DRAFT *I-39/90/94 TRAFFIC IMPACT ANALYSIS*

Study Summary Report

I-39/90/94
Madison – Portage
US 12 & 18 Interchange – I-90/94
Dane & Columbia Counties
Stage 1

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EXECUTIVE SUMMARY

In recent years, several local governments have expressed interest in new interchange access to the Interstates in the Madison metropolitan area. The Federal Highway Administration (FHWA) and the Wisconsin Department of Transportation (WisDOT) agreed the Madison-area interstate and intersecting freeways were complex enough that a system-wide analysis of possible new access locations was necessary to understand what cumulative effects to the Madison area freeway and local system would result from new interchanges. The I-39/90/94 Traffic Impact Analysis (TIA) study was designed to provide that information and determine the potential viability of thirteen existing grade separated crossings where the conversion to an interchange was physically possible. One location where a crossing does not currently exist was also evaluated. Study limits extend north, south, and east of the Madison Metro area to ensure study results would be of value decades later if development eventually extended that far. In addition, the TIA investigated nine locations for the potential to create new grade separated crossings. Grade separated crossings, without interchange ramps, have potential benefits of reducing cross road traffic at adjacent interchanges and improving local connections for communities divided by freeways.

Results from the I-39/90/94 TIA save time and effort for WisDOT, FHWA, and municipalities by eliminating future requests for locations this study finds unfeasible and by producing preliminary analysis for the I-39/90/94 Environmental Study. Exhibit 1 shows the TIA study limits and locations evaluated which includes the potential interchanges and crossings listed in Table 1.

Table 1. I-39/90/94 TIA Screening Locations

Interchanges	Grade Separated Crossings
• **Femrite Drive** (at I-39/90) • **County AB** (at I-39/90) • **County BB** (at I-39/90) • **Milwaukee Street** (at I-39/90) • **County T** (at I-39/90/94) • **Lien Rd** (at I-39/90/94) • **Portage Rd** (at I-39/90/94) • **Hanson Road** (at I-39/90/94) • **Hoepker Road** (at I-39/90/94) • **Cuba Valley Road / Windsor Road** (at I-39/90/94) • **Sprecher Road** (at I-94) • **Milwaukee Street Extension** (at I-94) • **Gaston Road** (at I-94) • **Ridge Road** (at I-94)	• **Daley Road** (Crossing I-39/90/94 between Cuba Valley Road and County V) • **Daentl Road / East Metro Boulevard** (Crossing I-39/90/94 between US 51 and WIS 19) • **East Metro Boulevard / Token Creek Lane** (Crossing US 51 between I-39/90/94 and WIS 19) • **Anderson Road** (Crossing I-39/90/94 between Hoepker Road and US 51) • **Portage Road / Eastpark Boulevard Connector** (Crossing I-39/90/94 between US 151 and Hanson Road) • **City View Drive** (Crossing I-39/90/94 between High Crossing Boulevard and Lien Road) • **Capitol Drive** (Crossing US 151 between American Parkway and County C) • **Thompson Road** (Crossing US 151 between County C and Main Street) • **Buss Road** (Crossing I-94 between Gaston Road and County N)

Process

Five major efforts were completed during the I-39/90/94 TIA in order to evaluate potential new interchanges and grade separated crossings. Locations considered were evaluated by the I-39/94/94 Technical Advisory Committee (TAC) that consisted of representatives from WisDOT SW Region Major Studies, WisDOT SW Region Environment, WisDOT SW Region Traffic, WisDOT BTO, WisDOT BPD, WisDOT EPDS, WisDOT TFS, FHWA, City of Madison, Madison Area Transportation Planning Board, and Dane County. This summary report is organized into five sections based on the major completed:

Section 1: **Existing Conditions Analysis –** This effort showed how current freeway access serves existing needs in terms of traffic operations, trends, safety, and roadway geometrics.

Section 2: **Traffic Forecasting** – Interchanges are permanent fixtures in the transportation system and have lasting impacts. To ensure long-term needs and consequences are considered, the evaluation of new access points and grade separated crossings used predicted conditions in 2050.

Section 3: **Future Year Baseline Traffic Operations** – Applying future year 2050 traffic forecasts to the existing system established a baseline for determining long-term impacts due to a new interchange or grade separated crossing.

Section 4: **Tier 1 Screening** – Viability of potential grade separated crossing and interchanges was evaluated from a high-level perspective motivated by FHWA's Interstate Access Justification Report (IAJR) requirements. Locations were evaluated in a data-driven analysis and local input from surrounding townships, villages, cities, and Dane County. The goal of Tier 1 Screening was to document whether or not individual locations merit additional consideration and a more detailed analysis effort base on consensus of the I-39/90/94 TAC. Locations passing Tier 1 are not definitively viable, and locations failing Tier 1 should not be reconsidered in the future unless conditions substantially change compared to 2050 predictions used to test them in the TIA study.

Section 5: **Tier 2 Screening** – Potential interchanges passing Tier 1 Screening were evaluated in greater detail during Tier 2. Conceptual geometric layouts, alternatives, and detailed traffic analyses were used to further understand impacts of each location. Additional consideration for grade separated crossings passing Tier 1 was deferred to the upcoming I-39/90/94 Environmental Study in order to better evaluate local system effects. Also, no new crossings have been locally requested or were found to be of such value to the system that WisDOT should consider programming them as stand-alone projects in advance of the preferred alternative that is expected to be recommended in an Environmental Impact Statement around 2018.

Existing Conditions Summary

Outcomes of the existing conditions analysis showed that critical sections of the corridor operate acceptably in the existing year 2012; however, there are safety concerns and the physical system is reaching the end of its intended service life. About 500 crashes per year occurred within the study area during the 5 year period between 2007-2011, which have harmful social, economic, and traffic effects. Bottlenecks form on I-39/90/94 between the Madison Beltline and US 151 during peak holiday weekends. These highest volume hours of the year may provide a view of what future year congestion could look like on a typical day.

Traffic Forecasting Summary

WisDOT Traffic Forecasting Section used the October 2013 Dane County Travel Demand Model and AADT forecasts to develop unconstrained future year 2050 traffic volumes. An unconstrained forecast allowed testing the effects of the full demand that a new interchange could experience. Socio-economic and planned development data showed population growth in the City of Madison and surrounding areas. As a result, the interstate showed growth rates from 1.3% to 1.7% per year, and higher rates between 1.8% and 2.0% per year on US 151 and WIS 30 that connect major population and employment centers.

Future Year Baseline Traffic Operations Summary

Analysis showed that the existing freeway system cannot safely or efficiently handle the forecasted future year traffic. Modeling showed that peak hour queues could span much of the corridor, from the Badger Interchange as far north as County V. Bottlenecks and long queues indicated that capacity improvements may be needed regardless of consideration of new interchanges.

Tier 1 Findings

Interchange screening locations were grouped by geographic location and evaluated together. Report exhibits also follow this grouping:

- Interchanges on I-39/90/94 north of US 51
- Interchanges on I-39/90/94 between US 51 & US 151
- Interchanges on I-39/90 between US 151 & Beltline
- Interchanges on I-94 east of I-39/90

A key finding during the Tier 1 Screening processes was that no new access should be allowed between the US 12/18 (Madison Beltline) and US 151 system interchanges. Figure 1 shows that potential interchanges in this area share many negative characteristics including: very high traffic demand, decreased service life of the interstate facility, added traffic to residential neighborhoods, and considerable physical constraints.

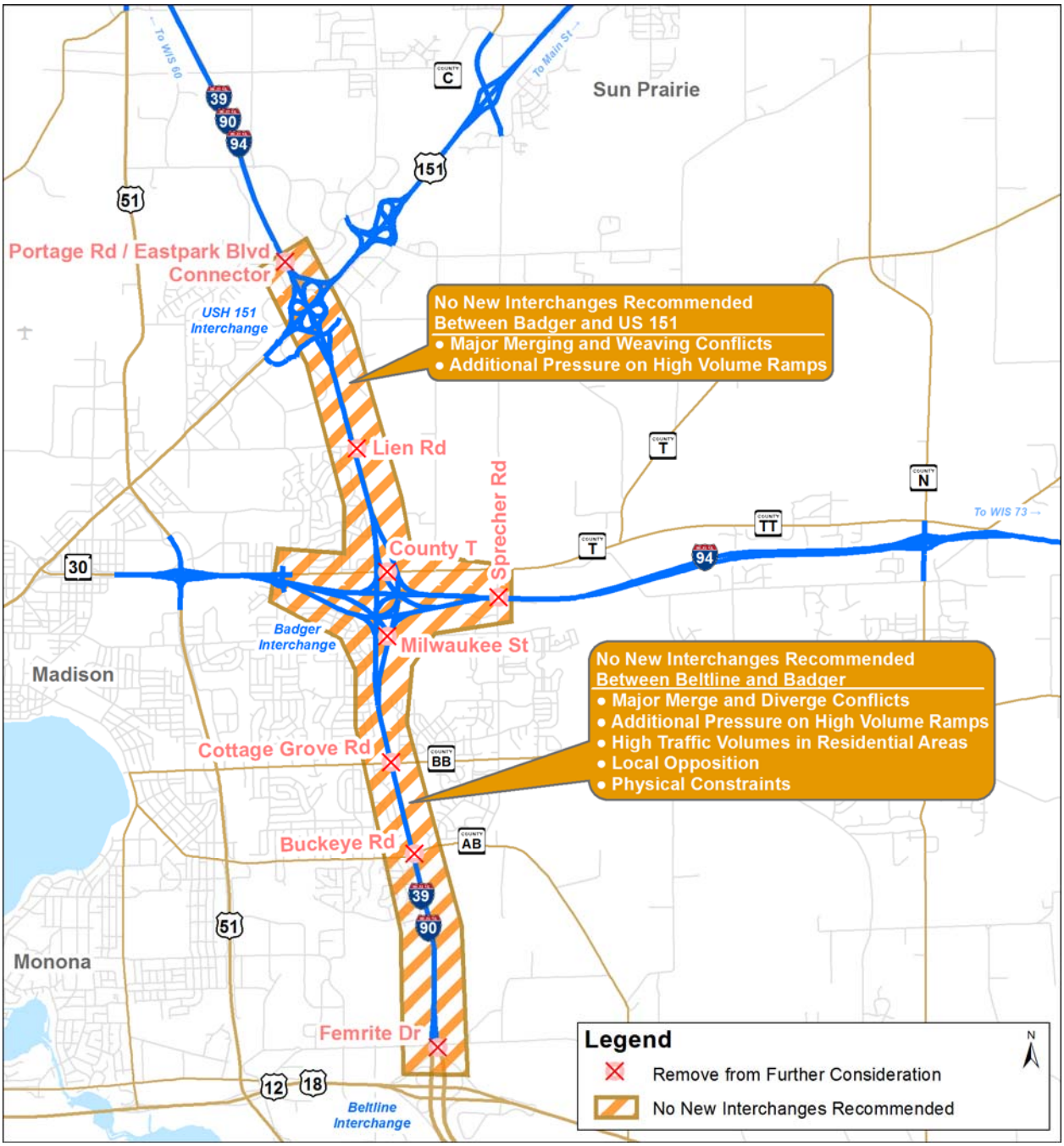

Figure 1. Tier 1 Interchange Conclusions

Tier 1 Screening found that the Ridge Road location on I-94 between County N and WIS 73 did not warrant further analysis at this time during the TIA. Lack of demand at Ridge Road makes this location a low priority for new interstate access. All information presented, especially local input during Tier 1 Screening, represents a snapshot of information gathered during each stage of the TIA. Local opinions may change over time with changes in leadership and politics. If conditions change in the future, a Ridge Road interchange may be reconsidered.

Grade separated crossings evaluated during Tier 1 Screening had a range of positive effects. Some locations were particularly beneficial to the WisDOT highway network due to reductions in traffic at existing interchanges. For other locations with minimal benefit to the WisDOT highway network, WisDOT should give further consideration to the crossing if requested by a municipality because crossings can connect communities divided by the freeway and improve bicycle and pedestrian mobility. Further evaluation of grade separated crossings will be performed in the I-39/90/94 Environmental Study as shown in Table 2.

Table 2. Grade Separated Crossing Recommendations

No Further Evaluation Recommended at this Time[1]	WisDOT Will Evaluate in More Detail During the I-39/90/94 Environmental Study
• Daley Road • Daentl Road / East Metro Boulevard • City View Drive • Capitol Drive • Buss Road	• Portage Road / Eastpark Boulevard Connector[2] • East Metro Boulevard / Token Creek Lane • Anderson Road • Thompson Road

1. WisDOT could allow the crossing if requested by a municipality, but does not expect it will be of value as part of the I-39/90/94 Environmental Study preferred alternative
2. The Portage Road / Eastpark Blvd Connector evaluated in Tier 2 Screening was ultimately recommended for further evaluation in the environmental study of the corridor.

Tier 2 Findings

Primary findings from Tier 2 analysis included identification of issues that need to be addressed before any additional consideration of the interchange locations passing Tier 1 Screening. Locations evaluated during Tier 2 included the following locations and results:

- **Interchanges on I-39/90/94 north of US 51 – Cuba Valley Road or Windsor Road:** An interchange on I-39/90/94 between WIS 19 and County V would increase interstate access for the DeForest area. Local support for either location is limited to the Village of DeForest, with township boards and residents concerned about increased traffic on local roads, development pressure, funding, and costs. At this time, the Village of DeForest is not sponsoring the interchange so an IAJR is not being pursued. Traffic impacts were found to have minimal benefit for the freeway system, adjacent interchanges, and local roads. Achieving desirable cross road intersection spacing was challenging in the preliminary geometric designs due to developer desires, WisDOT standards, and potential for property relocations. Improvements to the WIS 19 and US 51 interchanges south of this location as part of the EIS preferred alternative should satisfactorily address current and long term congestion at both locations, reducing the value of a new access in the future.

- **Interchanges on I-94 east of I-39/90 – Milwaukee Street Extension or Gaston Road:** Located on I-94 less than 2 miles east of the I-39/90 & I-94 / WIS 30 (Badger) interchange, an interchange in this location would serve the east side of Madison and Cottage Grove. A new interchange shifts traffic away from existing service interchanges, but may not eliminate the need for capacity improvements to accommodate future year traffic on the freeway or local road system. Interchange traffic may also impact the local system beyond the extents evaluated during the TIA and may require widening of local roads or changes in intersection control. The configuration of the mainline and Badger Interchange will play a large role in the viability of a new access in this location due to the close proximity between interchanges that presents challenges for safe and efficient operations. The upcoming I-39/90/94 Environmental Study will provide additional insight into the viability of a new interchange.

- **Interchanges on I-39/90/94 between US 51 & US 151 – Hanson Road or Hoepker Road:** Existing and future traffic needs are complex in the area surrounding I-39/90/94 and US 151 due to the close proximity of the existing interchange at US 51 and system interchange at US 151, forecasted traffic increases, and physical constraints. A potential interchange on I-39/90/94 at Hanson Road or Hoepker Road would add to this complexity, but may benefit the freeway and local road system by drawing traffic away from congested ramps and intersections. A new interchange may also allow removal of low volume movements at the I-39/90/94 & US 51 interchange to facilitate free-flow traffic along US 51. Evaluation of the Hanson Road and Hoepker Road locations will occur within the context of mainline and adjacent interchange alternative analysis in the upcoming I-39/90/94 Environmental Study in order to better understand impacts.

Findings of the I-39/90/94 TIA provide important assessments and guidance that will permanently shape the future of the interstate in the Madison area but do not replace the IAJR process. Per the requirements of the IAJR policy, access cannot be added if they result in significant risk of long term gridlock and impair mobility on the interstate. The iconic interstate system connects communities, drives economic growth, and allows for efficient travel throughout the country. Preserving these functions is necessary to adequately serve future generations. Any consideration for a new interchange would require additional steps:

- **State and Federal approval process** – Changes to interstate access require completion of an IAJR to provide additional details about the purpose, need, impacts, and answer many of the outstanding questions regarding the effects of a new interchange. The process requires a local sponsor to submit an IAJR to WisDOT. If WisDOT supports the request, they submit the IAJR to the local FHWA Division Office. FHWA has final approval for new interchange requests. Proposed interchanges within the

Madison Area Transportation Management Area require ultimate approval from FHWA in Washington DC rather than the Wisconsin Regional Office.

- **Inclusion in regional long range plans** – The interchange sponsor would need to complete the process for including the interchange in the Madison Area Metropolitan Planning Organization (MPO) Long Range Transportation Plan (RTP) and Transportation Improvement Plan (TIP). These plans ensure that improvements are consistent with the transportation needs and goals for the greater Madison area.

- **Environmental documentation** – NEPA documentation is required to establish a need for the interchange and investigate all potential environmental effects in detail including: natural, historic, cultural, noise, economic, social, and health impacts. This process encourages responsible planning and provides additional opportunity for public input.

SECTION 1
Existing Conditions

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INTRODUCTION

A planning level operational and safety analysis was completed for the existing year 2012 conditions and is documented in this section. The existing conditions analysis provides a baseline for future comparisons and shows how the current freeway access serves existing needs. This section also documents the various traffic simulation models used throughout the project for existing and future alternatives analysis. The I-39/90/94 TIA study area encompasses four major freeways in the greater Madison area, I-39/90, I-94, US 151, and WIS 30. The corridor includes 39 miles of freeway mainline and 15 interchanges. Both the freeway mainline and interchange intersections were analyzed.

Existing conditions analysis results are incorporated into the traffic forecasting process, future year 2050 traffic analysis, initial access and crossing analysis using high level screening criteria (Tier 1 Screening), and detailed analysis of potential access and crossing locations (Tier 2 Screening). After the completion of the I-39/90/94 TIA, the project will transition into the second stage of the project, the I-39/90/94 Environmental Impact Statement (EIS) study. The I-39/90/94 EIS will investigate corridor needs on I-39/90/94 from the US 12/18 interchange in Madison to the I-39 interchange in Portage.

The I-39/90/94 TIA planning study is one of many on-going studies and improvement projects in Dane County that are shaping the long-range transportation system plan in Wisconsin. Other roadways being studied in the surrounding area are shown in Exhibit 2 and include the Beltline (US 12/14/18/151), US 12 north of Middleton, US 12/18 east of Madison, US 51, US 14 west of Middleton, US 151 (Verona Road), I-39/90 south of Madison, and I-39/90/94 north of Portage.

I-39/90/94 Corridor Needs

The purpose of this section is to document existing conditions and identify needs for the I-39/90/94 corridor. The I-39/90/94 corridor has the following needs:

- **I-39/90/94 is a route of National, state and regional importance.** I-39/90/94 is part of the Interstate Highway System and the National Highway System. It is classified as a Wisconsin Corridors 2030 Backbone route, signifying its importance to through traffic and commodities transport. I-39/90/94 provides a north-south route through Wisconsin crucial to the trucking and tourism industries. Because of the importance of this route, it is critical to maintain good traffic flow and travel time reliability through the corridor.

- **Crash rates are above average.** Crashes on I-39/90/94 exceed the average crash rates along 288 miles of I-94 from Minnesota to Waukesha County. Eight freeway segments and five intersections exceed the average crash rates. There are over 500 crashes a year in the I-39/90/94 study area, which is about 1.4 crashes per day. Sixteen fatal crashes occurred within the study area between 2007 and 2011. The high crash rates in the project study area not only result in a high societal cost due to deaths, injuries and property damage, but also motorist delay as the crashes reduce the capacity of the roadway on a regular basis.

- **Many of the features of I-39/90/94 do not meet current design standards.** There are several substandard horizontal curves and vertical curves at interchanges and along the mainline. A number of bridges are in need of bridge maintenance or replacement over the next 15 years.

PROJECT BACKGROUND

Project Location

The I-39/90/94 Traffic Impact Analysis project area includes four major freeways in Dane and Columbia counties: I-39/90/94, I-94, US 151, and WIS 30. The study area begins on I-39/90 just north of the US 12/18 interchange near Madison and extends 22 miles north to the I-39/90/94 and WIS 60 interchange. Also included in the study area are I-94 from I-39/90 to WIS 73, WIS 30 from I-39/90 to US 51, US 151 from East Springs Drive to Main Street in Sun Prairie, WIS 19 from I-39/90/94 to US 51, and US 51 from I-39/90/94 to WIS 19. The four freeways provide primary connections between the cities of Madison, Monona, and Sun Prairie, and the villages of Cottage Grove, Waunakee, and DeForest. A project location map is shown in Exhibit 1.

Access is provided from I-39/90/94 to the three additional freeways within the study area through free-flow system interchanges. The study area contains a total of 15 system and service interchanges on the freeway segments and a small number of at-grade intersections on US 51 and WIS 19. The functional class for each interchange crossroad within the corridor is shown in Table 1.1.

Table 1.1: I-39/90/94 Interchanges / Crossroad Functional Class

Interchange Crossroad	Functional Classification
WIS 60 – east of I-39/90/94	Major collector
WIS 60 – west of I-39/90/94	Minor arterial
County V	Minor arterial
WIS 19 – east of I-39/90/94	Principal arterial
WIS 19 – west of I-39/90/94	Minor arterial
US 51	Principal arterial
US 151 – east of I-39/90/94	Principal arterial – freeway
US 151 – west of I-39/90/94	Principal arterial – other
High Crossing Blvd	Minor arterial
American Pkwy	Minor arterial
County C/Reiner Rd	Minor arterial
Main St – east of US 151	Principal arterial – other
Main St – west of US 151	Collector
Thompson Dr	Minor arterial
I-94	Principal arterial – interstate
WIS 30	Principal arterial – freeway
County N	Minor arterial
WIS 73	Minor arterial
US 12/18 – east of I-39/90/94	Principal arterial – other
US 12/18 – west of I-39/90/94	Principal arterial – freeway

Corridor Significance

The I-39/90/94 corridor serves as a critical north-south route in south central Wisconsin. The three Interstate Highways that run concurrently provide important connections for national, regional and local traffic. The Wisconsin tourism and freight economies depends on the I-39/90/94 corridor for regional mobility.

I-39/90/94 is part of the Dwight D. Eisenhower National System of Interstate and Defense Highways (commonly known as the Interstate Highway System). The Interstate Highway System was authorized by the Federal Aid Highway Act of 1956. The original interstate system included in the Act of 1956 was completed across the nation in 1992. I-39/90/94 is included in Wisconsin's National Highway System (NHS) under the 1991 Intermodal Surface Transportation Act (See Figure 1.1). The NHS was developed to respond to demographic and travel demand changes that have occurred in the last 40 years. Highways in the national system serve major population centers, rural areas, ports, airports, and international border crossings; meet national defense requirements and serve interstate and inter-regional travel.

I-39/90/94 is the only triple-concurrent interstate (three interstates on the same roadbed) in the country. The I-39/90/94 corridor can be thought of as the trunk of a tree. South of the corridor are the roots that spread out into southern Wisconsin, Illinois, and Iowa. North of the corridor are the branches that spread out to Northern Wisconsin, Upper Michigan, and Minnesota. Likewise, I-39/90/94 is the trunk of the interstate highway system in Wisconsin. Vehicle, freight, and tourist traffic that drive Wisconsin's economic engine depend on good mobility in this corridor.

I-39/90/94 is a 6-lane divided urban freeway throughout the study area.

I-39 is a north-south interstate that runs from Bloomington/Normal, Illinois to Wausau, Wisconsin. It was designed to replace US 51, which in the 1980's was one of the busiest two lane roads in the United States. I-39 was constructed in the 1980's and 1990's. Cities connected by I-39 include Rockford, Janesville, Madison, Portage, and Stevens Point. I-39 runs concurrently with I-90 from Rockford, Illinois to Portage, Wisconsin and with I-94 from Madison to Portage.

I-90 is the longest Interstate Highway in the United States, going through 13 states. It is an east-west highway that runs approximately 3100 miles from the Atlantic Ocean in Boston, Massachusetts to the Pacific Ocean in Seattle, Washington. In the Midwest, it runs through Chicago, Madison, and La Crosse. In Wisconsin, I-90 was constructed in the 1960's. Nationally, I-90 was completed in 1991 with the opening of the final segment in Wallace, Idaho. Much of I-90 east of the Wisconsin / Illinois border is a toll road. Because I-90 was constructed approximately 30 years prior to I-39, many Madison locals still refer to the highway as just "I-90". In fact the exit numbers on the highway still reflect the I-90 mileage rather than I-39.

I-94 is the northernmost east-west Interstate Highway connecting the Great Lakes and Intermountain regions of the United States. It was constructed in Wisconsin during the 1960's. I-94 runs from Port Huron, Michigan (east of Detroit) to Billings, Montana. East of Port Huron, the interstate becomes Canada 402 and provides the only east-west interstate highway/freeway connection to Toronto, Ontario. In the Midwest, it connects Chicago and Minneapolis, running through Milwaukee, Madison and Eau Claire. I-94 joins I-39/90 at the Badger Interchange on the east side of Madison and runs concurrently with I-39/90 to Portage and continues with I-90 to Tomah.

WIS 30 is a 4-lane divided urban freeway that provides an east-west route within Madison that provides a connection to I-39/90 and I-94 to the east. East of the Badger Interchange, I-94 is an east-west 6-lane divided urban freeway that heads to Milwaukee. East of the County N interchange, I-94 transitions to a 4-lane divided rural freeway.

US 151 is a north-south highway that connects Dubuque, Iowa and Fond Du Lac, Wisconsin, and passes through the City of Madison. South of I-39/90/94, US 151 is a 6-lane divided urban roadway with many at-grade intersections and driveways. Just west of I-39/90/94, US 151 transitions into a 6-lane divided urban freeway and continues north.

US 51 is a north-south route that travels through the center of the state of Wisconsin connecting Stoughton – Madison – DeForest – Portage among others. A segment of US 51 is included in the study area that connects I-39/90/94 to WIS 19. This portion of US 51 is a 4-lane divided rural expressway. US 51 is also the "Blue" route for I-39/90/94, which means it is used as the alternate route for interstate traffic for construction and crash events.

WIS 19 is a 4-lane divided rural roadway with several intersections and access points. WIS 19 is an east-west route that connects Sun Prairie and Waunakee. An interchange is located at the junction of US 51 and WIS 19, with free flow traffic along US 51.

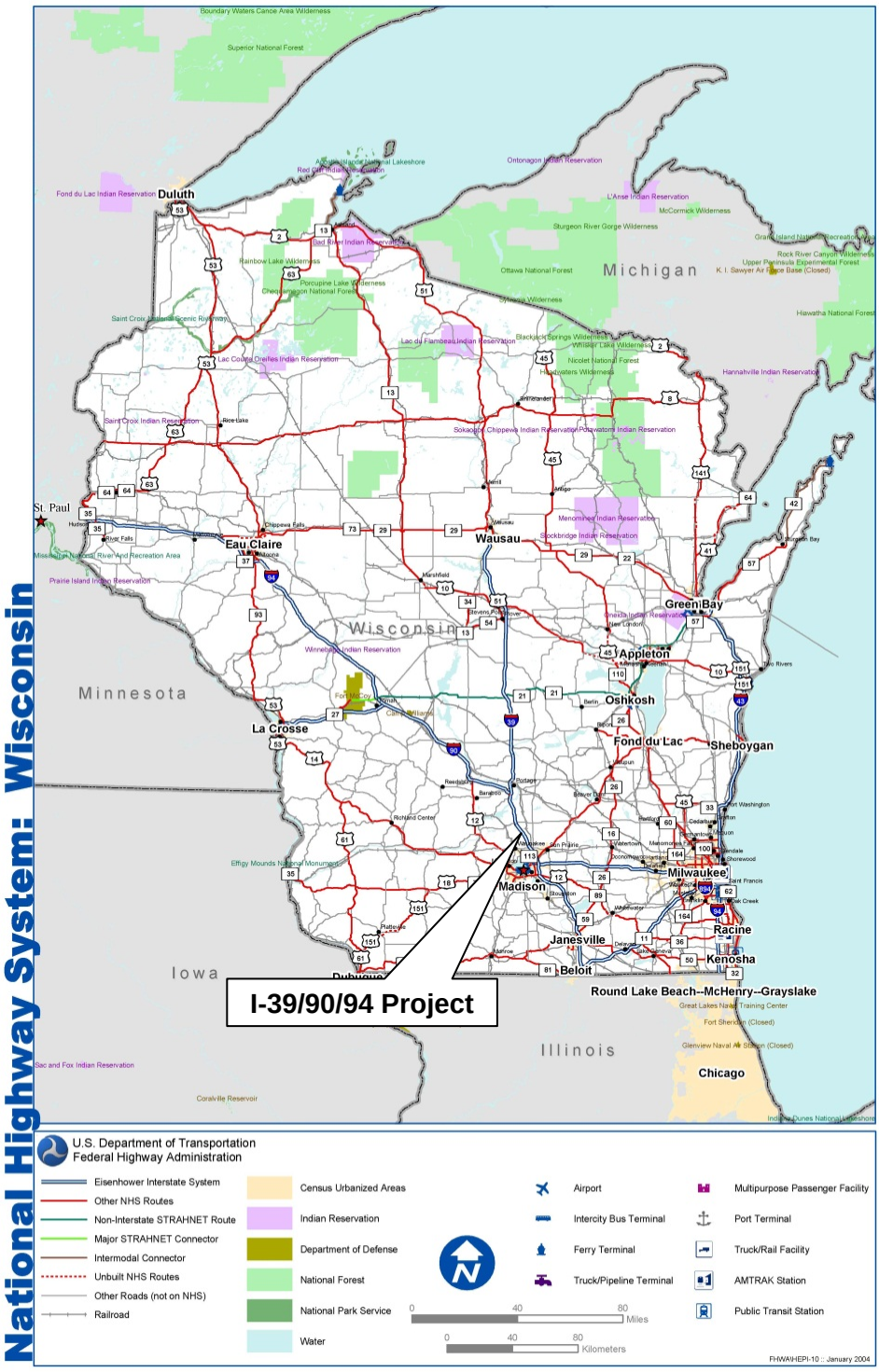


Figure 1.1: Wisconsin National Highway System

METHODOLOGY

Traffic Volumes

Mainline Traffic Volumes

Within the I-39/90/94 corridor, there are five Automatic Traffic Recorder (ATR) stations; three along I-39/90/94, one on I-94, and one on US 151. Hourly volumes were collected for all of 2012 at each of these ATR stations for the total roadway and for each direction of travel. This hourly volume data was analyzed to determine volumes to use in the existing year operations analysis.

Four analysis time periods were chosen for the mainline, which include the weekday AM, weekday PM, Friday PM and Sunday peak hours. To best analyze a real world scenario, ATR volume data was chosen from a specific date and time to represent the operational analysis time periods. A memo describing the process used to determine which specific 2012 hourly traffic volumes were chosen is attached in Appendix A.

Tube counts and other available volume data were collected for each ramp and along the mainline. Traffic volumes along the I-39/90/94 corridor mainline were balanced between interchanges for each analysis time period based on available volume data. The volumes at the ATR locations were held constant during the balancing process. The balanced existing year 2012 mainline and ramp volumes for the four analysis peak hours can be seen in Exhibit 3.

Intersection Traffic Volumes

At each of the interchanges within the corridor, intersection turning movement counts were collected at all of the ramp terminals and the adjacent intersections. Previous counts completed in 2011 or 2012 were collected. Turning movement counts were conducted at all the remaining intersections as part of this study. The date for each count performed is found in Appendix B.

Turning movement counts at each interchange were evaluated to determine an AM and PM peak hour specific to each interchange. Traffic volumes for each peak hour were balanced within each interchange. Balanced existing year 2012 peak hour traffic volumes for each interchange can be seen in Exhibit 4. The exact hour when the AM and PM peak hour occurs at each interchange is included in Exhibit 4. Friday PM and Sunday PM peak traffic was not evaluated at intersections because traffic in those time periods was similar, or significantly less than the AM and PM peak volumes.

Safety Analysis

Crash data within the I-39/90/94 corridor was collected for the five-year period from 2007 to 2011. Data was obtained from the I-94 Data Management System and the Wisconsin Traffic Operations and Safety Laboratory WisTransPortal Crash Database and Meta-Manager. The I-94 Data Management System was created as part of the I-94 Operational & Safety Needs Study, which analyzed a 288 miles of I-94 from the Minnesota border to the Waukesha County border. The I-94 Data Management System tracks geometric, traffic operations and safety information for the 288 mile I-94 corridor, which will be referred to as the greater I-94 corridor.

For the crash analysis, the corridor was divided into different influence areas. The five types of influence areas are merge, diverge, basic freeway, weave, and ramp terminal intersection. Each segment of the corridor was assigned one of the five influence area types, with no overlap in the segments. Crashes within the corridor were assigned to one of the influence areas.

Crash rates were calculated for each of these influence areas based on collected crash data and WisDOT five-year historical traffic volumes. Segment crash rates are calculated and reported as the number of crashes per one hundred million vehicle miles traveled. Ramp terminal intersection crash rates are measured in number of crashes per million entering vehicles. A figure showing the definition of the five influence areas can be found in Appendix C.

The calculated crash rates were compared to the greater I-94 corridor 2007-2011 averages for each respective influence area type. Each segment was assigned a crash rate condition rating, which range from Good to Poor to Extreme. These were developed to help identify safety issues throughout the corridor through common terms. The condition rating scale was developed based on the average crash rates within the greater I-94 corridor. Table 1.2 shows the condition rating scale for each influence area type. Locations with a crash rate less than the average are classified as Good. The greater I-94 corridor did not contain any weave influence areas. Weave influence areas have similar characteristics to merge influence areas and were therefore compared using the merge influence area averages.

Table 1.2: Influence Area Crash Rate Condition Scale

Influence Area Type	Good	Acceptable	Poor	Severe	Extreme
Freeway	< 35.4	35.4 - 60.4	60.4 - 85.3	85.3 - 110.3	> 110.3
Weave	< 53.5	53.5 - 96.6	96.6 - 139.6	139.6 - 182.7	> 182.7
Merge	< 53.5	53.5 - 96.6	96.6 - 139.6	139.6 - 182.7	> 182.7
Diverge	< 50.3	50.3 - 91.7	91.7 - 133.2	133.2 - 174.7	> 174.7
Ramp Terminal	< 0.60	0.60 - 1.02	1.02 - 1.43	1.43 - 1.84	> 1.84

Additional details on the crash analysis methodology can be found in Appendix C.

Operational Analysis

The study conducted a capacity analysis to determine existing (2012) level of service (LOS) for various sections of I-39/90/94 using Paramics microsimulation and Synchro traffic analysis software. Roadway LOS is a measure of a highway's response to the traffic demands placed on it.

Table 1.3 summarizes each LOS characteristics. Traffic factors such as peak hour volumes, truck percentages, posted speed limits, number of driving lanes, lane widths and interchange density affect the LOS. Levels range from "A" to "F" in order of decreasing quality, similar to report card grades. Levels "A", "B" and "C" are desirable, Level "D" is acceptable and Levels "E" and "F" are considered poor.

Table 1.3: Level of Service Characteristics

LOS A 	Unrestricted free flow Drivers virtually unaffected by others High level of freedom to select speed and maneuver Excellent level of driver comfort and convenience
LOS B 	Slightly restricted stable flow Drivers aware of use by others Slight restriction in speed and maneuvering Good level of driver comfort and convenience
LOS C 	Moderately restricted stable flow Driver operation significantly affected by others Moderate restriction in speed and maneuvering Fair level of comfort and convenience
LOS D 	Heavily restricted flow Driver operation completely affected by others Severe restriction in speed and maneuvering Poor level of driver comfort and convenience
LOS E 	Unstable flow (approach flow > discharge flow) Slow speeds and traffic backups; some stoppage Total restriction in vehicle maneuvering High driver frustration
LOS F 	Forced flow (approach flow > discharge flow) Stop and go movements with long backups and delay Forced vehicle maneuvers Maximum driver frustration

Source: Highway Capacity Manual 2010

Mainline Operational Analysis

Existing freeway traffic operations were analyzed using Paramics software (version 6.9.3). Paramics is a microsimulation traffic analysis software that analyzes individual vehicle interactions and is Wisconsin DOT's chosen tool for complicated freeway traffic analysis. Paramics was chosen for the project because of the complex interactions between the existing and possible new interchanges to be evaluated during the project. Paramics software outputs results that are similar, but not exactly the same as the results from the Transportation Research Board's Highway Capacity Manual 2010 (HCM 2010). To assign a level of service, the Paramics density output was compared to the HCM 2010 LOS thresholds. In order to make the comparison, appropriate adjustments were made to the Paramics results, such as truck and lane adjustments, to make them compatible with the HCM 2010 ranges.

The existing freeway layout was analyzed with existing 2012 weekday AM, weekday PM, Friday PM and Sunday peak hour traffic volumes. Origin-destination (OD) data is an important input into the Paramics model so traffic engineers can understand where people are coming from, and where they are going to. To develop the model, OD data from the Madison Metropolitan Planning Organization (MPO) accepted travel demand model was used and supplemented with field data collected as part of the Madison Beltline OD Study in 2012. OD data has become easier to collect within the last 3 years because of the emergence of Bluetooth data collection, and the model constructed for this project reflects state of the art OD accuracy.

An important element of a traffic model is how accurately it reflects existing conditions. The models developed for this study meet and exceed the rigorous standards of the WisDOT simulation guidelines and FHWA Traffic Analysis Toolbox. The model is compared with the real world on the basis of existing traffic volumes, speeds, travel times and bottleneck locations. The model is also peer reviewed by outside experts to verify the accuracy of the model for its intended application. The ability of a model to replicate existing conditions gives confidence that the same model will give good results when testing alternative designs.

The documentation for the Paramics model construction can be found in Appendix D. The documentation includes model construction parameters, comparisons of model results to existing field conditions, and comparisons of Paramics to HCM 2010 results for representative segments.

Intersection Operational Analysis

Existing intersection traffic operations at each interchange were analyzed using Synchro 8 software. Operational analysis outputs from Synchro for stop controlled and signalized intersections are based on the methodology established in the Transportation Research Board's Highway Capacity Manual 2010 (HCM 2010). The HCM 2010 does not provide LOS and delay results for channelized right turns with yield control at signalized intersections. As a result, the LOS and delay reported for this right turn lane configuration are based on The Percentile Delay Method performed by Synchro.

The existing intersection configurations were analyzed with actual volumes from specific dates that reflect 2012 AM and PM peak hour traffic volumes. The intersection traffic volume count dates are shown in Appendix B. Peak hour factors used in the analysis were calculated by intersection and the heavy vehicle percentages were calculated by approach.

OPERATIONAL ANALYSIS RESULTS

Existing Volume Trends

The study area has a wide variety of travel patterns moving through it. There are two main types of travel patterns in the corridor: recreational traffic and commuting traffic. Recreational traffic typically occurs on summer weekends and reflects that tourism is an important part of Wisconsin's economy. Commuting traffic makes up a large part of the total volume during the weekday AM and PM peak hours on all roadways studied and reflects the strong base of employment in the Madison area. In some parts of the study area, the recreational traffic represents the highest traffic volumes, and in others, the commuting traffic represents the highest traffic volumes. Data from each of the ATR locations within the corridor was collected and used to evaluate these trends within the corridor. The average daily traffic volumes for each day of the week in January and August were compared to evaluate which locations are primarily commuting roadways and which experience greater volume increases in the summer due to recreational traffic.

The I-39/90/94 ATR station between County V and WIS 60 indicated primarily recreational trends with daily traffic volumes increasing by 75% to 90% on Fridays and Sundays in the summer compared to the winter. This relationship is illustrated in Figure 1.2.

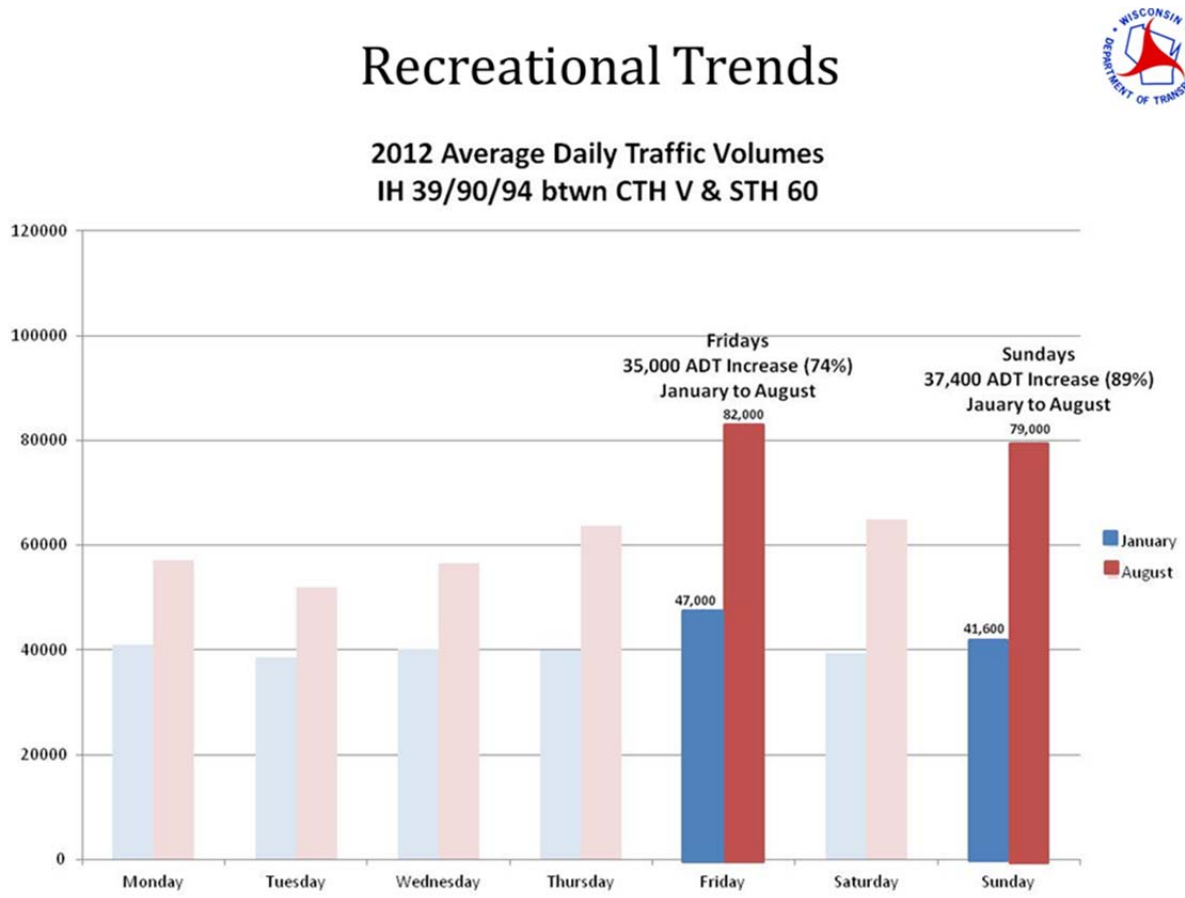


Figure 1.2: Recreational Trends – I-39/90/94 btwn County V & WIS 60

US 151 showed primarily commuter traffic patterns with the highest directional volumes occurring during the weekday AM and PM peak hours. This relationship is illustrated in Figure 1.3.

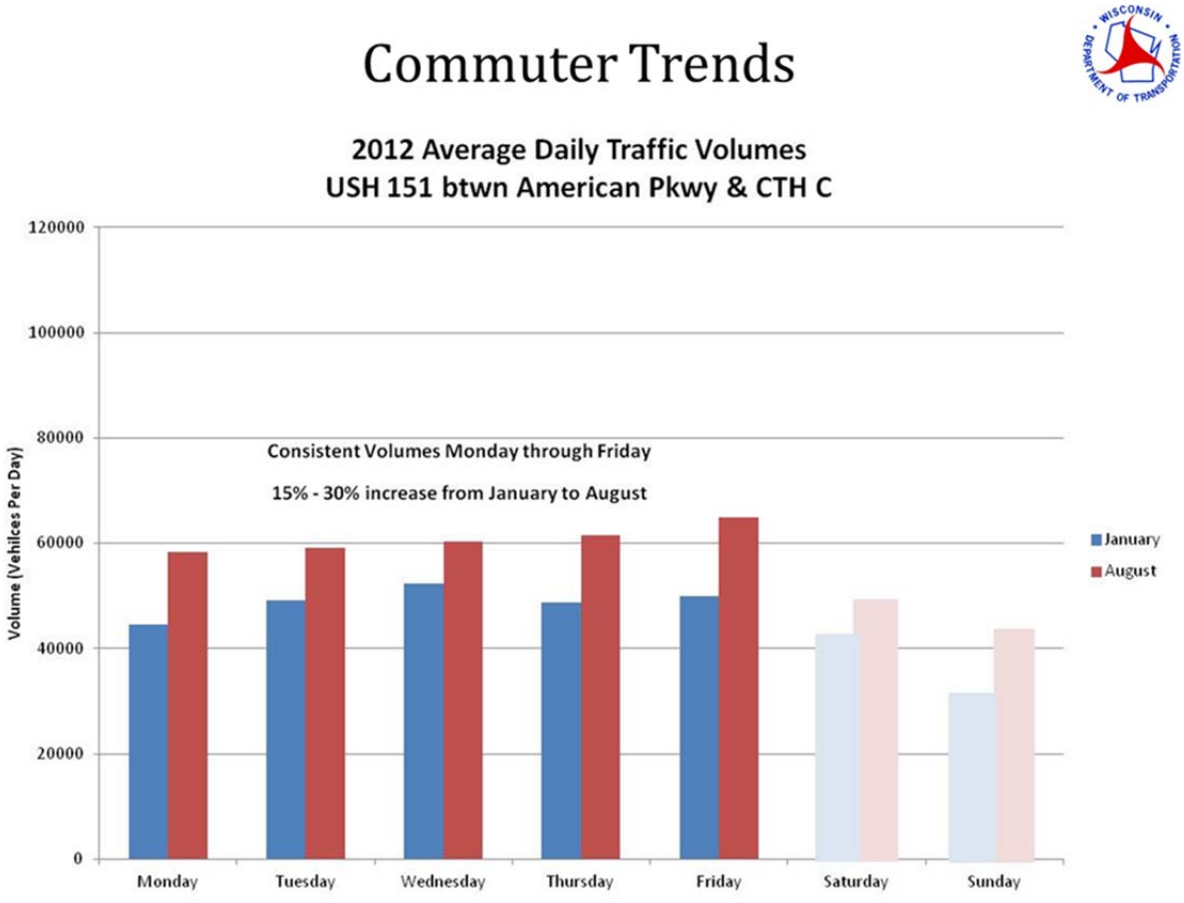


Figure 1.3: Commuter Trends – US 151 btwn American Pkwy & County C

Traffic volumes on I-39/90 in Madison between US 12/18 and I-94/WIS 30 are a combination of both commuter and recreational traffic patterns. This segment of roadway has a large amount of commuter traffic to/from the City of Madison. During the summer, recreational traffic travels through this segment, adding to the existing commuter traffic. The combination results in the segment of I-39/90/94 from US 12/18 to US 151 to experience the highest traffic volumes within the project study area. The traffic trends for this segment are illustrated in the Figure 1.4.

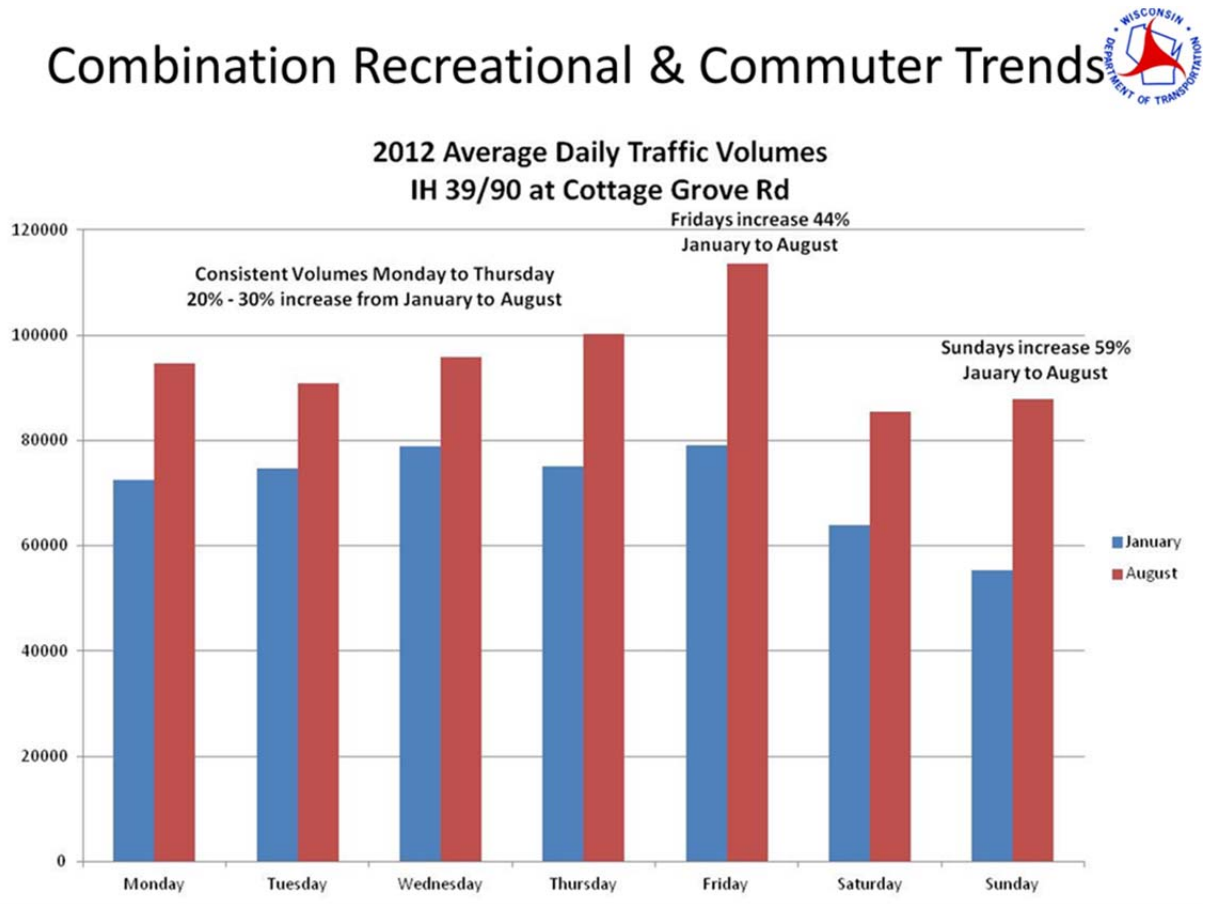


Figure 1.4: Combination Trends – I-39/90 at Cottage Grove Rd

Due to the different traffic volume trends on each freeway within the project limits, the highest hourly volumes at each ATR location occur during different peak time periods. Figure 1.5 shows the controlling time period when the highest volumes are seen in each direction at the ATR locations.

Figure 1.5: Controlling Time Periods

Because the highest peak traffic volume does not occur on all the freeways during the same time period, four time periods were used to evaluate peak volumes in the project area. The time periods include weekday AM and PM peak hours, Friday PM peak hour, and Sunday peak hour.

Since the traffic modeling requires balanced volumes throughout the model network, volumes need to be determined for each analysis time period to accurately represent that peak period. To best analyze a real world scenario, the project team chose volume data from a specific date and time to represent the analysis time periods. This method ensures that the volumes modeled are a scenario that occurred in real life and also allows the use of other available volume and travel time data from that particular day.

Table 1.4 below shows the real life days chosen to represent the peak hours and what K value is represented at the ATR locations during each time period. Traffic engineers use K values to determine the level of traffic to design a facility. The number after the K represents the rank of the hour that volume represents, out of all of the hours of the year. For instance, K30 represents the 30th highest hourly volume for the entire year and is typically used by FHWA for

design of the interstate highway system. K100 represents the 100th highest hourly volume in the entire year, and has been used by WisDOT for recreational interstate design. K250 represents the 250th highest hourly volume in the entire year, and has been used by WisDOT for freeway design in the urban Milwaukee area. The design K hour for this study has not been determined, but the 4 periods selected will give the study team the flexibility to evaluate improvement alternatives for various design hours. For more details on the selection of the peak hour traffic volumes please see Appendix A.

Table 1.4: Analysis Periods and Representative K Values

		Weekday AM Peak Hour	Weekday PM Peak Hour	Friday PM Peak Hour	Sunday Peak Hour
		THU 8/30/12 7-8 AM	TUE 11/20/12 4-5 PM	FRI 8/10/12 3-4 PM	SUN 8/19/12 2-3 PM
I-39/90 @ CG Rd	Northbound	K400	**K100**	**K30**	K1000
	Southbound	K500	**K100**	**K100**	**K30**
	Roadway	K400	**K100**	**K30**	**K250**
I-39/90/94 btwn 151 & 51	Northbound	K2200	K400	**K30**	K400
	Southbound	K1700	K550	**K250**	**K30**
	Roadway	K2000	K450	**K100**	**K30**
I-39/90/94 btwn V & 60	Northbound	K2600	K500	**K30**	**K250**
	Southbound	K1750	K700	**K250**	**K30**
	Roadway	K2300	K600	**K100**	**K30**
I-94 btwn N & 73	Eastbound	K3000	**K30**	**K250**	**K100**
	Westbound	**K100**	K1200	K350	K350
	Roadway	K800	**K250**	K150	**K100**
US 151 btwn Amer & C	Northbound	K2200	**K30**	K400	K1100
	Southbound	**K30**	K700	K750	K750
	Roadway	**K250**	**K100**	K350	K1000

Mainline Operational Analysis Results

The full results summarized on Exhibit 5 indicate that most of the freeways in the study area are operating at an acceptable level (LOS C or better). Table 1.5 shows locations that have operations that are beginning to degrade (LOS D or worse).

Table 1.5. 2012 Mainline LOS Results

Location	AM	PM	FRI	SUN	K30
NB I-39/90/94 - Between Beltline & WIS 60					
NB south of WB US 12/18 entrance	A	A	C	B	C
NB on from WB US 12/18	C	D	B	B	B
NB on from EB US 12/18	B	C	C	B	C
NB btwn WB US 12/18 entrance & WB WIS 30 exit	C	C	D	B	D
NB off to WB WIS 30	B	C	C	B	C
NB off to EB I-94	C	D	D	C	D
NB on from EB WIS 30	B	B	C	B	C
NB on from WB I-94	B	B	B	B	B
NB I-39/90/94 btwn WB I-94 entrance & US 151 C-D	B	C	D	B	D
NB off to US 151/High Crossing C-D	C	C	C*	B	C*
NB btwn C-D exit & C-D entrance	A	B	B	B	B
SB I-39/90/94 - Between WIS 60 & Beltline					
SB btwn NB US 51 entrance & US 151 C-D Exit	A	B	B	C	C
SB off to US 151 C-D	B	B	B	C	C
SB btwn C-D exit & C-D entrance	A	B	B	C	C
SB on from US 151 C-D	B	B	B	B	B
SB on from High Crossing Blvd	B	B	B	B	B
SB btwn High Crossing entrance & EB I-94 exit	B	C	C	C	C
SB off to EB I-94	B	B	B	C	C
SB off to WB WIS 30	C	C	C	B	B
SB on from WB I-94	B	B	B	B	B
SB on from EB WIS 30	B	B	B	B	B
SB btwn EB WIS 30 entrance & WB US 12/18 exit	C	C	C	C*	C*
SB off to WB US 12/18	C	C	C	C	C
SB off to EB US 12/18	A	B	B	C	C
SB south of EB US 12/18 exit	A	B	B	C	C
SB US 151 Between Main St & East Springs					
SB north of Main St exit	C	B	A	A	C
SB off to Main St	B	B	B	B	B
SB on from Main St	B	A	A	A	B
SB btwn Main St entrance & County C exit	B	A	A	A	B
SB off to County C	B	B	B	B	B
SB on from County C	B	A	A	A	B
SB btwn County C entrance & WB American Pkwy exit	C	A	A	A	C
SB off to American Pkwy	C	B	B	B	C
SB on from High Crossing Blvd	B	B	B	B	B
SB on from EB American Pkwy & off to NB I-39/90/94	C	B	B	B	C
SB on from NB I-39/90/94 & off to SB I-39/90/94	D	B	B	B	D
SB on from SB I-39/90/94	A	B	B	B	A

* Borderline LOS D

The existing traffic operations issues occur mainly in the Madison urban area on I-39/90/94 between the Madison Beltline and US 151. This area carries the highest traffic volumes in the corridor, mixing commuting and recreational traffic. All of the locations with a LOS D in the existing conditions reflect bottleneck locations with significant weaving or merging.

For northbound I-39/90/94 traffic, a significant amount of traffic is added at the Madison Beltline interchange. Roughly half of the volume on the interstate during the PM peak hour comes from the Madison beltline, which enters as two lanes, and merges to one. During the Friday PM peak, a large amount of recreational traffic is added to the normal commuting traffic creating weaving issues between the Badger interchange and US 151 interchanges. Approximately half of the traffic entering northbound I-39/90/94 from WIS 30 exits at the US 151 / High Crossing exit. This movement enters on the left side of the freeway, crosses four lanes of traffic and exits on the right. This movement creates a bottleneck for northbound traffic and represents the worst location for northbound traffic.

For southbound I-39/90/94 traffic, there is a bottleneck between US 151 and the Badger Interchange forming during the Sunday PM peak. This bottleneck is the result of recreational traffic sorting itself out onto I-94 and I-39/90, combined with the high merging volume from US 151. This bottleneck represents the worst traffic conditions seen in the existing year model. This location experienced breakdown conditions during the 2013 4th of July holiday weekend. The holiday traffic volumes at this location were slightly higher than those evaluated in the Sunday PM peak model. Reoccurring breakdowns at this location are imminent in the next few years.

For southbound US 151, the AM peak hour traffic (~1800 vehicles) destined for southbound I-39/90/94 is nearing the capacity (~2000 vehicles) of the loop ramp. This traffic needs to change lanes into the exit lane in a short distance, competing with entrance lane traffic for the same space. This location represents the worst traffic operations segment in the AM peak hour.

In summary, most of the freeways in the project area are working acceptably, with a few problem segments. These problem segments represent bottleneck locations where traffic breakdowns are expected to occur first, and then spread into adjacent segments. Bottleneck locations are like viruses that infect adjacent “healthy” segments as they get worse.

Interchange Ramp Terminal Intersection Operational Analysis Results

The results summarized in Table 1.6 indicate that most of the interchange ramp terminal intersections in the project area are operating at an acceptable level. More detailed intersection results, field observations, traffic volumes and interchange layouts are shown in Exhibit 4. HCM 2010 operational analysis reports showing all of the detailed inputs used for each intersection traffic analysis can be found in Appendix E.

Table 1.6: 2012 Interchange Ramp Terminal Intersection Operational Results

	Location	LOS		Off-Ramp Approach LOS	
		AM	PM	AM	PM
I-39/90/94 Between WIS 60 & US 12/18 Beltline					
	I-39/90/94 & WIS 60				
	SB Ramps	B	B	B	B
	NB Ramps	B	B	A	B
	I-39/90/94 & County V				
	SB Ramps	A	A	D	D
	NB Ramps	B	B	D	D
*	I-39/90/94 & WIS 19				
	SB Off Ramp	F	D	F	D
	SB On Ramp	D	C		
	NB On Ramp	B	B		
	County CV	A	B		
	NB Off Ramp	A	B	B	B
	US 51 & WIS 19				
	SB Ramps	A	B	C	C
	NB Ramps	A	A	C	C
	I-39/90/94 & US 51				
	SB Off Ramp	C	C	C	C
	NB Off Ramp	C	C	C	D
	I-39/90/94 & High Crossing Blvd				
	SB On Ramp	A	B		
	NB Off Ramp	A	A	B	B
US 151 Between Main St & East Springs Dr					
	US 151 & Main St				
	SB Ramps	C	B	C	C
	NB Ramps	B	B	B	C
*	US 151 & County C				
	SB Ramps	C	C	D	C
	NB Ramps	B	E	C	F
	US 151 & American Pkwy				
	American Pkwy & High Crossing	B	C		
	American Pkwy & East Park Blvd	C	D		
	US 151 & East Springs Dr				
	US 151 & East Springs	A	B		
WIS 30 & I-94 Between US 51 & WIS 73					
	WIS 30 & US 51				
	EB Ramps	B	B	E	E
	WB Ramps	C	C	E	E
	WIS 30 & Thompson Dr				
	EB Off Ramp	A	C	A	D
	WB On Ramp	A	B		
	I-94 & County N				
	EB Ramps	A	A	A	A
	WB Ramps	A	A	A	A
	I-94 & WIS 73				
	EB Ramps	B	C	B	C
	WB Ramps	C	C	B	B

* Improvements are planned in near future

Legend: Blue is LOS A/B, Green LOS C, Yellow is LOS D, Orange is LOS E and Red is LOS F.

The intersections that are experiencing poor operations in the 2012 analysis are:

- I-39/90 SB Ramps & WIS 19
- US 151 NB Ramps & County C
- American Parkway & East Park Blvd
- US 51 & WIS 30

At I-39/90 SB Ramps & WIS 19, and US 151 NB Ramps & County C, the existing intersection has stop sign control on the off ramp. These intersections are planned for signalization in the near future, which should address the problems at those intersections.

At US 51 & WIS 30, the Stoughton Road (US 51) Corridor study is evaluating improvements to the interchange that will be included in its environmental document.

SAFETY ANALYSIS RESULTS

Five-year crash rates (2007-2011) were computed for each influence area within the I-39/90/94 study limits and compared to the greater I-94 corridor averages. Each segment was assigned a condition rating, which range from Good to Extreme. These were developed to help identify safety issues throughout the corridor using common terms. The safety condition ratings, which are based on average crash rates for each influence area type, are shown in Table 1.7. Information on the development of the crash rate condition scale is included in the Methodology section of this report. The Safety Analysis Summary in Appendix C provides additional details on the analysis methodology and results.

Table 1.7: Safety Condition Ratings

Within the 5-year (2007-2011) crash analysis period, there were 1,809 crashes attributed to the 96 influence areas analyzed along the freeway mainline, and 706 crashes at the 28 ramp terminal intersections. Between 2007 and 2011, around 500 crashes occurred per year, which translates into about 1.4 crashes per day. The majority of crashes within the corridor were either minor injury (C severity) or property damage only. Table 1.8 shows all the crashes within the I-39/90/94 study area broken down by crash severity. A "K" crash severity represents a fatality, and A to C indicates major to minor injury respectively.

Table 1.8: Crash Severity Distribution

Mainline Crashes			Ramp Terminal crashes		
Severity	**Crashes**	**Percent**	**Severity**	**Crashes**	**Percent**
Total	**1,809**	**100%**	**Total**	**706**	**100%**
K	12	0.70%	K	4	0.60%
A	68	4%	A	20	3%
B	228	13%	B	59	8%
C	203	11%	C	137	19%
PDO	1,289	72%	PDO	486	69%

About half of the 96 mainline influence areas were rated Good with below average crash rates in comparison to the greater I-94 corridor, and approximately 90% rated Good or Acceptable. The top 15 highest crash rate mainline influence areas are shown in Table 1.9. Specific crash histories for each interchange are shown in Exhibit 6. Two interchanges were reconstructed with safety improvements during the crash analysis period from 2007 to 2011. Ramp terminals at I-94 & County N were converted from stop controlled intersections to roundabouts and all ramp lengths were increased to improve acceleration and deceleration distances. The I-39/90/94 & WIS 60 interchange was also improved by increasing the acceleration and deceleration distances on all ramps. These improvements are expected to reduce the crashes at these specific locations, but not enough time has elapsed to determine the impact on safety at these locations.

Table 1.9: Highest Mainline Total Crash Rates

	Segment Location	Interchange	Influence Area Type	Total Crash Rate*	Condition Rating	
1	SB US 151 Weave	I-39/90/94 & US 151	Weave	173.3	Severe	
2	SB I-39/90/94 Off-Ramp	I-39/90/94 & WIS 60	Diverge	143.5	Severe	**
3	WB I-94 Off-Ramp	I-94 & County N	Diverge	124.5	Poor	**
4	I-39/90 SB to US 12/18 WB Ramp	I-39/90 & US 12/18	Diverge	117.3	Poor	
5	SB I-39/90/94 On-Ramp	I-39/90/94 & US 51	Merge	107.8	Poor	
6	SB US 151 Off-Ramp	US 151 & Main St	Diverge	101.2	Poor	
7	US 12/18 EB to I-39/90 NB On-Ramp	I-39/90 & US 12/18	Merge	99.7	Poor	
8	WB WIS 30 Weave – Thompson to US 51	WIS 30 & US 51	Weave	96.7	Poor	
9	SB US 151 On-Ramp	US 151 & American Pkwy	Merge	89.7	Acceptable	
10	SB US 51 On-Ramp	US 51 & WIS 19	Merge	87.9	Acceptable	
11	SB I-39/90/94 On-Ramp	I-39/90/94 & WIS 60	Merge	85.5	Acceptable	**
12	NB US 151 Off-Ramp	US 151 & American Pkwy	Diverge	82.6	Acceptable	
13	I-39/90/94 SB to US 151 SB Ramp	I-39/90/94 & US 15	Merge	82.5	Acceptable	
14	WB WIS 30 Weave – US 51 to Fair Oaks	WIS 30 & US 51	Weave	76.0	Acceptable	
15	I-39/90/94 SB to I-94 EB Ramp	I-39/90 & WIS 30/I-94	Merge	75.0	Acceptable	

* Crash rates are listed in crashes per hundred million vehicle miles traveled (Crashes/HMVMT)
** Interchange under construction during part of 2007-2011 crash analysis years

Of the 28 ramp terminal intersections, 15 were rated Good, and 23 were rated Good or Acceptable. The top 10 ramp terminals with the highest total crash rates are shown in Table 1.10. Detailed crash histories for each interchange can be seen in Exhibit 6.

Table 1.10: Highest Ramp Terminal Total Crash Rates

	Intersection	Total Crash Rate*	Condition Rating	
1	WIS 30 & US 51 - SB Ramps	1.81	Severe	
2	I-39/90/94 & County V - SB Ramps	1.34	Poor	
3	WIS 19 & County CV	1.34	Poor	
4	WIS 30 & Thompson Dr - WB Ramp	1.31	Poor	
5	I-94 & WIS 73 - EB Ramps	1.05	Poor	
6	US 51 & WIS 19 - NB Ramps	0.98	Acceptable	
7	US 151 & American Pkwy - NB Ramps	0.85	Acceptable	
8	I-39/90/94 & WIS 60 - SB Ramps	0.82	Acceptable	**
9	I-39/90/94 & WIS 19 - SB Ramps	0.79	Acceptable	
10	US 151 & American Pkwy - SB Ramps	0.79	Acceptable	

* Crash rates are listed in crashes per million entering vehicles (Crashes/MEV)
** Interchange under construction during part of 2007-2011 crash analysis years

BICYCLE AND PEDESTRIAN ACCOMMODATIONS

Table 1.12 summarizes the existing bicycle and pedestrian accommodations at each of the interchanges within the corridor. The existing accommodations have been evaluated to determine if they meet Trans 75, which is the Wisconsin statute for bicycle and pedestrian accommodations along roadways. Table 1.12 has been color coded using the scale shown in Table 1.11 to identify where improvements could be made using the color scheme shown below.

Table 1.11: Existing Bicycle and Pedestrian Accommodation Ratings

Meets Trans 75

Meets Trans 75, but improvements could be made

Does not meet Trans 75

Table 1.12: Existing Bicycle and Pedestrian Accommodations

Interchange	Existing Bicycle Accommodations	Existing Pedestrian Accommodations
I-39/90/94 & WIS 60	• None	• None
I-39/90/94 & County V	• 5 ft. designated bike lane along EB and WB County V from Hickory Ln to Morrisonville Rd	• Sidewalk along north side of County V from Hickory Ln to Morrisonville Rd • Sidewalk along south side of County V from I-39/90/94 SB ramp to Morrisonville Rd
I-39/90/94 & WIS 19	• None	• None
US 51 & WIS 19	• 6 ft paved shoulder along EB and WB WIS 19	• None
I-39/90/94 & US 51	• 6 ft paved shoulder along SB and NB US 51 between Token Creek Ln and I-39/90/94	• None
I-39/90/94 & US 151	• 9 ft paved shoulder along EB US 151 • 7 ft paved shoulder along WB US 151	• None
I-39/90/94 & High Crossing Blvd	• 6 ft designated bike lane along both sides of High Crossing Blvd between E Springs Dr and Crossroads Dr	• Sidewalk along south side of High Crossing Blvd between E Springs Dr and Crossroads Dr • Sidewalk along north side of High Crossing Blvd between E Springs Dr and I-39/90/94
US 151 & American Pkwy	• 5 ft paved shoulder along both sides of American Pkwy from Eastpark Blvd to High Crossing Blvd	• Sidewalk along both sides of American Pkwy from Eastpark Blvd to High Crossing Blvd
US 151 & County C/ Reiner Rd	• 6 ft paved shoulder along both sides of County C/Reiner Rd from O'Keeffe Ave to Brooks Dr	• Sidewalk along NB County C/Reiner Rd from O'Keeffe Ave to Brooks Dr
US 151 & Main St	• 10 ft multi-use path along north side of Main St between N Thompson Dr and O'Keeffe Ave	• Sidewalk along south side of Main St between US 151 ramps • 10 ft multi-use path along north side of Main St between N Thompson Dr and O'Keeffe Ave
I-39/90 & I-94/WIS 30	• None	• None
I-39/90 & US 12/18	• None	• None
WIS 30 & US 51	• None	• None
WIS 30 & Thompson Dr	• 8 ft path along both sides of Thompson Dr between the roundabouts	• 8 ft path along both sides of Thompson Dr between the roundabouts
I-94 & County N	• 6 ft paved shoulder along roadways and multi-use path through the roundabouts	• Sidewalk along east side of County N from Gaston Rd to I-94 EB ramps roundabout • 10 ft multi-use path along both sides through the roundabouts
I-94 & WIS 73	• None	• None

EXISTING PHYSICAL CONDITIONS

Existing Grade Separated Crossings

There are 19 existing grade separated crossings within the I-39/90/94 study area. All of these roadways cross one of the interstates in the corridor. No roadways cross WIS 30 or US 151 within the study area. Table 1.13 lists all the existing grade separated crossings and their existing 2012 traffic volumes.

Table 1.13: Existing Grade Separated Crossings

Freeway	Between Interchanges	Grade Separated Crossing	Existing 2012 AADT
I-39/90/94	WIS 60 & County V	County K	270**
		Patton Road	204
		County DM	724
		County I	1,904
I-39/90/94	County V & WIS 19	Cuba Valley Road	980
		River Road / Windsor Road	2,700
I-39/90/94	US 51 & US 151	Hoepker Road	4,430
		Hanson Road	3,124*
I-39/90/94	US 151 & WIS 30	Lien Road	8,667*
		County T	7,055
I-94	I-39/90 & County N	Sprecher Road	9,676*
		Gaston Road	2,233
I-94	County N & WIS 73	Baxter Road	537
		Ridge Road	219
		Oak Park Road	371
I-39/90	I-94/WIS 30 & US 12/18	Milwaukee Street	15,598*
		County BB (Cottage Grove Road)	16,911*
		County AB (Buckeye Road)	7,485*
		Femrite Drive	3,500

*Average Annual Weekday Traffic (AAWT) Count
**Traffic Count from 2009

Existing Roadway Geometrics

The analysis and evaluation of existing conditions satisfies a number of objectives. First, it identifies the extent of substandard freeway elements that are a result of revised policies or design standards since the feature was initially constructed. Second, it highlights the area where operational problems and crash frequency may be prevalent, and it provides the opportunity to determine whether the problems are attributable or related to geometric design. Third, it identifies features of the freeway system that currently meet only minimum design

standards, which if incorporated into the overall rehabilitation or short-term "fix," could be improved to full standard at marginal additional cost in some cases.

The geometrics investigation was completed along the I-94 mainline within the study area. This includes 35 miles of mainline along I-39/90/94 from WIS 60 to the I-94/WIS 30 interchange and I-94 east to WIS 73. Eight interchanges on I-94 were included in the investigation. The analysis was completed for this portion of the study area because it is included in the I-94 Data Management System, which was used to identify substandard geometric features. A separate geometric analysis was completed for the I-39/90 freeway section between the Badger and US 12/18 Beltline interchanges, which is not included in the I-94 Data Management System. The analysis found no deficiencies in horizontal, vertical, or cross section elements. The 13 controlling criteria identified in the WisDOT Facilities Development Manual (FDM) chapter 11-1-2.3 were used to determine the critical data to be collected and applying condition ratings. Data was collected within the following mainline geometric categories:

1. Horizontal alignment
2. Vertical curves
3. Vertical tangent grades
4. Lane and shoulder widths
5. Roadway cross slope
6. Pavement Condition
7. Entrance ramp tapers and deceleration lengths
8. Exit ramp tapers and acceleration lengths
9. Side Slopes

Condition ratings, which range from Good to Extreme, were developed for to help identify substandard geometrics within the corridor. The development of the rating thresholds are based on a combination of design speed and current desirable and minimum standards, depending on the geometric feature. The condition rating thresholds for each geometric feature can be found in Appendix F.

The overall results show in general the I-39/90/94 study corridor has good geometric design standards, meeting current desirable standards. This reflects the forethought of the designers of the original interstate system to construct the system to a high standard level.

Horizontal Curves

Data was collected for 43 horizontal curves along mainline I-39/90/94 and I-94. One horizontal curve was rated Severe and no curves were rated Poor or Extreme. The one mainline substandard horizontal curve was located within the Badger interchange. The location of the substandard curve is shown in Figure 1.6.

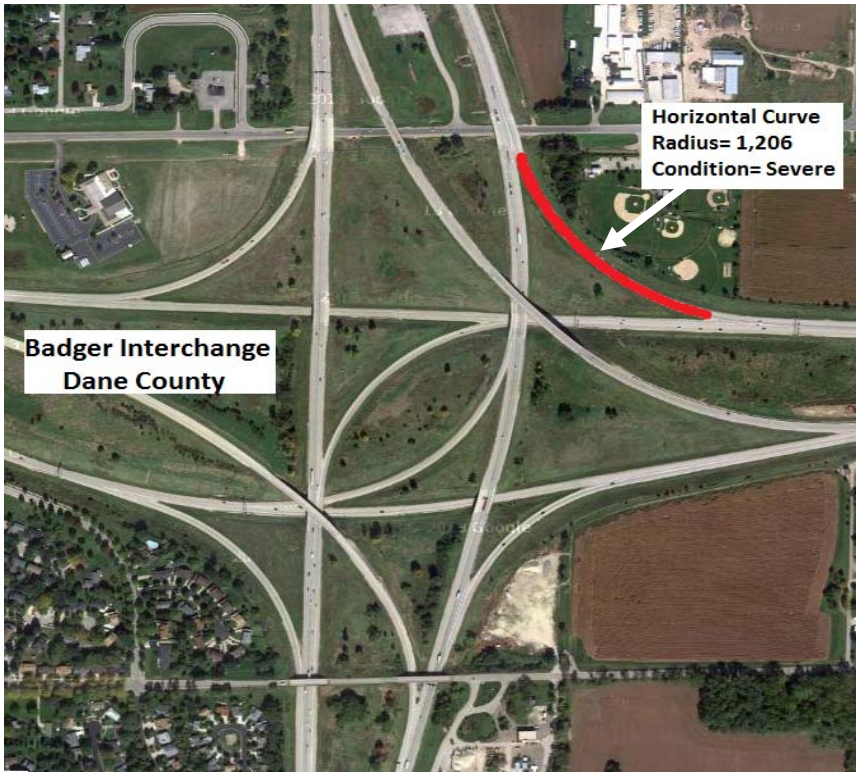


Figure 1.6: Location of Substandard Mainline Horizontal Curve

Data was collected for 58 horizontal curves located along ramps. A total of 21 horizontal curves were found to be substandard, four rated Poor, eight rated Severe, and nine were rated Extreme. All of the deficient horizontal curves are located along the ramps of two interchanges, I-39/90/94 & US 51 and I-39/90/94 & US 151.

Vertical Curves

Data was collected for 156 vertical curves within the study area along mainline I-39/90/94 and I-94. Nine crest vertical curves and two sag vertical curves were found to be substandard. These vertical curves are listed in Table 1.14. The two crest vertical curves with an Extreme condition rating are located within the Badger Interchange, one of which is at the same location as the substandard horizontal mainline curve.

Data was also collected for ten vertical curves along ramps. Four of the vertical curves were rated Severe, and two of which are crest curves and the other two being sag curves. The ramp deficient vertical curves occur along the I-39/90/94 & US 151 interchange ramps.

Table 1.14: Substandard Mainline Vertical Curves

Location	Curve Type	Condition Rating	Desirable K-Value	Actual K-Value
WB I-94 to NB I-39/90/94	Crest	Extreme	314 to 401	146
SB I-39/90/94 to EB I-94	Crest	Extreme	314 to 401	77
WB I-94 after WIS 73 exit	Crest	Severe	314 to 401	237
SB I-39/90/94 to EB I-94	Crest	Severe	314 to 401	230
SB I-39/90/94 to EB I-94	Crest	Severe	314 to 401	185
EB I-94 between WIS 73 ramps	Crest	Poor	314 to 401	280
EB I-94 after Oak Park Rd overpass	Crest	Poor	314 to 401	270
WB I-94 before Oak Park Rd overpass	Crest	Poor	314 to 401	287
WB I-94 after WIS 73 exit	Crest	Poor	314 to 401	280
SB I-39/90/94 to EB I-94	Sag	Poor	314 to 401	136
SB I-39/90/94 to EB I-94	Sag	Poor	314 to 401	144

Vertical Tangent Grades

Vertical tangent grade data was collected for 125 segments of mainline I-39/90/94. All of the 125 segments were rated as good.

Lane and Shoulder Widths

Lane and shoulder width data was collected for 50 segments on mainline I-39/90/94 and I-94. All of the 50 locations have a condition rating of Good.

The original typical section for mainline interstate construction used some design values that are now considered deficient. Table 1.15 provides a summary of typical section standards comparing the original construction to current interstate standards.

Table 1.15: Interstate Typical Section Standards

Geometric Design Standard	Original I-Standards	Current I-Standards
Travel Lane Cross Slope	1.00%	2.00%
Shoulder Cross Slope	4.20%	4.00%
Left (Median) Shoulder Width (4-Lane)	5 feet	6 feet
Shoulder Foreslope	4:1	6:1
Clear Zone–Outside	22 feet 1 inch min. 29 feet 1 inch desirable	30 to 34 feet with 6:1 slope 38 to 46 feet with 4:1 slope
Paved Shoulder–Outside (4-Lane, Truck traffic < 250 DHV)	7’	10’
Paved Shoulder–Inside (4-Lane)	3’	4’

One standard that has remained is the 12-foot-wide travel lane. Most of the original interstate standards that are now considered deficient have been corrected through resurfacing and rehabilitation projects. Improvements have included increasing the pavement cross slope to 2 percent, widening the median shoulder to 6 feet, and paving the shoulders to current width standards. However, often these projects did not complete grading outside of the base course shoulders, creating shoulder foreslopes steeper than 4:1.

Roadway Cross Slope

Roadway cross slope data was collected for 17 segments of mainline I-39/90/94 and I-94. None of these segments had a rating of Poor, Severe, or Extreme. Six segments received a rating of Good, and eleven segments received a rating of Acceptable.

Pavement Condition

Pavement condition in the study corridor is in good condition. Pavement ratings were obtained from the I-94 Data Management System for 57 miles of mainline, inclusive of both directions, for I-39/90/94 and I-94. The average International Roughness Index (IRI) for the pavement sections was 1.6 (good). An IRI of zero represents a perfectly smooth pavement and values over 5.0 are very rough. Typical Pavement Condition Index (PCI) ratings were favorably ranked from 85 to 100. Regular routine maintenance is recommended to preserve the quality of the pavement. About 75% of the pavement is less than 10 years old. The latest pavement rehabilitation project in the corridor was an asphalt overlay completed in 2013 on I-39/90/94 between the Badger and US 51 interchanges, and in 2014 between the US 51 and County V interchanges.

Entrance Ramp Acceleration Lengths

Entrance ramp acceleration length data was collected for 16 entrance ramps to mainline I-39/90/94 and I-94. Two segments resulted in Poor ratings, both of which are located at the I-39/90/94 & US 51 interchange. The Acceleration Length for both of these ramps was found to be 550 ft. The desirable acceleration length is 1,200 ft.

Exit Ramp Deceleration Lengths

Exit ramp deceleration length data was collected for 14 exit ramps from mainline I-39/90/94 and I-94. The data collected showed 12 ramps with a rating of Good, and 2 ramps with a rating of Acceptable.

Side Slopes

A majority of the study corridor contains side slopes and clear zones that do not meet current design standards. Construction of the original interstate typically used a combination of 4:1 and 10:1 foreslopes for a minimum distance of 22 feet and a desirable distance of 29 feet from the edge of travel lane. Nearly all of the subsequent overlay constructions did not include grading of the existing side slopes and showed the new base course foreslope matching at the existing subgrade intercept. Theoretically, this increased the base course foreslopes to be steeper than 4:1, but still flatter than 3:1.

One section of the study corridor was reconstructed in 2011, which included complete reconstruction of the roadway, 6:1 side slopes, and 30 foot clear zones. This section extends 5.2 miles along I-94 from the I-39/90 & WIS 30 interchange to the County N interchange.

Existing Bridges

Fifty four bridges are located along the I-39/90/94 and I-94 corridor. Current sufficiency ratings were determined for each of the bridges. A sufficiency rating between 80 and 50 qualifies the bridge for federal rehabilitation funding. A bridge is eligible for federal bridge replacement funding with a sufficiency rating of 50 or less. Table 1.16 lists the bridges that qualify for federal replacement funding (red) and federal rehabilitation funding (orange).

Table 1.16: Bridges Eligible for Federal Funding

Structure	Sufficiency Rating	Feature On	Feature Under
B-13-100	21.1	Hoepker Rd	I-39/90/94
B-13-089	43.3	River Rd	I-39/90/94
B-13-131	58.9	Milwaukee St	I-94 WB
B-13-155	60.9	Baxter Rd	I-94
B-11-015	63.1	SB I-39/90/94	WIS 60
B-13-157	65.5	Oak Park Rd	I-94
B-11-017	66.0	County K	I-39/90/94
B-13-087	66.0	SB I-39/90/94	Cuba Valley Rd
B-13-159	67.0	WB I-94	WIS 73
B-13-158	67.0	EB I-94	WIS 73
B-13-088	67.0	NB I-39/90/94	Cuba Valley Rd
B-11-016	67.0	NB I-39/90/94	WIS 60
B-13-085	73.9	County DM	I-39/90/94
B-11-018	75.4	Patton Rd	I-39/90/94
B-13-156	76.5	Ridge Rd	I-94
B-13-103	76.6	NB I-39/90/94	US 151
B-13-102	76.6	SB I-39/90/94	US 151
B-13-093	79.6	SB I-39/90/94	CMSTP&P RR

Six additional bridges are located between the Badger and US 12/18 Beltline interchange. These bridges have sufficiency ratings from 80.0 to 98.0. The lowest rated bridge in this section is B-13-112 on Cottage Grove Rd over I-39/90 with a rating of 80.0.

SUMMARY

Three major areas were documented in this memo: traffic operations, safety, and physical conditions. In general, the freeways in the study area are currently in good shape with the following problems identified in the corridor:

- **Bottlenecks in traffic are forming.** There are bottlenecks on I-39/90/94 between the Madison Beltline and US 151. While these locations currently are operating at an acceptable level in the design hours, they experience breakdown conditions during peak holiday weekends, such as the 4th of July, Memorial Day and Labor Day (top 10 traffic volume hours of the year).
- **Crashes exceed statewide average.** Between 2007 and 2011, there were 12 fatal crashes and 68 incapacitating injury crashes. More than one person a month is killed or permanently incapacitated in this corridor. Approximately 500 crashes occurred per year, which translates into about 1.4 crashes per day. In addition to the social effect of these crashes, they also create traffic congestion due to lane closures and clearing the incidents.
- **The physical system is reaching the end of its intended life.** The freeway was constructed for a 50 year design life, using standards from the 1960's. The structures in the corridor are showing signs of their age and need rehabilitation. Several locations in the corridor have geometric designs that are now consider substandard.

SECTION 2

Traffic Forecasting

EXHIBITS

APPENDICES

INTRODUCTION

This section documents the process and results followed to develop the year 2050 No-Build traffic forecast used for 2050 No-Build and Baseline traffic operational analysis. An unconstrained year 2050 No-Build traffic forecast was developed for the AM, PM, Friday PM, and Sunday PM peak hours. The forecast was developed using AADT forecasts from WisDOT Traffic Forecasting Section (TFS) as well as the October 2013 Dane County Travel Demand Model (TDM). The TDM was unconstrained by assuming an extra lane on the interstate in order to estimate the full traffic demand for the interstate. Updates to the socio-economic data and highway network within the Dane County TDM occurred prior to AADT forecasting. The peak hour forecasts were then developed based on the balanced 2050 AADT volumes. The traffic forecasts developed were used in future year 2050 traffic operational analysis described in Section 3, Tier 1 screening described in Section 4, and Tier 2 Screening evaluations described in Section 5.

YEAR 2050 NO-BUILD TRAFFIC FORECAST

The October 2013 version of the Dane County TDM was used to represent existing travel conditions in Dane County and was used to develop future year 2050 traffic forecasts. This version is prior to the time-of-day model that was under development and not yet approved during the TIA. The October 2013 version of the TDM has a year 2050 population control total about 36,000 higher than the new time-of-day model. Using a higher population in the TDM makes the traffic forecasts in the TIA conservative and analysis useful for years beyond 2050. Updates were made to the Dane County TDM, including existing and future socio-economic data and changes to the highway network. Year 2050 No-Build AADT forecasts were developed using I-94 forecasts from WisDOT TFS and the Dane County TDM. These volumes were used to develop unconstrained year 2050 No-Build peak hour volumes for the AM, PM, Friday PM, and Sunday PM periods. More detailed information describing the process followed to develop the year 2050 No-Build traffic forecast is included in Appendix G.

Dane County Travel Demand Model Updates

<u>Socio-Economic Data</u>

The socio-economic data was updated in the Dane County TDM based on data collected through meetings with local municipalities and coordination with the Madison Area Transportation Planning Board (TPB) and City of Madison planning staff. Meetings were held with the Madison Area TPB, City of Madison, City of Sun Prairie, Village of DeForest, and Village of Cottage Grove to discuss future land uses, planned developments, phasing, and density of development. Prior to the meetings, existing Traffic Impact Analysis reports that have previously been submitted to WisDOT were reviewed to identify planned developments within the area. Several developments were identified in the DeForest and East Madison / Sun Prairie areas and are shown in Exhibit 7. The neighborhoods within the City of Madison were also identified and are shown in Exhibit 8. Meeting minutes and associated documentation is attached in Appendix H.

The information collected was used in the development of socio-economic data for the years 2010 and 2050. The 2010 socio-economic data consisted of existing land use, household and population data, employment locations, and employee estimates. The data was developed using information from the local municipalities as well as other household and employment data sources such as the US Census and InfoUSA. The Dane County TDM was updated by allocating the land use, household, employment, and population data to the newly created Traffic Analysis Zones (TAZs) within the model.

The Dane County TDM is split into TAZs, each of which is assigned individual socio-economic data based on the existing or future land use and development. This includes the density of households, employment, type of land use (residential, commercial, industrial, etc) as well as other data. The Dane County TDM then uses the assigned data in each TAZ to allocate trips throughout roadway network within the model.

The 2050 socio-economic data was developed by applying available future growth and development information to the 2010 socio-economic data. Future land use plans were incorporated into the Dane County TDM and used as a base for anticipated growth and land use type. The existing and anticipated future City and Village boundaries are shown in Exhibit 9. The future land use maps used to build the 2050 socio-economic data are included in Appendix I.

The Wisconsin Department of Administration (WisDOA) year 2035 projections for population and households were applied to the 2010 data to develop 2050 population and household data. The Woods & Poole industry growth rate percentages were applied to the 2010 employment data to project the 2050 employment numbers. Through coordination with the Madison Area TPB and the City of Madison, the projected 2050 household, population, and employment numbers were evaluated and adjusted based on review of developable acreage, local development plans and outreach with local communities.

Table 2.1 summarizes the population, household, and employment data that was implemented in the Dane County TDM for this study. The October 2013 version of the TDM used during the TIA has a year 2050 population control total about 36,000 higher than the new time-of-day model.

Table 2.1: Dane County Control Totals Used for TIA Study

Model	Population	Households	Employment			
			Retail	Service	Other	Total
Year 2010	488,073	203,750	34,229	205,157	71,084	310,470
Year 2050	729,347	320,792	51,795	298,180	133,308	483,283
Growth 2010-2050	241,274	117,042	17,566	93,023	62,224	172,813
Percent Increase	49.40%	57.40%	51.30%	45.30%	87.50%	55.70%
Growth Rate 2010-2050	1.20%	1.40%	1.30%	1.10%	2.20%	1.40%

Dane County Highway Network

The highway network within the Dane County TDM was reviewed for TAZ connectivity, functional classification, travel lanes, and travel speeds. The highway system was updated to include recent improvement projects. Additional detail was incorporated into the travel demand model to improve representation of current and future conditions.

For this project, the Dane County TDM was used to represent the year 2050 Existing and Committed network. To develop the year 2050 Existing and Committed network, a list of committed and planned improvements was compiled. The list was based on improvements identified in the Madison Area TPB's 2013-2017 Transportation Improvement Program, Regional Transportation Plan 2035, and studies within the I-39/90/94 TIA study area. A list of the planned improvements that were incorporated in the 2050 Existing and Committed network is included in Appendix J.

Committed improvements incorporated into the model also include:

- I-39/90 expansion to 6-lanes from the Dane / Rock County line to US 12/18
- US 51 expansion to 4-lanes and freeway conversion from WIS 19 to County V

Year 2050 No-Build AADT Traffic Forecast

Year 2050 No-Build AADT forecasts were prepared by WisDOT Traffic Forecasting Section (TFS) for the I-94 corridor from WIS 67 in Oconomowoc, WI to the Wisconsin / Minnesota State Line near Hudson, WI. This forecast includes a majority of the I-39/90/94 TIA study area extending along I-39/90/94 from the Badger Interchange to WIS 60 and included freeway mainline and ramp AADT volumes. The I-94 corridor forecast from WisDOT TFS is attached in Appendix K. The WisDOT TFS AADT forecast was used for this portion of the I-39/90/94 TIA study area and the Dane County TDM was used to supplement the forecast and develop a balanced set of AADT volumes for the remainder of the study area and intersecting arterials. The Dane County TDM used to develop the year 2050 No-Build AADT traffic forecast had a version date of February 2014.

The 2050 No-Build forecast includes all the committed and planned highway improvements incorporated into the year 2050 Existing and Committed model. Table 2.2 provides a summary of the year 2050 No-Build AADT forecasts for all mainline segments and intersecting arterials within the study area. The areas shaded in gray were provided by WisDOT TFS and the remaining were developed using the Dane County TDM.

AADT's along I-39/90/94 are expected to grow by an average of 1.4% per year and range from 82,000 to 132,000 vehicles per day. Traffic along the US 151 and I-94 corridors, which serve as commuting corridors for suburban communities, are expected to grow at approximately 1.5% per year or greater. Five locations were forecasted to have growth rates exceeding 3.0% per year, shown in red text in Table 2.2. Each of these locations was evaluated to verify the anticipated growth rate for reasonableness. Local development and growth in the nearby municipality influenced these growth rates, as well as the expansion and freeway conversion of US 51, north of WIS 19.

Throughout the corridor, WIS 60 is the only roadway located within Columbia County, which is not included in the Dane County TDM. As a result, an annual growth rate of 1% was applied to the existing WIS 60 AADT to estimate the year 2050 AADT volumes.

Figure 2.1 displays the existing 2012 and future 2050 no-build AADT volumes along the corridor. The 2050 AADT forecasts for the mainline, ramps, and arterials within the study area can also be seen in Appendix L.

Traffic volumes along I-39/90/94 are anticipated to grow at a rate greater than the 1.2% population growth within Dane County. A significant amount of population and employment growth is anticipated within the east side of the City of Madison, City of Sun Prairie, Village of DeForest, and Village of Cottage Grove. These communities are located along the I-39/90/94 corridor, causing the volumes along I-39/90/94 to grow faster than the average population growth.

Volumes along WIS 30 are anticipated to increase between 2.0% and 2.2% per year, which is a higher rate than I-39/90/94. WIS 30 provides a freeway route into downtown Madison, which is a highly concentrated employment area, drawing traffic from the growing communities east of Madison.

Table 2.2: I-39/90/94 TIA Corridor AADT Forecast Summary

Location	Existing 2012 AADT	AADT Growth	Year 2050 AADT	Percent Growth	Difference Ave. Growth
I-39/90/94					
N of WIS 60	52,800	28,900	81,700	54.7%	1.4%
N of County V	52,900	30,000	82,900	56.7%	1.5%
N of WIS 19	51,700	32,500	84,200	62.9%	1.7%
N of US 51	62,400	33,500	95,900	53.7%	1.4%
N of US 151	58,500	29,800	88,300	50.9%	1.3%
N of Badger Int.	88,400	43,800	132,200	49.5%	1.3%
N of Beltline Int.	84,500	44,700	129,200	52.9%	1.4%
US 151					
S of I-39/90/94	42,400	18,700	61,100	44.1%	1.2%
N of I-39/90/94	61,700	41,800	103,500	67.7%	1.8%
N of American Pkwy	54,500	32,400	86,900	59.4%	1.6%
N of County C	48,200	22,250	70,450	46.2%	1.2%
N of Main St	35,800	23,850	59,650	66.6%	1.8%
I-94/WIS 30					
W of US 51	29,700	25,300	55,000	85.2%	2.2%
W of Thompson Dr	37,700	30,950	68,650	82.1%	2.2%
W of I-39/90	28,000	21,800	49,800	77.9%	2.0%
W of County N	41,300	27,500	68,800	66.6%	1.8%
W of WIS 73	38,500	21,900	60,400	56.9%	1.5%
E of WIS 73	33,500	18,000	51,500	53.7%	1.4%
US 51					
N of WIS 19	18,500	7,000	25,500	37.8%	1.0%
N of I-39/90/94	20,100	10,500	30,600	52.2%	1.4%
S of I-39/90/94	16,200	21,350	37,550	131.8%	3.5%
N of WIS 30	41,500	12,950	54,450	31.2%	0.8%
S of WIS 30	50,000	15,000	65,000	30.0%	0.8%
WIS 19					
W of I-39/90/94	15,500	11,350	26,850	73.2%	1.9%
E of I-39/90/94	20,000	12,200	32,200	61.0%	1.6%
E of US 51	14,500	18,400	32,900	126.9%	3.3%
WIS 60					
W of I-39/90/94	4,500	1,700	6,200	37.8%	1.0%
E of I-39/90/94	2,500	950	3,450	38.0%	1.0%
WIS 73					
N of I-94	5,000	3,500	8,500	70.0%	1.8%
S of I-94	4,000	5,000	9,000	125.0%	3.3%
County V					
W of I-39/90/94	7,200	7,900	15,100	109.7%	2.9%
E of I-39/90/94	11,200	5,750	16,950	51.3%	1.4%
County N					
N of I-94	8,700	19,150	27,850	220.1%	5.8%
S of I-94	10,800	15,800	26,600	146.3%	3.8%

#.#% Location with greater than 3% average growth

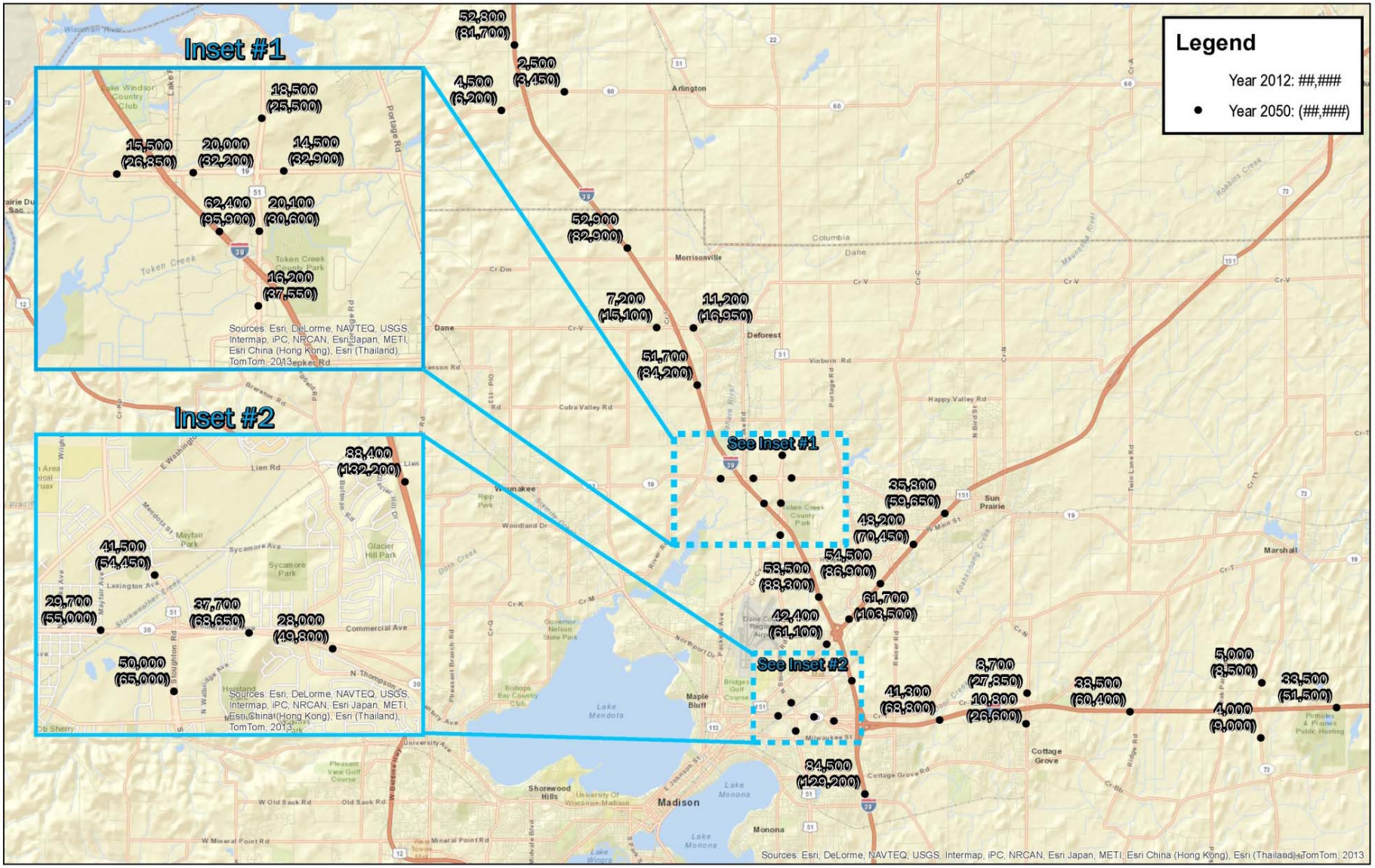


Figure 2.1. Existing Year 2012 and Future Year 2050 No-Build AADT Volumes

Year 2050 No-Build Peak Hour Forecasts

Year 2050 No-Build peak hour forecasts were developed for the AM, PM, Friday PM and Sunday PM peak hours based on the forecasted AADT's. The peak hour forecasts included hourly volumes for the mainline, ramps, local arterials, and intersection turning movements.

Existing 2012 balanced peak hour forecasts were previously developed for the AM, PM, Friday PM and Sunday PM peak periods. To develop the year 2050 No-Build peak hour volumes, a peak hour specific K-factor was calculated for each ramp and mainline segment by direction. A K-factor is calculated by dividing the hourly volume by the AADT at that location. These K-factors were used as a base to forecast the year 2050 No-Build volumes.

In the future, congestion is anticipated that will cause peak hour traffic spreading across multiple hours. As a result, the calculated K-factors were adjusted using the methodology outlined in WisDOT's Transportation Planning Manual. The adjustments are made by using an equation to determine the amount of peak spreading, which is then applied to reduce the K-factor. The K-factor equations were developed using the 2010 to 2011 Automatic Traffic Recorder (ATR) data. The equation includes coefficients and constants related to the roadway type and peak period. The K-factors were only reduced along the mainline segments.

Next, the reduced K-factors were multiplied by the year 2050 No-Build mainline AADT's to determine the peak hour forecast. The original K-factors were used to calculate the forecasted peak hour ramp volumes. Adjustments were then made to the ramp volumes to balance the volumes along the corridor. While developing the peak hour forecasts, it was assumed that there was an additional lane in each direction along I-39/90/94. With this assumption, the year 2050 mainline hourly volumes were allowed to exceed existing capacity, resulting in an unconstrained year 2050 No-Build peak hour forecast.

The balanced year 2050 No-Build peak hour volumes are shown in Exhibit 10. The year 2050 No-Build K30 hourly volumes are shown in Figure 2.2. The existing year 2012 and future year 2050 AADTs, peak hour volumes, and K-factors for the mainline and ramps are included in Appendix L.

Peak hour turning movement volumes were developed for the ramp and arterial intersections using the AADT growth at each intersection approach. The growth rate between intersection movements was applied to the existing turning movement volumes to calculate the preliminary year 2050 No-Build turning movement volumes.

After establishing the preliminary turning movement volumes, these volumes were compared to the balanced peak hour ramp volumes. Adjustments were made to match the turning movement volumes to the ramp volumes and associated arterial volumes. The amount of adjustment was minimal as both the ramp and arterial peak hour volumes were developed from the same existing AADT source. The year 2050 No-Build peak hour turning movement volumes along the cross arterials are shown in Exhibit 11.

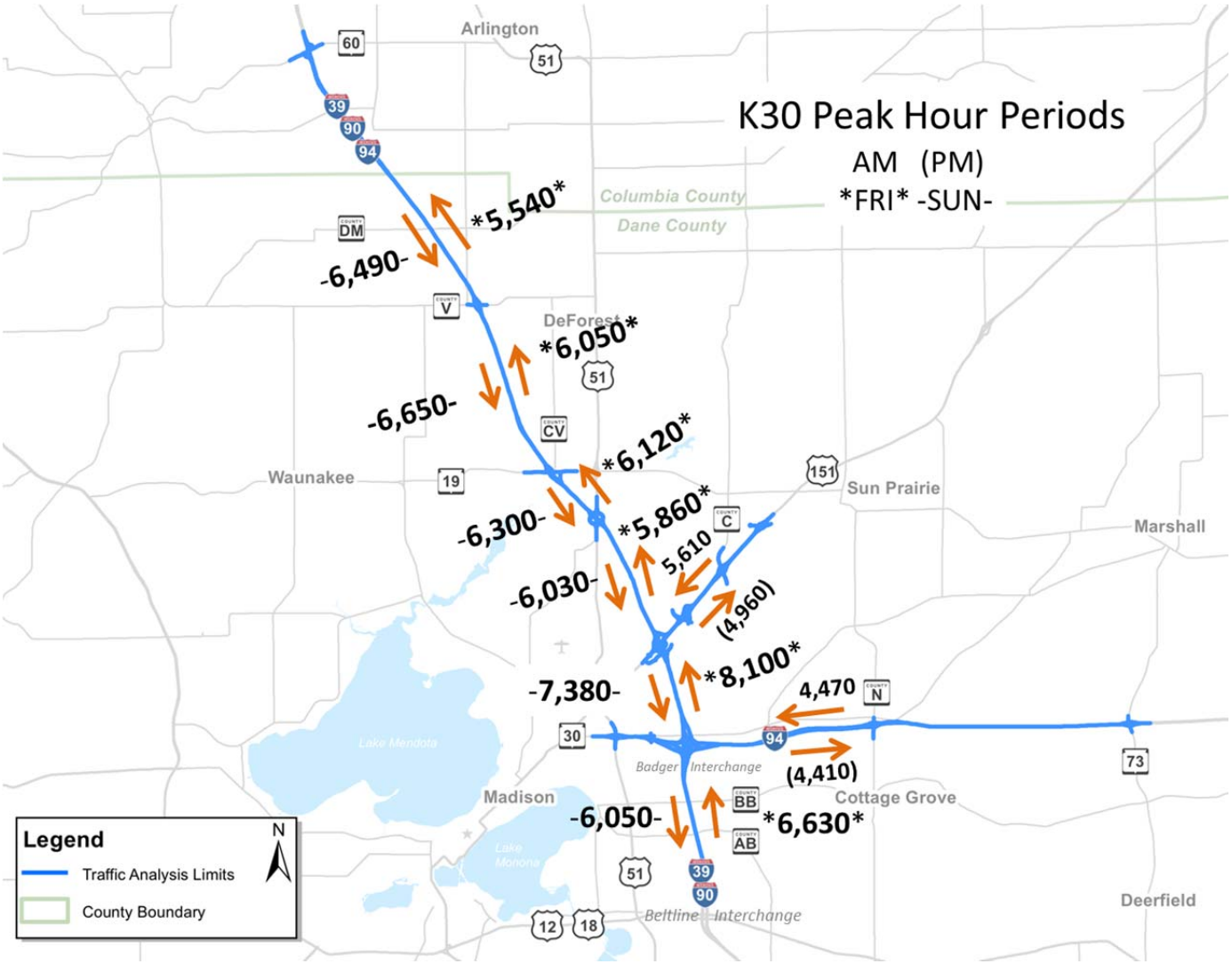


Figure 2.2. Year 2050 No-Build K30 Hourly Volumes

K30 represents the 30th highest hour of traffic volumes within a year. The K30 volumes along the project corridor occur during the following peak hour periods:

- AM – WB I-94, WB WIS 30, SB US 151
- PM – EB I-94, EB WIS 30, NB US 151
- Friday – NB I-39/90/94, NB I-39/90
- Sunday – SB I-39/90/94, SB I-39/90

The highest volumes within the corridor are located along I-39/90/94 between the I-94 / WIS 30 (Badger) and US 151 interchanges. This segment provides a connection between several freeways to the north and south. North of this segment, I-39/90/94 provides access to US 151 and US 51. To the south, access is provided to I-94, WIS 30, and US 12/18. Traffic traveling between any of these freeways converge on I-39/90/94 between the Badger and US 151 interchanges.

Volumes along I-39/90/94 significantly drop north of US 151. The largest movements at this interchange are from northbound I-39/90/94 to northbound US 151 and the reverse movement of southbound US 151 to southbound I-39/90/94. This adds to the high I-39/90/94 volumes south of US 151 and the drop in traffic to the north.

SUMMARY

This section documents the year 2050 traffic forecasts used for future year traffic operational analysis. Traffic forecasts were developed using AADT forecasts provided by WisDOT TFS, as well as the Dane County TDM. These forecasts gave consideration to socio-economic data, planned developments, and committed highway improvements in order to represent future year conditions. Forecasts were then input into traffic analysis models to evaluate how the highway network would perform in the future. Major findings from this effort are:

- **Areas surrounding the interstate are growing at a faster rate than the rest of Dane County.** By 2050, the Dane County population is expected to grow by 1.2% per year to over 725,000 people. Much of this growth will occur in the City of Madison and outlying areas that include: the Village of DeForest, City of Sun Prairie, and Village of Cottage Grove. These areas surrounding the interstate are already expanding and have plans for continued growth. As a result, volumes along the interstate are anticipated to grow at a rate of 1.3% to 1.7%, which is faster than the average Dane County population growth rate.

- **Major routes connected by the interstate are expected to have significant traffic growth.** There are few routes that connect outlying areas to the major employment centers in Madison's downtown and west side. Commuters prefer limited access, high speed routes, such as US 151 and WIS 30 that are connected by the interstate. Traffic growth on these routes was forecasted higher than the interstate, with WIS 30 growing at 2.0% per year and 1.8% per year on US 151.

The traffic forecasting efforts serve as a foundation for the future year baseline traffic operational analysis and Tier 2 Interchange Screening.

SECTION 3

Year 2050 Baseline Operations

EXHIBITS

APPENDICES

INTRODUCTION

Future year 2050 traffic operations were analyzed to establish a baseline for making before-and-after comparisons of potential new interchanges during the Tier 2 Screening evaluation. Analyzing how the existing system performs under future year forecasted volumes shows where the system has spare capacity and where improvements may be needed. Adding new interchanges to the system has the potential to help, or hurt, traffic operations. The future year baseline model does not represent a preferred alternative for the corridor, but provides context for how potential new interchanges may affect the system in the future.

YEAR 2050 OPERATIONAL ANALYSIS METHODOLOGY

All future year analysis began with the Paramics and Synchro traffic models used for the existing year 2012 evaluation discussed in the Existing Conditions Technical Memo. The existing year evaluation produced models that replicated existing field conditions, which increases confidence that these same models will yield good results when applying forecasted future year volumes. Four general steps were taken to convert existing year to future year models:

1. Modifications were made to reflect the planned and committed improvements that are assumed to be in place by the year 2050. These improvements include:
    - Modification of the I-39/90 & US 12/18 (Madison Beltline) Interchange
    - Signalization of the US 151 & County C interchange ramp terminals (installed in 2013)
    - Signalization and re-alignment of the I-39/90/94 & WIS 19 SB on-ramp (scheduled for year 2017)
2. Signal timing improvements within confines of existing signal head infrastructure
3. Calibration settings and non-forecasted traffic parameters (peak hour factor, % heavy vehicles, etc) were carried over from the existing year analysis to the future year analysis
4. Future year 2050 forecasted volumes and OD matrices were input into the models

Results of the future year analysis included freeway and intersection level of service (LOS) as a performance measure. LOS describes the quality and characteristics of traffic flow based on the traffic demand, physical characteristics of the roadway, and available capacity. Table 3 shows the LOS scale which ranges from LOS A, representing free-flowing traffic, to LOS F which represents unstable breakdown conditions

Table 3: Level of Service Characteristics

 LOS A	**Unrestricted free flow** • Drivers virtually unaffected by others • High level of freedom to select speed and maneuver • Excellent level of driver comfort and convenience
 LOS B	**Slightly restricted stable flow** • Drivers aware of use by others • Slight restriction in speed and maneuvering • Good level of driver comfort and convenience
 LOS C	**Moderately restricted stable flow** • Driver operation significantly affected by others • Moderate restriction in speed and maneuvering • Fair level of comfort and convenience
 LOS D	**Heavily restricted flow** • Driver operation completely affected by others • Severe restriction in speed and maneuvering • Poor level of driver comfort and convenience
 LOS E	**Unstable flow (approach flow > discharge flow)** • Slow speeds and traffic backups; some stoppage • Total restriction in vehicle maneuvering • High driver frustration
 LOS F	**Forced flow (approach flow > discharge flow)** • Stop and go movements with long backups and delay • Forced vehicle maneuvers • Maximum driver frustration

Source: Highway Capacity Manual 2010

Mainline Operational Analysis Methodology

Paramics software (version 6.9.3) was used to obtain freeway LOS results. Paramics is a microsimulation traffic analysis tool that analyzes individual vehicle interactions and is WisDOT's chosen tool for complex freeway traffic analysis. The Federal Highway Administration (FHWA) approved the use of Paramics for this project. Software outputs are similar, but not exactly the same as the results from the Highway Capacity Manual 2010 (HCM 2010). To obtain level of service, Paramics trajectory output was post-processed to match the density calculation for merge, diverge, and basic freeway influence areas as defined in the HCM 2010. This method allows density results from Paramics to be compatible with the HCM 2010 guidance for use of microsimulation tools.

Due to the magnitude of the forecasted volumes and limited spare capacity in critical sections of the freeway network, two Paramics models were developed:

- **2050 No-Build Model (Constrained)** – this model reflects the existing year lane configuration, with the addition of the planned and committed improvements. All calibration and simulation settings were inherited from the Existing Year 2012 Paramics model.

- **2050 Baseline Model (Unconstrained)** – this model includes capacity improvements beyond the planned and committed improvements to allow the full demand volume to enter the network. Exhibit 12 shows all changes made to the existing network. The major capacity expansion was an additional lane on both northbound and southbound I-39/90 from the Beltline Interchange to WIS 60. Other expansions included geometric features, such as 2-lane loop ramps, that would likely not be implemented. This Baseline model does not represent a preferred alternative, but rather allows the simulation to produce valid results when evaluating potential new interchanges.

Documentation for the Paramics models is included in Appendix D.

Intersection Operational Analysis Methodology

Traffic operations at each interchange were analyzed using Synchro 8 software. Ramp terminal intersections, and the adjacent intersection on either side of the terminals, were included in the analysis. HCM 2010 reports from Synchro were obtained for all intersection control types (signals, stop, and roundabouts). The HCM 2010 does not provide LOS and delay results for unsignalized channelized right turns signalized intersections. As a result, the LOS and delay reported for this right turn lane configuration are based on The Percentile Delay Method performed by Synchro.

Future year Synchro models included the modifications for the planned and committed improvements. Signal timing and phasing was optimized within the confines of existing signal head infrastructure. Unlike the Paramics freeway analysis, capacity expansion assumptions were not needed to establish baseline conditions because the HCM 2010 is a deterministic method that directly accounts for the full demand volume.

YEAR 2050 MAINLINE OPERATIONAL ANALYSIS RESULTS

2050 No-Build (Constrained) Freeway Model

The 2050 No-Build (Constrained) Model results showed extensive gridlock throughout each simulated time period. Slow speeds and queuing were especially prevalent between the Beltline, Badger, and US 151 interchanges. Figure 3 shows an example of the magnitude of queuing observed during the simulation at the start of the peak 15 minute period; conditions only degraded as the simulation went on. Queued conditions can also be seen as far north as County V during the Sunday southbound peak period due to recreational traffic.

Significant congestion indicated that the existing network will have difficulty in safely and efficiently accommodating future traffic demands, regardless of the presence of new interchanges. Simulated traffic volumes downstream of the bottlenecks were well below the target demands due to the congestion. Without valid simulation of demand volumes, the model gives an inadequate representation of traffic operations and cannot fairly evaluate the effects of new interchanges.

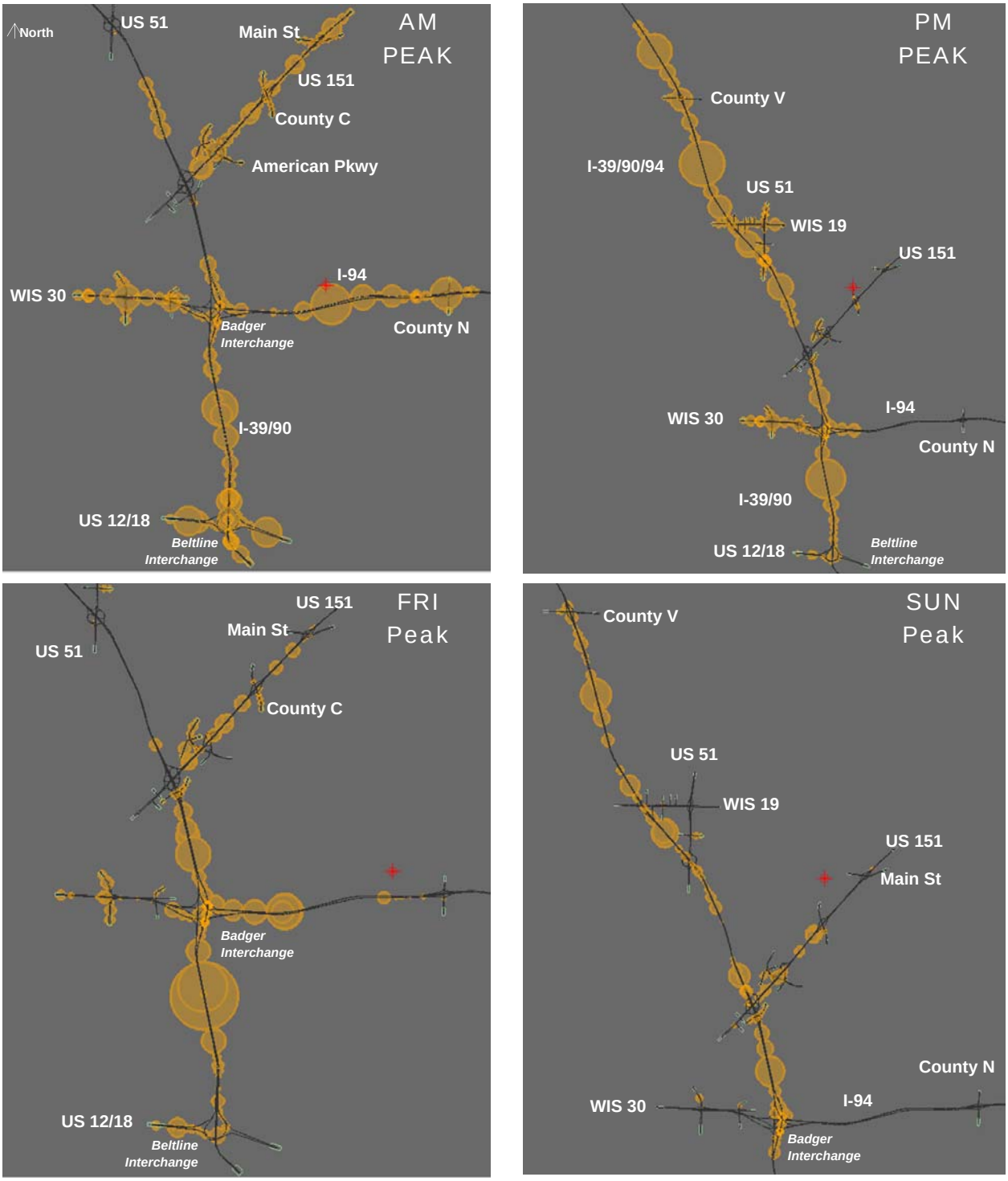


Figure 3. 2050 Constrained Model Network Queuing – Paramics Screenshots

2050 Baseline (Unconstrained) Freeway Model

Results from the 2050 Baseline Model show that traffic flows through the network but in many areas does not achieve LOS C that FHWA typically desires. The capacity expansion assumptions in the baseline model still resulted in LOS D or worse within segments shown in Figure 4. Detailed results for all segments are included in Exhibit 13.

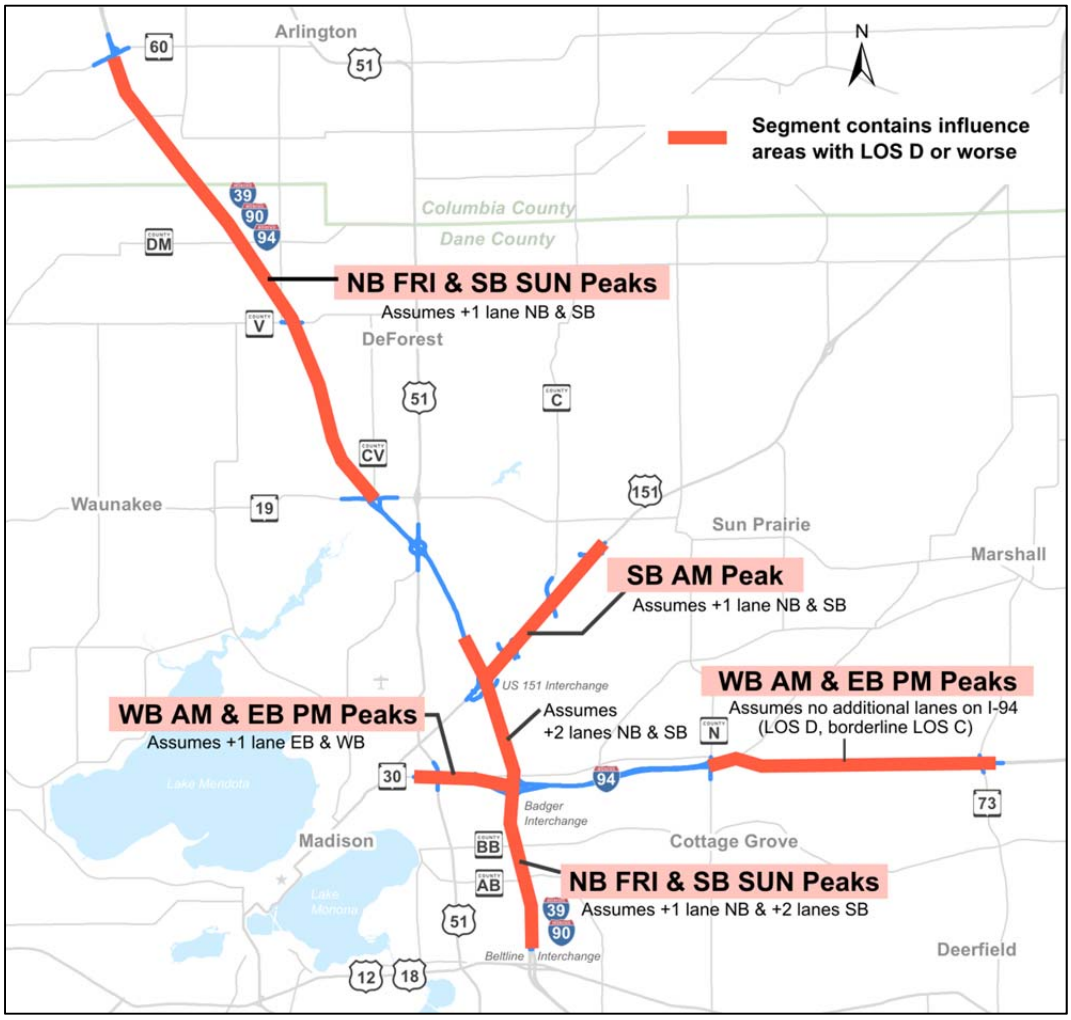


Figure 4. 2050 Baseline Model Results – Segments Containing LOS D or Worse

The 2050 Baseline model showed congestion during all peak periods. During the AM and PM commuting peaks, bottlenecks occurred on the major routes to and from the City of Madison. Routes especially affected included southbound US 151 and westbound WIS 30 in the AM peak and their reverse movements in the PM peak. Operations were unstable on US 151 near the American Parkway Interchange, which provides access to major employment centers.

Friday and Sunday peak recreational traffic had the largest impact between the major system interchanges and on areas outside of Madison. Between the Beltline and US 151 interchanges, LOS E and LOS F were found throughout due to required weaving maneuvers, mix of commuter and recreational traffic during the northbound Friday peak, and high southbound Sunday peak

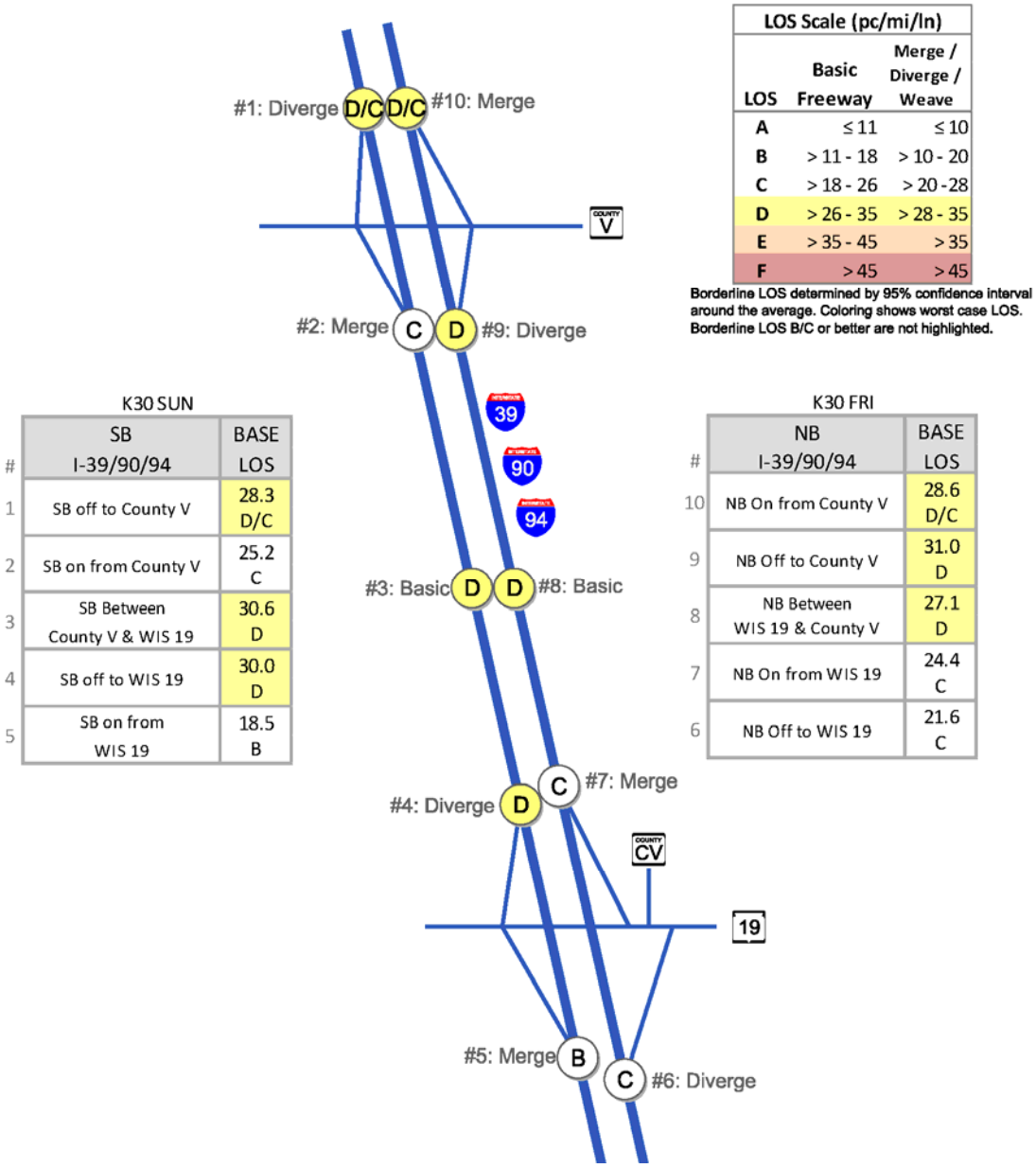
volumes. Poor operations occurred even with 4 additional lanes on I-39/90/94 between the Badger and US 151 interchanges (6-lanes in each direction). Outside of Madison, four lanes in each direction on I-39/90/94 from WIS 19 to WIS 60 resulted in LOS D in the Friday and Sunday peaks.

Specific baseline results of interest for the Tier 2 Interchange Screening are described in the following sections and include:

- **I-39/90/94 between WIS 19 and County V** – for evaluating the potential Cuba Valley Road or Windsor Road interchange
- **I-94 between I-39/90 (Badger Interchange) and County N** – for evaluating the potential Milwaukee Street Extension or Gaston Road interchange
- **I-39/90/94 between US 151 and US 51** – for evaluating the potential Hanson Road or Hoepker Road interchange

I-39/90/94 between WIS 19 and County V

The potential Cuba Valley Road or Windsor Road interchange is located in the 4 mi segment between WIS 19 and County V. Capacity expansion assumptions included one additional lane on the freeway (4-lanes in each direction) and an auxiliary lane between the WIS 19 and US 51 interchanges. The auxiliary lane is likely needed regardless of the number of mainline lanes. Figure 5 shows LOS D in the 2050 Baseline Model. Southbound peak traffic is slightly higher than the northbound peak, and the LOS results reflect this with slightly higher densities.



LOS Scale (pc/mi/ln)		
LOS	Basic Freeway	Merge / Diverge / Weave
A	≤ 11	≤ 10
B	> 11 - 18	> 10 - 20
C	> 18 - 26	> 20 - 28
D	> 26 - 35	> 28 - 35
E	> 35 - 45	> 35
F	> 45	> 45

Borderline LOS determined by 95% confidence interval around the average. Coloring shows worst case LOS. Borderline LOS B/C or better are not highlighted.

K30 SUN

#	SB I-39/90/94	BASE LOS
1	SB off to County V	28.3 D/C
2	SB on from County V	25.2 C
3	SB Between County V & WIS 19	30.6 D
4	SB off to WIS 19	30.0 D
5	SB on from WIS 19	18.5 B

K30 FRI

#	NB I-39/90/94	BASE LOS
10	NB On from County V	28.6 D/C
9	NB Off to County V	31.0 D
8	NB Between WIS 19 & County V	27.1 D
7	NB On from WIS 19	24.4 C
6	NB Off to WIS 19	21.6 C

Figure 5. Future Year 2050 Baseline LOS between WIS 19 and County V

I-94 between I-39/90 (Badger Interchange) and County N

Analysis of the freeways near the Badger interchange resulted in a baseline LOS C after including the capacity expansions described below. Figure 6 shows results for this area. Exceptions include areas with significant weaving that cause unstable operations with LOS D or worse, including:

- **WIS 30 between US 51 and Thompson Drive (EB & WB)** – results showed LOS D borderline LOS E with an expanded cross section that includes three mainline lanes and one auxiliary lane in each direction. This expanded cross section includes one additional mainline lane compared to existing conditions. Future year 2050 peak volumes for US 51 and Thompson Drive ramps in this weave are 1,500 to 1,800 vph. These volumes are at the rule-of-thumb limits for single lane ramps.

- **I-39/90/94 between the Badger and US 151 Interchanges (NB & SB)** – this segment is considered a weave due to the combination of left and right entrances and exits. In the 2050 Baseline Model there are 6-lanes in each direction. Increasing the number of lanes from existing year conditions (4-lanes in each direction) allows demand volume to be serviced, but decreases safety due to the increase in lane changing. With the expanded cross section, results showed unstable operations ranging from LOS E to LOS F.

- **I-39/90 between the Beltline and Badger Interchanges (NB & SB)** – this segment has similar issues as the interstate segment between the Badger and US 151 interchanges, but is spread out over a longer distance. Baseline results show northbound LOS E/D and southbound LOS D. Differences between travel directions are due to the higher northbound peak traffic volumes and the baseline assumption of four northbound lanes and five southbound lanes.

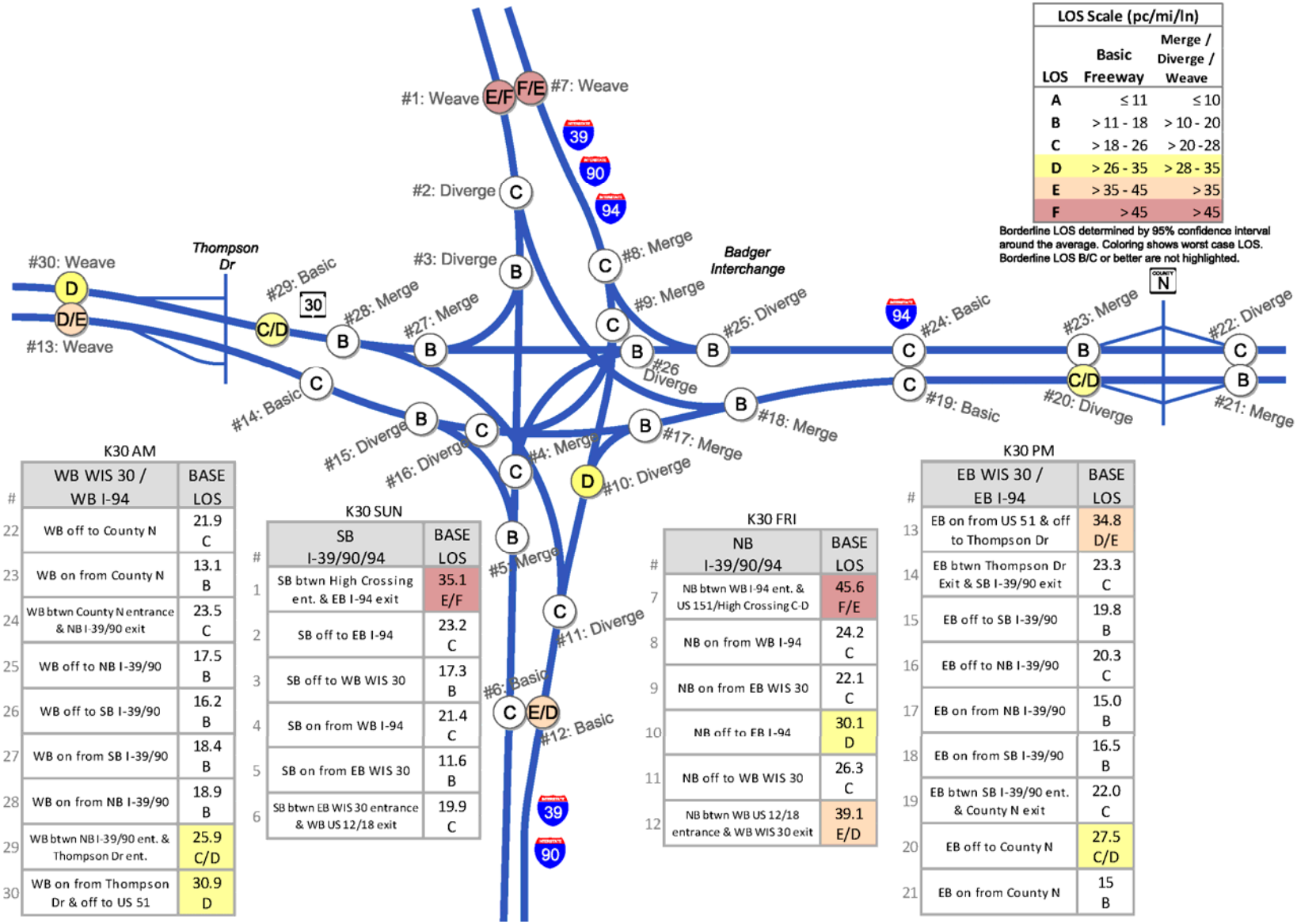


Figure 6. Future Year 2050 Baseline LOS near the Badger Interchange

I-39/90/90 between US 151 and US 51

The potential new interchange of I-39/90/94 & Hoepker Road or Hanson Road is located in a complex area between closely spaced system interchanges. The 2050 Baseline Model assumes major, and possibly impractical, lane configurations that include:

- 6-lanes in each direction between the Badger and US 151 interchanges
- 3-lane exit (2 exit only lanes and one optional exit) for NB I-39/90/94 to NB US 151
- 2-lane loop ramp for SB US 151 to SB I-39/90/94
- 5-lanes (3 through and 2 auxiliary) for NB and SB US 151 between US 151 and American Parkway
- 3 NB right turn lanes and 3 WB left turn lanes, with major priority for all movements at the American Parkway and Eastpark Boulevard intersection

Results showed unstable operations with LOS F (southbound) and LOS E (northbound) between the Badger and US 151 interchanges as a result of the complex lane changing between the major merge and diverge areas. Other areas of instability included southbound US 151 between I-39/90/94 and County C, and I-39/90/94 at the northbound merge from the collector-distributor road. Consequently, these results show that extensive reconfiguration to existing interchanges may be required to achieve safe and efficient traffic flow.

Due to the assumptions required and the instability of results in the 2050 Baseline model, the impacts of a Hoepker Road or Hanson Road interchange cannot be fully understood without further study of the future configuration of existing interchanges.

YEAR 2050 NO-BUILD INTERSECTION OPERATIONAL ANALYSIS RESULTS

Overall intersection and off-ramp approach LOS results, shown in Figure 7, reveal that many intersections are nearing or exceeding capacity in future no-build conditions. A detailed set of results that includes intersections adjacent to ramp terminals can be seen in Exhibit 11 (Synchro Reports are included in Appendix M). Poorly operating ramp terminals have the potential to result in queues extending onto the mainline freeway. Locations of concern include:

- **I-39/90/94 & WIS 19** – Heavy arterial through traffic along WIS 19 in combination with heavy left turns resulted in poor operations with the existing lane configurations. Signal coordination between the ramp terminal intersections and County CV is challenging with the forecasted volumes. The WIS 19 & County CV intersection shows overall LOS C, but left turn movements to and from County CV are at capacity with LOS E and LOS F respectively.

- **I-39/90/94 & US 51** – The unsignalized left turn from southbound I-39/90/94 to northbound US 51 showed failing LOS F due to heavy conflicting traffic. Due to the loop ramp, southbound I-39/90/94 exiting vehicles may have difficulty seeing queued vehicles at the base of the ramp, causing safety concerns.

- **American Parkway & Eastpark Boulevard** – Heavy turning volumes at this signalized intersection caused queuing and delays on all approaches. This intersection is already experiencing congestion in the current year with LOS D on the northbound and eastbound approaches and LOS F for the northbound right turn. Future year operations are expected to degrade to LOS F for the entire intersection with queues extending on to US 151.

- **WIS 30 & US 51** – Poor LOS E and LOS F resulted from heavy westbound ramp traffic from WIS 30 in combination with heavy northbound and southbound US 51 traffic.

- **WIS 30 & Thompson Drive** – Increased traffic on County T (Commercial Avenue) and traffic using the I-94 eastbound off-ramp caused congestion and overall LOS F.

- **I-94 & County N** – LOS F resulted from increased through traffic on County N and growth in traffic accessing I-94.

- **I-94 & WIS 73** – While volumes are low at this interchange, the unsignalized left turns and lack of mainline left turn bays resulted in LOS F.

Many intersections adjacent to the ramp terminals were found to operate near or over capacity and queues could interfere with ramp terminal operations. Side road intersections of concern include:

- **Reiner Road & O'Keeffe Avenue** – adjacent to US 151 & County C
- **Main Street & O'Keeffe Avenue** – adjacent to US 151 & Main Street
- **County TT & County N** – adjacent to I-94 & County N
- **US 51 & County CV** – adjacent to I-39/90/94 & US 51

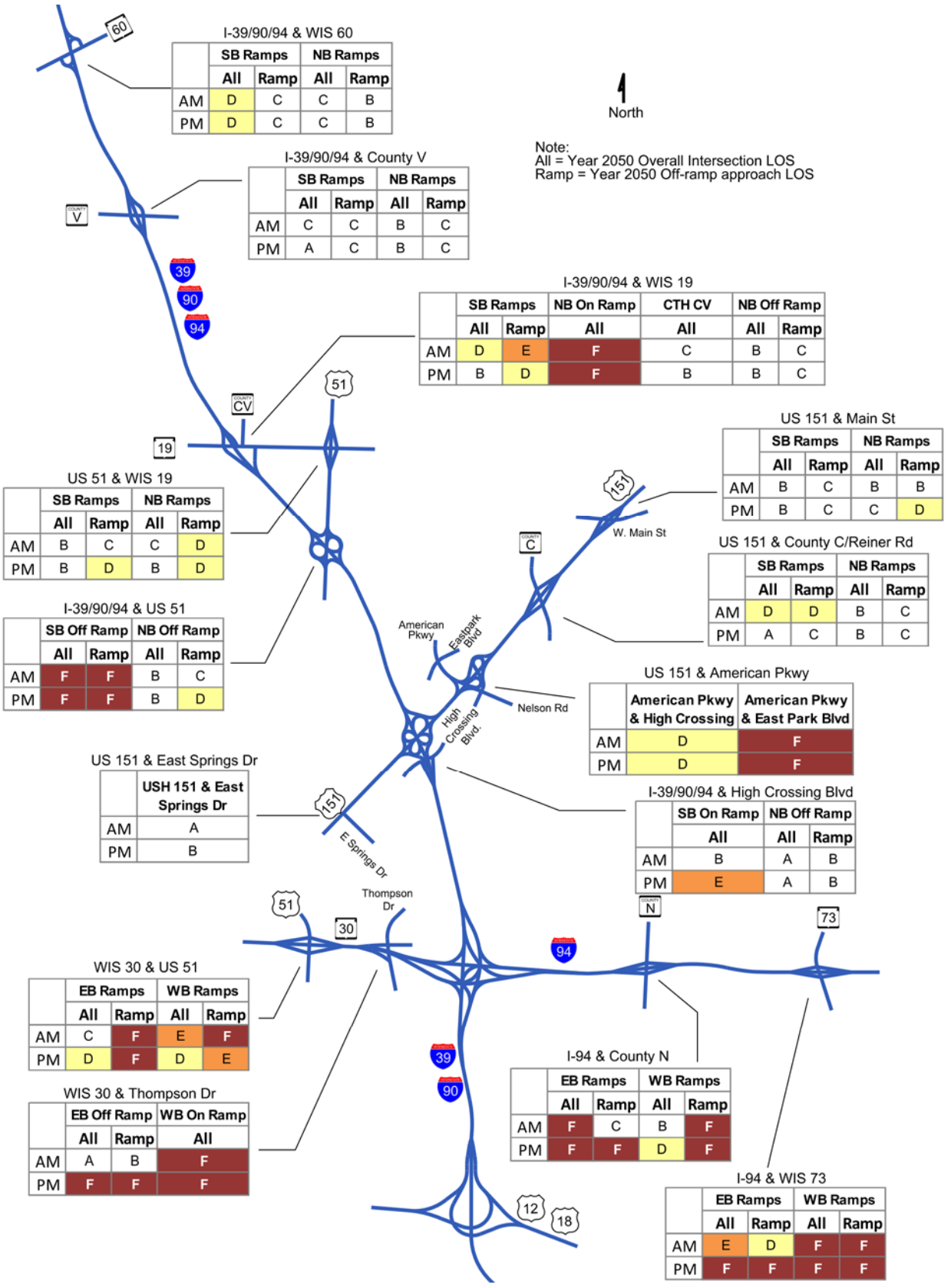


Figure 7. Future Year 2050 Baseline Ramp Terminal Intersection Results

SUMMARY

This section documents the year 2050 no-build and baseline traffic operations. Operational analysis was based on traffic forecasts developed using AADT forecasts provided by WisDOT TFS, as well as the Dane County TDM. Major findings from this effort are:

- **The existing freeway system cannot accommodate future demand**. Freeway congestion in the no-build scenario resulted in gridlock to the extent that the full demand volume could not be serviced within the peak hour. During peak Sunday traffic, queues were shown to extend from the Badger Interchange as far north as County V. AM and PM peak commuter traffic also showed poor operations with queues extending on to adjacent arterials including WIS 19, US 51, WIS 30, and County N. Decreased efficiency contributes to costly delay and decreased safety.

- **Baseline improvements were established to evaluate potential new interchanges**. Unstable freeway operations in the no-build scenario resulted in the need for an unconstrained model to establish a baseline LOS. This baseline model assumes capacity improvements, primarily one extra lane in each direction, in order to allow simulation of the full demand volume for evaluating potential new interchanges. The assumptions made do not represent a preferred alternative of the future system.

- **Capacity improvements may be needed regardless of consideration for new interchanges.** Despite added lanes in the baseline conditions, some areas continue to operate poorly and need more complex solutions. The sections of interstate carrying the highest volumes of traffic between the Beltline and US 151 Interchanges, where no new interchanges are being considered, were shown to operate at LOS D/E and some sections at LOS F in the baseline model. This showed that adding lanes to increase capacity is not automatically effective and may worsen the existing weaving conditions. Significant reconfiguration of these sections may be required to safely and efficiently accommodate future traffic.

SECTION 4

Tier 1 Screening

EXHIBITS

APPENDICES

INTRODUCTION

This section documents the process and results from the first of a two-tier process used to evaluate a large number of potential interchange and crossing locations in the Madison metropolitan area. Tier 1 Screening is an evaluation of the viability of physically possible locations of new access and of new grade separated crossings against IAJR-based screening criteria, using high level data and broad perspectives. Tier 2 Screening involves a focused analysis, including conceptual geometric layouts and traffic analysis, of the locations passing Tier 1 to further understand impacts.

The goal of Tier 1 Screening is to document whether or not individual locations merit additional consideration and a more detailed analysis effort. Locations passing Tier 1 are not definitively viable. Their viability cannot be determined without additional and more detailed study. Locations eliminated in Tier 1 cannot be considered in the future unless conditions substantially change.

Studied locations represent a thorough list of potential interchange and crossing locations. In the future, if a different location is proposed near, or within, the I-39/90/94 TIA study area, the outcomes considered here can be used as a basis for evaluating the proposed location.

METHODOLOGY

Tier 1 Screening consisted of three parts: (1) development of screening factors, (2) development of high level data to screen, and (3) screening of locations and results. Analysis with high level data allowed a large list of locations to be evaluated in categories that included: traffic, safety, geometrics, environmental, and local input. Summaries of data in these categories showed the magnitude of change between future year 2050 no-build and build scenarios. The year 2050 no-build scenarios include all committed projects and planned local and county highway improvements identified in Appendix N, as well as one additional lane along each direction of the I-39/90/94 mainline. The year 2050 build scenarios include one new interchange or crossing in addition to all the improvements included in the 2050 no-build scenario. All scenarios were developed independently of each other. Finally, a series of discussions and reviews resulted in consensus from the I-39/90/94 Technical Advisory Committee (TAC) for which locations moved on to the Tier 2 Screening evaluation. The I-39/90/94 TAC consists of representatives from: WisDOT SW Region Major Studies, WisDOT SW Region Environment, WisDOT SW Region Traffic, WisDOT BTO, WisDOT BPD, WisDOT EPDS, WisDOT TFS, FHWA, City of Madison, Madison Area Transportation Planning Board, and Dane County.

Interchange and Grade Separated Crossing Screening Factors

Tier 1 Screening factors emulated the information required for the Federal Highway Administration (FHWA) Interstate Access Justification Report (IAJR) that is used to review new interstate interchange access. The interstate was created to provide safe and efficient regional mobility. The eight policy points of an IAJR, which emphasize the key purposes of the interstate, are summarized as:

1. Need for new interchange cannot be accommodated by the existing interchanges and local road system, or a reasonably improved existing system
2. Reasonable transportation system management will not alleviate the need for new access
3. New interchange does not have a significant adverse effect on operations and safety of the Interstate
4. Connects to a public road, provides all movements, and meets current standards
5. Consistent with local and regional land use and transportation plans
6. New access is in context with long range Interstate system plan
7. Local system can accommodate new traffic to bring traffic to the new interchange and distribute traffic from the new interchange
8. New access has been included in the required environmental evaluation, review, and processing.

While this study is not preparing any IAJRs, it uses these policy points to screen the viability of possible new access locations and eliminate those that on the whole, fail to meet the IAJR requirements. Tier 1 Screening also evaluated factors important to WisDOT, local municipalities, and agencies. Development of screening factors involved the integration of data from a variety of sources into meaningful information. Four key sources of information described in Table 4.1 include: the Dane County Travel Demand Model (TDM), a variety of safety resources, input from municipalities, and GIS databases.

Table 4.1. Screening Factor Data Sources

Data Source	Description
The Dane County Travel Demand Model (TDM)	The TDM was used to evaluate the changes between future year 2050 build and no-build traffic information if an interchange or grade separated crossing were to be added to the network. The Tier 1 Screening analysis used the new model as of October 2013 for analysis. This model is capable of evaluating travel patterns on the major local, county, state, and interstate highways in Dane County. For future year 2050 build and no-build scenarios, the interstate was unconstrained by adding one additional lane in each direction on the interstate. Additional lanes are not being considered for construction, but the assumption was necessary to allow all traffic to enter the network model. Unconstraining the model in this manner results in estimation of total demand and therefore reduces bias when comparing screening locations. Future year 2050 no-build and build scenarios also include committed and planned projects outlined in Appendix N. These projects did not address all future capacity issues on the non-freeway system, resulting in roadways that experience varying levels of congestion; however these are anticipated to have a minimal influence on route choice. Additional capacity improvements were not incorporated for non-freeway roadways, allowing for a consistent evaluation of each alternative.

Data Source	Description
Safety Data Resources	Safety information came from the I-94 Data Management System, I-39/90/94 TIA Existing Conditions Technical Memo, Meta Manager, and traffic information from the Dane County TDM. Integrating these data sources resulted in an evaluation, inspired by Highway Safety Manual concepts, which demonstrated the change in crashes between future build and no-build conditions. The crash analysis along the freeway used existing 2007-2011 crash rates from the I-94 Data Management System. The non-freeway crash analysis results were based on the assigned roadway peer group and the associated statewide average crash rate. This evaluation provided comprehensive results for freeways, interchanges, ramp terminal intersections, and non-freeways.
Input from Municipalities	Local input was critical for establishing the level of local support for each screened location. A significant outreach effort distributed surveys to municipalities that asked questions about land use, connectivity, multimodal issues, and overall position regarding the potential new interchanges and grade separated crossings in or near their jurisdictions. Local townships, villages, cities, and Dane County were asked for their input. Many municipalities took the extra effort to discuss the interchanges and grade separated crossings at their local board meetings. Of the 12 municipalities who were sent a survey, 8 replied with input. A summary of the received local input can be seen in Exhibit 16 through Exhibit 19, for interchanges and Exhibit 20 for grade separated crossings. Full responses from the municipalities are attached in Appendix O. All responses represent a snapshot of current opinions, which may change over time with changes in leadership and politics. Some positions changed over the course of the study.
GIS Basemaps	Physical constraints and environmental impacts were assessed through office reviews of GIS data sources. For the physical constraints, reviews of aerial photography for buildings, utilities, and other features resulted in a list of considerations that would impact the design of each screening location. Field visits were completed to verify geometric constraints. Literature searches produced maps of potential archaeological and historic sites near the screening locations. Approximate wetland locations were obtained by a DNR countywide GIS dataset.

Traffic Analysis and Use of the Dane County TDM

The 2050 no-build and all future build scenarios evaluated in the I-39/90/94 TIA used the unconstrained Dane County TDM. Assuming an unconstrained model is appropriate for the high-level screening purpose of the TIA and does not represent a preferred alternative for the corridor. Future environmental studies of this corridor would not assume an unconstrained model in order to provide a detailed capacity analysis of the interstate.

Traffic analyses used the TDM to compare between the future year 2050 no-build scenario without a new interchange and a future year 2050 build scenario with a new interchange. Relative changes in future year vehicle miles traveled (VMT) show how an interchange influences broad trip making behavior trends; changes in future year AADT shows how an interchange influences demand. Unless otherwise stated, all VMT and AADT numbers refer to results from future year 2050 scenarios.

Screening Factor Descriptions

Table 4.2 and Table 4.3 describe the factors used during Tier 1 Screening for the interchanges and grade separated crossing locations. These factors were developed by the I-39/90/94 TAC. Screening factor categories include Traffic, Safety, Regional Importance, Geometrics, Local Input, and Environmental Constraints. Many traffic and safety screening factors were evaluated on the interstate, as well as non-freeways, in order to better understand individual and net effects of each location to be screened.

In the tables and verbiage below, the term "TIA freeways" refers to the traffic analysis limits shown in Exhibit 1 with the addition of US 12/18 (Madison Beltline) from I-39/90 to Verona Road and I-39/90 from the Beltline to the Dane / Rock County border. The term "non-freeways" refers to all remaining roads in Dane County, including U.S., state, and county highways, and local roads. Appendix P contains additional technical details regarding screening factor methodology and data.

Table 4.2. Description of Tier 1 Interchange Screening Factors

Category	Factor	Purpose and Description
Traffic Operations	Freeway VMT	• Demonstrates the magnitude of traffic added to or removed from the TIA freeway system. • Based on changes between 2050 no-build and 2050 build scenarios in the Dane County Travel Demand Model (TDM) • Important factor because an increase in VMT decreases the service life of the freeway • Evaluated based on an unconstrained TIA freeway system, so the analysis results represent full demand with no diversion due to congestion
	Non-Freeway VMT	• Demonstrates the relative magnitude of traffic diverting away from the non-freeway system • Measures the change in VMT for all other roads in the TDM not included in the Freeway VMT statistic • Valuable for municipalities interested in improving mobility and extending the service life of non-freeways
	Total VMT	• Shows the net relative change in travel patterns to Dane County • Summation of the Freeway and Non-Freeway VMT for each interchange screening location • Meaningful factor that represents the regional effect of the interchange on mobility
	AADT per Ramp	• Illustrates the traffic demand for the new interchange • Calculated by averaging the AADT of all ramps • Provides a sense of the size of interchange needed and demand for access. For example, do the new interchange ramps carry high volumes of traffic similar to the Beltline & US 151 interchange, or low amounts similar to I-94 & WIS 73?
	Impact to Existing High and Moderate Volume Ramps	• Describes the change in volume demand at existing interchanges due to the new interchange • Summarized by quantifying the change in future year AADT at existing high and moderate volume ramps that have less capacity to accommodate additional traffic • Useful for understanding if the new interchange helps or hurts critical traffic movements on the interstate
	Congested Roadway Relief	• Evaluates changes in congestion of the non-freeway network based on volume-to-capacity ratios • Identifies roadways that are over capacity in the no-build scenario and measures the total miles of roadway in the build scenario that are no longer over capacity and the total miles of roadway that over capacity and previously were not • Important for showing if the non-freeway system can efficiently accommodate traffic to and from the interchange
	Additional Congested Roadways	
Safety	Freeway Safety	• Shows the changes in expected crashes on the basic freeway segments between interchanges • This screening factor, and all safety factors, evaluates how well the interchange meets the goal of the transportation system to provide safe and efficient travel

Category	Factor	Purpose and Description
Safety	Interchange Safety	• Evaluates the changes in safety at merge and diverge areas on the TIA freeways • Includes all merges and diverges on the freeway associated with the new interchange and the immediately adjacent existing interchanges • Merge and diverge areas are the least safe portions of the freeway system; this factor is important to show how these areas are affected
	Ramp Terminal Safety	• Assesses the anticipated change in crashes at ramp terminal intersections • Understanding the change in crashes at intersections is useful for a complete picture of safety
	Non-Freeway Safety	• Shows the change in safety on the non-freeway network beyond interchange limits • Essential for counterbalancing the freeway safety analysis because crashes may increase on the interstate due to increased traffic volumes, but overall crashes may decrease due to traffic reductions on the typically higher crash rate non-freeway network
Regional Importance	Roadway Functional Class	• Identifies the cross road functional classification based on the Dane County Function Class Map, attached in Appendix Q • Classifications indicate the purpose and importance of the cross road connecting the interchange to the interstate • Important to show how the interchange plays into the larger context of the transportation system
Geometrics	Interchange Spacing	• Demonstrates how close the new interchange is to existing interchanges • New interchanges are desirably spaced no closer than 2 miles to system interchanges or 1 mile to service interchanges for safety and efficiency. Exhibit 14 shows the desirable spacing from the existing interchanges. • Reveals the extent to which the interchange fits into the existing freeway system and influences safety, efficiency, cost
	Side Road Access Spacing	• Demonstrates the proximity of adjacent existing intersections on the cross road to interchange ramp terminals • Access points on the interchange cross road are desirably 1,320 ft away from the terminal intersections for safety and efficiency • Important for understanding potential re-configuration of the local system and cost implications
	Planned Cross Road Width and Cross Road Widening Needed	• Provides context for any expansion that would be required due to a new interchange • Many cross roads at the interchange screening locations are planned for future expansion, and this factor is a baseline for the cross road widening needed • Shows total roadway lanes needed to accommodate the additional interchange traffic • Any widening of the interchange crossroad, as indicated by the TDM, was stated as an indicator of the extent of changes required beyond current system plans • Valuable for local municipalities to understand how well the interchange fits long range plans

Category	Factor	Purpose and Description
Geometrics	Physical Constraints	• Lists physical features that will impact interchange design • Field reviews were conducted to identify any constraints, such as utilities, buildings, and terrain that require consideration for the interchange locations • Has important implications for costs, relocations, and design complexity that can limit practicality of the interchange
Local Input	Local Support	• Indicates surrounding municipality support or opposition for the interchange • Summarized by survey responses of questions regarding overall support, local system effects, land use implications, connectivity, and multimodal considerations for the new interchange • Essential for understanding community needs, economic value, and any special issues • A summary of received local input is included in Exhibit 16 through Exhibit 19
Environmental Constraints	Natural Environment	• Identifies nearby natural environmental features that may influence design, which are shown in Exhibit 15 • Potential wetland or natural resource water impacts were identified based on reviews of GIS maps. This level of analysis was intended to identify any major obstacles that would prevent further consideration of an interchange • The natural environment evaluation identifies essential resources that must be protected and minimally impacted by new infrastructure
	Cultural Environment	• Identifies potential historic and cultural features in the vicinity of the new interchange • Based on literature searches for previously recorded historic and archaeological sites, and review of GIS databases for park and recreational areas, shown in Exhibit 15 • Important for preserving culture and identifying any major obstacles that would prevent further consideration of an interchange

Table 4.3. Description of Grade Separated Crossing Screening Factors

Category	Factor	Purpose and Description
Traffic Operations	Freeway VMT	• See description in Table 4.2. The same process was used to evaluate VMT changes for both grade separated crossings and interchanges.
	Non-Freeway VMT	
	Total VMT	
	Crossing AADT	• The amount of daily traffic using the new crossing location indicated demand for the location. High demand did not necessarily indicate need for location, but rather shows that a large amount of traffic would divert to this crossing. Low demand was an indicator of lack of need for the crossing.
	Impact to Existing High and Moderate Volume Ramps	• See description in Table 4.2. The same process was used to evaluate traffic impacts to high and moderate volume ramps.
	Impact to Adjacent Interchange Crossroads	• The total change in crossroad AADT at adjacent interchanges was evaluated to demonstrate the potential traffic benefits to existing interchanges • Grade separated crossings can extend the service life of existing interchanges by reducing interchange crossroad volume
	Congested Roadway Relief	• See description in Table 4.2. The same process was used to evaluate local road congestion for both grade separated crossings and interchanges.
	Additional Congested Roadways	
Safety	Freeway Safety	• See description in Table 4.2. The same process was used to evaluate Freeway and Non-Freeway crashes for both grade separated crossings and interchanges.
	Interchange Safety	
	Non-Freeway Safety	
	Intersection Safety	• Change in crashes between 2050 no-build and build conditions was evaluated at the two nearest intersections connecting the grade separated crossing. If no intersection was present in the no-build condition, this factor represents the amount of new intersection crashes. The amount of crashes was estimated based on change in total entering traffic and a Highway Safety Manual safety performance function for intersection crashes.
Regional Importance	Roadway Functional Class	• See description in Table 4.2. The same process was used to evaluate functional class for both grade separated crossings and interchanges.
Geometrics	Cross Road Width Needed	• Indicates the total number of lanes needed to accommodate the grade separated crossing traffic as determined by the TDM.
	Physical Constraints	• See description in Table 4.2. The same process was used to evaluate physical constraints, local support, and environmental impacts for both grade separated crossings and interchanges.
Local Input	Local Support	
Environmental Constraints	Natural Environment	
	Cultural Environment	

INTERCHANGE SCREENING FACTOR FINDINGS

The Tier 1 Screening evaluation gathered and created a large amount of information. Organizing the information in graphs, tables, and maps aided understanding of how results compare between locations and provided context to the numerical results. The following section highlights important trends from each interchange screening factor category identified in Table 4.2. Detailed information for each location is included in Exhibit 16 through Exhibit 19.

Traffic

Changes in traffic affect safety, mobility, interchange design, and the environment. VMT statistics demonstrate the magnitude of traffic changes on a broad level. All interchange screening locations added to future year VMT on the freeways, with the exception of the Portage Road / Eastpark Boulevard Connector. Three interchanges that showed the most notable changes in VMT are listed in Table 4.4.

Table 4.4. Range of VMT Changes for Interchange Screening Locations

Interchange Screening Location	Change Between Future Year VMT with and without a New Interchange		
	Freeway	Non-Freeway	Net
Portage Rd / Eastpark Blvd Connector	-4,300	1,100	-3,200
Buckeye Rd (County AB)	110,100	-125,600	-15,500
Cottage Grove Rd (County BB)	122,300	-139,100	-16,800

Large increases in VMT undesirably reduce the service life of the network and aggravate existing congested locations. Cottage Grove Road and Buckeye Road were the two locations with the high impact to the freeway, but also reduce sizable amounts of traffic from the non-freeway network. The Portage Road / Eastpark Boulevard Connector demonstrates the opposite situation where freeway VMT is reduced, due to the interchange allowing a more direct route between I-39/90/94 and US 151, at the expense of adding traffic to the local system.

A general trend amongst all interchange screening locations was that the VMT statistics provide a general description, but mask important details that are illustrated in the traffic maps included in Exhibit 16 through Exhibit 19. Figure 4.1 shows a portion of the Cottage Grove Road Interchange traffic map. Roadways with increases in future year AADT are shown in red, and decreases are shown in blue. Thicker and darker lines represent higher magnitudes of change. These maps visually demonstrate specific changes in traffic volumes and travel patterns that are important for understanding the extent of impacts caused by new interchanges.

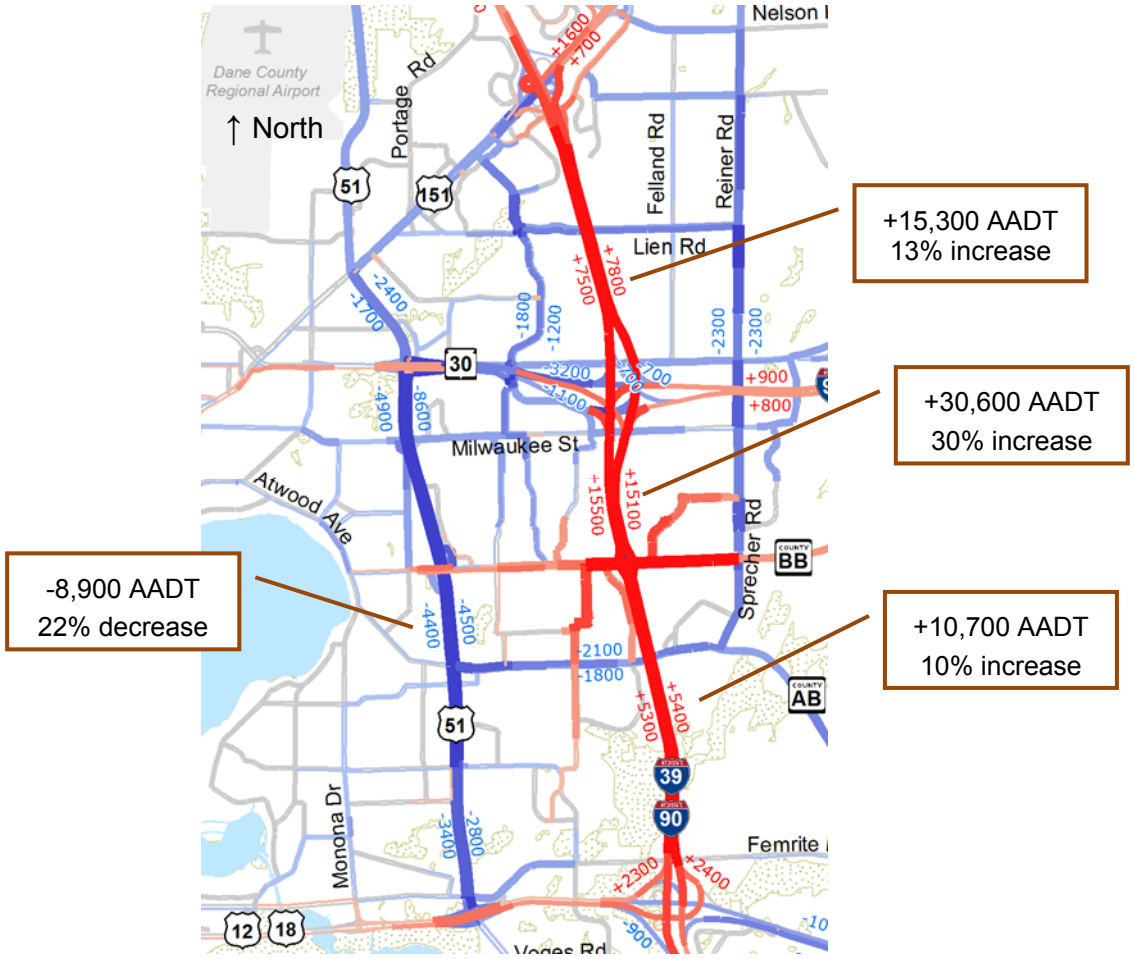


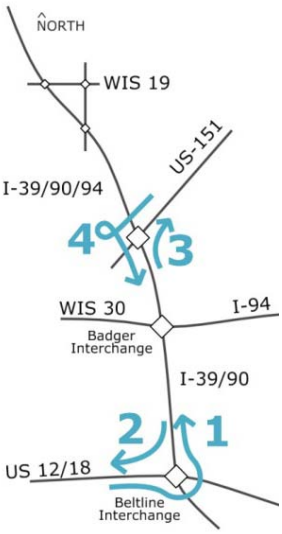
Figure 4.1. Example Change Between Future Year AADT with and without a Cottage Grove Road Interchange

Figure 4.1 exemplifies the widespread impacts that an interchange can create. With an interchange at Cottage Grove Road, traffic patterns completely change on the east side of Madison along I-39/90 between the Beltline and US 151 interchanges. Such changes have consequences on long range plans for the interstate and non-freeways (especially US 51 and Cottage Grove Road in this example), and land use. Other screening locations with large impacts to traffic patterns include Buckeye Road, Milwaukee Street Extension, and Lien Road.

Many screening locations also had significant impacts to existing interchanges. Thirty existing ramps were identified as carrying high or moderate traffic volumes today. These ramps are approaching or at capacity and provide important mobility within the study area. Table 4.5 highlights four of these critical ramps and the change in daily traffic caused by new interchanges. New interchanges not listed in Table 4.5 have no significant impact at these four ramps.

Table 4.5. Change in Future Year AADT at Critical Existing Ramps

Interchange Screening Location	To/From Beltline		To/From US 151	
	1. NB on from EB Beltline	2. SB off to WB Beltline	3. NB off to NB US 151	4. SB on from SB US 151
Hoepker Rd	—	—	-1,200	—
Hanson Rd	—	—	-2,800	-2,800
County T	—	—	+2,000	+1,100
Milwaukee St Ext.	—	—	+1,200	—
Milwaukee St	+1,400	+1,600	—	—
Cottage Grove Rd	+2,400	+2,300	+2,800	+3,200
Buckeye Rd	+2,500	+2,900	+2,100	+2,400
Femrite Dr	-1,600	-2,200	—	—



— No significant change in Future Year AADT due to new interchange

Some interchanges, like Hoepker Road, Hanson Road, and Femrite Drive, reduce traffic at these critical ramps and are beneficial for extending the life of the interstate and enhancing mobility. Conversely, interchanges that add traffic to already heavy volume movements may have significant impacts by requiring additional ramp lanes, collector-distributor roads, or special geometry to relieve congestion and increased weaving movements caused by the new interchange.

Further understanding the impacts and size of new screening interchanges was demonstrated by the average ramp demand and making comparisons to locally well-known interchanges. Overall trends in interchange demand ranged from very low to very high as shown in Table 4.6.

Table 4.6. Interchange Screening Locations Compared to Existing Interchanges

Interchange Screening Location	Average Ramp Demand (Future Year 2050 AADT)	Analogous Existing Interchange and Existing Average Ramp Demand (Existing Year 2012 AADT)
Ridge Rd	2,050	I-94 & WIS 73 (1,760 Existing AADT)
Hanson Rd	7,375	Beltline & Monona Dr (7,450 Existing AADT)
Cottage Grove Rd	15,275	Beltline & US 151 Verona Rd (15,525 Existing AADT)

The Beltline & US 151 Verona Road interchange is locally known for its high volume movements and traffic delays; Cottage Grove Road would have similar volumes and would require a high level interchange configuration to accommodate the anticipated traffic. Ridge Road was unique due to its low volume ramps that demonstrate no need for the interchange in the foreseeable future unless planned area land use changed significantly.

Safety

Safety results showed that the interchange screening locations added a total of 8 to 37 crashes/year at interchange merge/diverges, ramp terminals, and basic freeway segments combined. Crashes decreased on the non-freeway network from 0 to 135 crashes/year county-wide. The large decrease on the non-freeway network results from higher crash rates on the non-freeway network compared to freeways (about 65 - 300 crashes/hundred million vehicle miles traveled (HMVMT) on non-freeways and 35 - 80 crashes/HMVMT on freeways).

Numerical trends did not show large increases in crashes on the interstate; however, engineering judgment regarding geometrics and interchange spacing contributed to safety considerations and concerns. A common conclusion was that new interchanges between the Beltline and US 151 system interchanges would significantly impact safety and LOS due to high traffic volumes and significant weaving movements at the new merges/diverges they would introduce. Figure 4.2 shows the existing worst case lane changes between the I-39/90 & I-94 / WIS 30 (Badger) and US 151 interchanges. An interchange at either Lien Road or County T would further increase these weaving, merge, and diverge movements, and have a negative effect on safety and operations.

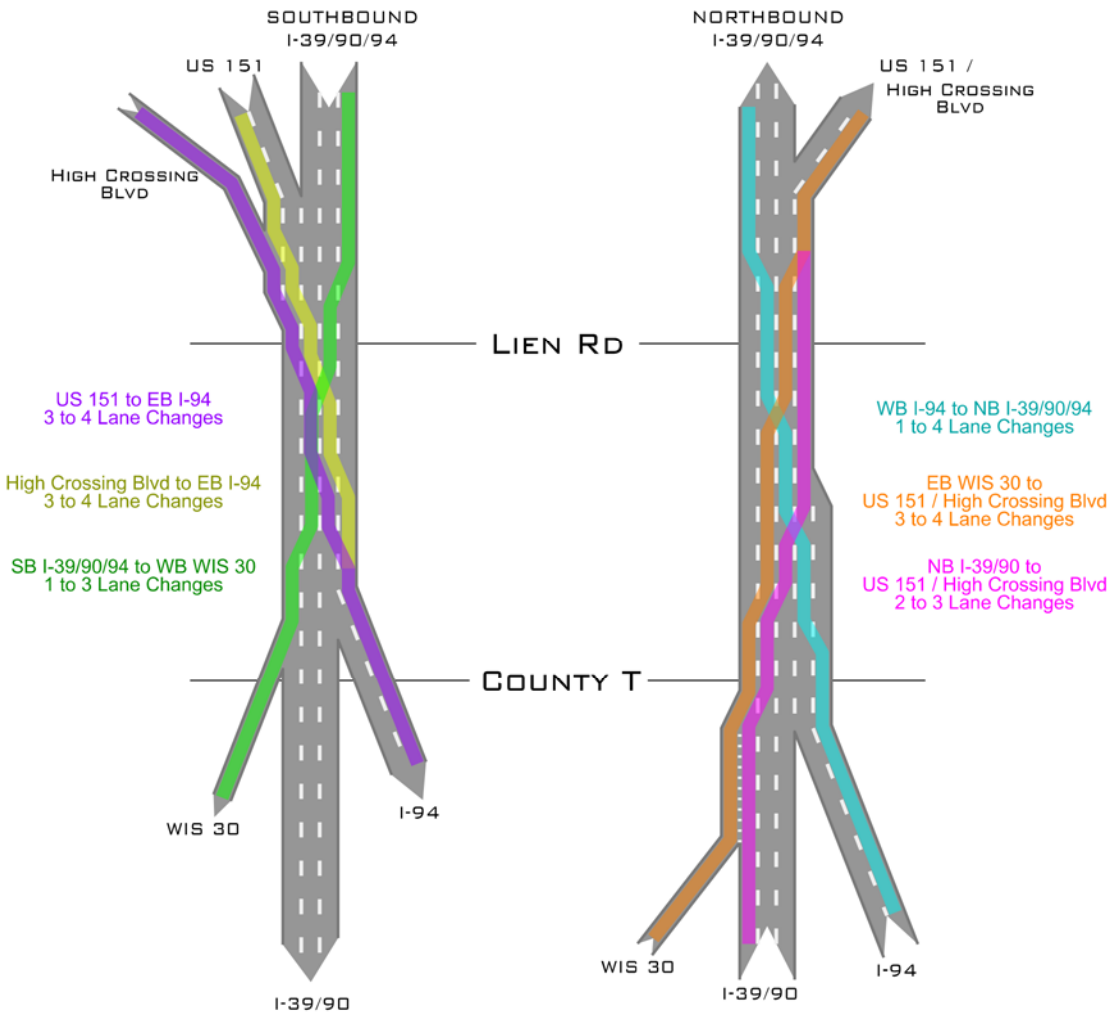


Figure 4.2. Existing Weaving / Merge / Diverge Conflicts

Interchanges with similar safety concerns include the following:

- **Portage Road / Eastpark Boulevard Connector** – embedded with US 151 merges and diverges from I-39/90/94
- **Sprecher Road** – near major diverge of I-94 to NB / SB I-39/90 and WIS 30
- **Milwaukee Street** – near major merges of I-94 and WIS 30 with SB I-39/90
- **Cottage Grove Road** – within weaving area between Badger and Beltline
- **Buckeye Road** – within weaving area between Badger and Beltline
- **Femrite Drive** – embedded with merges of EB and WB Beltline to NB I-39/90

Regional Importance

Functional class of the interchange cross roads ranged from local roads to minor arterials, as shown in Table 4.7.

Table 4.7. Interchange Crossroad Functional Class

Minor Arterial	Collector	Local Road
• Hoepker Rd • County T • Sprecher Rd • Cottage Grove Rd • Buckeye Rd • Femrite Dr	• Cuba Valley Rd • Hanson Rd • Portage Rd / Eastpark Blvd Connector • Lien Rd • Milwaukee St Ext. • Gaston Rd • Milwaukee St	• Ridge Rd

Arterials are better candidates for interchanges because by definition, they provide the highest level of mobility to large traffic volumes. For example, Cottage Grove Road has regional importance because it extends 20 mi to Lake Mills and beyond, provides a parallel route to I-94, and connects many rural areas. Conversely, Ridge Road which is classified as a local road, would require significant improvements in order to accommodate additional traffic and offers limited regional connections.

Trends in traffic patterns also revealed the relative regional importance predicted for each evaluated interchange. The Sprecher Road half interchange shown in Figure 4.3 illustrates the potential for an interchange to primarily serve traffic that uses the interstate for one or two interchanges and therefore has minimal regional importance.

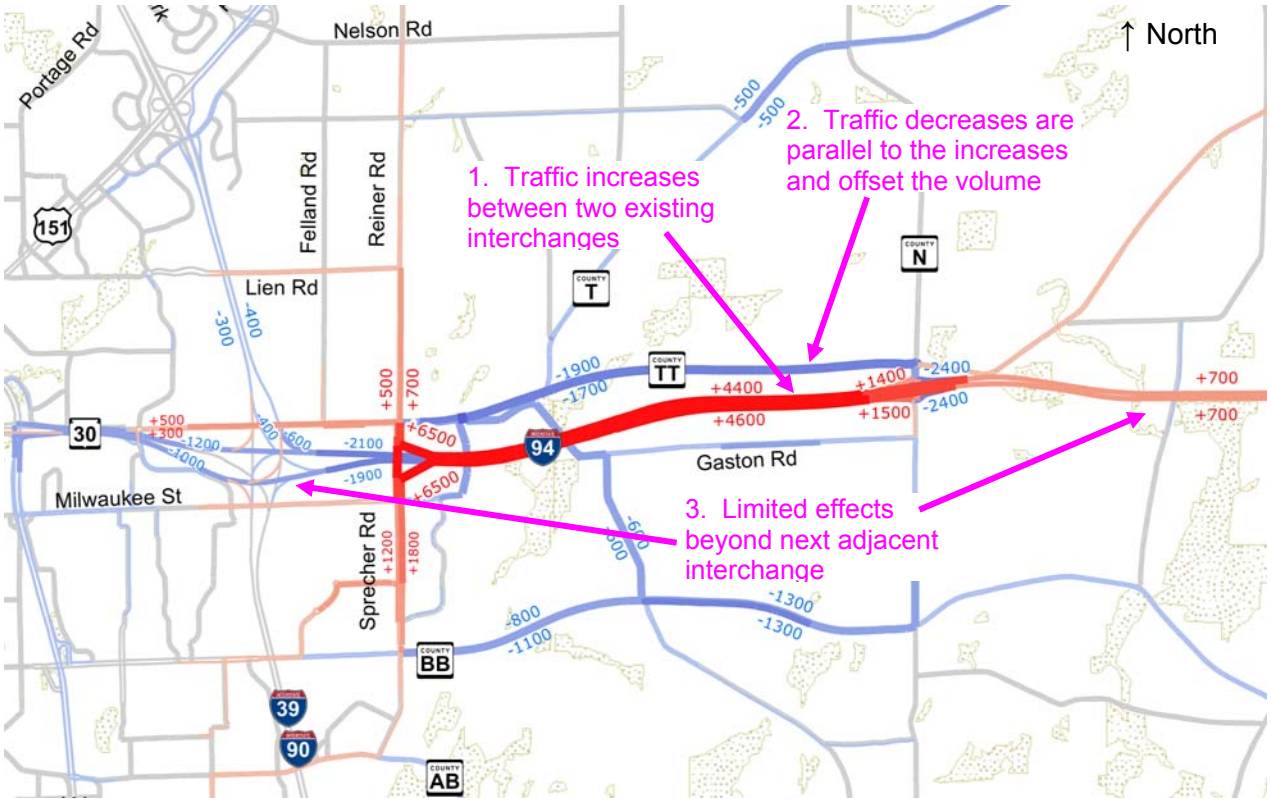


Figure 4.3. Local Trip Traffic Patterns at Sprecher Road

Traffic that previously used the existing County N interchange now accesses I-94 at the new Sprecher Road Interchange. The new interchange pulls traffic that was accommodated on local routes parallel to I-94 onto the interstate system. In addition, the County N ramps servicing Madison show an increase in volume, however there is not an increase in volume along the interstate west of Sprecher Road. This indicates that the additional volume using the County N interchange is using the interstate to travel to the adjacent Sprecher Road interchange.

Other interchanges with similar local traffic patterns include: Lien Road, County T, Ridge Road, and Milwaukee Street.

Geometrics

Spacing, geometrics, and consideration of physical constraints all influence safety and efficiency. Exhibit 14 shows the spacing between existing interchanges and new interchange screening locations. Table 4.8 lists all interchanges and classifies their spacing as Acceptable, Marginal, or Poor based on the distance to existing system and service interchanges compared to interchange spacing standards in urban areas.

Table 4.8. Interchange Spacing Assessment

Acceptable	Marginal	Poor
> 2 mi to system > 1 mi to service	~ 2 mi to system ~ 1 mi to service	< 2 mi to system < 1 mi to service
• Cuba Valley Rd • Ridge Rd	• Hoepker Rd • Gaston Rd • Buckeye Rd	• Hanson Rd • Portage Rd • Lien Rd • County T • Sprecher Rd • Milwaukee St Ext • Milwaukee St • Cottage Grove Rd • Femrite Dr

Interchanges classified with Poor spacing tend to be located in areas with heavy weave, merge, or diverge movements, as noted in the Safety discussion. Less than desirable geometrics not only increase the risk for crashes, but can create bottlenecks in traffic flow. Accommodating traffic at closely spaced interchanges typically requires collector-distributor (C-D) roads. Adding C-D roads at the Badger, Beltline, and US 151 interchanges would require extensive reconfiguration within tight right-of-way limits and increase the complexity and cost of these system interchanges.

Geometrics of interchanges are also affected by physical features such as buildings, utilities, terrain and other natural features. Site visits and reviews of aerial photography produced a list of considerations that would impact the design of each screening location. Identified physical constraints ranged from small utilities constraints up to major multi-million dollar facilities. For example, Figure 4.4 shows features near Femrite Drive that would impact interchange design.

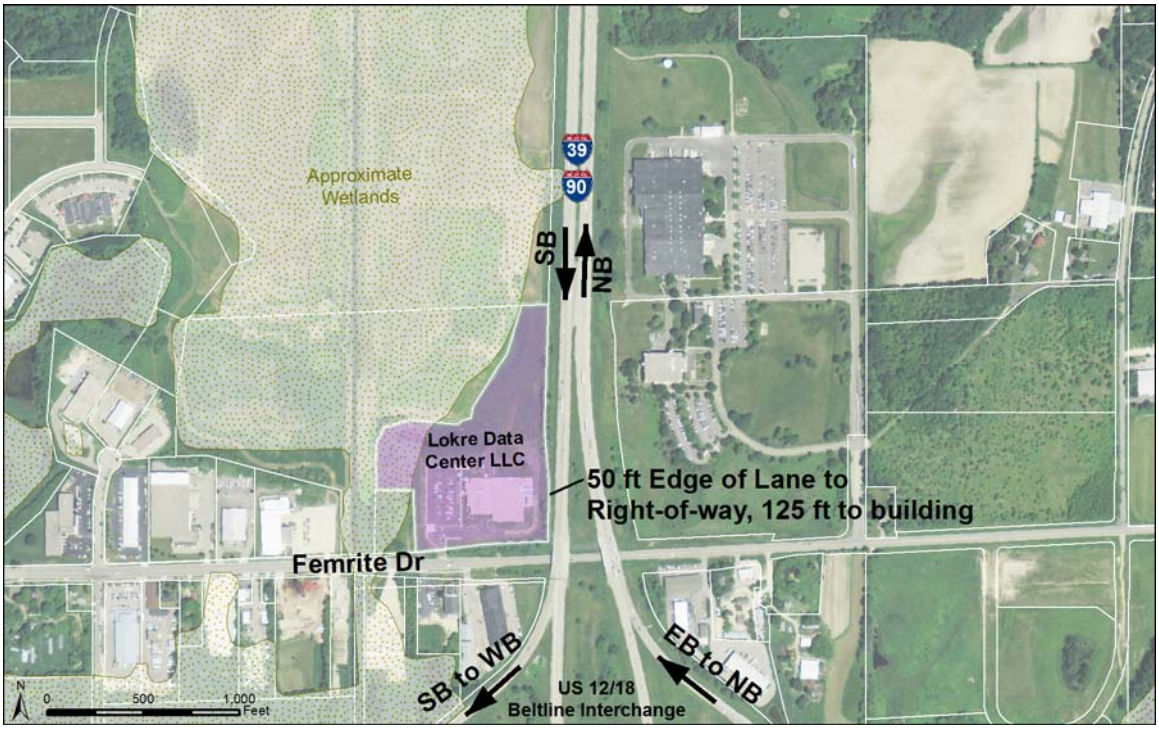


Figure 4.4. Physical Constraints Near Femrite Drive

The evaluation at Femrite Drive identified high-value properties abutting on both sides. On the west, a data center property assessed at $17.1 million in 2013, and additional properties east of the interstate valued at $5 million. An interchange design to avoid these buildings would involve complicated geometrics and embedment within the Beltline system interchange. Current plans for reconstructing the Beltline interchange include a C-D road west of mainline I-39/90, which further limits space for adding an additional off-ramp to Femrite Drive. A wetland bank site located immediately north of the data center, and a stream crossing immediately west, further place constraints on design possibilities.

Physical constraints at other screening locations were less severe than Femrite Drive, but still may create design challenges. Utilities were commonly found near interchange screening locations. The two largest utility constraints are shown in Figure 4.5 near Cuba Valley Road, and Figure 4.6 near Hanson Road. Hanson Road is also in close proximity (within 700 ft) to a new UW Hospital that started construction during 2013.

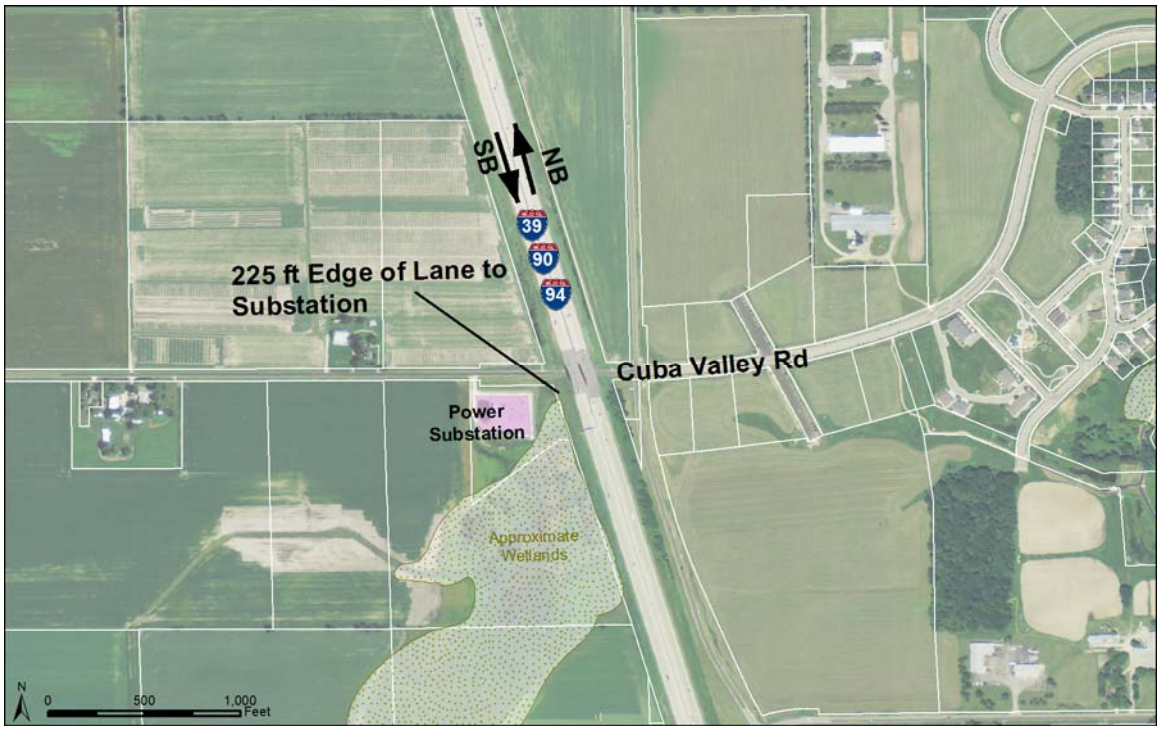


Figure 4.5. Physical Constraints near Cuba Valley Road

Figure 4.6. Physical Constraints near Hanson Road

Local Input

Understanding desires and concerns of locals was a critical component for Tier 1 Screening to establish the purpose and need for interchanges. One of the IAJR policy points refers to consistency between the new access and local and regional transportation. FHWA will not accept new access requests without the support of all bordering municipalities. Exhibit 16 through Exhibit 19 summarizes the input received regarding interchange locations, with original responses in Appendix O. All responses represent a snapshot of current opinions, which may change over time with changes in leadership and politics. Responses tended to show local support for interchanges in areas with potential business or residential growth, and opposition to locations in well-established residential areas. Table 4.9 lists locations following these trends.

Table 4.9. Local Input Regarding Interchanges near Businesses and Residential Areas

Areas with Development Potential	Established Residential Areas
• Cuba Valley Rd* • Hoepker Rd • Hanson Rd • Lien Rd • Milwaukee St Ext. • Gaston Rd* • Femrite Dr	• Portage Rd • County T • Milwaukee St • Cottage Grove Rd • Buckeye Rd

*Supported by villages, but opposed by townships

Another common trend was that townships often expressed concerns about agricultural land use changing to business and residential uses as a result of a new interchange. While one purpose of an interchange is to provide beneficial access, the facility should not do so by dividing communities and changing land use to other than what the local entities support. Further indication of local support and public opinions would be sought during the I-39/90/94 Environmental Study.

Municipalities also focused on bicycle and pedestrian themes. Responses commonly stated that new interchanges would improve mobility, except on high vehicle traffic corridors such as Cottage Grove Road and Buckeye Road. The Portage Road / Eastpark Boulevard Connector has mixed support because of the business development on the east side of the interstate and established residential development on the west side. Providing pedestrian and bicycle access only is a possibility that will be explored during the Environmental Study for the I-39/90/94 corridor.

Environmental Impact

All interchange locations had some degree of environmental impact in the high level screening. However, none of the impacts identified were considered fatal flaws preventing further interchange consideration. Femrite Drive has the potential for the highest level of environmental impacts with the extensive wetlands west of the interstate and a contaminated site near Ohmeda Drive. Details in Exhibit 15 list nearby natural and cultural environment features for

each interchange. All impacts identified were the result of office reviews of small-scale GIS data sources and literature search results exemplified by Exhibit 15.

INTERCHANGE SCREENING RESULTS

Of the 14 interchange locations considered, eight have been eliminated from further consideration after Tier 1 screening. A decision on one other location has been deferred until a municipality requests it in the future. The remaining five locations are analyzed in greater detail in Tier 2. All locations and their status after Tier 1 Screening are listed in Table 4.10 and are shown in Exhibit 21.

Local input and traffic results helped define the perceived purpose for each location, which helped to organize the discussion. Interchanges with a similar purpose and need were grouped and evaluated together. Interchange groupings included:

- I-39/90/94 north of US 51
- I-39/90/94 between US 51 and US 151
- I-39/90 between US 151 and Beltline interchanges
- I-94 east of I-39/90 (Badger Interchange)

Table 4.10 shows which geographic areas warrant further consideration for an interchange. Future developments north of US 51, between US 151 & US 51, and between the Badger and County N desire increased access to facilitate growth and improve mobility. Only one of the potential interchange locations within each geographic area advancing to Tier 2 could be approved and constructed under the IAJR process because of minimum interchange spacing requirements.

Between the Beltline and US 151 interchanges, all new interchanges were removed from further consideration. Within this section of the interstate, there are three closely spaced system interchanges with several lane drops, add lanes, and weaving segments. The addition of another interchange within this area would further increase traffic volumes, number of lanes, conflicting movements, and weaving within this segment. In addition to these reasons, a new interchange would also decrease the service life of critical ramps within the system interchanges, increase traffic through residential neighborhoods, and cause impacts to residential and business developments along the corridor. In the future, no new interchanges will be considered between the Beltline and US 151 interchanges. Any requests or proposals for new interstate access between the Beltline and US 151, including locations not evaluated in this evaluation, will likely be denied by WisDOT due to similar impacts.

Table 4.10. Interchanges Screening Locations Advancing to Tier 2 Analysis

Geographic Area	Advance to Tier 2	Remove from Further Consideration
I-39/90/94 north of US 51	• Cuba Valley Rd	-
I-39/90/94 between US 51 and US 151	• Hoepker Rd • Hanson Rd	• Portage Rd / Eastpark Blvd Connector
I-39/90 between US 151 and Badger	-	• Lien Rd • County T • Milwaukee Street • Cottage Grove Rd (County BB) • Buckeye Rd (County AB) • Femrite Dr
I-94 east of I-39/90 (Badger Interchange)	• Milwaukee St Ext. • Gaston Rd	• Sprecher Rd • Ridge Rd*

* Tier 1 Screening results indicate that a Ridge Rd interchange would have minimal positive and negative effects, and no immediate need for further analysis in Tier 2. This location may be evaluated in detail at a later time if conditions change and an interchange is requested or WisDOT believes it would have merit.

Two special recommendations resulted from the Tier 1 evaluation. First, Ridge Road was found to have minimal negative impacts and minimal benefits. If future conditions substantially change from the Tier 1 Screening assumptions, this interchange may be reconsidered in the future. Second, the Cuba Valley Road interchange is in close proximity to Windsor Road, which provides a greater regional connection compared to Cuba Valley Road. Windsor Road is analyzed as an alternative to Cuba Valley Road in Tier 2 Screening.

To determine locations advancing to Tier 2, screening factor results were compiled and discussed with the I-39/90/94 TAC.

The I-39/90/94 TAC developed a list of positive and negative aspects for each interchange. Being mindful of global safety, mobility, and FHWA policy, allowed consensus about the impacts of each interchange. All factors were given careful consideration during assessments. Removal from further consideration required the aggregation of multiple and significant negative effects and was not based on any single factor. Locations advancing to Tier 2 Screening did not demonstrate overwhelming negatives and required additional detailed analysis to fully understand and evaluate impacts.

Exhibit 16 through Exhibit 19, organized by geographic area, assess the positive and negative impacts of each interchange. These assessments led to the recommendations shown for advancing, or not advancing, the location to Tier 2 analysis. The expert panel unanimously agreed on the recommendation for all interchange locations other than Femrite Drive. The City of Madison expressed desire for further consideration of Femrite Drive, but the panel felt that the negatives at the location outweighed the benefits.

GRADE SEPARATED CROSSING SCREENING FACTOR FINDINGS

Similar to the interchange evaluation, the Tier 1 Screening evaluation for grade separated crossings gathered and created a large amount of information. The following section highlights important trends from each grade separated crossing screening factor category identified in Table 4.3. Detailed information for each location is included in Exhibit 20.

Traffic

Grade separated crossing screening locations had noticeably less traffic impacts than the interchanges. Changes in VMT on the freeways ranged from a decrease of 3,300 VMT due to the Portage Road / Eastpark Boulevard Connector to an increase of 2,400 VMT due to the Anderson Road crossing. All grade crossings, except Anderson Road, decreased freeway VMT. Decreases in VMT are desirable for easing congestion and extending the service life of the freeway system.

In general, grade separations are good for the operations of the freeway and adjacent interchanges. Table 4.11 lists all grade separated crossings that decreased adjacent interchange crossroad AADT by 1,000 or more.

Table 4.11. Grade Separated Crossings Impact to Adjacent Interchange Crossroads

Grade Separated Crossing	Adjacent Interchange Crossroad	Change in Adjacent Crossroad AADT
Daentl Rd / East Metro Blvd	I-39/90/94 & WIS 19	-2,000
	I-39/90/94 & US 51	-1,500
Portage Rd / Eastpark Blvd Connector	I-39/90/94 & US 151	-2,300
City View Dr	I-39/90/94 & High Crossing Blvd	-6,000
Capitol Dr	US 151 & American Pkwy	-1,300
Thompson Rd	US 151 & County C	-2,700
	US 151 & Main St	-5,500

None of the grade separated crossings increased adjacent crossroad AADT by a significant amount; the largest increase was 700 AADT at I-39/90/94 & US 51 due to the Anderson Road location.

Traffic impacts to the local road system were typically isolated between existing grade separated crossings or interchanges. Figure 4.7, a crop from the East Metro Boulevard / Token Creek Lane traffic map, provides an example of the typical extent of changes in AADT. All traffic maps in Exhibit 20 show specific impacts to the roadway network.

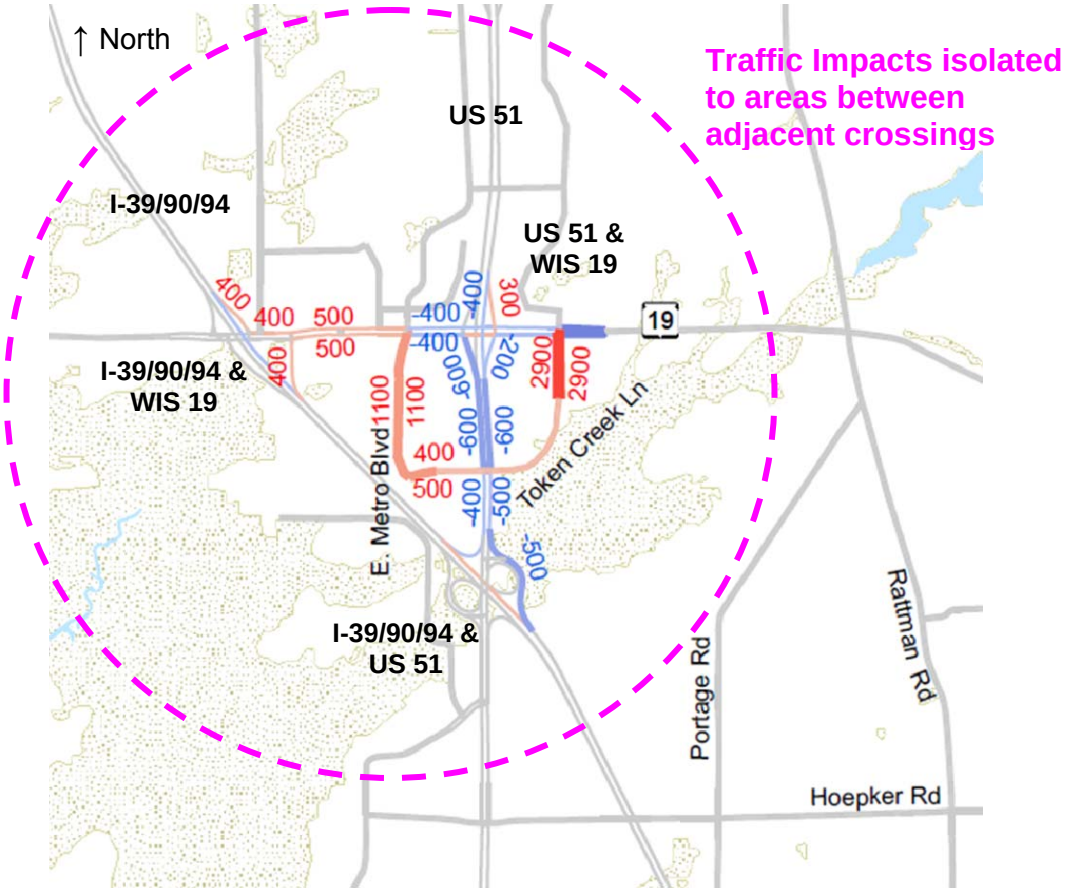


Figure 4.7. East Metro Boulevard / Token Creek Lane – Changes in AADT

The magnitude of traffic using the new grade separated crossing varied from 200 AADT at Daley Road to 9,100 AADT at Thompson Road. The low demand for Daley Road indicates little need for a crossing at this location. The highest crossing volumes are shown in Table 4.12 which have the potential to increase mobility by connecting communities currently separated by the freeway.

The projected year 2050 AADT crossing volumes are based on the assumption that the identified planned and committed improvements shown in Appendix N are the only changes to the existing network. If additional improvements are made, or some planned improvements do not occur, the anticipated 2050 AADT volumes may be different. For example, the Anderson Road crossing assumes full access at the existing US 51 & County CV / Anderson Road intersection. If US 51 is converted to a freeway, and the existing Anderson Road intersection is replaced with a grade separated crossing, the 2050 AADT volume for an I-39/90/94 crossing on Anderson Road will be much lower.

Table 4.12. Highest Grade Separated Crossing Volumes

Grade Separated Crossing	Crossing AADT
Thompson Rd	9,100
City View Dr	7,000
Anderson Rd	4,700
Portage Rd / Eastpark Blvd Connector	4,100
Daentl Rd / E. Metro Blvd	1,900
Buss Rd	1,800
Capitol Dr	1,700
E. Metro Blvd / Token Creek Ln	900
Daley Rd	200

Safety

Due to the low volume increases on the freeway, safety results at most showed an increase of about 1 crash/year added to freeway. This result shows that grade separated crossings have no significant impact on freeway safety.

Non-freeway safety results showed minimal impact, with up to 4 additional crashes/year. Due to the methodology, the non-freeway safety analysis was less sensitive to small changes in traffic compared to the intersection crash analysis. Evaluation of crashes at adjacent intersections provided a better representation of safety impacts due to the grade separated crossings. Total results ranged from 0 to 10 additional intersection crashes per year and did not reveal any specific safety concerns. Crash results for each evaluated intersection are listed in the details of Exhibit 20.

Regional Importance

Evaluating functional class showed the relative importance of the cross road in the network. An arterial crossing that serves more traffic has greater benefit than local road crossings that benefit few. However, lower functional class crossings can still provide benefit by connecting communities divided by the freeway. Functional class also provides a sense of the magnitude and type of facility that would be required to accommodate its users. Listings of the functional class, either existing or assumed, are shown in Table 4.13.

Table 4.13. Grade Separated Crossing Functional Class

Minor Arterial	Collector	Local Road
• Capitol Dr[1]	• Portage Rd / Eastpark Blvd Connector[2] • City View Dr • Thompson Rd	• Daley Rd • East Metro Blvd / Token Creek Ln • Daentl Rd / E. Metro Blvd • Anderson Rd • Buss Rd

1. Assumed due to connection of two minor arterials and extension of O'Keefe Ave
2. Assumed because the crossing would connect two collectors

Geometrics

Typical physical constraints for the grade separated crossing locations included small utilities and buildings in the vicinity of the new crossing. No locations had any single obstacle that would prevent a grade crossing. Details in Exhibit 20 list physical constraints identified for each grade separated crossing.

A City View Drive grade separated crossing requires the most geometric considerations due to the proximity of numerous buildings, large power poles, and a railroad underpass all shown in Figure 4.8.

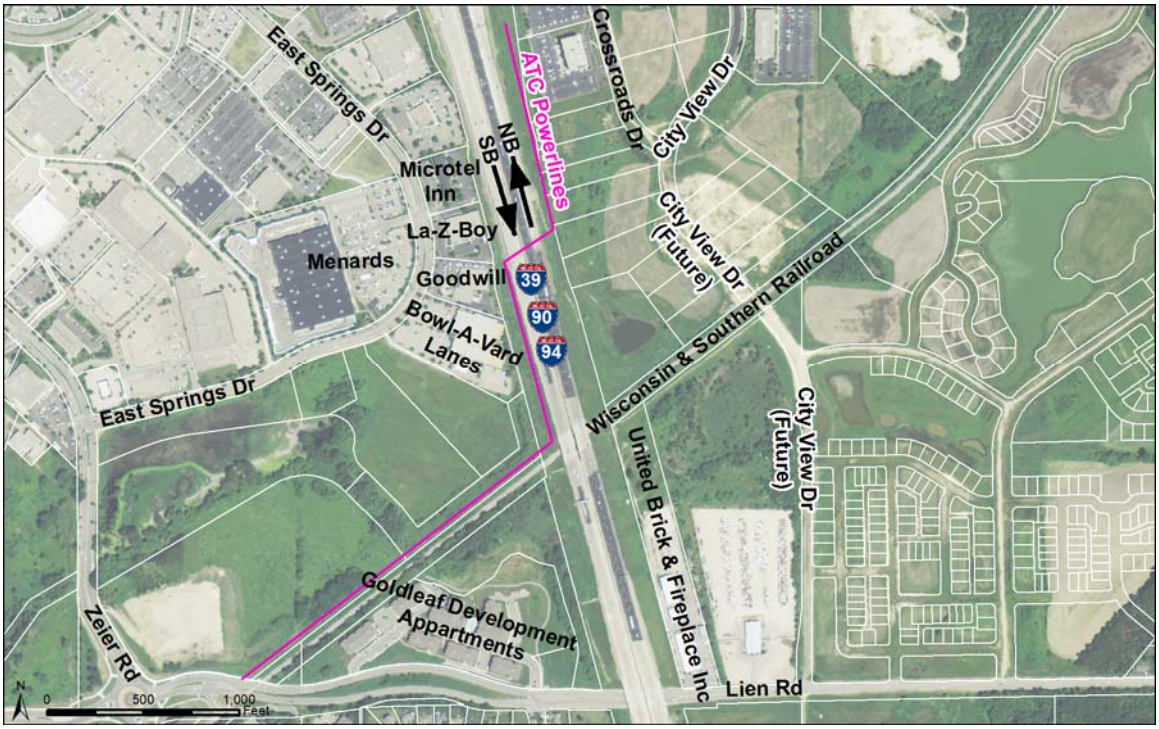


Figure 4.8. Physical Constraints Near City View Drive

Local Input

Local input was critical for establishing the purpose and need of the grade separated crossings. Exhibit 20 summarizes the input received, with original responses in Appendix O. All responses represent a snapshot of current opinions, which may change over time with changes in leadership and politics. Responses showed a trend that locations with high volume (Thompson Road, City View Drive, and Anderson Road) were all supported by the municipalities. This is an important finding that validates the need for increased connectivity in these areas. Daley Road was consistently opposed by the Village of DeForest and Town of Vienna due to the lack of attractions and agricultural land use in the area, which was consistent with the low AADT anticipated for the crossing.

A City View Drive crossing may be less important to the City of Madison if City View Drive can be successfully extended to Lien Road. Lien Road is 0.5 miles south of City View and already crosses I-39/90/94, providing access to the East Towne Mall area. However, connecting City

View Drive to Lien Road requires crossing a railroad, and the extension may not occur if the railroad does not grant a new at-grade crossing. Without the extension, a City View Drive grade separated crossing with I-39/90/94 is important to provide connectivity.

The City of Madison expressed concerns about the Portage Road / Eastpark Boulevard Connector adding undesirable traffic to the residential development west of the interstate, and would prefer a bicycle and pedestrian only crossing. Other responses regarding bicycle and pedestrian accommodations revealed a theme that all grade separated crossing locations would enhance multi-modal connectivity.

The City of Sun Prairie expressed special interest in a Thompson Road crossing and has this location in long term plans. The city has benefited from the Bird Street crossing located outside the projects limits (north of the US 151 & Windsor Street interchange) and feels Thompson Road would provide similar benefits. Sun Prairie has growing developments on either side of US 151 and a crossing would increase mobility and reduce traffic at adjacent interchanges.

The Village of DeForest expressed the importance of the East Metro Boulevard / Token Creek Lane location for access to existing businesses and future development plans. Currently, the location is an existing at-grade intersection with US 51. The US 51 Draft Environmental Impact Statement (EIS) shows right-in-right-out access at East Metro Boulevard only and no access at Token Creek Lane. A grade separated crossing would allow local connections desired by the village.

Environmental Impact

No identified environmental constraints were considered fatal flaws preventing further consideration of the crossing. Details in Exhibit 20 list nearby environmental and cultural features for each interchange. All impacts identified were the result of office reviews of small-scale GIS data sources exemplified by Exhibit 15. Thompson Road, shown in Figure 4.9, is an example of a location near potential historic sites and wetlands that may impact the design and location of the crossing.

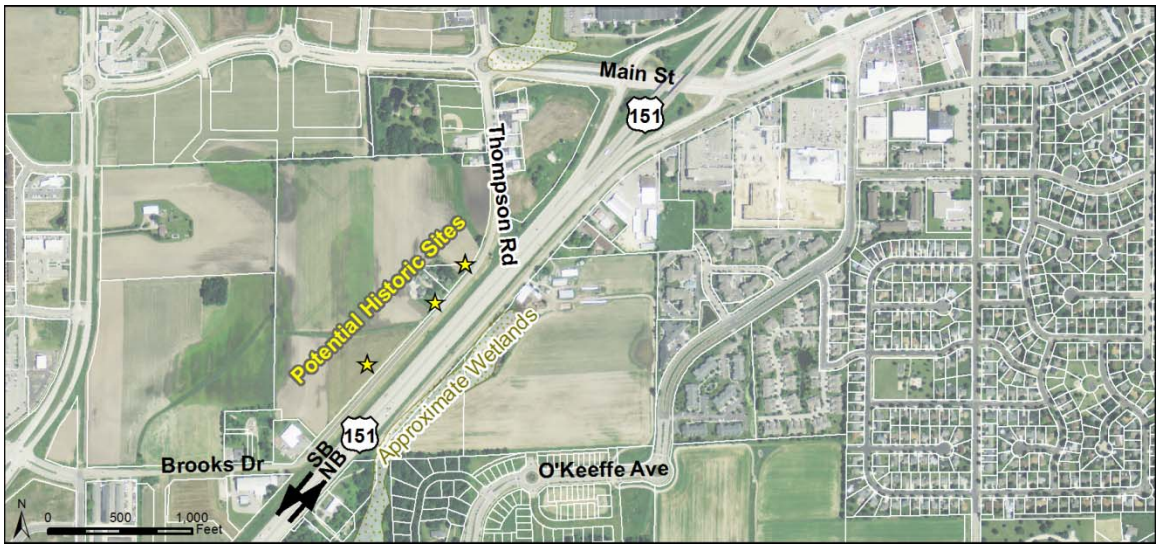


Figure 4.9. Environmental Constraints near Thompson Road

GRADE SEPARATED CROSSING SCREENING RESULTS

Results for the grade separated crossing screening are summarized below. One location, the Portage Road / Eastpark Boulevard Connector, was recommended for analysis during the Tier 2 Screening process because of its possible effects on analysis of interchanges being considered during Tier 2 Screening in the same area. Three additional grade separated crossing locations will be further analyzed during the I-39/90/94 Environmental Study. Two of the locations serve the I-39/90/94 & US 51 area and have potential benefit due to proposed access changes from the US 51 Draft EIS. Five locations with minimal effect on the travel network are delayed from further analysis, but may be reconsidered if municipalities express interest. Regardless of the recommendations made during the TIA, Anderson Road, Portage Road / Eastpark Boulevard Connector, and Capitol Drive will be analyzed as potential new bicycle and pedestrian crossings during the I-39/90/94 Environmental Study.

Similar to the interchange screening, the I-39/90/94 TAC discussion of each grade separated crossing resulted in recommendations for which locations should be further considered. Due to isolated traffic and safety effects, less impacts to the freeways, and generally positive benefits of grade separated crossings, the recommendations were divided into four categories:

- ***Remove from further consideration.*** These grade separated crossings would not be allowed by WisDOT because they have significant negative impacts to communities and the transportation system, and/or have extensive physical and environmental constraints.

- ***No further evaluation at this time.*** WisDOT could allow the crossing if requested and funded by a municipality. These grade separated crossings do not show any imminent traffic need or provide significant positive impacts to communities and the transportation system. Further analysis may be done in the future if municipalities show interest in the location. At this time, these locations are not anticipated to provide enough value to be included in a state/federal funded I-39/90/94 Environmental Study preferred alternative.

- ***Additional analysis recommended as part of the Tier 2 Screening analysis.*** Results from Tier 1 Screening show some value to the crossing location, especially in combination with interchanges being considered in Tier 2, but requires further investigation.

- ***WisDOT will evaluate in more detail during the I-39/90/94 Environmental Study.*** Tier 1 Screening was sufficient to show these grade separated crossings may have benefits and require further evaluation during the I-39/90/94 Environmental Study for possible inclusion in the preferred alternative.

Remove crossing from further consideration

- No grade separated crossings were removed from further consideration.

No further evaluation recommended at this time

C1. Daley Road

(Crossing I-39/90/94 between Cuba Valley Road and County V) – 200 AADT

- Low demand/AADT
- Minimal change in interstate and interchange traffic volumes
- The Village of DeForest and Town of Vienna are opposed to a crossing at this location

C2. Daentl Road / East Metro Boulevard

(Crossing I-39/90/94 between US 51 and WIS 19) – 1,900 AADT

- Reduces traffic volumes along US 51 and at the US 51 & WIS 19 interchange
- May cause impacts to existing businesses and residential properties
- West of I-39/90/94, Daentl Road has low development possibilities and does not provide good roadway connections
- The Village of DeForest is opposed to a crossing at this location

C6. City View Drive

(Crossing I-39/90/94 between High Crossing Boulevard and Lien Road) – 7,000 AADT

- Reduces traffic volumes along High Crossing Blvd
- Minimal decrease in traffic along I-39/90/94 and US 151
- Potential impacts to existing businesses
- Constrained by WSOR railroad crossing located south of City View Drive
- The City of Madison has plans to extend City View Drive to connect to Lien Road, but this extension may not occur if the railroad does not grant a new at-grade crossing. Without the extension, a City View Drive grade separated crossing with I-39/90/94 is important to provide connectivity.

C7. Capitol Drive

(Crossing US 151 between American Parkway and County C) – 1,700 AADT

- Low demand/AADT
- No current request from a municipality for a crossing at this location
- Low impact on volumes at adjacent interchanges
- An off-road bicycle and pedestrian crossing at this location is included in the Bicycle Transportation Plan prepared by the Madison Area Metropolitan Planning Organization (Appendix R)

C9. Buss Road

(Crossing I-94 between Gaston Road and County N) – 1,800 AADT

- Low demand/AADT
- Minimal change in interstate and interchange traffic volumes

Additional analysis recommended as part of the Tier 2 Screening analysis

C5. Portage Road / Eastpark Boulevard Connector

(Crossing I-39/90/94 between US 151 and Hanson Road) – 4,100 AADT

- Reduces traffic at the US 151 & American Parkway interchange
- Reduces traffic on US 151 through the I-39/90/94 & US 151 interchange
- Negative: Increases traffic through residential neighborhoods west of I-39/90/94
- An off-road bicycle and pedestrian crossing at this location is included in the Bicycle Transportation Plan prepared by the Madison Area Metropolitan Planning Organization (Appendix R)

WisDOT will evaluate in more detail during the I-39/90/94 Environmental Study

C3. East Metro Boulevard / Token Creek Lane

(Crossing US 51 between I-39/90/94 and WIS 19) – 900 AADT

- Will provide connection between these two roads if US 51 is converted to a Freeway and access is restricted as currently shown in the US 51 Draft EIS

C4. Anderson Road

(Crossing I-39/90/94 between Hoepker Road and US 51) – 4,700 AADT

- Currently recommended as a bike and pedestrian overpass in the US 51 Draft EIS
- The proposed alternative in the US 51 Draft EIS removes access from Anderson Road to US 51 and Anderson Road is a grade separated crossing over US 51
- With the proposed removal of the US 51 & Anderson Road at-grate intersection, there is low volume demand for Anderson Road to be a grade separated crossing with I-39/90/94
- A crossing that accommodates vehicles may cause negative impacts to Token Creek Park including the purchase of land
- The City of Madison has requested a bicycle and pedestrian crossing of I-39/90/94 at Anderson Road

C8. Thompson Road

(Crossing US 151 between County C and Main Street) - 9,100 AADT

- Reduces traffic at the US 151 interchanges with County C and Main Street
- This crossing is included in the City of Sun Prairie transportation and land use plans

SUMMARY

The Tier 1 Screening process is part of a comprehensive evaluation of potential new interchanges and grade separated crossings on the interstate system in the Madison Metropolitan area. The I-39/94/94 Technical Advisory Committee (TAC) evaluated these locations and consisted of representatives from WisDOT SW Region Major Studies, WisDOT SW Region Environment, WisDOT SW Region Traffic, WisDOT BTO, WisDOT BPD, WisDOT EPDS, WisDOT TFS, FHWA, City of Madison, Madison Area Transportation Planning Board, and Dane County. The I-39/90/94 TAC analyzed locations from a high level perspective to identify locations that may benefit communities and the transportation system. The I-39/90/94 TAC considered factors such as traffic impact, safety, spacing to adjacent interchanges, physical and environmental constraints, and local community input. Consensus from the expert panel resulted in recommendations of locations for Tier 2 Screening.

Interchange Screening Results

The major conclusion from the interchange screening process was that no new access should be allowed between the US 12/18 (Madison Beltline) and US 151 system interchanges. Figure 4.10 reveals findings within this segment. Potential I-39/90 Interchanges between US 12/18 (Madison Beltline) and US 151 shared many negative characteristics:

- **Very high traffic demand.** Many screening locations had forecasted volumes comparable to present-day congested interchanges on the Beltline. For example, Cottage Grove Road would be expected to behave similar to the Madison Beltline & Verona Road interchange that contributes to daily reoccurring congestion and reduced reliability.

- **Decreased service life of the interstate facility.** Increased traffic negatively affects safety, operations, and maintenance of the interstate, shortening the service life of the facility. Some of the evaluated interchange locations add up to 30% additional traffic to this segment of the interstate. Additional traffic further intensifies already complicated merging and weaving conflicts between system interchanges, causing serious safety concerns. Finally, new interchanges added in this area accelerate the need for costly improvements to the system interchanges due to added traffic at key system ramps that are already at, or exceeding, capacity.

- **Added traffic to residential neighborhoods.** Well established residential areas exist adjacent to the evaluated interchange crossroads. Added traffic volume to residential streets decreases desirability, increases congestion and noise, reduces safety, and challenges bicycle and pedestrian mobility.

- **Physical constraints.** Residential and business developments, utilities, wetlands, and streams exist along this segment which would be impacted by many of the interchange screening locations. Narrow right-of-way along the interstate restricts design possibilities and greatly increases real estate costs to build an interchange.

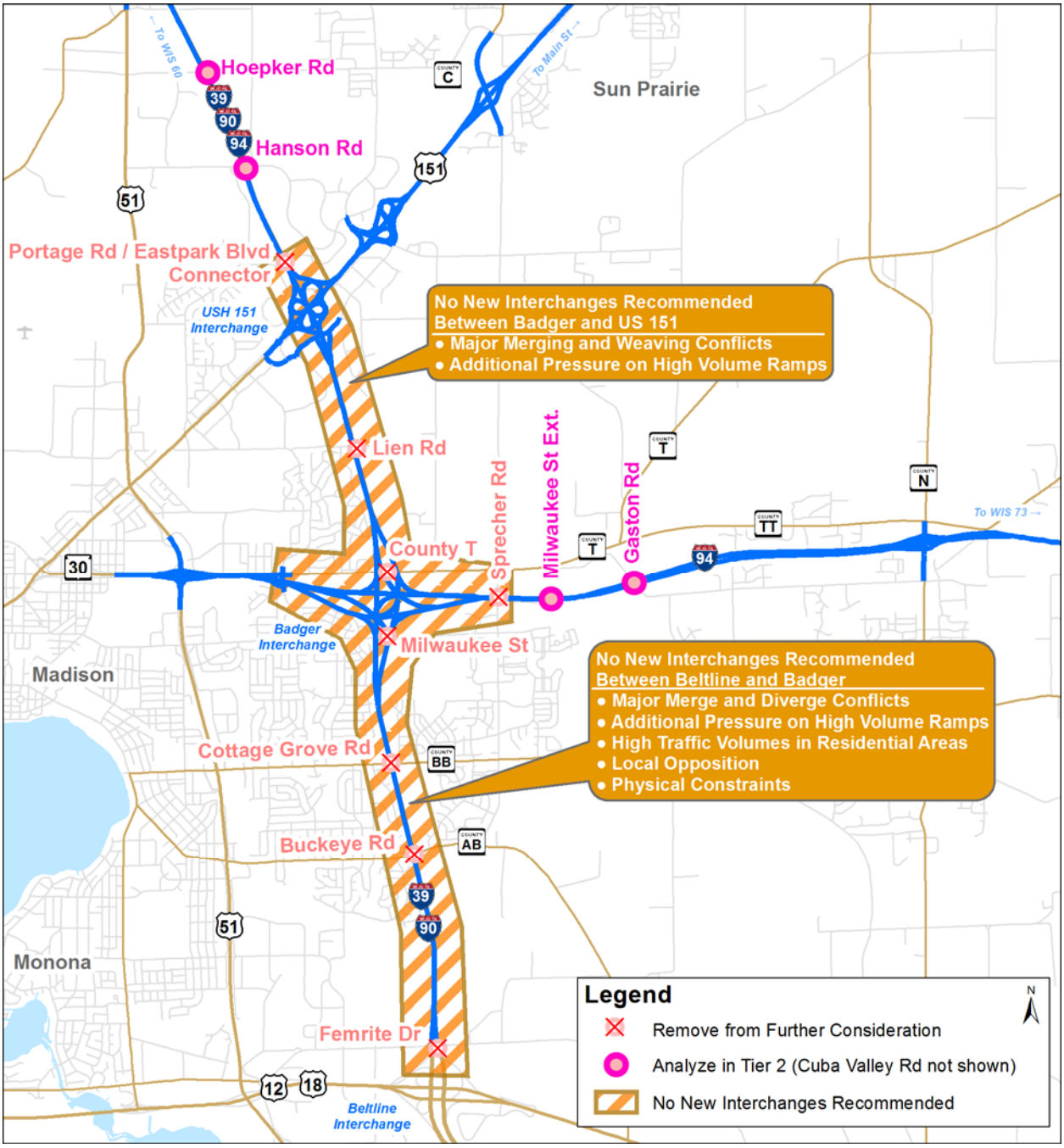


Figure 4.10. Tier 1 Interchange Screening Conclusions

Outside of the Beltline to US 151 corridor, some new interchange locations have the potential to bring economic and traffic benefits to the area. These locations require additional detailed analysis to fully understand their positive and negative impacts. Locations advancing to the Tier 2 Screening analysis, as shown in Exhibit 21, include:

Table 4.14. Interchange Locations Advancing to Tier 2 Screening

Interchanges Advancing to Tier 2 Screening
• Cuba Valley Road
• Hoepker Road / Hanson Road
• Milwaukee Street Extension / Gaston Road

Grade Separated Crossing Screening Results

Establishing connections with grade separated crossings are good for the interstate in general. Traffic on adjacent interchange crossroads as well as bicycle and pedestrian mobility can be improved with additional crossings. Grade separations connect communities that may have been severed by the freeway.

The grade separations evaluated by the study had a range of positive effects. Some locations were particularly beneficial to the WisDOT highway network due to reductions in traffic at existing interchanges. These locations are recommended to be further evaluated in either the Tier 2 Screening of this study, or in the I-39/90/94 Environmental Study. For other locations with minimal benefit to the WisDOT highway network, WisDOT should give further consideration to the crossing if requested by a municipality. WisDOT will evaluate cost sharing of grade separations on a case by case basis.

WisDOT should consider all crossing requests from municipalities, and no grade separated crossings were dismissed from further analysis. The screening locations were categorized as:

Table 4.15. Grade Separated Crossing Tier 1 Screening Recommendations

No Further Evaluation Recommended at this Time[1]	Additional Analysis Recommended as Part of the Tier 2 Screening Analysis	WisDOT Will Evaluate in More Detail During the I-39/90/94 Environmental Study
• Daley Road • Daentl Road / East Metro Boulevard • City View Drive • Capitol Drive • Buss Road	• Portage Road / Eastpark Boulevard Connector[2]	• East Metro Boulevard / Token Creek Lane • Anderson Road • Thompson Road • Portage Road / Eastpark Boulevard Connector[2]

1. WisDOT could allow the crossing if requested by a municipality, but does not expect it will be of value as part of the I-39/90/94 Environmental Study preferred alternative
2. The Portage Road / Eastpark Boulevard Connector was evaluated during Tier 2 and will be further analyzed during the I-39/90/94 Environmental Study

SECTION 5

Tier 2 Screening

EXHIBITS

APPENDICES

INTRODUCTION

This section contains the results from the second part of the two-tier screening process. Tier 1 Screening evaluated 14 potential interchange locations from broad and high-level perspectives guided by the FHWA IAJR policy points. Locations passing Tier 1 Screening did not show enough disbenefit to discard them from further consideration and were moved on to Tier 2 Screening to better understand impacts and benefits. All five locations evaluated in Tier 2 remain viable though some need more evaluation as part of the Interstate Study but none are guaranteed approval for final design or construction. Tier 2 results focus upon benefits and obstacles that would need to be considered if a location should be further pursued through the FHWA IAJR process. Interchanges evaluated during Tier 2 Screening include:

- Cuba Valley Road and Windsor Road
- Milwaukee Street Extension and Gaston Road
- Hanson Road and Hoepker Road

One grade separated crossing, the Portage Road / Eastpark Boulevard Connector, was evaluated in combination with Hanson or Hoepker Road interchanges. A discussion of this crossing is included under the FHWA Policy Point #7 section for these interchanges. Further evaluation of the grade separated crossings will be performed during the upcoming I-39/90/94 Environmental Study.

METHODOLOGY

Tier 2 Screening involved additional investigation of four areas, including: geometrics, traffic analysis, construction cost estimates, and environmental investigations.

Geometrics

Several conceptual layouts were developed for each interchange location. These high level conceptual alternatives were discussed by the I-39/90/94 Technical Advisory Committee in regards to design standards, physical constraints, connection to the mainline freeway, access spacing, and impacts to the local system and properties. Appendix S shows the conceptual interchange alternatives. Alternatives considered included standard diamond interchanges, partial cloverleaves, split-diamond, and off-alignment designs. Other alternatives may be proposed and should be investigated as part of an IAJR as long as they meet the conditions and criteria identified for the interchanges in this report. One or two conceptual alternatives deemed plausible for each interchange by the study team and municipalities with an interest in each location were carried forward for traffic analysis and further geometric design.

Additional design details were incorporated into the alternatives to develop preliminary interchange layouts. The preliminary layouts include proposed lane configurations along the mainline, ramps, side roads and at the intersections. Modifications to the local road network required to achieve desired access spacing are shown. The refined geometric designs do not represent preferred alternatives or final designs.

Traffic Analysis

Tier 2 Screening included mainline freeway and ramp terminal intersection traffic analysis. Year 2050 AM, PM, Friday, and Sunday peak hour traffic forecasts were developed based on AADT forecasts from the Dane County TDM, which was modified to include the potential new interchange. The 2050 AADT forecasts for the different alternatives can be seen in Appendix T. The year 2050 peak hour volumes were modeled in Paramics and Synchro to evaluate changes in traffic operations as a result of the potential new interchange.

Freeway analysis started with the year 2050 Baseline Paramics Model and was modified to include the potential new interchange. Ramp terminal intersections were analyzed in Synchro. The traffic models were used to identify improvements along the freeway mainline, adjacent roadways, and at intersections that may be necessary to obtain acceptable LOS operations with the addition of a new interchange. All traffic analysis targeted LOS C or better for the mainline freeway and off-ramp approaches for future year 2050 operations. Appendix D contains documentation for the Paramics models developed during Tier 2 Screening.

Construction Cost Estimates

Planning level cost estimates for the construction of each potential interchange were developed based on the geometric designs. Estimates included construction costs for new structures, widening of existing structures, ramps, ramp terminal intersections, and local roads immediately adjacent to the interchange. Modifications needed along the freeway mainline due to a new interchange that are beyond the future year baseline assumptions were also included in the cost estimates. The cost estimate for the different alternatives can be seen in Appendix U.

All cost estimates are based on 2014 dollars and do not include costs for engineering, real estate, or utilities. Local road construction needed to accommodate traffic beyond the immediate vicinity of the interchange would further increase costs. The local municipality requesting the interchange may be responsible for up to 100% of the cost. Local funding can come from public or private sources. WisDOT's share, if any, will be based on benefits to the state highway network and the timing of construction.

Environmental Constraints

Environmental surveys were conducted along the corridor to identify potential wetland, parkland, historic, and archaeological constraints. The DNR Wisconsin Wetland Inventory was used to identify wetland areas. Parkland was identified through County parcel information.

Potentially historic sites were identified through an archival and literature search and then field verified through a windshield survey. The windshield survey identified properties within the study area that are at least 40 years old and have historical or architectural significance. An archival and literature search was completed to identify previously recorded archaeological sites within the study corridor.

Two indirect and cumulative effects analyses were completed for the potential interchange locations. One analysis was completed for the potential interchange location of Cuba Valley Road and Windsor Road, and compared the anticipated impacts between the two locations. The other analysis was completed for the Milwaukee Street Extension and Gaston Road locations. An indirect and cumulative effects analysis for the Hanson Road and Hoepker Road locations will be conducted during the upcoming Environmental Study.

TIER 2 SCREENING RESULTS – INTERCHANGES ON I-39/90/94 NORTH OF US 51

CUBA VALLEY ROAD TIER 2 SCREENING RESULTS

Two locations were studied between the existing I-39/90/94 interchanges at County V and WIS 19. The Village of DeForest has expressed interest in an interchange at Cuba Valley Road in the past, and the Town of Windsor suggested Windsor Road as an alternate interchange study location during the public input portion of the TIA. On April 29th, 2014 a meeting was held with representatives from the Village of DeForest, the Town of Vienna, the Town of Windsor, and the Park Towne Developer to discuss and refine locally desired interchange concepts. On May 15th, 2014 members of the study team presented information on the concepts at a Town of Windsor board meeting and did the same during a June 2nd, 2014 meeting with the Town of Vienna. The following describes the Tier 2 Screening results and supplement the detailed summary in Exhibit 22 for Cuba Valley Road.

Geometrics

Tier 2 Screening evaluated a diamond partial cloverleaf (diamond parclo) interchange at I-39/90/94 & Cuba Valley Road shown in Exhibit 22. Five alternative concepts were discussed before selecting this design for detailed analysis. This diamond parclo does not represent a final locally preferred alternative design, but provides advantages and disadvantages as compared to a traditional full diamond design with no loop ramp as shown in Figure 5.1. Impacts to the power substation and wetlands could be expensive to mitigate if a full diamond design was considered. The 35 mph loop southbound on-ramp is cause for concern due to possible speed differential between vehicles merging on to the interstate and higher speed mainline traffic. Conflicts can be minimized by providing sufficient acceleration length.

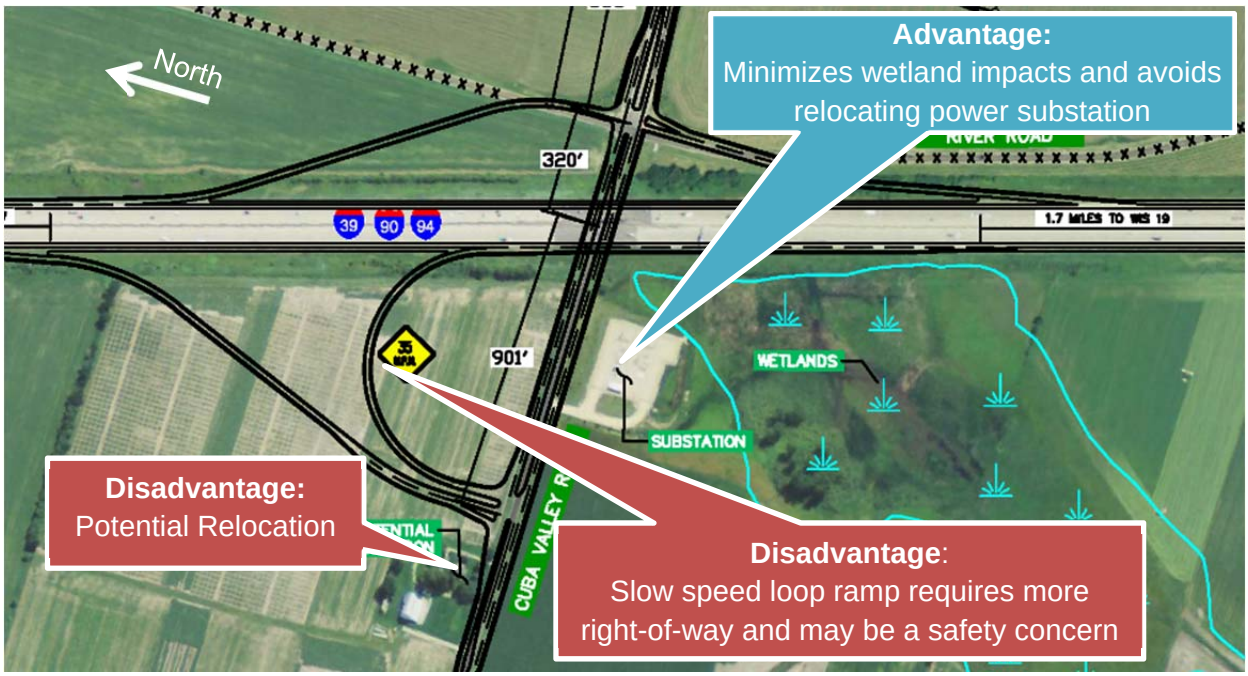


Figure 5.1. Potential Cuba Valley Road Interchange Design

Cuba Valley Road Design

Forecasted traffic volumes indicated the need for a 4-lane cross section (two lanes in each direction) plus turn lanes on Cuba Valley Road starting at the southbound ramp terminal intersection extending to Conservancy Way. Signalized intersections were assumed for the intersection designs, although roundabouts should be considered in future analysis.

Accommodating a 4-lane cross-section would require replacement of the existing interstate bridge. Existing bridge piers only allow for one lane in each direction, and the haunch slab design limits structure rehabilitation options. The bridge structures would likely need replacing and widening with any mainline interstate reconstruction project affecting the area. If standard beams are used and the new structures are lengthened to accommodate a widened Cuba Valley Road, the existing profile of the interstate would need to be raised approximately 3 feet in order to accommodate the new bridge structure depth required for the expanded cross section and standard vertical clearance for Cuba Valley Road. Cuba Valley Road cannot be lowered to obtain the clearance due to drainage issues and wetland concerns. This is a significant impact that requires 1 mile of interstate reconstruction in order to tie into the existing profile.

Access Spacing

The distance between intersections plays an important role in traffic operations and safety. If spaced too close, weaving conflicts and lane imbalance issues may occur. Conservancy Way has existing dead-end stubs intersecting Innovation Drive east of the interstate that are located approximately 685 feet from the potential northbound off-ramp intersection. Re-aligning Conservancy Way further east to provide the desirable spacing of 1,320 feet, shown in Figure 5.2, would minimize unsafe weaving between the off-ramp and Conservancy Way intersections and to provide efficient traffic flow.

Depending on final design, relocations may be necessary. East of the interstate, the Conservancy Way alignment may impact a structure north of Innovation Drive in order to achieve desirable access spacing. West of the interstate, farm and residential access near the southbound off-ramp shown in Figure 5.1 would need to be relocated.

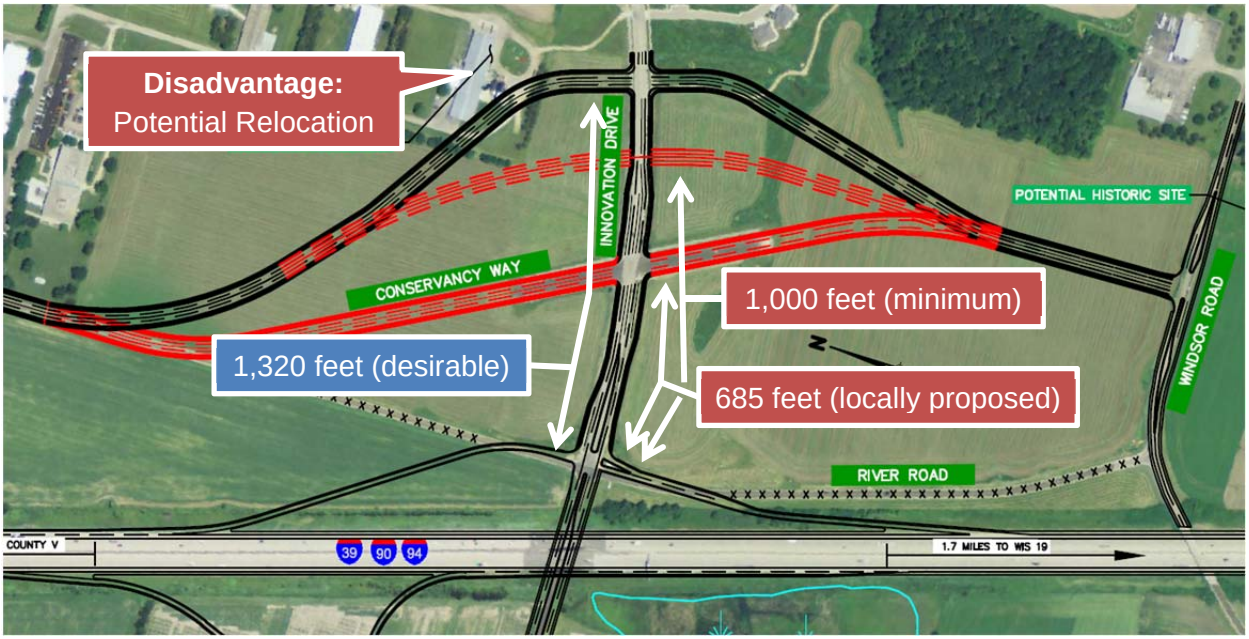


Figure 5.2. Cuba Valley Road Access Spacing East of I-39/90/94

Traffic

A Cuba Valley Road interchange would have minimal impact to freeway traffic operations. Low volume ramps and 2 mile spacing between interchanges may cause slight increases in traffic density, but not enough to change Level of Service (LOS). On- and off-ramp volumes are all less than 550 vehicles per hour during AM and PM peak periods and lower during peak interstate recreational hours.

Intersection operations at the new interchange would operate at LOS C or better with signalized control and two lanes in each direction on Cuba Valley Road east of the interstate. Traffic along Cuba Valley Road west of I-39/90/94 was forecasted to double between existing year and year 2050 conditions, shown in Table 5.1. An interchange at Cuba Valley Road and an extension of Innovation Drive to County CV would increase volumes on Cuba Valley Road by 2,800 vehicles per day. This increase in traffic is about an extra 5 vehicles per minute during the peak hours. Table 5.1 also shows that an interchange at Windsor Road has minimal impact to Cuba Valley Road traffic volumes.

Table 5.1. Cuba Valley Road Traffic West of I-39/90/94

Scenario	AADT (veh/day)
Existing Year 2012	1,800
No-Build (Year 2050) (without extension to County CV)	3,800
No-Build (Year 2050) (with extension to County CV)	4,500
With Cuba Valley Road Interchange (Year 2050) (with extension to County CV)	6,600
With Windsor Road Interchange (Year 2050) (without extension to County CV)	3,900

Impacts to adjacent interchanges would be minimal. The County V interchange would still operate at LOS C or better as traffic volumes are not significantly affected by a new Cuba Valley Road interchange. At the WIS 19 interchange, substandard LOS in future years would exist with or without a new Cuba Valley Road interchange. Figure 3 shows the primary movements where peak hour volumes would decrease due to a new interchange, as well as what intersections would still operate poorly. Traffic forecasts predicted that a Cuba Valley Road interchange would only slightly slow the traffic growth on WIS 19. Peak hour traffic west of the interstate on WIS 19 without a Cuba Valley Road interchange was forecasted to grow at 1.4% per year, meaning that year 2050 traffic volumes would be 1.5 times higher than existing year 2012 volumes. Adding a new Cuba Valley Road interchange resulted in a forecasted growth rate of 1.0% per year and traffic 1.4 times higher than the existing year 2012 volumes. This reduction in growth is not enough to mitigate the need for intersection improvements along WIS 19 to accommodate future traffic.

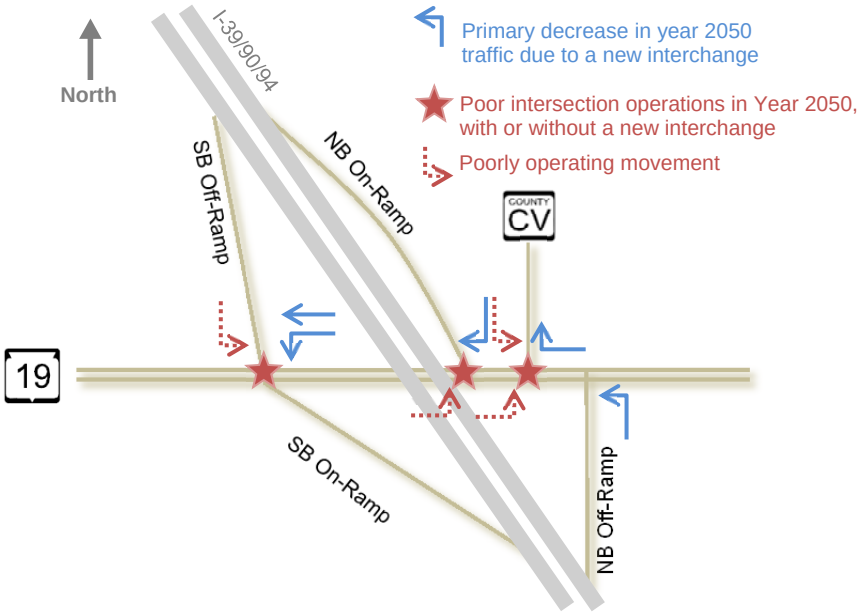


Figure 5.3. Traffic Impacts to WIS 19 Interchange

Local Input

Local officials from the Village of DeForest are in favor of a Cuba Valley Road interchange for its potential to increase the pace of economic development in the area and improve interstate access and regional connectivity for the village. Housing and commercial growth in the area has been growing steadily in recent years and is anticipated to continue, causing the need to accommodate future traffic in the DeForest area. The Town of Westport is neutral regarding a Cuba Valley Road interchange because the minor potential to improve development in the town is offset by perceived issues resulting from increased traffic on town roads. The towns of Windsor and Vienna are opposed to an interchange at Cuba Valley Road.

The Town of Vienna, Town of Windsor, and the general public have concerns about a Cuba Valley Road interchange. Increased traffic on Cuba Valley Road west of the interstate would be undesirable for the residents and agricultural land use. Public opinion received from town residents is overwhelmingly negative. Separate petitions were delivered to each town board signed by residents that oppose the interchange for concerns about increased traffic volumes, safety issues, noise impacts, and decreased property values. Others questioned the need for an additional interchange due to the close proximity of WIS 19 and County V. Both town boards are also concerned about cost sharing and the cost not only to build the interchange, but also for extra improvements and maintenance of local roads that interchange-related traffic would bring.

Appendix V contains meeting minutes and other local input regarding Cuba Valley Road interchange.

Cost Estimate

The Cuba Valley Road interchange alternative developed would total $21.3 million, excluding real estate and utility costs. This construction cost estimate includes:

- **$10 million** – for 1 mile of interstate reconstruction to obtain the vertical clearance for Cuba Valley Road
- **$4 million** – for structure costs for the northbound and southbound interstate bridges
- **$7.3 million** – for interchange and local road construction costs

WINDSOR ROAD TIER 2 SCREENING RESULTS

The following describes the Tier 2 Screening results and supplement the detailed summary in Exhibit 22 for the Windsor Road interchange screening location.

Geometrics

Tier 2 Screening evaluated a tight diamond interchange at I-39/90/94 & Windsor Road shown in Exhibit 22. This tight diamond interchange brings the ramps as close together as possible without using a more expensive design with retaining walls. This design provides advantages and disadvantages shown in Figure 5.4.

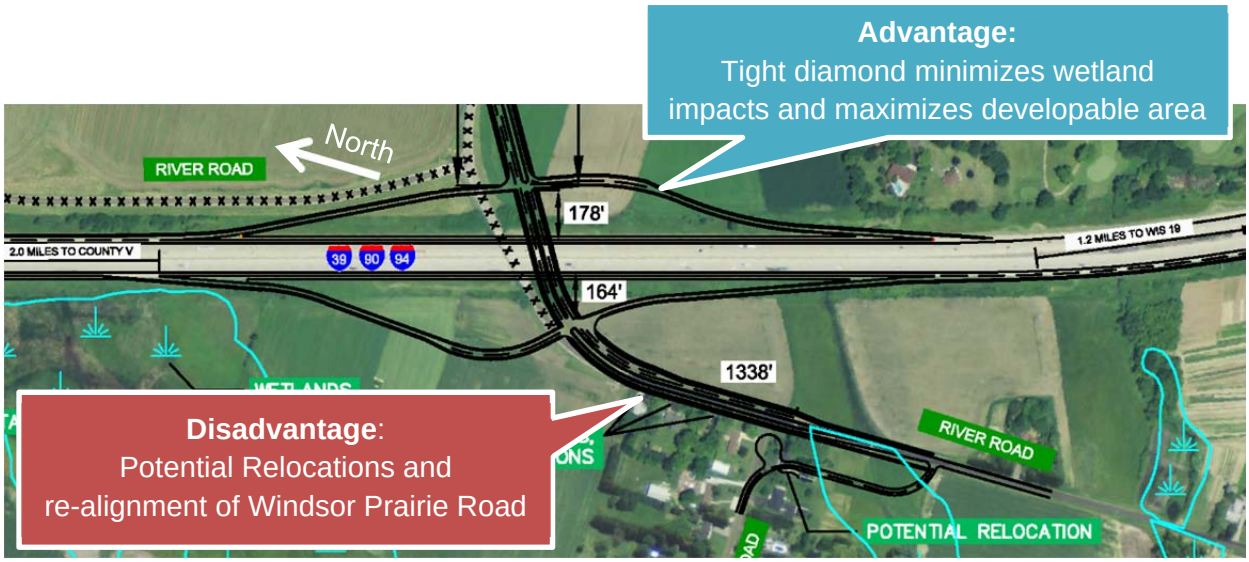


Figure 5.4. Potential Windsor Road Interchange Design

Windsor Road Design

Forecasted traffic volumes indicated the need for a two-lane cross section (one lane in each direction), with back-to-back look ahead left turn lanes on the Windsor Road structure over the interstate. Signalized intersections were used as a basis for the intersection designs; however, roundabouts should be considered as well in future analyses.

This design includes reducing the skew angle of the River Road bridge to adjust the horizontal curve west of the bridge. This would improve the design speed and sight distance while reducing the cost of the overpass structure. No mainline reconstruction would be necessary to obtain proper vertical clearance.

Access Spacing

Re-aligning Windsor Prairie Road to increase the distance to the southbound ramp intersection may be required as shown in Figure 5.5, depending on the final design. Residential driveways that currently connect to River Road would be eliminated due to their close proximity to the southbound off-ramp intersection. A frontage road or cul-de-sac that would provide replacement access for these homes could be explored. These town road and driveway

changes would result in one or more residential relocations. The locally proposed Conservancy Way alignment provides approximately 1,000 foot spacing from the potential northbound off-ramp intersection. Re-alignment of Conservancy Way further east would be required to achieve desirable spacing for safe and efficient traffic flow between intersections.

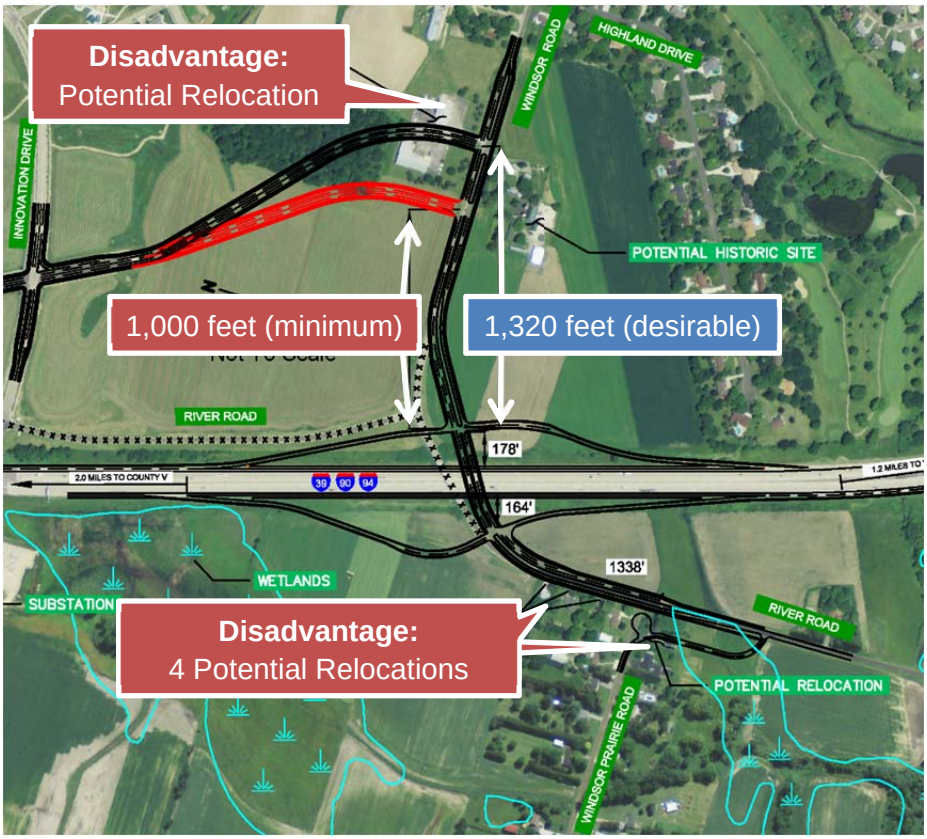


Figure 5.5. Windsor Road Access Spacing

Traffic

Freeway traffic operations would be slightly impacted due to a Windsor Road interchange. The 1 mile spacing between WIS 19 and Windsor Road would cause traffic density to increase, and likely decrease the average speed, due to closely spaced merge and diverge movements. An auxiliary lane may need to be considered between WIS 19 and Windsor Road in order to provide adequate distance for safe lane changing to and from interchanges. This would be determined based on final 2050 traffic forecasts that will be produced later in 2014.

Ramp intersections at a Windsor Road interchange would function well with LOS C or better if signalized. Traffic volumes and operations at a Windsor Road interchange would be similar to a Cuba Valley Road interchange. With an interchange, year 2050 average daily traffic on Windsor Road near Highland Drive is anticipated to be 6,800 veh/day. This volume represents an increase of 1,500 veh/day, or about 3 veh/min during peak hours, more than the no-build year 2050 scenario. Adjacent interchanges of County V and WIS 19 are impacted similarly to the Cuba Valley Road alternative, with WIS 19 having the same operational issues with or without this interchange, as depicted in Figure 5.3.

Local Input

The Village of DeForest and developers prefer the Cuba Valley Road location for direct access, but have also expressed interest in a Windsor Road alternative. The towns of Vienna, Windsor and Westport are opposed to an interchange at Windsor Road.

Public opinions heard at board meetings in the towns of Windsor and Vienna were overwhelmingly negative. Separate petitions were delivered to each town board signed by residents that oppose the interchange for concerns of potential relocations, safety, noise, and decreased property values. Increased traffic on Windsor Road east of the interstate would be undesirable for the surrounding neighborhoods, pedestrians, and bicyclists. Others have questioned the need for an additional interchange due to the close proximity of WIS 19 and County V. Town boards are also concerned about cost sharing and the cost not only to build the interchange, but also for extra improvements and maintenance of local roads that interchange-related traffic would bring.

The Town of Westport is strongly opposed to a Windsor Road interchange. The interchange would create pressure for developments along River Road and increase traffic on it. Both changes would be undesirable for the rural characteristics of the area. The township would prefer to see improvements to the WIS 19 interchange and further investigation of a North Mendota Parkway.

Appendix V contains meeting minutes and other local input regarding a potential Windsor Road interchange.

Cost Estimate

The Windsor Road interchange alternative developed would total $9.8 million, excluding real estate and utility costs. This construction cost estimate includes:

- **$3.2 million** – for the River Road structure costs
- **$6.6 million** – for interchange and local road construction costs
- No significant interstate mainline reconstruction; however there is a risk for additional cost if mainline auxiliary lanes are needed between Windsor Road and WIS 19

FHWA POLICY POINT ASSESSMENT

The interstate highway system provides important regional mobility. FHWA has eight policy points designed to evaluate justification for any new access and impacts to the system and environment. Full text of FHWA policy points is included in Exhibit 25. Both Cuba Valley Road and Windsor Road locations are similar regarding these policy points. The following discussion supplements the findings in Exhibit 22 and applies equally to either location, except where noted.

Policy Point #1: Need for new interchange cannot be accommodated by the existing interchanges and local road system, or a reasonably improved existing system

The Village of DeForest has plans for continued business and residential development east of the interstate along areas surrounding Cuba Valley Road and Windsor Road. Steady growth in the area has brought additional traffic. These areas can be accessed by existing adjacent interstate interchanges located at County V, about 2 miles north, and WIS 19, about 2 miles south. Forecasts predict that growth in DeForest and surrounding areas will continue to cause traffic to increase on WIS 19, County CV, and River Road. Adding a new interchange would slightly slow traffic growth along WIS 19, but not to the extent that capacity improvements at the WIS 19 interchange could be eliminated. No capacity improvements are predicted for the County V interchange with or without a new interchange. A future environmental study of the corridor will evaluate the capacity at the WIS 19 and County V interchanges in greater detail. Local road improvements at the intersections of WIS 19 & County CV and WIS 19 & River Road may also accommodate the demand.

Policy Point #2: Reasonable transportation system management will not alleviate the need for new access

Data for this policy point was not evaluated during the TIA, but is unlikely to change the need for an interchange.

Policy Point #3: New interchange does not have a significant adverse effect on operations and safety of the Interstate

Due to the relatively small increase predicted for traffic on the interstate, either potential new interchange has minor impacts on freeway operations or safety. The new interchange ramp terminal intersections are expected to operate well with signals or roundabouts. A Windsor Road interchange may require an auxiliary lane to WIS 19 because of the close proximity between interchanges. This auxiliary lane would allow drivers additional length to safely make merging and diverging maneuvers and lessen the density of traffic. More study of this issue would be needed after updated 2050 forecasts are produced.

Policy Point #4: Connects to a public road, provides all movements, & meets current standards

Both locations meet urban interstate access spacing requirements by providing at least 1 mile between interchange ramp gores, connect to public roads, and provide all on- and off-ramps to the interstate.

WisDOT provides access management policies to promote safety and efficiency. Per WisDOT standards, a distance of ¼ mile (1,320 feet) is desirable between any interchange ramp terminal intersection and the next adjacent driveway or intersection. Dedicating this distance to the interchange minimizes conflicts that can cause queues spilling back into adjacent intersections or the freeway, delays on the crossroad, and also provides adequate distance for lane changing between intersections. A primary concern with both locally preferred interchange designs is the deficient cross road spacing between the northbound off-ramp and Conservancy Way intersections. Additionally, one or more private drives near the southbound ramp intersection are well inside the 1,320 feet desirable (1,000 feet minimum) standard for right-in-right-out consideration.

The Cuba Valley Road design includes a 35 mph loop ramp, which is the minimum allowed design speed. While meeting standards, this loop ramp is cause for concern due to the potential conflict between slow speed vehicles merging on to the interstate with high speed mainline traffic. Conflicts can be minimized by providing sufficient acceleration length.

Policy Point #5: Consistent with local and regional land use and transportation plans

There are divided opinions regarding a Cuba Valley Road or Windsor Road interchange and how it may fit into land use plans. The Village of DeForest supports an interchange in this area due to its potential economic benefit, but is not currently sponsoring the interchange. The towns of Vienna, Windsor, and Westport are opposed to a new interchange. Consistent and sustainable long term planning would require consensus between municipalities.

The Madison Area Metropolitan Planning Organization (MPO) maintains a Regional Transportation Plan (RTP) to guide the overall direction of transportation needs and priorities for a 20 year long range timeframe. The current RTP 2035 does not include either interchange location. Any new interchange would need to be added to the RTP as part of the IAJR process. Concurrence from the Madison Area MPO must be obtained before it can be added.

Policy Point #6: New access is in context with long range Interstate system plan

The purpose of the TIA is to evaluate the potential viability of new accesses onto I-39/90/94 and freeways intersecting it in the greater Madison area. Cuba Valley Road and Windsor Road are the only two evaluated on I-39/90/94 north of the US 51 interchange. Only one site, not both, could be chosen for an interchange. All other potential interchanges evaluated in the TIA are located south of the US 51 interchange and do not address needs in the DeForest area.

Interstate access points should provide regional connectivity to support the primary purpose of the interstate, which is to provide mobility. Cuba Valley Road is a collector street and provides regional travel through its connection to the minor arterial of WIS 113 5 miles west of the interstate. East of the interstate, Cuba Valley Road turns into Innovation Drive, which currently dead-ends in less than 1 mile. Innovation Drive would be required to extend ¼ mile east to connect with the minor arterial of County CV to provide a greater regional connection. Department of Natural Resources approval of this connection may be difficult due to the need to cross the Yahara River headwaters.

Windsor Road is a minor arterial and provides a regional connection 2 miles east of the interstate to the principal arterial of US 51. West of the interstate, River Road extends 1.5 miles to the minor arterial of WIS 19 and an additional 3.5 miles to the principal arterial of WIS 113. The Windsor Road location has a greater regional reach than the Cuba Valley Road location, but the overall connectivity of each is substantially below that of the County V and WIS 19 interchanges to the north and south.

Policy Point #7: Local system can accommodate new traffic to bring traffic to the new interchange and distribute traffic away from the new interchange

Traffic increases can be accommodated by the local system with improvements to upgrade pavement condition and desirable cross section. These improvements may increase future repair and replacement costs for municipalities. River Road east of the interstate would need to be eliminated between Conservancy Way and Windsor Road and Conservancy Way re-aligned in order to provide desirable access spacing for the northbound interchange ramps. A new intersection with Windsor Road & Conservancy Way restores continuity for River Road east and west of the interstate. The Cuba Valley Road interchange also requires the extension of Innovation Drive to connect with County CV in order to service regional traffic to and from the interchange.

Policy Point #8: New access has been included in the required environmental evaluation, review, and processing.

The TIA evaluated wetlands, cultural, indirect, and cumulative environmental impacts from a high level perspective. Both interchanges have the potential to impact wetlands west of the interstate, depending on alignment of the southbound ramps and local roads. A potential historic site near Windsor Road & Conservancy Way exists and would need to be evaluated for historic eligibility and any potential impacts. Indirect and cumulative effects may include loss of agricultural land and natural resources, dispersion of development away from WIS 19 and County V, and increased development pressure along River Road west of I-39/90/94. Development pressure on Cuba Valley Road west of I-39/90/94 would be less with a Windsor Road interchange compared to a Cuba Valley Road interchange.

All environmental impacts, including additional consideration for ecological, aesthetic, economic, social, and health, would need further investigation and an environmental document must be completed to meet National Environmental Policy Act (NEPA) requirements.

SUMMARY

Tier 2 Screening results for a Cuba Valley Road or Windsor Road interchange include the following summary points and next steps to consider:

- **Local support for the Interchange is mixed –** The Cuba Valley Road interchange is consistent with land use and transportation planning in the Village of DeForest east of the interstate. The Village of DeForest has expressed interest in the interchange for its potential economic benefit, but is not currently sponsoring the interchange. The Town of Vienna and residents near the interchange locations do not support a new interchange at Cuba Valley Road or

Windsor Road due to the potential for increased traffic, costs, noise, safety issues, and conflicts with desired agricultural land use. The Town of Windsor is opposed to both a Cuba Valley Road and Windsor Road interchange due to increased traffic, obligations to enhance Windsor Road, as well as cost sharing issues. The Town of Westport is also against a Windsor Road interchange, believing it would stimulate pressure for development inconsistent with the desired land use along River Road. Consensus would need to be achieved for a new interchange to be consistent with long-term planning in the area.

- **Interchange design must meet desirable geometric standards –** The permanent and costly nature of infrastructure necessitates the best possible design to minimize long-term safety issues, inefficiencies, and costly reconstruction. The concepts evaluated in the TIA considered one possible alternative in detail for each potential interchange location; other alternatives could be considered. Achieving desirable cross road intersection spacing was found to be particularly challenging during the TIA evaluation due to developer desires, WisDOT standards, and potential for property relocations. The southbound low speed loop on-ramp evaluated in the Cuba Valley Road design presented concern due to the potential for speed differential between vehicles merging on to the interstate and higher speed mainline traffic. For the Windsor Road interchange, concern was expressed regarding the curvature west of the interstate on River Road that may limit design speed and sight distance. Any final design would need to address these concerns.
- **Traffic impacts are minimal –** A Cuba Valley Road interchange has minimal impact to freeway operations, but also has minimal benefit for adjacent interchanges. A Windsor Road interchange has some impact to the freeway operations due to weaving caused by the close proximity to WIS 19. Weaving conflicts should be evaluated further to identify if an auxiliary lane between the WIS 19 and Windsor Road interchanges would minimize operational issues. Interchange and intersection improvements would be needed at WIS 19 with or without a new interchange. Existing interchanges and local roads could likely be improved to accommodate future traffic volumes without constructing a new interchange.
- **Costs –** The local municipality requesting the interchange is responsible for up to 100% of the cost. Funding can come from public or private sources. WisDOT's share, if any, is based on benefits to the state highway network and the timing of construction. For instance, the bridges over Cuba Valley Road or the River Road bridge over I-39/90/94 will be replaced as part of a larger I-39/90/94 WisDOT reconstruction project, WisDOT would pay their share of the bridge replacement costs.

The I-39/90/94 TIA has evaluated the Cuba Valley Road and Windsor Road interchange locations from high level and detailed perspectives to better understand the benefits and impacts. Further consideration for an interchange would involve the following tasks:

- **Federal approval process** – Changes to interstate access require completion of an IAJR to provide additional details about the purpose, need, impacts, and answer many of the outstanding questions regarding the effects of a new interchange. The process requires a local sponsor to submit an IAJR to WisDOT. The most likely local sponsor is the Village of DeForest, however the village is not interested is sponsorship at this time. If WisDOT supports the request, they submit the IAJR to the local FHWA Division Office. FHWA has final approval for new interchange requests. Since the proposed interchange is within the Madison Area Transportation Management Area, ultimate approval comes from FHWA in Washington DC rather than the Wisconsin Regional Office.

- **Inclusion in regional long range plans** – The interchange sponsor would need to complete the process for including the interchange in the Madison Area Metropolitan Planning Organization (MPO) Long Range Transportation Plan (RTP) and Transportation Improvement Plan (TIP). These plans ensure that improvements are consistent with the transportation needs and goals for the greater Madison area.

- **Environmental documentation** – NEPA documentation is required to establish a need for the interchange and investigate all potential environmental effects in detail including: natural, historic, cultural, noise, economic, social, and health impacts. This process encourages responsible planning and provides additional opportunity for public input.

TIER 2 SCREENING RESULTS – INTERCHANGES ON I-94 EAST OF I-39/90

MILWAUKEE STREET EXTENSION TIER 2 SCREENING RESULTS

Two locations were studied on I-94 between the existing I-39/90 & I-94 / WIS 30 (Badger Interchange) and County N interchange:

- **Milwaukee Street Extension** – Milwaukee Street currently dead-ends east of Sprecher Road and is planned to be extended under I-94 and connect to County T. This potential interchange would provide interstate access for current and future developments on the east side of Madison that do not have direct access to the interstate.
- **Gaston Road** – This potential interchange connects to the interstate where existing Gaston Road is a grade separated crossing underneath I-94 located 0.5 mi east of Milwaukee Street Extension.

The following describes the Tier 2 Screening results for the Milwaukee Street Extension and supplements the detailed summary in Exhibit 23. Four alternative concepts were discussed before selecting Alternative B and Alternative C for detailed analysis in the Tier 2 Screening process. These selected alternatives are shown in Exhibit 23 and discussed in the following sections. The alternatives discussed here do not represent all alternatives possible or a recommended alternative. Other configurations are possible as long as they meet FHWA IAJR policy point objectives.

Interchange Alternatives Overview

Alternative B is a standard diamond interchange connecting to County T on the north side of I-94, and connecting to Milwaukee Street south of I-94. Figure 5.6 highlights features and impacts of the geometric design that are further discussed in the following sections. The WB on-ramp and EB off-ramp each require two lanes and the gores are located about 1.0 mile from the Badger Interchange. Gore locations do not meet the requirement for 2.0 mile spacing between system and service interchanges.

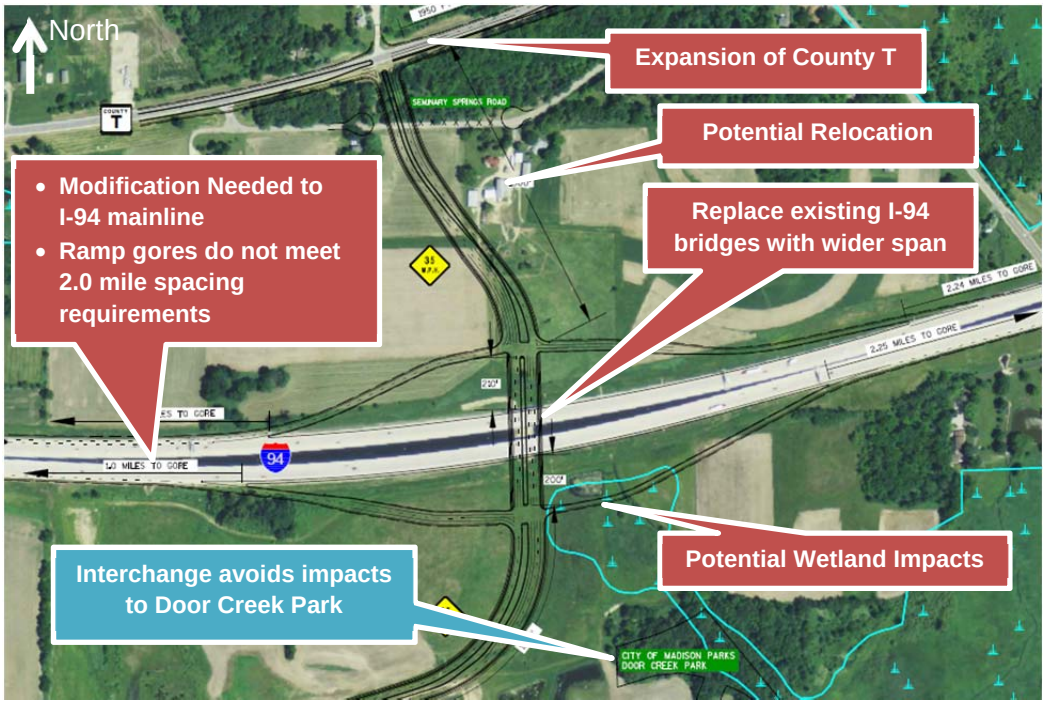


Figure 5.6. Potential Milwaukee Street Extension Alternative B Design

Alternative C adds a T-intersection that connects the interchange to County T only by creating a separate new road. This alternative concept is supported by the City of Madison because it would minimize impacts to neighborhoods south of I-94 by limiting the traffic volume increase on Milwaukee Street. This style of diamond interchange is similar to the existing US 12/18 & Monona Drive interchange on the Madison Beltline. Figure 5.7 highlights features and impacts of the geometric design that are further discussed in the following sections. Ramps facing the Badger interchange require two lanes; however the WB on-ramp could drop to one lane before merging with I-94. The ramp gores are located approximately 1.2 miles from the Badger Interchange and do not meet the requirement for 2.0 mile spacing between system and service interchanges.

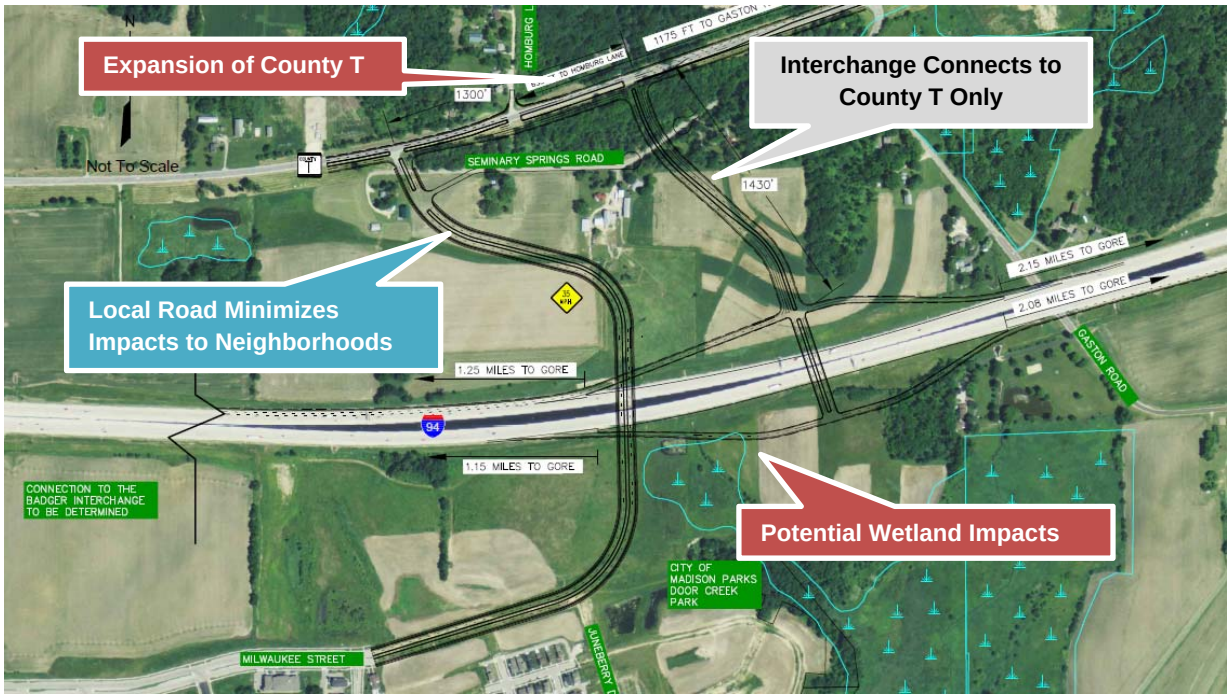


Figure 5.7. Milwaukee Street Extension Alternative C Design

Freeway Traffic Operations

A Milwaukee Street Extension interchange would have operational impacts to the interstate and local road systems. Figure 5.8 and Figure 5.9 highlight key changes in peak hour future year 2050 traffic volumes that have the following impacts for Alternative B and Alternative C:

- **Need for additional lanes on I-94** – Traffic utilizing the new interchange is large enough to require additional lanes between the Badger and new interchange to allow LOS C for the merging and weaving movements. Alternative B requires two additional lanes along both EB and WB I-94 to maintain LOS C. The addition of only one WB I-94 lane resulted in LOS F because of the short weaving 1.0 mile distance. Alternative C has less traffic and can operate at LOS C with one additional lane along both EB and WB I-94 and a 1.2 mile weaving distance.
- **Need for modification of I-39/90 NB to EB I-94 ramp –** Traffic volume on the NB I-39/90 to EB I-94 ramp in the future year 2050 baseline scenario was near the capacity of a one lane ramp. Adding a new interchange would further increase traffic volumes and likely require a two lane ramp.
- **Lower ramp volume increases at Thompson Drive and County N Interchanges** – The new interchange would attract traffic previously using these existing adjacent service interchanges. This has the effect of slowing traffic growth at existing interchanges. A new interchange at Milwaukee Street Extension or Gaston Road would likely allow both of the Thompson Drive ramps to remain as one lane. These ramps may need expansion to two lanes without a new interchange, which would be costly and cause impacts to existing commercial and residential properties and increase weaving

conflicts on WIS 30. Even with a new interchange, capacity improvements may still be necessary to the ramp terminal intersections and mainline. Mainline LOS along WIS 30 will not improve with a new interchange because the total amount of traffic using WIS 30 is still projected to increase significantly. Expansion of WIS 30 from a 4-lane to a 6-lane cross section assumed in the future year baseline model may be necessary with or without the new interchange.

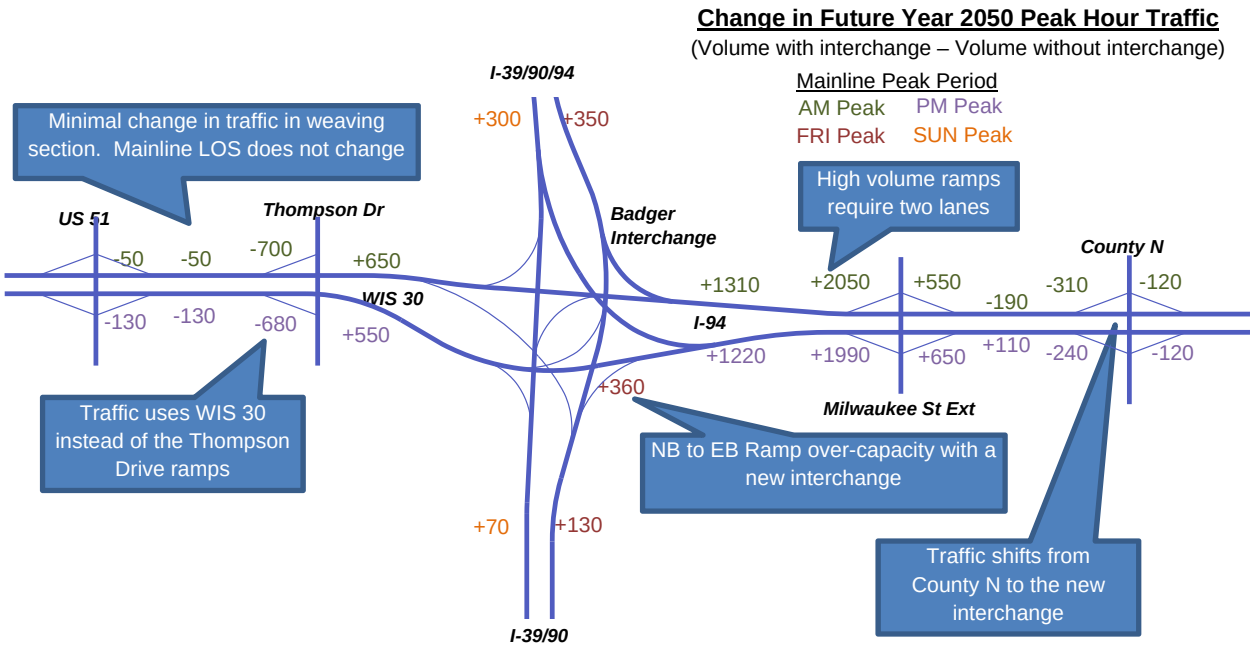


Figure 5.8. Traffic Changes with Milwaukee Street Extension Alternative B

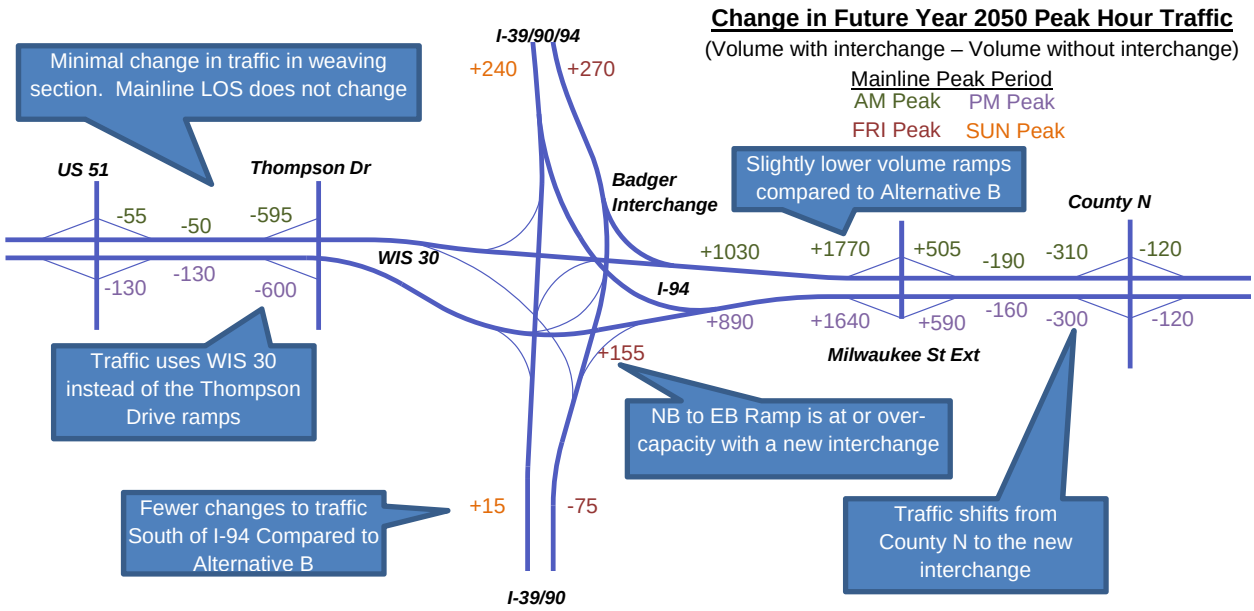


Figure 5.9. Traffic Changes with Milwaukee Street Extension Alternative C

Local Road Traffic Operations

For both Alternative B and Alternative C, the new ramp terminal intersections would operate at LOS C or better with signalized control. Alternative B has additional impacts because of its direct connection to Milwaukee Street Extension. Forecasted average daily traffic volumes along Milwaukee St Extension showed increases of about 10,000 AADT south of the Alternative B interchange. This is about 17 additional vehicles per minute in the peak hours. The Alternative C interchange does not require the local road connection between Milwaukee Street and County T. Forecasts for the local road connection will be evaluated as part of the detailed analysis included in the upcoming environmental study of the corridor.

A new interchange also increases traffic along County T, and both alternatives would require expansion of County T to a 4-lane cross section with turn lanes in order to maintain LOS C or better. Exact limits of the expansion were not analyzed in detail, but improvements are likely needed beyond the immediate area around the interchange as shown in Figure 5.10. Limits and degree of the local system improvements are likely different between the interchange alternatives. Alternative B allows interchange access from Milwaukee Street and may require improvements at the Sprecher Road & Milwaukee Street intersection. Removing Milwaukee Street interchange access in Alternative C shifts traffic to Sprecher Road, Reiner Rd, and County T and adds additional traffic pressure to intersections along these routes. Peak hour approach volumes on County T at the new interchange intersection are up to 2.75 times higher in Alternative C compared to Alternative B. An IAJR for either alternative would need to study changes to the local system in greater detail.

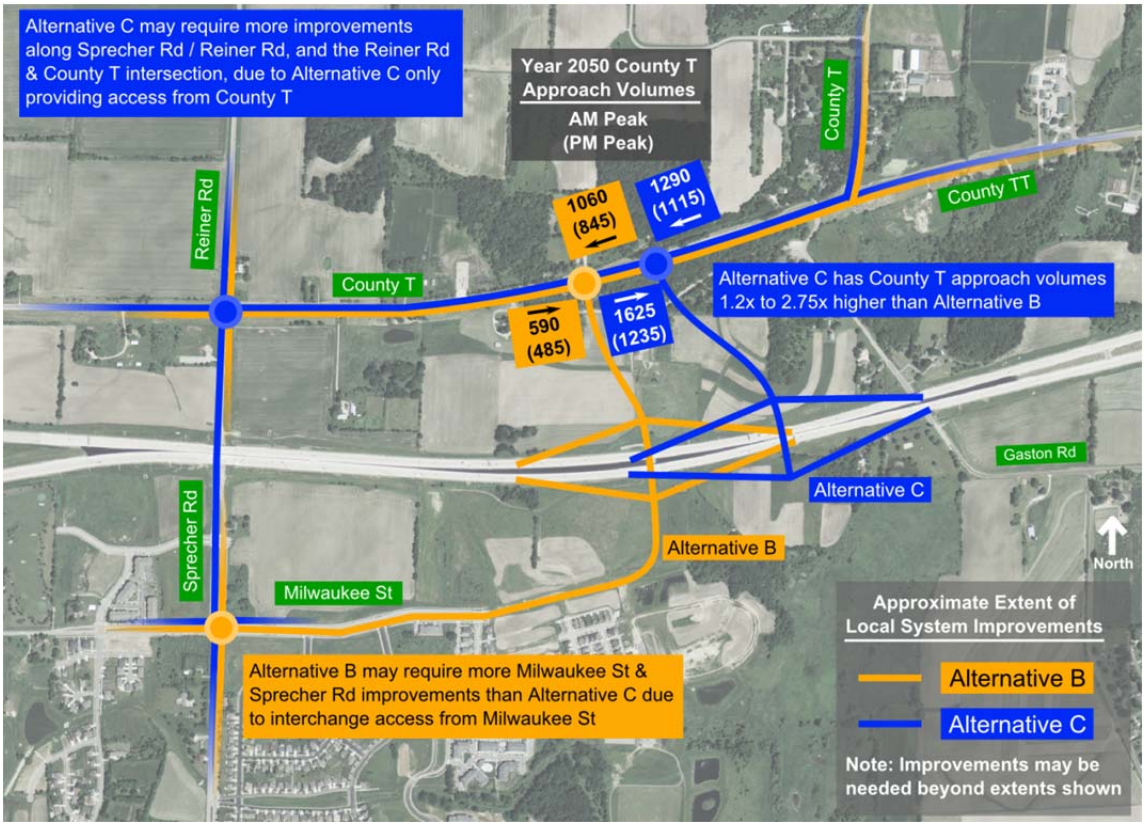


Figure 5.10. Potential Impacts to the Local Transportation System

Forecasts showed traffic diverting away from the Thompson Drive and County N interchanges to the new Milwaukee Street Extension interchange. This has the effect of slowing traffic growth at the existing interchanges and extending their service life. However, Figure 5.11 shows the trends in future year operations where many intersection approaches still operate poorly (LOS F) with a new interchange.

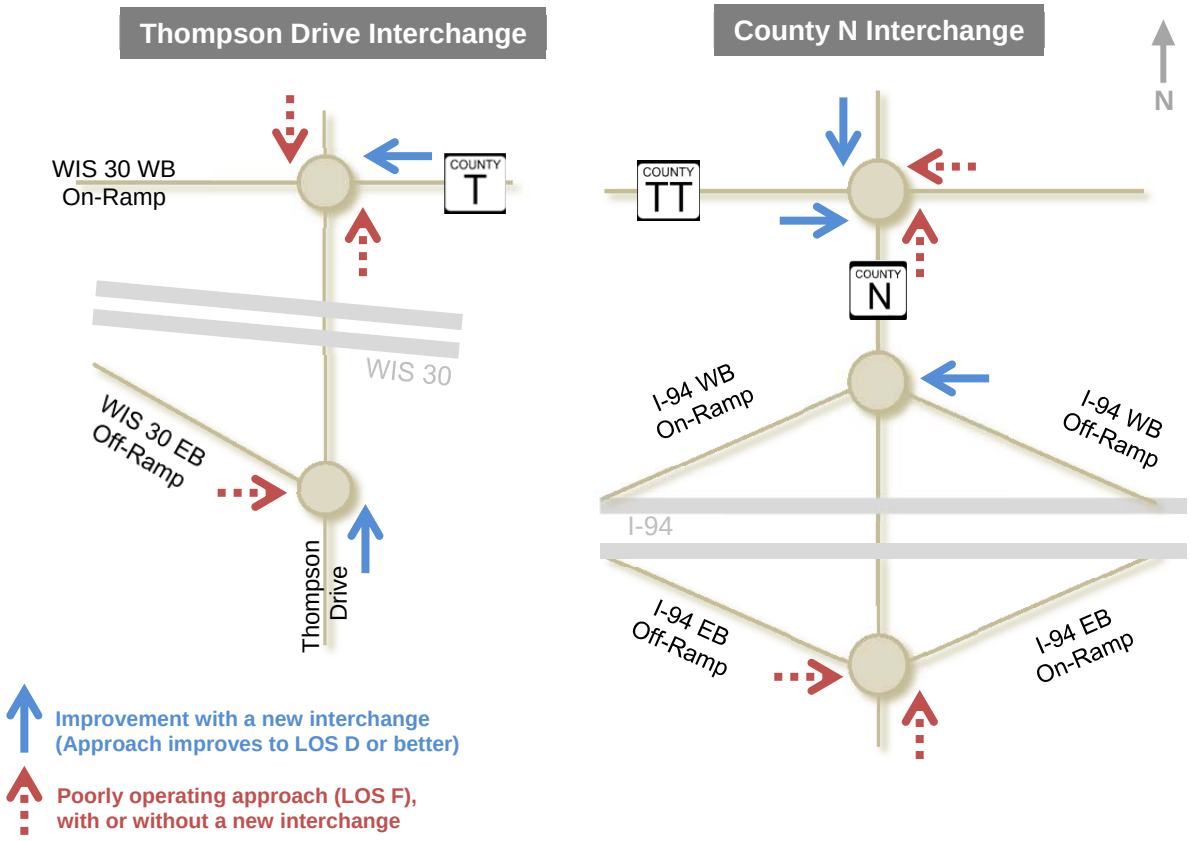


Figure 5.11. Change in Future Year Traffic Operations at Adjacent Service Interchanges with Milwaukee Street Extension Alternative B or Alternative C

Impacts to I-94 and the Badger Interchange

Several options for mainline I-94 geometrics were considered during Tier 2 Screening. Options focused on the number of lanes on I-94 between the new interchange and Badger Interchange, additional lanes at ramps, and the use of optional exits versus exit only lanes. These options were developed under the assumption that the new interchange would be constructed on I-94 without making significant improvements to the Badger Interchange and allow for future year LOS C operations. This assumption allowed demonstration of the potential impacts a new interchange has if other interstate improvements do not occur.

Analysis results showed that the operations and geometrics of the existing Badger Interchange are affected by the addition of the Milwaukee Street Extension interchange that would operate at LOS C. The lane configuration option selected for the Tier 2 Screening detailed traffic analysis is shown in Figure 5.12 for Alternative B and Figure 5.13 for Alternative C. These

designs include features that should be reexamined by the upcoming I-39/90/94 environmental study before further consideration of the interchange:

- **Additional lanes on EB and WB I-94** – A new interchange would require additional lanes between the Badger and new interchange. The magnitude of expansion depends on traffic volumes and separation between the Badger and new interchange. Alterative B would require two additional EB and WB lanes, while Alternative C with lower traffic and longer distance to the Badger interchange would require one additional EB & WB lane. Additional lanes in both alternatives remove the existing WB I-94 left lane gain and EB I-94 left lane drop east of the Badger Interchange.
- **Potential modification of the WB I-94 to NB I-39/90/94 Exit –** Traffic volumes do not warrant a three lane exit, however for Alternative B, the additional lane allows one continuous lane for WB I-94 to NB I-39/90/94 interstate-to-interstate movement. The additional exit lane also complicates the merge north of the Badger, and a safe location for dropping the lane would need to be determined. Alternative C would not require modification of this exit due to only one lane added to WB I-94.
- **Two lane exit for NB I-39/90 to EB I-94** – An additional exit-only lane was assumed for this ramp. The location of where to begin this lane along NB I-39/90 would need to be determined.
- **Disrupted route continuity –** The additional mainline and exit lanes disrupt lane continuity for the WB I-94 to NB I-39/90/94 and NB I-39/90 to EB I-39/90/94 interstate-to-interstate movements. Requiring drivers to change lanes to stay on their current route may cause driver confusion and increase the risk for crashes.
- **Increased weaving conflicts at the Badger Interchange** – Adding lanes intensifies weaving conflicts by increasing the number of lane changes needed to reach exits. Figure 5.14 shows an example of the number of lane changes required in the short weaving distance that would compound speed variance between entering and exiting vehicles and decrease safety.

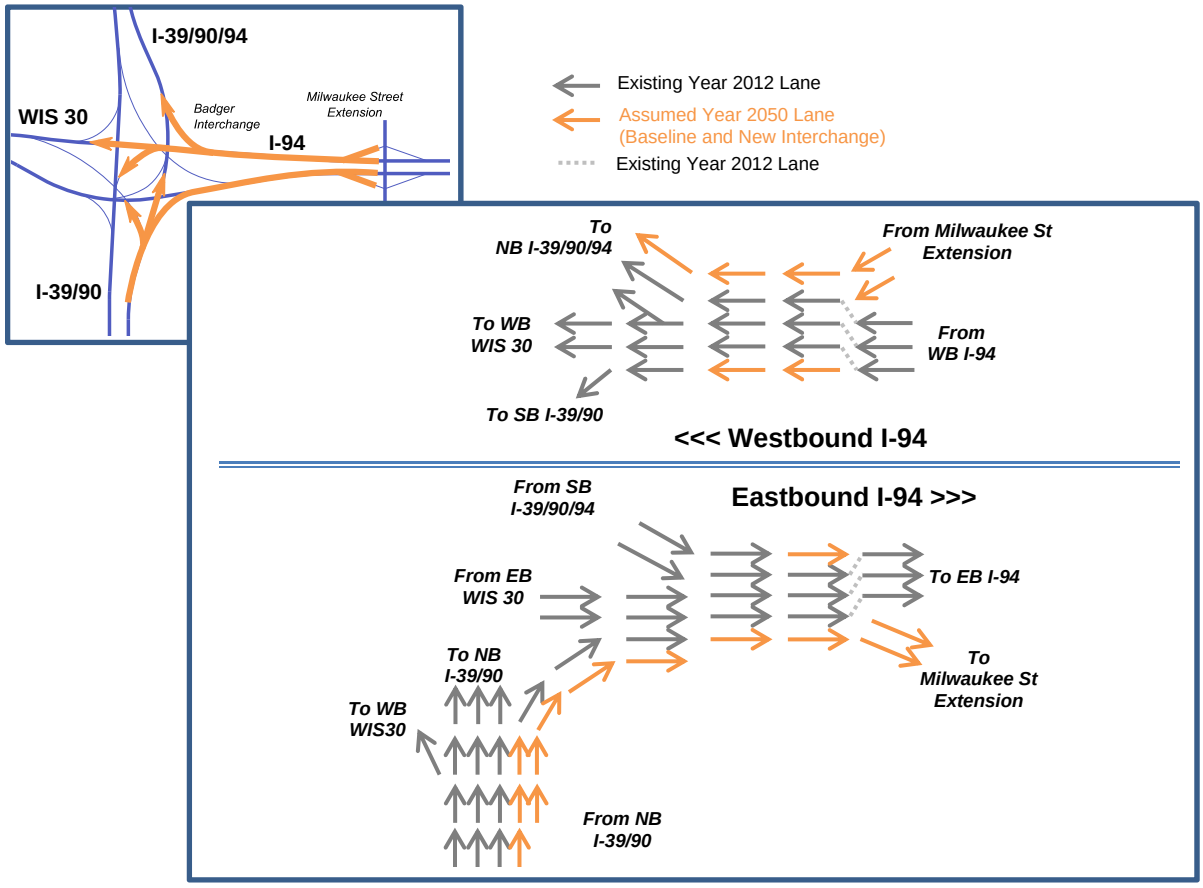


Figure 5.12. Assumed Lane Configuration for Milwaukee Street Extension Alternative B

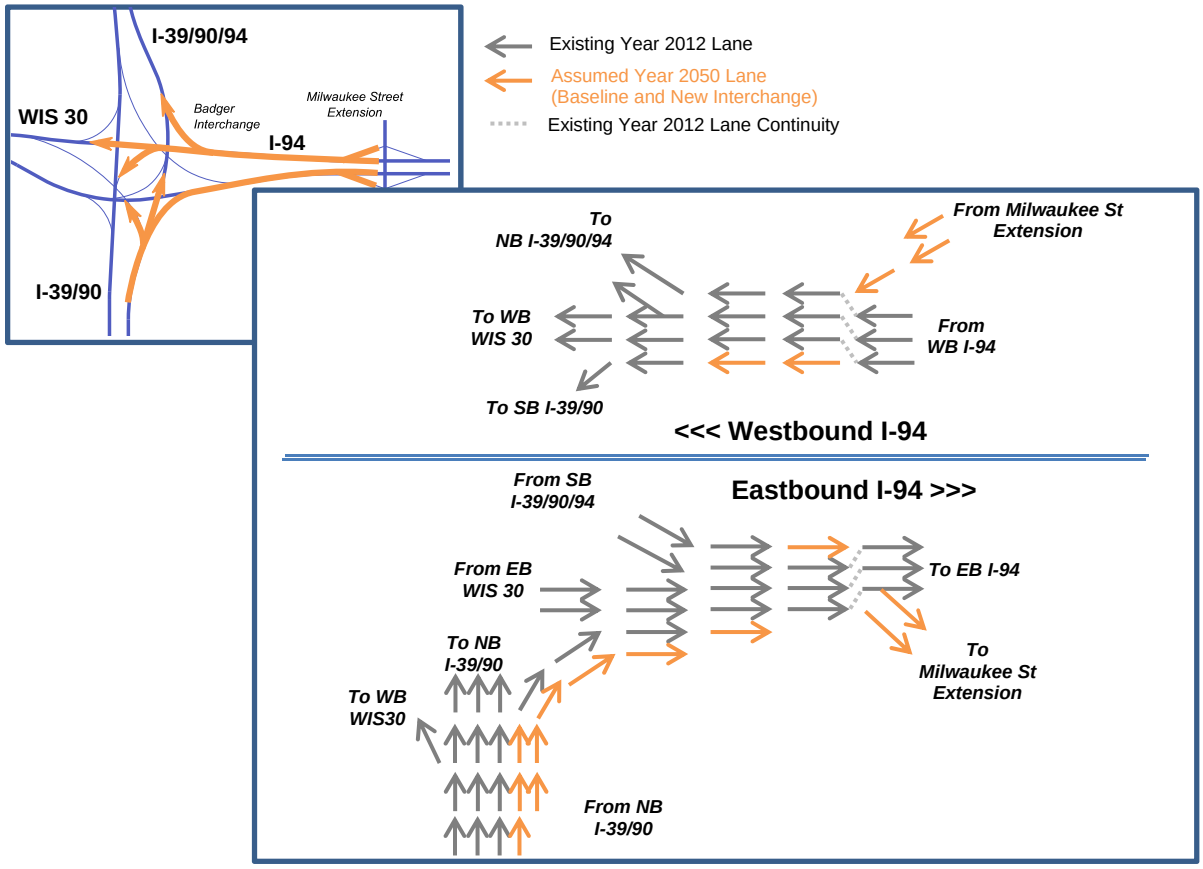


Figure 5.13. Assumed Lane Configuration for Milwaukee Street Extension Alternative C

Safely and efficiently accommodating a Milwaukee Street Extension interchange would likely require a more advanced design than simply adding lanes to the existing interstate. A design utilizing a collector-distributor road or braided ramp configuration would minimize weaving conflicts shown in Figure 5.14, improve route continuity, and allow better spacing between service and system interchanges. A design of this complexity requires detailed consideration of future capacity needs that will be evaluated in an upcoming environmental study of the corridor.

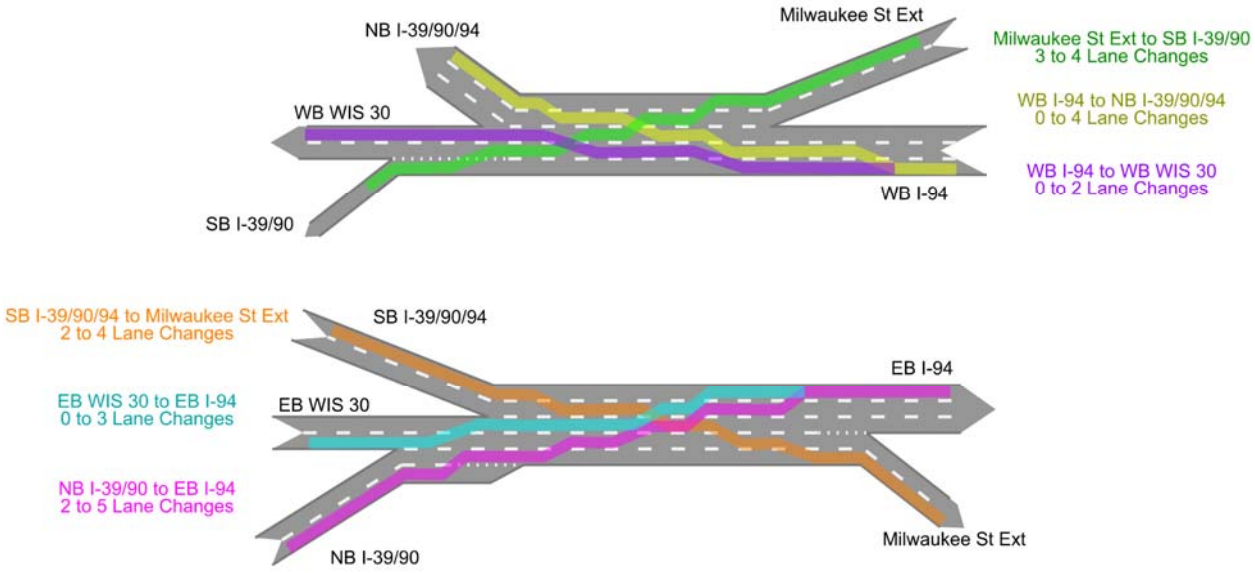


Figure 5.14. Example Alternative B Weaving Conflicts between the Badger and New Interchange (Maximum Lane Changes Shown)

Local Road Design

Alternative B

Forecasted traffic volumes indicated the need for a 4-lane cross section (two lanes in each direction), plus turn lanes, on Milwaukee Street Extension. The standard diamond design includes signalized intersections with look-ahead left turn lanes for both ramp terminals (two NB left turn lanes and one SB left turn lane) that contribute to a total of seven lanes underneath I-94. Dual right turn lanes are also included for the SB and EB right turns at the ramp terminal intersections. Alternative intersection or interchange designs, such as a diverging diamond, may reduce the number of lanes needed.

Existing bridge spans for the Milwaukee Street Extension underpass were designed to accommodate two 11 foot lanes, a 16 foot raised median, sidewalk, and bicycle lanes. The existing bridges were evaluated to determine if retaining walls could be used to accommodate a 7-lane cross section, plus bicycle and pedestrian facilities, for the new interchange. The existing spans are not long enough to accommodate the NB Milwaukee Street Extension lanes, even with the use of retaining walls. As a result, the bridges would need to be replaced to allow for the wider cross section along Milwaukee Street Extension. The new bridges would consist of two spans, which requires a median along Milwaukee Street Extension for placement of the piers.

To obtain desirable 1,320 foot access spacing between the ramp terminal and adjacent intersection, Seminary Springs Road could be converted to a cul-du-sac. Relocations may be necessary depending on final design. Juneberry Drive would need to remain as an existing dead-end street south of I-94 to achieve desirable access spacing.

The County T & Milwaukee Street Extension intersection is a T-intersection that would require a 4-lane cross section with turn lanes for all approaches. Dual NB right and WB left turns would be needed to accommodate the primary movements to and from the interchange. It may be possible to allow County T to remain a 2-lane cross section, depending on lane continuity and other improvements needed along County T and the County T & Reiner Road intersection. Further study of the local system is necessary to understand the full impacts of the potential interchange.

Alternative C

The Milwaukee Street Extension does not connect directly to the interchange in Alternative C. Existing Milwaukee Street east of Sprecher Road has a 4-lane cross section, which was shown to continue under I-94 and connect to County T. Ultimate design and construction of this local road connection would be at the discretion of the City of Madison and WisDOT and is not needed for the new interchange to function.

The frontage road connection to the interchange would require a new T-intersection with County T and ramp terminal intersections on either side of I-94. Signalized intersections were assumed for all local road intersections and interchange ramp terminals. A 4-lane cross section, plus turn lanes, would be required to accommodate traffic to and from the interchange. Heavy turning volumes would likely require dual right turn lanes for the NB and EB approaches at the County T intersection, and for the SB right turn at the WB on-ramp intersection. Underneath I-94, the interchange access road has a 4-lane cross section and does not need additional turn lanes due to T-intersection design of the EB on-ramp intersection.

To obtain desirable 1,320 foot access spacing between the ramp terminal and adjacent intersection, Seminary Springs Road could be converted to a cul-du-sac and may require relocations.

The County T & Milwaukee Street Extension intersection is a T-intersection that would require a 4-lane cross section with turn lanes for all approaches. Dual turn lanes would be needed for all approaches: WB left, EB right, NB left, and NB right in order to accommodate traffic to and from the interchange. This intersection requires more lanes than Alternative B due to all traffic accessing the interchange from County T and not Milwaukee Street. Dropping lanes to maintain a 2-lane east-west cross section may not be feasible with Alternative C. Further study of the local system is necessary to understand the full impacts of the potential interchange.

Local Input

The City of Madison is supportive of a Milwaukee Street Extension interchange if it can operate safety with the proximity to the Badger interchange. Existing and future developments on both the north and south sides of I-94 could benefit from improved access to the interstate. The City's Fire Station #13 located on Town Center Drive in the NW quadrant of Milwaukee Street & Sprecher Road would also benefit from interstate access potentially decreasing response times. Current access occurs through indirect routes by using the WIS 30 & US 51 or I-94 & County N interchanges. The Sprecher Neighborhood plan recognizes the potential for a new interchange,

but does not specify its connectivity to the local road system. Local residents do not want additional traffic through their streets.

The City of Madison proposed Milwaukee Street Extension Alternative C as a way of minimizing traffic impacts through existing neighborhoods south of I-94. Eliminating a direct connection of the interchange to Milwaukee Street Extension would encourage traffic to use the existing minor arterials of Sprecher Road and County T. The City of Madison also expressed interest in evaluating a local road connection between Milwaukee Street and Gaston Road south of I-94 in order to improve regional connectivity. Further study and public involvement is necessary to understand needs, concerns, and impacts on existing and planned land use regarding a potential interchange.

The Town of Burke and Town of Blooming Grove are also affected by a potential Milwaukee Street Extension interchange. No response was received from the Town of Burke after initial and follow-up inquiries. The Town of Blooming Grove responded by indicating that the portion of their township near the interchange will likely be annexed into the City of Madison in the near future (end of 2015) and felt that Alternative B may provide benefit to the area.

The Milwaukee Street Extension interchange alternatives are outside the municipal limits of the Village of Cottage Grove and Township of Cottage Grove; neither municipality commented on the interchange.

Appendix V contains local input received during Tier 2 Screening regarding Milwaukee Street Extension interchanges.

Cost Estimate

Construction cost estimates for the Milwaukee Street Extension interchange alternatives are:

- **Alternative B - $35.4–39.1 million** which includes:
  - **$18.8–22.5 million** for approximately 1.2 miles of I-94 mainline complete reconstruction (6 lane cross section) and 7.8 lane-miles of new lane construction
  - **$4.4 million** for replacing eastbound and westbound interstate bridges
  - **$12.2 million** for interchange and local road construction costs

- **Alternative C – $30.8–34.1 million** which includes:
  - **$17.5–20.8 million** for approximately 1.4 miles of I-94 mainline complete reconstruction (6 lane cross section) and 5.5 lane-miles of new lane construction
  - **$6.4 million** for widening of the existing interstate bridges over Gaston Road and Milwaukee Street Extension and a new overpass for the interchange access road
  - **$6.9 million** for interchange and local road construction costs (excludes the local road extension of Milwaukee Street to County T)

All cost estimates exclude engineering, real estate and utility costs. Local road construction costs only include the intersections and roads immediately adjacent to the interchange. Widening or other improvements to County T, Reiner Road, Sprecher Road, and Milwaukee Street would add further costs.

GASTON ROAD TIER 2 SCREENING RESULTS

The following describes the Tier 2 Screening results for the Gaston Road interchange and supplement the detailed summary in Exhibit 23. Two conceptual alternative designs were considered before selecting Gaston Road Alternative B for detailed consideration during the Tier 2 Screening process. The alternatives discussed here do not represent all alternatives possible or a recommended alternative. Other configurations are possible as long as they meet FHWA IAJR policy point objectives.

Interchange Alternative Overview

Tier 2 Screening evaluated a diamond interchange at I-94 & Gaston Road shown in Exhibit 23. This design provides advantages and disadvantages shown in Figure 5.15. Creating an interchange on a new Vilas Road alignment east of the existing Gaston Road grade separated crossing minimizes impacts to residential properties along Gaston Road. One relocation may be necessary near the relocated Vilas Road & Gaston Road intersection. Wetlands north of I-94 will likely be impacted due to the new alignment of Vilas Road. Two potentially historic properties are located near the interchange, with one potentially impacted in the NW quadrant of the County T & County TT intersection depending on the intersection design.

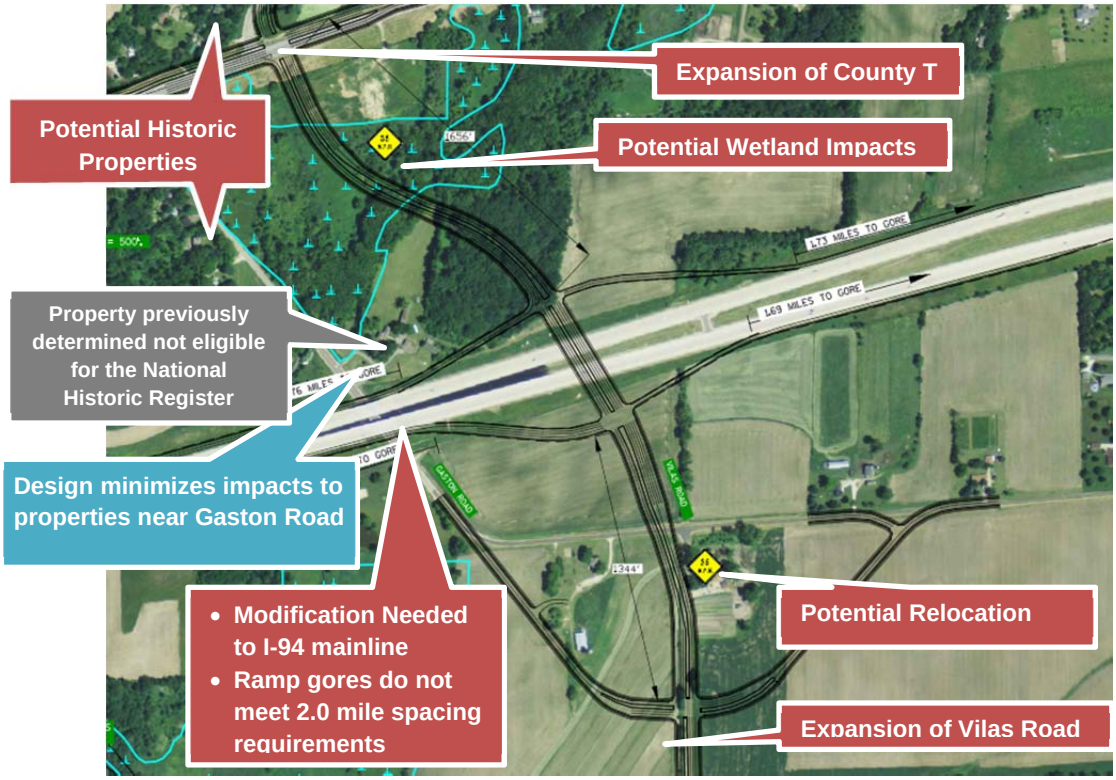


Figure 5.15. Potential Gaston Road Interchange Design

Freeway Traffic Operations

Traffic impacts for the Gaston Road interchange are similar to the Milwaukee Street Extension alternatives, except that more traffic is attracted from the Cottage Grove area instead of the City of Madison. The connections to Gaston Road, Vilas Road, County T, and County TT make the interchange easily accessible for residents and businesses on the west side of Cottage Grove. Figure 5.16 shows changes in future year 2050 traffic volumes that have the following impacts:

- **Need for additional lanes on I-94 –** High volume westbound on-ramp and eastbound off-ramps require adding at least one additional lane to both directions of I-94 between the Badger and new interchange. Adding one additional lane eastbound and westbound may be feasible but resulted in LOS C borderline LOS D and reduced mainline speeds in the weaving section. Adding two lanes to I-94 resulted in LOS B, but also resulted in underutilized lanes and extra capacity.
- **Increased weaving conflicts at the existing Badger Interchange –** Reduced volumes and longer gore-to-gore distance compared to the Milwaukee Street Extension alternatives help weaving operations, but not to the extent that operations and safety concerns are eliminated. Weaving conflicts would be identical to those shown in Figure 5.14.
- **Need for modification of I-39/90 NB to EB I-94 ramp –** With the future year 2050 baseline volumes near capacity, the Gaston Road alternative is likely to require a two lane ramp.
- **Decreased ramp volumes at Thompson Drive and County N Interchanges –** A Gaston Road interchange primarily attracts traffic away from County N, and does not influence Thompson Drive as much as a Milwaukee Street Extension interchange.

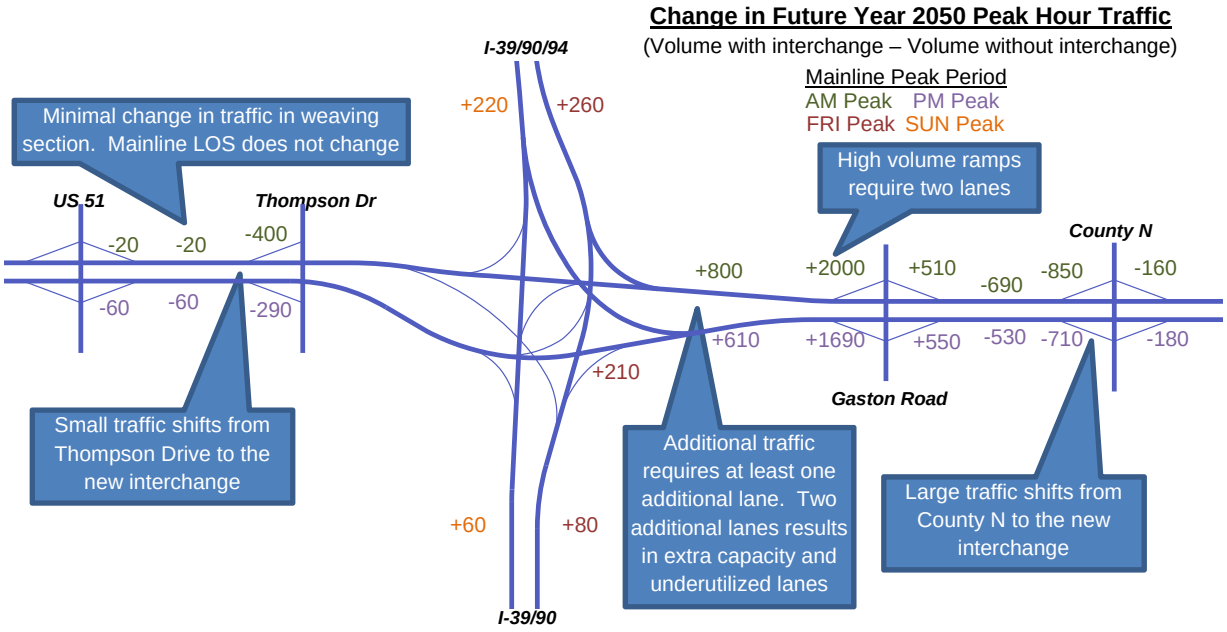


Figure 5.16. Traffic Changes with Gaston Road Alternative B

Local Road Traffic Operations

The potential Gaston Road interchange has similar impacts to the local road system as Milwaukee Street Extension Alternative B. New ramp terminal intersections and the relocated Vilas Road & Gaston Road intersection would operate at LOS C or better with signal control. A Gaston Road interchange has more effect on the adjacent County N interchange intersections than the Thompson Drive intersections. The EB off-ramp approach at County N improves to LOS D, however the NB approach and the County TT & County N intersection still operate poorly (LOS F) with a new interchange. Overall intersection performance remains LOS F at both Thompson Drive intersections with or without a Gaston Road interchange.

The Gaston Road interchange also increases traffic along County T and other local roads. The County T & County TT intersection required expansion of all approaches to include a 4-lane cross section with turn lanes in order to maintain LOS C. Exact limits of the impacts to the local system were not analyzed in detail, but improvements are likely needed beyond the immediate area around the interchange. Expansion to a 4-lane cross section may be required for County T between Reiner Road and County TT, and for Vilas Road between County BB and the new interchange. An IAJR for a Gaston Road interchange would need to study changes to the local system in greater detail.

Impacts to I-94 and the Badger Interchange

Options for the number of lanes on I-94 and the connection to the Badger Interchange were developed for Gaston Road in the same manner as the Milwaukee Street Extension interchange. This included consideration for additional mainline lanes, ramp lanes, and exit configurations in order to maintain future year LOS C operations even if no other interstate improvements occur.

Analysis results showed that the operations and geometrics of the existing Badger Interchange are affected with the addition of the Gaston Road interchange. The lane configuration option selected for the Tier 2 Screening detailed traffic analysis is the same as Milwaukee Street Extension Alternative B shown in Figure 5.12. This design includes features that should be reexamined by the upcoming I-39/90/94 environmental study before further consideration of the interchange:

- **Two additional lanes on EB and WB I-94** – These additional lanes extend the full distance between the Badger and Gaston Road interchanges. Two additional lanes are not efficient due to the excess spare capacity. One additional lane may be a feasible alternative but results in LOS C/D. However, the design allows two lane entrance/exit ramps from the new interchange and also removes the existing WB I-94 left lane gain and EB I-94 left lane drop east of the Badger Interchange.
- **Three lane exit for WB I-94 to NB I-39/90/94 –** Traffic volumes do not warrant a 3-lane exit, however, the additional lane allows one continuous lane for WB I-94 to NB I-39/90/94 interstate-to-interstate movement. The additional exit lane also complicates the merge north of the Badger, and a safe location for dropping the lane would need to

be determined. Dropping the extra lane before this ramp in order to maintain a 2-lane exit may be feasible if mainline LOS C/D is acceptable.

- **Two lane exit for NB I-39/90 to EB I-94** – An additional exit-only lane was assumed for this ramp. The location of where to begin this lane along NB I-39/90 would need to be determined.
- **Disrupted route continuity –** The additional mainline and exit lanes disrupt lane continuity for the WB I-94 to NB I-39/90/94 and NB I-39/90 to EB I-94 interstate-to-interstate movements. Requiring drivers to change lanes to stay on their current route may cause driver confusion and increase the risk for crashes.
- **Increased weaving conflicts at the Badger Interchange** – Adding lanes intensifies weaving conflicts by increasing the number of lane changes needed to reach exits. Figure 5.14 shows an example of the number of lane changes required in the short weaving distance that would compound speed variance between entering and exiting vehicles and decrease safety.

Safely and efficiently accommodating a Gaston Road interchange may require a collector-distributor road or braided ramp configuration that should be evaluated as a future alternative for this interchange. A design utilizing a collector-distributor road or braided ramp configuration would overcome several design challenges by: minimizing weaving conflicts, improving route continuity, allow better spacing between service and system interchanges, may require less lane-miles along I-94, and minimize underutilized lanes, while still maintaining desirable level of service. A design of this complexity requires detailed consideration of future capacity needs that will be evaluated in an upcoming environmental study of the corridor.

Local Road Design

Forecasted traffic volumes indicated the need for a 4-lane cross section, plus turn lanes, on the re-aligned Vilas Road. Expansion of the Vilas Road cross section would likely extend one mile south to County BB. Signalized intersections were assumed for all local road intersections and interchange ramp terminals. The standard diamond design is similar to the Milwaukee Street Extension Alternative B and includes look-ahead left turn lanes for both ramp terminals. The interchange was assumed to use a new bridge over I-94 for easier constructability and to obtain standard vertical clearances. This new bridge includes a 4-lane divided cross section plus two NB left and one SB left turn lane, for a total of seven lanes. Dual right turn lanes are included for the SB and EB right turns at the ramp terminal intersections. Alternative intersection or interchange designs may reduce the number of lanes needed.

Obtaining desirable 1,320 foot access spacing between the ramp terminals and adjacent intersections would require the Gaston Road & Vilas Road intersection to shift approximately 750 feet south of its existing location. Other access modifications may be needed along Gaston Road, including: removal or relocation of the Gaston Road & Seminary Springs Road intersection and driveway relocations in the NW and NE quadrants of the relocated Gaston Road & Vilas Road intersection.

The County T & County TT / Vilas Road intersection is a four-leg intersection that would require a 4-lane cross section with turn lanes for all approaches. Dual turn lanes would be needed for the EB right and NB left turns, which are the primary movements at the interchange. It may be possible to allow SB County T and WB County TT to remain a 2-lane cross section further upstream of the intersection, depending on lane continuity and other improvements needed along local routes. Further study of the local system is necessary to understand the full impacts of the potential interchange.

Local Input

The City of Madison is in favor of a Gaston Road interchange if it can function safely, although a Milwaukee Street Extension alternative would better serve the needs of the city. The interchange location is consistent with current land use plans, which could be adjusted as needed to maintain land uses compatible with an interchange.

The Village of Cottage Grove is in favor of a Gaston Road interchange because the village is currently serviced by only one interchange at County N. Adding a second access point would create a loop of primary corridors (County N, County BB, Vilas Rd, and County TT) to benefit residents, businesses, and emergency services. Constructing a connection between Milwaukee Street and Vilas Road was suggested, but may not be feasible due to barriers between the corridors that include wetlands, Door Creek, and the City of Madison Door Creek Park.

Responses from townships included opposition from the Town of Cottage Grove stating that the interchange is not in the best interest of its residents due to negative impacts to the farming community and encouragement of urban sprawl. No response was received from the Town of Burke, and the Town of Blooming Grove did not express a direct opinion about the Gaston Road interchange alternative.

Appendix V contains local input received during Tier 2 Screening regarding a Gaston Road interchange.

Cost Estimate

Construction cost for the Gaston Road alternative is estimated at: **$40.6–44.7 million** which includes:

- **$20.6–24.7 million** for approximately 1.9 miles of I-94 mainline complete reconstruction (6 lane cross section) and 5.1 lane-miles of new lane construction
- **$6.9 million** for a new Vilas Road overpass and widening eastbound and westbound interstate bridges over Gaston Road
- **$13.1 million** for interchange and local road construction costs

All cost estimates exclude engineering, real estate and utility costs. Local road construction costs only include the intersections and roads immediately adjacent to the interchange. Widening or other improvements to County T and roads would add further costs.

FHWA POLICY POINT ASSESSMENT

The interstate highway system provides important regional mobility. FHWA has eight policy points designed to evaluate justification for any new access and impacts to the system and environment. Full text of FHWA policy points is included in Exhibit 25. Both Milwaukee Street Extension and Gaston Road locations are similar regarding these policy points. The following discussion supplements the findings in Exhibit 23 and applies equally to all locations, except where noted.

Policy Point #1: Need for new interchange cannot be accommodated by the existing interchanges and local road system, or a reasonably improved existing system

The City of Madison and Village of Cottage Grove have plans for continued business and residential development in the areas surrounding Milwaukee Street Extension and Gaston Road. The east side of Madison does not have any service interchanges providing access to the interstate. As a result, the local road system sees an increase in pressure due to additional vehicle traffic destined for the interstate. The interchanges of WIS 30 & Thompson Drive, WIS 30 & US 51, US 12/18 & US 51, and I-94 & County N are used to access the interstate, most of which require back tracking / route misdirection.

Forecasts predict that growth on the east side of Madison and Cottage Grove will continue to cause traffic to increase on County T, County N, US 51, and WIS 30. Adding a new interchange shifts traffic away from existing interchanges potentially reducing the amount of improvements needed along the freeway or local roadway system. For example, both of the Thompson Drive ramps may need expansion to two lanes in the future, which would be costly and cause many impacts within this constrained area. A new interchange at Milwaukee Street Extension or Gaston Road would likely allow the ramps to remain as one lane. A future environmental study of the corridor will evaluate the capacity on the interstate and at the existing interchanges in greater detail.

Policy Point #2: Reasonable transportation system management will not alleviate the need for new access

Data for this policy point was not evaluated during the TIA, but is unlikely to change the need for an interchange.

Policy Point #3: New interchange does not have a significant adverse effect on operations and safety of the Interstate

A new Milwaukee Street Extension or Gaston Road interchange adds a substantial amount of traffic to I-94 that would have an adverse impact on operations if improvements are not made to the existing I-94 mainline and Badger Interchange. The alternatives evaluated for the Milwaukee Street Extension and Gaston Road interchanges were developed with the assumption that the existing ramp locations and alignments at the Badger Interchange would not change. As a result, the alternatives increased the number of lanes along I-94 between the new interchange and Badger interchange as well as along the ramps to and from I-94.

Accommodating the interchange traffic by adding lanes to I-94 would intensify the weaving maneuvers as a result of the left-hand entrances and exits, which causes safety concerns. Adverse impacts are greatest for Milwaukee Street Extension Alternative B due to its closer proximity to the Badger Interchange and higher volumes than the other locations considered. This interchange alternative requires vehicles from Milwaukee Street destined for SB I-39/90 to complete 3 to 4 lane changes along WB I-94 within 1.0 miles. A design utilizing a C-D road or braided ramp configuration would minimize safety and operation issues, but would require reconfiguration of the Badger interchange.

Policy Point #4: Connects to a public road, provides all movements, & meets current standards

None of the locations meet urban interstate access spacing requirements by providing at least 2 miles between the Badger Interchange and new interchange ramp gores. A design utilizing a C-D road or braided ramps would be required to meet spacing standards. The new interchanges meet requirements of connecting to public roads and providing all movements to and from the interstate.

WisDOT provides access management policies to promote safety and efficiency. Per WisDOT standards, a distance of ¼ mile (1,320 feet) is desirable between any interchange ramp terminal intersection and the next adjacent driveway or intersection. Milwaukee St Extension can be designed to meet standards by placing cul-du-sacs on Seminary Springs Road and, for Alternative B only, maintaining the existing dead-end of Juneberry Drive south of Milwaukee Street. Gaston Road Alternative B would require relocation of the Gaston Road & Vilas Road intersection 750 feet south of its existing location.

Policy Point #5: Consistent with local and regional land use and transportation plans

The City of Madison is in favor of a Milwaukee Street Extension Interchange for its potential to improve interstate connectivity on the east side of Madison. The Sprecher Road neighborhood recognizes the location as a potential new interchange, but does not specify its connection to the local road system. Residents near the potential new interchange do not want to see traffic volumes increase along their residential streets. Planned land use is largely residential in areas east of I-39/90, and may need to be adjusted to allow land uses compatible with an interchange. Alternative C may minimize traffic impacts to existing and future neighborhoods south of I-94 by eliminating the direct connection to Milwaukee Street. Further public outreach is needed to understand the communities' needs and concerns.

The Village of Cottage Grove is in favor of a Gaston Road interchange. This potential interchange would act as a second interstate access point for the Village and create a closed loop of primary corridors for the Village. The Town of Cottage Grove is opposed to a Gaston Road interchange due to impacts to farming communities and potential to encourage urban sprawl.

Local input from the Township of Blooming Grove showed preference for the Milwaukee Street Extension Alternative B, but noted that the City of Madison is likely to annex their land in the

vicinity of the interchange in the near future. No response was received from the Town of Burke.

The Madison Area Metropolitan Planning Organization (MPO) maintains a Regional Transportation Plan (RTP) to guide the overall direction of transportation needs and priorities for a 20 year long range timeframe. The current RTP 2035 does not include either interchange location. Any new interchange would need to be added to the RTP as part of the IAJR process. Concurrence from the Madison Area MPO must be obtained before a new interchange can be added to the RTP.

Policy Point #6: New access is in context with long range Interstate system plan

The purpose of the TIA is to evaluate the potential viability of new access points onto I-39/90/94 and intersecting freeways in the greater Madison area. Milwaukee Street Extension and Gaston Road are only locations evaluated on I-94 during the Tier 2 Screening. Only one site, not both, could be chosen for an interchange.

Interstate access points should provide regional connectivity to support the primary purpose of the interstate, which is to provide mobility. Milwaukee Street is approximately 5 miles long through the City of Madison and provides regional travel by its connections to the principal arterials of US 51 and US 151. North of I-94, Milwaukee Street Extension connects to the minor arterial of County T, which connects to County TT and County N.

Gaston Road is an urban collector that serves as a 2.5 mile east-west route through the Village and Town of Cottage Grove. Regional connections to Gaston Road include north-south collector routes of County T north of I-94 and Vilas Road south of I-94, as well as the principal arterial of County N in the Village of Cottage Grove.

Policy Point #7: Local system can accommodate new traffic to bring traffic to the new interchange and distribute traffic away from the new interchange

Improvements to the local system will be necessary to accommodate increased traffic volumes due to a new interchange. Depending on the selected interchange location, local roads requiring improvements may include: Milwaukee Street, County T, County TT, Gaston Road, and Vilas Road. Improvements may include roadway widening, changes in intersection control, and intersection improvements. A new interchange may increase future repair and replacement costs along local roads for municipalities.

The interchange alternatives considered likely have different magnitudes and extents of local system improvements needed beyond the intersections immediately adjacent to the potential interchange. Milwaukee Street Extension Alternative B may require improvements at the Milwaukee Street & Sprecher Road intersection because of the interchange access. Milwaukee Street Extension Alternative C shifts all traffic to County T, which may require improvements to the Sprecher Road / Reiner Road & County T intersection. Both Alternative B and C would require expansion of to a 4-lane cross section on County T.

The Gaston Road alternative attracts more traffic from Cottage Grove than Milwaukee Street Extension because of its direct connection to Vilas Road. Local system improvements for this

alternative would include expansion of Vilas Road to a 4-lane cross section between County BB and the interchange. Improvements would also be needed at the County T & County TT intersection and expansion of County T west of the interchange.

An IAJR for any alternative would need to study changes to the local system in greater detail.

Policy Point #8: New access has been included in the required environmental evaluation, review, and processing.

The TIA evaluated wetlands, park land, archaeological, and historic impacts from a high level perspective. All interchange alternatives are anticipated to have varying degrees of wetland impacts, with Gaston Road to have the greatest, followed by Milwaukee Street Extension Alternative C, and Milwaukee Street Alternative B with the least. Two potentially eligible historic sites are located in the vicinity of Gaston Road. One is located in the northwest quadrant of the County T & County TT intersection and the other is located along Gaston Road just south of County T. Further investigations will be required to determine if the sites are eligible for the National Historic Register and if the sites are adversely impacted by the new interchange.

All environmental impacts, including additional consideration for ecological, aesthetic, noise, economic, social, and health, would need further investigation and an environmental document must be completed to meet National Environmental Policy Act (NEPA) requirements.

SUMMARY

Tier 2 Screening results for a Milwaukee Street Extension or Gaston Road interchange include the following summary points and next steps to consider:

- **Impacts operations and safety at the Badger Interchange –** The potential Milwaukee Street Extension or Gaston Road interchange increases peak hour traffic east of the Badger Interchange that cannot be safely or efficiently accommodated in the existing lanes of I-94. Expanding the existing cross-section would intensify weaving movements by increasing the number of lane changes required in the short 1 to 2 mile distance between interchanges. Increased lane changing and traffic volumes would create speed variability and increase the risk for crashes.
- **Viability depends on the configuration of the Badger Interchange –** The existing Badger interchange uses left-hand and right-hand exits that complicate route continuity and weaving sections between the Badger and potential new interchange. If the Badger Interchange was reconfigured to remove left-hand exits or incorporate a C-D road, a new service interchange may be more easily accommodated with fewer impacts to traffic operations and safety. A future environmental study of the interstate will evaluate the needs of the existing system which may provide additional insight into viability of a new interchange.
- **Traffic shifts away from existing service interchanges may not eliminate the need for capacity improvements –** All potential new interchange locations had the effect of slowing traffic growth at existing interchanges and potentially

extending their service life. However, ramp terminal intersections on Thompson Drive and County N still showed deficient capacity in year 2050 for many approaches even with a new interchange. Mainline traffic volumes on WIS 30 did not significantly change by adding a new interchange. Expansion of the WIS 30 mainline to a 6-lane cross section that was assumed in the future year baseline model may still be necessary. However, a new interchange may allow Thompson Drive ramps to remain as one lane instead of possible expansion to two lanes.

- **Impacts to local roads –** A new Milwaukee Street Extension or Gaston Road interchange has effects beyond the immediate area surrounding the interchange. Improvements, including roadway widening and changes in intersection control, may be needed along Milwaukee Street, County T, County TT, Gaston Road, and Vilas Road. Magnitude and extent of improvement depends on interchange location and requires further analysis during the IAJR process.
- **Costs –** The local municipality requesting the interchange is responsible for up to 100% of the cost. Local funding can come from public or private sources. WisDOT's share, if any, is based on benefits to the state highway network and the timing of construction. For instance, if existing bridges on I-94 will be replaced as part of a larger reconstruction project, WisDOT would pay their share of the bridge replacement costs. The recent expansion of the Badger to County N interchange section of I-94 significantly reduces the potential for WisDOT to pay for any portion based on structural or pavement improvement or replacement needs.

The I-39/90/94 TIA has evaluated the Milwaukee Street Extension and Gaston Road interchange locations from high level and detailed perspectives to better understand the benefits and impacts. Further consideration for an interchange would involve the following tasks:

- **Federal approval process** – Changes to interstate access require completion of an IAJR to provide additional details about the purpose, need, impacts, and answer many of the outstanding questions regarding the effects of a new interchange. The process requires a local sponsor, such as the City of Madison or Village of Cottage Grove, to submit an IAJR to WisDOT. If WisDOT supports the request, they submit the IAJR to the local FHWA Division Office. FHWA has final approval for new interchange requests. Since the proposed interchange is within the Madison Area Transportation Management Area, ultimate approval comes from FHWA in Washington DC rather than the Wisconsin Regional Office.
- **Inclusion in regional long range plans** – The interchange sponsor would need to complete the process for including the interchange in the Madison Area Metropolitan Planning Organization (MPO) Long Range Transportation Plan (RTP) and Transportation Improvement Plan (TIP). These plans ensure that improvements are consistent with the transportation needs and goals for the greater Madison area.

- **Environmental documentation** – NEPA documentation is required to establish a need for the interchange and investigate all potential environmental effects in detail including: natural, historic, cultural, noise, economic, social, and health impacts. This process encourages responsible planning and provides additional opportunity for public input.

TIER 2 SCREENING RESULTS – INTERCHANGES ON I-39/90/94 BETWEEN US 51 & US 151

HANSON ROAD AND HOEPKER ROAD TIER 2 SCREENING RESULTS

Two potential interchange locations and one potential grade separated crossing were studied on I-39/90/94 between the existing US 151 and US 51 interchanges:

- **Hanson Road** – Currently a grade-separated crossing over I-39/90/94, Hanson Road is located 3,500 feet north of the US 151 interchange. East of I-39/90/94, Hanson Road is called Eastpark Boulevard.
- **Hoepker Road** – This location is an existing grade-separated crossing over I-39/90/94 and is 4,300 feet north of Hanson Road and 1.5 miles south of the US 51 interchange.
- **Portage Road / Eastpark Boulevard Connector** – This potential grade separated crossing would connect Portage Road and Eastpark Boulevard south of the existing Hanson Road crossing. Tier 2 Screening considered the crossing in combination with each of the potential interchanges as discussed in the FHWA IAJR Policy Point #7 section.

Traffic operations and needs near the I-39/90/94 & US 151 interchange are complex due to closely spaced system and service interchanges. The study team and the City of Madison agreed that the level of analysis necessary to fully understand future traffic patterns with and without a new interchange was beyond the scope of the TIA. For this reason, a detailed traffic analysis of similar scope performed for other Tier 2 locations would not provide useful information for further evaluating Hanson Road or Hoepker Road at this time. These potential interchanges will be evaluated further in conjunction with mainline and adjacent interchange alternative analysis during the upcoming environmental study. The future analysis will need to coordinate the interests of the Dane County Airport, City of Madison and US 51 Stoughton Road EIS project. The following discusses the potential interchanges in the context of the FHWA IAJR policy points.

FHWA POLICY POINT ASSESSMENT

The interstate highway system provides important regional mobility. FHWA has eight policy points designed to evaluate justification for any new access and impacts to the system and environment. Full text of FHWA policy points is included in Exhibit 25.

Policy Point #1: Need for new interchange cannot be accommodated by the existing interchanges and local road system, or a reasonably improved existing system

The City of Madison, City of Sun Prairie, and the Village of DeForest have plans for continued business and residential development north of the I-39/90/94 & US 151 interchange. The American Center Business Park is located in the north quadrant of the interchange and is home to variety of major traffic generators including: large employers, technical colleges, restaurants, and a new 494,000 square-foot hospital with 100 beds. North of the business park, the City of Sun Prairie has been developing residential lands west of County C and plans to continue expansion. The Dane County Regional Airport, along with industrial developments near Hanson

Road and Manufacturers Drive, are located west of I-39/90/94. The major traffic generators and planned developments will increase traffic in the Hanson Road and Hoepker Road area. Capacity improvements will likely be needed to accommodate future year traffic, which may include, but is not limited to, improvements at local road intersections or the existing US 151 & American Parkway interchange.

Interstate access to and from this area is provided by the existing I-39/90/94 & US 151, I-39/90/94 & US 51, and US 151 & American Parkway interchanges. As shown in Figure 5.17, substantial traffic volume increases on the mainline and ramps are forecasted for the year 2050. Figure 5.17 also depicts mainline auxiliary and ramp lanes that were incorporated into the Baseline Paramics traffic model used during the Tier 2 Screening process. These changes were necessary to improve traffic flow through the model in order to provide a reasonable understanding of the system effects resulting from each potential new interchange. This modified Baseline model includes major diverges, multiple auxiliary lanes, and 2-lane tight loop ramps that may not be feasible and are not ideal. As such it does not represent a preferred alternative, but rather allows the simulation to produce valid results. Even with the additional capacity, the model showed unstable operations near the US 151 interchange on I-39/90/94 and US 151. This finding suggested that solutions other than simply adding lanes to the existing system may be needed and that a new interchange would likely increase the complexity of the area.

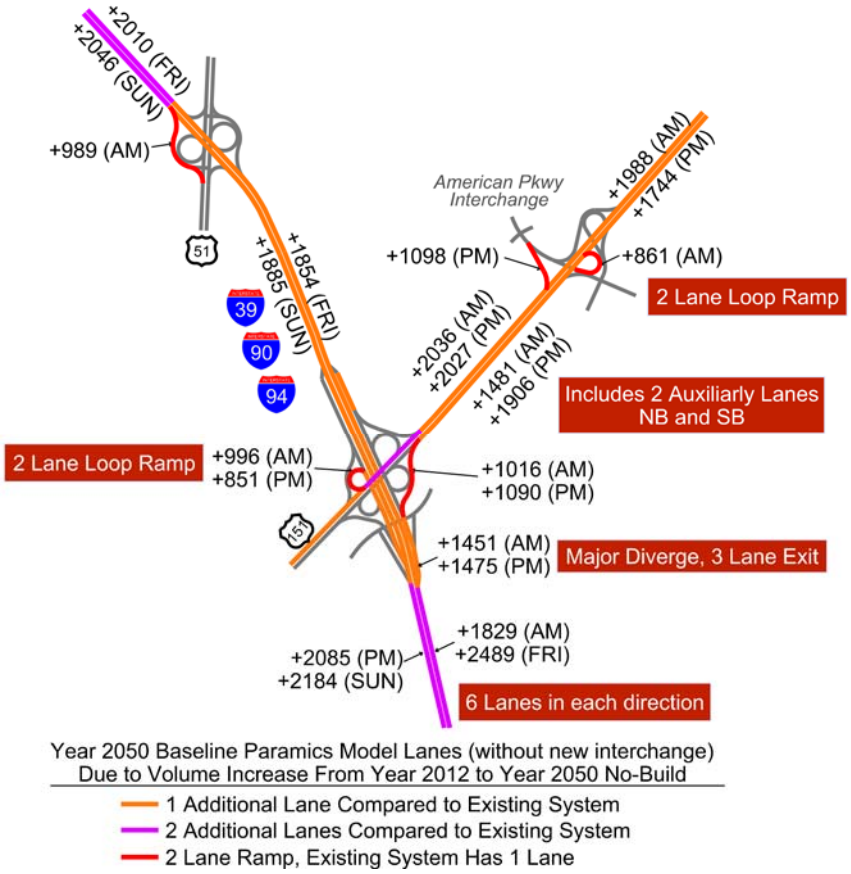


Figure 5.17. Traffic Increases from Year 2012 to Year 2050 No-Build and Assumed Lanes

Future configurations in this section of freeway may require advanced designs that incorporate additional lanes, move gore locations, include C-D roads, or use braided ramps. North of this area, the US 15 and WIS 19 interchanges are closely spaced and also may require a C-D road to operate as one combined interchange. A new interchange here must be compatible with all such changes to the existing freeway components. Designs of this magnitude are beyond the scope of this TIA study and prevent fair evaluation of a potential new interchange in this specific section of interstate. For this reason, a full evaluation of the viability of a new interchange at either Hoepker or Hanson Road will be completed during the upcoming environmental study of the I-39/90/94 corridor between the Madison Beltline and Portage.

Forecasted traffic volumes indicate that a new interchange at Hanson Road or Hoepker Road may improve conditions at the US 151 & American Parkway interchange but does not eliminate capacity deficiencies at the US 151 and US 51 interchanges or mainline freeway between them. Exhibit 24 shows peak hour ramp and intersection forecasts. Figure 5.18 highlights the major changes in future year peak hour traffic caused by a Hanson Road or Hoepker Road interchange. Lanes added to the Baseline model do not represent a preferred alternative, but show the relationship between traffic volumes and existing capacity. Changes in traffic volumes further illustrate the complicated relationship between interchanges in this area and the need to understand a new interchange in context with long-term lane configurations. A new interchange slows traffic growth at the US 151 system interchange, but major ramps would still require two lanes to accommodate year 2050 volumes.

For the I-39/90/94 & US 51 interchange, minimal changes in traffic volumes occur. The SB I-39/90/94 to SB US 51 ramp has the highest volume and is at- or over-capacity in the year 2050 with one lane. Lower volume movements at the US 51 interchange, such as the SB I-39/90/94 to NB US 51 and SB US 51 to NB I-39/90/94 movements, could potentially be removed and redirected to a new Hanson or Hoepker Road interchange, or the existing WIS 19 interchange. Relocating movements at the existing US 51 interchange would facilitate free-flow movements along US 51.

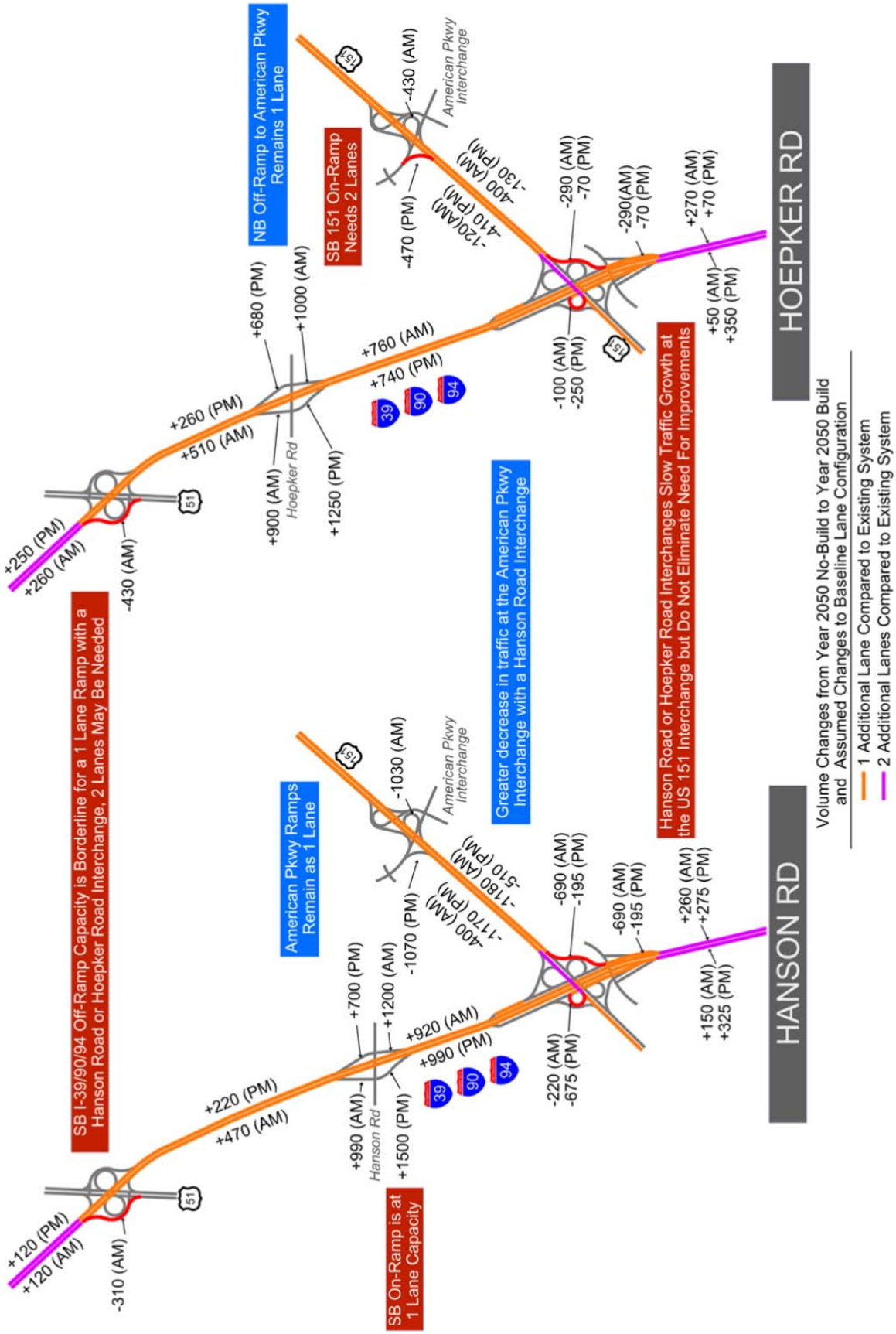


Figure 5.18. Changes in Volume from 2050 No-Build to 2050 Build and Assumed Lanes

Policy Point #2: Reasonable transportation system management will not alleviate the need for new access

Data for this policy point was not evaluated during the TIA. Reasonable transportation system management measures will be examined and a determination as to their viability and effect on the need for a new interchange as part of the upcoming environmental study of the corridor.

Policy Point #3: New interchange does not have a significant adverse effect on operations and safety of the Interstate

Adding a new interchange directly to the interstate mainline, without improvements to the mainline and existing interchanges, may have a negative impact on existing operations and safety. Both operations and safety of the interstate may degrade due to the additional merge and diverge areas created by the new interchange. However, impacts may be moderate because the potential new interchange would serve the most volume during the US 151 AM northbound and PM southbound peaks which are opposite of the Friday PM northbound and Sunday PM southbound interstate mainline peak times. The effect on future interstate operations and safety will not be known until analysis of advanced designs such as the use of a C-D road or braided ramp configuration is completed during the environmental study of the corridor.

Either location would be less than 2 miles away from the existing US 151 and US 51 interchanges. Closely spaced interchanges tend to increase weaving and auxiliary lanes should be considered to lessen conflicts. Auxiliary lanes between the potential new interchange and existing interchanges would range from 0.5 miles to 1.5 miles in length and may be approaching the practical maximum length for safe and efficient operations.

Policy Point #4: Connects to a public road, provides all movements, & meets current standards

A Hanson Road or Hoepker Road would connect to public roads and provide all movements, however, the interchange design would need to consider several design constraints.

Figure 5.19 shows constraints near the Hanson Road location and Figure 5.20 near the Hoepker Road location. Constraints found at both locations include: wetlands, utilities, potential historic sites, and potential relocation of nearby buildings. Achieving desirable intersection spacing may be challenging for the Hanson Road location due to closely spaced existing intersections. Interchange alternatives should be considered to minimize impacts which may include: a standard diamond configuration, partial cloverleaf, or other site-specific designs.

The Dane County Regional Airport provided input on both locations regarding structure height restrictions and lighting glare impacts that need to be considered. Interchange structures and high mast lighting for either Hanson Road or Hoepker Road must comply with Federal Aviation Administration regulations and Dane County height limitation zoning ordinances. The runway protection zone for airport runway 3/21 also restricts options for intersection control at adjacent intersections. Particularly for US 51 & Hanson Road, signalization is not feasible due to pole structure heights and lighting conflicting with the Runway 21 instrument landing system precision approach.

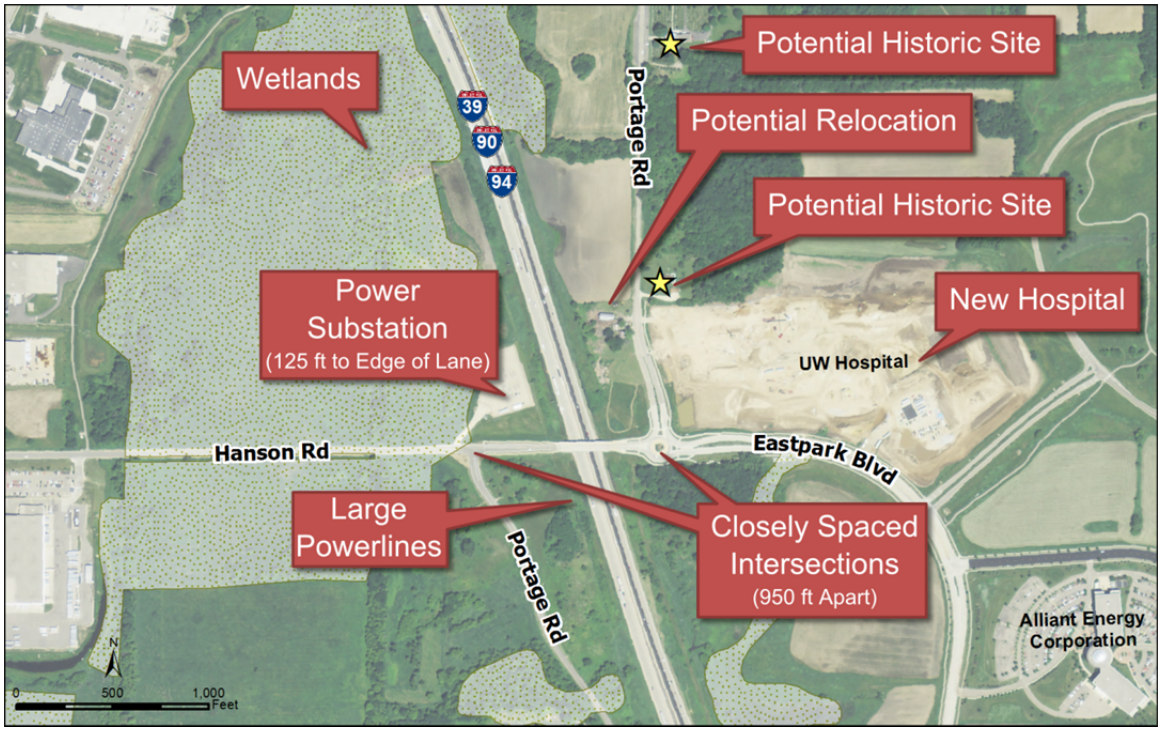


Figure 5.19. Physical Constraints Near Hanson Road

Figure 5.20. Physical Constraints Near Hoepker Road

Policy Point #5 : Consistent with local and regional land use and transportation plans

Hanson Road

The City of Madison is in favor of a Hanson Road interchange and is a potential sponsor. The interchange would improve access, mobility, and potentially reduce congestion at adjacent interchanges. Developments east and west of the interstate would benefit from new access.

West of the interstate, a new interchange would provide more direct connections for light industrial land use and the Dane County Regional Airport. A new interchange would also regain connectivity lost at the US 51 & Hanson Road intersection if it is converted to right-in-right out access as a potential alternative in the Stoughton Road Draft EIS (DEIS).

East of the interstate, the potential interchange would service a large business park and a major new hospital. The new hospital is expected to be a large traffic generator and will require about 800 full time employees and 24/7 emergency medical services (EMS). Efficient traffic flow will be critical for employees, patients, and EMS. Improving interstate access for EMS may decrease response times for all types of emergencies, including crashes on the freeway. The land use plan for the area east of I-39/90/94, the Pumpkin Hollow Neighborhood Development Plan, recommends a large area of residential development in addition to office uses. These uses and their locations may need to be adjusted to insure compatible uses are positioned in close proximity to the interchange, in addition to the variations in traffic that would be expected along Portage Road and other roadways if an interchange is located there.

The City of Madison Rattman Neighborhood plan covers the triangular area bounded by I-39/90/94, US 151, and Hoepker Road. The potential interchange at Hanson Road is consistent with the commercial land use identified in the neighborhood plan. This neighborhood plan recognizes the potential for a Hanson Road interchange, as well as the potential need for modifications of the I-39/90/94 & US 151 interchange. An interchange in this area would improve access to the existing and planned industrial lane west of I-39/90/94.

The Dane County Airport provided input about the runway approach requirements at the US 51 & Hanson Road intersection. Federal Aviation Administration criteria concerning the runway protection zone for Runway 21 will prohibit future intersection development and options for intersection control at Highway 51 and Hanson Road. Particularly for US 51 and Hanson Road, improvements and signalization is not feasible due to pole structure heights and lighting conflicting with the Runway 21 instrument landing system precision approach.

No response was received from the Town of Burke regarding a potential Hanson Road interchange.

Hoepker Road

The City of Madison is in favor of a Hoepker Rd interchange for the same reasons as the Hanson Road location. Hoepker Road is currently outside any of the City of Madison neighborhood plans and not included in the Rattman Neighborhood plan. The city's comprehensive plan recognizes the need for coordination in this peripheral planning area between the City of Madison, Village of DeForest, Town of Burke, and City of Sun Prairie.

The City of Sun Prairie is in favor of a Hoepker Road interchange. Residential and business expansion on the west side of the city will increase congestion at the American Parkway and County C interchanges with US 151 and along the US 151 and WIS 19 corridors. The city feels that a new interchange would have positive benefits by providing an alternate route and improve access for business and emergency services.

If it is determined an interchange is needed, Dane County Airport prefers Hoepker Road.

Policy Point #6: New access is in context with long range Interstate system plan

The purpose of the TIA is to evaluate the potential viability of new access points onto I-39/90/94 and intersecting freeways in the greater Madison area. Only one site, not both, could be chosen for an interchange. Interstate access points should support the primary purpose of the interstate by providing regional mobility.

Hanson Road is a 2.5 mile east-west urban collector extending between US 51 and American Parkway. US 51 is a principal arterial that provides regional mobility as an alternate route for I-39/90/94 and extends the full north-south length of Wisconsin and beyond. American Parkway is a minor arterial that provides mobility between US 151 and Hoepker Road.

Hoepker Road is 0.75 miles north of Hanson Road and is a 3.5 mile east-west minor arterial extending from County CV to County C. Between these termini, Hoepker Road also connects to US 51 and American Parkway, providing northerly access to the American Center Business Park. County CV is a minor arterial providing a connection between DeForest and Madison. If recommendations from the Stoughton Road DEIS are implemented, a connection between Hoepker Road and County CV would be maintained through realignment of County CV to connect with Hoepker Road at a proposed interchange with US 51. County C is a minor arterial extending 20 miles between Sun Prairie and Rio. County C also connects to US 151 and the east side of Madison via Reiner Rd and Sprecher Road.

Policy Point #7: Local system can accommodate new traffic to bring traffic to the new interchange and distribute traffic away from the new interchange

A Hanson Road or Hoepker Road interchange likely affects operations on the local system beyond the immediate area surrounding the potential interchange. The American Center Business Park is home to many existing and future major traffic generators that may require improvements along Hanson Road, Hoepker Road, Portage Road, and/or Eastpark Boulevard. Extents of local road improvements due to a new interchange would likely occur between US 51 and American Parkway and may include roadway widening and changes in intersection control.

Two intersections of particular interest include US 51 & Hanson Road and American Parkway & Eastpark Boulevard. For US 51 & Hanson Road, improvements need to consider height and lighting restrictions required for airport operations, as well as access management needs on US 51. The American Parkway & Eastpark Boulevard intersection is at-capacity in the existing year and future volumes are likely to remain high even with the addition of a new interchange. An IAJR for any alternative would need to study impacts to the local system in greater detail.

During Tier 2 Screening, a potential new grade separated crossings was evaluated to connect Portage Road to Eastpark Boulevard south of the existing Hanson Road crossing. This potential new crossing, called the Portage Road / Eastpark Boulevard Connector, was evaluated for its potential to help distribute traffic to or from a Hanson or Hoepker Road interchange by providing an adjacent parallel route. Traffic forecasts shown in Exhibit 24 indicate that the crossing has little impact on volumes at a Hanson Road or Hoepker Road interchange. The City of Madison has expressed interest in the potential for a pedestrian/bicycle-only Portage Road / Eastpark Boulevard Connector. Further evaluation of the grade separated crossing, with and without potential new interchanges, will be conducted in the upcoming environmental study of the corridor.

Policy Point #8: New access has been included in the required environmental evaluation, review, and processing

The TIA evaluated wetlands, park land, archaeological, and historic impacts from a high level perspective. For the Hanson Road location, there are potential historic and previously reported archaeological sites in the vicinity of the interchange. Potential historic sites are located north of the Hanson Road overpass along the east side of Portage Road and may or may not be impacted, depending on the interchange design.

For Hoepker Road, no archaeological sites are anticipated to be within the vicinity of the potential interchange. Two potential historic sites are located on Hoepker Road: one in the NW quadrant of the Manufacturers Drive intersection, and one in the NE quadrant of the Portage Road intersection. Other features near Hoepker Road include wetlands south of the potential interchange, and Token Creek County Park 0.5 miles north.

All environmental impacts, including additional consideration for ecological, aesthetic, noise, economic, social, and health, would need further investigation and an environmental document must be completed in order to comply with IAJR and National Environmental Policy Act (NEPA) requirements.

SUMMARY

Tier 2 Screening Results for a Hanson Road or Hoepker Road interchange include the following summary points and next steps to consider:

- **Viability of a new Hanson Road or Hoepker Road interchange depends on mainline and adjacent interchange configuration** – Existing and future traffic needs are complex in this area due to the closely spaced system interchanges, forecasted traffic increases, and physical constraints. These factors create many unknowns regarding the capacity and configuration of the mainline that would be further complicated by the addition of a new interchange. Evaluation of the Hanson Road and Hoepker Road locations should occur within the context of mainline and adjacent interchange alternatives to better understand interactions and impacts. This evaluation will occur during the upcoming environmental study of the I-39/90/94 corridor from the Madison Beltline to Portage.

- **Potential congestion relief for existing interchanges** – A Hanson Road or Hoepker Road interchange has potential benefits by drawing traffic volume away from the US 151 & American Parkway interchange, thereby extending its service life. Hanson Road may have more benefit than Hoepker Road because Hanson Road is closer to major traffic generators and may allow both the US 151 NB off-ramp and SB on-ramp to remain as one lane at the American Parkway interchange. The I-39/90/94 & US 151 system interchange benefits from shifting traffic from US 151 & American Parkway to a Hanson Road or Hoepker Road interchange with I-39/90/94 because of the potential for lower traffic growth rates and reduced merging and diverging intensity for movements to and from US 151. These movements are at or near capacity in the existing year 2012 and would benefit from a new Hanson Road or Hoepker Road interchange, however capacity improvements may be necessary to safely and efficiently accommodate year 2050 traffic with or without a new interchange. A new interchange may also allow removal of low volume movements at the I-39/90/94 & US 51 interchange to facilitate free-flow traffic along US 51.

The I-39/90/94 TIA has evaluated the Hanson Road and Hoepker Road interchange locations from a high level perspective. Further evaluation consideration for an interchange would involve the following tasks:

- **Additional traffic and geometric investigations** – Further analysis regarding a potential Hanson Road or Hoepker Road interchange should be completed in conjunction with mainline and adjacent interchange alternative evaluation during the upcoming environmental study of I-39/90/94. Analysis should include traffic, geometrics, and environmental factors, to the extent done for other Tier 2 Screening locations. Additional analysis is also necessary to understand the impacts to the local system and to the Dane County Regional Airport runway protection zone.
- **Federal approval process** – Changes to interstate access require completion of an IAJR to provide additional details about the purpose, need, impacts, and answer many of the outstanding questions regarding the effects of a new interchange. The process requires a local sponsor, such as the City of Madison, to submit an IAJR to WisDOT. If WisDOT supports the request, they submit the IAJR to the local FHWA Division Office. FHWA has final approval for new interchange requests. Since the proposed interchange is within the Madison Area Transportation Management Area, ultimate approval comes from FHWA in Washington DC rather than the Wisconsin Regional Office.
- **Inclusion in regional long range plans** – The interchange sponsor would need to complete the process for including the interchange in the Madison Area Metropolitan Planning Organization (MPO) Long Range Transportation Plan (RTP) and Transportation Improvement Plan (TIP). These plans ensure that improvements are consistent with the transportation needs and goals for the greater Madison area.

- **Environmental documentation** – NEPA documentation is required to establish a need for the interchange and investigate all potential environmental effects in detail including: natural, historic, cultural, noise, economic, social, and health impacts. This process encourages responsible planning and provides additional opportunity for public input.