converts it, using a moveable barrier system, to a northbound lane during the morning peak. There would be one entrance at the south end and one exit at the north end. Re-entry to northbound TH 77 would occur as a lane adds to the ramps at I-494.
  - *This was removed from consideration due to the physical constraints of constructing a lane-add on the north end between I-494 and Old Shakopee Road.*

- Alternative 3B
  - This alternative is essentially the same as Alternative 3A, except that the contraflow lane would re-enter northbound TH 77 as a merge.
  - Depending on the management strategies for the contra-flow lane and intermediate access options, there are four subalternatives:
    a. Alternative 3B_GP: A general purpose contra-flow lane between 138th Street and Old Shakopee Road without intermediate access
    b. Alternative 3B_MnPASS: A MnPASS contra-flow lane between 138th Street and Old Shakopee Road without intermediate access
    c. Alternative 3B_IA_GP: A general purpose contra-flow lane between 138th Street and Old Shakopee Road with intermediate access between Cliff Road exit ramp and entrance ramp.
    d. Alternative 3B_IA_MnPASS: A MnPASS contra-flow lane between 138th Street and Old Shakopee Road with intermediate access between Cliff Road exit ramp and entrance ramp.

- Alternatives 3C/3D
  - These alternatives are pared down versions of Alternative 3A/3B, with the southerly contraflow lane entrance being located in the area of I-35E
  - *These alternative were removed from further consideration in the beginning of the study given they do not provide enough additional capacity at I-35E. In addition, they result in poor lane continuity.*

Alternative 3B – Stored Visualization

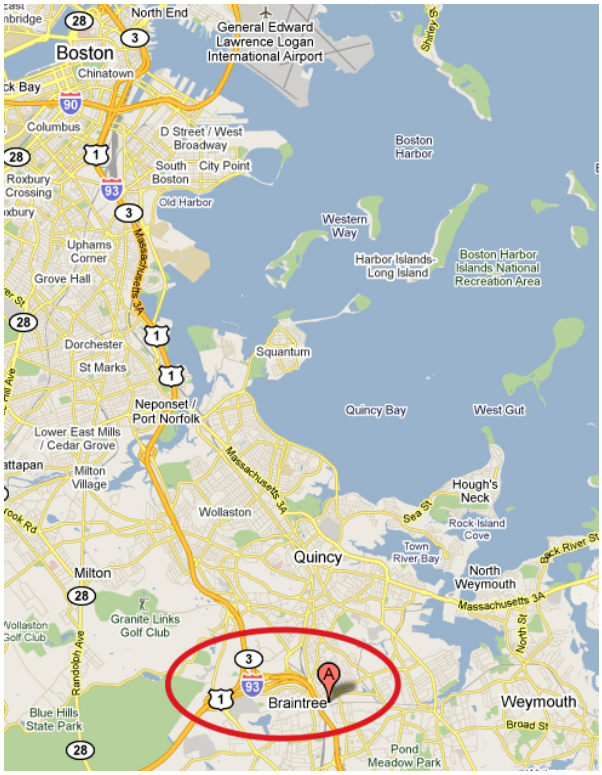
Alternative 3B – Deployed Visualization

The health of Minnesota's business community is dependent on the ability of businesses to connect with other communities. To accomplish this, communities rely of the safe and efficient transportation system to move freight, transfer goods and services and to have employees at work in a timely and safe manner. Many suburban communities around the country are served and benefit from Managed Lane facilities that utilize Intelligent Transportation Systems, movable barrier, and metering technology. Alternate 3B involves the deployment of a movable barrier system to take advantage of the underutilized southbound lanes during morning peak period as one of the concepts being studied.

During the study several questions were raised relative to the operation associated with Alternative 3B. The questions concerned the experience of other cities that have similar systems installed in their communities. Issues of noise, winter maintenance, safety, and aesthetics were of concern. The following are five (5) examples of suburban communities in major metropolitan areas similar to those in the Twin Cities.

Braintree, MA

Braintree is a suburb of Boston, MA with a population of 33,828 with a median family income of $90,590 per year. Braintree is served by I-93 connecting the community to downtown Boston. I-93 carries an average daily traffic count of 203,000 vehicles per day. Braintree is at the southernmost tip of the Managed Contraflow Lanes of I-93 Southeast Expressway headed into Boston. Residents of Braintree are among the 18,000 commuters who benefit each day from safer and more reliable trips to and from Boston.



There is about one mile of the movable 24-inch Series 300 Concrete Barrier within the city limits. The barrier is transferred by a barrier transfer machine that travels at 5 to 8 mph during the barrier transfer. The system was installed in 1994.

Since the system has been installed no complaints have been received concerning noise created by the transfer of the barrier. The barrier is transferred during snow and ice conditions except under exceptional occasions with extremely severe weather and during those extreme weather conditions there is almost no traffic so opening the contraflow lane is unnecessary.

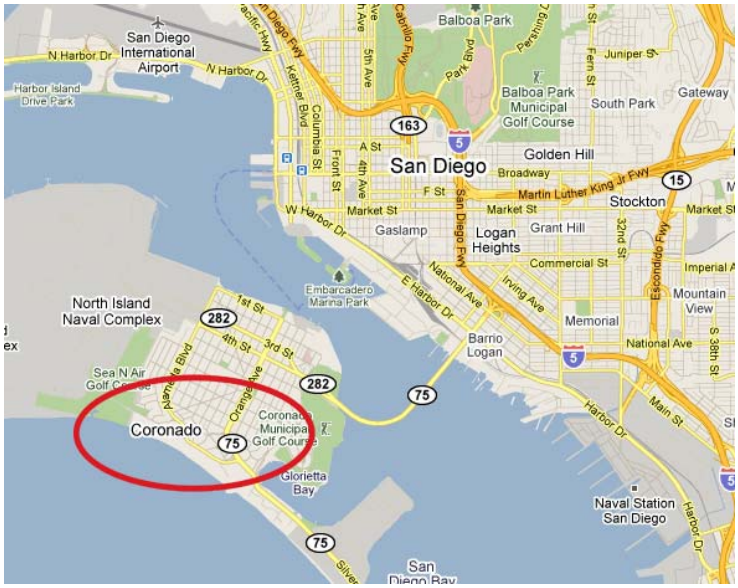
The barrier wall provides positive barrier separation from traffic flowing in the opposite direction. A breakdown of the BTM occurs on average about once per year and the machine is usually fixed on the spot with relatively short delays.

Coronado, CA

Coronado is a suburb of San Diego, CA with a population of 24,100 with a median family income of $91,748 per year. Coronado is served by the Coronado Bridge connecting the community to downtown San Diego. The bridge carries an average daily traffic count of 89,000 vehicles per day. Coronado is connected to San Diego by the bridge and is the only access to the island other than by water transport. There are 65,000 daily commuters who benefit each day from safer and more reliable trips to and from San Diego.

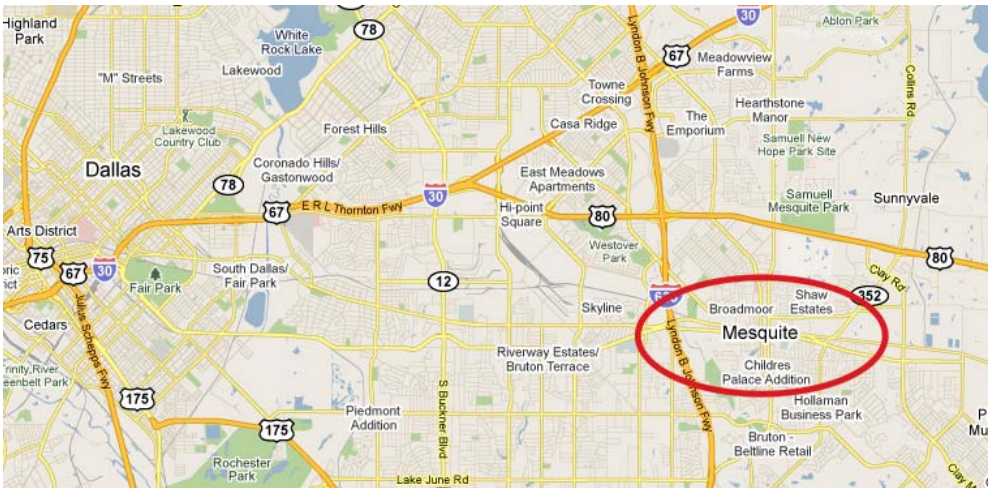
There is about 8,500 feet of the movable 24-inch Series 300 Concrete Barrier on the bridge and approaches. The barrier is transferred by a barrier transfer machine that travels at 5 to 7 mph during the barrier transfer. The system was installed in 1993.

Since the system has been installed we are not aware that any documented complaints have been received concerning noise created by the transfer of the barrier. Obviously there is no concern for snow and ice operation or maintenance. The barrier wall provides positive barrier separation from traffic flowing in the opposite direction.



Mesquite, TX

Mesquite is a suburb of Dallas, TX with a population of 136,750 with a median family income of $56,357 per year. Mesquite is served by the I-30 connecting the community to downtown Dallas. I-30 carries an average daily traffic count of 160,000 vehicles per day. There are 15,000 daily commuters who benefit each day from safer and more reliable trips to and from downtown Dallas.



There is total of over 84 miles of movable barrier contraflow managed lanes in the Dallas metro area or as it referred to locally as the Dallas "Metroplex". Of that total system of managed lanes there is about 15,840 feet of the movable 24-inch Series 300 Concrete Barrier within the city limits of Mesquite. The barrier is transferred by a barrier transfer machine that travels at 7 to 9 mph during the barrier transfer. The system in Mesquite was one of the first in the Dallas area and was installed in 1991. The system has been expanded three (3) times to help the Dallas metro area reach its air quality goals. At the latest expansion of the I-30 Contraflow Lane an environmental Categorical Exclusion (Revised) dated October 10, 2005 was issued by the Federal Highway Administration to the Texas DOT. The following are excerpts from that document relative to noise, the document stated:

Noise Assessment

Since the proposed project involves the construction of interim HOV lanes in the median, with no added permanent through lanes, a traffic noise analysis is not required by the FHWA Regulation 23 CFR 772 or TxDOT's 1996 Guidelines for Analysis and Abatement of Highway Traffic Noise. No extended disruption of normal activities is expected. Provisions would be included in the plans and specifications that require the contractor to make every reasonable effort to minimize construction noise through abatement measures such as work-hour controls and proper maintenance of muffler systems.

Noise associated with the construction of the project is difficult to predict. Heavy machinery, the major source of noise in the construction, is constantly moving in unpredictable patterns. However, construction normally occurs during daylight hours when occasional loud noises are more tolerable. No extended disruption of normal activities is expected.

The overall conclusion in this Categorical Exclusion regarding this project stated:

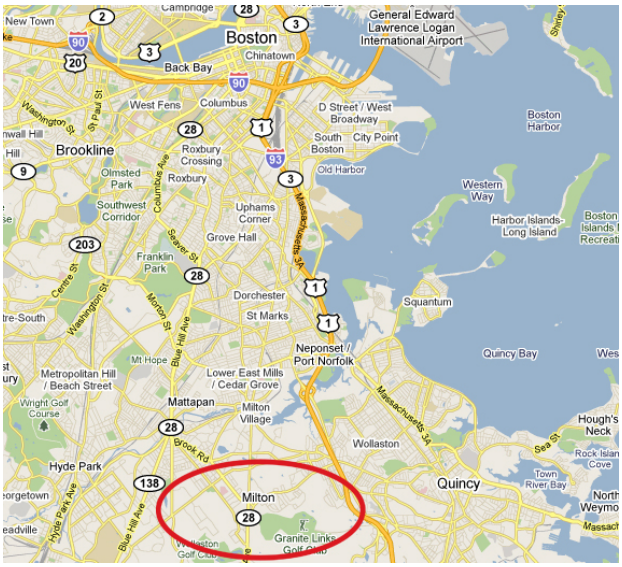
Conclusion

The engineering, social, economic, and environmental studies conducted thus far, indicate that no significant environmental effects are expected to occur; therefore, the proposed project qualifies as a categorical exclusion. The proposed action has no significant impacts as described in 23 CFR 771.117 (a) and (b).

It is interesting to note that when the environmental categorical exclusion was granted by the FHWA, it did not even mention any concern for noise related to the actual barrier transfer operation. Since the system has been installed no recorded complaints have been received concerning noise created by the transfer of the barrier. Here again, the barrier wall provides positive barrier separation from traffic flowing in the opposite direction.

Milton, MA

Milton is a suburb of Boston, MA with a population of 26,062 with a median family income of $107,261 per year. Milton is served by I-93 connecting the community to downtown Boston. I-93 carries an average daily traffic count of 161,000 vehicles per day. Milton is at the southern end of the Managed Contraflow Lanes of I-93 Southeast Expressway headed into Boston. Residents of Milton are among the commuters who benefit each day from safer and more reliable trips to and from Boston.

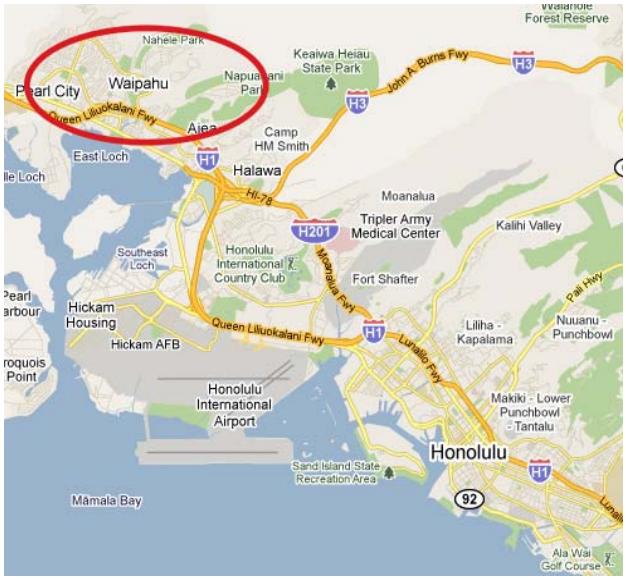


Milton has been listed in the top 10 of the Money Magazine's "Best Places to Live" in the US multiple times. Like so many other small communities, Milton relies on and benefits from the I-93 Managed Lane corridor.

There is about 10,560 feet of the movable 24-inch Series 300 Concrete Barrier within the city limits. The barrier is transferred by a barrier transfer machine that travels at 5 to 8 mph during the barrier transfer. The system was installed in 1994.

Since the system has been installed, no documented complaints have been received concerning noise created by the transfer of the barrier. The barrier is transferred during snow and ice conditions except under exceptional occasions with extremely severe weather and during those extreme weather conditions there is almost no traffic, so opening the contraflow lane is unnecessary. The barrier wall provides positive barrier separation from traffic flowing in the opposite direction. A breakdown of the BTM occurs on average about once per year and the machine is usually fixed on the spot with relatively short delays.

Waipahu, HI



Waipahu is a suburb of Honolulu, HI with a population of 33,108 with a median family income of $51,855 per year. Waipahu is served by the H-1 Freeway connecting the community to downtown Honolulu. The H-1 carries an average daily traffic count of 215,000 vehicles per day. Waipahu is connected to Honolulu by the H-1 and is the primary linkage to and from the community to Honolulu. Moveable barrier is used on the H-1 to create a Contraflow HOV lane reducing congestion saving 25 minutes of travel time.
There is about 1,800 feet of a combination of movable 24-inch Series 300 Concrete Barrier and 18-inch CRTS Barrier on the H-1 in Waipahu. The barrier is transferred by a barrier transfer machine that travels at 6 to 9 mph during the barrier transfer. The system was installed in 1998.

Since the system has been installed, we are not aware that any documented complaints have been received concerning noise created by the transfer of the barrier. Obviously, winter operation and maintenance are not an issue in Hawaii. The barrier wall provides positive barrier separation from traffic flowing in the opposite direction.

3.4 Alternative 4 and Subalternatives

The issue of providing congestion relief for afternoon peak traffic was given consideration. However, the southbound traffic congestion during the PM peak period is far less severe than northbound during the AM peak period. One concept was proposed to provide a contraflow lane from Old Shakopee Road to Diffley Road. It is described as follows.

- Alternative 4A
  - This alternative would use a moveable barrier system to convert the existing inside northbound lane into an additional southbound lane between Old Shakopee Road and Diffley Road in the PM peak, with one entrance at north end and one exit at south end, re-entering southbound TH 77 as a merge.
  - *This alternative was removed from further consideration due to concerns on the downstream capacity limitations of the signals on Cedar Avenue (CSAH 23). It was recommended that further study was necessary in the future if a southbound contraflow lane was wanted.*

4.0 Primary Alternatives Geometry Design Standards and Layouts

Conceptual geometric layouts were developed for the alternatives that were considered for further evaluation. It is noted that the proposed geometric changes are based on the analysis based on the level of analysis done to date. As preliminary design and geometric analysis continues, it is expected that some modifications and refinements will be needed.

The significant geometric changes in this study for each of the alternatives are described as follows.

4.1 Alternative 1A

Figure 5 summarizes the design standards that were used to develop the geometry layout for Alternative 1A. It is noted that the figure indicates the design exceptions that were proposed for this alternative to better utilize the existing infrastructure investments. The primary geometric changes include:

- Construct a 12-foot lane (with full inside shoulder) northbound to connect existing three lane sections (from north of 140th Street to Diffley Road)
- Inside shoulders northbound and southbound reconstructed to I-35E (urban section). Generally, the southbound inside shoulder is held at 10 feet while northbound inside shoulder varies (10 feet and greater)
- Bus shoulders maintained on outside shoulder
- Need to add about 4 miles of noise walls at the south end(2 miles each side)
- The bridge over I-35E needs restriping to accommodate the outside lane-add. It is noted that there is an adverse superelevation on the outside lane over the bridge as the result of the restriping. The adverse suerelevation does not meet design standards for roadway cross-slopes, and therefore creates safety concerns. Another safety concern is that to accommodate adding the outside lane, the inside wave area is narrowed. Widening or re-decking the bridge could be an option to remedy the safety problems but would add significant costs to this alternative.

Appendix 2-1 illustrates the layout for Alternative 1A with typical sections in the flyout boxes and also included in Appendix 2-4. An image visualization has been created for this alternative. It is included in Appendix 2-5.

4.2 Alternative 2B - MnPASS

Figure 6 summarizes the freeway mainline design standards and design exceptions that were proposed to develop the layout for the Alternative 2B MnPASS while Figure 7 illustrates the guidelines for the ingress/egress to open access locations. The primary geometric changes include:

- Construct 12-foot lane and 2-foot buffer (with full inside shoulder) northbound to connect existing three lane sections (from north of 140th Street to Diffley Road)
- Inside shoulders northbound and southbound reconstructed to I-35E (urban section). Generally, the southbound inside shoulder is held at 10 feet while northbound inside shoulder varies (10 feet and greater)
- Construct 4th lane northbound north of TH 13 by widening to the right and then restriping the lane configuration over the Minnesota River Bridge. Section on the Minnesota River Bridge includes a 12-foot MnPASS lane with 2-foot buffer, 3-12 foot lanes, a 2-foot inside shoulder, and a 4 foot outside shoulder
- Construct 4th lane and full outside shoulder north of the Minnesota River Bridge to Old Shakopee Road (4th lane drops at Old Shakopee Road as an exit only)
- Bus shoulders maintained on outside shoulder EXCEPT over the Minnesota River Bridge
- Need to add about 4 miles of noise walls at the south end (2 miles each side)
- MnPASS lane terminates just north of Old Shakopee Road
- Similarly, it is noted that there is an adverse superelevation on the outside lane on the bridge over the I-35E as the result of the restriping. This may cause serious safety concerns as mentioned previously. Widening or re-decking the bridge could be an option to remedy the safety problems, but would add significant costs to this alternative.
- Will greatly reduce snow storage capacity on the Minnesota River Bridge

Appendix 2-2 illustrates the layout for Alternative 2B. The typical sections are illustrated in the flyout boxes and also included in Appendix 2-4.

4.3 Alternative 3B MnPASS with Intermediate Access

While developing typical sections (lane and shoulder widths) for the contraflow lane, several alternatives were considered with various combinations of lane widths (from 11 feet to 14 feet) and shoulder widths (from 4 feet to 10 feet) before choosing the current configuration of 13.5-foot lanes (12.5 feet when barrier is deployed) and an 8 foot inside shoulder (10 feet when barrier is deployed) for most of the non-bridged parts of TH 77. Other locations (both in the United States and abroad) where a moveable barrier has been installed have used lane widths of 10 to 12 feet, with little or no shy distance to the barrier. In these cases, the available roadway width was the driving factor in determining lane width rather than the need for shy distance.

Figures 8 and 9 respectively summarize the design standards and design exceptions that were proposed for this study to develop the geometry layouts as well as barrier storage for Alternative 3B MnPASS with intermediate Access. The primary geometric changes include:

- 13-foot southbound inside shoulder to be reconstructed as it will be in use by northbound traffic in AM peak, along with the barrier transfer machine during deployment and retraction of moveable barrier
- 3rd lane with full shoulder constructed from north of 140th Street to southerly crossover, located south of McAndrews Avenue overpass. There is some desire to locate the southerly crossover as far north as possible. The exact location of the crossover will be determined in the next phase based on operational analysis, stakeholder input, and design and cost considerations.
- 12-foot lanes maintained (0.5 foot buffer on each side of deployed barrier). Southbound inside shoulder will be 10 feet during deployment, and 10 feet when barrier is stored

- Existing emergency vehicle crossovers maintained in two locations – one north of I-35E, and one south of the Minnesota River Bridge. An opening in the non-deployed moveable barrier will be provided to allow for emergency vehicles to crossover the TH 77 median when the contraflow lane is not in operation. During contraflow lane operations the crossovers will not be accessible to southbound TH 77 Traffic.
- Emergency pull-offs will be provided every one-half mile along the contraflow lane.
- Bus shoulders maintained on outside shoulder
- The barrier machine noise is a concern and noise walls may be required depending on the further analysis in the pre-design phase.
- Inside shoulder on Minnesota River Bridge reduced to 4.5 feet during moveable barrier deployment, with 27 feet to accommodate the contraflow lane, barrier, and inside southbound lane. Inside shoulder on Minnesota River Bridge reduced to 6 feet when moveable barrier is not deployed.
- Northerly crossover occurs south of Old Shakopee Road, but traffic is prevented from merging/weaving to exit to Old Shakopee Road
- Intermediate crossover located north of I-35E (under Cliff Road Bridge)

Appendix 2-3 illustrates the layout for Alternative 3B MnPASS with Intermediate Access. The typical sections are illustrated in the flyout boxes and also included in the Appendix 2-4. Image visualizations have been created for this alternative respectively with the moveable barriers deployed and stored. They are included in Appendix 2-6A and Appendix 2-6B.

Figure 5 – Design Standards Form for Alternative 1A

Critical Design Element	Existing Condition, Minimum	Proposed Condition, Minimum	Mn/DOT Standard for New Construction/ Reconstruction	Mn/DOT Road Design Manual or Mn/DOT LRFD Bridge Design Manual
Design Speed	Design Speed selected for this project is **70** mph.			Table 2-5.06A
Lane Width	**12__ft**	**12__ft**	12 ft	4-3.01.02
Shoulder Width Right Left	**10__ft** **10__ft**	**10__ft** **13 ft 5 in (Beg to I-35E)** **10__ft (North of I-35E)**	__10__ft __10__ft	Table 4-4.01A, or Table 4-401C Table 4-4.01B
Bridge Shoulder Width Right Left	**7'5"__ft** **5'6"__ft**	***3'2"__ft (I-35E)** ***5'6"__ft (I-35E)**	__12__ft __12__ft	Table 9-2.03A
Horizontal Clearance to Obstructions	**10__ft**	***3'2"__ft**	__10__ft	Section 4-6.05
Horizontal Alignment, Radius	**5730__ft**	**5730__ft**	__2083_ ft min.	Table 3-2.03A or Table 3-2.03B
Superelevation	**0.015**	**0.015(Minimum)** **0.033(Maximum)** ***_0.024(I-35E)****	0.06 maximum	Section 3-3.0

* An asterisk preceding proposed condition indicates a Geometric Design Exception.

** The proposed inside lane and weaving lane across the TH 77 Bridge over I-35E are sloped at 0.024 to the right. The northbound TH 77 alignment is in a 45-degree left curve, creating an adverse superelevation for those lanes.

Figure 6 – Design Standards Form for Alternative 2B MnPASS

Critical Design Element	Existing Condition, Minimum	Proposed Condition, Minimum	Mn/DOT Standard for New Construction/ Reconstruction	Mn/DOT Road Design Manual or Mn/DOT LRFD Bridge Design Manual
Design Speed	Design Speed selected for this project is **70** mph.			Table 2-5.06A
Lane Width	**12 ft**	**12 ft**	12 ft	4-3.01.02
Shoulder Width Right Left	 **10__ft** **10__ft**	 **10 ft** **11 ft 5 in (Beg to I-35E)** **10 ft (North of I-35E)**	 10__ft 10__ft	Table 4-4.01A, or Table 4-401C Table 4-4.01B
Bridge Shoulder Width Right Left	 **7'5" (over I35E)** **7'5" (over Access Rd)** **10'3" (MN river)** **5'6" (over I35E)** **11'5" (over Access Rd)** **10'3" (MN river)**	 ***3'2" (over I35E)** ***5'5" (over Access Rd)** ***4' (MN river)** ***3'6" (over I35E)** ***9'5" (over Access Rd)** ***2' (MN river)**	 __12__ft __12__ft	Table 9-2.03A
Horizontal Clearance to Obstructions	**10__ft**	***2'__ft**	10__ft	Section 4-6.05
Horizontal Alignment, Radius	**2546__ft**	**2546__ft**	2083_ ft min.	Table 3-2.03A or Table 3-2.03B
Superelevation	**0.015**	**0.015(Minimum)** **0.057(Maximum)** ***_0.024(I-35E)****	0.06 maximum	Section 3-3.0

* An asterisk preceding proposed condition indicates a Geometric Design Exception.

** The proposed inside lane and weaving lane across the TH 77 Bridge over I-35E are sloped at 0.024 to the right. The northbound TH 77 alignment is in a 45 degree left curve, creating an adverse superelevation for those lanes.

Figure 7 – Guidelines for Ingress/Egress to Open Access Treatments for Alternative 2B MnPASS

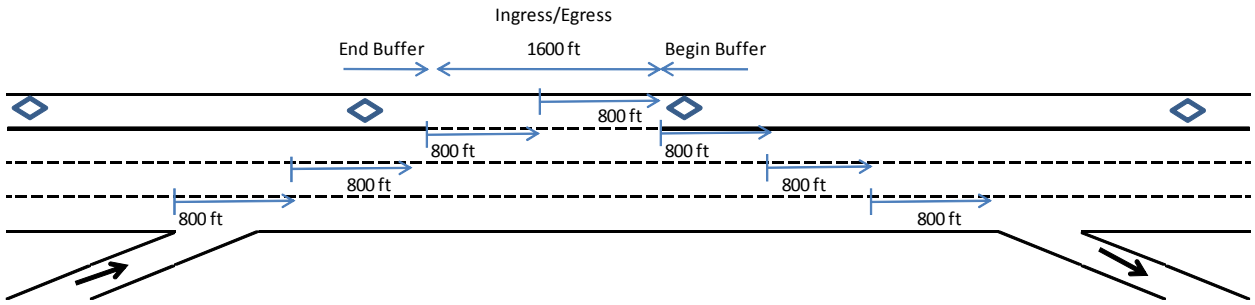


Figure 8 – Design Standards Form for Alternative 3B MnPASS

Critical Design Element	Existing Condition, Minimum	Proposed Condition, Minimum	Mn/DOT Standard for New Construction/ Reconstruction	Mn/DOT Road Design Manual or Mn/DOT LRFD Bridge Design Manual
Design Speed	Design Speed selected for this project is **70** mph.			Table 2-5.06A
Lane Width	**12__ft**	**12__ft**	12 ft	4-3.01.02
Shoulder Width Right Left	 **10__ft** **10__ft**	 **10 ft** ***0 ft**	 __10__ft __10__ft	Table 4-4.01A, or Table 4-401C Table 4-4.01B
Bridge Shoulder Width Right Left	**7'5" (@ I35E)** **11'5" (@ Access Rd)** **12'9" (@ MN river)** **----------** **11'5" (@ I35E)** **11'5" (@ Access Rd)** **8' (@ MN river)**	***7'5" (@ I35E, SB Traffic)** ***8'5" (@ I35E, NB Traffic)** ***11'5" (@ Access Rd, SB Traffic)** ***8'5" (@ Access Rd, NB Traffic)** **12'9" (@ MN river, SB Traffic)** ***5'6" (@ MN river, NB Traffic)** **----------** ***0'6" (@ I35E, SB/NB Traffic)** ***6" (@ Access Rd, SB/NB Traffic)** ***0' (@ MN river, SB/NB Traffic)**	__12__ft __6__ft	Table 9-2.03A
Horizontal Clearance to Obstructions	**10__ft**	***5'6"__ft**	__10__ft	Section 4-6.05
Stopping Sight Distance	**____ft**	**____ft**	_730_ ft min.	Section 2-5.08.01
Horizontal Alignment, Radius	**2546__ft**	**__2546__ft**	__2083_ ft min.	Table 3-2.03A or Table 3-2.03B
Grades, Percent	**___% maximum**		__3_% maximum	Table 3-4.02A
Vertical Alignment, K value Crest Sag	 **__ ft/% min.** **__ ft/% min.**	 **__ ft/% min.** **__ ft/% min.**	 _247_ ft/% min. _181_ ft/% min.	 Figure 3-4.04A Figure 3-4.04D
Normal Cross Slope			0.02	Table 4-3.01A
Superelevation		**0.057**	0.06 maximum	Section 3-3.0
Vertical Clearance > Highway under bridge > Railroad under bridge > Highway under sign or pedestrian bridge	 **___ ft** **___ ft** **___ ft**		 16 ft-4 in 23 ft-0 in 17 ft-4 in	Table 9-2.01B

* An asterisk preceding proposed condition indicates a Geometric Design Exception.

Figure 9 – Design Standards Form for Alternative 3B –Barrier Stored (Southbound Only)

Critical Design Element	Existing Condition, Minimum	Proposed Condition, Minimum	Mn/DOT Standard for New Construction/ Reconstruction	Mn/DOT Road Design Manual or Mn/DOT LRFD Bridge Design Manual
Design Speed	Design Speed selected for this project is **70** mph.			Table 2-5.06A
Lane Width	**12__ft**	**12__ft**	12 ft	4-3.01.02
Shoulder Width Right Left	**10__ft** **10__ft**	**10 ft** **10 ft**	__10__ft __10__ft	Table 4-4.01A, or Table 4-401C Table 4-4.01B
Bridge Shoulder Width Right Left	**7'5" (@ I35E)** **11'5" (@ Access Rd)** **12'9" (@ MN river)** **----------** **11'5" (@ I35E)** **11'5" (@ Access Rd)** **8' (@ MN river)**	***7'5" (@ I35E)** ***11'5" (@ Access Rd)** ***12'9" (@ MN river)** **----------** ***9'5" (@ I35E)** ***9'5" (@ Access Rd)** ***6' (@ MN river)**	__12__ft __12__ft	Table 9-2.03A
Horizontal Clearance to Obstructions	**10__ft**	***5'6"__ft**	__10__ft	Section 4-6.05
Stopping Sight Distance	**____ft**	**____ft**	_730_ ft min.	Section 2-5.08.01
Horizontal Alignment, Radius	**2546__ft**	**__2546__ft**	__2083_ ft min.	Table 3-2.03A or Table 3-2.03B
Grades, Percent	**___% maximum**		__3_% maximum	Table 3-4.02A
Vertical Alignment, K value Crest Sag	**__ ft/% min.** **__ ft/% min.**	**__ ft/% min.** **__ ft/% min.**	_247_ ft/% min. _181_ ft/% min.	Figure 3-4.04A Figure 3-4.04D
Normal Cross Slope			0.02	Table 4-3.01A
Superelevation		**0.057**	0.06 maximum	Section 3-3.0
Vertical Clearance > Highway under bridge > Railroad under bridge > Highway under sign or pedestrian bridge	**___ ft** **___ ft** **___ ft**		16 ft-4 in 23 ft-0 in 17 ft-4 in	Table 9-2.01B

* An asterisk preceding proposed condition indicates a Geometric Design Exception.

5.0 Primary Alternatives Technical Evaluations

Based on proceeding evaluation, three primary alternatives were considered for further technical evaluations. With combinations of the geometry elements and option of MnPASS or General Purpose Lane, a number of subalternatives were proposed for technical evaluation. Two technical evaluations were conducted for these alternatives: a regional model travel demand forecasting analysis and a State-of-Art micro-simulation CORSIM model operational analysis. The detailed analysis and results are documented in their corresponding memorandums, and they are attached in the appendices. (Appendix 3: TH77 Managed Lanes Corridor Study, Travel Demand Forecasting Results dated June 2, 2010; and Appendix 4: TH 77 Managed Lanes Study, CORSIM Modeling Analysis Memorandum, dated June 21, 2010).

The regional traffic forecast and CORSIM modeling analysis methodologies and results are summarized as follows.

5.1 Regional Traffic Forecast Analysis

One of the key tasks in this study was to develop 2010 and 2030 forecast travel demand for a no-build and a number of build alternatives. The latest Twin Cities Regional Travel Demand Model was used for the regional traffic forecast analysis. The regional model was developed in the 2001 – 2003 timeframe as a part of the Twin Cites Travel Behavior Inventory (the 2000 TBI), and used information from the 2000 Census; the year 2000 Regional Home Interview Survey and a concurrent set of external surveys done as a part of the 2000 TBI. The regional model has been enhanced since then. One of the key enhancements was that toll modeling was added into the model in 2006-2007 to model I-394 and I-35W HOT lanes. This toll model was used in the evaluation of MnPASS options for this TH 77 Managed Lanes Study. The regional model included the seven core counties of the region, as well as a set of ring counties surrounding the core. A total of 1,632 zones were included with 1,201 zones in the seven-county area.

This regional traffic forecast analysis had two primary purposes. First, the forecast was used to identify general demand characteristics in the corridor, including average daily traffic, peak hour traffic spatial and temporal distributions, toll and HOV demand, as well as to provide an estimate for toll revenues. Secondly, the travel demand model output provided growth factors and ramp-to-ramp movements during the peak periods for use in the CORSIM traffic simulation model.

The main inputs to the model included:

- **Socioeconomic Data.** This included population, households, retail and non-retail employment by traffic analysis zone (TAZ). The socioeconomic data for the entire region was provided by the Metropolitan Council. The planned development for the Mall of America expansion was incorporated in the study.
- **Networks.** These include highway network and transit network. The latest networks that were enhanced in the I-94 Managed Lanes Study were used for this study. The networks included all the transportation network assumptions in the latest 2008 Transportation System Plan (TSP) by Metropolitan Council. The 2030 transit network was refined further to be consistent with the latest Cedar Avenue Transit Study.

The toll model is embedded within the Cube/Voyager equilibrium assignment routine in the regional model. There are three key assumptions required for this model. First, a "diversion curve" must be supplied which identifies the probability of toll choice given the value of time. This was derived from a user survey of MnPASS toll users completed for the I35W UPA project. Second, a toll policy curve must be supplied which relates the toll to the level of service (as described by v/c ratio) on the toll facility. This was derived from the current MnPASS toll policy, and is designed to maintain a near free-flow level of service on any MnPASS facility. It has a maximum of $8.00 and a minimum of $0.25. Finally, an assumption is made with regard to the hourly capacity of a MnPASS lane. This was set at 1,400 vehicles/hour/lane, which was the value used for the I35W UPA and I94 Managed Lane studies. It is further supported by similar results from recent studies of managed lane practical capacities in the field.

The base year regional model was validated by comparing the daily and peak hour volume outputs against actual traffic counts from 2007. The base-year discrepancy in each link was accounted for adjustments for future year daily and peak hour traffic forecasts. The Regional Model does not do well on the peak hour spreading. Reasonable engineering and planning judgment was used for the peak hour spreading adjustments. The adjusted peak hour traffic forecasts were further balanced for the CORSIM model inputs.

Figure 10 illustrates all the alternatives that were modeled in the regional travel demand model.

Figure 10 – Alternatives Modeled in the Regional Model

Alternative Designation	Description	1997	2010	2030
No-Build	Regional Plan with no capacity expansion on Cedar Avenue			
1A	Add NB Lane from 140th to Diffley lane add			
2B GP	Added NB General Purpose Lane from 140th to OSR			
2B MnPASS	Added NB MnPASS Lane from 140th to OSR			
2B MnPASS IA	Added NB MnPASS Lane from 140th to OSR with intermediate access north of I35E			
2B MnPASS OA	Added NB MnPASS Lane from 140th to OSR with open access/egress throughout			
2B MnPASS OA Toll-controlled	Added NB MnPASS Lane from 140th to OSR with open access/egress throughout. Use higher toll to limit demand to 1100 vph on bridge			
3B GP	Added NB General Purpose Reversible Lane from 140th to OSR			
3B MnPASS	Added NB MnPASS Reversible Lane from 140th to OSR			
3B MnPASS IA	Added NB MnPASS Reversible Lane from 140th to OSR with intermediate access north of I35E			
3B MnPASS IA Ext	Added NB MnPASS Reversible Lane from 140th to North of I494 with intermediate access north of I35E			
3B MnPASS IA Toll-controlled	Added NB MnPASS Reversible Lane from 140th to OSR with intermediate access north of I35E. Use higher toll to limit demand to 1100 vph on bridge			

The regional travel demand model analysis of the TH77 managed lane corridor alternatives reveals the following findings:

1. Travel demand in the corridor is highly directional and characterized by home to work/work to home trips in the am and pm peak periods, with a heavy northbound predominance in the AM peak period and southbound predominance in the PM peak period. Southbound trips in the AM peak period can be easily accommodated by two lanes through 2030.
2. Due to planned intensive development in the region, latent demand is sufficient to use the capacity expansion proposed for the northbound TH 77 Minnesota River Bridge.
3. Due to demand shifts to the build alternatives, there is some relief to parallel routes, including TH 169, I35W, I494, TH55, TH13 and I35E. However, additional traffic demand will be placed on TH77 north of the corridor, TH62 and I494 between I35W and TH5.
4. The build alternatives provide a reduction in corridor travel time between 140th Street and I-494 interchange from 2 to 6 minutes in 2030 for general purpose traffic. For MnPASS users, proposed Alternative 3B reversible lane and Alternative 2B MnPASS lane provide a time savings of about 12 minutes over the No-Build travel times.
5. The regional model shows that Alternative 2B General Purpose provides the greatest overall region-wide vehicle hours of delay reduction due to the most capacity expansion on the corridor. However, it is noted that the alternative also feeds most traffic into I-494/TH 77 interchange while the traffic is not manageable. Since this area has no major capacity enhancement projects, the additional volume will greatly increase congestion and delay through the interchange for TH77 and I-494 traffic.
6. Alternative 2B General Purpose would remove the bus shoulder, and result in a six minute additional travel time for buses, which translates to a reduction of about 2,000 daily transit trips, and about 500 additional vehicle trips. Conversely, the 3B MnPASS alternatives provide a transit time savings of about 5 minutes, and would result in an additional 1,800 transit trips per day, and a reduction of about 490 vehicles per hour in the travel shed for year 2030.
7. A very high toll for the 2B MnPASS alternative is required to lower the overall peak segment, peak hour demand to about 1100 vph on a MnPASS lane. This essentially prices out almost all paying trips, leaving only HOV vehicles. For the 3B MnPASS alternative, a toll of about $3.60 would effectively reduce the overall demand, leaving about 26% of the MnPASS traffic as SOV paying traffic.
8. Alternative 2B, general purpose, unlike the MnPASS alternatives does not provide the user with a reliable, congestion-free option on TH 77, and in fact reduces the service level and reliability for transit users, while adding additional vehicular traffic due to mode shift away from transit. It has serious limitations with regard to capability to respond to future increases in demand, unlike the flexibility offered by the managed lanes alternatives, including the MnPASS options.

5.2 CORSIM Simulation Modeling Analysis

As one of the tasks for the project, CORSIM model simulation and analysis was conducted to test a number of concepts developed in the preceding project tasks. The purpose of simulation was to identify the operational deficiencies and efficiencies associated with geometric changes to the existing infrastructure. The primary inputs for simulation models include the traffic-volume data including turning movements and Origin-Destination (OD), traffic control

data including ramp metering and geometry data. In addition to the animation, the simulation model outputs include queue length, delay time, speeds, densities, volumes and etc. The criteria for Freeway Level of Service from the Highway Capacity Manual (HCM) were used to evaluate TH 77 freeway mainline operations for each of the alternatives.

Based on Steering Committee guidelines and requirements, the CORSIM model limits extend to include several major interchanges and intersections in the influence area of the project. The traffic models created for this study included following freeways:

- TH 77 between 140th Street and TH 62
- I-494 between I-35W and TH 5
- TH 77/I-35E interchange and its Collector-Distributor (CD) roads
- TH 77/TH 13 interchange
- TH 77/I-494 interchange and its CD roads including ramps from/to Mall of America
- TH 77 ramp terminal intersections on McAndrews Road (County Road 38), 127th Street, Cliff Road, Diffley Road and Old Shakopee Road

The CORSIM Traffic Model Simulation and Analysis for this study included the following step by step approach:

- An existing condition CORSIM Model was calibrated based on actual conditions in 2007.
- The planned improvements to the I-494 and 140th Street/Cedar Avenue intersection were identified and incorporated into all 2030 CORSIM models, including the no build model.
- The 2030 no build, and build Alternatives 1A, 2B and 3B and their primary variations were analyzed to identify their operational advantages and disadvantages.
- Based on the preliminary results and findings from the 2030 models, sensitivity tests were conducted for the 2030 Alternatives 2B MnPASS and 3B_IA MnPASS.
- The based 2010 CORSIM no build and models were analyzed
- Based on the preliminary results and findings from 2010 models, sensitivity tests were conducted to identify the impacts of the improvements to the I-494 on the operations of TH 77 in the project area.
- The modeling results and findings were summarized and documented.

To fully understand the advantages and disadvantages associated with each alternative, a number of modeling alternatives and scenarios were developed based on different combinations of the geometry elements, MnPASS or General Purpose Lane option, year of traffic forecasts and capacity constraint boundary conditions on I-494. Figure 11 summarizes all the modeling alternatives and scenarios in the modeling analysis process. It is noted that the actual traffic condition in 2007 was used for CORSIM Model calibration.

Figure 11 – Alternatives Modeled in CORSIM

Base Options	Primary Alternatives	2010	2030
Nobuild		Forecast/CORSIM	Forecast/CORSIM
Alternative 1A	General Purpose	Forecast/CORSIM*	Forecast/CORSIM*
Alternative 2B	General Purpose		Forecast/CORSIM
	MnPASS (Open Access)	Forecast/CORSIM**	Forecast/CORSIM***
Alternative 3B	General Purpose		Forecast/CORSIM
	Intermediate Access General Purpose		Forecast/CORSIM
	MnPASS		Forecast/CORSIM
	Intermediate Access MnPASS	Forecast/CORSIM**	Forecast/CORSIM***

Note: * Sensitivity tests in CORSIM analysis assuming the Alternative 3B_IA_MnPASS forecasts

** Sensitivity tests in CORSIM analysis assuming the improvement to the I-494/I-35W interchange

*** Sensitivity tests assuming limited MnPASS demands on the Minnesota River Bridge in both forecast and CORSIM modeling processes

The CORSIM model analysis reveals the following findings:

- The Southbound TH 77 operations for all the alternatives, including the contra-flow alternatives, are acceptable for year 2030. Southbound trips in the AM peak period can be easily accommodated by two lanes through 2030.
- Under NoBuild conditions during the AM peak hour, northbound TH 77 operations would become worse than existing, especially along the 2-lane segment between Diffley Road and 138th Street. The queue backs into the 140th Street signalized intersection by year 2030. The congestion persists on the Minnesota River Bridge. The duration of the peak period is also prolonged.
- Under the Alternative 1A condition, the northbound bottleneck between Diffley Road and 138th Street is removed due to the capacity expansion. Approximately 900 more vph are served on the corridor than for the NoBuild. However, the congestion on the Minnesota River Bridge becomes worse due to the removal of the upstream bottleneck.
- Under the Alternative 2B_GP condition, it is noted that approximately 2,000 more vph are served on the bridge and about 1,400 more vph on the segments in the I-35E interchange area. The operations between 138th Street and Old Shakopee Road are much better than NoBuild due to the capacity expansion. However, due to more traffic (approximately 1,800 vph more than NoBuild) passing into I-494/TH 77/MOA interchange area, the operations in the interchange area become worse and unacceptable.
- Under the Alternative 2B_MnPASS (Open Access) condition with the current pricing strategies for the MnPASS lane, the I-494/TH 77 interchange is overloaded due to an additional 1,700 vph passing into the I-494/TH 77/MOA interchange area. The demands on the bridge should be managed at the level of 1,300-1,400 vph in order not to overload the I-494/TH 77 interchange.

- Under all four alternative 3B modeling scenarios, it is noted that their demands between Old Shakopee Road and I-494 interchange in year 2030 are about the same as those for the alternative 2B_GP and 2B_MNPASS scenarios. All four modeling scenarios overload the I-494/TH 77 interchange. For the MnPASS alternatives, the demands on the bridge should be managed at the level of 1,100-1,200 vph in order not to overload the I-494/ TH 77 interchange.
- There are trade-offs for the intermediate accesses for the 3B Alternatives. While the intermediate access provides the free flow lane to the travelers from I-35E, it creates weaving problems between I-35E and the new entrance ramp to the contra-flow lane. Further study is necessary to identify the appropriate location for the intermediate access.
- Relocation of the contraflow entrance ramp north of I-494 would not reduce the congestion in the I-494/TH 77 interchange area as the demands for the interchange remain unchanged and because a lot of congestion is caused by downstream condition on I-494, comparing to the scenario where the entrance ramp is south of the interchange.

5.3 Alternative Costs

The project costs include construction, bridges and structures, right-of-way, start-up, and engineering/project delivery costs. The estimated costs for the three primary alternatives in 2010 Dollars are as follows. (The values are estimated as ranges due to the difficulty in qualifying some of the costs).

- Alternative 1A: $25 to 30 Million
- Alternative 2B_MNPASS: $40 to 50 Million
- Alternative 3B_MNPASS_Intermediate Access: $30 to 40 Million (This includes $8M for noise walls and full rebuild of shoulders. Also included is the cost of the barrier transfer machine. Future discussions with FHWA and others will determine if these items are needed.)

These costs do not include annual maintenance or operating costs. It is noted that these are scoping level cost ranges and substantial cost development will be done if the study is taken to the pre-design level.

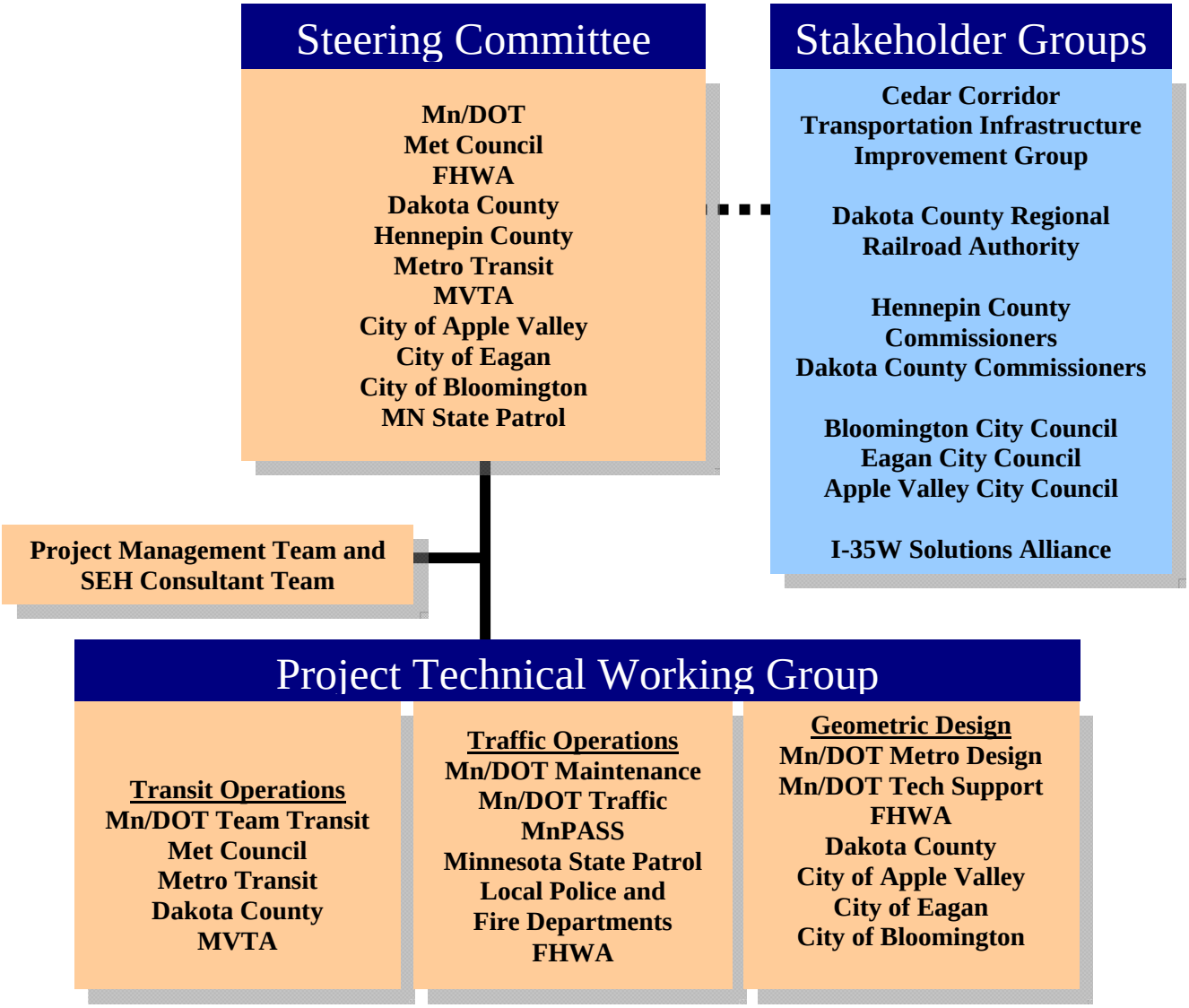
Based on information gather for other contraflow systems similar to what is proposed here, annual operating and maintenance costs are anticipated to be approximately $500,000 to $750,000

6.0 Project Team Meetings and Communications

6.1 Project Team/Stakeholders

Over the course of the study a number of stakeholders have been involved. Involvement varies depending on the stakeholder roles and responsibilities. In addition, Mn/DOT retained SEH Inc. and PB Americas (Consultant Team) to assist in developing this Highway 77 Corridor Managed Lane Study. The Consultant Team works closely with all stakeholders involved with this study. The organizational chart in Figure 12 identifies the various agencies and organizations involved in the study.

Figure 12 – Project Team Groups Organizational Chart



6.1.1 Steering Committee

The formation of a Steering Committee includes various stakeholders to provide oversight, direct policy, formulate political decisions and help provide overall direction for the study. The Steering Committee met approximately quarterly to review the progress of the study and to provide high-level direction. Each Steering Committee meeting was held approximately one week after a meeting of the Technical Working Group. In coordination with Mn/DOT's project manager, the Consultant Team established the membership of the Steering Committee. The Consultant Team scheduled Steering Committee meetings, prepared meeting agendas and reminders approximately one week prior to each meeting, and prepared and distributed meeting minutes to attendees and other interested parties. The following is a list of the agencies and organizations represented on the SC:

Mn/DOT Office of Operations and Maintenance, Metro District
Mn/DOT Area Management
Mn/DOT Metro Maintenance
Mn/DOT Office of Technical Support
Metropolitan Council
Federal Highway Administration (FHWA)
Dakota County
Hennepin County
Metro Transit
Minnesota Valley Transit Authority (MVTA)
City of Apple Valley
City of Eagan
City of Bloomington
Minnesota State Patrol (MSP)

6.1.2 Technical Working Group

The study's Technical Working Group (TWG) was divided into three general areas (subgroups) including transit operations, traffic operations, and geometric design. The Consultant Team prepared for and attended four TWG meetings. Early meetings were "segmented" to address each of the three general areas identified above. In coordination with Steering Committee, the Consultant Team established the membership of each technical working subgroup. Stakeholders that had direct involvement in delivering the study were invited to join together to form the TWG. The Consultant Team scheduled the TWG meetings, developed appropriate exhibits, prepared agendas and meeting reminders approximately one week prior to each meeting, and prepared and distributed meeting minutes to attendees and other interested parties. The following is a list of the agencies and organizations represented on the TWG by subgroup:

Transit Operations
Mn/DOT Team Transit
Met Council
Metro Transit
Dakota County
Minnesota Valley Transit Authority

Traffic Operations
Mn/DOT Metro Maintenance
Mn/DOT Metro Traffic
MnPASS
Minnesota State Patrol

Geometric Design
Mn/DOT Metro Design
Mn/DOT Office of Technical Support
Federal Highway Administration
Dakota County
City of Apple Valley
City of Eagan
City of Bloomington
Mn/DOT Area Management

6.1.3 Project Management Team

In addition to the above, there is also the day-to-day Project Management Team (PMT). The PMT works closely with the Steering Committee, the TWG and the Consultant Team. The PMT meets at least once a month and reviews study progress, provides direction for the study and helps decide the agenda for future Steering Committee and TWG meetings. The Consultant Team prepared for and attended approximately 11 monthly PMT meetings. In coordination with Steering Committee, the Consultant Team established the membership of the PMT. The Consultant Team scheduled the PMT meetings, prepared meeting agendas and reminders approximately one week prior to each meeting, and prepared and distributed meeting minutes to attendees and other interested parties. The following is a list of the agencies and organizations represented on the PMT:

Mn/DOT Project Manager
Mn/DOT Office of Operations and Maintenance, Metro District
Mn/DOT Metro Traffic
Mn/DOT Area Management
Dakota County
Mn/DOT Metro Maintenance

6.1.4 Other Stakeholders

In addition, there are also a number of stakeholders that have an interest or become exposed to the project. During the course of the study, meetings were held with the following stakeholders to get their input and to keep them informed of the study's progress. The following table lists specific contracts that were made during the study. Those stakeholders include:

- Cedar Avenue BRT Policy & TAC Group: The Consultant Team coordinated with the Cedar Ave BRT Policy and TAC Groups during the study since providing a "transit advantage" was a high priority.
- Local Elected Officials: This stakeholder group consists of elected officials from the cities and counties along the TH 77 corridor. Several meetings were held with city councils and county commissioners during the project.
- I-35W Solutions Alliance

TH 77 Moveable Barrier Study - Information sharing

Date	Contact
October 1, 2008	Cedar BRT TAC Group
October 28, 2008	Laura Adelman, This Week Newspaper – Phone Interview
November 14, 2008	CIC Group
February 4, 2009	Senator Chris Gerlach
February 19, 2009	Representative Tara Mack
February 27, 2009	Representative Phil Sterner
March 12, 2009	35W Solutions Alliance
November 2, 2009	Bloomington City Council
November 2, 2009	Project Oversight Committee
November 5, 2009	Apple Valley City Council
November 10, 2009	Eagan City Council
November 17, 2009	Dakota County Regional Rail Authority
November 19, 2009	Cedar Ave Public Open House
December 1, 2009	Incident Management Meeting with Local Responders
December 2, 2009	Cedar Avenue Technical Advisory Committee Meeting
December 10, 2009	35W Solutions Alliance
February 18, 2010	Cedar Ave Public Open House
March 3, 2010	Cedar Avenue Technical Advisory Committee Meeting
March 3, 2010	Senator Chris Gerlach
March 3, 2010	Representative Tara Mack
March 9, 2010	Representative Phil Sterner
March 18, 2010	Cedar Ave Public Open House
March 23, 2010	Mn/DOT-Met Council Planning Staff
March 30, 2010	Mtg with Apple Valley Mayor, City Admin, PW Director, and Commissioner Branning
April 8, 2010	Apple Valley City Council
April 12, 2010	Bloomington City Council
April 13, 20010	Dakota County Physical Development Committee
April 15, 2010	Cedar Ave Public Open House
May 5, 2010	Cedar Avenue Technical Advisory Committee Meeting
May 11, 2010	Eagan City Council
May 13, 2010	Hwy 77 Public Open House
May 14, 2010	Capital Improvements Committee
May 20, 2010	Cedar Ave Public Open House
June 10, 2010	TAB Policy Committee
June 15, 2010	Mtg with Apple Valley Mayor, City Admin, and PW Director

- Drivers/Transit Users/General Public: This group of stakeholders consists of the driving public who will be exposed to the improvements, transit riders in the corridor and the general public that live along the corridor or that have businesses that may be impacted by the corridor improvements. Two 'open houses' were conducted to provide information to the general public and to solicit their comments.
- Other Interested Parties: Interest is anticipated from the media, professional associations, road safety experts, educational institutions, and other governmental agencies.

6.2 Public Community Outreach and Open Houses

Several public open house meetings were held to collect public comments and concerns on the projects. Those comments are attached in the Appendix 5.

6.3 Website

http://www.dot.state.mn.us/metro/projects/hwy77managedlanes/index.html

7.0 Evaluation Summary

7.1 Findings

The findings of the study are summarized as follows:

1. There are capacity deficiencies with the current configuration of northbound TH 77 in the study area. Specifically, the two-lane freeway segment between the County Road 38 and the Diffley Road Interchange and the Minnesota River Bridge are the two major bottlenecks along the corridor.
2. Travel demand in the corridor is highly directional and characterized by home to work/work to home trips in the AM and PM peak periods, with a heavy northbound predominance in the AM peak period and southbound predominance in the PM peak period. Southbound trips in the AM peak period can be easily accommodated by two lanes through 2030.
3. Under no build conditions, the northbound traffic congestion deteriorates dramatically during AM peak period, especially south of the Minnesota River Bridge. The congestion level of the no build alternative along the corridor is worse than any of the build alternatives.
4. The capacity constrained boundaries, especially the interchange of I-494/I-35W, play critical roles in identifying advantages and disadvantages for each alternative. The amount of additional traffic served on the northbound TH 77 Minnesota River Bridge is largely dependent on the realization of the improvements planned for I-494 in order not to overload the I-494/TH 77 interchange.
5. Due to planned intensive development in the region, latent demand is sufficient to use the capacity expansion proposed for the northbound TH 77 Minnesota River Bridge. As mentioned previously, the demands on the Bridge need to be managed due to the capacity constraints downstream. However, a high toll is required to lower the overall peak demand to an acceptable level of about 1,100 vph on a MnPASS lane. This might price out most of paying trips leaving approximately 25% HOV vehicles.
6. From TH 77 corridor travel time perspective, all the three primary alternatives provide noticeable travel time savings for the travelers south of I-35E while not much for travelers north of I-35E on the general purpose lanes. The Alternatives MnPASS 2B and 3B provide free flow MnPASS lanes for all the travelers along the corridor while the Alternative 1A does not.

7. Alternative 1A removes the two-lane bottleneck and preserves the current bus-only-shoulder along the corridor. However, it worsens the current bottleneck at the Minnesota River Bridge, resulting in longer travel time for travelers from ramps between I-35E and TH 13 to the I-494 and north. Furthermore, it does not provide advantages to HOVs and SOVs willing to pay.
8. The general purpose lane options of the Alternatives 2B and 3B overload the I-494/TH 77 interchange due to their higher unmanaged demands on the Minnesota River Bridge. The operations of the TH 77 and I-494 freeways become unacceptable, although the 2B and 3B general purpose alternatives provide more vehicle hours of delay reduction from a regional perspective. Their corresponding MnPASS options provide better operations along the TH 77 corridor and its adjacent roadways because the demands on the TH 77 corridor can be managed.
9. It is noted that Alternative 2B requires the removal of the bus shoulder on the Minnesota River Bridge while Alternative 3B does not. The removal of the bus-only-shoulder reduces the reliability of the transit operations on the bridge. Also, the loss of the shoulders negatively impacts snow storage and removal operations on the bridge.
10. For Alternative 3B, the point where the contra-flow lane merges back onto northbound TH 77 should be located north of the exit ramp to the Old Shakopee Road and south of I-494. Due to corridor constraints north of Old Shakopee Road, the crossover from the contraflow lane to northbound TH 77 is located south of Old Shakopee Road, parallel to TH 77 until a point beyond the nose of the exit to Old Shakopee Road. A raised barrier may be required to prevent the merging traffic from attempting to weave across to the Old Shakopee Road exit. Buses operating in the contraflow lane would not be able to exit to the Mall of America. The relocation of the merging point north of I-494 will not relieve the operations of the I-494/TH 77 interchange. It only changes travel patterns along the corridor. When the merging point is relocated from south of I-494 to north of I-494, the travelers from south on TH 77 would only use the TH 77 general purpose lanes to access I-494 while those travelers continuing on TH 77 north of I-494 would have the option of using the contra-flow lane. The demands for the I-494/TH 77 remain unchanged for the two scenarios.
11. There are trade-offs for the intermediate access at the Cliff Road Interchange proposed for Alternative 3B. While it provides a free flow lane to the travelers from I-35E, it creates weaving problems between I-35E and the new entrance ramp to the contra-flow lane on the left. Further study is necessary to identify the preferred location, if any, for the intermediate access.
12. For Alternatives 1A and 2B, the bridge over I-35E needs restriping to accommodate the outside lane-add. It is noted that there is an adverse superelevation on the outside lane over the bridge as the result of the restriping. The adverse superelevation does not meet design standards for roadway cross-slopes and therefore creates safety concerns. Another safety concern is that to accommodate adding the outside lane, the inside weave area is narrowed. Widening or re-decking the bridge could be an option to remedy the safety problems but would add significant costs to this alternative.
13. Additional analysis and study on the typical sections for Alternative 3B are necessary. A variety of typical sections would be considered in the pre-design phase to better accommodate exiting infrastructure.
14. Alternative 3B will require special accommodations for emergency vehicle operations. Possibilities include providing emergency pullouts and openings in the barrier at crossovers.

15. It is noted that the construction for the project is not funded. In the recent Metropolitan Highway System Investment Study (MHSIS), it is concluded that highway investments in the Metro Long Range (LR) plan should be focused on the need to enhance system performance including managing and optimizing effectiveness of the existing system, and implementing strategic and affordable capacity expansion. Alternatives 2B MnPASS and 3B MnPASS are consistent with the Metro LR plan while Alternative 1A does not provides managed lanes to comply well with the plan. It makes difficult for Alternative 1A to compete for funding.

7.2 Alternative Advantages and Disadvantages

The study reveals each primary alternative has its advantages and disadvantages. They are summarized in Figure 13.

7.3 Next Steps

The next step in the project development process is to complete preliminary engineering and an environmental review to address Federal and State environmental regulations. Based on input from project partners Apple Valley, Bloomington, Dakota County, and Eagan, Alternatives 2B and 3B will be brought forward for further consideration. Letters of support from each partner are included in Appendix 6.

During the preliminary engineering phase, connections from the Cedar Grove Transit Station in Eagan to Highway 77 will be considered to enhance transit service at this location. Preliminary layouts for Cedar Grove connection will be developed in conjunction with the Highway 77 layout.

The scope and scale of environmental analysis to be conducted will be determined in coordination with FHWA. The environmental review process will involve an assessment of the full range of social, economic, and environmental factors including:

- Air quality
- Contaminated properties
- Environmental justice
- Fish and wildlife
- Historic and archaeological
- Noise
- Threatened and endangered species
- Water quality
- Wetlands

Figure 13 – Alternative Advantages and Disadvantages

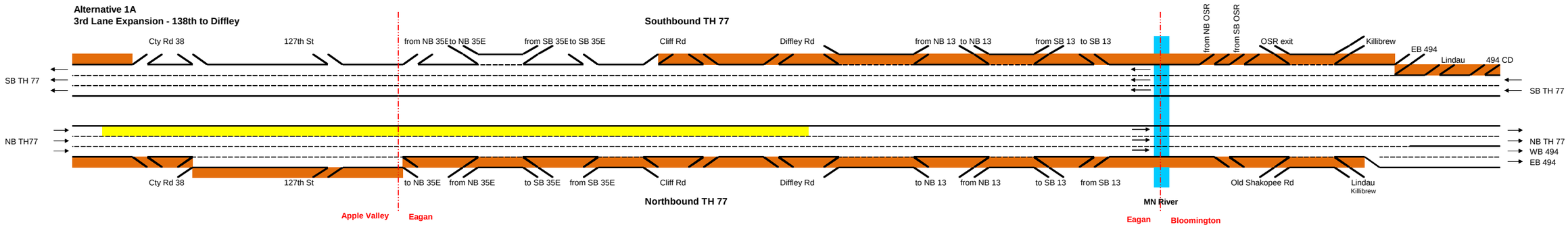
Alternative	Advantages	Disadvantages
No build	• No construction cost	• NB traffic congestion deteriorates dramatically during a.m. peak period, especially south of the Minnesota River Bridge
Alternative 1A	• Relieves bottleneck north of 138th Street • Provides congestion relief for general purpose traffic over no build	• No increased capacity over river – moves bottleneck to Hwy 13 • Does not enhance advantages to transit • Does not provide congestion-free choice for general purpose traffic and carpools • Does not improve travel time reliability • Inconsistent with MHSIS long range plan currently under review • Worsens the current bottleneck at the Minnesota River Bridge • Requires concrete median barrier from 138th Street to I-35E
Alternative 2B MnPASS (Open Access)	• Relieves bottleneck north of 138th Street and at the river bridge without overloading I-494 interchange • Increases capacity over bridge - attracts trips away from regional system • Provides transit advantage for express buses from the City of Apple Valley • Provides congestion-free choice for general purpose traffic and carpools • Improves travel time reliability – except for station-to-station transit service and express buses from the City of Eagan	• Requires concrete median barrier from 138th to I-35E • Lack of bus shoulder over bridge takes away transit advantage for station to station service and express buses out of Eagan – limited travel time reliability • Limited snow storage will require peak period lane closures during some snow storms

Alternative	Advantages	Disadvantages
Alternative 3B Interim Access MnPASS	• Relieves bottleneck north of 138th Street and at the river bridge without overloading the I-494 interchange • Increases throughput over bridge, attracts trips away from regional system • Provides transit advantage for express buses from Apple Valley and south while preserving bus shoulders for station to station service and express buses from Eagan • Does provide congestion-free choice for general purpose traffic and carpools • Does improve travel time reliability • Utilizes existing infrastructure • Provides Contra-flow Access for Travelers from I-35E	• Ongoing operations and maintenance costs • Intermediate access north of I-35E does not provide access to contra flow lane for users north of I-35E • Weaving problems between I-35E and the new contra-flow interim access ramp • Reduces emergency vehicle access

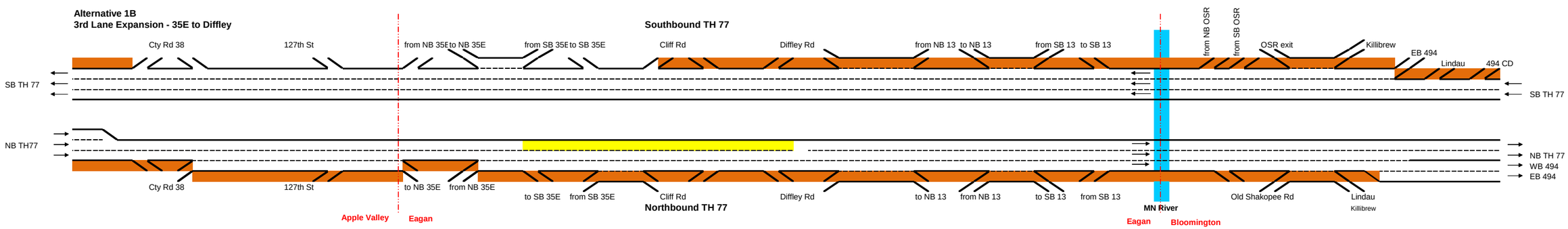
Appendix 1

Appendix 1-1: Lane Diagrams – Alternative 1 and Subalternatives
Appendix 1-2: Lane Diagrams – Alternative 2 and Subalternatives
Appendix 1-3: Lane Diagrams – Alternative 3 and Subalternatives
Appendix 1-4: Lane Diagrams – Alternative 4 and Subalternatives

Alternative 1A
3rd Lane Expansion - 138th to Diffley



Alternative 1B
3rd Lane Expansion - 35E to Diffley

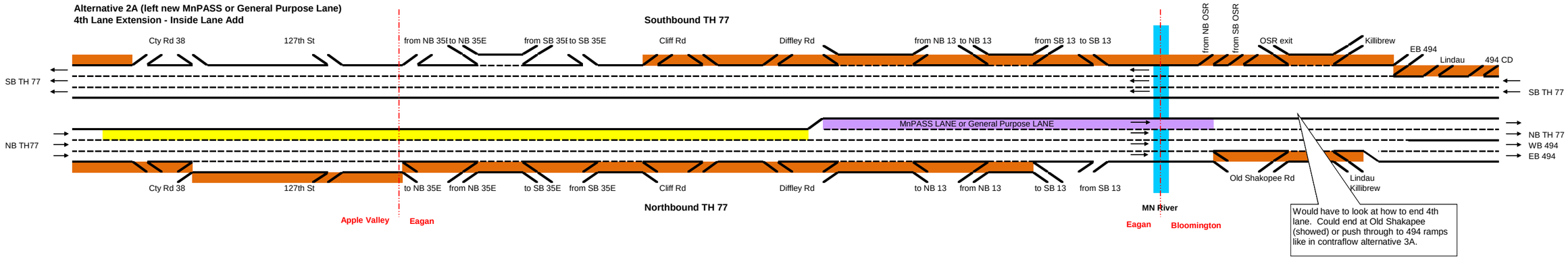


Bus Only Shoulder

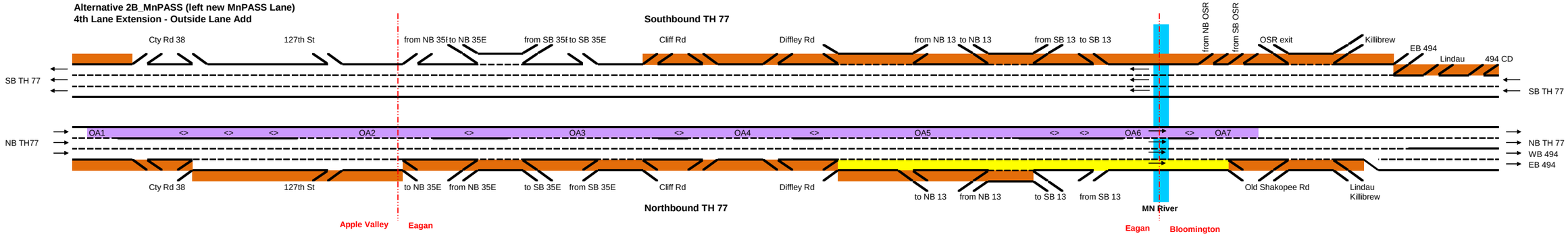
Proposed General Purpose Lane Improvement

6/29/2010

Alternative 2A (left new MnPASS or General Purpose Lane)
4th Lane Extension - Inside Lane Add



Alternative 2B_MnPASS (left new MnPASS Lane)
4th Lane Extension - Outside Lane Add



Note:
OA1 (MnPASS Begin): Open Access to MnPASS traffic from 140th Street
OA2: Open Access to MnPASS traffic from Cty Rd 38 and 127th entrance ramps and MnPASS traffic to NB and SB I-35E exit ramps
OA3: Open Access to MnPASS traffic from NB and SB I-35E entrance ramps and MnPASS traffic to Cliff Road exit ramp
OA4: Open Access to MnPASS traffic from Cliff Road entrance ramp and MnPASS traffic to Diffley Road exit ramp
OA5: Open Access to MnPASS traffic from Diffley Road entrance ramp and MnPASS traffic to NB and SB TH 13 exit ramps
OA6: Open Access to MnPASS traffic from NB and SB TH 13 entrance ramps
OA7(MnPASS end):Open Access to Old Shakopee Road exit ramp and further north

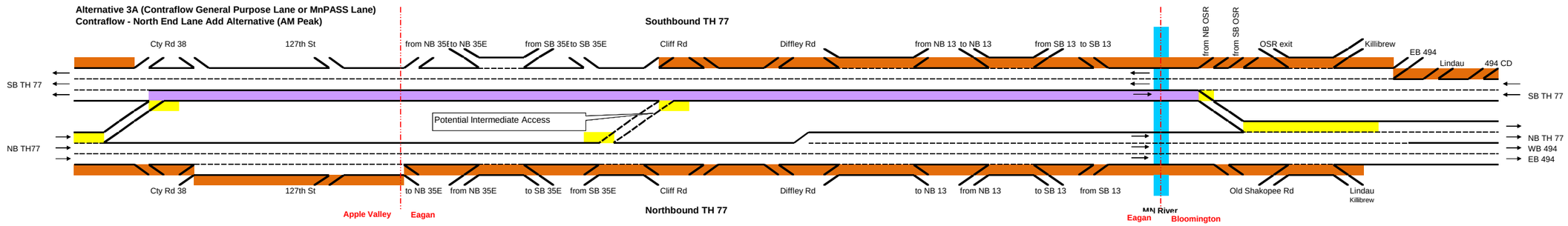
Bus Only Shoulder

Proposed General Purpose Lane Improvement

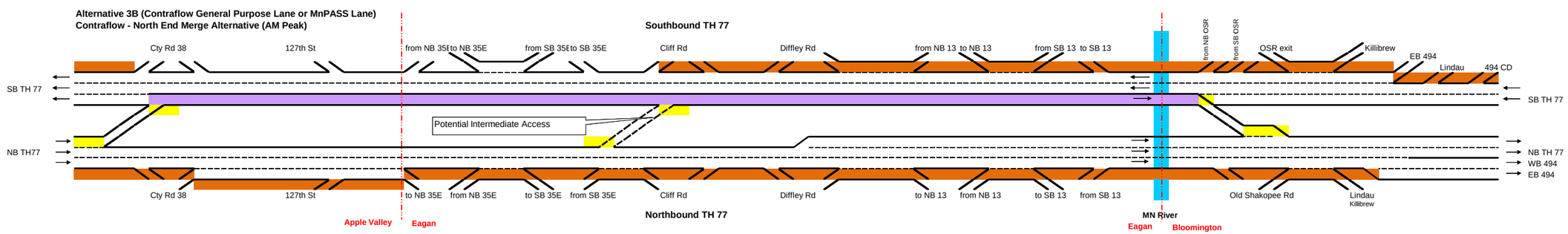
Proposed MnPASS or General Purpose Lane Improvement

6/29/2010

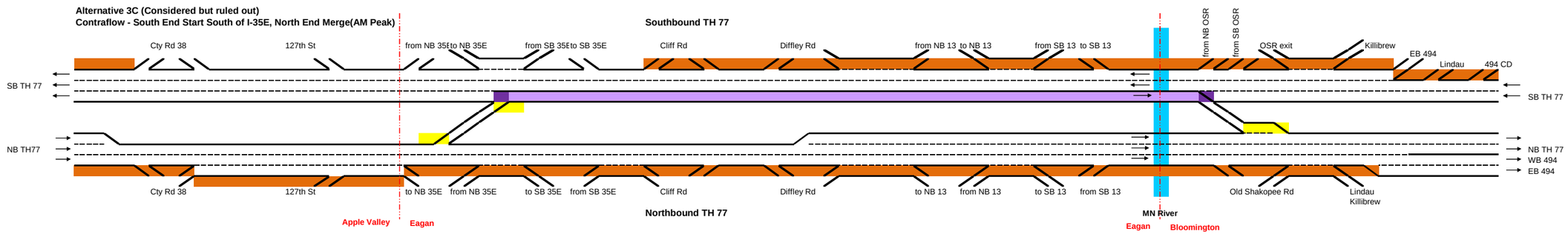
Alternative 3A (Contraflow General Purpose Lane or MnPASS Lane)
Contraflow - North End Lane Add Alternative (AM Peak)



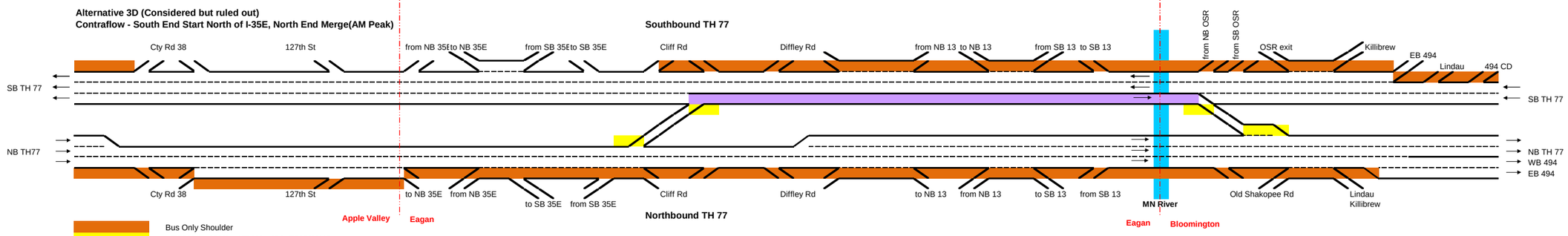
Alternative 3B (Contraflow General Purpose Lane or MnPASS Lane)
Contraflow - North End Merge Alternative (AM Peak)



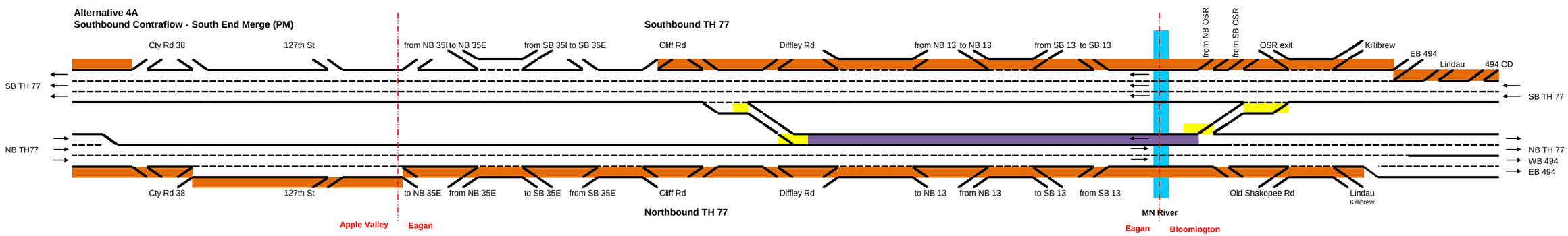
Alternative 3C (Considered but ruled out)
Contraflow - South End Start South of I-35E, North End Merge(AM Peak)



Alternative 3D (Considered but ruled out)
Contraflow - South End Start North of I-35E, North End Merge(AM Peak)



Bus Only Shoulder
Proposed General Purpose Lane Improvement
Proposed MnPASS or General Purpose Contraflow Lane



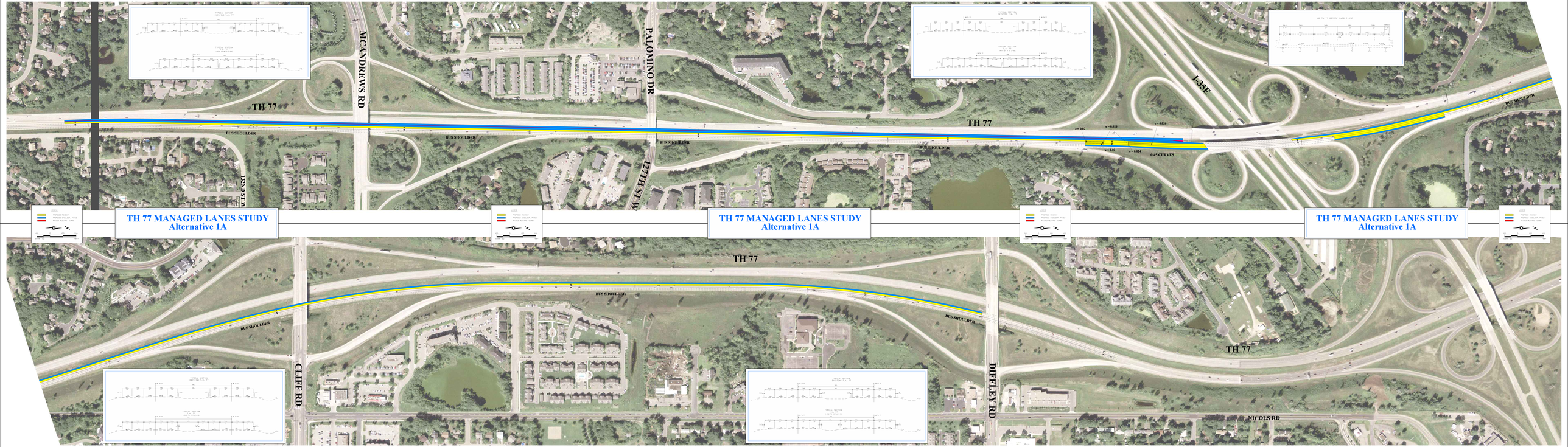
Bus Only Shoulder

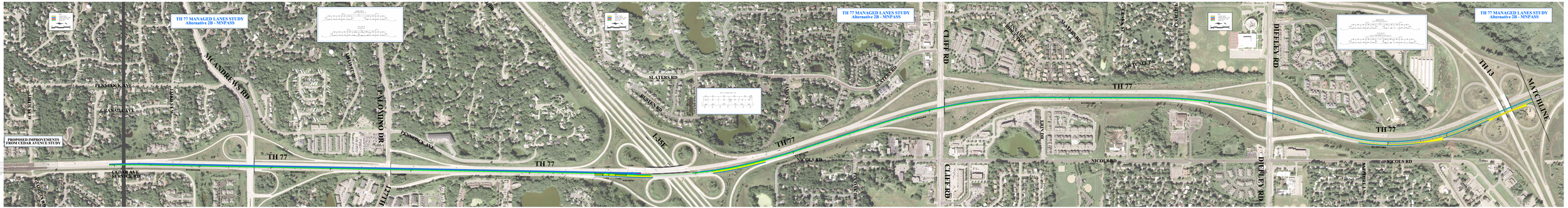
Proposed General Purpose Lane Improvement

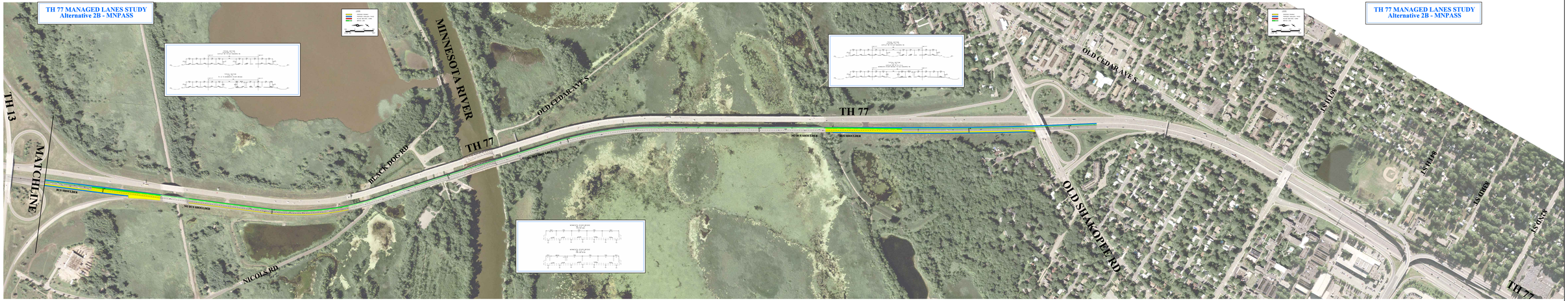
Proposed MnPASS or General Purpose Contraflow Lane

Appendix 2

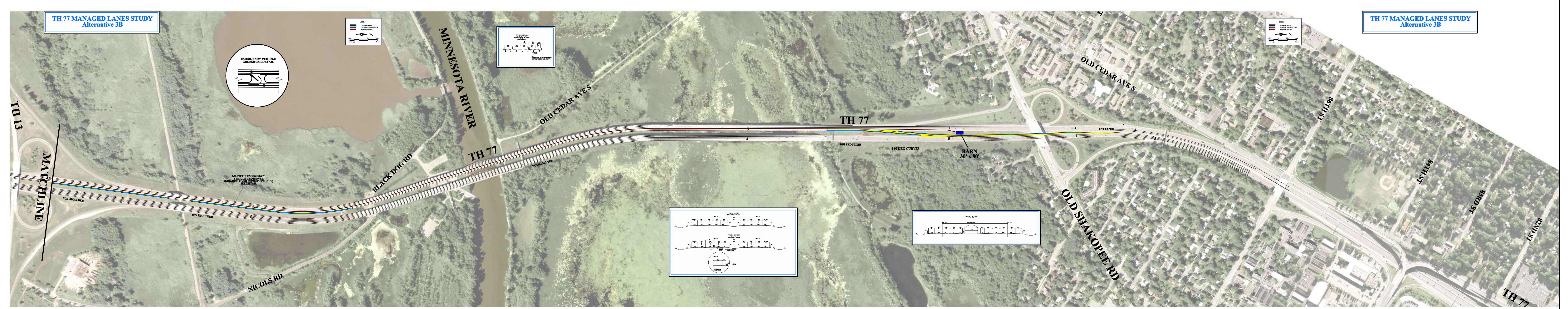
Appendix 2-1: Concept Layout – Alternative 1A (See attached CD)
Appendix 2-2: Concept Layout – Alternative 2B MnPASS (See attached CD)
Appendix 2-3: Concept Layout – Alternative 3B MnPASS with Intermediate Access (See attached CD)
Appendix 2-4: Typical Sections for Alternatives 1A, 2B MnPASS and 3B MnPASS
Appendix 2-5: Image Visualization for Alternative 1A (See attached CD)
Appendix 2-6A: Image Visualization for Alternative 3B (Moveable Barrier Deployed) (See attached CD)
Appendix 2-6B: Image Visualization for Alternative 3B (Moveable Barrier Stored) (See attached CD)


TH 77 MANAGED LANES STUDY
Alternative 1A
TH 77
MCANDREWS RD
PALOMINO DR
127TH ST W
I-35E
BUS SHOULDER
TH 77 MANAGED LANES STUDY
Alternative 1A
TH 77
BUS SHOULDER
TH 77 MANAGED LANES STUDY
Alternative 1A
TH 77
BUS SHOULDER
CLIFF RD
DIFFLEY RD
NICOLS RD

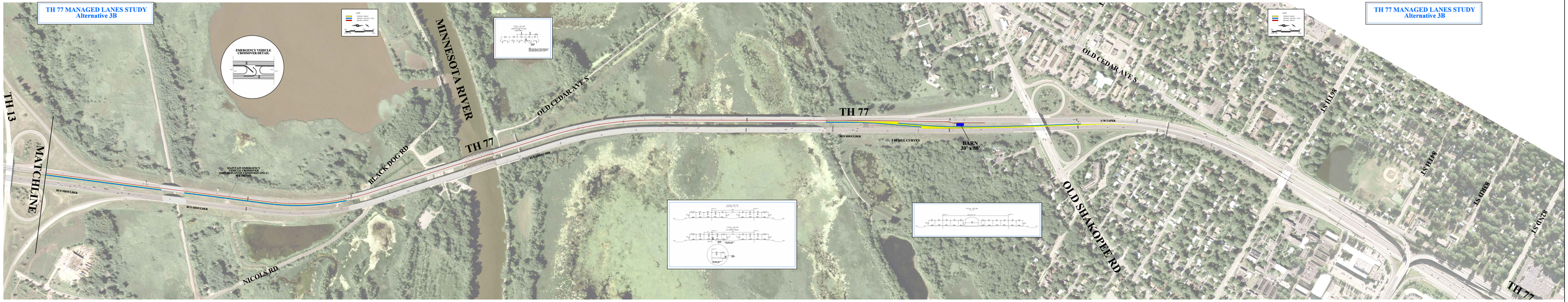

TH 77 MANAGED LANES STUDY
Alternative 2B - MNPASS
PROPOSED IMPROVEMENTS FROM CEDAR AVENUE STUDY
MCANDREWS RD
PENNSYLVANIA AVE
GRANDVIEW AVE
W 87 STREET
W 85 STREET
TALOMINO DR
PENNSYLVANIA AVE
CEDAR AVE
SOUTH CEDAR RD
TH 77
I-35E
SLATERS RD
BUSHES RD
S SAINT
NICOLS RD
TH 77
CLIFF RD
BENJAMIN AVE
BRENTWOOD DR
SLATERS RD
TOWER DR
CLIFF RD
ARTCRAFT DR
TH 77
DIFFLEY RD
TH 13
MATCHLINE
TH 77
NICOLS RD
DIFFLEY RD
NICOLS RD


TH 77 MANAGED LANES STUDY
Alternative 2B - MNPASS
TH 13
MATCHLINE
MINNESOTA RIVER
OLD CEDAR AVE S
BLACK DOG RD
TH 77
NO BUS SHOULDER
NICOLS RD
OLD SHAKOPEE RD
LS 14TH
LS 17TH
AS 0TH
LS 0TH
TH 77
TH 77 MANAGED LANES STUDY
Alternative 2B - MNPASS

TH 77 MANAGED LANES STUDY
Alternative 3B
TH 77 MANAGED LANES STUDY
Alternative 3B
TH 77 MANAGED LANES STUDY
Alternative 3B
PROPOSED IMPROVEMENTS FROM CEDAR AVENUE STUDY
EMERGENCY VEHICLE CROSSOVER DETAIL
TH 77
I-35E
MCANDREWS RD
PALOMINO DR
PENNCOCK AVE
GRANADA AVE
CEDAR AVE SERVICE RD
GEORGIA RD
127TH
SLATERS RD
RUSTEN RD
JAMES ST
CLIFF RD
CINNAMON RIDGE RD
CLARK ST
METCALF DR
ERIN DR
NICOLS RD
PIN OAK DR
DIFFLEY RD
SAPPHIRE LN
TH 13
MATCHLINE

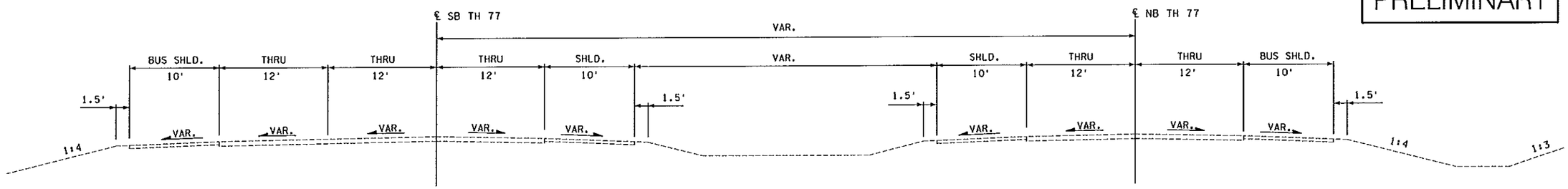


TH 77 MANAGED LANES STUDY
Alternative 3B
TH 77 MANAGED LANES STUDY
Alternative 3B
EMERGENCY VEHICLE CROSSOVER DETAIL
TH 13
MATCHLINE
TH 77
MINNESOTA RIVER
BLACK DOG RD
NICOLS RD
OLD CEDAR AVE S
OLD SHAKOPEE RD
BARN

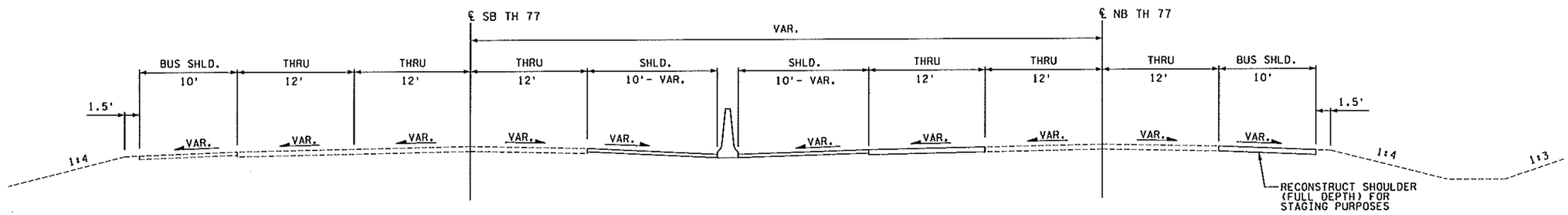

TH 77 MANAGED LANES STUDY
Alternative 3B
EMERGENCY VEHICLE CROSSOVER DETAIL
MINNESOTA RIVER
OLD CEDAR AVE S
TH 77
TH 13
MATCHLINE
BLACK DOG RD
NICOLS RD
BUS SHOULDER
MAINTAIN EMERGENCY CROSSOVER ACCESS (NORTHBOUND TO SOUTHBOUND ONLY) SEE DETAIL
BUS SHOULDER
BUS SHOULDER
1 DEDEG CURVES
BARN
30' x 80'
1/30 TAPER
OLD SHAKOPEE RD
LS H1L98
LS H1L98
LS G0R8
LS G0X8
TH 77
TH 77 MANAGED LANES STUDY
Alternative 3B

PRELIMINARY

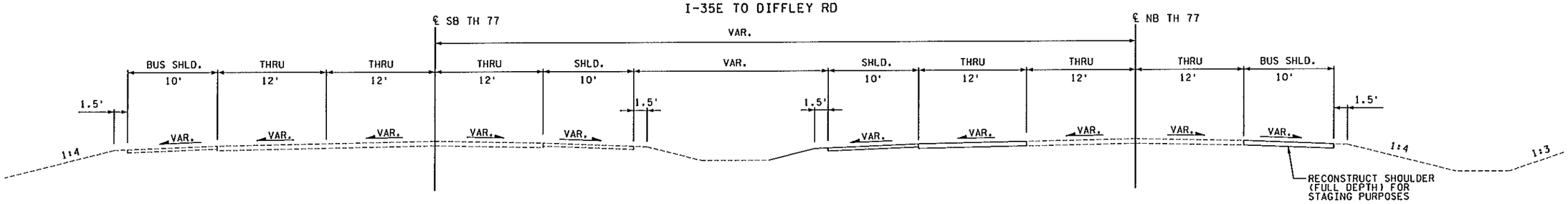
TYPICAL SECTION
EXISTING T.H. 77



TYPICAL SECTION
T.H. 77
140TH ST W TO I-35E



TYPICAL SECTION
T.H. 77
I-35E TO DIFFLEY RD



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T.H. 77 MANAGED LANES

ALTERNATE 1A TYPICAL SECTIONS

FIGURE No. 1A-1

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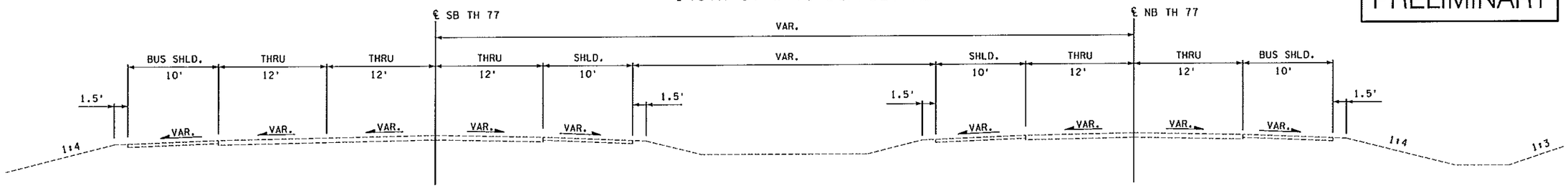
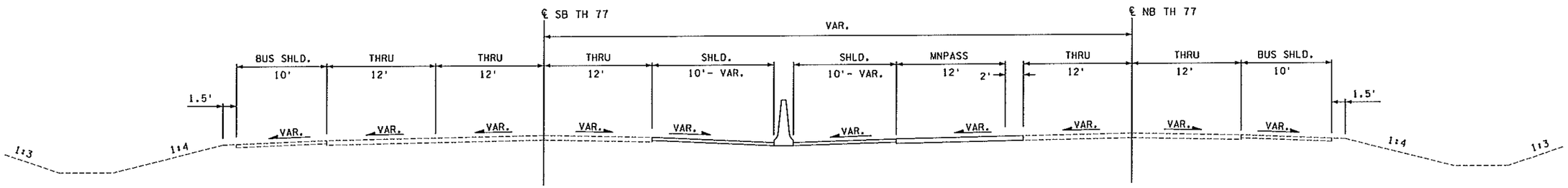
PRELIMINARY

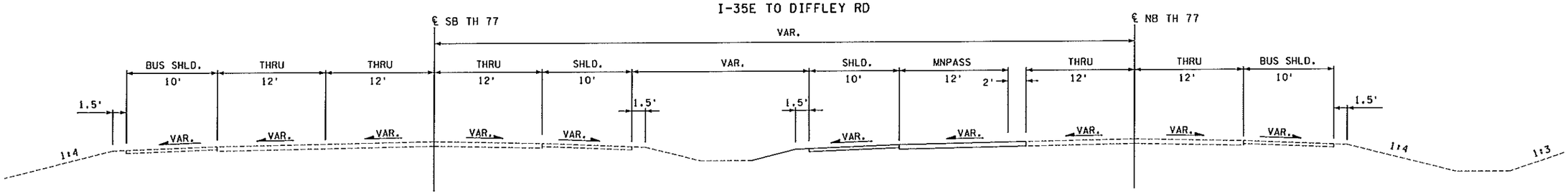
TYPICAL SECTION
EXISTING T.H. 77
140TH ST W TO DIFFLEY RD



TYPICAL SECTION
T.H. 77
140TH ST W TO I-35E



TYPICAL SECTION
T.H. 77
I-35E TO DIFFLEY RD



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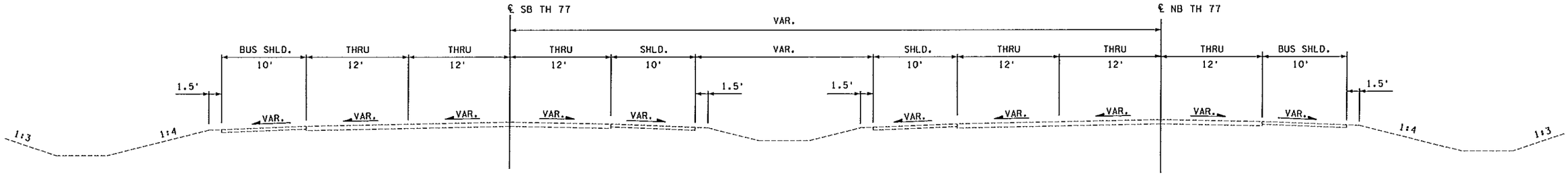
T.H. 77 MANAGED LANES

ALTERNATE 2B (MNPASS) TYPICAL SECTIONS

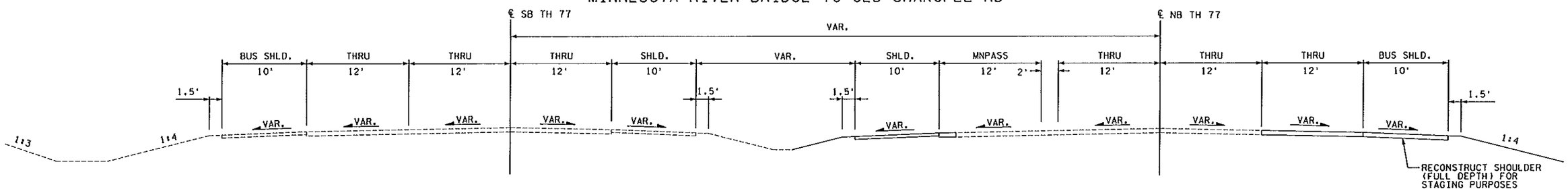
FIGURE No. 2B(MP)-1

PRELIMINARY

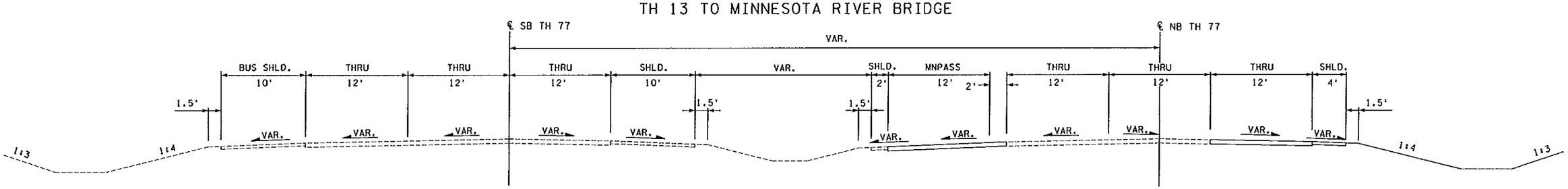
TYPICAL SECTION
EXISTING T.H. 77
DIFFLEY RD TO OLD SHAKOPEE RD



TYPICAL SECTION
T.H. 77
DIFFLEY RD TO TH 13 &
MINNESOTA RIVER BRIDGE TO OLD SHAKOPEE RD



TYPICAL SECTION
T.H. 77
TH 13 TO MINNESOTA RIVER BRIDGE



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T.H. 77 MANAGED LANES
ALTERNATE 2B (MNPASS) TYPICAL SECTIONS

FIGURE No. 2B(MP)-2

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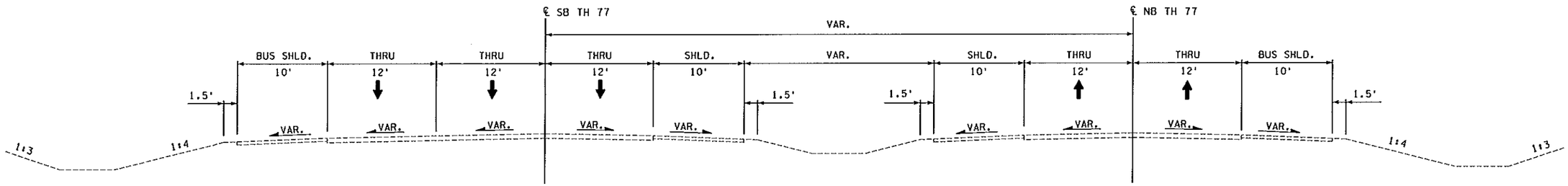
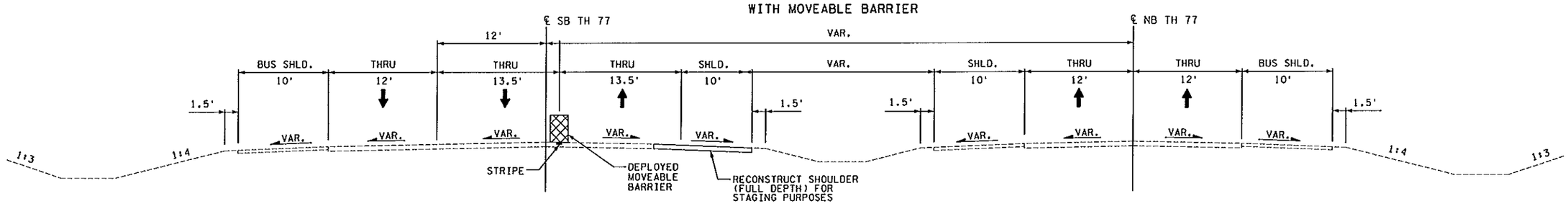
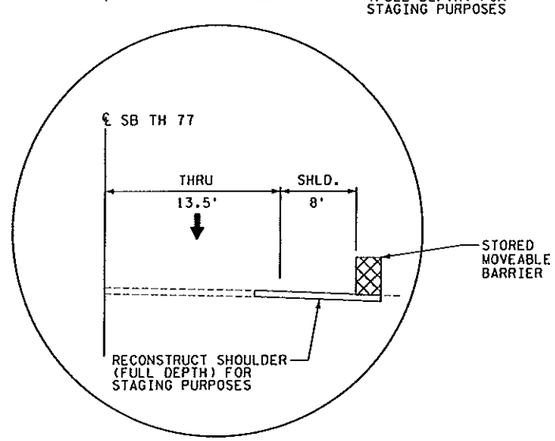
PRELIMINARY

TYPICAL SECTION
EXISTING T.H. 77



TYPICAL SECTION
T.H. 77
WITH MOVEABLE BARRIER





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T.H. 77 MANAGED LANES

ALTERNATE 3B (CONTRAFLOW) TYPICAL SECTIONS

FIGURE No. 3B-1

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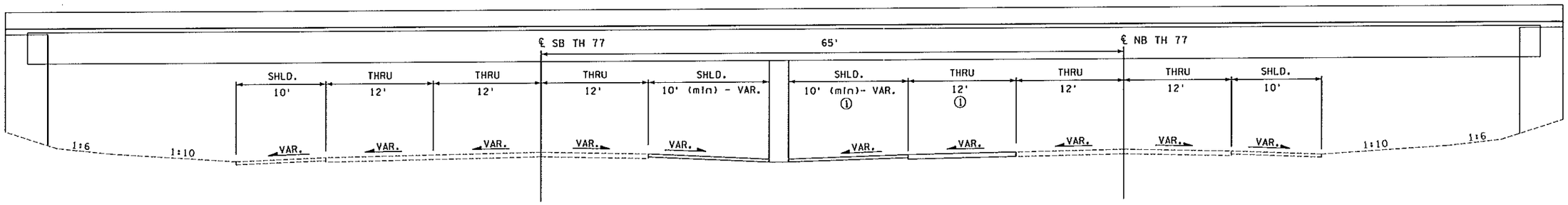
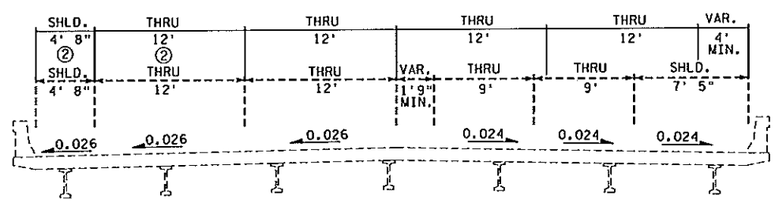
PRELIMINARY

TYPICAL SECTION
T.H. 77
McAndrews Rd and Palmino Dr
Alt 1a and 2b



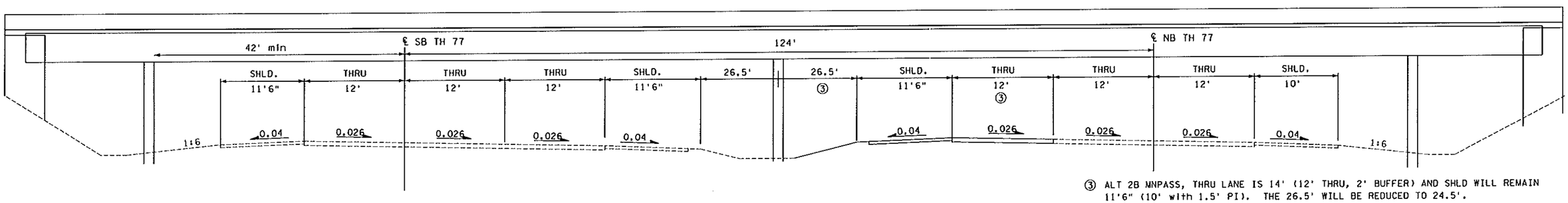
① IN ALT 2B MNPASS, THRU LANE IS 14' (12' THRU, 2' BUFFER) AND SHLD STILL MEETS 10' MINIMUM

TYPICAL SECTION
N.B. T.H. 77
NB TH 77 over I-35E (BR # 19860)
Alt 1a and 2b



② IN ALT 2B MNPASS, THRU LANE IS 14' (12' THRU, 2' BUFFER) AND SHLD IS 3'6"

TYPICAL SECTION
T.H. 77
Cliff Road (BR # 19067)
Alt 1a and 2b



③ ALT 2B MNPASS, THRU LANE IS 14' (12' THRU, 2' BUFFER) AND SHLD WILL REMAIN 11'6" (10' with 1.5' PI). THE 26.5' WILL BE REDUCED TO 24.5'.

NOTE:
WHERE SIGNIFICANT LANE AND/OR SHOULDER WIDTH CHANGES ARE PROPOSED, EXISTING CONDITIONS ARE SHOWN USING DASHED LINES WITH PROPOSED WIDTHS SHOWN ABOVE USING SOLID LINES.

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T.H. 77 MANAGED LANES
BRIDGE TYPICALS
ALT 1A and 2B

FIGURE No. B-1

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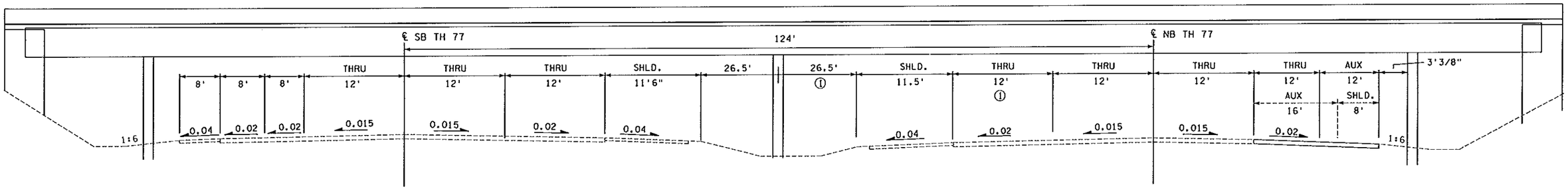
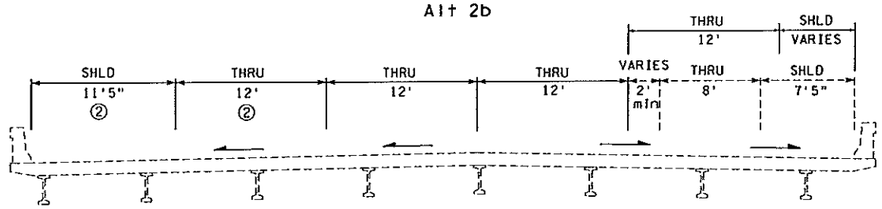
PRELIMINARY

TYPICAL SECTION
T.H. 77
TH 13 over TH 77 (BR # 19055)
Alt 2b



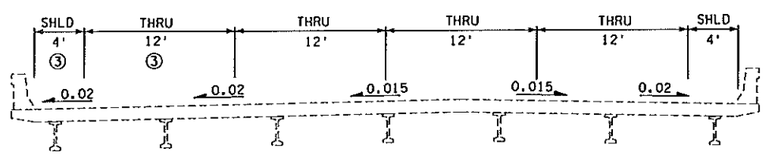
① ALT 2B MNPASS, THRU LANE IS 14' (12' THRU, 2' BUFFER) AND SHLD WILL REMAIN 11'6" (10' with 1.5' PI). THE 26.5' WILL BE REDUCED TO 24.5'.

TYPICAL SECTION
N.B. T.H. 77
ACCESS ROAD BR #19014
Alt 2b



② ALT 2B MNPASS, THRU LANE IS 14' (12' THRU, 2' BUFFER) AND SHLD IS 9'5"

TYPICAL SECTION
N.B. T.H. 77
Minnesota River Bridge (BR # 9600)
Alt 2b



③ ALT 2B MNPASS, THRU LANE IS 14' (12' THRU, 2' BUFFER) AND SHLD IS 2'

NOTE:
WHERE SIGNIFICANT LANE AND/OR SHOULDER WIDTH CHANGES ARE PROPOSED, EXISTING CONDITIONS ARE SHOWN USING DASHED LINES WITH PROPOSED WIDTHS SHOWN ABOVE USING SOLID LINES.

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T.H. 77 MANAGED LANES
BRIDGE TYPICALS
ALT 2B

FIGURE No. B-2

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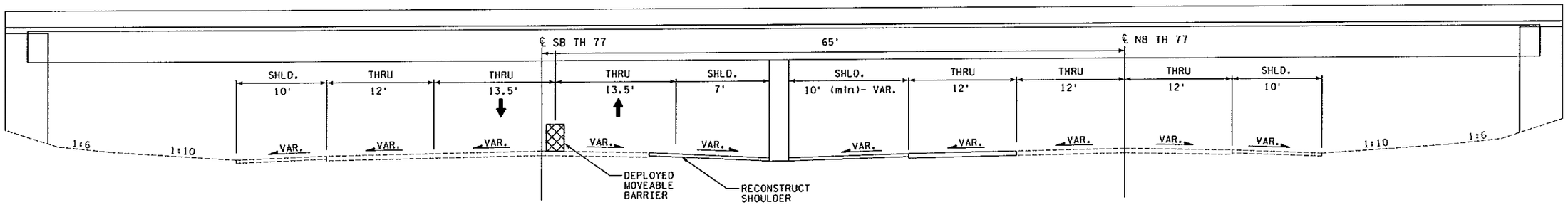
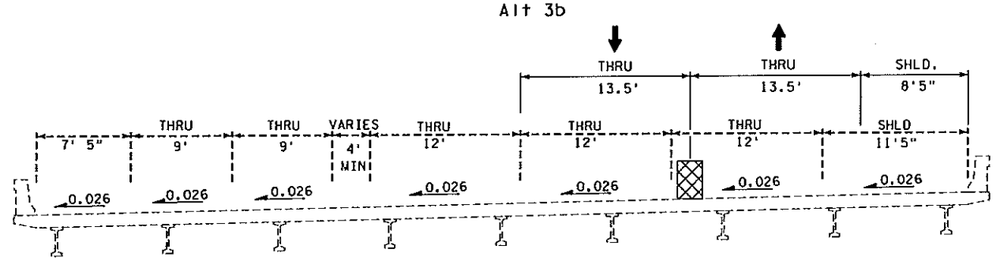
PRELIMINARY

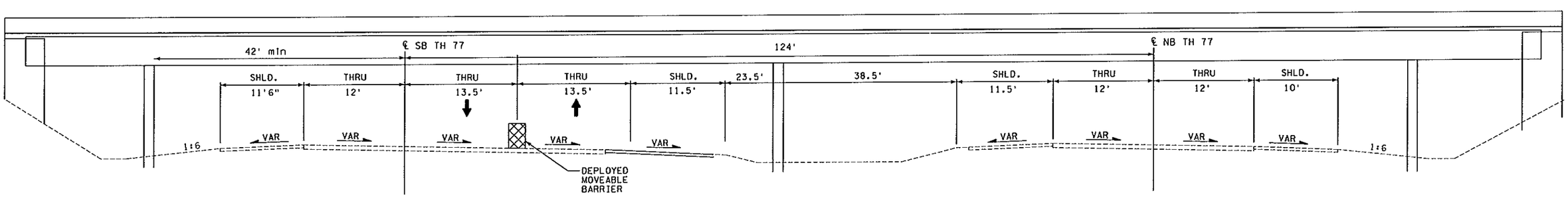
TYPICAL SECTION
T.H. 77
McAndrews Rd and Pollmino Dr
Alt 3b



TYPICAL SECTION
S.B. T.H. 77
SB TH 77 over I-35E (BR # 19859)
Alt 3b



TYPICAL SECTION
T.H. 77
Cliff and Diffley Road
Alt 3b



NOTE:
WHERE SIGNIFICANT LANE AND/OR SHOULDER WIDTH CHANGES ARE PROPOSED, EXISTING CONDITIONS ARE SHOWN USING DASHED LINES WITH PROPOSED WIDTHS SHOWN ABOVE USING SOLID LINES.

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T.H. 77 MANAGED LANES
BRIDGE TYPICALS
ALT 3B

FIGURE
No. B-3

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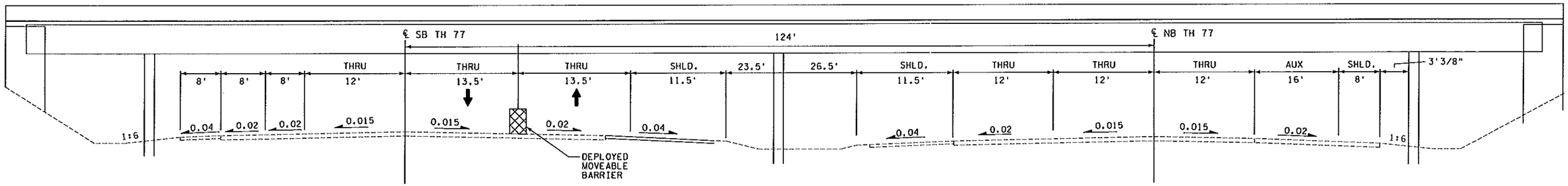
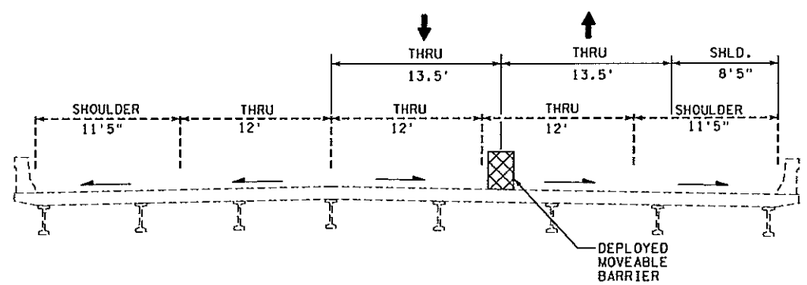
PRELIMINARY

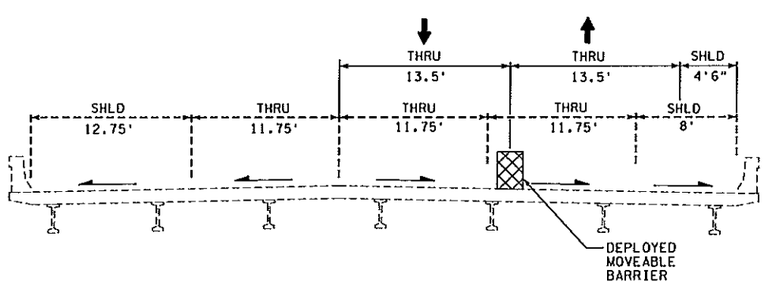
TYPICAL SECTION
T.H. 77
TH 13 over TH 77 (BR #19055)
Alt 3b



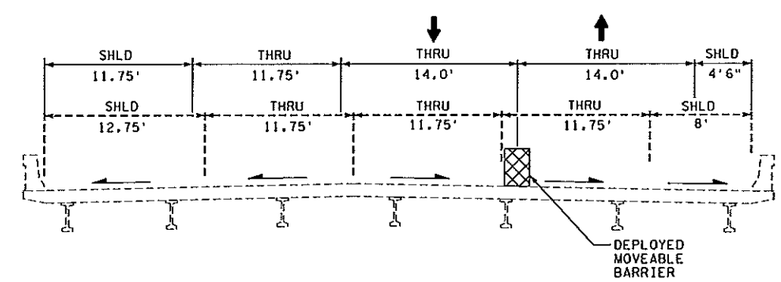
TYPICAL SECTION
S.B. T.H. 77
ACCESS ROAD BR #19013
Alt 3b



TYPICAL SECTION
S.B. T.H. 77
MINNESOTA RIVER (BR #9600)
Alt 3b



TYPICAL SECTION
S.B. T.H. 77
MINNESOTA RIVER (BR #9600)
Alt 3b - 14' Lane Option



NOTE:
WHERE SIGNIFICANT LANE AND/OR SHOULDER WIDTH CHANGES ARE PROPOSED, EXISTING CONDITIONS ARE SHOWN USING DASHED LINES WITH PROPOSED WIDTHS SHOWN ABOVE USING SOLID LINES.

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T.H. 77 MANAGED LANES
BRIDGE TYPICALS
ALT 3B

FIGURE No. B-4

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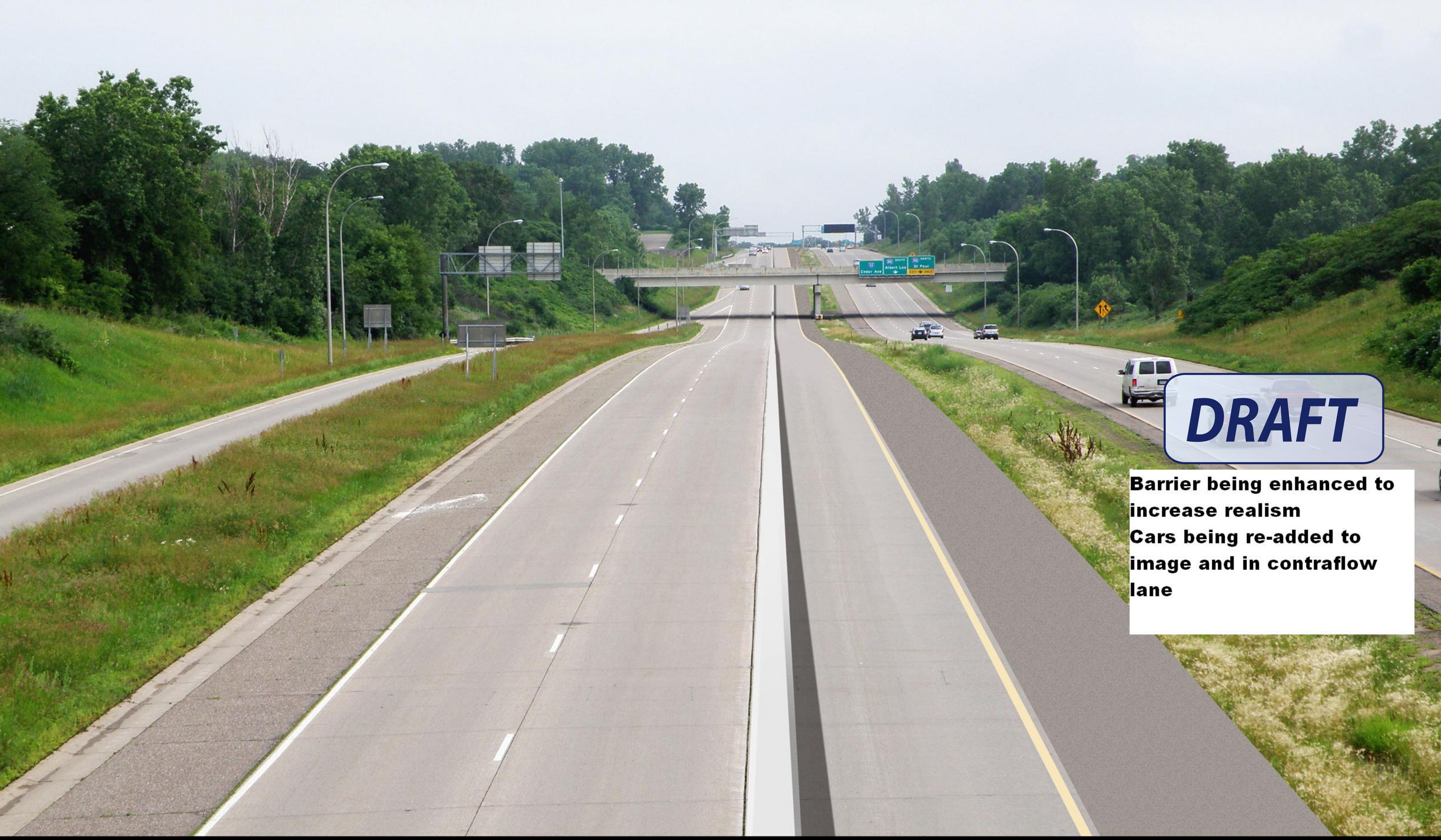
DRAFT

Noise Walls being added along outside ramps in residential areas
Barrier details being added to increase realism

TH 77 Managed Lanes Study - Alt 1a (Third Lane Constructed Northbound Between 138th & Diffley)

Apple Valley, Eagan and Bloomington, Minnesota



TH 77 Managed Lanes Study - Alt 3b (Contraflow Lane with Movable Barrier Deployed)

Apple Valley, Eagan and Bloomington, Minnesota

TH 77 Managed Lanes Study - Alt 3b (Contraflow Lane with Movable Barrier Stored)

Apple Valley, Eagan and Bloomington, Minnesota

Appendix 3

Travel Demand Forecasting Results Memorandum dated June 2, 2010

Memorandum To: Jim Henricksen, MnDOT

From: Steve Ruegg, PB
Andrew Coe, PB

Copy to: Brian Kary, MnDOT
Brian Isaacson, MnDOT
Mark Filipi, Met Council

Date: June 2, 2010

Subject: TH77 Managed Lanes Corridor Study, Travel Demand Forecasting Results

Introduction:

This memorandum describes the results of the travel demand forecasting conducted for year 2007 and forecast years 2010 and 2030 in support of the TH77 Managed Lanes Corridor Study. The TH77 Managed Lanes Corridor Study (the "study") is a project conducted to evaluate options to increase capacity of TH77 between County Road 38 (CR38) in Apple Valley and I-494 in Bloomington. Basic Options that were anticipated for study include the addition of a northbound lane between CR38 and Diffley Road; the addition of a fourth lane northbound across the Minnesota River, between Diffley Road and Old Shakopee Road and the addition of an AM northbound contra-flow lane between CR38 and Old Shakopee Road. Combinations of these elements and the use of HOV or HOT (MnPASS) lane management were also included in developing potential alternatives. One of the key initial tasks in this study was to develop 2007, 2010 and 2030 forecast travel demand for a no-build and build scenarios. These forecasts had two primary purposes. First, the forecast was used to identify general demand in the corridor, including toll and hov demand, as well as provide an estimate for toll revenues. Secondly, the travel demand model output will provide growth factors and ramp-to-ramp movements for use in the CORSIM simulation model. The approach and methodology used, as well as model validation and reasonableness checking, is described in the memo entitled "TH77 Managed Lanes Corridor Study, Travel Demand Forecasting Methodology" revised Feb 4, 2010. That memo provides the peak hour model flows used for the CORSIM analysis. Those demand volumes are adjusted to reflect actual counts, subarea flow characteristics, and peak spreading. This memo will focus on direct model results on a system level, showing how demand is affected by the alternatives being tested compared to base no-build volumes.

Toll Modeling:

The Twin Cities Regional Model ("the model") was used to develop the travel demand forecasts for this study. However, since toll options were included in the alternatives tested, a toll model was included in the assignment routine. This is the same methodology that was used in the evaluation of the I35W UPA HOT lane project, and was developed by Colby Brown of Citilabs. The model is embedded within the

CUBE/Voyager equilibrium assignment routine. Within each equilibrium iteration, the toll model performs the following calculations:

1. Compute toll and non-toll travel times for each Origin-Destination zone (OD) pair
2. Compute the toll skims for each OD pair along the toll-favored paths
3. Compute the cost/incremental time savings for toll users, and use this to compute the potential toll market for each OD pair
4. Run a multi-class equilibrium assignment, including assigning toll users to toll-favored paths. HOV trips are assigned separately, and are allowed to use HOT lane favored paths.
5. Once all OD pairs have been assigned, compute peak v/c ratios for each toll segment
6. Use the v/c ratios to compute an updated toll for each toll segment.
7. End of equilibrium iteration, if equilibrium is not reached, return to step 1 and repeat steps 1-7 until user equilibrium is obtained.

There are three key assumptions required for this model. First, a "diversion curve" must be supplied which identifies the probability of toll choice given the value of time. This was derived from a user survey of MnPASS toll users completed for the I35W UPA project. Figure 1 shows this curve. Second, a toll policy curve must be supplied which relates the toll to the level of service (as described by v/c ratio) on the toll facility. This was derived from the current MnPASS toll policy, and is designed to maintain a near free-flow level of service on any MnPASS facility. It has a maximum of $8.00 and a minimum of $0.25. Figure 2 shows the toll policy function. Finally, an assumption is made with regard to the hourly capacity of a MnPASS lane. This was set at 1,400 vehicles/hour/lane, which was the value used for the I35W UPA and I94 Managed Lane studies. It is further supported by similar results from recent studies of managed lane practical capacities in the field.

Figure 1: Toll Model: Willingness to Pay

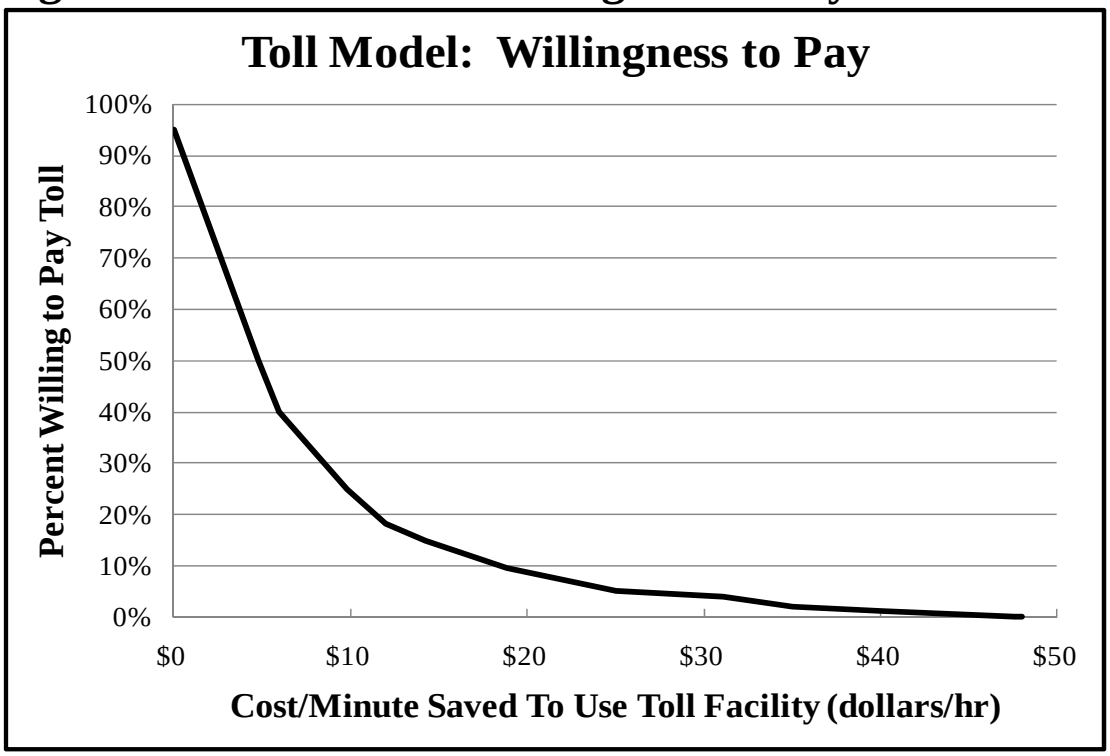
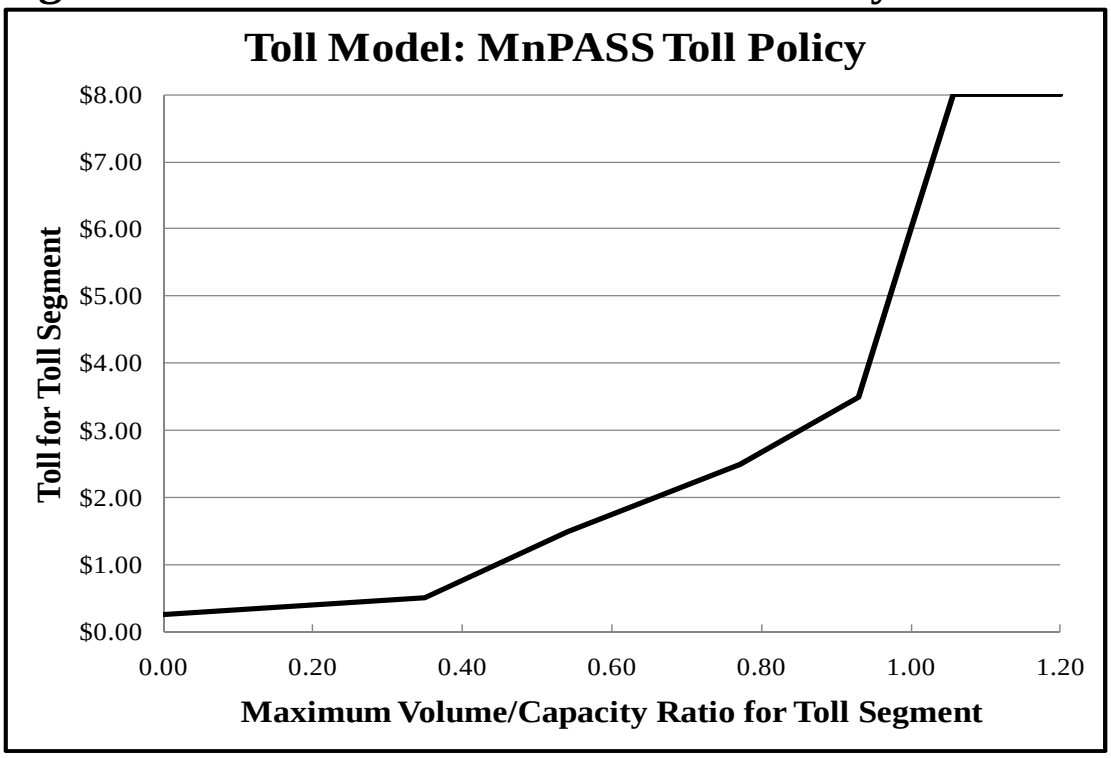


Figure 2: Toll Model: MnPASS Toll Policy



Modeled Alternatives:

Table 1 shows the list of alternatives that were modeled by the regional travel demand model.

Table 1: Modeled Alternatives

Alternative Designation	Description	1997	2010	2030
No-Build	Regional Plan with no capacity expansion on Cedar Avenue			
1A	Add NB Lane from 140th to Diffley lane add			
2B GP	Added NB General Purpose Lane from 140th to OSR			
2B MnPASS	Added NB MnPASS Lane from 140th to OSR			
2B MnPASS IA	Added NB MnPASS Lane from 140th to OSR with intermediate access north of I35E			
2B MnPASS OA	Added NB MnPASS Lane from 140th to OSR with open access/egress throughout			
2B MnPASS OA Toll-controlled	Added NB MnPASS Lane from 140th to OSR with open access/egress throughout. Use higher toll to limit demand to 1100 vph on bridge			
3B GP	Added NB General Purpose Reversible Lane from 140th to OSR			
3B MnPASS	Added NB MnPASS Reversible Lane from 140th to OSR			
3B MnPASS IA	Added NB MnPASS Reversible Lane from 140th to OSR with intermediate access north of I35E			
3B MnPASS IA Ext	Added NB MnPASS Reversible Lane from 140th to North of I494 with intermediate access north of I35E			
3B MnPASS IA Toll-controlled	Added NB MnPASS Reversible Lane from 140th to OSR with intermediate access north of I35E. Use higher toll to limit demand to 1100 vph on bridge			

Results:

This section summarizes the demand model results in five separate areas, including corridor travel market, trip diversion patterns, change in transit demand, diurnal demand and performance and overall system measures of effectiveness.

Travel Market:

Figure 3 and Figure 4 shows the AM peak hour vehicle trip origins and destinations associated with the TH77 corridor. Figure 3 shows trip origins by zone and Figure 4 shows the trip destinations by zone. This pattern is similar to home end trip distribution

(Figure 3) and work and shopping trip end locations (Figure 4). The peak period travel market in the corridor is predominantly work trips which comprise at least 50 percent of all trips. Furthermore, trips are highly directional, with 80 percent northbound in the AM peak hour, and 72 percent southbound in the PM peak hour at the river bridge. Southbound demand in the AM peak hour remains well below the 2-lane capacity in 2030.

Figure 3: Number of Corridor Trips by Origin, AM Peak Hour, Year 2030

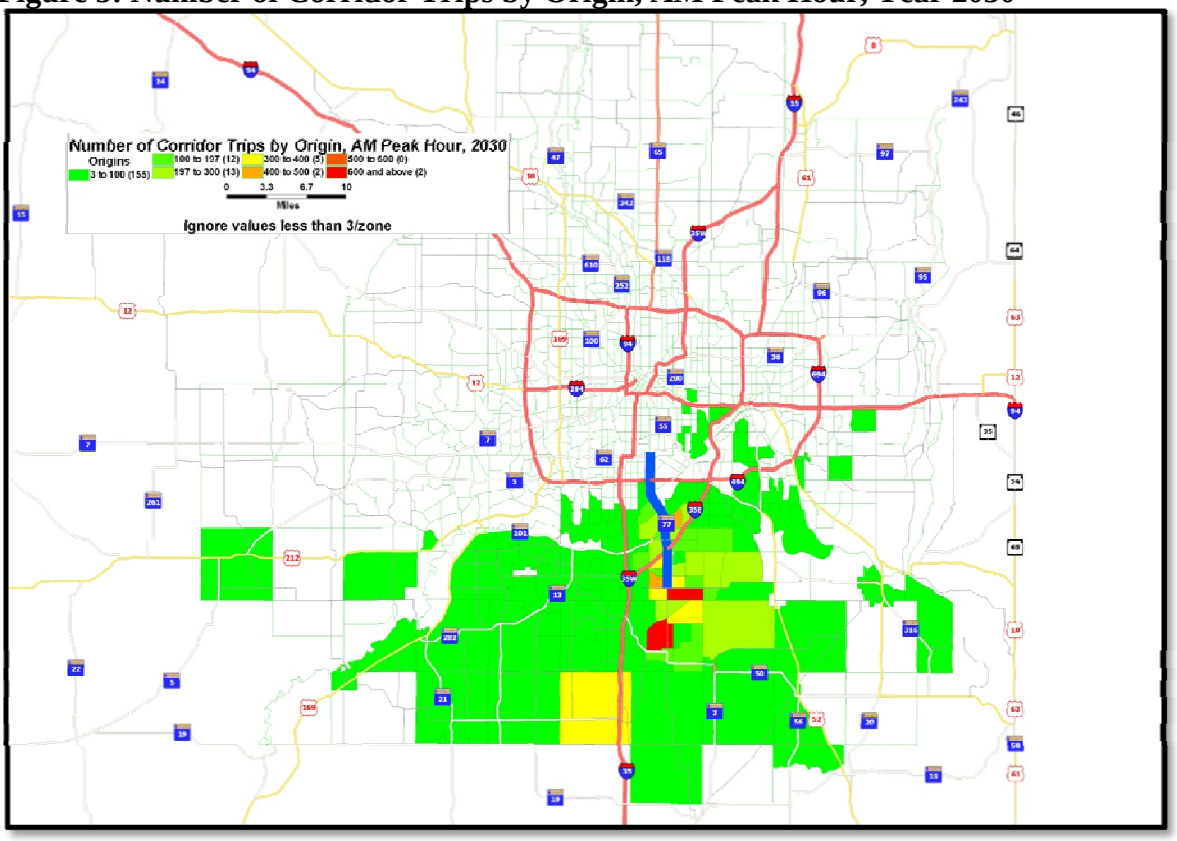
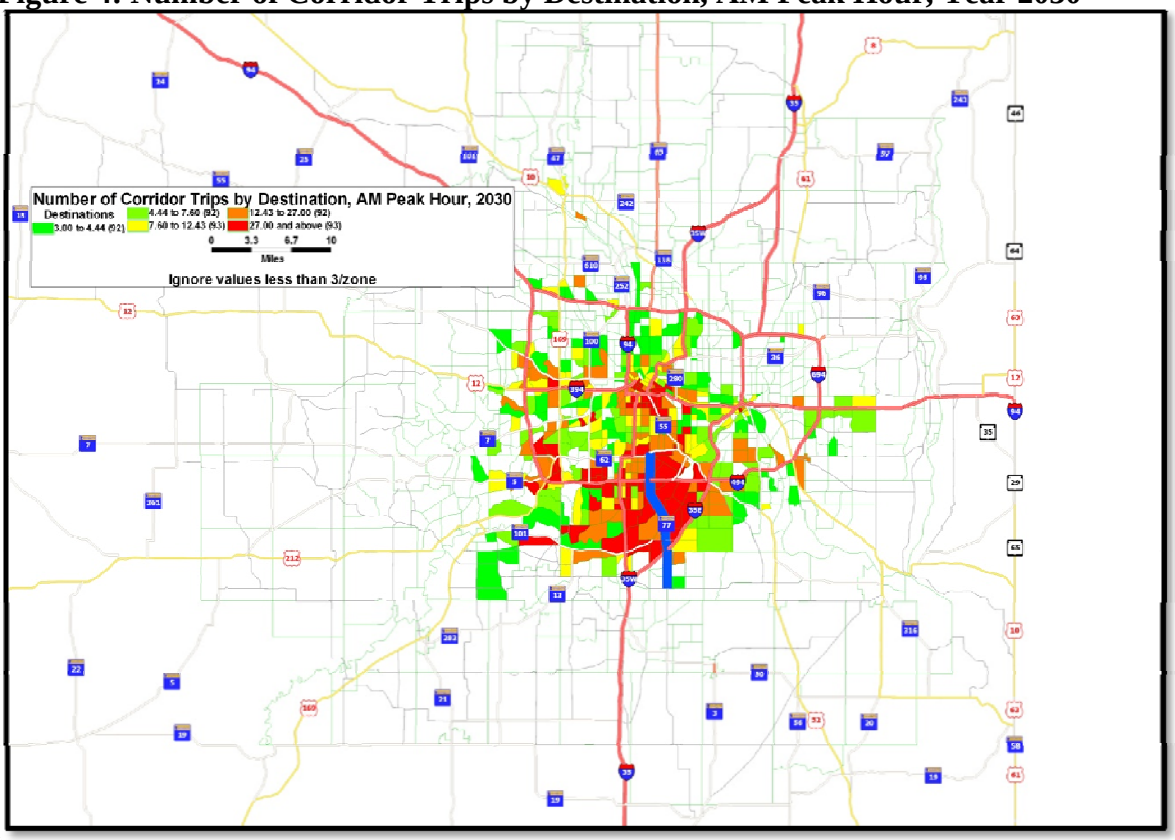


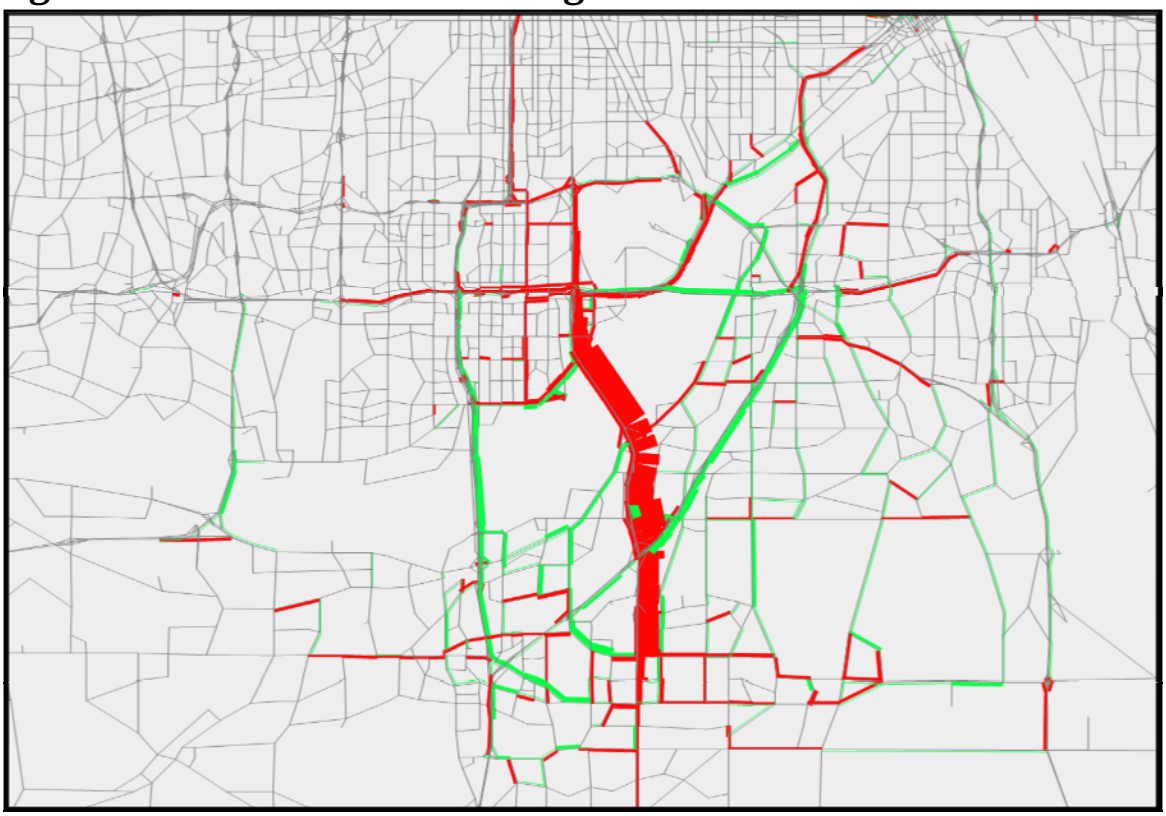
Figure 4: Number of Corridor Trips by Destination, AM Peak Hour, Year 2030



Trip Diversion:

Figure 5 is exemplary of trip diversion patterns that result when comparing build versus no-build assignments. Red bands indicate links with increases in trips for the build alternative, and green bands indicates a decrease in trips for the build alternative, compared with the no-build alternative. The example shown in Figure 5 is the difference between alternative 2B, general purpose and the no-build for 2030. This alternative was chosen for illustrative purposes because alternative 2b, general purpose diverts the greatest number of trips.

Figure 5: Pattern of Flow Changes for Build Alternatives



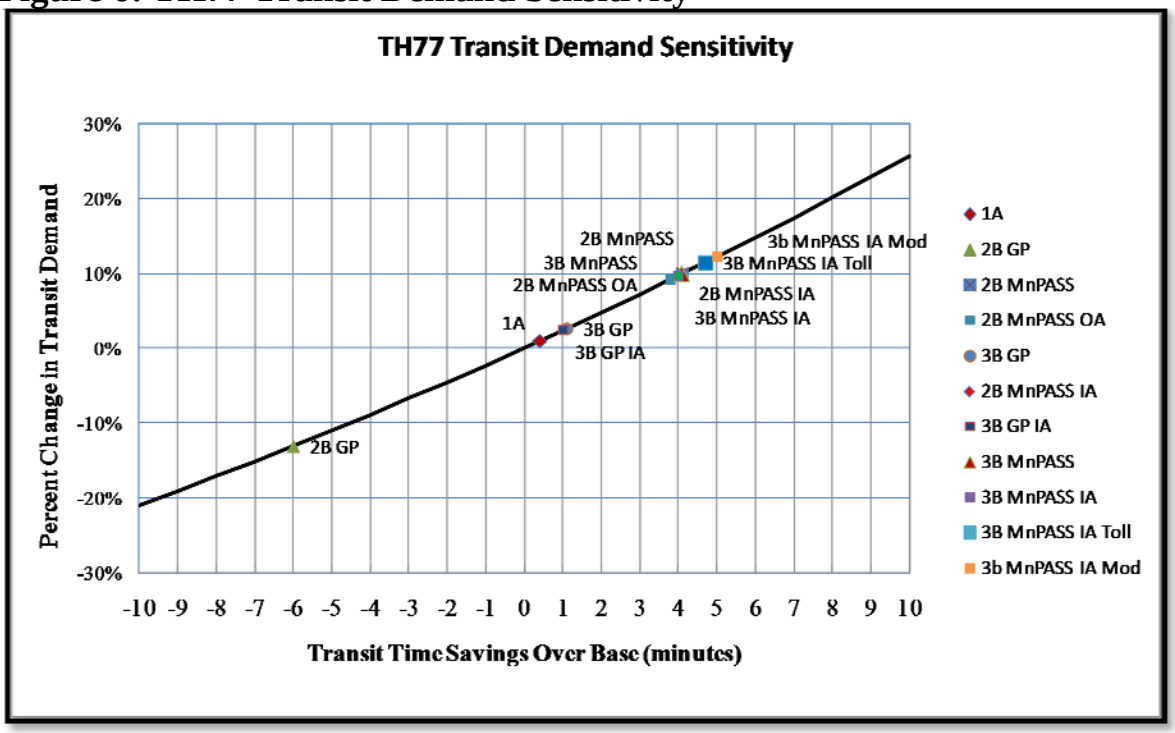
Of the trips diverted from alternative routes, about 38 percent are from I-35W; 23 percent from I-494; 17% from TH55 (Mendota Bridge) and 10% from TH169. The remainder of the trips are distributed between I35E and TH52. This diversion pattern is a result of peak hour latent demand for AM northbound trips based on path-choice. The pattern also suggests, though the model cannot directly show this, that some peak demand concentration may be a result of increased capacity on TH77. It is also true that while a relatively small improvement in level of service on TH77 is evident for general purpose traffic under the build alternatives, system-wide benefits in reduction of congestion, and potential shortening of the peak period also result on parallel routes, including I35W, I35E, TH13, TH55 and I494.

Figure 5 also illustrates the general pattern that the build alternatives do increase demand on TH77 north of the project area (north of Old Shakopee Road) as well as increasing peak hour demand on I-494 and TH62.

Note that approximately 60% of the northbound AM Peak demand on the TH77 Minnesota River bridge are destined for the Old Shakopee Road and Mall of America exits and I-494 (eastbound and westbound).

Transit Demand Sensitivity:
Improving a transit travel time advantage, as would be the case for the 3B alternatives, would increase transit demand in the corridor. Figure 6 shows the relationship between minutes saved or lost relative to the no-build condition, and the percent change in travel demand for transit routes on TH77. It also shows where the modeled alternatives lie along this line. Travel time savings are based on AM peak hour modeled travel times, and assume bus shoulder lane use for general purpose alternatives when available. Under the 2B general purpose alternatives, which utilize the existing shoulder lane on TH77 for an additional general purpose lane, longer transit travel times would result by about 6 minutes, as transit services would no longer have access to the transit-only shoulder lanes. This translates to a reduction in transit demand of about 13 percent. The MnPASS options result in about a 4-5 minute time savings, which corresponds to an increase in transit ridership of about 10 to 12 percent. Forecasted overall transit demand in the corridor is estimated at about 15,500 for 2030. Given this, the Alt 2B general purpose alternative may result in a decrease of about 2,000 daily transit trips. The 3B alternatives, with the transit advantage of faster trips, would result in an increase of about 1,800 daily transit trips. In terms of peak hour vehicle trips, this translates to an increase of about 500 vehicles per hour for 2B general purpose, and up to 490 vehicles per hour removed for the 3B alternatives.

Figure 6: TH77 Transit Demand Sensitivity

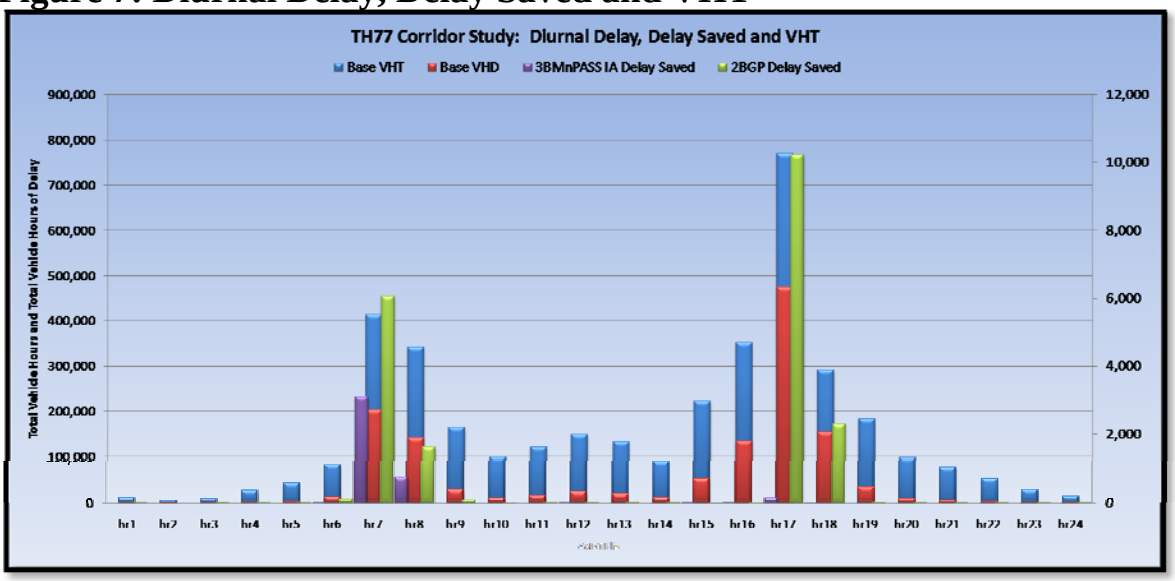


Diurnal Demand Patterns:

Therefore, the additional lane in alternative 2B, which is present all day, does serve to reduce delay during the PM peak period as well as in the AM peak period. In contrast, the 3B and similar alternatives gain all of their delay reduction benefit only in the AM peak period, when the additional lane is operating.

Figure **7** shows how the VHT and delay vary by hour in terms of both total values for the base and incremental savings for build alternatives. Blue and red bars show the base alternative total vehicle-hours (blue bars) and total vehicle-hours of delay (red bars) in the region (left axis applies). Both peak during the AM and PM peak periods. The green and purple bars (right axis applies) show the savings in delay for the 2B General Purpose (green) and 3B MnPASS Intermediate Access (purple) alternatives. These bars reflect the impact of the build alternatives on TH77 traffic. As the figure shows, the savings in delay hours are being accrued only during the AM peak period for the 3B alternatives, but a large amount of delay is reduced in the PM peak period with alternative 2B, since the additional lane is present all day for this alternative. The 3B alternative, shown in purple, is representative of and similar to all 3B and 2B alternatives, except for 2B general purpose. There is significant northbound demand in the PM peak period on TH77, associated with the Mall of America and other attractions north of the river. Therefore, the additional lane in alternative 2B, which is present all day, does serve to reduce delay during the PM peak period as well as in the AM peak period. In contrast, the 3B and similar alternatives gain all of their delay reduction benefit only in the AM peak period, when the additional lane is operating.

Figure 7: Diurnal Delay, Delay Saved and VHT



System Measures of Effectiveness:

Figure 8 through Figure 11 show the performance measures of the alternatives. These are system-wide measures, and take into account the effect of path choices on a regional basis, and benefits that accrue to parallel routes in the region. All measures are computed

by summing all regional link values, and therefore are subject to the effect of incomplete assignment convergence.

In Figure 8, delay hours are the increment of vehicle hours contributed by travel time beyond the free-flow time. Alternative 2b has by far the most savings, as it adds the most total capacity to the system, improving the overall level of service on TH77 and other routes to the greatest extent of any alternative. In addition the general purpose alternatives, the alternatives that restricted MnPASS lane use through higher tolls reduce delay by preserving an excellent level of service on the MnPASS lane, while limiting the additional delay on general purpose lanes north of the corridor. Alternative 1A performs well by reducing the delay on TH77 south of Diffley Road, while not inducing greater demand on TH77 north of TH13 and across the Minnesota River. Figure 9 shows a very similar pattern with respect to overall vehicle-hours of travel saved.

Figure 10 shows the pattern of vehicle-miles of travel saved by each alternative. The pattern largely follows that of the vehicle-hours of travel saved, with the general purpose alternatives saving the most vehicle miles. The 2B MnPASS alternative actually increases (negative savings) the VMT because under this alternative there are no intermediate access or egress locations, so users of the MnPASS lane may travel further to access and use this lane. The fact that all but one of these alternatives has a net positive distance savings indicates that there is a latent demand for TH77 which is apparently a more direct route (i.e., a shorter route) for many users' trips, but one that is not used due to the congested conditions of the no-build alternative, leading to a less than optimal travel time.

Figure 11 is a planning-level estimate of annual toll revenues from the TH77 MnPASS alternatives. This is not an investment-grade forecast. The revenue is calculated by multiplying the AM peak hour toll by the toll-paying single-occupant vehicles by toll segment. The AM peak hour conditions (demand and toll) are assumed to persist for an equivalent of 2 hours. The estimate also assumes 250 revenue-days per year. Most alternatives have annual revenues of between $450,000 and $650,000. The alternative 2B MnPASS open access alternative generates the largest overall revenue, and the toll-controlled 2B MnPASS option generates the least, since there are very few toll-paying vehicles at the high toll rate necessary to suppress demand under this alternative. The 3B MnPASS toll-restrict option revenue may be greatly overstated, since this model run was computed by restricting capacity, and not by toll policy.

Figure 8: Average Daily System Delay-Hours Saved

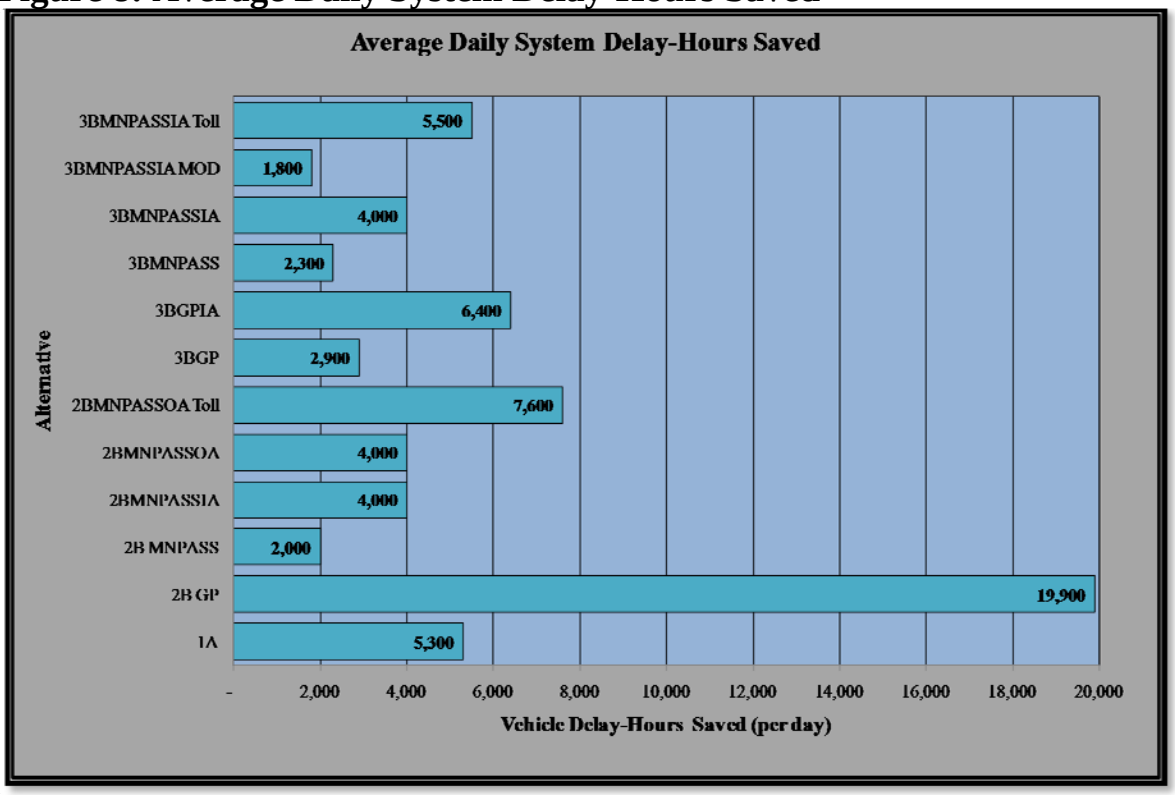


Figure 9: Average Daily System Vehicle-Hours Saved

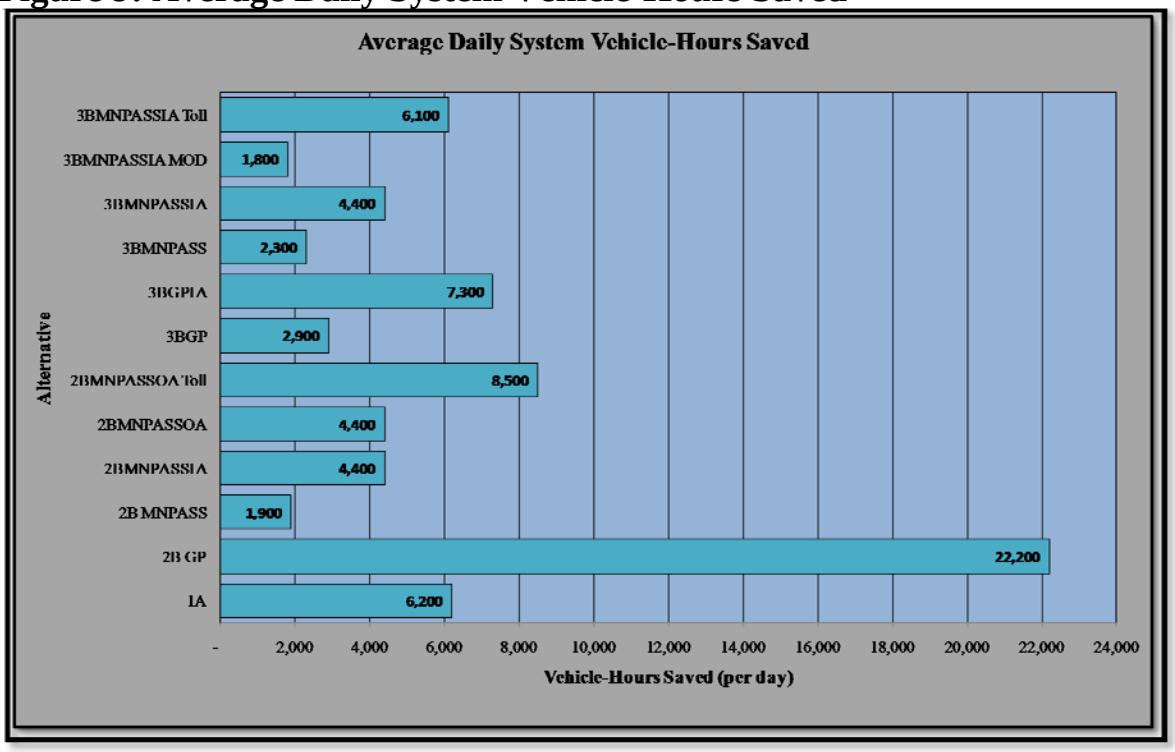


Figure 10: Average Daily System Vehicle-Miles Saved

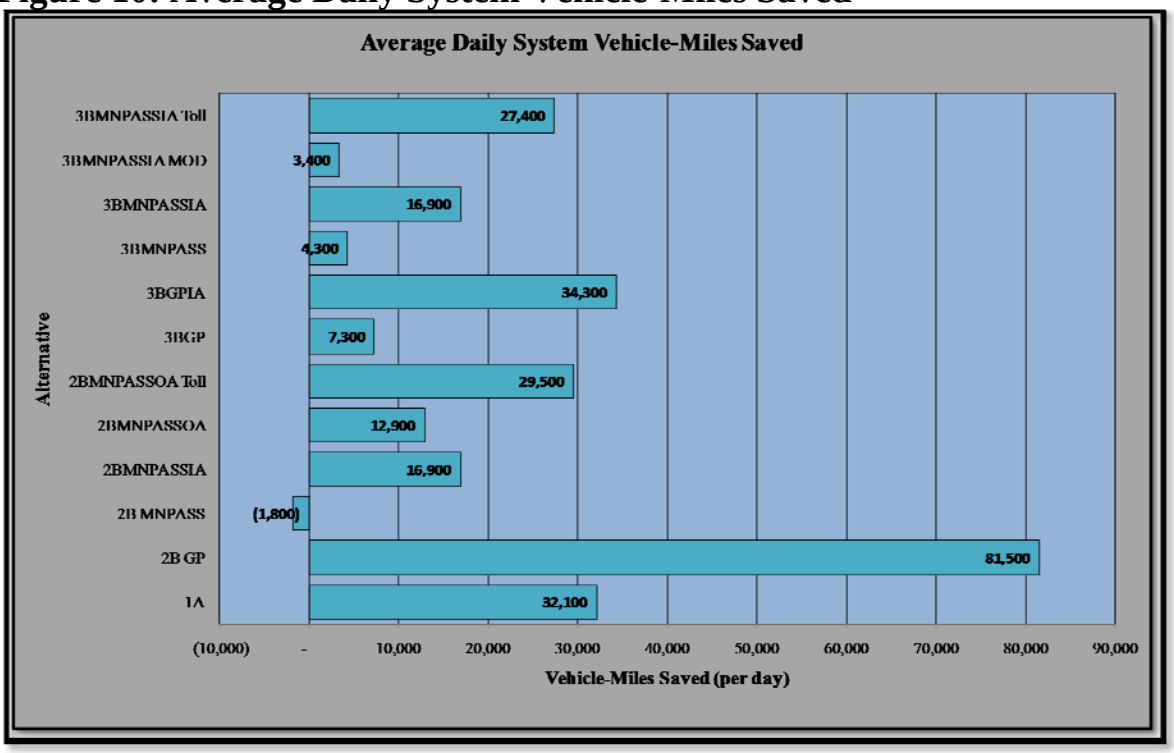


Figure 11: Annual Revenue from MnPASS Lane

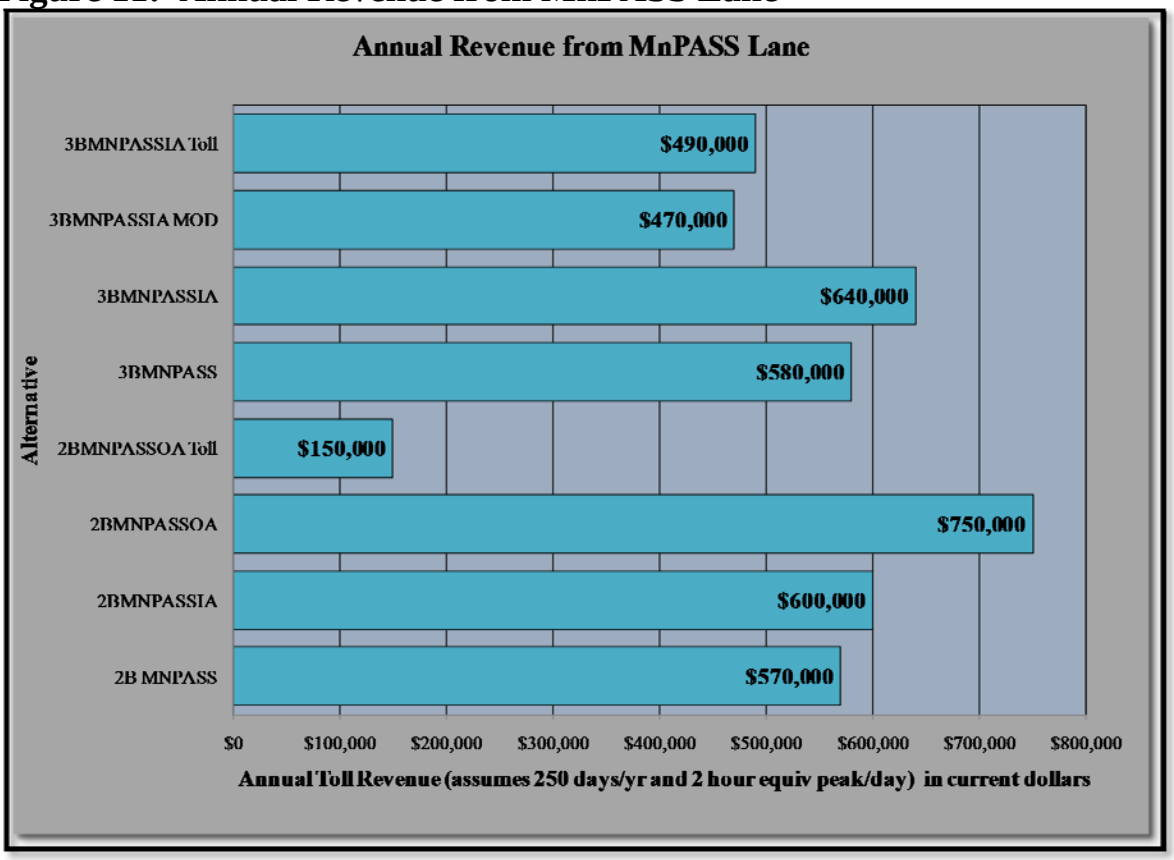


Table 2 summarizes the corridor performance measures from the regional model. Note that the MnPASS time savings are probably over-estimated since weaving delay at the termini are not included. The 2010 results reflect considerably less peak hour congestion, and therefore show higher speeds, and somewhat lower toll levels. A much more significant share of paying vehicles is forecast for 2010, 2B than is the case in 2030 as demand could be controlled to acceptable levels while still allowing 17 percent paying trips. The three alternatives tested in 2010 are those selected for final consideration.

Table 2: TH77 AM Peak Hour Performance of Alternatives Relative to No-Build – Regional Model (times in min, speed in mph)

Alternative Designation	GP Time Saved	MnPASS Lane Time Saved*	Transit Time Saved**	Percent Paying Vehicles	Peak Toll	GP Avg Speed	MnPASS Lane Avg Speed	Transit Avg Speed**
Year 2030								
1A	2.5		0.4			17.7		31.2
2B GP	3.5		-6.0			18.6		20.5
2B MnPASS	3.2	15.5	4.1	48%	$2.30	18.3	44.4	44.4
2B MnPASS IA	2.9	15.5	4.1	33%	$2.70	18.0	44.4	44.4
2B MnPASS OA	3.4	15.2	3.8	21%	$3.70	18.2	42.2	42.2
2B MnPASS OA Toll-controlled	2.8	16.1	4.6	2%	$9.59	17.7	46.7	46.7
3B GP	6.1		1.1			21.2		33.0
3B GP IA	5.1		1.0			20.2		32.7
3B MnPASS	3.4	15.5	4.1	48%	$2.30	18.5	44.4	44.4
3B MnPASS IA	2.1	15.4	4.0	34%	$2.80	17.4	43.8	43.8
3B MnPASS IA Ext	4.2	16.4	5.0	48%	$1.90	19.2	49.5	49.5
3B MnPASS IA Toll-controlled	2.1	16.1	4.7	26%	$3.60	17.4	49.0	49.0
Year 2010								
1A	1.9		0.2			24.6		33.8
2B MnPASS OA Toll-controlled	1.9	9.8	3.9	17%	$8.61	24.5	50.1	50.1
3B MnPASS IA Toll-controlled	1.9	11.3	3.9	30%	$2.10	23.5	50.4	50.4

*Reversible lane time savings based on Regional Model, CORSIM estimates about 12 min time savings
**Transit time savings & speeds based on use of shoulder lane (if available) with max speed of 35mph or 15 mph over prevailing GP speed

Conclusions:

The regional travel demand model analysis of the TH77 managed lane corridor alternatives leads to the following general conclusions:

1. Travel demand in the corridor is highly directional and characterized by home to work/work to home trips in the am and pm peak periods, with a heavy northbound predominance in the AM peak period and southbound predominance in the PM peak period. Southbound trips in the AM peak period can be easily accommodated by two lanes through 2030.
2. Latent demand, both spatially and temporally is sufficient to use most of the AM peak hour capacity provided by an additional general purpose lane northbound. While the model does not directly account for shifts in time of departure, it is reasonable to assume that this would happen in this corridor, being work-trip dominated and heavily peaked in the AM peak period, with high use in the AM peak shoulders. Therefore, while some improvement in general purpose travel time occurs (between 2 and 6 minutes) the overall level of service remains low.
3. Due to demand shifts to the build alternatives, there is some relief to parallel routes, including TH 169, I35W, I494, TH55, TH13 and I35E. However, additional traffic demand will be placed on TH77 north of the corridor, TH62 and I494 between I35W and TH5.
4. It is reasonable to assume that the build alternatives will tend to contract the duration of the AM peak period, as travelers shift to more desirable travel time slots.
5. The build alternatives provide a reduction in corridor travel time from 2 to 6 minutes in 2030 for general purpose traffic. Alternative 2B, general purpose provides the largest time savings of 6 minutes while the 2 minute reduction applies to alternative 1A. For MnPASS users proposed reversible lanes provide a time savings of about 12 minutes over the No-Build travel times.

   Comparing overall, weighted travel times between general purpose and MnPASS lane travelers reveals that the 6 min time savings for autos in the 2B, general purpose alternative compares with 4.5 to 4.9 overall average time savings for the alternative 2B MnPASS lane alternatives, and 5.2 to 5.4 minutes overall average time savings for the 3B alternatives (GP and MnPASS).
6. Alternative 2B, general purpose would remove the transit shoulder lane, and result in a 6 minute additional travel time for buses, which translates to a reduction of about 2,000 daily transit trips, and about 500 additional vehicle trips. Conversely, the 3B MnPASS alternatives provide a transit time savings of about 5 minutes, and would result in an additional 1,800 transit trips per day, and a reduction of about 490 vehicles per hour in the travel shed for year 2030.
7. Alternative 2B, general purpose provides by far the greatest overall vehicle hours of delay reduction at almost 20,000 vehicle-hours. Most of the other alternatives

show delay savings of between 4,000 and 6,400 vehicle-hours over the 2030 no-build condition. The difference is largely due to savings during the PM peak period for alternative 2B, general purpose. While most PM north-bound traffic in the corridor is not at capacity, it is significant, and experiences some delay, both on TH77 and parallel routes. In addition, the planned expansion of the Mall of America will have its greatest traffic impact in the PM peak hour period. However, note that the 2B alternative also focuses the greatest increase in traffic on the TH77/I494 interchange area. Since this area has no major capacity enhancement projects, the additional volume will greatly increase congestion and delay through the interchange for TH77 and I-494 traffic.

8. A very high toll for the 2B MnPASS alternative is required to lower the overall peak segment, peak hour demand to about 1100 vph on a MnPASS lane. This essentially prices out almost all paying trips, leaving only HOV vehicles. For the 3B MnPASS alternative, a toll of about $3.60 would effectively reduce the overall demand, leaving about 26% of the MnPASS traffic as SOV paying traffic.

9. Alternative 2B, general purpose, unlike the MnPASS alternatives does not provide the user with a reliable, congestion-free option onTH77, and in fact reduces the service level and reliability for transit users, while adding additional vehicular traffic due to mode shift away from transit. It has serious limitations with regard to capability to respond to future increases in demand, unlike the flexibility offered by the managed lanes alternatives, including the MnPASS options.

Appendix 4

CORSIM Modeling Analysis Memorandum dated June 21, 2010

MEMORANDUM

TO: Kevin Sommers, MnDOT

COPY TO: James Aswegan, MnDOT
Amr Jabr, MNDOT
Brian Kary, MnDOT

FROM: Haifeng Xiao, SEH
Graham Johnson, SEH
Tom Sohrweide, SEH
Mark Dierling, SEH

DATE: June 21, 2010

RE: TH 77 Managed Lanes Study, CORSIM Modeling Analysis Memorandum Draft
SEH Project Number: A-107598

1. Introduction

Providing access to the Central Business District (CBD) of Minneapolis, as well as to businesses on the I-494 corridor including the Mall of America, the TH 77 corridor is a critical link in the Twin Cities' Metropolitan Freeway System. The TH 77 Managed Lanes Study is undertaken to identify operational deficiencies and to evaluate various options to improve the capacity of the corridor between 140th Street in the City of Apple Valley and Old Shakopee Road in the City of Bloomington.

As one of the tasks for the project, CORSIM model simulation and analysis was conducted to test three build alternatives (Alternatives 1A, Alternative 2B and Alternative 3B) and their variations that were selected from a number of concepts developed in the preceding project tasks (*Alternatives Memorandum* dated on October 30, 2009). The study was focused on the Northbound TH 77 during AM peak period for the years of 2030 and 2010, in addition to the base year 2007 for the model calibration.

This memorandum summarizes the methodology and assumptions made for the CORSIM modeling analysis, followed by the results and findings.

2. TH 77 CORSIM Model Limits (inclusive)

Based on Mn/DOT's guidelines and requirements, the CORSIM model limits extend to include several major interchanges and intersections in the influence area of the project. The traffic models created for this study included following freeways:

- TH 77 between 140th Street and TH 62
- I-494 between I-35W and TH 5
- TH 77/I-35E interchange and its Collector-Distributor (CD) roads
- TH 77/TH 13 interchange
- TH 77/I-494 interchange and its CD roads including ramps from/to Mall of America
- TH 77 ramp terminal intersections on McAndrews Road (County Road 38), 127th Street, Cliff Road, Diffley Road and Old Shakopee Road

Figure 1 illustrates the project area and the CORSIM model limits for this study.

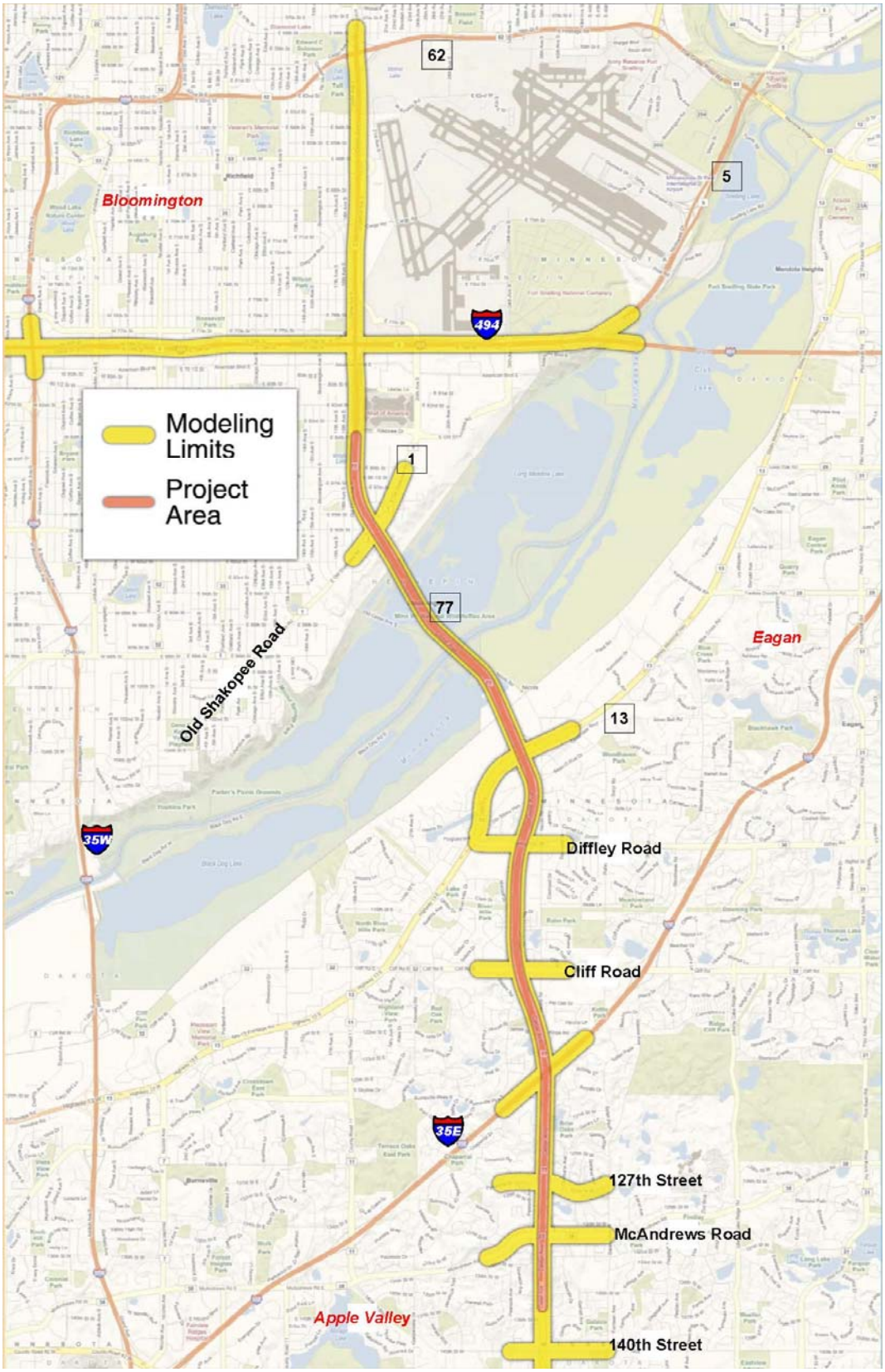


Figure 1 Project Area and CORSIM Model Limits

3. CORSIM Modeling Approach and Level of Service Criteria

The CORSIM Traffic Model Simulation and Analysis for this study included the following step by step approach:

- An existing condition CORSIM Model was calibrated based on actual conditions in 2007.
- The planned improvements to the I-494 and 140th Street/Cedar Avenue intersection were identified and incorporated into all 2030 CORSIM models, including the nobuild model.
- The 2030 nobuild, and build Alternatives 1A, 2B and 3B and their primary variations were analyzed to identify their operational advantages and disadvantages.
- Based on the preliminary results and findings from the 2030 models, sensitivity tests were conducted for the 2030 Alternatives 2B MnPASS and 3B_IA MnPASS.
- The based 2010 CORSIM nobuild and models were analyzed
- Based on the preliminary results and findings from 2010 models, sensitivity tests were conducted to identify the impacts of the improvements to the I-494 on the operations of TH 77 in the project area.
- The modeling results and findings were summarized and documented.

The criteria for Freeway Level of Service from the Highway Capacity Manual (HCM) were used to evaluate TH 77 freeway mainline operations for this study. They are summarized in table 1.

Table - 1 Freeway Measures of Effectiveness (MOEs)

Level of Service (LOS)	Description	Density (pc/mi/ln)
A	Free flow operations where free flow speeds and operating speeds are the same. Vehicles are unimpeded in their ability to maneuver.	≤ 10.00
B	Free flow speeds are generally maintained. Vehicle's ability to maneuver is only slightly restricted.	> 10.0 – 20.0
C	Free flow speeds are generally maintained. Freedom to maneuver is noticeably restricted. Queues may be expected to form behind any significant blockage.	> 20.0 – 28.0
D	Speeds begin to decline with increased traffic. Freedom to maneuver is more noticeably restricted. Queues can be expected to form behind any minor incident.	> 28.0 – 35.0
E	The lower boundary of LOS E is considered at capacity. Operations are very volatile with extremely limited room to maneuver. Any disruption such as lane changing or vehicle entering from a ramp can cause a breakdown and extensive queuing.	> 35.0 – 43.0
F	Total breakdown in vehicular flow. Traffic is under stop and go conditions.	> 43.0

4. Base Model Assumptions

The base conditions for the CORSIM modeling are as follows:

- **Base existing conditions within the TH 77 CORSIM model limits**
  - 2007 conditions

- **Base 2010 NoBuild conditions within the TH 77 CORSIM model limits**
  - Same as 2007 conditions

- **Base 2030 NoBuild conditions within the TH 77 CORSIM model limits**
  - Base existing conditions described above, with the following:
    - Completion of TH 62 Crosstown Project
    - Assuming a full auxiliary lane to the westbound I-494 when the loop ramp of the NB I-35W to WB I-494 comes in.
    - Assuming a full WB I-494 auxiliary lane between Portland Ave and Nicollet Ave
    - Assuming southbound dual left turn lanes and westbound dual right turn lanes for the intersection Cedar Avenue & 140th Street

Figure 2 in the appendix illustrates three primary build alternatives and their sub-alternatives developed for the CORSIM models. They are summarized as following:

- **Alternative 1A**
  - A third lane added to Northbound TH 77 on the left between 138th Street and Diffley Road

- **Alternative 2B**
  - A third lane added to Northbound TH 77 on the left between 138th Street and Diffley Road
  - A fourth lane added to the Northbound TH 77 Minnesota River Bridge on the right between the Diffley Road entrance ramp and the Old Shakopee Road exit ramp. Depending on the management strategies for the left lane between 138th Street and Old Shakopee Road, two modeling analysis scenarios are analyzed:
    (a) Alternative 2B_GP: A regular general purpose lane
    (b) Alternative 2B_MnPASS: A managed MnPASS lane on the left with open access at multiple locations.

- **Alternative 3B**
  - Northbound TH 77 as existing
  - The left lane of Southbound TH 77 is closed between 138th Street and Old Shakopee Road for the contra-flow lane during AM peak hour.
  - Depending on the management strategies for the contra-flow lane and intermediate access options, four base modeling analysis scenarios were analyzed:
    (a) Alternative 3B_GP: A general purpose contra-flow lane between 138th Street and Old Shakopee Road without intermediate access
    (b) Alternative 3B_MnPASS: A MnPASS contra-flow lane between 138th Street and Old Shakopee Road without intermediate access

(c) Alternative 3B_IA_GP: A general purpose contra-flow lane between 138th Street and Old Shakopee Road with intermediate access between Cliff Road exit ramp and entrance ramp.
(d) Alternative 3B_IA_MnPASS: A MnPASS contra-flow lane between 138th Street and Old Shakopee Road with intermediate access between Cliff Road exit ramp and entrance ramp.

- Based on the preliminary results of these four scenarios, an additional scenario (named as 3B modified scenario) was modeled for Alternative 3B_IA_MNPASS assuming the contra-flow exit located north of I-494 interchange instead of Old Shakopee Road(no contra-flow traffic was allowed to use the I-494/TH 77 interchange)

5. Traffic Forecasts

All the 2010 and 2030 peak hour forecasts that were used in CORSIM analysis were developed using the Twin Cities Regional Model. (*TH 77 Managed Lanes Corridor Study, Travel Demand Forecasting Results* Dated on June 2, 2010)

6. CORSIM Modeling Alternatives and Scenarios

To fully understand the advantages and disadvantages associated with each alternative, a number of modeling alternatives and scenarios were developed based on different combinations of the geometry elements, MnPASS or General Purpose Lane option, year of traffic forecasts and capacity constraint boundary conditions on I-494. Table 2 summarizes all the modeling alternatives and scenarios in the modeling analysis process. It is noted that the actual traffic condition in 2007 was used for CORSIM Model calibration.

Table 2 - TH 77 Alternatives for Modeling Analysis

Base Options	Primary Alternatives	2010	2030
Nobuild		Forecast/CORSIM	Forecast/CORSIM
Alternative 1A	General Purpose	Forecast/CORSIM*	Forecast/CORSIM*
Alternative 2B	General Purpose		Forecast/CORSIM
	MnPASS (Open Access)	Forecast/CORSIM**	Forecast/CORSIM***
Alternative 3B	General Purpose		Forecast/CORSIM
	Interim Access General Purpose		Forecast/CORSIM
	MnPASS		Forecast/CORSIM
	Interim Access MnPASS	Forecast/CORSIM**	Forecast/CORSIM***

Note: * Sensitivity tests in CORSIM analysis assuming the Alternative 3B_IA_MnPASS forecasts
**Sensitivity tests in CORSIM analysis assuming the improvement to the I-494/I-35W interchange
***Sensitivity tests assuming limited MnPASS demands on the Minnesota River Bridge in both forecast and CORSIM modeling processes

7. 2030 CORSIM Modeling Analysis

7.1. 2030 Base Model Runs

All future CORSIM models were built based on the existing models to reflect the proposed geometry for the different concepts and scenario variations in the study area. The calibrated parameters in the existing models were carried forward.

Figures 3-1 and 3-2 in the appendix respectively summarize the northbound and southbound TH 77 freeway model results for all the 2030 base modeling scenarios. For comparison purposes, the results for the existing model are also included in the figures. The 2030 CORSIM modeling results reveal the following findings:

- The Southbound TH 77 operations for all the alternatives, including the contra-flow alternatives, are acceptable for year 2030 (all modeling scenarios in the Figure 3-2).
- Under 2030 NoBuild conditions during the AM peak hour, northbound TH 77 operations would become worse than existing, especially along the 2-lane segment between Diffley Road and 138th Street. The queue backs into the 140th Street signalized intersection. The congestion persists on the Minnesota River Bridge (modeling scenario #2 in the Figure 3-1).
- Under the Alternative 1A condition, the northbound bottleneck between Diffley Road and 138th Street is removed due to the capacity expansion. Approximately 900 more vph are served on the corridor than for the NoBuild. However, the congestion worsens on the Minnesota River Bridge (modeling scenario #3 in the Figure 3-1).
- Under the Alternative 2B_GP condition, it is noted that approximately 2000 more vph are served on the bridge and about 1400 more vph on the segments in the I-35E interchange area. The operations between 138th Street and Old Shakopee Road are much better than NoBuild due to the capacity expansion. However, due to more traffic (approximately 1,300 vph more than NoBuild) passing into I-494/TH 77/MOA interchange area, the operations in the interchange area become worse and unacceptable (modeling scenario #4-1 in the Figure 3-1).
- Under the Alternative 2B_MnPASS condition with the current pricing strategies for the MnPASS lane, the I-494/TH 77 interchange is overloaded due to an additional 1,700 vph passing into the I-494/TH 77/MOA interchange area (modeling scenario #4-2 in Figure 3-1).
- Under all four alternative 3B modeling scenarios, it is noted that their demands between Old Shakopee Road and I-494 interchange in year 2030 are about the same as those for the alternative 2B_GP 2B_MNPASS scenarios. All four modeling scenarios overload the I-494/TH 77 interchange. (Modeling scenarios #5-1, #5-2, #5-3, and #5-4 in the Figure 3-1).
- There are trade-offs for the intermediate accesses for the 3B Alternatives. While the intermediate access provides the free flow lane to the travelers from the City of Eagan and I-35E, it creates weaving problems between I-35E and the new entrance ramp to the contra-flow lane. Further study is necessary to identify the appropriate location for the intermediate access.
- Under the 3B modified modeling scenario, it is noted that the queue would still build back from I-494/TH 77 interchange onto the northbound TH 77 freeway mainline. Based on forecasts from the regional model, more traffic on the Minnesota River Bridge would be destined to I-494 interchange even though the traffic going north would bypass the interchange. It indicates the latent demand of I-494/TH 77 interchange is sufficient to use the capacity expansion in the area (modeling scenario #5-4 modified in the Figure 3-1).

7.2. 2030 Alternatives Sensitivity Tests

Based on the modeling results from the base 2030 alternatives, it was recognized that the I-494/TH 77 interchange is overloaded by the full capacity expansion on the northbound TH 77 Minnesota River Bridge due to the current near-capacity operation on I-494 and limited improvement projects planned before 2030.Since the demands on the MnPASS lanes are manageable, sensitivity tests were conducted

for the Alternatives 2B_MnPASS and 3B_IA_MnPASS to identify how much more traffic the Minnesota River Bridge can serve for northbound TH 77, while not overloading the I-494/TH 77 interchange.

The assumptions made for the 2B and 3B MnPASS sensitivity tests are as following:

- The geometry and forecasts for the base 2030 2B_MnPASS and 3B_IA_MnPASS Alternatives were used as base in the sensitivity tests.
- The demands for the general purpose lanes on the northbound TH 77 Minnesota River Bridge remained unchanged for all tested scenarios.
- The demands for the MnPASS lane on the bridge were reduced incrementally by 100 vph from its original forecasts to as low as 900 vph to create different sensitivity test scenarios.
- The demands for the upstream entrance ramps and downstream exit ramps in those scenarios were reduced proportionally based on their original forecasts to balance out the demand reductions on MnPASS Lane.
- The operation of the I-494/TH 77 interchange was considered to be acceptable if the queues didn't back up from the interchange onto the TH 77 freeway mainline.

Figures 4-1 and 4-2 in the appendix respectively summarize the northbound TH 77 freeway model results for the Alternatives 2B_MnPASS and 3B_IA_MnPASS. For comparison purposes, the results for the existing model and 2030 NoBuild are also included in the figures. From the figures, it can be seen that the appropriate demands on the MnPASS lanes are the ranges 1,300-1,400 vph for the alternative 2B_MnPASS and 1,000-1,100 vph for the alternative 3B_IA_MnPASS. Higher demands would overload the I-494/TH 77 interchange while lower demands would lead to under-utilized TH 77 freeway between the Old Shakopee Road and I-494.

Additionally, a sensitivity test was conducted for the Alternative 1A using the forecasts for the 2030 3B MnPASS with Intermediate Access Alternative in order to evaluate the traffic operations on the TH 77 corridor between the two build Alternatives with the same demands on the Minnesota River Bridge (#3-1 in the Figure 3-1). It is noticed that the 3B forecasts are significantly higher than the 1A forecasts on the Minnesota River Bridge. It was a concern that the Alternative 1A forecasts might be in lower range due to capacity-constrained assignment approach in the Twin Cities Regional Model that was utilized to develop the forecasts for this study. The sensitivity test of the Alternative 1A with the 3B forecasts was to address this concern. The results showed the queue extends from Minnesota River Bridge into I-35E interchange area due to the higher traffic demands, which is much worse than the Alternative 3B. It is noted that the freeway operation north of Minnesota River Bridge is much better than Alternative 3B due to the bridge that functions as a meter.

8. 2010 CORSIM Base Model and Sensitivity Results

Based on the findings from the 2030 modeling analysis, it was determined to conduct 2010 modeling analysis for three build alternatives namely 1A, 2B_MnPASS and 3B_IA_MnPASS, in addition to the NoBuild to better understand their operational advantages and disadvantages.

It is noted that all the base 2010 CORSIM modeling alternatives didn't include the improvements to the I-494 freeway and 140th Street/Cedar Avenue intersection. Due to similar overloading problems in the I-494/TH 77 interchange area revealed by the base model results, sensitivity tests were conducted assuming the I-494 improvements for the 2010 CORSIM models.

Two more 2010 scenarios, respectively Alternative 1A with 3B forecasts and Alternative 3B with 1A forecasts, were modeled in order to evaluate the TH 77 operations with the same demands for different

geometry concepts. It was again to address the concern on the operations of Alternative 1A under higher demands.

Figure 5 in the appendix summarizes the northbound TH 77 freeway model results for all the 2010 modeling scenarios. For comparison purposes, the results for the existing and NoBuild model are also included in the figures.

The 2010 CORSIM modeling results reveal the following findings:

- During the AM peak hour, Northbound TH 77 operations would become worse under NoBuild conditions than existing, especially along the 2-lane segment. The queue backs into the 140th Street signalized intersection. The congestion persists on the Minnesota River Bridge (modeling scenario #2-10 in the Figure 5).
- Under Alternative 1A condition, the northbound bottleneck between Diffley Road and 138th Street is removed due to the capacity expansion. There is no congestion during the AM peak hour in 2010. The congestion persists on the Minnesota River Bridge (modeling scenario #3-10 in the Figure 5). The queue backs into the Cliff Road interchange area if the forecasted demands for the 3B Alternative were served (modeling scenario #3-10-01 in the Figure 5).
- Under Alternative 2B_MnPASS condition, it is noted that approximately 1,500 more vph than existing will be served on the bridge. The operations between 138th Street and Diffley Road are much better than NoBuild due to the capacity expansion. However, due to more traffic passing into I-494/TH 77/MOA interchange area, with no capacity improvement to I-494, the queue backs from the westbound I-494 into the I-494/TH 77 interchange and then the TH 77 mainline (modeling scenario #4-2-10 in the Figure 5). A sensitivity test was conducted assuming the previously identified improvements to I-494 would be implemented in 2010. The results show that the TH 77 operations would improve substantially (modeling scenario #4-2-10-494Improved in the Figure 5).
- Under Alternative 3B_IA_MnPASS condition, it is noted that approximately 1,100 more vph than existing will be served on the bridge. The TH 77 freeway operations south of the Old Shakopee Road are a little better than exiting. Similarly, the additional 1,100 vph crossing the rive would overload the I-494/TH 77 interchange due to current near-capacity operations on I-494 (modeling scenario #5-4-10 in the Figure 5). A sensitivity test was conducted assuming the previously identified improvements to I-494 would be implemented in 2010. The results show that the TH 77 operations north of Old Shakopee Road would improve (modeling scenario #5-4-10-494Improved in the Figure 5). Another sensitivity test was conducted assuming the forecasted demands for the Alternative 1A were used for the analysis. The results show that the freeway TH 77 would operate well north of Diffley Road, while the congestion south of Diffley Road would become a little worse than exiting due to higher demands on the two-lane segment.

9. Bus Only Shoulders Analysis

Authorized buses are allowed to run on the outside shoulders within the TH 77 corridor to avoid congestion on the mainline. The general rules for bus only shoulder lanes are twofold. First, the maximum speed for buses on the shoulder is 35 mph. Second, the speed of the buses on the shoulder is limited to no more than 15 mph above the speed of the adjacent general traffic.

One of the goals for this project is to preserve or enhance advantages for transit. All previous CORSIM modeling analysis was conducted for general traffic due to their unique operations. The freeway bus-only shoulders were not included in the CORSIM models. Therefore, the Measures of Effectiveness (MOEs) for buses weren't available from model outputs. To analyze bus operations for different modeling

scenarios, the output for speeds in the general purpose lanes and freeway segment distance were used to calculate the average running speeds based on the assumption that buses would run either on the right lane or shoulder lane. Therefore the speed for buses on any freeway segment could be calculated as follows:

- For the freeway segments where bus-only shoulders were not available, the freeway speeds were used for buses.
- For the freeway segments where bus-only shoulders were available, the bus speed would be the right lane speed if it was greater than 35 mph; 35 mph if the freeway speed was between 35 mph and 20 mph; or the freeway speed plus 15 mph when the right lane is less than 20 mph.

Figure 6 in the appendix illustrates the transit travel times from the 2030 CORSIM models for the northbound TH 77 between 140th Street and I-494 for the alternatives that were under consideration. For comparison purpose, the travel times for the traffic in the general purpose lanes, MnPASS lanes and contra-flow lanes are also included for corresponding alternatives. It is noted all the build alternatives preserve the bus-only-shoulders except the Alternative 2B_GP, which adds a fourth lane by removing the bus-only-shoulders on the Minnesota River Bridge. From the figure, it can be seen that the variances of the transit travel times are not as significant as those of the general purpose traffic for different alternatives. It should be noted that those transit travel times are estimated based on normal traffic conditions. Due to the removal of the bus-only-shoulder on the Minnesota Rive Bridge, the transit travel time for Alternative 2B_GP is the least reliable if an incident occurs on the TH 77 Minnesota River Bridge or to the north.

10. Northbound TH 77 Travel Time to I-494 Analysis

Figure 7-1 in the appendix illustrates the northbound TH 77 travel times to I-494 from different locations south of the Minnesota River Bridge based on the 2010 model results. Figure 7-2 illustrates the 2030 results for several alternatives that were under consideration.

The figures further reinforce some previous findings.

- The travel times increased substantially under NoBuild conditions, especially for the locations south of I-35E.
- The current near-capacity operations on I-494 have significant impacts on the operational characteristics of the build alternatives proposed for northbound TH 77. Figure 7-1 for the year of 2010 shows that the alternative 2B MnPASS alternative feeds more traffic (1,500 vph) than the current I-494 can accommodate, resulting in queues backing from I-494 onto TH 77. Consequently, the travel times from locations north of I-35E for this alternative are longer than those for the NoBuild.
- The travel times on the northbound TH 77 between the I-35E and the Minnesota River Bridge for different alternatives vary much less than those of freeway segment south of I-35E.

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Modeling Scenario			#1				#2				#3				2030 Alternative 2B											
															#4-1 2030 Alt2B_GP				#4-2 2030 Alt2B_MnPASS							
			Existing				2030 Nobuild				2030 Alternative 1A				All general purpose Lanes				General Purpose Lanes				Access Restricted MnPASS Lane			
			AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)			
			Vol	Speed	Density		Vol	Speed	Density		Vol	Speed	Density		Vol	Speed	Density		Vol	Speed	Density		Vol	Speed	Density	
			(vph)	(MPH)	(vplph)	LOS	(vph)	(MPH)	(vplph)	LOS	(vph)	(MPH)	(vplph)	LOS	(vph)	(MPH)	(vplph)	LOS	(vph)	(MPH)	(vplph)	LOS	(vph)	(MPH)	(vplph)	LOS
From	To	#	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	3-1	3-2	3-3	3-4	4-1	4-2	4-3	4-4	5-1	5-2	5-3	5-4	5-5	5-6	5-7	5-8
WB TH 62 Exit Loop	End Northbound TH 77	1	1,237	53	10	A	1,274	54	11	B	1,171	54	11	B	1,270	54	10	A	1,286	53	11	B				
EB TH 62 Entrance Loop	WB TH 62 Exit Loop	2	2,493	27	40	E	2,303	50	15	B	2,216	50	15	B	2,583	50	16	B	2,431	50	16	B				
EB TH 62 Exit Ramp	EB TH 62 Entrance Loop	3	2,447	36	39	E	2,237	51	21	C	2,152	51	21	C	2,525	50	24	C	2,374	51	23	C				
66th Street Entrance Ramp	EB TH 62 Exit Ramp	4	2,941	40	27	C	2,692	51	17	B	2,622	51	17	B	3,076	50	20	B	2,913	51	19	B				
66th Street Exit Ramp	66th Street Entrance Ramp	5	2,731	53	26	C	2,487	55	22	C	2,430	55	22	C	2,858	54	25	C	2,741	54	24	C				
WB I-494 Entrance Ramp	66th Street Exit Ramp	6	3,404	60	25	C	3,074	62	22	C	3,059	62	23	C	3,408	61	24	C	3,497	60	26	C				
WB I-494 HOV Exit Loop	WB I-494 Entrance Ramp	7	3,142	61	24	C	2,877	63	22	C	2,870	63	23	C	3,234	62	24	C	3,309	61	26	C				
EB I-494 Entrance Loop	WB I-494 HOV Exit Loop	8	3,275	62	17	B	3,017	62	16	B	2,995	62	16	B	3,427	61	17	B	3,680	60	19	B				
I-494 EB/WB Exit Ramp	EB I-494 Entrance Loop	9	3,056	65	22	C	2,840	66	21	C	2,819	66	21	C	3,257	64	24	C	3,505	63	26	C				
Killebrew Exit Ramp	I-494 EB/WB Exit Ramp	10	4,835	63	20	C	4,668	64	19	B	4,672	64	20	C	5,681	46	38	E	5,654	33	48	F				
Old Shakopee Rd Entrance	Killebrew/Lindau Exit	11	5,835	62	22	C	5,731	63	22	C	5,700	63	22	C	7,005	51	34	D	6,896	46	37	E				
Old Shakopee Rd Exit(Contraflo	ar Old Shakopee Rd Entrance	12	5,461	62	28	C	5,381	63	27	C	5,358	63	28	D	6,739	47	46	F	6,617	48	43	F				
(Old Shakopee Rd Exit)	(Contraflow Entrance)	13																	8,624	45	45	F	1,718	58	28	D
WB TH 13 Entrance (Bridge)	Old Shakopee Rd Exit	14	6,958	51	42	E	6,956	54	40	E	6,971	48	46	F	8,980	44	48	F	6,906	45	48	F				
WB TH 13 Exit	WB TH 13 Entrance	15	6,197	33	53	F	6,312	41	45	F	6,296	37	52	F	8,260	54	34	D	6,282	49	40	E	1,527	57	25	C
EB TH 13 Entrance	WB TH 13 Exit	16	6,205	28	46	F	6,316	35	37	E	6,623	38	37	E	8,285	57	24	C	7,904	53	28	D				
EB TH 13 Exit	EB TH 13 Entrance	17	5,499	38	48	F	5,735	49	37	E	6,096	50	40	E	7,601	64	28	C	7,316	58	29	D				
Diffley Rd Entrance	EB TH 13 Exit	18	5,614	41	34	D	5,899	50	28	C	6,300	53	29	D	7,750	63	28	C	7,501	63	26	C				
Diffley Rd Exit	Diffley Rd Entrance	19	4,583	49	36	E	4,820	59	30	D	5,496	63	28	D	6,592	61	34	D	6,423	58	34	D	1,411	56	24	C
Cliff Rd Entrance	Diffley Rd Exit	20	4,618	35	56	F	4,947	38	55	F	5,678	58	29	D	6,808	48	41	E	6,499	38	47	F				
Cliff Rd Exit	Cliff Rd Entrance	21	3,705	19	92	F	3,823	17	103	F	4,829	64	25	C	5,727	49	39	E	3,802	16	105	F	1,167	57	19	B
SB I-35E Entrance	Cliff Rd Exit	22	3,961	21	61	F	4,204	19	69	F	5,162	64	20	B	6,020	61	24	C	5,450	18	69	F				
SB I-35E Exit	SB I-35E Entrance	23	3,909	23	83	F	4,158	21	89	F	5,119	58	29	D	5,972	54	35	D	5,394	26	62	F				
NB I-35E Entrance	SB I-35E Exit	24	3,936	18	73	F	4,208	16	79	F	5,146	50	25	C	5,995	40	35	E	4,413	17	78	F				
NB I-35E Exit	NB I-35E Entrance	25	2,900	15	111	F	3,350	13	119	F	4,177	64	21	C	4,735	57	27	C	4,478	15	92	F	1,032	56	17	B
Palomino Entrance	NB I-35E Exit	26	4,410	27	59	F	4,915	14	90	F	5,795	57	23	C	6,357	56	25	C	6,300	18	74	F				
McAndrews Entrance	Palomino Entrance	27	3,756	48	35	E	4,326	11	118	F	5,145	61	21	C	5,703	60	23	C	5,519	18	69	F				
McAndrews Exit	McAndrews Entrance	28	2,750	62	24	C	3,077	10	132	F	4,003	65	20	C	4,228	65	20	C	2,865	16	80	F	1,239	59	20	C
(Contraflow Exit)	McAnddews Exit	29	2,808	56	21	C	3,227	11	112	F	4,123	60	22	C	4,272	61	22	C	2,963	31	42	E				
Begin NB TH 77	McAndrews Exit(Contraflow	30																	4,202	51	26	C				
Comments		33	During a.m. peak 1) Slowdown approaching TH62 interchange 2) Slowdown on the Minnesota River Bridge 3) Bottleneck along the 2-lane segment between 138th St and Diffley Rd				1) Crosstown project improves the NB TH 77 operations in TH62/TH77 Interchange Area 2) Congestion on the Minnesota River Bridge 3) Congestion along the 2-lane segment becomes worse, "metering"				1) Crosstown project improves the NB TH 77 operations in TH62/TH77 Interchange Area 2) Bottleneck along the 2-lane segment removed 3) Still congestion on the Minnesota River Bridge				1) Crosstown project improves the NB TH 77 operations in TH62/TH77 Interchange Area 2) Bad operations between Old Shakopee Rd and MN River Bridge 3) Minor operation problem in				1) Similar congestion locations as existing south of the Old Shakopee Road 2) Attracts more demands, causing congestion between 494 ramps and Old Shakopee Road 3) Free flow in the MnPASS lane							

Modeling Scenario			2030 Alternative 3B Contraflow Lane																							
			#5-1 2030 Alt3B_GP								#5-2 Alt3B_MnPASS								#5-3 2030 Alt3B_Interim Access_GP							
			General Purpose NB Maineline				General Purpose Contraflow Lane				General Purpose NB Maineline				MnPASS Contraflow Lane				General Purpose NB Maineline				General Purpose Contraflow Lane			
			AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)			
			Vol	Speed	Density		Vol	Speed	Density		Vol	Speed	Density		Vol	Speed	Density		Vol	Speed	Density		Vol	Speed	Density	
			(vph)	(MPH)	(vplph)	LOS	(vph)	(MPH)	(vplph)	LOS	(vph)	(MPH)	(vplph)	LOS	(vph)	(MPH)	(vplph)	LOS	(vph)	(MPH)	(vplph)	LOS	(vph)	(MPH)	(vplph)	LOS
From	To	#	6-1	6-2	6-3	6-4	6-5	6-6	6-7	6-8	7-1	7-2	7-3	7-4	7-5	7-6	7-7	7-8	8-1	8-2	8-3	8-4	8-5	8-6	8-7	8-8
WB TH 62 Exit Loop	End Northbound TH 77	1	1,372	53	12	B					1,330	54	11	B					1,273	54	10	B				
EB TH 62 Entrance Loop	WB TH 62 Exit Loop	2	2,613	50	17	B					2,578	50	17	B					2,505	49	16	B				
EB TH 62 Exit Ramp	EB TH 62 Entrance Loop	3	2,548	50	25	C					2,513	50	24	C					2,447	50	24	C				
66th Street Entrance Ramp	EB TH 62 Exit Ramp	4	3,071	50	20	B					3,045	50	20	B					2,970	50	19	B				
66th Street Exit Ramp	66th Street Entrance Ramp	5	2,865	54	25	C					2,843	54	25	C					2,795	54	25	C				
WB I-494 Entrance Ramp	66th Street Exit Ramp	6	3,578	60	27	C					3,540	60	26	C					3,538	59	27	C				
WB I-494 HOV Exit Loop	WB I-494 Entrance Ramp	7	3,394	60	27	C					3,350	60	26	C					3,361	59	27	C				
EB I-494 Entrance Loop	WB I-494 HOV Exit Loop	8	3,587	60	19	B					3,694	60	20	B					3,552	60	19	B				
I-494 EB/WB Exit Ramp	EB I-494 Entrance Loop	9	3,414	63	26	C					3,523	63	27	C					3,384	62	26	C				
Killebrew Exit Ramp	I-494 EB/WB Exit Ramp	10	5,673	41	38	E					5,678	44	36	E					5,679	34	45	F				
Old Shakopee Rd Entrance	Killebrew/Lindau Exit	11	6,950	56	30	D					6,970	54	31	D					6,965	48	34	D				
Old Shakopee Rd Exit(Contraflo	ar Old Shakopee Rd Entrance	12	6,688	42	43	F					6,650	41	44	F					6,683	37	50	F				
(Old Shakopee Rd Exit)	(Contraflow Entrance)	13	8,639	51	37	E	1,604	53	28	D	8,638	50	37	E	1,545	53	28	D	8,638	45	43	E	1,797	53	33	D
WB TH 13 Entrance (Bridge)	Old Shakopee Rd Exit	14	7,035	46	47	F	1,604	53	28	D	7,093	43	49	F	1,545	53	28	D	6,841	40	52	F	1,797	53	32	D
WB TH 13 Exit	WB TH 13 Entrance	15	6,348	38	49	F					6,381	34	54	F					6,174	34	53	F				
EB TH 13 Entrance	WB TH 13 Exit	16	6,352	32	40	E	1,604	53	28	D	6,422	29	45	F	1,545	53	28	D	6,241	28	45	F	1,797	53	32	D
EB TH 13 Exit	EB TH 13 Entrance	17	5,749	46	39	E					5,777	40	45	F					5,595	39	46	F				
Diffley Rd Entrance	EB TH 13 Exit	18	5,906	48	29	D					5,936	42	33	D					5,752	43	33	D				
Diffley Rd Exit	Diffley Rd Entrance	19	4,886	56	32	D					4,775	52	33	D					4,752	50	35	E				
Cliff Rd Entrance	Diffley Rd Exit	20	4,997	38	56	F					4,893	37	56	F					4,803	37	55	F	1,797	52	30	D
Cliff Rd Exit	Cliff Rd Entrance	21	3,839	19	92	F	1,604	54	28	D	3,703	22	84	F	1,545	54	28	D	3,737	21	83	F				
SB I-35E Entrance	Cliff Rd Exit	22	4,198	24	56	F					4,059	37	38	E					4,499	32	45	F				
SB I-35E Exit	SB I-35E Entrance	23	4,160	30	67	F					4,007	44	46	F					4,437	34	64	F				
NB I-35E Entrance	SB I-35E Exit	24	4,200	26	54	F					4,068	40	34	D					4,464	25	59	F	1,345	54	24	C
NB I-35E Exit	NB I-35E Entrance	25	3,112	31	57	F					3,135	58	27	C					3,371	30	69	F				
Palomino Entrance	NB I-35E Exit	26	4,785	50	28	D					4,793	56	25	C					4,929	41	39	E				
McAndrews Entrance	Palomino Entrance	27	4,094	60	21	C					4,142	60	22	C					4,227	53	28	D				
McAndrews Exit	McAndrews Entrance	28	2,646	66	19	B	1,604	54	26	C	2,621	66	19	B	1,545	54	26	C	2,731	64	20	C	1,345	55	23	C
(Contraflow Exit)	McAnddews Exit	29	2,663	65	17	B					2,643	64	18	B					2,820	64	19	B				
Begin NB TH 77	McAndrews Exit(Contraflow	30	4,267	55	24	C					4,188	55	24	C					4,165	56	24	C				
Comments		33	1) Still bottleneck along the 2-lane segment 2) Attracts more demands, especially between Contraflow end point and 494 ramps 3) High weaving demands creat bottleneck in 494 and MOA interchanges area, queue backs up into 2-lane segment bottleneck area								1) Similar to contraflow lane as a general purpose lane alternative(# 4); 2) Operates little better in 494/MOA interchange area than #4, though still unacceptable LOS.								1) Similar to without interim access alternative(# 4);							

Modeling Scenario			2030 Alternative 3B Contraflow Lane																							
			#5-4 2030 Alt3B_Interim Access_MnPASS								#5-4 Modified (Contraflow Access North of 494)															
			General Purpose NB Maineline				MnPASS Contraflow Lane				General Purpose NB Maineline				MnPASS Contraflow Lane											
			AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)											
			Vol	Speed	Density		Vol	Speed	Density		Vol	Speed	Density		Vol	Speed	Density									
			(vph)	(MPH)	(vplph)	LOS	(vph)	(MPH)	(vplph)	LOS	(vph)	(MPH)	(vplph)	LOS	(vph)	(MPH)	(vplph)	LOS								
From	To	#	9-1	9-2	9-3	9-4	9-5	9-6	9-7	9-8	9-1	9-2	9-3	9-4	9-5	9-6	9-7	9-8								
WB TH 62 Exit Loop	End Northbound TH 77	1	1,267	54	10	A					1,344	53	12	B												
EB TH 62 Entrance Loop	WB TH 62 Exit Loop	2	2,479	49	16	B					2,631	49	18	B												
EB TH 62 Exit Ramp	EB TH 62 Entrance Loop	3	2,419	50	23	C					2,574	50	25	C												
66th Street Entrance Ramp	EB TH 62 Exit Ramp	4	2,951	50	18	B					3,134	50	20	C												
66th Street Exit Ramp	66th Street Entrance Ramp	5	2,718	54	23	C					2,939	54	26	C												
WB I-494 Entrance Ramp	66th Street Exit Ramp	6	3,486	60	25	C					3,756	57	30	D												
WB I-494 HOV Exit Loop	WB I-494 Entrance Ramp	7	3,305	61	25	C					3,477	27	44	F	1,513	53	28	D								
EB I-494 Entrance Loop	WB I-494 HOV Exit Loop	8	3,704	60	19	B					2,093	61	11	B												
I-494 EB/WB Exit Ramp	EB I-494 Entrance Loop	9	3,533	62	26	C					1,916	65	14	B												
Killebrew Exit Ramp	I-494 EB/WB Exit Ramp	10	5,721	33	45	F					4,085	23	50	F												
Old Shakopee Rd Entrance	Killebrew/Lindau Exit	11	7,016	47	35	E					5,599	44	30	D												
Old Shakopee Rd Exit(Contraflo	ar Old Shakopee Rd Entrance	12	6,707	37	48	F					5,235	48	30	D												
(Old Shakopee Rd Exit)	(Contraflow Entrance)	13	8,641	45	41	E	1,573	53	28	D	7,134	40	52	F	1,513	53	25	C								
WB TH 13 Entrance (Bridge)	Old Shakopee Rd Exit	14	7,068	41	50	F	1,573	54	28	D	7,134	40	52	F	1,513	53	27	C								
WB TH 13 Exit	WB TH 13 Entrance	15	6,293	31	56	F					6,390	29	64	F												
EB TH 13 Entrance	WB TH 13 Exit	16	6,425	26	48	F	1,573	54	28	D	6,434	23	58	F	1,513	54	27	C								
EB TH 13 Exit	EB TH 13 Entrance	17	5,690	38	45	F					5,678	31	59	F												
Diffley Rd Entrance	EB TH 13 Exit	18	5,864	44	31	D					5,829	33	41	E												
Diffley Rd Exit	Diffley Rd Entrance	19	4,805	54	31	D					4,702	42	41	E												
Cliff Rd Entrance	Diffley Rd Exit	20	4,875	43	44	F	1,573	53	26	C	4,783	36	55	F	1,513	53	25	C								
Cliff Rd Exit	Cliff Rd Entrance	21	3,592	46	38	E					3,535	20	83	F												
SB I-35E Entrance	Cliff Rd Exit	22	4,739	48	32	D					4,500	29	48	F												
SB I-35E Exit	SB I-35E Entrance	23	4,673	36	63	F					4,436	27	76	F												
NB I-35E Entrance	SB I-35E Exit	24	4,717	23	65	F	769	55	13	B	4,487	19	72	F	890	55	16	B								
NB I-35E Exit	NB I-35E Entrance	25	3,539	19	93	F					3,431	14	112	F												
Palomino Entrance	NB I-35E Exit	26	5,371	21	72	F					5,200	19	75	F												
McAndrews Entrance	Palomino Entrance	27	4,653	15	98	F					4,524	17	87	F												
McAndrews Exit	McAndrews Entrance	28	3,055	17	89	F	769	56	13	B	3,099	23	68	F	890	56	15	B								
(Contraflow Exit)	McAnddews Exit	29	3,217	23	65	F					3,142	35	41	E												
Begin NB TH 77	McAndrews Exit(Contraflow	30	3,986	46	29	D					4,032	49	28	D												
Comments		33	1) Much less demand on the contral flow MnPASS lane between 138th St and Cliff Road than the alternative with a general purpose lane 2) Worse operation on NB mainline south of I-35E than the alternative without interim access due to higher demands with shifted traffic. 3) Bottleneck in 494/MOA interchange area as the other Alt 3B scenarios;								1) Still Bottleneck in 494/MOA and Old Shakopee Road interchange areas as the other Alt 3B scenarios; 2) Operation problems in the new contraflow access point, might need further investigation.													

* TH77 Managed Lanes Study Area Highlighted in Light green,Minnesota River Bridge in Blue,Contraflow acess segments in Purple, restricted Alt2B_MnPASS lane in Green
** HCM Level of Service (LOS) Criteria: LOS D(28-35 vplph); LOS E(35-43 vplph); LOS F(>43vplph)
*** Modeling Scenarios Description:
2030 Alternative 1A: A 3rd lane constructed for NB TH 77 between 138th Street and Diffley Road
2030 Alternative 2B: 4th lane over the MN River Bridge, in addition to Alt1A improvement(two 2030 scenarios: Inside lane general purpose or MnPASS lane)
2030 Alternative 3B: Contraflow between CR 38 and Old Shakopee Road (four 2030 scenarios: Contraflow general purpose or MnPASS lane, with or without intermediate access at Cliff Road)

TH 77 Managed Lanes Study
Between 140th Street and I-494

Figure 3- 1
2030 Base CORSIM Model Results
Northbound TH77 AM Peak Hour Operations Comparison

Modeling Scenario			#1				#2				#3				#4 2030 Alternative 2B								#5 2030 Alternative 3B Contraflow Lane																			
			Existing				2030 Nobuild				2030 Alternative 1A				#4-1 2030 Alt2B_GP				#4-2 2030 Alt2B_MnPASS				#5-1 2030 Alt3B_GP				#5-2 2030 Alt3B_MnPASS				#5-3 2030 Alt3B_Interim Access_GP				#5-4 2030 Alt3B_Interim Access_MnPASS				#5-4 Modified (Contraflow Access North of 494)			
			AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)				AM (7:00-8:00am)			
			Vol	Speed	Density	LOS	Vol	Speed	Density	LOS	Vol	Speed	Density	LOS	Vol	Speed	Density	LOS	Vol	Speed	Density	LOS	Vol	Speed	Density	LOS	Vol	Speed	Density	LOS	Vol	Speed	Density	LOS	Vol	Speed	Density	LOS	Vol	Speed	Density	LOS
			(vph)	(MPH)	(vplph)		(vph)	(MPH)	(vplph)		(vph)	(MPH)	(vplph)		(vph)	(MPH)	(vplph)		(vph)	(MPH)	(vplph)		(vph)	(MPH)	(vplph)		(vph)	(MPH)	(vplph)		(vph)	(MPH)	(vplph)		(vph)	(MPH)	(vplph)		(vph)	(MPH)	(vplph)	
From	To	#	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	3-1	3-2	3-3	3-4	4-1	4-2	4-3	4-4	5-1	5-2	5-3	5-4	6-1	6-2	6-3	6-4	7-1	7-2	7-3	7-4	8-1	8-2	8-3	8-4	9-1	9-2	9-3	9-4	9-1	9-2	9-3	9-4
Begin Southbound TH 77	WB TH 62 Entrance Loop	1	998	58	7	A	1,218	58	11	B	1,202	58	11	B	1,159	58	9	A	1,151	58	10	B	1,229	58	11	B	1,222	58	11	B	1,204	58	11	B	1,185	58	11	B	1,204	58	11	B
WB TH 62 Entrance Loop	EB TH 62 Exit Loop	2	1,375	52	7	A	1,635	51	11	B	1,593	52	10	B	1,528	52	8	A	1,538	52	10	A	1,616	51	11	B	1,601	52	10	B	1,568	52	10	B	1,565	52	10	B	1,574	52	10	B
EB TH 62 Exit Loop	EB TH 62 Entrance Ramp	3	1,147	61	8	A	1,327	60	11	B	1,338	60	11	B	1,301	60	9	A	1,292	60	11	B	1,307	60	11	B	1,295	60	11	B	1,331	60	11	B	1,307	60	11	B	1,308	60	11	B
EB TH 62 Entrance Ramp	66th Street Exit Ramp	4	2,160	63	10	A	2,334	63	12	B	2,338	63	12	B	2,315	63	11	B	2,344	62	12	B	2,338	63	12	B	2,322	63	12	B	2,395	62	12	B	2,306	63	12	B	2,312	63	12	B
66th Street Exit Ramp	66th Street Entrance Ramp	5	1,923	67	12	B	2,060	66	15	B	2,086	66	15	B	2,079	66	13	B	2,083	66	15	B	2,058	66	15	B	2,049	66	15	B	2,173	66	16	B	2,049	66	15	B	2,019	66	14	B
66th Street Entrance Ramp	Diagonal Blvd Exit Ramp	6	2,064	65	11	B	2,194	64	13	B	2,216	64	13	B	2,220	64	12	B	2,234	63	13	B	2,194	64	13	B	2,185	64	13	B	2,322	64	14	B	2,215	63	13	B	2,173	64	13	B
Diagonal Blvd Exit Ramp	Diagonal Blvd Entrance Ramp	7	1,932	67	13	B	2,049	66	15	B	2,080	66	16	B	2,088	66	14	B	2,091	66	16	B	2,050	66	15	B	2,042	66	15	B	2,189	66	17	B	2,079	66	16	B	2,031	66	15	B
Diagonal Blvd Entrance Ramp	I-494 EB/WB CD Rd Exit Ramp	8	2,052	65	9	A	2,190	64	11	B	2,219	64	11	B	2,231	64	10	B	2,232	64	11	B	2,192	64	11	B	2,181	64	11	B	2,330	64	11	B	2,218	64	11	B	2,143	64	10	B
I-494 EB/WB CD Rd Exit Ramp	Lindau/Killebrew Exit Ramp	9	1,293	64	7	A	1,363	63	8	A	1,355	64	8	A	1,374	63	8	A	1,390	63	9	A	1,357	63	8	A	1,364	63	9	A	1,491	63	9	A	1,409	63	9	A	1,330	64	8	A
Killebrew Exit Ramp to CD Rd	SB I-494 CD Rd Entrance Ramp	10	1,046	68	7	A	1,025	68	7	A	1,020	68	8	A	1,028	68	7	A	1,044	68	8	A	1,019	68	7	A	1,018	68	8	A	1,153	68	8	A	1,065	68	8	A	1,006	68	7	A
I-494 CD RD Entrance	Lindau Entrance	11	1,377	64	8	A	1,354	65	8	A	1,328	65	8	A	1,324	65	7	A	1,367	65	8	A	1,332	65	8	A	1,345	65	8	A	1,475	65	9	A	1,380	65	8	A	1,260	66	8	A
Lindau Entrance	EB I-494 Entrance	12	1,405	67	7	A	1,377	67	7	A	1,346	67	7	A	1,342	67	6	A	1,389	67	7	A	1,355	67	7	A	1,368	67	7	A	1,496	67	8	A	1,402	67	8	A	1,278	67	7	A
EB I-494 Entrance	Killebrew Entrance	13	1,980	64	9	A	1,895	65	9	A	1,841	65	9	A	1,847	65	9	A	1,911	65	10	A	1,872	65	9	A	1,883	65	10	A	2,028	65	10	B	1,921	65	10	A	1,795	65	9	A
Killebrew Entrance	Old Shakopee Rd Exit	14	2,036	60	9	A	1,902	67	7	A	1,848	61	8	A	1,854	66	7	A	1,918	67	7	A	1,879	60	8	A	1,890	61	8	A	2,035	58	9	A	1,928	61	8	A	1,800	67	7	A
Old Shakopee Rd Exit	SB Old Shakopee Entrance	15	1,673	68	8	A	1,591	68	8	A	1,541	68	7	A	1,611	68	7	A	1,644	68	8	A	1,590	66	9	A	1,590	66	9	A	1,721	66	10	A	1,628	66	9	A	1,549	67	9	A
SB Old Shakopee Entrance	NB Old Shakopee Entrance	16	1,713	68	7	A	1,637	68	7	A	1,593	68	7	A	1,670	67	7	A	1,705	67	7	A	1,639	67	10	A	1,639	66	10	A	1,773	66	11	B	1,674	66	10	B	1,589	66	9	A
NB Old Shakopee Entrance (Br	WB TH 13 Exit	17	1,993	67	9	A	1,928	67	9	A	1,873	68	9	A	1,951	67	9	A	1,976	67	9	A	1,933	66	14	B	1,929	66	14	B	2,076	66	15	B	1,994	66	14	B	1,910	66	13	B
WB TH 13 Exit	WB TH 13 Entrance	18	1,744	68	8	A	1,754	68	8	A	1,715	68	8	A	1,752	68	8	A	1,787	68	9	A	1,722	66	13	B	1,711	66	13	B	1,831	66	13	B	1,776	66	13	B	1,733	66	12	B
WB TH 13 Entrance	EB TH 13 Exit	19	1,813	65	6	A	1,843	65	6	A	1,825	64	6	A	1,851	64	6	A	1,883	64	6	A	1,801	63	8	A	1,790	63	8	A	1,904	64	8	A	1,867	63	8	A	1,816	64	8	A
EB TH 13 Exit	EB TH 13 Entrance	20	1,347	67	6	A	1,437	67	6	A	1,419	67	6	A	1,423	67	6	A	1,467	67	7	A	1,420	65	10	A	1,404	66	9	A	1,531	66	10	B	1,485	66	10	A	1,428	66	9	A
EB TH 13 Entrance	Diffley Rd Exit	21	1,357	68	5	A	1,457	68	5	A	1,439	67	5	A	1,443	68	5	A	1,487	68	5	A	1,440	66	7	A	1,424	67	7	A	1,551	67	7	A	1,505	67	7	A	1,448	67	7	A
Diffley Rd Exit	Diffley Rd Entrance	22	1,209	69	5	A	1,286	69	6	A	1,262	69	6	A	1,279	69	6	A	1,323	69	6	A	1,268	67	9	A	1,262	68	9	A	1,410	67	10	B	1,343	67	10	B	1,307	67	9	A
Diffley Rd Entrance	Cliff Rd Exit	23	1,358	67	5	A	1,418	67	6	A	1,411	67	6	A	1,430	67	6	A	1,465	67	6	A	1,404	66	9	A	1,392	66	9	A	1,536	66	9	A	1,476	66	9	A	1,434	66	9	A
Cliff Rd Exit	Cliff Rd Entrance	24	1,140	69	5	A	1,195	69	6	A	1,209	69	6	A	1,213	69	6	A	1,256	69	6	A	1,199	67	9	A	1,173	68	9	A	1,291	67	9	A	1,274	67	9	A	1,247	67	9	A
Cliff Rd Entrance	SB I-35E Exit	25	1,475	65	6	A	1,427	65	6	A	1,503	65	6	A	1,480	65	6	A	1,494	65	6	A	1,466	64	9	A	1,401	64	8	A	1,642	63	10	A	1,588	63	9	A	1,507	64	9	A
SB I-35E Exit	SB I-35E Entrance	26	1,165	69	5	A	1,067	69	5	A	1,132	68	5	A	1,107	69	5	A	1,132	69	6	A	1,116	68	8	A	1,055	68	8	A	1,279	67	9	A	1,218	67	9	A	1,203	67	9	A
SB I-35E Entrance	NB I-35E Exit	27	1,611	61	6	A	1,826	58	8	A	1,760	59	7	A	1,733	59	7	A	1,704	60	7	A	1,640	59	9	A	1,633	58	9	A	1,777	59	10	A	1,751	59	10	A	1,782	59	10	A
NB I-35E Exit	NB I-35E Entrance	28	1,500	67	7	A	1,597	66	8	A	1,560	66	8	A	1,545	66	7	A	1,585	67	8	A	1,533	65	12	B	1,500	65	12	B	1,666	65	13	B	1,614	65	12	B	1,657	65	12	B
NB I-35E Entrance	Palomino Exit	29	1,518	68	6	A	1,621	67	7	A	1,584	67	7	A	1,569	67	6	A	1,617	67	7	A	4,267	67	9	A	4,188	66	9	A	4,165	66	10	A	3,986	66	9	A	4,032	66	10	A
Palomino Exit	McAndrews Exit	30	1,450	67	6	A	1,555	67	7	A	1,514	67	7	A	1,501	67	6	A	1,547	67	7	A	1,493	66	10	A	1,459	66	10	A	1,628	66	11	B	1,571	66	10	B	1,616	66	10	B
McAndrews Exit	McAndrews Entrance	31	1,245	68	6	A	1,343	67	7	A	1,341	67	7	A	1,328	67	6	A	1,362	67	7	A	1,320	66	10	B	1,282	66	10	B	1,442	66	11	B	1,407	66	10	B	1,431	66	10	B
McAndrews Entrance	END SB TH 77	32	1,346	63	5	A	1,404	63	6	A	1,445	63	6	A	1,428	63	6	A	1,426	63	6	A	1,486	62	9	A	1,411	62	9	A	1,549	62	9	A	1,559	62	10	A	1,528	62	9	A
Comments		33	1) Freeflow during a.m. peak				1) Freeflow during a.m. peak				1) Freeflow during a.m. peak				1) Freeflow during a.m. peak				1) Freeflow during a.m. peak				1) Freeflow during a.m. peak on two-la				1) Freeflow during a.m. peak on t				1) Freeflow during a.m. peak on t				1) Freeflow during a.m. peak on t				1) Freeflow during a.m. peak on t			

* TH77 Managed Lanes Study Area Highlighted in Green,Minnesota River Bridge in Blue,Contraflow acess segments in Purple, restricted Alt2B_MnPASS lane in Green

** HCM Level of Service (LOS) Criteria: LOS D(28-35 vplph); LOS E(35-43 vplph); LOS F(>43vplph)

*** Modeling Scenarios Description:

2030 Alternative 1A: A 3rd lane constructed for NB TH 77 between 138th Street and Diffley Road

2030 Alternative 2B: 4th lane over the MN River Bridge, in addition to Alt1A improvement(two 2030 scenarios: Inside lane general purpose or MnPASS lane)

2030 Alternative 3B: Contraflow between CR 38 and Old Shakopee Road (four 2030 scenarios: Contraflow general purpose or MnPASS lane, with or without intermediate access at Cliff Road)

TH 77 Managed Lanes Study
Between 140th Street and I-494

Figure 3-2
2030 Base CORSIM Model Results
Southbound TH77 Peak Hour Operations Comparison

Alternative 2B Bridge MnPASS Lane Volume Scenarios (vph)

Modeling Scenario			#1 Existing				#2 2030 Nobuild				#4-2 1,720 vph(Origional forecast) General Purpose Lanes				#4-2 1,720 vph(Origional forecast) Access Restricted MnPASS Lane			
			Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS
From	To	#	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	5-1	5-2	5-3	5-4	5-5	5-6	5-7	5-8
WB TH 62 Exit Loop	End Northbound TH 77	1	1,237	53	10	A	1,274	54	11	B	1,286	53	11	B				
EB TH 62 Entrance Loop	WB TH 62 Exit Loop	2	2,493	27	40	E	2,303	50	15	B	2,431	50	16	B				
EB TH 62 Exit Ramp	EB TH 62 Entrance Loop	3	2,447	36	39	E	2,237	51	21	C	2,374	51	23	C				
66th Street Entrance Ramp	EB TH 62 Exit Ramp	4	2,941	40	27	C	2,692	51	17	B	2,913	51	19	B				
66th Street Exit Ramp	66th Street Entrance Ramp	5	2,731	53	26	C	2,487	55	22	C	2,741	54	24	C				
WB I-494 Entrance Ramp	66th Street Exit Ramp	6	3,404	60	25	C	3,074	62	22	C	3,497	60	26	C				
WB I-494 HOV Exit Loop	WB I-494 Entrance Ramp	7	3,142	61	24	C	2,877	63	22	C	3,309	61	26	C				
EB I-494 Entrance Loop	WB I-494 HOV Exit Loop	8	3,275	62	17	B	3,017	62	16	B	3,680	60	19	B				
I-494 EB/WB Exit Ramp	EB I-494 Entrance Loop	9	3,056	65	22	C	2,840	66	21	C	3,505	63	26	C				
Killebrew Exit Ramp	I-494 EB/WB Exit Ramp	10	4,835	63	20	C	4,668	64	19	B	5,654	33	48	F				
Old Shakopee Rd Entrance	Killebrew/Lindau Exit	11	5,835	62	22	C	5,731	63	22	C	6,896	46	37	E				
Old Shakopee Rd Exit(Contraflo	ar Old Shakopee Rd Entrance	12	5,461	62	28	C	5,381	63	27	C	6,617	48	43	F				
(Old Shakopee Rd Exit)	(Contraflow Entrance)	13									8,624	45	45	F	1,718	58	28	D
WB TH 13 Entrance (Bridge)	Old Shakopee Rd Exit	14	6,958	51	42	E	6,956	54	40	E	6,906	45	48	F				
WB TH 13 Exit	WB TH 13 Entrance	15	6,197	33	53	F	6,312	41	45	F	6,282	49	40	E	1,527	57	25	C
EB TH 13 Entrance	WB TH 13 Exit	16	6,205	28	46	F	6,316	35	37	E	7,904	53	28	D				
EB TH 13 Exit	EB TH 13 Entrance	17	5,499	38	48	F	5,735	49	37	E	7,316	58	29	D				
Diffley Rd Entrance	EB TH 13 Exit	18	5,614	41	34	D	5,899	50	28	C	7,501	63	26	C				
Diffley Rd Exit	Diffley Rd Entrance	19	4,583	49	36	E	4,820	59	30	D	6,423	58	34	D	1,411	56	24	C
Cliff Rd Entrance	Diffley Rd Exit	20	4,618	35	56	F	4,947	38	55	F	6,499	38	47	F				
Cliff Rd Exit	Cliff Rd Entrance	21	3,705	19	92	F	3,823	17	103	F	3,802	16	105	F	1,167	57	19	B
SB I-35E Entrance	Cliff Rd Exit	22	3,961	21	61	F	4,204	19	69	F	5,450	18	69	F				
SB I-35E Exit	SB I-35E Entrance	23	3,909	23	83	F	4,158	21	89	F	5,394	26	62	F				
NB I-35E Entrance	SB I-35E Exit	24	3,936	18	73	F	4,208	16	79	F	4,413	17	78	F				
NB I-35E Exit	NB I-35E Entrance	25	2,900	15	111	F	3,350	13	119	F	4,478	15	92	F	1,032	56	17	B
Palomino Entrance	NB I-35E Exit	26	4,410	27	59	F	4,915	14	90	F	6,300	18	74	F				
McAndrews Entrance	Palomino Entrance	27	3,756	48	35	E	4,326	11	118	F	5,519	18	69	F				
McAndrews Exit	McAndrews Entrance	28	2,750	62	24	C	3,077	10	132	F	2,865	16	80	F	1,239	59	20	C
(Contraflow Exit)	McAnddews Exit	29	2,808	56	21	C	3,227	11	112	F	2,963	31	42	E				
Begin NB TH 77	McAndrews Exit(Contraflow	30									4,202	51	26	C				
Comments		33	During a.m. peak 1) Slowdown approaching TH62 interchange 2) Slowdown on the Minnesota River Bridge 3) Bottleneck along the 2-lane segment between 138th St and Diffley Rd				1) Crosstown project improves the NB TH 77 operations in TH62/TH77 Interchange Area 2) Congestion on the Minnesota River Bridge 3) Congestion along the 2-lane segment becomes worse, "metering"				1) Similar congestion locations as existing south of the Old Shakopee Road 2) Attracts more demands, causing congestion between 494 ramps and Old Shakopee Road 3) Free flow in the MnPASS lane							

Modeling Scenario			#4-2-1 1,500 vph General Purpose Lanes				#4-2-1 1,500 vph Access Restricted MnPASS Lane				#4-2-2 1,400 vph General Purpose Lanes				#4-2-2 1,400 vph Access Restricted MnPASS Lane			
			Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS
From	To	#	5-1	5-2	5-3	5-4	5-5	5-6	5-7	5-8	5-1	5-2	5-3	5-4	5-5	5-6	5-7	5-8
WB TH 62 Exit Loop	End Northbound TH 77	1	1,290	53	11	B					1,289	53	11	B				
EB TH 62 Entrance Loop	WB TH 62 Exit Loop	2	2,397	50	15	B					2,378	50	15	B				
EB TH 62 Exit Ramp	EB TH 62 Entrance Loop	3	2,340	51	22	C					2,321	51	22	C				
66th Street Entrance Ramp	EB TH 62 Exit Ramp	4	2,861	51	18	B					2,834	51	18	B				
66th Street Exit Ramp	66th Street Entrance Ramp	5	2,689	54	23	C					2,662	54	24	C				
WB I-494 Entrance Ramp	66th Street Exit Ramp	6	3,418	61	24	C					3,378	61	25	C				
WB I-494 HOV Exit Loop	WB I-494 Entrance Ramp	7	3,230	61	24	C					3,191	62	25	C				
EB I-494 Entrance Loop	WB I-494 HOV Exit Loop	8	3,586	61	18	B					3,541	61	18	B				
I-494 EB/WB Exit Ramp	EB I-494 Entrance Loop	9	3,411	64	24	C					3,366	64	25	C				
Killebrew Exit Ramp	I-494 EB/WB Exit Ramp	10	5,484	38	44	F					5,404	39	39	E				
Old Shakopee Rd Entrance	Killebrew/Lindau Exit	11	6,683	51	35	D					6,582	53	30	D				
Old Shakopee Rd Exit(Contraflo	ar Old Shakopee Rd Entrance	12	6,404	51	41	E					6,303	55	36	E				
(Old Shakopee Rd Exit)	(Contraflow Entrance)	13	8,410	45	47	F	1,503	53	30	D	8,308	50	39	E	1,402	58	23	C
WB TH 13 Entrance (Bridge)	Old Shakopee Rd Exit	14	6,907	50	48	F					6,906	55	39	E				
WB TH 13 Exit	WB TH 13 Entrance	15	6,269	47	46	F	1,339	55	25	C	6,264	54	36	E	1,248	58	21	C
EB TH 13 Entrance	WB TH 13 Exit	16	7,703	50	32	D					7,607	57	25	C				
EB TH 13 Exit	EB TH 13 Entrance	17	7,125	55	33	D					7,034	61	27	C				
Diffley Rd Entrance	EB TH 13 Exit	18	7,309	58	31	D					7,218	63	25	C				
Diffley Rd Exit	Diffley Rd Entrance	19	6,247	54	38	E	1,235	55	22	C	6,164	58	33	D	1,152	57	19	B
Cliff Rd Entrance	Diffley Rd Exit	20	6,323	37	48	F					6,240	37	47	F				
Cliff Rd Exit	Cliff Rd Entrance	21	3,801	16	107	F	1,022	55	18	B	3,802	16	105	F	951	57	16	B
SB I-35E Entrance	Cliff Rd Exit	22	5,304	17	71	F					5,234	17	71	F				
SB I-35E Exit	SB I-35E Entrance	23	5,249	26	61	F					5,179	26	60	F				
NB I-35E Entrance	SB I-35E Exit	24	4,396	17	79	F					4,389	17	77	F				
NB I-35E Exit	NB I-35E Entrance	25	4,349	15	89	F	904	56	15	B	4,287	15	87	F	841	57	14	B
Palomino Entrance	NB I-35E Exit	26	6,169	18	72	F					6,108	19	70	F				
McAndrews Entrance	Palomino Entrance	27	5,388	18	69	F					5,327	18	67	F				
McAndrews Exit	McAndrews Entrance	28	2,864	20	78	F	1,109	60	18	B	2,864	17	84	F	1,047	60	17	B
(Contraflow Exit)	McAnddews Exit	29	2,962	31	50	F					2,962	28	55	F				
Begin NB TH 77	McAndrews Exit(Contraflow	30	4,071	45	31	D					4,009	44	31	D				
Comments		33																

Modeling Scenario			#4-2-3 1,300 vph General Purpose Lanes				#4-2-3 1,300 vph Access Restricted MnPASS Lane				#4-2-4 1,200 vph General Purpose Lanes				#4-2-4 1,200 vph Access Restricted MnPASS Lane			
			Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS
From	To	#	5-1	5-2	5-3	5-4	5-5	5-6	5-7	5-8	5-1	5-2	5-3	5-4	5-5	5-6	5-7	5-8
WB TH 62 Exit Loop	End Northbound TH 77	1	1,288	53	11	B					1,282	54	11	B				
EB TH 62 Entrance Loop	WB TH 62 Exit Loop	2	2,358	50	15	B					2,334	50	15	B				
EB TH 62 Exit Ramp	EB TH 62 Entrance Loop	3	2,301	51	22	C					2,277	51	21	C				
66th Street Entrance Ramp	EB TH 62 Exit Ramp	4	2,804	51	18	B					2,772	51	17	B				
66th Street Exit Ramp	66th Street Entrance Ramp	5	2,633	54	23	C					2,601	55	23	C				
WB I-494 Entrance Ramp	66th Street Exit Ramp	6	3,337	62	24	C					3,292	62	24	C				
WB I-494 HOV Exit Loop	WB I-494 Entrance Ramp	7	3,149	62	24	C					3,104	62	24	C				
EB I-494 Entrance Loop	WB I-494 HOV Exit Loop	8	3,492	61	18	B					3,442	61	18	B				
I-494 EB/WB Exit Ramp	EB I-494 Entrance Loop	9	3,318	65	24	C					3,268	64	24	C				
Killebrew Exit Ramp	I-494 EB/WB Exit Ramp	10	5,323	61	23	C					5,240	53	27	C				
Old Shakopee Rd Entrance	Killebrew/Lindau Exit	11	6,482	62	25	C					6,379	60	25	C				
Old Shakopee Rd Exit(Contraflo	ar Old Shakopee Rd Entrance	12	6,203	59	33	D					6,100	59	32	D				
(Old Shakopee Rd Exit)	(Contraflow Entrance)	13	8,210	53	36	E	1,306	58	22	C	8,107	51	37	E	1,202	59	20	C
WB TH 13 Entrance (Bridge)	Old Shakopee Rd Exit	14	6,904	57	37	E					6,905	56	38	E				
WB TH 13 Exit	WB TH 13 Entrance	15	6,257	54	36	E	1,163	58	19	B	6,255	54	36	E	1,070	58	18	B
EB TH 13 Entrance	WB TH 13 Exit	16	7,515	57	25	C					7,420	57	25	C				
EB TH 13 Exit	EB TH 13 Entrance	17	6,946	61	27	C					6,856	62	26	C				
Diffley Rd Entrance	EB TH 13 Exit	18	7,130	63	25	C					7,040	63	25	C				
Diffley Rd Exit	Diffley Rd Entrance	19	6,081	57	33	D	1,073	57	18	B	5,998	58	32	D	989	57	17	B
Cliff Rd Entrance	Diffley Rd Exit	20	6,157	36	48	F					6,074	37	46	F				
Cliff Rd Exit	Cliff Rd Entrance	21	3,801	16	104	F	886	57	15	B	3,802	17	103	F	817	58	13	B
SB I-35E Entrance	Cliff Rd Exit	22	5,168	16	74	F					5,099	16	73	F				
SB I-35E Exit	SB I-35E Entrance	23	5,114	25	62	F					5,045	26	60	F				
NB I-35E Entrance	SB I-35E Exit	24	4,381	17	78	F					4,373	17	77	F				
NB I-35E Exit	NB I-35E Entrance	25	4,230	15	89	F	784	57	13	B	4,167	15	83	F	723	57	12	B
Palomino Entrance	NB I-35E Exit	26	6,052	18	72	F					5,989	20	66	F				
McAndrews Entrance	Palomino Entrance	27	5,270	18	67	F					5,208	20	61	F				
McAndrews Exit	McAndrews Entrance	28	2,866	20	88	F	990	60	16	B	2,866	20	73	F	928	60	15	B
(Contraflow Exit)	McAnddews Exit	29	2,964	24	67	F					2,964	30	48	F				
Begin NB TH 77	McAndrews Exit(Contraflow	30	3,954	36	41	E					3,892	48	28	D				
Comments		33	1) Operations between Old Shakoppe Road and I-494 are at acceptable levels															

Modeling Scenario			#4-2-5 900 vph General Purpose Lanes				#4-2-5 900 vph Access Restricted MnPASS Lane			
			Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS
From	To	#	5-1	5-2	5-3	5-4	5-5	5-6	5-7	5-8
WB TH 62 Exit Loop	End Northbound TH 77	1	1,281	53	11	B				
EB TH 62 Entrance Loop	WB TH 62 Exit Loop	2	2,277	50	15	B				
EB TH 62 Exit Ramp	EB TH 62 Entrance Loop	3	2,220	51	21	C				
66th Street Entrance Ramp	EB TH 62 Exit Ramp	4	2,688	51	17	B				
66th Street Exit Ramp	66th Street Entrance Ramp	5	2,517	55	23	C				
WB I-494 Entrance Ramp	66th Street Exit Ramp	6	3,173	62	24	C				
WB I-494 HOV Exit Loop	WB I-494 Entrance Ramp	7	2,985	62	23	C				
EB I-494 Entrance Loop	WB I-494 HOV Exit Loop	8	3,305	62	17	B				
I-494 EB/WB Exit Ramp	EB I-494 Entrance Loop	9	3,131	65	23	C				
Killebrew Exit Ramp	I-494 EB/WB Exit Ramp	10	4,997	64	21	C				
Old Shakopee Rd Entrance	Killebrew/Lindau Exit	11	6,076	63	23	C				
Old Shakopee Rd Exit(Contraflo	ar Old Shakopee Rd Entrance	12	5,797	60	31	D				
(Old Shakopee Rd Exit)	(Contraflow Entrance)	13	7,804	53	35	E	902	59	15	B
WB TH 13 Entrance (Bridge)	Old Shakopee Rd Exit	14	6,902	57	38	E				
WB TH 13 Exit	WB TH 13 Entrance	15	6,237	55	35	E	802	59	14	B
EB TH 13 Entrance	WB TH 13 Exit	16	7,134	57	24	C				
EB TH 13 Exit	EB TH 13 Entrance	17	6,585	62	25	C				
Diffley Rd Entrance	EB TH 13 Exit	18	6,769	64	24	C				
Diffley Rd Exit	Diffley Rd Entrance	19	5,750	58	31	D	741	58	13	B
Cliff Rd Entrance	Diffley Rd Exit	20	5,826	34	49	F				
Cliff Rd Exit	Cliff Rd Entrance	21	3,799	17	102	F	614	58	10	B
SB I-35E Entrance	Cliff Rd Exit	22	4,894	14	80	F				
SB I-35E Exit	SB I-35E Entrance	23	4,842	23	65	F				
NB I-35E Entrance	SB I-35E Exit	24	4,349	17	76	F				
NB I-35E Exit	NB I-35E Entrance	25	3,986	16	80	F	544	58	9	A
Palomino Entrance	NB I-35E Exit	26	5,808	21	61	F				
McAndrews Entrance	Palomino Entrance	27	5,027	22	56	F				
McAndrews Exit	McAndrews Entrance	28	2,864	24	66	F	749	61	13	B
(Contraflow Exit)	McAnddews Exit	29	2,962	33	47	F				
Begin NB TH 77	McAndrews Exit(Contraflow	30	3,711	45	30	D				
Comments		33								

* TH77 Managed Lanes Study Area Highlighted in Light green,Minnesota River Bridge in Blue,Contraflow acess segments in Purple, restricted Alt2B_MnPASS lane in Green
** HCM Level of Service (LOS) Criteria: LOS D(28-35 vplph); LOS E(35-43 vplph); LOS F(>43vplph)
*** Sensitivity Test Modeling Scenarios:
1) Origional 2030 Alternative 2B_MnPASS as base: Third Lane addition between Diffley Road and CR 38, Fouth Lane addition between Old Shakoppe Road and Diffley Road
2) The origional 2030 forecast for the MnPASS lane on the Minnesota River Bridge was 1,720 vph
3) Five different demand scenarios were assumed for the MnPASS lane on the bridge in the sensitivity tests: 1500 vph, 1400 vph, 1300 vph, 1200 vph and 900 vph
4) The demands for the downstream/upstream ramps were reduced proportionately based on the origonal forecasts

Figure 4-1
CORSIM Model Results
2030 Alternative 2B_MnPASS Sensitivity Tests
Northbound TH 77 AM Peak Hour Operations Comparison

Alternative 3B Bridge MnPASS Contraflow Lane Volume Scenarios (vph)

Modeling Scenario			#1 Existing				#2 2030 Nobuild				#5-4 1,570 vph (Origional forecast) General Purpose NB Maineline				#5-4 1,570 vph (Origional forecast) MnPASS Contraflow Lane			
			Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS
From	To	#	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	9-1	9-2	9-3	9-4	9-5	9-6	9-7	9-8
WB TH 62 Exit Loop	End Northbound TH 77	1	1,237	53	10	A	1,274	54	11	B	1,267	54	10	A				
EB TH 62 Entrance Loop	WB TH 62 Exit Loop	2	2,493	27	40	E	2,303	50	15	B	2,479	49	16	B				
EB TH 62 Exit Ramp	EB TH 62 Entrance Loop	3	2,447	36	39	E	2,237	51	21	C	2,419	50	23	C				
66th Street Entrance Ramp	EB TH 62 Exit Ramp	4	2,941	40	27	C	2,692	51	17	B	2,951	50	18	B				
66th Street Exit Ramp	66th Street Entrance Ramp	5	2,731	53	26	C	2,487	55	22	C	2,718	54	23	C				
WB I-494 Entrance Ramp	66th Street Exit Ramp	6	3,404	60	25	C	3,074	62	22	C	3,486	60	25	C				
WB I-494 HOV Exit Loop	WB I-494 Entrance Ramp	7	3,142	61	24	C	2,877	63	22	C	3,305	61	25	C				
EB I-494 Entrance Loop	WB I-494 HOV Exit Loop	8	3,275	62	17	B	3,017	62	16	B	3,704	60	19	B				
I-494 EB/WB Exit Ramp	EB I-494 Entrance Loop	9	3,056	65	22	C	2,840	66	21	C	3,533	62	26	C				
Killebrew Exit Ramp	I-494 EB/WB Exit Ramp	10	4,835	63	20	C	4,668	64	19	B	5,721	33	45	F				
Old Shakopee Rd Entrance	Killebrew/Lindau Exit	11	5,835	62	22	C	5,731	63	22	C	7,016	47	35	E				
Old Shakopee Rd Exit(Contraflo	an Old Shakopee Rd Entrance	12	5,461	62	28	C	5,381	63	27	C	6,707	37	48	F				
(Old Shakopee Rd Exit)	(Contraflow Entrance)	13									8,641	45	41	E	1,573	53	28	D
WB TH 13 Entrance (Bridge)	Old Shakopee Rd Exit	14	6,958	51	42	E	6,956	54	40	E	7,068	41	50	F	1,573	54	28	D
WB TH 13 Exit	WB TH 13 Entrance	15	6,197	33	53	F	6,312	41	45	F	6,293	31	56	F				
EB TH 13 Entrance	WB TH 13 Exit	16	6,205	28	46	F	6,316	35	37	E	6,425	26	48	F	1,573	54	28	D
EB TH 13 Exit	EB TH 13 Entrance	17	5,499	38	48	F	5,735	49	37	E	5,690	38	45	F				
Diffley Rd Entrance	EB TH 13 Exit	18	5,614	41	34	D	5,899	50	28	C	5,864	44	31	D				
Diffley Rd Exit	Diffley Rd Entrance	19	4,583	49	36	E	4,820	59	30	D	4,805	54	31	D				
Cliff Rd Entrance	Diffley Rd Exit	20	4,618	35	56	F	4,947	38	55	F	4,875	43	44	F	1,573	53	26	C
Cliff Rd Exit	Cliff Rd Entrance	21	3,705	19	92	F	3,823	17	103	F	3,592	46	38	E				
SB I-35E Entrance	Cliff Rd Exit	22	3,961	21	61	F	4,204	19	69	F	4,739	48	32	D				
SB I-35E Exit	SB I-35E Entrance	23	3,909	23	83	F	4,158	21	89	F	4,673	36	63	F				
NB I-35E Entrance	SB I-35E Exit	24	3,936	18	73	F	4,208	16	79	F	4,717	23	65	F	769	55	13	B
NB I-35E Exit	NB I-35E Entrance	25	2,900	15	111	F	3,350	13	119	F	3,539	19	93	F				
Palomino Entrance	NB I-35E Exit	26	4,410	27	59	F	4,915	14	90	F	5,371	21	72	F				
McAndrews Entrance	Palomino Entrance	27	3,756	48	35	E	4,326	11	118	F	4,653	15	98	F				
McAndrews Exit	McAndrews Entrance	28	2,750	62	24	C	3,077	10	132	F	3,055	17	89	F	769	56	13	B
(Contraflow Exit)	McAnddews Exit	29	2,808	56	21	C	3,227	11	112	F	3,217	23	65	F				
Begin NB TH 77	McAndrews Exit(Contraflow	30									3,986	46	29	D				
Comments		33	During a.m. peak 1) Slowdown approaching TH62 interchange 2) Slowdown on the Minnesota River Bridge 3) Bottleneck along the 2-lane segment between 138th St and Diffley Rd				1) Crosstown project improves the NB TH 77 operations in TH62/TH77 interchange Area 2) Congestion on the Minnesota River Bridge 3) Congestion along the 2-lane segment becomes worse, "metering"				1) Bottleneck 140th Street 2) Queues back up into study area from TH77/I-494 interchange ramps; 3) Bottleneck in the TH 77/I-35E interchange area, metering traffic							

Modeling Scenario	#5-4-1 1,300 vph General Purpose NB Maineline				#5-4-1 1,300 vph MnPASS Contraflow Lane				#5-4-2 1,200 vph General Purpose NB Maineline				#5-4-2 1,200 vph MnPASS Contraflow Lane			
	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS
From	9-1	9-2	9-3	9-4	9-5	9-6	9-7	9-8	9-1	9-2	9-3	9-4	9-5	9-6	9-7	9-8
WB TH 62 Exit Loop	1,268	54	10	A					1,267	54	10	A				
EB TH 62 Entrance Loop	2,429	50	16	B					2,411	49	16	B				
EB TH 62 Exit Ramp	2,369	50	23	C					2,351	50	23	C				
66th Street Entrance Ramp	2,879	50	18	B					2,853	50	18	B				
66th Street Exit Ramp	2,646	54	23	C					2,620	54	23	C				
WB I-494 Entrance Ramp	3,382	60	25	C					3,345	60	25	C				
WB I-494 HOV Exit Loop	3,201	61	25	C					3,164	61	25	C				
EB I-494 Entrance Loop	3,582	61	18	B					3,539	60	19	B				
I-494 EB/WB Exit Ramp	3,411	63	25	C					3,368	64	25	C				
Killebrew Exit Ramp	5,506	47	33	D					5,431	54	27	C				
Old Shakopee Rd Entrance	6,747	56	29	D					6,653	59	26	C				
Old Shakopee Rd Exit(Contraflo	6,438	45	38	E					6,344	47	36	E				
(Old Shakopee Rd Exit)	8,372	53	34	D	1,306	54	23	C	8,278	53	34	D	1,212	54	22	C
WB TH 13 Entrance (Bridge)	7,066	45	47	F	1,306	54	23	C	7,066	43	49	F	1,212	54	22	C
WB TH 13 Exit	6,291	35	53	F					6,291	33	56	F				
EB TH 13 Entrance	6,423	29	45	F	1,306	54	23	C	6,423	27	48	F	1,212	54	22	C
EB TH 13 Exit	5,687	41	43	F					5,687	38	47	F				
Diffley Rd Entrance	5,861	45	30	D					5,861	42	33	D				
Diffley Rd Exit	4,804	55	32	D					4,804	53	33	D				
Cliff Rd Entrance	4,874	39	53	F	1,306	54	21	C	4,874	38	54	F	1,212	54	20	C
Cliff Rd Exit	3,591	19	86	F					3,591	19	89	F				
SB I-35E Entrance	4,612	35	42	E					4,568	32	45	F				
SB I-35E Exit	4,550	30	71	F					4,506	29	73	F				
NB I-35E Entrance	4,594	21	70	F	628	56	11	B	4,550	20	71	F	578	55	10	B
NB I-35E Exit	3,459	16	107	F					3,430	15	107	F				
Palomino Entrance	5,290	19	77	F					5,261	19	77	F				
McAndrews Entrance	4,597	14	107	F					4,577	13	108	F				
McAndrews Exit	3,056	12	122	F	628	56	10	B	3,055	12	120	F	578	56	10	B
(Contraflow Exit)	3,218	14	103	F					3,217	14	100	F				
Begin NB TH 77	3,846	19	83	F					3,795	19	75	F				
Comments	1) NB TH 77 north of Old Shakopee Road: Queues back up into TH 77 freeway mainline from TH77/I-494 interchange ramps occasionally; Unacceptable operations in the northern contraflow merging segment 2) NB TH 77 south of Old Shakopee Road: Unacceptable operations; Better than 2030 nobuild								1) NB TH 77 north of Old Shakopee Road: Queues back up into TH 77 freeway mainline from TH77/I-494 interchange ramps occasionally; Unacceptable operations in the northern contraflow merging segment 2) NB TH 77 south of Old Shakopee Road: Unacceptable operations; Better than 2030 nobuild							

Modeling Scenario	#5-4-3 1,100 vph General Purpose NB Maineline				#5-4-3 1,100 vph MnPASS Contraflow Lane				#5-4-4 1,000 vph General Purpose NB Maineline				#5-4-4 1,000 vph MnPASS Contraflow Lane			
	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS
From	9-1	9-2	9-3	9-4	9-5	9-6	9-7	9-8	9-1	9-2	9-3	9-4	9-5	9-6	9-7	9-8
WB TH 62 Exit Loop	1,270	54	10	A					1,267	54	10	A				
EB TH 62 Entrance Loop	2,393	50	16	B					2,371	49	16	B				
EB TH 62 Exit Ramp	2,333	50	23	C					2,311	50	22	C				
66th Street Entrance Ramp	2,827	50	18	B					2,797	51	18	B				
66th Street Exit Ramp	2,594	54	23	C					2,564	54	23	C				
WB I-494 Entrance Ramp	3,305	60	25	C					3,262	61	24	C				
WB I-494 HOV Exit Loop	3,124	61	24	C					3,081	61	24	C				
EB I-494 Entrance Loop	3,492	60	18	B					3,442	61	18	B				
I-494 EB/WB Exit Ramp	3,321	64	25	C					3,271	64	24	C				
Killebrew Exit Ramp	5,347	51	30	D					5,266	58	24	C				
Old Shakopee Rd Entrance	6,546	57	28	C					6,447	60	25	C				
Old Shakopee Rd Exit(Contraflo	6,236	47	36	E					6,137	49	34	D				
(Old Shakopee Rd Exit)	8,168	52	34	D	1,101	54	20	C	8,070	53	33	D	1,004	54	18	B
WB TH 13 Entrance (Bridge)	7,067	45	48	F	1,101	54	20	C	7,066	45	48	F	1,004	54	18	B
WB TH 13 Exit	6,292	34	54	F					6,291	33	55	F				
EB TH 13 Entrance	6,424	29	45	F	1,101	54	20	C	6,423	27	48	F	1,004	55	18	B
EB TH 13 Exit	5,688	41	44	F					5,687	38	47	F				
Diffley Rd Entrance	5,861	44	32	D					5,860	43	33	D				
Diffley Rd Exit	4,803	55	32	D					4,802	55	32	D				
Cliff Rd Entrance	4,873	38	54	F	1,101	55	18	B	4,872	38	54	F	1,004	55	16	B
Cliff Rd Exit	3,590	18	91	F					3,590	18	94	F				
SB I-35E Entrance	4,514	30	48	F					4,467	28	51	F				
SB I-35E Exit	4,453	28	75	F					4,407	27	76	F				
NB I-35E Entrance	4,497	19	72	F	519	56	9	A	4,451	19	72	F	469	56	8	A
NB I-35E Exit	3,394	15	110	F					3,362	15	110	F				
Palomino Entrance	5,225	19	77	F					5,194	19	78	F				
McAndrews Entrance	4,553	14	106	F					4,532	13	105	F				
McAndrews Exit	3,055	13	116	F	519	57	9	A	3,056	13	118	F	469	57	8	A
(Contraflow Exit)	3,217	16	93	F					3,218	15	97	F				
Begin NB TH 77	3,736	26	60	F					3,687	19	75	F				
Comments	1) NB TH 77 north of Old Shakopee Road: Queues back up into TH 77 freeway mainline from TH77/I-494 interchange ramps occasionally; Unacceptable operations in the northern contraflow merging segment 2) NB TH 77 south of Old Shakopee Road: Unacceptable operations; Better than 2030 nobuild								1) NB TH 77 north of Old Shakopee Road: Acceptable operations 2) NB TH 77 south of Old Shakopee Road: Unacceptable operations; Better than 2030 nobuild							

Modeling Scenario	#5-4-5 900 vph General Purpose NB Maineline				#5-4-5 900 vph MnPASS Contraflow Lane			
	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS
From	9-1	9-2	9-3	9-4	9-5	9-6	9-7	9-8
WB TH 62 Exit Loop	1,272	54	10	B				
EB TH 62 Entrance Loop	2,358	50	16	B				
EB TH 62 Exit Ramp	2,298	50	22	C				
66th Street Entrance Ramp	2,775	50	18	B				
66th Street Exit Ramp	2,541	54	23	C				
WB I-494 Entrance Ramp	3,228	61	24	C				
WB I-494 HOV Exit Loop	3,046	61	24	C				
EB I-494 Entrance Loop	3,401	61	18	B				
I-494 EB/WB Exit Ramp	3,230	64	24	C				
Killebrew Exit Ramp	5,188	60	23	C				
Old Shakopee Rd Entrance	6,348	60	25	C				
Old Shakopee Rd Exit(Contraflo	6,038	50	33	D				
(Old Shakopee Rd Exit)	7,972	53	33	D	903	54	16	B
WB TH 13 Entrance (Bridge)	7,069	44	48	F	903	54	16	B
WB TH 13 Exit	6,294	34	54	F				
EB TH 13 Entrance	6,426	29	46	F	903	55	16	B
EB TH 13 Exit	5,690	40	45	F				
Diffley Rd Entrance	5,863	43	32	D				
Diffley Rd Exit	4,805	54	33	D				
Cliff Rd Entrance	4,875	38	55	F	903	55	15	B
Cliff Rd Exit	3,592	17	95	F				
SB I-35E Entrance	4,422	26	53	F				
SB I-35E Exit	4,363	26	78	F				
NB I-35E Entrance	4,407	19	73	F	415	56	7	A
NB I-35E Exit	3,334	15	110	F				
Palomino Entrance	5,165	19	77	F				
McAndrews Entrance	4,512	14	104	F				
McAndrews Exit	3,057	14	108	F	415	57	7	A
(Contraflow Exit)	3,219	16	87	F				
Begin NB TH 77	3,634	24	57	F				
Comments	1) NB TH 77 north of Old Shakopee Road: Acceptable operations 2) NB TH 77 south of Old Shakopee Road: Unacceptable operations; Better than 2030 nobuild							

* TH77 Managed Lanes Study Area Highlighted in Light green,Minnesota River Bridge in Blue,Contraflow acess segments in Purple, restricted Alt2B_MnPASS lane in Green
** HCM Level of Service (LOS) Criteria: LOS D(28-35 vplph); LOS E(35-43 vplph); LOS F(>43vplph)
*** Sensitivity Test Modeling Scenarios:
1) Origional 2030 Alternative 3B_Interim Access_MnPASS as base: Contraflow between CR 38 and Old Shakopee Road (Contraflow MnPASS lane with an intermediate access at Cliff Road)
2) The origional 2030 forecast for the contraflow MnPASS lane on the Minnesota River Bridge was 1,570 vph
3) Five different demand scenarios were assumed for the MnPASS lane on the bridge in the sensitivity tests: 1300 vph, 1200 vph, 1100 vph, 1000 vph and 900 vph
4) The demands for the downstream/upstream ramps were reduced proportionately based on the origonal forecasts

TH 77 Managed Lanes Study
Between 140th Street and I-494

Figure 4-2
CORSIM Model Results
2030 Alternative 3B_Interim Access_MnPASS Sensitivity Tests
Northbound TH 77 AM Peak Hour Operations Comparison

Modeling Scenario			#1 Existing				#2-10 2010 Nobuild				#3-10 2010 Alternative 1A				#3-10-01 2010 Alternative 1A (with 3B forecasts)			
			Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS
From	To	#	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	3-1	3-2	3-3	3-4	3-1	3-2	3-3	3-4
WB TH 62 Exit Loop	End Northbound TH 77	1	1,237	53	10	A	1,170	54	10	B	1,133	54	9	A	1,324	54	11	B
EB TH 62 Entrance Loop	WB TH 62 Exit Loop	2	2,493	27	40	E	2,296	50	15	B	2,203	50	14	B	2,556	50	16	B
EB TH 62 Exit Ramp	EB TH 62 Entrance Loop	3	2,447	36	39	E	2,241	51	22	C	2,150	51	21	C	2,494	50	24	C
66th Street Entrance Ramp	EB TH 62 Exit Ramp	4	2,941	40	27	C	2,723	51	18	B	2,649	51	17	B	3,033	50	19	B
66th Street Exit Ramp	66th Street Entrance Ramp	5	2,731	53	26	C	2,573	54	23	C	2,498	55	22	C	2,865	54	25	C
WB I-494 Entrance Ramp	66th Street Exit Ramp	6	3,404	60	25	C	3,368	61	26	C	3,352	60	26	C	3,556	61	26	C
WB I-494 HOV Exit Loop	WB I-494 Entrance Ramp	7	3,142	61	24	C	3,162	62	25	C	3,148	61	25	C	3,363	61	25	C
EB I-494 Entrance Loop	WB I-494 HOV Exit Loop	8	3,275	62	17	B	3,307	62	18	B	3,292	62	18	B	3,693	61	19	B
I-494 EB/WB Exit Ramp	EB I-494 Entrance Loop	9	3,056	65	22	C	3,117	65	24	C	3,113	65	23	C	3,506	65	25	C
Killebrew Exit Ramp	I-494 EB/WB Exit Ramp	10	4,835	63	20	C	4,954	62	21	C	4,984	52	31	D	5,401	59	24	C
Old Shakopee Rd Entrance	Killebrew/Lindau Exit	11	5,835	62	22	C	5,854	62	23	C	5,879	59	25	C	6,555	62	24	C
Old Shakopee Rd Exit(Contraflo	an Old Shakopee Rd Entrance	12	5,461	62	28	C	5,466	63	28	D	5,505	62	29	D	6,236	61	31	D
(Old Shakopee Rd Exit)	(Contraflow Entrance)	13																
WB TH 13 Entrance (Bridge)	Old Shakopee Rd Exit	14	6,958	51	42	E	6,971	52	42	E	6,970	50	45	F	7,868	47	50	F
WB TH 13 Exit	WB TH 13 Entrance	15	6,197	33	53	F	6,218	35	54	F	6,305	36	54	F	7,121	25	78	F
EB TH 13 Entrance	WB TH 13 Exit	16	6,205	28	46	F	6,230	28	47	F	6,405	33	42	E	7,125	18	78	F
EB TH 13 Exit	EB TH 13 Entrance	17	5,499	38	48	F	5,542	38	48	F	5,859	45	43	F	6,435	20	97	F
Diffley Rd Entrance	EB TH 13 Exit	18	5,614	41	34	D	5,657	40	35	D	6,011	53	28	D	6,544	19	77	F
Diffley Rd Exit	Diffley Rd Entrance	19	4,583	49	36	E	4,682	49	37	E	5,276	64	27	C	5,521	18	98	F
Cliff Rd Entrance	Diffley Rd Exit	20	4,618	35	56	F	4,717	36	57	F	5,384	60	27	C	5,560	22	74	F
Cliff Rd Exit	Cliff Rd Entrance	21	3,705	19	92	F	3,720	18	99	F	4,735	64	24	C	4,535	31	54	F
SB I-35E Entrance	Cliff Rd Exit	22	3,961	21	61	F	3,994	20	66	F	5,009	64	19	B	4,771	60	20	C
SB I-35E Exit	SB I-35E Entrance	23	3,909	23	83	F	3,942	22	89	F	4,959	59	27	C	4,698	58	27	C
NB I-35E Entrance	SB I-35E Exit	24	3,936	18	73	F	3,973	16	79	F	4,979	52	23	C	4,735	49	24	C
NB I-35E Exit	NB I-35E Entrance	25	2,900	15	111	F	3,018	12	125	F	4,066	65	21	C	3,629	64	19	B
Palomino Entrance	NB I-35E Exit	26	4,410	27	59	F	4,513	17	80	F	5,518	59	21	C	5,187	56	22	C
McAndrews Entrance	Palomino Entrance	27	3,756	48	35	E	3,860	17	93	F	5,036	62	20	C	4,488	61	19	B
McAndrews Exit	McAndrews Entrance	28	2,750	62	24	C	2,943	21	89	F	3,849	65	20	B	3,354	65	18	B
(Contraflow Exit)	McAnddews Exit	29	2,808	56	21	C	2,959	31	50	F	3,869	61	21	C	3,364	61	19	B
Begin NB TH 77	McAndrews Exit(Contraflow E	30																
Comments		33																

Modeling Scenario			Alternative 2B_MnPASS Open Access: #4-2-10 2010 Alt2B_MnPASS General Purpose Lanes				Alternative 2B_MnPASS Open Access: #4-2-10 2010 Alt2B_MnPASS Access Restricted MnPASS Lane				Alternative 2B_MnPASS Open Access: #4-2-10 2010 Alt2B_MnPASS_494 Improved General Purpose Lanes				Alternative 2B_MnPASS Open Access: #4-2-10 2010 Alt2B_MnPASS_494 Improved Access Restricted MnPASS Lane			
			Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS
From	To	#	5-1	5-2	5-3	5-4	5-5	5-6	5-7	5-8	5-1	5-2	5-3	5-4	5-5	5-6	5-7	5-8
WB TH 62 Exit Loop	End Northbound TH 77	1	1,214	54	10	A					1,214	53	11	B				
EB TH 62 Entrance Loop	WB TH 62 Exit Loop	2	2,462	49	16	B					2,462	49	17	B				
EB TH 62 Exit Ramp	EB TH 62 Entrance Loop	3	2,412	50	23	C					2,412	50	25	C				
66th Street Entrance Ramp	EB TH 62 Exit Ramp	4	3,021	50	19	B					3,021	50	20	C				
66th Street Exit Ramp	66th Street Entrance Ramp	5	2,875	54	26	C					2,875	54	27	C				
WB I-494 Entrance Ramp	66th Street Exit Ramp	6	3,525	61	26	C					3,525	60	28	D				
WB I-494 HOV Exit Loop	WB I-494 Entrance Ramp	7	3,337	61	26	C					3,337	61	27	C				
EB I-494 Entrance Loop	WB I-494 HOV Exit Loop	8	3,680	60	19	B					3,680	60	20	C				
I-494 EB/WB Exit Ramp	EB I-494 Entrance Loop	9	3,503	62	27	C					3,503	64	28	D				
Killebrew Exit Ramp	I-494 EB/WB Exit Ramp	10	5,571	24	62	F					5,571	56	28	D				
Old Shakopee Rd Entrance	Killebrew/Lindau Exit	11	6,614	33	49	F					6,614	59	28	D				
Old Shakopee Rd Exit(Contraflo	an Old Shakopee Rd Entrance	12	6,263	35	57	F					6,263	54	39	E				
(Old Shakopee Rd Exit)	(Contraflow Entrance)	13	8,014	38	49	F	1,544	57	27	C	8,014	49	41	E	1,544	57	27	C
WB TH 13 Entrance (Bridge)	Old Shakopee Rd Exit	14	6,470	34	59	F					6,470	51	43	F				
WB TH 13 Exit	WB TH 13 Entrance	15	5,806	29	66	F	1,332	54	25	C	5,806	45	43	F	1,332	57	24	C
EB TH 13 Entrance	WB TH 13 Exit	16	7,142	31	47	F					7,142	51	29	D				
EB TH 13 Exit	EB TH 13 Entrance	17	6,445	35	48	F					6,445	59	28	C				
Diffley Rd Entrance	EB TH 13 Exit	18	6,577	42	40	E					6,577	63	25	C				
Diffley Rd Exit	Diffley Rd Entrance	19	5,490	49	40	E	1,178	56	21	C	5,490	60	31	D	1,178	58	21	C
Cliff Rd Entrance	Diffley Rd Exit	20	5,538	41	42	E					5,538	45	38	E				
Cliff Rd Exit	Cliff Rd Entrance	21	3,520	33	56	F	1,022	59	17	B	3,520	34	53	F	1,022	60	17	B
SB I-35E Entrance	Cliff Rd Exit	22	4,812	61	20	C					4,812	60	21	C				
SB I-35E Exit	SB I-35E Entrance	23	4,750	57	28	C					4,750	57	28	C				
NB I-35E Entrance	SB I-35E Exit	24	3,940	47	28	D					3,940	46	29	D				
NB I-35E Exit	NB I-35E Entrance	25	3,805	63	21	C	857	60	14	B	3,805	63	21	C	857	61	14	B
Palomino Entrance	NB I-35E Exit	26	5,274	57	22	C					5,274	57	22	C				
McAndrews Entrance	Palomino Entrance	27	4,558	61	19	B					4,558	61	19	B				
McAndrews Exit	McAndrews Entrance	28	2,361	65	19	B	986	60	17	B	2,361	65	19	B	986	60	17	B
(Contraflow Exit)	McAnddews Exit	29	2,368	64	18	B					2,368	64	18	B				
Begin NB TH 77	McAndrews Exit(Contraflow E	30	3,354	55	21	C					3,354	55	21	C				
Comments		33																

Modeling Scenario			Alternative 3B_IA_MnPASS: #5-4-10 2010 Alt3B_IA_MnPASS General Purpose NB Maineline				Alternative 3B_IA_MnPASS: #5-4-10 2010 Alt3B_IA_MnPASS MnPASS Contraflow Lane				Alternative 3B_IA_MnPASS: #5-4-10-2 2010 Alt3B_IA_MnPASS_494 Improved General Purpose NB Maineline				Alternative 3B_IA_MnPASS: #5-4-10-2 2010 Alt3B_IA_MnPASS_494 Improved MnPASS Contraflow Lane			
			Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS
From	To	#	9-1	9-2	9-3	9-4	9-5	9-6	9-7	9-8	9-1	9-2	9-3	9-4	9-5	9-6	9-7	9-8
WB TH 62 Exit Loop	End Northbound TH 77	1	1,324	53	12	B					1,324	53	12	B				
EB TH 62 Entrance Loop	WB TH 62 Exit Loop	2	2,556	49	17	B					2,556	50	17	B				
EB TH 62 Exit Ramp	EB TH 62 Entrance Loop	3	2,494	50	25	C					2,494	50	25	C				
66th Street Entrance Ramp	EB TH 62 Exit Ramp	4	3,033	50	20	C					3,033	50	20	C				
66th Street Exit Ramp	66th Street Entrance Ramp	5	2,865	54	27	C					2,865	54	27	C				
WB I-494 Entrance Ramp	66th Street Exit Ramp	6	3,556	58	29	D					3,556	59	28	D				
WB I-494 HOV Exit Loop	WB I-494 Entrance Ramp	7	3,363	59	28	D					3,363	59	28	C				
EB I-494 Entrance Loop	WB I-494 HOV Exit Loop	8	3,693	60	20	C					3,693	60	20	C				
I-494 EB/WB Exit Ramp	EB I-494 Entrance Loop	9	3,506	62	28	D					3,506	63	27	C				
Killebrew Exit Ramp	I-494 EB/WB Exit Ramp	10	5,401	38	44	F					5,401	62	23	C				
Old Shakopee Rd Entrance	Killebrew/Lindau Exit	11	6,555	51	33	D					6,555	59	28	C				
Old Shakopee Rd Exit(Contraflo	an Old Shakopee Rd Entrance	12	6,236	41	44	F					6,236	45	39	E				
(Old Shakopee Rd Exit)	(Contraflow Entrance)	13	7,868	50	36	E	1,087	54	21	C	7,868	53	34	D	1,087	54	21	C
WB TH 13 Entrance (Bridge)	Old Shakopee Rd Exit	14	6,781	47	46	F	1,087	54	21	C	6,781	48	45	F	1,087	54	21	C
WB TH 13 Exit	WB TH 13 Entrance	15	6,034	35	53	F					6,034	35	54	F				
EB TH 13 Entrance	WB TH 13 Exit	16	6,038	28	46	F	1,087	54	21	C	6,038	28	47	F	1,087	54	20	C
EB TH 13 Exit	EB TH 13 Entrance	17	5,348	39	46	F					5,348	39	46	F				
Diffley Rd Entrance	EB TH 13 Exit	18	5,457	42	33	D					5,457	42	33	D				
Diffley Rd Exit	Diffley Rd Entrance	19	4,434	53	33	D					4,434	52	33	D				
Cliff Rd Entrance	Diffley Rd Exit	20	4,473	39	53	F	1,087	54	19	B	4,473	39	52	F	1,087	54	19	B
Cliff Rd Exit	Cliff Rd Entrance	21	3,448	26	68	F					3,448	27	67	F				
SB I-35E Entrance	Cliff Rd Exit	22	4,226	42	35	E					4,226	42	35	D				
SB I-35E Exit	SB I-35E Entrance	23	4,153	37	58	F					4,153	38	57	F				
NB I-35E Entrance	SB I-35E Exit	24	4,190	27	54	F	545	55	11	B	4,190	27	54	F	545	55	10	B
NB I-35E Exit	NB I-35E Entrance	25	3,084	29	63	F					3,084	30	61	F				
Palomino Entrance	NB I-35E Exit	26	4,642	40	39	E					4,642	43	36	E				
McAndrews Entrance	Palomino Entrance	27	3,943	53	28	D					3,943	55	26	C				
McAndrews Exit	McAndrews Entrance	28	2,809	62	24	C	545	56	10	B	2,809	64	23	C	545	56	10	B
(Contraflow Exit)	McAnddews Exit	29	2,819	61	21	C					2,819	62	22	C				
Begin NB TH 77	McAndrews Exit(Contraflow E	30	3,364	55	21	C					3,364	55	21	C				
Comments		33																

Modeling Scenario			#5-4-10-01 2010 Alt3B_IA_MnPASS (1A Forecasts) General Purpose NB Maineline				#5-4-10-01 2010 Alt3B_IA_MnPASS (1A Forecasts) MnPASS Contraflow Lane			
			Vol (vph)	Speed (MPH)	Density (vplph)	LOS	Vol (vph)	Speed (MPH)	Density (vplph)	LOS
From	To	#	9-1	9-2	9-3	9-4	9-5	9-6	9-7	9-8
WB TH 62 Exit Loop	End Northbound TH 77	1	1,133	54	10	B				
EB TH 62 Entrance Loop	WB TH 62 Exit Loop	2	2,203	50	15	B				
EB TH 62 Exit Ramp	EB TH 62 Entrance Loop	3	2,150	51	22	C				
66th Street Entrance Ramp	EB TH 62 Exit Ramp	4	2,649	51	18	B				
66th Street Exit Ramp	66th Street Entrance Ramp	5	2,498	54	23	C				
WB I-494 Entrance Ramp	66th Street Exit Ramp	6	3,352	59	27	C				
WB I-494 HOV Exit Loop	WB I-494 Entrance Ramp	7	3,148	60	26	C				
EB I-494 Entrance Loop	WB I-494 HOV Exit Loop	8	3,292	61	18	B				
I-494 EB/WB Exit Ramp	EB I-494 Entrance Loop	9	3,113	64	24	C				
Killebrew Exit Ramp	I-494 EB/WB Exit Ramp	10	4,984	61	23	C				
Old Shakopee Rd Entrance	Killebrew/Lindau Exit	11	5,879	61	24	C				
Old Shakopee Rd Exit(Contraflo	an Old Shakopee Rd Entrance	12	5,505	51	31	D				
(Old Shakopee Rd Exit)	(Contraflow Entrance)	13	6,970	57	28	D	963	54	17	B
WB TH 13 Entrance (Bridge)	Old Shakopee Rd Exit	14	6,007	58	34	D	963	54	17	B
WB TH 13 Exit	WB TH 13 Entrance	15	5,342	49	34	D				
EB TH 13 Entrance	WB TH 13 Exit	16	5,442	47	26	C	963	55	17	B
EB TH 13 Exit	EB TH 13 Entrance	17	4,896	60	28	C				
Diffley Rd Entrance	EB TH 13 Exit	18	5,048	60	21	C				
Diffley Rd Exit	Diffley Rd Entrance	19	4,313	62	27	C				
Cliff Rd Entrance	Diffley Rd Exit	20	4,421	48	40	E	963	55	16	B
Cliff Rd Exit	Cliff Rd Entrance	21	3,772	56	34	D				
SB I-35E Entrance	Cliff Rd Exit	22	4,526	50	31	D				
SB I-35E Exit	SB I-35E Entrance	23	4,476	38	59	F				
NB I-35E Entrance	SB I-35E Exit	24	4,496	26	59	F	483	56	8	A
NB I-35E Exit	NB I-35E Entrance	25	3,583	24	78	F				
Palomino Entrance	NB I-35E Exit	26	5,035	30	51	F				
McAndrews Entrance	Palomino Entrance	27	4,553	36	48	F				
McAndrews Exit	McAndrews Entrance	28	3,366	49	39	E	483	57	8	A
(Contraflow Exit)	McAnddews Exit	29	3,386	53	31	D				
Begin NB TH 77	McAndrews Exit(Contraflow E	30	3,869	52	26	C				
Comments		33								

* TH77 Managed Lanes Study Area Highlighted in Light green,Minnesota River Bridge in Blue,Contraflow acess segments in Purple, restricted Alt2B_MnPASS lane in Green
** HCM Level of Service (LOS) Criteria: LOS D(28-35 vplph); LOS E(35-43 vplph); LOS F(>43vplph)
*** Modeling Scenarios Description:
The improvement at 140 St and 494 were assumed for all 2030 Models, but not for 2010 models with exception for the alternative 2B and alternative 3B models. The modeling scenarios with and without 494 improvements were tested for the two alternatives for year 2010
Alternative 1A: A 3rd lane constructed for NB TH 77 between 138th Street and Diffley Road
Alternative 2B_MnPASS: 4th lane over the MN River Bridge, in addition to Alt1A improvement(Inside MnPASS lane with open access)
Alternative 3B: Contraflow between CR 38 and Old Shakopee Road (Contraflow MnPASS lane, with intermediate access at Cliff Road)

TH 77 Managed Lanes Study
Between 140th Street and I-494

Figure 5
2010 CORSIM Model Results
TH 77 Northbound AM Peak Hour Operations Comparison

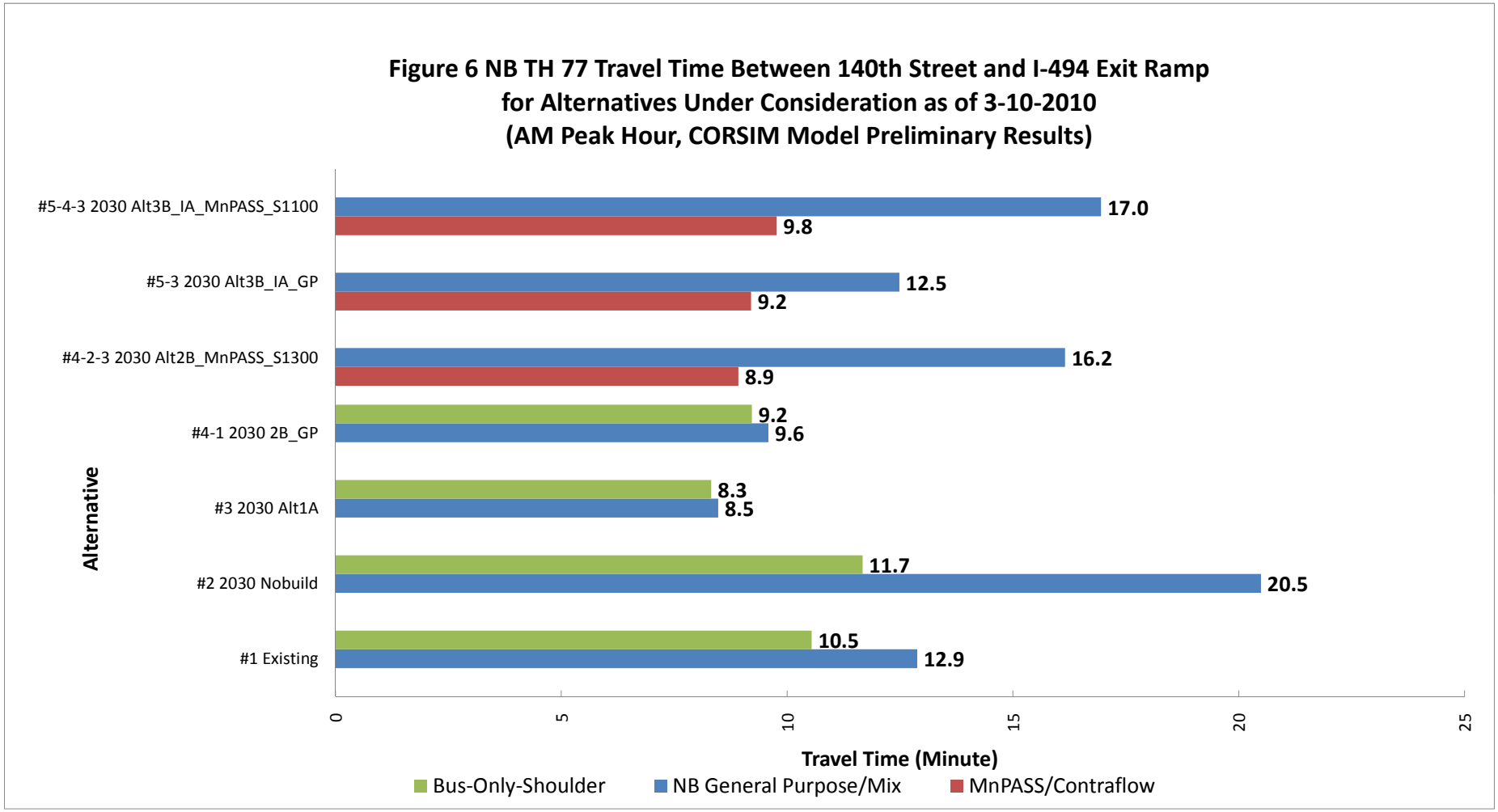


Figure 6 NB TH 77 Travel Time Between 140th Street and I-494 Exit Ramp
for Alternatives Under Consideration as of 3-10-2010
(AM Peak Hour, CORSIM Model Preliminary Results)
#5-4-3 2030 Alt3B_IA_MnPASS_S1100
17.0
9.8
#5-3 2030 Alt3B_IA_GP
12.5
9.2
#4-2-3 2030 Alt2B_MnPASS_S1300
16.2
8.9
#4-1 2030 2B_GP
9.2
9.6
#3 2030 Alt1A
8.3
8.5
#2 2030 Nobuild
11.7
20.5
#1 Existing
10.5
12.9
Alternative
0
5
10
15
20
25
Travel Time (Minute)
Bus-Only-Shoulder
NB General Purpose/Mix
MnPASS/Contraflow

Table NB TH 77 Travel Time to I-494 Ramp (2010 AM Peak, CORSIM Model Results)

Start Location	#1 Existing	#2-10 2010 Nobuild	#3-10 2010 Alt 1A	#3-10-01 2010 Alt 1A w_3B	#4-2-10 2010 Alt2B MnPASS	#4-2-10-01 2010 Alt 2B MnPass	#5-4-10 2010 Alt 3B_IA_	#5-4-10-2 2010 Alt 3B_IA_MnPass	#5-4-10-1 2010 Alt 3B_IA_ MnPass_W_1A
140th St	12.9	16.9	8.6	12.5	11.9	9.1	11.1	10.5	10
CR 38	11.7	13.8	7.5	11.4	10.8	7.9	10	9.4	8.5
I-35E	8.4	8.5	6.2	10.1	9.4	6.6	7.9	7.4	5.8
Cliff Rd	5.9	5.8	5.4	8.7	8.3	5.4	6.4	5.9	4.9
Diffley Rd	4.4	4.4	4.5	5.6	6.8	4.2	5	4.6	3.8
TH 13	3.1	3.1	3.3	3.3	5.3	3.3	3.8	3.3	2.9

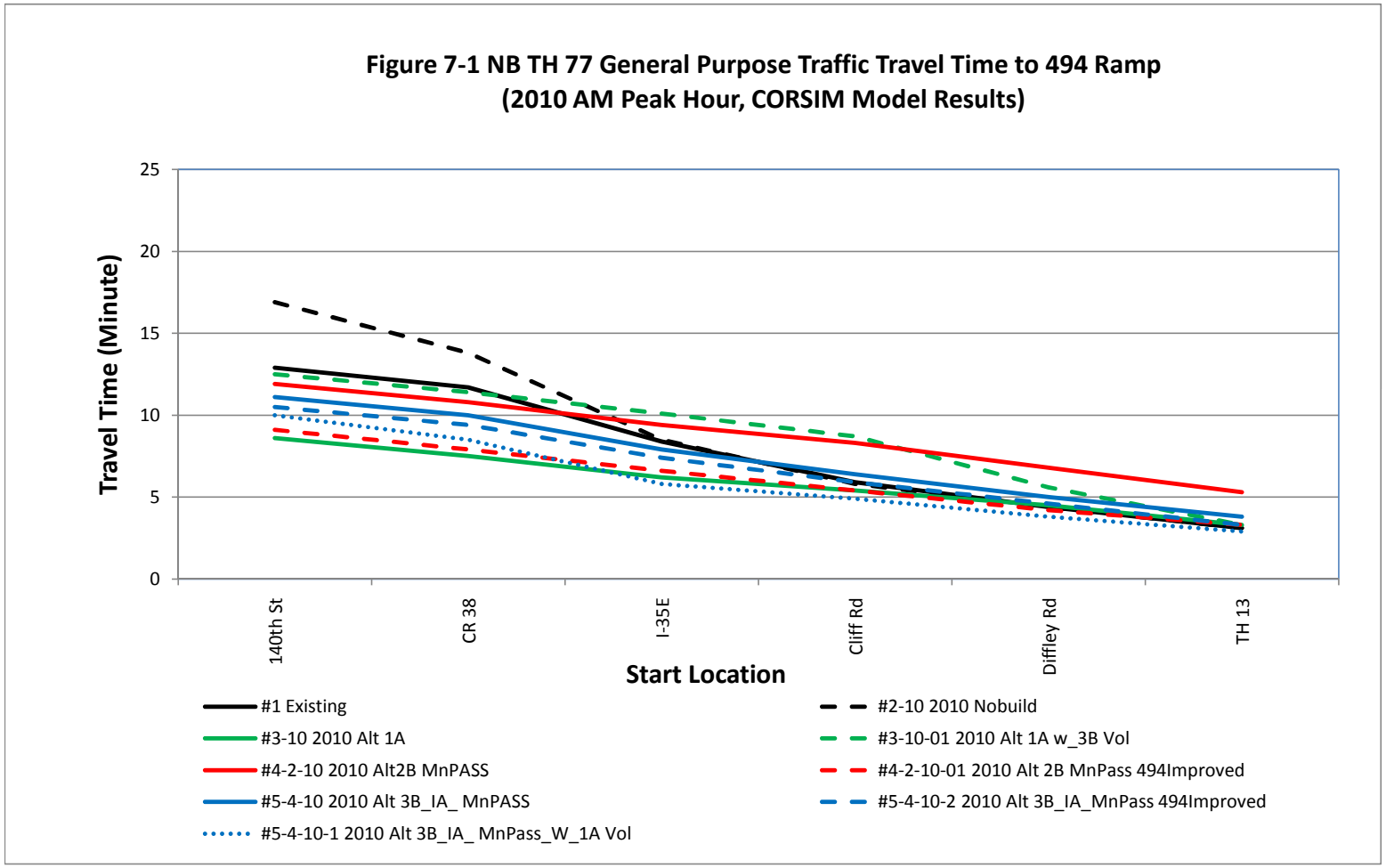
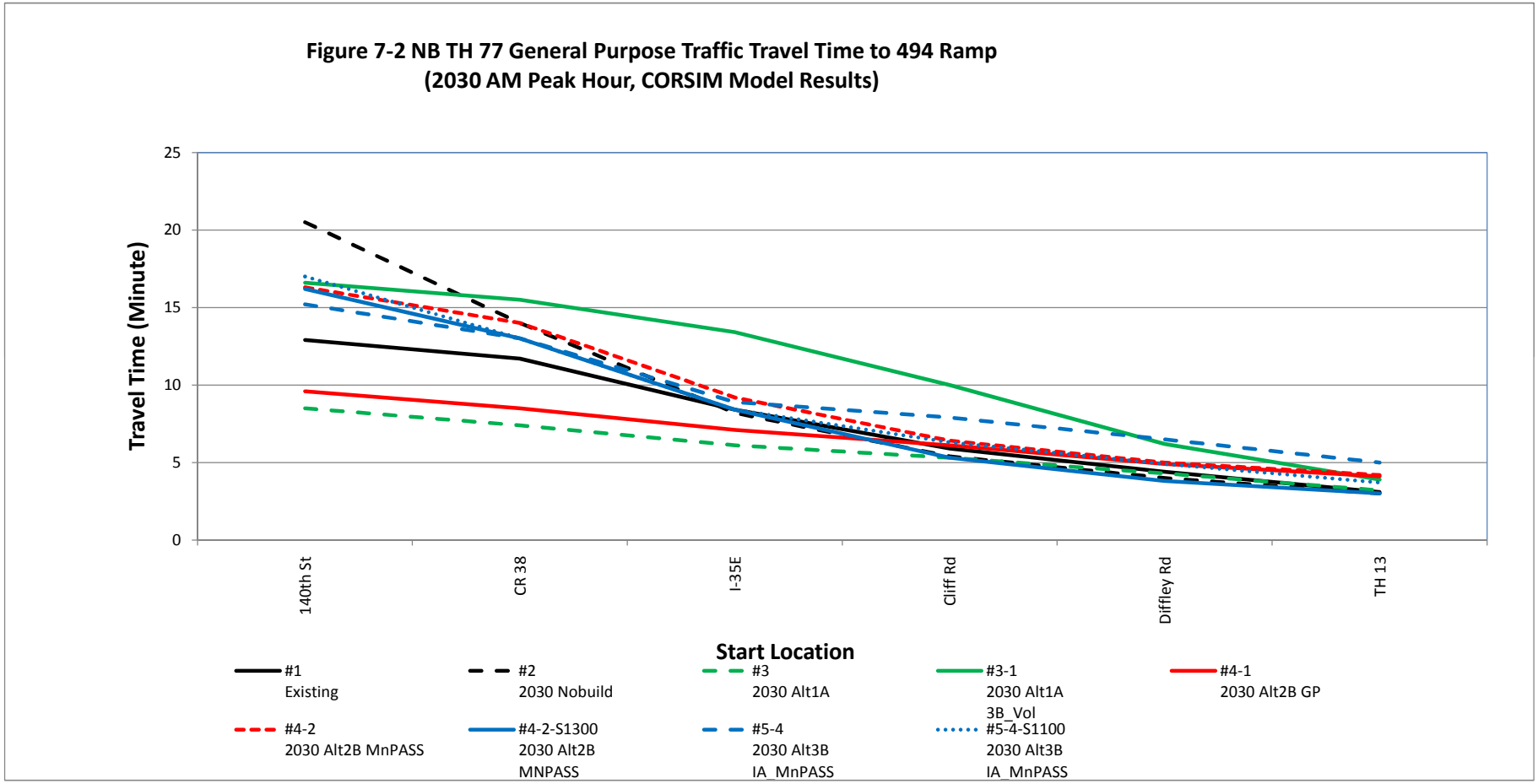


Table NB TH 77 Travel Time to I-494 Ramp (2030 AM Peak,CORSIM Model Results)

Start Location	#1 Existing	#2 2030 Nobuild	#3 2030 Alt1A	#3-1 2030 Alt1A 3B_Vol	#4-1 2030 Alt2B GP	#4-2 2030 Alt2B MnPASS	#4-2-S1300 2030 Alt2B MNPASS	#5-4 2030 Alt3B IA_MnPASS	#5-4-S1100 2030 Alt3B IA_MnPASS
140th St	12.9	20.5	8.5	16.6	9.6	16.3	16.2	15.2	17
CR 38	11.7	14	7.4	15.5	8.5	14	13	13	13
I-35E	8.4	8.2	6.1	13.4	7.1	9.2	8.4	8.9	8.4
Cliff Rd	5.9	5.4	5.3	10	6.1	6.4	5.3	7.9	6.3
Diffley Rd	4.4	4	4.3	6.2	4.9	5	3.8	6.5	4.9
TH 13	3.1	3	3.2	3.9	4.1	4.2	3	5	3.7



Appendix 5

Open House Comments Received

Comment from 11/19/09 Open House

107598 MNTMD
16.00 —

I prefer 3A or 3B with movable barriers. I have seen positive results in other cities I've been to.

Highway 77 Managed Lanes Corridor Study
Public Open House
May 13, 2010

Name: STEVE KALDENBACH

Address: 2144 WARRICK COURT

City/State/Zip: EAGAN, MN, 55122

Phone: 612 282 6071 **Email:** skaldenbach@edkraemer.com

Comments: OUR PROPERTY BACKS ONTO TH 77 NEAR THE SW corner of TH77 & CLIFF RD. WE ARE SURPRISED AT HOW THE SOUND FROM THE Highway travels to our house and makes it difficult to have a normal conversation in our backyard. IT SEEMS as if there is a gap in the berms next to the highway adjacent to our house. If you go north or South there is a berm - that buffers the houses from the highway. AS RESIDENTS WE ARE IN FAVOUR OF THE PROJECT, AS LONG AS NOISE WALLS ARE INSTALLED ALONG THE SB SIDE FROM CLIFF RD SOUTH TO 35E/TH77 INTERCHANGE. →

SEH Inc.
3535 Vandais Center Dr.
St. Paul, MN 55110

IF CAPACITY IS INCREASED FROM THIS PROJECT, I CAN ASSUME THAT NOISE VOLUME WOULD ALSO INCREASE, SO I BELIEVE NOISE WALLS OR NOISE MITIGATION ARE INEVATBLE.

MARK DIERLING
SHORT ELLIOTT HENDRICKSON INC
3535 VADNAIS CENTER DRIVE
ST PAUL MN 55110

Highway 77 Managed Lanes Corridor Study
Public Open House
May 13, 2010

Name: MICHAEL RETTERATH

Address: 8524 15th AVE S,

City/State/Zip: BLOOMINGTON, MN 55425

Phone: 507-383-0889 **Email:** ——

Comments: ALTERNATIVE 3B APPEARS TO BE A GREAT SOLUTION TO RELIEVE CONGESTION ALONG HWY 77. I WOULD BE INTERESTED TO SEE FURTHER PLANNING - INCLUDING CROSS-OVER LOCATIONS, BARRIER VEHICLE STORAGE OPTIONS, BARRIER "BREAK" LOCATIONS, ETC.

Highway 77 Managed Lanes Corridor Study
Public Open House
May 13, 2010

Name: Jeffrey B. Paulson

Address: 1820 E 86th St.

City/State/Zip: Bloomington, MN 55425

Phone: (952) 948-9299 **Email:**

Comments: Reasearch Feasibility of Fusing carbon Fiber/Kevlar material for barriers used on road for alternative 3B, instead of traditional concrete materials. I prefer a roadway plan that uses as many lanes and possible for the longest distances possible Thank You for holding the Open House.

Highway 77 Managed Lanes Corridor Study
Public Open House
May 13, 2010

Name: BRAD GUDENKAUF

Address: 2140 Warrick Ct

City/State/Zip: Eagan, MN 55122

Phone: **Email:** riley.bear@comcast.net

Comments: Informative presentation, thank you for organizing it. Option 3B interests me most because of utilization of current infrastructure. I would like to say a Noise wall should be included in the project. At this time traffic noise makes it uncomfortable to be outside in the afternoons thru evening.

Highway 77 Managed Lanes Corridor Study
Public Open House
May 13, 2010

Name: Susan Gudenkauf

Address: 2140 WARRICK COURT

City/State/Zip: EAGAN MN 55122

Phone: 6519941844 **Email:** Love4NBA@comcast.net

Comments:

We really need a noise barrier between Cliff Road and 35E on 77 South. It is excruciatingly loud to the point that we can't even be in our back yard and have a conversation. Please put a noise barrier there with whatever option is decided

Thank you

Highway 77 Managed Lanes Corridor Study
Public Open House
May 13, 2010

Name: Beth Nuthals

Address: 2216 Rocky Rapids Way

City/State/Zip: Eagan, MN 55122

Phone: _____ **Email:** _____

Comments: These options don't address the South bound issues. I don't have any North bound issues in my commute. The bottleneck @ 138th seems to be more of an issue than the bridge itself once a person gets on the bridge things go pretty smoothly.

Highway 77 Managed Lanes Corridor Study
Public Open House
May 13, 2010

Name: Bill Nau

Address: 9101 Springside Ln

City/State/Zip: Bloomington MN 55425

Phone: 952-884-2544 **Email:** BillNau@gmail.com

Comments: Please add me to your email list on this project.

Thank You

Appendix 6

Support Letters

City of Apple Valley
7100 147th Street West
Apple Valley, MN 55124-9016

Telephone (952) 953-2500
Fax (952) 953-2515
www.cityofapplevalley.org

January 13, 2011

Mr. Amr Jabr
Director, Office of Operations and Maintenance
Minnesota Department of Transportation
1500 West County Road B-2
Roseville, MN 55113

Re: TH 77 Corridor Managed Lanes Study

Dear Mr. Jabr:

The Apple Valley City Council recently reviewed the Final Report for the *Trunk Highway 77 Corridor Managed Lanes Study*, dated August 6, 2010. This study identified three primary alternatives to improve the capacity of the corridor. The Minnesota Department of Transportation has requested that the City of Apple Valley and other agencies participating in the study identify two of the three primary alternatives for further consideration as part of an environmental assessment process. The report offers the following three primary alternatives for consideration.

- Alternative 1A – Third northbound lane addition between 138th Street and Diffley Road
- Alternative 2B – Third northbound MnPASS lane, with a fourth lane over the River Bridge
- Alternative 3B – Northbound contra-flow lane from Apple Valley over the River Bridge

Section 7 of the report provides an evaluation summary for the three alternatives listed above. This section of the report indicates that Alternative 1A provides no increased capacity over the river, moves the traffic congestion bottleneck to the Highway 13 interchange, does not enhance advantages for transit, does not provide congestion-free choices for general purpose traffic and carpools, and does not improve travel time reliability. These conclusions do not support Alternative 1A as a viable solution to the current traffic challenges along the Highway 77 corridor.

The Apple Valley City Council is generally supportive of proceeding with an environmental assessment process for Alternatives 2B and 3B subject to the following conditions. These conditions are based on concerns previously expressed by the City during the study process.

1. Alternative 2B: A third northbound general purpose lane be extended to the MnPASS portion of the proposed third lane, the transition to MnPASS occurring approximately 3,600 feet or more north of 140th Street. The purpose of this condition is to avoid further compounding traffic congestion within the signalized portion of Cedar Avenue, provide opportunity to access the MnPASS lane from westbound 140th Street, and preserve the character of Downtown Apple Valley.

2. Alternative 3B: A third northbound general purpose lane be extended to the starting point of the contra-flow lane located approximately 3,600 feet or more north of 140th Street to avoid further compounding traffic congestion within the signalized portion of Cedar Avenue, provide opportunity to access the contra-flow lane from westbound 140th Street, and preserve the character of Downtown Apple Valley.

3. Any MnPASS portion of the new third lane or contra-flow lane should function as an HOV facility on the day of opening, allowing toll free use by passenger vehicles with multiple occupants.

The City appreciates your willingness to attend previous City Council meetings to discuss the technical aspects of the study and consider the City's concerns related to the Trunk Highway 77 corridor. Apple Valley staff would like to continue their involvement in the environmental and engineering design process as this project moves forward.

Sincerely,

CITY OF APPLE VALLEY

Mary Hamann-Roland

Mary Hamann-Roland
Mayor

CITY OF
BLOOMINGTON
MINNESOTA

December 6, 2010

Mr. Amr Jabr
Director, Office of Operations and Maintenance
Minnesota Department of Transportation
1500 West County Road B-2
Roseville, MN 55113

RE: TH 77 Corridor Managed Lanes Study
Final Report - Preferred Alternatives

Dear Mr. Jabr:

The City of Bloomington would like to thank MnDOT for the work in completing the TH 77 Corridor Managed Lanes Study. We also appreciate the opportunity for Bloomington's involvement and participation on the project team.

Increasing congestion is the most significant challenge that the Bloomington roadway network will face in the coming years. Part of Bloomington's current congestion is due to development within the City. Another significant component, however, is the spillover of traffic from outside Bloomington onto local streets in an effort to avoid highly congested portions of the regional highway system such as I-494. To address congestion, the City is supportive of measures that eliminate bottlenecks, diversify transportation options, facilitate high quality transit systems, and increase roadway capacities while avoiding relocating or exasperating congestion or bottlenecks elsewhere.

The next steps for the TH 77 corridor project would involve identifying and reaching consensus on two technically-preferred alternatives, then proceeding with the appropriate environmental reviews. The technically-preferred alternatives would be selected from the following primary alternatives identified in the *TH-77 Corridor Managed Lanes Study Final Report*:

- Alternative 1A - Third lane addition (138th Street to Diffley Road)
- Alternative 2B - Fourth (MnPASS) lane over Minnesota River Bridge
- Alternative 3B - Contra-flow MnPASS lane with intermediate access

MAYOR AND CITY COUNCIL
1800 W. OLD SHAKOPEE ROAD, BLOOMINGTON MN 55431-3027
PH 952-563-8782 FAX 952-563-8754 TTY 952-563-8740

AN AFFIRMATIVE ACTION/EQUAL OPPORTUNITIES EMPLOYER

The three alternatives noted above are consistent with, and support the goals and strategies outlined in the Bloomington's Comprehensive Plan for addressing congestion; increasing regional roadway system capacity, and supporting transit systems. The City recognizes that Alternative 1A provides congestion relief to other local agencies along southern portions of the corridor; however, transit system benefits and enhanced connections to Bloomington are not realized under this option. The City, therefore, is most supportive of Alternatives 2B and 3B; as they enhance suburb to suburb transit connections and increase corridor capacity in a manner that manages demand north of the Minnesota River Bridge. Alternatives 2B and 3B increase corridor capacity without overloading the I-494/TH 77 interchange.

Increased congestion at the I-494/TH 77 interchange would further transfer regional trips onto the City street network, especially at East Old Shakopee Road.

Managing demand north of the river and enhancing the transit system along the corridor will continue to be a prime focus for the City. We look forward to our continued partnership and participation with MnDOT on the TH 77 corridor project.

Sincerely,

Gene Winstead
Mayor

cc: City Council
City Manager
Director of Public Works

Dakota
COUNTY

Dakota County
Regional Railroad Authority

Dakota County
Administration Center
1590 Highway 55
Hastings, MN 55033

651.438.4418
Fax 651.438.4405

September 28, 2010

Mr. Amr Jabr
Director, Office of Operations and Maintenance
Minnesota Department of Transportation
1500 West County Road B-2
Roseville, MN 55113

Dear Mr. Jabr:

Dakota County would like to thank you for your efforts and involvement with Dakota County on the State Highway 77 managed lanes study. Dakota County realizes there is more planning and environmental analysis to be done before this project would become a reality.

Dakota County supports moving forward with two alternatives for the environmental assessment for State Highway 77 managed-lane. Alternative 2B is defined as an additional fourth lane over the Minnesota River Bridge, which currently is defined as a MnPASS lane on the left shoulder of Cedar Avenue. Alternative 3B is currently defined as a contraflow MnPASS lane which uses a moveable barrier system to provide additional capacity during peak periods. Dakota County recognizes there is local city support for alternative 1A, which is the third lane addition between 138th Street and Diffley road. The County, however, acknowledges and supports the analysis completed during the study that concludes alternative 1A does not solve the long term congestion issues near the Minnesota River crossing nor provide enhancement advantages to the Cedar Avenue Transitway.

Cedar Avenue's bus rapid transit project is a priority to our community and citizens; therefore, it is important that Dakota County and Mn/DOT staff work closely together in the next phase of the development of the preferred alternative for the State Highway 77 managed lane and Cedar Grove Station design for access to State Highway 77. The two alternatives 2B and 3B would function differently with BRT station stops at the existing Cedar Grove and proposed Cliff Road stations in Eagan. Dakota County staff would like to work collaboratively with Mn/DOT staff on the access locations to TH 77, station stop designs and various options while considering the most appropriate TH 77 managed-lane option that would benefit the transit investment being made in the Cedar Avenue Transitway and State Highway 77. Dakota County staff also would like to continue involvement in the environmental and preliminary engineering technical involvement as this project continues to move forward.

Thank you for your continued partnership on this project.

Sincerely,

Willis E. Branning, Chair
Dakota County Regional Railroad Authority

C: Regional Railroad Authority
Brandt Richardson, County Administrator

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with 30% post-consumer waste.
AN EQUAL OPPORTUNITY EMPLOYER

City of Eagan

Mike Maguire
Mayor

Paul Bakken
Cyndee Fields
Gary Hansen
Meg Tilley
Council Members

Thomas Hedges
City Administrator

Municipal Center
3830 Pilot Knob Road
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3501 Coachman Point
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651.675.5360 fax
651.454.8535 TDD

www.cityofeagan.com

The Lone Oak Tree
The symbol of
strength and growth
in our community.

January 31, 2011

Mr. Amr Jabr
Director, Office of Operations and Maintenance
Minnesota Department of Transportation
1500 West County Road B-2
Roseville, MN 55113

Re: TH 77 Corridor Managed Lanes Study – Final Report Comments

Dear Mr. Jabr,

The City of Eagan appreciates the initiative and effort of MnDOT to address the ever increasing congestion along TH 77 from Apple Valley to Bloomington by identifying and evaluating numerous and innovative design alternatives. We also appreciate the time you have provided in presenting the study's information with the City Councils of the affected communities, the Dakota County Board and the general public through the various public informational open houses.

We understand that originally, up to 9 alternatives were identified for preliminary consideration, and that considerable evaluation went into determining their respective feasibility and practicality in trying to maximize their congestion relief benefits while minimizing the related significant infrastructure investment that would be required to implement any type of improvement while recognizing the funding constraints that we all have to work with.

We have received and reviewed the Final Report dated August 6, 2010 wherein it has narrowed down these numerous alternatives to the following 3:

- Alternative 1A – A third northbound lane addition (138th St to Diffley Rd)
- Alternative 2B (MnPASS) – The 3rd NB lane addition (Alt 1A) plus a reconfigured 4th lane over the River Valley dedicated as a MnPASS lane.
- Alternative 3B (MnPASS) – A Contra Flow lane for northbound traffic from Apple Valley to Bloomington dedicated as a MnPASS lane with intermediate access in Eagan.

You have requested the various community agencies to select 2 of these 3 alternatives as Preferred Alternatives for further environmental assessment. This request was considered by our City Council at their regular meeting held on January 18, 2011. Unfortunately, none of these alternatives fully address the needs of all Eagan commuters, including general purpose travel, car pooling and transit users. Since Alternative 1A really doesn't address the congestion issue along the entire corridor and merely moves it from Apple Valley to TH 13 in Eagan, it should not be given further consideration and will not be endorsed or supported by the City of Eagan.

This leaves only Alternatives 2B & 3B left for Eagan's requested support. However, neither of these two adequately addresses both the general purpose and transit commuter needs from Eagan.

Alternative 2B with its MnPASS lane for HOV and toll users comes at the expense of severely diminished service out of our new Cedar Grove Transit Station (CGTS) for express and station-to-station transit operations due to the elimination of a dedicated bus-only shoulder over the Minnesota River Valley. This is unacceptable. We cannot endorse further consideration of this alternative and will strenuously object to it as a viable option until some type of dedicated access accommodations are made for the CGTS to directly access the MnPASS lane. As part of its previous review and discussion of the Managed Lane Study, the City Council indicated that its support for any alternative depends on it not creating transportation or transit disadvantages for Eagan residents and businesses using Cedar Avenue via Cliff Road, Diffley Road or TH 13. To that end, the Council has stated in its comments regarding other Cedar Avenue Studies and Reports that it is necessary for those agencies participating in the Cedar Corridor planning and development processes to accelerate the analysis and implementation of BRT access improvements at the CGTS so it not only be integrated fully into the BRT service system, but as soon as possible.

Alternative 3B (MnPASS) will address our transit needs by retaining the bus-only shoulder along the entire route. However, while the Contra Flow lane will begin in Apple Valley and end in Bloomington, the "Potential Intermediate Access" in Eagan under the Cliff Rd. bridge will only accommodate those Eagan commuters who would backtrack on 35E to access TH 77. The increased travel time of this more circuitous route would most likely negate any travel time benefit afforded by the Contra Flow lane. Consideration should be given to locating this Intermediate Access point further north so that the northbound Cliff Rd entrance ramp has an opportunity to access it. It should be noted that the Cliff Rd (Principal Arterial) interchange is also identified as a future Transit Station for the Cedar Ave. BRT.

We understand that it is extremely difficult to address all concerns when trying to retrofit a capacity improvement into an existing freeway design. But we must make every effort to insure that future highway investments maximize transit and other multi-modal opportunities.

While we realize that you were requesting Eagan to endorse two of the three alternatives, unfortunately we can only support one of them: Alternative 3B (MnPASS) and will object to further consideration of either of the other two for reasons stated previously.

Again, thank you for your past efforts in trying to address the congestion issues along one of the major river crossings in the metro area. I look forward to learning about your continued innovated approaches to address the concerns we have noted.

Sincerely,

Mike Maguire

Mike Maguire
Mayor

City of Eagan

Mike Maguire
Mayor

Paul Bakken
Cyndee Fields
Gary Hansen
Meg Tilley
Council Members

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The Lone Oak Tree
The symbol of
strength and growth
in our community.

Mr. Amr Jabr
Director, Office of Operations and Maintenance
Minnesota Department of Transportation
1500 West County Road B-2
Roseville, MN 55113

March 8, 2011

Re: TH 77 Corridor Managed Lanes Study – Final Report Comments

Dear Mr. Jabr,

On January 31, the City of Eagan commented on the TH 77 Managed Lane Study and its Final Report based on the City Council's review at their January 18, 2011 meeting. In that letter we stated our support for Alternative 3B only, for several reasons. You have reiterated the need for Eagan to include support for a second alternative to allow the Study to proceed with the next phase of Environmental Assessments and pre-Design Layouts. Our Council understands that Eagan's support for Alternative 2B would then be in concert with Bloomington, Apple Valley and Dakota County.

In our previous letter, we expressed our significant concerns regarding any of the Final Report Alternatives to adequately address both the general purpose and transit commuter needs from Eagan, especially access from its transit stations and maintaining priority service along the corridor. This still remains of critical importance to our community. However, based on MnDOT's stated commitment at our Workshop meeting on March 8 to include transit access options for the existing Cedar Grove Transit Station and the future Cliff Road station as part of the next level of the Environmental Assessments and Pre-Design Process, the City of Eagan will support the inclusion of Alternative 2B in addition to Alternative 3B for the purpose of proceeding to the next level of environmental assessments.

Again, we understand that it is extremely difficult to address all concerns when trying to retrofit a capacity improvement into an existing freeway design, but we must make every effort to insure that future highway investments maximize transit and other multi-modal opportunities.

Again, thank you for your past efforts in trying to address the congestion issues along one of the major river crossings in the metro area. I look forward to learning about your continued innovative approaches to address the concerns we have noted.

Sincerely,

Mike Maguire

Mike Maguire
Mayor