Appendix K. Traffic Analyses

MEMORANDUM

Summary of Traffic Documentation in Appendix K

Date:	4/26/2024 (Revised 9/24/2024)
Topic:	Summary of Traffic Documentation in Appendix K
From:	Tim Flynn, HNTB Corporation

This technical memorandum briefly summarizes each of the traffic-related memos located in Appendix K of the I-39/90/94 Interstate North and South Segments' EIS document.

Design Hour Volume Justification, May 3, 2023

This document provides recommendations on establishing the design hour volume (DHV) to use in establishing the traffic operations of the I-39/90/94 subject facility based on analyzing traffic data along the corridor and guidance from the WisDOT Facilities Development Manual (FDM). It was determined that **The I-39/90/94 mainline north of US 151 would use K30 volumes, the I-39/90/94 mainline south of US 151 would use K100 volumes, and the ramp terminals and cross streets would use K250 volumes.** The design hour volumes were approved by the Bureau of Project Development and the Federal Highway Administration.

Design Considerations and Representative Day Methodology, August 8, 2022

This document determines what representative days will be used for the project for the purposes of traffic volume development and VISSIM micro-simulation validation. The representative days were identified through a cluster analysis using continuous count site (CCS) traffic data, National Performance Management and Research Data Set (NPMRDS) speeds, precipitation data, and corridor crashes. The desirable Levels of Service (LOS) are also determined. Locations north of CTH I were determined to have a LOS C desirable threshold, and locations south of CTH I were determined to have a LOS D desirable threshold. **Therefore, the Interstate North segment is assigned an LOS C desirable threshold, and the Interstate South segment is assigned an LOS D desirable threshold.** The US 51 corridor has a desirable threshold of LOS D.

Traffic Forecasting Methodology, September 24, 2024

This document describes the methodology for developing traffic forecasts in the I-39/90/94 and US 51 project. The existing year for the Interstate North corridor is 2021 and the existing year for the Interstate South corridor is 2019. The project study limits are described, including what intersections will be included in the VISSIM micro-simulation analysis and the Synchro traffic operations analysis. This document also summarizes other memos regarding COVID-19 Pandemic Impacts on Corridor Traffic (also described above), Design Hour Volume Identification (also described above), and Boat and Trailer Impact Truck Percentages, which compared truck percentage data collected by video and by axle classification system. The truck percentage results were similar, except for vehicle class 8, which showed a difference of approximately 5% between the two collection systems. A new Section 6 is added to the document, describing the Selected Alternative (also referred to the preferred Build Alternative) forecasting. The existing, no build, no build 'plus 1', and preferred build traffic volume exhibits were included as attachments to the Traffic Forecasting Methodology memo to better organize the traffic volume exhibits within Appendix K. Attachments J through P accompany the new narrative in Section 6. Some key attachments (Attachments B, G, J, and K) are summarized below.

COVID Pandemic Impacts on Corridor Traffic, August 9, 2022 (Attachment B)

This document analyzed traffic volumes during the pre- and post-COVID-19 pandemic period of 2020. **I-39/90/94 daily traffic volumes in the year 2021 recovered to pre-pandemic levels of the year 2019 after decreasing in the year 2020**. However, US 51 daily volumes were still about 10-15% lower than

pre-pandemic year 2019 levels. This is because the higher levels of work-from-home behavior impacted US 51 traffic patterns more than I-39/90/94 traffic patterns.

The document also briefly summarizes the use of the Statewide Travel Demand Model, which was utilized for the Interstate North corridor, and the Dane County Travel Demand Model, which was utilized for the Interstate South corridor and both the US 51 North and South corridors. The Statewide model only includes daily volumes. Therefore, daily model growth was applied in the traffic forecasting process in the Interstate North corridor. The Dane County model includes peak period volumes, including AM, PM, midday, and night-time, therefore peak period volume model assignment growth could be used in the traffic forecasting process in the Interstate South corridor. Traffic Analysis and Forecasting Information System (TAFIS) data was utilized, where available, to compare against the travel demand model growth and was used in the development of the project's future traffic forecasts. This document describes the workflow in developing traffic forecasts. This workflow generally includes comparing the forecasts developed from TAFIS and from the travel demand model, if they are within 10%, then the demand model-derived forecasts are used. If they are not within 10%, then the two forecasts are averaged, and if the average is within 10% of the TAFIS-based forecasts, then the average forecast is selected as the forecast. If the average is not within 10% of the TAFIS-based forecasts, then engineering judgment is applied to develop the forecast. This forecasting process is consistent with the process outlined in the *WisDOT Transportation Planning Manual (Chapter 9, Figure 10.5.1).*

Dane County Travel Demand Model Validation, August 2022 (Attachment G)

This report documents the validation of the Dane County travel demand model (DCTDM) by HNTB. The base year of the DCTDM is the year 2016. The validation efforts included an initial check on the model, trip distribution result validation, mode split validation, and highway assignment validation. Various data sets were used for the validation efforts, including origin-destination data from Replica and Streetlight, time-of-day traffic count data from WisDOT's Traffic Data System (TRADAS), and travel time and speed data from NPMRDS data in the Dane County road network. The initial check on the model identified a cluster-related issue within the current version of the model, causing the model to generate different results for every independent run. The solution was to rename an intermediate file and modify the corresponding code to accommodate the file name change. Generally, the validation review found good performance related to trip distribution, mode split, and highway assignment. However, two issues were uncovered, including the model overestimating the intra-district level traffic flow compared with Streetlight and Replica data and the model overestimating the travel speed on five major corridors in Dane County. The recommendations to correct these issues included implementing reduction factors on the intra-zonal terminal time to encourage the intra-zonal trip flows in the trip distribution step, and activating the intersection delay function to reduce travel speed in the major corridors and downtown areas.

High-Level Traffic Impacts of Various Interstate and US 51 Alternatives, September 24, 2024 (Attachment J)

This document provides high-level assessments of traffic impacts from potential interchange and mainline alternatives in the Interstate and US 51 corridors. The DCTDM was generally used for these traffic impact assessments through the use of difference plots that compare the alternative model's traffic volumes to the no build model's traffic volumes. The year 2050 DCTDM baseline model included committed roadway improvements and the Greater Madison Area MPO's recommended bike, pedestrian, and transit improvements, including additional bike and pedestrian connections, bus rapid transit north-south and east-west alignments through Madison, and updated Madison Metro routes. Future alternatives that were assessed include Interstate capacity expansion, new interchanges at Hoepker Road and Milwaukee Street, various alternative interchange designs in the

US 151/High Crossing Blvd/American Pkwy area, reduced speed along the US 51 South segment, and reduced speed along East Washington Avenue. Three new alternative assessments were added onto this report (#31, #32, and #33). Additionally, the previously numbered #31 is now #34.

US 51 North Corridor Forecast Methodology, November 28, 2022 (Attachment K)

This memo investigates whether to use Year 2018 (pre-COVID) or Year 2022 (Post-COVID) counts to use as a base from which to develop future Year 2050 traffic forecasts along the US 51 corridor. The memo describes how US 51 traffic counts in Year 2022 are still lower than Year 2018 in many locations. It is believed this is because the US 51 corridor has a significant commuter component as well as carrying traffic to and from Madison Area Technical College. It is believed that the growing practice of work-from-home, and remote MATC classes contributed to Year 2022 traffic counts along US 51 being less than Year 2018 counts. The memo concluded that the project will use Year 2022 counts as the base year for US 51 forecasts because using Year 2018 counts may overestimate traffic forecasts. Additionally, there is no indication that work-from-home practices and remote MATC classes will not continue. However, a sensitivity traffic analysis of year 2018-derived forecasts will be developed at locations near MATC to compare to the Year 2022-derived traffic forecast.

Safety Analysis Methodology, November 21, 2022

This document provides guidance on the predictive safety models used Interactive Highway Safety Design Manual software (IHSDM) for the I-39/90/94 and US 51 corridors. It includes descriptions of the software version, analysis years, model development, model attributes and coding.

VISSIM Analysis Methodology, July 8, 2022

This document provides guidance on the development of the VISSIM microsimulation models for the I-39/90/94 and US 51 corridors. It includes descriptions of the software version, model geometric coding, driving behavior coding procedures, project area limits describing what intersections are modeled, peak periods modeled, calibration and validation procedures, and performance measures.

I-39/90/94 Interstate North and South Segments – Future No Build Operations, April 18, 2024

These documents show the results of the year 2050 future no build level of service (LOS) traffic operations conducted for the I-39/90/94 North and South Segment Corridor Study. The documents provide further details about the analyzed limits, methodology, and results of the year 2050 no build traffic operations *I-39/90/94 South Segment No Build Traffic Operations, March 9, 2023* (Appendix A) and *I-39/90/94 North Segment No Build Traffic Operations, March 9, 2023* (Appendix B).

The year 2050 No Build Friday PM and Sunday PM peak hour traffic operations are analyzed for the North Segment and the weekday AM, weekday PM, Friday PM, and Sunday PM peak hour traffic operations for the South Segment. The document shows there are several unacceptable year 2050 No Build peak hour traffic operations in the Interstate corridor. Unacceptable peak hour traffic operations include LOS D or worse in the North Segment and LOS E or worse in the South Segment. Every I-39/90/94 segment in the North Segment observes unacceptable LOS D conditions or worse along at least one direction during the Friday PM or Sunday PM peak hour. Along the South Segment, every I-39/90/94 segment except between WIS 60 and CTH V observes unacceptable LOS E conditions or worse under year 2050 No Build conditions. In addition, several locations along the I-94/WIS 30, US 151, and US 151 C-D corridors also observe unacceptable LOS E conditions or worse under year 2050 No Build conditions.

Table 1 summarizes the year 2050 No Build peak hour traffic LOS operations. The Highway Capacity Software (HCS) Version 2022 was used for these analyses. The key is below, which describes the coloring used for Table 1.

	Better than acceptable LOS operations (LOS A or B in North Segment; LOS A, B, or C in South Segment)
	At the acceptable LOS operations (LOS C in North Segment; LOS D in South Segment)
	Worse than acceptable LOS operations but not LOS F (LOS D or E in North Segment; LOS E in South Segment)
	Failing LOS operations (LOS F in North or South Segments)

Table 1. Future 2050 No-Build Level of Service Summary

Interstate Corridor (North/South)	Highway	I-39/90/94 Location (Interchange to Interchange)	LEVEL OF SERVICE (LOS) SUMMARY							
			AM		PM		FRI		SUN	
			SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB
Interstate North (LOS C or better is acceptable)	I-90/94	N of US 12/WIS 16	--	--	--	--	D	E	F	D
		US 12/WIS 16 to WIS 13	--	--	--	--	D	E	F	D
		WIS 13 to WIS 23	--	--	--	--	D	E	F	E
		WIS 23 to US 12	--	--	--	--	D	D	F	D
		US 12 to WIS 33	--	--	--	--	D	E	D	D
		WIS 33 to I-39	--	--	--	--	D	D	D	D
	I-39/90/94	I-39 to Rest Area	--	--	--	--	C	D	D	C
		Rest Area TO CTH CS	--	--	--	--	C	D	D	C
		CTH CS to WIS 60	--	--	--	--	C	D	D	C
Interstate South (LOS D or better is acceptable)		WIS 60 to CTH V	B	B	B	B/C	C	D	D	B/C
		CTH V to WIS 19	B	B	B	C	C	D	E	C
		WIS 19 to US 51	C	B	C	D	D	F	E	C
		US 51 to US 151	C	C	C	D	D	F	E	C
		US 151 to Badger Interchange	C	C/D	D	D	F	F	E	C
	I-39/90	Badger Interchange to Beltline Interchange	E	E	E	E	F	F	E	D
	I-94/WIS 30	Fair Oaks to US 51	B	D	D	B	D/E	C	B	B
		US 51 to Thompson	B	F	E	B/C	E	C	B	B
		Thompson to Badger Int.	B	D/E	D	B/C	D	C	A/B	B
		Badger Int. to CTH N	B	C	C	B	C	C	C	B
	US 151	SB I-90 to NB I-90	D	B	F	B/C	F	C	C	B
		NB I-90 to American Pkwy	D	C	D	C	D	D	C	B
		American Pkwy to Grand Ave	D	A/B	C	C/D	C/D	C	C	B
		Grand Ave to Main St	C	A	B	C	B	B	B	B
		North of Main St	--	A/B	--	C	--	C	--	B
	NB US 151 CD	From NB I-90	--	F	--	F	--	F	--	B/C
		Diverge to NB US 151	--	F	--	F	--	F	--	A
	SB US 151 CD	SB US 151 to NB US 151	F	--	F	--	C	--	B/C	--
		South of Weave	E	--	E	--	F	--	D	--

The traffic model results of the I-39/90/94 North Segment No Build traffic operations report (Appendix B) was removed for file size considerations. It was originally located in the Draft EIS Appendix K from pages 363 to 565. The traffic model results can be accessed through the Draft EIS Appendix K document available online at the I-39/90/94 study website at https://wisconsindot.gov/Documents/projects/by-region/sw/399094/24apktrafficanalysis.pdf.

I-39/90/94 North Segment – 2050 Preferred Build Alternative VISSIM Analysis, June 24, 2024
This report summarizes the VISSIM microsimulation traffic operations analysis of the Year 2050 Preferred Build Alternative along the I-39/90/94 North Segment. The results showed that the Preferred Build has higher speed than both the future no build and existing scenarios. Travel time through the North segment corridor is also between approximately 2% to 8% faster with the Preferred Build than the future no build. The appendices to this report are not included due to file size constraints. Please contact David Schmidt, P.E., WisDOT Study Manager, (608) 246-3867, david2.schmidt@dot.wi.gov to request a copy of these appendices.

I-39/90/94 North Segment – 2050 Preferred Build Alternative IHSDM Analysis, May, 2024
This report summarizes the IHSDM predictive safety analysis of the Year 2050 Preferred Build Alternative along the I-39/90/94 North Segment. The results showed a small 1% increase in overall increase in total crashes, however the fatal and injury crashes was expected to decrease by 7% from the future no build scenario. The appendices to this report are not included due to file size constraints. Please contact David Schmidt, P.E., WisDOT Study Manager, (608) 246-3867, david2.schmidt@dot.wi.gov to request a copy of these appendices.

I-39/90/94 South Segment – 2050 Preferred Build Alternative VISSIM Analysis, July, 2024
This report summarizes the VISSIM microsimulation traffic operations analysis of the Year 2050 Preferred Build Alternative along the I-39/90/94 South Segment. The results show that under the Preferred Build the Interstate South segment is expected to operate at LOS D or better conditions during the Weekday AM, Weekday PM, Friday PM, and Sunday PM peaks. This is an improvement compared to the future no build which operates at LOS F conditions at some locations in each of the four peak periods. The appendices to this report are not included due to file size constraints. Please contact David Schmidt, P.E., WisDOT Study Manager, (608) 246-3867, david2.schmidt@dot.wi.gov to request a copy of these appendices.

I-39/90/94 South Segment – 2050 Preferred Build Alternative IHSDM Analysis, June 12, 2024
This report summarizes the IHSDM predictive safety analysis of the Year 2050 Preferred Build Alternative along the I-39/90/94 South Segment. The results showed a 6% decrease in total crashes per lane-mile, a 1% decrease in fatal and injury crashes per lane-mile, and an 8% decrease in property damage crashes per lane-mile under the Preferred Build scenario compared to the future no build scenario. The appendices to this report are not included due to file size constraints. Please contact David Schmidt, P.E., WisDOT Study Manager, (608) 246-3867, david2.schmidt@dot.wi.gov to request a copy of these appendices.

LIST OF ACRONYMS

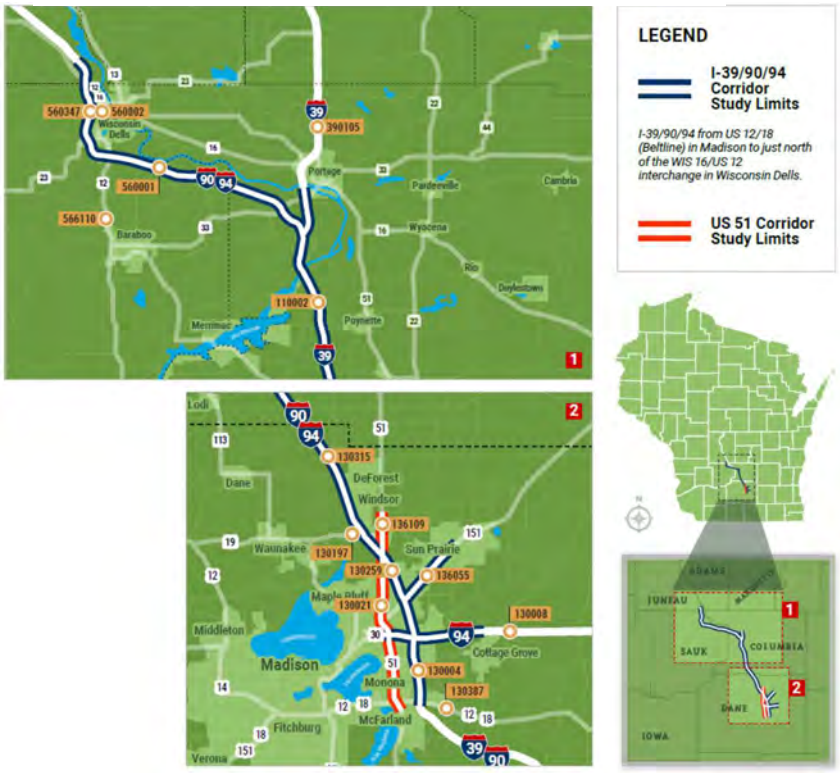
AADT	Average Annual Daily Traffic
ATR	Automatic Traffic Recorder
AWDT	Average Weekday Daily Traffic
BRT	Bus Rapid Transit
CCS	Continuous Count Sites
DCTDM	Dane County Travel Demand Model
DHV	Design Hour Volume
EB/NB/SB/WB	Eastbound, Northbound, Southbound, Westbound
EE	External-to-External Trips
EI-IE	External-to-Internal / Internal-to-External trips
EWA	East Washington Avenue
FDM	WisDOT's Facilities Development Manual
GMMPO	Greater Madison Metropolitan Planning Organization
K30	30th highest hour volume
K100	100th highest hour volume
LOS	Level of Service
NHS	National Highway System
NPMRDS	National Performance Management and Research Data Set
OD	Origin-Destination
ODME	Origin-Destination Matrix Estimation
SWTDM	Statewide Travel Demand Model
TAFIS	Traffic Analysis and Forecasting Information System
TPM	Transportation Planning Manual
VISSIM	A micro-simulation traffic engineering software used for traffic analysis
VHT	Vehicle-hours Traveled
VMT	Vehicle-miles Traveled
WisDOT	Wisconsin Department of Transportation

Design Hour Volume Justification

Date:	May 3, 2023
Topic:	Design Hour Volume Justification
From:	CDMCT

1. Overview

Figure 1: Continuous Count Sites in the I-39/90/94 Study Limits



The Wisconsin Department of Transportation (WisDOT) is studying the Interstate 39/90/94 (I-39/90/94) corridor between US 12/18 in Madison to US 12/WIS 16 north of Wisconsin Dells. WisDOT's Transportation Planning Manual Chapter 9 and Facilities Development Manual (FDM) provide recommendations on establishing the design hour volume (DHV) to use in establishing the operations of the subject facility. The FDM identifies the 30th highest hour of the day as the generally recommended design hour volume for a freeway facility including I-39/90/94. The FDM provides exceptions to this general recommendation when level of service using the 30th highest design hour is financially cost prohibitive or for urbanized areas with a population over 200,000 residents. Figure 1 shows the I-39/90/94 corridor along with the US 51 corridor that is being studied in parallel with I-39/90/94. The I-39/90/94 analysis is divided into two design sections with the north and south section limits transitioning south of WIS 60 in Columbia County. Based on analysis detailed below, the 30th highest hourly volume is recommended as the DHV for all Interstate segments in Columbia, Juneau and Sauk counites highlighted in Figure 1 and for all Interstate segments in Dane County except the segments between US 12/18 and US 151, which is recommended to use the 100th highest hourly volume.

2. Traffic Count Analysis

COVID 19 impacted traffic volumes both nationally and in the study corridor. Average annual daily traffic from available continuous count sites (CCS) were compared for years 2019, 2020 and 2021 as shown in Table 1, with 2021 post-COVID traffic volumes at or exceeding 2019 pre-COVID volumes at most locations.

Table 1: Summary of Interstate's Average Annual Daily Traffic 2019-2021

Facility	Location	2019	2020	2021	% Recovery
Interstate	N of US 12/18 (Beltline), Dane Cty	97,500	79,500	92,500	95%
Interstate	Btwn US 51 and US 151, Dane Cty	71,200	62,000	72,000	101%
Interstate	Dane/Columbia Cty Line	59,100	50,400	58,400	99%
Interstate	Wisc River Bridge, Columbia Cty	56,900	49,100	58,100	102%
Interstate	Wisconsin Dells, Sauk Cty	42,900	36,200	43,400	101%

Figure 2 and Figure 3 show detailed monthly average traffic volumes for I-39/90/94 north of US 151 and I-90/94 north of US 12/18. Traffic volumes dropped significantly in March of 2020 due to the State of Wisconsin's Safer at Home restrictions. Monthly traffic volumes continued to lag 2019 monthly averages through the remainder of 2020 and into early 2021. March 2021 volumes north of US 151 showed similar volumes to 2019 data with subsequent monthly volumes in 2021 indicating traffic demands were similar to or were exceeding 2019 volumes. Volumes on I-90/94 north of US 12/18 show 2021 and 2022 traffic volumes still slightly lower than 2019 volumes.

Figure 2: Monthly Volumes on I-39/90/94 N of US 151 During COVID

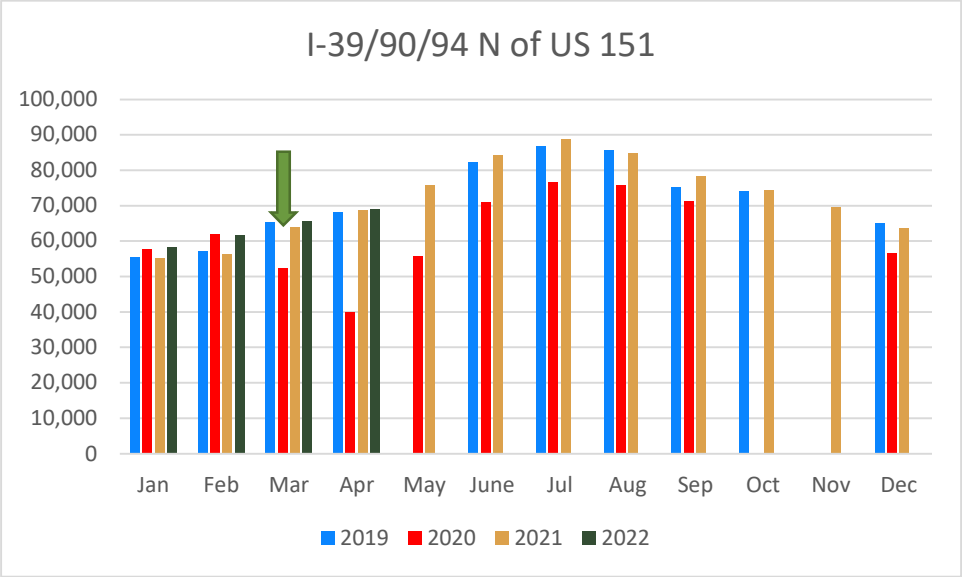
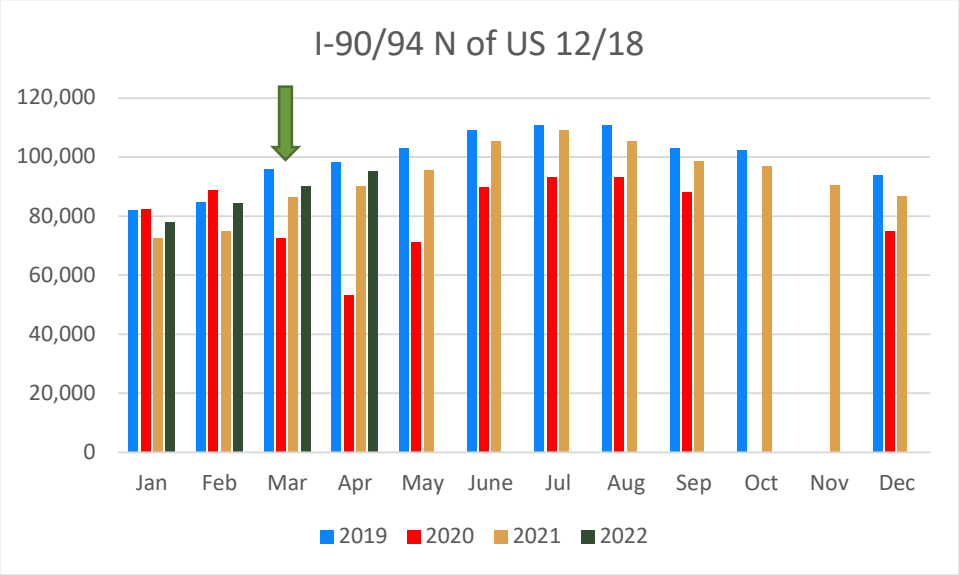


Figure 3: Monthly Volumes on I-90/94 N of US 12/18 During COVID



The south design section is using previously developed traffic data from 2019 for operations and forecasting purposes. The 2019 count data set is being used to maximize the investment in data collection and traffic analysis already completed with the 2019 data. The north design section is using 2021 data as a new data collection effort was required and 2021 daily counts show higher volumes than do 2019 daily counts.

Available year 2021 continuous count site data on and in proximity to the I-39/90/94 corridor were reviewed to determine the highest traffic demands periods. Figure 1 and Table 1 show the locations along I-39/90/94 analyzed along with support locations. Table 3 shows the number of high-volume hours that occur in each day of the week in year 2021 for I-39/90/94 locations. Note that Friday and Sunday contain most of the high-volume hours along the Interstate. Table 2 shows the observed K30 and K100 hourly volumes in year 2021 and includes K250 in urbanized areas.

Table 2: Summary of Observed Peak Traffic Demands from Continuous Count Sites – Year 2021

Station	Direction	Segment	K30	K100	K250
560347	I-90/94 WB (NB)	Between WIS 13 & WIS 23	2,802	2,514	
	I-90/94 EB (SB)		3,004	2,686	
560001	I-90/94 WB (NB)	Between WIS 12 & WIS 33	2,697	2,507	
	I-90/94 EB (SB)		2,847	2,592	
110002	I-39/90/94 NB (WB)	Between I-39 Split & CTH CS	4,071	3,720	
	I-39/90/94 SB (EB)		4,410	4,095	
130315	I-39/90/94 NB (WB)	Between WIS 60 & CTH V	4,111	3,741	
	I-39/90/94 SB (EB)		4,330	4,000	
130259	I-39/90/94 NB (WB)	Between US 51 & US 151	4,385	4,100	3,677
	I-39/90/94 SB (EB)		4,518	4,215	3,558
130004	I-39/90 NB (WB)	Between I-94/WIS 30 & US 12/18	4,588	4,327	4,019
	I-39/90 SB (EB)		4,518	4,236	3,972
130006	I-39/90 NB (WB)	South of US 12/18	2,736	2,605	2,465
	I-39/90 SB (EB)		3,347	3,064	2,809

Table 3 through Table 5 show the number of days in which the highest 30, 100 and 250 hours of traffic were observed throughout the year. Note the high number of hours that occur during the Friday and Sunday timeframe.

Table 3: Summary of 30th Highest Hour Traffic Demands by Day of Week – Year 2021

Station	Roadway	Segment	Sun	Mon	Tue	Wed	Thu	Fri	Sat
560347	I-90/94 EB	Between WIS 13 & WIS 23	6	7	7	2	2	3	3
	I-90/94 WB		0	17	6	5	2	0	0
560001	I-90/94 EB	Between WIS 12 & WIS 33	25	5	0	0	0	0	0
	I-90/94 WB		11	0	0	0	0	15	4
110002	I-39/90/94 NB	Between I-39 Split & CTH CS	0	0	0	0	0	25	5
	I-39/90/94 SB		22	8	0	0	0	0	0
130315	I-39/90/94 NB	Between WIS 60 & CTH V	0	0	0	0	0	27	3
	I-39/90/94 SB		26	4	0	0	0	0	0
130259	I-39/90/94 NB	Between US 51 & US 151	0	0	0	0	0	29	1
	I-39/90/94 SB		24	6	0	0	0	0	0
130004	I-39/90 NB	Between I-94/WIS 30 & US 12/18	0	0	0	0	5	25	0
	I-39/90 SB		19	1	0	0	1	9	0
130006	I-39/90 NB	South of US 12/18	11	0	0	0	0	10	9
	I-39/90 SB		18	11	0	1	0	0	0

Contains 1/3 to 2/3 of 2021's Highest Hourly Volumes

Contains More than 2/3 of 2021's Highest Hourly Volumes

Table 4: Summary of 100th Highest Hour Traffic Demands by Day of Week – Year 2021

Station	Roadway	Segment	Sun	Mon	Tue	Wed	Thu	Fri	Sat
560347	I-90/94 EB	Between WIS 13 & WIS 23	17	18	12	3	15	13	22
	I-90/94 WB		10	28	18	19	17	0	8
560001	I-90/94 EB	Between WIS 12 & WIS 33	89	9	0	2	0	0	0
	I-90/94 WB		33	2	0	0	0	47	18
110002	I-39/90/94 NB	Between I-39 Split & CTH CS	1	0	0	0	1	78	20
	I-39/90/94 SB		80	20	0	0	0	0	0
130315	I-39/90/94 NB	Between WIS 60 & CTH V	1	0	0	0	2	78	19
	I-39/90/94 SB		87	13	0	0	0	0	0
130259	I-39/90/94 NB	Between US 51 & US 151	0	0	0	0	1	85	14
	I-39/90/94 SB		80	20	0	0	0	0	0
130004	I-39/90 NB	Between I-94/WIS 30 & US 12/18	0	0	0	0	18	71	11
	I-39/90 SB		50	8	1	4	8	29	0
130006	I-39/90 NB	South of US 12/18	26	0	1	2	0	44	27
	I-39/90 SB		74	15	3	3	0	5	0

Contains 1/3 to 2/3 of 2021's Highest Hourly Volumes

Contains More than 2/3 of 2021's Highest Hourly Volumes

Table 5: Summary of 250th Highest Hour Traffic Demands by Day of Week – Year 2021

Station	Roadway	Segment	Sun	Mon	Tue	Wed	Thu	Fri	Sat
560347	I-90/94 EB	Between WIS 13 & WIS 23	38	39	32	14	43	26	58
	I-90/94 WB		36	51	34	40	41	21	27
560001	I-90/94 EB	Between WIS 12 & WIS 33	201	19	0	4	0	21	5
	I-90/94 WB		65	3	0	4	1	134	43
110002	I-39/90/94 NB	Between I-39 Split & CTH CS	33	2	0	2	5	161	47
	I-39/90/94 SB		203	30	1	2	0	8	6
130315	I-39/90/94 NB	Between WIS 60 & CTH V	28	1	0	1	6	167	47
	I-39/90/94 SB		212	21	1	2	0	6	8
130259	I-39/90/94 NB	Between US 51 & US 151	25	0	0	3	8	173	41
	I-39/90/94 SB		189	29	2	3	1	19	7
130004	I-39/90/94 NB	Between I-94/WIS 30 & US 12/18	20	5	5	12	41	124	43
	I-39/90/94 SB		86	25	15	14	24	65	21
130006	I-39/90 NB	South of US 12/18	50	3	2	4	6	136	49
	I-39/90 SB		135	36	9	15	15	37	3

Contains 1/3 to 2/3 of 2021's Highest Hourly Volumes

Contains More than 2/3 of 2021's Highest Hourly Volumes

Table 3 through Table 5 show that the count locations along I-39/90/94 typically have the majority of the 30 highest hours and 100 highest hours occur during Friday in the I-39/90/94 NB (WB) direction, and during Sunday in the I-39/90/94 SB (EB) direction. The exception is the northernmost location (ID 560347) near Wisconsin Dells, which does not have a strong discernable pattern of highest hours of travel.

Table 6 compares the K30 and K100 hourly volumes between year 2019 and year 2021 for the south design section in Dane County to assess if the volume profiles have changed significantly. K30 and K100 volumes along I-39/90/94 are fairly similar during year 2019 and year 2021 with 2021 volumes slightly higher than 2019 volumes on average. Typically, the year 2019 and year 2021 K30 and K100 volumes are within 7% of each other. The one exception is station 130006 [I-39/90 EB (SB)], which is between 11 to 15% higher in year 2021 than year 2019, during which time construction activities on I-39/90 between Madison and the Illinois state line impacted traffic patterns south of Madison. 2019 counts are being used to represent the base condition for the south design section as 2021 counts were not higher than 2019 and considerable investment was made to collect 2019 traffic data and develop traffic analysis tools based on that data. Published 2022 counts show a mix of locations with volumes higher or lower than 2021 counts.

Table 6: Comparison of Year 2019 and Year 2021 K30 and K100 Hourly Volumes in South Design Section

Station	Direction	Segment	2019 K30	2021 K30	K30 %Diff	2019 K100	2021 K100	K100 %Diff
130315	I-39/90/94 NB (WB)	Between WIS 60 & CTH V	4,138	4,111	-0.7%	3,750	3,741	-0.2%
	I-39/90/94 SB (EB)		4,348	4,330	0.4%	3,865	4,000	3.5%
130259	I-39/90/94 NB (WB)	Between US 51 & US 151	4,458	4,385	-1.6%	4,005	4,100	2.4%
	I-39/90/94 SB (EB)		4,478	4,518	0.9%	4,021	4,215	4.8%
130004	I-39/90 NB (WB)	Between I-94/ WIS 30 & US 12/18	4,884	4,588	-6.1%	4,627	4,327	-6.5%
	I-39/90 SB(EB)		4,762	4,518	-5.1%	4,552	4,236	-6.9%
130006	I-39/90 NB (WB)	South of US 12/18	2,774	2,736	-1.4%	2,563	2,605	1.6%
	I-39/90 SB (EB)		2,896	3,347	15.6%	2,742	3,064	11.7%

Table 7 below shows the AADT's for 2019 and 2021 at the 3 available CCS in the north design section. Unlike the south design section, the 2021 volumes are consistently higher in the north design section compared to 2019 volumes and new traffic analysis models are being developed for this section. Therefore 2021 volumes will be used as the baseline for the north design section. Published 2022 AADT's at the three sites in Table 7 note a slight

reduction (1-2%) in volumes compared to 2021 but these slight reductions are within regular annual fluctuations and do not invalidate the use of the data.

Table 7: Comparison of Year 2019 and Year 2021 K30 and K100 Hourly Volumes in North Design Section

Station	Segment	2021 AADT	2019 AADT	AADT %Diff
560347	Between WIS 13 and WIS 23	43,400	42,900	+1.1%
560001	Between US 12 & STH 33	40,100	39,800	+0.7%
110002	Between I-39 & CTH CS	58,100	56,900	+2.1%

3. Design Hour Volume Determination

WisDOT FDM 11-5-3.5.1 defines the determination of DHV for the LOS analysis. The process varies depending on the type of facility. The existing year DHV will be used as the base line for forecasting future year no build and alternative scenarios DHVs. Existing, future no build and future build alternative DHVs will be analyzed with a combination of VISSIM and VISTRO/Synchro to estimate traffic operations such as delay, density and travel times during the design hours.

3.1. I-39/90/94 Design Hour Volume Determination

FDM 11-5-3.1.1 provides guidance on the DHV for freeways, multilane highways and two-lane highways. This applies to both the north and south I-39/90/94 sections. The general guidance is to use the 30th highest hourly volume of year as the DHV which the design team intends to do for all Interstate segments north of Dane County and for most segments of the Interstate in Dane County. The FDM notes that the higher design hours may be used in urbanized areas or the 200th or 250th highest hour may be justified in areas where there is little difference between the 30th and 250th hour and the 250th hour volumes are consistent with AM or PM peak hours. Therefore, a project-specific evaluation of the appropriate design hour is conducted.

2018 is the most recent year that coverage counts were available that have been seasonally adjusted, Table 8 and Figure 4 show that the Interstate traffic volumes in Dane County are significantly higher in the two segments between US 151 and US 12/18 compared to the rest of the Interstate corridor. Selecting the 30th highest hour for all segments of the Interstate in Dane County would lead to the two high volume segments driving capacity needs throughout the corridor.

Table 8: 2018 Average Annual Daily Traffic Volumes on Madison Area Interstate System

Station	Facility	Segment	2018 AADT
130315	I-39/90/94	Between WIS 60 and CTH V	59,300
130989	I-39/90/94	Between CTH V and WIS 19	66,600
131566	I-39/90/94	Between WIS 19 and US 51	74,400
130259	I-39/90/94	Between US 51 & US 151	70,700
130611	I-39/90/94	Between US 151 & I-94/WIS 30	108,000
130004	I-39/90	Between I-94/WIS 30 & US 12/18	98,900
130006	I-39/90	South of US 12/18	54,500

Figure 4: 2018 Interstate AADT in Madison area

Table 2 shows 250th hour volumes for site 130004 on I-39/90 in the urbanized Madison area are 12 to 21 percent lower than the 30th highest hour and therefore do not fit the FDM's definition of 'little difference between the 30th and 250th hour'. By contrast, the 100th highest hours are all approximately six to seven percent lower than the 30th highest hour.

Table 6 shows the 100th highest volumes in the high daily volume segment (130004) are 2-4% higher than the 30th highest volume in the adjacent segment (130259). Selecting the 100th highest volume as the DHV for the two high volume segments with the 30th highest volume for the remainder of the Dane County segments and all Interstate segments north of Dane County provides a volume set that is consistent with higher observed volumes between US 151 and US 12/18 but minimizes the potential for level of service to drive towards financially cost prohibitive solutions.

Note that FDM 11-5.3.1.1 does not pertain to the ramp terminal intersections or cross streets at interchanges. These locations are covered by FDM 11-5.3.1.2 which provides guidance on the determination of DHVs for urban streets, intersections and ramp terminals. At these locations, DHVs should be based on the AM or PM peak hour volumes for individual turning and through movements. This will result in a variation in traffic volumes between ramps (driven by the representative day to achieve K30/100 volumes on the Interstate mainline) and the turning movements at the ramp terminal (driven by the peak hour volumes).

Table 9 summarizes the designated DHVs identified per the FDM 11-5-3 guidance by facility type and location.

Table 9: Summary of Design Hour Volume Designation

Corridor	Facility Type	Designated Design Hour Volume	Volume Set
Interstate North	Interstate Mainline -Northbound	K30	Summer Fridays
	Interstate Mainline -Southbound		Summer Sundays
	Ramp Terminals and Cross Streets	K250	Weekend Peaks
Interstate South	Interstate (N of US 151) Mainline - Northbound	K30	Summer Fridays
	Interstate (N of US 151) Mainline - Southbound		Summer Sundays
	Urban (US 12/18 to I-94 and I-94 to US 151) Interstate Mainline	K100	AM/PM Peaks
	Ramp Terminals and Cross Streets	K250	AM/PM Peaks

WisDOT
Southwest Regional Office
Madison Office
2101 Wright Street
Madison, WI 53704

Governor Tony Evers
Secretary Craig Thompson
wisconsindot.gov
Telephone: (608) 246-3800
FAX: (608) 246-7996
Email: swr.dtsd@dot.wi.gov

Date: May 3, 2023

To: Beth Cannestra
Director, Bureau of Project Development
Attn: Michael Hoelker, P.E.

From: Frank Pritzlaff, P.E.
DTSD, Southwest Region Project Manager

Subject: Design Hour Volume Variance for Interstate 39/90/94 Between US 12/18 and US 151
Project ID 1012-05-03
Interstate 39/90/94 from US 12/18 in Madison to US 12/WIS 16 in Wisconsin Dells

The project team has reviewed traffic volumes and patterns on the Interstate system for the I-39/90/94 Interstate Corridor EIS within the study limits of US 12/18 in Madison and US 12/WIS 16 in Wisconsin Dells. For the purpose of reviewing traffic volumes and patterns, the Interstate in the study area was broken up into segments, demarcated by marked changes in traffic characteristics of volumes and patterns. Two segments of Interstate within the Interstate study area experience higher traffic volumes than the rest of the segments in the Interstate study area: the segment of Interstate 39/90 between US 12/18 and Interstate 94 and the segment of Interstate 39/90/94 between Interstate 94 and US 151 in Dane County. The team is requesting approval of the attached memorandum to use the 100th highest hour as the design hour volume for these two segments of the Interstate as allowed in the Department's Facilities Development Manual (FDM). All other corridor Interstate segments within the NEPA limits between US 151 and US 12/WIS 16 will use the 30th highest hour as the design hour volume per the Depa tm DM.

Jim Oettinger, P.E.
Digitally signed by Jim Oettinger, P.E.
DN: C=US, E=james.oettinger@dot.wi.gov, CN="Jim Oettinger, P.E."
Date: 2023.05.23 12:43:28-05'00'

Southwest Region Project Development Chief — Date

Concur: William Strobel
Digitally signed by William Strobel
Date: 2023.05.24 13:12:29 -05'00'

Bureau of Project Development, — Date
Design Standards and Oversight Section Chief

July 25, 2023

Federal Highway Administration — Date

WisDOT, Division of Transportation Development
Bureau of State Highway Programs
4822 Madison Yards Way
6th Floor South
Madison, WI 53705

Governor Tony Evers
Secretary Craig Thompson
wisconsindot.gov
Telephone: (608) 267-7754
Email: Jeffrey.Gust@dot.wi.gov

Date: May 2, 2023
To: Daniel Schave, P.E.
DTSD, Southwest Region Supervisor
Attn: Jim Oettinger, P.E.
From: Jeff Gust, P.E. JRG
DTIM, Bureau of State Highway Programs
Subject: Design Hour Volume Variance for I-39/90/94 Between US 12/18 and US 151

The Wisconsin Department of Transportation (WisDOT) is studying the Interstate 39/90/94 (I-39/90/94) corridor between US 12/18 in Madison and US 12/WIS 16 north of Wisconsin Dells. WisDOT's Facilities Development Manual (FDM) 11-5-3.5.1.1 provides recommendations on establishing the design hour volume (DHV) to use in establishing the operations of the subject facility. While the FDM identifies the 30th highest hour of the day as the generally recommended design hour volume for freeway facilities, exceptions to this general recommendation apply when level of service using the 30th highest design hour is financially cost prohibitive or for urbanized areas with a population over 200,000 residents. Selection of an appropriate DHV is to be based on an analysis of traffic volume data.

The existing year DHV will be used as the base line for forecasting future year no build and alternative scenarios DHVs. Existing, future no build and future build alternative DHVs will be analyzed with a combination of VISSIM and VISTRO/Synchro to estimate traffic operations such as delay, density and travel times during the design hours. Note that the majority of both the top 30 and top 100 hourly volumes occur on Fridays and Sundays due to the large volume of summer tourist traffic.

A thorough analysis of data from several years at traffic count stations on the I-39/90/94 corridor led the project team, in collaboration with the Bureau of State Highway Programs, to select the 100th highest hour as the DHV for the two Interstate segments between US 12/18 and US 151. Given their location in the heart of the Madison metropolitan area, these segments carry significant commuter traffic as well as traditional Interstate demands (freight, long distance trips, and recreational travel). Neither the typical 30th highest hour nor the 200th or 250th highest hour recommended for highly urbanized freeways seemed appropriate given the demand profile of the corridor, but the 100th highest hour is fitting not only as middle ground but also for volume consistency along the entire corridor. Using the 100th highest hour between US 12/18 and US 151, which is only 2-4% higher than the 30th highest hour at other Dane County segments, provides a volume set that is consistent with higher observed volumes on these segments but minimizes the potential for level of service to drive towards financially cost prohibitive solutions. The 30th highest hour will be used throughout the remainder of the corridor. These design hours are consistent with the applicable FDM policy (11-5-3.5.1.1).

Thank you for the opportunity to comment. Please contact me or Ben Rouleau if you have any questions.

Design Considerations and Representative Day Methodology

Date:	August 8, 2022
Topic:	Design Considerations and Cluster Analysis for Determining Representative Days
From:	CDMCT

1. Overview

The Wisconsin Department of Transportation (WisDOT) Facilities Development Manual (FDM) provides recommendations on which traffic data to use in establishing the operations of the subject facility. The FDM also recommends the desirable level of service (LOS) a facility should be designed to accommodate. These recommendations applications are detailed in this memorandum.

Representative days will be identified for the I-39/90/94 and US-51 corridors for the purposes of traffic volume development and VISSIM microsimulation validation. The representative day will be identified through a k-means cluster analysis using available continuous count site (CCS) traffic data, National Performance Management and Research Data Set (NPMRDS) speeds, precipitation data, and corridor crashes. Cluster analysis is the process of grouping a set of objects based on similar characteristics. The targeted condition will vary between the I-39/90/94 analysis targeting K30 or K100 conditions while the US 51 segments will be analyzed with peak hour volumes in the K200 to K250 range.

2. Desirable Levels of Service

WisDOT FDM 11-5-3.1 defines the desirable LOS thresholds as the desirable degree of design year congestion. The desirable LOS is determined by the type of roadway facility and whether the roadway is in an urban or rural area as shown in Table 1.

Table 1: Desirable Levels of Service

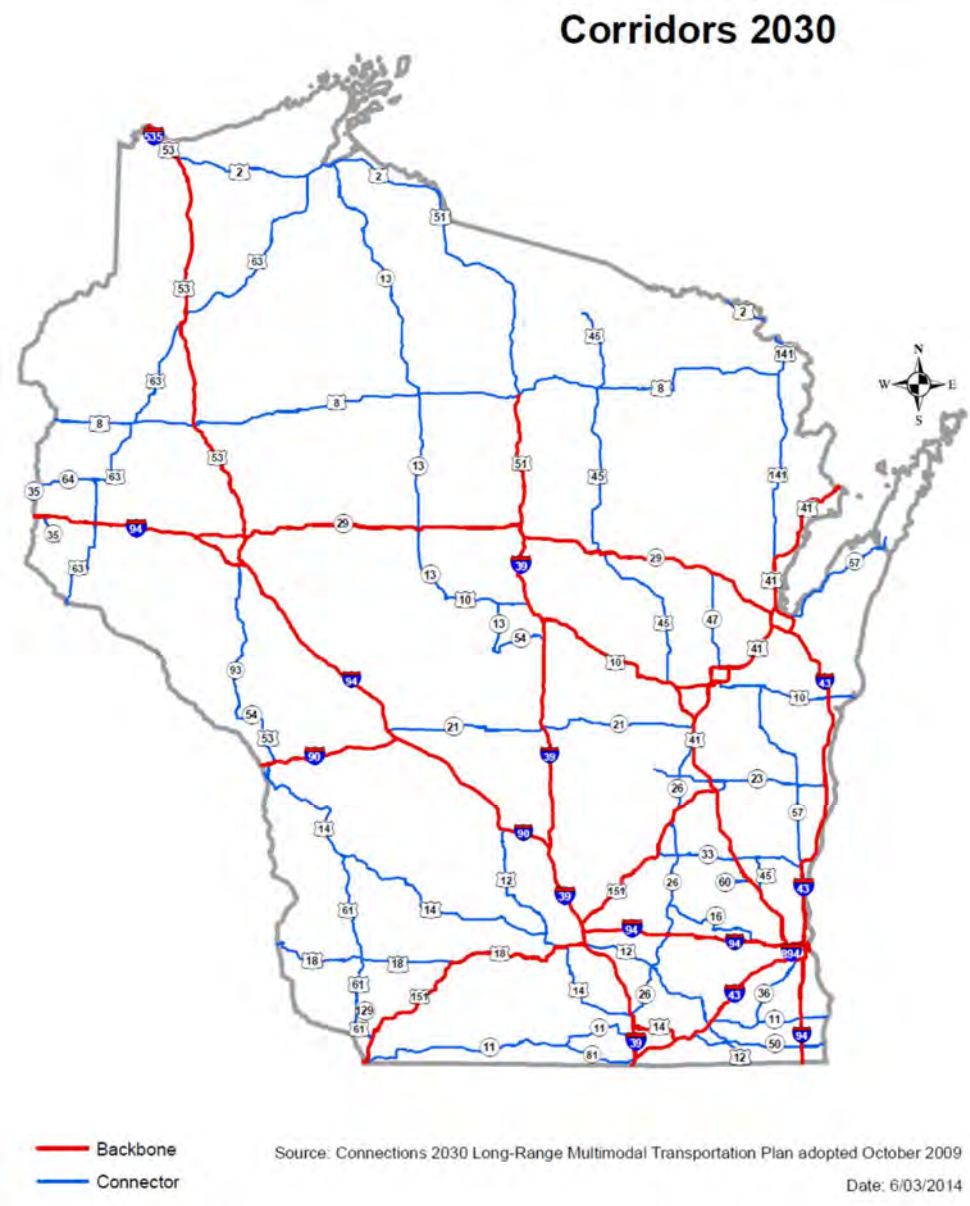
STH Sub-System	Rural and Small Urban Areas	Urbanized Areas with Population >50,000
C2030 Backbone and Connector Routes	LOS C (≤ 4.0)	LOS D (≤ 5.0)
National Highway System (NHS) Routes	LOS D (≤ 5.0)	LOS D (≤ 5.0)
Non-NHS Routes	LOS D (≤ 5.0)	Mid LOS E (≤ 5.5)

Source: WisDOT FDM 11-5-3 Table 3.1

2.1. I-39/90/94 Desirable Level of Service

Figure 1 displays the facilities defined by the Connections 2030 plan as Backbone and Connector facilities. The entire Wisconsin Interstate system including the segment between US 12/18 (Beltline) and north US 12 interchange in Wisconsin Dells is defined as a Backbone facility.

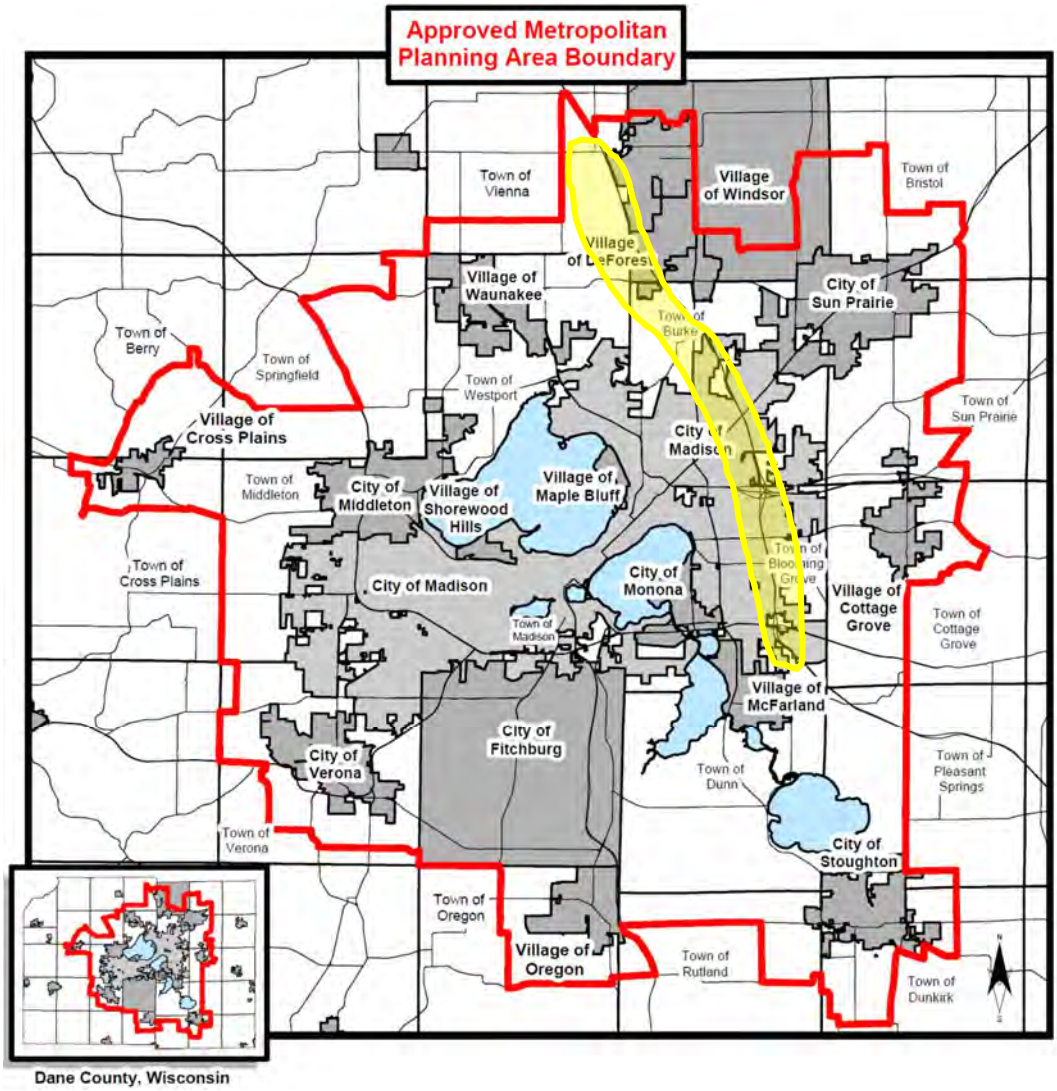
Figure 1: Corridors 2030 Facilities Map



The area type does change within the Interstate's project limits. The Madison metropolitan planning boundary mapping shown in Figure 2 shows existing city boundaries along with the planning boundary. The planning

boundary is used to define the spatial limits of the urban area to provide a consistent designation through the greater Madison area. This provides an urban designation for I 39/90/94 from the project's southern limit at the Beltline to the CTH I overpass near DeForest with a desirable LOS threshold of D. Interstate segments north of CTH I are defined as rural with a desirable LOS threshold of C.

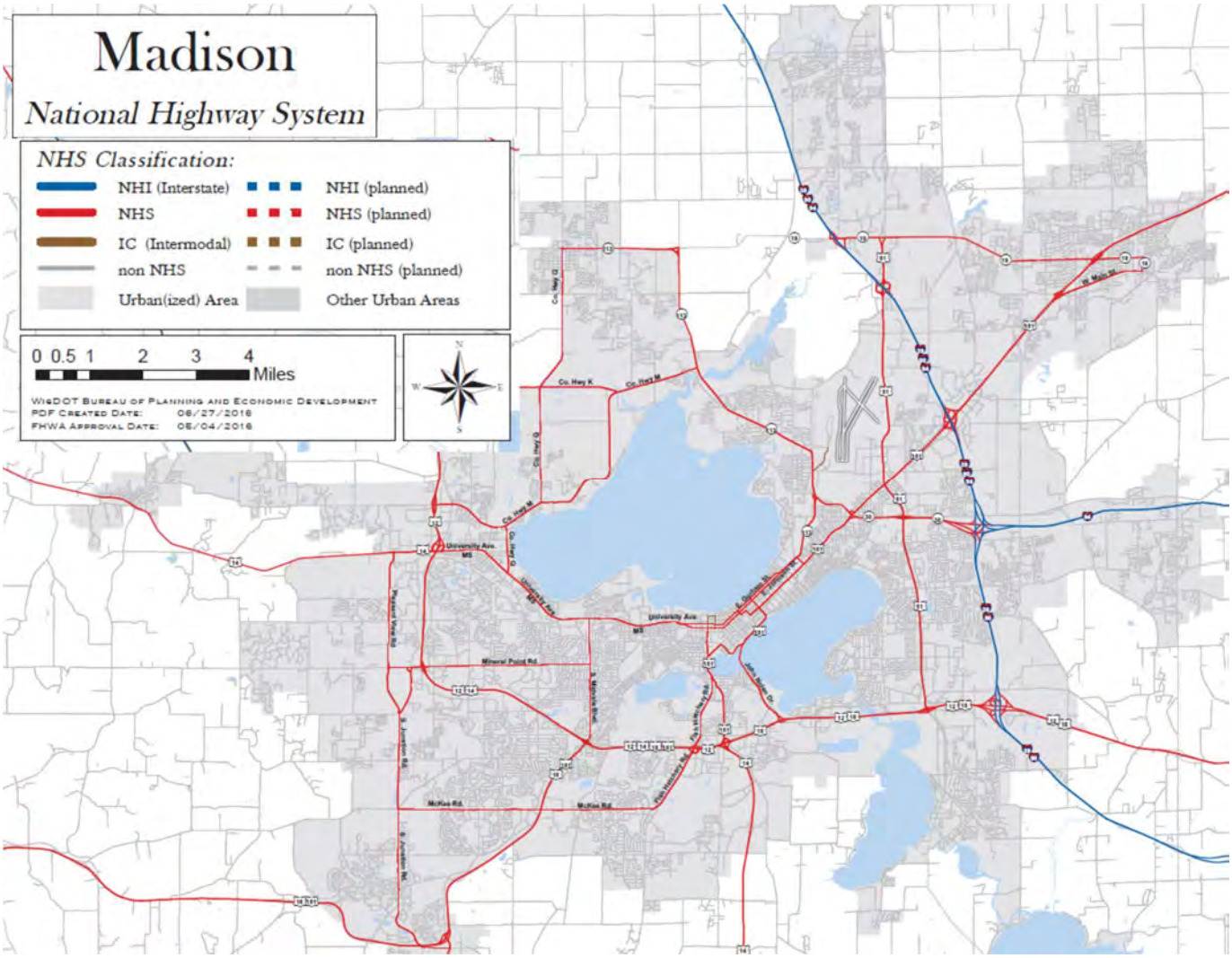
Figure 2: Approved Madison Metropolitan Planning Area Boundary



2.2. US 51 Desirable Level of Service

Figure 3 shows that US 51 between the US 12/18 (Beltline) and STH 19 is defined as part of the National Highway System (NHS). The limits of US 51 are also within the planning boundary and, therefore, considered urban. All segments of US 51 north of US 12/18 (Beltline) have a desirable LOS threshold of D. Segments of US 51 south of US 12/18 are not part of NHS and therefore have a desirable LOS of mid-E.

Figure 3: National Highway System in the Madison area



3. Traffic Count Analysis

Available year 2021 CCS data on and in proximity to the corridors were reviewed to determine the time periods when the highest traffic demands were predominantly occurring. Figure 4 below shows the locations along IH 39/90/94 and US 51 analyzed along with support locations.

Table 3 shows the number of high volume hours occur in each day of the week in year 2021 for Interstate and US 51 CCS locations. Note that Friday and Sunday contain most of the high volume hours along the Interstate while the high volume hours occur primarily on weekdays along US 51. Table 2 shows the observed K30 and K100 hourly volumes in year 2021 along with the K250 in urbanized areas.

Figure 4: Continuous Count Sites in the Study Limits

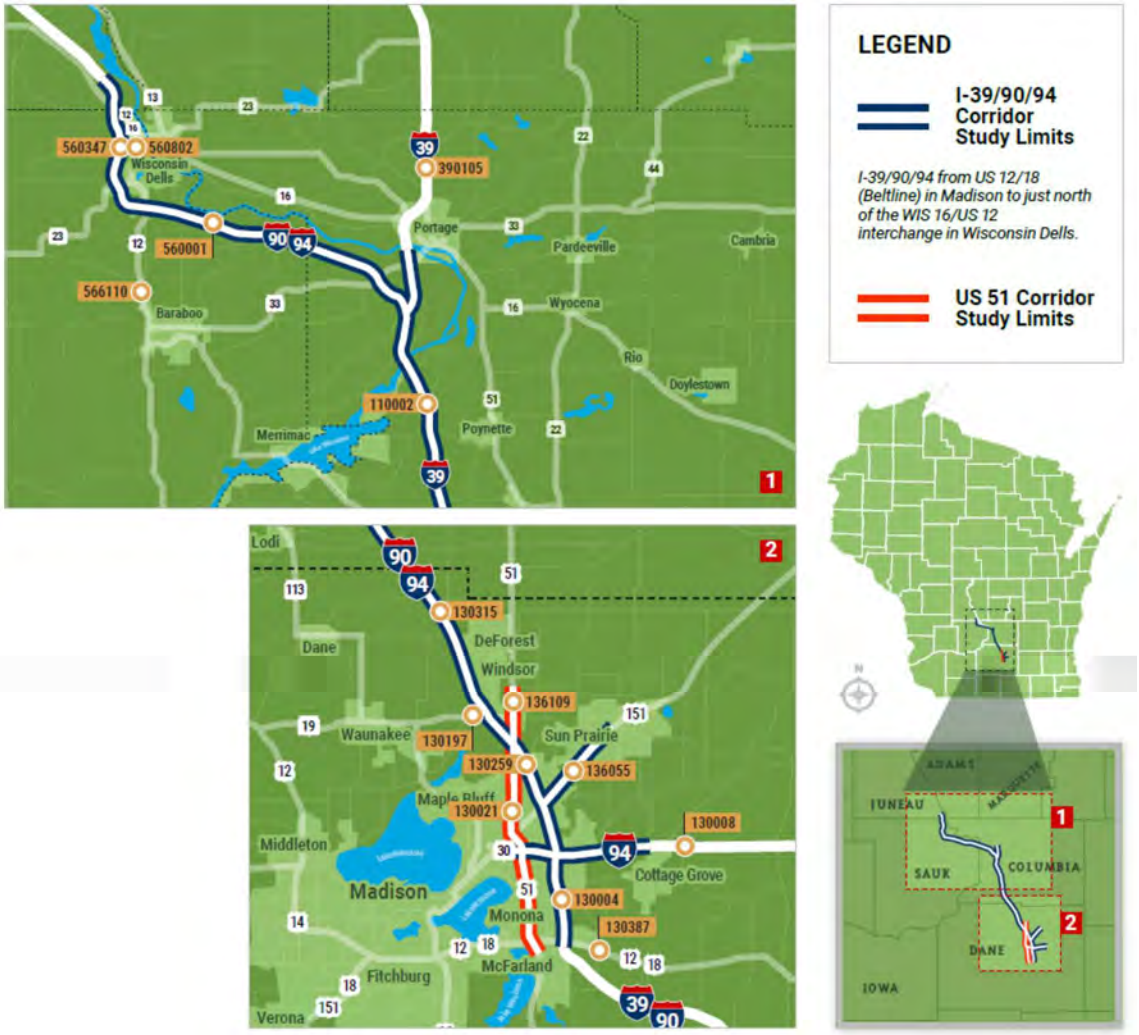


Table 2: Summary of Observed Peak Traffic Demands – Year 2021

Station	Direction	Segment	K30	K100	K250
560347	IH 90/94 WB (NB)	Between WIS 13 & WIS 23	2,802	2,514	
	IH 90/94 EB (SB)		3,004	2,686	
560001	IH 90/94 WB (NB)	Between WIS 12 & WIS 33	2,697	2,507	
	IH 90/94 EB (SB)		2,847	2,592	
110002	IH 39/90/94 NB (WB)	Between IH 39 Split & CTH CS	4,071	3,720	
	IH 39/90/94 SB (EB)		4,410	4,095	
130315	IH 39/90/94 NB (WB)	Between WIS 60 & CTH V	4,111	3,741	
	IH 39/90/94 SB (EB)		4,330	4,000	
130259	IH 39/90/94 NB (WB)	Between US 51 & US 151	4,385	4,100	3,677
	IH 39/90/94 SB (EB)		4,518	4,215	3,558
130004	IH 39/90 NB (WB)	Between IH 94/WIS 30 & US 12/18	4,588	4,327	4,019
	IH 39/90 SB (EB)		4,518	4,236	3,972
130006	IH 39/90 NB (WB)	South of US 12/18	2,736	2,605	2,465
	IH 39/90 SB (EB)		3,347	3,064	2,809
136109	US 51 NB	North of WIS 19	1,337	1,260	1,121
	US 51 SB		1,191	1,082	1,003
130021	US 51 NB	North of US 151	939	865	774
	US 51 SB		747	700	643

Table 3 shows the days in which the highest 30 hours, 100 hours and 250 hours of traffic throughout the year. Note the high number of hours that occur during the Friday and Sunday timeframe.

Table 3: Summary of Traffic Demands by Day of Week – Year 2021

Top 30 Hrs.	Roadway	Segment	Sun	Mon	Tue	Wed	Thu	Fri	Sat
560347	IH 90/94 EB	Between WIS 13 & WIS 23	6	7	7	2	2	3	3
	IH 90/94 WB		0	17	6	5	2	0	0
560001	IH 90/94 EB	Between WIS 12 & WIS 33	25	5	0	0	0	0	0
	IH 90/94 WB		11	0	0	0	0	15	4
110002	IH 90/94 NB	Between IH 39 Split & CTH CS	0	0	0	0	0	25	5
	IH 90/94 SB		22	8	0	0	0	0	0
130315	IH 90/94 NB	Between WIS 60 & CTH V	0	0	0	0	0	27	3
	IH 90/94 SB		26	4	0	0	0	0	0
130259	IH 90/94 NB	Between US 51 & US 151	0	0	0	0	0	29	1
	IH 90/94 SB		24	6	0	0	0	0	0
130004	IH 39/90 NB	Between IH 94/WIS 30 & US 12/18	0	0	0	0	5	25	0
	IH 39/90 SB		19	1	0	0	1	9	0
130006	IH 39/90 NB	South of US 12/18	11	0	0	0	0	10	9
	IH 39/90 SB		18	11	0	1	0	0	0
136109	US 51 NB	North of WIS 19	0	1	6	7	4	12	0
	US 51 SB		2	2	11	11	4	0	0
130021	US 51 NB	North of US 151	0	1	11	11	5	2	0
	US 51 SB		0	1	14	8	3	4	0
136055	US 151 NB	Between American Pkwy & Reiner Rd	0	2	11	4	8	5	0
	US 151 SB		0	5	11	11	2	1	0

Contains 1/3 to 2/3 of 2021's Highest Hourly Volumes

Contains More than 2/3 of 2021's Highest Hourly Volumes

Top 100 Hrs.	Roadway	Segment	Sun	Mon	Tue	Wed	Thu	Fri	Sat
560347	IH 90/94 EB	Between WIS 13 & WIS 23	17	18	12	3	15	13	22
	IH 90/94 WB		10	28	18	19	17	0	8
560001	IH 90/94 EB	Between WIS 12 & WIS 33	89	9	0	2	0	0	0
	IH 90/94 WB		33	2	0	0	0	47	18
110002	IH 90/94 NB	Between IH 39 Split & CTH CS	1	0	0	0	1	78	20
	IH 90/94 SB		80	20	0	0	0	0	0
130315	IH 90/94 NB	Between WIS 60 & CTH V	1	0	0	0	2	78	19
	IH 90/94 SB		87	13	0	0	0	0	0
130259	IH 90/94 NB	Between US 51 & US 151	0	0	0	0	1	85	14
	IH 90/94 SB		80	20	0	0	0	0	0
130004	IH 39/90 NB	Between IH 94/WIS 30 & US 12/18	0	0	0	0	18	71	11
	IH 39/90 SB		50	8	1	4	8	29	0
130006	IH 39/90 NB	South of US 12/18	26	0	1	2	0	44	27
	IH 39/90 SB		74	15	3	3	0	5	0
136109	US 51 NB	North of WIS 19	0	10	28	21	22	19	0
	US 51 SB		2	15	31	25	20	7	0
130021	US 51 NB	North of US 151	0	14	26	26	21	13	0
	US 51 SB		1	10	33	34	16	6	0
136055	US 151 NB	Between American Pkwy & Reiner Rd	0	7	23	24	26	20	0
	US 151 SB		0	17	25	22	17	17	2

Top 250 Hrs.	Roadway	Segment	Sun	Mon	Tue	Wed	Thu	Fri	Sat
560347	IH 90/94 EB	Between WIS 13 & WIS 23	38	39	32	14	43	26	58
	IH 90/94 WB		36	51	34	40	41	21	27
560001	IH 90/94 EB	Between WIS 12 & WIS 33	201	19	0	4	0	21	5
	IH 90/94 WB		65	3	0	4	1	134	43
110002	IH 90/94 NB	Between IH 39 Split & CTH CS	33	2	0	2	5	161	47
	IH 90/94 SB		203	30	1	2	0	8	6
130315	IH 90/94 NB	Between WIS 60 & CTH V	28	1	0	1	6	167	47
	IH 90/94 SB		212	21	1	2	0	6	8
130259	IH 90/94 NB	Between US 51 & US 151	25	0	0	3	8	173	41
	IH 90/94 SB		189	29	2	3	1	19	7
130004	IH 39/90 NB	Between IH 94/WIS 30 & US 12/18	20	5	5	12	41	124	43
	IH 39/90 SB		86	25	15	14	24	65	21
130006	IH 39/90 NB	South of US 12/18	50	3	2	4	6	136	49
	IH 39/90 SB		135	36	9	15	15	37	3
136109	US 51 NB	North of WIS 19	0	35	51	50	56	58	0
	US 51 SB		2	44	74	60	50	20	0
130021	US 51 NB	North of US 151	0	36	57	63	55	39	0
	US 51 SB		1	35	69	69	59	17	0
136055	US 151 NB	Between American Pkwy & Reiner Rd	0	31	52	51	55	60	1
	US 151 SB		3	34	38	37	41	83	14

Table 3 shows that the count locations along I-39/90/94 typically have the majority of the 30 highest hours and 100 highest hours occur during Friday in the I-39/90/94 NB (WB) direction, and during Sunday in the I-39/90/94 SB (EB) direction. The exception is the northernmost location (ID 560347) near Wisconsin Dells, which does not have a strong discernable pattern of highest hours of travel.

The south design segment is using previously developed traffic data from 2019 for operations and forecasting purposes. Table 4 compares the K30 and K100 hourly volumes between year 2019 and year 2021 for the south design segment in Dane County to assess if the volume profiles have changed significantly. It also shows that K30 and K100 volumes along I-39/90/94 are fairly similar during year 2019 and year 2021 with 2021 volumes slightly higher than 2019 volumes on average. Typically, the year 2019 and year 2021 K30 and K100 volumes are within 7% of each other. The one exception is station 130006 [I-39/90 EB (SB)], which is between 11 to 15% higher in year 2021 than year 2019, during which time construction activities on I-39/90 between Madison and the Illinois state line impacted traffic patterns south of Madison.

Table 4: Comparison of Year 2019 and Year 2021 K30 and K100 Hourly Volumes

Station	Direction	Segment	2019 K30	2021 K30	K30 %Diff	2019 K100	2021 K100	K100 %Diff
110002	I-39/90/94 NB (WB)	Between I-39 Split & CTH CS	4,007	4,071	1.6%	3,603	3,720	3.2%
	I-39/90/94 SB (EB)		4,282	4,410	3.0%	3,842	4,095	6.6%
130315	I-39/90/94 NB (WB)	Between WIS 60 & CTH V	4,138	4,111	-0.7%	3,750	3,741	-0.2%
	I-39/90/94 SB (EB)		4,348	4,330	0.4%	3,865	4,000	3.5%
130259	I-39/90/94 NB (WB)	Between US 51 & US 151	4,458	4,385	-1.6%	4,005	4,100	2.4%
	I-39/90/94 SB (EB)		4,478	4,518	0.9%	4,021	4,215	4.8%
130004	I-39/90 NB (WB)	Between I-94/ WIS 30 & US 12/18	4,884	4,588	-6.1%	4,627	4,327	-6.5%
	I-39/90 SB(EB)		4,762	4,518	-5.1%	4,552	4,236	-6.9%
130006	I-39/90 NB (WB)	South of US 12/18	2,774	2,736	-1.4%	2,563	2,605	1.6%
	I-39/90 SB (EB)		2,896	3,347	15.6%	2,742	3,064	11.7%

Table 4 shows that K30 and K100 volumes along IH 39/90/94 are fairly similar during year 2019 and year 2021. Typically, the year 2019 and year 2021 K30 and K100 volumes are within 7% of each other. The one exception is IH 39/90 EB (SB), which is between 11 to 15% higher in year 2021 than year 2019. The US 51 count location K30 and K100 volumes are somewhat lower in year 2021 compared to year 2019. Year 2021 K30 and K100 hourly volumes are about 18 to 30% lower than the year 2019 K30 and K100 volumes.

4. Design Hour Volume Determination

WisDOT FDM 11-5-3.5.1 defines the determination of design hour volumes (DHV) for the LOS analysis. The process varies depending on the type of facility. The existing year DHV will be used as the base line for forecasting future year no build and alternative scenarios DHV's. Existing, future no build, and future build alternative DHV's will be analyzed with a combination of VISSIM and VISTRO/Synchro to estimate traffic operations such as delay,

density and travel times during the design hours. Table 5 summarizes the designated DHV's identified per the FDM 11-5-3 guidance by facility type and location.

Table 5: Summary of Design Hour Volume Designation

Corridor	Facility Type	Designated Design Hour Volume	Volume Set
Interstate North	Interstate Mainline and Ramps-Northbound	K30	Summer Fridays
	Interstate Mainline and Ramps-Southbound		Summer Sundays
	Ramp Terminals and Cross Streets	K250	Weekend Peaks
Interstate South	Interstate (N of 151) Mainline and Ramps-Northbound	K30	Summer Fridays
	Interstate (N of 151) Mainline and Ramps-Southbound		Summer Sundays
	Urban (12/18 to 151) Interstate Mainline and Ramps	K100	AM/PM Peaks
	US 151 Freeway Mainline and Ramps	K30	AM/PM Peaks
	Ramp Terminals and Cross Streets	K250	AM/PM Peaks
US 51 North	Arterials, Intersections and Ramp Terminals	K250	AM/PM Peaks
US 51 South	Arterials, Intersections and Ramp Terminals	K250	AM/PM Peaks

4.1. I-39/90/94 Design Hour Volume Determination

FDM 11-5-3.1.1 provides guidance on the DHV for freeways, multilane highways and two-lane highways. This applies to both the north and south I-39/90/94 segments. The general guidance is to use the 30th highest hourly volume of year as the DHV. The FDM notes that the 100th highest volume may be used in urbanized areas or the 200th or 250th highest hour may be justified in areas where there is little difference between the 30th and 250th hour and the 250th hour volumes are consistent with AM or PM peak hours. Therefore, a project-specific evaluation of the appropriate design hour is conducted.

2018 is the most recent year that coverage counts were available that have been seasonally adjusted, Table 6 and Figure 1 show that the Interstate traffic volumes in Dane County are significantly higher in the two segments between US 151 and US 12/18 compared to the rest of the Interstate corridor. Selecting the 30th highest hour for all segments of the Interstate in Dane County would lead to the two high volume segments driving capacity needs throughout the corridor.

Table 6: 2018 Average Annual Daily Traffic Volumes on Madison Area Interstate System

Station	Facility	Segment	2018 AADT
130315	I-39/90/94	Between WIS 60 and CTH V	59,300
130989	I-39/90/94	Between CTH V and WIS 19	66,600
131566	I-39/90/94	Between WIS 19 and US 51	74,400
130259	I-39/90/94	Between US 51 & US 151	70,700
130611	I-39/90/94	Between US 151 & I-94/WIS 30	108,000
130004	I-39/90	Between I-94/WIS 30 & US 12/18	98,900
130006	I-39/90	South of US 12/18	54,500

Table 7 shows the 250th hour volumes for the segments of the Interstate in the urbanized Madison area are 12 to 21 percent lower than the 30th highest hour. By contrast, the 100th highest hours are all approximately six to seven percent lower than the 30th highest hour. Table 4 shows the 100th highest volumes in the high daily volume segment (130004) are 2-4% higher than the 30th highest volume in the adjacent segment (130259). Selecting the 100th highest volume as the DHV for the two high volume segments with the 30th highest volume for the remainder of the Dane County provides a volume set that is consistent with higher observed volumes between US 151 and US 12/18 but minimizes the potential for level of service to drive towards financially cost prohibitive solutions.

Table 7: Hourly Volume Comparison for Madison Area Interstate Segments

Station	Direction	Segment	K30	K100	K250
130259	IH 39/90/94 NB (WB)	Between US 51 & US 151	4,385	4,100	3,677
	IH 39/90/94 SB (EB)		4,518	4,215	3,558
130004	IH 39/90 NB (WB)	Between IH 94/WIS 30 & US 12/18	4,588	4,327	4,019
	IH 39/90 SB (EB)		4,518	4,236	3,972

Note that FDM 11-5.3.1.1 does not pertain to the ramp terminal intersections or cross streets at interchanges. These locations are covered by FDM 11-5.3.1.2 which provides guidance on the determination of DHV's for urban streets, intersections and ramp terminals. At these locations, DHV's should be based on the AM or PM peak hour volumes for individual turning and through movements. This will result in a variation in traffic volumes between ramps (driven by the representative day to achieve K30/100 volumes on the Interstate mainline) and the turning movements at the ramp terminal (driving by the peak hour volumes).

4.2. US 51 Design Hour Volume Determination

The segment of US 51 crossing Milwaukee Street and Cottage Grove Road operates as a freeway with interchanges at the two cross streets and may be covered by FDM 11-5-3.1.1. The remainder of US 51 operates as an expressway with side-street stop control (Hoepker Road, Hanson Road and Reider Road intersections) or as an urban arterial and covered by FDM 11-5-3.1.2. Current CCS data does not exist for the freeway segments around Milwaukee Street and Cottage Grove Road which prohibits a thorough review of observed hourly volumes. Additionally, previous traffic operations indicate the freeway segments were not controlling the overall traffic operations of the corridor.

DHV's for US 51 are therefore based on the AM or PM peak hour volumes for individual turning and through movements.

5. Temporal Analysis Periods

Based on the CCS data analysis and the DHV determination, the Representative Day Cluster analysis was completed for the following corridors and time periods:

- I-39/90/94 North Segment (Clusters for Northbound and Southbound traffic)
  - 2021, Friday, 12-6 PM
  - 2021, Sunday 10 AM – 6PM
- I-39/90/94 South Segment (Clusters for Northbound and Southbound traffic)
  - 2019, Friday, 12-6 PM
  - 2019, Sunday, 10 AM – 6PM
  - 9/2018 - 2019, Weekday, 6- 9 AM
  - 9/2018 - 2019, Weekday, 3 – 7 PM
- US-51 North Segment (Clusters for Northbound and Southbound traffic)
  - 2021, Weekday, 6 - 9 AM
  - 2021, Weekday, 3 - 7 PM
- US-51 South Segments (Clusters for Northbound and Southbound traffic)
  - 2022, Weekday, 6 - 9 AM
  - 2022, Weekday, 3 - 7 PM

The selected representative day cluster will have the following characteristics:

- No operational impact from crashes
- No influence of poor weather conditions
- Highest traffic demand tier
- No travel speed anomalies

From the representative day clusters, a single day was chosen that best matches the targeted K volume for each project segment.

6. K-Means Clustering Methodology

As part of WisDOT's traffic microsimulation guidelines, a single day is selected as the basis for calibrating a model. This proposed cluster methodology seeks to find a group of days that fit the design hour and target operating conditions. A single day is then selected from this group to serve as the target for model calibration. The target operations conditions are days void of severe weather events, unusual traffic volume, and incidents that impact travel speeds beyond normal operating conditions.

Data clustering is a process of grouping a set of objects based on similar characteristics. Cluster methodologies are not specified in the Trip Generation Manual nor in the Traffic Engineering, Operations & Safety Manual, but WisDOT approved the clustering approach for this project. One common algorithm is the k-means, which is proposed for this project. The k-means algorithm requires the analyst to identify the number of *k* clusters for the data set. The algorithm uses an iterative refinement approach to minimize the squared Euclidean distance within

each cluster. The Euclidean distance is measured between a data point and its cluster's centroid using normalized input data sets, including precipitation, travel speeds, traffic volume, and crashes. For this project, the k-means function in R is applied for a *k* input from 2 to 20. The optimal *k* for each analysis set is determined by graphing the within-cluster sum of squares (WCSS) for each *k* input and identifying the elbow of the trend line (the point at which the rate of decrease for the WCSS levels off). The WCSS will continue to decrease with an increased *k input* beyond the elbow, however, the new clusters that are developed do not provide meaningful division of data. Using the optimal *k,* the representative day cluster is determined from a manual review of the input data to find the largest set of days with the highest volumes and void of influence from crashes and weather events.

6.1. Input Data

Four input data sets were considered: precipitation, travel speeds, traffic volume, and crashes. The datasets were developed for every applicable day for the identified scenarios. Each input data set is normalized on a scale of 0 to 1.

6.1.1. Precipitation

Precipitation data was obtained from the Iowa Environmental Mesonet website. The total precipitation data for station DLL, located near Wisconsin Dells and Baraboo was considered for the cluster analysis. The precipitation data is normalized between 0 (no precipitation) and 1 (max precipitation), with values in between calculated using linear interpolation.

6.1.2. Travel Speeds

A corridor average travel speed is calculated for each directional segment using INRIX data available through NPMRDS. The travel speed data in normalized between 0 (lowest travel speed) to 1 (maximum travel speed), with values in between calculated using linear interpolation.

6.1.3. Traffic Volume

The project team reviewed all available traffic counts in the corridor and included all stations that are reliably providing data through the analysis period. The traffic input value at each station is the sum of traffic for the specified time-period. Each CCS location is normalized between 0 (lowest volume) to 1 (maximum volume), with values in between calculated using linear interpolation.

6.1.4. Crashes

The total crashes for the direction of travel are considered for each cluster analysis. The north segment freeway example uses the total mainline crashes as its target input. The crash data is normalized between 0 (no crashes) to 1 (most crashes), with values in between calculated using linear interpolation.

6.2. Cluster Selection Process

The representative day cluster is identified using the optimal *k* through an inspection of the clustering results. The goal of the selection process is to identify the largest group of days that achieve four criteria:

1) No operational impact from crashes
2) No influence of poor weather conditions
3) Highest traffic demand tier
4) No travel speed anomalies

7. Representative Day Cluster Results

The cluster analysis was completed for the I-39/90 north segments, I-39/90 south segment, and US-51 North segments. The US-51 south segment will be completed later using 2022 data.

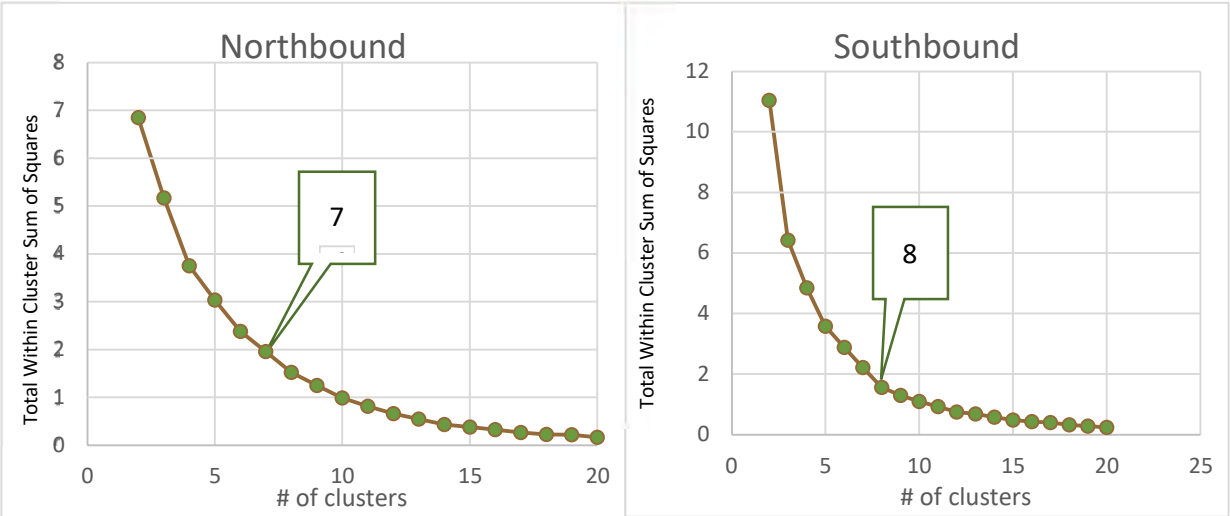
7.1. I-39/90 North Segment Results

Representative day clusters are developed for 2021 Friday and 2021 Sunday. The analysis results in a grouping of days that are representative of peak summer Friday and Sunday travel conditions that are void of major incident or weather events. From the representative day cluster, a single day is chosen that best represents a K30 travel condition. See **Error! Reference source not found.**for summary of highest hour volumes at each ATR station.

7.1.1. 2021 Friday (2-8 PM)

Data clusters were evaluated for NB and SB I-39/90. The within cluster sum of squares, used for choosing the optimal *k*, is shown in Figure 5. The selected *k* is identified in the figure.

Figure 5: Within Cluster Sum of Squares – 2021 Friday



The representative day cluster for northbound includes twelve days and southbound has eight days. There are seven overlapping representative days, these days are summarized in Table 8. A single representative day out of the cluster is chosen that best represents a K30 travel conditions for NB I-39/90. The K30 for the northbound ATR

counts is 4,007 (ATR 110002) and 2,697 (ATR 560001). The chosen day is 8/6/2021, which experiences free flow travel conditions for both directions, with no crashes, no precipitation, and a peak hour volume 91 vehicles greater than K30 at ATR 110002 and 45 vehicles greater than the K30 at ATR 560001.

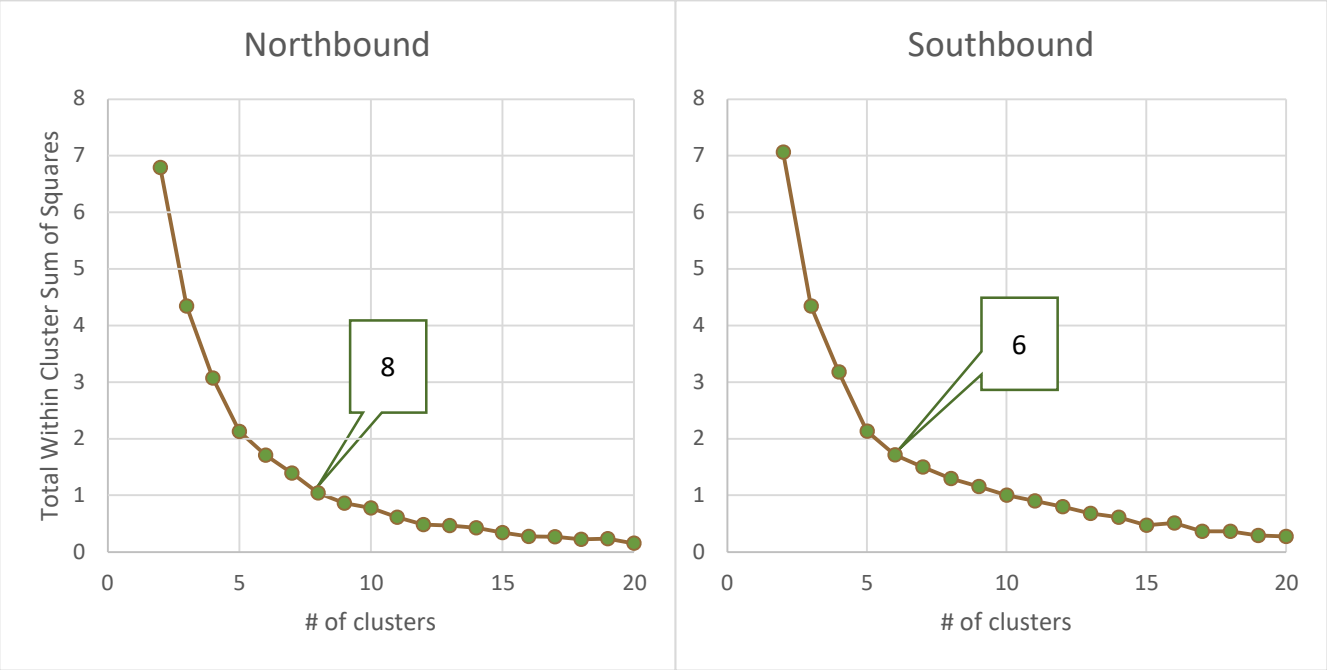
Table 8: 2021 Friday – Representative Days

Date	Precip.	Average Speed		ATR 110002 (peak hour volume)		ATR 560001 (peak hour volume)		Total Crashes	
		NB	SB	NB	SB	NB	SB	NB	SB
6/18/2021	0	67	71	3883	3027	2560	2163	0	0
7/9/2021	0	65	71	4030	3333	2548	2253	1	0
7/23/2021	0	69	71	4333	3343	2782	2322	0	0
7/30/2021	0	70	71	4337	3332	2818	2300	0	0
8/6/2021	0	71	71	4098	3380	2742	2454	0	0
8/13/2021	0	70	72	4147	3127	2651	2259	0	0
8/20/2021	0	71	70	3885	3086	2551	2292	0	0

7.1.2. 2021 Sunday (10 AM – 6 PM)

Data clusters were evaluated for NB and SB I-39/90 using 2021 Sunday data. The internal cluster sum of squares, used for identifying the optimal cluster, is shown in Figure 6. Northbound uses eight clusters and southbound uses six clusters.

Figure 6: Within Cluster Sum of Squares – 2021 Sunday



The representative day cluster for northbound includes five days and southbound has eight days. There are three overlapping representative days, these days are summarized in Table 9. A single representative day out of the cluster is chosen that best represents southbound K30 travel conditions. The southbound K30 for ATR 110002 is 4,410 and ATR 560001 is 2,847. The chosen representative day is 6/27/2021, which experiences reduced speeds for SB, free flow travel conditions for NB, there are two total crashes in the corridor (crashes on summer Sunday's is common in this corridor), no precipitation, and a peak hour volume 74 vehicles greater than K30 at ATR 110002 and 65 vehicles greater than the K30 at ATR 560001.

Table 9: 2021 Sunday – Representative Days

Date	Precip.	Average Speed		ATR 110002 (peak hour volume)		ATR 560001 (peak hour volume)		Total Crashes	
		NB	SB	NB	SB	NB	SB	NB	SB
6/27/2021	0	71	57	3498	4484	2749	2912	0	2
7/11/2021	0	72	56	3375	4489	2620	3012	0	2
7/25/2021	0	71	62	3614	4625	2734	3017	1	2

7.2. I-39/90 South Segment Results

The I-39/90 south segment corridor will use 2019 as the base year condition for the VISSIM microsimulation modeling. These models were already calibrated using representative days selected before this cluster analysis. Therefore, the cluster analysis for the I-39/90 south segment is used only to validate the representative days' selection. The Friday PM and Sunday PM volumes along the I-39/90/94 segment align with the K30 volumes for 2019 and 2021.

The selected representative days from the previous study are shown in Table 10. The cluster analysis detailed in this section indicates that the selected days for Weekday AM, Friday peak, and Sunday Peak are within the representative day clusters.

The Weekday PM (11/15/2018) is not included in the desirable representative day cluster due to lower traffic volumes on the Interstate. Previous analysis to establish the representative day for the I-39/90/94 south segment included US 151 volumes. The selected day (11/15/2018) included PM peak hours equivalent to K30 volumes for the US 151 corridor. Friday and Sunday volumes on the Interstate are higher than weekday AM and PM volumes, so selecting the highest PM peak hour volume was unnecessary. Selecting a K30 equivalent volume on US 151 provides an appropriate volume for analyzing US 151 and the interchange between US 151 and the Interstate.

Table 10: I-39/90 South Segment Representative Days

Time Period	Date	Analysis Hour	Contained in Representative Cluster
Weekday AM Peak Hour	9/17/2018	7:00 – 8:00 AM	Yes
Weekday PM Peak Hour	11/15/2018	4:00 – 5:00 PM	No*
Friday Peak Hour	7/19/2019	4:00 – 5:00 PM	Yes
Sunday Peak Hour	8/18/2019	1:00 – 2:00 PM	Yes

* - Weekday PM Peak Hour was selected to provide K30 equivalent volumes for US 151 corridor as Interstate volumes are highest on Friday and Sunday.

7.2.1. 2019 Friday (2-8 PM)

The representative day cluster for northbound includes 17 days and southbound has 24 days. There are 12 overlapping representative days, summarized in Table 11. The previously selected representative day (7/19/2019) is in the representative day cluster with a *k* set to four for NB and five for SB. For the NB cluster, six is the ideal *k*, but this value omits the selected representative day because on 7/19/2019 there was one crash recorded. However, the volume and speed metrics align with the other representative days, indicating this day is acceptable for representing design hour volumes. The K30 for ATR 130006 is 2,716, and ATR 130315 is 4,131. Traffic on 7/19/2019 experienced nearly free flow travel conditions for both directions, with no precipitation and one crash.

The peak hour volume is 17 vehicles fewer than the K30 at ATR 130006 and 97 vehicles greater than the K30 at ATR 130315.

Figure 7: Within Cluster Sum of Squares – 2019 Friday

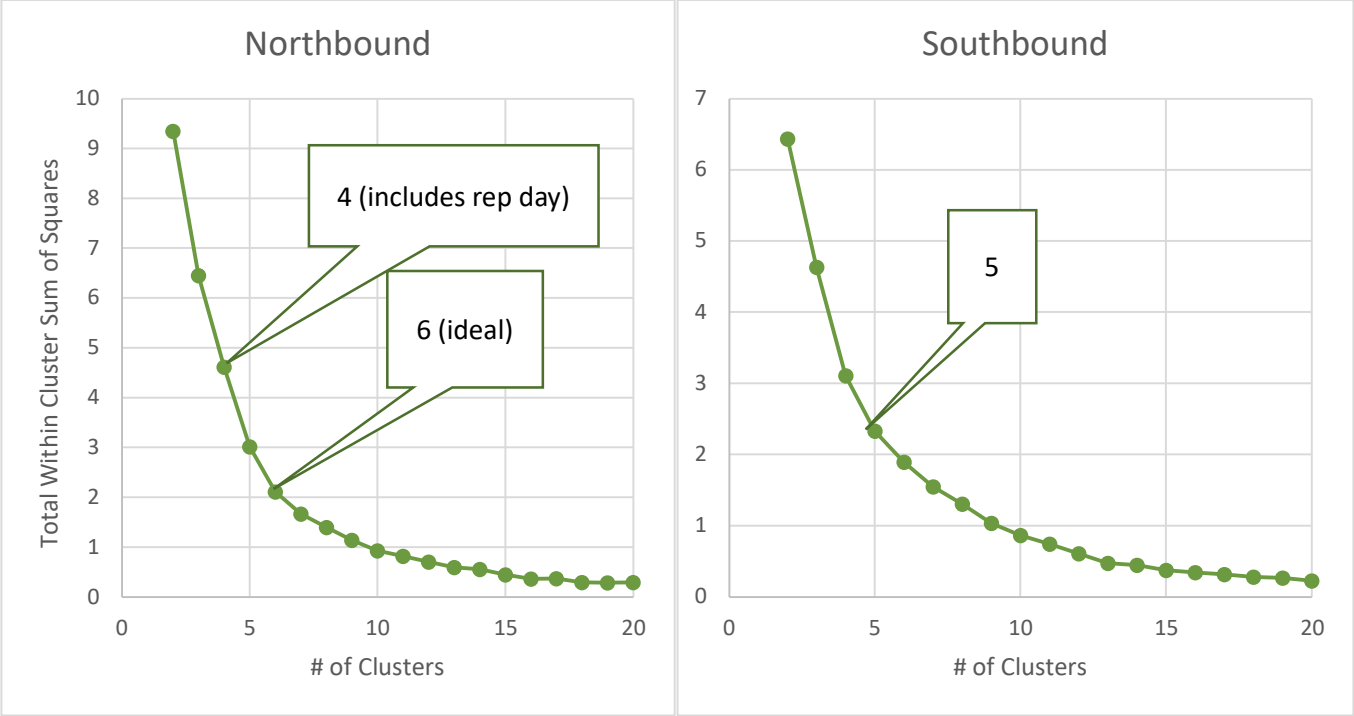


Table 11: 2019 Friday – Representative Days

Date	Precip.	Average Speed		ATR 130006 (peak hour volume)		ATR 130315 (peak hour volume)		Total Crashes	
		NB	SB	NB	SB	NB	SB	NB	SB
6/7/2019	0	70	66	2651	2270	3804	2416	0	0
6/21/2019	0	70	66	2790	2183	4290	2394	0	0
6/28/2019	0	70	67	2831	2235	4158	2439	0	0
7/12/2019	0	69	66	2829	2348	4177	2573	0	0
7/19/2019	0	69	66	2816	2204	4287	2503	1	0
7/26/2019	0	70	66	2888	2387	4441	2614	0	0
8/9/2019	0	68	67	2892	2331	4602	2673	0	0
8/16/2019	0	69	67	2699	2291	4228	2479	0	0
8/23/2019	0	67	67	2567	2361	3996	2433	0	0
8/30/2019	0	66	67	2916	2007	4811	2178	1	0
9/27/2019	0	69	66	2568	2146	4084	2197	0	0
10/4/2019	0	58	68	2494	1978	4115	2233	0	0

7.2.2. 2019 Sunday (10 AM – 6 PM)

The representative day cluster for northbound includes 12 days, and southbound has 13 days. There are nine overlapping representative days, summarized in Table 5. The previous study selected 8/18/2019 as the representative day, which reflects a design hour volume. The travel conditions for this day include no precipitation, no crashes, free-flow travel conditions, and the volume is only 172 vehicles lower than K30 at ATR 130006 and 30 fewer vehicles at ATR 130315. The within-cluster sum of squares for the tested *k* values is summarized in Figure 8.

Figure 8: Within Cluster Sum of Squares – 2019 Sunday

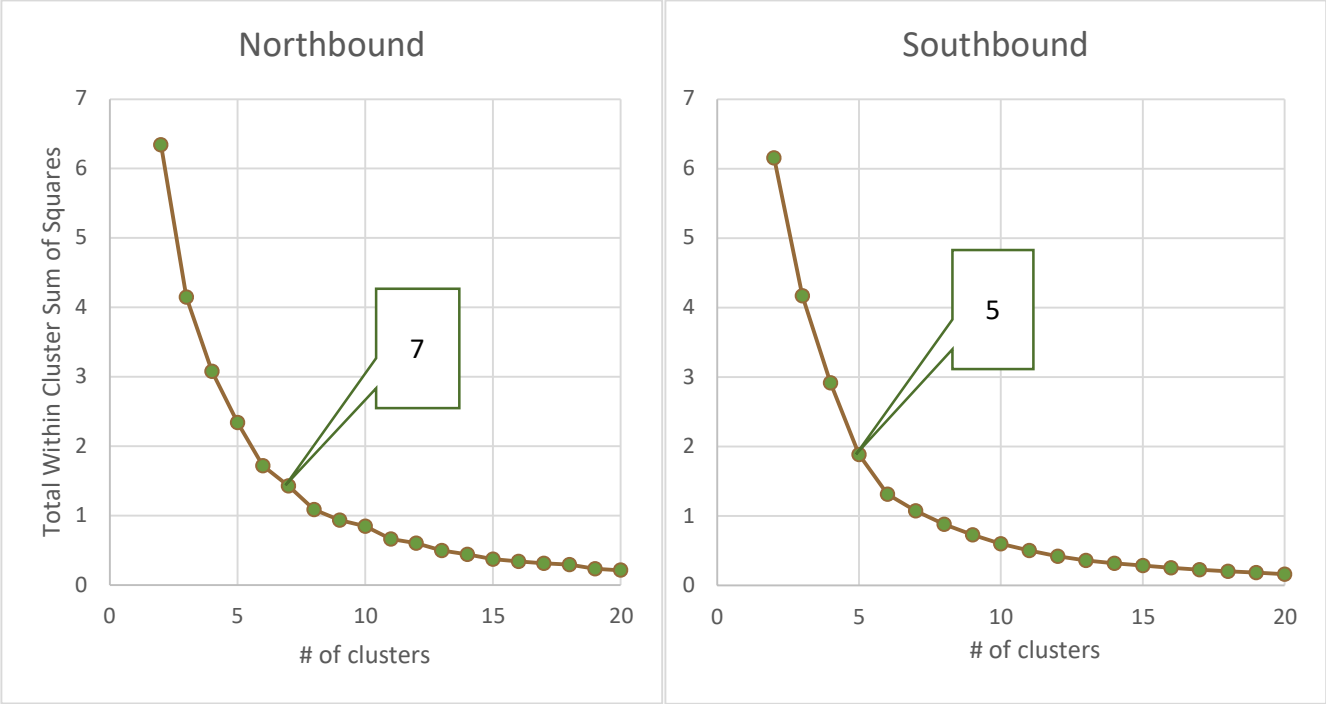


Table 12: 2019 Sunday – Representative Days

Date	Precip.	Average Speed		ATR 130006 (peak hour volume)		ATR 130315 (peak hour volume)		Total Crashes	
		NB	SB	NB	SB	NB	SB	NB	SB
6/9/2019	0	69	66	2305	2506	2926	3599	0	0
6/16/2019	0	69	68	2490	2501	3153	3846	0	0
7/14/2019	0	70	67	2616	2562	3363	3803	0	1
7/21/2019	0	69	67	2576	2558	3596	4028	0	1
7/28/2019	0	70	66	2678	2656	3636	4278	0	0
8/4/2019	0	70	67	2650	2583	3498	4085	0	0
8/11/2019	0	70	66	2784	2568	3454	4173	0	0
8/18/2019	0	69	66	2343	2596	3152	4107	0	0
8/25/2019	0	70	67	2371	2460	3124	3924	0	0

7.2.3. 2018/2019 AM Weekday (6-9 AM)

A cluster analysis was completed for September 2018 through 2019 for AM Weekday. The 2018 days were added to 2019 to include the representative days chosen from the previous analysis. The representative day cluster for northbound includes 104 days, and southbound has 141 days. There are 89 overlapping representative days (Table 14), these days are summarized by min, max, and average values in Table 13. The previously selected representative day of 9/17/2018 is contained within the cluster and has no precipitation, no crashes, and near-free-flow travel conditions. The traffic volume on I-39/90/94 is well below the K30, as the peak conditions occur on Friday and Sunday. However, the selected day represents a typical weekday AM travel condition. The K30 for ATR 130315 is 2,752, and ATR 130006 is 2,300.

Figure 9: Within Cluster Sum of Squares – 2019 Weekday AM Peak Period

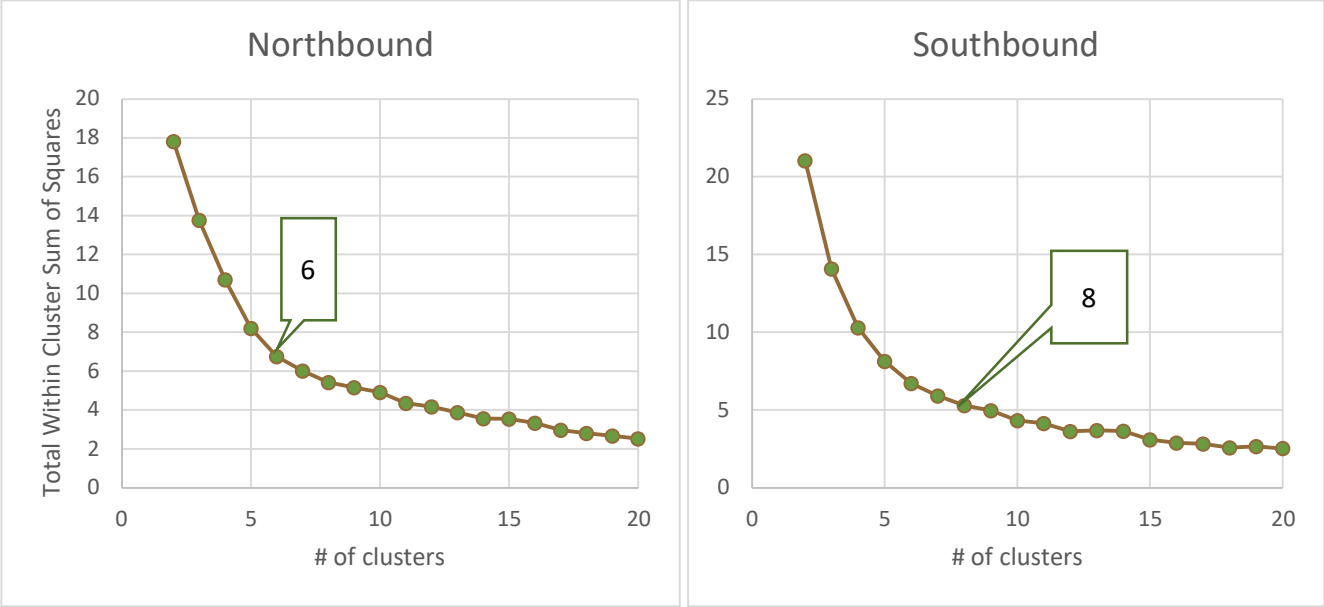


Table 13: 2019 Weekday AM Peak Period Summarized – Representative Days

Data (85 days)	Precip.	Average Speed		ATR 130006 (peak hour volume)		ATR 130315 (peak hour volume)		Total Crashes	
		NB	SB	NB	SB	NB	SB	NB	SB
Max	0.07	71	69	2359	1522	1938	1987	0	0
Min	0	66	65	2006	1206	1320	1658	0	0
Average	0	69	67	2222	1312	1543	1848	0	0
9/17/2018	0	68	67	2091	1259	1520	1987	0	0

Table 14: Representative Days – 2018/2019 AM Weekday – I-39/90 South Segment

Monday	Tuesday	Wednesday	Thursday
9/17/2018	4/16/2019	9/12/2018	9/20/2018
4/15/2019	5/28/2019	9/19/2018	10/4/2018
4/22/2019	6/4/2019	9/26/2018	10/25/2018
5/13/2019	6/11/2019	10/3/2018	11/15/2018
5/20/2019	6/18/2019	11/14/2018	4/4/2019
6/3/2019	6/25/2019	4/24/2019	4/18/2019
6/17/2019	7/2/2019	5/22/2019	4/25/2019
6/24/2019	7/9/2019	5/29/2019	5/9/2019
7/8/2019	7/16/2019	6/5/2019	5/23/2019
7/15/2019	7/23/2019	6/12/2019	5/30/2019
7/22/2019	7/30/2019	6/19/2019	6/6/2019
7/29/2019	8/6/2019	6/26/2019	6/27/2019
8/5/2019	8/13/2019	7/10/2019	7/11/2019
8/12/2019	8/27/2019	7/17/2019	7/25/2019
9/16/2019	9/10/2019	7/24/2019	8/1/2019
9/23/2019	9/17/2019	8/7/2019	8/8/2019
9/30/2019	10/8/2019	8/14/2019	8/15/2019
10/14/2019		8/21/2019	8/22/2019
11/4/2019		8/28/2019	8/29/2019
11/25/2019		9/4/2019	9/5/2019
12/2/2019		9/11/2019	9/12/2019
		9/25/2019	9/19/2019
		10/9/2019	9/26/2019
		10/16/2019	10/3/2019
		11/20/2019	10/10/2019
			11/7/2019

7.2.4. 2018/2019 PM Weekday (3-7 PM)

The PM weekday cluster analysis was completed for I-39/90 south segment. The representative day cluster for northbound includes 45 days, and southbound has 70 days. There are 30 overlapping representative days (Table 15), these days are summarized by min, max, and average values in Table 16. The previous study selected 11/15/18 as the representative day; this day is not included in the representative day cluster identified by this analysis. On 11/15/18, there was no precipitation, no crashes, and speed was near free flow conditions. While the traffic volume on I-39/90 is much lower than the K30, the PM volume on US 151 on 11/15/18 was equivalent to

the K30 for US 151, which makes this day suitable for representing PM weekday conditions. The K30 for ATR 130315 is 3,981, and ATR 130006 is 2,822.

Figure 10: Within Cluster Sum of Squares – 2019 Weekday PM Peak Period

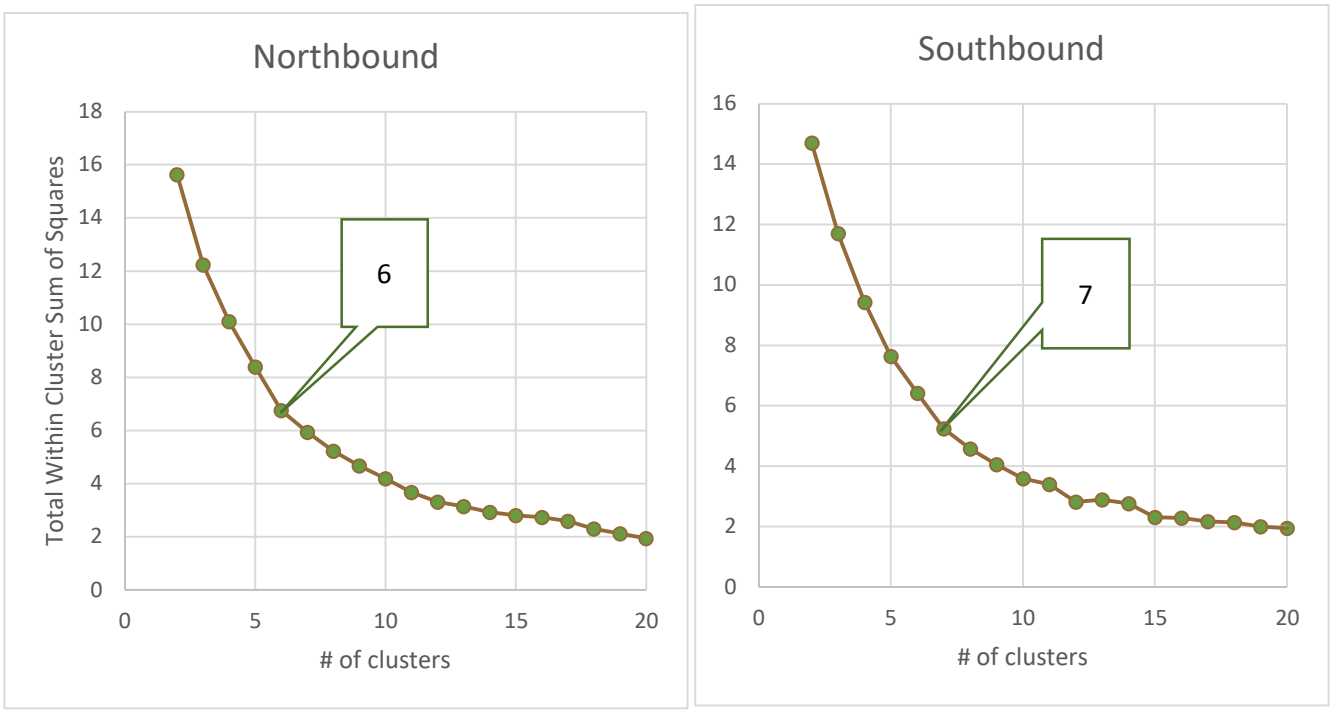


Table 15: Representative Days – 2018/2019 AM Weekday – I-39/90 South Segment

Monday	Tuesday	Wednesday	Thursday
7/1/2019	7/2/2019	12/26/2018	10/4/2018
7/29/2019	7/9/2019	6/26/2019	10/25/2018
8/5/2019		7/10/2019	3/28/2019
11/25/2019		7/17/2019	4/18/2019
		7/24/2019	5/2/2019
		8/7/2019	5/9/2019
		8/28/2019	5/16/2019
		11/27/2019	5/23/2019
			6/6/2019
			6/13/2019
			6/20/2019
			8/22/2019
			9/26/2019
			10/10/2019
			10/24/2019
			12/26/2019

Table 16: 2019 Weekday PM Peak Period Summarized – Representative Days

Data (30 days)	Precip.	Average Speed		ATR 130006 (peak hour volume)		ATR 130315 (peak hour volume)		Total Crashes	
		NB	SB	NB	SB	NB	SB	NB	SB
Max	0.04	71	67	2342	3081	3326	2812	0	0
Min	0	68	65	1498	2420	2534	1877	0	0
Average	0	69	67	1931	2631	2846	2272	0	0
11/15/18	0	68	66	1409	2022	2014	1925	0	0

7.3. US 51 Corridor

Cluster analysis was not conducted. The average peak hour data was used for the study. Traffic counts were collected in year 2022. Year 2022 counts along US 51 were generally lower than year 2018 because US 51 is more of a commuter route for workers and students at Madison Area Technical College (MATC). A separate memo was developed ("US 51 Forecast Methodology Memo"), which documented the decision to use year 2022 volumes as the base for future forecasts. Furthermore, the higher Year 2018 counts were used as the basis for forecasts at some US 51 corridor locations for a sensitivity analysis to confirm that the future design could also accommodate the year 2018-based future forecasts.

8. Traffic Count Balancing

Representative day hourly volume traffic count balancing will use CCS count data, non-CCS mainline and ramp coverage counts, and Streetlight data. The CCS count data from the representative day will be used to establish control points along the corridor within the traffic balancing process. Streetlight data collected from the representative day and from the various coverage count dates will be used by the CDMCT to factor available ramp and non-CCS mainline coverage counts to the representative day as described below.

8.1. Streetlight Factoring

Coverage counts collected along the corridor typically did not occur on the selected representative day. Therefore, a process was developed using Streetlight data to factor the coverage counts to mimic the representative day. The Streetlight data for this project is being provided at locations related to the external zones in the VISSIM network for origin-destination data purposes, instead of the actual non-CCS mainline and ramp segment locations. Therefore, an origin-destination matrix estimation (ODME) process was used to establish non-CCS mainline and ramp segment volumes. These non-CCS segment volumes from Streetlight are used to develop factors between the representative day and coverage count date. The factor is then applied to the actual coverage count to develop a representative day target volume.

8.2. Balancing

The CCS control volumes and the non-CCS developed target volumes are balanced along the corridor to develop the representative day traffic volumes. This process results in volumes throughout the corridor that equate to conditions on the representative day and not necessarily the K30 volume everywhere. Year 2022 intersection turning volume counts, where available, are compared to the balanced volumes to refine the traffic balancing process.

8.3. OD

Streetlight origin-destination data from the representative day will be used as a seed matrix for an origin-destination matrix estimation process to establish peak hour vehicle trip tables for each required model set. CDMCT will provide each design team with the peak hour volumes on mainline and ramp segments along with an OD trip table for ramp-to-ramp movements that matches the peak hour volume sets.

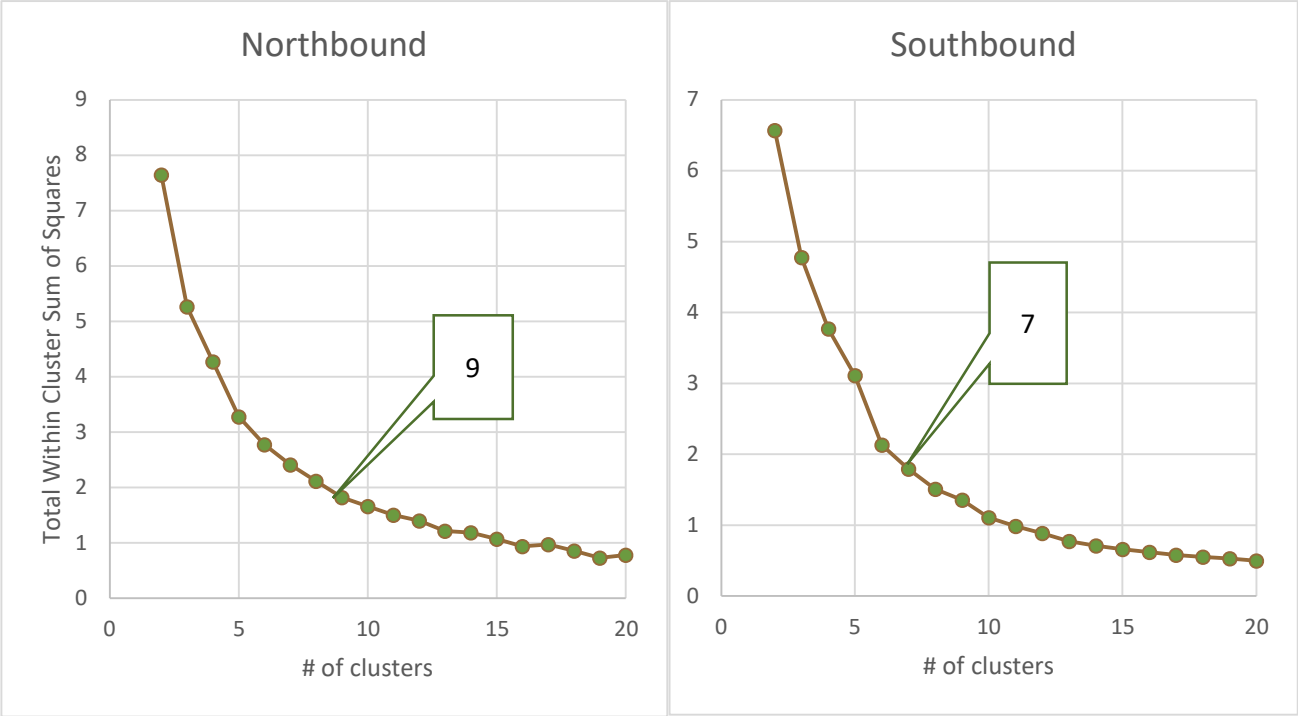
9. APPENDIX A

Cluster Analysis Results for US 51 North Segment

9.1.1. 2021 AM Weekday

The optimal *k* value was determined through an evaluation of the within cluster sum of squares for various *k* scenarios. Northbound analysis selected a *k* of 9 and southbound a *k* of 7.

Figure 11: Within Cluster Sum of Squares – 2021 Weekday AM Peak Period



The representative day cluster for northbound includes 46 days and southbound has 49 days. There are 27 overlapping representative days (Table 17**Error! Reference source not found.**), these days are summarized by min, max, and average values in **Error! Reference source not found.**. A single representative day out of the cluster is chosen that best represents SB K30 travel conditions. The K30 for ATR 130021 is 686 and ATR 136109 is 1188. The selected representative day is 9/8/21. This day has no precipitation and no crashes. The southbound volume matches closely with the K30 at ATR 130021 and ATR 136109.

Table 17: US-51 North Segment – AM Peak – Representative Days

Monday	Tuesday	Wednesday	Thursday
9/20/2021	9/7/2021	9/8/2021	9/9/2021
10/11/2021	9/14/2021	9/15/2021	9/23/2021
10/18/2021	9/28/2021	9/22/2021	9/30/2021
	10/5/2021	9/29/2021	10/14/2021
	10/12/2021	10/20/2021	
	10/19/2021	10/27/2021	
	10/26/2021	11/10/2021	
	11/9/2021	11/17/2021	
	11/16/2021	12/1/2021	
	11/30/2021		

Table 18: 2021 Weekday AM Peak Period Summarized – Representative Days

Data (27 days)	Precip.	Average Speed		ATR 130021 (peak volume)		ATR 136109 (peak volume)		Total Crashes	
		NB	SB	NB	SB	NB	SB	NB	SB
Max	0.03	38	39	608	755	678	1288	0	0
Min	0	34	35	470	636	613	1128	0	0
Average	0	35	37	523	690	639	1211	0	0
Rep. Day (9/8/21)	0	38	38	514	691	658	1182	0	0

Table 17**Error! Reference source not found.** and Table 18**Error! Reference source not found.** represent the K30 volumes in year 2021, however the traffic volumes in the first part of year 2021 were still suppressed by the COVID-19 pandemic. Table 13 shows that all the days in the K30 representative days cluster are from the fourth quarter of 2021. Therefore, a comparison was conducted of the year 2021 and year 2019 traffic volumes at the two ATR locations along US 51. Table 19 shows that the K250 volumes of year 2019 are actually pretty similar to the K30 volumes of year 2021. The US 51 weekday volumes should be represented by K250 volumes instead of K30, therefore the K30 year 2021 volumes can be used to represent K250 volumes in normal, non-pandemic years.

Table 19: 2021 Weekday AM Peak Period Comparison – Year 2019 K250 vs Year 2021 K30

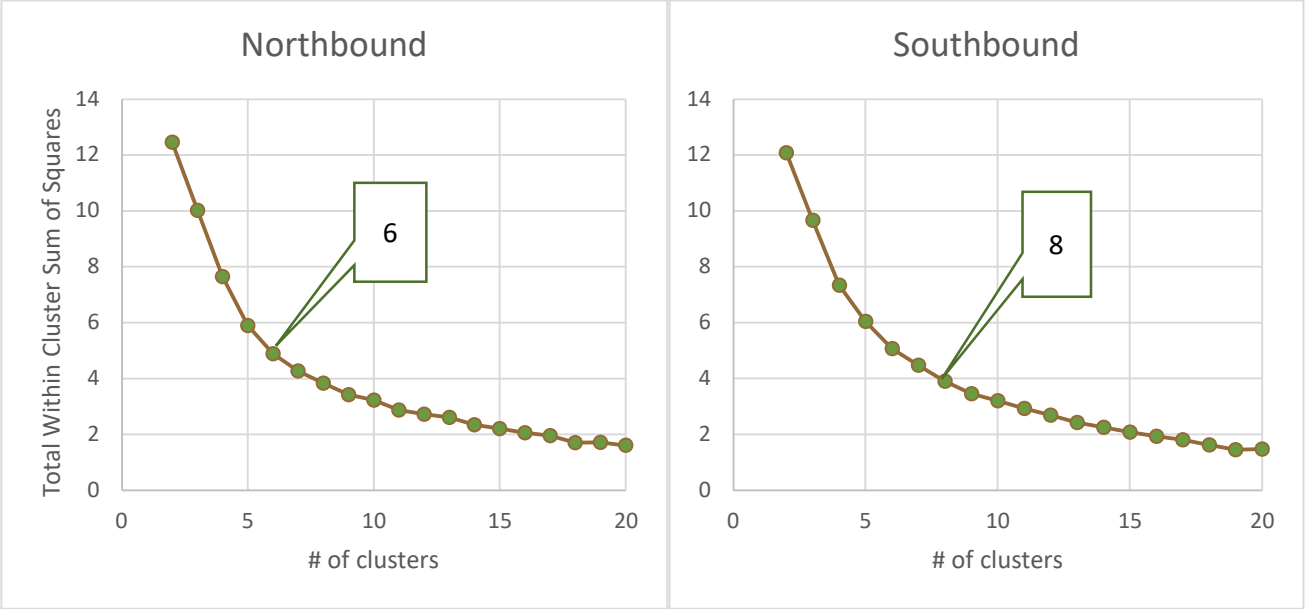
	ATR 130021 (peak volume)			
	NB	SB	NB	SB
Rep. Day (9/8/21)	514	691	658	1182
K250 Year 2019	480	767	358	1340
Coverage Count North of ATR 130021 (130212 on 7/12/22)	440	737 (approx. K316 of 2019)	--	--
From Coverage Count South of ATR 130021 (131909 on 7/12/22)	547	645 (approx. K632 of 2019)	--	--
From Coverage Count South of ATR 136109 (130201 & ramps on 5-7/22)	--	--	576	1135 (approx. K444 in 2019)

Table 19 also shows the traffic volumes from the coverage counts located to the adjacent north and south of the ATR counts. The volumes from the coverage count feeding into the ATR is compared to the ATR K250 year 2019 volume. In most cases they are comparable. The coverage counts can be factored to better align with the K250 volume.

9.1.2. 2021 PM Weekday

The optimal *k* value was determined through an evaluation of the within cluster sum of squares for various *k* scenarios. Northbound analysis selected a *k* of 6 and southbound a *k* of 8 as shown in Figure 12**Error! Reference source not found.**.

Figure 12: Within Cluster Sum of Squares – 2021 Weekday PM Peak Period



The representative day cluster for northbound includes 65 days and southbound has 73 days. There are 38 overlapping representative days (Table 20**Error! Reference source not found.**). These days are summarized by min, max, and average values in **Error! Reference source not found.**. A single representative day out of the cluster is chosen that best represents NB K30 travel conditions. The K30 for ATR 130021 is 939 and ATR 136109 is 1337. The selected representative day is 10/19/2021, which has no precipitation, no crashes, and peak hour volumes for SB US 51 similar to the K30 volumes.

Table 20: US-51 North Segment – PM Peak – K30 Representative Days

Monday	Tuesday	Wednesday	Thursday
5/17/2021	5/11/2021	5/5/2021	4/22/2021
8/30/2021	8/3/2021	8/18/2021	5/13/2021
	9/21/2021	9/1/2021	6/17/2021
	9/28/2021	9/8/2021	7/29/2021
	10/5/2021	9/22/2021	8/5/2021
	10/12/2021	10/6/2021	8/19/2021
	10/19/2021	10/20/2021	8/26/2021
	10/26/2021	10/27/2021	9/2/2021
	11/9/2021	11/3/2021	9/9/2021
	11/16/2021	11/10/2021	9/30/2021
	11/30/2021	12/1/2021	10/14/2021
	12/14/2021	12/8/2021	10/21/2021

Table 21: 2021 Weekday PM Peak Period Summarized – Representative Days

Data (38 days)	Precip.	Average Speed		ATR 130021 (peak volume)		ATR 136109 (peak volume)		Total Crashes	
		NB	SB	NB	SB	NB	SB	NB	SB
K30 Max	0	34	34	1073	793	1529	791	0	0
K30 Min	0	31	30	838	658	1195	663	0	0
K30 Average	0	32	31	924	716	1297	719	0	0
K30 Rep. Day (10/19/21)	0	33	31	914	671	1326	753	0	0

Table 20**Error! Reference source not found.** and Table 21 represent the K30 volumes in year 2021, however the traffic volumes in the first part of year 2021 were still suppressed by the COVID-19 pandemic. **Error! Reference source not found.** shows that most of the days in the K30 representative days cluster are from the fourth quarter of 2021. Therefore, a comparison was conducted of the year 2021 and year 2019 traffic volumes at the two ATR locations along US 51. Table 22 shows that the K250 volumes of year 2019 are actually pretty similar to the K30 volumes of year 2021. The US 51 weekday volumes should be represented by K250 volumes instead of K30, therefore the K30 year 2021 volumes can be used to represent K250 volumes in normal, non-pandemic years.

Table 22: 2021 Weekday PM Peak Period Comparison – Year 2019 K250 vs Year 2021 K30

	ATR 130021 (peak			
				SB
K30 Rep. Day (10/19/21)	914	671	1326	753
K250 Year 2019	940	617	1357	604
Coverage Count North of ATR 130021 (130212 on 7/12/22)	845 (approx. K439 of 2019)	570	--	--
Coverage Count South of ATR 130021 (131909 on 7/12/22)	768 (approx. K547 of 2019)	683	--	--
From Coverage Count South of ATR 136109 (130201 & ramps on 5-7/22)		--	1324 (approx. K292 of 2019)	727

Table 22 also shows the traffic volumes from the coverage counts located to the adjacent north and south of the ATR counts. The volumes from the coverage count feeding into the ATR is compared to the ATR K250 year 2019 volume. In most cases they are comparable. The coverage counts can be factored to better align with the K250 volume.

MEMORANDUM

Traffic Forecasting Methodology

Date:	May 1, 2023 (Revised September 24, 2024)
Topic:	Traffic Forecasting Methodology
From:	CDMCT

1. Overview

Traffic forecasts are being developed for the I-39/90/94 and US 51 (Stoughton Road) corridors to help establish the Purpose and Need for the corridors including quantifying impacts to safety, mobility, environmental impacts, access to services and user transportation costs. The traffic forecasts will also be used for determining the preferred alternative and during any subsequent facility design. Forecasts developed by the CDMCT will be submitted to WisDOT Southwest Region Traffic and the Traffic Forecasting Section for review and approval prior to use by the segment design teams. The limits of the projects are shown in Figure 1.

2. Forecasting Inputs

Traffic forecasts are developed using historic, existing and projected future year datasets including traffic counts, housing, employment and transportation system attributes such as number of lanes and facility speeds.

The Wisconsin Department of Transportation (WisDOT) traffic forecasting methodology relies on the most recent traffic count and average annual daily traffic volume growth rates estimated through the use of travel demand models. This methodology is described in the Transportation Planning Manual (TPM), available at: https://wisconsindot.gov/Documents/projects/data-plan/plan-res/tpm/9.pdf

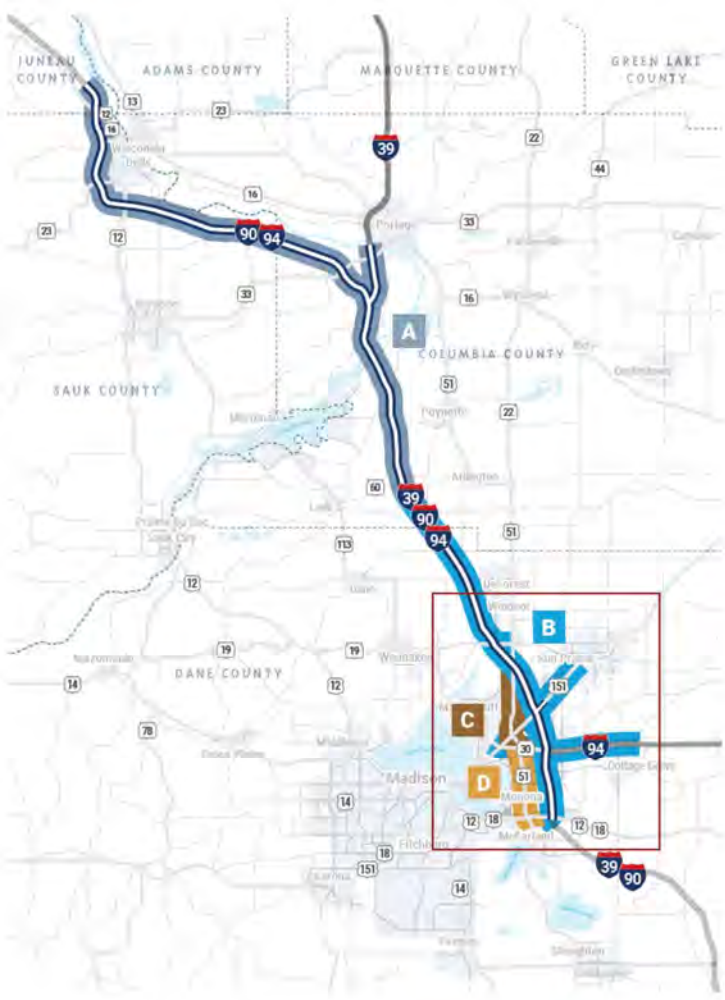
Streetlight origin-destination (OD) data will be used to calculate the existing differences in travel patterns between weekday PM period movements and both Friday afternoon and Sunday afternoon movements. These differences are applied to the scenario-specific trip tables to estimate Friday and Sunday trip tables by scenario with peak period growth rates and subarea trip tables extracted for traffic forecast development. See section 3.6 for more details.

2.1. Existing Traffic Counts

The existing year for the design segments varies based on the year traffic counts were conducted as shown below:

- Interstate north – Existing year=2021
- Interstate south – Existing year =2019
- Stoughton Road north – Existing year =2022
- Stoughton Road south – Existing year =2022

Figure 1: I-39/90/94 and US 51 Study Limits



A North Interstate VISSIM + *VISTRO*
I-39/90/94 NORTH

- US 12 North & NB/SB I-90/94 ramps
- WIS 13 & County H
- WIS 23 & I-90/94 EB/WB ramps
- WIS 23 & Commerce Ave
- ***WIS 23 & US 12***
- US 12 South & I-90/94 EB/WB ramps
- US 12 & Gasser Rd
- ***County BD & US 12 NB/SB ramps***
- WIS 33 & I-90/94 NB/SB ramps
- WIS 33 & NB/SB I-39 ramps
- WIS 33 & County U
- Cascade Mtn Rd & NB/SB I-39 ramps
- Cascade Mtd Rd & County U
- WIS 78 & Petro gas station access
- WIS 78 & Arco Dr
- County CS & I-39/90/94 NB/SB ramps
- County CS & Love's gas station access
- County CS & County J/Smokey Hollow Rd
- WIS 60 & I-39/90/94 NB/SB ramps
- WIS 60 & Sunset Dr

B South Interstate VISSIM + *SYNCHRO*
I-39/90/94 SOUTH

- ***County V & SB/NB I-39/90/94 ramps***
- ***County V & Hickory Ln***
- ***County V & Morrisonville Rd***
- WIS 19 & SB I-94 ramps
- ***WIS 19 & NB I-94 ramps***
- ***WIS 19 & County CV***
- ***WIS 19 & Tierney Crossing/Liuna Way***
- ***WIS 19 & Pepsi Way***
- ***WIS 19 & N Towne Rd***
- ***US 51 & NB/SB I-39/90/94***
- US 51 & Williamsburg Way
- WIS 19 & NB/SB US 51
- NB/SB I-39/90 & High Crossing Blvd
- US 151 & E Springs Dr
- US 151 & RIRO
- American Parkway & Eastpark Blvd
- High Crossing Blvd & Nelson Rd
- ***Grand Ave & NB/SB 151***
- ***Main St NB/SB 151***
- ***EB/WB WIS 30 & N Thompson Dr***
- ***EB/WB I-94 & County N***
- ***County N & County TT***
- ***County N & Gaston Rd***

C US 51 North VISSIM + *SYNCHRO*
US 51 NORTH-CENTRAL

- ***US 51 & Daentl Rd***
- ***US 51 & County CV***
- ***US 51 & Hoepker Rd***
- ***US 51 & Hanson Rd***
- ***US 51 & Rieder Rd***
- ***US 51 & Pierstorff Rd***
- US 51 & Kinsman Blvd
- US 51 & Anderson St
- US 51 & E Washington Rd (US 151)
- E Washington Rd (US 151) & Mendota St
- E Washington Rd (US 151) & Wright St
- US 51 & Commercial Ave
- Commercial Ave & Frontage Rd
- US 51 & EB/WB WIS 30

D US 51 South VISSIM + *SYNCHRO*
US 51 SOUTH

- ***US 51 & Corporate Dr***
- ***SB US 51 & Milwaukee St***
- ***Milwaukee St & Regas Rd***
- ***Milwaukee St & Dempsey Rd***
- ***Milwaukee St & Stoughton Frontage Rd***
- ***Milwaukee St & Walbridge Ave***
- ***NB/SB US 51 & Cottage Grove Rd***
- ***Cottage Grove Rd & Dempsey Rd***
- ***Cottage Grove Rd & Atlas Ave***
- US 51 & Buckeye Rd
- Buckeye Rd & E Frontage Rd
- Buckeye Rd & W Frontage Rd
- US 51 & Pflaum Rd
- Pflaum Rd & E Frontage Rd
- Pflaum Rd & W Frontage Rd
- US 51 & Broadway
- Broadway & Copps Ave
- Broadway & Femrite Dr
- US 51 & EB/WB Beltline
- US 51 & Voges Rd
- Terminal Dr & Terminal Dr
- Voges Rd & Triangle St

Average Annual Daily Traffic (AADT) as published by WisDOT will form the target daily traffic volumes for the corridor. These daily traffic volumes are checked, then balanced through the interchange ramps for limited access facilities within the I-39/90/94 segments and through the major intersections for the US 51 segments. Design hour volumes (DHV) will also be developed for each corridor. Design segment teams will develop balanced volume sets for interchange ramp terminals and cross streets along the Interstate segments and for major nearby intersections along the US 51 segments.

Existing DHV traffic counts are established for each mainline and ramp segment using the Representative Typical Day methodology available in the "Design Considerations and Cluster Analysis for Determining Representative Days" memo.

2.1.1. Boat and Trailer Impacts on Truck Percentages

The impacts of personal vehicles pulling boats and trailers on truck percentages was investigated. The Interstate system provides a critical transportation link for freight movements across the system. The I-39/90/94 corridor through Wisconsin is also critical for recreational vehicles traveling to and from Northern Wisconsin, especially during the summer. A comparison of video and axle classification data has shown that existing vehicle classification counters that rely on axle patterns may classify personal vehicles with trailers as commercial trucks. Specifically, vehicle class 8, defined as four or fewer axle single-trailer trucks, may include both commercial trucks with trailer or personal vehicles with trailers. This analysis process was detailed in a memorandum called "Boat/Trailer Impacts on Truck Percentages" (August 19, 2022) and is provided in Attachment A.

In summary of this memorandum, the comparison between truck percentage data collected by video and by the axle classification system shows that the difference between the two truck percentage collection systems was minimal during non-tourist days. However, on more heavily traveled tourist days during the summer weekends, particularly in the northbound direction on Fridays and the southbound direction on Sundays, the difference is approximately 5%. Most of this difference was due to data differences in the vehicle class 8.

2.1.2. COVID-19 Pandemic Impacts on Corridor Traffic

The COVID-19 pandemic impacted traffic volumes throughout the US including the I-39/90/94 and US 51 corridors. A memorandum called "Impacts of COVID pandemic on Corridor Traffic Patterns and Volumes" (August 9, 2022) was produced to detail this COVID-19 impact to the project area corridors.

The memo can be found located in Attachment B.

The memo shows that the year 2021 I-39/90/94 corridor volumes within the project study area have returned to the pre-COVID-19 year 2019 levels. However, the year 2021 US 51 corridor volumes are still 10-15% below pre-pandemic year 2019 volumes. The memo shows Replica data revealing levels of Dane County residents working from home is still higher than pre-pandemic levels. The resulting lower number of commuter vehicles has impacted the US 51 corridor volumes, which more directly serves commuter trips than the varied uses of Interstate trips.

2.2. Design Hour Volume Identification

WisDOT FDM 11-5-3.5.1 defines the determination of design hour volumes (DHV) for the LOS analysis. The process varies depending on the type of facility. The existing year DHV will be used as the base line for forecasting future year no build and alternative scenarios DHV's. Existing, future no build and future build alternative DHV's will be analyzed with a combination of VISSIM and VISTRO/Synchro to estimate traffic operations such as delay, density and travel times during the design hours.

2.3. I-39/90/94 and US 51 Design Hour Volume Determination

Desired level of service and development of the design hour volumes (DHV) through the representative day process are described in the "Design Considerations and Cluster Analysis for Determining Representative Days" memo.

The document also reviews 2019 and 2021 counts along the Interstate and US 51 corridors.

2.3.1. I-39/90/94 Design Hour Volumes

Per FDM 11-5-2.1.1, K30 volumes are used for DHV's on I-39/90/94 from the northern limits of the project to US 51 in Dane County. K100 volumes are used on I-39/90/94 between US 51 in Dane County to the southern limits.

Note that FDM 11-5.3.1.1 does not pertain to the ramp terminal intersections or cross streets at interchanges. These locations are covered by FDM 11-5.3.1.2 which provides guidance on the determination of DHV's for urban streets, intersections and ramp terminals. At these locations, DHV's should be based on the AM or PM peak hour volumes for individual turning and through movements. This will result in a variation in traffic volumes between ramps (driven by the representative day to achieve K30/100 volumes on the Interstate mainline) and the turning movements at the ramp terminal (driving by the peak hour volumes).

2.3.2. US 51 Design Hour Volumes

The segment of US 51 crossing Milwaukee Street and Cottage Grove Road operates as a freeway with interchanges at the two cross streets and may be covered by FDM 11-5-3.1.1. The remainder of US 51 operates as an expressway with side-street stop control (Hoepker Road, Hanson Road and Reider Road intersections) or as an urban arterial and covered by FDM 11-5-3.1.2. Current CCS data does not exist for the freeway segments around Milwaukee Street and Cottage Grove Road which prohibits a thorough review of observed hourly volumes. Additionally, previous traffic operations indicate the freeway segments were not controlling the overall traffic operations of the corridor.

DHV's for US 51 are therefore based on the AM or PM peak hour volumes for individual turning and through movements.

2.4. Travel Demand Models

Two travel demand model sets, the Dane County travel demand model (DCTDM) and the Statewide travel demand model (SWTDM) are available for use in traffic forecasting for the I-39/90/94 and US 51 corridors.

2.4.1. Statewide Travel Demand Model

SWTDM covers all of the state of Wisconsin along with decreasing detail in neighboring states and a skeleton network for national freight travel. The SWTDM uses networks, zones and socio-economic data from available regional travel demand models including the DCTDM. SWTDM analyzes travel at the average annual daily traffic level and does not include peak period components or outputs. While the DCTDM and SWTDM both cover Dane

County and utilize the same model inputs, the results of the two models will not exactly match but are typically similar in nature. WisDOT's current approach is that the SWTDM may be used for traffic forecasting in areas that are not covered by regional travel demand models (the DCTDM in this case). Given the regional nature of the project and the noted change in housing in the Baraboo area, the project team determined that using SWTDM was appropriate for this project to analyze and forecast traffic demands in Columbia, Sauk and Juneau counties.

The CDMCT used SWTDM version STDM 2.1.0.0 for the I-39/90/94 project. Version 2.1.0.0 includes model years 2017 and 2050 and was provided by the Department on April 14, 2022.

Due to the geographic extent of the proposed I-39/90/94 project, the SWTDM and DCTDM have an iterative relationship. Lane additions on I-39/90/94 in one county may impact traffic demand in other counties. The SWTDM input network geodatabases were updated for Future build scenarios to include additional capacity, then resulting assignments and subarea extractions from SWTDM were used to update the DCTDM external trip input files. This iterative approach provides consistency between the DCTDM and the SWTDM.

Future year 2050 land use and transportation system attributes are used by the SWTDM to estimate future traffic demands. 2050 housing, employment and transportation system data were provided by WisDOT as part of the SWTDM model set. Recently identified land developments were reviewed by CDMCT, region staff and stakeholders for inclusion into the 2050 input data. The City of Baraboo noted an increase in their projected housing growth and the City of Wisconsin Dells noted a change in the planned location of the new high school facility, both updates were incorporated into the SWTDM's 2050 socio-economic files. Documentation related to conversations with all stakeholders is available in Attachment C. The process used to update the SWTDM to incorporate updated housing and enrollment data, network edits to improve local calibration and the updating of all Dane County projection data is detailed in Attachment D. Mapping of final housing and employment totals by TAZ are available in Attachment E. Committed roadway improvements were also reviewed by CDMCT, region staff and stakeholders for inclusion into the 2050 input data. Mapping of the final committed transportation projects is also available in Attachment F.

2.4.2. Dane County Travel Demand Model

DCTDM covers all of Dane County and thereby encompasses three of the four subject corridors. DCTDM includes a 2016 base analysis year and a 2050 future analysis year. DCTDM models four distinct time periods of the day, AM, midday, PM and night. The traffic assignments from the four time periods are aggregated to a daily value that represents an Average Weekday Daily Traffic (AWDT), with the 2016 daily model assignments validated to 2016 observed traffic counts. The peak period component of DCTDM is desirable for the complex congested urban corridors of this project and was further validated as part of this project to provide a more reliable platform for forecasting peak period traffic patterns. Attachment G provides documentation on the peak period validation efforts and results for the DCTDM.

Future year 2050 land use and transportation system attributes are used by the DCTDM to estimate future traffic demands. 2050 housing, employment and transportation system data were provided by the Greater Madison Metropolitan Planning Organization (GMMPO). Recently identified land developments were reviewed by CDMCT, region staff, GMMPO staff and stakeholders for inclusion into the 2050 input data. Mapping of final housing and employment totals by TAZ are available in Attachment E. Committed transportation improvements including both

roadway and transit projects were also reviewed by CDMCT, region staff, GMMPO staff and stakeholders for inclusion into the 2050 input data. Mapping of the final committed transportation projects is in Attachment F.

Vehicle travel that crosses the Dane County line, defined as external trips of the DCTDM, are calculated with the aid of the SWTDM. Two types of external travel are modeled by DCTDM and updated as described below:

- External to external (EE) trips are those trips that start and end outside of Dane County. These trips are observable from the Streetlight OD data, entered into the DCTDM as trip tables, and can be forecasted using the SWTDM. Future year DCTDM EE inputs are estimated by comparing scenario-specific subarea extractions from the SWTDM and applying those differences to the calibrated base year trip tables.
- External to internal and corresponding internal to external (EI-IE) trips have one trip end inside of Dane County and one trip end outside Dane County. These trips are observable from the Streetlight OD data, entered into the DCTDM as trip ends for inclusion in the destination choice, and can be forecasted using the SWTDM.

Peak period traffic assignments and ramp-to-ramp subarea trip table extractions from the DCTDM will be used for traffic forecasting purposes.

2.5. TAFIS

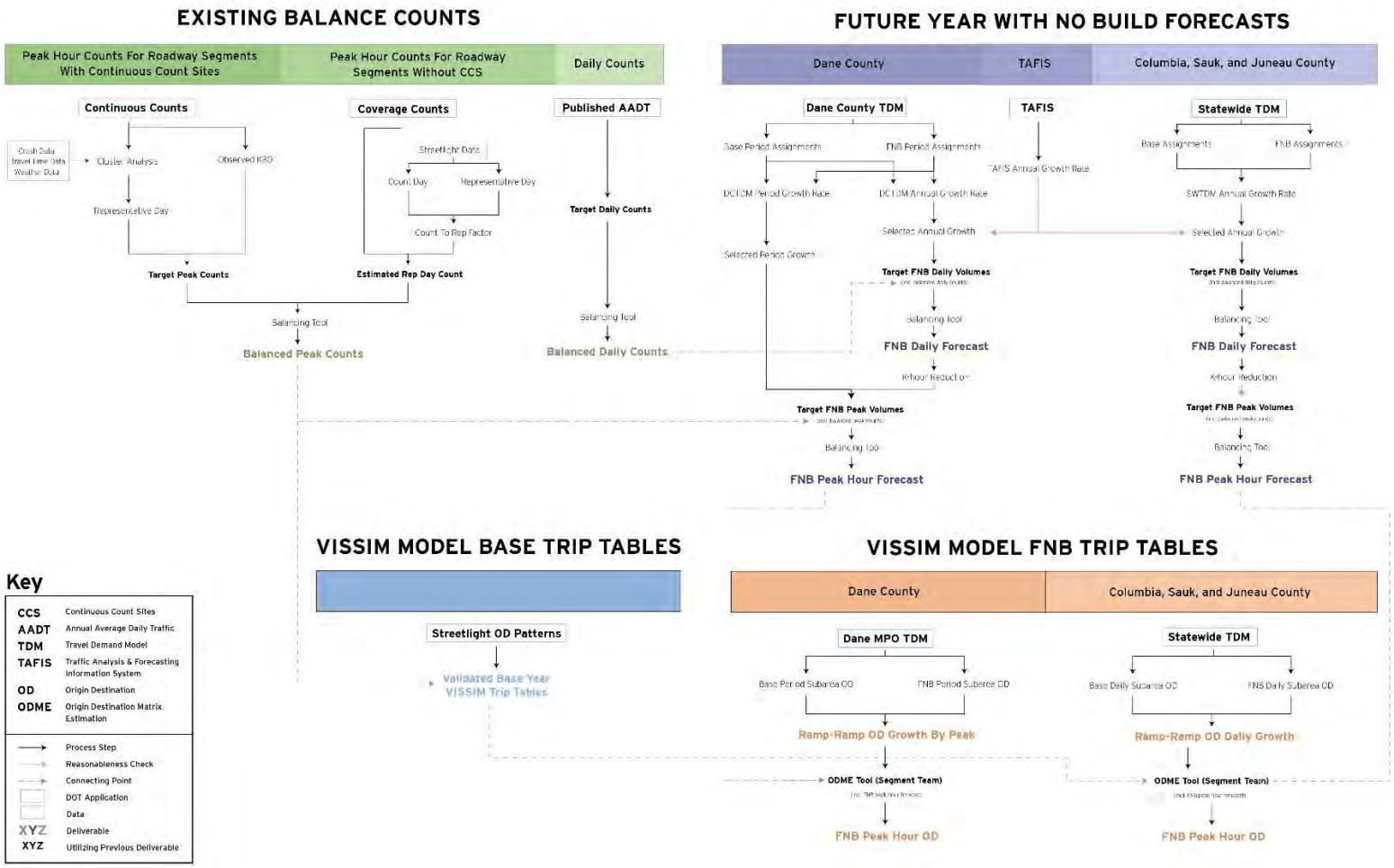
Traffic Analysis and Forecasting Information System (TAFIS) data provides a historical look at traffic demands at count sites across Wisconsin. TAFIS traffic growth rates are estimated with statistical methods applied to available historic counts. The resulting growth rate is applied to the most recent traffic count at the location to forecast future traffic demands. This process does not use projected changes in land use or transportation system attributes. TAFIS provides a benchmark for checking the reasonableness of traffic forecasts developed through demand models.

CDMCT will review TAFIS projections for all design segments. In locations where the TAFIS and travel demand model generated growth rates are not similar, CDMCT will coordinate with WisDOT traffic forecasting section and region staff to verify the appropriate growth rate to apply in developing the Future No Build forecasts. Attachment H includes a comparison of the TAFIS forecasts to the E+C No Build forecasts developed as part of the project.

3. Future No Build Growth

The traffic projection process is outlined in Figure 2. Balanced traffic counts are used in conjunction with demand model generated growth rates to produce target values for daily and design hour traffic projections. Those target values are then balanced to produce the traffic forecasts. The traffic forecasts are then used to produce OD tables for VISSIM model analysis.

Figure 2: Traffic Projection Workflow



3.1. AADT Growth

The 2050 travel demand models described in Section 2.4 and the historic-based TAFIS growth rates described in Section 2.5 are used to develop growth rates for the mainline and ramps throughout the corridors. Per WisDOT's TPM Chapter 9, both the demand model and TAFIS generated growth rates will be reviewed and considered. Traffic forecasts developed using the growth rates from TAFIS and the demand model will be compared and if these two forecasts are within 10% of each other, the demand model-generated traffic forecast is selected. If the TAFIS and demand model forecasts are more than 10% apart, then the average between the TAFIS and demand model forecasts is calculated, and if that average value is within 10% of the TAFIS forecast, the averaged value is selected. In cases where the TAFIS and average forecasts are not within 10%, engineering judgement is used. For locations that do not have a TAFIS forecast, the demand model growth is used to generate the forecast. A 0.25% minimal growth rate was also applied to generate the traffic forecasts, which effected few locations within the corridor. In areas with higher land use growth, the demand model generated growth rates will be given greater consideration. For areas inside of Dane County, the DCTDM will be used to generate daily growth rates, while areas outside of Dane County will use the SWTDM to generate daily growth rates.

The selected growth rate at each location will be applied to the location's existing year daily traffic count to establish the future year daily target value. A traffic balancing exercise is conducted through the corridor to establish the 2050 No Build AADT values for mainline and ramps.

3.2. Future No Build Peak Period Growth (Dane Only)

The 2050 DCTDM includes four time periods which sum to the daily values including trip tables by purpose and traffic assignment by link. The AM and PM period model outputs are validated and will be used to provide 3-hour peak period specific growth rates by location. The peak period modeling is sensitive to congestion that varies between peak and off-peak conditions. This approach provides for off-peak traffic volumes to grow while congested peak period traffic volumes may be constrained by capacity resulting in potentially lower peak period growth rates compared to the daily growth rate.

Unlike the daily traffic growth rate, the peak period growth rates estimated by the DCTDM cannot be compared directly to historic growth rates using TAFIS. Prior to using peak period growth rates, the K-design hour reduction factor described in Section 3.3 should be estimated and applied to the daily growth rate to form an estimated design hour volume for comparison purposes.

Example below is for an illustrative northbound Interstate group 5 segment in Dane County:

2016 DCTDM link AM period assignment: 4000

2016 DCTDM link PM period assignment: 4800

2016 DCTDM link daily assignment: 15,000

2021 AM peak hour balanced count: 1900

2021 PM peak hour balanced count: 2300

2050 DCTDM link AM period assignment: 5000

2050 DCTDM link PM period assignment: 5700

2050 DCTDM link daily assignment: 19,600

2021 daily directional balanced count: 17,700

AM growth = $\left(\frac{5000}{4000}\right)^{\frac{1}{2050-2016}} - 1$ = 0.66% CAGR 2050 AM TDM target value = $1900 * (1.0066)^{2050-2021}$=2299

PM growth = $\left(\frac{5700}{4800}\right)^{\frac{1}{2050-2016}} - 1$ = 0.51% CAGR 2050 PM TDM target value = $2300 * (1.0051)^{2050-2021}$=2666

Daily growth = $\left(\frac{19,600}{15,000}\right)^{\frac{1}{2050-2016}} - 1$ = 0.79% CAGR 2050 AADT TDM target value = $17,700 * (1.0079)^{2050-2021}$= 22,236

3.3. Future No Build K-Design Hours

The portion of the daily traffic anticipated to occur in the design hour decreases as the AADT of the facility increases. The K-design hour process is directly. applicable for weekday AM/PM, Friday and Sunday analysis. WisDOT uses the following equation to estimate the design hour by K-hour.

$$K\% = (Constant + AADT * Coefficient)/AADT$$

Table 1 below provides the Constant and Coefficient by Seasonal Factor Group and K-Factor.

Table 1: K-Factor Equation Values by Seasonal Factor Group

	K30		K100		K250	
	Const	Coeff	Const	Coeff	Const	Coeff
Group 1 Urban Interstate	1463.45	0.07557	1254.81	0.07415	1068.46	0.07188
Group 2 Urban Other 4+ Lanes	433.8571	0.09422	358.2153	0.09152	277.8403	0.08796
Group 3 Rural Interstate	796.1749	0.08746	586.8914	0.08463	289.6699	0.08482
Group 5 Rec Interstate	445.5	0.12687	374.9063	0.11213	246.2874	0.10064
Group 6 Rec Other	695.0795	0.08429	443.7057	0.08946	253.2792	0.08988

Data published June 2020 by WisDOT.

At each location, the K% equation is applied for K30, K100 and K250 parameters, then the K-hour that most closely matches the balanced hourly volume at that location is selected. The corresponding K% equation is then applied to the future AADT value by location, resulting in an estimated reduction in the percent of daily traffic occurring within the K design hour. This reduction is consistent with peak spreading that occurs as congestion levels build with increased traffic volumes. The K% reduction is applied in conjunction with the growth factor to estimate the target design hour volumes. These target design hour volumes are used directly for balancing within areas outside of Dane County.

The example below uses the illustrative northbound Interstate location from section 3.2.

2021 direction balanced count: 17,700 AADT=35,400 K30=2468,
K100=2172~PM count of 2300,
K250=1904~ AM count of 1900

2050 target directional value: 22,236 AADT=44,470 K100= 374.9+44,470*0.11213 = 2,680 PM (directional)
K250= 246.3+44,470*0.10064 = 2,361 AM (directional)

3.4. Future No Build Design Hour Volume Comparison (Dane Only)

The DCTDM generated peak period growth rates are applied to balanced base year design hour volumes to develop target design hour counts. The K-hour factors are applied to the target daily volumes. These two processes generate design hour volumes which are reviewed and a target value for balancing selected. Based on WisDOT guidance, the forecast generated by the travel demand model shall be selected if within 10% of the alternative approach (in this case the K-hour estimation process). The comparison using the illustrative values from Section 3.2 are shown below.

Time Period	DCTDM generated	K-hour generated	Percent Difference	Target Value Selected
AM hour	2299	2361	-2.7%	2299
PM hour	2666	2680	-0.5%	2666

3.5. Future No Build Design Hour Trip Tables

The projected design hour target volumes selected in section 3.2 are balanced to form the design hour volumes for analysis. To aid in VISSIM operations analysis, CDMCT provides each design segment team with vehicle trip tables extracted from the DCTDM or SWTDM that include mainline and ramp movements.

3.5.1. Dane County (DCTDM)

Subarea trip tables are extracted from the DCTDM to represent the ramp to ramp movements through the I-39/90/94 South corridor and external to external movements through the two US 51 VISSIM models. Year 2016 AM and PM period trip tables are extracted from the base DCTDM, along with year 2050 AM and PM period tables. While the 2016 tables could be used as starting points for the VISSIM analysis, the design teams will use Streetlight-derived trip tables as their seed matrices. CDMCT will use the 2016 and 2050 subarea tables to develop forecasted growth matrices following NCHRP 765's section 6.12 technique guidance which incorporates differences in ramp to ramp trip movements between the 2016 subarea extraction and the 2050 subarea extraction. Additionally, the trip table row and columns sums are maintained such that traffic volumes and entry and exit points are held constant. This process will allow the proportion of the movements to align with the demand model generated trip matrix while keeping the total volume on each ramp consistent with the forecasted value. Using ramp-to-ramp level analysis allows the trip table forecasting process to respond to projected changes in housing, employment and transportation system input data. Ramp-to-ramp forecasting also provides detail to potential weave analyses for both No Build and subsequent alternatives.

Each design segment team then applies the forecasted growth matrices to their base year VISSIM trip tables to formulate target 2050 No Build trip tables. An Origin-Destination Matrix Estimation (ODME) process is then applied by the segment teams to adjust the target trip tables to align with design hour traffic projections. The resulting adjusted trip tables are then used in subsequent traffic operations analysis.

3.5.2. Areas outside of Dane County (SWTDM)

The SWTDM does not model peak periods, therefore, only daily growth rates and subarea trip tables are available. Streetlight data will be used to establish existing year design hour trip tables for VISSIM analysis. As note in Section 3.3, design hour traffic forecasts are developed for areas outside of Dane County using the K-design hour values estimated from projected AADT values. Ramp to ramp trip growth is also calculated using daily data extracted from SWTDM's 2017 and 2050 model sets using a subarea matrix extraction. Ramp to ramp growth matrices are then forecasted using NCHRP 765's section 6.12 technique which incorporates differences in ramp to ramp trip movements between the 2017 subarea extraction and the 2050 subarea extraction.

3.5.3. Future Developments (DCTDM)

A study was conducted to identify new developments in the I-39/90/94 and US 51 corridor study areas and determine if the DCTDM socio-economic projections accurately reflect the latest development plans. This study was detailed in the "Land Development Status with 2050 DCTDM" memorandum (April 3, 2023). The memo can be found in Attachment I. The study identified several TAZs within the project corridor area that should include updated socio-economic data.

3.6. Friday/Sunday Trip Table Development

Neither the DCTDM nor SWTDM explicitly model the unique nature of the tourist travel along the I-39/90/94 corridor beyond what is averaged into available summary count data. The northbound tourist travel on Friday afternoons and the complimentary southbound Sunday during the summer tourist season form the highest demands for a majority of the I-39/90/94 corridor.

Streetlight origin-destination data is available to provide differences between the demand models' definitions of trips (average annual or average weekday) and the Friday-Sunday patterns within the corridor. CDMCT will analyze the Streetlight OD data to establish factors to convert the available weekday PM period trip tables from the DCTDM to represent the Friday-Sunday patterns. These factors will then be applied to future model scenario (No Build and Alternatives) PM peak period trip tables for assignment within the DCTDM. Forecasting of peak period growth rates are estimated using NCHRP 765's 6.12 technique using demand model subarea trip table extractions for both 2016 and 2050 similar to the processes noted for the design hour analysis above.

4. Cross Street Growth Rates

CDMCT provided the segment design teams with growth rates for interchange cross streets and facilities crossing the Interstate. These growth rates were developed using the approach defined above, namely demand model assignments and TAFIS where available were compared and a resulting forecasted value was calculated. A growth rate for each side of the interchange was estimated based on the rates from the various links in the respective area. The segment design teams then applied the growth rate to the intersection counts to establish target volumes and completed the traffic balancing. This effort was delegated to the segment design teams to more closely align with the activities of establishing design alternatives and conducting the subsequent traffic operational analysis.

5. Speed Reduction Sensitivity Testing

The City of Madison lowered the posted speed on US 151 (East Washington Avenue) on the east side of Madison. In October 2020, speeds on East Washington Avenue (EWA) were reduced from 35 mph to 25 mph between Pinckney Street and Baldwin Street, and from 35 mph to 30 mph between Baldwin Street and Marquette Street In July 2022, the section of East Washington Avenue between Stoughton Road and East Springs Drive had its speed limit reduced from 40 mph to 35 mph.

Traffic counts were collected by WisDOT along EWA during 2020 from WisDOT continuous count sites (CCS). Tables 2 and 3 show counts in September, October, and November 2020 at two control sites where the posted speed limit did not change. Table 4 shows traffic counts during the same period along East Washington Avenue where the speed limit was reduced in October 2020. These observed traffic volume sets indicate that the speed reduction from September to November 2020, before and after the East Washington Avenue speed reductions at both control sites was an average of about 7-8%. The observed traffic volume counts on East Washington Avenue showed a reduction of about 14%. Therefore, the speed limit change had an impact of 6-7% reduction in traffic volumes, because the East Washington Avenue observed counts were reduced by about 6-7% beyond what the control site locations observed in traffic volume counts.

Table 2: 2020 ATR Data for Count Site 136055, located on US 151 Northeast of I-39/90/94 corridor

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Total	Avg.
September	42,719	52,046	56,520	57,619	59,307	64,601	50,942	383,214	54,744.86
October	41,408	53,730	54,914	56,193	57,899	63,676	49,561	366,381	52,340.14
November	38,981	54,001	52,933	56,765	48,125	59,386	47,681	357,872	51,124.57
Sept to Nov Shift	92.4%	103.8%	93.7%	98.5%	81.1%	91.9%	93.6%	93.4%	93.4%

Table 3: 2020 ATR Data for Count Site 130011, located on the Beltline near the Park St. interchange

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Total	Avg.
September	81,239	106,138	115,991	117,932	119,158	125,416	95,878	761,752	108,821.7
October	79,775	109,899	114,289	116,912	117,595	125,288	95,409	759,167	108,452.4
November	71,343	108,949	107,470	113,497	99,203	114,721	87,655	702,838	100,405.4
Sept to Nov Shift	87.8%	102.6%	92.7%	96.2%	83.3%	91.5%	91.4%	92.3%	92.3%

Table 4: 2020 ATR Data for Count Site 130032, located on East Washington Avenue at Yahara River Bridge.

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Total	Average
September (before)	23,206	30,466	33,629	34,139	35,064	37,326	28,382	222,212	31,744.57
October	21,481	29,767	31,597	32,081	32,414	35,129	26,506	208,975	29,853.57
November (after)	19,929	28,868	29,576	30,744	27,219	30,402	24,157	190,895	27,270.71
Sept to Nov Shift	85.9%	94.8%	87.9%	90.1%	77.6%	81.4%	85.1%	85.9%	85.9%
Control Group % Reduction	89.0%	103.0%	93.0%	97.0%	82.6%	91.6%	92.2%	92.6%	92.6%
EWA posted speed change impact	-3.10%	-8.21%	-5.08%	-6.89%	-4.95%	-10.23%	-7.08%	-6.74%	-6.74%

The DCTDM was modified to reflect lower speeds on EWA using the user-speed function, which allows a specific speed to be allocated to a model link rather than the speed identified in a model-wide lookup table. DCTDM was tested with the two different sets of user-speeds. One set included reducing the model speed by 50% of the posted speed limit reduction, and one included reducing the model speed by 80% of the posted speed limit reduction. The 80% reduction lowered the model assignment volumes too low, therefore the 50% reduction was

assessed further. The 50% reduction means that in areas where the posted speed limit was reduced by 10 mph, the model speed was reduced by 5 mph, and in areas where the speed limit was reduced by 5mph, the model speed was reduced by 2.5 mph. Table 5 shows how the 50% model speed reduction impacted the model volume outputs.

Table 5: Dane County Travel Demand Model Simulated 50% Speed Reductions along East Washington Ave. using a 2016 Base Year

Segment of Road	Original Posted Speed	New Posted Speed	Original Model Speed	Tested Model Speed	Model Assignment; Original Speed	Model Assignment; Tested Speed	Assignment Reduction Due to Tested Speed
Outbound Traffic							
W. of Blair	35 mph	25 mph	36 mph	31 mph	10,062	9,233	8% reduction
W. of Ingersoll	35 mph	25 mph	36 mph	31 mph	20,544	17,676	14% reduction
Yahara River	35 mph	30 mph	38 mph	36 mph	21,306	19,022	11% reduction
W. of 5th	35 mph	30 mph	40 mph	36 mph	19,494	16,643	15% reduction
W. of Marquette	35 mph	30 mph	38 mph	36 mph	23,870	22,152	7% reduction
Inbound Traffic							
W. of Blair	35 mph	25 mph	36 mph	31 mph	15,982	10,764	33% reduction
W. of Ingersoll	35 mph	25 mph	36 mph	31 mph	22,634	16,964	25% reduction
Yahara River	35 mph	30 mph	38 mph	36 mph	22,283	17,114	23% reduction
W. of 5th	35 mph	30 mph	40 mph	36 mph	20,021	16,090	20% reduction
W. of Marquette	35 mph	30 mph	38 mph	36 mph	22,170	20,953	5% reduction

Table 5 shows that even reducing the model speed by half of the total posted speed limit reduction still reduces the model assignments between 5% to 33%. This is generally much higher than the expected 6-7% reduction that was shown in Table 4, based on the observed traffic volumes. Therefore, the model speeds were not adjusted along East Washington Avenue.

6. Build Alternative Forecasts

Future year build alternative traffic forecasts are developed using demand model-projected changes in traffic assignments at the peak period level for Dane County and at the daily level for other areas. The future no-build balanced projections are adjusted by applying differences between the future no-build and the specific alternative's model outputs. Target volumes are then balanced through the corridor. Changes in patterns from

subarea extractions between the future no-build and the specific alternative are applied to the future no-build trip tables in conjunction with the alternative's traffic forecasts to produce trip tables for use in VISSIM analysis.

6.1. Interstate South and US 51 Build Alternative Forecasts

Several Build alternatives and their traffic impacts are detailed in a separate memo called "I-39/90/94 and US 51 Corridor Studies" (April 4, 2024). The memo can be found located in Attachment J.

The memo details the traffic impacts of the following build alternative separately using volume difference plots:

- Additional Interstate Capacity ("Plus 1 lane in each direction")
- Hoepker Road Interchange
- US 51 South speed reduction
- High Crossing Blvd Interchange North Ramps
- Milwaukee Street Interchange
- Doubling Transit
- American Parkway Interchange Reconfiguration
- WIS 19 Widening
- East Washington Avenue Speed Reduction
- Various combinations of the above alternatives
- Critical Alternative forecasting (described in more detail in Section 6.2 below)
- US 151 Interchange, High Crossing Blvd Interchange & American Pkwy Interchange Alternatives
- US 51 South Corridor Alternative Designs
- US 51 North Corridor Speed Reduction

6.2. Critical Alternative Forecasts

The three projects along the I-39/90/94 south segment and the US 51 north and south segments occurring simultaneously in Dane County resulted in a comingling of impacts. For example, the potential addition of an interchange of I-39/90/94 at Hoepker Road would impact both the I-39/90/94 corridor and the US 51 North corridor. CDMCT conducted a series of DCTDM alternative runs to estimate the impact of various combinations of projects on each respective area of each corridor. Alternatives tested include:

- Hoepker Road interchange
- Milwaukee Street interchange
- High Crossing Road interchange north ramps
- American Parkway reconfiguration at US 151
- Stoughton Road South speed reduction

- East Washington Avenue speed reduction
- WIS 19 expansion between River Road and Williamsburg Way
- Interstate capacity expansion between US 12/18 and Wisconsin Dells

Various combinations of projects were coded into the Dane County travel demand model to estimate the combination that generated the highest traffic assignment for each location along the three Dane County study corridors. These assignments were then incorporated into the traffic forecasting process to estimate the highest traffic volume that a location would be anticipated to accommodate across the various combinations of projects. A 'critical' forecast was then developed for each individual interchange based on these highest traffic volumes. This 'critical' forecast allows the segment design teams to size the facilities to access environmental impacts and select a preferred alternative for subsequent analysis. The results of the 'critical' forecasting is presented in the "I-39/90/94 and US 51 Corridor Studies" (April 4, 2024) memo that can be found located in Attachment J.

Final traffic forecasts were developed that use the preferred alternative geometry at each location throughout Dane County.

1. I-39/90/94 Frontage Roads

5. US 51 Forecasts based on Year 2018 Traffic Counts

   A memo titled "US 51 North Corridor Forecast Methodology" (November 2022), which is included in Attachment K, explains why year 2022 counts, instead of year 2018 counts, were used as a basis to develop future forecast volumes along the US 51 corridor. Year 2018 counts are higher than year 2022 in some areas of the US 51, mainly in the North corridor near Madison Area Technical College. This is likely because there are more remote classes during and after COVID than there were previously. Because this situation of more remote classes is believed to continue, and because year 2018 counts may artificially inflate future forecasts, year 2022 counts were used as a basis to develop US 51 forecast volumes. The memo provides more details.

   As a sensitivity check, some US 51 forecasts were developed using 2018 traffic counts to provide higher forecast volumes in case the US 51 traffic growth reverts to pre-COVID patterns. These forecasts were only developed in the vicinity of Madison Area Technical College along the US 51 corridor where year 2018 counts are generally higher than year 2022 counts. The US 51 corridor team used the year 2018-based forecasts as a comparison check during traffic operations analysis against the year 2022-based forecasts to confirm that no recommendations would be impacted.

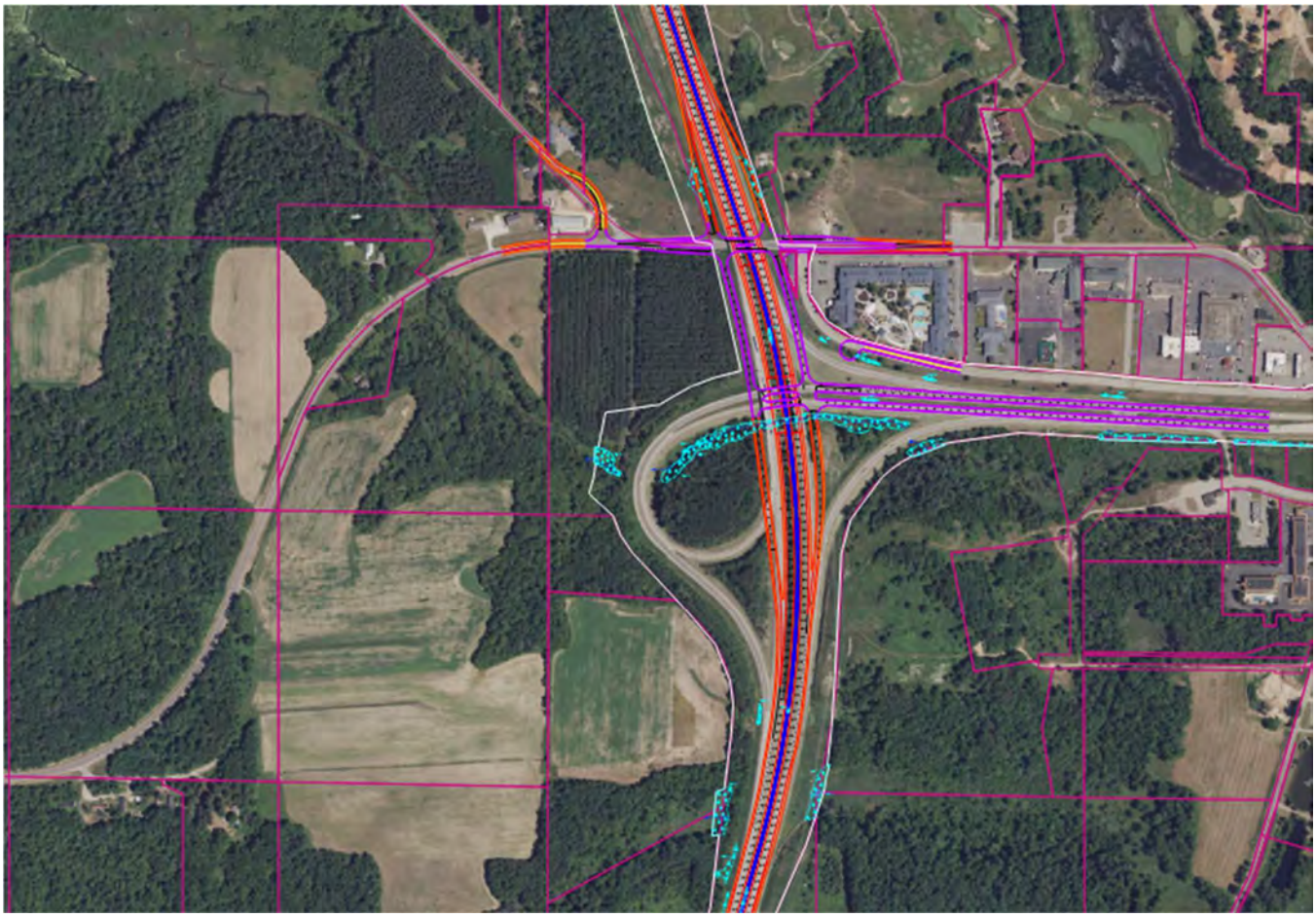
6.4. Interstate North Build Alternative Forecasts

In the Interstate North corridor, traffic forecast volumes were developed for a build alternative with two potential interchange reconfigurations:

- WIS 13/CTH H Interchange Reconfiguration
- I-39/90/94 Interchange Reconfiguration

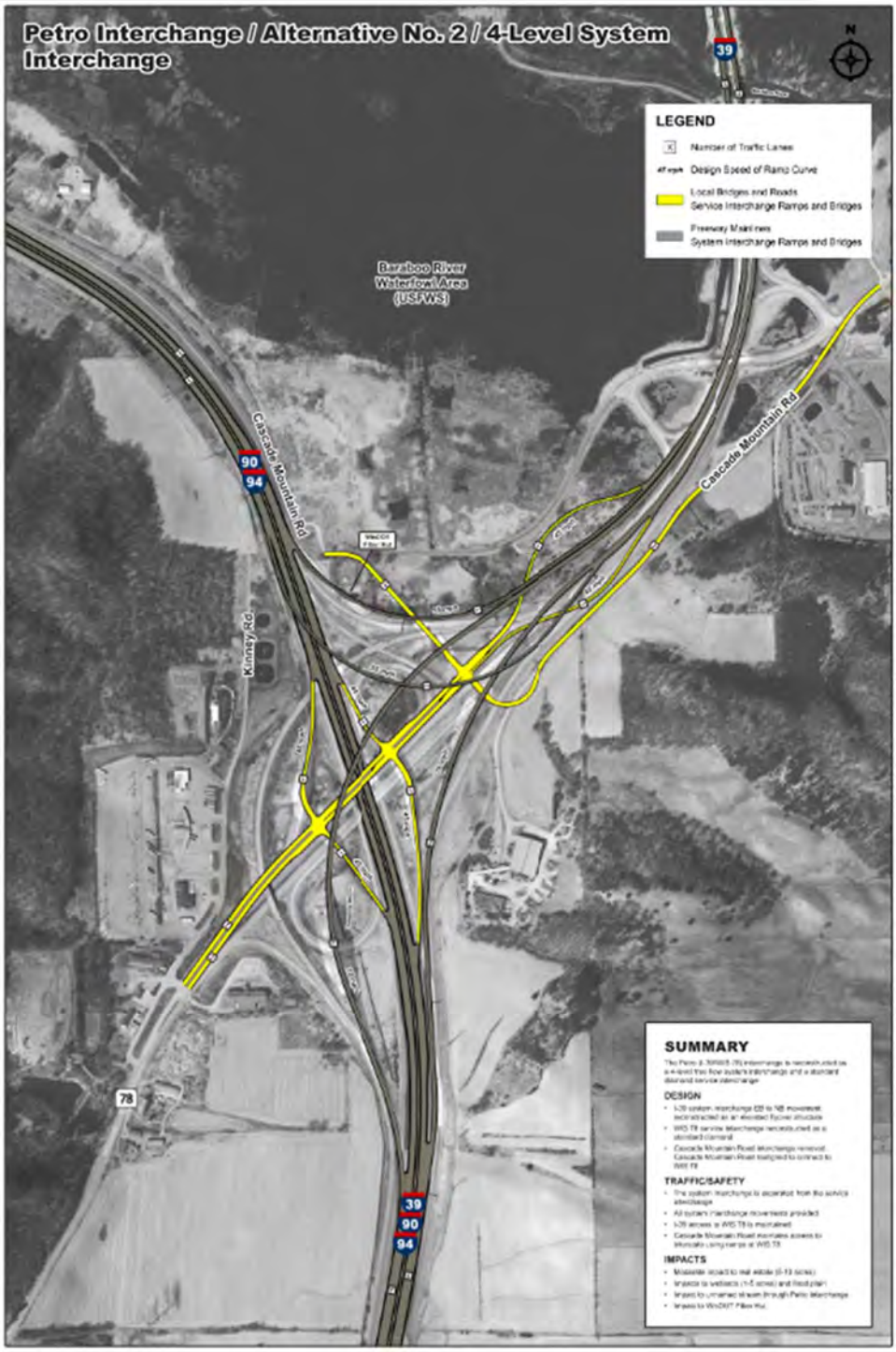
The WIS 13/CTH H interchange reconfiguration includes a split diamond at WIS 13 and CTH H, shown below in Figure 3.

Figure 3: Interstate North Alternative – WIS 13/CTH H Split Diamond



The I-39/90/94 interchange reconfiguration includes two flyover ramps from I-39 SB to I-90/94 EB, and from I-90/94 EB to I-39 NB. In addition, I-90/94 diamond interchange ramps are incorporated within the interchange with two ramp terminal intersections along WI 78. And, the I-39 interchange with Cascade Mountain Road is replaced with an at-grade intersection located just east of diamond ramp terminal intersections. The interchange design is shown in Figure 4.

Figure 4: Interstate North Alternative – I-39 & I-90/94 System Interchange Reconstruction



6.5. Existing Volumes

The existing year volumes are included in Attachments L1, L2, L3, and L4.

The Interstate North existing year 2021 volumes are included in Attachment L1.

The Interstate South existing year 2019 volumes are included in Attachment L2.

The US 51 North existing year 2022 volumes are included in Attachment L3.

The US 51 South existing year 2022 are included in Attachment L4.

6.6. Existing plus Committed Alternative Forecasts

The existing plus committed future year 2050 forecast volumes are included in Attachments M1, M2, M3, and M4.

The Interstate North existing plus committed year 2050 forecast volumes are included in Attachment M1.

The Interstate South existing plus committed year 2050 forecast volumes are included in Attachment M2.

The US 51 North existing plus committed year 2050 forecast volumes are included in Attachment M3.

The US 51 South existing plus committed year 2050 forecast volumes are included in Attachment M4.

6.7. Existing plus Committed "Plus 1" Build Alternative Forecasts

The existing plus committed "plus 1" future year 2050 forecast volumes are included in Attachments N1 and N2. This "plus 1" scenario assumes the existing plus committed future year 2050 conditions with one lane of capacity added along I-39/90/94.

The Interstate North existing plus committed "plus 1" year 2050 forecast volumes are included in Attachment N1.

The Interstate South existing plus committed "plus 1" year 2050 forecast volumes are included in Attachment N2.

6.8. Interstate North Preferred Alternative Build Forecasts

The Interstate North Preferred Alternative includes the reconstructed I-39 system interchange with I-90/94, but keeps the WIS 13 interchange as its current design instead of the CTH H/WIS 13 split diamond.

The daily, and Friday PM and Sunday PM peak hour forecasts are located in Attachment O.

6.9. Interstate South Preferred Alternative 1 Build Forecasts

The Interstate South Preferred Alternative 1 includes new interchanges at Hoepker Blvd and at Milwaukee Street. It also utilizes the Alternative 1 design for the area, including the US 151 interchange, High Crossing Blvd interchange, and the American Parkway interchange.

The daily and Weekday AM, Weekday PM, Friday PM, and Sunday PM peak hour forecasts are located in Attachment P.

Attachment A
Boat/Trailer Impacts on Truck Percentages

MEMORANDUM

Boat/Trailer Impacts on Truck Percentages

Date:	August 19, 2022
Topic:	Impacts of Personal Vehicles Pulling Boats and Trailers on Truck Percentages
From:	CDMCT

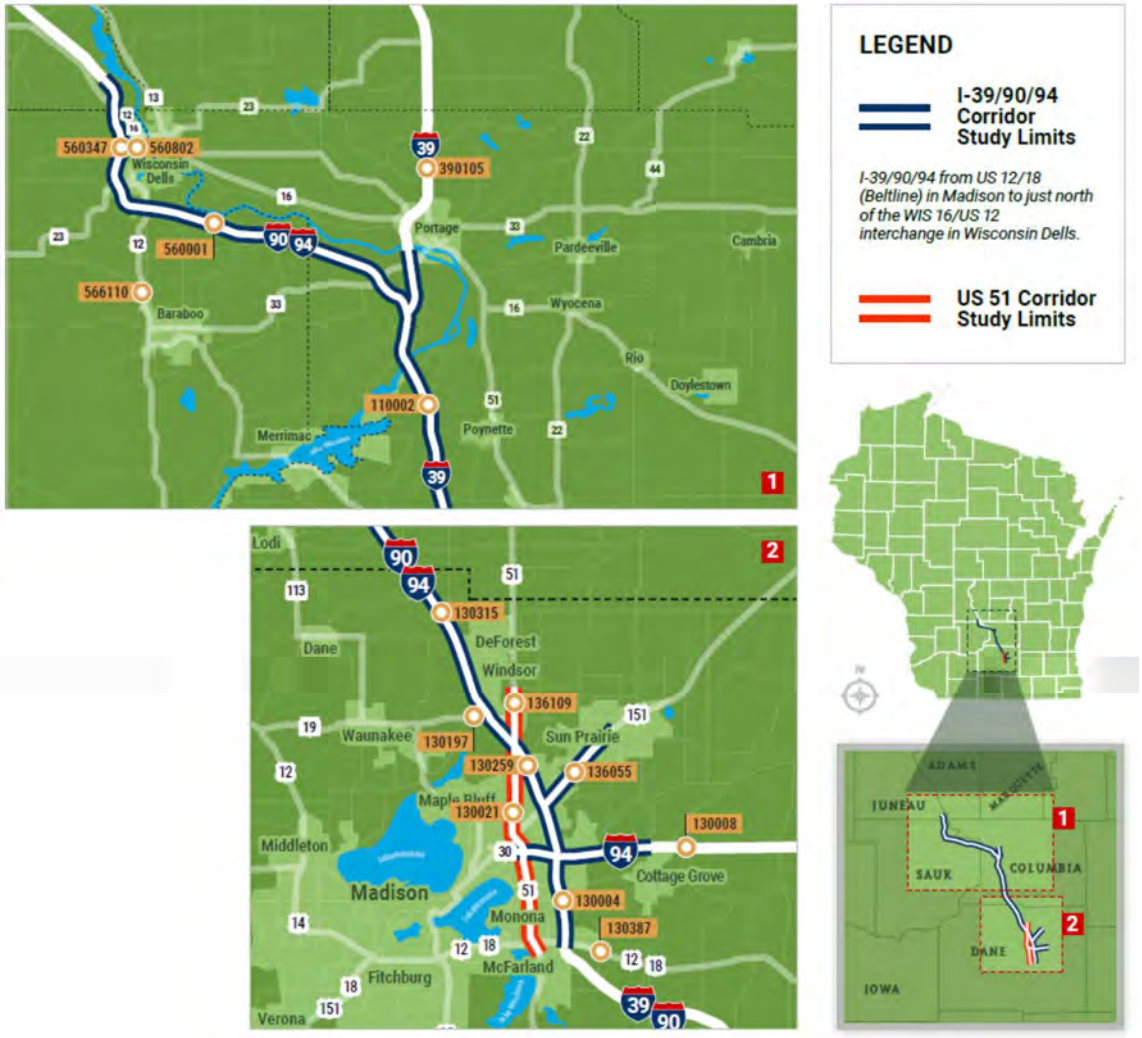
The Interstate system provides a critical transportation link for freight movements across the country. The Interstate 39/90/94 corridor serves as a route for nationwide movement and is also the primary connection between Chicago and points east with Minneapolis/St Paul and points west. Table 1 shows that annual truck percentages (total annual trucks divided by total annual vehicles) ranges from 21 to 31 percent in 2021. The location of each count site is shown in Figure 1.

Table 1 Annual Truck Percentages along I-39/90/94 in 2021

Site ID	Location	2021 Truck Percentage
110002	I-39/I-90/I-94 BTWN CTH CS & I-39/STH 78 - DEKORRA	25.3%
130005	I-39/I-90 - BTWN STH 30 AND USH 12-18 - COTTAGE GROVE	21.0%
130259	I-39/I-90/I-94 BTWN USH 151 AND USH 51- HOEPKER RD	24.8%
130315	I-39/I-90/I-94 BTWN CTH V AND STH 60 - VIENNA TNSHP	24.8%
560001	I-90/I-94 EAST OF CTH A - DELTON TNSHP	31.2%
560347	I-90/I-94 NORTH OF STH 23 DELTON TNSHP HPMS	28.3%

The truck classifications in Table 1 are calculated at these locations using the length of vehicle and the pattern of axles.

Figure 1: Traffic Count Sites



The I-39/90/94 corridor also serves a robust tourist market. Northern Wisconsin recreational areas are heavily used during weekends, particularly between Memorial Day and Labor Day. The tourist travelers are regularly hauling personal recreational equipment including boat trailers and snowmobile trailers. The existing vehicle classification counters that rely on axle patterns may classify these personal vehicles with trailers as commercial trucks. Specifically, vehicle class 8, defined as four or fewer axle single-trailer trucks, may include both commercial trucks with trailers or personal vehicles with trailers. Table 2 provides a description of each vehicle classification.

Table 2: Descriptions of Vehicle Classifications

FHWACLS1	Percent of total traffic classified as a motorcycle
FHWACLS2	Percent of total traffic classified as a passenger car
FHWACLS3	Percent of total traffic classified as other two-axle four-tire single-unit trucks
FHWACLS4	Percent of total traffic classified as a bus
FHWACLS5	Percent of total traffic classified as two-axle six-tire single-unit trucks
FHWACLS6	Percent of total traffic classified as three-axle single-unit trucks
FHWACLS7	Percent of total traffic classified as four or more single-unit trucks
FHWACLS8	Percent of total traffic classified as four or fewer axle single-trailer trucks
FHWACLS9	Percent of total traffic classified as five-axle single-trailer trucks
FHWACLS10	Percent of total traffic classified as six or more axle single-trailer trucks
FHWACLS11	Percent of total traffic classified as five or fewer axle multi-trailer trucks
FHWACLS12	Percent of total traffic classified as six-axle multi-trailer trucks
FHWACLS13	Percent of total traffic classified as seven-axle multi-trailer trucks

A video collection effort was conducted near count station 130315, located between CTH V and STH 60 near the Dane/Columbia County line. The video collection allowed for more clear classification of personal vehicles with trailers compared to trucks with trailers. Three sets of counts were conducted as noted below:

10:00 AM Wednesday, May 11 to 2:00 PM Thursday, May 12, 2022 – mid-week and prior to Memorial Day representing a non-tourist activity day. This day serves as a control for non-tourist days.

1:00 PM Thursday, May 26 to 11:59 PM Friday, May 27, 2022 – the Thursday and Friday leading into Memorial Day weekend with high northbound tourist activity

8:00 AM Sunday, May 29 to 11:59 PM Monday, May 30, 2022 – the Sunday and Monday of Memorial Day weekend with high southbound tourist activity

Table 3 provides the volumes by vehicle classification for the three count sets. Note that the axle classification method predicts vehicles classified as type 8 at a rate 103 to 434 percent greater than the video detection method. Review of video by DOT staff determined this difference is the misclassification of personal vehicles pulling trailers that are being classified by the axle method as trucks. Also note that classification 4 (buses) is counted at a higher rate using the axle method, however the overall magnitude of vehicles is lower than class 8. It should be noted that some of the class 4 (buses) difference may be due to a known issue with traffic counts that can misidentify class 5 vehicles as class 4 vehicles, however both class 4 and 5 are represented in the 2D bin in WisPAVE, so this issue has no effect on pavement design.

Overall truck percentage is calculated by summing the total vehicles in classes 4 through 13 and dividing by the total vehicles counted. The non-tourist days on May 11th and 12th show a difference in overall truck percentage between the two count methods of 1.14 percent, well within expected accuracy for vehicle classification. The tourist days of May 26 through May 30 show a difference between the count methods of 5.19 percent in the northbound direction and 3.4 percent in the southbound direction. The bulk of that difference is from vehicle class 8, indicating the misclassification of personal vehicles with trailers as trucks with trailers is impacting the reported truck percentage.

Table 3: Video and Axle Classification County Data at 130315, May 2022

Date	5/11/2022			5/26-27/2022			5/29-30/2022		
Direction	SB			NB			SB		
Data Source	Video	Axle	%Diff	Video	Axle	%Diff	Video	Axle	%Diff
Class 1	96	76	-20.8%	581	64	-89%	321	230	-28%
Class 2	17,629	18,328	4.0%	48,719	47,881	-2%	62,130	61,684	-1%
Class 3	5,168	4,947	-4.3%	14,890	13,536	-9%	14,828	14,156	-5%
Class 4	64	420	556.3%	96	444	363%	48	174	263%
Class 5	909	986	8.5%	1,365	2,106	54%	845	1,414	67%
Class 6	295	234	-20.7%	414	314	-24%	156	122	-22%
Class 7	50	42	-16.0%	71	69	-3%	6	2	-67%
Class 8	362	736	103.3%	848	3,600	325%	510	2,723	434%
Class 9	8,236	8,328	1.1%	8,421	8,866	5%	4,311	4,422	3%
Class 10	150	107	-28.7%	149	123	-17%	61	47	-23%
Class 11	286	272	-4.9%	359	376	5%	28	37	32%
Class 12	161	166	3.1%	115	140	22%	39	52	33%
Class 13	2	6	200.0%	0	72	n/a	1	17	1600%
Total Vehicles	33,408	34,648	3.7%	76,028	77,591	2%	83,284	85,080	2%
Total Trucks (4-13)	10,515	11,297	7.4%	11,838	16,110	36%	6,005	9,010	50%
Truck Percentage	31.47%	32.61%		15.57%	20.76%		7.2%	10.6%	

Note that the tourist activity is focused on the northbound direction on Fridays and southbound on Sundays (or Mondays for Memorial Day and Labor Day). This leads to a limited number of days per year that the misclassification of personal vehicles with trailers is impacting the truck percentage value calculated using the axle classification method. In a given year, approximately 15 weeks fall within the Memorial Day to Labor Day window. Assuming two days of counts are impacted per direction per summer weekend, then 30 days per year are experiencing a bias in the truck percentages. While vehicle counts on these weekend days are higher than average daily counts, the net effect on overall average truck percentage is expected to align with the 330 non-tourist days which show little overall difference in total truck percentages between the two collection methods.

Operational analysis conducted during the Friday and Sunday peak tourist days should consider the noted shift in traffic from trucks with trailers to personal vehicles with trailers. The overall length of the total vehicle and trailer is not anticipated to vary greatly between the two vehicle types, therefore, the impacts to traffic operations are not anticipated to be significant.

Attachment B
COVID Impacts on Corridor Traffic

MEMORANDUM

COVID Pandemic Impacts on Corridor Traffic

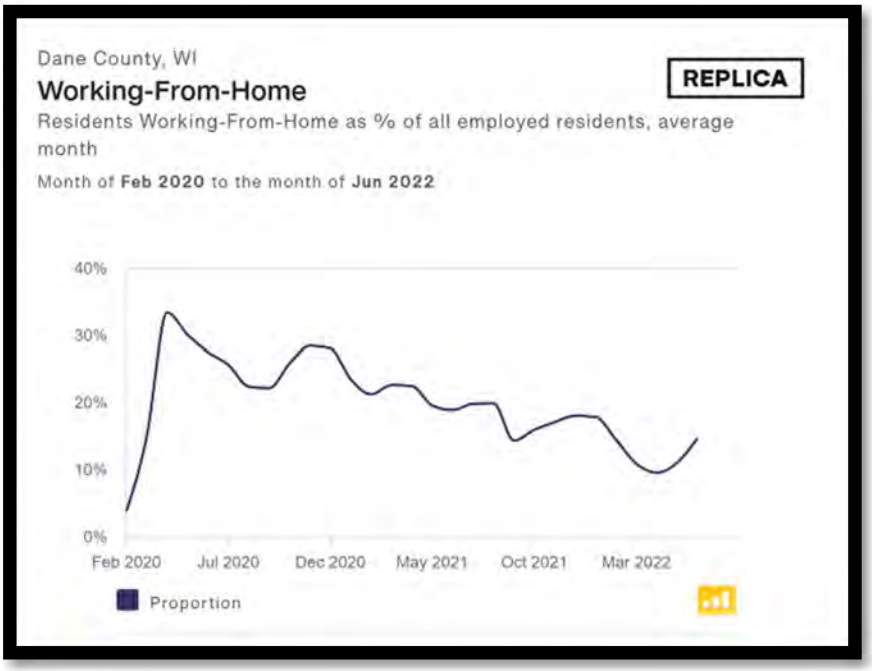
Date:	August 9, 2022
Topic:	Impacts of COVID Pandemic on Corridor Traffic Patterns and Volumes
From:	CDMCT

The COVID-19 pandemic impacted traffic volumes throughout the US including the Interstate 39/90/94 and US 51 corridors. These two facilities serve different travel markets with the Interstate system serving a combination of regional commuters, long distance travelers and freight movements while the US 51 corridor is utilized by commuters and travelers to local businesses. These travel markets have responded differently to the pandemic in both volume reductions and subsequent volume recoveries.

Continuous traffic count sites along the Interstate and US 51 corridors provide insight into the traffic volume patterns along each corridor as shown below. Interstate corridor volumes have recovered to 2019 pre-pandemic volumes while US 51's 2021 volumes are 10-15% below pre-pandemic volumes.

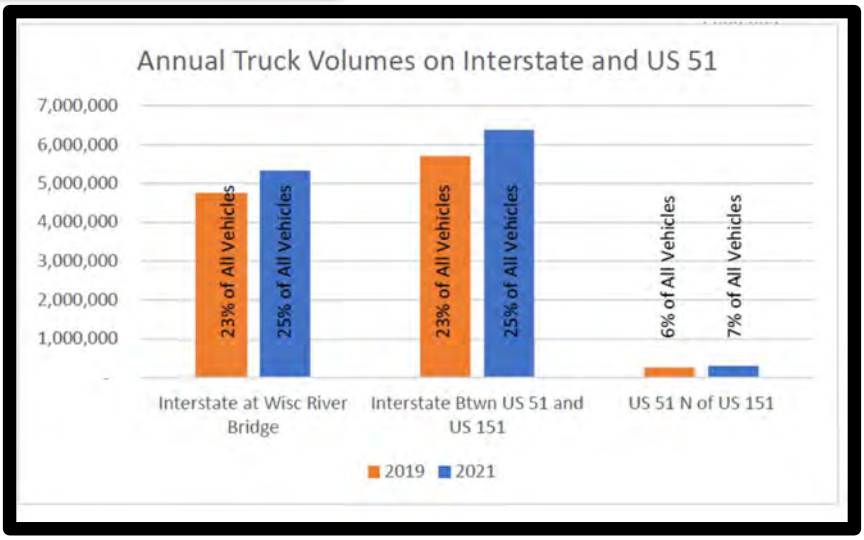
Average Daily Traffic Volumes by Year

Facility	Location	2019	2020	2021	% Recovery
Interstate	N of US 12/18 (Beltline), Dane Cty	97,500	79,500	92,500	95%
Interstate	Btwn US 51 and US 151, Dane Cty	71,200	62,000	72,000	101%
Interstate	Dane/Columbia Cty Line	59,100	50,400	58,400	99%
Interstate	Wisc River Bridge, Columbia Cty	56,900	49,100	58,100	102%
Interstate	Wisconsin Dells, Sauk Cty	42,900	36,200	43,400	101%
US 51	S of US 12/18 (Beltline), Dane Cty	28,900	23,200	25,900	90%
US 51	N of US 151, Dane Cty	15,200	12,100	12,800	84%



Replica data shown in the figure to the left reveals that the portion of Dane County residents Working From Home peaked during the pandemic lockdown and have not yet returned to pre-pandemic levels. The lower commuter volumes have impacted US 51, which more directly serves commuters compared to the varied uses of the Interstate.

Total truck volumes along both the Interstate and US 51 corridors have increased 12-16% between the 2019 and 2021 data, consistent with national trends of increased product shipping. This results in trucks representing a slightly higher portion of total traffic as shown in the figure to the right.



Interstate 39/90/94 volumes have returned to pre-pandemic levels as increased truck volumes have offset the lagging commuter volumes. Those lagging commuter volumes more dramatically impact the US 51 corridor resulting in the delayed recovery of volumes from pre-pandemic values and a determination to delay traffic analysis on the US 51 corridor until 2022 counts are collected.

Attachment C
Land Use Meeting Notes

Notes regarding Statewide Model Housing, Employment and Project Updates for I-39/90/94 Study

Sauk County – phone conversation with Patrick Gavinski, provided high resolution mapping on 6/9, awaiting details from Melanie PlattGibson (608-963-3871)

Call on 7/11 with Melanie: Melanie noted Baraboo's large housing growth planned for next 5 years with upwards of 3000 housing units planned. Melanie initiated discussions with Tim McCumber and Tom Diehl regarding Lake Delton growth, no major housing planned. Melanie was going to follow up with Tim and Tom for employment growth related to TIF/TID. Melanie to review housing and employment growth maps provided to determine if any updates are required.

Columbia County - phone conversation, awaiting details

Table of roadway projects provided on 6/24 by Chris Hardy. Housing and employment data coordination initiated with Kurt Calkins. Discussed project with Renee Johnson of Columbia County Planning and Zoning. Columbia County noted their recent plan update include coordination with townships within the Interstate study limits. Provided detailed mapping of housing and employment for review. Received email from Columbia County on August 12 concurring with housing and employment values for 2050 model.

Juneau County – left message (along with email), awaiting details

With limits of project pulling back to US 12/STH 16 interchange and discussions with Town of Lyndon, no further outreach was conducted.

City of Wisconsin Dells 6/3/22 Chris Tollaksen

Exit 87 and Trout Road is the focus of upcoming development. 75 new multifamily units going in currently, another 150 anticipated in next 5-6 years. There is room for more development but nothing planned, including plans for hotel and commercial development. City is interested in pushing WIS 13 through to CTH H to open area for more development.

60 housing units on E side of Wis Dells, in area originally planned for new high school.

Jerry reviewed 2050 SE data in SW model, new HS was located in the E side. Needs to be relocated to the NW portion of city as it was built there a couple years back.

WIS 13 north of town, plans for 30-40 housing units.

No roadway projects identified.

6/29/22 - Nutura discussed via email. Restaurant for 300 seats plus rooms, but no specifics available.

City of Portage 6/6/22 Phil Livingston

Philip provided a list of resurfacing projects for Portage on 6/17. Reconstruction projects have not been identified as of 6/17.

Meeting with Steve Sobiek to discuss SE data info on 7/13. Steve noted employment growth anticipated for north side of Portage, consistent with statewide model numbers. Housing was also discussed with agreement in the areas and general magnitudes of growth identified by the statewide model.

City of Baraboo 6/6/22 Casey Bradley

3000 new housing units anticipated for Baraboo in next 5+ years.

281 new HH on WIS 33 east of town

500-700 in downtown area, specifics include:

Vine-Walnut 150

Lynn & River 66

2nd&3rd, near Broadway – 100-200 apartments

4th/5th/Ash/Oak – 100-200, the employment here to be split and moved, half to WIS 136/Sauk(Old 12?) and half to east side new fire station

12/CTH W, west of interchange, 300 units plus hotel, restaurant, gas station, mixed use, new VA clinic (15k sf)

12/CTH W east of interchange, hotel by pizza ranch

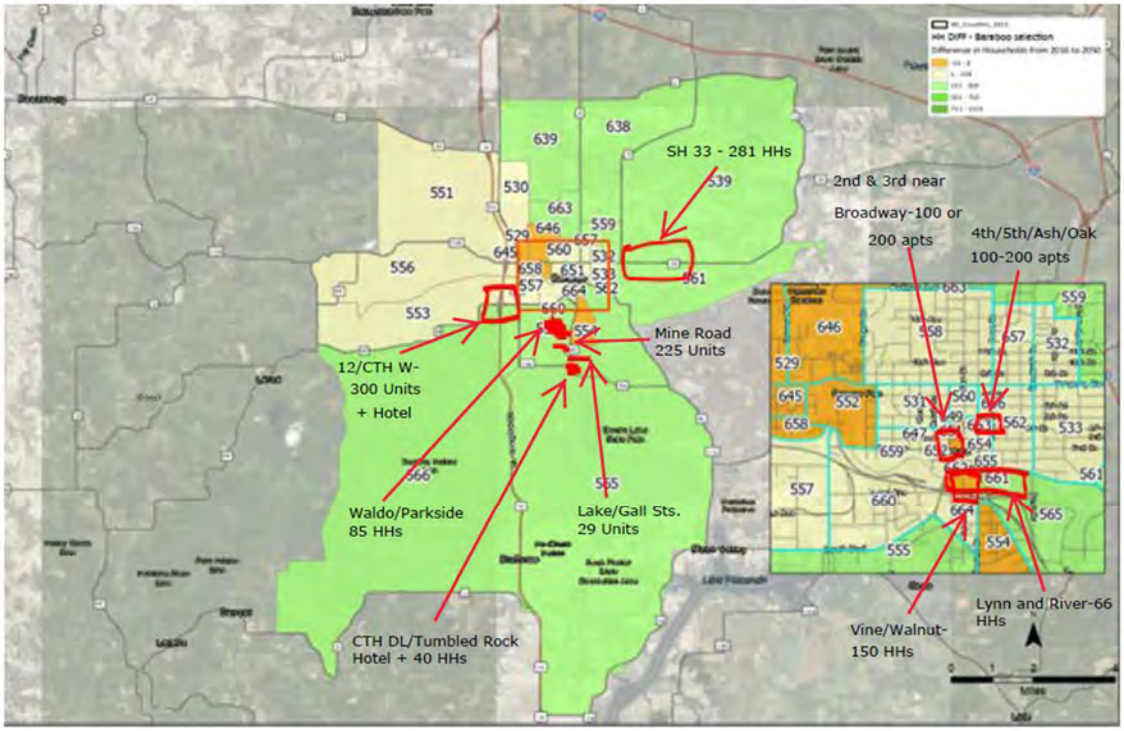
Waldo/Parkside, 85 new HH

Mine Road – 225 units

CTH DL/Tumbled Rock, hotel & 40 HH

Lake St/Gall – 29 units

STH 33 speed reduction on east side of town to 25 mph. Other Roadway projects were primarily local in nature to connect to the new developments.



Village of Lake Delton – Tim McCumber, last contact 6/13/22. Tim provided info to Melanie Platt Gibson from Sauk County which was included in notes identified above.

Town of Fairfield – email from Mark Steward, Town chariman on 6/13 indicating: "There are no plans for increased housing or employment in the Town. Road projects remain as resurfacing projects. No new roads or bridges are planned at this time."

Town of Delton – email from Deb Kowakle, town clerk on 6/13: " [W]e [the town of Delton] have no way of knowing or even guessing what the projections might be on any of these issues. Please keep us informed on any of these issues that will effect the Town of Delton in the future. If you have further suggestions or wish to discuss this further, please let me know."

Town of Arlington – no response, covered by Columbia County review.

Town of Caledonia – no response, covered by Columbia County review.

Town of Dekorra – no response, covered by Columbia County review.

Town of Lyndon – S. Mitchell, call 6/6/2022

No roadway or development projects to note. Sent summary email and graphics showing housing and employment growth along with WisDOT 6 year transportation projects map for reference.

Attachment D
Statewide Model Input Updates

MEMORANDUM

Input Updates to Statewide Travel Demand Model

Date:	August 29, 2022
Topic:	Statewide Travel Demand Model Input Updates
From:	CDMCT

1. Introduction

The Wisconsin Department of Transportation (WisDOT) is conducting a study of the Interstate 39/90/94 (I-39/90/94) corridor. The study includes developing new traffic forecasts for the I-39/90/94 between Wisconsin Dells and Madison. The limits of I-39/90/94 extend from Sauk County through Columbia County and into Dane County. WisDOT's traffic forecasting policy notes the use of travel demand models to develop future year traffic projections. Due to the geographic limits of the I-39/90/94 study, both the Dane County travel demand model (DCTDM) and Wisconsin's Statewide travel demand model (STDM) are used in traffic forecasting. This memo gives a brief overview of the updates that were made to the model sets.

2. Input Updates

The CDMCT developed mapping showing the DCTDM and STDM housing and employment values by transportation analysis zone (TAZ), along with future transportation improvements. The housing and employment growth maps were circulated to project stakeholders along the extent of the corridor. Details pertaining to changes noted in housing are available in the Baraboo Housing Memo.

The stakeholders noted edits need for the STDM. The Greater Madison Metropolitan Planning Organization (GMMPO) maintains the housing and employment data for the DCTDM. GMMPO provided the most recent input data for the DCTDM, however the DCTDM data is an input into the STDM and required reformatting and recalculation to comply with STDM format and required attributes. Changes were made to four different .xlsx files for updates in statewide models and one .xlsx file for the Dane County specific model.

The two main districts in Wisconsin that needed to be adjusted for the corridor model updates were District 2 (Dane County), and District 11 (Sauk and Columbia Counties). Before the updates were made, Dane County's employment numbers were last updated for the model in 2021. Baraboo's Housing counts were performed this year, but the corridor model for Baraboo needed to be tweaked to represent our client's estimates more accurately. A new school district in Wisconsin Dells had also been relocated to a new high school location, and those changes between TAZs had not been accounted for, so changes were made to get those enrollment numbers in the correct location. And, after the employment numbers were updated for Dane County, an additional TAZ had to have their employment numbers updated.

Files Updated:

- Dane_SE_2050 (Dane County Specific File)
- DIST_ALL_NAIC_2050 (Lists all the Wisconsin Counties, Districts with NAICS Industry Codes)
- NAICS_2050 (List all NAICS Industry Code Counts per TAZ)
- SE_2050_totals (Lists Statewide Totals for each County, District, and TAZ)

- Wisconsin_All_District_2050 (Similar to the SE_2050_totals file)

2.1. Updates to the Baraboo Housing Numbers in the Statewide Housing Model files

Based on the recommendations from the Sauk County/Baraboo Housing Memo, the household number additions to Baraboo were updated in each of the respective TAZs for all the 2050 Statewide Model Files (Dane_SE_2050 not included). The district specific file (d11_SE_2050) was updated to include these numbers as well. The additional household counts were added to the five specific TAZs (539, 555, 561, 565, & 566) specified in the Baraboo Housing memo for each of the files. The original housing data file (Baraboo_Housing.xlsx) which showed 2016 base year counts and 2050 projections was updated by manually hardcoding the additional housing counts into each respective TAZ, and then linked using the equals function to each Statewide Model spreadsheet so that the housing counts could be easily updated for every file without having to copy and paste data repetitively. Based on the recommendations, a total of 1,000 households were added to the Statewide and district specific model files.

2.2. Updates to the Employment Numbers for the Statewide and Dane County Models

Since the employment numbers per TAZ have changed for the 2050 projections, each of the Statewide Model files and the Dane County file were updated to include these changes. The new employment numbers were already calculated beforehand in the NAICS_2050 file. In the NAICS 2050 file, the changes in employment numbers per TAZ were grouped by NAICS industry codes. The process for updating was by grouping these different codes into basic industry groups (Service, Retail, Manufacturing, etc.) and calculating a sum for each industry group. We used the NAICS_2050 file's proportions and applied them to the DIST_ALL_NAIC_2050 file via the copy/paste method. We also used the NAICS_2050 file and applied it to the Dane_SE_2050 file for the county specific model using that same method. Any missing numbers or extra information was accounted for, as well as numbers by SV and WV category (SV10, SV20, SV30). SV denotes the combination of the size of household and the number of vehicles they own, while WV denotes the combination of workers and vehicles, and the numbers next to WV (WV10, WV21) denote how many workers live at each residence and how many vehicles each of workers own. For example, if it reads WV12, that means there is a certain percentage of households with one worker and two vehicles in that TAZ. For the SV and WV fields, we would link those to the spreadsheet with all the updated data and have them read out as percentages, not have them copied and pasted for each spreadsheet. For spreadsheet files with missing fields, we would calculate a combined percentage of one field already in the spreadsheet and the field not in the spreadsheet. For the Wisconsin_All_District_2050 and SE_2050_totals files, the sums for each industry group were calculated via a simple equals function which would link the new employment counts in the NAICS_2050 and DIST_ALL_NAICS_2050 files to the other two spreadsheets.

2.3. Relocation of School District Population Counts between TAZs for the Statewide Model

The Wisconsin Dells High School had moved to a recently opened and constructed building near the US 12 Corridor, which is in a different TAZ than where it was located previously. Although the current counts are correct (1,012 enrolled in the school district), all Statewide Model files had to be updated to include the relocation of the counts from one TAZ to another. For each of the files updated to include these numbers, the SCHENR (reflecting school enrollment) column was updated. Calculations for these updates were done on a separate tab for each statewide model excel file, and then copied or linked back to other statewide model spreadsheets.

2.4. Updates to Employment Numbers in the Industry and Retail NAICS Sectors for TAZ 1076 (Dane County)

Later in the process, new updates in employment numbers in TAZ 1076 needed to be accounted for in the statewide model and Dane County specific files. TAZ 1076 is in a triangular boundary, marked by the interstate (going diagonally from Northwest to Southeast) as the area's hypotenuse, US 51 which runs north to south forming the eastern boundary, and WIS 19 which runs east to west serving as the northern boundary. In terms of land-use categorization, this triangular area is mostly office industrial. This area characteristically caters to truckers and delivery drivers as there are many large industrial distribution centers and warehouses such as Pepsi-Cola Center of Madison, North American Mechanical, and Badger State Freight. The retail and service sectors in this area are tied to the industrial/manufacturing sector here, as many of the stores and services cater to truck drivers or other employees that travel far distances on a regular basis. Those stores include smaller auto-repair shops, tire shops, and auto parts stores, as well as travel-based retail with hotel chains, chain restaurants, and Gander RV of Madison. As such, most of the trips generated in and around this area are trucks and other larger vehicles. Destination choices from office industrial settings such as this are usually Home-Based Work Trips, shopping trips, or other trips.

Starting with the SE_2050_totals file, an update tab (usually titled updates_1076) would be added to show the mathematical process of changes made to the employment numbers for the zone, and then that data would be copied back to the main data tab on the same spreadsheet. All copied data would then be linked to all the other spreadsheets (NAICS_2050, DIST_ALL_NAIC_2050, Dane_SE_2050, and Wisconsin_All_District_2050) that needed the same update via the equals function on excel. For these updates, an additional 232.5 jobs were added to the industry sector and an additional 273 jobs were added to the Retail sector as per recommendations from GMMPO.

The Dane County model's input socio-economic file was also updated to include the additional employment. The employment numbers were updated based on the already existing employment in the TAZ and tied to the NAICS industry codes. The changes to employment numbers in the statewide model files were simple increases in counts based on the specific industry codes for the Retail and Industrial sectors. Employment numbers were only updated for those two categories, which accurately reflect the majority of employment in TAZ 1076.

3. Statewide Model Results

Table 1and Table 2 below provide a summary of the change in model inputs for Districts 2 and 11.

Table 1: District 2 Housing and Employment Totals

Category	Before Updates	After Updates	Difference
Households	333,229	347,785	+14,556
Retail Emp.	96,985	58,039.26	-38,945.74
Service Emp.	263,178	315,394.67	+52,216.67
Total Emp.	452,720	470,769.83	+18,049.83
Emp. per HH	1.36	1.35	-0.01
School Enrollment	109,466	109,466	0

Table 2: District 11 Housing and Employment Totals

Category	Before Updates	After Updates	Difference
Households	144,538	145,538	+1,000
Retail Emp.	40,730	40,730	0
Service Emp.	34,207	34,207	0
Total Emp.	175,027	175,027	0
Emp. per HH	1.21	1.20	-0.01
School Enrollment	46,045	46,405	0

3.1. Trip Balancing

Ultimately, the number of attractions within a geographic area should be equivalent to the number of productions so that each production has exactly one attraction with a factor of 1.00. Travel demand models will scale the number of attractions to equal the number of productions.

3.2. Trip Balancing Table Overall

Due to the geographic scale of the STDM, the balancing of attractions to productions is done at a regional scale for multiple geographies independently. The STDM balances attractions by trip purpose to force attractions to equal productions within geographic areas defined by the Bureau of Economic Analysis (BEA). The BEA that includes Columbia, Dane and Sauk counties is shown in Figure 1 below. Increasing housing in this area will increase trip productions which will result in an equal increase in attractions, even with no change in employment.

Figure 1: BEA 101

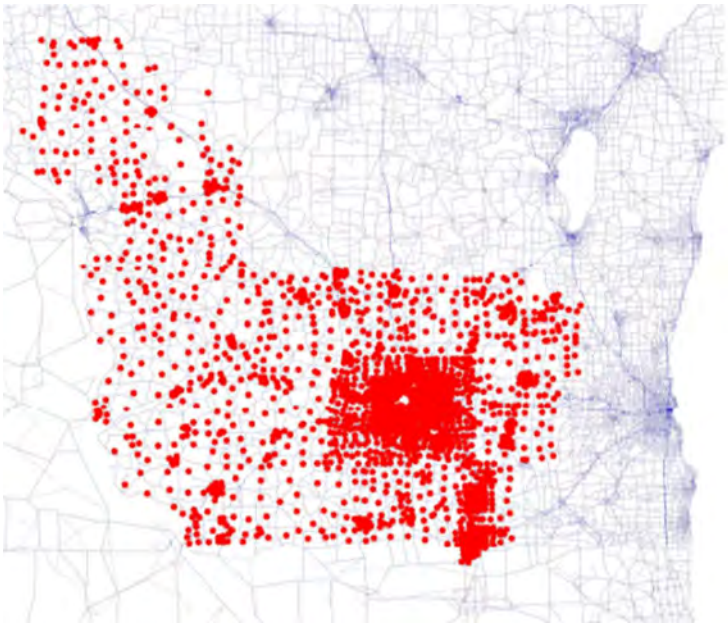


Table 3 shows the resulting number of trip productions and attractions prior to trip balancing for BEA 101. Note the increase in productions for each trip purpose. Trip attractions did not increase for all purposes prior to balancing based on the changes in employment used in the Dane County area. Balancing attractions to productions results in an increase in trip attractions despite an initial calculation of lower attractions based on employment. This also results in an increase in trips between the original and updated input sets for TAZ that did not have a change in employment data due to the attractions being balanced to a higher total to align with overall production increases.

Table 3: Trip Productions and Attractions with Original and Updated Socio-Economic Data

	Original			Updated		
Type	**Productions**	**Attractions**	**Factor**	**Productions**	**Attractions**	**Factor**
HBW	1,157,937	1,078,588	1.073567	1,401,007	1,066,781	1.313304
HBSHOP	911,171	987,219	0.922967	934,874	770,680	1.21305
HBSCH	406,050	217,657	1.865549	416,512	218,717	1.904337
HBO	1,541,347	1,365,532	1.128752	1,583,777	1,317,393	1.202206
NHB	1,883,803	1,928,423	0.976862	1,939,354	1,627,723	1.191452
UNIV	147,680	12,375	11.9337	158,773	12,375	12.83011
TOTALS	6,047,987	5,589,794	1.08197	6,434,296	5,013,669	1.283351

*HBW = Home Based Work Trips, HBSHOP = Home Based Shopping Trips,

HBSCH = Home Based School Trips, HBO = Home Based Other Trips, NHB = Non Home Based Trips,

UNIV = University Based Trips

4. Network Edits

Minor edits were made to the STDM input geodatabases used to create the model networks. The two specific locations include:

4.1. US 12 interchange in Lake Delton

The 2017 STDM assignments at the US 12 interchange with I-90/94 in Lake Delton were initially showing two ramp movements with zero traffic movements. Figure 2 shows the on the left side of the figure that southbound US 12 to westbound I-90/94 and the eastbound I-90/94 exit to northbound US 12 both had zero traffic assignment. A review of shortest paths in the area indicated that trips to/from the north or west of the WIS 23 interchange with I-90/94 were using US 12 through Lake Delton rather than using the subject ramps and I-90/94. The centroid connection to zone 10379 was modified to provide an effective route to US 12 just north of I-90/94, consistent with the actual access provided at Meadow View Court as shown in Figure 3.

The modified geodatabase was rerun through the STDM with revised results available on the right side of Figure 2. The resulting traffic assignments are non-zero and similar in magnitude to published AADT as shown in Figure 3.

Figure 2: 2017 STDM Assignments at US 12 interchange with I-90/94 in Lake Delton

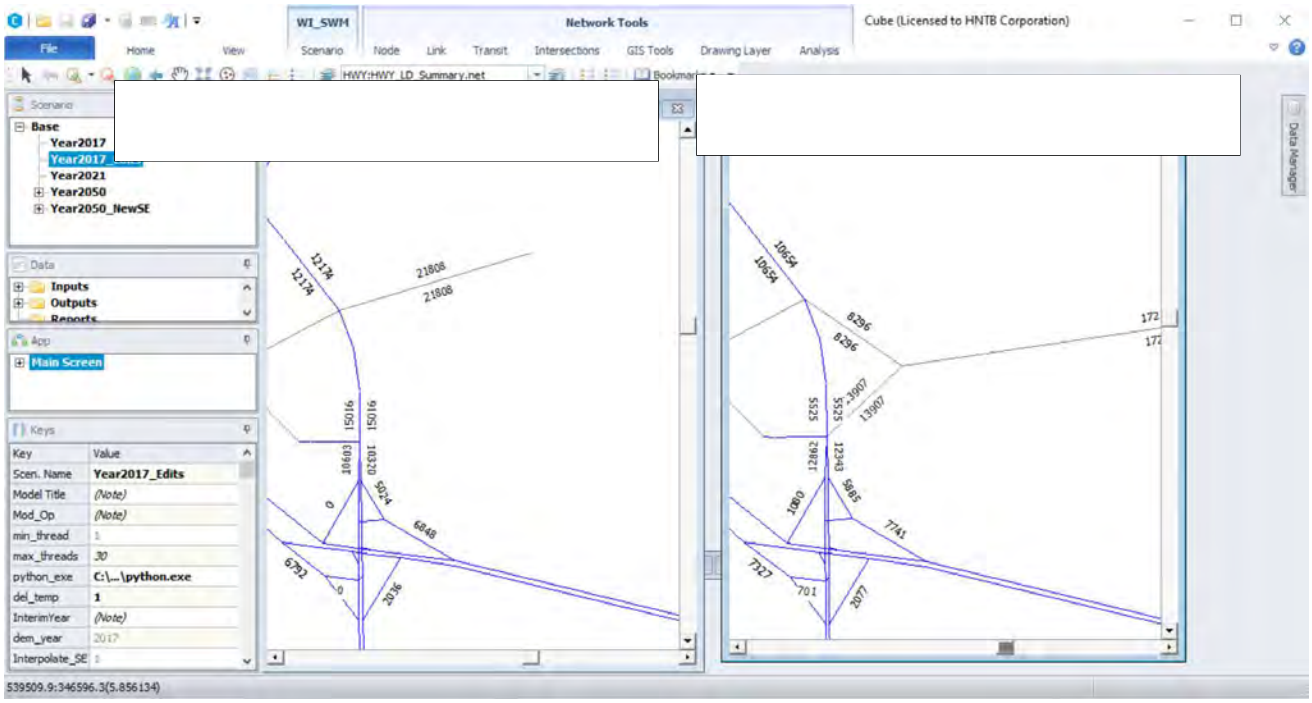
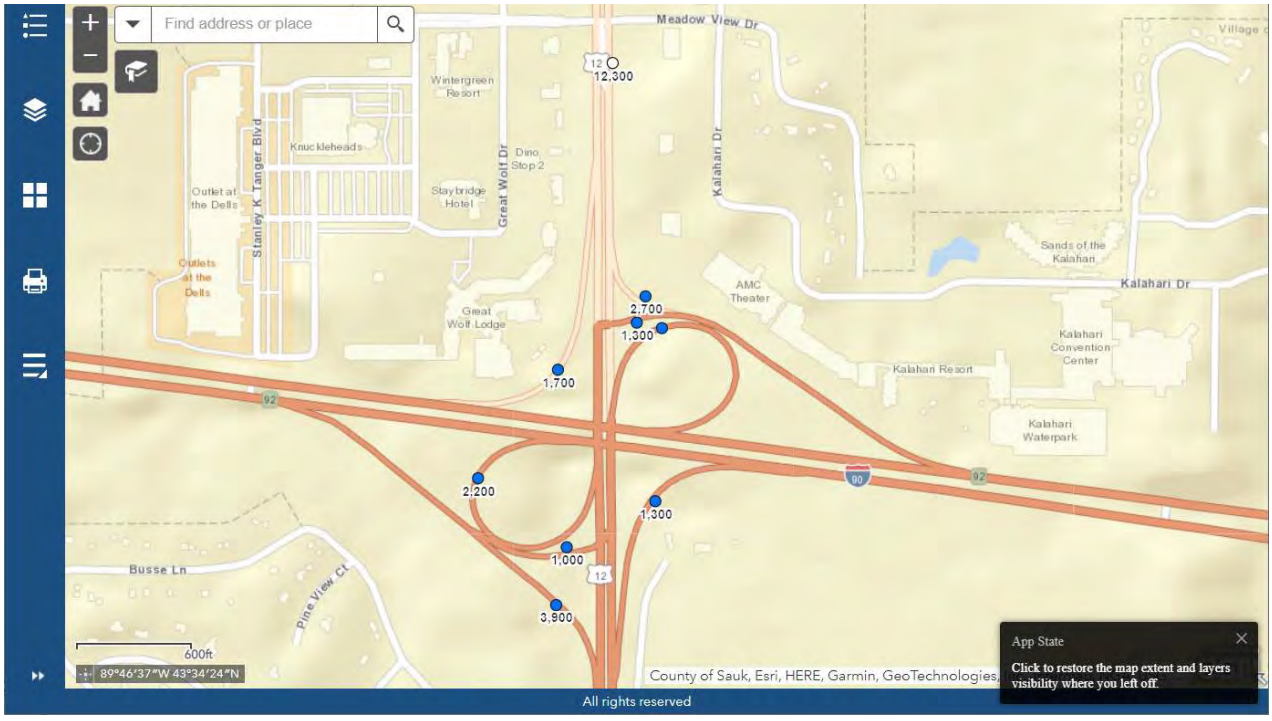


Figure 3: Traffic counts and street map in area of US 12 interchange with I-90/94 in Lake Delton



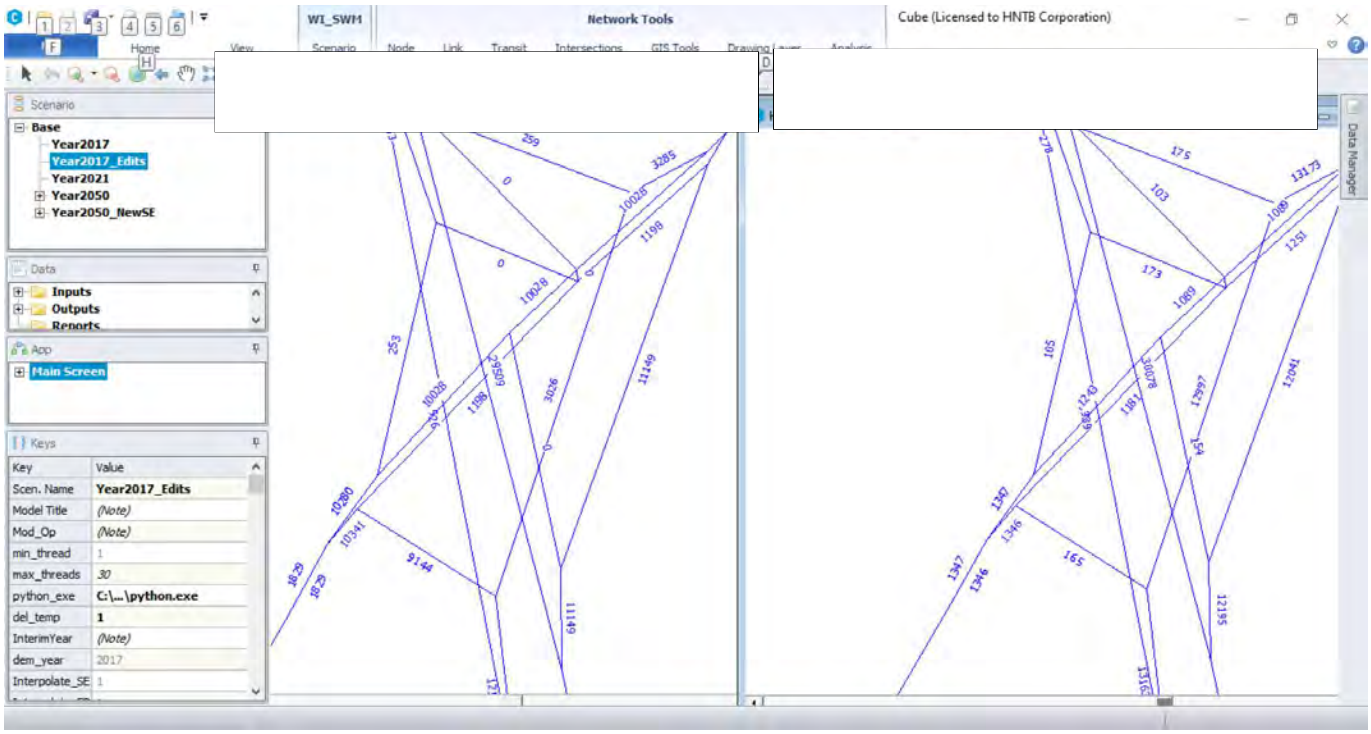
4.2. I-39/90/94 system interchange south of Portage

The 2017 STDM assignments at the I-39 interchange with I-90/94 south of Portage indicated an issue with how the southbound I-39 to south/eastbound I-39/90/94 movement was routed. The original geodatabase coded the system ramps that carry I-39 as service ramps with a speed of 35 miles per hour. The southbound mainline of I-39 that becomes WIS 78 was coded as interstate with a speed of 65 miles per hour. The left side of Figure 4 shows that this speed differential resulted in southbound I-39 traffic routing along WIS 78 then making a U-turn at the Petro gas station and returning north to enter I-39/90/94 as the service ramp. Modifying the link classification of both the I-39 system ramps and the segment of WIS 78 within the system interchange addressed the mis-routing as shown on the right side of Figure 4.

A second modification in the area was made to provide local access between zone 1111 and WIS 78. The initial geodatabase provided access only to CTH U. Local trips in the vicinity of the system interchange were forced to use CTH U and Cascade Road interchange with I-39. The modified access at 1111 allows those trips to use WIS 78 and the local ramps at the system interchange as shown in Figure 4.

A final modification was made to incorporate a turn prohibitor along WIS 78 at the transition from a median divided to undivided roadway south of the entrance ramp to southbound I-39/90/94. The divided roadway network in the model allowed for U-turn type movements. This provided an unrealistically shorter path than using the eastbound exit ramp to northbound I-39.

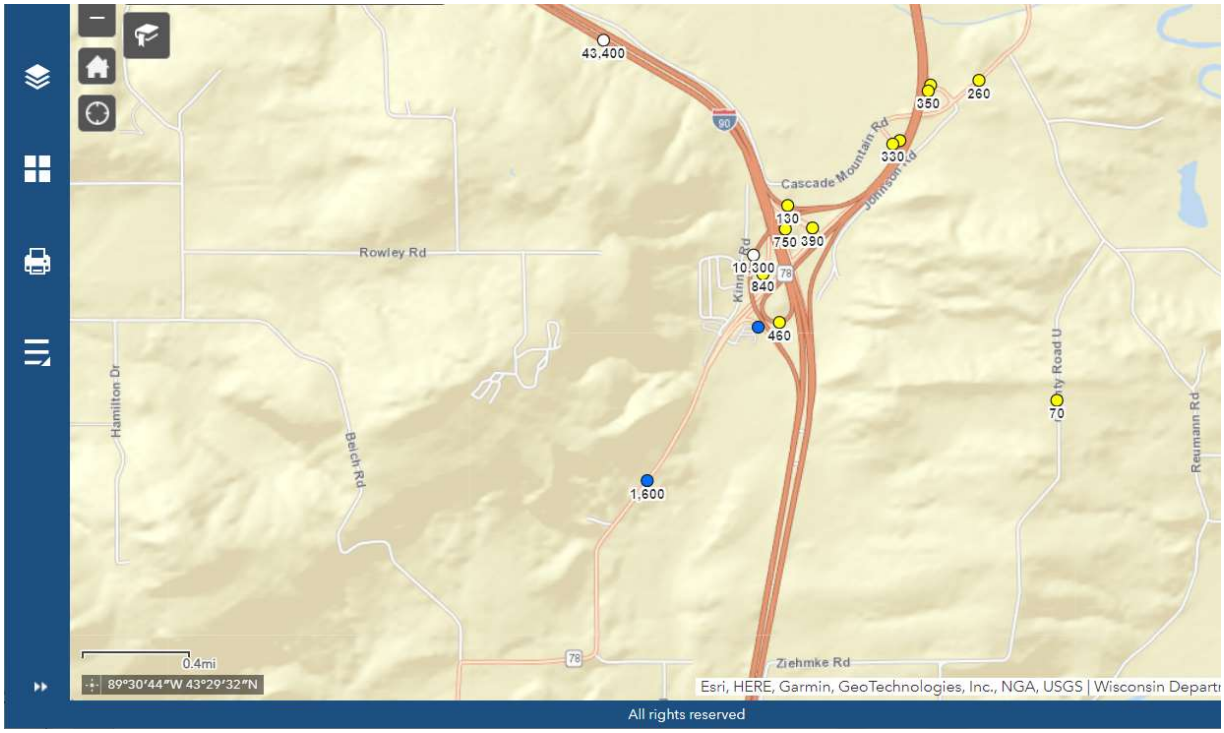
Figure 4: 2017 STDM Assignments at I-39 interchange with I-90/94 south of Portage



Traffic counts shown in **Error! Not a valid bookmark self-reference.** indicate the modified functional classification of the I-39 ramps, the modified access to zone 1111 and the turn prohibition along WIS 79 provide improved assignments in the system interchange area. Assignments for movements between I-90/94 to the northwest and

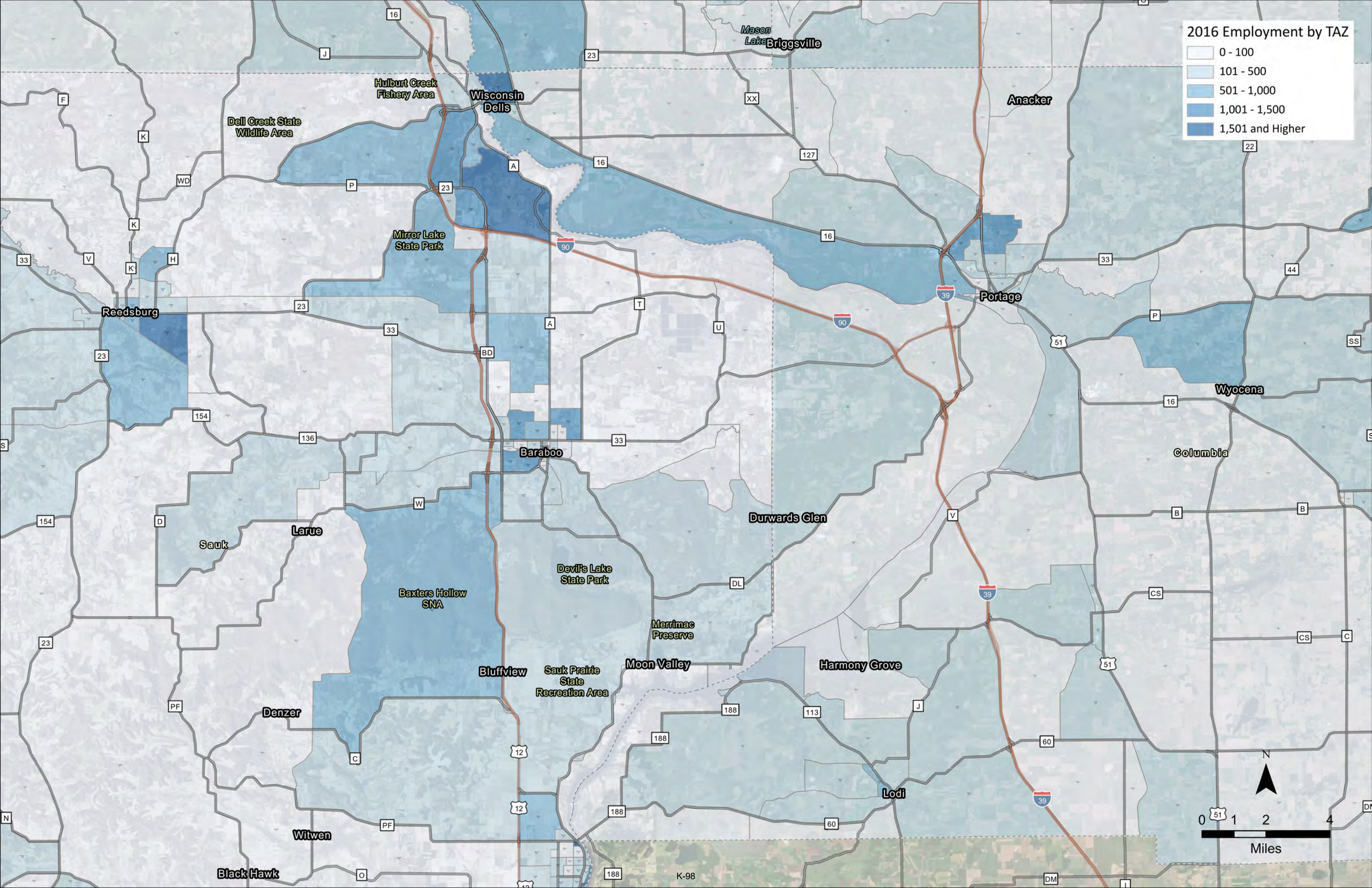
I-39 are lower than counts due to WIS 33 providing a faster route that the model assignments utilize compared to actual drivers who are not aware of WIS 33's connection between I-39 and I-90/94. Initial assignments on CTH U to the south and east of the system interchange were approximately 800 vehicles per day while the published count is under 100. The modified access at zone 1111 brought assignments on CTH U to under 100 vehicles per day.

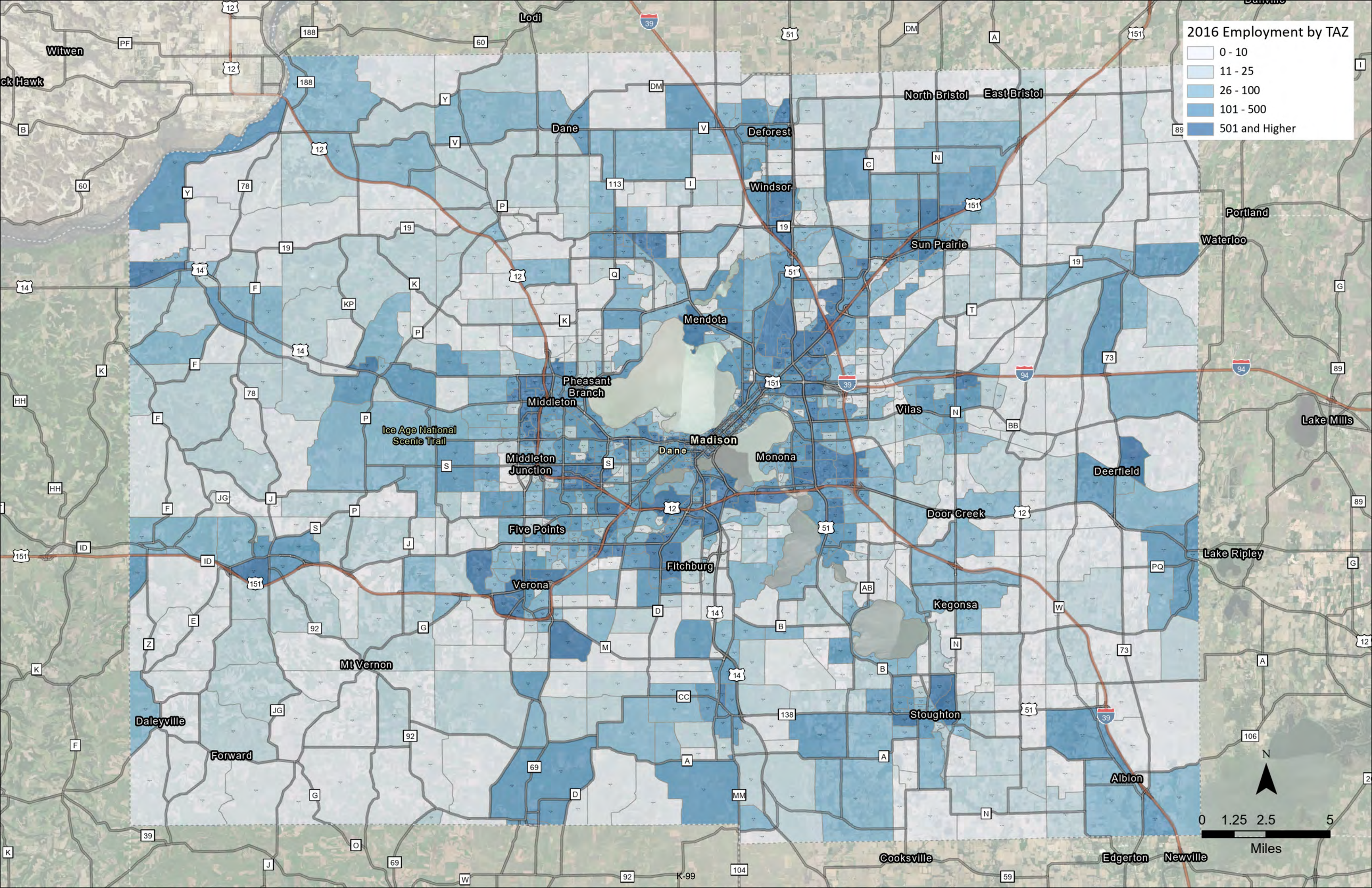
Figure 5: Traffic counts and street map in area of I-39 interchange with I-90/94 south of Portage



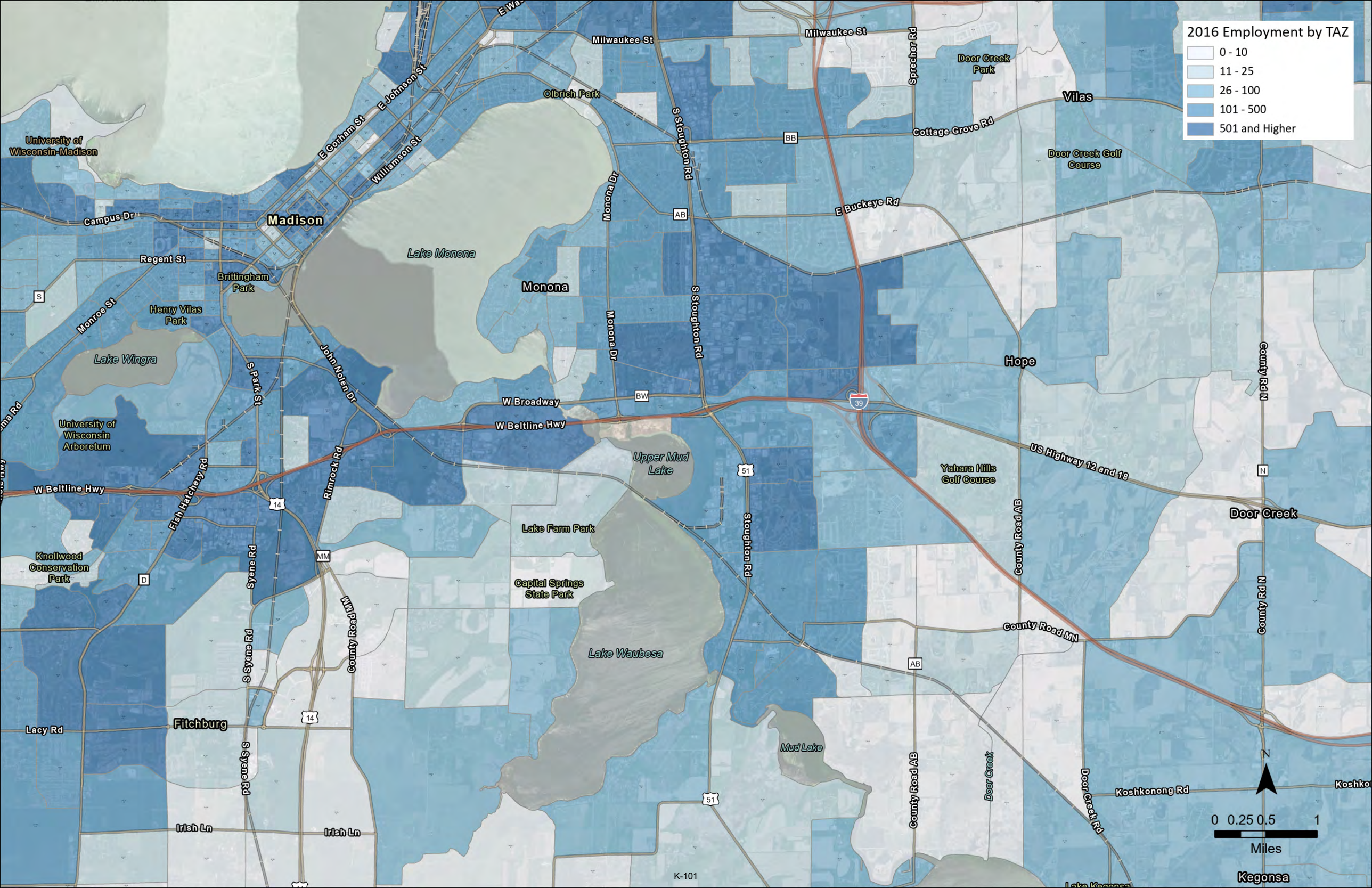
Attachment E
Land use mapping

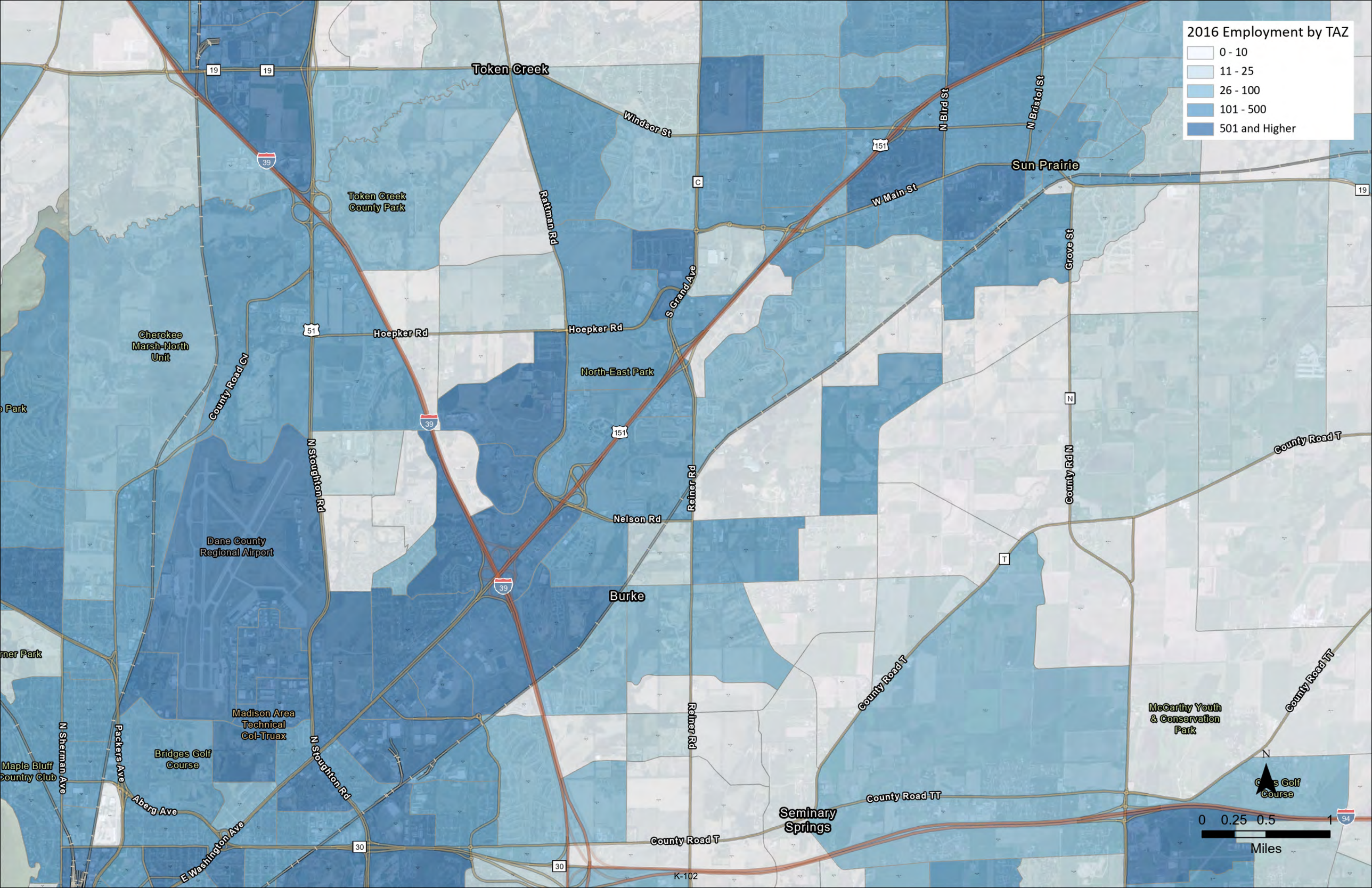
2016 Employment by TAZ
0 - 10
11 - 25
26 - 100
101 - 500
501 and Higher
Lake Mendota
Lake Monona
Lake Wingra
Madison
Monona
University of Wisconsin-Madison
University Hospital
Madison Area Technical Col-Truax
Bridges Golf Course
Maple Bluff Country Club
Demetral Field
Tenney Park
Hudson Park
Olbrich Park
East Morland Park
Heistand Park
Brittingham Park
James Madison Park
Goodman Park
Turville Point Conservation Park
Quann Park
Alliant Energy Center
Duane F Bowman Park
Harvey E Schmidt Park
Hoyt Park
Forest Hill Cemetery
Resurrection Cemetery
Glenway Municipal Golf Course
Edgewood College
SSM Health St. Mary's Hospital – Madison
Monona Municipal Golf Course
Edna Taylor Conservation Park
Roselawn Memorial Park
Anderson St
Aberg Ave
Lexington Ave
Burke Ave
Commercial Ave
Webb Ave
Union St
Atwood Ave
Langdon St
Linden Dr
Campus Dr
University Ave
W Johnson St
E Main St
Williamson St
Spaight St
Regent St
Rowley Ave
Van Hise Ave
Monroe St
Nichols Rd
Douglas Trl
Acacia Ln
Owen Rd
W Dean Ave
E Dean Ave
E Buckeye Rd
Hegg Ave
Drexel Ave
Maher Ave
Turner Ave
Camden Rd
Helgesen Dr
Leo Dr
Femrite Dr
E Broadway
W Broadway
Waunona Way
W Beltline Hwy
Tulane Ave
Onyx Ln
Retana Dr
Garnet Ln
Meadowlark Dr
Topaz Ln
Dempsey Rd
Atlas Ave
S Stoughton Rd
Johns St
Oak St
N 5th St
Winnebago St
E Washington Ave
N Sherman Ave
Ruskin St
Huxley St
Sheridan Dr
Farwell Dr
Lien Rd
Lake Mendota Dr
Edgehill Dr
Oxford Rd
Locust Dr
University Ave
Harvey St
Price Pl
Hillcrest Dr
Larkin St
Commonwealth Ave
Keyes Ave
Adams St
S Randall Ave
S Mills St
John Nolen Dr
N Wingra Dr
S Park St
Bram St
Tonyawatha Trl
Winneguah Rd
Bridge Rd
Monona Dr
Progress Rd
Dairy Dr
Agriculture Dr
Daniels St
Vondron Rd
Ellen Ave
Keating Ter
Owen Dr
Toepfer Ave
S Midvale Blvd
Odana Rd
Council Crst
Yuma Dr
Monona Rd
Ames St
Lake Mendota Dr
Edgehill Dr
Oxford Rd
Locust Dr
University Ave
Harvey St
Price Pl
Hoyt Park
Hillcrest Dr
Larkin St
Commonwealth Ave
Keyes Ave
Monroe St
Adams St
S Randall Ave
S Mills St
John Nolen Dr
N Wingra Dr
S Park St
Bram St
Tonyawatha Trl
Winneguah Rd
Bridge Rd
Monona Dr
Progress Rd
Dairy Dr
Agriculture Dr
Daniels St
Vondron Rd
Ellen Ave
Keating Ter
Owen Dr
Toepfer Ave
S Midvale Blvd
Odana Rd
Council Crst
Yuma Dr
Monona Rd
Ames St
0 0.25 0.5
Miles
N
30
39
BB
K-97

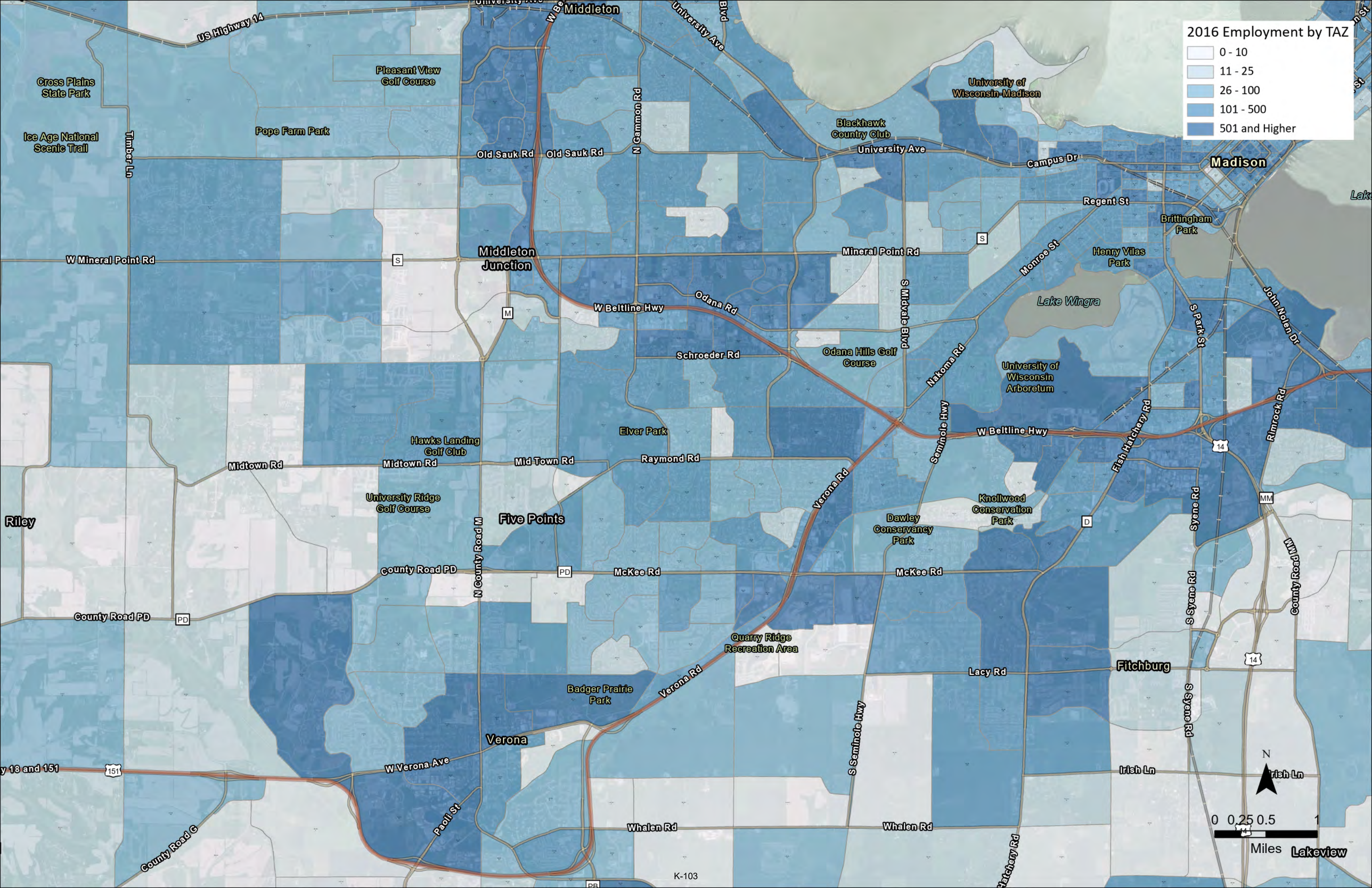

2016 Employment by TAZ
0 - 100
101 - 500
501 - 1,000
1,001 - 1,500
1,501 and Higher
Mason Lake
Briggsville
Hulburt Creek Fishery Area
Wisconsin Dells
Anacker
Dell Creek State Wildlife Area
Mirror Lake State Park
Reedsburg
Portage
Wyocena
Baraboo
Columbia
Durwards Glen
Larue
Sauk
Devil's Lake State Park
Baxters Hollow SNA
Merrimac Preserve
Bluffview
Sauk Prairie State Recreation Area
Moon Valley
Harmony Grove
Denzer
Lodi
Witwen
Black Hawk
K-98
N
0 1 2 4
Miles

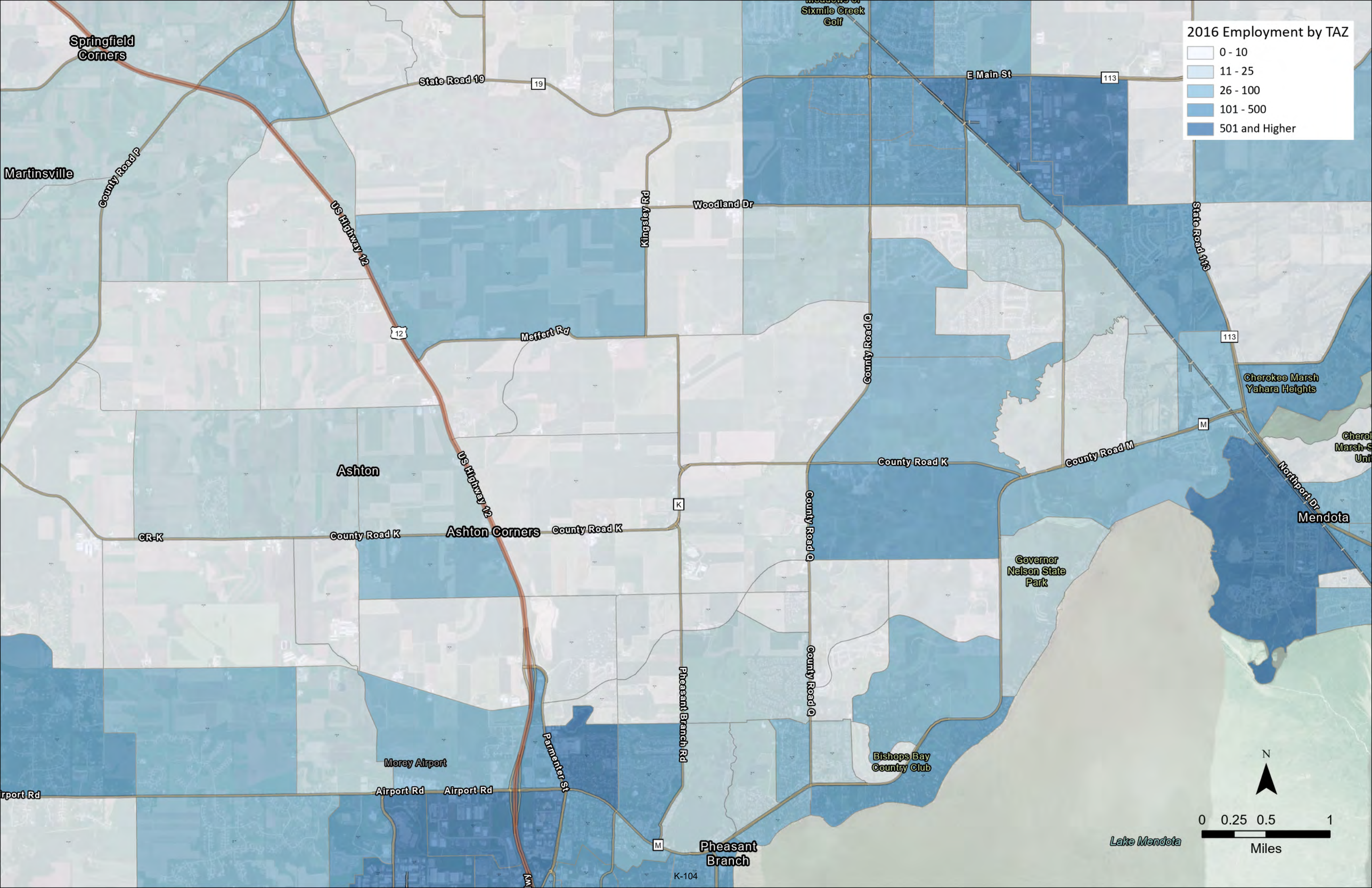

2016 Employment by TAZ
0 - 10
11 - 25
26 - 100
101 - 500
501 and Higher
Lodi
Witwen
Dane
Deforest
North Bristol
East Bristol
Windsor
Sun Prairie
Portland
Waterloo
Mendota
Pheasant Branch
Middleton
Ice Age National Scenic Trail
Madison
Middleton Junction
Monona
Vilas
Lake Mills
Deerfield
Door Creek
Five Points
Fitchburg
Verona
Lake Ripley
Kegonsa
Mt Vernon
Stoughton
Daleyville
Forward
Albion
Cooksville
Edgerton
Newville
K-99
N
0 1.25 2.5 5
Miles

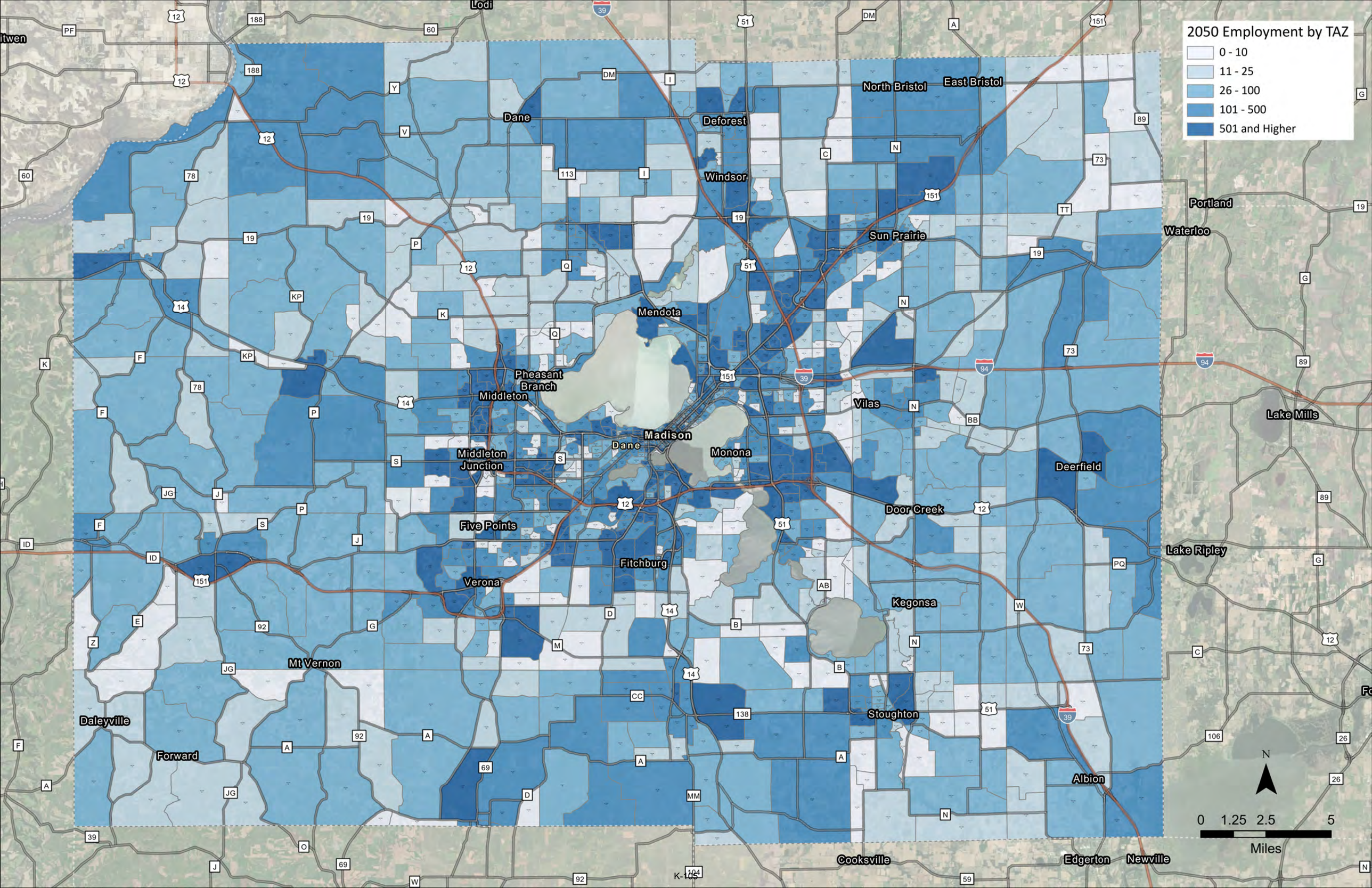
2016 Employment by TAZ
0 - 10
11 - 25
26 - 100
101 - 500
501 and Higher
Lake Mendota
Lake Monona
Lake Wingra
Madison
Monona
Maple Bluff Country Club
Bridges Golf Course
Madison Area Technical Col-Truax
Demetral Field
Tenney Park
Hudson Park
Olbrich Park
East Morland Park
Heistand Park
James Madison Park
University of Wisconsin-Madison
University Hospital
Brittingham Park
Edgewood College
SSM Health St. Mary's Hospital – Madison
Glenway Municipal Golf Course
Resurrection Cemetery
Forest Hill Cemetery
Hoyt Park
Goodman Park
Turville Point Conservation Park
Quann Park
Alliant Energy Center
Duane F Bowman Park
Harvey E Schmidt Park
Monona Municipal Golf Course
Edna Taylor Conservation Park
Roselawn Memorial Park
Anderson St
Lien Rd
N Stoughton Rd
Lexington Ave
Myrtle St
Burke Ave
Commercial Ave
Webb Ave
Union St
Sheridan Dr
Farwell Dr
N Sherman Ave
Ruskin St
Huxley St
Packers Ave
N 5th St
Oak St
Winnebago St
Atwood Ave
E Washington Ave
Garnet Ln
Onyx Ln
Meadowlark Dr
Retana Dr
Topaz Ln
Dennett Dr
Johns St
Dempsey Rd
Atlas Ave
S Stoughton Rd
Lake Mendota Dr
Edgehill Dr
Oxford Rd
Observatory Dr
University Ave
Langdon St
E Main St
Williamson St
Spaight St
Locust Dr
Harvey St
Campus Dr
Kendall Ave
Van Hise Ave
Regent St
Rowley Ave
Price Pl
Hillcrest Dr
Larkin St
Commonwealth Ave
Keyes Ave
Monroe St
Adams St
S Randall Ave
S Mills St
John Nolen Dr
N Wingra Dr
S Park St
Bram St
Monona Dr
Hegg Ave
Drexel Ave
Maher Ave
Buckeye Rd
Turner Ave
Camden Rd
E Buckeye Rd
Vondron Rd
Ellen Ave
Helgesen Dr
E Dean Ave
W Dean Ave
Tonyawatha Trl
Nichols Rd
Douglas Trl
Acacia Ln
Owen Rd
Winnequah Rd
Bridge Rd
Daniels St
Progress Rd
Dairy Dr
Agriculture Dr
Femrite Dr
Waunona Way
W Broadway
E Broadway
W Beltline Hwy
Leo Dr
Keating Ter
Ames St
Odana Rd
Council Crst
Yuma Dr
Toepfer Ave
S Midvale Blvd
S Owen Dr
Price Pl
Ferry Bay Club
30
39
BB
K-100
N
0 0.25 0.5
Miles

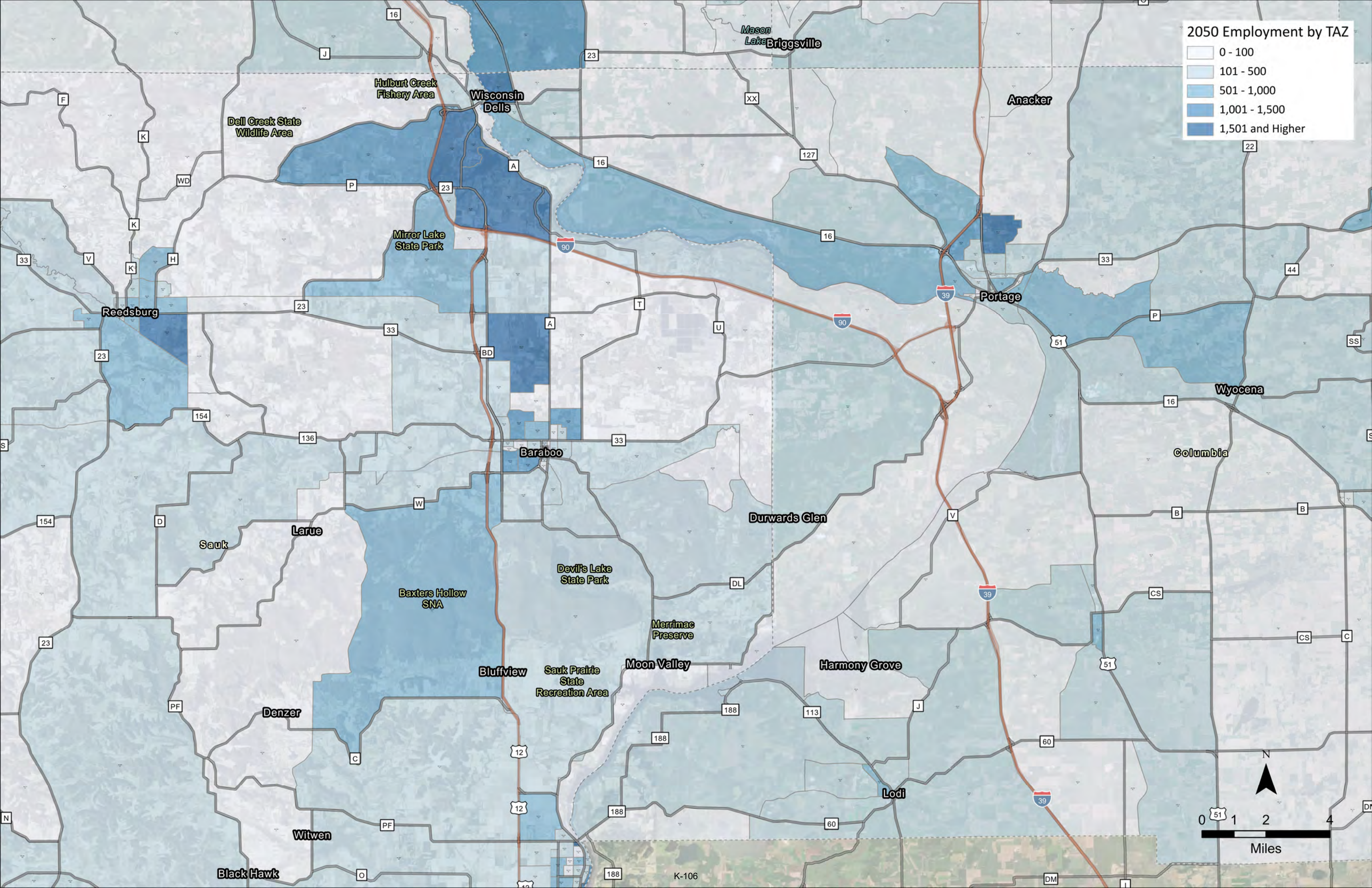

2016 Employment by TAZ
0 - 10
11 - 25
26 - 100
101 - 500
501 and Higher
Milwaukee St
Olbrich Park
Sprecher Rd
Door Creek Park
Vilas
Cottage Grove Rd
Door Creek Golf Course
University of Wisconsin-Madison
E Gorham St
E Johnson St
Williamson St
S Stoughton Rd
BB
Monona Dr
AB
E Buckeye Rd
Campus Dr
Madison
Regent St
Brittingham Park
Lake Monona
Monona
S
Monroe St
Henry Vilas Park
Lake Wingra
John Nolen Dr
S Park St
Hope
W Broadway
BW
39
W Beltline Hwy
University of Wisconsin Arboretum
Upper Mud Lake
51
US Highway 12 and 18
Yahara Hills Golf Course
N
County Rd N
Door Creek
Rimrock Rd
Fish Hatchery Rd
14
Lake Farm Park
Knollwood Conservation Park
D
Syene Rd
MM
Capital Springs State Park
County Road MM
Lake Waubesa
County Road MN
AB
Lacy Rd
Fitchburg
Mud Lake
County Road AB
Door Creek
Door Creek Rd
Koshkonong Rd
Irish Ln
Irish Ln
K-101
Kegonsa
N
0 0.25 0.5 1
Miles

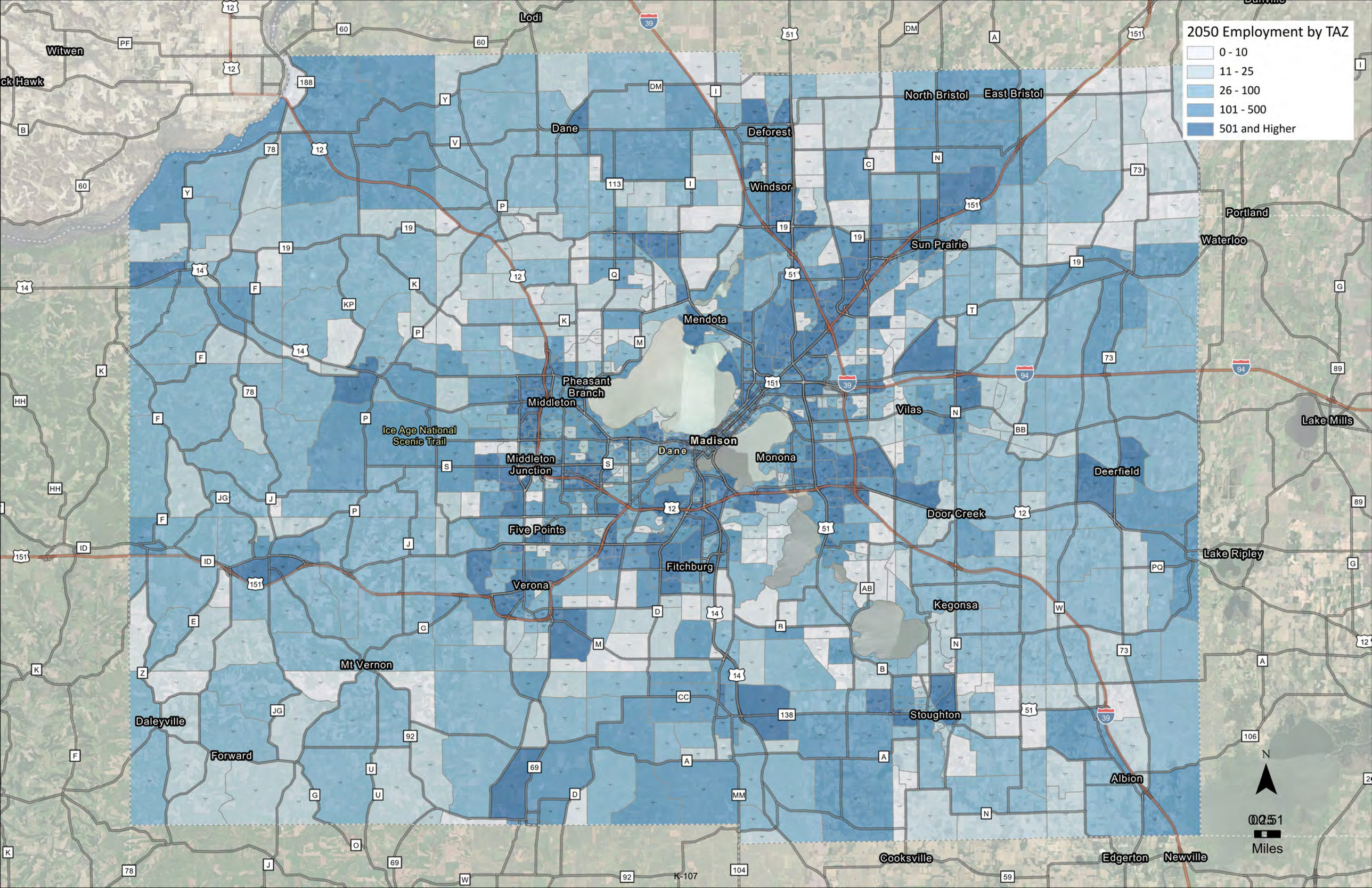

2016 Employment by TAZ
0 - 10
11 - 25
26 - 100
101 - 500
501 and Higher
Token Creek
Windsor St
Token Creek County Park
Rattman Rd
C
N Bird St
N Bristol St
151
Sun Prairie
W Main St
Grove St
19
S Grand Ave
Hoepker Rd
Hoepker Rd
51
Cherokee Marsh-North Unit
North-East Park
County Road CV
39
N Stoughton Rd
Nelson Rd
Reiner Rd
County Rd N
County Road T
Dane County Regional Airport
Burke
T
Madison Area Technical Col-Truax
Bridges Golf Course
Packers Ave
N Sherman Ave
Aberg Ave
E Washington Ave
30
Reiner Rd
County Road T
McCarthy Youth & Conservation Park
County Road TT
Seminary Springs
94
K-102
N
0 0.25 0.5 1
Miles


2016 Employment by TAZ
0 - 10
11 - 25
26 - 100
101 - 500
501 and Higher
US Highway 14
Middleton
University Ave
Cross Plains State Park
Pleasant View Golf Course
University of Wisconsin-Madison
Ice Age National Scenic Trail
Timber Ln
Pope Farm Park
Old Sauk Rd
N Gammon Rd
Blackhawk Country Club
University Ave
Campus Dr
Madison
Regent St
Brittingham Park
W Mineral Point Rd
Middleton Junction
Mineral Point Rd
Monroe St
Henry Vilas Park
W Beltline Hwy
Odana Rd
S Midvale Blvd
Lake Wingra
John Nolen Dr
S Park St
Schroeder Rd
Odana Hills Golf Course
Nakoma Rd
University of Wisconsin Arboretum
Seminole Hwy
Fish Hatchery Rd
Rimrock Rd
Elver Park
Hawks Landing Golf Club
Midtown Rd
Mid Town Rd
Raymond Rd
University Ridge Golf Course
Five Points
N County Road M
Verona Rd
Dawley Conservancy Park
Knollwood Conservation Park
Syene Rd
County Road MM
Riley
County Road PD
McKee Rd
Quarry Ridge Recreation Area
Fitchburg
Lacy Rd
Badger Prairie Park
S Seminole Hwy
S Syene Rd
Verona
W Verona Ave
Irish Ln
Paoli St
Whalen Rd
County Road G
N
0 0.25 0.5 1
Miles
Lakeview

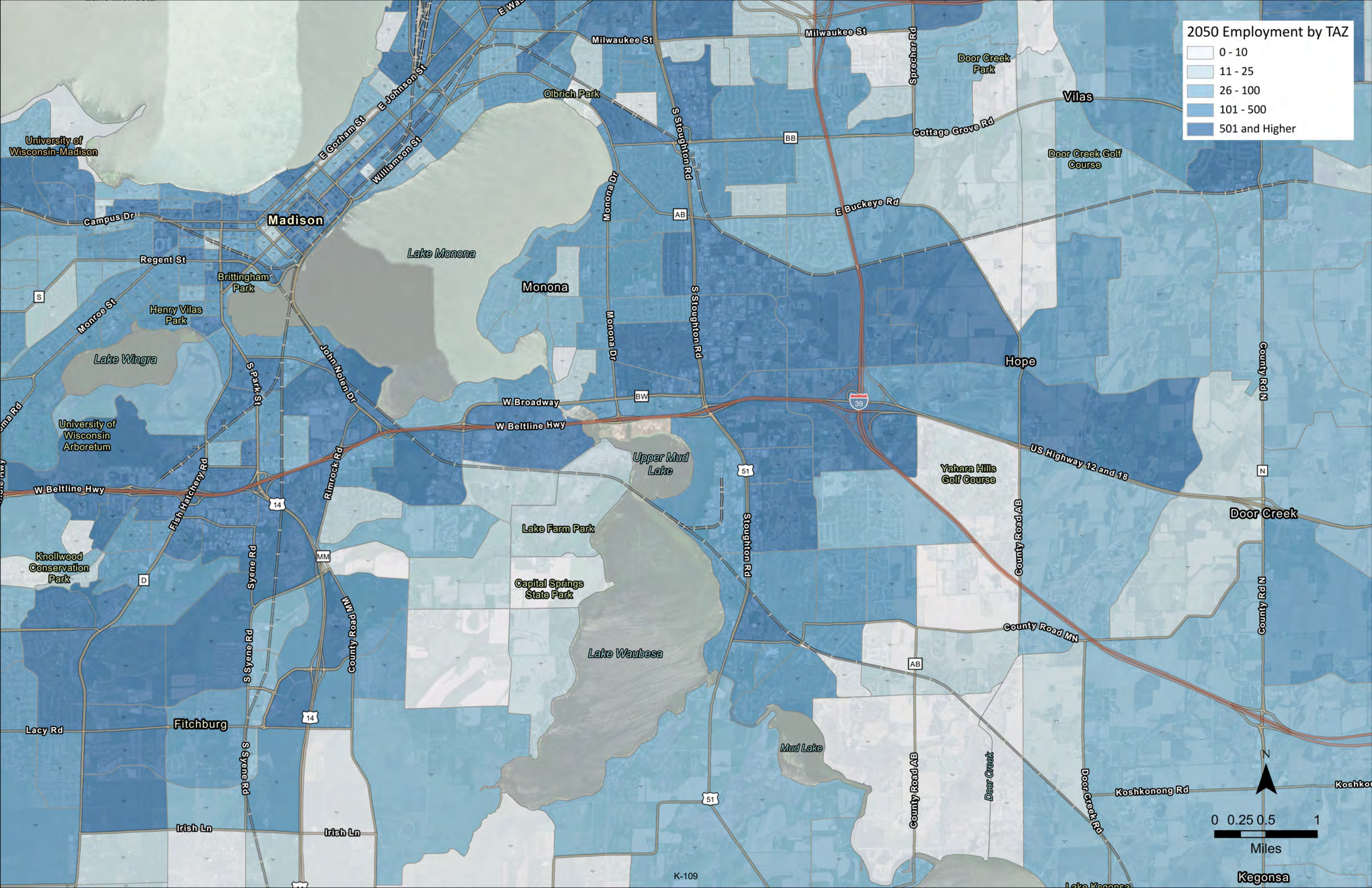

2016 Employment by TAZ
0 - 10
11 - 25
26 - 100
101 - 500
501 and Higher
Springfield Corners
Martinsville
County Road P
State Road 19
19
US Highway 12
12
Kingsley Rd
Woodland Dr
Meffert Rd
Sixmile Creek Golf
E Main St
113
State Road 113
County Road Q
Cherokee Marsh Yahara Heights
M
Ashton
CR-K
County Road K
Ashton Corners
K
County Road M
Northport Dr
Mendota
Governor Nelson State Park
Pheasant Branch Rd
Parmenter St
Morey Airport
Airport Rd
Bishops Bay Country Club
Pheasant Branch
K-104
Lake Mendota
N
0 0.25 0.5 1
Miles

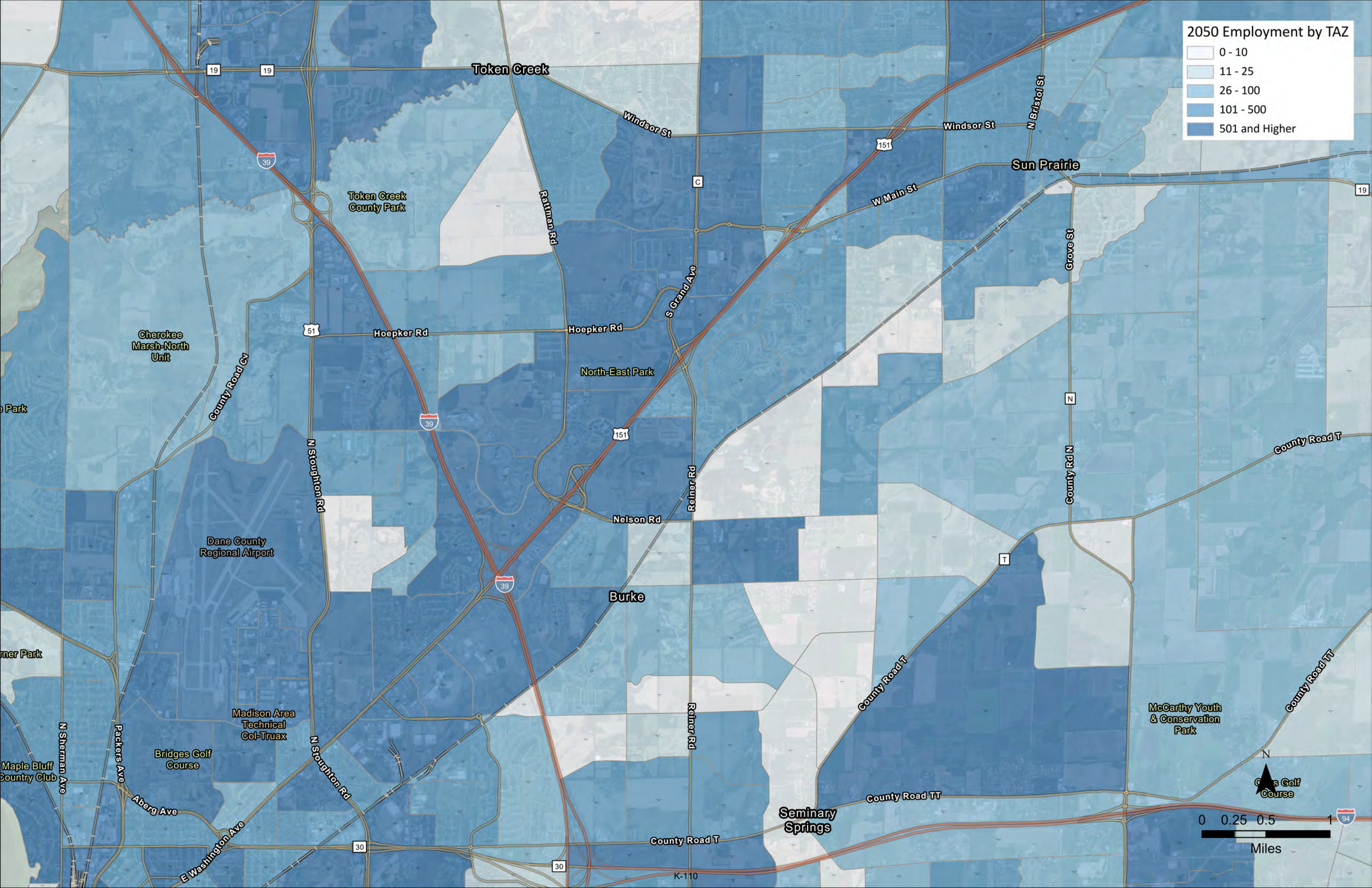

2050 Employment by TAZ
0 - 10
11 - 25
26 - 100
101 - 500
501 and Higher
Lodi
Dane
Deforest
North Bristol
East Bristol
Windsor
Sun Prairie
Portland
Waterloo
Mendota
Pheasant Branch
Middleton
Madison
Middleton Junction
Monona
Vilas
Deerfield
Door Creek
Lake Ripley
Lake Mills
Five Points
Fitchburg
Verona
Kegonsa
Stoughton
Mt Vernon
Daleyville
Forward
Albion
Cooksville
Edgerton
Newville
K-105
N
0 1.25 2.5 5
Miles

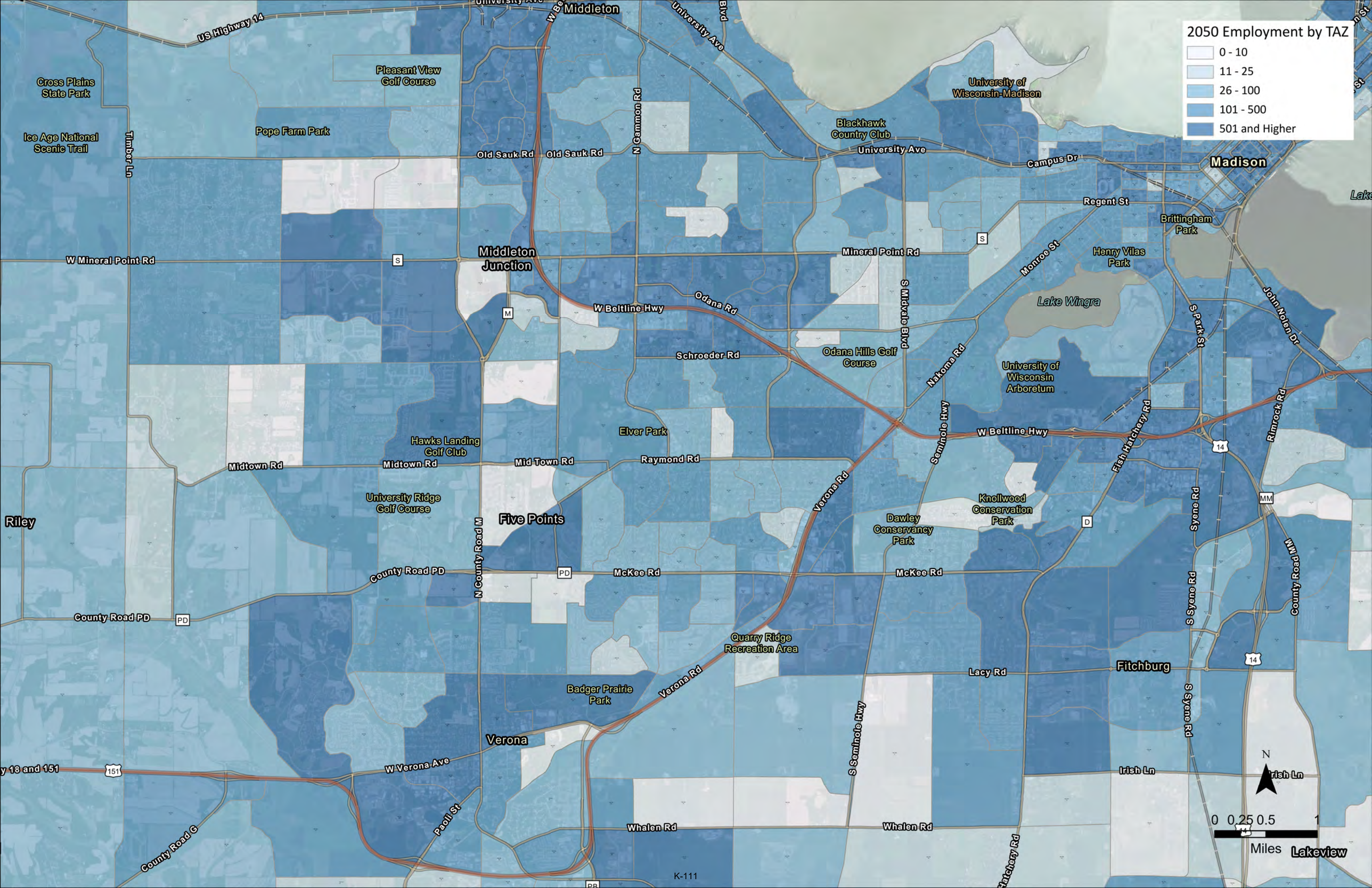

2050 Employment by TAZ
0 - 100
101 - 500
501 - 1,000
1,001 - 1,500
1,501 and Higher
Mason Lake
Briggsville
Hulburt Creek Fishery Area
Wisconsin Dells
Dell Creek State Wildlife Area
Anacker
Mirror Lake State Park
Reedsburg
Portage
Wyocena
Baraboo
Columbia
Durwards Glen
Devil's Lake State Park
Baxters Hollow SNA
Merrimac Preserve
Sauk
Larue
Bluffview
Sauk Prairie State Recreation Area
Moon Valley
Harmony Grove
Denzer
Lodi
Witwen
Black Hawk
K-106
0 1 2 4
Miles
N

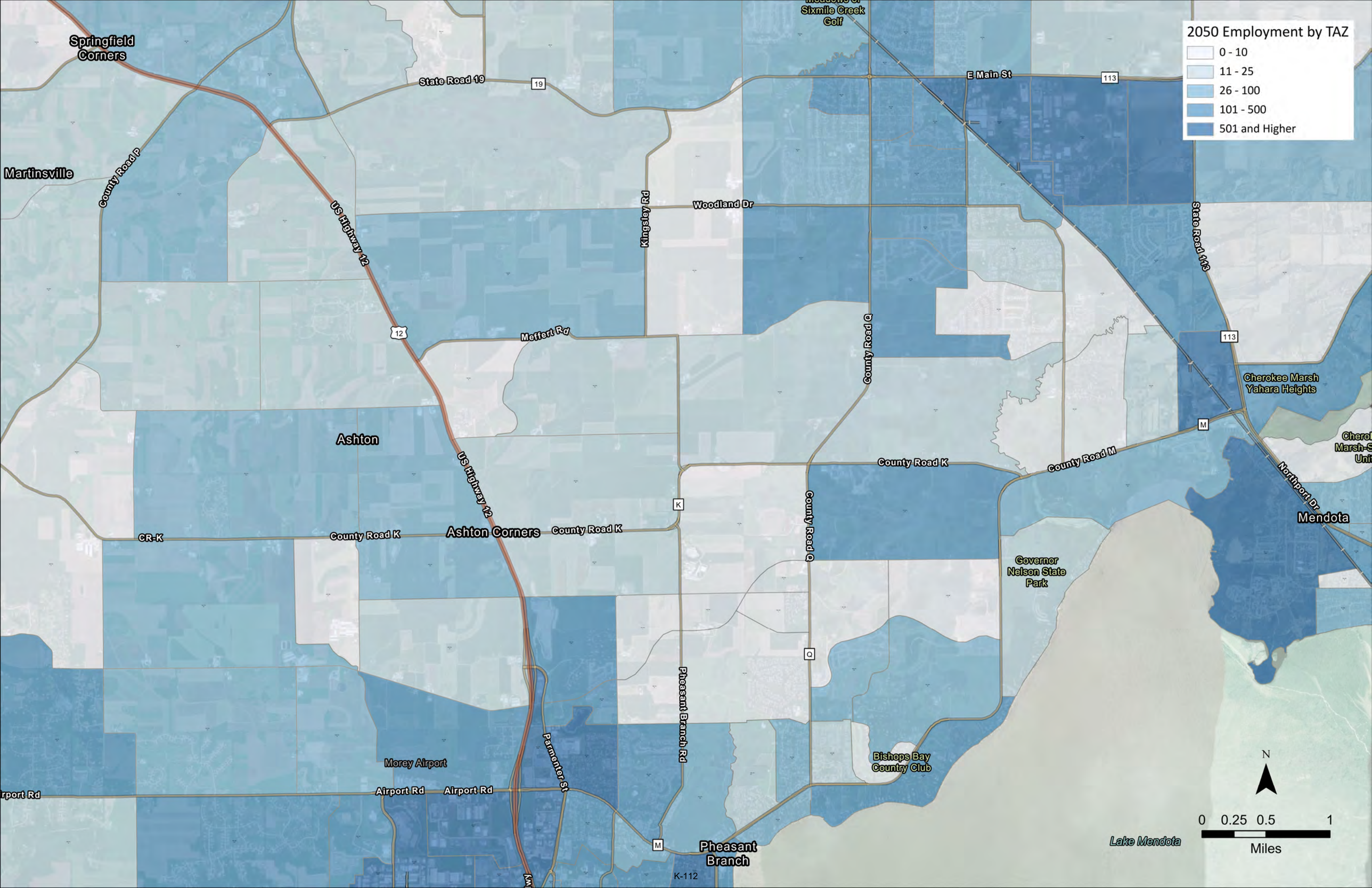

2050 Employment by TAZ
0 - 10
11 - 25
26 - 100
101 - 500
501 and Higher
Lodi
Witwen
Dane
Deforest
North Bristol
East Bristol
Windsor
Portland
Waterloo
Sun Prairie
Mendota
Pheasant Branch
Middleton
Ice Age National Scenic Trail
Madison
Dane
Monona
Vilas
Lake Mills
Middleton Junction
Five Points
Fitchburg
Verona
Deerfield
Door Creek
Lake Ripley
Kegonsa
Mt Vernon
Stoughton
Daleyville
Forward
Albion
Cooksville
Edgerton
Newville
N
0 0.25 0.5
Miles

2050 Employment by TAZ
0 - 10
11 - 25
26 - 100
101 - 500
501 and Higher
Lake Mendota
Lake Monona
Lake Wingra
Madison
Monona
Maple Bluff Country Club
Bridges Golf Course
Madison Area Technical Col-Truax
Demetral Field
Tenney Park
Hudson Park
Olbrich Park
East Morland Park
Heistand Park
James Madison Park
University of Wisconsin-Madison
University Hospital
Hoyt Park
Resurrection Cemetery
Forest Hill Cemetery
Glenway Municipal Golf Course
Edgewood College
SSM Health St. Mary's Hospital – Madison
Brittingham Park
Goodman Park
Turville Point Conservation Park
Quann Park
Alliant Energy Center
Duane F Bowman Park
Harvey E Schmidt Park
Monona Municipal Golf Course
Edna Taylor Conservation Park
Rcselawn Memorial Park
Anderson St
Lien Rd
N Stoughton Rd
Lexington Ave
Myrtle St
Burke Ave
Commercial Ave
Webb Ave
Union St
Atwood Ave
Richard St
Tulane Ave
Dempsey Rd
Johns St
Atlas Ave
S Stoughton Rd
Garnet Ln
Onyx Ln
Meadowlark Dr
Merryturn Rd
Sheridan Dr
Farwell Dr
N Sherman Ave
Ruskin St
Huxley St
Packers Ave
N 5th St
Oak St
E Washington Ave
Winnebago St
E Dayton St
E Main St
Williamson St
Spaight St
Lake Mendota Dr
Edgehill Dr
Oxford Rd
Locust Dr
University Ave
Harvey St
Observatory Dr
Campus Dr
W Johnson St
Price Pl
Van Hise Ave
Regent St
Rowley Ave
Commonwealth Ave
Keyes Ave
Monroe St
Adams St
S Randall Ave
S Mills St
John Nolen Dr
N Wingra Dr
S Park St
S Midvale Blvd
Larkin St
Hillcrest Dr
S Owen Dr
Toepfer Ave
Keating Ter
Ames St
Odana Rd
Council Crst
Yuma Dr
Koma Rd
Leo Dr
Drexel Ave
Hegg Ave
Buckeye Rd
Maher Ave
Turner Ave
Camden Rd
E Buckeye Rd
Vondron Rd
Ellen Ave
E Dean Ave
W Dean Ave
Helgesen Dr
Douglas Trl
Acacia Ln
Owen Rd
Midmoor Rd
Monona Dr
Tonyawatha Trl
Winnebago Trl
Bridge Rd
Daniels St
Dairy Dr
Agriculture Dr
Progress Rd
Femrite Dr
Waunona Way
W Broadway
E Broadway
W Beltline Hwy
Beltline Hwy
Sheboygan Ave
Packers Ave
Lien Rd
30
39
BB
N
0
0.25
0.5
Miles


2050 Employment by TAZ
0 - 10
11 - 25
26 - 100
101 - 500
501 and Higher
Milwaukee St
Olbrich Park
E Johnson St
E Gorham St
Williamson St
University of Wisconsin-Madison
Campus Dr
Madison
Regent St
Brittingham Park
Monroe St
Henry Vilas Park
Lake Wingra
S Park St
John Nolen Dr
Lake Monona
Monona
Monona Dr
S Stoughton Rd
BB
AB
BW
Cottage Grove Rd
E Buckeye Rd
Milwaukee St
Sprecher Rd
Door Creek Park
Vilas
Door Creek Golf Course
Hope
County Rd N
W Broadway
W Beltline Hwy
39
51
University of Wisconsin Arboretum
Fish Hatchery Rd
Rimrock Rd
14
MM
D
Knollwood Conservation Park
Syene Rd
S Syene Rd
County Road MN
Upper Mud Lake
Lake Farm Park
Capital Springs State Park
Lake Waubesa
Stoughton Rd
Yahara Hills Golf Course
US Highway 12 and 18
County Road AB
Door Creek
Mud Lake
Door Creek
Door Creek Rd
Koshkonong Rd
Lacy Rd
Fitchburg
Irish Ln
Irish Ln
K-109
Kegonsa
N
0 0.25 0.5 1
Miles


2050 Employment by TAZ
0 - 10
11 - 25
26 - 100
101 - 500
501 and Higher
Token Creek
Windsor St
Sun Prairie
W Main St
Rattman Rd
S Grand Ave
N Bristol St
Grove St
Token Creek County Park
Cherokee Marsh-North Unit
Hoepker Rd
North-East Park
County Road CV
N Stoughton Rd
Dane County Regional Airport
Nelson Rd
Reiner Rd
Burke
County Rd N
County Road T
County Road TT
McCarthy Youth & Conservation Park
Madison Area Technical Col-Truax
Bridges Golf Course
N Sherman Ave
Packers Ave
Aberg Ave
E Washington Ave
Seminary Springs
K-110
0 0.25 0.5 1
Miles


2050 Employment by TAZ
0 - 10
11 - 25
26 - 100
101 - 500
501 and Higher
US Highway 14
Middleton
University Ave
Cross Plains State Park
Pleasant View Golf Course
University of Wisconsin-Madison
Ice Age National Scenic Trail
Timber Ln
Pope Farm Park
Old Sauk Rd
N Gammon Rd
Blackhawk Country Club
Campus Dr
Madison
Regent St
Brittingham Park
W Mineral Point Rd
Middleton Junction
Mineral Point Rd
Monroe St
Henry Vilas Park
W Beltline Hwy
Odana Rd
S Midvale Blvd
Lake Wingra
John Nolen Dr
S Park St
Schroeder Rd
Odana Hills Golf Course
Nakoma Rd
University of Wisconsin Arboretum
Seminole Hwy
Fish Hatchery Rd
Rimrock Rd
Elver Park
Hawks Landing Golf Club
Midtown Rd
Mid Town Rd
Raymond Rd
Verona Rd
University Ridge Golf Course
Riley
Five Points
N County Road M
Dawley Conservancy Park
Knollwood Conservation Park
Syene Rd
S Syene Rd
County Road MM
County Road PD
McKee Rd
Quarry Ridge Recreation Area
Badger Prairie Park
Fitchburg
Lacy Rd
S Seminole Hwy
Verona
W Verona Ave
Irish Ln
County Road G
Paoli St
Whalen Rd
Fish Hatchery Rd
Lakeview
N
0 0.25 0.5 1
Miles


2050 Employment by TAZ
0 - 10
11 - 25
26 - 100
101 - 500
501 and Higher
Springfield Corners
Martinsville
State Road 19
19
County Road P
US Highway 12
12
Kingsley Rd
Woodland Dr
Meffert Rd
Sixmile Creek Golf
E Main St
113
State Road 113
County Road Q
Cherokee Marsh Yahara Heights
M
Ashton
County Road K
CR-K
Ashton Corners
K
Pheasant Branch Rd
Q
County Road M
Northport Dr
Mendota
Governor Nelson State Park
Bishops Bay Country Club
Morey Airport
Airport Rd
Parmenter St
Pheasant Branch
K-112
Lake Mendota
N
0 0.25 0.5 1
Miles

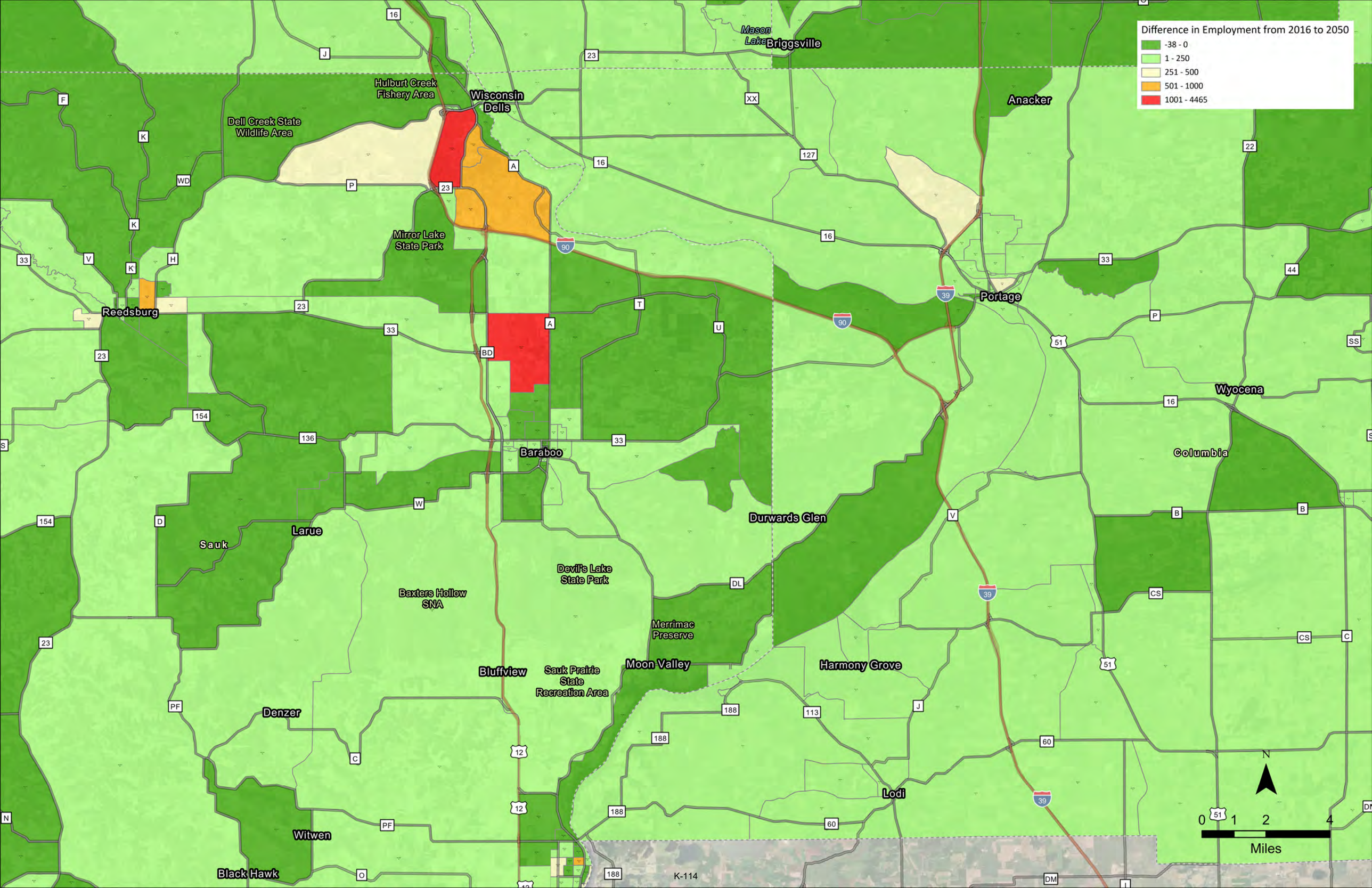
Difference in Employment from 2016 to 2050

- Loss of 501 or more
- Loss between 1 and 500
- Gain between 0 and 100
- Gain between 101 and 500
- Gain of 501 and Higher

Lodi
North Bristol
East Bristol
Dane
Deforest
Windsor
Portland
Waterloo
Sun Prairie
Mendota
Pheasant Branch
Middleton
Ice Age National Scenic Trail
Middleton Junction
Madison
Dane
Monona
Vilas
Lake Mills
Deerfield
Door Creek
Five Points
Fitchburg
Verona
Lake Ripley
Kegonsa
Mt Vernon
Daleyville
Forward
Stoughton
Albion
Cooksville
Edgerton
Newville
Fort Atkin

N

0 1.25 2.5 5
Miles


Difference in Employment from 2016 to 2050
-38 - 0
1 - 250
251 - 500
501 - 1000
1001 - 4465
Mason Lake
Briggsville
Hulburt Creek Fishery Area
Wisconsin Dells
Dell Creek State Wildlife Area
Anacker
Mirror Lake State Park
Reedsburg
Portage
Baraboo
Wyocena
Columbia
Durwards Glen
Larue
Sauk
Devil's Lake State Park
Baxters Hollow SNA
Merrimac Preserve
Moon Valley
Harmony Grove
Bluffview
Sauk Prairie State Recreation Area
Denzer
Witwen
Black Hawk
Lodi
K-114
N
0 1 2 4
Miles

Difference in Employment from 2016 to 2050

- Loss of 500 or more
- Loss between 1 and 500
- Gain between 0 and 100
- Gain between 101 and 500
- Gain of 501 and Higher

Witwen
Lodi
Dane
Deforest
North Bristol
East Bristol
Windsor
Sun Prairie
Portland
Waterloo
Mendota
Pheasant Branch
Middleton
Middleton Junction
Ice Age National Scenic Trail
Madison
Dane
Monona
Vilas
Lake Mills
Deerfield
Door Creek
Five Points
Fitchburg
Verona
Lake Ripley
Kegonsa
Mt Vernon
Stoughton
Daleyville
Forward
Albion
Cooksville
Edgerton
Newville

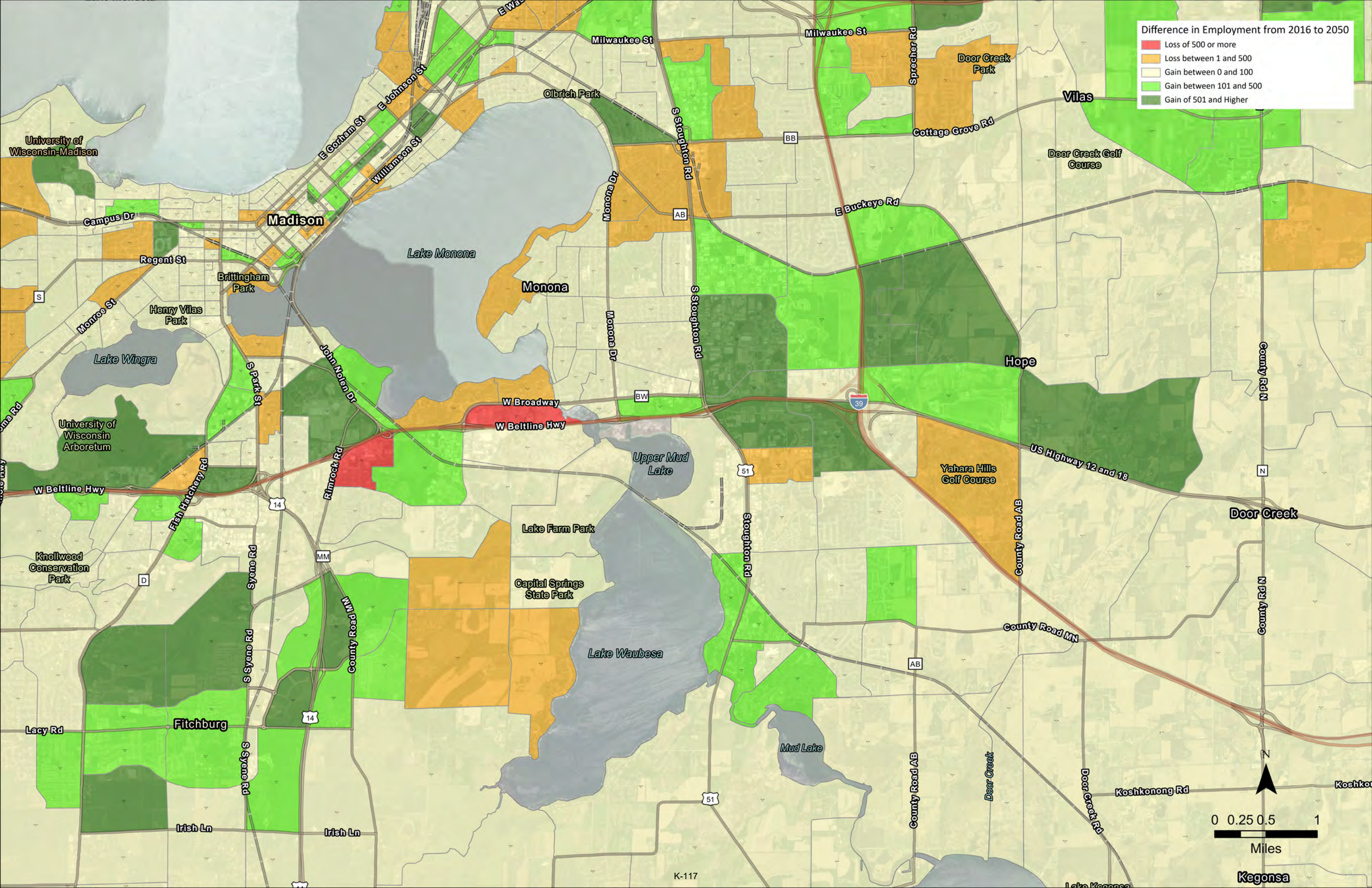
N

0 0.25 0.5 1 Miles

Difference in Employment from 2016 to 2050

- Loss of 500 or more
- Loss between 1 and 500
- Gain between 0 and 100
- Gain between 101 and 500
- Gain of 501 and Higher

Lake Mendota
Lake Monona
Lake Wingra
Madison
Monona
Sycamore Park
Heistand Park
East Morland Park
Tenney Park
Hudson Park
Olbrich Park
James Madison Park
Brittingham Park
Goodman Park
Turville Point Conservation Park
Quann Park
Alliant Energy Center
Duane F Bowman Park
Harvey E Schmidt Park
Edna Taylor Conservation Park
Roselawn Memorial Park
Monona Municipal Golf Course
Maple Bluff Country Club
Bridges Golf Course
Madison Area Technical Col-Truax
Demetral Field
University of Wisconsin-Madison
University Hospital
Hoyt Park
Resurrection Cemetery
Forest Hill Cemetery
Glenway Municipal Golf Course
Edgewood College
SSM Health St. Mary's Hospital – Madison
Lake Mendota Dr
Edgehill Dr
Oxford Rd
Locust Dr
University Ave
Harvey St
Observatory Dr
Campus Dr
Price Pl
Hillcrest Dr
S Owen Dr
Keating Ter
Ames St
Toepfer Ave
Larkin St
Commonwealth Ave
Rowley Ave
Van Hise Ave
Regent St
Keyes Ave
Monroe St
Adams St
S Randall Ave
S Mills St
N Wingra Dr
S Park St
S Midvale Blvd
Odana Rd
Council Crst
Yuma Dr
Oma Rd
Sheridan Dr
Farwell Dr
N Sherman Ave
Ruskin St
Huxley St
Packers Ave
Anderson St
Myrtle St
Commercial Ave
Union St
Oak St
N 5th St
Webb Ave
Lexington Ave
Burke Ave
N Stoughton Rd
30
Winnebago St
Atwood Ave
E Washington Ave
E Dayton St
E Main St
Williamson St
Spaight St
Richard St
Tulane Ave
Dempsey Rd
Johns St
Garnet Ln
Onyx Ln
Topaz Ln
Meadowlark Dr
Merryturn Rd
Atlas Ave
S Stoughton Rd
BB
Leo Dr
Drexel Ave
Hegg Ave
Buckeye Rd
Maher Ave
Turner Ave
Camden Rd
E Buckeye Rd
Monona Dr
Vondron Rd
Ellen Ave
E Dean Ave
W Dean Ave
Helgesen Dr
Tonyawatha Trl
Midmoor Rd
Douglas Trl
Acacia Ln
Owen Rd
Monona Dr
Wunderlich Rd
Bridge Rd
Daniels St
Progress Rd
Dairy Dr
Agriculture Dr
Femrite Dr
E Broadway
W Broadway
Waunona Way
W Beltline Hwy
John Nolen Dr
Williamson St
Spaight St
E Main St
E Dayton St
E Washington Ave
Monroe St
Regent St
University Ave
W Johnson St
Madison
Lake Monona
Monona
N
0 0.25 0.5 Miles


Difference in Employment from 2016 to 2050
Loss of 500 or more
Loss between 1 and 500
Gain between 0 and 100
Gain between 101 and 500
Gain of 501 and Higher
Milwaukee St
Olbrich Park
E Johnson St
E Gorham St
Williamson St
University of Wisconsin-Madison
Campus Dr
Madison
Regent St
Brittingham Park
Lake Monona
Monona
Monona Dr
S Stoughton Rd
BB
AB
Cottage Grove Rd
Sprecher Rd
Door Creek Park
Vilas
Door Creek Golf Course
E Buckeye Rd
Monroe St
Henry Vilas Park
Lake Wingra
S Park St
John Nolen Dr
W Broadway
W Beltline Hwy
BW
39
Hope
County Rd N
University of Wisconsin Arboretum
Fish Hatchery Rd
Rimrock Rd
Upper Mud Lake
51
US Highway 12 and 18
Yahara Hills Golf Course
Door Creek
Knollwood Conservation Park
Syene Rd
MM
Lake Farm Park
Capital Springs State Park
Stoughton Rd
County Road AB
Lake Waubesa
County Road MN
Fitchburg
Lacy Rd
Mud Lake
Door Creek
Door Creek Rd
Koshkonong Rd
Irish Ln
N
0 0.25 0.5 1
Miles
Kegonsa

Difference in Employment from 2016 to 2050

- Loss of 500 or more
- Loss between 1 and 500
- Gain between 0 and 100
- Gain between 101 and 500
- Gain of 501 and Higher

Token Creek
Windsor St
N Bristol St
Sun Prairie
W Main St
Grove St
Token Creek County Park
Rattman Rd
S Grand Ave
Hoepker Rd
Cherokee Marsh-North Unit
County Road CV
North-East Park
N Stoughton Rd
Reiner Rd
Nelson Rd
County Rd N
County Road T
Dane County Regional Airport
Burke
Madison Area Technical Col-Truax
McCarthy Youth & Conservation Park
N Sherman Ave
Packers Ave
Bridges Golf Course
Maple Bluff Country Club
Aberg Ave
E Washington Ave
County Road TT
Seminary Springs
K-118
0 0.25 0.5 1
Miles

Difference in Employment from 2016 to 2050
- Loss of 500 or more
- Loss between 1 and 500
- Gain between 0 and 100
- Gain between 101 and 500
- Gain of 501 and Higher

Middleton
US Highway 14
Cross Plains State Park
Ice Age National Scenic Trail
Timber Ln
Pleasant View Golf Course
Pope Farm Park
Old Sauk Rd
N Gammon Rd
University Ave
Blackhawk Country Club
University of Wisconsin-Madison
Madison
Campus Dr
Regent St
Brittingham Park
Henry Vilas Park
Lake Wingra
Monroe St
John Nolen Dr
S Park St
W Mineral Point Rd
Middleton Junction
Mineral Point Rd
S Midvale Blvd
W Beltline Hwy
Odana Rd
Schroeder Rd
Odana Hills Golf Course
Nakoma Rd
Seminole Hwy
University of Wisconsin Arboretum
Fish Hatchery Rd
Rimrock Rd
Elver Park
Hawks Landing Golf Club
Midtown Rd
Mid Town Rd
Raymond Rd
University Ridge Golf Course
Riley
Five Points
N County Road M
County Road PD
McKee Rd
Verona Rd
Dawley Conservancy Park
Knollwood Conservation Park
Syene Rd
S Syene Rd
County Road MM
Quarry Ridge Recreation Area
Fitchburg
Lacy Rd
Badger Prairie Park
Verona
S Seminole Hwy
W Verona Ave
Irish Ln
Paoli St
Whalen Rd
County Road G
K-119
Lakeview
N
0 0.25 0.5 1
Miles

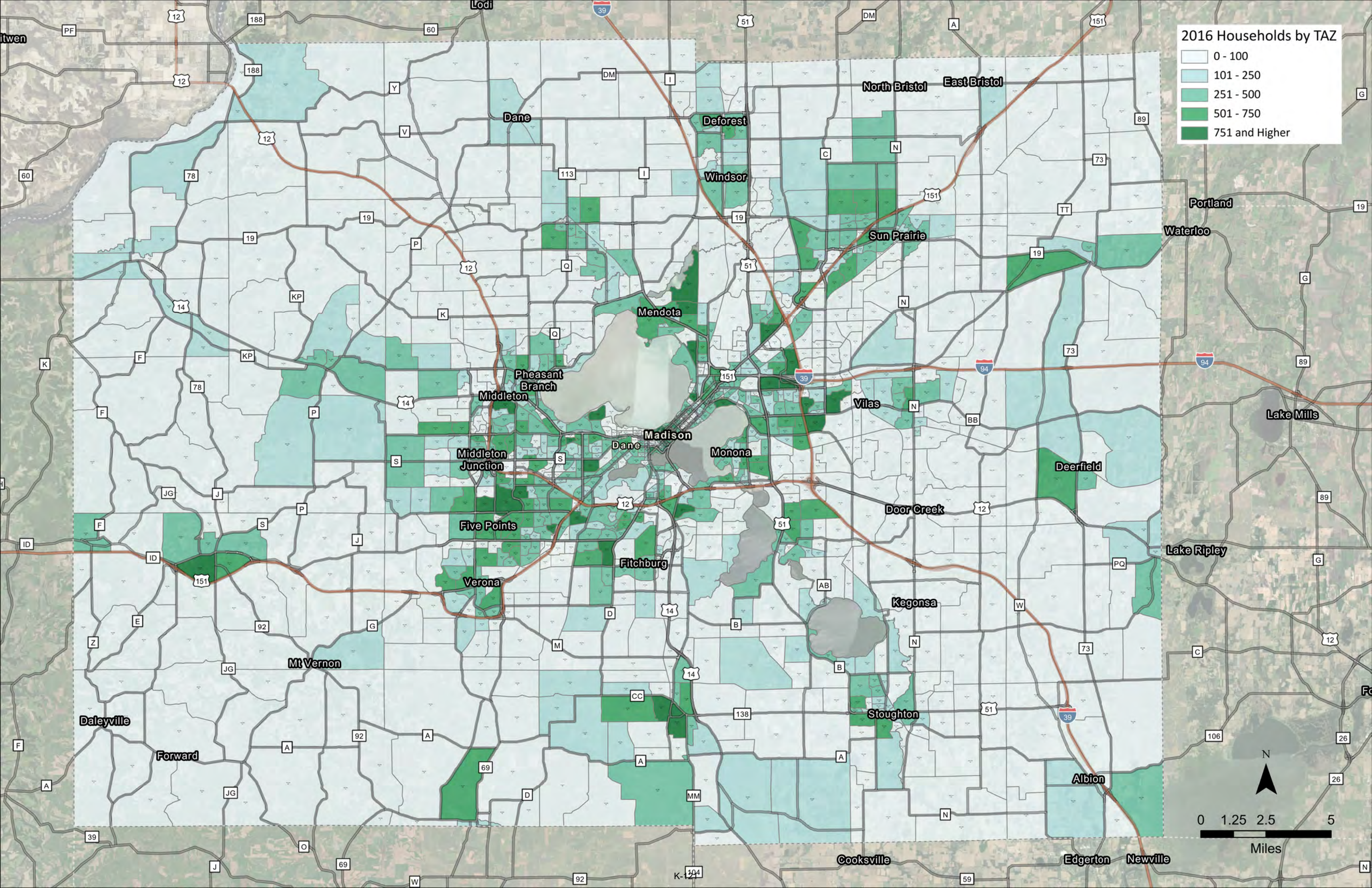
Difference in Employment from 2016 to 2050

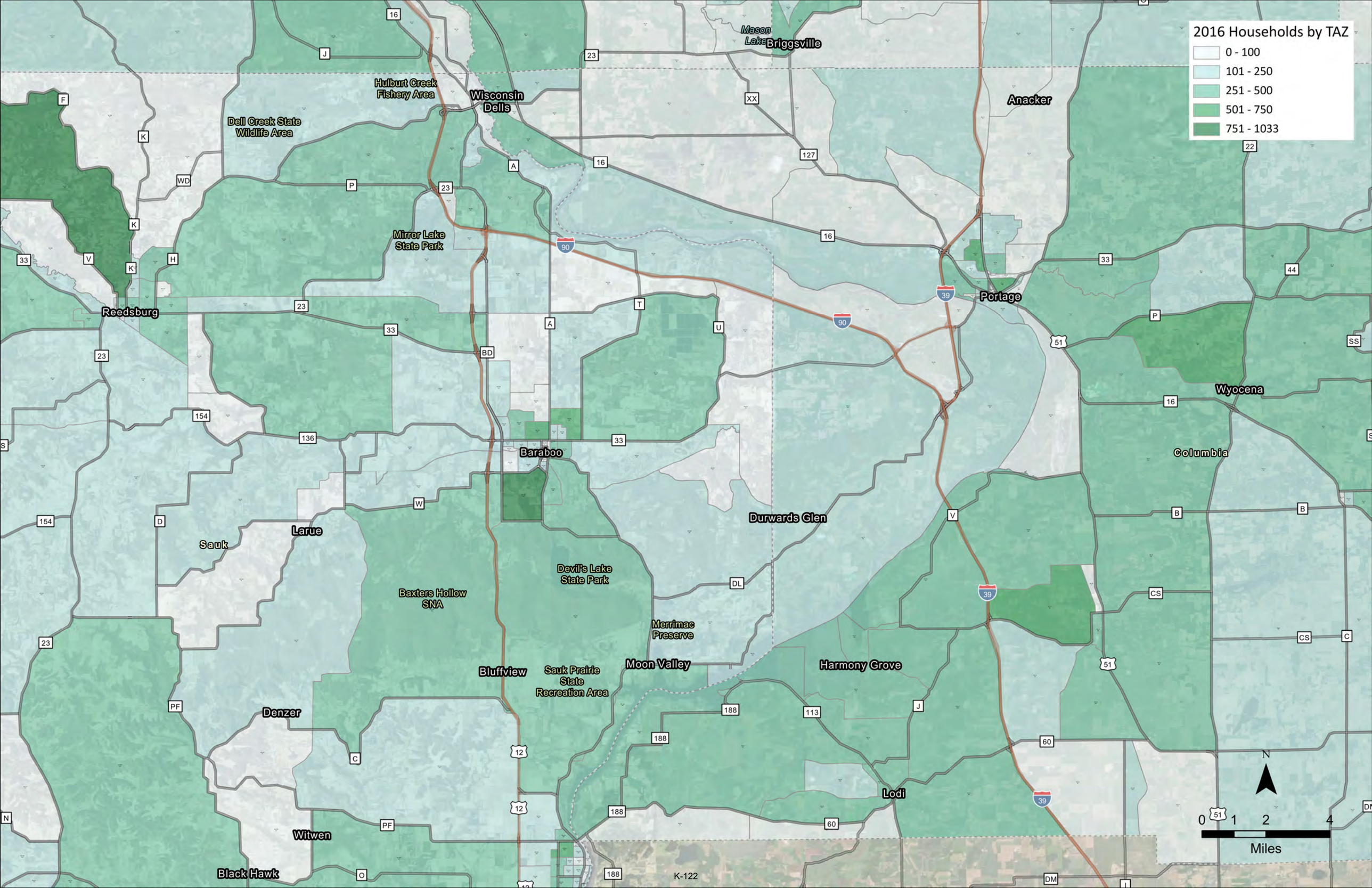
- Loss of 500 or more
- Loss between 1 and 500
- Gain between 0 and 100
- Gain between 101 and 500
- Gain of 501 and Higher

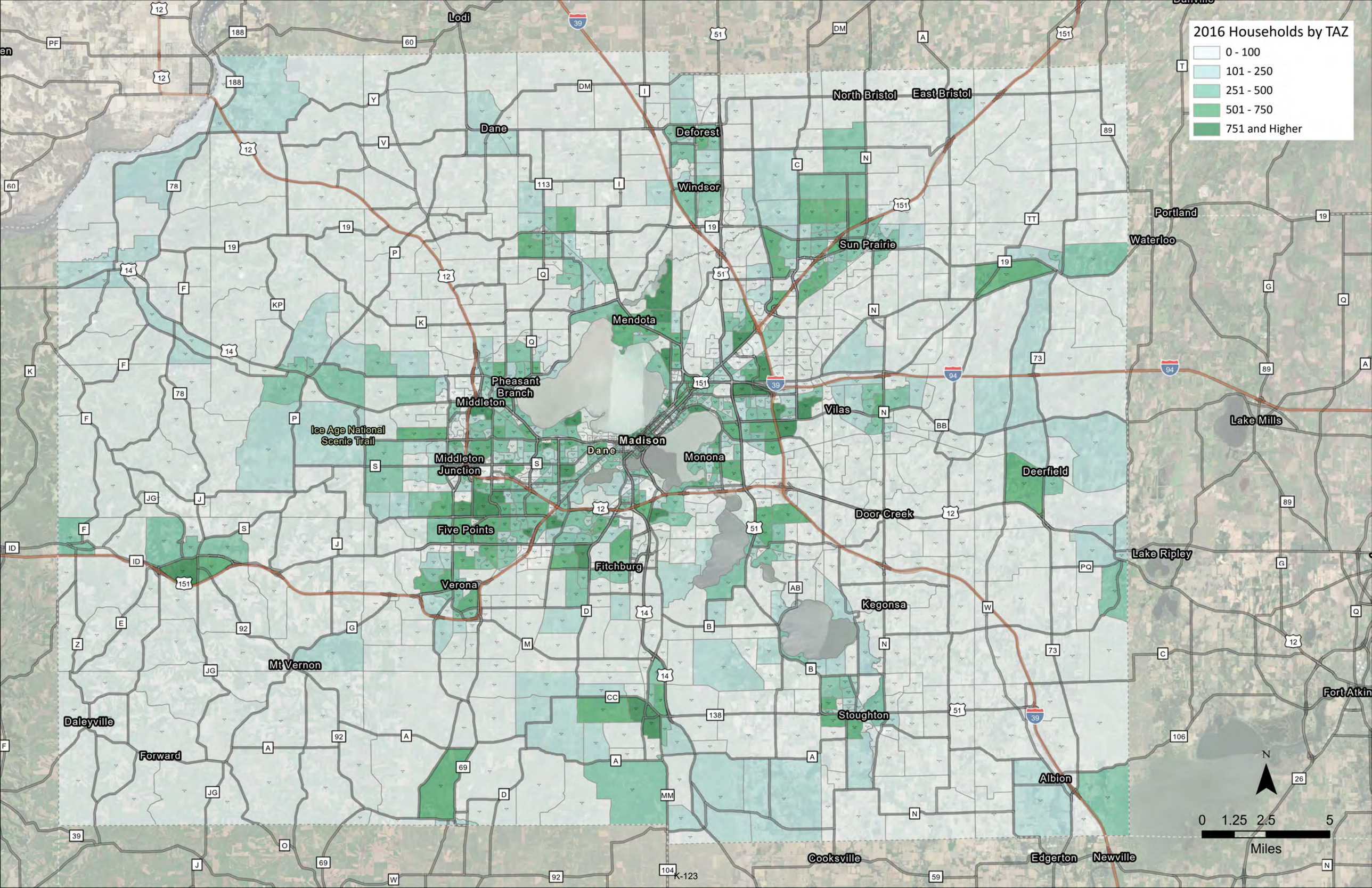
Springfield Corners
Martinsville
County Road P
State Road 19
19
US Highway 12
12
Kingsley Rd
Woodland Dr
Sixmile Creek Golf
E Main St
113
State Road 113
Meffert Rd
County Road Q
Cherokee Marsh Yahara Heights
M
Ashton
US Highway 12
County Road K
CR-K
Ashton Corners
K
Pheasant Branch Rd
Q
Governor Nelson State Park
Bishops Bay Country Club
Northport Dr
Mendota
Morey Airport
Airport Rd
Parmenter St
Pheasant Branch
K-120
Lake Mendota

N

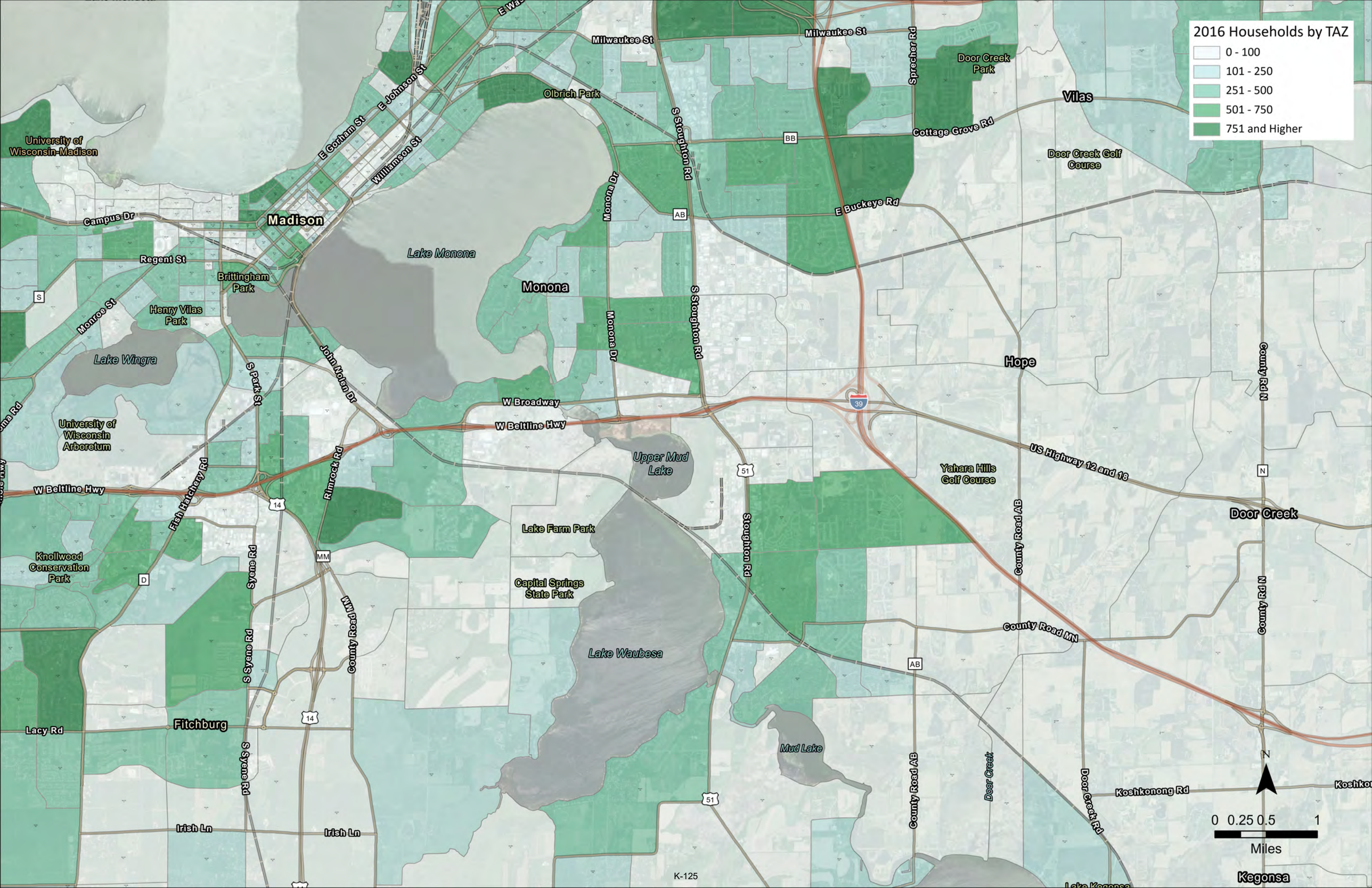
0 0.25 0.5 1
Miles

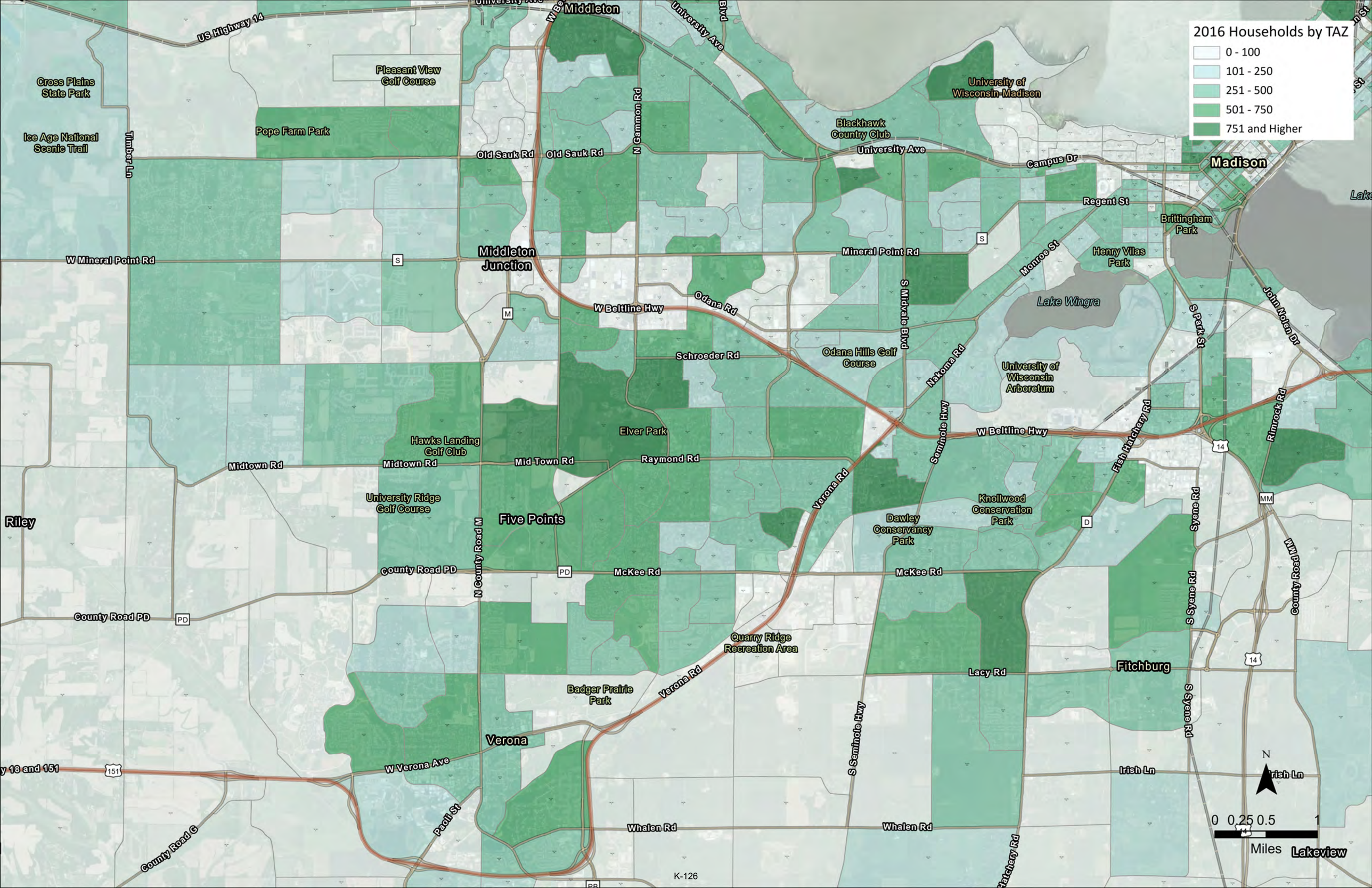

2016 Households by TAZ
0 - 100
101 - 250
251 - 500
501 - 750
751 and Higher
Lodi
Dane
Deforest
North Bristol
East Bristol
Windsor
Sun Prairie
Portland
Waterloo
Mendota
Pheasant Branch
Middleton
Middleton Junction
Madison
Dane
Monona
Vilas
Lake Mills
Deerfield
Door Creek
Five Points
Fitchburg
Verona
Lake Ripley
Kegonsa
Mt Vernon
Stoughton
Daleyville
Forward
Albion
Cooksville
Edgerton
Newville
N
0 1.25 2.5 5
Miles

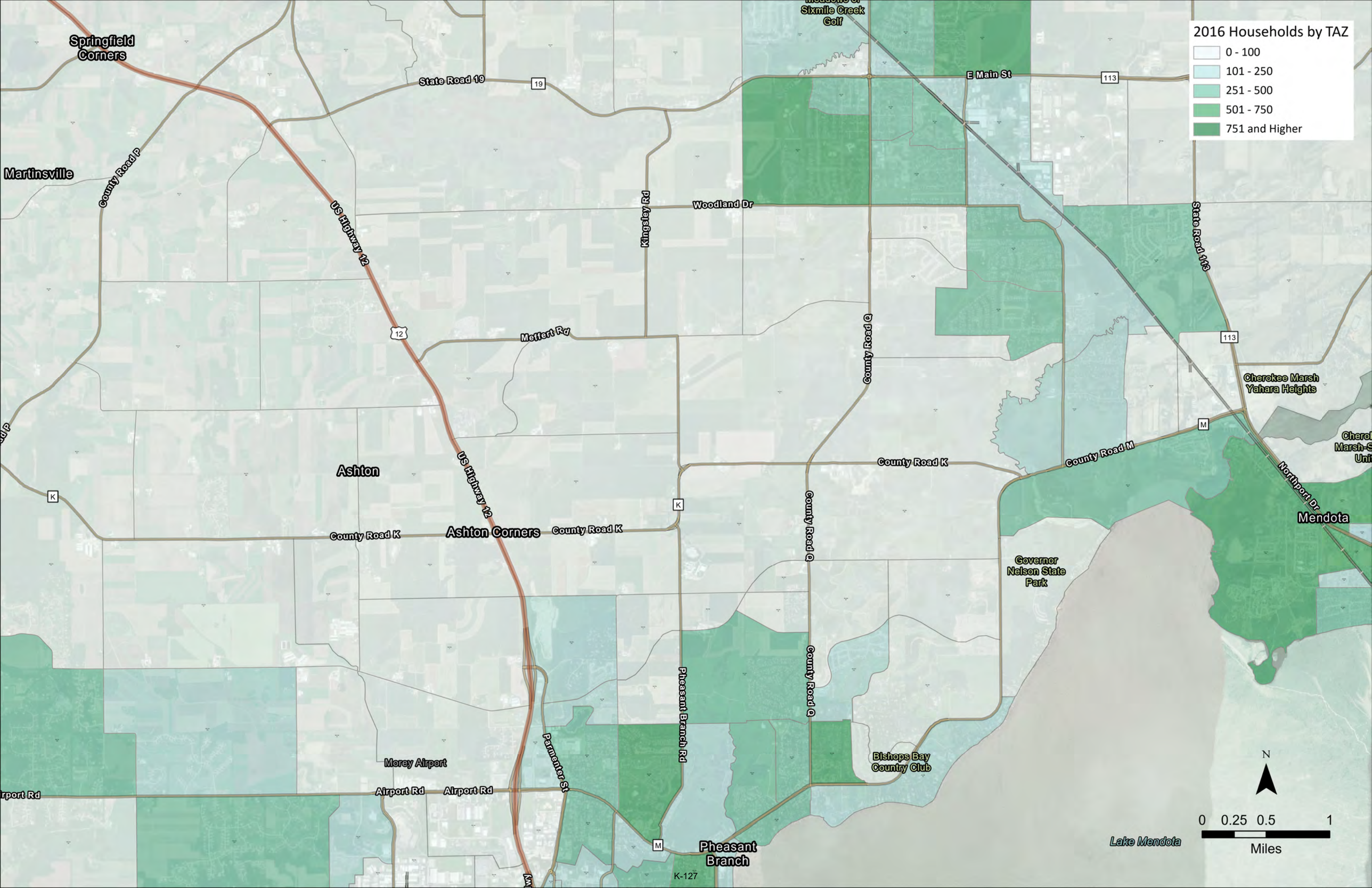

2016 Households by TAZ
0 - 100
101 - 250
251 - 500
501 - 750
751 - 1033
Mason Lake
Briggsville
Hulburt Creek Fishery Area
Wisconsin Dells
Dell Creek State Wildlife Area
Anacker
Mirror Lake State Park
Reedsburg
Portage
Wyocena
Columbia
Baraboo
Durwards Glen
Larue
Sauk
Devil's Lake State Park
Baxters Hollow SNA
Merrimac Preserve
Bluffview
Sauk Prairie State Recreation Area
Moon Valley
Harmony Grove
Denzer
Lodi
Witwen
Black Hawk
K-122
N
0 1 2 4
Miles

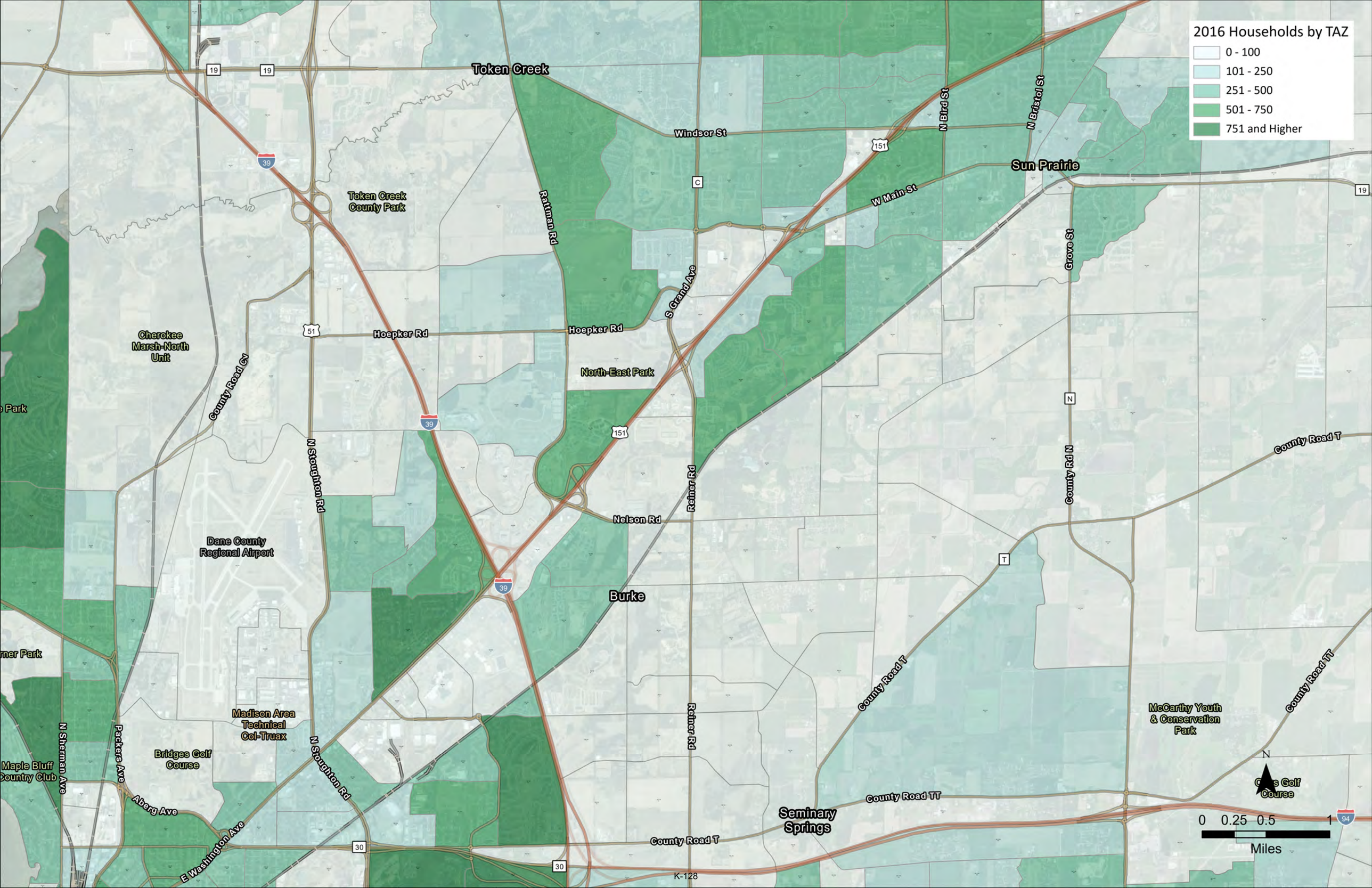

2016 Households by TAZ
0 - 100
101 - 250
251 - 500
501 - 750
751 and Higher
Lodi
Dane
Deforest
North Bristol
East Bristol
Windsor
Portland
Waterloo
Sun Prairie
Mendota
Pheasant Branch
Middleton
Ice Age National Scenic Trail
Middleton Junction
Madison
Dane
Monona
Vilas
Lake Mills
Deerfield
Door Creek
Five Points
Fitchburg
Verona
Lake Ripley
Kegonsa
Mt Vernon
Daleyville
Forward
Stoughton
Albion
Fort Atkin
Cooksville
Edgerton
Newville
N
0 1.25 2.5 5
Miles

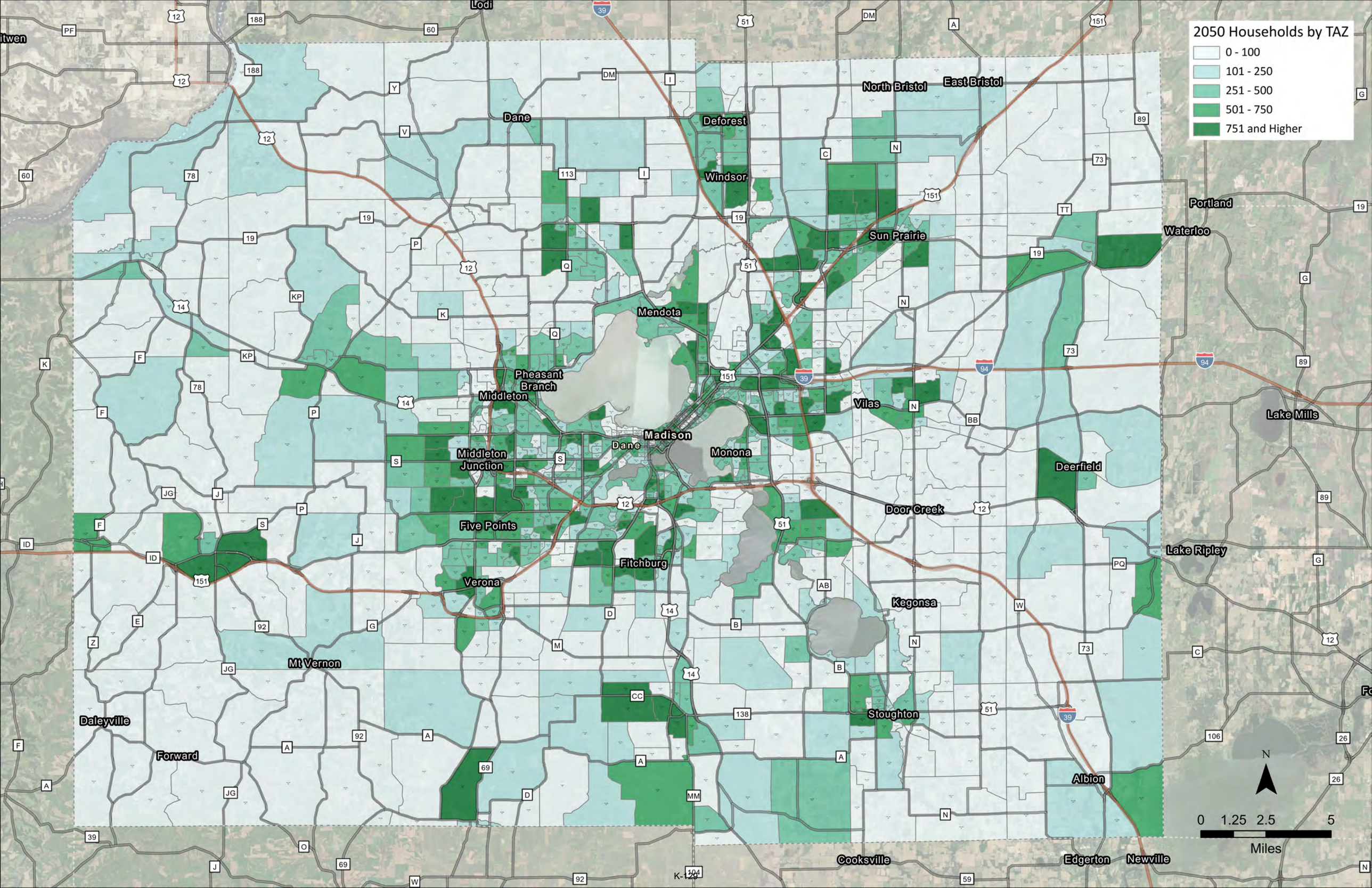
2016 Households by TAZ
0 - 100
101 - 250
251 - 500
501 - 750
751 and Higher
Lake Mendota
Lake Monona
Lake Wingra
Madison
Monona
University of Wisconsin-Madison
Madison Area Technical Col-Truax
Bridges Golf Course
Maple Bluff Country Club
Demetral Field
Heistand Park
East Morland Park
Tenney Park
Hudson Park
Olbrich Park
James Madison Park
University Hospital
Brittingham Park
SSM Health St. Mary's Hospital – Madison
Edgewood College
Resurrection Cemetery
Forest Hill Cemetery
Glenway Municipal Golf Course
Monona Municipal Golf Course
Edna Taylor Conservation Park
Roselawn Memorial Park
Goodman Park
Turville Point Conservation Park
Quann Park
Alliant Energy Center
Duane F Bowman Park
Harvey E Schmidt Park
Anderson St
Lien Rd
E Washington Ave
Lexington Ave
Burke Ave
Commercial Ave
Webb Ave
Union St
Aberg Ave
Sheridan Dr
Parwell Dr
N Sherman Ave
Ruskin St
Huxley St
N 5th St
Oak St
Atwood Ave
Winnebago St
Tulane Ave
Dempsey Rd
Johns St
Garnet Ln
Onyx Ln
Meadowlark Dr
Retana Dr
Leo Dr
Ellen Ave
Vondron Rd
E Buckeye Rd
Hegg Ave
Drexel Ave
Buckeye Rd
Maher Ave
Turner Ave
Monona Dr
S Stoughton Rd
E Dean Ave
W Dean Ave
Helgesen Dr
Daniels St
Douglas Trl
Acacia Ln
Nichols Rd
Owen Rd
Femrite Dr
Progress Rd
Agriculture Dr
W Broadway
E Broadway
W Beltline Hwy
Waunona Way
Wisconsin Ave
Lake Mendota Dr
Edgehill Dr
Oxford Rd
Locust Dr
University Ave
Harvey St
Linden Dr
Campus Dr
Langdon St
E Main St
Williamson St
Spaight St
E Dayton St
Price Pl
Hoyt Park
Van Hise Ave
Regent St
Rowley Ave
Commonwealth Ave
Keyes Ave
Monroe St
Adams St
S Randall Ave
S Mills St
John Nolen Dr
N Wingra Dr
S Park St
Beld St
Bram St
Tonyawatha Trl
Winnebago Rd
Bridge Rd
Hillcrest Dr
Larkin St
S Owen Dr
Toepfer Ave
Keating Ter
Ames St
S Midvale Blvd
Council Crst
Yuma Dr
Odana Rd
Edgewood Dr
Price Pl
Lake Mendota Dr
Sheridan Dr
N Sherman Ave
Ruskin St
Huxley St
Anderson St
Madison Area Technical Col-Truax
E Washington Ave
Lien Rd
Lexington Ave
Burke Ave
Commercial Ave
Webb Ave
Union St
Aberg Ave
Heistand Park
East Morland Park
Garnet Ln
Onyx Ln
Meadowlark Dr
Retana Dr
Tulane Ave
Dempsey Rd
Johns St
Alias Ave
S Stoughton Rd
Leo Dr
Ellen Ave
Vondron Rd
E Buckeye Rd
Hegg Ave
Drexel Ave
Buckeye Rd
Maher Ave
Turner Ave
Monona Dr
E Dean Ave
W Dean Ave
Helgesen Dr
Daniels St
Douglas Trl
Acacia Ln
Nichols Rd
Owen Rd
Femrite Dr
Progress Rd
Agriculture Dr
W Broadway
E Broadway
W Beltline Hwy
Waunona Way
Wisconsin Ave
Lake Mendota Dr
Edgehill Dr
Oxford Rd
Locust Dr
University Ave
Harvey St
Linden Dr
Campus Dr
Langdon St
E Main St
Williamson St
Spaight St
E Dayton St
Price Pl
Hoyt Park
Van Hise Ave
Regent St
Rowley Ave
Commonwealth Ave
Keyes Ave
Monroe St
Adams St
S Randall Ave
S Mills St
John Nolen Dr
N Wingra Dr
S Park St
Beld St
Bram St
Tonyawatha Trl
Winnebago Rd
Bridge Rd
Hillcrest Dr
Larkin St
S Owen Dr
Toepfer Ave
Keating Ter
Ames St
S Midvale Blvd
Council Crst
Yuma Dr
Odana Rd
Edgewood Dr
0
0.25
0.5
Miles
N
39
30
BB

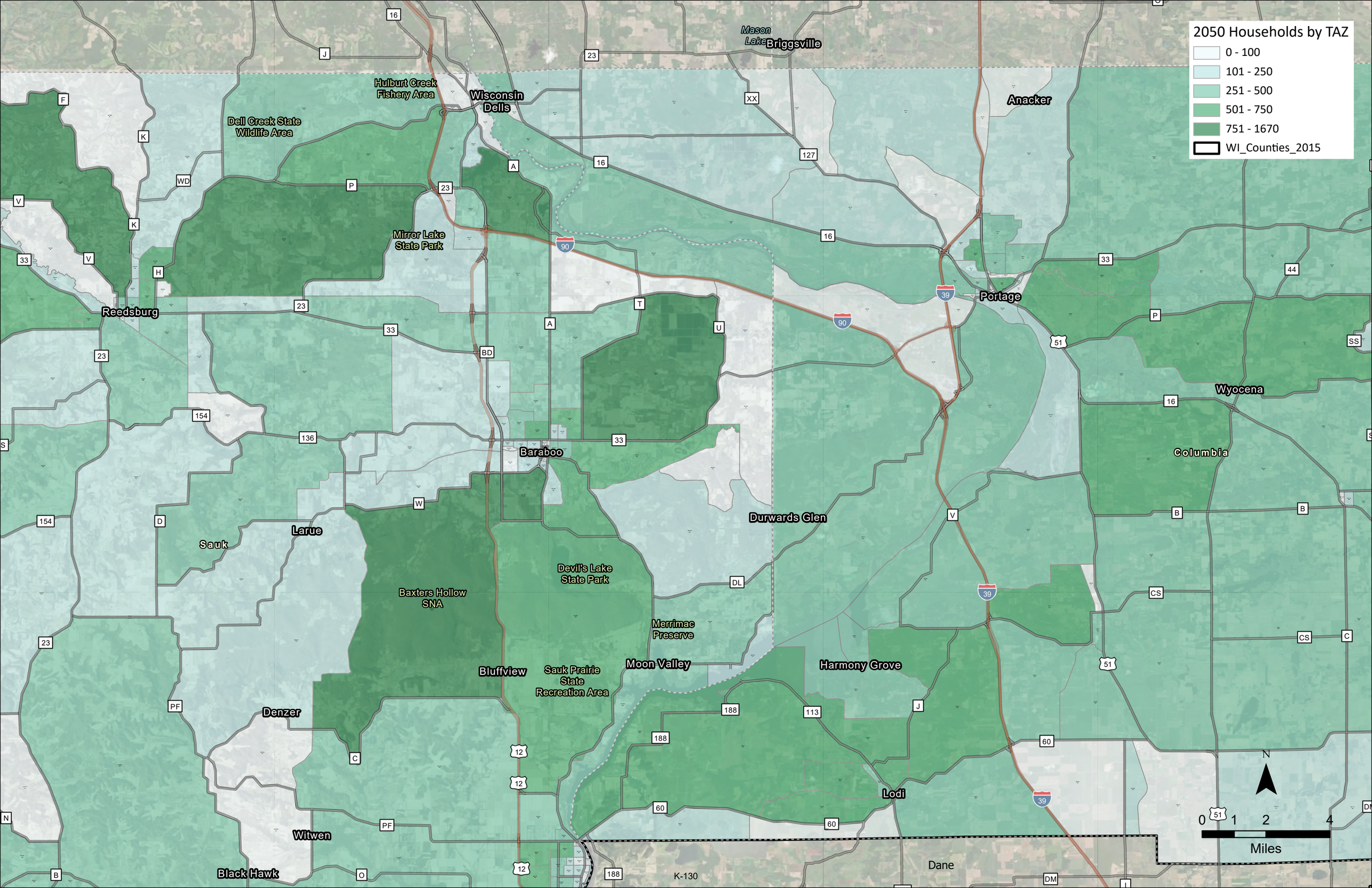

2016 Households by TAZ
0 - 100
101 - 250
251 - 500
501 - 750
751 and Higher
Milwaukee St
Milwaukee St
Sprecher Rd
Door Creek Park
Vilas
Olbrich Park
S Stoughton Rd
BB
Cottage Grove Rd
Door Creek Golf Course
E Johnson St
E Gorham St
Williamson St
University of Wisconsin-Madison
Monona Dr
AB
E Buckeye Rd
Campus Dr
Madison
Lake Monona
Regent St
Brittingham Park
Monona
S
Monroe St
Henry Vilas Park
Lake Wingra
John Nolen Dr
S Park St
Monona Dr
S Stoughton Rd
Hope
W Broadway
39
W Beltline Hwy
University of Wisconsin Arboretum
Upper Mud Lake
51
Yahara Hills Golf Course
US Highway 12 and 18
N
Door Creek
W Beltline Hwy
Fish Hatchery Rd
14
Rimrock Rd
Stoughton Rd
County Road AB
Knollwood Conservation Park
D
Syene Rd
MM
Lake Farm Park
County Rd N
Capital Springs State Park
County Road MN
County Road MW
Lake Waubesa
AB
Lacy Rd
Fitchburg
14
S Syene Rd
Mud Lake
Door Creek
Door Creek Rd
Koshkonong Rd
Irish Ln
Irish Ln
51
0 0.25 0.5 1
Miles
Kegonsa

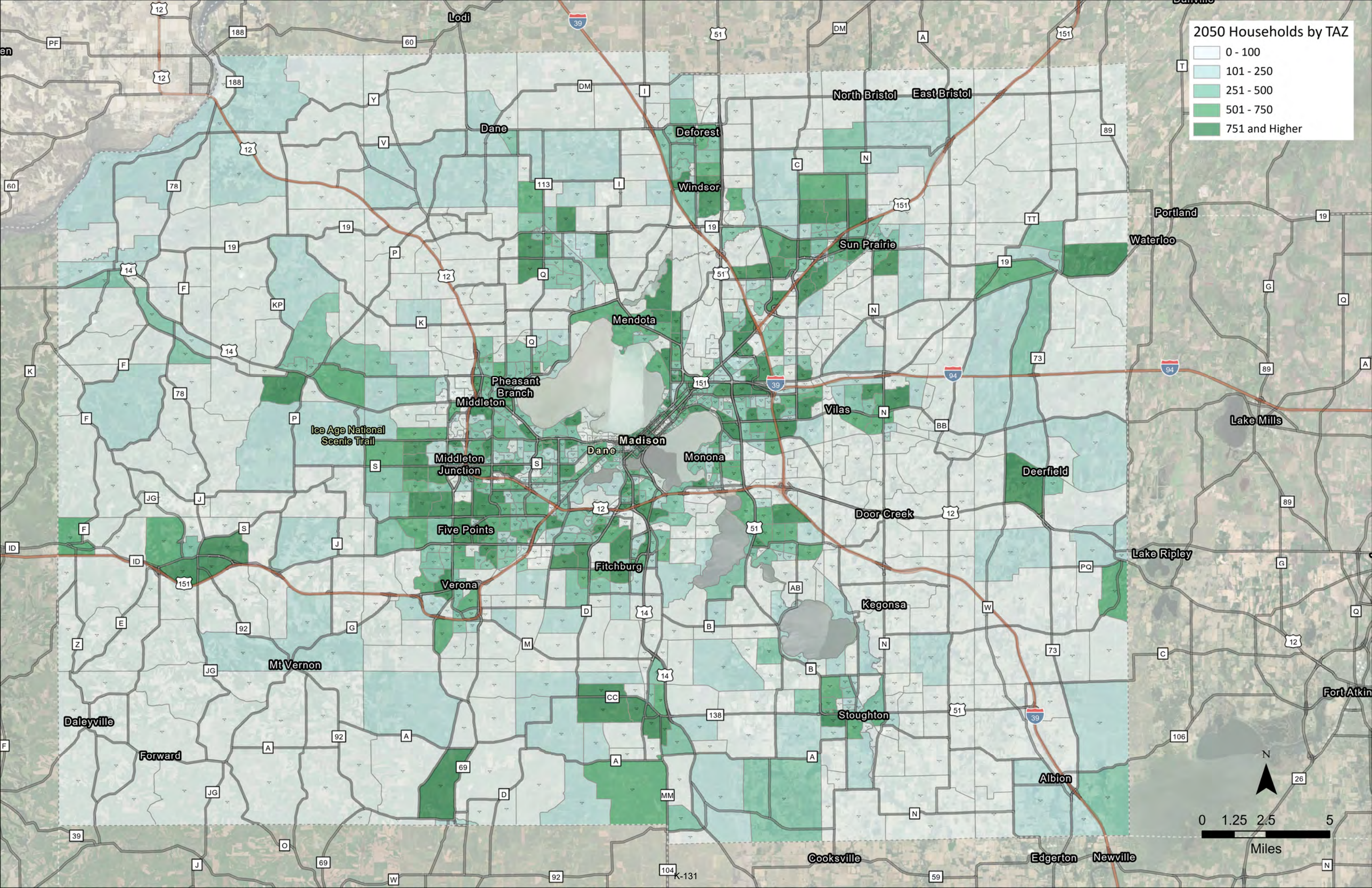

2016 Households by TAZ
0 - 100
101 - 250
251 - 500
501 - 750
751 and Higher
US Highway 14
Middleton
University Ave
Pleasant View Golf Course
University of Wisconsin-Madison
Cross Plains State Park
Ice Age National Scenic Trail
Timber Ln
Pope Farm Park
Old Sauk Rd
N Gammon Rd
Blackhawk Country Club
Campus Dr
Madison
Regent St
Brittingham Park
W Mineral Point Rd
Middleton Junction
Mineral Point Rd
Monroe St
Henry Vilas Park
Lake Wingra
W Beltline Hwy
Odana Rd
S Midvale Blvd
John Nolen Dr
S Park St
Schroeder Rd
Odana Hills Golf Course
Nakoma Rd
University of Wisconsin Arboretum
Seminole Hwy
Elver Park
Hawks Landing Golf Club
Midtown Rd
Mid Town Rd
Raymond Rd
Fish Hatchery Rd
Rimrock Rd
University Ridge Golf Course
Five Points
Riley
County Road PD
McKee Rd
Dawley Conservancy Park
Knollwood Conservation Park
Syene Rd
County Road MM
Quarry Ridge Recreation Area
Verona Rd
Badger Prairie Park
Fitchburg
Lacy Rd
Verona
W Verona Ave
Irish Ln
Pacll St
County Road G
Whalen Rd
Lakeview
N
0 0.25 0.5 1
Miles


2016 Households by TAZ
0 - 100
101 - 250
251 - 500
501 - 750
751 and Higher
Springfield Corners
Martinsville
State Road 19
19
County Road P
US Highway 12
12
Kingsley Rd
Woodland Dr
Sixmile Creek Golf
E Main St
113
State Road 113
Cherokee Marsh Yahara Heights
Metfert Rd
County Road Q
M
Ashton
K
County Road K
Ashton Corners
Pheasant Branch Rd
Parmenter St
Morey Airport
Airport Rd
Pheasant Branch
Bishops Bay Country Club
Governor Nelson State Park
Mendota
Northport Dr
Lake Mendota
N
0 0.25 0.5 1
Miles

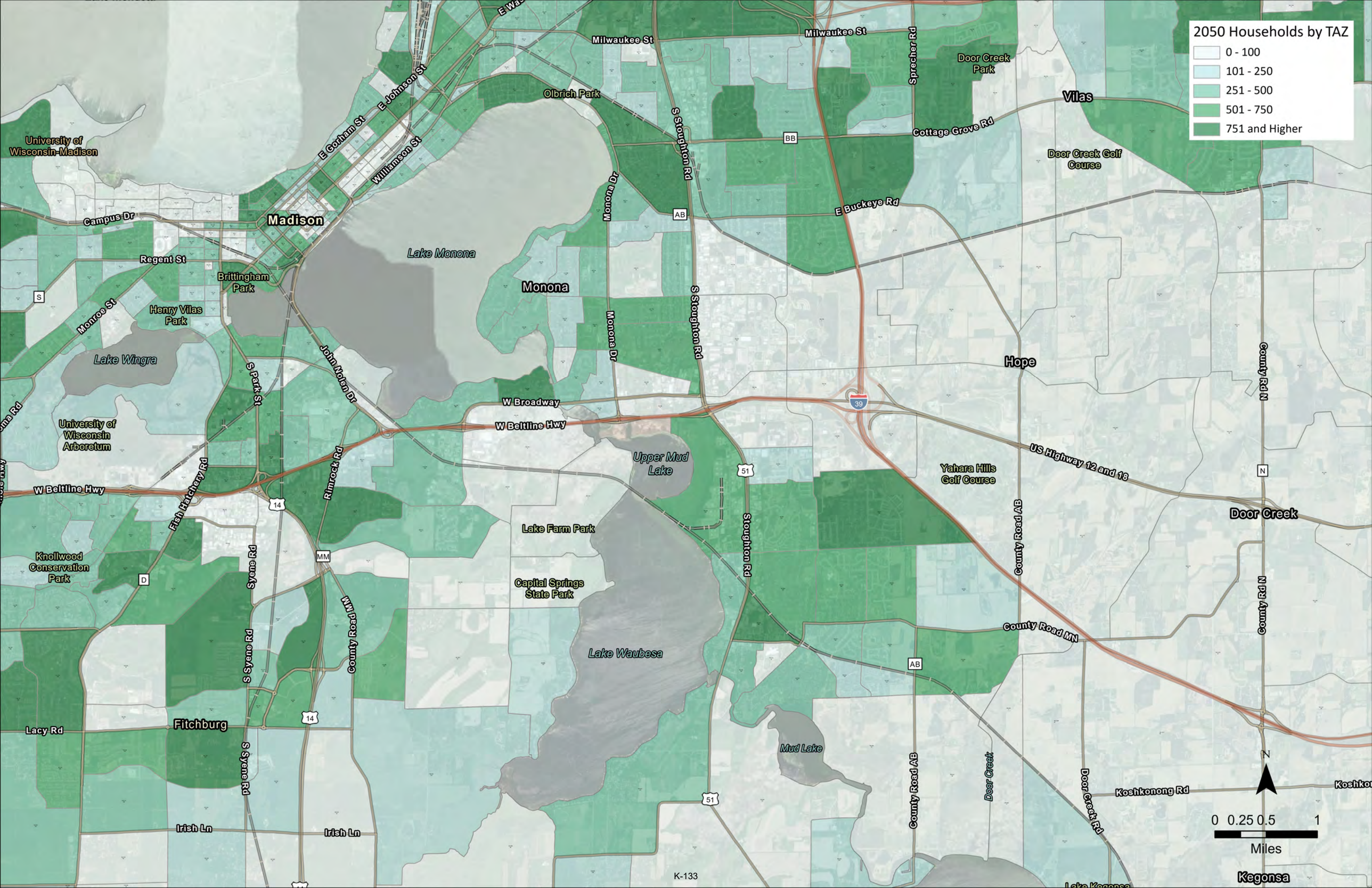

2016 Households by TAZ
0 - 100
101 - 250
251 - 500
501 - 750
751 and Higher
Token Creek
Windsor St
N Bird St
N Bristol St
Sun Prairie
W Main St
Grove St
Token Creek County Park
Ratfman Rd
S Grand Ave
Hoepker Rd
Hoepker Rd
Cherokee Marsh-North Unit
North-East Park
County Road CV
N Stoughton Rd
Reiner Rd
Nelson Rd
Dane County Regional Airport
Burke
County Road T
County Road TT
McCarthy Youth & Conservation Park
Madison Area Technical Col-Truax
Bridges Golf Course
Maple Bluff Country Club
N Sherman Ave
Packers Ave
Aberg Ave
E Washington Ave
Seminary Springs
K-128
0 0.25 0.5 1
Miles
N

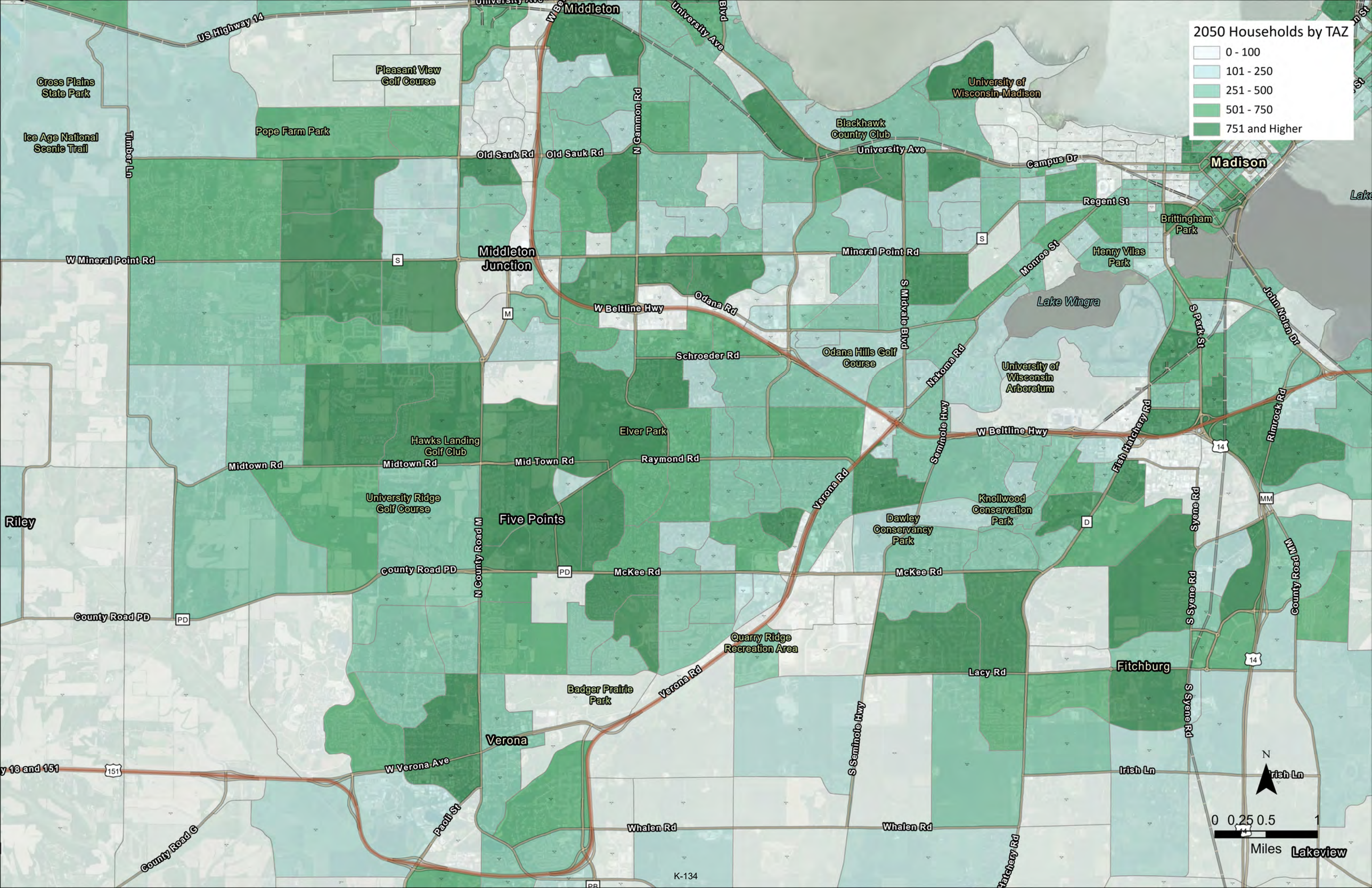

2050 Households by TAZ
0 - 100
101 - 250
251 - 500
501 - 750
751 and Higher
Lodi
Dane
Deforest
North Bristol
East Bristol
Windsor
Sun Prairie
Portland
Waterloo
Mendota
Pheasant Branch
Middleton
Madison
Dane
Middleton Junction
Monona
Vilas
Deerfield
Lake Mills
Five Points
Door Creek
Lake Ripley
Fitchburg
Verona
Kegonsa
Mt Vernon
Stoughton
Daleyville
Forward
Albion
Cooksville
Edgerton
Newville
N
0 1.25 2.5 5
Miles

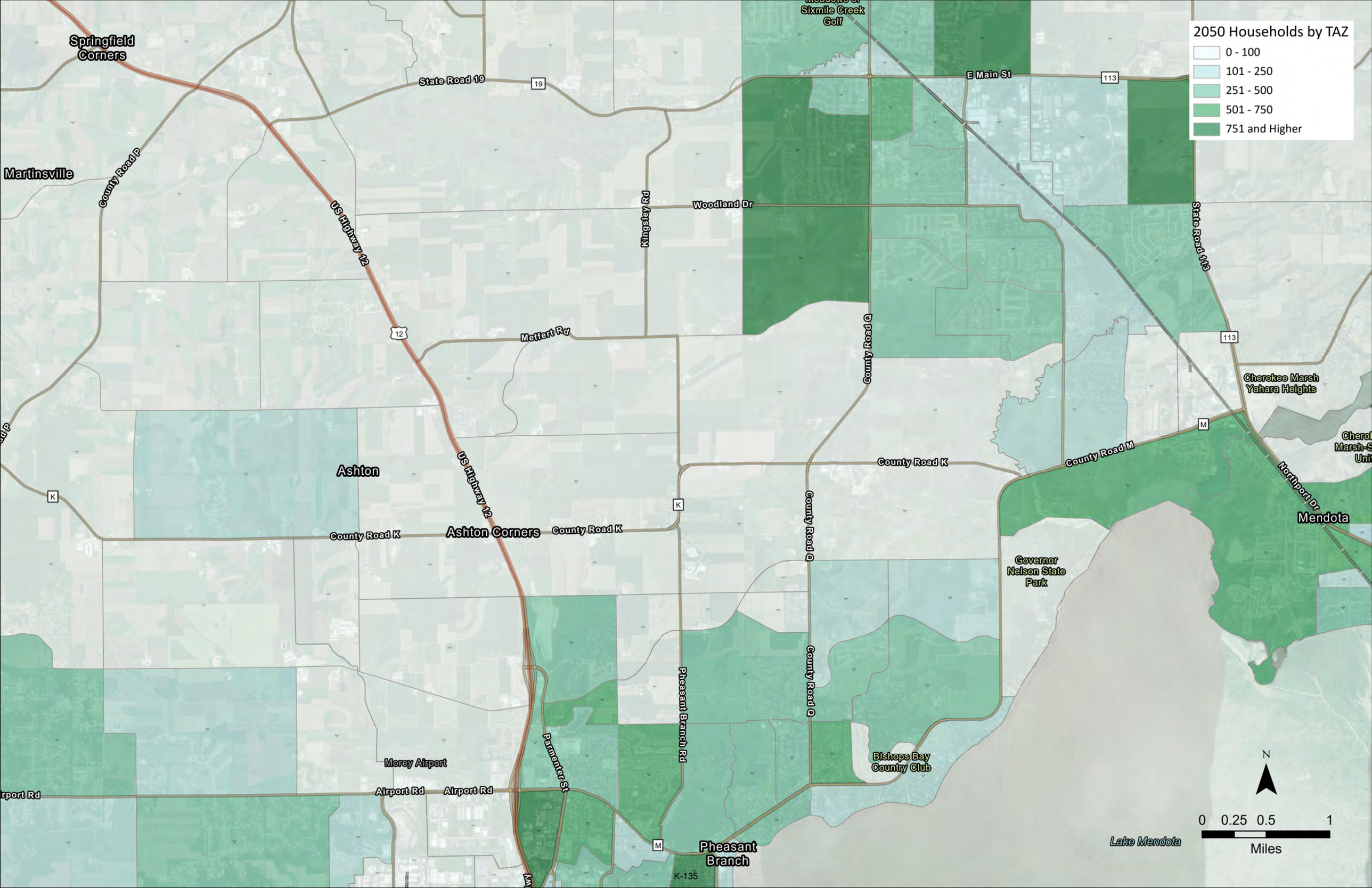

2050 Households by TAZ
0 - 100
101 - 250
251 - 500
501 - 750
751 - 1670
WI_Counties_2015
Mason Lake
Briggsville
Hulburt Creek Fishery Area
Wisconsin Dells
Dell Creek State Wildlife Area
Anacker
Mirror Lake State Park
Reedsburg
Portage
Wyocena
Baraboo
Columbia
Durwards Glen
Larue
Sauk
Devil's Lake State Park
Baxters Hollow SNA
Merrimac Preserve
Bluffview
Sauk Prairie State Recreation Area
Moon Valley
Harmony Grove
Denzer
Lodi
Witwen
Black Hawk
Dane
K-130
N
0 1 2 4
Miles

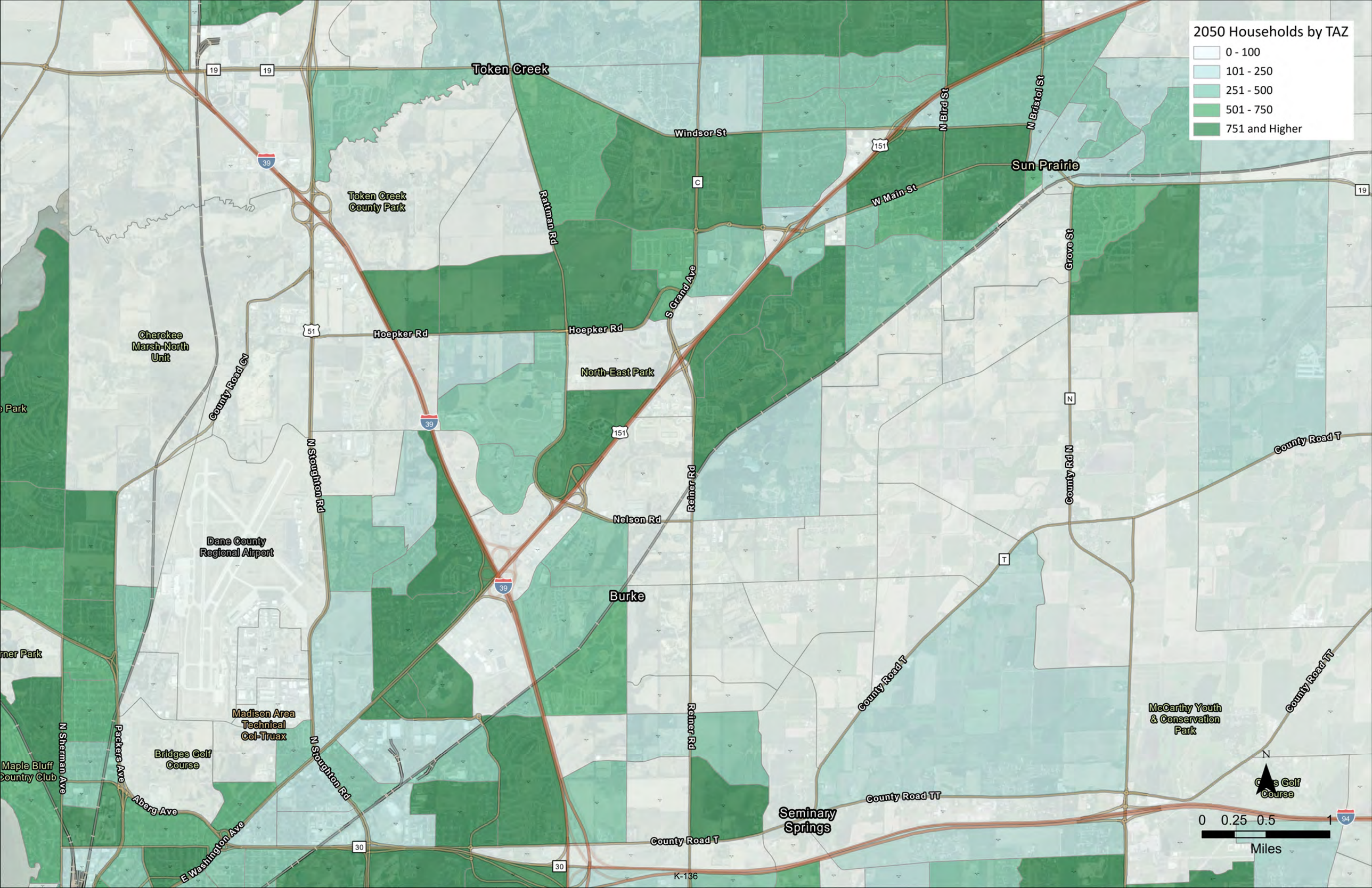

2050 Households by TAZ
0 - 100
101 - 250
251 - 500
501 - 750
751 and Higher
Lodi
Dane
Deforest
North Bristol
East Bristol
Windsor
Portland
Waterloo
Sun Prairie
Mendota
Pheasant Branch
Middleton
Ice Age National Scenic Trail
Middleton Junction
Madison
Dane
Monona
Vilas
Lake Mills
Deerfield
Door Creek
Five Points
Fitchburg
Verona
Lake Ripley
Kegonsa
Mt Vernon
Daleyville
Forward
Stoughton
Albion
Fort Atkin
Cooksville
Edgerton
Newville
N
0 1.25 2.5 5
Miles

2050 Households by TAZ
0 - 100
101 - 250
251 - 500
501 - 750
751 and Higher
Lake Mendota
Lake Monona
Lake Wingra
Madison
Monona
Maple Bluff Country Club
Bridges Golf Course
Madison Area Technical Col-Truax
Demetral Field
Heistand Park
East Morland Park
Tenney Park
Hudson Park
Olbrich Park
James Madison Park
University of Wisconsin-Madison
University Hospital
Brittingham Park
Forest Hill Cemetery
Resurrection Cemetery
Glenway Municipal Golf Course
Edgewood College
SSM Health St. Mary's Hospital – Madison
Goodman Park
Turville Point Conservation Park
Quann Park
Alliant Energy Center
Duane F Bowman Park
Harvey E Schmidt Park
Monona Municipal Golf Course
Edna Taylor Conservation Park
Roselawn Memorial Park
Anderson St
Sheridan Dr
Farwell Dr
N Sherman Ave
Ruskin St
Huxley St
Aberg Ave
Lexington Ave
Burke Ave
Commercial Ave
Webb Ave
Union St
Oak St
N 5th St
Winnebago St
Atwood Ave
E Washington Ave
Lien Rd
Garnet Ln
Onyx Ln
Meadowlark Dr
Retana Dr
Tulane Ave
Dempsey Rd
Atlas Ave
Topaz Ln
Johns St
S Stoughton Rd
Leo Dr
Drexel Ave
Hegg Ave
Buckeye Rd
Maher Ave
Turner Ave
Camden Rd
E Buckeye Rd
Vondron Rd
Ellen Ave
Helgesen Dr
Daniels St
Dairy Dr
Agriculture Dr
Progress Rd
Femrite Dr
Monona Dr
Winnebago Rd
Bridge Rd
Tonyawatha Trl
Nichols Rd
Douglas Trl
Acacia Ln
Owen Rd
W Dean Ave
E Dean Ave
Waunona Way
W Broadway
E Broadway
W Beltline Hwy
E Dayton St
E Main St
Williamson St
Spaight St
Langdon St
University Ave
Campus Dr
Linden Dr
W Johnson St
Locust Dr
Harvey St
Oxford Rd
Lake Mendota Dr
Edgehill Dr
Price Pl
Hoyt Park
Van Hise Ave
Regent St
Rowley Ave
Hillcrest Dr
Keating Ter
Ames St
Odana Rd
Council Crst
Yuma Dr
Larkin St
S Owen Dr
Teepfer Ave
S Midvale Blvd
Commonwealth Ave
Keyes Ave
Monroe St
Adams St
S Randall Ave
S Mills St
John Nolen Dr
N Wingra Dr
S Park St
Bedford St
Bram St
Monroe St
Lake Mendota
Maple Bluff Country Club
Bridges Golf Course
Madison Area Technical Col-Truax
Demetral Field
Heistand Park
East Morland Park
Tenney Park
Hudson Park
Olbrich Park
James Madison Park
University of Wisconsin-Madison
University Hospital
Brittingham Park
Forest Hill Cemetery
Resurrection Cemetery
Glenway Municipal Golf Course
Edgewood College
SSM Health St. Mary's Hospital – Madison
Goodman Park
Turville Point Conservation Park
Quann Park
Alliant Energy Center
Duane F Bowman Park
Harvey E Schmidt Park
Monona Municipal Golf Course
Edna Taylor Conservation Park
Roselawn Memorial Park
Madison
Monona
0
0.25
0.5
1
Miles
N


2050 Households by TAZ
0 - 100
101 - 250
251 - 500
501 - 750
751 and Higher
Milwaukee St
Olbrich Park
S Stoughton Rd
Sprecher Rd
Door Creek Park
Vilas
Cottage Grove Rd
BB
Door Creek Golf Course
E Johnson St
E Gorham St
Williamson St
University of Wisconsin-Madison
Campus Dr
Madison
Monona Dr
AB
E Buckeye Rd
Lake Monona
Regent St
Brittingham Park
Monona
S
Monroe St
Henry Vilas Park
Lake Wingra
S Park St
John Nolen Dr
Hope
W Broadway
W Beltline Hwy
39
University of Wisconsin Arboretum
Fish Hatchery Rd
Rimrock Rd
Upper Mud Lake
51
Yahara Hills Golf Course
US Highway 12 and 18
County Road AB
Door Creek
N
County Rd N
14
MM
Knollwood Conservation Park
D
Syene Rd
Lake Farm Park
Capital Springs State Park
Stoughton Rd
County Road MN
Lake Waubesa
Fitchburg
Lacy Rd
S Syene Rd
Mud Lake
Door Creek
Door Creek Rd
Koshkonong Rd
Irish Ln
0 0.25 0.5 1
Miles
Kegonsa
K-133


2050 Households by TAZ
0 - 100
101 - 250
251 - 500
501 - 750
751 and Higher
US Highway 14
Middleton
University Ave
Pleasant View Golf Course
Cross Plains State Park
Ice Age National Scenic Trail
Timber Ln
Pope Farm Park
Old Sauk Rd
N Gammon Rd
University of Wisconsin-Madison
Blackhawk Country Club
Campus Dr
Madison
Regent St
Brittingham Park
W Mineral Point Rd
Middleton Junction
Mineral Point Rd
Monroe St
Henry Vilas Park
Lake Wingra
W Beltline Hwy
Odana Rd
S Midvale Blvd
John Nolen Dr
S Park St
Schroeder Rd
Odana Hills Golf Course
Nakoma Rd
University of Wisconsin Arboretum
Seminole Hwy
Fish Hatchery Rd
Rimrock Rd
Elver Park
Hawks Landing Golf Club
Midtown Rd
Mid Town Rd
Raymond Rd
Verona Rd
University Ridge Golf Course
Riley
Five Points
N County Road M
Dawley Conservancy Park
Knollwood Conservation Park
Syene Rd
County Road MM
County Road PD
McKee Rd
Quarry Ridge Recreation Area
Badger Prairie Park
Fitchburg
Lacy Rd
S Syene Rd
Verona
W Verona Ave
Irish Ln
Paoli St
Whalen Rd
County Road G
N
0 0.25 0.5 1
Miles
Lakeview


2050 Households by TAZ
0 - 100
101 - 250
251 - 500
501 - 750
751 and Higher
Springfield Corners
Martinsville
State Road 19
19
County Road P
US Highway 12
12
Kingsley Rd
Woodland Dr
Sixmile Creek Golf
E Main St
113
State Road 113
Cherokee Marsh Yahara Heights
Meffert Rd
County Road Q
Ashton
Ashton Corners
County Road K
K
County Road M
M
Northport Dr
Mendota
Governor Nelson State Park
Pheasant Branch Rd
Parmenter St
Morey Airport
Airport Rd
Bishops Bay Country Club
Pheasant Branch
K-135
Lake Mendota
N
0 0.25 0.5 1
Miles


2050 Households by TAZ
0 - 100
101 - 250
251 - 500
501 - 750
751 and Higher
Token Creek
Windsor St
Sun Prairie
W Main St
Token Creek County Park
Rattman Rd
S Grand Ave
N Bird St
N Bristol St
Grove St
Hoepker Rd
Cherokee Marsh-North Unit
North-East Park
County Road CV
N Stoughton Rd
Reiner Rd
County Road T
Dane County Regional Airport
Nelson Rd
Burke
Madison Area Technical Col-Truax
Bridges Golf Course
Maple Bluff Country Club
N Sherman Ave
Packers Ave
Aberg Ave
E Washington Ave
County Road TT
Seminary Springs
McCarthy Youth & Conservation Park
0 0.25 0.5 1
Miles
K-136

Difference in Households from 2016 to 2050

- -75 - -1
- 0 - 250
- 251 - 500
- 501 - 1500
- 1501 - 3831

Lodi
North Bristol
East Bristol
Dane
Deforest
Windsor
Portland
Waterloo
Sun Prairie
Mendota
Pheasant Branch
Middleton
Ice Age National Scenic Trail
Middleton Junction
Madison
Dane
Monona
Vilas
Lake Mills
Deerfield
Door Creek
Five Points
Fitchburg
Verona
Lake Ripley
Kegonsa
Mt Vernon
Daleyville
Forward
Stoughton
Albion
Fort Atkin
Cooksville
Edgerton
Newville

N

0 1.25 2.5 5
Miles

Difference in Households from 2016 to 2050

-75 - -1
0 - 250
251 - 500
501 - 1500
1501 - 3831

Madison
Monona
Lake Mendota
Lake Monona
Lake Wingra
University of Wisconsin-Madison
Madison Area Technical Col-Truax
Bridges Golf Course
Maple Bluff Country Club
Sycamore Park
Heistand Park
East Morland Park
Demetral Field
Tenney Park
Hudson Park
Olbrich Park
James Madison Park
Brittingham Park
Goodman Park
Turville Point Conservation Park
Quann Park
Alliant Energy Center
Duane F Bowman Park
Harvey E Schmidt Park
Monona Municipal Golf Course
Edna Taylor Conservation Park
Roselawn Memorial Park
Hoyt Park
Resurrection Cemetery
Forest Hill Cemetery
Glenway Municipal Golf Course
Edgewood College
SSM Health St. Mary's Hospital – Madison
University Hospital

Anderson St
Aberg Ave
Lexington Ave
Burke Ave
Commercial Ave
Webb Ave
Union St
Oak St
N 5th St
Atwood Ave
Winnebago St
E Washington Ave
Tulane Ave
Dempsey Rd
Johns St
Alias Ave
Onyx Ln
Meadowlark Dr
Retana Dr
Topaz Ln
Garnet Ln
Leo Dr
Ellen Ave
Vondron Rd
E Buckeye Rd
Helgesen Dr
Daniels St
Progress Rd
Dairy Dr
Agriculture Dr
Femrite Dr
E Broadway
W Broadway
W Beltline Hwy
Waunona Way
Bridge Rd
Winnequah Rd
Nichols Rd
Douglas Trl
Acacia Ln
Owen Rd
Tonyawatha Trl
Monona Dr
Hegg Ave
Drexel Ave
Buckeye Rd
Maher Ave
Turner Ave
Camden Rd
S Stoughton Rd
E Dean Ave
W Dean Ave
Sheridan Dr
Farwell Dr
N Sherman Ave
Ruskin St
Huxley St
E Dayton St
E Main St
Williamson St
Spaight St
Langdon St
Linden Dr
Campus Dr
University Ave
W Johnson St
Van Hise Ave
Rowley Ave
Regent St
Commonwealth Ave
Keyes Ave
Monroe St
Adams St
S Randall Ave
S Mills St
John Nolen Dr
N Wingra Dr
S Park St
Bedford St
Bram St
Lake Mendota Dr
Edgehill Dr
Oxford Rd
Locust Dr
University Ave
Harvey St
Price Pl
Hillcrest Dr
Larkin St
S Owen Dr
Keating Ter
Ames St
Tecumseh Ave
S Midvale Blvd
Council Crst
Yuma Dr
Odana Rd
Monroe St
Lake Mendota Dr
Sycamore Park
Heistand Park
Leo Dr
Vondron Rd
Ellen Ave
Helgesen Dr
Daniels St
Progress Rd
Dairy Dr
Agriculture Dr
Femrite Dr
Roselawn Memorial Park
Edna Taylor Conservation Park
Owen Rd
Douglas Trl
Acacia Ln
Nichols Rd
Monona Municipal Golf Course
Monona Dr
Winnequah Rd
Bridge Rd
Waunona Way
W Broadway
E Broadway
W Beltline Hwy
Tonyawatha Trl
Hegg Ave
Drexel Ave
Buckeye Rd
Maher Ave
Turner Ave
Camden Rd
S Stoughton Rd
E Dean Ave
W Dean Ave
Lexington Ave
Burke Ave
Commercial Ave
Webb Ave
Union St
Oak St
N 5th St
Atwood Ave
Winnebago St
E Washington Ave
Tulane Ave
Dempsey Rd
Johns St
Alias Ave
Onyx Ln
Meadowlark Dr
Retana Dr
Topaz Ln
Garnet Ln
Anderson St
Aberg Ave
Commercial Ave
Demetral Field
Tenney Park
Hudson Park
Olbrich Park
James Madison Park
Brittingham Park
Goodman Park
Turville Point Conservation Park
Quann Park
Alliant Energy Center
Duane F Bowman Park
Harvey E Schmidt Park
Sheridan Dr
Farwell Dr
N Sherman Ave
Ruskin St
Huxley St
E Dayton St
E Main St
Williamson St
Spaight St
Langdon St
Linden Dr
Campus Dr
University Ave
W Johnson St
Van Hise Ave
Rowley Ave
Regent St
Commonwealth Ave
Keyes Ave
Monroe St
Adams St
S Randall Ave
S Mills St
John Nolen Dr
N Wingra Dr
S Park St
Bedford St
Bram St
Lake Mendota Dr
Edgehill Dr
Oxford Rd
Locust Dr
University Ave
Harvey St
Price Pl
Hillcrest Dr
Larkin St
S Owen Dr
Keating Ter
Ames St
Tecumseh Ave
S Midvale Blvd
Council Crst
Yuma Dr
Odana Rd
Monroe St
30
39
BB
N
0 0.25 0.5 1 Miles

Difference in Households from 2016 to 2050
-75 - -1
0 - 250
251 - 500
501 - 1500
1501 - 3831

Milwaukee St
Olbrich Park
E Johnson St
E Gorham St
Williamson St
University of Wisconsin-Madison
Campus Dr
Madison
Regent St
Brittingham Park
Lake Monona
Monona
Monona Dr
S Stoughton Rd
AB
BB
Cottage Grove Rd
Vilas
Door Creek Park
Sprecher Rd
Door Creek Golf Course
E Buckeye Rd
Monroe St
Henry Vilas Park
Lake Wingra
S Park St
John Nolen Dr
W Broadway
W Beltline Hwy
Hope
39
University of Wisconsin Arboretum
Fish Hatchery Rd
Rimrock Rd
Upper Mud Lake
51
US Highway 12 and 18
Yahara Hills Golf Course
Door Creek
County Road AB
County Rd N
Knollwood Conservation Park
Syene Rd
MM
Lake Farm Park
Capital Springs State Park
Stoughton Rd
County Road MN
Lake Waubesa
Lacy Rd
Fitchburg
S Syene Rd
County Road MM
Mud Lake
Door Creek
Door Creek Rd
Koshkonong Rd
Irish Ln
Irish Ln
K-139
Lake Kegonsa
Kegonsa
N
0 0.25 0.5 1
Miles

Difference in Households from 2016 to 2050
-75 - -1
0 - 250
251 - 500
501 - 1500
1501 - 3831

US Highway 14
Middleton
University Ave
Blvd
Cross Plains State Park
Pleasant View Golf Course
University of Wisconsin-Madison
Ice Age National Scenic Trail
Timber Ln
Pope Farm Park
Old Sauk Rd
N Gammon Rd
Blackhawk Country Club
University Ave
Campus Dr
Madison
Regent St
Brittingham Park
W Mineral Point Rd
Middleton Junction
Mineral Point Rd
Monroe St
Henry Vilas Park
Lake Wingra
W Beltline Hwy
Odana Rd
S Midvale Blvd
John Nolen Dr
S Park St
Schroeder Rd
Odana Hills Golf Course
Nakoma Rd
University of Wisconsin Arboretum
Seminole Hwy
Elver Park
Hawks Landing Golf Club
Midtown Rd
Mid Town Rd
Raymond Rd
Fish Hatchery Rd
Rimrock Rd
Riley
University Ridge Golf Course
Five Points
N County Road M
Verona Rd
Dawley Conservancy Park
Knollwood Conservation Park
Syene Rd
County Road MM
County Road PD
McKee Rd
Quarry Ridge Recreation Area
S Syene Rd
Badger Prairie Park
Fitchburg
Lacy Rd
S Seminole Hwy
Verona
W Verona Ave
Irish Ln
Paoli St
Whalen Rd
County Road G
Lakeview
N
0 0.25 0.5 1
Miles

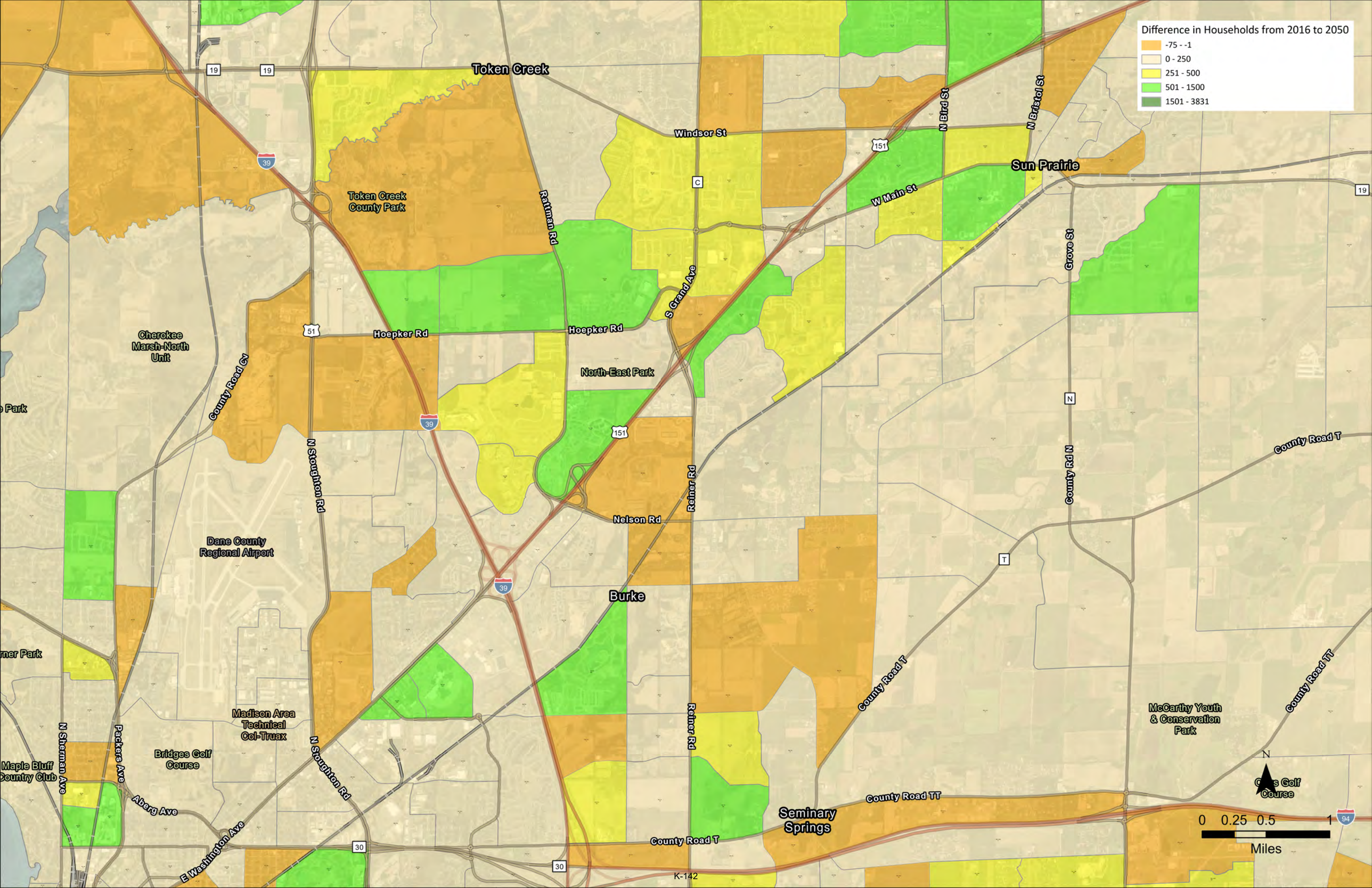
Difference in Households from 2016 to 2050
-75 - -1
0 - 250
251 - 500
501 - 1500
1501 - 3831

Springfield Corners
Martinsville
Ashton
Ashton Corners
Morey Airport
Pheasant Branch
Cherokee Marsh
Yahara Heights
Mendota
Governor Nelson State Park
Bishops Bay Country Club
Lake Mendota
K-141

State Road 19
E Main St
Woodland Dr
Metfert Rd
County Road K
County Road M
Airport Rd
Parmenter St
Pheasant Branch Rd
Northport Dr
State Road 113
County Road P
US Highway 12
Kingsley Rd
County Road Q

19
113
12
K
M

N
0 0.25 0.5 1
Miles


Difference in Households from 2016 to 2050
-75 - -1
0 - 250
251 - 500
501 - 1500
1501 - 3831
Token Creek
Windsor St
Sun Prairie
W Main St
N Bird St
N Bristol St
Grove St
Token Creek County Park
Rattman Rd
C
S Grand Ave
Hoepker Rd
Hoepker Rd
Cherokee Marsh-North Unit
County Road CV
North-East Park
N Stoughton Rd
Dane County Regional Airport
Nelson Rd
Reiner Rd
Burke
County Rd N
County Road T
McCarthy Youth & Conservation Park
Madison Area Technical Col-Truax
Bridges Golf Course
N Sherman Ave
Packers Ave
Aberg Ave
E Washington Ave
Seminary Springs
County Road TT
Maple Bluff Country Club
N
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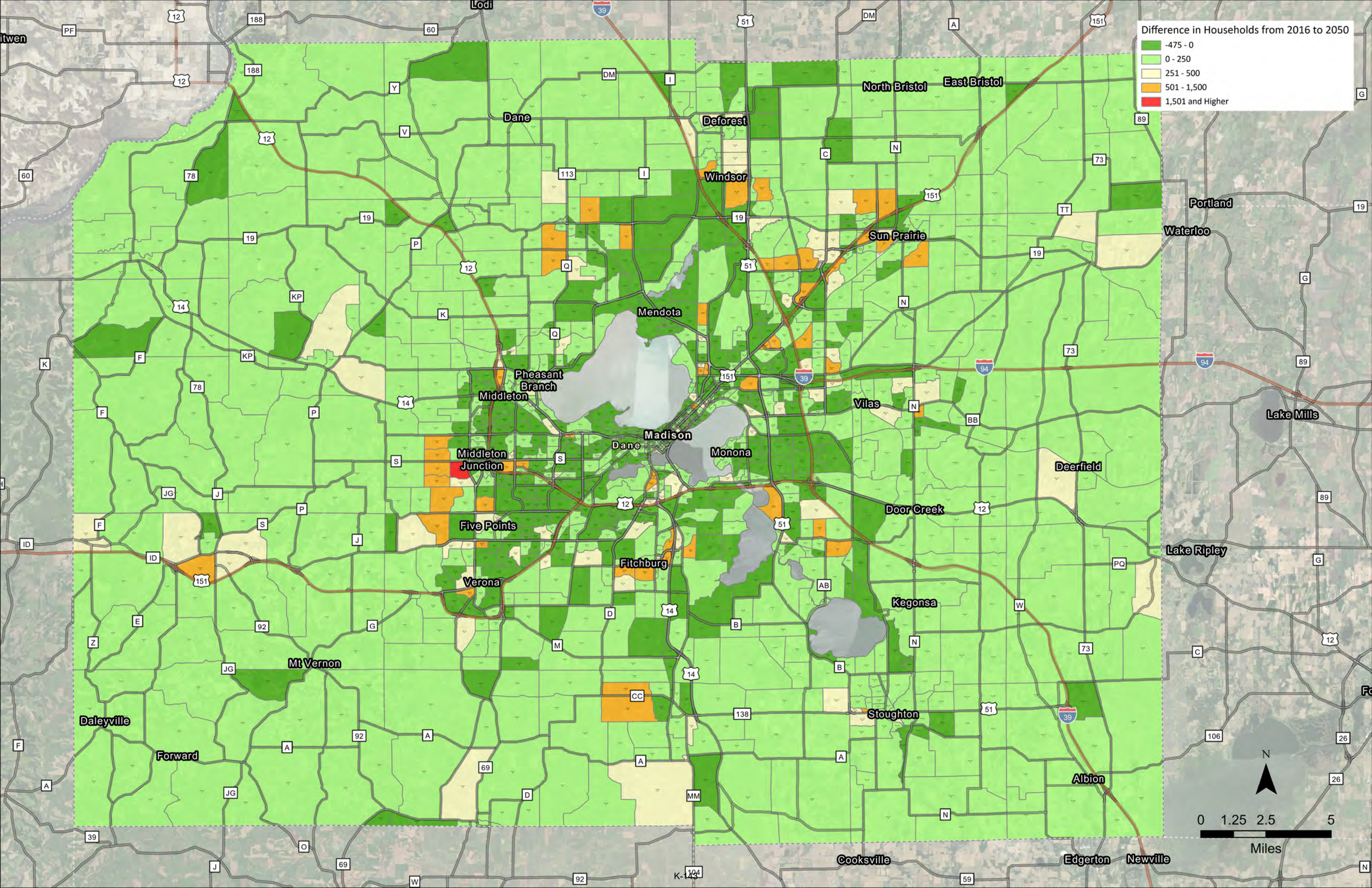
Miles
K-142


Difference in Households from 2016 to 2050
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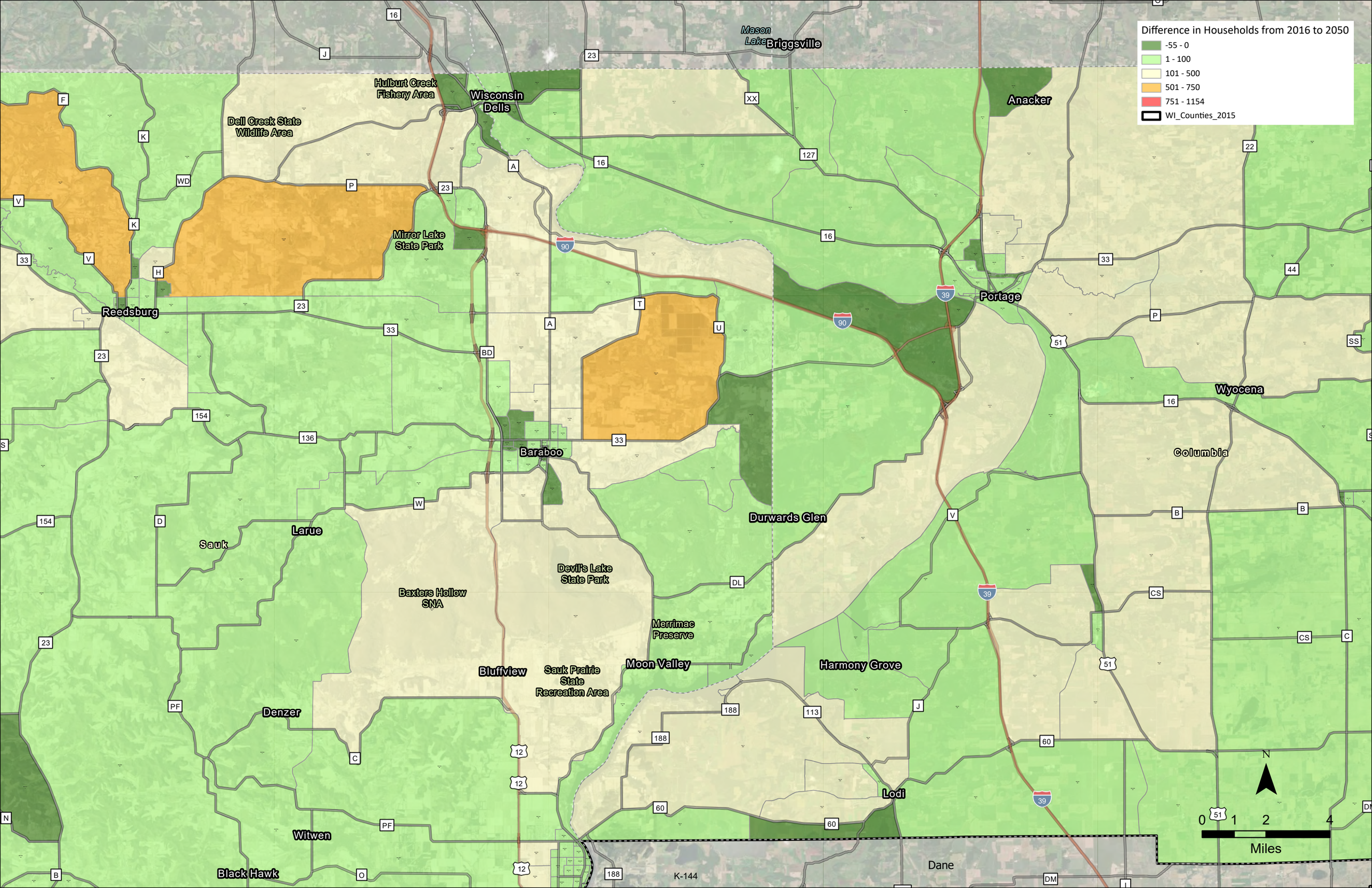
0 - 250
251 - 500
501 - 1,500
1,501 and Higher
Lodi
Dane
Deforest
North Bristol
East Bristol
Windsor
Sun Prairie
Portland
Waterloo
Mendota
Pheasant Branch
Middleton
Madison
Dane
Monona
Middleton Junction
Five Points
Vilas
Lake Mills
Deerfield
Door Creek
Lake Ripley
Fitchburg
Verona
Kegonsa
Mt Vernon
Daleyville
Forward
Stoughton
Albion
Cooksville
Edgerton
Newville
N
0 1.25 2.5 5
Miles


Difference in Households from 2016 to 2050
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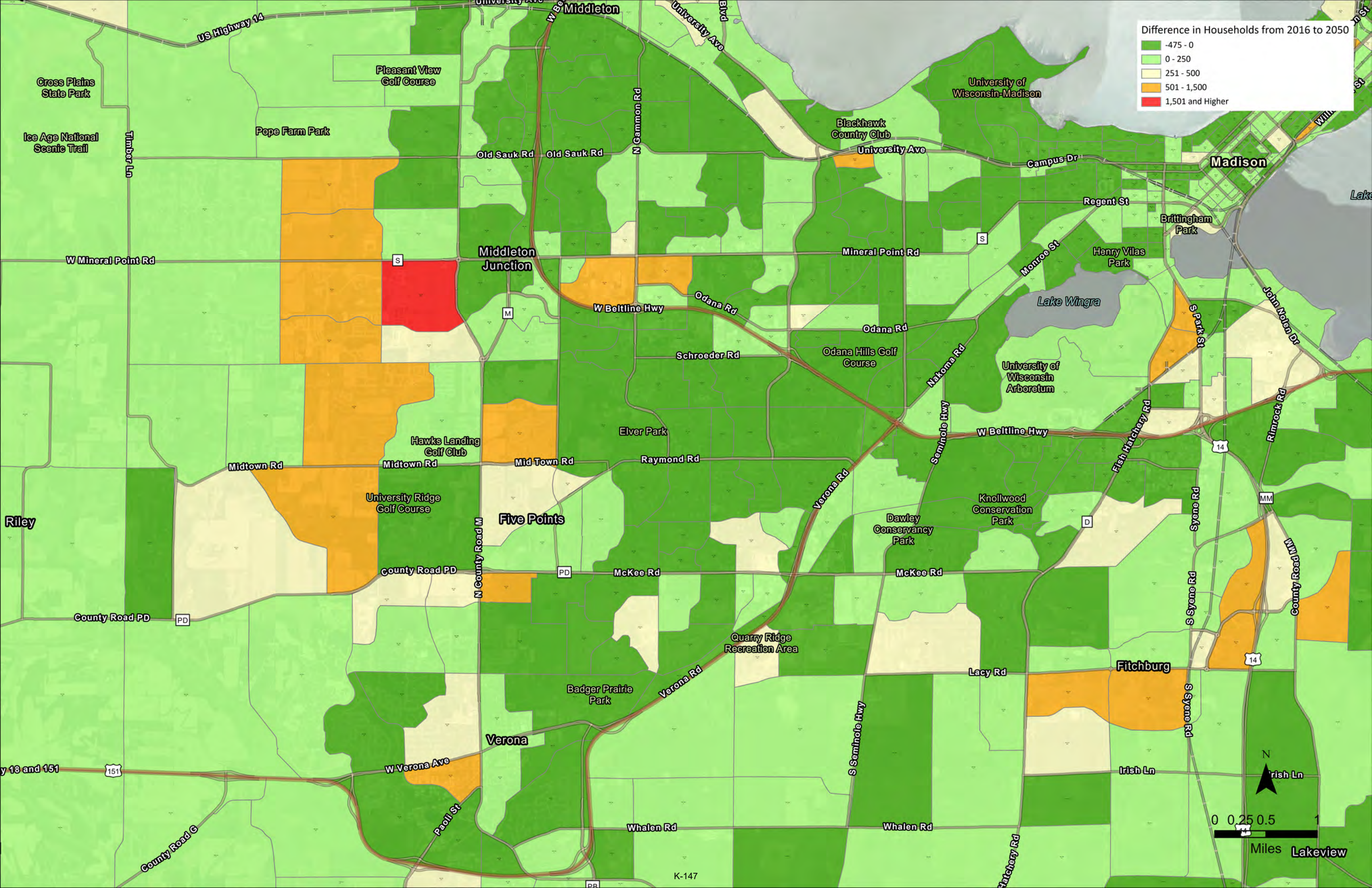
1 - 100
101 - 500
501 - 750
751 - 1154
WI_Counties_2015
Mason Lake
Briggsville
Hulburt Creek Fishery Area
Wisconsin Dells
Dell Creek State Wildlife Area
Anacker
Mirror Lake State Park
Reedsburg
Portage
Baraboo
Wyocena
Columbia
Durwards Glen
Sauk
Larue
Devil's Lake State Park
Baxters Hollow SNA
Merrimac Preserve
Moon Valley
Harmony Grove
Bluffview
Sauk Prairie State Recreation Area
Denzer
Lodi
Witwen
Black Hawk
Dane
K-144
N
0 1 2 4
Miles

Difference in Households from 2016 to 2050
-475 - 0
0 - 250
251 - 500
501 - 1,500
1,501 and Higher

Lake Mendota
Lake Monona
Lake Wingra
Madison
Monona
Maple Bluff Country Club
Bridges Golf Course
Madison Area Technical Col-Truax
Sycamore Park
Demetral Field
Heistand Park
East Morland Park
Tenney Park
Hudson Park
Olbrich Park
James Madison Park
University of Wisconsin-Madison
University Hospital
Hoyt Park
Resurrection Cemetery
Forest Hill Cemetery
Glenway Municipal Golf Course
Edgewood College
SSM Health St. Mary's Hospital – Madison
Brittingham Park
Goodman Park
Turville Point Conservation Park
Quann Park
Alliant Energy Center
Duane F Bowman Park
Harvey E Schmidt Park
Monona Municipal Golf Course
Edna Taylor Conservation Park
Roselawn Memorial Park
Anderson St
Sheridan Dr
Farwell Dr
Fremont Ave
N Sherman Ave
Ruskin St
Huxley St
Packers Ave
Coolidge St
Commercial Ave
Webb Ave
Burke Ave
Mayfair Ave
Walsh Rd
E Washington Ave
Oak St
Union St
N 5th St
Winnebago St
Atwood Ave
E Washington Ave
Garnet Ln
Onyx Ln
Meadowlark Dr
Merryturn Rd
Topaz Ln
Dennett Dr
Johns St
Dempsey Rd
Atlas Ave
S Stoughton Rd
Lake Mendota Dr
Edgehill Dr
Oxford Rd
Locust Dr
University Ave
Harvey St
Campus Dr
Observatory Dr
Kendall Ave
Van Hise Ave
Rowley Ave
Regent St
Hillcrest Dr
Keating Ter
Orchard Dr
Charles Ln
Odana Rd
Council Crst
Koma Rd
Price Pl
Larkin St
S Owen Dr
Tooepfer Ave
S Midvale Blvd
Monroe St
Commonwealth Ave
Keyes Ave
Monroe St
Adams St
S Randall Ave
Vilas Ave
N Wingra Dr
S Park St
S Bird St
John Nolen Dr
Langdon St
E Main St
Williamson St
Spaight St
University Ave
W Johnson St
Tonyawatha Trl
Nichols Rd
Douglas Trl
Acacia Ln
Owen Rd
Monona Dr
Winnequah Rd
Bridge Rd
Waunona Way
W Broadway
E Broadway
W Beltline Hwy
Femrite Dr
Progress Rd
Daniels St
Dairy Dr
Agriculture Dr
Pflaum Rd
Helgesen Dr
Vondron Rd
Ellen Ave
Leo Dr
E Buckeye Rd
Buckeye Rd
Hegg Ave
Drexel Ave
Maher Ave
Turner Ave
Camden Rd
Monona Dr
E Dean Ave
W Dean Ave
Tonyawatha Trl
151
30
39
BB
K-145
N
0 0.25 0.5 1
Miles

Difference in Households from 2016 to 2050
-475 - 0
0 - 250
251 - 500
501 - 1,500
1,501 and Higher

Milwaukee St
Olbrich Park
E Johnson St
E Gorham St
Williamson St
University of Wisconsin-Madison
Campus Dr
Madison
Regent St
Brittingham Park
Lake Monona
Monona
Monona Dr
S Stoughton Rd
BB
AB
Cottage Grove Rd
Vilas
Door Creek Park
Door Creek Golf Course
E Buckeye Rd
Sprecher Rd
Milwaukee St
S
Monroe St
Henry Vilas Park
Lake Wingra
S Park St
John Nolen Dr
W Broadway
W Beltline Hwy
University of Wisconsin Arboretum
Hope
39
County Rd N
US Highway 12 and 18
Upper Mud Lake
51
Yahara Hills Golf Course
Door Creek
County Road AB
Fish Hatchery Rd
14
Rimrock Rd
MM
Knollwood Conservation Park
D
Syene Rd
Lake Farm Park
Capital Springs State Park
Stoughton Rd
County Road MN
N
Lake Waubesa
Fitchburg
Lacy Rd
S Syene Rd
County Road MM
Mud Lake
Door Creek
Door Creek Rd
Koshkonong Rd
Irish Ln
Irish Ln
0 0.25 0.5 1
Miles
Kegonsa


Difference in Households from 2016 to 2050
-475 - 0
0 - 250
251 - 500
501 - 1,500
1,501 and Higher
US Highway 14
Middleton
University Ave
Blvd
Cross Plains State Park
Pleasant View Golf Course
University of Wisconsin-Madison
Ice Age National Scenic Trail
Timber Ln
Pope Farm Park
N Gammon Rd
Blackhawk Country Club
Old Sauk Rd
Old Sauk Rd
University Ave
Campus Dr
Madison
Regent St
Brittingham Park
W Mineral Point Rd
Middleton Junction
Mineral Point Rd
Monroe St
Henry Vilas Park
Lake Wingra
W Beltline Hwy
Odana Rd
Odana Rd
John Nolen Dr
S Park St
Schroeder Rd
Odana Hills Golf Course
Nakoma Rd
University of Wisconsin Arboretum
Elver Park
W Beltline Hwy
Hawks Landing Golf Club
Midtown Rd
Midtown Rd
Mid Town Rd
Raymond Rd
Seminole Hwy
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County Road MM
N County Road M
County Road PD
County Road PD
McKee Rd
McKee Rd
Quarry Ridge Recreation Area
Fitchburg
Lacy Rd
S Syene Rd
Badger Prairie Park
Verona Rd
S Seminole Hwy
Verona
W Verona Ave
Irish Ln
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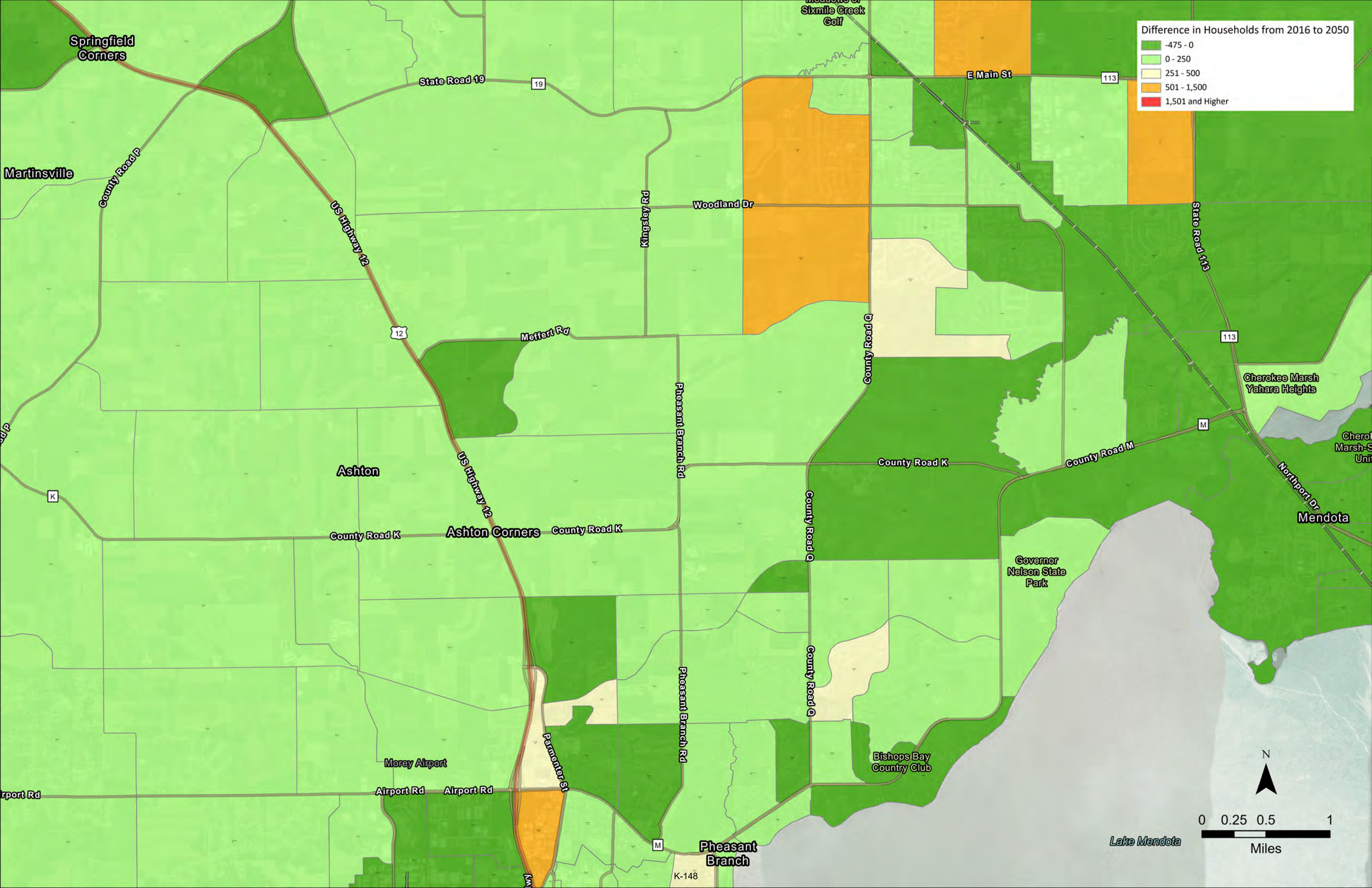
Paoli St
Whalen Rd
Whalen Rd
County Road G
N
0 0.25 0.5 1
Miles
Lakeview


Difference in Households from 2016 to 2050
-475 - 0
0 - 250
251 - 500
501 - 1,500
1,501 and Higher
Springfield Corners
Martinsville
Ashton
Ashton Corners
Sixmile Creek Golf
State Road 19
19
E Main St
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County Road P
US Highway 12
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Kingsley Rd
Woodland Dr
Meffert Rd
Pheasant Branch Rd
County Road Q
State Road 113
Cherokee Marsh Yahara Heights
County Road K
County Road M
Northport Dr
Mendota
Governor Nelson State Park
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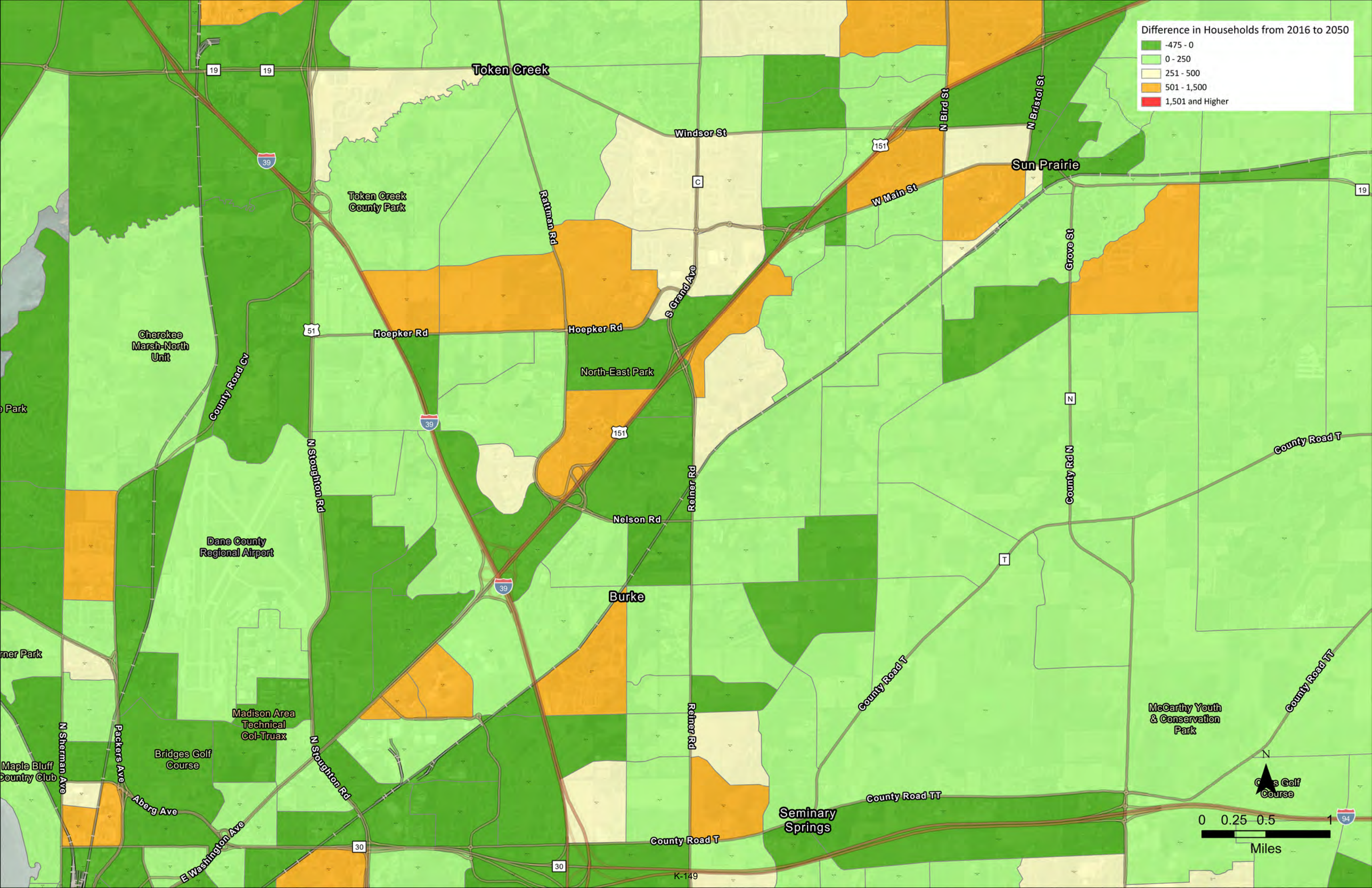
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Hoepker Rd
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County Road CV
North-East Park
Dane County Regional Airport
N Stoughton Rd
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Bridges Golf Course
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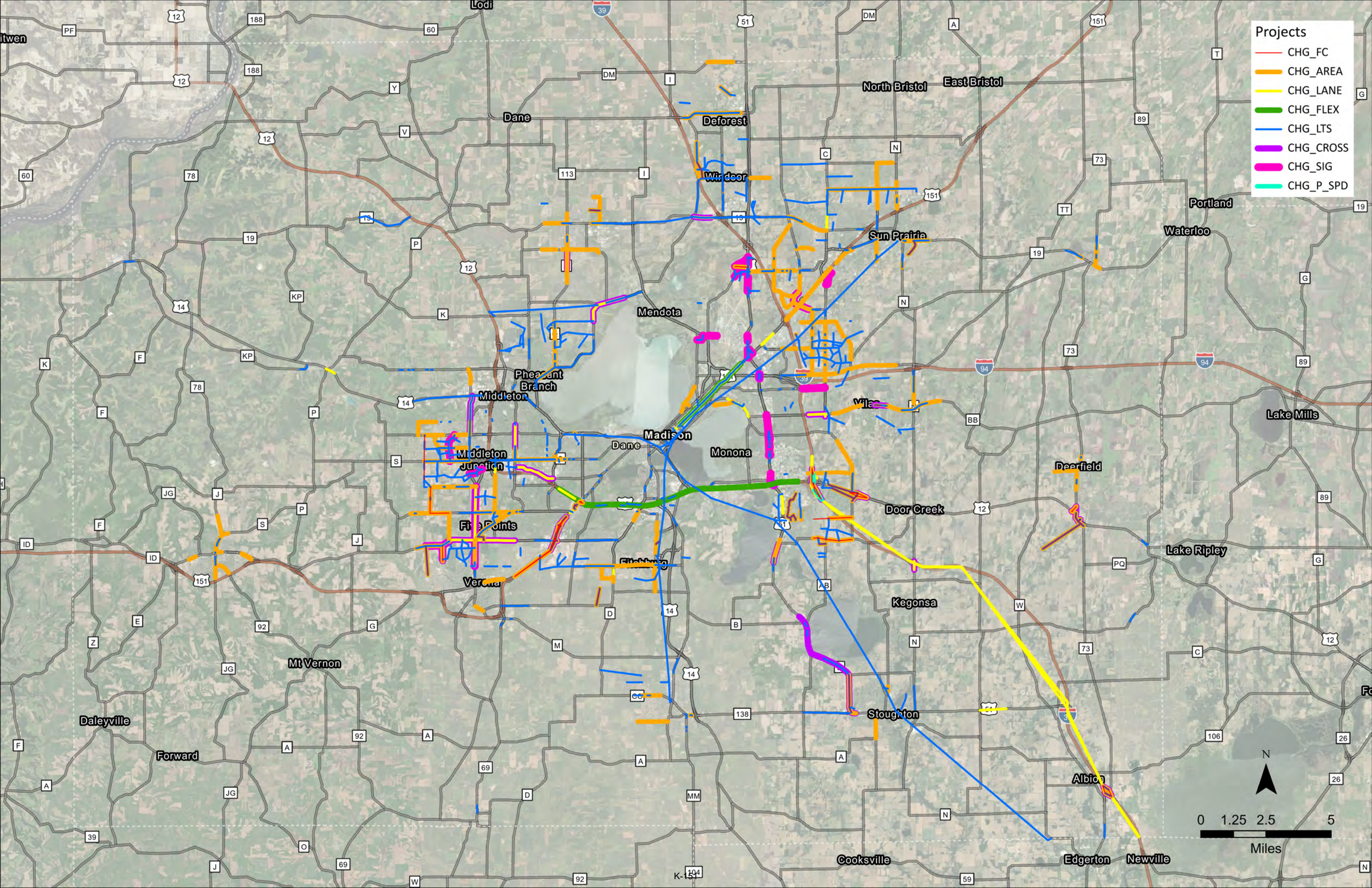
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Mendota
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Middleton Junction
Five Points
Verona
Fitchburg
Mt Vernon
Daleyville
Forward
Kegonsa
Stoughton
Deerfield
Door Creek
Lake Ripley
Albion
Cooksville
Edgerton
Newville
Lake Mills
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Projects
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Lake Monona
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SSM Health St. Mary's Hospital – Madison
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Resurrection Cemetery
Forest Hill Cemetery
Edna Taylor Conservation Park
Roselawn Memorial Park
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Coolidge St
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Observatory Dr
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Van Hise Ave
Regent St
Rowley Ave
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Garnet Ln
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Merryturn Rd
Dennett Dr
Johns St
Dempsey Rd
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Mayfair Ave
Walsh Rd
Packers Ave
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Fremont Ave
Ruskin St
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Ann St
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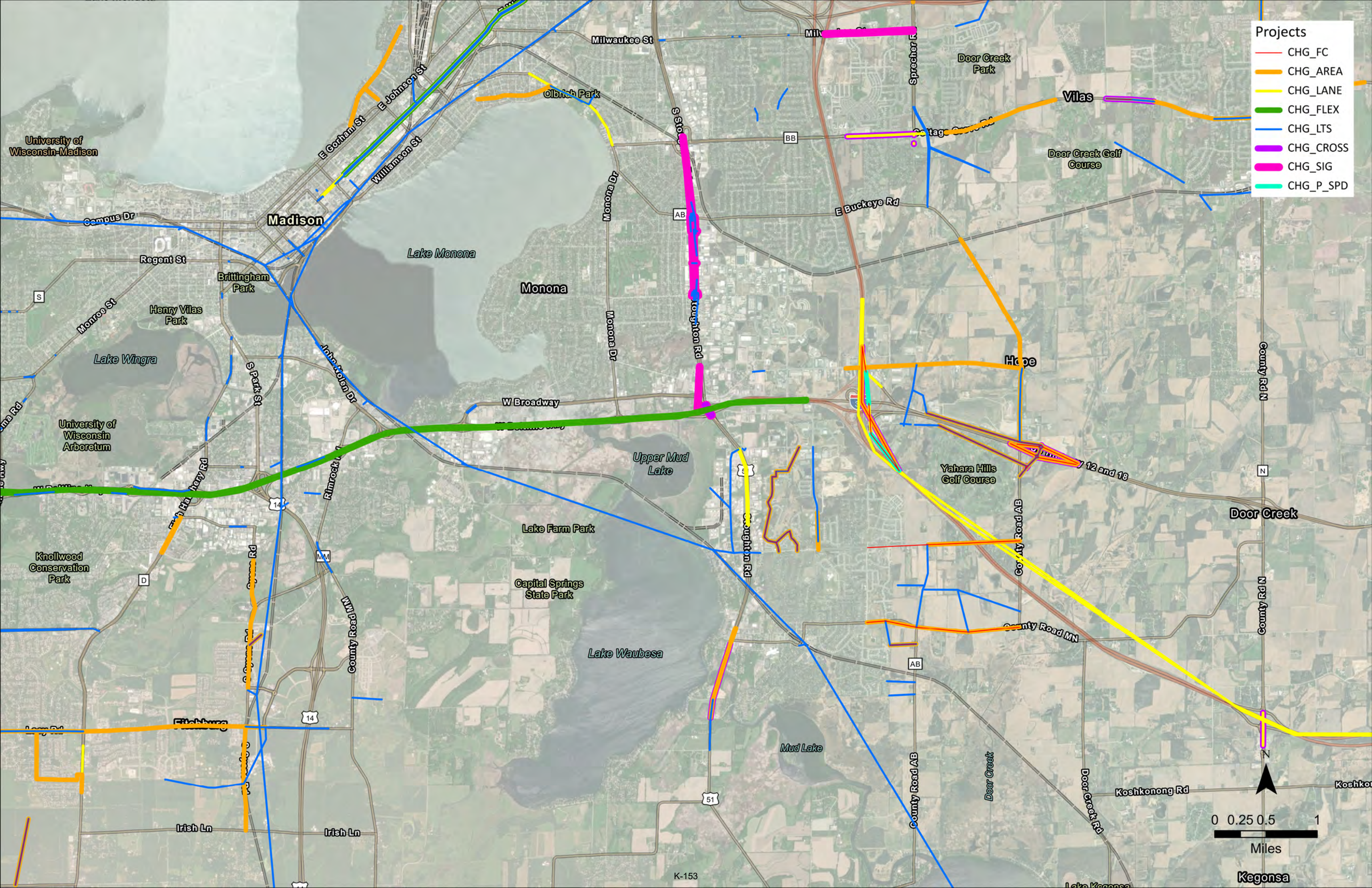
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Upper Mud Lake
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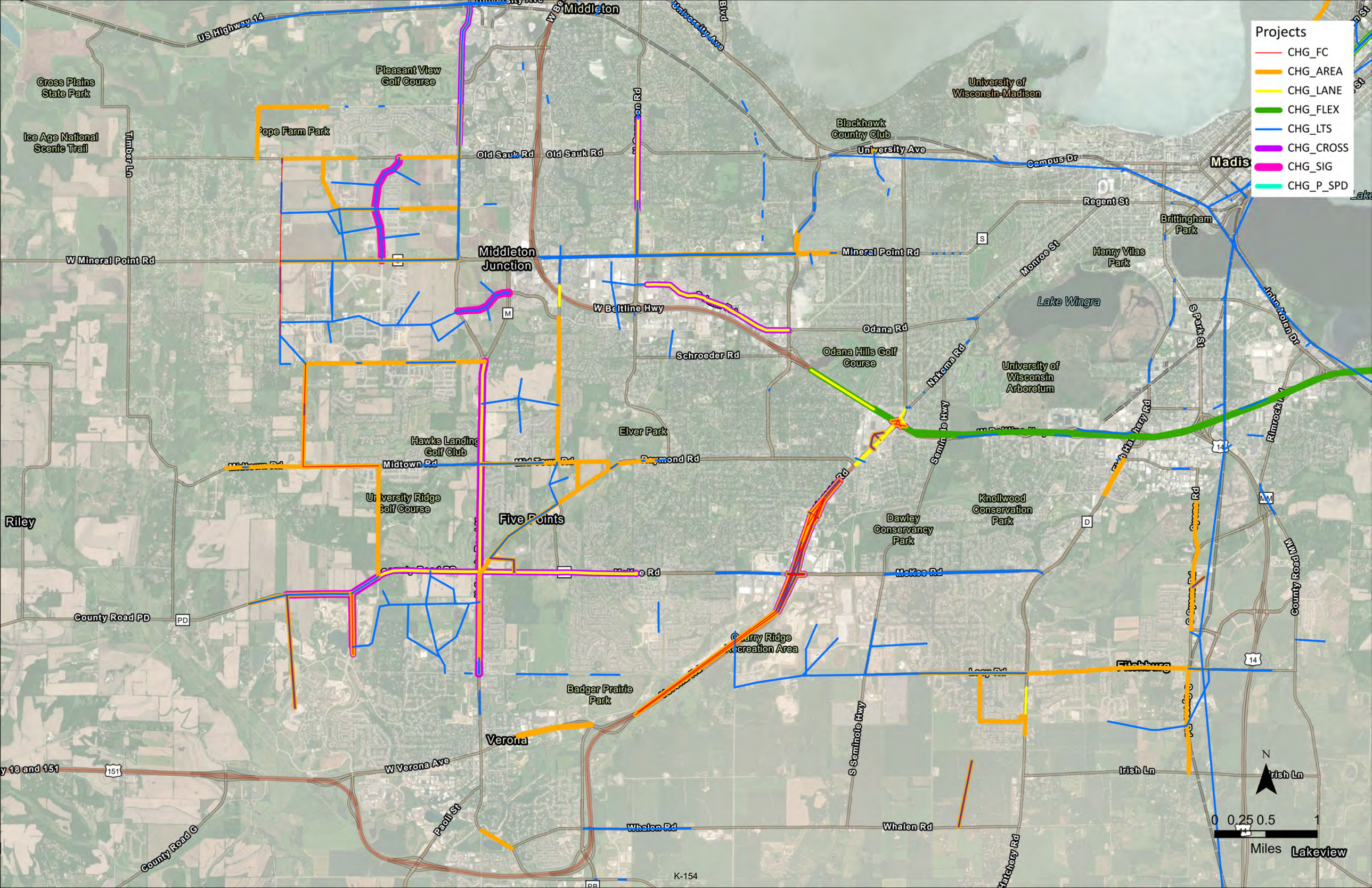
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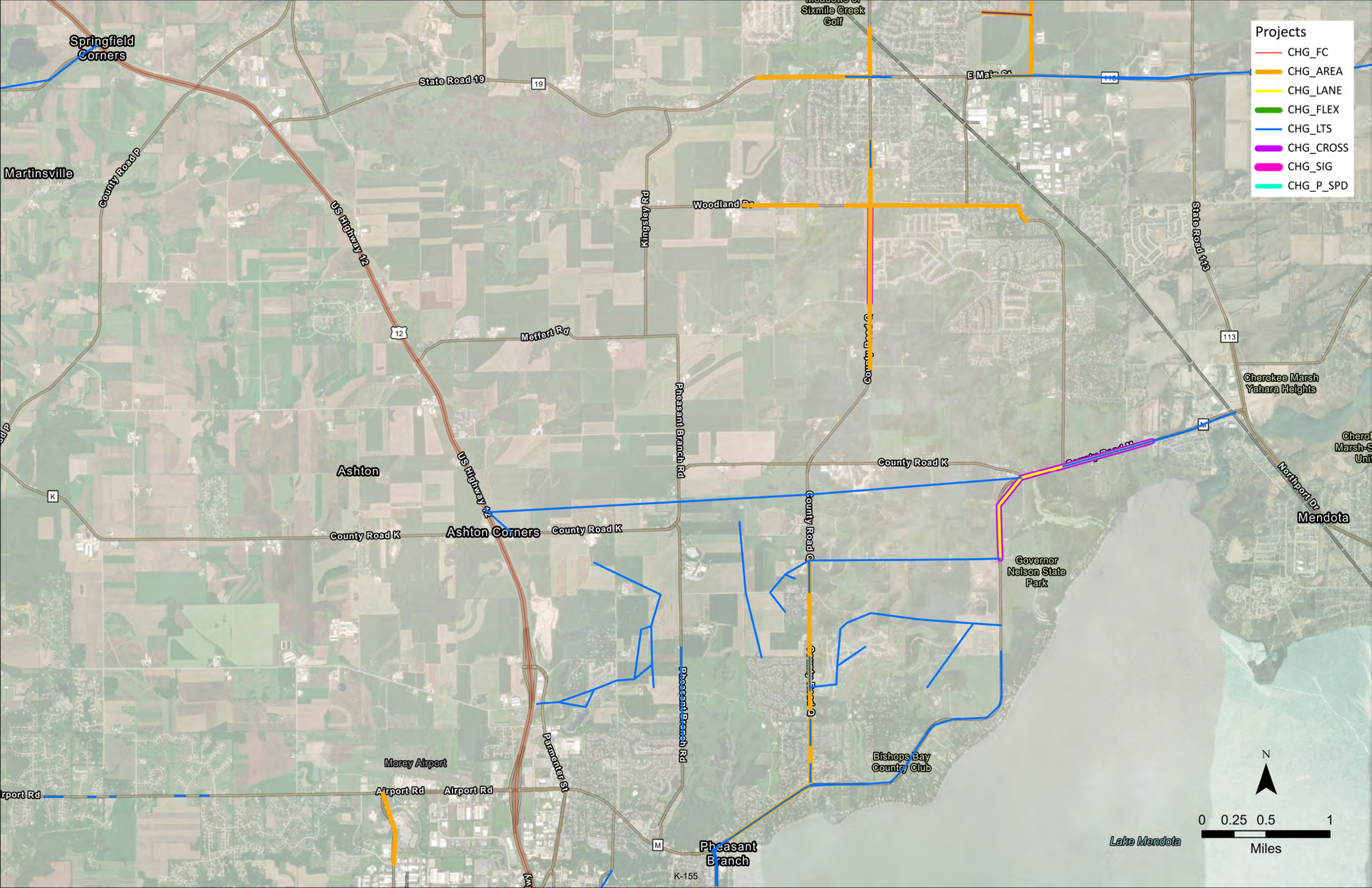
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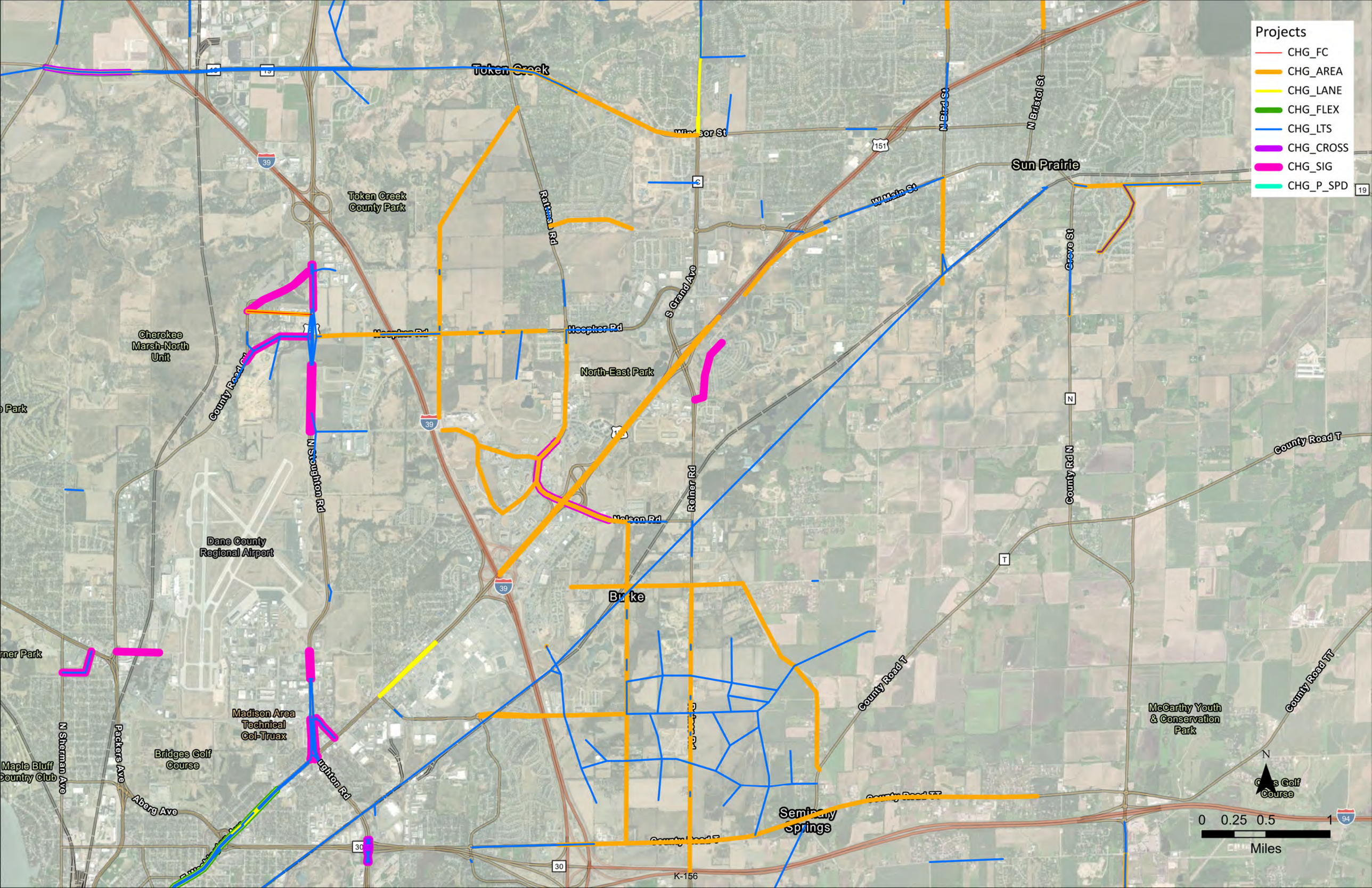
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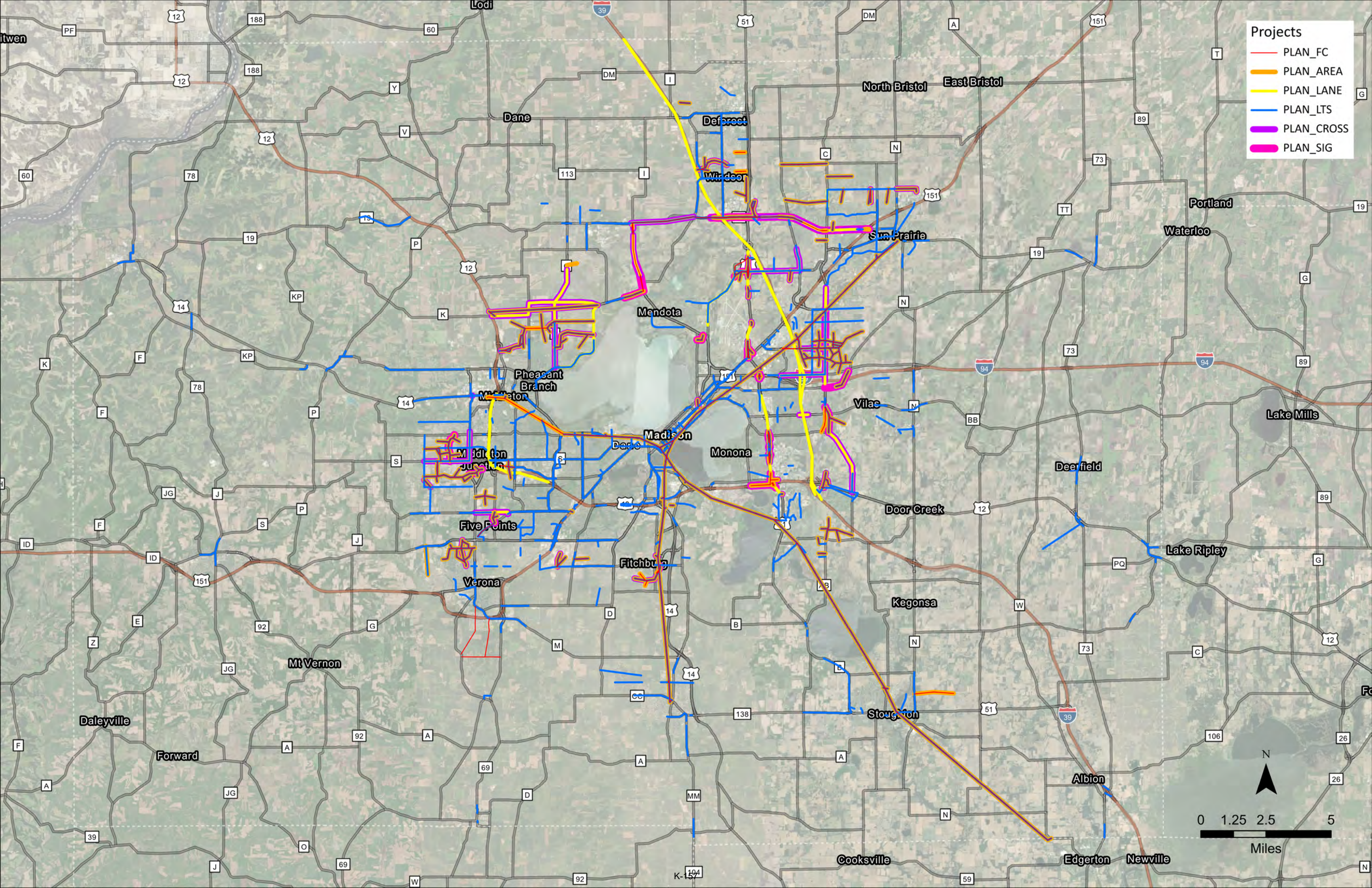
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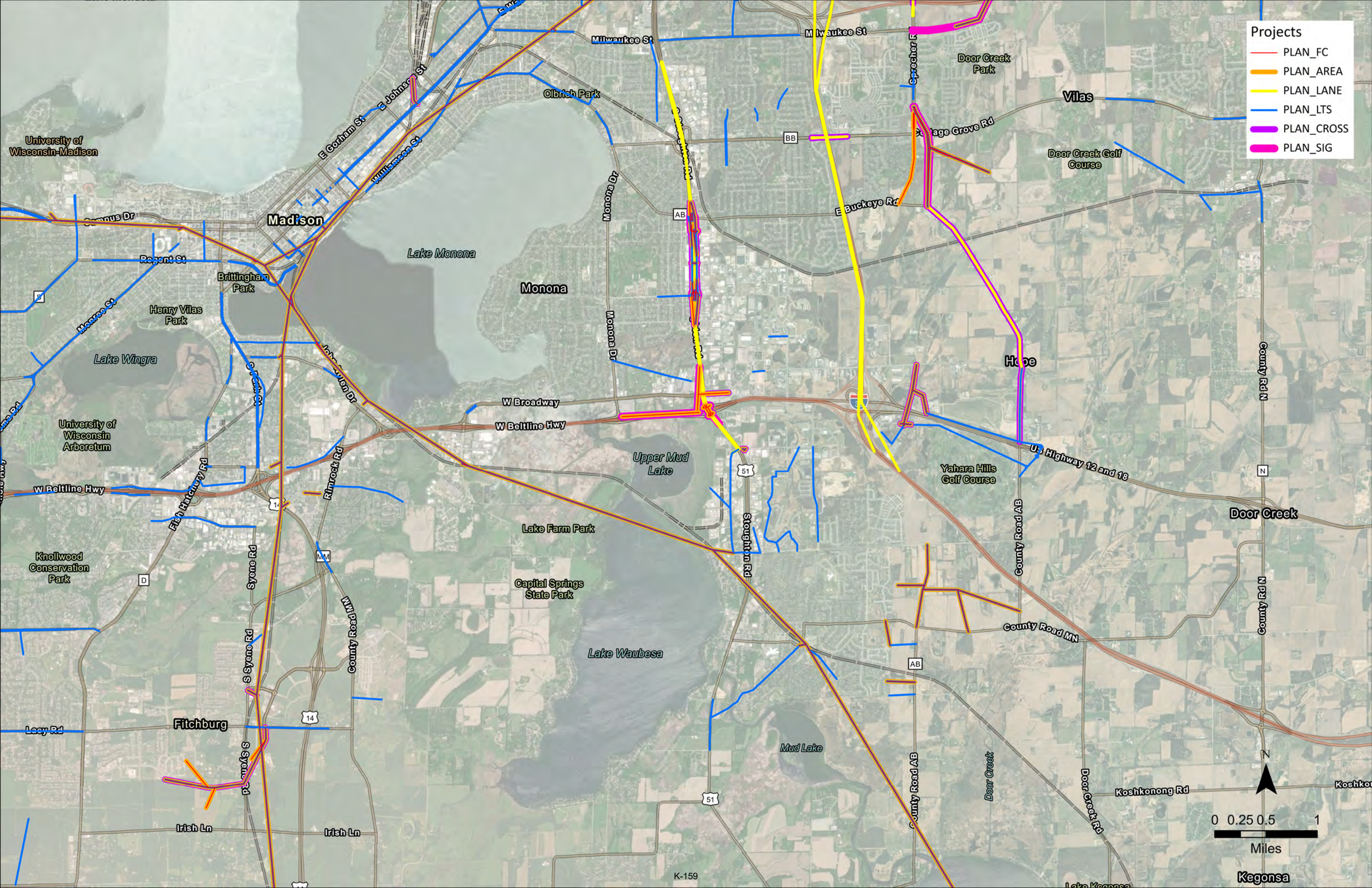
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Olbrich Park
Door Creek Park
Door Creek Golf Course
Yahara Hills Golf Course
Brittingham Park
Henry Vilas Park
Knollwood Conservation Park
University of Wisconsin-Madison
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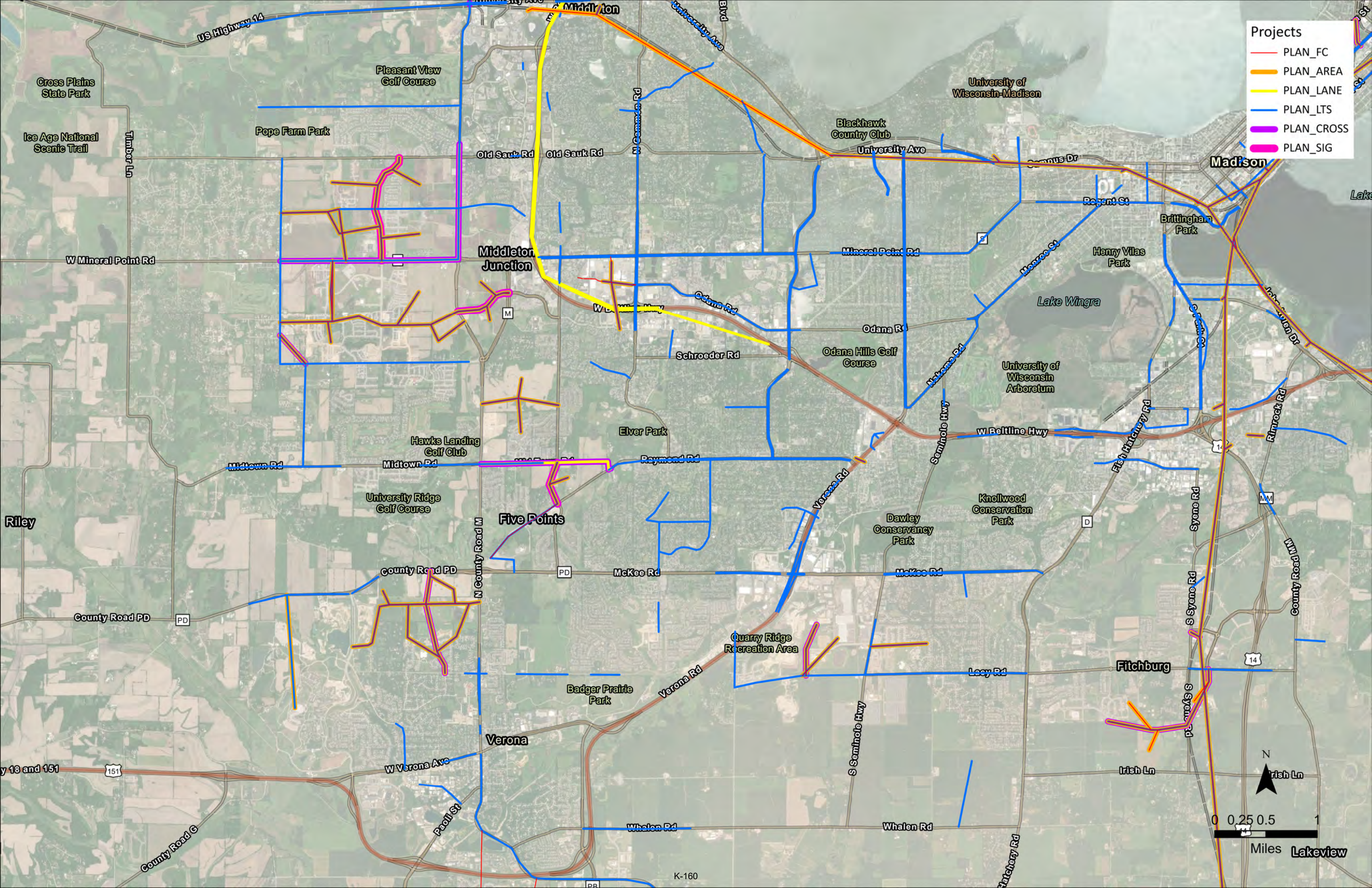
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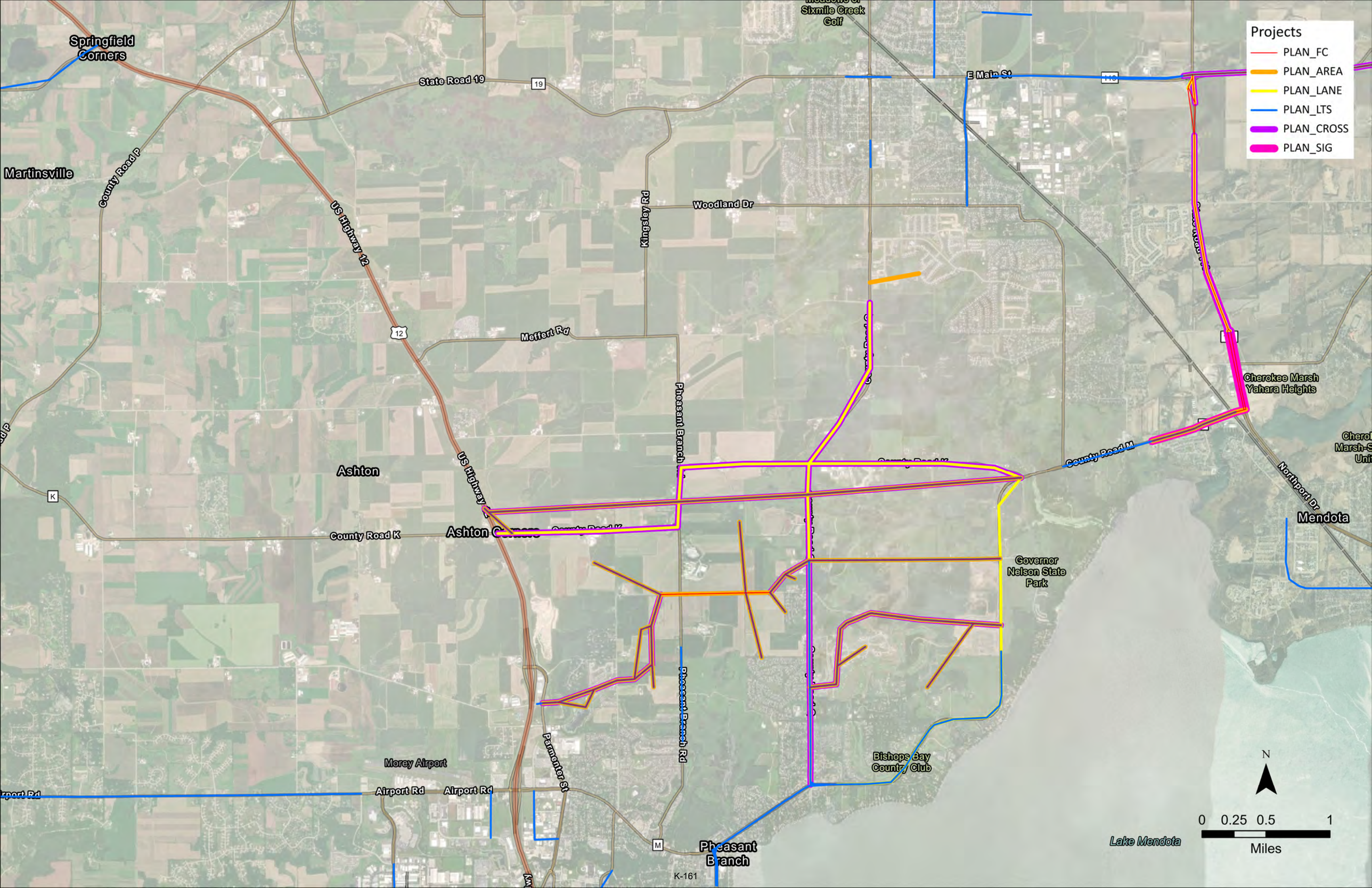
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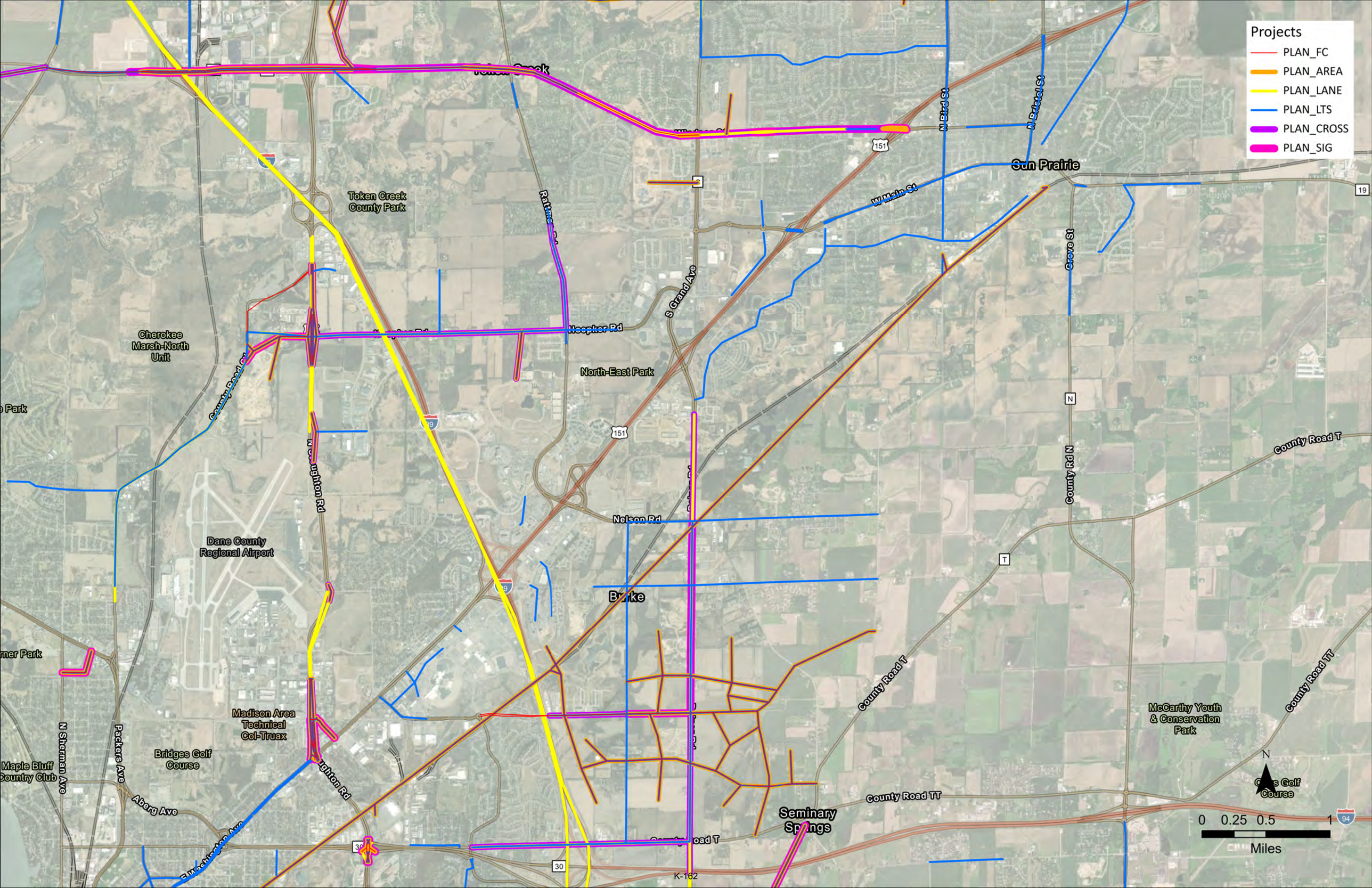
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Attachment G
Dane County Travel Demand Model Peak Period Validation Memo

Dane County Travel Demand Model Validation Report

August 2022

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1. INTRODUCTION

1.1 OVERVIEW

This report documents the validation effort for Dane County TDM base year model (Dane_Version_7_2_1_0_toHNTB_20220413) by HNTB modeling team. The major two efforts involve validation on the base year model and recommendation on the updates on the base year model

1.2 BASE YEAR MODEL VALIDATION

The base year of the Dane County is 2016. The following efforts were performed on the validation:

- Initial check on the model
- Trip distribution result validation
- Mode split validation
- Highway assignment validation.

The data set used for the validation efforts includes:

- Third-party OD data including Replica and Streetlight data from 2026
- Time of day traffic count data from WisDOT's TRAffic Data System (TRADAS, a product from Chaparral Systems)
- Travel time/speed data from NPMRDS data set in Dane County region road network.

1.3 RECOMMENDATION ON THE UPDATES OF THE BASE YEAR MODEL

With the base year validation, some updates on the TDM model are proposed, including the following three aspects:

- Cluster related update to fix random result
- Intersection signal delay integration to reduce speed error percentage
- Interzonal terminal time modification to reduce the district-to-district flow pattern difference.

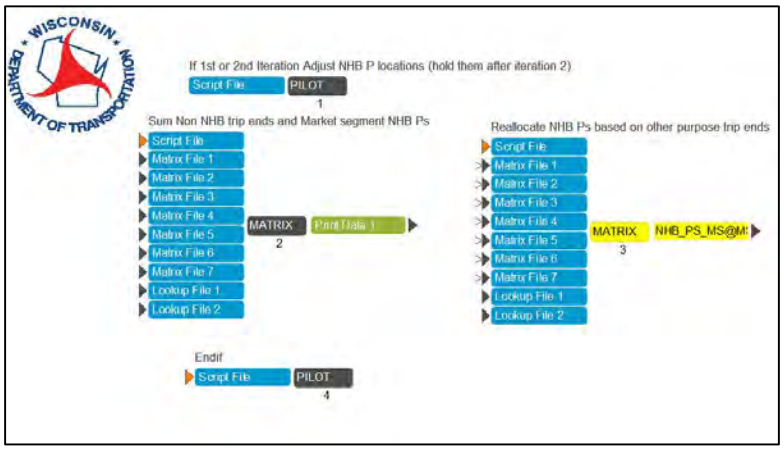
2. BASE YEAR MODEL VALIDATION

This chapter discusses the efforts committed for the base year model validation.

2.1 MODEL INITIAL CHECKING

Some initial checks were performed on the Dane County TDM model (Dane_Version_7_2_1_0_toHNTB_20220413) from WisDOT. A cluster related issue was identified within current version of model, causing model generating different results for every independent run. The problem happens in the NHB destination choice module, where the program generates an intermediate file without TOD and MS token in the name when reallocating NHB personal trip based on other purpose trip ends. This issue cause multi-thread of Cube cluster shares some intermediate file. The quick solution is the rename the intermediate file with TOD and MS token and modify the corresponding code to accommodate this file name change. After this modification, the problem is solved. Figure 2-1 illustrates the location of the problematic file name.

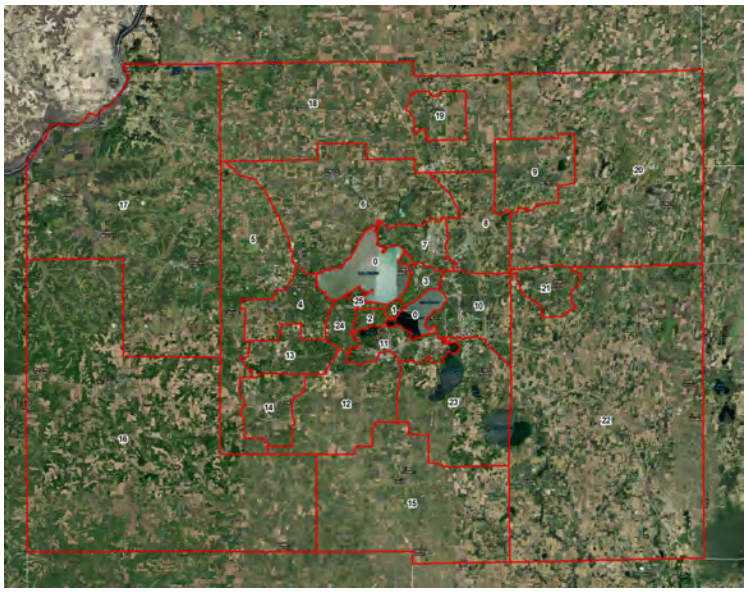
Figure 2-1: File name changing



2.2 TRIP DISTRIBUTION VALIDATION

There are two sets of 2016 traffic flow OD data available for trip distribution purpose. One set of data is from 2016 Replica data and anther is from 2016 Streetlight data. For both data set, the data were collected based on 2010 census tracts within Dane County area. For the model validation purpose, the 2010 census tracts are aggregated into the following 25 districts. Figure 2-2 illustrates the boundary of the 25 districts within Dane County area.

Figure 2-2: District definition



The following two chapters are mainly focusing on the validation on the trip distribution model results based on Replica and Streetlight data. There are two general types of aggregate checks of trip distribution results: trip length checks and O-D pattern checks on base year scenarios.

2.2.1 Trip Length Validation

The main trip length checks for base year scenarios involve comparing average trip lengths and trip length frequency distributions between model results and observed data from the Replica and Streetlight data sets. Trip lengths are represented in minutes. Trip length checks are performed separately for trip purposes and TODs. Figure 2-3 shows an example trip length distribution.

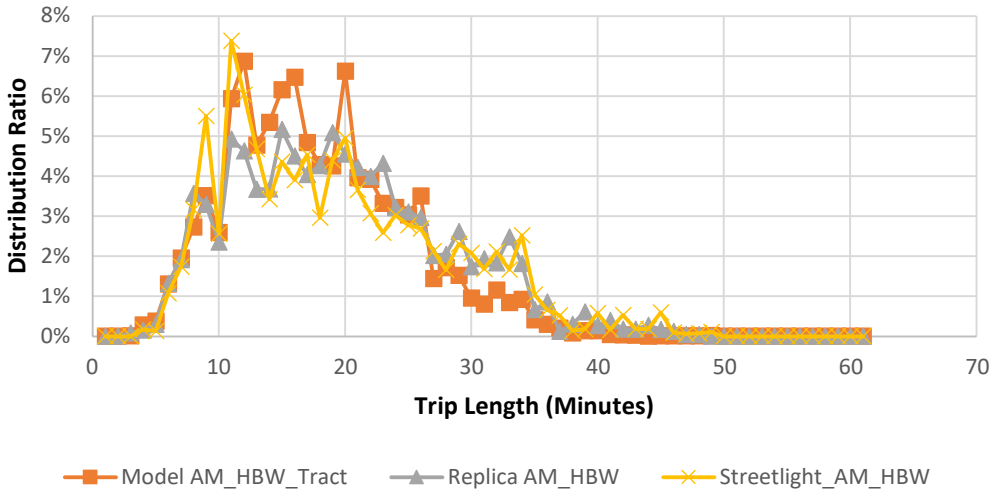
We check trip length frequency distributions by using coincidence ratios (CR). When the observed and modeled trip length frequency distributions are plotted, the CR is defined as the quotient between the sum of the lower value of the two distributions and the sum of the higher value of the two distributions at each increment. Generally, the CR measures the percent of area that "coincides" for the two curves. The procedure to calculate the coincidence of distributions is as follows:

$$CR = \frac{\sum_T [\min (PM_T, PO_T)]}{\sum_T [\max (PM_T, PO_T)]}$$

Where *CR* is the Coincidence Ratio; PM_T is the proportion of modeled distribution in interval *T*; PO_T is the proportion of observed distribution in interval *T*; and the *T* is histogram interval for time.

The coincidence ratio lies between 0 and 1.0, where a ratio of 1.0 indicates identical distributions.

Figure 2-3: Trip length distribution comparison



The following Table 2-1 and Table 2-2 are the Coincidence ratio values between model and Streetlight data and between model and Replica data. All the CR values are within the reasonable range, namely greater than 0.6 for purpose-specific peak periods and greater than 0.7 for all-purpose peak periods.

Table 2-1: Coincidence ratio between model and Streetlight data

Trip Purpose	AM	MD	PM	NT	Daily
HB Work	0.75	0.66	0.70	0.70	0.72
HB Other	0.74	0.73	0.68	0.73	0.73
No HB	0.72	0.66	0.66	0.67	0.68
All Purpose	0.76	0.73	0.70	0.73	0.73

Table 2-2: Coincidence ratio between model and Replica data

Trip Purpose	AM	MD	PM	NT	Daily
HB Work	0.74	0.78	0.72	0.78	0.76
HB School	0.68	0.72	0.67	0.68	0.72
HB Shopping	0.71	0.71	0.63	0.71	0.69
HB Other	0.66	0.73	0.70	0.73	0.72
All Purpose	0.75	0.74	0.70	0.75	0.74

2.2.2 District to District Traffic Flow Pattern Validation

It is difficult to validate origin-destination trip table at the zone interchange level due to low sample rate in survey data set from Replica or Streetlight. For example, the sample rate for the 2016 streetlight data within Dane County area is less than 3%. It is therefore necessary to check origin-

destination patterns at a more aggregate level. Generally, this is described as a district-level validation. Twenty-five districts we defined in Figure 2-1 is used for this purpose. The following tables show the difference of trip flow percentage between model and Replica and Streetlight data respectively.

In this validation process, the normalized Levenshtein distance for OD matrices (NLOD, Behara (2020)) is first utilized to perform OD matrix pattern comparison between model and Streetlight and Replica data. Compared with traditional method, the NLOD can take the OD matrix structural information into consideration. Levenshtein distance is a measure of proximity between two strings. It is mainly applied to compare sequences in linguistics domain such as plagiarism detection and speech recognition; in molecular biology for comparing sequences of macro molecules, etc. Levenshtein distance calculates least expensive set of insertions, deletions or substitutions that are required to transform one string into another one. For the OD matrices similarity comparison, the Levenshtein distance is modified into an optimization approach to estimate the minimum cost required to transform each sorted row of query OD matrix into sorted row of reference OD matrix. The formula of the levenshtein distance can be illustrated in the following three equation:

$$LOD_n(R_Y^n - R_X^n) = \min_S\left(\sum_{k=0}^{k=s}\beta_k\right) \quad \text{Eq(1)}$$

$$NLOD_n(R_Y^n - R_X^n) = \frac{LOD_n(R_Y^n - R_X^n)}{(\sum_{j=1}^{j=M} A_{xj}^n + \sum_{i=1}^{i=M} A_{xi}^n)} \quad \text{Eq(2)}$$

$$NLOD(Y,X) = \frac{\sum_{n=1}^{n=M} NLOD_n(R_Y^n - R_X^n)}{M} \quad \text{Eq(3)}$$

Where,

X is the reference matrix(M*M)

Y is the query matrix (M*M)

R is the sorted rows for X and Y

n is the current row number for both matrix

S is the sequence of edit operations to transform R_Y^n to R_X^n

β_k is the cost associated with each edit operation

A_{xj}^n is the cell value of OD matrix X in row n and jth column

The overall comparison between OD matrices is the normalized Levenshtein distance NLOD, which has the value between 0 and 1. One stands for two matrices are identical and zero means no similarity at all. The following Table 2-3 shows the normalized levenshtein distance for TOD matrices between model and observed data from Streetlight and Replica. According to the table, there are two observations: 1. The OD trip patterns from model and observed data set are comparable, the average Levenshtein distance is 0.63 for Streetlight data and 0.6 for Replica data. 2. The OD from model is more similar to Streetlight data. It should be noted that the data from Streetlight or Replica data are not ground-true data, which are expanded based on some collected sample data. When the sample rate is small, the accuracy of the data is questionable.

Table 2-3: Normalized LevenShtein distance summary

TOD	NLOD with Streetlight data	NLOD with Replica data
AM	0.63	0.61
MD	0.64	0.59
PM	0.63	0.59
NT	0.64	0.59

The second effort for the similarity comparison is to visually compare the OD trip pattern to identity some potential problems. For simplification, the trip flow percentage difference between model and observed OD matrices are produced. The following Table 2-4 to Table 2-7 Table 2-8 are the trip flow percentage difference between model and Streetlight data and Table 2-8 to Table 2-11 are trip flow percentage difference between model and Replica data. The values in the table are highlighted with colors. Blue color means the negative values and red means positive values.

Compared with Streetlight and Replica data, one of the common observations is that the model underestimate the intra-district TOD flows, especially for district 14-17 and 22-23. In order to alleviate this issue, a recommendation is to reduce the terminal time in zone level to encourage more intra-district level trip flows.

Table 2-4: Trip flow percentage difference between model and Streetlight for AM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	sum
1	-5%	-8%	2%	-3%	1%	2%	0%	0%	0%	0%	-3%	-1%	0%	-4%	4%	9%	9%	2%	0%	1%	0%	5%	5%	-3%	-12%	0%
2	-5%	-4%	4%	-3%	2%	3%	2%	0%	0%	0%	-7%	-1%	-1%	-2%	3%	9%	11%	2%	0%	1%	0%	4%	5%	-4%	-19%	0%
3	-13%	2%	-6%	1%	2%	2%	-4%	-3%	-1%	-4%	-5%	2%	-1%	0%	4%	10%	8%	1%	0%	1%	0%	5%	6%	-2%	-3%	0%
4	-6%	-1%	0%	-9%	0%	2%	-1%	0%	0%	-1%	-4%	-1%	-2%	0%	1%	9%	8%	4%	1%	0%	0%	3%	2%	1%	-4%	0%
5	-1%	1%	1%	-16%	-4%	2%	0%	0%	0%	0%	-2%	-1%	-1%	-3%	1%	7%	6%	5%	1%	0%	0%	3%	2%	1%	-1%	0%
6	0%	-1%	1%	-5%	-1%	-8%	1%	-2%	2%	0%	-2%	0%	0%	0%	2%	4%	5%	3%	-1%	2%	0%	2%	2%	0%	-3%	0%
7	-5%	1%	-8%	-2%	2%	3%	-7%	-6%	1%	-5%	-1%	2%	-1%	1%	5%	4%	4%	2%	0%	2%	0%	3%	6%	0%	-1%	0%
8	-4%	0%	-3%	2%	1%	3%	-7%	-2%	-4%	-4%	-1%	1%	0%	0%	3%	3%	3%	2%	-1%	2%	0%	2%	5%	0%	-1%	0%
9	-4%	0%	0%	0%	0%	5%	0%	-9%	-8%	0%	0%	2%	0%	0%	2%	2%	2%	1%	-1%	4%	0%	1%	4%	0%	-1%	0%
10	-2%	-1%	-4%	-1%	0%	2%	-3%	-7%	0%	5%	-3%	3%	-1%	1%	3%	3%	2%	1%	0%	2%	-2%	3%	3%	0%	-1%	0%
11	-6%	-6%	0%	-8%	-1%	2%	0%	2%	1%	5%	1%	-4%	-3%	-1%	4%	4%	3%	1%	0%	2%	0%	3%	7%	-5%	-2%	0%
12	-2%	-2%	1%	-7%	1%	2%	0%	0%	0%	3%	-8%	-10%	-3%	-4%	3%	9%	5%	1%	0%	1%	0%	5%	6%	-2%	-1%	0%
13	-3%	-1%	0%	-12%	1%	1%	-1%	-2%	0%	-1%	-7%	-6%	5%	-3%	1%	10%	7%	3%	0%	0%	0%	4%	2%	0%	-1%	0%
14	-3%	0%	2%	-2%	2%	1%	0%	-1%	0%	0%	-3%	-4%	0%	-20%	1%	11%	6%	2%	0%	1%	1%	6%	3%	0%	-1%	0%
15	0%	1%	3%	-2%	-1%	2%	3%	2%	1%	2%	-7%	0%	0%	-2%	-24%	5%	4%	1%	0%	1%	0%	3%	10%	0%	-2%	0%
16	2%	4%	3%	-2%	-1%	1%	0%	1%	0%	1%	-4%	0%	1%	-5%	1%	-25%	6%	2%	0%	0%	0%	7%	5%	1%	2%	0%
17	4%	5%	4%	-7%	-14%	2%	1%	-1%	0%	0%	-4%	1%	1%	2%	2%	8%	-17%	3%	0%	0%	0%	4%	3%	1%	2%	0%
18	-2%	1%	1%	8%	6%	-1%	-5%	-8%	-5%	-5%	-2%	0%	2%	2%	1%	5%	6%	1%	-12%	0%	-1%	2%	2%	4%	-1%	0%
19	-4%	1%	-5%	6%	5%	0%	-6%	-5%	-6%	0%	-1%	0%	1%	2%	0%	3%	3%	-4%	5%	1%	0%	2%	0%	3%	-2%	0%
20	-3%	0%	1%	2%	1%	4%	0%	-6%	-16%	5%	3%	2%	1%	1%	2%	3%	2%	1%	0%	-7%	-3%	1%	5%	1%	0%	0%
21	-4%	0%	-3%	3%	3%	0%	-3%	-9%	-5%	-11%	-2%	-3%	4%	4%	1%	7%	4%	2%	1%	0%	-1%	11%	1%	2%	-2%	0%
22	1%	0%	1%	2%	1%	0%	0%	-3%	0%	-3%	-5%	1%	2%	3%	1%	9%	4%	0%	0%	0%	-2%	-15%	1%	1%	1%	0%
23	0%	0%	2%	-2%	0%	1%	1%	-2%	0%	-10%	-5%	2%	0%	0%	5%	8%	4%	1%	0%	1%	0%	5%	-10%	0%	0%	0%
24	-6%	-9%	0%	-3%	6%	4%	-1%	-1%	0%	-1%	-5%	0%	0%	1%	1%	9%	7%	5%	1%	0%	0%	3%	1%	2%	-13%	0%
25	-2%	-14%	4%	1%	2%	2%	2%	0%	0%	0%	-1%	0%	-1%	1%	2%	10%	10%	2%	0%	1%	0%	4%	5%	-6%	-23%	0%
Sum	-3%	-1%	-1%	-3%	1%	1%	-2%	-3%	-2%	-2%	-4%	-1%	0%	-1%	2%	8%	6%	2%	0%	1%	-1%	4%	4%	0%	-3%	0%

Table 2-5: Trip flow percentage difference between model and Streetlight for MD

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	sum
1	-4%	-5%	-3%	-1%	2%	2%	0%	-2%	0%	-2%	-5%	1%	-1%	0%	3%	9%	11%	1%	0%	1%	0%	4%	4%	-3%	-11%	0%
2	-6%	-10%	2%	0%	2%	2%	1%	0%	0%	-1%	-7%	0%	-1%	0%	4%	9%	12%	2%	0%	1%	0%	4%	4%	-6%	-14%	0%
3	-3%	4%	-17%	1%	2%	2%	-7%	-8%	0%	-8%	-2%	2%	0%	1%	4%	9%	9%	1%	0%	0%	0%	5%	5%	-1%	1%	0%
4	0%	0%	0%	-12%	0%	1%	0%	0%	0%	0%	-3%	-1%	-10%	2%	1%	8%	8%	4%	0%	0%	0%	3%	1%	-1%	0%	0%
5	1%	1%	1%	-14%	-10%	0%	0%	0%	0%	0%	-2%	-1%	-6%	1%	1%	7%	7%	5%	0%	0%	0%	3%	1%	3%	1%	0%
6	1%	2%	0%	-2%	0%	-21%	-1%	-2%	2%	1%	0%	1%	-1%	0%	2%	3%	5%	3%	0%	2%	0%	1%	3%	1%	0%	0%
7	1%	3%	-9%	0%	2%	5%	-15%	-13%	0%	-4%	0%	3%	-1%	0%	6%	4%	4%	2%	-1%	2%	-1%	3%	6%	0%	1%	0%
8	1%	2%	-3%	2%	2%	4%	-4%	-17%	-6%	-4%	1%	3%	0%	0%	4%	3%	3%	1%	0%	2%	-1%	2%	5%	0%	1%	0%
9	0%	1%	0%	1%	1%	7%	1%	-12%	-18%	3%	2%	2%	0%	0%	2%	2%	1%	0%	-1%	4%	-1%	1%	4%	0%	0%	0%
10	-1%	0%	-5%	0%	0%	1%	-2%	-8%	0%	-2%	0%	3%	0%	1%	3%	2%	2%	1%	0%	3%	-1%	2%	0%	0%	0%	0%
11	-2%	-2%	-1%	-5%	0%	2%	1%	1%	1%	5%	-10%	-4%	-5%	0%	5%	3%	3%	1%	0%	3%	0%	3%	4%	-3%	0%	0%
12	1%	0%	1%	-3%	1%	2%	1%	2%	1%	4%	-8%	-20%	-8%	-4%	4%	8%	5%	1%	0%	1%	0%	5%	6%	-2%	0%	0%
13	0%	0%	0%	-11%	2%	1%	-1%	0%	0%	0%	-5%	-6%	-10%	1%	0%	10%	7%	3%	0%	0%	1%	5%	1%	1%	0%	0%
14	1%	1%	1%	5%	4%	1%	0%	0%	0%	1%	-1%	-7%	-2%	-37%	0%	9%	6%	2%	0%	1%	1%	7%	2%	3%	0%	0%
15	2%	3%	3%	0%	0%	2%	3%	3%	1%	3%	0%	1%	-1%	-1%	-41%	5%	3%	1%	0%	1%	0%	0%	9%	0%	1%	0%
16	4%	4%	3%	6%	2%	1%	1%	1%	0%	1%	0%	2%	1%	-2%	2%	-50%	6%	2%	0%	0%	0%	7%	5%	2%	2%	0%
17	5%	5%	4%	0%	-2%	1%	1%	0%	0%	1%	-1%	2%	-1%	1%	2%	6%	-38%	3%	0%	0%	0%	4%	3%	2%	2%	0%
18	1%	2%	1%	12%	8%	0%	-1%	-12%	-9%	-1%	-1%	1%	2%	2%	1%	5%	7%	-8%	-17%	0%	0%	1%	1%	4%	1%	0%
19	-1%	0%	-1%	9%	5%	1%	-1%	-4%	-5%	3%	0%	0%	2%	1%	0%	3%	3%	-8%	-13%	1%	1%	1%	0%	3%	0%	0%
20	0%	1%	0%	2%	1%	4%	1%	-7%	-12%	6%	3%	4%	1%	1%	2%	2%	2%	0%	0%	-15%	-3%	1%	5%	0%	0%	0%
21	0%	1%	0%	5%	2%	0%	-3%	-9%	-3%	-7%	-2%	1%	4%	4%	1%	6%	3%	1%	1%	-1%	-16%	9%	1%	2%	0%	0%
22	2%	2%	2%	4%	2%	1%	1%	-1%	0%	-1%	-1%	3%	2%	2%	0%	9%	4%	1%	0%	0%	-1%	-35%	3%	1%	1%	0%
23	1%	2%	2%	1%	1%	2%	2%	0%	1%	-14%	-5%	3%	-1%	0%	6%	8%	4%	1%	0%	1%	0%	4%	-20%	0%	1%	0%
24	-3%	-7%	-1%	-1%	6%	2%	0%	0%	0%	0%	-5%	-3%	-2%	2%	1%	9%	8%	4%	1%	0%	0%	3%	1%	-9%	-6%	0%
25	-7%	-15%	3%	0%	2%	2%	2%	0%	0%	0%	-2%	2%	0%	1%	3%	10%	11%	2%	0%	0%	0%	4%	4%	-6%	-17%	0%
Sum	-1%	0%	-2%	-2%	2%	1%	-2%	-6%	-3%	-2%	-4%	-1%	-3%	-1%	2%	7%	7%	2%	-1%	1%	-1%	4%	3%	-1%	-2%	0%

Table 2-6: Trip flow percentage difference between model and Streetlight for PM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	sum
1	0%	-1%	-9%	-4%	1%	2%	-1%	-3%	-2%	-2%	-4%	0%	-2%	-1%	4%	9%	9%	1%	-1%	0%	-1%	4%	4%	-4%	0%	0%
2	-7%	-3%	-1%	-2%	2%	2%	1%	0%	0%	-1%	-7%	-2%	-2%	0%	4%	9%	10%	2%	0%	0%	0%	4%	3%	-8%	-3%	0%
3	-1%	5%	-16%	1%	2%	2%	-8%	-8%	-1%	-8%	-3%	2%	0%	1%	5%	9%	7%	1%	-1%	0%	-1%	4%	4%	-1%	3%	0%
4	-1%	0%	0%	-6%	2%	0%	0%	0%	0%	0%	-4%	-3%	-11%	0%	0%	7%	7%	5%	0%	0%	0%	3%	1%	-1%	0%	0%
5	0%	1%	0%	-9%	1%	-2%	0%	0%	-1%	0%	-4%	-1%	-7%	-1%	0%	6%	4%	5%	0%	0%	0%	2%	1%	2%	1%	0%
6	1%	2%	0%	-1%	1%	-21%	0%	0%	1%	1%	0%	2%	-1%	0%	2%	3%	4%	1%	-2%	2%	0%	1%	2%	1%	1%	0%
7	1%	3%	-7%	0%	2%	5%	-10%	-12%	-1%	-4%	0%	3%	-1%	0%	6%	3%	3%	1%	-2%	2%	-1%	3%	5%	0%	2%	0%
8	1%	2%	-3%	1%	1%	4%	-2%	-7%	-8%	-4%	1%	3%	-1%	0%	4%	2%	2%	1%	-1%	1%	-2%	1%	4%	0%	1%	0%
9	0%	1%	0%	1%	1%	7%	2%	-9%	-19%	3%	2%	2%	0%	0%	2%	1%	1%	0%	-2%	3%	-1%	1%	3%	0%	0%	0%
10	0%	0%	-5%	0%	1%	1%	-2%	-7%	-1%	3%	0%	3%	0%	1%	3%	2%	1%	1%	0%	3%	-2%	1%	0%	0%	0%	0%
11	-1%	-1%	-2%	-4%	0%	2%	1%	1%	1%	5%	-3%	-5%	-6%	-2%	4%	2%	2%	1%	0%	3%	0%	2%	4%	-3%	1%	0%
12	0%	1%	1%	-1%	1%	1%	1%	1%	1%	4%	-8%	-15%	-10%	-4%	3%	7%	4%	1%	0%	1%	-1%	5%	6%	-1%	1%	0%
13	-1%	0%	-1%	-8%	2%	1%	0%	0%	0%	0%	-5%	-7%	-8%	1%	0%	9%	6%	3%	0%	1%	1%	5%	1%	0%	0%	0%
14	-1%	0%	0%	5%	2%	1%	0%	0%	0%	2%	-2%	-8%	-5%	-22%	0%	8%	5%	2%	0%	1%	1%	7%	1%	2%	1%	0%
15	3%	4%	3%	0%	0%	3%	3%	3%	1%	4%	1%	1%	-1%	0%	-44%	4%	2%	1%	0%	1%	0%	0%	9%	0%	2%	0%
16	3%	4%	3%	6%	2%	2%	1%	1%	0%	1%	0%	3%	2%	-1%	2%	-54%	5%	2%	0%	0%	0%	8%	4%	2%	2%	0%
17	5%	6%	3%	3%	-4%	2%	1%	1%	-1%	1%	1%	3%	1%	2%	2%	4%	-43%	3%	0%	0%	0%	4%	2%	1%	3%	0%
18	0%	2%	-1%	12%	8%	0%	-1%	-9%	-8%	-1%	-1%	2%	3%	2%	1%	4%	6%	-2%	-23%	0%	0%	1%	0%	5%	1%	0%
19	0%	1%	0%	8%	4%	1%	-1%	-1%	-6%	3%	0%	1%	2%	1%	0%	2%	3%	-4%	-20%	1%	1%	1%	0%	3%	0%	0%
20	0%	1%	0%	2%	1%	5%	2%	-5%	-12%	8%	4%	3%	1%	1%	3%	2%	2%	1%	0%	-22%	-2%	1%	4%	1%	1%	0%
21	0%	1%	0%	5%	2%	0%	-1%	-10%	-2%	-10%	-1%	2%	4%	4%	0%	5%	3%	1%	1%	-1%	-12%	8%	-1%	2%	0%	0%
22	2%	2%	1%	3%	2%	1%	1%	-1%	0%	1%	0%	3%	2%	2%	1%	8%	3%	1%	0%	0%	-1%	-36%	3%	1%	1%	0%
23	1%	3%	1%	1%	1%	1%	1%	0%	0%	-9%	-2%	4%	0%	1%	7%	7%	3%	1%	0%	1%	-1%	2%	-24%	0%	1%	0%
24	-4%	-5%	-2%	0%	6%	2%	0%	0%	0%	0%	-6%	-3%	-3%	1%	0%	8%	7%	5%	1%	0%	0%	3%	1%	-5%	-2%	0%
25	-8%	-11%	-1%	-2%	2%	0%	1%	0%	-1%	0%	-2%	1%	-1%	0%	3%	9%	10%	2%	0%	0%	0%	4%	4%	-10%	-1%	0%
Sum	-1%	0%	-2%	-1%	2%	1%	-1%	-5%	-3%	-2%	-3%	-1%	-3%	-1%	2%	7%	5%	2%	-1%	1%	-1%	4%	2%	-1%	0%	0%

Table 2-7: Trip flow percentage difference between model and Streetlight for NT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Sum
1	-10%	-4%	-9%	0%	2%	2%	0%	-1%	-1%	-2%	-5%	1%	-2%	0%	4%	9%	10%	1%	0%	0%	0%	4%	4%	-3%	-1%	0%
2	-11%	-10%	0%	0%	2%	2%	1%	0%	0%	-1%	-6%	0%	-2%	1%	4%	9%	11%	2%	0%	1%	0%	4%	4%	-7%	-3%	0%
3	-3%	4%	-19%	2%	2%	2%	-6%	-6%	-1%	-10%	-3%	2%	-1%	1%	4%	9%	8%	2%	0%	1%	0%	5%	5%	-1%	2%	0%
4	0%	0%	-1%	-8%	2%	0%	0%	0%	0%	0%	-3%	-2%	-14%	1%	1%	9%	7%	4%	0%	0%	0%	3%	1%	-1%	0%	0%
5	0%	2%	1%	-15%	0%	-2%	0%	0%	0%	0%	-2%	-2%	-5%	0%	1%	7%	3%	6%	0%	1%	0%	3%	1%	2%	1%	0%
6	1%	2%	1%	-2%	3%	-24%	0%	-1%	2%	0%	0%	1%	-1%	0%	2%	3%	5%	2%	-1%	2%	0%	1%	3%	2%	1%	0%
7	1%	3%	-9%	0%	2%	4%	-13%	-10%	0%	-4%	0%	3%	-1%	0%	6%	4%	4%	1%	-1%	1%	-1%	3%	6%	0%	1%	0%
8	1%	2%	-3%	2%	1%	4%	-4%	-9%	-7%	-5%	1%	3%	-1%	0%	4%	3%	3%	1%	-1%	1%	-2%	2%	4%	0%	1%	0%
9	0%	1%	0%	1%	1%	7%	1%	-8%	-18%	1%	2%	2%	0%	0%	2%	2%	1%	-1%	-1%	2%	-1%	1%	4%	0%	0%	0%
10	-1%	1%	-6%	0%	1%	1%	-2%	-6%	0%	-1%	0%	3%	-1%	0%	3%	3%	2%	1%	0%	3%	-2%	2%	1%	0%	0%	0%
11	-2%	-2%	-2%	-3%	-1%	2%	1%	1%	1%	5%	-7%	-5%	-5%	0%	5%	3%	3%	1%	0%	2%	0%	2%	5%	-2%	0%	0%
12	0%	0%	1%	1%	2%	2%	1%	2%	0%	4%	-8%	-20%	-11%	-4%	4%	8%	5%	1%	0%	1%	0%	5%	6%	-2%	1%	0%
13	-1%	0%	0%	-6%	3%	0%	0%	0%	0%	0%	-4%	-7%	-12%	0%	0%	10%	7%	3%	0%	0%	0%	5%	1%	1%	0%	0%
14	0%	1%	1%	8%	3%	1%	0%	0%	0%	1%	-3%	-9%	-7%	-25%	0%	9%	6%	2%	0%	1%	1%	7%	1%	3%	1%	0%
15	3%	4%	3%	1%	1%	2%	3%	3%	1%	3%	1%	0%	-1%	-1%	-43%	5%	3%	1%	0%	1%	0%	1%	8%	1%	1%	0%
16	4%	4%	3%	7%	2%	2%	1%	1%	0%	1%	0%	3%	2%	-1%	2%	-54%	6%	2%	0%	0%	0%	7%	5%	3%	2%	0%
17	5%	6%	4%	2%	-1%	2%	1%	1%	0%	1%	-1%	1%	1%	1%	1%	5%	-43%	3%	0%	0%	0%	4%	3%	2%	1%	0%
18	1%	2%	-1%	11%	8%	1%	0%	-7%	-7%	-2%	0%	2%	2%	2%	1%	5%	6%	-5%	-23%	0%	-1%	1%	1%	4%	1%	0%
19	0%	1%	0%	8%	5%	3%	-2%	-2%	-6%	1%	-3%	0%	2%	1%	0%	3%	3%	-8%	-12%	1%	0%	2%	0%	3%	0%	0%
20	-1%	0%	0%	2%	1%	5%	1%	-4%	-8%	8%	3%	3%	0%	1%	3%	2%	2%	-1%	0%	-23%	-2%	1%	4%	1%	1%	0%
21	0%	1%	0%	6%	2%	0%	-2%	-7%	-5%	-12%	-1%	1%	4%	4%	1%	6%	3%	1%	1%	0%	-14%	10%	1%	2%	1%	0%
22	2%	2%	2%	4%	2%	1%	0%	0%	0%	-2%	-2%	2%	2%	2%	0%	9%	4%	1%	0%	0%	-1%	-33%	4%	1%	1%	0%
23	2%	3%	1%	2%	1%	2%	2%	1%	1%	-10%	-3%	3%	-1%	0%	7%	8%	4%	1%	0%	1%	-1%	3%	-29%	0%	1%	0%
24	-4%	-9%	-3%	0%	6%	2%	0%	0%	0%	0%	-4%	-4%	-3%	2%	1%	9%	7%	5%	1%	0%	0%	3%	1%	-8%	-2%	0%
25	-12%	-11%	1%	-1%	3%	1%	2%	1%	-1%	1%	-2%	1%	-3%	0%	3%	10%	10%	2%	0%	0%	0%	4%	4%	-9%	-4%	0%
Sum	-2%	0%	-3%	0%	3%	1%	-2%	-4%	-3%	-3%	-3%	-2%	-4%	0%	2%	7%	6%	2%	-1%	1%	-1%	4%	3%	-1%	0%	0%

Table 2-8: Trip flow percentage difference between model and Replica for AM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	sum
1	4%	0%	3%	-2%	0%	1%	-2%	0%	0%	-3%	-5%	2%	-2%	-10%	1%	8%	9%	1%	-1%	0%	0%	4%	3%	-2%	-10%	0%
2	-2%	-7%	4%	-3%	1%	2%	-1%	0%	0%	-2%	-3%	0%	-1%	-4%	2%	9%	11%	2%	0%	0%	0%	3%	3%	-3%	-10%	0%
3	-3%	1%	-7%	-2%	1%	2%	-6%	-3%	-1%	-4%	-3%	2%	1%	-2%	4%	10%	8%	1%	0%	1%	0%	4%	4%	-2%	-4%	0%
4	-5%	-4%	0%	-7%	2%	1%	-1%	-1%	0%	-1%	-3%	0%	1%	0%	1%	9%	7%	4%	0%	0%	0%	3%	2%	0%	-9%	0%
5	-3%	-1%	1%	-6%	-5%	2%	-1%	0%	0%	-1%	-2%	-1%	0%	-1%	1%	6%	3%	5%	1%	0%	0%	3%	2%	3%	-6%	0%
6	-2%	-2%	1%	-4%	2%	-7%	-1%	0%	2%	0%	-1%	0%	-1%	0%	2%	4%	5%	3%	-1%	1%	0%	1%	3%	0%	-6%	0%
7	-1%	0%	-5%	-3%	0%	3%	-3%	-4%	0%	-2%	-2%	2%	-1%	0%	5%	4%	4%	2%	-1%	1%	0%	2%	6%	-1%	-4%	0%
8	-3%	0%	-2%	-1%	2%	4%	-5%	6%	-10%	-2%	-2%	2%	-1%	0%	3%	3%	3%	1%	-1%	1%	-1%	2%	4%	0%	-3%	0%
9	-3%	-1%	-1%	0%	1%	6%	-2%	-6%	-3%	0%	0%	2%	-1%	0%	2%	2%	1%	-1%	-1%	5%	-1%	0%	4%	0%	-3%	0%
10	-5%	-4%	-3%	-3%	0%	1%	-3%	-4%	-1%	12%	0%	3%	0%	0%	2%	3%	2%	1%	0%	2%	0%	2%	3%	-2%	-4%	0%
11	-3%	-3%	-1%	-7%	-1%	1%	0%	0%	1%	2%	3%	2%	-3%	-3%	3%	3%	3%	0%	0%	2%	0%	2%	6%	-3%	-5%	0%
12	-2%	-4%	0%	-4%	1%	0%	0%	0%	0%	1%	-1%	-6%	-1%	-7%	2%	8%	5%	1%	0%	1%	0%	5%	6%	0%	-6%	0%
13	-3%	-3%	0%	-4%	3%	1%	-2%	-1%	0%	-2%	-3%	-3%	2%	-4%	0%	10%	7%	2%	0%	0%	0%	4%	1%	2%	-7%	0%
14	-3%	-3%	1%	-1%	2%	1%	-1%	-1%	-1%	0%	-3%	-5%	3%	-11%	0%	10%	5%	2%	0%	1%	1%	5%	2%	2%	-6%	0%
15	0%	-1%	3%	-5%	0%	2%	2%	2%	1%	0%	-2%	1%	-1%	-1%	-18%	5%	3%	0%	0%	1%	0%	2%	10%	-1%	-5%	0%
16	0%	1%	3%	-2%	1%	1%	0%	0%	0%	0%	-2%	-1%	1%	-4%	1%	-16%	5%	1%	0%	0%	0%	7%	5%	1%	-2%	0%
17	3%	4%	3%	-5%	-2%	-1%	-1%	0%	0%	0%	-1%	1%	0%	0%	1%	7%	-17%	2%	0%	0%	0%	3%	3%	1%	-2%	0%
18	-1%	1%	1%	8%	7%	-3%	-4%	-6%	-3%	-2%	-1%	1%	1%	1%	1%	5%	6%	0%	-10%	0%	0%	1%	1%	3%	-4%	0%
19	-2%	-2%	-3%	5%	5%	0%	-8%	-5%	-4%	-1%	-3%	-1%	1%	2%	0%	2%	3%	1%	10%	1%	0%	1%	1%	2%	-4%	0%
20	0%	0%	1%	1%	1%	4%	0%	-4%	-14%	5%	2%	2%	1%	1%	3%	3%	2%	1%	-1%	-8%	-2%	1%	4%	0%	-2%	0%
21	-2%	-2%	-2%	2%	3%	-2%	-5%	-6%	-6%	-6%	-4%	1%	4%	3%	1%	7%	4%	2%	-1%	0%	1%	10%	0%	0%	-4%	0%
22	-1%	0%	1%	0%	2%	-1%	-3%	-3%	-1%	-5%	-3%	0%	1%	2%	1%	9%	4%	0%	0%	0%	-1%	-6%	3%	1%	-2%	0%
23	-1%	0%	1%	-2%	1%	2%	0%	-2%	0%	-5%	-3%	2%	0%	0%	4%	7%	3%	-1%	0%	1%	0%	3%	-7%	0%	-3%	0%
24	-7%	-8%	0%	2%	7%	3%	-2%	-1%	-1%	-2%	-3%	-1%	3%	1%	1%	8%	7%	5%	1%	0%	0%	3%	2%	-2%	-12%	0%
25	1%	-4%	3%	-7%	2%	0%	2%	0%	-1%	-4%	-1%	1%	-2%	-1%	2%	9%	9%	1%	0%	0%	0%	4%	3%	-6%	-12%	0%
Sum	-2%	-1%	0%	-2%	2%	0%	-2%	-2%	-3%	-1%	-2%	0%	0%	-2%	1%	7%	5%	2%	-1%	0%	0%	3%	3%	0%	-5%	0%

Table 2-9: Trip flow percentage difference between model and Replica for MD

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	sum
1	2%	-2%	0%	-3%	1%	1%	-2%	-2%	-2%	-4%	-2%	0%	-3%	-2%	2%	8%	10%	1%	0%	0%	0%	3%	3%	-3%	-8%	0%
2	0%	-8%	1%	-2%	1%	0%	0%	-1%	-1%	-2%	-3%	-1%	-3%	-1%	2%	8%	12%	1%	0%	0%	-1%	3%	3%	-4%	-7%	0%
3	0%	2%	-10%	0%	2%	1%	-6%	-5%	-1%	-7%	-2%	1%	-1%	0%	4%	9%	9%	1%	-1%	1%	0%	4%	4%	-1%	-3%	0%
4	-2%	-1%	0%	-9%	2%	1%	-1%	-1%	0%	-1%	-3%	-1%	-3%	1%	0%	8%	6%	4%	0%	0%	0%	3%	1%	1%	-3%	0%
5	0%	0%	0%	-4%	-10%	0%	0%	0%	0%	-1%	-2%	-1%	-2%	0%	0%	6%	3%	5%	0%	0%	0%	3%	1%	3%	-2%	0%
6	0%	0%	0%	-1%	2%	-12%	0%	0%	1%	0%	-1%	0%	-1%	0%	2%	3%	5%	2%	-2%	2%	0%	1%	2%	0%	-2%	0%
7	1%	2%	-5%	-1%	1%	4%	-13%	-6%	-1%	-2%	1%	2%	-1%	0%	5%	4%	4%	1%	-1%	1%	0%	2%	6%	-1%	-1%	0%
8	-1%	1%	-3%	1%	1%	3%	-4%	1%	-8%	-3%	0%	2%	-1%	0%	3%	2%	2%	1%	-1%	1%	-1%	1%	4%	0%	-1%	0%
9	-1%	0%	-1%	1%	1%	6%	-1%	-7%	-9%	1%	0%	2%	-1%	0%	2%	1%	1%	0%	-2%	4%	-1%	0%	3%	0%	-1%	0%
10	-3%	-1%	-4%	-1%	0%	1%	-2%	-5%	-2%	7%	0%	3%	-1%	0%	2%	2%	2%	0%	0%	3%	-1%	1%	2%	-1%	-2%	0%
11	-2%	-2%	-1%	-5%	-1%	1%	0%	0%	0%	5%	-3%	0%	-4%	-1%	4%	3%	3%	0%	0%	2%	0%	2%	5%	-3%	-3%	0%
12	0%	-1%	0%	-2%	1%	0%	1%	1%	0%	3%	-3%	-16%	-4%	-4%	3%	7%	4%	1%	0%	1%	0%	4%	6%	-1%	-2%	0%
13	-2%	-2%	-1%	-2%	2%	0%	-2%	-1%	-1%	-1%	-4%	-4%	-5%	0%	0%	9%	7%	2%	0%	0%	0%	4%	1%	2%	-4%	0%
14	-1%	-1%	1%	3%	2%	0%	-1%	-1%	0%	1%	-2%	-6%	-1%	-17%	-1%	7%	5%	2%	0%	1%	0%	6%	2%	3%	-2%	0%
15	0%	1%	2%	-2%	-1%	2%	2%	1%	0%	1%	0%	1%	-1%	-2%	-19%	4%	3%	0%	0%	1%	0%	1%	8%	-1%	-1%	0%
16	2%	2%	3%	3%	1%	1%	1%	0%	0%	1%	-1%	1%	1%	-3%	1%	-32%	6%	1%	0%	0%	0%	7%	4%	2%	0%	0%
17	4%	4%	3%	0%	-3%	1%	0%	0%	-1%	1%	-1%	1%	0%	0%	1%	7%	-29%	2%	0%	0%	0%	3%	3%	2%	0%	0%
18	1%	1%	0%	11%	7%	-2%	-1%	-6%	-4%	-1%	-2%	0%	2%	1%	1%	4%	6%	-10%	-13%	0%	0%	1%	1%	4%	-1%	0%
19	-1%	-1%	-2%	7%	4%	-1%	-3%	-3%	-6%	1%	-1%	0%	1%	1%	0%	2%	3%	0%	-4%	1%	0%	1%	0%	3%	-1%	0%
20	0%	0%	0%	1%	1%	4%	1%	-3%	-8%	8%	3%	3%	1%	1%	3%	2%	2%	1%	-1%	-21%	-2%	1%	4%	0%	-1%	0%
21	0%	-1%	-2%	3%	2%	-1%	-3%	-9%	-6%	-4%	-2%	2%	3%	3%	0%	6%	3%	1%	-1%	-1%	-2%	8%	-1%	1%	-1%	0%
22	1%	1%	1%	2%	2%	0%	-1%	-3%	-1%	-2%	-1%	2%	1%	1%	1%	9%	4%	0%	0%	0%	-1%	-19%	3%	1%	-1%	0%
23	0%	0%	0%	-1%	0%	1%	1%	-2%	0%	-5%	-3%	3%	-1%	0%	5%	7%	4%	0%	0%	1%	-1%	3%	-11%	0%	-2%	0%
24	-5%	-6%	-1%	5%	6%	1%	-1%	-1%	0%	-2%	-4%	-2%	1%	2%	0%	8%	7%	4%	0%	0%	0%	3%	1%	-8%	-8%	0%
25	1%	-1%	1%	-1%	1%	0%	0%	0%	-2%	-1%	-1%	0%	-3%	0%	2%	9%	10%	1%	0%	0%	0%	3%	3%	-5%	-17%	0%
Sum	-1%	0%	-1%	-1%	2%	0%	-2%	-3%	-3%	-1%	-2%	-1%	-2%	-1%	1%	6%	6%	1%	-1%	0%	-1%	3%	3%	-1%	-3%	0%

Table 2-10: Trip flow percentage difference between model and Replica for PM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	sum
1	3%	2%	0%	-4%	1%	0%	0%	-2%	-3%	-5%	-2%	0%	-4%	-1%	2%	7%	8%	1%	-1%	0%	-1%	2%	2%	-3%	-1%	0%
2	1%	-3%	2%	-3%	1%	-1%	1%	0%	-2%	-3%	-2%	-2%	-3%	-2%	2%	7%	9%	1%	-1%	0%	-1%	2%	2%	-4%	-1%	0%
3	4%	5%	-12%	0%	2%	1%	-6%	-5%	-3%	-7%	-2%	0%	-2%	0%	4%	9%	7%	1%	-2%	0%	-1%	3%	3%	-1%	2%	0%
4	-1%	1%	0%	-4%	2%	-1%	-1%	0%	-1%	-2%	-3%	-3%	-5%	0%	-1%	6%	5%	4%	0%	0%	0%	2%	0%	2%	0%	0%
5	0%	1%	0%	-1%	-7%	0%	0%	1%	-1%	-2%	-2%	-1%	-4%	-1%	-1%	5%	2%	5%	0%	0%	0%	2%	1%	3%	0%	0%
6	1%	1%	0%	1%	2%	-17%	0%	1%	1%	1%	0%	0%	-1%	0%	1%	2%	3%	1%	-2%	1%	-1%	0%	2%	1%	0%	0%
7	1%	3%	-4%	-1%	1%	4%	-5%	-9%	-2%	-2%	1%	2%	-2%	-1%	5%	3%	2%	1%	-3%	1%	-1%	0%	5%	0%	1%	0%
8	0%	1%	-2%	0%	1%	3%	-1%	3%	-8%	-3%	1%	2%	-2%	-1%	3%	2%	1%	1%	-2%	0%	-1%	-1%	2%	0%	0%	0%
9	0%	0%	0%	1%	1%	6%	1%	-9%	-8%	2%	1%	2%	-1%	0%	2%	1%	1%	0%	-2%	0%	-2%	0%	3%	0%	0%	0%
10	-1%	0%	-3%	-1%	0%	1%	-2%	-4%	-2%	9%	0%	2%	-2%	0%	1%	2%	1%	0%	-1%	2%	-2%	-1%	1%	-1%	0%	0%
11	0%	0%	-1%	-5%	-1%	0%	0%	0%	-1%	7%	-1%	0%	-5%	-2%	3%	2%	2%	0%	-1%	2%	-1%	0%	4%	-2%	0%	0%
12	1%	1%	0%	-1%	0%	0%	1%	1%	0%	4%	-1%	-14%	-7%	-4%	2%	6%	3%	1%	0%	1%	0%	4%	5%	-1%	0%	0%
13	-2%	-1%	0%	1%	3%	-1%	-1%	-1%	-1%	-1%	-4%	-5%	-4%	1%	-1%	7%	5%	2%	0%	0%	0%	4%	0%	2%	-1%	0%
14	-3%	0%	-1%	5%	2%	1%	0%	0%	0%	2%	-2%	-7%	-4%	-15%	-1%	7%	4%	2%	0%	1%	0%	6%	1%	3%	0%	0%
15	2%	3%	2%	-1%	0%	2%	3%	2%	1%	2%	1%	-1%	-2%	-2%	-29%	3%	2%	1%	0%	1%	0%	2%	7%	-1%	1%	0%
16	3%	3%	3%	5%	1%	1%	1%	1%	0%	1%	0%	1%	2%	0%	1%	-41%	4%	1%	0%	0%	0%	8%	4%	2%	1%	0%
17	4%	6%	3%	2%	-2%	1%	1%	1%	-1%	1%	0%	2%	0%	0%	1%	4%	-36%	2%	0%	0%	0%	3%	2%	2%	2%	0%
18	1%	2%	-1%	11%	8%	1%	0%	-6%	-8%	-1%	-2%	0%	1%	0%	0%	3%	5%	-7%	-11%	0%	0%	0%	-1%	4%	0%	0%
19	-1%	0%	-1%	7%	4%	0%	-2%	-3%	-6%	3%	-1%	0%	1%	1%	0%	2%	2%	-8%	-1%	0%	0%	0%	0%	3%	-1%	0%
20	0%	1%	0%	1%	1%	5%	2%	-1%	-1%	9%	3%	4%	0%	1%	3%	2%	1%	1%	0%	-31%	-2%	-1%	4%	1%	0%	0%
21	0%	1%	-1%	4%	2%	0%	-1%	-7%	-5%	-2%	-2%	2%	4%	3%	0%	5%	2%	1%	0%	-3%	-10%	7%	-2%	2%	0%	0%
22	1%	1%	1%	3%	1%	0%	0%	-1%	-2%	-1%	0%	3%	1%	1%	-1%	8%	3%	0%	0%	0%	-1%	-21%	2%	1%	1%	0%
23	1%	2%	0%	0%	1%	2%	1%	-1%	-1%	-6%	-1%	3%	-1%	0%	6%	7%	3%	0%	-1%	1%	-2%	1%	-15%	0%	1%	0%
24	-3%	-3%	-2%	5%	6%	-1%	-1%	-1%	-1%	-3%	-3%	-3%	0%	1%	-1%	7%	6%	4%	0%	0%	0%	2%	0%	-7%	-2%	0%
25	0%	1%	1%	-4%	1%	-1%	1%	0%	-1%	-2%	-1%	-1%	-4%	-2%	1%	8%	8%	1%	-1%	0%	-1%	3%	2%	-5%	-5%	0%
Sum	0%	1%	-1%	0%	1%	0%	-1%	-3%	-4%	-1%	-2%	-1%	-2%	-1%	1%	5%	4%	1%	-1%	0%	-1%	2%	2%	0%	0%	0%

Table 2-11: Trip flow percentage difference between model and Replica for NT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Sum
1	3%	0%	-1%	-3%	1%	1%	0%	-2%	-3%	-4%	-3%	-1%	-5%	-1%	2%	8%	9%	1%	-1%	0%	0%	2%	3%	-5%	-1%	0%
2	-1%	-5%	1%	-3%	2%	1%	1%	1%	-2%	-2%	-3%	-1%	-5%	-1%	2%	8%	10%	2%	0%	0%	-1%	3%	3%	-5%	-4%	0%
3	2%	4%	-13%	1%	2%	1%	-7%	-5%	-2%	-8%	-3%	1%	-1%	1%	4%	9%	8%	1%	-1%	0%	-1%	3%	4%	-2%	2%	0%
4	-1%	-1%	0%	-5%	3%	-1%	-1%	0%	0%	-1%	-3%	-2%	-6%	0%	0%	7%	6%	4%	0%	0%	0%	2%	1%	1%	-1%	0%
5	0%	0%	1%	0%	-7%	-1%	0%	0%	-1%	-1%	-2%	-1%	-4%	-2%	0%	5%	2%	5%	0%	0%	0%	2%	0%	3%	1%	0%
6	1%	1%	1%	0%	3%	-19%	1%	1%	1%	1%	0%	-1%	-1%	0%	2%	3%	3%	2%	-2%	1%	0%	0%	2%	1%	-1%	0%
7	1%	3%	-5%	0%	2%	5%	-10%	-7%	-2%	-3%	0%	2%	-2%	0%	5%	3%	3%	1%	-1%	1%	-1%	1%	5%	0%	1%	0%
8	0%	2%	-2%	1%	1%	3%	-3%	2%	-6%	-5%	0%	2%	-1%	0%	3%	2%	2%	1%	-2%	0%	-2%	0%	2%	0%	0%	0%
9	-1%	0%	0%	0%	1%	6%	0%	-5%	-10%	0%	1%	2%	-1%	0%	2%	1%	1%	0%	-2%	2%	-2%	0%	3%	0%	0%	0%
10	-1%	0%	-3%	-1%	0%	1%	-2%	-4%	-2%	4%	2%	3%	-2%	0%	2%	2%	1%	1%	-1%	2%	-2%	0%	2%	-1%	0%	0%
11	0%	0%	-1%	-4%	0%	1%	1%	0%	0%	6%	-4%	-1%	-6%	-2%	3%	2%	2%	0%	0%	2%	-1%	1%	3%	-3%	0%	0%
12	1%	0%	1%	-1%	1%	1%	1%	1%	0%	4%	-2%	-16%	-8%	-4%	2%	7%	4%	1%	0%	1%	0%	3%	5%	-1%	0%	0%
13	-2%	-2%	0%	1%	3%	0%	-1%	-2%	-1%	-1%	-4%	-5%	-9%	1%	0%	9%	6%	2%	0%	0%	0%	4%	1%	2%	-1%	0%
14	-3%	0%	0%	5%	2%	1%	0%	0%	0%	1%	-2%	-7%	-4%	-15%	-1%	7%	5%	2%	0%	1%	0%	6%	2%	2%	0%	0%
15	2%	2%	3%	-1%	1%	2%	3%	2%	0%	2%	1%	1%	-1%	-2%	-30%	4%	3%	1%	0%	1%	0%	1%	8%	0%	0%	0%
16	3%	3%	3%	5%	2%	2%	1%	0%	0%	1%	-1%	1%	2%	0%	1%	-45%	5%	1%	0%	0%	0%	7%	5%	2%	1%	0%
17	5%	6%	3%	3%	0%	2%	1%	0%	0%	0%	0%	1%	1%	1%	1%	6%	-43%	2%	0%	0%	0%	4%	3%	2%	2%	0%
18	1%	2%	0%	10%	8%	1%	-1%	-3%	-5%	-1%	-2%	0%	1%	1%	0%	4%	5%	-16%	-12%	0%	0%	0%	0%	4%	0%	0%
19	0%	0%	-1%	6%	4%	-2%	-3%	-1%	-4%	1%	-1%	0%	2%	1%	0%	2%	3%	-4%	-7%	0%	-1%	1%	-1%	3%	0%	0%
20	1%	1%	1%	1%	1%	4%	2%	-2%	-2%	8%	3%	3%	0%	1%	2%	2%	2%	0%	-1%	-31%	-2%	1%	4%	0%	0%	0%
21	-1%	0%	-1%	4%	2%	0%	-1%	-6%	-5%	-6%	-2%	1%	4%	3%	1%	6%	3%	1%	0%	-2%	-9%	7%	-1%	2%	-1%	0%
22	1%	2%	1%	3%	2%	0%	0%	-1%	-1%	-1%	-1%	2%	2%	2%	0%	9%	4%	1%	0%	0%	-1%	-27%	3%	1%	0%	0%
23	0%	2%	2%	1%	1%	2%	1%	-1%	0%	-4%	-1%	3%	-2%	0%	6%	7%	4%	0%	0%	1%	-1%	3%	-23%	0%	0%	0%
24	-4%	-5%	-3%	4%	6%	1%	-1%	0%	-1%	-2%	-4%	-2%	0%	2%	0%	7%	6%	4%	0%	0%	0%	3%	1%	-10%	-3%	0%
25	-3%	-2%	1%	-2%	2%	0%	1%	0%	-1%	-1%	-1%	-1%	-6%	-1%	1%	9%	9%	1%	-1%	0%	0%	3%	3%	-6%	-5%	0%
Sum	0%	0%	-1%	0%	2%	0%	-1%	-3%	-3%	-2%	-2%	-1%	-3%	-1%	1%	6%	5%	1%	-1%	0%	-1%	2%	2%	-1%	-1%	0%

2.3 MODE CHOICE VALIDATION

The Dane County TDM model utilize a nest logit mode choice model to produce the mode share for the eight modes: Drive Alone, Shared Ride, Walk, Bike, Walk to Bus, Drive to Bus, Walk to Premium and Drive to Premium.

The most basic checks of mode choice model results are comparison of modeled trips by mode, or mode shares, to observed data by market segment. Market segments includes trip purposes as well as demographic segments, such as income or vehicles availability levels and geographically defined segments. Mode choice models are typically applied using trip tables as inputs. The model choice model's results, therefore, are shares of the total trip table for each market segment that use each of the modal alternatives. Validation of the model's aggregate results involves checking the shares of the model's base year scenarios results against observed mode shares. The following Table 2-12 is the target model share from survey. Table 2-13 is the mode share from model. Table 2-14 contains the model share difference between model and survey. It shows that mode share difference between model and survey are minimal, which means mode choice of the model is reasonable.

Table 2-12: Target mode share from survey

	Survey Shares							
	DA	**SR**	**WALK**	**BIKE**	**BUS_W**	**BUS_D**	**SCHOOLBUS**	**Total**
HBW	75.6%	10.6%	2.4%	5.9%	4.7%	0.7%		100.0%
	86.2%		8.4%		5.4%			100.0%
HBU	34.7%	17.3%	21.8%	8.4%	17.8%	0.1%		100.0%
	52.0%		30.2%		17.8%			100.0%
HB Shop	49.3%	38.8%	8.1%	2.4%	1.4%	0.0%		100.0%
	88.1%		10.5%		1.4%			100.0%
HB School	12.6%	41.5%	10.1%	6.8%	4.1%	0.0%	25.1%	100.0%
	54.1%		16.8%		4.1%		25.1%	100.0%
HB SocRec	33.8%	34.2%	24.2%	6.8%	1.1%	0.0%		100.0%
	68.0%		31.0%		1.1%			100.0%
HBO	34.3%	48.7%	14.5%	1.5%	0.9%	0.0%		100.0%
	83.1%		16.0%		0.9%			100.0%
NHB	45.8%	33.5%	14.7%	2.9%	1.6%	0.1%	1.4%	100.0%
	79.3%		17.6%		1.7%		1.4%	100.0%

Table 2-13: Mode share from model

	Model Share							
	DA	**SR**	**WALK**	**BIKE**	**BUS_W**	**BUS_D**	**SCHOOLBUS**	**Total**
HBW	76.0%	9.9%	2.1%	7.7%	3.4%	0.8%		100.0%
	85.9%		9.9%		4.3%			100.0%
HBU	33.1%	17.4%	21.7%	10.5%	17.1%	0.3%		100.0%
	50.5%		32.2%		17.3%			100.0%
HB Shop	51.3%	37.7%	6.4%	3.9%	0.6%	0.0%		100.0%
	89.0%		10.4%		0.6%			100.0%
HB School	12.5%	44.1%	10.0%	5.8%	2.6%	0.0%	24.9%	100.0%
	56.6%		15.9%		2.6%		24.9%	100.0%
HB SocRec	33.0%	34.7%	24.7%	7.0%	0.6%	0.0%		100.0%
	67.8%		31.7%		0.6%			100.0%
HBO	32.9%	49.1%	16.2%	1.1%	0.7%	0.0%		100.0%
	82.0%		17.3%		0.7%			100.0%
NHB	45.5%	33.3%	15.5%	3.2%	0.9%	0.0%	1.5%	100.0%
	78.8%		18.8%		0.9%		1.4%	100.0%

Table 2-14: Model share difference between model and survey

	Model Share - Survey Shares							
	DA	SR	WALK	BIKE	BUS_W	BUS_D	SCHOOLBUS	Total
HBW	0.4%	-0.8%	-0.3%	1.8%	-1.3%	0.1%		0%
	-0.4%		1.5%		-1.1%			0%
HBU	-1.6%	0.1%	-0.1%	2.1%	-0.7%	0.2%		0%
	-1.5%		2.0%		-0.5%			0%
HB Shop	2.0%	-1.1%	-1.7%	1.5%	-0.7%	0.0%		0%
	0.9%		-0.2%		-0.7%			0%
HB School	-0.1%	2.6%	0.0%	-0.9%	-1.5%	0.0%	-0.1%	0%
	2.6%		-0.9%		-1.5%		-0.1%	0%
HB SocRec	-0.8%	0.6%	0.5%	0.2%	-0.5%	0.0%		0%
	-0.2%		0.7%		-0.5%			0%
HBO	-1.5%	0.4%	1.7%	-0.4%	-0.2%	0.0%		0%
	-1.1%		1.3%		-0.2%			0%
NHB	-0.3%	-0.2%	0.8%	0.4%	-0.8%	-0.1%	0.1%	0%
	-0.5%		1.2%		-0.9%		0.0%	0%

2.4 HIGHWAY ASSIGNMENT VALIDATION

Traffic assignment is the culmination of the modeling process. There are two major parts of validation efforts: 1. traffic volume validation and 2 travel time and speed validation. The two parts of work are introduced in the following two sub segments.

2.4.1 Peak period Traffic Volume Validation

The TOD traffic count data for volume validation is from WisDOT's TRAffic Data System (TRADAS, a product from Chaparral Systems). TRADAS is managed by the Bureau of State Highway Programs. It houses continuous (e.g., from fixed automated traffic recorders (ARTS) and short duration volume, speed, and vehicle classification data). TOD traffic counts are from 1,408 TRADAS sites, which were collected in different years in all available locations in Dane County. The countywide annual growth rate of 0.5% is applied to factor those collected traffic counts to convert them from various different years into 2016 traffic counts. There are two standard approaches for TOD volume validation. The first one is to compare the observed TOD traffic counts to model volumes for different links aggregated by various facility types. The second one is to compare the TOD traffic counts and mode volume by count groups. The following two tables show the peak period validation targets.

Table 2-15: Peak period RMSE% target by volume group

Volume group	Daily RMSE%	Peak RMSE%
0-1000	60%	100%
1000-2500	47%	62%
2500-5000	36%	50%
5000-1000	29%	40%
10000-20000	25%	33%
20000-30000	22%	26%
30000 and up	22%	25%

Table 2-16: Peak period V/C error% target by facility type

Function Class	Daily V/C error%	Peak V/C error%
Interstate	7%	10%
Freeway	7%	15%
Ramp	-	-
Expressway	10%	15%
Urban principal arterial	10%	15%
Urban minor arterial	15%	20%
Urban major collector	25%	30%
Urban minor collector	25%	35%
Urban local	-	-
Rural principal arterial	7%	15%
Rural minor arterial	10%	15%
Rural major collector	15%	20%
Rural minor collector	25%	30%
Rural local	25%	35%
Rural other	-	-

For the base year model, the peak period volume validation by volume group and facility type result is illustrated in the Table 2-17 and Table 2-18. The tables show the base year model has good peak period performance on both RMSE% and VC error%, except for some minor road facilities such as urban minor collector, and rural minor collectors.

Table 2-17: Peak period RMSE% by volume group for base year model

Volume Group	RMSE% AM	RMSE% PM	Allowable RMSE%
0 - 1,000	74%	84%	< 100%
1,000 - 2,500	38%	41%	< 62%
2,500 - 5,000	31%	29%	< 50%
5,000 - 10,000	24%	22%	< 40%
10,000 - 20,000	20%	16%	< 33%
20,000 - 30,000	17%	11%	< 26%
>30,000	N/A	8%	<25%

Table 2-18: Peak period V/C error% by facility type for base year model

Functional Class	AM V/C Error%	PM V/C Error%	Allowable V/C Error%
Interstate	8%	-1%	< 10%
freeway	-1%	-4%	< 15%
ramp	-6%	0%	
expressway	3%	2%	< 15%
urban principal arterial	1%	-9%	< 15%
urban minor arterial	-11%	-15%	< 20%
urban major collector	-22%	-28%	< 30%
urban minor collector	-65%	-56%	<35%
rural principal arterial	-14%	-5%	< 15%
rural minor arterial	6%	17%	< 15%
rural major collector	-9%	2%	< 20%
rural minor collector	61%	69%	< 30%
rural local	20%	30%	<35%

For the base year model, the daily volume validation by volume group and facility type result is illustrated in **Table 2-19** and **Table 2-20**. **Table 2-19** shows that in the daily level, the RMSE% measures of the model are mostly exceeding the allowable range. There might be two potential reasons for it: 1. The daily RMSE% allowable ranges are stricter than those for peak period 2. Off peak period RMSE% measures are large. **Table 2-20** indicates that in the daily, the V/C error% measures are within the allowable ranges for most of the major roads.

Table 2-19: Daily RMSE% by volume group for base year model

Volume Group	RMSE% Daily	Allowable RMSE%
0 - 1,000	145%	60%
1,000 - 2,500	89%	47%
2,500 - 5,000	51%	36%

5,000 - 10,000	39%	29%
10,000 - 20,000	29%	25%
20,000 - 30,000	25%	22%
>30,000	14%	22%

Table 2-20: Daily V/C error% by facility type for base year model

Functional Class	Daily V/C Error%	Daily Allowable V/C Error%
Interstate	-9%	7%
freeway	-4%	7%
ramp	0%	-
expressway	-1%	10%
urban principal arterial	-9%	10%
urban minor arterial	-12%	15%
urban major collector	-27%	25%
urban minor collector	-61%	25%
rural principal arterial	0%	7%
rural minor arterial	22%	10%
rural major collector	7%	15%
rural minor collector	74%	25%
rural local	35%	25%

2.4.2 Travel speed validation

Speed data from NPMRDS (2017) data are utilized to validate the model speed data. The nine corridors are selected for this purpose. The following Figure illustrate the location of the selected 9 corridors.

Figure 2-4: Corridors selected for travel speed validation

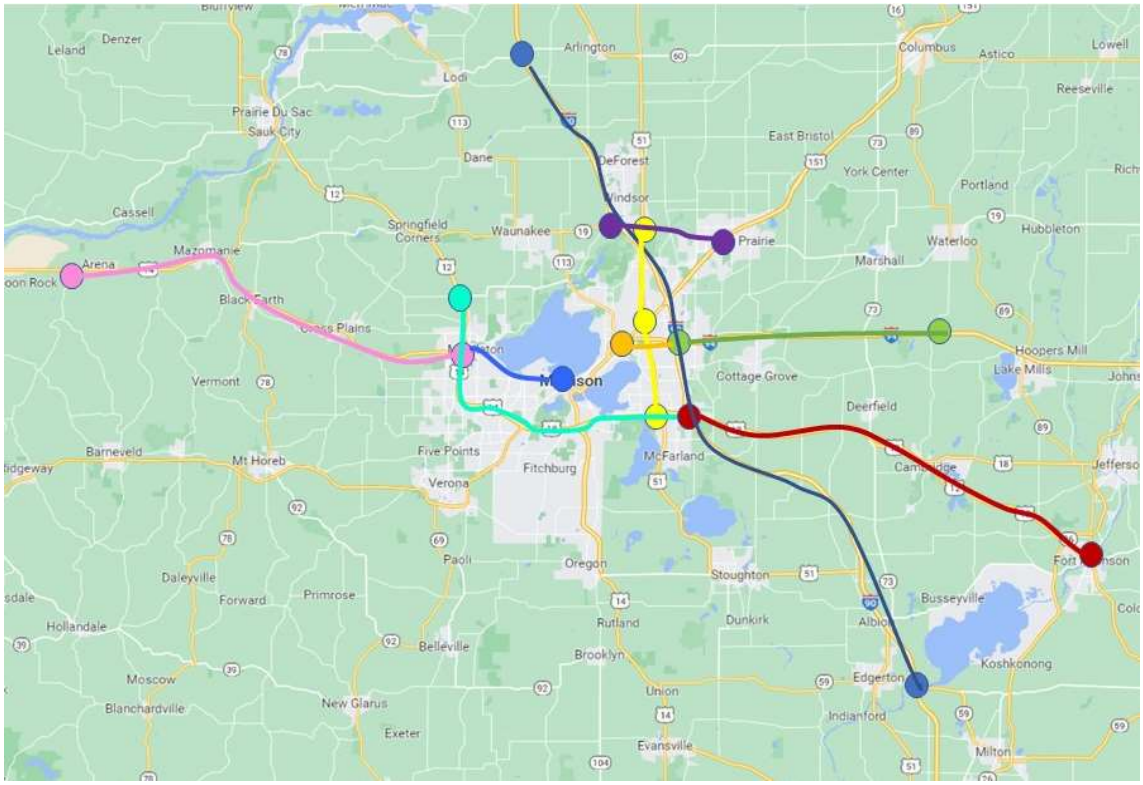


Table 2-21 shows the peak period speed validation result for the 9 corridors. There are 4 corridors with large speed error percentage (>20%), which are highlighted in the tables.

Table 2-21: Peak period travel speed validation

Route Information				AM Speed (mph)			PM Speed (mph)		
Route	**From**	**To**	**Dir**	**NPMRDS**	**Model**	**Diff%**	**NPMRDS**	**Model**	**Diff%**
I-90	County Line	County Line	N	64	70	9%	62	70	12%
I-90			S	65	70	8%	62	69	12%
I-94	I-90	County Line	E	67	69	3%	68	69	2%
I-94			W	68	70	3%	67	70	4%
US 51	US 151	S of SR 19	N	34	49	45%	33	49	49%
US 51			S	35	49	41%	30	49	61%
US 51	US 18	SR 19	N	32	46	44%	32	45	43%
US 51			S	33	49	48%	31	48	53%
SR 30	US 151	I 90	W	54	65	20%	55	65	19%
SR 30			E	57	66	17%	58	66	14%
SR 19	US 151	I-94	W	28	43	51%	26	42	60%
SR 19			E	30	43	40%	28	42	50%
US 14			W	44	49	12%	43	49	13%

US 14	US 12/14	County Line	E	45	49	9%	42	49	17%
US 18/12	I 90	SR 89	W	56	55	-3%	56	55	-2%
US 18/12			E	56	55	-1%	57	55	-3%
University Ave	US 12	N Bassett St	W	22	35	61%	19	33	71%
University Ave		Farley Ave	E	24	36	51%	19	36	87%
Beltline	Century Rd	I-90	W	45	58	29%	48	58	22%
Beltline			E	57	62	10%	42	61	46%

2.5 SUMMARY

This chapter performs some initial validation on the base year of the Dane County TDM model. The initial check identifies a cluster related issue which cause model produce different result for each independent run. General speaking, the based year model demonstrates reasonable performance on the trip distribution, mode split and highway assignment model. However, there are two potential issues which need to be aware of:

1. The model overestimates the intra-district level flow compared with Streetlight and Replica data
2. The model overestimates the travel speed on 5 major corridors in the Dane County areas.

In addition, the original model before updates were made (Chapter 3) does not meet all the daily level RMSE% measures by volume group.

3. BASE YEAR MODEL UPDATE RECOMMENDATION

This chapter proposes some recommendation on model updates based on the model validation result from Chapter 2 and implement these updates on the model and perform some analysis on it.

3.1 BASE YEAR MODEL RECOMMENDTATION

According to the initial validation results, the base year model looks reasonable, however there are still some potential issues need to be solved:

- Model underestimates the intra-distract level flows compared with Streetlight and Replica data
- Model overestimates the peak period travel speed on 5 major corridors

The recommendations to alleviate the above issues are:

- Implement reduction factors on the intra-zonal terminal time to encourage the intra-zonal trip flows in the trip distribution step
- Activate the intersection delay function to reduce travel time in the major corridors and downtown areas.

To verify the above recommendations, the following modifications are performed on the model. The results of the updated model are analyzed.

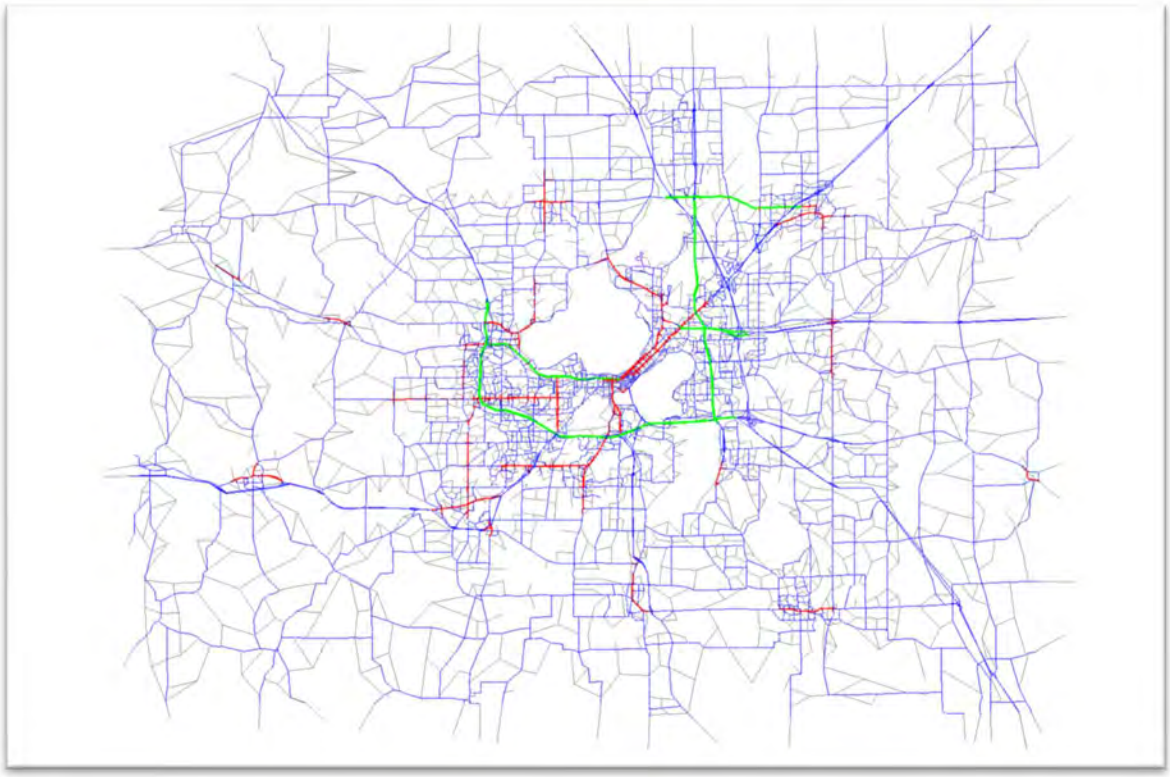
Table 3-1: The recommended modifications on the TDM model

Order	Purpose	Suggested modification on model
1	Increase Intra-district level traffic flow	Reduce the intra-zonal terminal time by 2/3 for the TAZs within district 12,14-17,20,22-23
2	Reduce model speed in some major corridors and downtown Madison area	Activate the model default intersection delay function. Apply the TOD intersection delay to the facilities including the 4 selected corridors US 51, SR 19, University Ave and Beltline. Use the factor of 0.5 to reduce the intersection delay for AM, MD, and PM period.

Figure 3-1 illustrates the selected links/corridors selected for implementing intersection delay. The green colored links are five selected corridors, and the red links are the default links selected by

the model for implementing intersection delay (low_FC=11), including local roads in downtown areas.

Figure 3-1: Corridors selected for implementing TOD intersection delay



3.2 TRIP DISTRIBUTION MODEL VALIDATION FOR UPDATED MODEL

3.2.1 Trip Length Validation

With the model updated, the trip length distribution can be validated based on the Streetlight and Replica data. the Coincidence ratios are calculated as the following Table 3-2 and Table 3-3. Compared with the base model the CR ratios change insignificantly and all of the CR ratios are within the allowable range.

Table 3-2: Coincidence ratio between model and Streetlight data

Trip Purpose	AM	MD	PM	NT	Daily
HB Work	0.76	0.72	0.71	0.74	0.76
HB Other	0.76	0.78	0.72	0.77	0.78
No HB	0.70	0.73	0.72	0.73	0.75
All Purpose	0.77	0.76	0.72	0.77	0.77

Table 3-3: Coincidence ratio between model and Replica data

Trip Purpose	AM	MD	PM	NT	Daily
HB Work	0.71	0.80	0.72	0.76	0.75
HB School	0.65	0.68	0.65	0.58	0.69
HB Shopping	0.73	0.74	0.68	0.74	0.73
HB Other	0.66	0.73	0.71	0.74	0.73
All Purpose	0.72	0.75	0.72	0.76	0.74

3.2.2 District to District Traffic Flow Pattern Validation

Table 3-4 shows the normalized levenshtein distance for TOD matrices between the updated model and observed data from Streetlight and Replica. The updated model does not change the Levenshtein distance significantly, compared with Table 2-3.

Table 3-4: Normalized LevenShtein distance summary for updated model

TOD	NLOD with Streetlight data	NLOD with Replica data
AM	0.64	0.61
MD	0.66	0.59
PM	0.64	0.59
NT	0.64	0.59

The following Table 3-5 to Table 3-8Table 2-8 are the TOD trip flow percentage difference between the updated model and Streetlight data and Table 3-9 to Table 3-12 are the TOD trip flow percentage difference between the updated model and Replica data. The values in the table are highlighted with colors. Blue color means the negative values and red means positive values.

Compared with the corresponding TOD trip flow percentage difference between the original model and the Streetlight data (Table 2-4 to Table 2-7) and Replica data (Table 2-8 to Table 2-11), the intra-district level flow difference percentage drops by roughly 10% for the selected districts in Table 3-1, indicating that approach of reducing intra-zonal terminal time works.

Table 3-5: Trip flow percentage difference between model and Streetlight for AM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	sum
1	-5%	-9%	1%	-3%	0%	2%	0%	0%	0%	0%	-3%	0%	0%	-4%	4%	10%	10%	1%	0%	1%	0%	5%	5%	-3%	-12%	0%
2	-5%	-5%	3%	-3%	1%	2%	1%	0%	0%	0%	-7%	0%	-1%	-2%	4%	10%	12%	2%	0%	1%	0%	4%	5%	-4%	-20%	0%
3	-14%	1%	-6%	0%	2%	2%	-5%	-3%	-1%	-4%	-5%	2%	-1%	0%	4%	11%	9%	1%	0%	1%	0%	5%	6%	-2%	-3%	0%
4	-6%	-2%	0%	-11%	-1%	2%	-1%	0%	0%	-1%	-4%	-1%	-3%	0%	1%	10%	9%	4%	1%	0%	0%	4%	2%	1%	-4%	0%
5	-1%	1%	1%	-16%	-5%	1%	0%	0%	0%	0%	-2%	-1%	-2%	-3%	1%	8%	7%	5%	1%	0%	0%	3%	2%	0%	-1%	0%
6	0%	-1%	0%	-5%	-2%	-9%	1%	-2%	2%	0%	-2%	0%	0%	0%	2%	4%	6%	3%	-1%	2%	0%	2%	2%	0%	-3%	0%
7	-5%	1%	-8%	-2%	2%	3%	-8%	-6%	1%	-5%	-1%	2%	-1%	1%	5%	5%	5%	2%	0%	2%	0%	4%	6%	0%	-1%	0%
8	-4%	0%	-3%	1%	1%	3%	-7%	-2%	-4%	-4%	-1%	1%	0%	1%	4%	3%	3%	2%	-1%	2%	0%	2%	5%	0%	-1%	0%
9	-4%	0%	-1%	0%	0%	5%	0%	-10%	-9%	0%	0%	3%	0%	0%	2%	3%	2%	1%	-1%	5%	0%	2%	5%	0%	-1%	0%
10	-2%	-1%	-4%	-1%	0%	1%	-3%	-7%	0%	3%	-3%	3%	-1%	1%	3%	3%	2%	1%	0%	2%	-2%	3%	4%	-1%	-1%	0%
11	-6%	-6%	0%	-8%	-2%	2%	0%	2%	1%	4%	0%	-3%	-3%	-1%	5%	4%	4%	1%	0%	2%	0%	3%	8%	-5%	-3%	0%
12	-2%	-2%	1%	-8%	0%	1%	-1%	0%	0%	2%	-8%	-2%	-4%	-4%	3%	9%	5%	1%	0%	1%	0%	5%	6%	-2%	-1%	0%
13	-3%	-1%	0%	-13%	0%	1%	-1%	-2%	0%	-1%	-7%	-5%	4%	-3%	1%	11%	8%	3%	0%	0%	0%	5%	2%	0%	-1%	0%
14	-4%	0%	1%	-4%	1%	1%	0%	-1%	0%	0%	-4%	-4%	-1%	-11%	1%	10%	6%	2%	0%	1%	0%	5%	2%	-1%	-1%	0%
15	-1%	1%	2%	-3%	-1%	2%	2%	1%	1%	1%	-7%	0%	0%	-2%	-14%	5%	3%	1%	0%	1%	0%	2%	9%	0%	-3%	0%
16	1%	3%	2%	-3%	-1%	1%	0%	1%	0%	1%	-4%	-1%	1%	-5%	1%	-16%	6%	1%	0%	0%	0%	6%	5%	1%	1%	0%
17	4%	4%	4%	-9%	-14%	1%	1%	-1%	0%	-1%	-4%	1%	0%	2%	2%	8%	-10%	2%	0%	0%	0%	4%	3%	0%	1%	0%
18	-2%	1%	1%	8%	6%	-2%	-5%	-8%	-5%	-5%	-2%	0%	2%	2%	1%	6%	7%	1%	-12%	0%	-1%	2%	2%	4%	-1%	0%
19	-4%	1%	-5%	6%	4%	0%	-6%	-5%	-6%	0%	-1%	0%	1%	2%	0%	4%	4%	-4%	4%	1%	0%	2%	0%	3%	-2%	0%
20	-3%	0%	0%	2%	1%	3%	0%	-7%	-17%	3%	2%	2%	1%	1%	2%	3%	2%	1%	0%	0%	-3%	1%	5%	1%	0%	0%
21	-4%	0%	-3%	3%	3%	0%	-3%	-9%	-5%	-11%	-2%	-3%	3%	5%	1%	8%	5%	2%	1%	0%	-2%	11%	1%	2%	-2%	0%
22	0%	0%	1%	1%	0%	0%	-1%	-3%	0%	-4%	-5%	0%	2%	2%	1%	9%	4%	0%	0%	0%	-2%	-7%	1%	0%	0%	0%
23	-1%	-1%	1%	-3%	0%	1%	0%	-2%	0%	-10%	-5%	2%	-1%	0%	5%	7%	4%	1%	0%	1%	0%	5%	-3%	0%	-1%	0%
24	-6%	-9%	0%	-4%	6%	3%	-1%	-1%	0%	-1%	-5%	0%	-1%	1%	1%	10%	8%	4%	1%	0%	0%	3%	2%	1%	-13%	0%
25	-2%	-14%	4%	1%	2%	2%	1%	0%	0%	0%	-1%	0%	-1%	1%	3%	11%	12%	2%	0%	1%	0%	4%	5%	-6%	-24%	0%
Sum	-4%	-1%	-1%	-4%	1%	1%	-2%	-4%	-2%	-2%	-5%	-1%	-1%	-1%	2%	9%	7%	2%	-1%	1%	-1%	5%	4%	-1%	-3%	0%

Table 3-6: Trip flow percentage difference between model and Streetlight for MD

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	sum
1	-5%	-6%	-4%	-1%	2%	2%	-1%	-2%	0%	-2%	-5%	1%	-1%	1%	3%	9%	12%	1%	0%	1%	0%	4%	5%	-3%	-11%	0%
2	-6%	-11%	2%	0%	2%	2%	1%	0%	0%	-1%	-7%	0%	-1%	0%	4%	10%	14%	2%	0%	1%	0%	4%	4%	-6%	-14%	0%
3	-3%	4%	-18%	1%	2%	2%	-7%	-8%	0%	-8%	-3%	3%	0%	1%	4%	10%	10%	1%	0%	0%	0%	5%	5%	-1%	1%	0%
4	0%	0%	0%	-13%	-1%	1%	0%	0%	0%	0%	-3%	-1%	-11%	2%	1%	9%	9%	4%	1%	0%	0%	3%	2%	-1%	-1%	0%
5	1%	1%	1%	-15%	-10%	0%	0%	1%	0%	0%	-2%	-1%	-6%	1%	1%	7%	7%	5%	0%	0%	0%	3%	2%	2%	0%	0%
6	1%	1%	0%	-3%	0%	-22%	-1%	-2%	2%	1%	0%	1%	-1%	0%	2%	4%	6%	2%	0%	2%	0%	1%	3%	1%	0%	0%
7	1%	3%	-9%	0%	2%	5%	-15%	-13%	0%	-4%	0%	3%	-1%	0%	6%	4%	4%	2%	-1%	2%	-1%	3%	7%	0%	1%	0%
8	1%	2%	-3%	2%	1%	4%	-4%	-17%	-6%	-4%	1%	3%	0%	0%	4%	3%	3%	1%	0%	2%	-1%	2%	5%	0%	1%	0%
9	0%	1%	0%	1%	1%	7%	1%	-13%	-19%	3%	1%	3%	0%	0%	2%	2%	2%	0%	-1%	4%	-1%	1%	4%	0%	0%	0%
10	-1%	0%	-5%	0%	0%	1%	-2%	-8%	0%	-3%	-1%	4%	0%	1%	3%	3%	2%	1%	0%	3%	-1%	2%	1%	0%	0%	0%
11	-3%	-3%	-1%	-5%	0%	2%	1%	1%	1%	5%	-10%	-3%	-5%	0%	5%	4%	4%	1%	0%	3%	0%	3%	5%	-3%	0%	0%
12	0%	0%	1%	-3%	0%	2%	1%	1%	1%	3%	-8%	-12%	-9%	-4%	3%	7%	5%	1%	0%	1%	0%	4%	6%	-2%	0%	0%
13	0%	0%	0%	-12%	2%	1%	-1%	0%	0%	0%	-5%	-5%	-10%	1%	0%	11%	8%	3%	0%	0%	0%	5%	2%	1%	0%	0%
14	1%	1%	1%	3%	3%	1%	0%	0%	0%	1%	-2%	-7%	-3%	-28%	0%	8%	6%	2%	0%	1%	1%	6%	2%	2%	0%	0%
15	1%	3%	2%	0%	0%	2%	3%	2%	1%	2%	0%	0%	-1%	-1%	-30%	5%	3%	1%	0%	1%	0%	-1%	8%	0%	1%	0%
16	3%	3%	3%	4%	1%	1%	1%	1%	0%	1%	0%	2%	0%	-2%	2%	-42%	6%	1%	0%	0%	0%	6%	4%	2%	1%	0%
17	4%	5%	3%	-1%	-2%	1%	0%	0%	0%	0%	-1%	2%	-1%	1%	2%	6%	-31%	2%	0%	0%	0%	3%	3%	2%	2%	0%
18	0%	2%	0%	12%	8%	0%	-1%	-12%	-9%	-1%	-1%	1%	2%	2%	1%	5%	8%	-8%	-17%	0%	0%	1%	1%	4%	1%	0%
19	-1%	0%	-1%	8%	4%	1%	-1%	-4%	-5%	3%	0%	0%	2%	1%	0%	3%	4%	-8%	-13%	1%	1%	1%	0%	3%	0%	0%
20	0%	0%	0%	2%	1%	4%	1%	-7%	-13%	5%	3%	4%	0%	1%	2%	2%	2%	0%	0%	-8%	-3%	0%	4%	0%	0%	0%
21	0%	1%	-1%	5%	2%	0%	-3%	-9%	-3%	-7%	-2%	1%	3%	4%	1%	7%	4%	1%	1%	-1%	-17%	9%	1%	2%	0%	0%
22	2%	2%	1%	3%	2%	1%	0%	-2%	0%	-2%	-1%	2%	1%	2%	0%	8%	4%	0%	0%	0%	-1%	-27%	3%	1%	1%	0%
23	1%	2%	1%	1%	0%	2%	1%	-1%	1%	-14%	-5%	3%	-1%	0%	6%	7%	4%	1%	0%	1%	0%	4%	-13%	0%	1%	0%
24	-3%	-7%	-1%	-1%	6%	2%	0%	0%	0%	0%	-5%	-3%	-2%	2%	1%	9%	8%	4%	1%	0%	0%	3%	1%	-10%	-6%	0%
25	-7%	-15%	3%	0%	2%	2%	2%	0%	0%	0%	-2%	2%	0%	1%	4%	10%	12%	2%	0%	0%	0%	4%	4%	-6%	-18%	0%
Sum	-1%	-1%	-2%	-3%	1%	1%	-2%	-6%	-3%	-3%	-4%	-1%	-3%	0%	3%	8%	8%	2%	-1%	1%	-1%	5%	4%	-1%	-2%	0%

Table 3-7: Trip flow percentage difference between model and Streetlight for PM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	sum
1	0%	-2%	-9%	-4%	1%	2%	-1%	-3%	-2%	-2%	-4%	0%	-2%	-1%	3%	9%	9%	1%	-1%	0%	-1%	4%	4%	-4%	0%	0%
2	-7%	-3%	-1%	-2%	2%	2%	1%	0%	0%	-1%	-7%	-2%	-2%	0%	4%	9%	11%	2%	0%	0%	0%	3%	3%	-8%	-3%	0%
3	-1%	4%	-16%	1%	2%	2%	-8%	-8%	-1%	-8%	-3%	2%	0%	1%	5%	9%	8%	1%	-1%	0%	-1%	4%	4%	-1%	3%	0%
4	-1%	0%	0%	-6%	2%	0%	0%	0%	0%	0%	-4%	-3%	-11%	0%	0%	7%	7%	5%	0%	0%	0%	3%	1%	-1%	0%	0%
5	0%	1%	0%	-9%	1%	-2%	0%	0%	-1%	0%	-4%	-1%	-7%	-1%	0%	6%	4%	6%	0%	0%	0%	2%	1%	2%	1%	0%
6	1%	2%	0%	-1%	1%	-21%	0%	0%	1%	1%	0%	2%	-1%	0%	2%	3%	5%	1%	-2%	2%	0%	1%	2%	1%	1%	0%
7	1%	2%	-7%	0%	2%	5%	-10%	-12%	-1%	-4%	0%	3%	-1%	0%	6%	3%	3%	2%	-2%	2%	-1%	3%	5%	0%	2%	0%
8	1%	2%	-3%	1%	1%	4%	-2%	-6%	-8%	-4%	1%	3%	-1%	0%	4%	2%	2%	1%	-1%	1%	-2%	1%	4%	0%	1%	0%
9	0%	1%	0%	1%	1%	7%	2%	-9%	-19%	3%	2%	2%	0%	0%	2%	1%	1%	0%	-2%	3%	-1%	1%	3%	0%	0%	0%
10	0%	0%	-5%	0%	1%	1%	-2%	-8%	-1%	3%	0%	3%	0%	1%	3%	2%	1%	1%	0%	3%	-2%	1%	0%	0%	0%	0%
11	-2%	-1%	-2%	-4%	0%	2%	1%	1%	1%	5%	-3%	-4%	-6%	-2%	4%	3%	2%	1%	0%	3%	0%	1%	4%	-3%	1%	0%
12	0%	0%	1%	-2%	0%	1%	1%	1%	0%	4%	-8%	-7%	-10%	-4%	3%	6%	4%	1%	0%	1%	-1%	4%	5%	-2%	1%	0%
13	-1%	0%	-1%	-8%	2%	1%	0%	0%	0%	0%	-5%	-6%	-8%	1%	0%	9%	6%	3%	0%	0%	1%	5%	1%	0%	0%	0%
14	-1%	0%	0%	3%	1%	1%	0%	0%	0%	2%	-2%	-8%	-6%	-14%	0%	7%	5%	2%	0%	1%	1%	6%	1%	2%	1%	0%
15	2%	3%	2%	0%	0%	2%	3%	3%	1%	3%	0%	0%	-1%	0%	-34%	3%	2%	1%	0%	1%	0%	-1%	8%	0%	2%	0%
16	3%	4%	3%	6%	2%	1%	1%	1%	0%	1%	0%	3%	1%	-1%	1%	-46%	5%	2%	0%	0%	0%	7%	4%	2%	2%	0%
17	4%	6%	3%	2%	-4%	2%	1%	1%	-1%	1%	1%	2%	1%	2%	2%	3%	-36%	3%	0%	0%	0%	3%	2%	1%	3%	0%
18	0%	2%	-1%	11%	8%	0%	-1%	-9%	-8%	-1%	-1%	2%	3%	2%	1%	4%	6%	-2%	-23%	0%	0%	1%	1%	4%	1%	0%
19	0%	1%	0%	8%	4%	1%	-1%	-1%	-6%	3%	0%	1%	2%	1%	0%	2%	3%	-4%	-20%	1%	1%	1%	0%	3%	0%	0%
20	0%	1%	0%	2%	1%	4%	2%	-6%	-12%	7%	3%	3%	1%	1%	3%	2%	1%	1%	0%	-15%	-3%	0%	4%	1%	0%	0%
21	0%	1%	0%	5%	2%	0%	-1%	-10%	-2%	-9%	-1%	2%	4%	4%	0%	6%	3%	1%	1%	-1%	-12%	8%	-1%	2%	0%	0%
22	2%	2%	1%	3%	1%	1%	1%	-1%	0%	1%	0%	2%	1%	2%	1%	7%	3%	1%	0%	0%	-1%	-30%	2%	1%	1%	0%
23	1%	2%	0%	1%	1%	1%	1%	-1%	0%	-9%	-3%	4%	0%	0%	6%	6%	3%	1%	0%	1%	-1%	1%	-18%	0%	1%	0%
24	-4%	-6%	-2%	0%	6%	2%	0%	0%	0%	0%	-6%	-4%	-3%	1%	0%	8%	7%	5%	1%	0%	0%	3%	1%	-5%	-2%	0%
25	-8%	-11%	-1%	-2%	2%	1%	1%	0%	-1%	0%	-2%	1%	-1%	0%	3%	10%	10%	2%	0%	0%	0%	4%	4%	-10%	-1%	0%
Sum	-1%	0%	-3%	-1%	2%	1%	-1%	-5%	-3%	-2%	-3%	-1%	-4%	-1%	2%	7%	6%	2%	-1%	1%	-1%	4%	3%	-1%	0%	0%

Table 3-8: Trip flow percentage difference between model and Streetlight for NT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Sum
1	-10%	-4%	-9%	-1%	2%	2%	0%	-1%	-1%	-2%	-5%	1%	-2%	0%	4%	9%	11%	1%	0%	0%	0%	4%	4%	-4%	-1%	0%
2	-12%	-11%	0%	0%	2%	2%	1%	0%	0%	-1%	-6%	0%	-2%	1%	4%	10%	12%	2%	0%	1%	0%	4%	4%	-7%	-3%	0%
3	-3%	4%	-19%	2%	2%	2%	-6%	-6%	-1%	-10%	-3%	2%	-1%	1%	4%	10%	9%	2%	0%	1%	0%	5%	5%	-1%	2%	0%
4	0%	0%	-1%	-9%	2%	0%	0%	0%	0%	0%	-3%	-2%	-14%	1%	1%	9%	7%	4%	0%	0%	0%	3%	2%	-1%	0%	0%
5	0%	2%	1%	-15%	0%	-2%	0%	0%	0%	0%	-2%	-2%	-6%	0%	1%	7%	4%	6%	0%	1%	0%	3%	1%	2%	1%	0%
6	1%	2%	1%	-2%	3%	-24%	0%	-1%	2%	0%	0%	1%	-1%	0%	2%	4%	5%	2%	-1%	2%	0%	1%	3%	2%	0%	0%
7	1%	3%	-9%	0%	2%	4%	-14%	-11%	0%	-4%	0%	3%	-1%	0%	6%	4%	4%	1%	-1%	1%	-1%	3%	6%	0%	1%	0%
8	0%	2%	-3%	2%	1%	4%	-5%	-9%	-7%	-5%	1%	3%	-1%	0%	4%	3%	3%	1%	-1%	1%	-2%	2%	4%	0%	1%	0%
9	0%	1%	0%	1%	1%	7%	1%	-8%	-19%	1%	1%	3%	0%	0%	2%	2%	2%	-1%	-1%	2%	-1%	1%	4%	0%	0%	0%
10	-1%	1%	-6%	0%	1%	1%	-2%	-6%	0%	-1%	-1%	3%	-1%	1%	3%	3%	2%	1%	0%	3%	-2%	2%	1%	0%	0%	0%
11	-3%	-2%	-3%	-3%	-1%	2%	1%	1%	1%	5%	-8%	-4%	-5%	0%	5%	3%	3%	1%	0%	2%	0%	2%	5%	-2%	0%	0%
12	-1%	0%	1%	0%	1%	2%	1%	2%	0%	4%	-8%	-12%	-11%	-4%	3%	7%	5%	1%	0%	1%	0%	4%	5%	-2%	0%	0%
13	-1%	0%	0%	-7%	3%	0%	-1%	0%	0%	0%	-4%	-7%	-13%	1%	0%	10%	8%	3%	0%	0%	0%	5%	1%	1%	0%	0%
14	0%	1%	0%	6%	2%	1%	0%	0%	0%	1%	-3%	-9%	-8%	-17%	0%	8%	6%	2%	0%	1%	1%	6%	1%	2%	1%	0%
15	2%	3%	2%	1%	1%	2%	3%	2%	1%	2%	0%	-1%	-1%	-1%	-33%	5%	3%	1%	0%	1%	0%	0%	7%	0%	0%	0%
16	3%	4%	3%	6%	1%	1%	1%	1%	0%	0%	0%	2%	1%	-1%	2%	-47%	5%	1%	0%	0%	0%	6%	4%	2%	2%	0%
17	5%	6%	3%	1%	-2%	2%	0%	1%	0%	1%	-1%	1%	1%	1%	1%	5%	-37%	2%	0%	0%	0%	4%	2%	2%	1%	0%
18	1%	1%	-1%	11%	7%	0%	0%	-7%	-7%	-2%	0%	2%	2%	2%	1%	5%	7%	-5%	-23%	0%	-1%	1%	1%	4%	1%	0%
19	0%	1%	0%	8%	5%	3%	-2%	-2%	-6%	0%	-3%	0%	2%	1%	0%	3%	3%	-8%	-12%	1%	0%	2%	0%	3%	0%	0%
20	-2%	0%	0%	2%	1%	4%	1%	-5%	-8%	7%	3%	3%	0%	1%	2%	2%	2%	-1%	0%	-16%	-2%	1%	4%	1%	0%	0%
21	-1%	1%	0%	6%	2%	-1%	-2%	-7%	-5%	-12%	-1%	1%	4%	4%	1%	7%	4%	1%	1%	0%	-15%	9%	1%	2%	1%	0%
22	2%	2%	1%	3%	1%	1%	0%	0%	0%	-2%	-2%	1%	2%	2%	0%	8%	4%	1%	0%	0%	-1%	-26%	3%	1%	1%	0%
23	1%	2%	1%	2%	1%	2%	1%	0%	1%	-11%	-3%	3%	-1%	0%	6%	7%	4%	1%	0%	1%	-1%	3%	-22%	0%	1%	0%
24	-4%	-9%	-3%	0%	6%	2%	0%	0%	0%	0%	-4%	-4%	-4%	2%	1%	9%	8%	5%	1%	0%	0%	3%	2%	-8%	-2%	0%
25	-12%	-12%	1%	-1%	3%	1%	2%	1%	-1%	1%	-2%	1%	-3%	0%	3%	11%	11%	2%	0%	0%	0%	4%	5%	-9%	-4%	0%
Sum	-2%	0%	-3%	-1%	2%	1%	-2%	-4%	-3%	-3%	-4%	-1%	-4%	0%	3%	8%	7%	2%	-1%	1%	-1%	4%	3%	-1%	0%	0%

Table 3-9: Trip flow percentage difference between model and Replica for AM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	sum
1	3%	0%	3%	-2%	0%	1%	-2%	0%	-1%	-3%	-5%	2%	-2%	-10%	1%	9%	10%	1%	-1%	0%	0%	4%	4%	-2%	-11%	0%
2	-3%	-8%	3%	-4%	1%	2%	-1%	0%	0%	-3%	-3%	0%	-1%	-4%	3%	10%	12%	2%	0%	0%	0%	3%	4%	-3%	-10%	0%
3	-3%	1%	-8%	-2%	0%	2%	-6%	-3%	-1%	-5%	-3%	2%	1%	-2%	4%	10%	9%	1%	0%	1%	0%	4%	5%	-2%	-4%	0%
4	-5%	-4%	0%	-9%	1%	1%	-1%	-1%	0%	-1%	-3%	1%	1%	0%	1%	10%	7%	4%	0%	0%	0%	3%	2%	0%	-9%	0%
5	-3%	-2%	1%	-7%	-6%	2%	-1%	0%	0%	-1%	-2%	-1%	0%	-1%	1%	7%	4%	5%	1%	0%	0%	3%	2%	3%	-6%	0%
6	-2%	-2%	1%	-5%	2%	-8%	-1%	0%	2%	0%	-1%	0%	-1%	0%	2%	4%	5%	3%	-1%	1%	0%	2%	3%	0%	-6%	0%
7	-1%	0%	-5%	-3%	0%	3%	-4%	-4%	0%	-3%	-2%	2%	-1%	0%	5%	5%	4%	1%	-1%	1%	0%	2%	6%	-1%	-4%	0%
8	-3%	0%	-2%	-1%	1%	3%	-5%	6%	-10%	-2%	-2%	2%	-1%	1%	3%	3%	3%	1%	-1%	1%	-1%	2%	5%	0%	-3%	0%
9	-3%	-1%	-1%	0%	1%	6%	-2%	-6%	-4%	0%	0%	2%	-1%	0%	2%	2%	2%	-1%	-1%	5%	-1%	1%	4%	0%	-3%	0%
10	-5%	-4%	-3%	-3%	0%	1%	-4%	-4%	-1%	10%	-1%	3%	0%	1%	2%	3%	2%	0%	0%	2%	0%	2%	3%	-2%	-4%	0%
11	-3%	-4%	-1%	-7%	-1%	1%	0%	0%	1%	1%	2%	3%	-3%	-3%	4%	4%	4%	0%	0%	2%	0%	3%	7%	-3%	-5%	0%
12	-2%	-4%	0%	-5%	0%	0%	0%	-1%	0%	0%	-2%	2%	-2%	-7%	2%	8%	5%	1%	0%	1%	0%	5%	6%	-1%	-6%	0%
13	-3%	-4%	0%	-5%	2%	1%	-2%	-1%	0%	-2%	-4%	-2%	1%	-3%	0%	11%	8%	2%	0%	0%	0%	4%	2%	1%	-7%	0%
14	-3%	-3%	1%	-3%	1%	0%	-2%	-1%	-1%	-1%	-3%	-5%	2%	-2%	0%	10%	5%	1%	0%	1%	0%	4%	2%	1%	-6%	0%
15	0%	-2%	2%	-5%	0%	1%	1%	1%	0%	-1%	-3%	1%	-1%	-1%	-8%	5%	3%	0%	0%	1%	0%	2%	9%	-1%	-5%	0%
16	0%	0%	3%	-3%	0%	0%	0%	0%	0%	0%	-2%	-1%	0%	-4%	1%	-6%	5%	1%	0%	0%	0%	6%	4%	0%	-3%	0%
17	3%	3%	3%	-6%	-3%	-1%	-1%	0%	0%	0%	-2%	1%	0%	0%	1%	7%	-10%	2%	0%	0%	0%	3%	3%	1%	-2%	0%
18	-1%	1%	1%	7%	6%	-3%	-4%	-6%	-3%	-2%	-1%	1%	1%	1%	1%	5%	7%	-1%	-10%	0%	0%	1%	1%	3%	-4%	0%
19	-2%	-2%	-3%	5%	5%	-1%	-8%	-5%	-4%	-1%	-3%	0%	1%	2%	0%	3%	4%	1%	10%	1%	0%	1%	1%	2%	-4%	0%
20	-1%	-1%	0%	1%	1%	3%	0%	-5%	-14%	3%	2%	2%	1%	1%	3%	3%	2%	1%	-1%	-1%	-2%	1%	4%	0%	-2%	0%
21	-2%	-2%	-2%	2%	3%	-2%	-5%	-6%	-6%	-7%	-4%	2%	3%	4%	1%	8%	5%	2%	-1%	0%	0%	11%	0%	0%	-4%	0%
22	-1%	-1%	1%	-1%	1%	-1%	-3%	-4%	-1%	-5%	-3%	0%	0%	2%	1%	9%	4%	0%	0%	0%	-1%	2%	3%	0%	-2%	0%
23	-1%	-1%	0%	-3%	1%	1%	-1%	-3%	0%	-5%	-4%	2%	-1%	0%	4%	7%	3%	-1%	0%	1%	0%	4%	0%	-1%	-4%	0%
24	-7%	-8%	-1%	1%	7%	3%	-2%	-1%	-1%	-2%	-3%	-1%	2%	1%	1%	9%	8%	4%	1%	0%	0%	3%	2%	-3%	-12%	0%
25	0%	-4%	3%	-7%	2%	-1%	2%	0%	-1%	-4%	-1%	1%	-2%	-1%	2%	10%	11%	1%	0%	0%	0%	4%	3%	-6%	-13%	0%
Sum	-2%	-2%	0%	-3%	1%	0%	-2%	-2%	-3%	-1%	-2%	1%	0%	-1%	2%	8%	6%	1%	-1%	1%	-1%	4%	4%	0%	-5%	0%

Table 3-10: Trip flow percentage difference between model and Replica for MD

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	sum
1	1%	-2%	0%	-3%	1%	1%	-2%	-2%	-2%	-4%	-2%	0%	-3%	-2%	2%	9%	11%	1%	0%	0%	0%	3%	3%	-3%	-8%	0%
2	-1%	-8%	1%	-3%	1%	0%	0%	-1%	-1%	-2%	-3%	-1%	-3%	-1%	3%	9%	13%	1%	0%	0%	-1%	3%	3%	-5%	-7%	0%
3	0%	2%	-11%	0%	2%	1%	-6%	-5%	-1%	-7%	-2%	1%	-1%	0%	4%	10%	10%	1%	-1%	1%	0%	4%	4%	-1%	-3%	0%
4	-2%	-1%	0%	-10%	2%	0%	-1%	-1%	0%	-1%	-3%	-1%	-3%	1%	0%	8%	7%	4%	0%	0%	0%	3%	1%	0%	-3%	0%
5	0%	0%	0%	-4%	-10%	0%	0%	0%	0%	-1%	-2%	-1%	-2%	0%	0%	6%	4%	5%	0%	0%	0%	3%	1%	3%	-2%	0%
6	0%	0%	0%	-1%	2%	-13%	-1%	0%	1%	0%	-1%	0%	-1%	0%	2%	4%	5%	2%	-2%	2%	0%	1%	3%	0%	-2%	0%
7	1%	2%	-5%	-1%	1%	4%	-14%	-6%	-1%	-2%	0%	3%	-1%	0%	6%	4%	4%	1%	-1%	1%	0%	2%	6%	-1%	-1%	0%
8	-1%	1%	-3%	1%	1%	3%	-4%	1%	-8%	-3%	0%	2%	-1%	0%	3%	3%	3%	1%	-1%	1%	-1%	1%	4%	0%	-1%	0%
9	-1%	0%	-1%	1%	1%	6%	-1%	-7%	-9%	1%	0%	2%	-1%	0%	2%	2%	1%	0%	-2%	4%	-1%	1%	4%	0%	-1%	0%
10	-3%	-1%	-4%	-1%	0%	1%	-3%	-5%	-2%	7%	0%	3%	-1%	0%	2%	3%	2%	0%	0%	3%	-1%	1%	2%	-1%	-2%	0%
11	-3%	-2%	-1%	-5%	-1%	1%	0%	0%	0%	4%	-4%	1%	-4%	-1%	4%	3%	3%	0%	0%	2%	0%	2%	6%	-3%	-3%	0%
12	-1%	-1%	0%	-2%	1%	0%	0%	0%	0%	2%	-3%	-8%	-5%	-4%	2%	6%	4%	1%	0%	1%	0%	4%	6%	-2%	-2%	0%
13	-2%	-2%	-1%	-2%	2%	0%	-2%	-1%	-1%	-1%	-4%	-4%	-6%	0%	0%	10%	7%	2%	0%	0%	0%	4%	1%	2%	-4%	0%
14	-2%	-1%	0%	1%	1%	0%	-1%	-1%	0%	0%	-2%	-6%	-2%	-9%	-1%	7%	5%	1%	0%	1%	0%	5%	2%	2%	-2%	0%
15	-1%	0%	2%	-2%	-1%	1%	2%	0%	0%	0%	-1%	0%	-1%	-2%	-9%	4%	3%	0%	0%	1%	0%	0%	7%	-1%	-1%	0%
16	2%	1%	2%	1%	1%	1%	0%	0%	0%	0%	-1%	1%	1%	-3%	1%	-24%	5%	1%	0%	0%	0%	6%	4%	1%	0%	0%
17	4%	4%	2%	-1%	-4%	0%	0%	0%	-1%	0%	-1%	1%	0%	0%	1%	6%	-22%	2%	0%	0%	0%	3%	3%	1%	0%	0%
18	1%	1%	0%	11%	7%	-2%	-2%	-6%	-4%	-1%	-2%	0%	1%	1%	1%	5%	6%	-10%	-13%	0%	0%	1%	1%	4%	-1%	0%
19	-1%	-1%	-2%	6%	4%	-1%	-3%	-3%	-6%	1%	-1%	0%	1%	1%	0%	2%	3%	0%	-4%	1%	0%	1%	0%	3%	-1%	0%
20	0%	0%	0%	1%	1%	4%	0%	-4%	-8%	6%	2%	3%	0%	1%	2%	2%	2%	1%	-1%	-14%	-2%	0%	4%	0%	-1%	0%
21	0%	-1%	-2%	3%	2%	-1%	-3%	-9%	-6%	-4%	-2%	2%	3%	3%	1%	6%	4%	1%	-1%	-1%	-2%	8%	-1%	1%	-1%	0%
22	1%	1%	0%	1%	1%	0%	-1%	-3%	-1%	-2%	-1%	1%	1%	1%	1%	8%	4%	0%	0%	0%	-1%	-12%	3%	1%	-1%	0%
23	0%	0%	0%	-2%	0%	1%	0%	-2%	0%	-6%	-4%	3%	-1%	0%	4%	7%	4%	0%	0%	1%	-1%	2%	-4%	-1%	-2%	0%
24	-5%	-6%	-1%	4%	6%	1%	-1%	-1%	0%	-2%	-4%	-2%	1%	2%	0%	9%	7%	4%	0%	0%	0%	3%	1%	-8%	-8%	0%
25	0%	-1%	1%	-2%	1%	0%	0%	0%	-2%	-1%	-2%	0%	-3%	0%	2%	10%	12%	1%	0%	0%	0%	3%	3%	-6%	-17%	0%
Sum	-1%	-1%	-1%	-1%	1%	0%	-2%	-3%	-3%	-2%	-2%	0%	-2%	-1%	2%	7%	6%	1%	-1%	0%	-1%	4%	3%	-1%	-3%	0%

Table 3-11: Trip flow percentage difference between model and Replica for PM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	sum
1	3%	2%	0%	-4%	1%	0%	0%	-2%	-3%	-5%	-2%	0%	-4%	-1%	2%	8%	9%	1%	-1%	0%	-1%	2%	3%	-3%	-1%	0%
2	1%	-4%	1%	-3%	1%	-1%	1%	0%	-2%	-3%	-2%	-2%	-3%	-2%	2%	8%	10%	1%	-1%	0%	-1%	2%	2%	-4%	-1%	0%
3	3%	5%	-12%	0%	2%	1%	-6%	-5%	-3%	-7%	-2%	0%	-2%	0%	4%	9%	7%	1%	-2%	0%	-1%	3%	3%	-1%	2%	0%
4	-1%	0%	0%	-4%	2%	-1%	-1%	0%	-1%	-2%	-3%	-3%	-5%	0%	-1%	6%	5%	4%	0%	0%	0%	2%	0%	2%	0%	0%
5	0%	1%	0%	-1%	-7%	0%	0%	1%	-1%	-1%	-2%	-1%	-4%	-1%	-1%	5%	3%	5%	0%	0%	0%	2%	1%	3%	0%	0%
6	1%	1%	0%	0%	2%	-17%	0%	1%	1%	1%	0%	0%	-1%	0%	1%	2%	3%	1%	-2%	1%	-1%	0%	2%	1%	0%	0%
7	1%	3%	-4%	-1%	1%	4%	-5%	-9%	-2%	-2%	1%	2%	-2%	-1%	5%	3%	2%	1%	-3%	1%	-1%	0%	5%	0%	1%	0%
8	0%	1%	-2%	0%	1%	3%	-1%	4%	-8%	-3%	0%	2%	-2%	-1%	3%	2%	2%	1%	-2%	0%	-1%	-1%	2%	0%	0%	0%
9	0%	0%	0%	1%	1%	6%	1%	-9%	-8%	2%	1%	2%	-1%	0%	2%	1%	1%	0%	-2%	0%	-2%	0%	3%	0%	0%	0%
10	-1%	0%	-3%	-1%	0%	1%	-2%	-4%	-2%	10%	0%	2%	-2%	0%	1%	2%	1%	0%	-1%	2%	-2%	-1%	1%	-1%	0%	0%
11	0%	0%	-1%	-5%	-1%	1%	0%	0%	-1%	7%	-2%	0%	-5%	-2%	3%	2%	2%	0%	-1%	2%	-1%	0%	4%	-2%	0%	0%
12	0%	0%	0%	-1%	0%	0%	0%	1%	0%	3%	-1%	-6%	-7%	-5%	1%	5%	3%	1%	-1%	1%	0%	3%	5%	-1%	0%	0%
13	-2%	-1%	0%	0%	2%	0%	-1%	-1%	-1%	-1%	-4%	-5%	-5%	1%	-1%	8%	5%	2%	0%	0%	0%	3%	0%	2%	-1%	0%
14	-3%	0%	-1%	4%	1%	1%	0%	0%	0%	2%	-2%	-7%	-5%	-7%	-1%	6%	4%	2%	0%	1%	0%	5%	1%	2%	0%	0%
15	1%	2%	2%	-1%	0%	2%	2%	2%	1%	1%	0%	-2%	-2%	-2%	-19%	3%	2%	1%	0%	1%	0%	1%	6%	-1%	1%	0%
16	2%	3%	2%	4%	1%	1%	1%	0%	0%	1%	-1%	1%	1%	0%	0%	-34%	3%	1%	0%	0%	0%	6%	3%	2%	1%	0%
17	4%	5%	2%	1%	-3%	1%	1%	0%	-1%	1%	0%	2%	0%	0%	1%	4%	-30%	2%	0%	0%	0%	3%	2%	2%	2%	0%
18	1%	2%	-1%	11%	7%	1%	0%	-6%	-8%	-1%	-2%	0%	1%	0%	0%	4%	5%	-7%	-11%	0%	0%	0%	-1%	4%	0%	0%
19	-1%	0%	-1%	7%	4%	0%	-2%	-3%	-6%	3%	-1%	0%	1%	1%	0%	2%	2%	-8%	-1%	0%	0%	0%	0%	3%	-1%	0%
20	0%	1%	0%	0%	1%	4%	1%	-1%	-2%	8%	3%	3%	0%	1%	2%	2%	1%	1%	0%	-25%	-2%	-1%	4%	0%	0%	0%
21	0%	1%	-1%	4%	2%	0%	-1%	-7%	-5%	-2%	-2%	2%	4%	3%	0%	5%	3%	1%	0%	-3%	-10%	6%	-2%	2%	0%	0%
22	1%	1%	1%	2%	1%	0%	0%	-2%	-2%	-1%	-1%	2%	1%	1%	-1%	7%	3%	0%	0%	-1%	-1%	-15%	1%	1%	0%	0%
23	1%	2%	0%	-1%	0%	1%	1%	-1%	-1%	-6%	-1%	3%	-1%	0%	5%	6%	3%	0%	-1%	0%	-2%	0%	-9%	0%	1%	0%
24	-3%	-3%	-2%	5%	6%	0%	-1%	-1%	-1%	-3%	-3%	-3%	0%	1%	-1%	7%	6%	4%	0%	0%	0%	2%	0%	-7%	-2%	0%
25	0%	1%	1%	-4%	1%	-1%	1%	0%	-1%	-2%	-1%	-1%	-4%	-2%	1%	8%	9%	1%	-1%	0%	-1%	2%	2%	-5%	-5%	0%
Sum	0%	1%	-1%	-1%	1%	0%	-1%	-3%	-4%	-1%	-2%	-1%	-3%	-1%	1%	6%	5%	1%	-1%	0%	-1%	3%	2%	0%	-1%	0%

Table 3-12: Trip flow percentage difference between model and Replica for NT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Sum
1	3%	0%	-1%	-3%	1%	1%	0%	-2%	-3%	-4%	-3%	-1%	-5%	-1%	2%	8%	9%	1%	-1%	0%	0%	2%	3%	-5%	-1%	0%
2	-1%	-5%	1%	-3%	2%	1%	1%	1%	-2%	-2%	-3%	-1%	-5%	-1%	2%	8%	10%	2%	0%	0%	-1%	3%	3%	-5%	-4%	0%
3	2%	4%	-13%	1%	2%	1%	-7%	-5%	-2%	-8%	-3%	1%	-1%	1%	4%	9%	8%	1%	-1%	0%	-1%	3%	4%	-2%	2%	0%
4	-1%	-1%	0%	-5%	3%	-1%	-1%	0%	0%	-1%	-3%	-2%	-6%	0%	0%	7%	6%	4%	0%	0%	0%	2%	1%	1%	-1%	0%
5	0%	0%	1%	0%	-7%	-1%	0%	0%	-1%	-1%	-2%	-1%	-4%	-2%	0%	5%	2%	5%	0%	0%	0%	2%	0%	3%	1%	0%
6	1%	1%	1%	0%	3%	-19%	1%	1%	1%	1%	0%	-1%	-1%	0%	2%	3%	3%	2%	-2%	1%	0%	0%	2%	1%	-1%	0%
7	1%	3%	-5%	0%	2%	5%	-10%	-7%	-2%	-3%	0%	2%	-2%	0%	5%	3%	3%	1%	-1%	1%	-1%	1%	5%	0%	1%	0%
8	0%	2%	-2%	1%	1%	3%	-3%	2%	-6%	-5%	0%	2%	-1%	0%	3%	2%	2%	1%	-2%	0%	-2%	0%	2%	0%	0%	0%
9	-1%	0%	0%	0%	1%	6%	0%	-5%	-10%	0%	1%	2%	-1%	0%	2%	1%	1%	0%	-2%	2%	-2%	0%	3%	0%	0%	0%
10	-1%	0%	-3%	-1%	0%	1%	-2%	-4%	-2%	4%	2%	3%	-2%	0%	2%	2%	1%	1%	-1%	2%	-2%	0%	2%	-1%	0%	0%
11	0%	0%	-1%	-4%	0%	1%	1%	0%	0%	6%	-4%	-1%	-6%	-2%	3%	2%	2%	0%	0%	2%	-1%	1%	3%	-3%	0%	0%
12	1%	0%	1%	-1%	1%	1%	1%	1%	0%	4%	-2%	-16%	-8%	-4%	2%	7%	4%	1%	0%	1%	0%	3%	5%	-1%	0%	0%
13	-2%	-2%	0%	1%	3%	0%	-1%	-2%	-1%	-1%	-4%	-5%	-9%	1%	0%	9%	6%	2%	0%	0%	0%	4%	1%	2%	-1%	0%
14	-3%	0%	0%	5%	2%	1%	0%	0%	0%	1%	-2%	-7%	-4%	-15%	-1%	7%	5%	2%	0%	1%	0%	6%	2%	2%	0%	0%
15	2%	2%	3%	-1%	1%	2%	3%	2%	0%	2%	1%	1%	-1%	-2%	-30%	4%	3%	1%	0%	1%	0%	1%	8%	0%	0%	0%
16	3%	3%	3%	5%	2%	2%	1%	0%	0%	1%	-1%	1%	2%	0%	1%	-45%	5%	1%	0%	0%	0%	7%	5%	2%	1%	0%
17	5%	6%	3%	3%	0%	2%	1%	0%	0%	0%	0%	1%	1%	1%	1%	6%	-43%	2%	0%	0%	0%	4%	3%	2%	2%	0%
18	1%	2%	0%	10%	8%	1%	-1%	-3%	-5%	-1%	-2%	0%	1%	1%	0%	4%	5%	-16%	-12%	0%	0%	0%	0%	4%	0%	0%
19	0%	0%	-1%	6%	4%	-2%	-3%	-1%	-4%	1%	-1%	0%	2%	1%	0%	2%	3%	-4%	-7%	0%	-1%	1%	-1%	3%	0%	0%
20	1%	1%	1%	1%	1%	4%	2%	-2%	-2%	8%	3%	3%	0%	1%	2%	2%	2%	0%	-1%	-31%	-2%	1%	4%	0%	0%	0%
21	-1%	0%	-1%	4%	2%	0%	-1%	-6%	-5%	-6%	-2%	1%	4%	3%	1%	6%	3%	1%	0%	-2%	-9%	7%	-1%	2%	-1%	0%
22	1%	2%	1%	3%	2%	0%	0%	-1%	-1%	-1%	-1%	2%	2%	2%	0%	9%	4%	1%	0%	0%	-1%	-27%	3%	1%	0%	0%
23	0%	2%	2%	1%	1%	2%	1%	-1%	0%	-4%	-1%	3%	-2%	0%	6%	7%	4%	0%	0%	1%	-1%	3%	-23%	0%	0%	0%
24	-4%	-5%	-3%	4%	6%	1%	-1%	0%	-1%	-2%	-4%	-2%	0%	2%	0%	7%	6%	4%	0%	0%	0%	3%	1%	-10%	-3%	0%
25	-3%	-2%	1%	-2%	2%	0%	1%	0%	-1%	-1%	-1%	-1%	-6%	-1%	1%	9%	9%	1%	-1%	0%	0%	3%	3%	-6%	-5%	0%
Sum	0%	0%	-1%	0%	2%	0%	-1%	-3%	-3%	-2%	-2%	-1%	-3%	-1%	1%	6%	5%	1%	-1%	0%	-1%	2%	2%	-1%	-1%	0%

3.3 MODE CHOICE VALIDATION

The following Table 3-13 is the mode share from the updated model. Table 3-14contains the model share difference between updated model and survey. It shows that updated mode share difference between model and survey are minimal, which means mode choice of the updated model is reasonable.

Table 3-13: Mode share from the updated model

	Model-Share							
	DA	SR	WALK	BIKE	BUS_W	BUS_D	SCHOOLBUS	Total
HBW	76.1%	9.9%	2.3%	7.4%	3.5%	0.8%		100.0%
	86.0%		9.7%		4.3%			100.0%
HBU	33.2%	17.5%	21.5%	10.4%	17.1%	0.3%		100.0%
	50.7%		31.9%		17.4%			100.0%
HB Shop	51.1%	37.4%	7.1%	3.8%	0.6%	0.0%		100.0%
	88.5%		10.9%		0.6%			100.0%
HB School	12.4%	43.5%	11.7%	6.0%	2.9%	0.0%	23.5%	100.0%
	55.8%		17.7%		2.9%		23.5%	100.0%
HB SocRec	32.4%	33.8%	26.4%	6.9%	0.6%	0.0%		100.0%
	66.2%		33.3%		0.6%			100.0%
HBO	32.7%	48.8%	16.7%	1.1%	0.7%	0.0%		100.0%
	81.6%		17.7%		0.7%			100.0%
NHB	45.0%	32.8%	16.7%	3.2%	0.9%	0.0%	1.5%	100.0%
	77.8%		19.9%		0.9%		1.4%	100.0%

Table 3-14: Model share difference between model and survey

	Model-Share - Survey Share							
	DA	SR	WALK	BIKE	BUS_W	BUS_D	SCHOOLBUS	Total
HBW	0.5%	-0.7%	-0.2%	1.5%	-1.2%	0.1%		0.0%
	-0.2%		1.3%		-1.1%			0.0%
HBU	-1.5%	0.2%	-0.3%	2.0%	-0.6%	0.2%		0.0%
	-1.3%		1.7%		-0.4%			0.0%
HB Shop	1.8%	-1.4%	-1.0%	1.4%	-0.8%	0.0%		0.0%
	0.4%		0.4%		-0.8%			0.0%
HB School	-0.2%	2.0%	1.6%	-0.7%	-1.1%	0.0%	-1.5%	0.0%
	1.8%		0.9%		-1.2%		-1.5%	0.0%
HB SocRec	-1.4%	-0.4%	2.2%	0.1%	-0.5%	0.0%		0.0%
	-1.8%		2.3%		-0.5%			0.0%
HBO	-1.6%	0.1%	2.1%	-0.4%	-0.2%	0.0%		0.0%
	-1.5%		1.7%		-0.2%			0.0%
NHB	-0.8%	-0.7%	2.0%	0.3%	-0.8%	-0.1%	0.1%	0.0%

	-1.6%	2.3%	-0.9%	0.0%	0.0%

3.4 HIGHWAY ASSIGNMENT VALIDATION

3.4.1 Peak period Traffic Volume Validation

For the base year model, the peak period volume validation by volume group and facility type results are illustrated in the Table 3-15 and Table 3-16. The peak period RMSE% values are all within the allowable ranges. Some of the V/C error% become worse in Table 3-16., such as AM V/C error% on Interstates, however most of V/C error% are still within the allowable ranges.

Table 3-15: Peak period RMSE% by volume group for base year updated model

Volume Group	RMSE% AM	RMSE% PM	Allowable RMSE%
0 - 1,000	73%	87%	< 100%
1,000 - 2,500	39%	43%	< 62%
2,500 - 5,000	32%	37%	< 50%
5,000 - 10,000	23%	32%	< 40%
10,000 - 20,000	21%	25%	< 33%
20,000 - 30,000	17%	11%	< 26%
>30,000	N/A	8%	<25%

Table 3-16: Peak period V/C error% by facility type for base year model

Functional Class	AM V/C Error%	PM V/C Error%	Allowable V/C Error%
Interstate	13%	6%	< 10%
freeway	-1%	-3%	< 15%
ramp	-7%	0%	
expressway	-4%	-9%	< 15%
urban principal arterial	-15%	-33%	< 15%
urban minor arterial	-12%	-16%	< 20%
urban major collector	-22%	-24%	< 30%
urban minor collector	-66%	-56%	<35%
rural principal arterial	-20%	-16%	< 15%
rural minor arterial	3%	12%	< 15%
rural major collector	-12%	1%	< 20%
rural minor collector	59%	71%	< 30%
rural local	17%	39%	<35%

Table 3-17 and Table 3-18 contain the RMSE% and V/C error% in daily level, which become a little bit worse compared with the original base year model.

Table 3-17: Daily RMSE% by volume group for base year model

Volume Group	RMSE% Daily	Allowable RMSE%
0 - 1,000	160%	60%
1,000 - 2,500	92%	47%
2,500 - 5,000	52%	36%
5,000 - 10,000	41%	29%
10,000 - 20,000	34%	25%
20,000 - 30,000	29%	22%
>30,000	17%	22%

Table 3-18: Daily V/C error% by facility type for base year model

Functional Class	Daily V/C Error%	Daily Allowable V/C Error%
Interstate	2%	7%
freeway	4%	7%
ramp	6%	-
expressway	-2%	10%
urban principal arterial	-21%	10%
urban minor arterial	-10%	15%
urban major collector	-23%	25%
urban minor collector	-61%	25%
rural principal arterial	-4%	7%
rural minor arterial	22%	10%
rural major collector	7%	15%
rural minor collector	76%	25%
rural local	36%	25%

3.4.2 Peak period Travel Speed Validation

Table 3-19 shows the peak period speed validation result for the 9 corridors for the updated model. There are 4 corridors with large speed error%, which are highlighted in the tables. With the proposed intersection delay function integration, the travel speed error% (Diff1% Vs. Diff0%) is reduced for the highlighted corridors.

Table 3-19: Peak period travel speed validation

Route Information				AM Speed Comparison			PM Speed Comparison		
Route	From	To	Dir	Model	Diff0%	Diff1%	Model	Diff0%	Diff1%
I-90	County Line	County Line	N	70	9%	9%	70	12%	12%
I-90			S	70	8%	7%	69	12%	12%
I-94	I-90		E	69	3%	3%	69	2%	2%

I-94		County Line	W	70	3%	3%	70	4%	4%
US 51	US 151	S of SR 19	N	46	45%	37%	44	49%	35%
US 51			S	46	41%	32%	43	61%	41%
US 51	US 18	SR 19	N	42	44%	31%	38	43%	19%
US 51			S	45	48%	36%	41	53%	31%
SR 30	US 151	I 90	W	65	20%	20%	65	19%	19%
SR 30			E	66	17%	17%	66	14%	14%
SR 19	US 151	I-94	W	38	51%	35%	34	60%	29%
SR 19			E	37	40%	23%	33	50%	17%
US 14	US 12/14	County Line	W	48	12%	9%	47	13%	8%
US 14			E	47	9%	5%	46	17%	9%
US 18/12	I 90	SR 89	W	55	-3%	-3%	55	-2%	-2%
US 18/12			E	55	-1%	-2%	54	-3%	-4%
University Ave	US 12	N Bassett St	W	32	61%	44%	28	71%	43%
University Ave		Farley Ave	E	33	51%	37%	30	87%	59%
Beltline	Century Rd	I-90	W	56	29%	25%	53	22%	12%
Beltline			E	62	10%	9%	61	46%	47%

3.5 SUMMARY

In this Chapter, some recommendations are proposed to alleviate the issue of the existing base year model, namely underestimated intra-district trip flows and overestimated peak period travel speed on some major corridors. The additional validation efforts are performed to demonstrate that the updated models can improve the model performance while not sacrificing the other aspect of the original model on trip distribution, mode choice and highway assignment.

Attachment H
Comparison of TAFIS Forecasts to the E+C No Build Forecasts

Interstate North Corridor – TAFIS Comparison to Daily E+C No Build Forecast

Road	Segment	TAFIS Count Site	TAFIS	Forecast	Difference	Ratio Difference
WB I-90	Between WI 60 & CTH CS	110311	29360	31680	2320	8%
WB I-90	Between CTH CS & I-39 split/WI 78	110002	34110	32130	-1980	-6%
WB I-90	Between I-39 split/WI 78 & WI 33	110190	25465	21860	-3605	-14%
WB I-90	Between WI 33 & US 51	560001	21765	23270	1505	7%
WB I-90	Between US 12 & WI 23	560351	27575	25320	-2255	-8%
WB I-90	Between WI 23 & WI 13	560347	25115	25370	255	1%
I-90 ramp	NB Ramp from WI 13	560683	780	1090	310	40%
WB I-90	Between WI 13 & US 12/16	290157	18755	22760	4005	21%
WB I-90	North of US 12/16	290156	21400	22100	700	3%
EB I-90	North of US 12/16	290156	21400	21500	100	0%
EB I-90	Between WI 13 & US 12/16	290157	18755	22020	3265	17%
I-90 ramp	SB ramp to WI 13	560684	920	1000	80	9%
EB I-90	Between WI 23 & WI 13	560347	25115	24890	-225	-1%
EB I-90	Between US 12 & WI 23	560351	27575	23780	-3795	-14%
EB I-90	Between WI 33 & US 51	560001	21765	23180	1415	7%
EB I-90	Between I-39 split/WI 78 & WI 33	110190	25465	21970	-3495	-14%
I-39 ramp	SB Ramp from I-39	111007	10280	10800	520	5%
EB I-90	Between CTH CS & I-39 split/WI 78	110002	34110	32240	-1870	-5%
EB I-90	Between WI 60 & CTH CS	110311	29360	31720	2360	8%
EB I-90	South of WI 60	130315	34390	33100	-1290	-4%
WB WI 23	West of CTH P	560348	1800	2000	200	11%
EB WI 23	West of CTH P	560348	1800	1940	140	8%
WB WI 33	West of I-90/94	110188	4625	4100	-525	-11%
EB WI 33	West of I-90/94	110188	4625	4100	-525	-11%
WB WI 60	West of Sunset Dr	110312	2860	3500	640	22%
EB WI 60	West of Sunset Dr	110312	2860	3500	640	22%
EB WI 60	East of I-39/90/94	110624	1615	1800	185	11%
WB WI 60	East of I-39/90/94	110624	1615	1800	185	11%
EB WI 33	East of CTH U	110595	4675	4840	165	4%
WB WI 33	East of CTH U	110595	4675	4880	205	4%
EB WI 13	East of Trout Rd	560803	5285	6000	715	14%
WB WI 13	East of Trout Rd	560803	5285	5790	505	10%
EB WI 13	Between I-90/94 & Trout Rd	560804	3100	4700	1600	52%
WB WI 13	Between I-90/94 & Trout Rd	560804	3100	4960	1860	60%
EB US 12	East of I-90/94	290177	1740	2120	380	22%
WB US 12	East of I-90/94	290177	1740	2130	390	22%
SB US 12	South of I-90/94	560356	10500	11400	900	9%
NB US 12	South of I-90/94	560356	10500	11700	1200	11%
SB US 12	North of I-90/94	560822	6150	8790	2640	43%
NB US 12	North of I-90/94	560822	6150	7640	1490	24%
SB US 12	North of WI 23	560353	5845	8610	2765	47%
NB US 12	North of WI 23	560353	5845	8610	2765	47%
SB I-39	North of WI 33	110115	10050	12250	2200	22%
SB I-39	Between WI 33 & Cascade Mtn	110775	9855	11660	1805	18%
WB WI 78	West of Arco Dr	110194	785	2600	1815	231%
EB WI 78	West of Arco Dr	110194	785	2600	1815	231%
NB I-39	Between WI 33 & Cascade Mtn	110775	9855	11780	1925	20%
NB I-39	North of WI 33	110115	10050	11900	1850	18%
WB I-90	South of WI 60	130315	34390	33000	-1390	-4%

Interstate South Corridor – TAFIS Comparison to Daily E+C No Build Forecast

Road	Segment	TAFIS Count Site	TAFIS	Forecast	Difference	Ratio Difference
NB I-90	South of Beltline	130006	32320	31600	-720	-2%
NB I-90	Between Beltline & I-94	130004	58940	63700	4760	8%
I-94 ramp	Ramp from I-94 WB to I-39/90 WB	131335	12330	14600	2270	18%
WB I-90	Between I-94 & US 151	130611	62200	70800	8600	14%
WB I-90	Between US 151 & US 51	130259	42040	47200	5160	12%
WB I-90	Thru US 51 interchange	131068	36220	37300	1080	3%
WB I-90	Between US 51 & WI 19	131566	40835	44600	3765	9%
WB I-90	Between WI 19 & CTH V	130189	33305	37200	3895	12%
WB I-90	North of CTH V	130315	34390	34100	-290	-1%
EB I-90	North of CTH V	130315	34390	33700	-690	-2%
EB I-90	Between WI 19 & CTH V	130189	33305	38100	4795	14%
EB I-90	Between US 51 & WI 19	131566	40835	44500	3665	9%
EB I-90	Thru US 51 interchange	131068	36220	36400	180	0%
EB I-90	Between US 151 & US 51	130259	42040	46700	4660	11%
SB I-90	Between I-94 & US 151	130611	62200	70900	8700	14%
SB I-90	Between Beltline & I-94	130004	58940	63000	4060	7%
SB I-90	South of Beltline	130006	32320	31200	-1120	-3%
WB WI 19	West of Tierney Crossing	130197	11615	13300	1685	15%
EB WI 19	West of Tierney Crossing	130197	11615	13600	1985	17%
EB WI 19	East of I-90/94	130200	6980	9700	2720	39%
WB WI 19	East of I-90/94	130200	6980	9400	2420	35%
EB WI 19	Between Pepsi Way & Towne Rd	130199	11570	11900	330	3%
WB WI 19	Between Pepsi Way & Towne Rd	130199	11570	10800	-770	-7%
SB US 51	Between WI 19 & Williamsburg	130201	12210	17000	4790	39%
NB US 51	Between WI 19 & Williamsburg	130201	12210	15400	3190	26%
SB US 51	North of WI 19	136109	12055	13300	1245	10%
NB US 51	North of WI 19	136109	12055	13600	1545	13%
SB US 51	South of I-90/94	130208	12825	16850	4025	31%
NB US 51	South of I-90/94	130208	12825	15570	2745	21%
EB US 151	West of East Springs Dr	131943	23670	26800	3130	13%
WB US 151	West of East Springs Dr	131943	23670	25800	2130	9%
EB US 151	Between I-90/94 & American Pkwy	131944	43840	51200	7360	17%
WB US 151	Between I-90/94 & American Pkwy	131944	43840	51700	7860	18%
EB US 151	Between American Pkwy & Reinder Rd	136055	41865	45500	3635	9%
EB US 151	Between American Pkwy & Reinder Rd	136055	41865	45700	3835	9%
EB Wis 30	Between Thompson & US 51	130576	25130	32100	6970	28%
I-94 ramp	Ramp from I-39/90 EB to I-94 EB	131329	14460	15400	940	7%
EB I-94	Between I-90/94 & CTH N	130250	23675	35000	11325	48%
EB I-94	East of CTH N	130008	29835	28100	-1735	-6%
WB I-94	East of CTH N	130008	29835	28100	-1735	-6%
WB I-94	Between I-90/94 & CTH N	130250	23675	35300	11625	49%
WB Wis 30	Between Thompson & US 51	130576	25130	33100	7970	32%
EB US 151	Between Reiner & Main St	131327	29655	34000	4345	15%
EB US 151	East of Main St	130958	22550	24400	1850	8%
WB US 151	East of Main St	130958	22550	25600	3050	14%
WB US 151	Between Reiner & Main St	131327	29655	33900	4245	14%
EB WIS 30	Between US 51 & Fair Oaks	131067	23340	28200	4860	21%
WB WIS 30	Between US 51 & Fair Oaks	131067	23340	26200	2860	12%
WIS 30 ramp	WIS 30 WB ramp to US 151 WB	131179	5940	6600	660	11%

US 51 North Corridor – TAFIS Comparison to Daily E+C No Build Forecast

Road	Segment	TAFIS Count Site	TAFIS	Forecast	Difference	Ratio Difference
SB US 51	North of Daentl	130208	12825	16980	4155	32%
SB US 51	Between Daentl & Anderson	130208	12825	16850	4025	31%
SB US 51	Between Anderson & Acker	130204	6905	9500	2595	38%
SB US 51	Between Hanson & Amelia Earhart	130212	6535	9500	2965	45%
SB US 51	Between Pierstorff & Kinsman	130021	8665	9230	565	7%
SB US 51	Between Kinsman & Stoughton Service Rd	131909	8175	8940	765	9%
SB US 51	Between Stoughton Service Rd & US 151	131957	12945	14000	1055	8%
SB US 51	Between US 151 & Commercial	130215	11100	13100	2000	18%
SB US 51	Between Commercial & WIS 30	130573	14095	15000	905	6%
SB US 51	Between WIS 30 & Milwaukee	130575	24465	30470	6005	25%
NB US 51	Between WIS 30 & Milwaukee	130575	24465	26480	2015	8%
NB US 51	Between Commercial & WIS 30	130573	14095	16200	2105	15%
NB US 51	Between US 151 & Commercial	130215	11100	14500	3400	31%
NB US 51	Between Stoughton Service Rd & US 151	131957	12945	13880	935	7%
NB US 51	Between Kinsman & Stoughton Service Rd	131909	8175	8860	685	8%
NB US 51	Between Pierstorff & Kinsman	130021	8665	9170	505	6%
NB US 51	Between Hanson & Amelia Earhart	130212	6535	8200	1665	25%
NB US 51	Between Anderson & Acker	130204	6905	8800	1895	27%
NB US 51	Between Daentl & Anderson	130208	12825	15570	2745	21%
WB US 151	East of Mendota	131939	28000	26200	-1800	-6%
EB US 151	East of Mendota	131939	28000	25690	-2310	-8%
EB US 151	West of Wright/Fair Oaks	131937	16200	680	-15520	-96%
WB US 151	West of Wright/Fair Oaks	131937	16200	26010	9810	61%
EB US 151	Between US 51 & Rowland	130222	16895	17110	215	1%
WB US 151	Between US 51 & Rowland	130222	16895	18510	1615	10%
EB US 151	Between MacArthur & Mendota	130219	20860	21910	1050	5%
WB US 151	Between MacArthur & Mendota	130219	20860	26000	5140	25%

US 51 South Corridor – TAFIS Comparison to Daily E+C No Build Forecast

Road	Segment	TAFIS Count Site	TAFIS	Forecast	Difference	Ratio Difference
SB US 51	North of Milwaukee	130575	24465	30500	6035	25%
SB US 51	Between Milwaukee & Cottage Grove	130268	28050	26800	-1250	-4%
SB US 51	Between Cottage Grove & Buckeye	130266	27305	27600	295	1%
SB US 51	Between Buckeye & Pflaum	132212	23445	25000	1555	7%
SB US 51	Between Pflaum & Broadway	130604	22335	24400	2065	9%
SB US 51	Between Broadway & Beltline	131507	27965	28400	435	2%
SB US 51	Between Beltline & Terminal Dr	131505	19070	20800	1730	9%
SB US 51	South of Terminal Drive	136056	15595	15400	-195	-1%
NB US 51	South of Terminal Drive	136056	15595	16200	605	4%
NB US 51	Between Beltline & Terminal Dr	131505	19070	20300	1230	6%
NB US 51	Between Broadway & Beltline	131507	27965	30300	2335	8%
NB US 51	Between Pflaum & Broadway	130604	22335	24400	2065	9%
NB US 51	Between Buckeye & Pflaum	132212	23445	25400	1955	8%
NB US 51	Between Cottage Grove & Buckeye	130266	27305	26000	-1305	-5%
NB US 51	Between Milwaukee & Cottage Grove	130268	28050	25600	-2450	-9%
NB US 51	North of Milwaukee	130575	24465	26500	2035	8%

Attachment I
Land Developments Status within 2050 DCTDM

MEMORANDUM

Land Developments Status within 2050 DCTDM

Date:	April 3, 2023
Topic:	Land Developments Status within 2050 DCTDM
From:	CDMCT

A study is being conducted to identify new developments and their effects on traffic patterns on facilities within the limits of the Interstate 39/90/94 and US 51 corridors, primarily in Dane County. Traffic patterns are being modeled with the Dane County Travel Demand Model (DCTDM) with an original model base year of 2016 and a future year TDM model for 2050.

The DCTDM includes year 2016 and 2050 socio-economic data in Traffic Analysis Zones (TAZs) that make up Dane County. Each of these TAZs includes data such as the number of households, the number of people employed in retail, service, manufacturing jobs, and the number of workers and non-workers that own vehicles, etc. Capital Area Regional Planning Commission (CARPC) and the Greater Madison Metropolitan Planning Organization (MPO) developed county-wide totals for 2050 housing and employment, then distributed that growth to TAZ's throughout the county. While development plans and community input are used in this process, new development plans are regularly being submitted. This report identifies TAZ's where development plans indicate higher growth in housing or employment than what has been allocated by CARPC and the MPO. These additional housing or employment estimates will be referred to as "additions" in this report.

The objective of this study is to clarify whether the DCTDM projections accurately reflect the incoming new plans proposed by developers. These proposals either have been or still need to be approved by the City of Madison. Ultimately, the DCTDM will have to be constantly updated to account for new developments.

List of Developments

Table 1 provides a summary of proposed or existing developments in the study area. Most of the developments in Table 1 can be separated into three land use categories. These developments are either residential (apartment complexes or neighborhoods) with varying amounts of units, or they are commercial developments, or industrial developments. Commercial and industrial developments range in variety from smaller sized (in terms of acreage) fast-food chains to large distribution centers that employ well over 100 people. There are a few public/institutional developments as well, including the UW Health Clinic at the American Center, and 4151 Nekoosa Trail, which currently serves as a fleet, fire, and radio center (public institution owned by the City of Madison). The 4151 Nakoosa Trail development is classified as industrial use.

Most of these developments are located within the city limits of Madison. However, a few of the multi-family residential apartment developments are in Sun Prairie near US 151 and Jenny Wren Trail and along Windsor Rd. There are also developments located in the village of Cottage Grove near the County Road N corridor, which include mostly commercial or industrial developments contributing to new job markets in this area. There are also two large, planned developments in the village of DeForest, including a top-golf like facility known as PinSeekers alongside River Road close to suburban single-family housing developments and a planned development for the

Texas gas station chain, Buc-ee's, along County Highway V. One Kwik Trip facility has also been proposed in the village of McFarland along the Stoughton Road corridor.

The status and timeframe of these development projects varies. Some are in the proposal or development phases. Some proposals were submitted as recently as 2022. However, other developments are currently under construction or are existing developments that have been recently surveyed. Developments that are existing still should be accounted for in the demand model for the purposes of ensuring the demand model makes projections that line up with real world traffic impacts, given that the base year for the model is 2016 and numerous developments on this list have been opened since then.

Table 1 Development Summary

Development	Location	Land Use	Additions	Timeframe	Acres	TAZ
Jenny Wren MF	US 151 and Jenny Wren Trail, Sun Prairie	Residential (MF)	108 HHs	Under C. since 2022	3.9	642
Sprecher & Milwaukee	4605 Sprecher (SW corner with Milwaukee St), Madison	Residential (MF)	160 HHs	Proposed in 2022	3.3	750
4151 Nakoosa Trail	Nakoosa Trail and Commercial Ave. (near WIS 30/US 51 interchange), Madison	Public/Institutional/Industrial (Fleet Services)	30 new employees	Existing (as of 2021)	2.5	702
Meadowlands	Close to I-39/90 and I-94 Interchange, along Milwaukee/Sprecher corridors, Madison (6583 Milwaukee St)	Residential (MF)	341 HHs	Under C. since 2022	17.1	752/755
Hidden Creek Res/Portage Rd Apts.	Portage Rd and Diloreto Ave., Alongside I-39/90/94 near US 151 Interchange and Airport, Madison	Residential (MF)	276 HHs	Existing (as of 2018)	14.6	686
Platos Madison	3841 E. Washington Ave., Madison	Residential (MF)	190 HHs	Approved 2022	7.5	693
Café Zupas/Chapter Aesthetic Studio	4522 E. Washington Ave., Madison	Commercial	20 new employees	Approved 2023	1.1	689
Signature Pointe Apartments	2101 – 2115 East Springs Dr., Madison	Residential (MF)	463 HHs	Approved 2022	14.6	697

Development	Location	Land Use	Additions	Timeframe	Acres	TAZ
Panera Bread	2649 East Springs Dr., on the corner of East Washington Ave., Madison	Commercial (Restaurant)	30 new employees	Existing	1	697
Lakeland University	2310 Crossroads Dr., Burke-Madison	Commercial-Institutional (Private University)	100 new employees	Approved 2022	3	700
American Center Apts.	5622 Eastpark Blvd. and American Center Dr/American Family Dr., Madison	Residential (MF)/Mixed Use	363 HHs	Under C (as of 2023)	7.8	688
Winston @ Churchill	4205 Portage Rd, Close to Hidden Creek Residences and Churchill Heights Park, Madison	Residential (MF)	487 HHs	Proposed in 2022	11.3	680/686
Acadia Behavioral Health Hospital	2335 City View Dr., Burke-Madison	Institutional (Private)	240 new employees	Approved 2023	4.5	700
Nelson Addition to Rustic Acres	Milwaukee St. and Rustic Dr., Madison	Residential (MF)	4 HHs	Existing (as of 2022)	1.4	750/752 753/755
Oak Park Place Madison East	5817 Halley Way, Madison	Residential (MF – Senior Living)	99 New HHs	Approved 2021	5.2	749
Capitol View Townhomes	5818 Gemini Dr., Madison	Residential (MF)	12 HHs	Approved 2021	1	749
DeForest Golf Range (PinSeekers)	River Rd close to I-39/90/94, DeForest	Commercial/Recreational	100 employees	Under C (as of 2023)	30.1	1041/ 1048/ 1052
Jannah Village	Felland Rd close to I-39/90 and I-94 split off, Madison	Residential (MF)	242 HHs	Under C (as of 2023)	9.4	716
UW Health Clinic at American Center	Eastpark Blvd and N. Biltmore Ln, Madison	Institutional (Medical)/Mixed Use	1,000 employees	Under C (as of 2023)	10.8	682

Development	Location	Land Use	Additions	Timeframe	Acres	TAZ
Alliant Energy	N. Biltmore Ln. and American Family Dr., Madison	Commercial/ Industrial (Office)	600+ employees	Existing (since 2002)	26	685
American Family Insurance	American Family Dr., Madison	Commercial (Office)	1,000+ employees	Existing	100	681
American Family Apts	In Eastpark/American Center Generally, Madison	Residential (MF)	900 HHs	Proposed 2022	35	681/682 685/678 620
6501 Town Center	NW Corner of Milwaukee and Sprecher, Madison/Cottage Grove	Mixed Use (primarily Residential and Commercial)	200 HHs (100 HHs for 6501)	Under C (as of 2023)	5	744
Van Buren Apts	Jenny Wren Trail, bordered by US 151 Sun Prairie	Residential (MF)	92 HHs	Proposed 2022	2.8	642
The Dog Den	410 Atlas Ave., Madison	Commercial	15 new employees	Existing	0.7	738
Young Blood Beer Company	S. Stoughton Rd., Madison	Industrial (Manufacturing)	20 new employees	Existing	<1	781
Home2Suites	2301 East Springs Dr, Near I-39/90/94 and High Crossing Blvd	Commercial (Hotel)	Max. 100 employees	Proposed 2019	4.6	697
Buc-ee's	I-39/90/94 and CTH V, Northwest Corner to the east of CTH I, DeForest	Commercial (Travel/Gas)	200 employees	Proposed 2023	1.7	1028
Window Tint Auto Repair	2425 S. Stoughton Rd., Madison	Commercial/ Industrial	10 employees	Approved 2022	0.5	781
The Hair Suites	4914 Pflaum Rd., Madison	Commercial	10 employees	Existing	0.1	781
Kwik Trip	Terminal Dr and Stoughton Road (US 51), McFarland	Commercial (Travel/Gas)	35 employees	Proposed 2021	3.85	801

Development	Location	Land Use	Additions	Timeframe	Acres	TAZ
Discovery Storage Madison	4408 Pflaum Rd and 2505 Seiferth Rd, Madison	Industrial (Warehouse/Storage)	25 employees	Approved 2022	1.18	787
FedEx Distribution Center	NE Corner of Hoepker Rd and US 51 (Stoughton Rd), Burke	Industrial (Warehouse/ Distribution Center)	260 employees	Existing	8.8	588
Red Rooster	2513 Seiferth Rd., Madison	Commercial	10 employees	UC/Existing	0.5	787
Precision Diagnostics	2702 Agriculture Dr., Madison	Commercial/ Industrial	17 employees	Existing	2.5	787
K9 Crush Dog Daycare	2918 Progress Rd., Madison	Commercial	12 employees	Existing	0.6	787
South Central Library System Warehouse	5426 Fen Oak Dr., Madison	Industrial (Warehouse/Office)	62 employees	Approved 2022	4.1	789
Saturday Properties	US 151 and Windsor (WIS 19) Dr, Sun Prairie	Residential (Adult Housing)	150 HHs	Proposed 2022	3.7	636
Truck Stop (Caledonia Grocery)	STH 33 and I 90/94,	Commercial (Travel/Gas/Hotel)	100 employees	Proposed 2021	14	D11 TAZ 88
Metro Tech Apartments	6321 Town Center Dr Near NW Corner of Milwaukee and Sprecher	Residential (MF)	74 HHs	In Dev. Phase	2.98	744
Wyoming Project Unit 1	4800 Voges Rd., Madison/McFarland	Industrial (Warehouse)	10 employees	Under C (as of 2023)	14.8	805
Wyoming Project Unit 2	4800 Voges Rd., Madison/McFarland	Industrial (Warehouse)	10 employees	Under C (as of 2023)	8.1	805
All Metals Recycling Center	5651 Tradesmen Dr.	Industrial/Other	300 employees	Proposed 2022	36	805

Development	Location	Land Use	Additions	Timeframe	Acres	TAZ
Grand Appliance & TV	SE Corner of Landmark Dr and Limestone Pass, Cottage Grove	Industrial (Utilities/Parking)	5 employees currently	Under C (as of 2023)	2.55	1158
BRANDtek Biodome	Landmark Dr and Commerce Pkwy, Cottage Grove	Industrial/Research (Biodome Facility)	40 employees	Proposed 2021	2.47	1155
Atlantis Valley Foods	SE Corner of Commerce Pkwy and Erb Rd, Cottage Grove	Industrial (Food Production)	65 employees	Under C (as of 2023)	5.34	1158
JEK Multi-Tenant Retail	NW Corner of Landmark Dr and Limestone Pass, Cottage Grove	Commercial (Retail/Office Space)	7 units	Under C (as of 2023)	2.75	1155
Jump Around Gymnastics	NE Corner of Landmark Dr and Limestone Pass, Cottage Grove	Recreational (Kids Gymnastics)	15 employees	Proposed 2021	1.4	1155
Project Silver Eagle	NW Corner of CTH N and CTH TT, Cottage Grove	Industrial (Distribution Center)	1000 employees	Proposed 2022	145	1121
Grace Coffee Co.	SW Corner of CTH N and Gaston Rd, Cottage Grove	Commercial (Restaurant/Coffee)	20 employees	Existing (as of 2022)	0.08	1150

Color Coding for Table 1

Light Green = Additions Accommodated for in the Demand Model

Dark/Navy Blue = Additions Not Accommodated for in the Demand Model

Yellow = Estimated Addition Amounts

Model Growth for Relevant TAZs

Table 2 summarizes the growth in socio-economic data at the TAZ level based on the development locations given in Table 1. TAZs that were listed in the rightmost column of Table 1 are noted in Table 2 below to mark their projections of growth or loss in additions relevant to the new developments proposed in the TAZs. Table 2 shows the variance in characteristics between TAZs as well as the model's projections of additions or losses signified in the Delta columns for each socio-economic field.

Table 2 DCTDM Housing and Employment Summary

TAZ	2016 HH	2050 HH	Delta	2016 Retail	2050 Retail	Delta	2016 Service	2050 Service	Delta	Total 2016 Employed	Total 2050 Employed	Delta
588	2	2	0	50	37	-13	204	356	152	381	1509	1128
620	141	981	840	7	4	-3	3	117	114	23	124	101
636	44	44	0	3	58	55	250	1313	1063	253	1411	1158
642	177	770	593	0	208	208	0	206	206	0	414	414
678	13	179	166	0	0	0	8	38	30	8	49	41
680	121	221	100	0	0	0	5	9	4	5	105	100
681	139	392	253	11	25	14	4166	7100	2934	4392	7456	3064
682	0	0	0	0	0	0	0	1081	1081	0	1093	1093
685	0	388	388	7	0	-7	696	1550	854	1496	2295	799
686	721	906	185	0	0	0	529	529	0	539	539	0
688	741	1873	1132	6	9	3	219	431	212	227	615	388
689	860	860	0	127	130	3	730	695	-35	857	825	-32
693	3	759	756	156	207	51	687	527	-160	857	738	-119
697	0	38	38	1035	1033	-2	918	1543	625	1971	2678	707
700	321	414	93	13	13	0	1124	1576	452	1290	1696	406
702	128	128	0	365	406	41	110	122	12	556	631	75
716	21	298	277	0	0	0	12	325	313	37	325	288
727	15	769	754	11	16	5	282	471	189	722	917	195
738	200	313	113	72	62	-10	796	880	84	1726	1964	238
744	115	116	1	0	0	0	0	283	283	51	334	283

TAZ	2016 HH	2050 HH	Delta	2016 Retail	2050 Retail	Delta	2016 Service	2050 Service	Delta	Total 2016 Employed	Total 2050 Employed	Delta
749	842	1056	214	0	0	0	127	336	209	127	337	210
750	196	633	437	0	0	0	5	0	-5	5	0	-5
752	1	274	273	0	0	0	0	2100	2100	0	2100	2100
753	431	442	11	0	0	0	15	15	0	23	24	1
755	332	512	180	0	0	0	0	87	87	2	90	88
781	2	2	0	120	120	0	1074	1149	75	2582	2923	341
787	56	55	-1	201	197	-4	2062	2311	249	3377	4415	1038
789	1	1	0	92	88	-4	1925	1937	12	2465	2862	397
801	75	627	552	72	74	2	16	103	87	258	326	68
805	7	6	-1	0	0	0	2	222	220	64	710	646
1028	23	39	16	14	14	0	3	2	-1	159	197	38
1041	34	500	466	12	41	29	125	169	44	137	329	192
1048	418	431	13	10	10	0	37	37	0	63	60	-3
1052	63	301	238	0	96	96	0	441	441	200	857	657
1121	121	126	5	5	33	28	12	761	749	34	1120	1086
1150	290	789	499	15	26	11	3	8	5	21	35	14
1155	7	4	-3	75	200	125	204	1454	1250	629	2250	1621
1158	399	753	354	150	296	146	49	153	104	232	501	269

Observations – Developments of Concern

Most of the developments in Table 1 are accounted for in the DCTDM's forecasted household and employment numbers. However, a few of these developments have additions that exceed the forecasted amounts for TAZs in 2050 according to Table 2. TAZs highlighted in these observations are shown in Table 3.

Two of these developments are located near Portage Dr., near the Dane County Regional Airport and US 151. These developments are The Winston at Churchill Park and Hidden Creek Residences. The Winston development plans to add 487 units of housing, but forecasted amounts for its location in either TAZ 686 or 680, show 100 additional housing units for TAZ 680 and 185 more units for TAZ 686. This new apartment development would exceed both TAZ household additions combined by over 200 housing units. In addition to The Winston development, Hidden Creek Residences, which already has existing buildings for dwelling units, is currently in the construction phase of adding on another building to the development. In summary, The TAZs in this area need to be modified to accommodate more growth in households.

Three more apartment complexes also require updated household TAZ data. The 6501 Town Center Apartments development is one of the many residential complexes in the Rustic Acres/Milwaukee-Sprecher area, which is projected to have marginal growth in the model compared to what the developers of the projects anticipate. The Milwaukee Street Special Area Plan (SAP) is what justifies the inclusion of many of these future or currently existing developments as they will be connected to the planned area via Milwaukee Street pedestrian and automobile routes. The City of Madison is currently fostering much of this future development along Milwaukee Street in anticipation of the SAP being carried out. Another development is the Metro Tech Apartment Complex, located next to the 6501 Town Center apartments. Combined, these apartment complexes are located in a TAZ with little projected growth in households. Both 6501 Town Center and Metro Tech apartments have units that exceed the amount projected for TAZ 744, which only projects one household to be added from 2016 to 2050 according to the DCTDM. The third development is The Meadowlands, an existing neighborhood development that plans for more multifamily household additions. The development is primarily single-family with 341 multifamily household units. TAZ 752 is where the multifamily housing will be located, but most of the existing development is located in TAZ 755.

A 900-unit development complex was proposed in association with American Family Insurance. This development plan was discussed in a regional planning meeting but had no specific locations proposed for the development. The combined number of household additions in the associated TAZs should more than account for the proposed new developments, so no adjustments to the housing units in this area are likely necessary.

An adult residential complex has been proposed in Sun Prairie at the southwest corner of US 151 and Windsor Rd (Wisconsin State Highway 19), with 150 housing units. No residential additions have been proposed for the TAZ this development is in.

The potential Buc-ee's Development would be located in TAZ 1028, which includes no growth in retail workers, a loss of one service worker, and overall employment numbers increasing by 38 employees overall in the TAZ between 2016 and 2050 according to the DCTDM. The potential Buc-ee's development anticipates around 200 hires to work either full or part time, so this new development has not yet been accounted for in the DCTDM TAZ projections.

A minor commercial development on East Washington Avenue near East Towne Mall is a small commercial strip where two tenants, Café Zupas and Chapter Aesthetic Studio, are planned. This development is located in TAZ 689. TAZ 689 projects a loss of 35 jobs according to the DCTDM, so the TAZ needs to be updated to accommodate the job growth, though overall employment is not expected to increase by a large margin.

Another large development projected for the Madison area is called Project Silver Eagle, which is a proposed warehouse/distribution center development at CTH N and CTH TT in Cottage Grove. This development, according to the proposal, is likely to serve as an Amazon Distribution Center with an estimated 1,000 to 1,500 jobs. The TAZ 1121 model growth does project an additional 1,086 employees in overall employment numbers, which would have the projection allowing for the lower end of the estimate proposed by Project Silver Eagle It is recommended that the TAZ project the higher end of the estimated jobs planned for this development.

One existing development classified as a public institutional land use is the City of Madison Fleet and Fire Services Center on Nakoosa Trail. The development is not fully accommodated for in the demand model. The number of total service jobs added in TAZ 12 does not account for the number of service jobs planned for the fleet/fire training center. At minimum, there should be at least 30 service workers employed at this location including job training staff. Overall employment numbers are less defined.

The Truck Stop in Columbia County at the southeast corner of WIS 33 and I-90/94 is the only development listed outside of Dane County and thus is not accounted for in the DCTDM but is accounted for in the Statewide Demand Model (STDM). Still, it is important as it is located within WisDOT's I-39/90/94 corridor study area. The STDM attributes in Dane County TAZs list the same socio-economic data attributes but use different coding for TAZ IDs in Dane County given that it is accounting for all TAZs in the state of Wisconsin. Thus, it will not be accounted for in the DCTDM. However, the STDM also does not account for any employment growth for the TAZ where this truck stop will be located, so the TAZ's socio-economic data for the STDM need to be updated to account for the new truck stop, which proposes more retail jobs for the convenience store development, a fast food restaurant add-on, which will increase the number of service and retail jobs, and a 4-story hotel with 70 rooms, which will create at minimum 30-40 jobs. Overall, there will be at least 100 jobs created by the new development.

Recommended TAZ Adjustments

Table 3 Recommended DCTDM Updates

TAZ	Land Use Assoc. with Adjustments	Model Attribute Delta (MAD)	Rec. Delta	Delta (Rec-MAD)	Developments Concerned
636	Residential	0 HHs	150 HHs	+150 HHs	Saturday Properties (Adult Residential)
680	Residential	100 HHs	500 HHs	+400 HHs	The Winston @ Churchill Park
686	Residential	186 HHs	300 HHs	+114 HHs	Hidden Creek Residences (or lot additions to HCR)
689	Commercial	-35 Total Emp.	35 Total Emp.	+70 Emp.	Café Zupas/CAS
697	Residential	38 HHs	501 HHs	+463 HHs	Signature Point Apts.
702	Public Industrial	12 Service Emp.	100 Service Emp.	+88 Service Emp.	4151 Nakoosa Trail (City of Madison Fleet Services)
744	Residential	1 HH	250 HHs	+249 HHs	6501 Town Center/Metro Tech Apts.
752	Residential	-1 HH	400 HHs	+401 HHs	The Meadowlands
1028	Commercial	38 Total Emp.	238 Total Emp.	+200 Total Emp.	Buc-ee's
1121	Private Industrial	1,086 Total Emp.	1,586 Total Emp.	+500 Total Emp.	Project Silver Eagle
STDM TAZ 88	Commercial	0 Total Emp.	200 Total Emp.	+200 Total Emp.	Truck Stop near Caledonia Grocery

It is recommended to modify and adjust the Dane County TDM TAZ files to accommodate more growth. Eleven TAZs should have their attributes modified to represent future developments more accurately in the DCTDM as well as the TAZ for the truck stop in the statewide model. Furthermore, there may be more recommended developments in the future that might change this current list.

Attachment J

I-39/90/94 and US 51 Corridor Studies Memo

High Level Traffic Impacts of Various Interstate South and US 51 Alternatives

I-39/90/94 and US 51 Corridor Studies

Date:	8/5/2024 (Revised 9/24/2024)
Topic:	High Level Traffic Impacts of Various Interstate South and US 51 Alternatives
From:	Jerry Shadewald, PE, PTOE

1. Introduction

The purpose of this briefing paper is to provide a high-level assessment of traffic impacts from potential interchange and mainline alternatives for the Interstate South and US 51 studies.

2. Methodology

The Dane County Travel Demand Model (DCTDM) is maintained by the Madison Metropolitan Planning Organization (MPO) and was made available to WisDOT for use on the Interstate South project and both US 51 north and south studies. DCTDM was used by the CDMCT and the Interstate South design teams to estimate changes in travel patterns for evaluating alternatives and developing traffic forecasts. CDMCT conducted additional validation efforts on the 2016 model, particularly regarding the AM and PM peak period components as documented in the Dane County Travel Demand Model Validation Report.

DCTDM inputs for 2050 were shared with the design teams and local stakeholders with revisions made to anticipated land uses to more closely align with current planning efforts. Additional employment was added to the DCTDM 2050 input files for the Epic area in Verona and the Interstate 39/90/94, WIS 19 and US 51 triangle south of DeForest. The DCTDM 2050 baseline condition model included committed roadway improvements and the MPO's following recommended bike, pedestrian and transit networks:

- Additional bicycle and pedestrian connections throughout Dane County
- Bus Rapid Transit (BRT) for both east-west and north-south alignments along with local service extensions.
- Routes in the Metro Network Redesign that focus resources on frequent service to densely developed corridors
- Regional express routes to outlying communities
- Routes added based on projected development along corridors including:
    - BRT to southwest and east Madison
    - N-S BRT to Fitchburg
    - BRT to Middleton
    - High frequency routes along Johnson/Gorham, Williamson Street, Monroe Street, Atwood Avenue, Old University Avenue and Watts Road

The DCTDM was then executed with the 2050 baseline conditions (no modifications to model inputs including no changes of the roadway with the Interstate south limits). The DCTDM was then rerun with various changes in 2050 model inputs including combinations of roadway alternative improvements. The following section provides a high-level assessment of the DCTDM's predicted changes in travel patterns with particular alternatives.

3. Base Year 2016 to 2050 Traffic Shifts

The DCTDM was executed with both the 2016 and 2050 datasets to estimate the changes in travel patterns resulting in the projected growth in housing and employment throughout Dane County. Figure 1 shows changes in daily directional traffic volumes for eastern Dane County. Note the major roadways throughout the area are predicted to have higher traffic volumes in 2050, many by more than 10,000 vehicles per day compared to the 2016 condition as indicated by the red coloring. Traffic forecasts for the Interstate 39/90/94 corridor were developed using both the DCTDM and WisDOT's Traffic Analysis and Forecasting Information System (TAFIS), consistent with WisDOT policy. The Interstate 39/90/94 corridor traffic volumes are predicted to grow between 0.37% and 1.19% annually. Total person trips for all of Dane County are predicted to increase by 1.15% annually while transit trips are predicted to increase 1.65% annually due in part to the increased transit service in the 2050 model input.

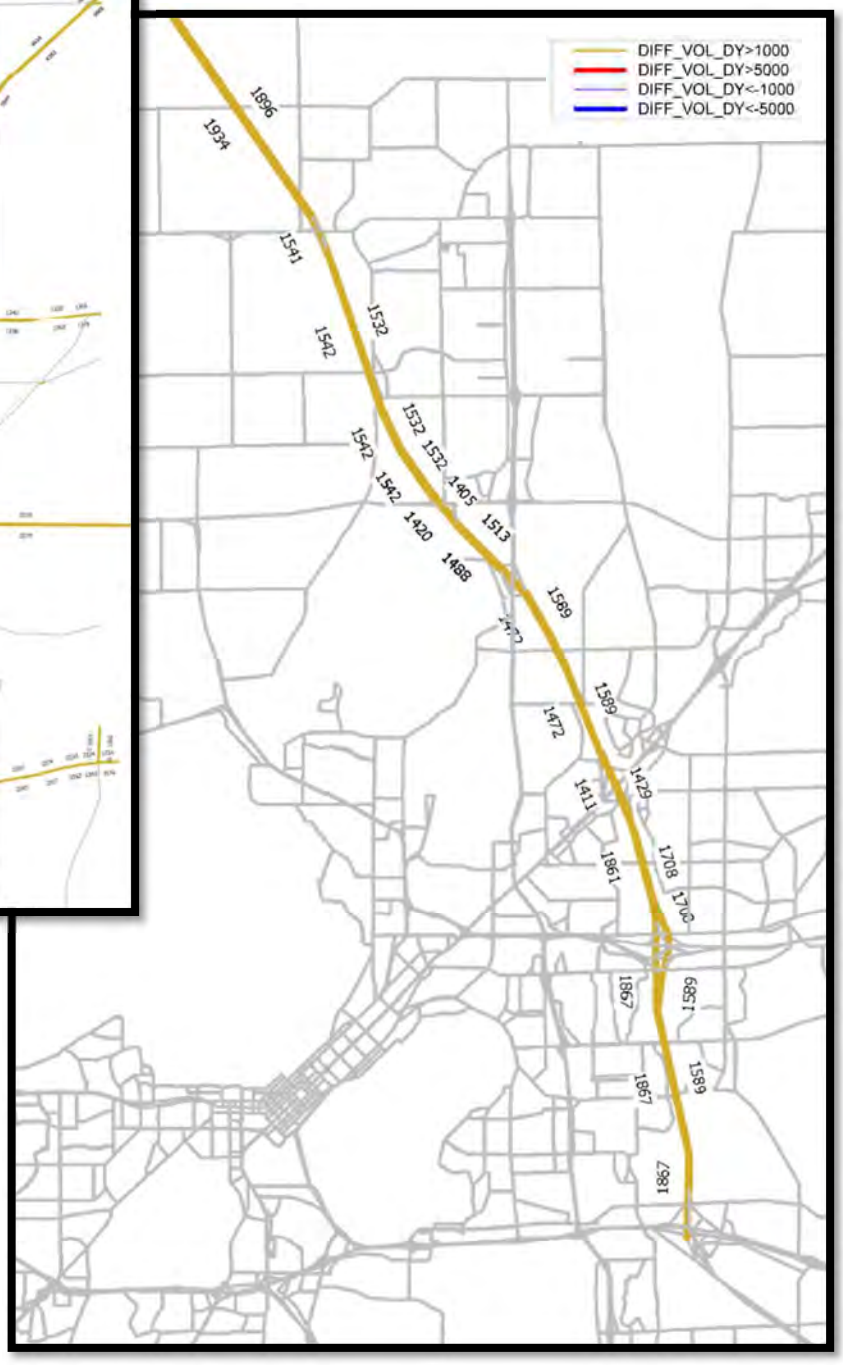
4. Additional Interstate Capacity

The Interstate South and Interstate North studies are both considering additional roadway capacity to improve traffic operations and improve travel time reliability between US 12/18 in Madison to US 12/WIS 16 in Wisconsin Dells. Since the DCTDM only covers Dane County, the Wisconsin Statewide Travel Demand Model (SWTDM) was used to project travel pattern changes from an additional Interstate lane between Madison and Wisconsin Dells. The SWTDM's predicted change in travel at the Dane/Columbia county line was then entered into the 2050 DCTDM. The 2050 DCTDM roadway network was then updated to include additional capacity on the Interstate system between the US 12/18 interchange and the Dane/Columbia county line. The expansion included one additional lane each direction, with a second additional lane each direction between US 12/18 and US 51. Figure 2 shows that the additional capacity on the Interstate increases volumes along the Interstate corridor. The increased volume is very regional in nature with the projected increase ranging from 1400 to 2000 vehicles per day each direction. This alternative results in the US 12 corridor between Madison and Wisconsin Dells having a small statewide travel demand model-projected reduction in volume. PM peak period volumes also indicate a minor decrease in volumes along the US 51 corridor between US 12/18 and WIS 30.

Vehicle miles traveled (VMT) increase 71,800 miles per day (0.37% of Dane County total) with the additional capacity.

Figure 1 Traffic Volume Growth Between 2016 and 2050

Figure 2 2050 Traffic Volume Shift From Additional Interstate Capacity



5. Hoepker Road Interchange

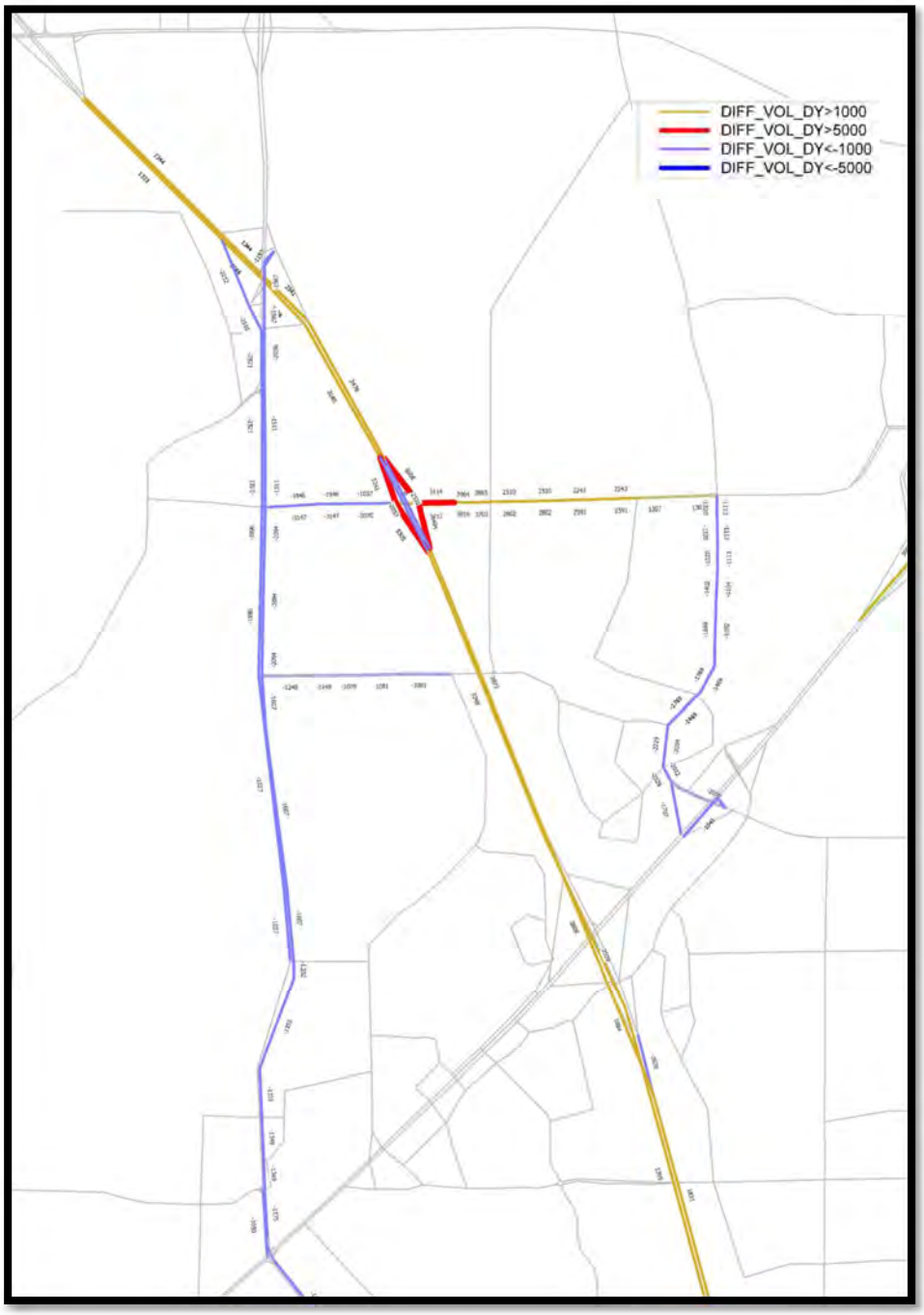
Hoepker Road connects CTH CV and US 51 with American Parkway and Grand Avenue, passing over Interstate 39/90/94. Constructing an interchange between Interstate 39/90/94 and Hoepker Road is being considered. The DCTDM network was updated to include the new Hoepker Road access.

Figure 6 shows the daily traffic differences with a proposed Hoepker Road interchange. The Interstate system volumes would be anticipated to increase between 2500 and 3900 vehicles per day per direction between US 51 and US 151, with smaller increases for the adjacent sections between WIS 19 and I-94. These volumes are primarily traffic diverted from US 51 and American Parkway which are projected to have traffic reductions of 1000 to 2000 vehicles per direction.

Volumes are projected to also increase on Hoepker Road east of the proposed interchange, however Hoepker Road volumes west of the interchange are projected to decrease. This reduction is due in part to regional travelers from the north exiting I-39/90/94 at US 51 destined for activities along Hoepker east of the Interstate who would use the Hoepker Road interchange instead.

County-wide VMT increases 8,400 miles per day, 0.04% of county total with access to the high-speed Interstate facility.

Figure 3 2050 Daily Traffic Volume Shifts from Hoepker Road Interchange



A similar scenario was evaluated that included the additional capacity on the Interstate with and without the Hoepker Road interchange. Hoepker's traffic shifts with an expanded I-39/90/94 are similar in extent with approximately 200 additional daily vehicles per direction on I-39/90/94.

6. Stoughton Road South

The South Stoughton Road (US 51) corridor is being studied between Voges Road and WIS 30. The initial discussions include a potential reconfiguration of US 51 to be less of a barrier to the community. While the study has not progressed sufficiently to provide detailed alternatives, the City of Madison would like to investigate a configuration that effectively reduces the speed along US 51 between US 12/18 and Buckeye Road. The DCTDM was coded with a 20% speed reduction along this stretch of US 51. This was an initial test that was run in November, 2022 to get a rough impression of impacts. More detailed tests along Stoughton Road South were conducted later once specific alternatives were developed. These are referred to in sections 26 to 33.

Figure 4 2050 Daily Traffic Volume Shifts from South Stoughton Road Speed Reduction

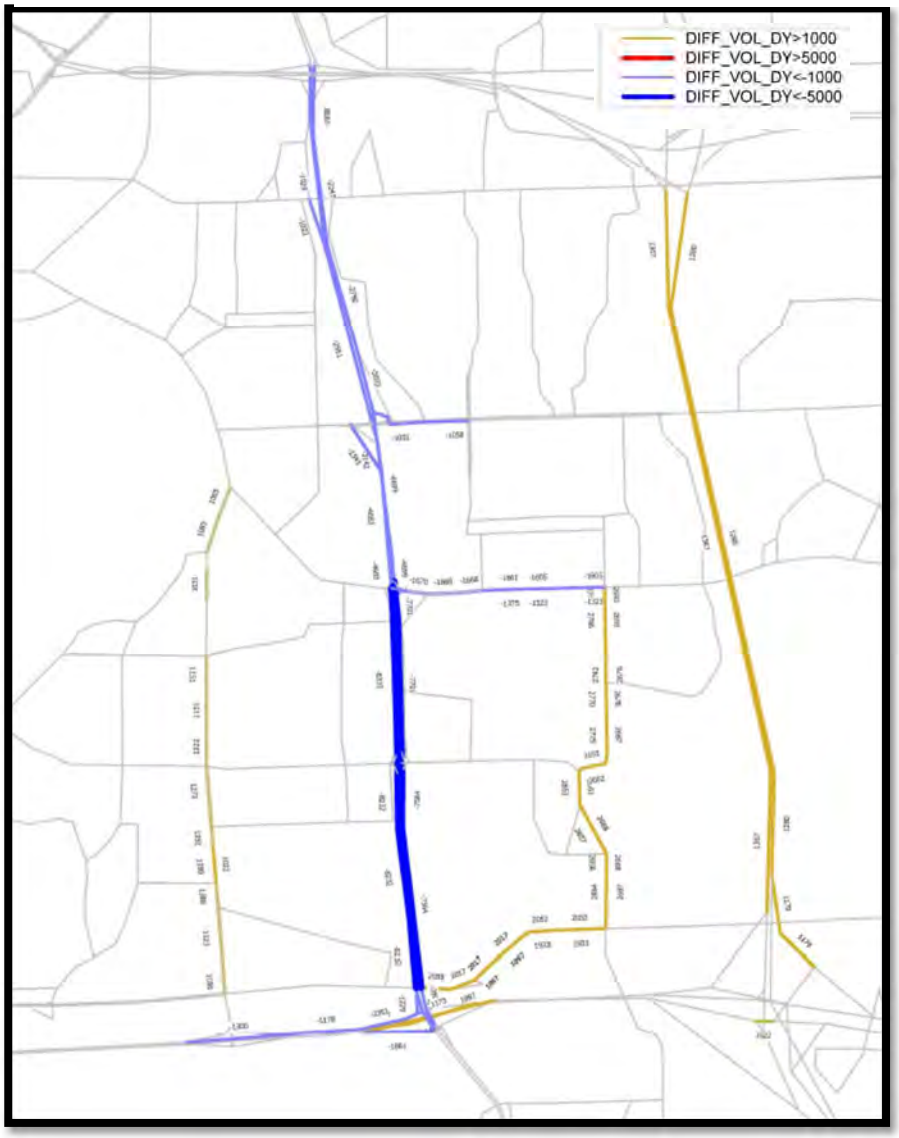


Figure 4 shows daily traffic is projected to decrease approximately 27-30% on US 51 through the impacted stretch with traffic diverting to I-39/90, Monona Drive to the west and Agriculture Drive/Vondron Drive to the east. The 1300 vehicles per day increase in each direction of I-39/90 represents less than 2.5% increase in projected volume. DCTDM also predicted nearly 1000 trips shifting to the non-motorized mode due to the speed reduction.

Impacts to US 51 north of WIS 30 are projected to be under 1000 vehicles per day per direction. VMT decreases in Dane County by 27,600 miles per day in Dane County, due in part to the shift to non-motorized travel and in part from the lower speed discouraged the out of direction travel afforded to drivers who used the higher speed Stoughton Road corridor.

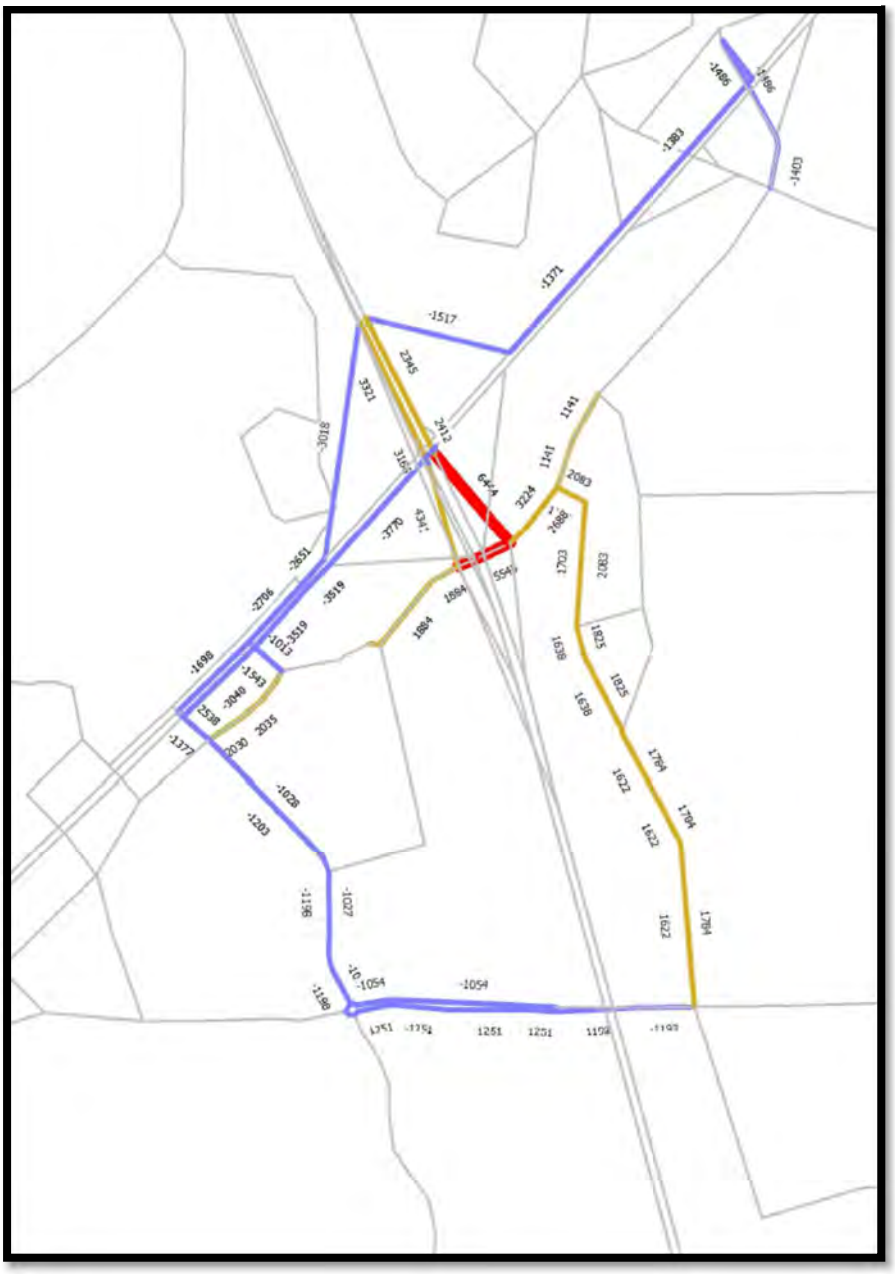
A similar scenario was evaluated that included the additional capacity on the Interstate with and without the Stoughton Road South speed reduction. The speed reduction's traffic shifts with an expanded I-39/90 are similar in extent with approximately 200 additional daily vehicles per direction on I-39/90.

7. High Crossing Boulevard Interchange North Ramps

High Crossing Boulevard currently has a half interchange with I-39/90/94 with northbound exit and southbound entrance ramps. There are currently no northbound entrance or southbound exit ramp. The DCTDM was coded to include the two missing movements to/from the north. Figure 5 shows that projected daily traffic shifts are local in nature with essentially no change in traffic patterns on I-39/90/94. Vehicles using US 151 to make movements to/from the north via I-39/90/94 could get directly to I-39/90/94.

Dane County VMT decreases nearly 5000 miles per day by replacing the longer distance access/egress routes between High Crossing Boulevard and I-39/90/94 to/from the north with direct ramp connections.

Figure 5 2050 Daily Traffic Volume Shifts from North Ramps at High Crossing Boulevard



8. Milwaukee Street Interchange

The City of Madison is planning to construct an extension of Milwaukee Street to cross under I-94 east of the Badger (I-39/90 and I-94) interchange. This extension is part of the 2050 committed improvements included in the DCTDM's 2050 network. A potential alternative is to construct a full interchange with I-94 as part of the extension. DCTDM was coded to include the interchange ramps and rerun. Figure 6 shows that traffic diverts from CTH N and the CTH N interchange and instead uses CTH T to access I-94 via the Milwaukee Street interchange. Volumes are projected to shift from CTH TT between CTH T and CTH N as those trips can be facilitated on I-94. Vehicles from the southern Sun Prairie area heading to I-39/90/94 north of US 151 are projected to travel south and access the Interstate system via Milwaukee Street, which is leading to the 15,600 mile (0.08%) increase in Dane County VMT.

9. Doubling Transit

The DCTDM was executed with an alternative that doubled the number of people using transit and removing those person trips from the auto mode. For this exercise, each person trip between an origin and destination as determined by the DCTDM to use transit was doubled up to the total amount of trips for each origin to destination pair, resulting in 182,000 total transit trips. The person trips shifted from the auto mode were reduced from the auto trip tables using an average auto occupancy of 1.5 persons per vehicle (which is a conservative approach which is removing more auto trips than using a more anticipated value of 1.7 persons per vehicle would remove). This results in approximately 60,000 fewer auto trips across Dane County. Figure 7 shows the regional nature of the auto volume reductions related to the doubling of transit, with I-39/90/94 auto volumes projected to decrease between US 12/18 and US 151 by 1125 to 1350 vehicles per direction per day.

0.7 to 2.3% fewer auto trips are projected on Interstate 39/90/94 between WIS 19 and US 12/18 if transit ridership were doubled. Interstate volumes are essentially unimpacted for segments north of WIS 19.

0.3 to 2.7% fewer auto trips are projected on US 51 between WIS 19 and WIS 30 if transit ridership were doubled.

0.9 to 2.5% fewer auto trips are projected on US 51 between WIS 30 and Voges Road if transit ridership were doubled.

Vehicle miles traveled (VMT) by automobiles in Dane County with a doubling of transit ridership are projected to decrease 2.2%. Doubling the transit ridership would likely require additional transit vehicles to serve the additional riders which would offset at least a portion of the auto VMT reduction.

Figure 6 2050 Daily Traffic Volume Shifts with Milwaukee Street Interchange.

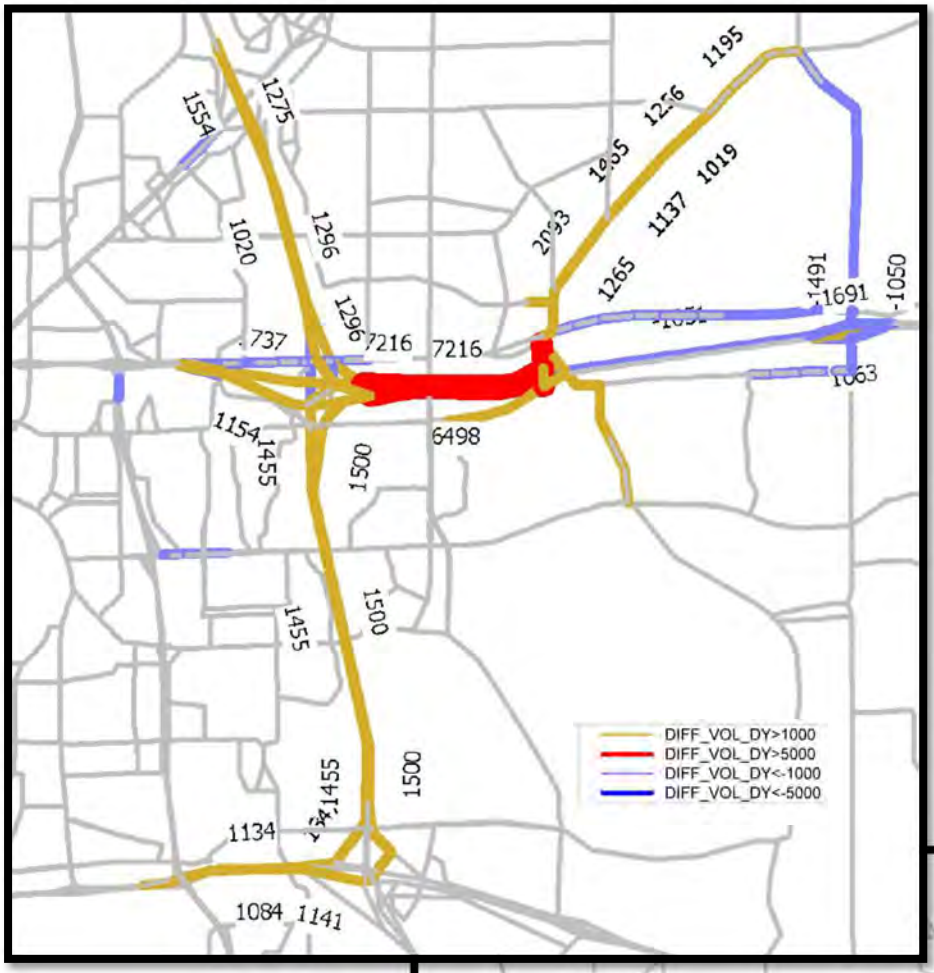
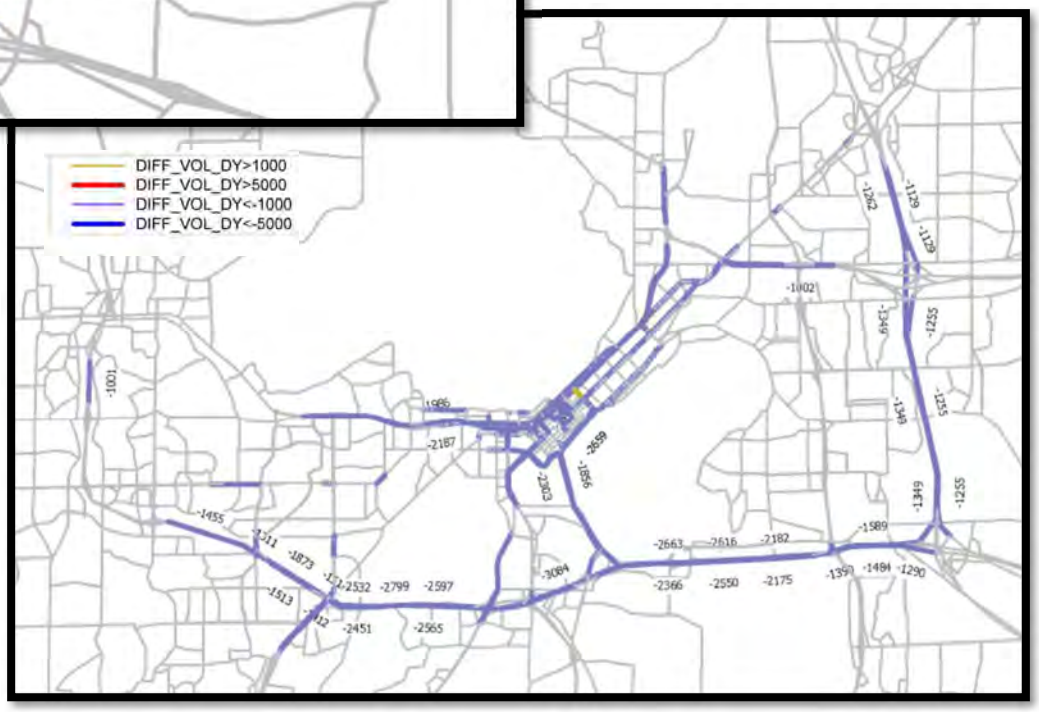


Figure 7 2050 Daily Traffic Volume Shifts with Doubled Transit Trips

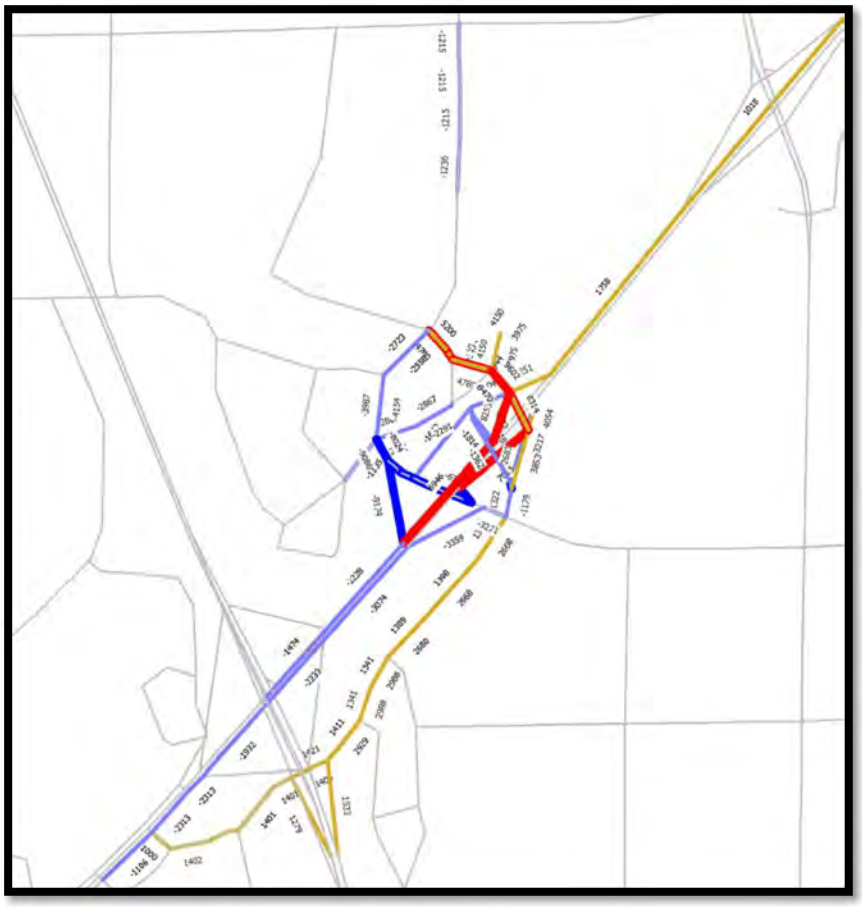


10. American Parkway Interchange Reconfiguration

The interchange between US 151 and I-39/90/94 may require modifications to improve traffic operations on the Interstate. These modifications may require modification of the US 151 interchange with American Parkway, aligning the ramps with an extended American Family Drive. A scenario was tested within the DCTDM to evaluate the impacts of a realigned American Parkway and ramping to/from US 151 along with associated minor changes in transit routes using the American Parkway interchange.

Figure 8 indicates changes in traffic patterns to be local in nature, with 4000-5000 vehicles shifting from US 151/East Washington Avenue to High Crossing Boulevard between American Parkway/Nelson Road and East Springs Drive. VMT and VHT both decrease with this scenario, due in part to removal of loop ramps that require out of direction travel to access US 151.

Figure 8 2050 Daily Traffic Volume Shifts from American Parkway Reconfiguration



11. WIS 19 Widening

WIS 19 between River Road and Williamsburg Way is being considered for expansion to improve traffic operations within the I-39/90/94 interchange. DCTDM was executed with a 6-lane cross section to estimate the shift in traffic from the additional capacity, but impacts were predicted to be less than 500 vehicles per day in either direction. An increase of up to 50 vehicles on WIS 19 at the I-39/90/94 ramp terminals and points west for peak hour analysis is recommended but no other traffic shifts are predicted.

12. Hoepker Road and High Crossing North Ramps

A scenario was tested with both the Hoepker Road interchange and the two High Crossing Boulevard ramps to/from the north included. The projected traffic shifts are shown in Figure 9. Comparing the shifts from the two projects combined with the two individual project's projected shifts from Figure 3 and Figure 5, the extents and magnitudes are similar. Hoepker Road interchange and the north High Crossing Boulevard projects have impacts that are essentially exclusive from each other.

13. Hoepker Road and Milwaukee Street Interchanges

The DCTDM was updated to include both the Hoepker Road interchange and the Milwaukee Street interchange.

Figure 10 shows the shifts in traffic with both the Hoepker Road and Milwaukee Street interchanges included. Comparing Figure 3 and Figure 6 to Figure 10, the combination of the two interchanges have similar diversions both individually as when combined. The increase in volume on I-39/90/94 with both interchanges is slightly higher through the US 151 interchange (4700 to 5300 per direction per day) compared to combining the two single scenarios (4400 to 4800 per direction per day). Hoepker Road interchange and the Milwaukee Street interchange projects have impacts that are relatively exclusive from each other with a small increase in additional volume on the I-39/90/94 mainline.

Figure 9 2050 Daily Traffic Volume Shifts from Hoepker and High Cross Interchanges

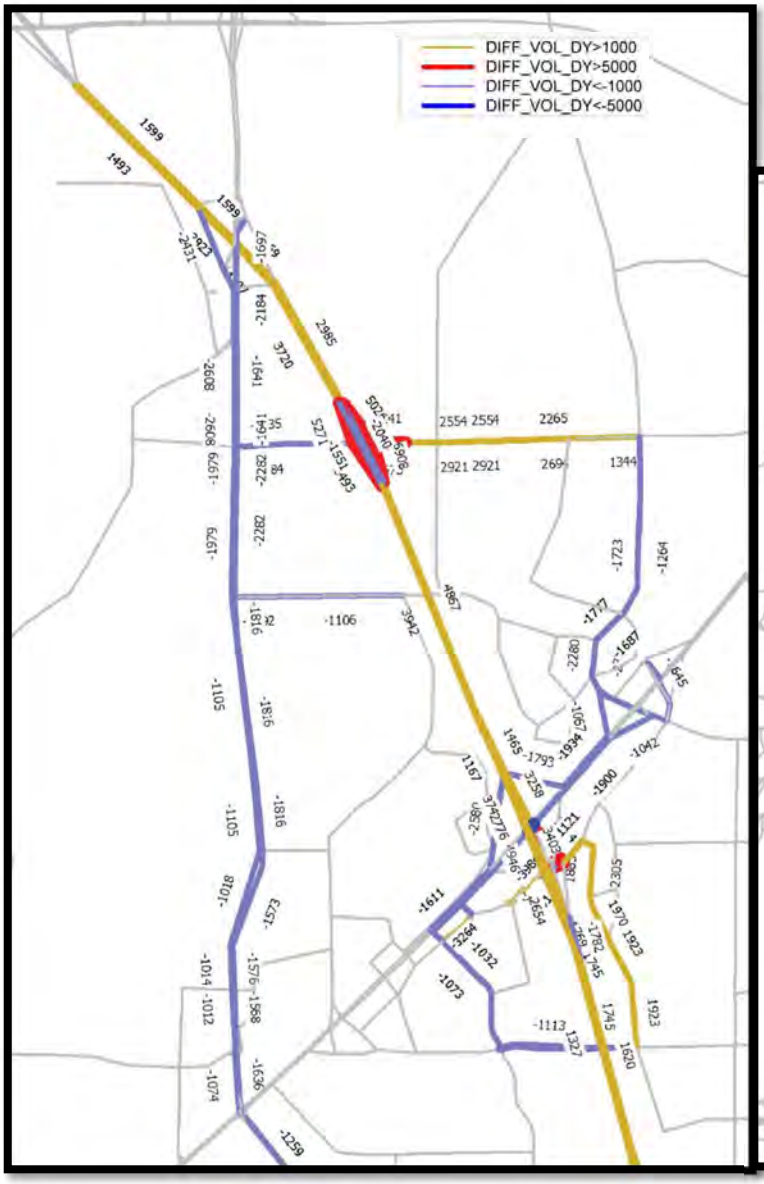
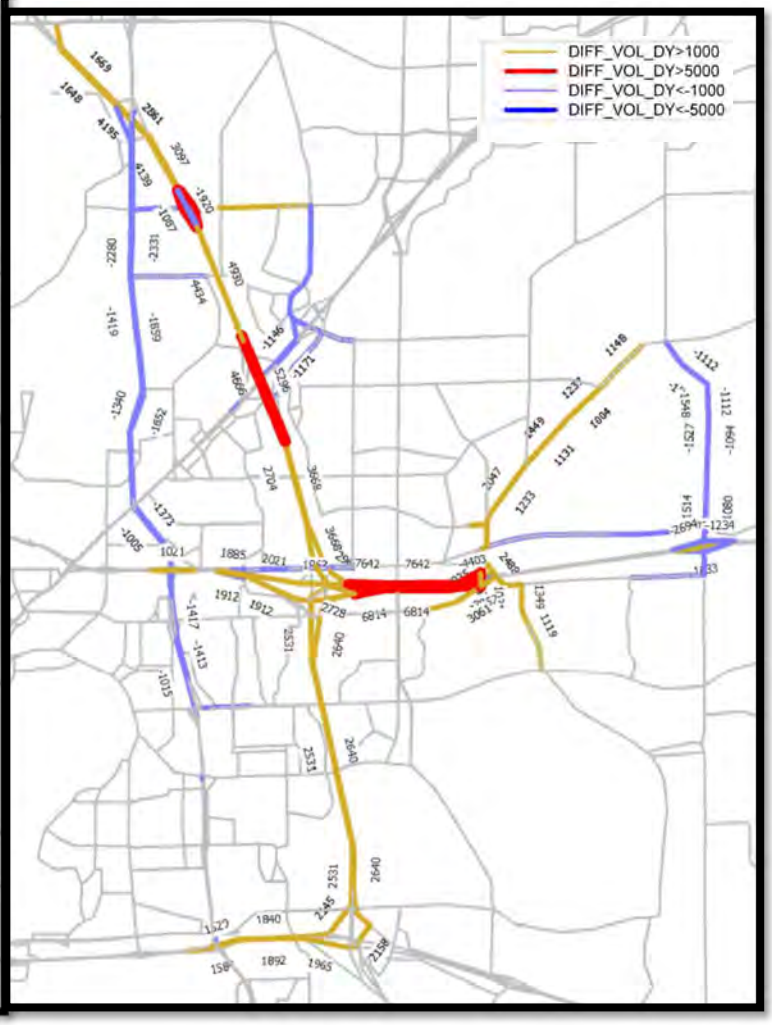


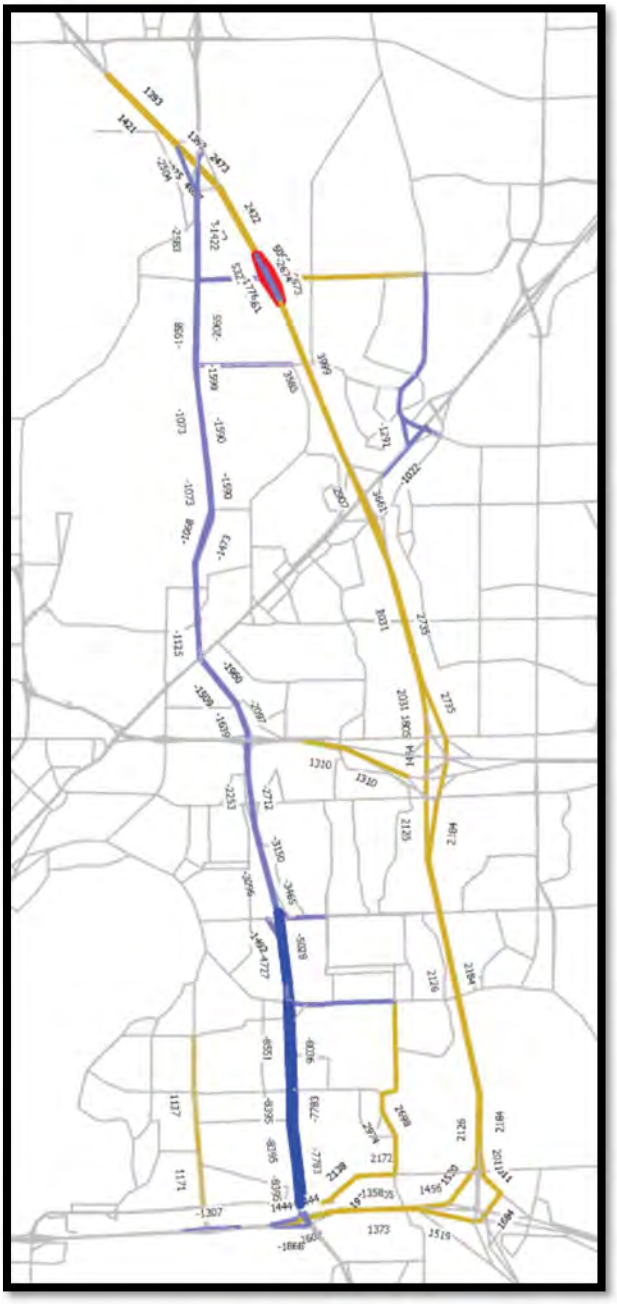
Figure 10 2050 Daily Traffic Volume Shifts from Hoepker and Milwaukee Interchanges



14. Stoughton Road South, Hoepker and Interstate Capacity

A scenario was evaluated that included the Stoughton Road South speed reduction, the potential interchange at Hoepker Road and the additional capacity on the Interstate system. Figure 12 shows that the scenario shifts traffic demands from US 51 to the Interstate system, which increases use of the ramps between the Interstate and the US 12/18 corridor to the west in addition to the ramps to/from WIS 30. The inclusion of the Hoepker interchange reduces traffic on US 51 between the Interstate and US 151 along with American Parkway and Hanson Road corridors.

Figure 11 2050 Daily Traffic Volume Shifts from Stoughton Road, Hoepker and Interchange Capacity

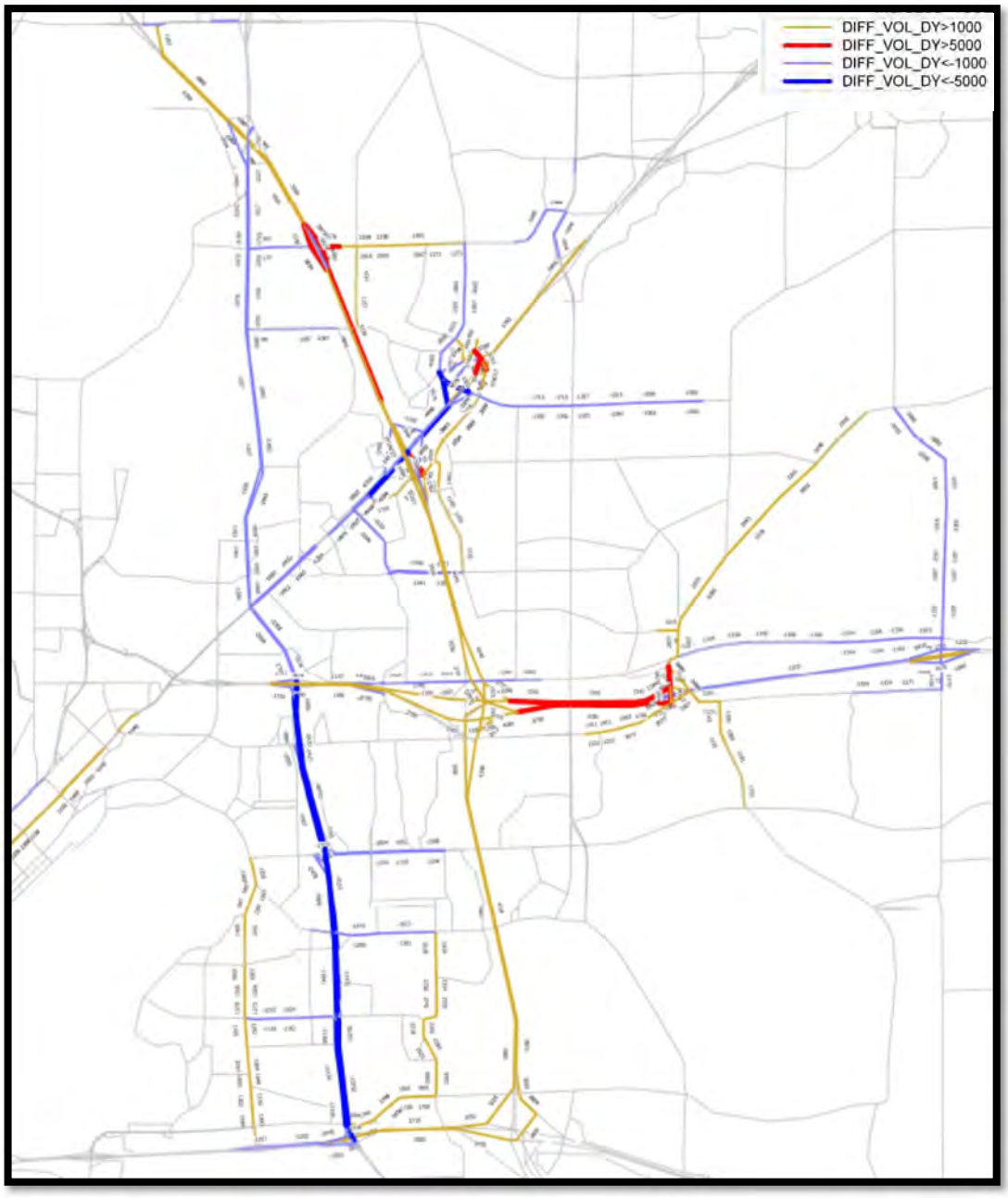


15. Stoughton Road South, Milwaukee Street, Hoepker Road, American Parkway and High Crossing Interchanges

A scenario was tested with speed reductions on South Stoughton Road, new interchanges at Milwaukee Street and Hoepker Road, reconfigured American Parkway and the inclusion of the north ramps at High Crossing Boulevard. Figure 12 shows the various impacts across the Madison area from the implementation of these four projects. Note that nearly all roadways that are shown as being impacted with the four projects were also shown as being impacted by one of the four facilities individually with a few notable exceptions:

- additional traffic reduction on WIS 19 west of US 151,
- additional traffic reduction on Cottage Grove Road west of I-39/90,
- additional traffic reduction on Nelson Road east of US 151.

Figure 12 2050 Daily Traffic Volume Shifts from Stoughton Road South, Hoepker and Milwaukee Interchanges, American Parkway reconfiguration and High Crossing North Ramps

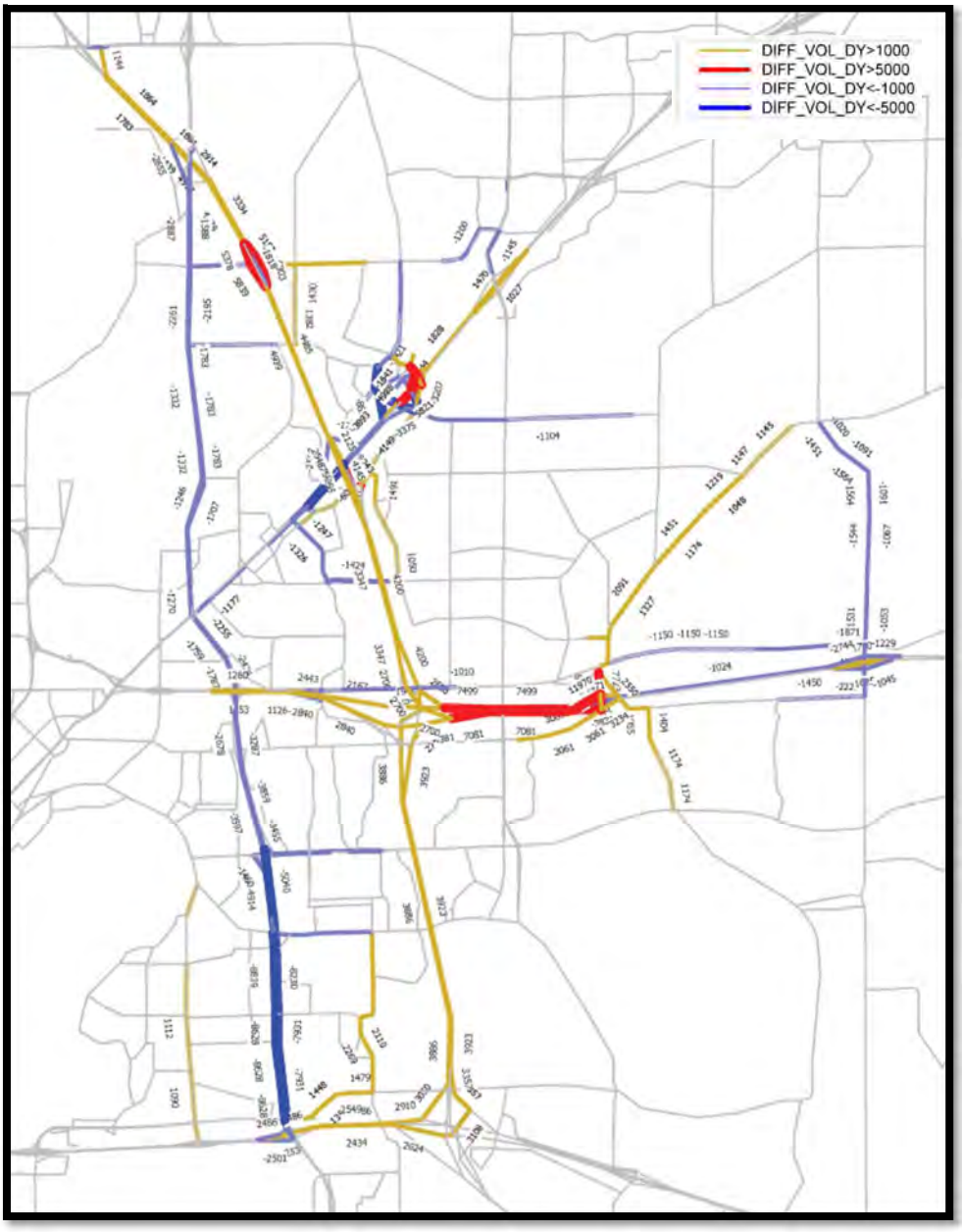


16. Plus 1 with Stoughton Road South, Milwaukee Street, Hoepker Road, American Parkway and High Crossing Interchanges

A similar scenario was tested with the Stoughton Road South speed reductions, added interchanges at Milwaukee and Hoepker, the High Crossing ramps to/from the north, the reconfigured American Parkway interchange with US 151 and the additional Interstate capacity. Figure 13 shows the various impacts across the Madison area. Noticeable differences between the base network comparison and added lane network comparison are that the decreases in volume along the Stoughton Road corridor (especially the middle and southern portions) are more marginal than the more drastic decreases along the Stoughton Road corridor in the base network.

The impacts of this scenario are similar to those noted for the previous scenario, which included all potential modifications except for the additional mainline capacity.

Figure 13 2050 Daily Traffic Volume Shifts from Stoughton Road South, Hoepker and Milwaukee Interchanges, American Parkway reconfiguration and High Crossing North Ramps with additional Interstate capacity

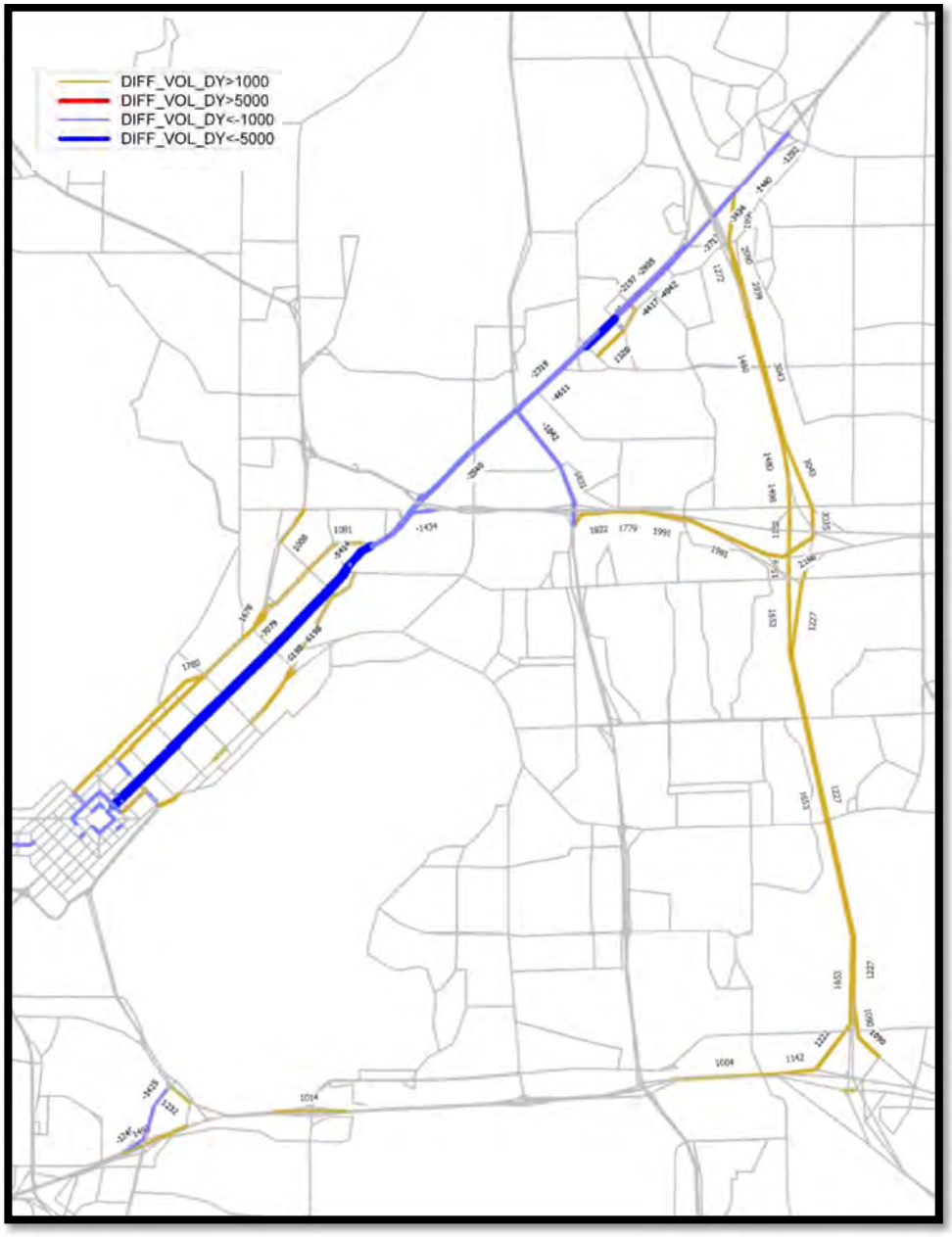


17. East Washington Avenue Speed Reduction

The City of Madison has recently lowered the posted speed on US 151 (East Washington Avenue) on the east side of Madison. In October 2020, speeds on East Washington Avenue (EWA) were reduced from 35 mph to 25 mph between Pinckney St. and Baldwin St., and from 35 mph to 30 mph between Baldwin St. and Marquette St. In July 2022, the section of East Washington Ave. between Stoughton Road and East Springs Dr. had its speed limit lowered to 35 miles per hour. These speed reductions were not incorporated into the future baseline project set and were therefore not incorporated into the No Build traffic forecasts. Figure 14 shows the DCTDM estimated traffic diversions to the Johnson/Gorham and Williamson Street corridors, along with WIS 30 and the Interstate due to the reduced EWA speeds. DCTDM also predicts a small shift away from automobiles with a corresponding reduction in VMT and VHT.

A review of 2020 traffic counts at the continuous count site along EWA indicates the reduction in traffic demand to be approximately 10-15%. This does not include the impacts of reducing speeds in the Stoughton Road to East Springs segment. Note the DCTDM's projected 30% reduction includes speed reductions in all three segments.

Figure 14 2050 Daily Traffic Volume Shifts from East Washington Avenue speed reductions



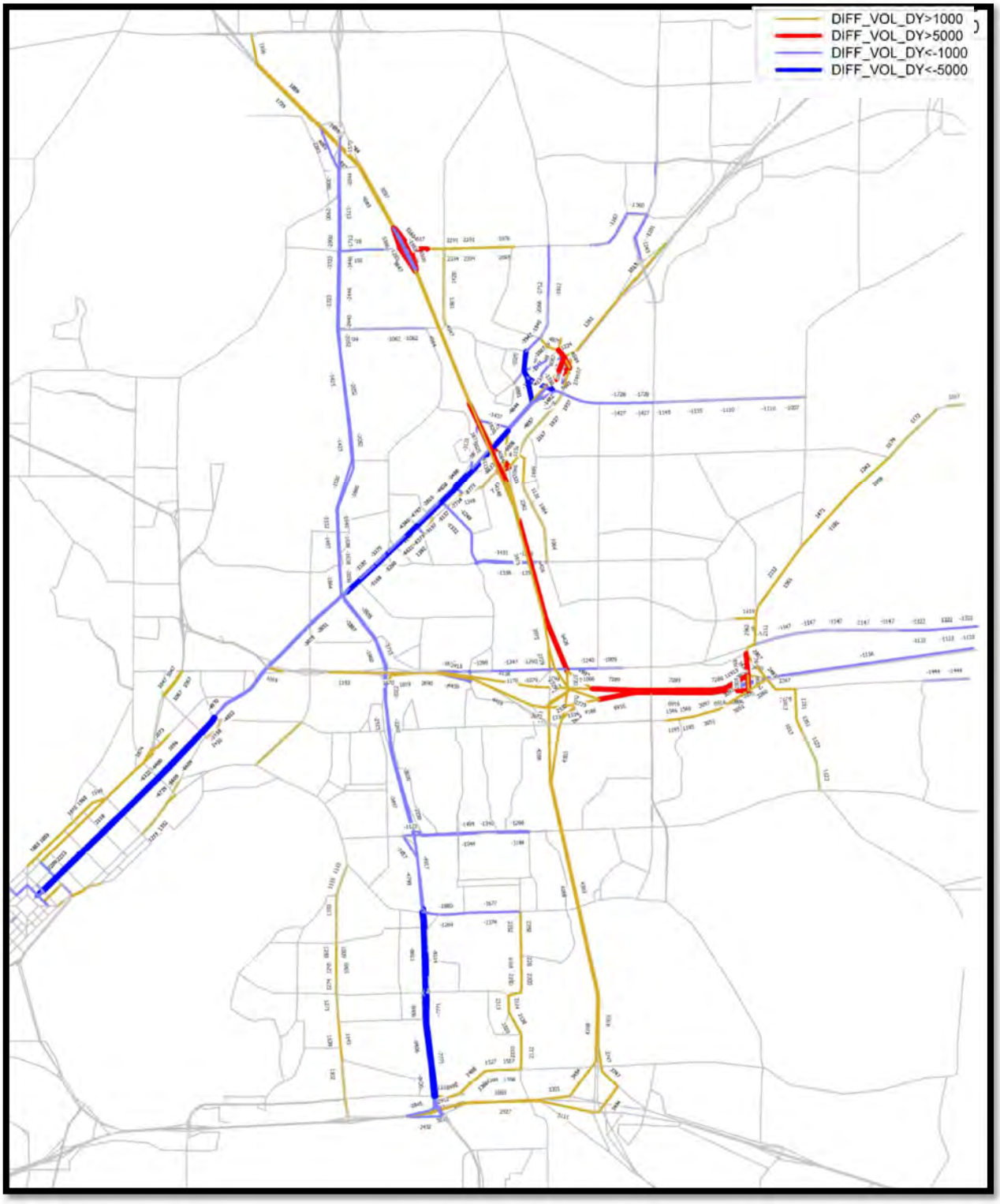
18. 6in1 plus 1

The DCTDM was executed with 6 potential projects incorporated into the input network plus the additional Interstate mainline capacity. These improvements include:

- Hoepker Road interchange
- Milwaukee Street interchange
- High Crossing Road interchange north ramps
- American Parkway reconfiguration at US 151
- Stoughton Road South speed reduction
- East Washington Avenue speed reduction
- Interstate capacity expansion between US 12/18 and Wisconsin Dells

Figure 15 shows the DCTDM estimated diversion with the 6 projects plus the additional Interstate lanes. This combination of projects generally generates the highest volumes along the Interstate between US 12/18 and the Columbia County line.

Figure 15 2050 Daily Traffic Volume Shifts with 6 projects and additional Interstate lanes



19. Traffic Forecasting Impacts By Critical Alternative

A traffic forecast was developed for each roadway segment of the Interstate South, US 51 North and US 51 South study areas. The forecast is the highest anticipated volume based on the various scenarios tested with the DCTDM. Each peak period's highest assignment was established on a link-by-link basis for all roadway segments that are to be forecasted for Interstate South. Table 1 shows that the 6in1 plus 1 scenario generated the critical forecast at 64 of the 341 links in the Interstate South corridor. Table 2 shows which scenarios were impactful to the respective influence areas across the three Dane County projects. Note that some scenarios that were less impactful were omitted from Table 2. General observations including combining multiple projects into one scenario typically increased demands along the Interstate system. Adding capacity or access to the Interstate system reduced demands along US 51 and lowering the speed on US 51 increased demands on the Interstate system.

Table 1 Number of Links Controlled by Scenario

Scenario	Number of Links
All6P1	64
5in1 P1	51
HpkrAmpk P1	25
AmPk	24
5in1	22
SRS P1	19
W19 P1	18
MkeHpkr P1	17
Base	16
SRSHpkr P1	15
SRS	12
HC P1	11
Hoepker P1	10
HCHpkr P1	9
High Xing	7
Hoepker	7
Milwaukee	7
P1	4
MkeHpkr	3

Table 2 Critical Scenarios by Interchange Influence Area

Seg	Influence Area	Plus 1 Lane		Hoepker I/C		SRS Spd		Milw St I/C		Hi Cr Ramps		Amer Pk .		WIS 19 P1		HpkAmP1		Hi X P1k		HpkHi X P1		MkeHpkP1		SRSHpkP1		SRSP1		5in1		5in1P1		6 Alts P1	
		ML	Xing	ML	Xing	ML	Xing	ML	Xing	ML	Xing	ML	Xing	ML	Xing	ML	Xing	ML	Xing	ML	Xing	ML	Xing	ML	Xing	ML	Xing	ML	Xing	ML	Xing	ML	Xing
I-39/90/94	CTH V																																
	WIS 19																																
	US 51																																
	Hoepker																																
	US 151/HCB																																
	I-94 (Badger)																																
I-39/90	US 12/18																																
I-94	Milwaukee St																																
	CTH N																																
US 151	American Pkwy																																
	Grand/Reiner																																
	WIS 19/ Main																																
WIS 30	I-39/90/94 to US 151																																
US 51 North	I-39/90/94 to Hoepker																																
	Hoepker to US 151																																
	US 151 to WIS 30																																
US 51 South	WIS 30 to Cot Gr Rd																																
	Cot Gr Rd to Pflaum																																
	Pflaum to US 12/18																																
	US 12/18 to Voges																																

Critical Forecasted Growth Forecasted Growth Forecasted Decline Check for Impact (May include increases and decreases) No Impact Forecasted

20. US 151 Interchanges with I-39/90/94 & American Parkway Original Alternative 1 – Directional Diamond

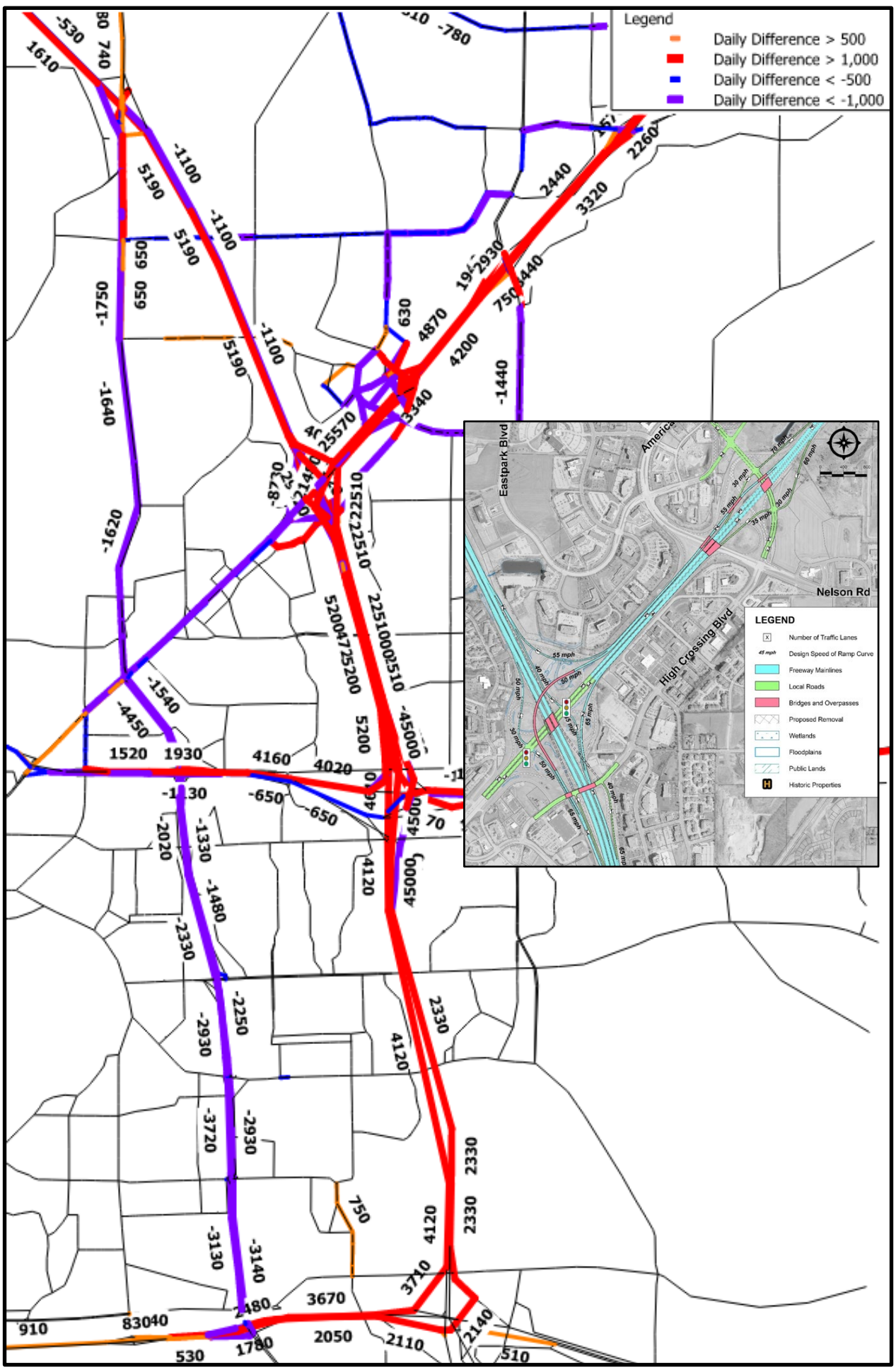
Several alternative designs were assessed at the US 151 interchanges with I-39/90/94 and with American Parkway. The original Alternative 1 design includes the following characteristics:

- Move American Pkwy Interchange to High Crossing/American Family Drive.
- Two signals at East Washington Avenue
- Slows down US 151 traffic approaching East Washington Avenue.

The highest volume traffic movements within the US 151 interchange are to/from I-39/90/94 south of the interchange and US 151 northeast of the Interstate. Alternative 1 is a directional interchange, the primary movements to/from the freeway portion of US 151 are free-flow ramps, but there is also an embedded diamond interchange that services East Washington Avenue. New signals will be needed on either side of the interstate at the diamond interchange ramps. Like most of the alternatives in this area, this alternative aims to keep speeds down at the local road portion of the interchange while allowing for freeway-to-freeway traffic to keep a reasonable rate of speed. The interchange at High Crossing/American Family Drive matches Madison neighborhood plans to connect HC and AmFam Drive. This alternative moves US 151 traffic away from American Pkwy/Nelson Road, which is designed as the main road to American Center. US 151 becomes a conventional diamond interchange with signals.

Figure 16 shows that about 6,000 daily vehicles are diverted from US 51 and from East Washington Avenue to I-39/90/94 and to WIS 30.

Figure 16 2050 Daily Traffic Volume Shifts with original Alternative 1



21. US 151 Interchanges with I-39/90/94 & American Parkway Alternative 2 – Loop Ramp Freeflow

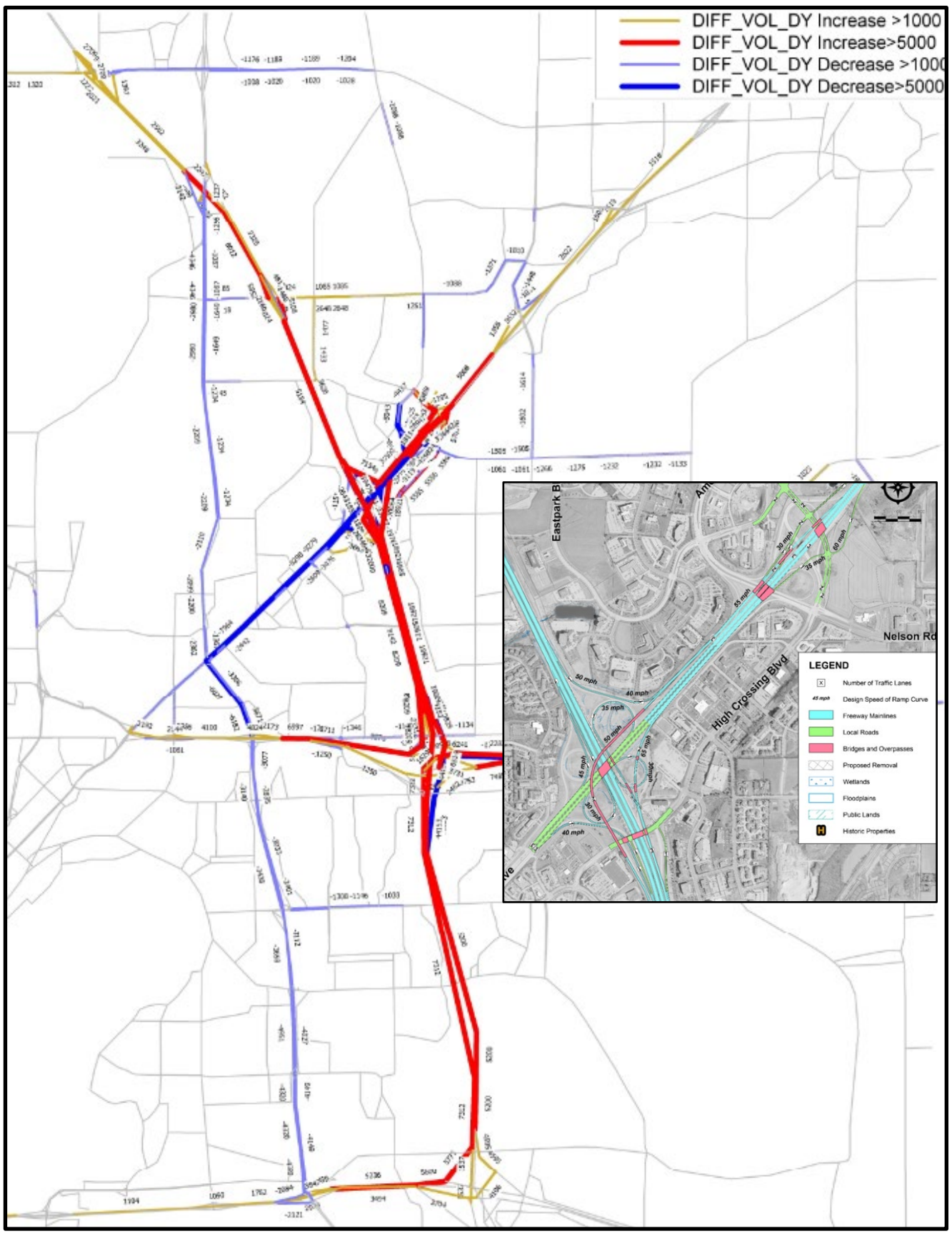
The Alternative 2 design for the US 151 interchanges with I-39/90/94 and with American Parkway includes the following characteristics:

- Move American Parkway interchange to High Crossing Blvd/American Family Drive.
- Freeflow loop ramps replace traffic signals.
- US 151 to southbound I-90 traffic flyover

Alternative 2 is a loop ramp free-flow interchange that is somewhat similar to the existing cloverleaf design that exists today except the two primary movements from South-to-East and from East-to-South are allowed freeflow movements for better operations. US 151 traffic travels through the I-39/90/94 & US 151 interchange without having to go through a controlled intersection before accessing East Washington. This alternative most closely resembles the current design but fixes the two pinch points with the East-to-South and South-to-East ramps. The loops reduce flexibility with the East-to-South flyover and getting it under High Crossing Blvd. Alternative 2 moves US 151 traffic away from American Pkwy/Nelson Road, which is designed as the main road to American Center. This alternative maintains the system interchange westbound on East Washington at higher speeds.

Figure 17 shows that about 8,000 daily vehicles are diverted from US 51 and from East Washington Avenue to I-39/90/94 and to WIS 30.

Figure 17 2050 Daily Traffic Volume Shifts with Alternative 2



22. US 151 Interchanges with I-39/90/94 & American Parkway Alternative 3 – East Washington Blvd - South

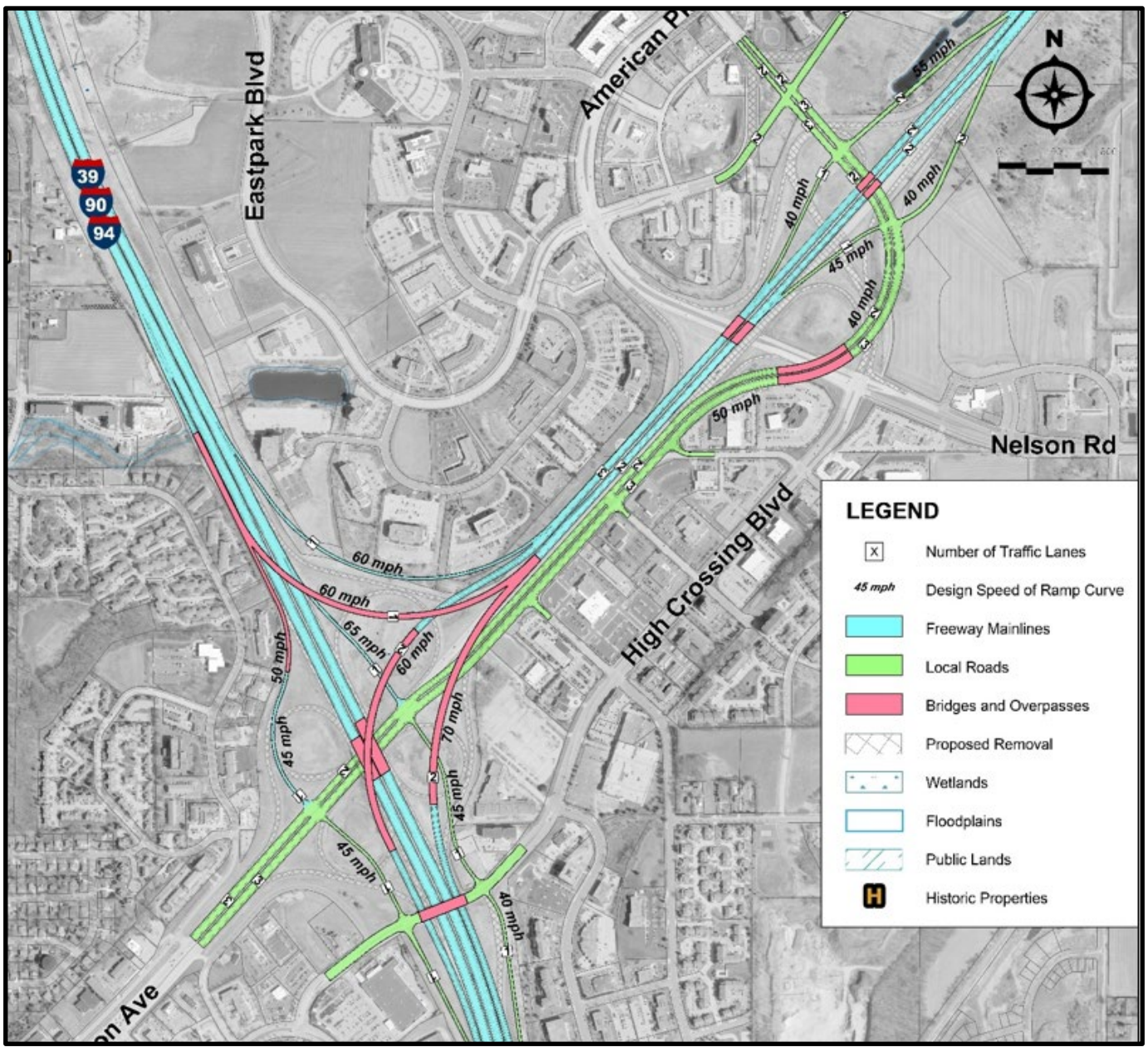
The Alternative 3 design for the US 151 interchanges with I-39/90/94 and with American Parkway includes the following characteristics:

- Extend East Washington Avenue into the business park connecting American Family Drive.
- Two signals at East Washington Avenue.
- High Crossing Blvd access from the north.
- East Washington Avenue extension increases local connectivity and redevelopment prospects.

Alternative 3 separates the movements of East Washington Avenue from US 151 to the east. The movements to the east are treated like a system interchange with freeflow movements while the combination of High Crossing Boulevard and East Washington Avenue forms a split diamond interchange. Alternative 3 extends East Washington Avenue to replace what is now Wayne Terrace and ties into an extension of American Family Drive. This would allow for better connectivity between the neighborhoods east and west of the interstate. This alternative also moves the interchange that is currently at American Parkway/Nelson Road to American Family Drive/East Washington Avenue. Alternative has three flyover ramps at the US 151 interchange. The East Washington Avenue extension provides connections in High Crossing Blvd area, as well as a direct urban connection to American Center.

This alternative is not high on the consideration list as traffic will excessively queue at the Tancho intersection and the off-ramp to American Family Drive. Three intersections here are just too closely spaced. Therefore, a traffic difference plot was not created for this Alternative. Figure 18 shows the Alternative 3 design.

Figure 18 2050 Alternative 3 Interchange Design



23. US 151 Interchanges with I-39/90/94 & American Parkway Alternative 4 – East Washington Blvd – North

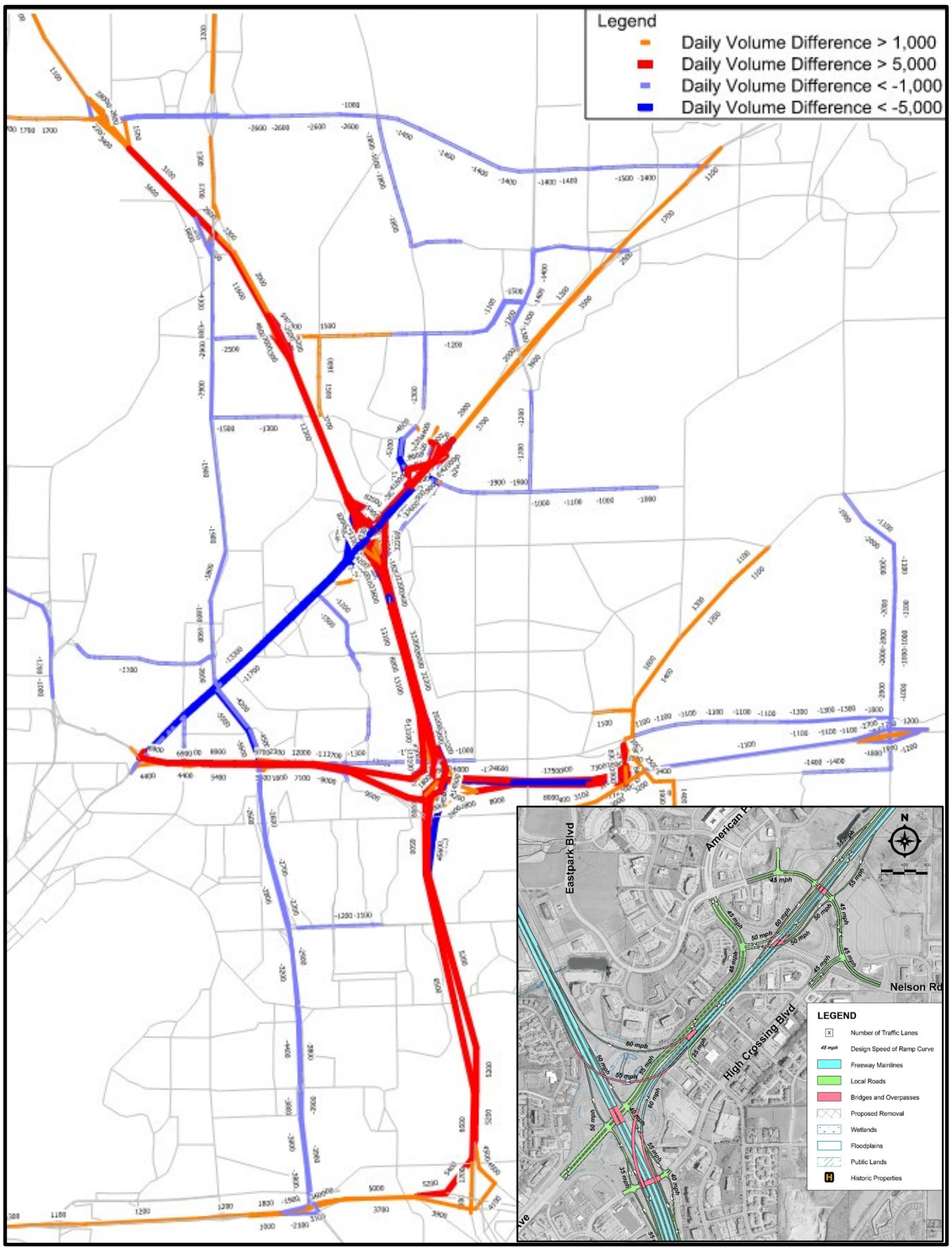
The Alternative 4 design for the US 151 interchanges with I-39/90/94 and with American Parkway includes the following characteristics:

- Extend East Washington Avenue into business park connecting to American Parkway.
- Two signals at East Washington Avenue.
- High Crossing Blvd access from the north.
- East Washington extension connects to American Center.

Alternative 4 extends East Washington Avenue to the east, but ties it into American Parkway rather than American Family Drive. This alternative also reroutes Nelson Road to tie into Eastpark Boulevard, with access to American Family Drive. Similar to Alternative 3, this alternative also moves the current American Parkway/Nelson Road interchange to the northeast to the realigned Nelson Road/Eastpark Boulevard. The Nelson Road/American Family Drive interchange opens up new parcels for development. High Crossing Blvd is a split diamond with the Interstate, but East Washington Avenue has direct connect ramps to/from the south. East Washington Avenue extension provides direct urban connection to American Center, but the extension doesn't provide new urban development opportunities.

Figure 19 shows that about 20,000-25,000 daily vehicles are diverted from US 51 and from East Washington Avenue to I-39/90/94 and to WIS 30.

Figure 19 2050 Daily Traffic Volume Shifts with Alternative 4



24. US 151 Interchanges with I-39/90/94 & American Parkway Alternative 5 – East Washington Blvd – High Crossing Blvd

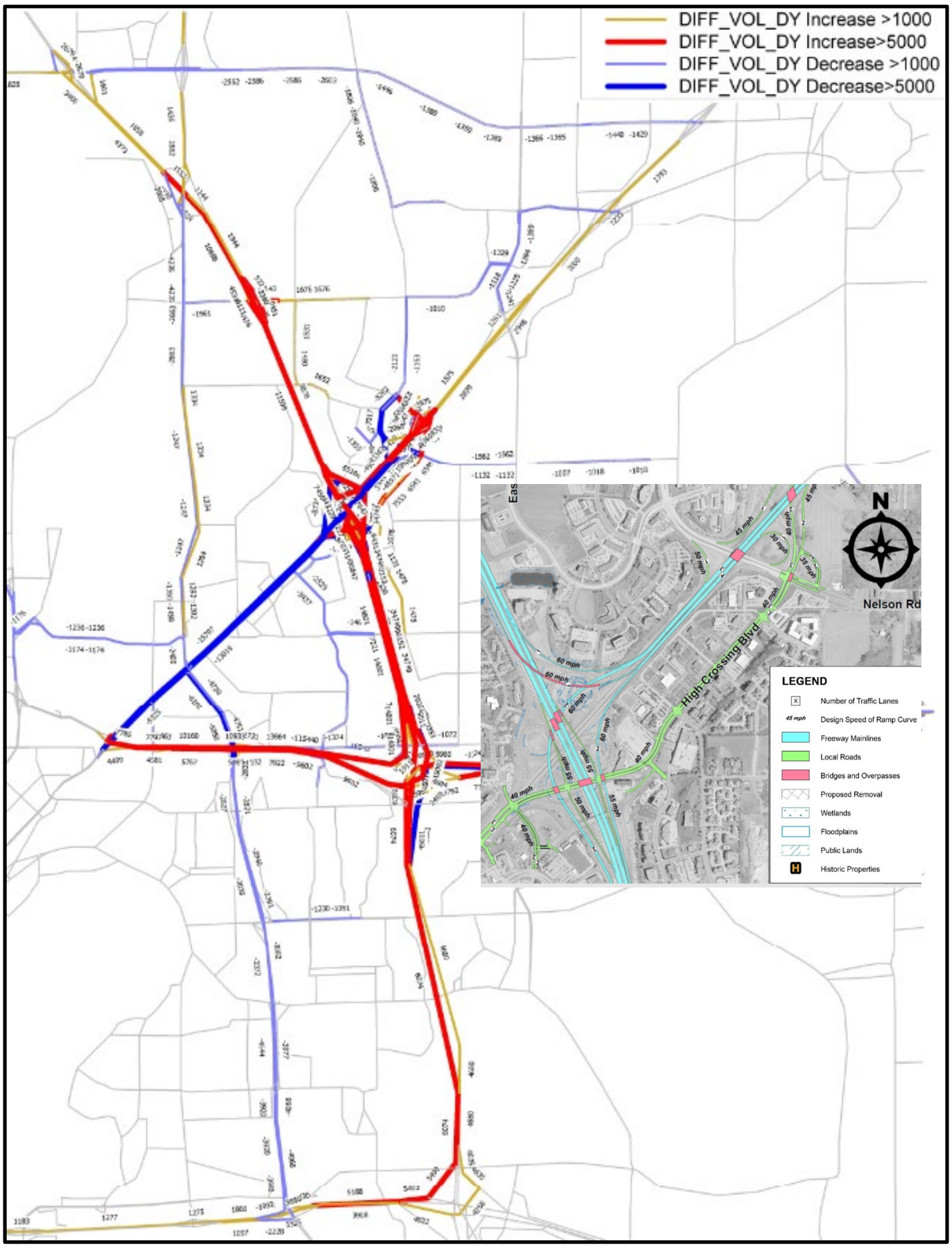
The Alternative 5 design for the US 151 interchanges with I-39/90/94 and with American Parkway includes the following characteristics:

- Extend East Washington Avenue to High Crossing Blvd into American Parkway.
- High Crossing Blvd becomes an extension of East Washington Avenue.
- Two signals at East Washington Avenue/High Crossing Blvd.
- Many freeflow ramps go below I-39/90/94.
- Increases local connectivity and redevelopment opportunities.

Alternative 5 uses existing High Crossing Boulevard to extend East Washington Avenue. This creates a lower speed transition into the City of Madison. High Crossing Blvd would be expanded to 6 lanes, within the existing right-of-way. Compared to Alternatives 3 and 4, it reduces the structure complexity and cost for the backbone directional ramps with 3 of the 4 ramps being at existing ground level. Alternative 5 extends and provides the potential for bicycle and pedestrian access beyond the Interstate to the Nelson Road area and a connection to the Daniel Morgan Path. This alternative provides a full diamond interchange between I-39/90/94 and East Washington Avenue/High Crossing Boulevard. This will provide direct access to both eastbound and westbound Interstate for businesses along High Crossing Boulevard. The US 151 southbound connection to East Washington Avenue is a free flow movement with geometry to reduce speeds. The partial jug handle interchange at Nelson Road provides a free flow connection for northbound East Washington Avenue/High Crossing Boulevard traffic to northbound US 151. Alternative 5 provides an improved connection to Hayes Road compared to the current frontage road intersections. This alternative also creates available land in the area of the current interchange loop ramps for potential additional development, stormwater facilities, or a park and ride lot. Access to the American Center area will be re-directed by use of the proposed East Washington Boulevard/High Crossing Blvd. The East Washington Avenue extension provides a direct urban connection to American Center and opens up High Crossing Blvd.

Figure 20 shows that about 25,000-28,000 daily vehicles are diverted from US 51 and from East Washington Avenue to I-39/90/94 and to WIS 30.

Figure 20 2050 Daily Traffic Volume Shifts with Alternative 5



25. US 151 Interchanges with I-39/90/94 & American Parkway Preferred Alternative 1

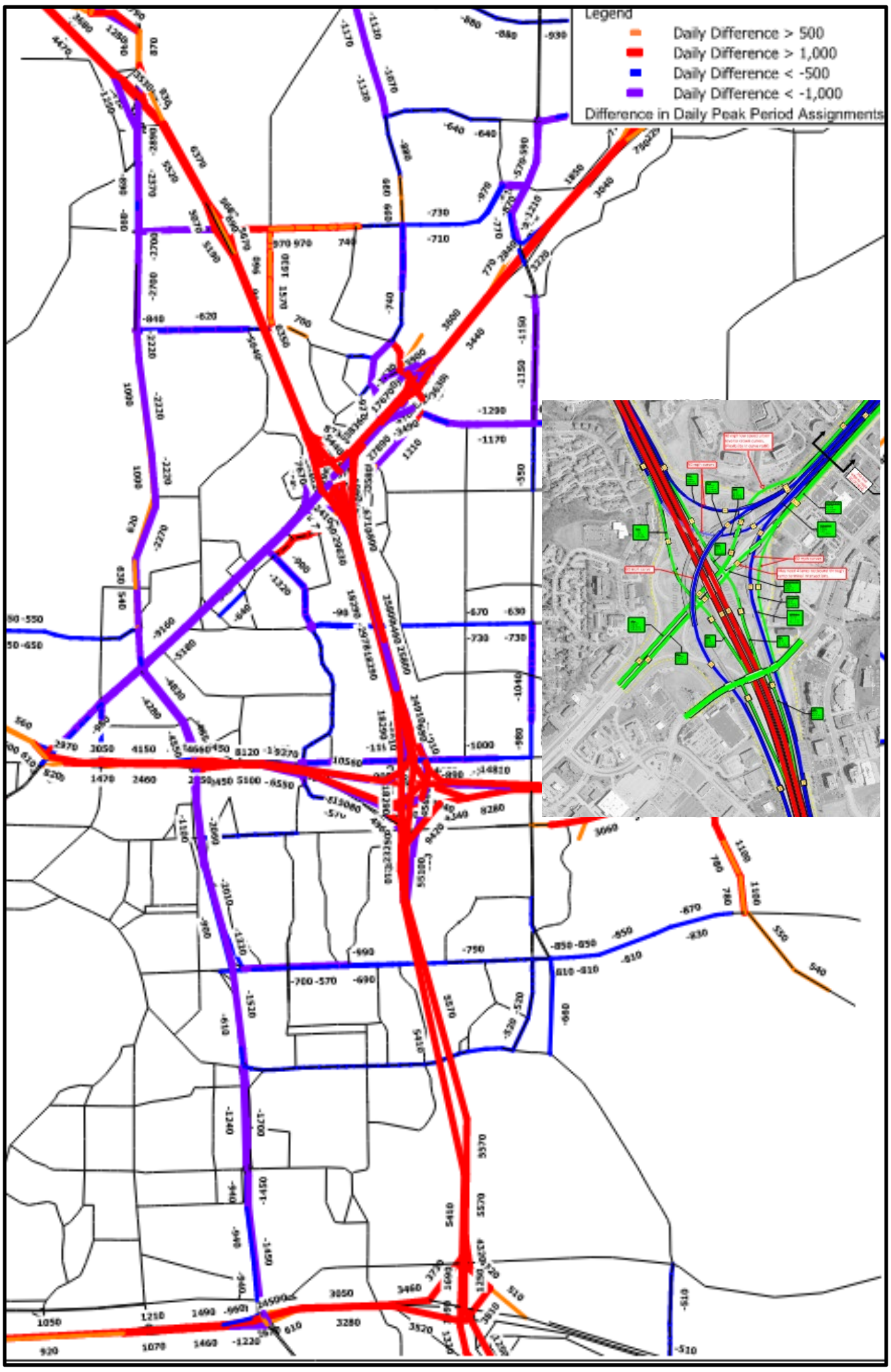
The Preferred Alternative 1 design for the US 151 interchanges with I-39/90/94 and with American Parkway includes the following characteristics:

- Mover American Pkwy Interchange to High Crossing/American Family Drive.
- Replace the loop ramps at US 151/East Washington Avenue with a conventional diamond with two signals at East Washington Avenue.
- High Crossing Blvd remains a half-diamond interchange with no connection to/from East Washington Avenue.
- Four flyover ramps that directly connect I-39/90/94 and US 151 to/from the east.

The highest volume traffic movements within the US 151 interchange are to/from I-39/90/94 south of the interchange and US 151 northeast of the Interstate. Four flyover ramps that directly link I-39/90/94 to US 151 to and from east are part of the preferred Alternative 1. Additionally, there is an embedded diamond interchange that services East Washington Avenue that replaces the loop ramps. New signals will be needed on either side of the interstate at the East Washington Avenue diamond interchange ramps. Like most of the alternatives in this area, this alternative aims to keep speeds down at the local road portion of the interchange while allowing for freeway-to-freeway traffic to keep a reasonable rate of speed. The interchange at High Crossing/American Family Drive matches Madison neighborhood plans to connect HC and AmFam Drive.

Figure 21 shows that about 13,000-18,000 daily vehicles are diverted from US 51 and from East Washington Avenue to I-39/90/94 and to WIS 30.

Figure 21 2050 Daily Traffic Volume Shifts with Preferred Alternative 1



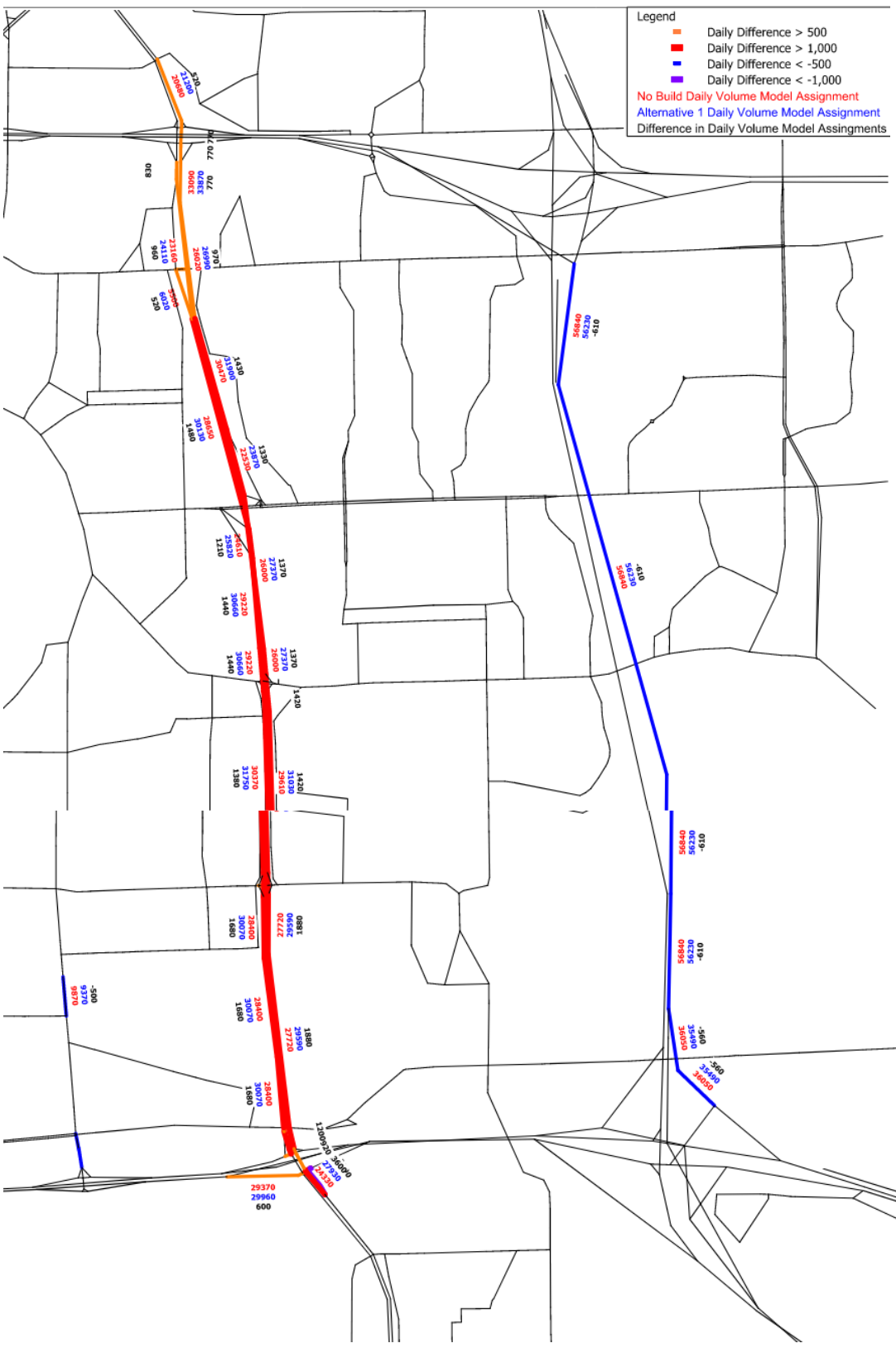
26. US 51 South Alternative 1 – US 51 Expansion only

This is a more current Stoughton Road South alternative, compared to the older scenario test shown in Section 6. The US 51 South Alternative 1 includes the following characteristics:

- Expansion of US 51 South from 4 lanes to 6 lanes between WIS 30 to the Beltline.
- The posted speed of US 51 South remains the same as existing conditions. Capacity is increased due to the lane expansion.

The US 51 South Alternative 1 includes an expansion of US 51 and no other change to US 51. However, the expansion increases the total capacity from 3,680 to 5,520 vehicles per hour per lane in each direction. Figure 22 shows the daily volume impact of Alternative 1 compared to the No Build conditions. It shows that US 51 South increases by about 3,000 daily vehicles with Alternative 1 in place. Adjacent north-south corridors such as I-39/90 decrease.

Figure 22 2050 US 51 South Daily Traffic Volume Shifts with Alternative 1



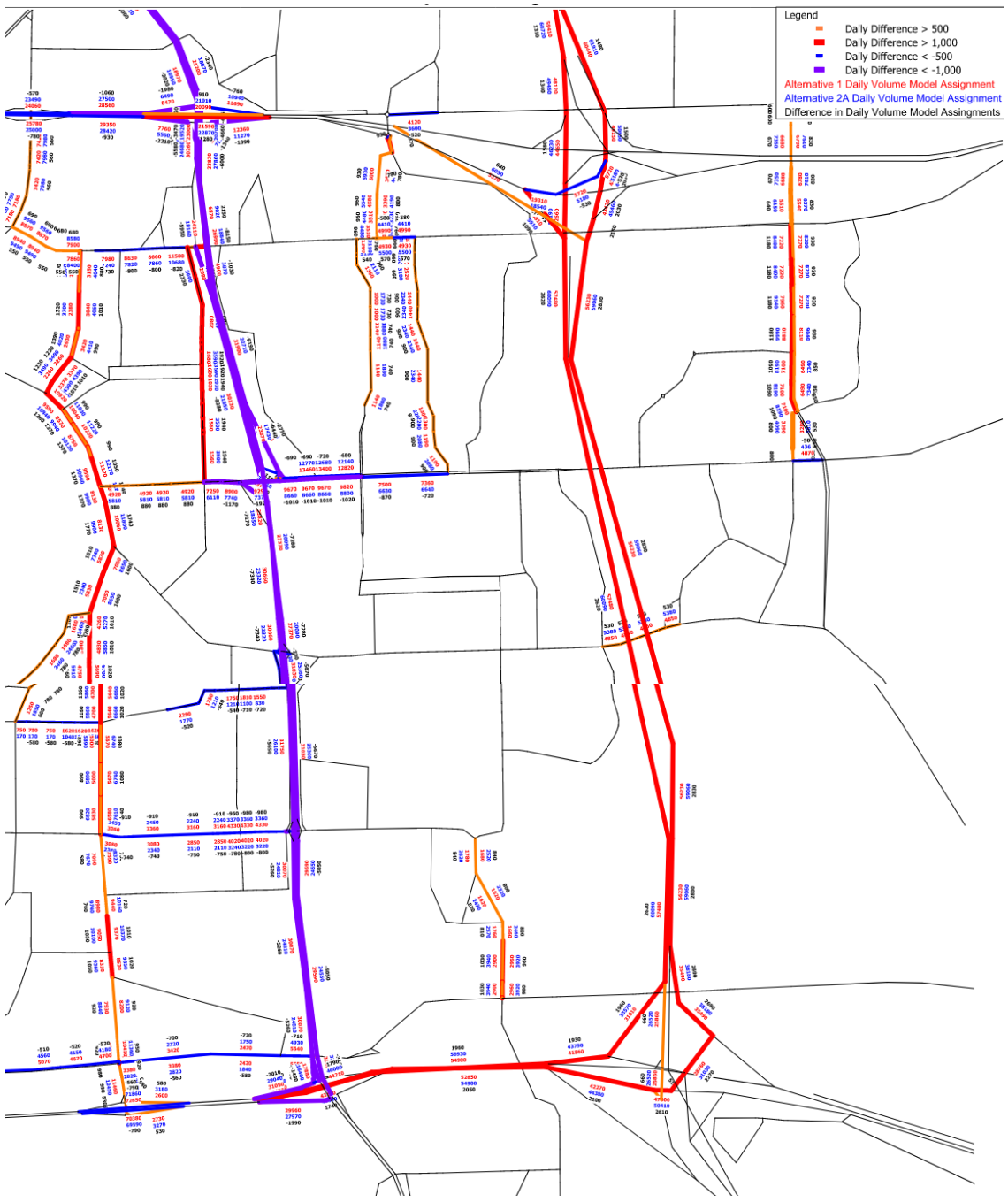
27. US 51 South Alternative 2A – US 51 Expansion & Coded as Urban Expressway

This is a more current Stoughton Road South alternative, compared to the older scenario test shown in Section 6. The US 51 South Alternative 2A includes the following characteristics:

- Expansion of US 51 South from 4 lanes to 6 lanes between WIS 30 to the Beltline.
- The posted speed of US 51 South is decreased from 55 mph to 35 mph. This speed reduction is represented in the model by coding US 51, between WIS 30 and the Beltline, as an Urban Expressway, which reduces the model speed to 42 mph and the capacity per lane to 1,350 vehicles per lane.

US 51 South Alternative 2A codes US 51 South from WIS 30 to the Beltline as an Urban Expressway rather than as a Suburban Expressway. This lowers the model speed from 55 mph to 42 mph between WIS 30 and Buckeye Road, and from 48 mph to 42 mph between Buckeye Road and the Beltline. In addition, the capacity per lane along US 51 between WIS 30 to the Beltline is reduced from 1,840 vehicles per hour per lane to 1,350 vehicles per hour per lane. However, the overall capacity has actually increased from 3,680 vehicles per hour per lane to 4,050 vehicles per hour per lane in each direction due to the lane expansion from 4 lanes to 6 lanes. Figure 23 shows the daily volume impact of Alternative 2A compared to Alternative 1 conditions. It shows that US 51 South decreases by about 10,000 to 17,000 vehicles per day with Alternative 2A in place compared to Alternative 1 conditions, which is closer to existing daily levels. Adjacent north-south corridors such as I-39/90 and Monona Drive increase. Other arterial streets also increase, including Dempsey Road, Acewood Blvd, Walter Street, Sprecher Road, and Agriculture Drive.

Figure 23 2050 US 51 South Daily Traffic Volume Shifts with Alternative 2A



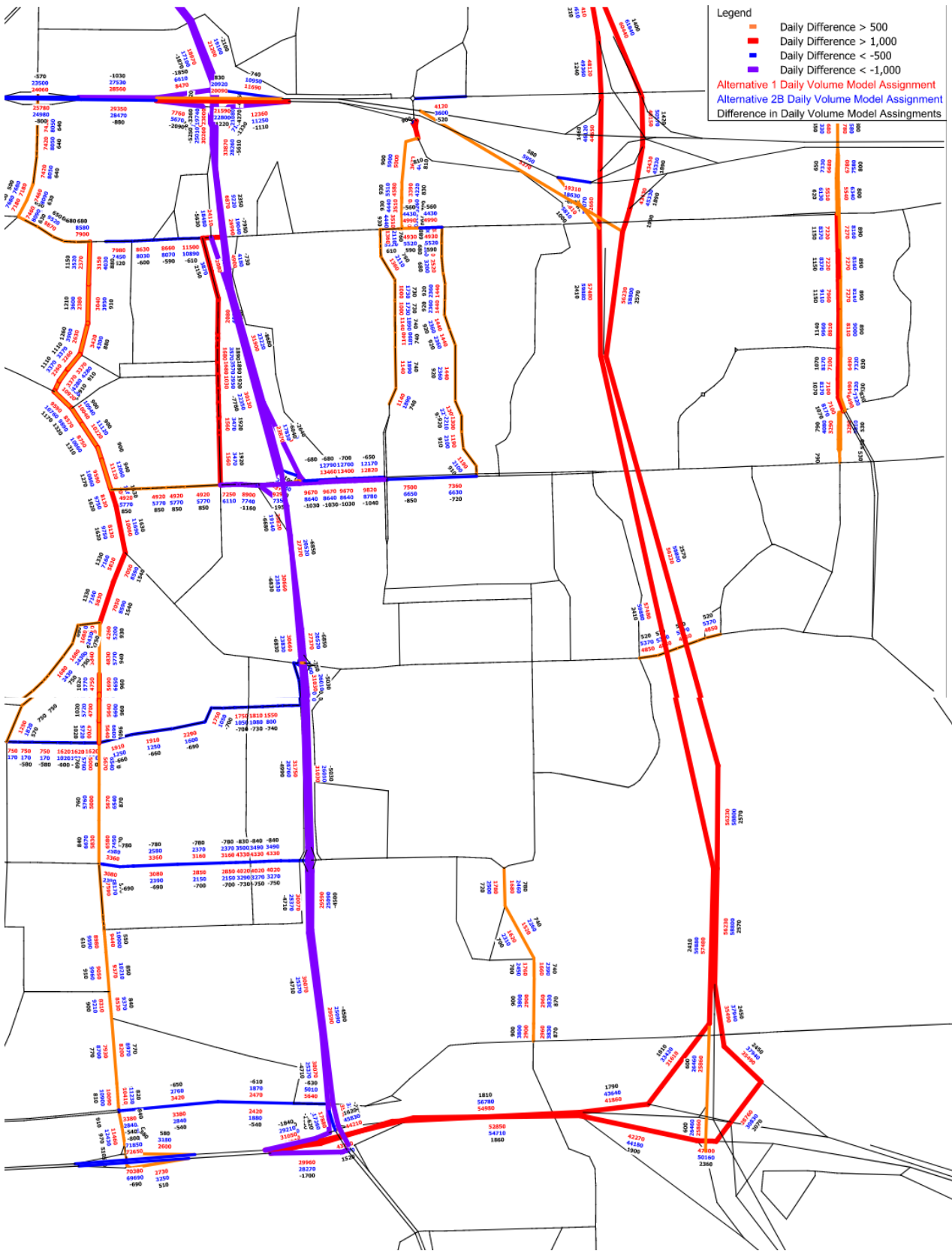
28. US 51 South Alternative 2B – US 51 Expansion & Coded as Suburban Expressway with 42 mph User Speed

This is a more current Stoughton Road South alternative, compared to the older scenario test shown in Section 6. The US 51 South Alternative 2B includes the following characteristics:

- Expansion of US 51 South from 4 lanes to 6 lanes between WIS 30 to the Beltline.
- The posted speed of US 51 South is decreased from 55 mph to 35 mph. This speed reduction is represented in the model by keeping US 51, between WIS 30 and the Beltline, as a Suburban Expressway, however with a 42 mph user speed designation.

US 51 South Alternative 2B keeps US 51 South from WIS 30 to the Beltline as a Suburban Expressway in the model, however with a user speed of 42 mph. This lowers the model speed from 55 mph to 42 mph between WIS 30 and Buckeye Road, and from 48 mph to 42 mph between Buckeye Road and the Beltline. The capacity per lane stays at 1,840 per hour per lane throughout the corridor, however the overall capacity increases from 3,680 vehicles to 5,520 vehicles per hour per lane in each direction due to the lane expansion from 4 lanes to 6 lanes. Figure 24 shows the daily volume impact of Alternative 2B compared to Alternative 1 conditions. It shows that US 51 South decreases by about 9,000 to 16,000 vehicles per day with Alternative 2B in place compared to Alternative 1 conditions, which is closer to existing daily levels. Adjacent north-south corridors such as I-39/90 and Monona Drive increase. Adjacent north-south corridors such as I-39/90 and Monona Drive increase. Other arterial streets also increase, including Dempsey Road, Acewood Blvd, Walter Street, Sprecher Road, and Agriculture Drive.

Figure 24 2050 US 51 South Daily Traffic Volume Shifts with Alternative 2B



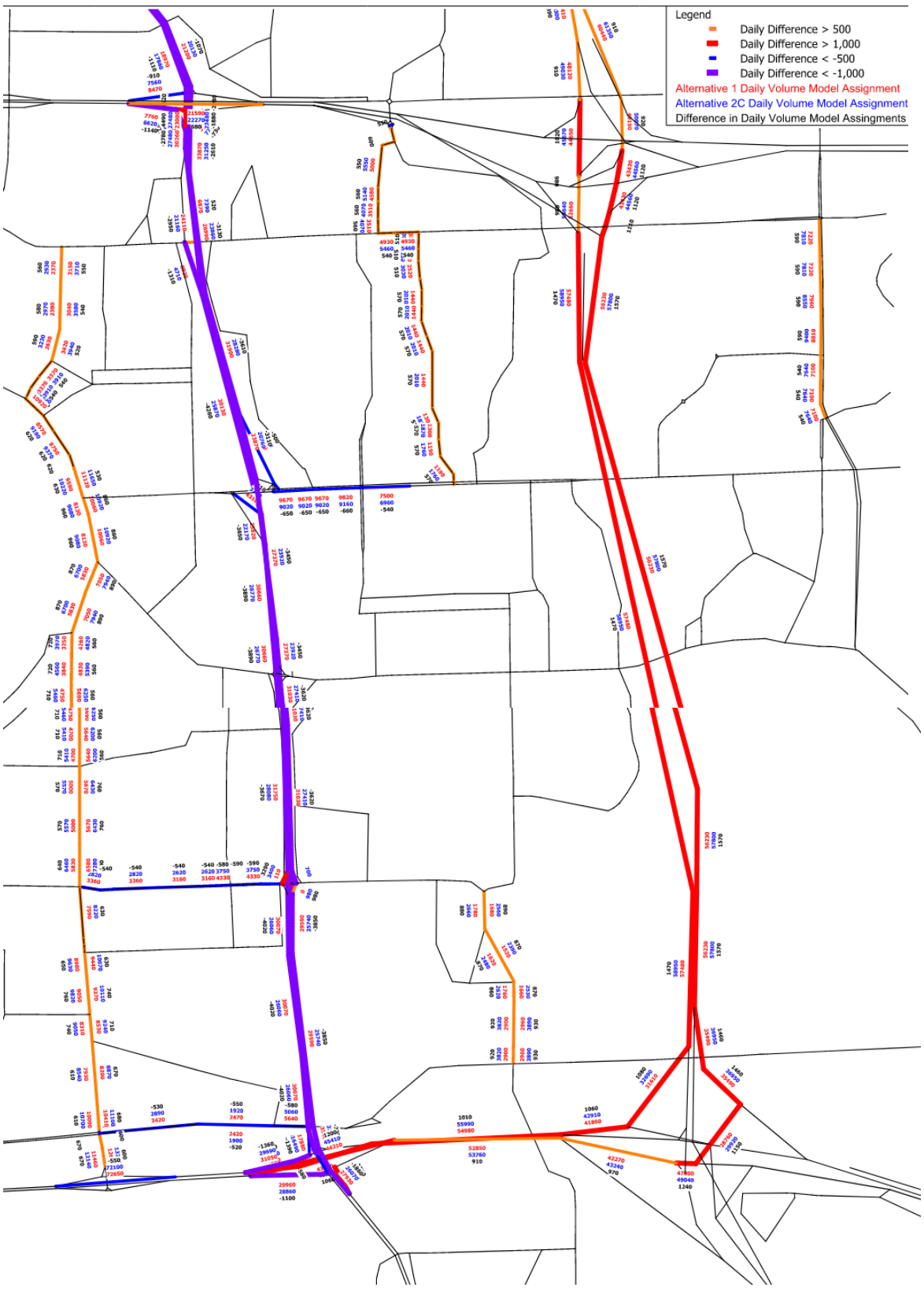
29. US 51 South Alternative 2C – US 51 Expansion and Coded as Suburban Expwy in North & Urban Expwy in South

This is a more current Stoughton Road South alternative, compared to the older scenario test shown in Section 6. The US 51 South Alternative 2C includes the following characteristics:

- Expansion of US 51 South from 4 lanes to 6 lanes between WIS 30 to the Beltline.
- The posted speed of US 51 South is decreased from 55 mph to 35 mph. This speed reduction is represented in the model by keeping US 51, between WIS 30 and Buckeye Road as a Suburban Expressway, however removing the 55 mph user speed, and by changing US 51 between Buckeye Road and the Beltline to an Urban Expressway.

US 51 South Alternative 2C keeps US 51 South from WIS 30 to Buckeye Road as a Suburban Expressway in the model, however it removes the 55 mph user speed, thereby reducing the model speed to 42 mph. Between Buckeye Road and the Beltline, US 51 is changed from a Suburban Expressway to an Urban Expressway in the model. This lowers the model speed from 48 mph to 42 mph between Buckeye Road and the Beltline. The capacity per lane per hour stays at 1,840 between WIS 30 and Buckeye Road, but is lowered from 1,840 to 1,350 per hour per lane between Buckeye Road and the Beltline. However, the overall capacity increases from 3,680 vehicles per hour per lane in each direction to 5,520 vehicles per hour per lane in each direction between WIS 30 and Buckeye Road and to 4,050 vehicles per hour per lane between Buckeye Road and the Beltline due to the lane expansion from 4 lanes to 6 lanes. Figure 25 shows the daily volume impact of Alternative 2C compared to Alternative 1 conditions. It shows that US 51 South decreases by about 7,000 to 8,000 vehicles per day with Alternative 2 in place compared to Alternative 1 conditions. Adjacent north-south corridors such as I-39/90 and Monona Drive increase. Other arterial streets also increase, including Dempsey Road, Acewood Blvd, Walter Street, Sprecher Road, and Agriculture Drive.

Figure 25 2050 US 51 South Daily Traffic Volume Shifts with Alternative 2C



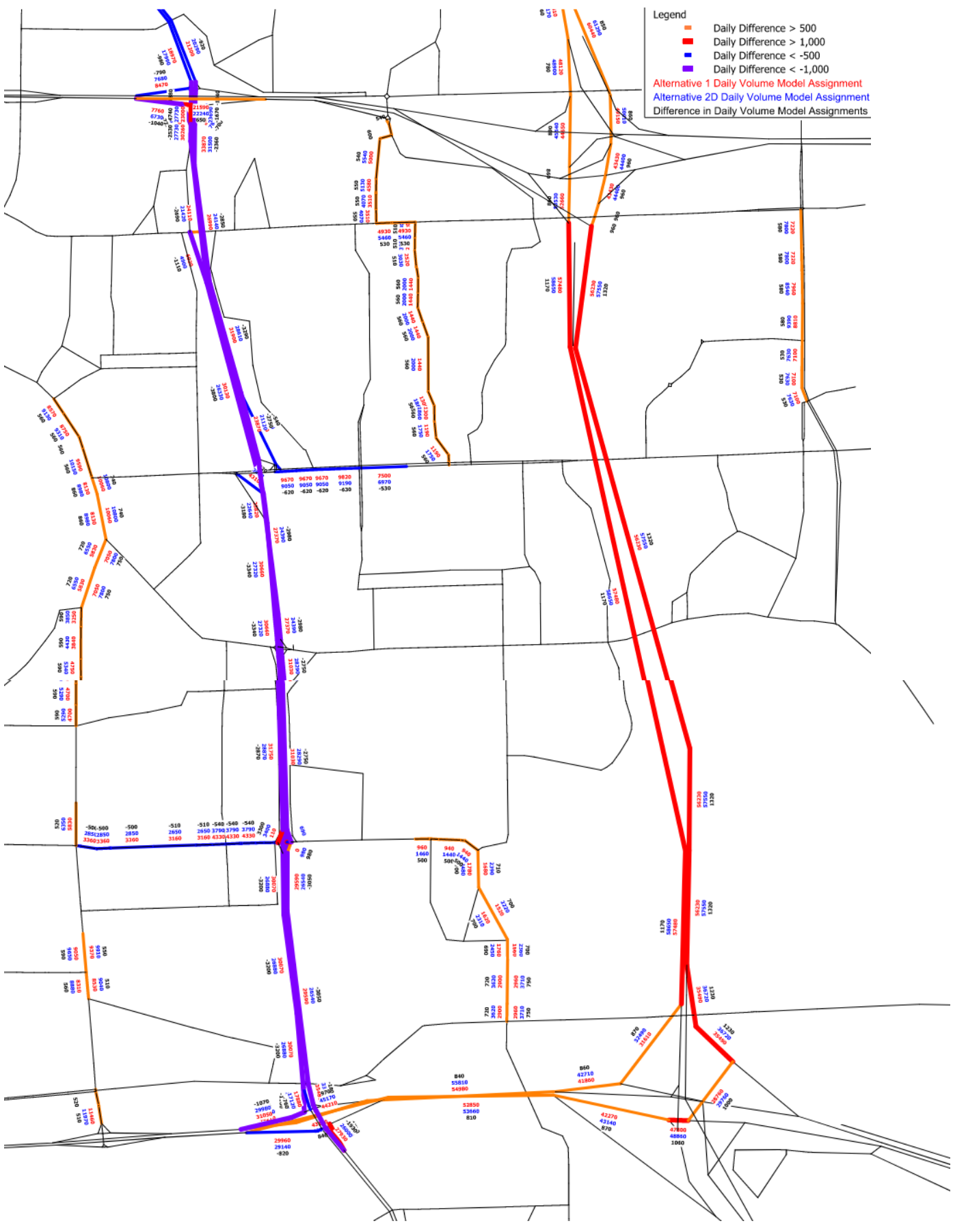
30. US 51 South Alternative 2D – US 51 Expansion & Coded as Suburban Expwy with User Speeds of 48 mph (in the North) & 42 mph (in the South)

This is a more current Stoughton Road South alternative, compared to the older scenario test shown in Section 6. The US 51 South Alternative 2D includes the following characteristics:

- Expansion of US 51 South from 4 lanes to 6 lanes between WIS 30 to the Beltline.
- The posted speed of US 51 South is decreased from 55 mph to 35 mph. This speed reduction is represented in the model by keeping US 51, between WIS 30 and Buckeye Road as a Suburban Expressway, however changing the 55 mph user speed to 48 mph between WIS 30 and Buckeye Road, and by adding a user speed of 42 mph along US 51 between Buckeye Road and the Beltline.

US 51 South Alternative 2D keeps US 51 South from WIS 30 to the Beltline as a Suburban Expressway in the model, however it changes the 55 mph user speed to 48 mph between WIS 30 and Buckeye Road. Additionally, between Buckeye Road and the Beltline, a user speed of 42 mph is included. These changes reduce the speeds along the US 51 South corridor from 55 mph in the north and 48 mph in the south to 48 mph in the north and 42 mph in the south. The capacity per hour per lane along US 51 stays at 1,840, however the overall capacity per hour per lane is increased from 3,680 to 5,520 in each direction due to the lane expansion from 4 lanes to 6 lanes. Figure 26 shows the daily volume impact of Alternative 2D compared to Alternative 1 conditions. It shows that US 51 South decreases by about 6,000 to 7,000 vehicles per day with Alternative 2D in place compared to Alternative 1 conditions. Adjacent north-south corridors such as I-39/90 and Monona Drive increase. Other arterial streets show an increase, such as Acewood Blvd, Sprecher Road, and Agriculture Drive, but not to the extent observed under Alternatives 2A, 2B, and 2C.

Figure 26 2050 US 51 South Daily Traffic Volume Shifts with Alternative 2D



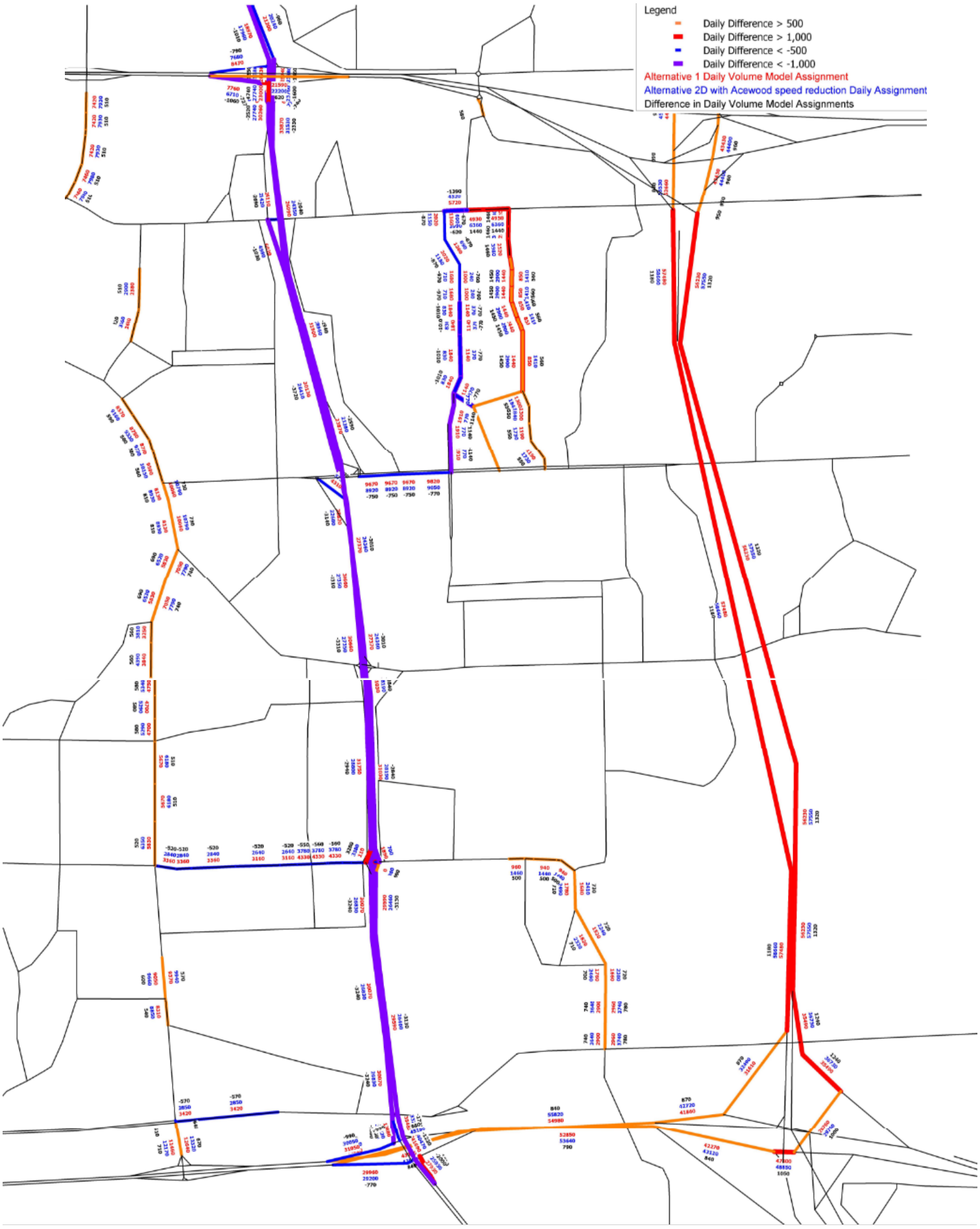
31. US 51 South Alternative 2D.1 – US 51 Expansion & Coded as Suburban Expwy with User Speeds of 48 mph (in the North) & 42 mph (in the South) with Acewood Blvd Speed Reduction

This is a more current Stoughton Road South alternative, compared to the older scenario test shown in Section 6. The US 51 South Alternative 2D.1 with Acewood Blvd Speed Reduction includes the following characteristics:

- Expansion of US 51 South from 4 lanes to 6 lanes between WIS 30 to the Beltline.
- The posted speed of US 51 South is decreased from 55 mph to 35 mph. This speed reduction is represented in the model by keeping US 51, between WIS 30 and Buckeye Road as a Suburban Expressway, however changing the 55 mph user speed to 48 mph between WIS 30 and Buckeye Road, and by adding a user speed of 42 mph along US 51 between Buckeye Road and the Beltline.
- Acewood Blvd input model speed is reduced from 30 mph to 25 mph between Milwaukee Street and Buckeye Road. This speed reduction accounts for potential City of Madison efforts as part of the Vision Zero program.

US 51 South Alternative 2D.1 keeps US 51 South from WIS 30 to the Beltline as a Suburban Expressway in the model, however it changes the 55 mph user speed to 48 mph between WIS 30 and Buckeye Road. Additionally, between Buckeye Road and the Beltline, a user speed of 42 mph is included. These changes reduce the speeds along the US 51 South corridor from 55 mph in the north and 48 mph in the south to 48 mph in the north and 42 mph in the south. The capacity per hour per lane along US 51 stays at 1,840, however the overall capacity per hour per lane is increased from 3,680 to 5,520 in each direction due to the lane expansion from 4 lanes to 6 lanes. The model input speed along Acewood Blvd is also reduced from 30 mph to 25 mph. Figure 27 shows the daily volume impact of Alternative 2D with Acewood Blvd speed reduction compared to Alternative 1 conditions. It shows that US 51 South decreases by about 6,000 to 7,000 vehicles per day with Alternative 2D in place compared to Alternative 1 conditions. Adjacent north-south corridors such as I-39/90 and Monona Drive increase. Acewood Blvd volumes decrease by approximately 2,000 vehicles per day and divert to Meadowlark Drive.

Figure 27 2050 US 51 South Daily Traffic Volume Shifts with Alternative 2D.1 with Acewood Blvd Speed Reduction



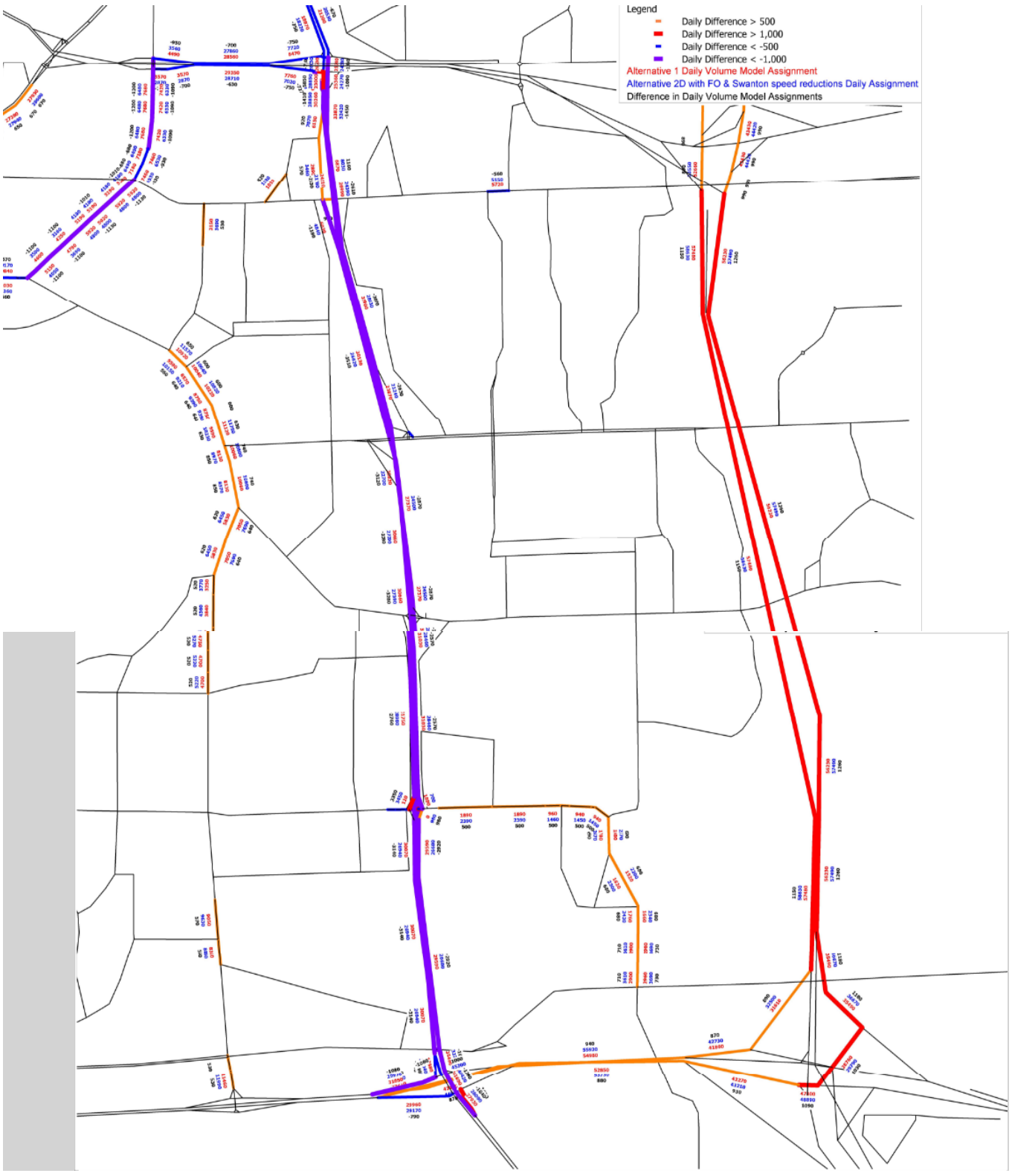
32. US 51 South Alternative 2D.2 – US 51 Expansion & Coded as Suburban Expwy with User Speeds of 48 mph (in the North) & 42 mph (in the South) with Fair Oaks Avenue and Swanton Road Speed Reductions

This is a more current Stoughton Road South alternative, compared to the older scenario test shown in Section 6. The US 51 South Alternative 2D.2 includes the following characteristics:

- Expansion of US 51 South from 4 lanes to 6 lanes between WIS 30 to the Beltline.
- The posted speed of US 51 South is decreased from 55 mph to 35 mph. This speed reduction is represented in the model by keeping US 51, between WIS 30 and Buckeye Road as a Suburban Expressway, however changing the 55 mph user speed to 48 mph between WIS 30 and Buckeye Road, and by adding a user speed of 42 mph along US 51 between Buckeye Road and the Beltline.
- Model input speeds are reduced from 38 mph to 30 mph along Fair Oaks Avenue between WIS 30 and Atwood Avenue, and along Swanton Road between Thompson Drive and Milwaukee Street. These speed reductions account for potential City of Madison efforts as part of the Vision Zero program.

US 51 South Alternative 2D.2 keeps US 51 South from WIS 30 to the Beltline as a Suburban Expressway in the model, however it changes the 55 mph user speed to 48 mph between WIS 30 and Buckeye Road. Additionally, between Buckeye Road and the Beltline, a user speed of 42 mph is included. These changes reduce the speeds along the US 51 South corridor from 55 mph in the north and 48 mph in the south to 48 mph in the north and 42 mph in the south. The capacity per hour per lane along US 51 stays at 1,840, however the overall capacity per hour per lane is increased from 3,680 to 5,520 in each direction due to the lane expansion from 4 lanes to 6 lanes. Also, model speeds along Fair Oaks Avenue and Swanton Road are reduced from 38 mph to 30 mph. Figure 28 shows the daily volume impact of Alternative 2D compared to Alternative 1 conditions. It shows that US 51 South decreases by about 6,000 to 7,000 vehicles per day with Alternative 2D in place compared to Alternative 1 conditions. Adjacent north-south corridors such as I-39/90 and Monona Drive increase. Daily volumes along Fair Oaks Avenue decrease by about 2,000 vehicles.

Figure 28 2050 US 51 South Daily Traffic Volume Shifts with Alternative 2D.2 with Fair Oaks Avenue & Swanton Road Speed Reductions



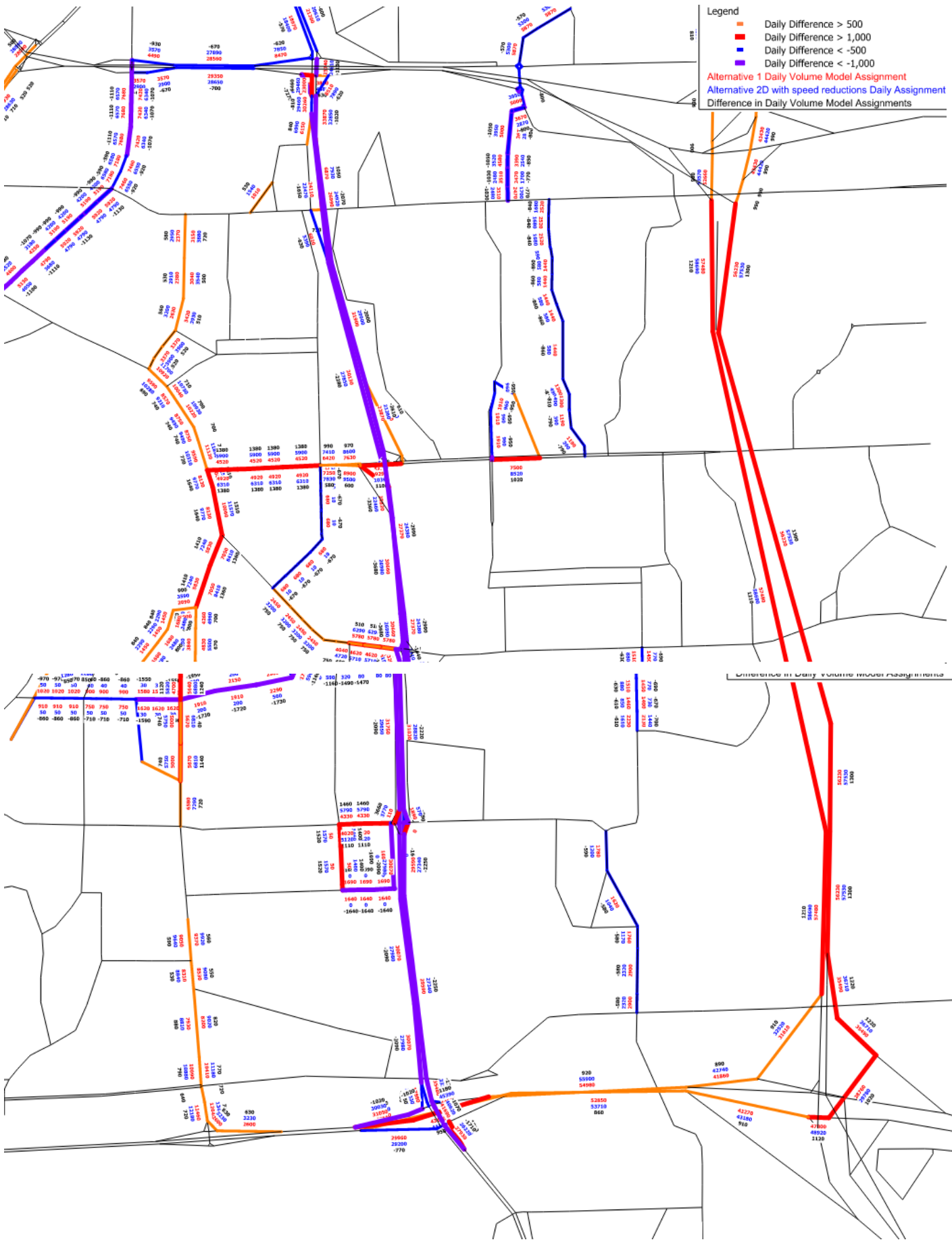
33. US 51 South Alternative 2D.3 – US 51 Expansion & Coded as Suburban Expwy with User Speeds of 48 mph (in the North) & 42 mph (in the South) with All Arterial Speed Reductions

This is a more current Stoughton Road South alternative, compared to the older scenario test shown in Section 6. The US 51 South Alternative 2D.3 includes the following characteristics:

- Expansion of US 51 South from 4 lanes to 6 lanes between WIS 30 to the Beltline.
- The posted speed of US 51 South is decreased from 55 mph to 35 mph. This speed reduction is represented in the model by keeping US 51, between WIS 30 and Buckeye Road as a Suburban Expressway, however changing the 55 mph user speed to 48 mph between WIS 30 and Buckeye Road, and by adding a user speed of 42 mph along US 51 between Buckeye Road and the Beltline.
- Model input speeds are reduced at several arterials, including the speed reductions on Acewood Blvd, Swanton Road, and Fair Oaks Avenue described in the previous two alternatives, with further reductions along Dempsey Road, Atlas Avenue, Meadowlark Drive, Merryturn Road, Allis Avenue/Dean Avenue, Tomkins Drive, Femrite Drive, Agriculture Drive, and Vondron Road, which are all reduced to 25 mph. These speed reductions account for potential City of Madison efforts as part of the Vision Zero program.

US 51 South Alternative 2D.3 keeps US 51 South from WIS 30 to the Beltline as a Suburban Expressway in the model, however it changes the 55 mph user speed to 48 mph between WIS 30 and Buckeye Road. Additionally, between Buckeye Road and the Beltline, a user speed of 42 mph is included. These changes reduce the speeds along the US 51 South corridor from 55 mph in the north and 48 mph in the south to 48 mph in the north and 42 mph in the south. The capacity per hour per lane along US 51 stays at 1,840, however the overall capacity per hour per lane is increased from 3,680 to 5,520 in each direction due to the lane expansion from 4 lanes to 6 lanes. Figure 29 shows the daily volume impact of Alternative 2D compared to Alternative 1 conditions. It shows that US 51 South decreases by about 3,000 to 6,000 vehicles per day with Alternative 2D in place compared to Alternative 1 conditions. Adjacent north-south corridors such as I-39/90 and Monona Drive increase with several of the reduced-speed arterial corridors decreasing.

Figure 29 2050 US 51 South Daily Traffic Volume Shifts with Alternative 2D.3 with All Arterial Speed Reductions



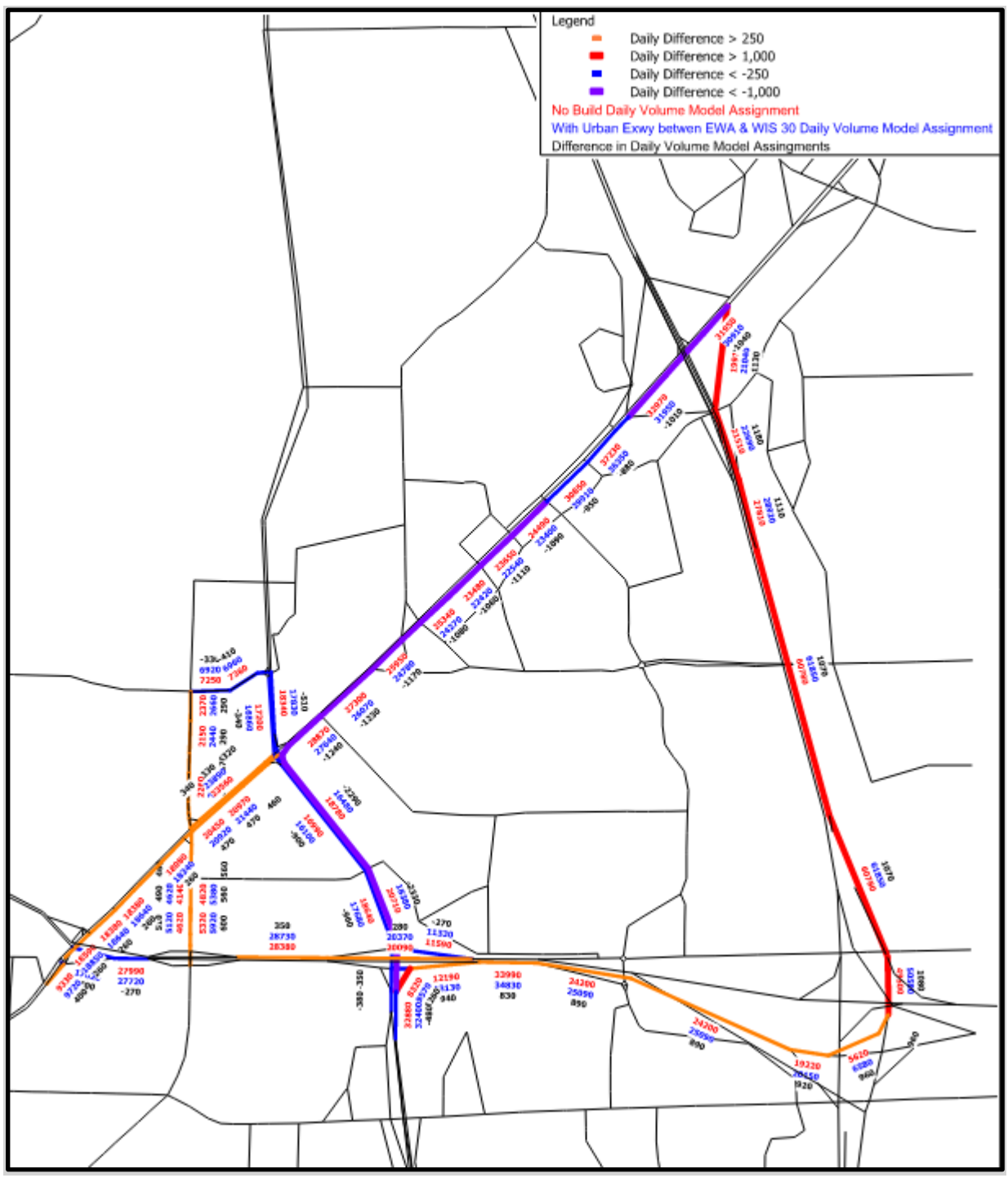
34. US 51 North Alternative 1 – US 51 at WIS 30 DDI with 35 mph Design Speed & US 51 at Commercial Ave with Raised 3-Leg

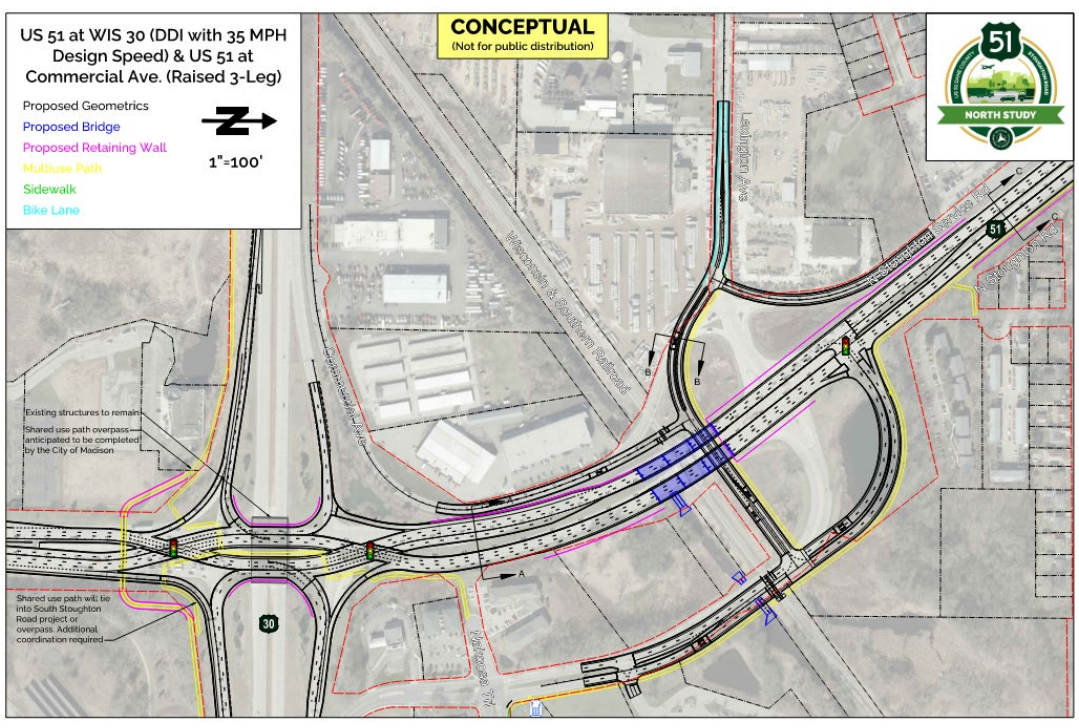
One Alternative for US 51 North Corridor has been proposed. US North Alternative 1 includes the following characteristics:

- A DDI Interchange at US 51 with WIS 30
- A Raised 3-leg configuration at US 51 with Commercial Avenue.
- US 51 between East Washington Avenue and WIS 30 posted speed is reduced from 55 mph to 35 mph.

In order to determine whether to adjust the model speed based on the proposed posted reduction from 55 mph to 35 mph, the functional class of US 51 between East Washington Avenue and WIS 30 was changed from a Suburban Expressway to an Urban Expressway. This area type change reduced the model input speed from 48 mph to 42 mph. Figure 30 below shows the impacts of this model input speed change would be a shift of about 3,000 daily vehicles from US 51 to parallel north-south routes such as I-39/90/94 and Fair Oaks Avenue. However, ultimately, similar to the East Washington Avenue speed reduction study described in a previous alternative above (See #17), this facility type change and resulting model input speed will not be incorporated in this Alternative. The reduction in posted speed along East Washington Avenue, described in #17 above, did not have the impact to traffic counts that the model predicted. Therefore, it was decided that the model input speed will not be changed for this US 51 North Alternative either.

Figure 30 2050 US 51 North Daily Traffic Volume Shifts with Alternative 1





Attachment K

US 51 North Corridor Forecast Methodology

WISCONSIN DOT

US 51 North Corridor Forecast Methodology

NOVEMBER 28, 2022

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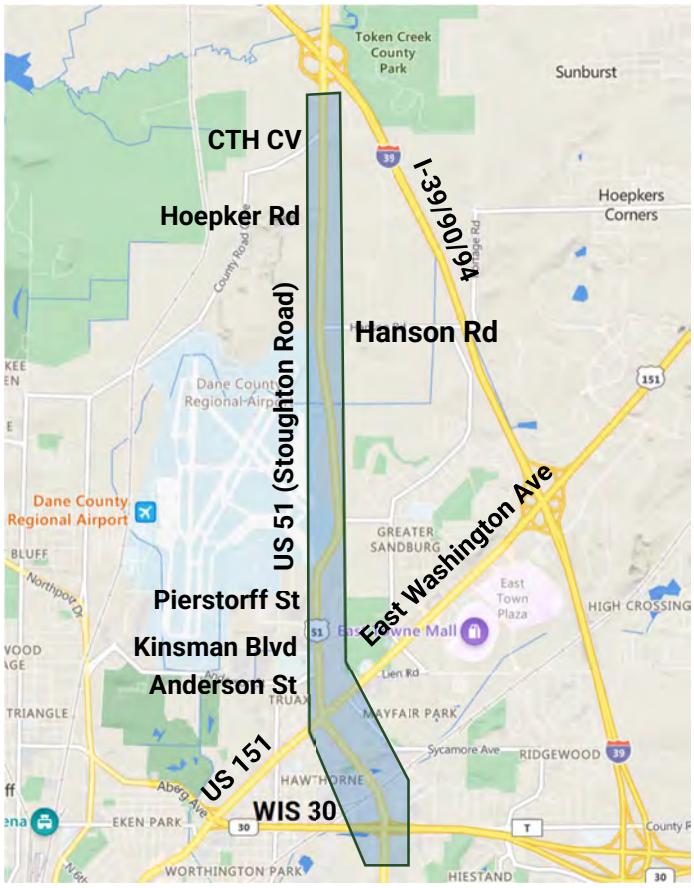
1.1 INTRODUCTION

As part of the I-39/90/94 & US 51 Corridor Traffic Study, future year 2050 forecasts will be developed for the US 51 North corridor between the I-39/90/94 interchange to south of WIS 30. The COVID-19 pandemic has had significant impact on travel behaviors in Dane County and raises discussions relating to the proper methods to develop future traffic volume forecasts. Many roadways, such as I-39/90/94, have observed traffic volumes recovering and exceeding pre-COVID levels by year 2022. Conversely, the US 51 North corridor is seeing year 2022 traffic volumes that are still below pre-COVID levels. The reasoning for this may include changing commuting patterns due to increasing work-from-home practices, decreased Madison Area Technical College (MATC) enrollment for in-person classes due to more classes being conducted remotely, and decreased MATC enrollment after peaking during the COVID-influenced economic downturn. The purpose of this technical memorandum is to summarize and compare US 51 North corridor volumes pre- and post-COVID, and present and assess potential methods of developing future year 2050 forecasts along US 51, as part of the I-39/90/94 & US 51 Corridor Traffic Study.

Figure 1 below shows the general project study area for the US 51 North corridor, which is one of the corridors studied as part of the I-39/90/94 & US 51 Corridor Traffic Study.

Figure 1: US 51 North Study Area Corridor Map



1.2 US 51 NORTH CORRIDOR TRAFFIC VOLUMES

In general, year 2022 traffic volumes are lower than year 2018 traffic levels along the US 51 study area corridor. **Table 1** below compares the Continuous Count Site (CCS) data at ATR 130021, located along US 51 between Kinsman Blvd. and Pierstorff Street, in year 2018 and year 2022, which accounts for pre- and post-COVID time periods. ATR 130021 is the only continuous count location within the project limits that provides data for pre- and post-COVID impacts. The CCS 130215, located between US 151 and WIS 30, is within the project limits but was installed in December of 2021, so a before and after comparison cannot be completed.

Table 1: Comparison of Traffic Volumes at CCS 130021 (US 51, between Kinsman Blvd & Pierstorff Street)

Time Period	US 51 Traffic Volume, between Kinsman Blvd & Pierstorff St (ATR 130021)							
	Year 2018 (October)		Year 2022 (October)		Difference		% Difference	
	NB	SB	NB	SB	NB	SB	NB	SB
AM Peak	456	931	457	721	1	-210	0.2%	-22.6%
PM Peak	1,217	760	969	698	-248	-62	-20.4%	-8.2%
Daily	9,484	8,928	8,394	7,915	-1,090	-1,013	-11.5%	-11.3%

Table 1 above shows that the year 2022 AM and PM peak hour and daily traffic volumes at CCS 130021 are less than year 2018 traffic volumes. During the AM and PM peak hours in the peak direction, year 2022 volumes along US 51 are about 20-22% lower than year 2018 volume levels. In the non-peak direction the year 2022 AM and PM peak hour volumes are more similar to the year 2018 volume levels. Additionally, daily traffic levels in year 2022 are approximately 11% lower than year 2018 levels in both northbound and southbound directions. This seems to indicate that a reduced on-site student body at Madison Area Technical College and COVID work-from-home policies are the driving forces behind persistent suppression of observable traffic volume along the US 51 North corridor.

Table 2 compares AM and PM peak hour volumes in year 2018 coverage counts to year 2022 coverage counts.

Table 2: Comparison of Coverage Count Traffic Volumes along US 51North Corridor

US 51 Location	Traffic Count Site ID	US 51 Peak Hour Volumes (Two-Way Traffic)							
		Year 2018 (Coverage Count		Year 2022 (Coverage Count)		Difference		% Difference	
		AM	PM	AM	PM	AM	PM	AM	PM
Between I-39/90/94 & CTH CV	130208	2,668	2,771	2,195	2,390	-473	-381	-17.7%	-13.7%
Between CTH CV & Hoepker Rd	130204	1,395	1,478	1,302	1,443	-93	-35	-6.7%	-2.4%
Between Hanson Rd & Amelia Earhart Dr	130212	1,283	1,510	1,156	1,398	-127	-112	-9.9%	-7.4%
Between Pierstorff St & Kinsman Blvd	130021	1,299	1,884	961	1,350	-338	-534	-26.0%	-28.3%
Between Kinsman Blvd & Anderson St	131909	1,366	1,625	1,197	1,442	-169	-183	-12.4%	-11.3%
Between Anderson St & US 151 (E. Washington Ave)	131957	2,082	2,552	1,826	2,381	-256	-171	-12.3%	-6.7%
Between US 151 (E. Washington Ave) & Lexington Ave.	130215	1,780	2,246	1,675	2,266	-105	20	-5.9%	0.9%
Between Lexington Ave & WIS 30	130573	2,022	2,602	2,136	2,879	114	277	5.6%	10.6%
South of WIS 30	130575	3,899	4,874	3,414	4,574	-485	-300	-12.4%	-6.2%
					Average:	-215	-158	-10.9%	-7.2%

Table 2 shows that year 2022 peak hour traffic volumes along US 51 are generally lower than in year 2018. Some of the largest differences generally occur in the US 51 North corridor between Pierstorff Street to US 151 (IDs 130021, 131909, and 131957). This area is largely comprised of Madison Area Technical College along with other offices. The areas of US 51 north of Pierstorff Street and south of US 151 don't show as much relative decrease in year 2022, although peak hour volumes are still generally lower. This again seems to indicate that the decrease in

commuter traffic to/from work and Madison Area Technical College is the main factor in driving the decrease in US 51 traffic volumes from year 2018 to year 2022.

Traffic volumes at signalized intersections along the US 51 North corridor are continuously collected with Gridsmart Technologies equipment. **Table 3** compares Gridsmart September 2019 and September 2022 peak hour and daily traffic volumes at three intersection locations along the US 51 North corridor.

Table 3: Comparison of Gridsmart Traffic Volumes along US 51 - Year 2019 vs Year 2022

Intersections	Time Period	US 51 North Corridor Daily and Peak Hour Traffic Volumes (from Gridsmart)*					
		Year 2019 (September)		Year 2022 (September)		US 51 (NB/SB)	
		US 51 (NB/SB)	Cross Street (EB/WB)	US 51 (NB/SB)	Cross Street (EB/WB)	Numerical Difference	% Difference
US 51 & Kinsman Blvd	AM	2,070	377	1,537	221	-533	-25.7%
	PM	1,614	870	1,344	525	-270	-16.7%
	Daily	19,641	6,213	16,851	3,886	-2,790	-14.2%
US 51 & Anderson Rd	AM	2,129	435	1,747	398	-382	-17.9%
	PM	1,817	903	1,628	851	-189	-10.4%
	Daily	25,481	10,516	20,513	8,755	-4,968	-19.5%
US 51 & US 151	AM	2,155	3,091	1,848	2,214	-307	-14.2%
	PM	2,496	3,443	2,333	3,015	-163	-6.5%
	Daily	29,813	43,425	27,713	36,925	-2,100	-7.0%
					AM Peak Average Difference:	-407	-19.3%
					PM Peak Average Difference:	-207	-11.2%
					Daily Average Difference:	-3,286	-13.6%

*Note: Gridsmart counts are on Wednesdays in September 2019, and Wednesdays in September 2022.

Table 3 shows that, according to Gridsmart traffic counts, US 51 peak hour and daily traffic volumes in year 2022, from Kinsman Blvd to US 151, are approximately 11% to 19% lower than year 2019 traffic levels. Year 2022 AM peak, PM peak, and daily counts along US 51 are lower

than year 2019 counts by approximately 400 vehicles, 200 vehicles, and 3,300 vehicles, respectively.

1.3 DANE COUNTY TRAVEL DEMAND MODEL

The Dane County travel demand model will be used to develop growth rates along the US 51 North corridor. The Dane County travel demand model's base year is year 2016. The future year Dane County travel demand model is year 2050, which matches the temporal limit of the US 51 North corridor study. The year 2016 base model is calibrated to traffic counts circa year 2016 along the existing roadway network, which includes year 2016 socio-economic data at the traffic analysis zone (TAZ) level (population, households, employment, etc). The future year 2050 Dane County travel demand model includes future socio-economic data forecasts, along with future committed roadway projects, which provide the basis for assigning future year 2050 traffic forecasts to the future network.

1.4 TRAFFIC FORECASTING METHODOLOGY DISCUSSION (PRE- vs POST-COVID)

The projected growth of year 2050 model assignments along the US 51 North study area corridor from the base year 2016 model assignments provides the basis for developing US 51 traffic forecasts used in the I-39/90/94 & US 51 Corridor Traffic Study. The year 2016 to year 2050 Dane County travel demand model annual growth is applied to an existing count and grown to year 2050 to develop the future forecast. However, there is a question whether the travel demand model annual growth should be applied to pre-COVID level traffic counts, or if it should be applied to post-COVID level traffic counts. Using counts collected in year 2018 may overestimate year 2050 forecasts because it doesn't incorporate the changing commuter behaviors that occurred during COVID, such as increased work-at-home practices and increased remote classes. These changing travel behaviors reduced traffic volumes along the US 51 North corridor during the first observable years post-COVID. Alternatively, using year 2022 counts as a base may under-predict year 2050 forecasts if the commuter behavior within the US 51 North corridor returns to pre-COVID conditions.

Table 4 takes the year 2018 coverage counts and year 2022 traffic counts from **Table 2** and provides sample AM and PM peak hour year 2050 forecasts using both the year 2018 and year 2022 counts as a base. For this comparison, it is assumed that the Dane County travel demand model is showing a 1% annual growth rate along the US 51 North corridor from the base year 2016 model assignments to the future year 2050 model assignments. **Table 5** provides a numerical and percent difference comparison between using year 2018 and year 2022 as the base year in developing potential year 2050 traffic forecasts along the US 51 North corridor.

Table 4: Sample Year 2050 Forecasts along US 51 using Base Year 2018 & Base Year 2022

US 51 Location	Traffic Count Site ID	US 51 Peak Hour Volumes (Two-Way Traffic)							
		Year 2018 (Coverage Count)		Year 2022 (Coverage Count)		Year 2050 Forecast using Base Year 2018 (1% Growth)		Year 2050 Forecast using Base Year 2022 (1% Growth)	
		AM	PM	AM	PM	AM	PM	AM	PM
Between I-39/90/94 & CTH CV	130208	2,668	2,771	2,195	2,390	3,668	3,810	2,900	3,158
Between CTH CV & Hoepker Rd	130204	1,395	1,478	1,302	1,443	1,918	2,032	1,720	1,907
Between Hanson Rd & Amelia Earhart Dr	130212	1,283	1,510	1,156	1,398	1,764	2,076	1,527	1,847
Between Pierstorff St & Kinsman Blvd	130021	1,299	1,884	961	1,350	1,786	2,590	1,270	1,784
Between Kinsman Blvd & Anderson St	131909	1,366	1,625	1,197	1,442	1,878	2,234	1,582	1,905
Between Anderson St & US 151 (E. Washington Ave)	131957	2,082	2,552	1,826	2,381	2,863	3,509	2,413	3,146
Between US 151 (E. Washington Ave) & Lexington Ave.	130215	1,780	2,246	1,675	2,266	2447	3,088	2,213	2,994
Between Lexington Ave & WIS 30	130573	2,022	2,602	2,136	2,879	2,780	3,578	2,822	3,804
South of WIS 30	130575	3,899	4,874	3,414	4,574	5,361	6,701	4,511	6,044

Table 5: Sample Comparison of Potential Year 2050 Forecasts along US 51 – Base Year 2018 vs 2022

US 51 Location	Traffic Count Site ID	US 51 Peak Hour Volumes (Two-Way Traffic)							
		Year 2050 Forecast using Base Year 2018 (1% Growth)		Year 2050 Forecast using Base Year 2022 (1% Growth)		Numerical Difference		Percent Difference	
		AM	PM	AM	PM	AM	PM	AM	PM
Between I-39/90/94 & CTH CV	130208	3,668	3,810	2,900	3,158	-768	-652	-20.9%	-17.1%
Between CTH CV & Hoepker Rd	130204	1,918	2,032	1,720	1,907	-198	-126	-10.3%	-6.2%
Between Hanson Rd & Amelia Earhart Dr	130212	1,764	2,076	1,527	1,847	-237	-229	-13.4%	-11.0%
Between Pierstorff St & Kinsman Blvd	130021	1,786	2,590	1,270	1,784	-516	-807	-28.9%	-31.1%
Between Kinsman Blvd & Anderson St	131909	1,878	2,234	1,582	1,905	-297	-329	-15.8%	-14.7%
Between Anderson St & US 151 (E. Washington Ave)	131957	2,863	3,509	2,413	3,146	-450	-363	-15.7%	-10.3%
Between US 151 (E. Washington Ave) & Lexington Ave.	130215	2447	3,088	2,213	2,994	-234	-94	-9.6%	-3.0%
Between Lexington Ave & WIS 30	130573	2,780	3,578	2,822	3,804	42	226	1.5%	6.3%
South of WIS 30	130575	5,361	6,701	4,511	6,044	-850	-658	-15.9%	-9.8%
					Average:	-390	-337	-14.3%	-10.8%

Assuming a 1% annual model growth rate along the US 51 North corridor, **Table 5** shows that future year 2050 traffic forecasts are expected to be lower if year 2022 is used as the base year, rather than year 2018. In this example, forecasts using year 2022 as the base year are approximately between 11% to 14% lower than year 2050 forecasts if year 2018 is used as the base year. Higher observable traffic counts in Year 2018 combined with an additional four years of potential growth are the contributing factors for the difference.

1.5 SENSITIVITY TESTING

Traffic forecasts will be developed for a single base year. WisDOT policy is to use the most recent traffic counts to develop forecasts, which will be the year 2022 count set. A sensitivity test is proposed to provide insight into what traffic forecasts might be if commuter behavior recovers fully from COVID impacts. The sensitivity test will identify key intersection approaches and apply the projected growth rate to the year 2018 data. A comprehensive forecast will not be developed, but rather tables similar to **Table 4** and **Table 5** as shown above.

1.6 CONCLUSION

Using year 2022 as the base year in developing year 2050 traffic forecasts along the US 51 North corridor is the recommended forecasting methodology. Increased work-at-home practices and remote Madison Area Technical College classes have had a real impact on suppressing traffic volumes along the US 51 North corridor. For the first observable years post-COVID, data indicates these travel behaviors are holding along US 51 (unlike I-39/90/94). Using year 2018 as the base year ignores the current trends of work-at-home practices and remote classes that are impacting US 51 North corridor traffic volumes. Using pre-COVID traffic volumes as the basis with which to forecast year 2050 traffic volumes may overestimate future forecasts if work-at-home and remote class behaviors continue at current activity levels. It is uncertain if these behaviors will continue through year 2050, therefore year 2018 will be used as a base year to develop a sensitivity test for year 2050 forecasts. These sensitivity forecasts will be developed to support analysis and compare with forecasts developed with year 2022 as the base and assess whether or not the two separate forecasts arrive at similar future US 51 design decisions.

The following year 2050 forecasting methodology for US 51 is recommended:

1. Use year 2022 as the base year to develop year 2050 forecasts along the US 51 North corridor.
2. Develop a second set of base year volumes from year 2018 and develop a year 2050 US 51 sensitivity forecast at select locations, including US 51 intersections at East Washington Ave, Anderson Street, Kinsman Blvd, and Hoepker Road at least, using year 2018 as the base.
3. Perform a sensitivity traffic analysis using the year 2018-dervived forecasts and compare to the year 2022-derived forecast

Attachment L1
Interstate North Existing Year Volume Exhibits

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

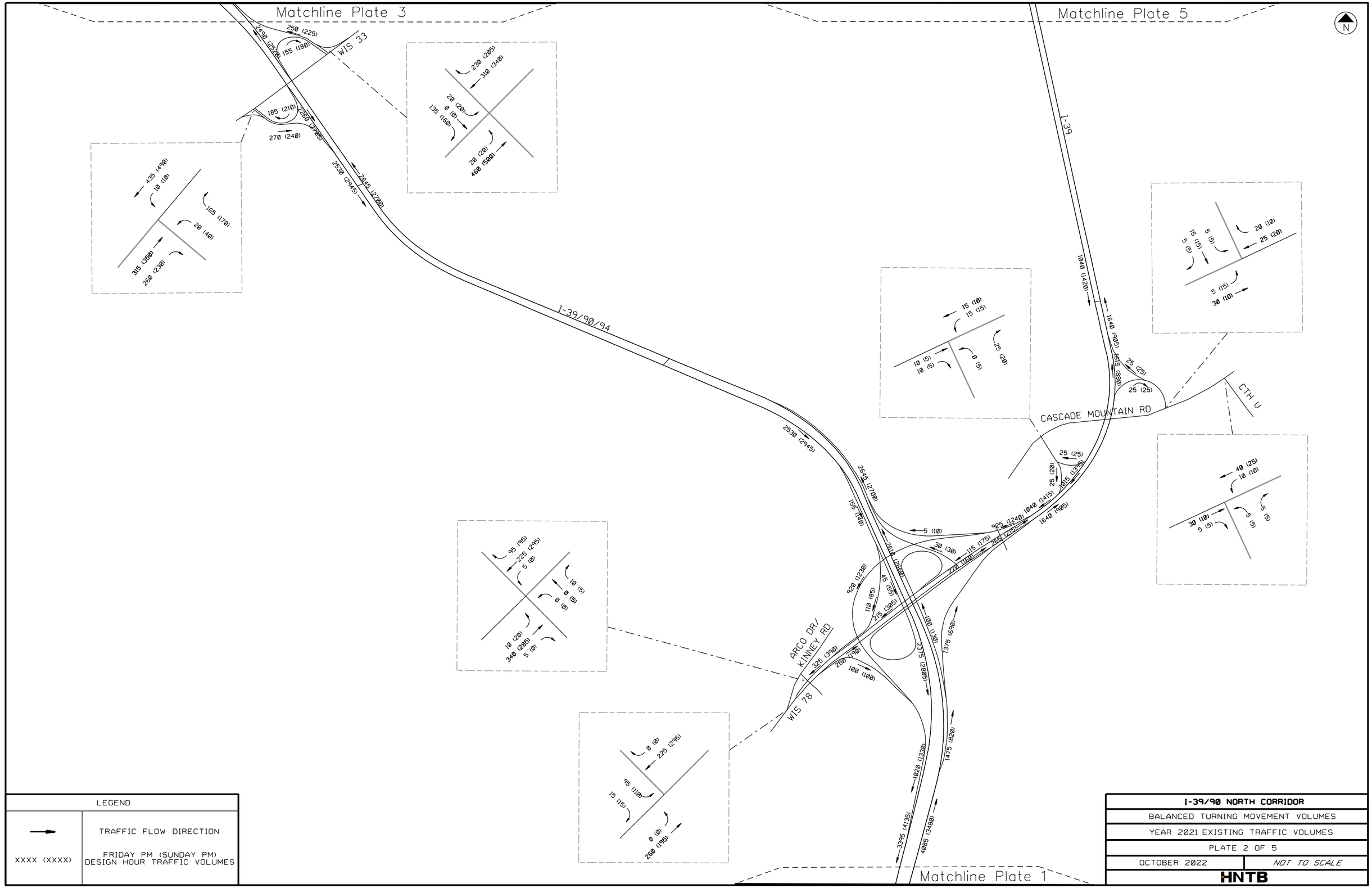
BALANCED TURNING MOVEMENT VOLUMES

YEAR 2021 EXISTING TRAFFIC VOLUMES

PLATE 1 OF 5

OCTOBER 2022 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

BALANCED TURNING MOVEMENT VOLUMES

YEAR 2021 EXISTING TRAFFIC VOLUMES

PLATE 2 OF 5

OCTOBER 2022 | *NOT TO SCALE*

HNTB

Matchline Plate 4

N

US 12

WHITLOCK ST

WIS 23

CTH P

COMMERCE ST

2890 (2795)
2675 (3170)
325 (285)
355 (275)
2350 (2885)
2535 (2520)
190 (205)
220 (340)

245 (245)
10 (15)
515 (575)
545 (550)
370 (300)
5 (5)
230 (265)
240 (290)
10 (20)

155 (95)
460 (450)
200 (180)
420 (500)
130 (130)
0 (0)
60 (75)

5 (5)
75 (110)
130 (180)
200 (120)
95 (80)
440 (450)
10 (5)
85 (130)
35 (25)
35 (30)
100 (90)
445 (495)

225 (195)
0 (0)
100 (90)
510 (455)
80 (125)
520 (590)
140 (215)

175 (260)
325 (345)
150 (190)
115 (135)
130 (130)
225 (280)
170 (215)
120 (160)
295 (360)
330 (360)
470 (485)
225 (345)

GASSER RD

MEADOWVIEW DR

US 12

845 (985)
1025 (1011)

615 (710)
255 (155)
465 (645)

230 (275)
560 (545)
255 (155)
570 (405)
815 (700)
1925 (2045)
2740 (2745)
2445 (2915)
2725 (2725)
2570 (3225)
2495 (2450)
2065 (2505)
2355 (2785)
505 (720)
290 (280)
100 (155)
405 (565)
90 (130)

I-90/94

I-90/94

580 (585)
100 (155)
935 (895)

985 (1150)
1025 (1011)
215 (245)
365 (285)
770 (905)
690 (1071)

Matchline Plate 2

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

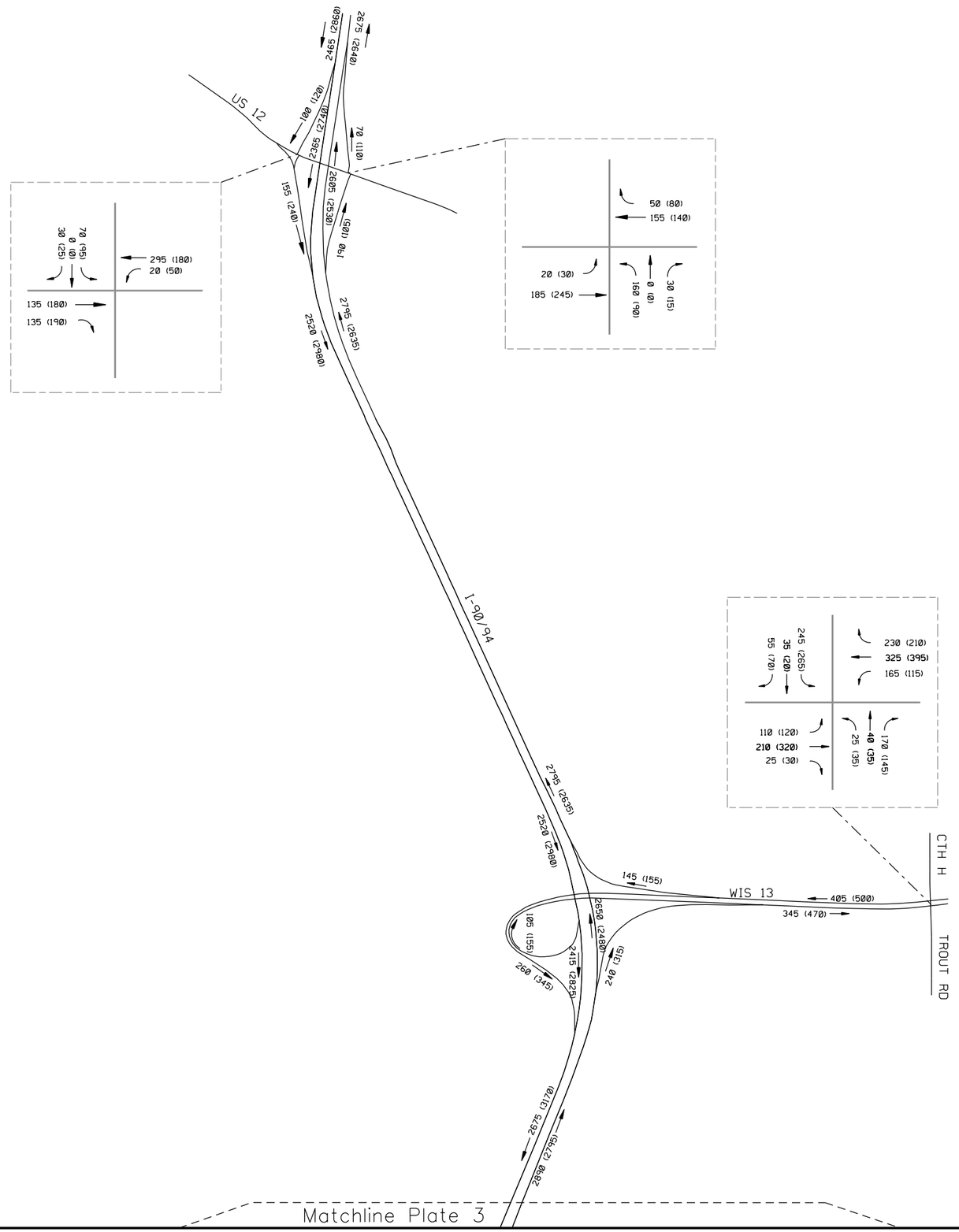
BALANCED TURNING MOVEMENT VOLUMES

YEAR 2021 EXISTING TRAFFIC VOLUMES

PLATE 3 OF 5

OCTOBER 2022 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

BALANCED TURNING MOVEMENT VOLUMES

YEAR 2021 EXISTING TRAFFIC VOLUMES

PLATE 4 OF 5

OCTOBER 2022 | *NOT TO SCALE*

HNTB

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

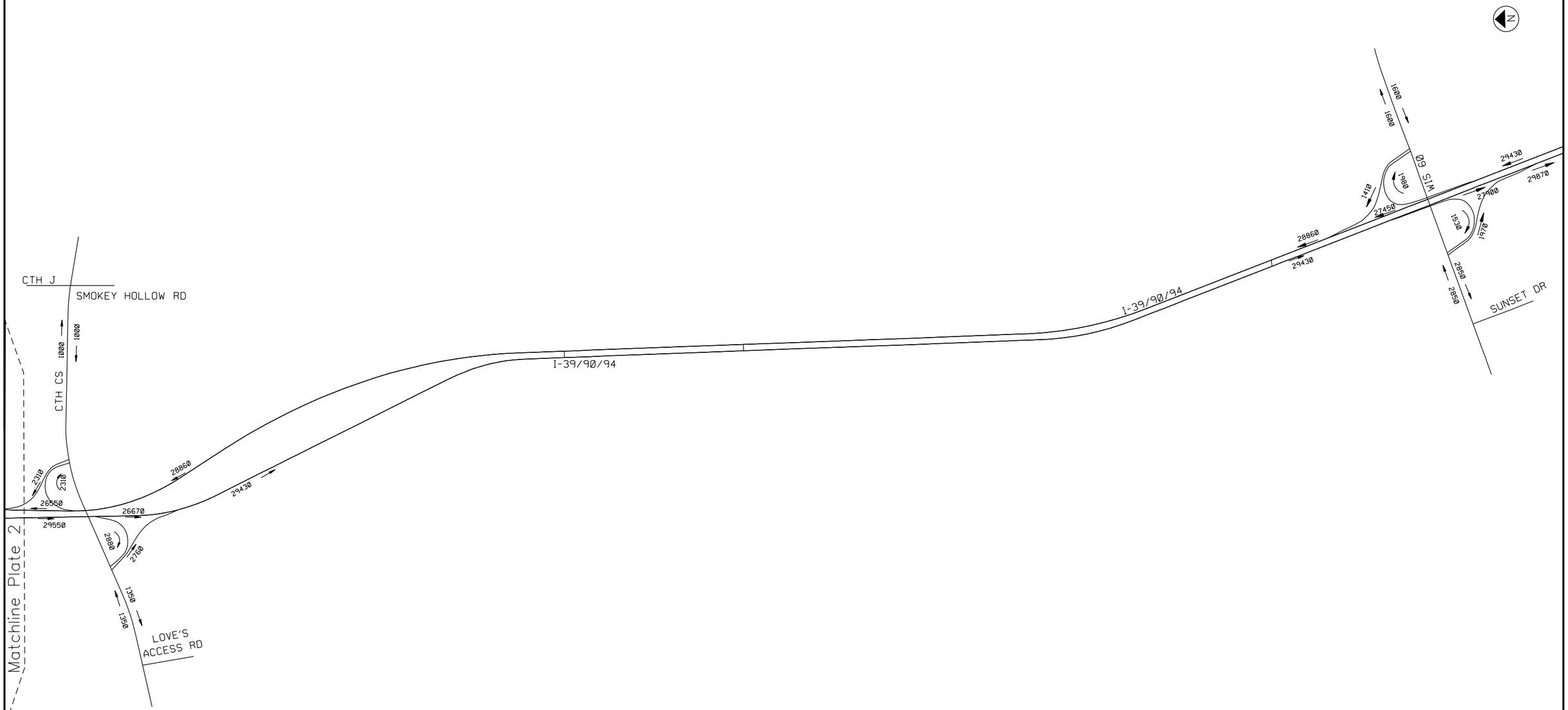
BALANCED TURNING MOVEMENT VOLUMES

YEAR 2021 EXISTING TRAFFIC VOLUMES

PLATE 5 OF 5

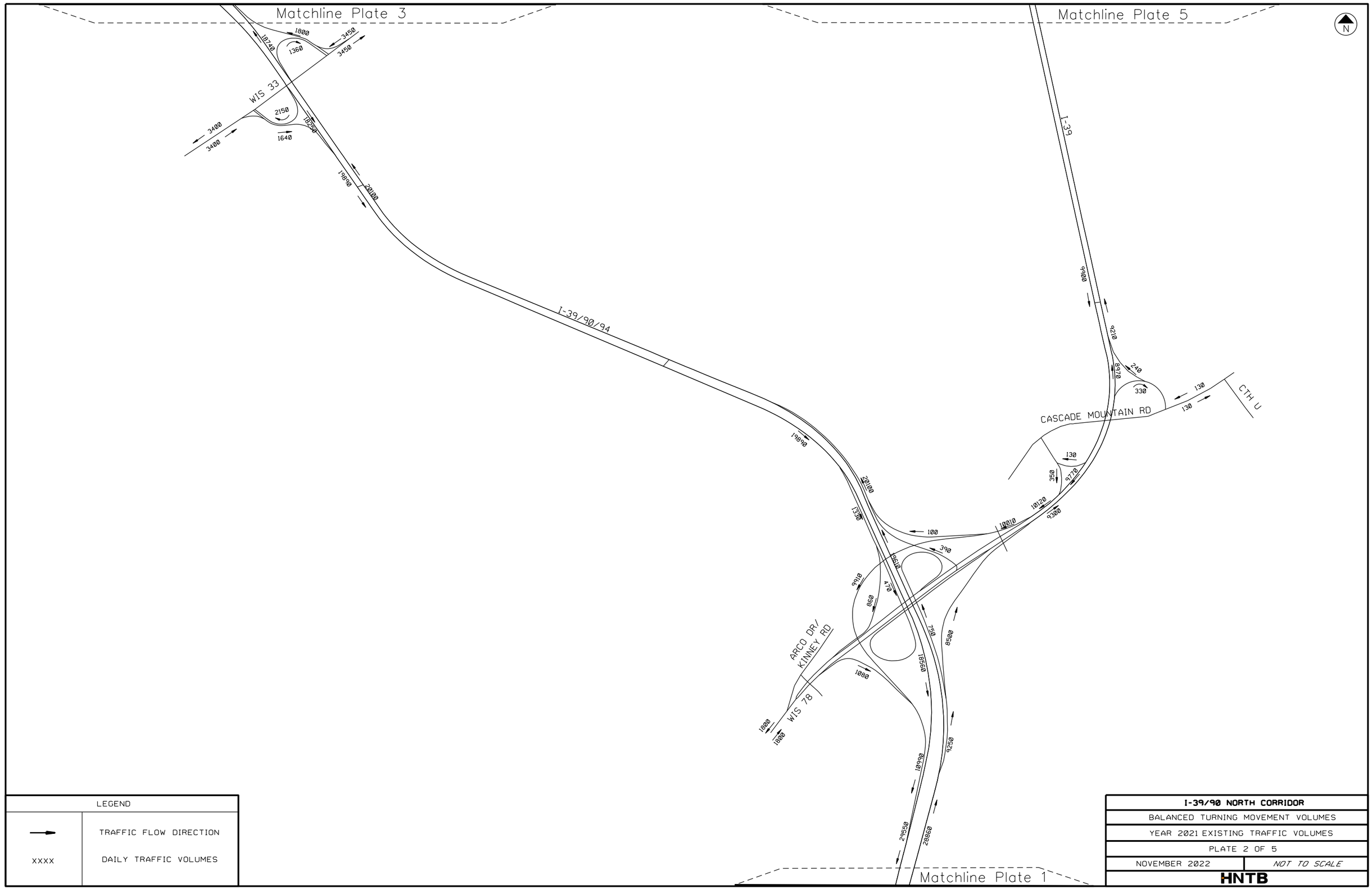
OCTOBER 2022 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2021 EXISTING TRAFFIC VOLUMES	
PLATE 1 OF 5	
NOVEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

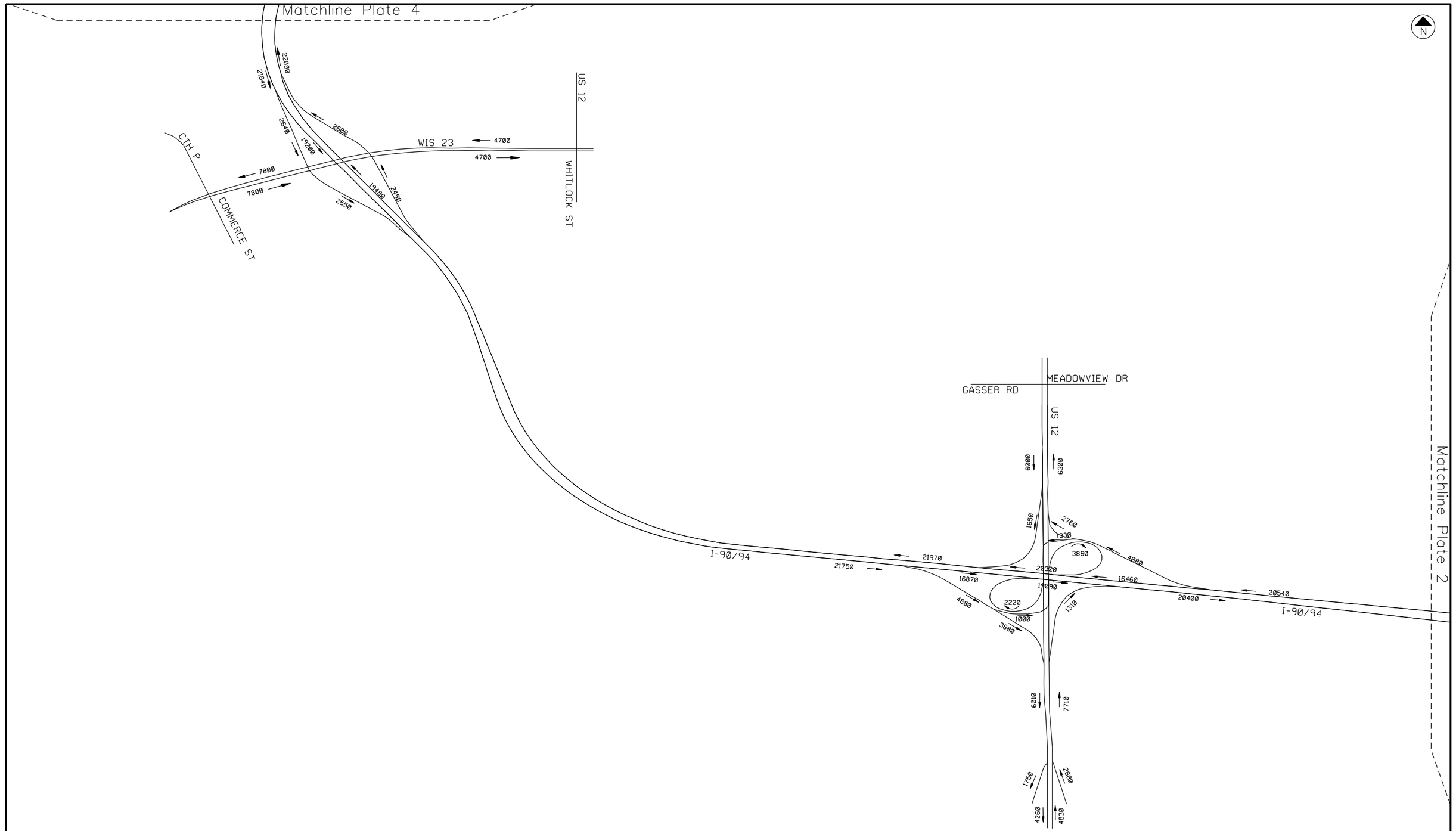
BALANCED TURNING MOVEMENT VOLUMES

YEAR 2021 EXISTING TRAFFIC VOLUMES

PLATE 2 OF 5

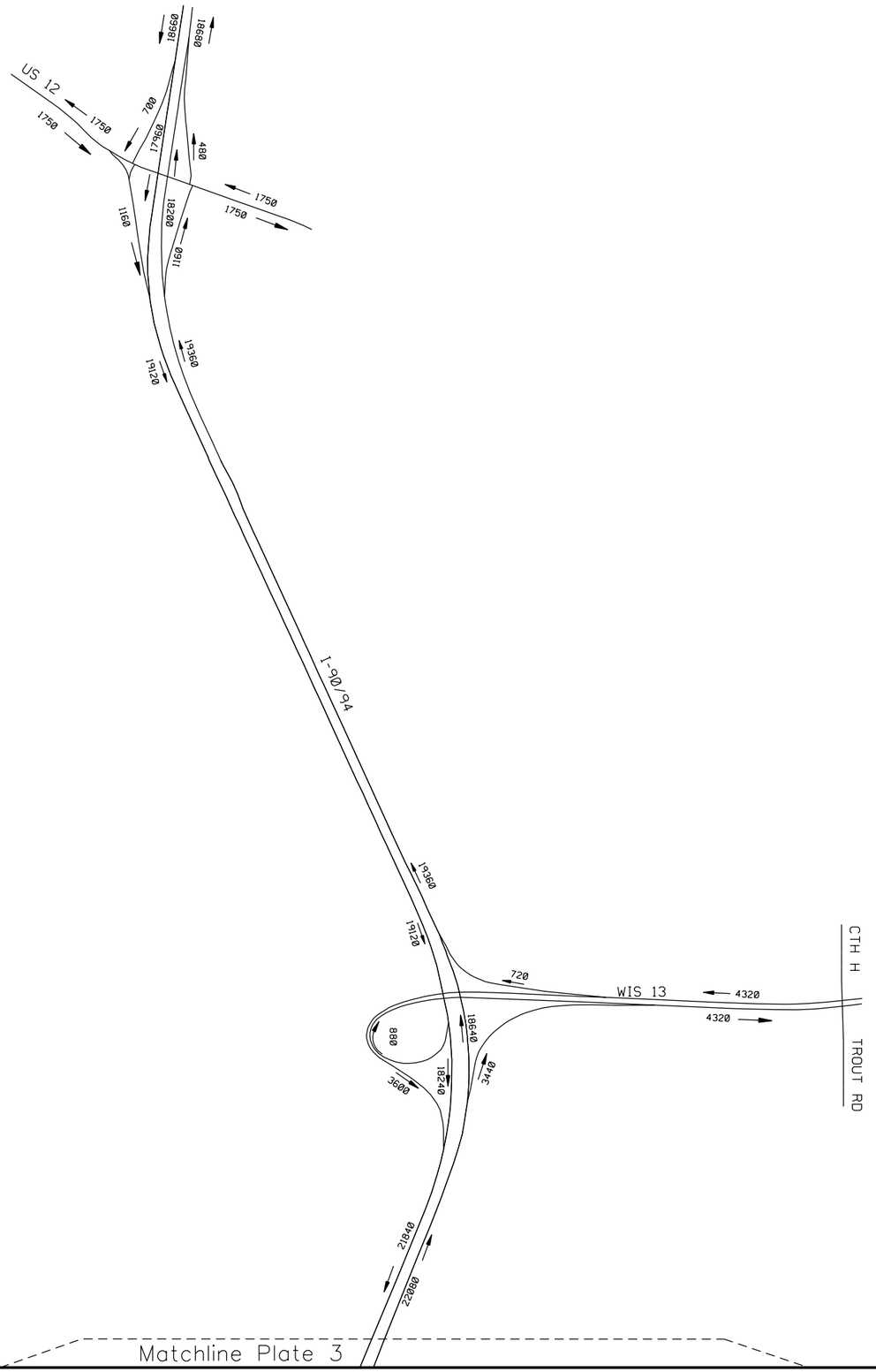
NOVEMBER 2022 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2021 EXISTING TRAFFIC VOLUMES	
PLATE 3 OF 5	
NOVEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

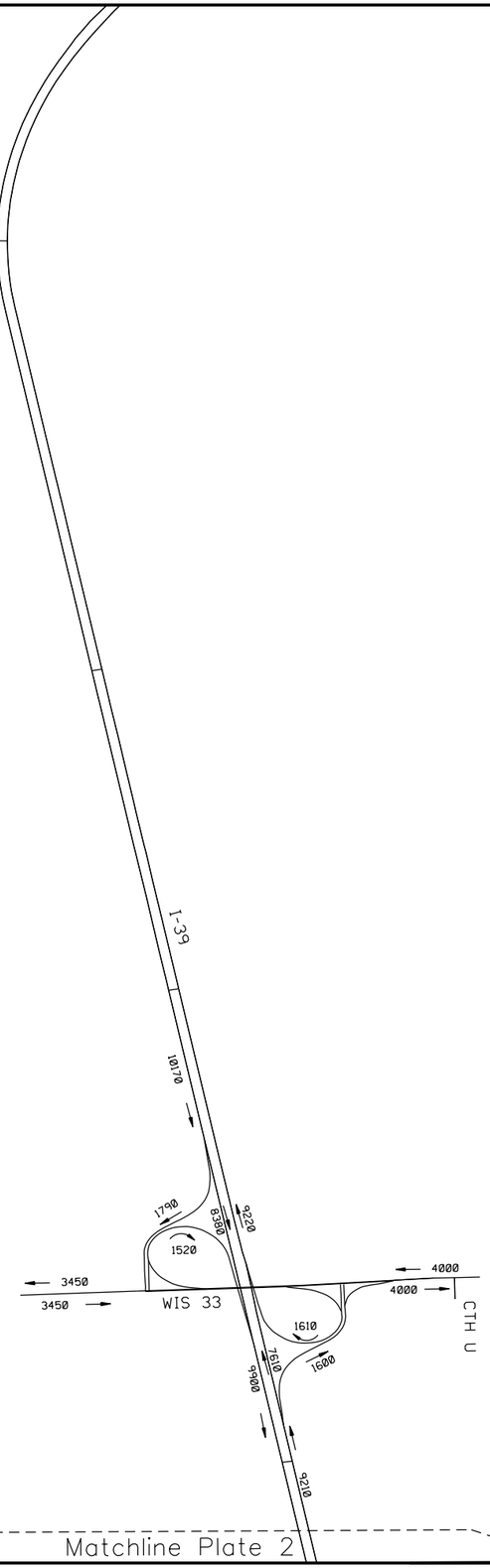
BALANCED TURNING MOVEMENT VOLUMES

YEAR 2021 EXISTING TRAFFIC VOLUMES

PLATE 4 OF 5

NOVEMBER 2022 | *NOT TO SCALE*

HNTB



Matchline Plate 2

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

BALANCED TURNING MOVEMENT VOLUMES

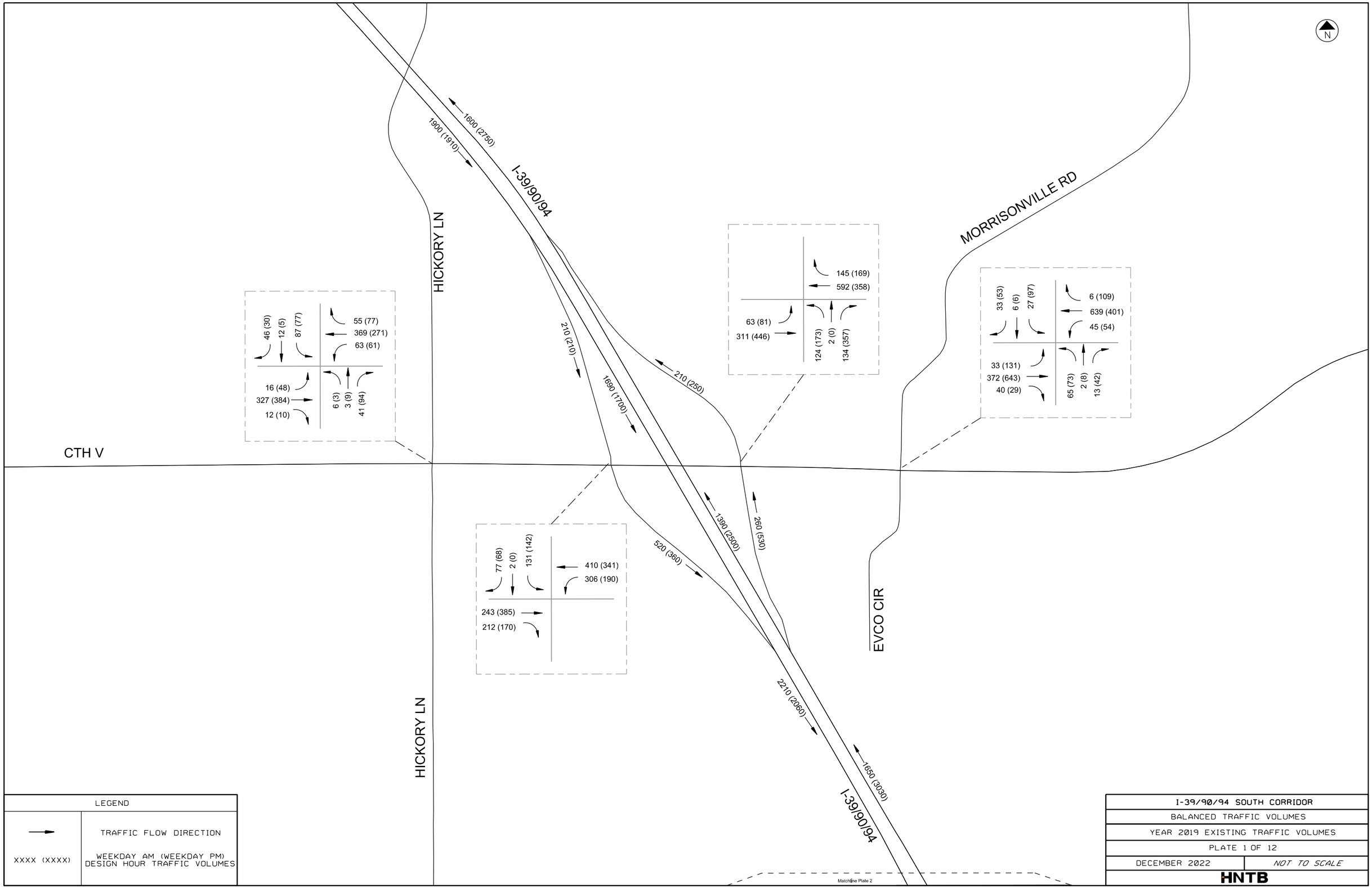
YEAR 2021 EXISTING TRAFFIC VOLUMES

PLATE 5 OF 5

NOVEMBER 2022 | *NOT TO SCALE*

HNTB

Attachment L2
Interstate South Existing Year Volume Exhibits



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 1 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 1

N

I-39/90/94

2210 (2060)

1650 (3030)

240 (200)

190 (280)

2020 (1780)

1410 (2830)

660 (670)

710 (700)

I-39/90/94

2680 (2450)

2120 (3530)

CTH CV

TIERNEY XING

DALMORE RD

WIS 19

LIUNA WAY

PEPSI WAY

Matchline Plate 4

Matchline Plate 3

75 (110)
0 (0)
95 (265)
40 (45)
1015 (890)
25 (10)
90 (135)
695 (1230)
0 (5)
0 (0)
0 (0)
0 (0)

5 (30)
135 (170)
1075 (915)
0 (0)
790 (1495)

115 (200)
1420 (1200)
40 (90)
455 (845)

340 (315)
110 (100)
185 (380)
1195 (1085)
85 (150)
370 (695)

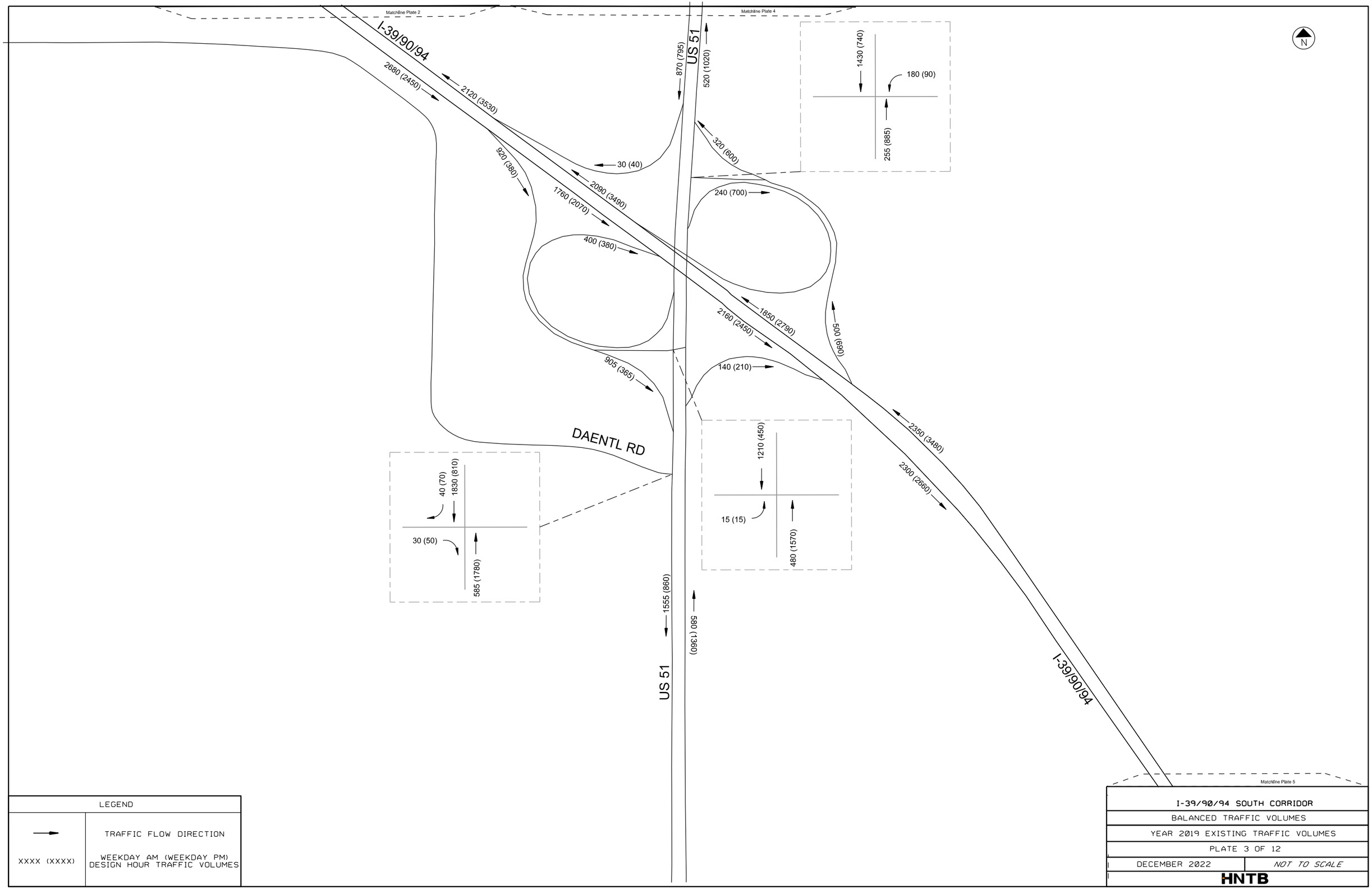
705 (610)
120 (60)
15 (5)
485 (805)
110 (145)
65 (145)

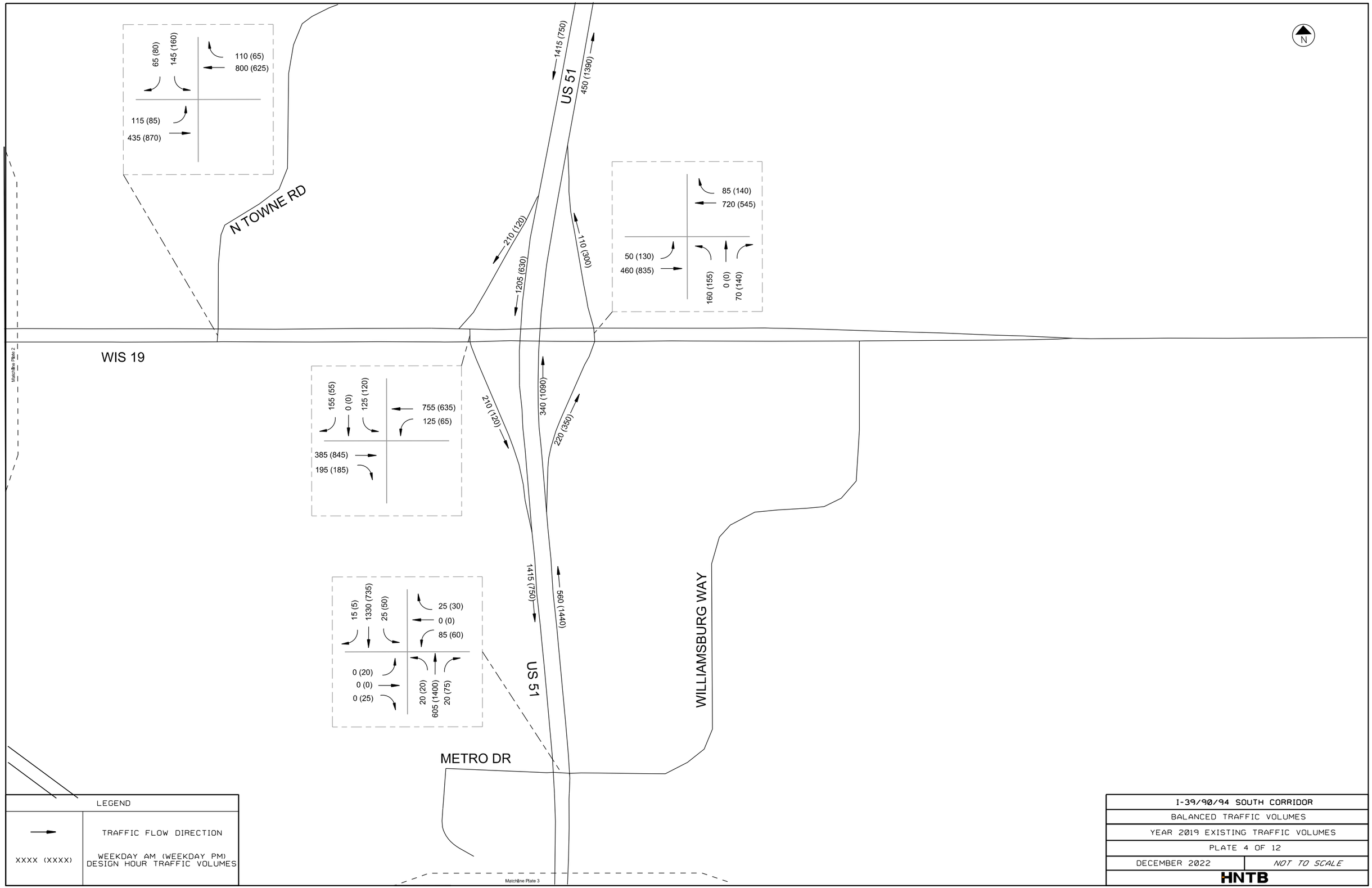
85 (90)
0 (0)
140 (170)
1125 (995)
295 (205)
355 (765)
400 (735)

815 (765)
480 (795)
565 (700)
130 (85)

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

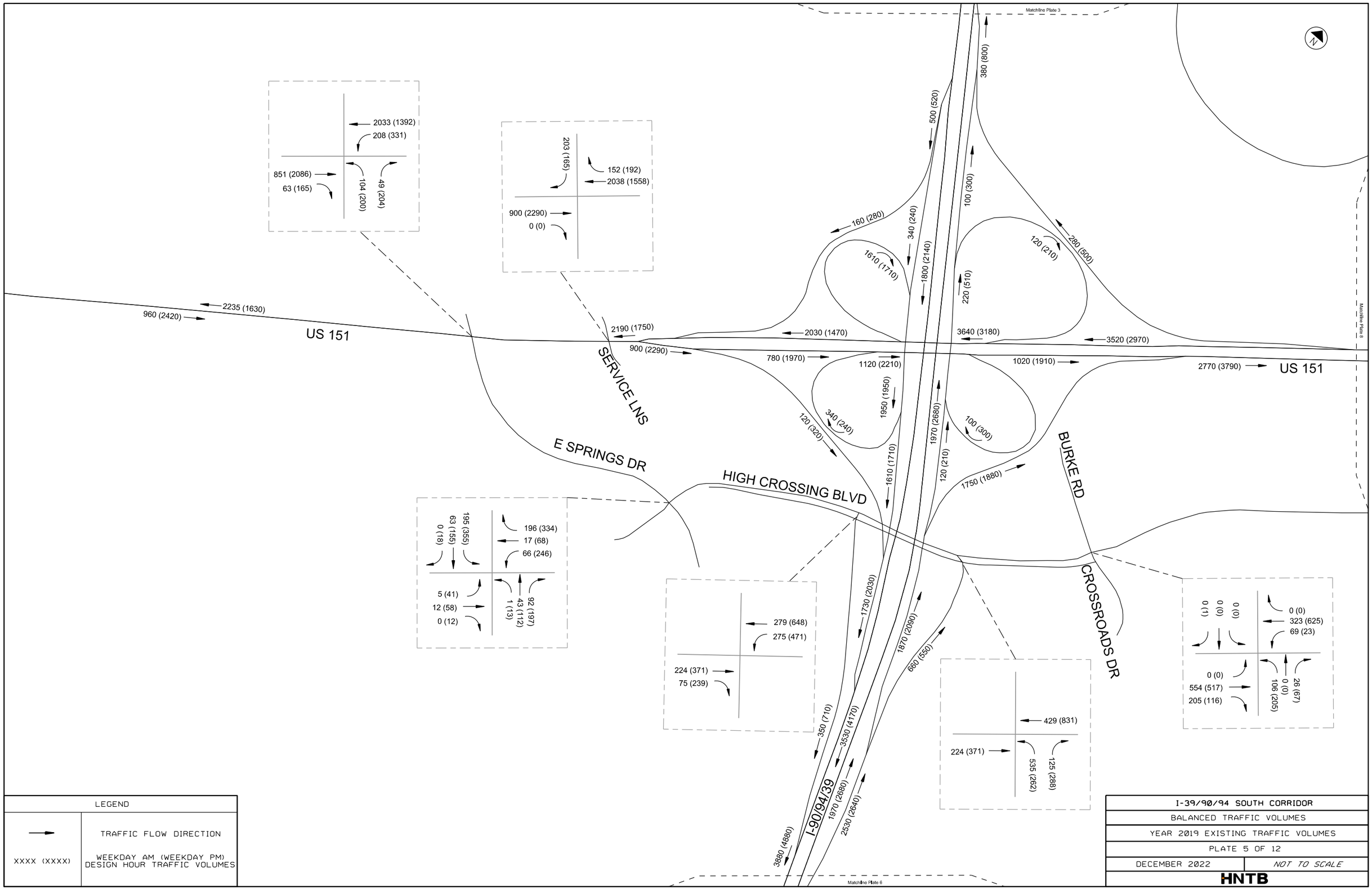
I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFICVOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 2 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	


Matchline Plate 2
Matchline Plate 4
I-39/90/94
US 51
DAENTL RD
2680 (2450)
2120 (3530)
870 (795)
520 (1020)
1430 (740)
180 (90)
255 (885)
320 (600)
30 (40)
920 (380)
2090 (3490)
1760 (2070)
240 (700)
400 (380)
1850 (2790)
2160 (2450)
500 (690)
905 (365)
140 (210)
2350 (3480)
2300 (2680)
1210 (450)
15 (15)
480 (1570)
40 (70)
1830 (810)
30 (50)
585 (1780)
1555 (860)
580 (1360)
Matchline Plate 5
N
LEGEND
TRAFFIC FLOW DIRECTION
XXXX (XXXX)
WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED TRAFFIC VOLUMES
YEAR 2019 EXISTING TRAFFIC VOLUMES
PLATE 3 OF 12
DECEMBER 2022
NOT TO SCALE
HNTB



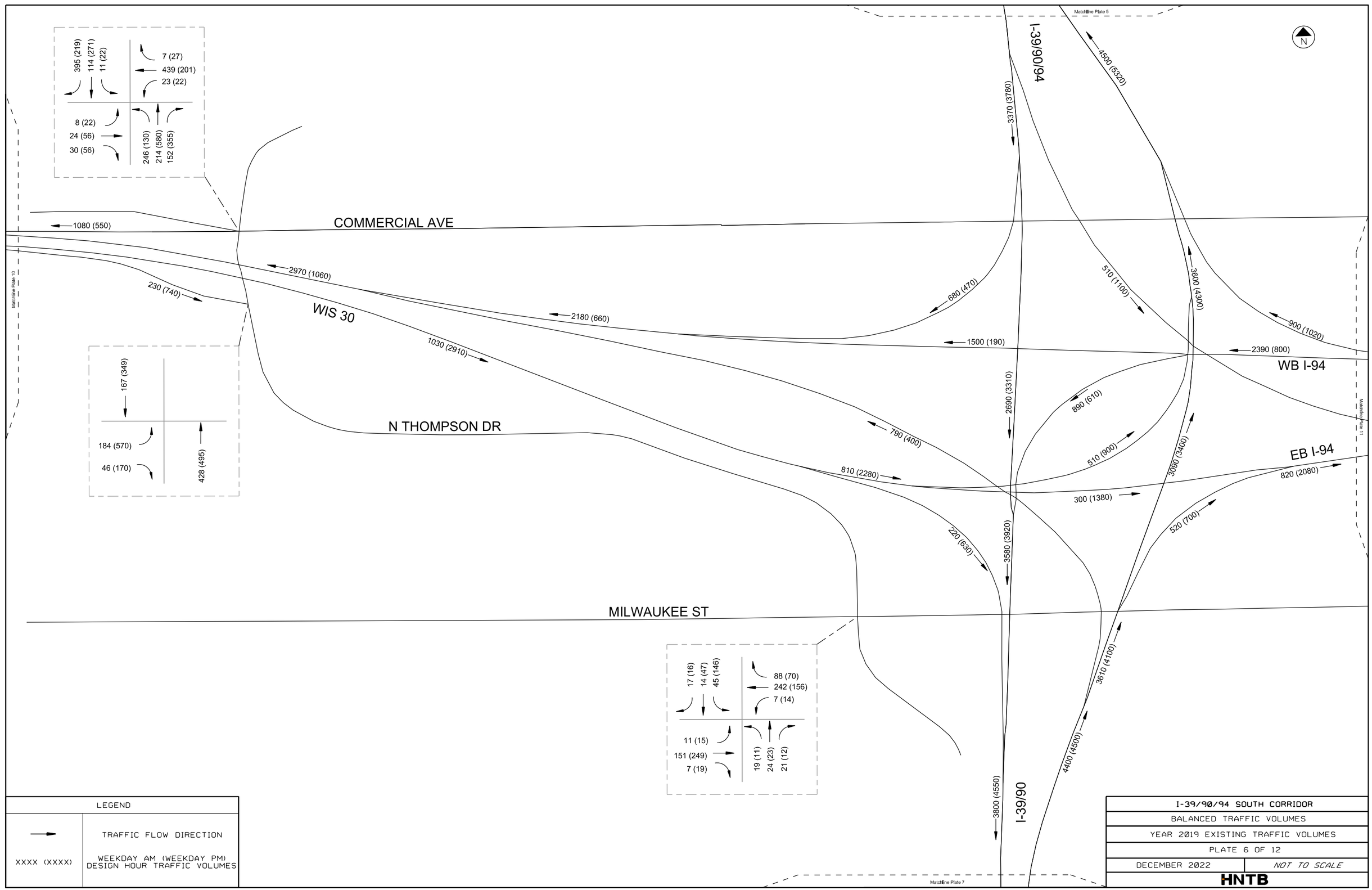
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 4 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 5 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 6 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 6

N

I-39/90

3800 (4550)

4400 (4500)

2720 (2590)

1080 (1960)

2920 (3225)

890 (500)

3610 (3090)

30 (20)

1480 (1275)

410 (275)

US 12/18

1110 (1980)

2370 (1775)

2510 (2950)

US 12/18

530 (950)

240 (350)

30 (25)

870 (1630)

1400 (2580)

2400 (1800)

I-39/90

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 7 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

AMERICAN PKWY

EASTPARK BLVD

52 (15)
398 (819)
7 (23)
10 (17)
25 (13)
157 (210)
21 (61)
10 (52)
105 (693)
781 (128)
762 (454)
163 (204)

420 (1120)
340 (120)
210 (160)
130 (170)
550 (280)
3800 (3470)
3380 (2350)
3250 (2180)
3800 (2460)
US 151

Matchline Plate 5

US 151
2550 (3620)
220 (170)
1040 (390)
1510 (3230)
150 (720)
1660 (3950)

Matchline Plate 9

280 (890)

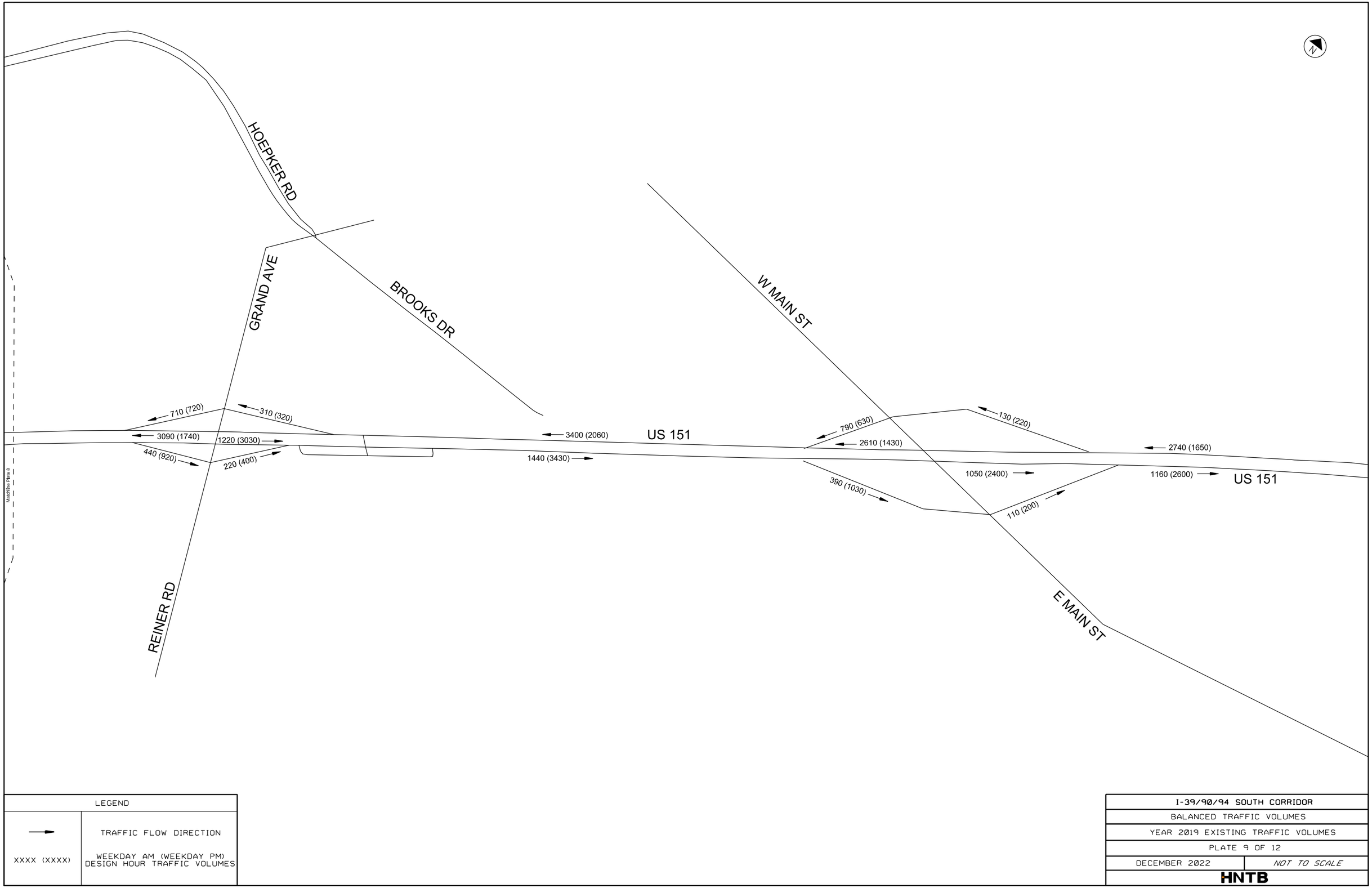
HIGH CROSSING BLVD

219 (232)
163 (292)
78 (286)
0 (0)
169 (130)
41 (30)
154 (180)
135 (496)
49 (87)
95 (135)
172 (96)
67 (109)

NELSON RD

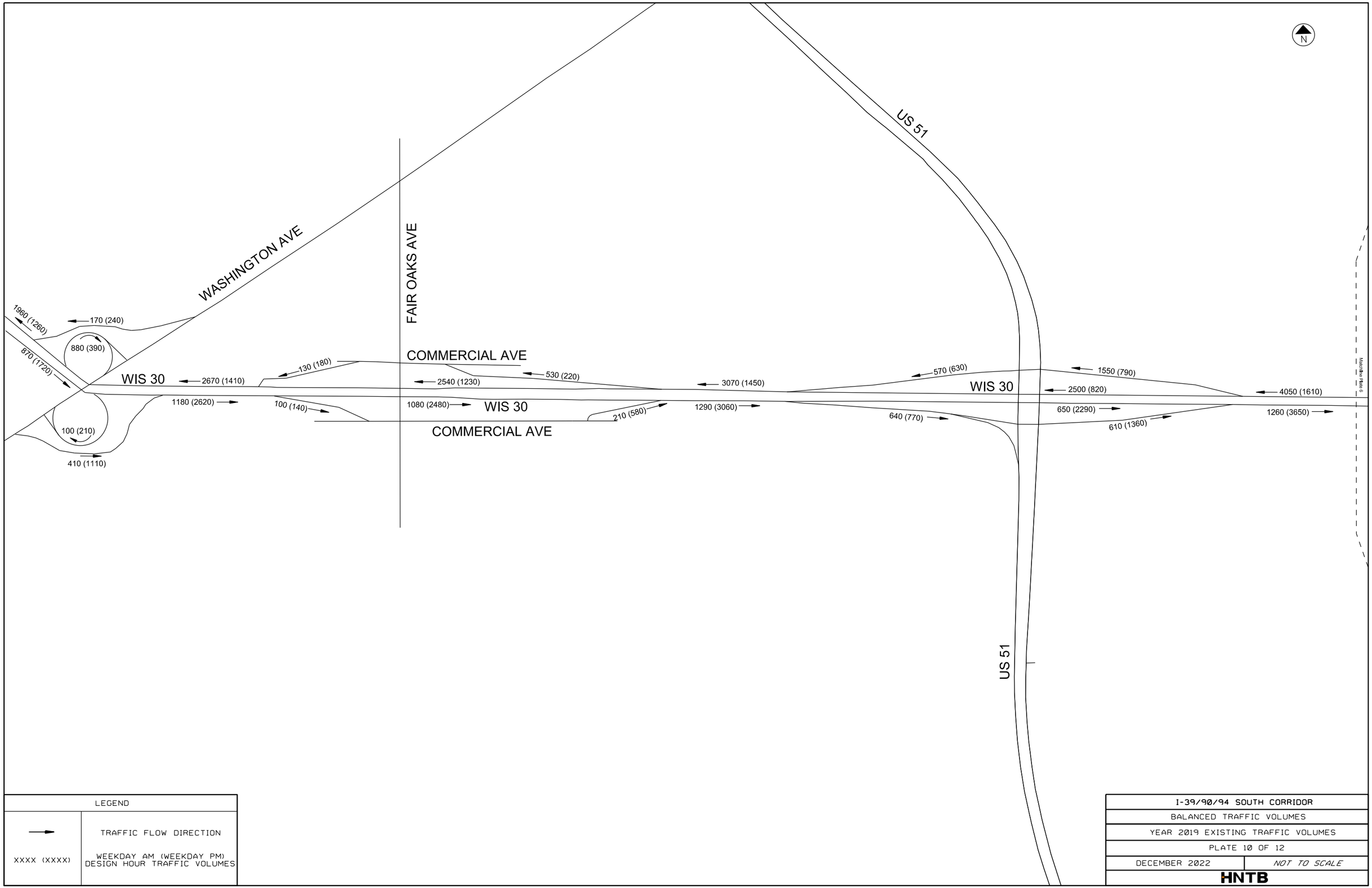
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 8 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



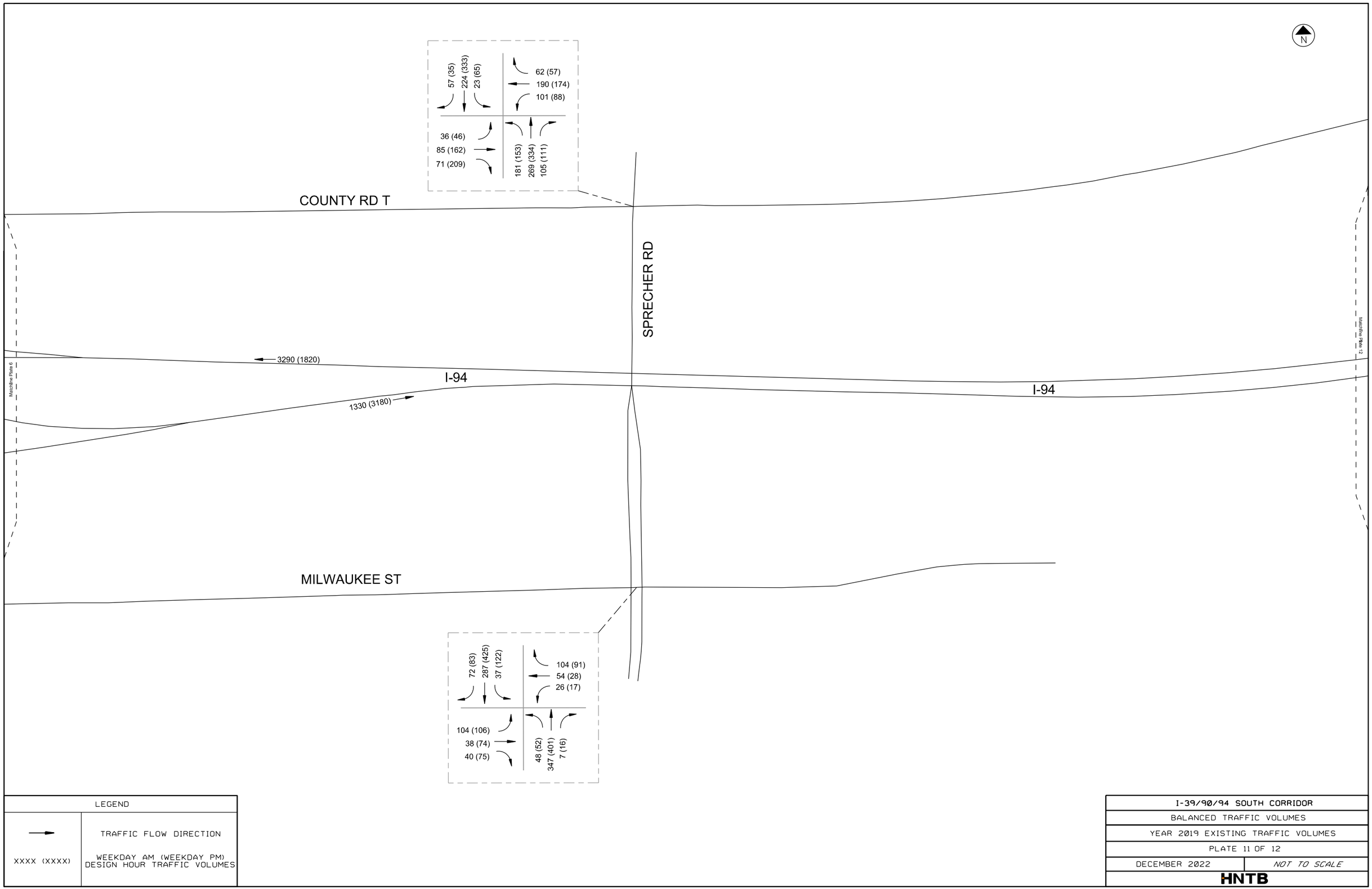
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 9 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



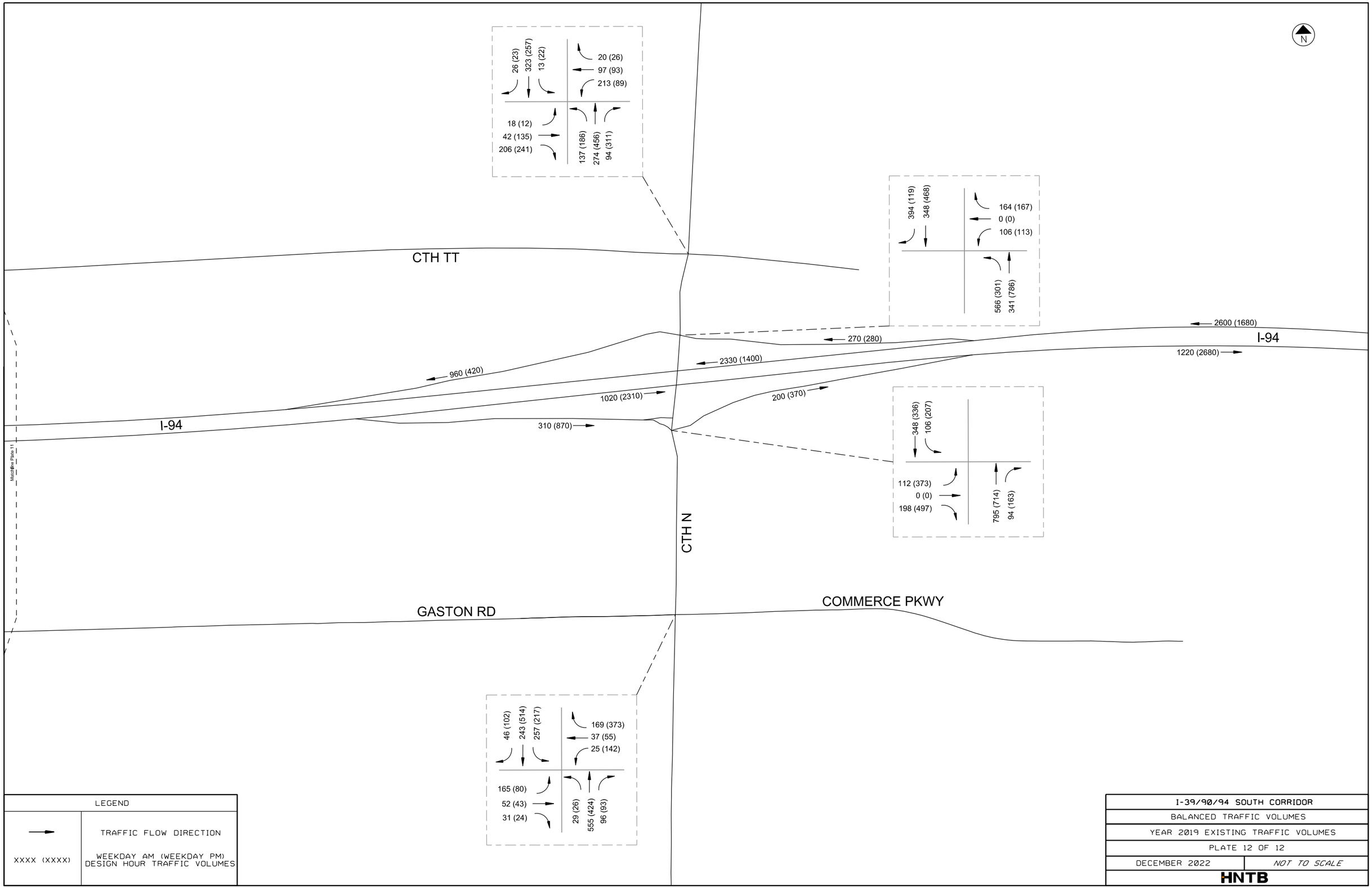
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

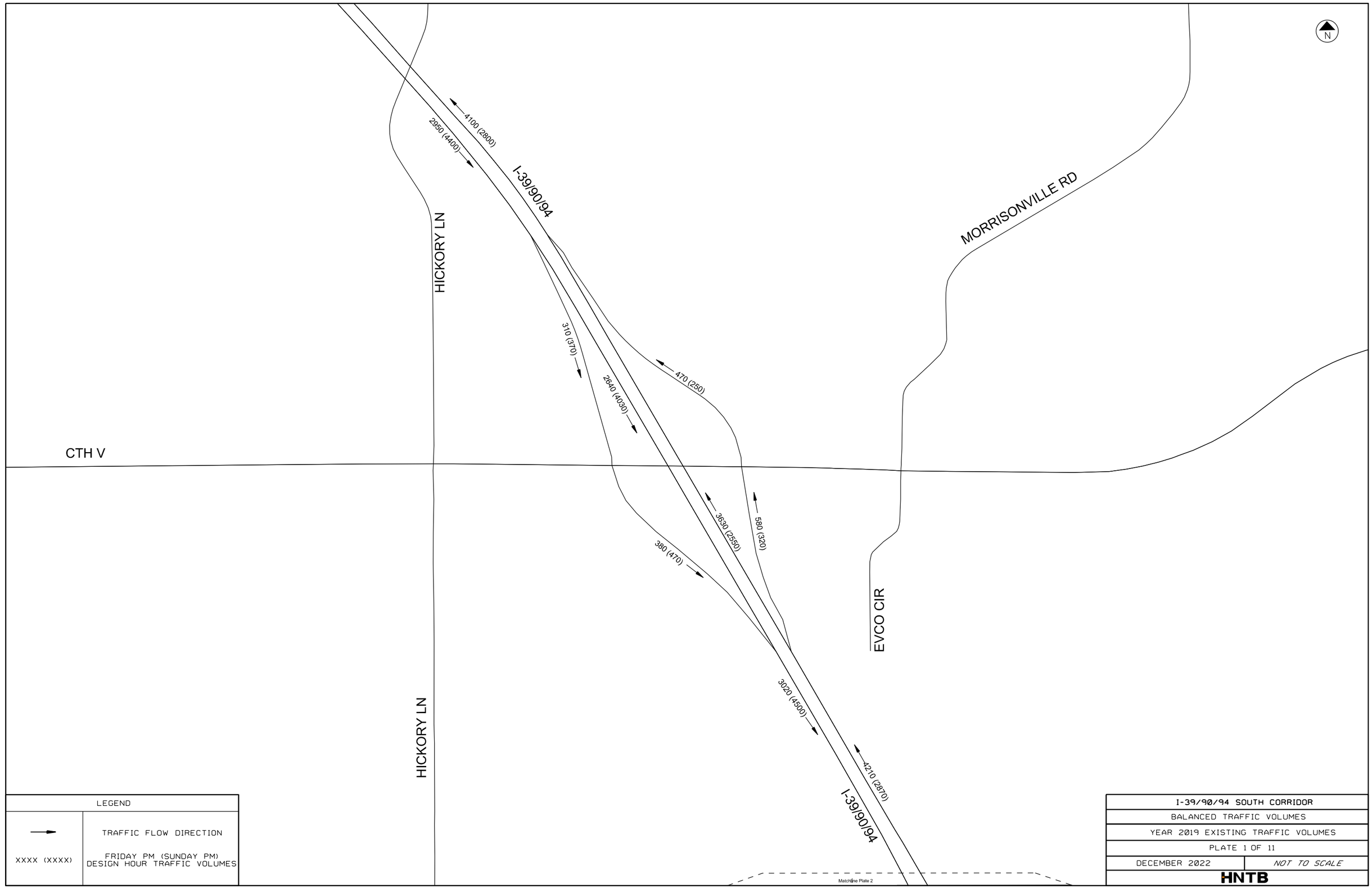
I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 10 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 11 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	


N
CTH TT
I-94
I-94
CTH N
GASTON RD
COMMERCE PKWY
26 (23)
323 (257)
13 (22)
20 (26)
97 (93)
213 (89)
18 (12)
42 (135)
206 (241)
137 (186)
274 (456)
94 (311)
394 (119)
348 (468)
164 (167)
0 (0)
106 (113)
566 (301)
341 (786)
2600 (1680)
270 (280)
1220 (2680)
2330 (1400)
960 (420)
1020 (2310)
200 (370)
310 (870)
348 (336)
106 (207)
112 (373)
0 (0)
198 (497)
795 (714)
94 (163)
46 (102)
243 (514)
257 (217)
169 (373)
37 (55)
25 (142)
165 (80)
52 (43)
31 (24)
29 (26)
555 (424)
96 (93)
LEGEND
TRAFFIC FLOW DIRECTION
XXXX (XXXX)
WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED TRAFFIC VOLUMES
YEAR 2019 EXISTING TRAFFIC VOLUMES
PLATE 12 OF 12
DECEMBER 2022
NOT TO SCALE
HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 1 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 1

N

3020 (4500)

4210 (2870)

I-39/90/94

CTH CV

TIERNEY XING

DALMORE RD

WIS 19

LIUNA WAY

260 (330)

420 (260)

2760 (4170)

3790 (2610)

700 (410)

730 (460)

PEPSI WAY

I-39/90/94

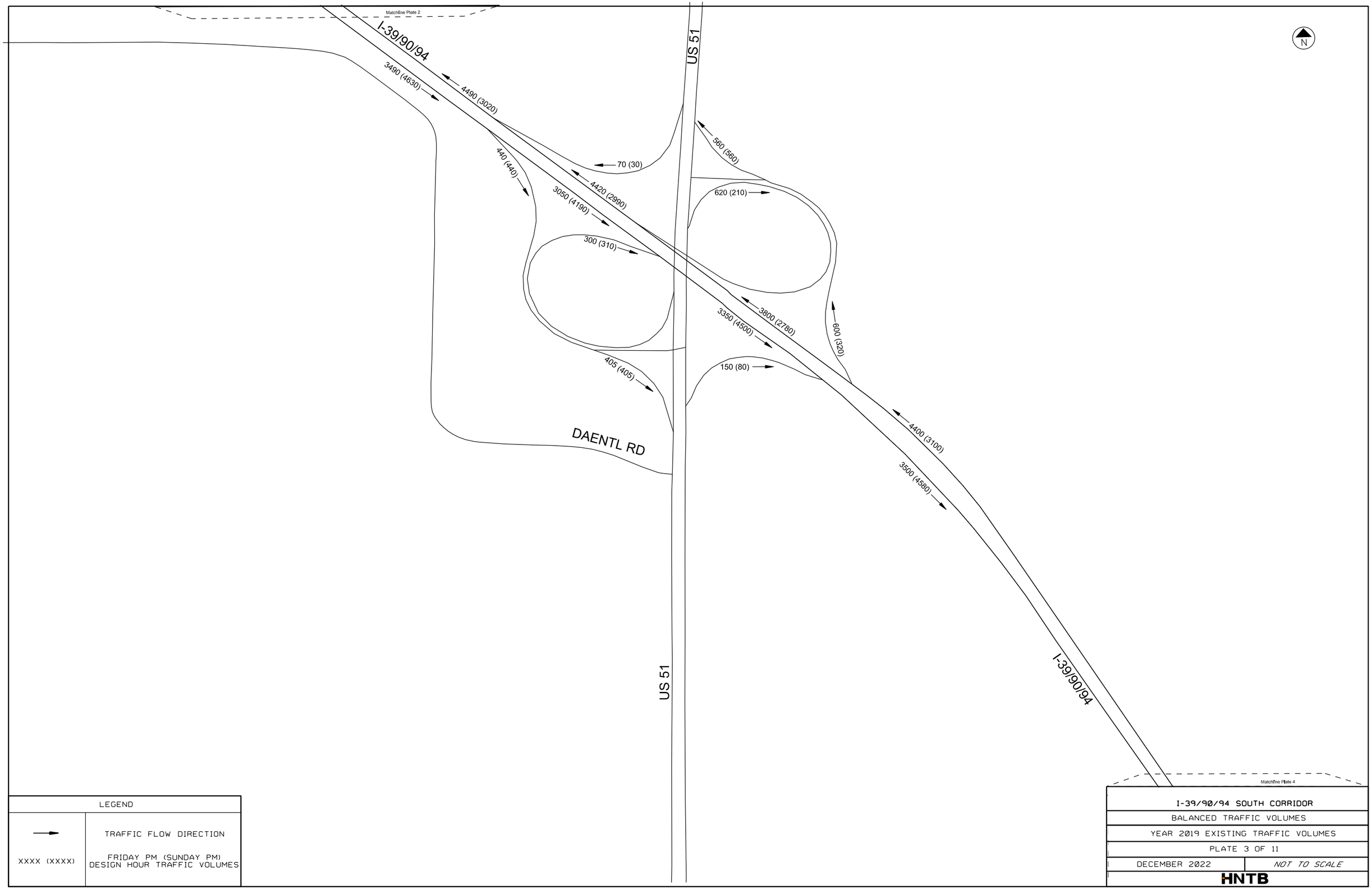
3490 (4630)

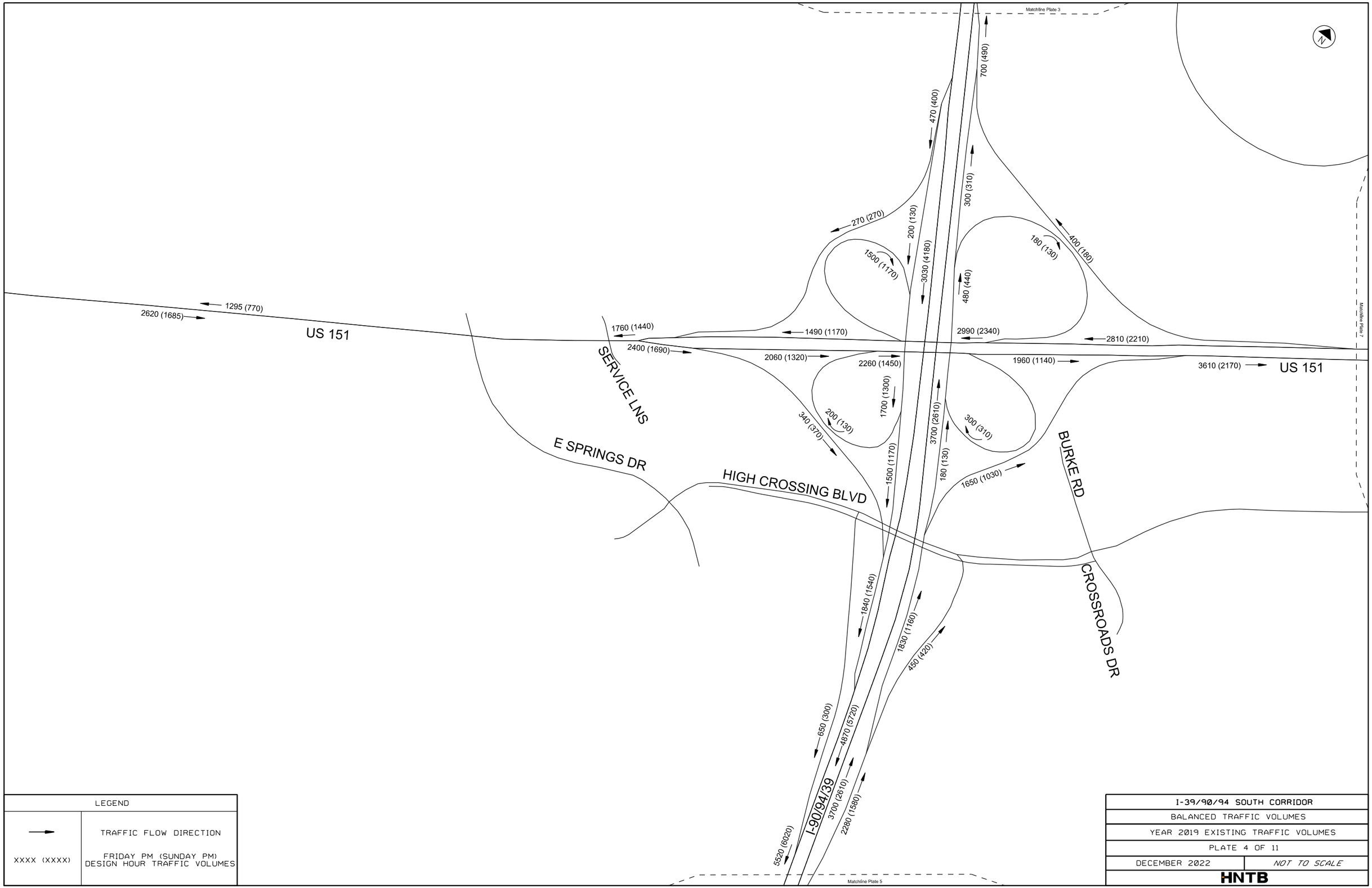
4490 (3020)

Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

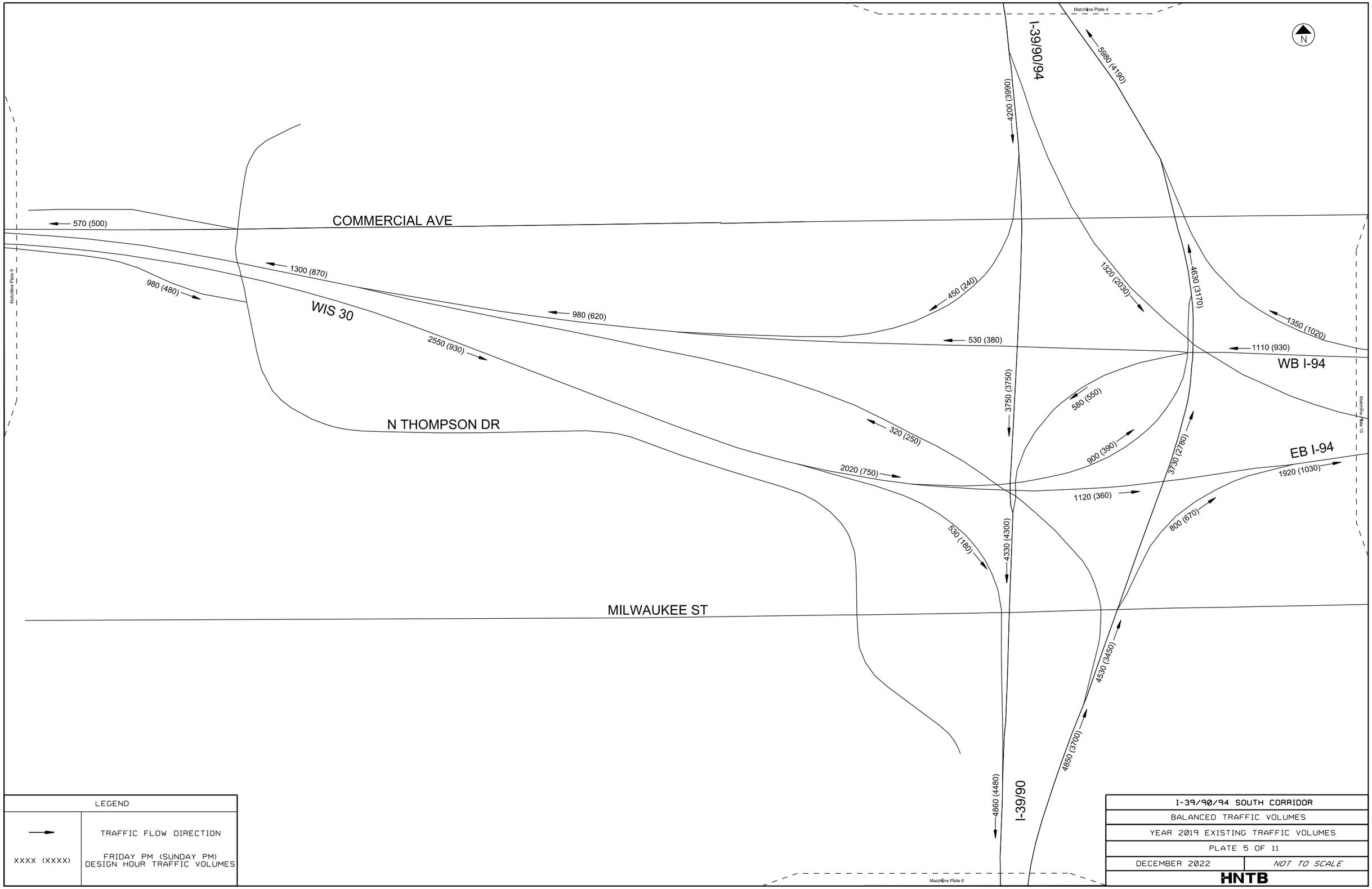
I-39/90/94 SOUTH CORRIDOR
BALANCED TRAFFIC VOLUMES
YEAR 2019 EXISTING TRAFFIC VOLUMES
PLATE 2 OF 11
DECEMBER 2022 | *NOT TO SCALE*
HNTB


Matchline Plate 2
I-39/90/94
US 51
3490 (4630)
4490 (3020)
70 (30)
560 (360)
440 (440)
4420 (2990)
620 (210)
3050 (4190)
300 (310)
3800 (2780)
3350 (4500)
600 (320)
405 (405)
150 (80)
DAENTL RD
4400 (3100)
3500 (4580)
N
US 51
I-39/90/94
Matchline Plate 4
LEGEND
TRAFFIC FLOW DIRECTION
XXXX (XXXX)
FRIDAY PM (SUNDAY PM)
DESIGN HOUR TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED TRAFFIC VOLUMES
YEAR 2019 EXISTING TRAFFIC VOLUMES
PLATE 3 OF 11
DECEMBER 2022
NOT TO SCALE
HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 4 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	


Matchline Plate 4
I-39/90/94
5980 (4190)
4200 (3990)
COMMERCIAL AVE
570 (500)
Matchline Plate 9
1300 (870)
980 (480)
WIS 30
980 (620)
450 (240)
1320 (2030)
4630 (3170)
1350 (1020)
530 (380)
1110 (930)
WB I-94
2550 (930)
3750 (3750)
580 (550)
Matchline Plate 10
320 (250)
900 (390)
3730 (2780)
N THOMPSON DR
EB I-94
2020 (750)
1920 (1030)
1120 (360)
530 (180)
4330 (4300)
800 (670)
MILWAUKEE ST
4530 (3450)
4850 (3700)
4860 (4480)
I-39/90
Matchline Plate 6
LEGEND
TRAFFIC FLOW DIRECTION
XXXX (XXXX)
FRIDAY PM (SUNDAY PM)
DESIGN HOUR TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED TRAFFIC VOLUMES
YEAR 2019 EXISTING TRAFFIC VOLUMES
PLATE 5 OF 11
DECEMBER 2022
NOT TO SCALE
HNTB

Matchline Plate 5

N

I-39/90

4860 (4480)

4850 (3700)

2480 (2680)

2380 (1800)

2910 (1990)

640 (550)

3020 (2350)

30 (20)

1940 (1710)

360 (220)

US 12/18

2510 (2700)

2580 (2260)

2550 (1770)

US 12/18

880 (570)

530 (380)

70 (40)

1980 (2320)

2860 (2890)

2650 (2300)

I-39/90

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 6 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

AMERICAN PKWY

EASTPARK BLVD

770 (210)

110 (70)

110 (70)

160 (40)

220 (120)

3210 (2390)

2440 (2180)

2280 (2140)

2500 (2260)

US 151

US 151

3460 (2110)

150 (60)

370 (200)

3090 (1910)

560 (280)

3650 (2190)

720 (320)

HIGH CROSSING BLVD

NELSON RD

Matchline Plate 6

Matchline Plate 8

N

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR

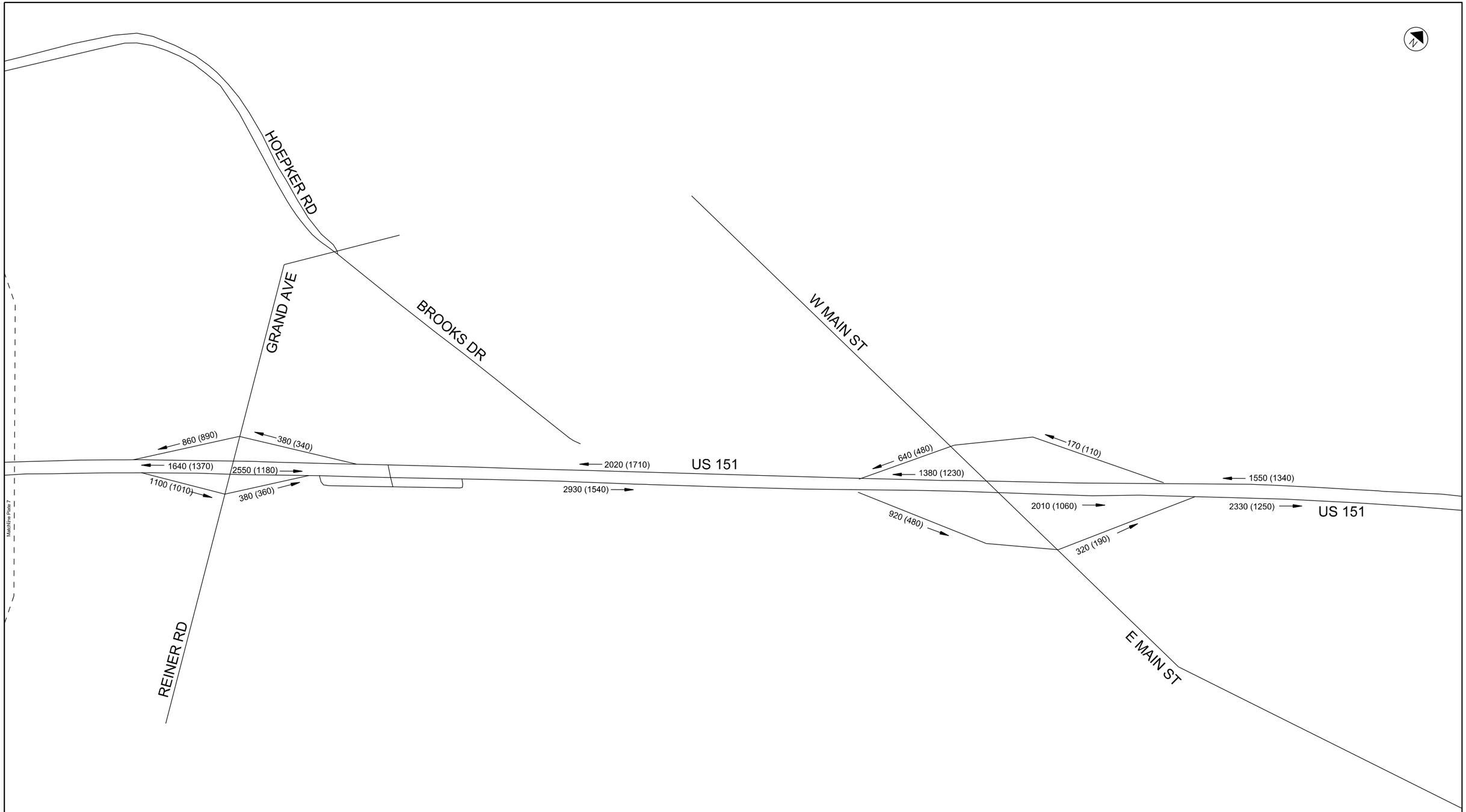
BALANCED TRAFFIC VOLUMES

YEAR 2019 EXISTING TRAFFIC VOLUMES

PLATE 7 OF 11

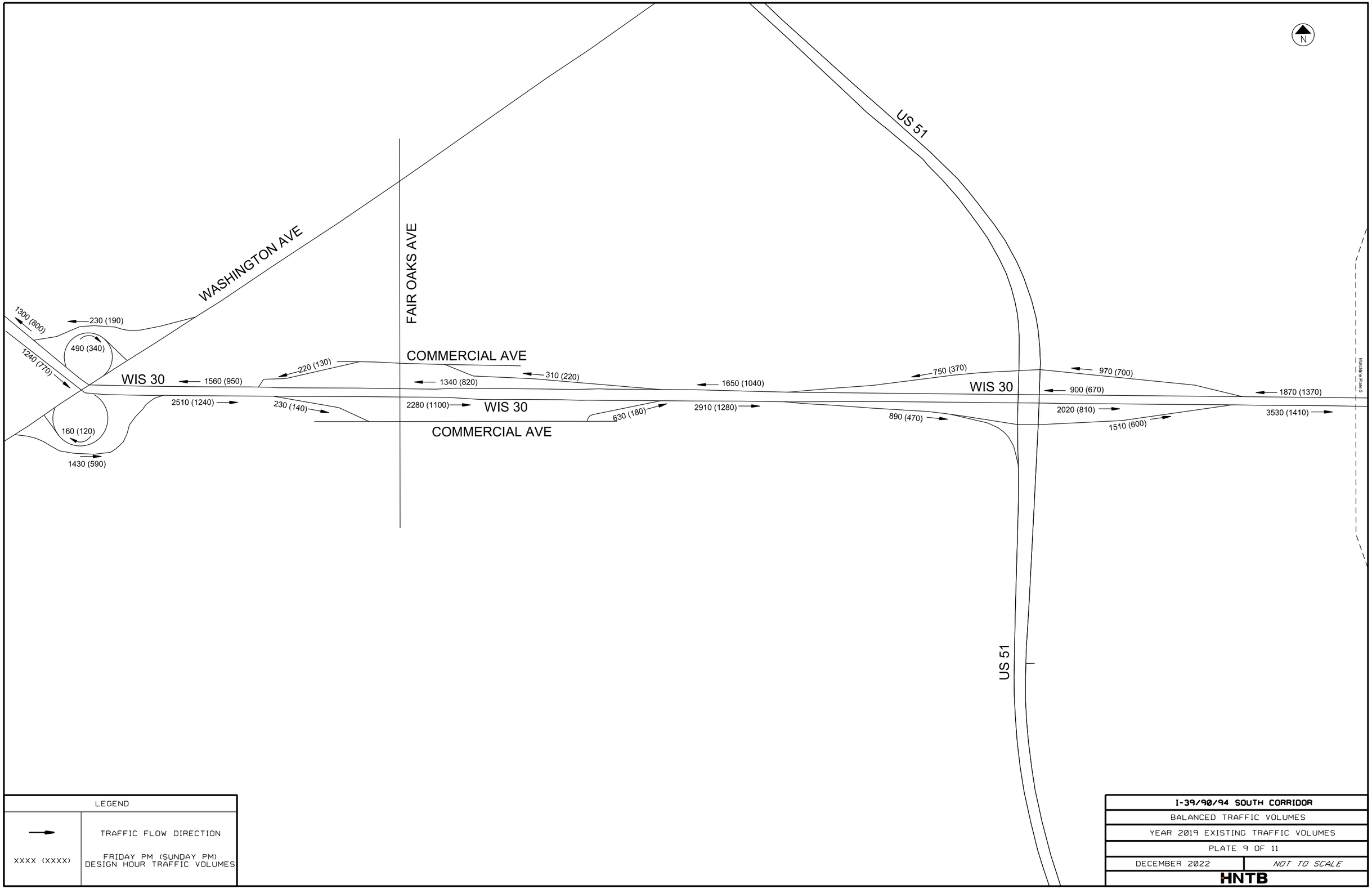
DECEMBER 2022 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 8 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR

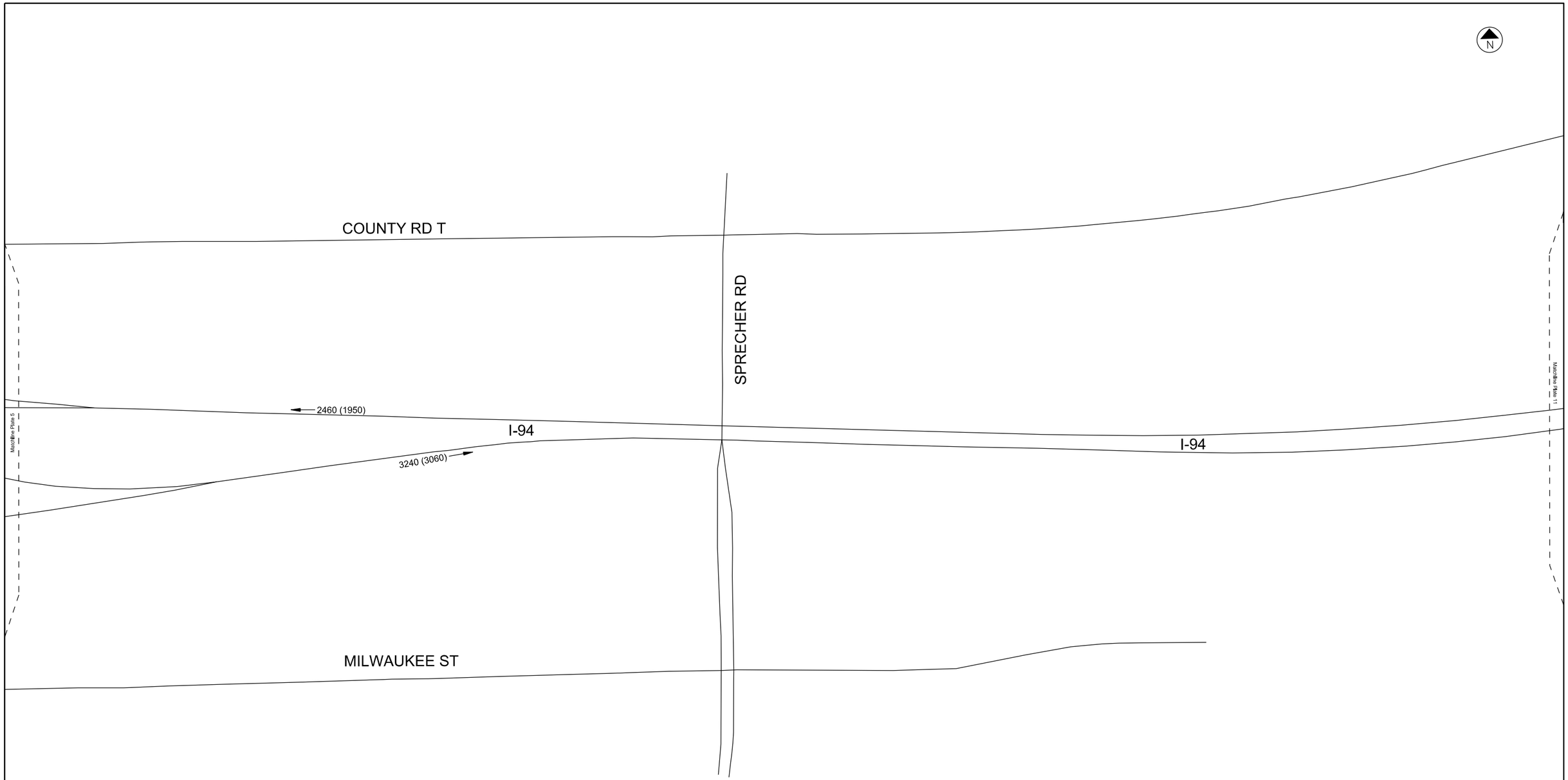
BALANCED TRAFFIC VOLUMES

YEAR 2019 EXISTING TRAFFIC VOLUMES

PLATE 9 OF 11

DECEMBER 2022 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 10 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

N

CTH TT

I-94

560 (450)

1900 (1500)

310 (370)

2210 (1870)

I-94

2930 (2610)

2480 (2290)

760 (770)

450 (320)

Matchline Plate 10

CTH N

GASTON RD

COMMERCE PKWY

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 11 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

N

I-39/90/94

HICKORY LN

MORRISONVILLE RD

CTH V

29650

29650

2650

27000

3400

4100

4100

5150

5150

26250

4600

4950

EVCO CIR

31950

30850

I-39/90/94

HICKORY LN

Matchline Plate 2

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 1 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 1

N

I-39/90/94

31950

30850

3250

3150

28700

CTH CV

TIERNEY XING

DALMORE RD

WIS 19

LIUNA WAY

9250

9250

7850

7850

Matchline Plate 4

27700

7000

7200

PEPSI WAY

I-39/90/94

35900

34700

Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR

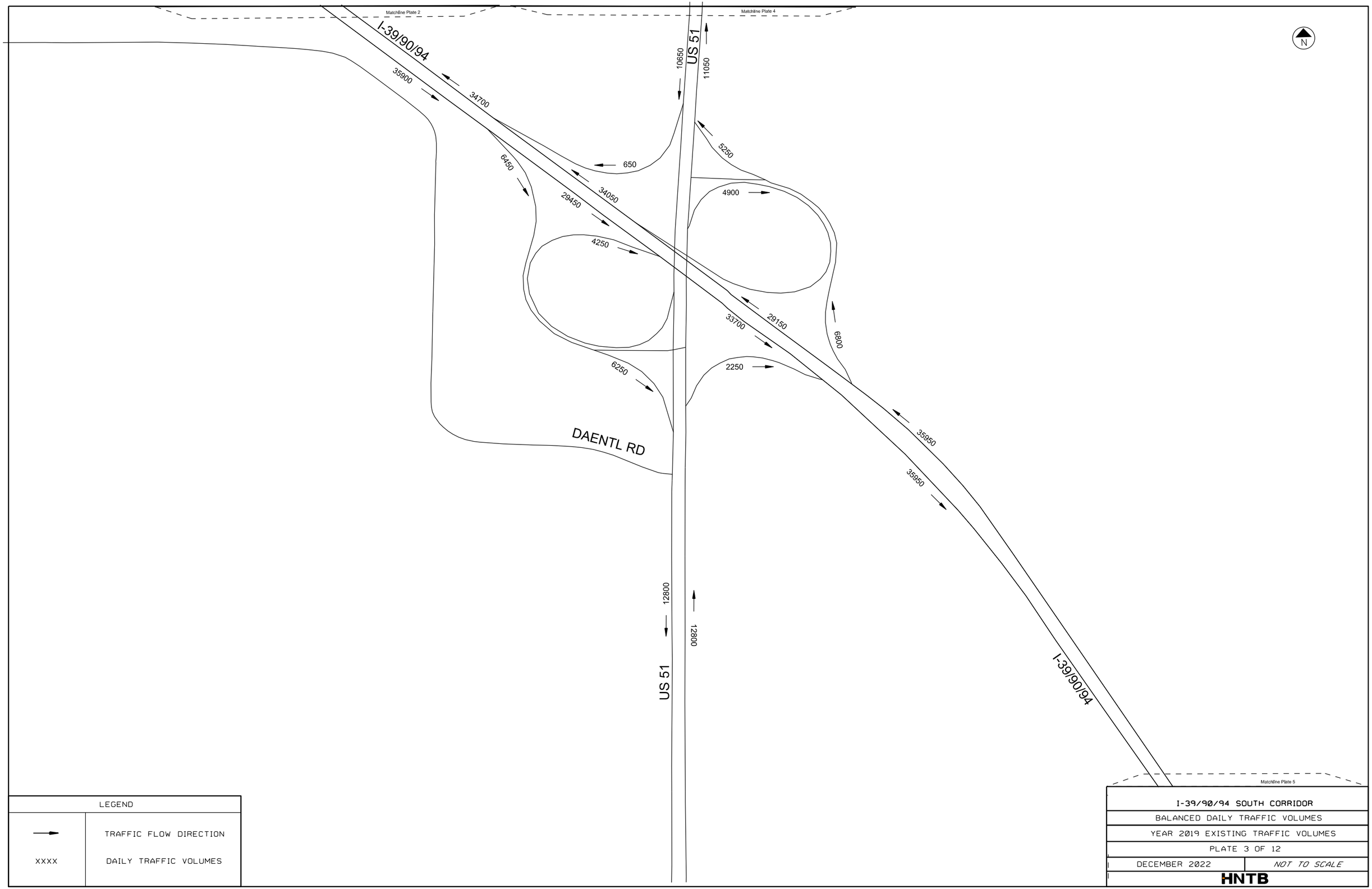
BALANCED DAILY TRAFFIC VOLUMES

YEAR 2019 EXISTING TRAFFIC VOLUMES

PLATE 2 OF 12

DECEMBER 2022 | *NOT TO SCALE*

HNTB


Matchline Plate 2
Matchline Plate 4
I-39/90/94
US 51
N
35900
34700
10650
11050
650
6450
5250
34050
29450
4900
4250
33700
29150
6800
6250
2250
DAENTL RD
35950
35950
12800
12800
US 51
I-39/90/94
Matchline Plate 5
LEGEND
TRAFFIC FLOW DIRECTION
XXXX
DAILY TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED DAILY TRAFFIC VOLUMES
YEAR 2019 EXISTING TRAFFIC VOLUMES
PLATE 3 OF 12
DECEMBER 2022
NOT TO SCALE
HNTB

N

US 51

9450

9950

N TOWNE RD

2100

2300

7350

7850

7000

7850

WIS 19

7000

Matchline Plate 2

3300

7650

3400

10650

11050

US 51

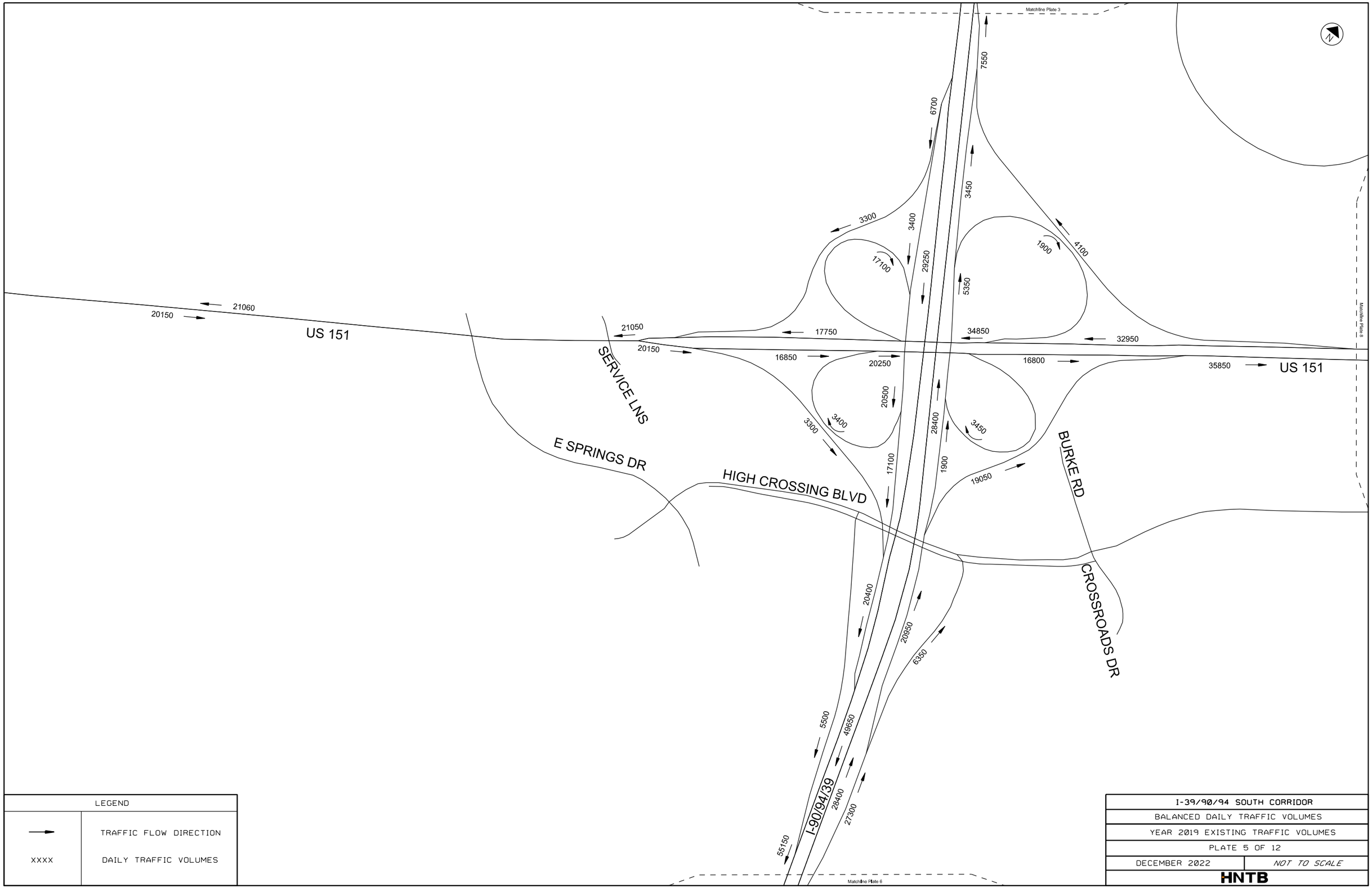
WILLIAMSBURG WAY

METRO DR

Matchline Plate 3

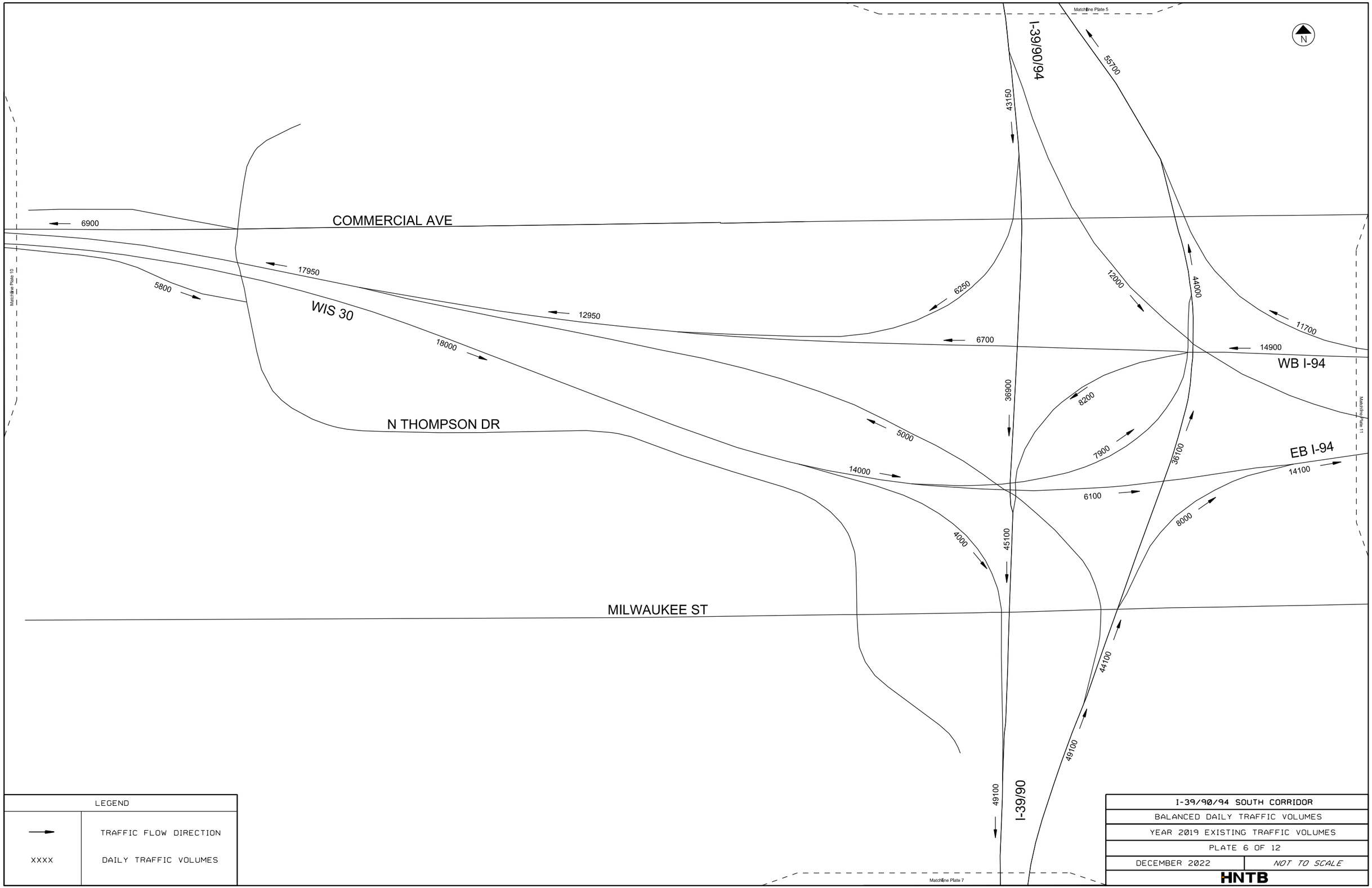
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 4 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 5 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	


Matchline Plate 5
Matchline Plate 10
Matchline Plate 11
Matchline Plate 7
I-39/90/94
I-39/90
COMMERCIAL AVE
WIS 30
N THOMPSON DR
MILWAUKEE ST
WB I-94
EB I-94
6900
17950
5800
18000
12950
6250
6700
14900
11700
12000
44000
43150
55700
36900
8200
7900
36100
6100
14100
8000
5000
14000
4000
45100
44100
49100
49100
N
LEGEND
TRAFFIC FLOW DIRECTION
XXXX
DAILY TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED DAILY TRAFFIC VOLUMES
YEAR 2019 EXISTING TRAFFIC VOLUMES
PLATE 6 OF 12
DECEMBER 2022
NOT TO SCALE
HNTB

Matchline Plate 6

N

I-39/90

49100

49100

20600

28500

31900

9000

37500

400

17200

3300

45350

US 12/18

45350

21000

26200

28600

7750

US 12/18

7750

8700

3200

500

17800

26500

26700

I-39/90

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 7 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

AMERICAN PKWY

EASTPARK BLVD

8300

2200

1900

1100

4100

37050

28750

27650

31750

US 151

US 151

33550

2300

7200

26350

5400

31750

6500

HIGH CROSSING BLVD

NELSON RD

Matchline Plate 5

Matchline Plate 9

N

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 8 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

HOEPKER RD

GRAND AVE

BROOKS DR

W MAIN ST

US 151

REINER RD

E MAIN ST

9500

9500

9400

3800

22350

22150

26150

7050

7050

7900

18250

2000

20250

9600

4200

26350

16650

18650

US 151

9700

2000

5200

5200

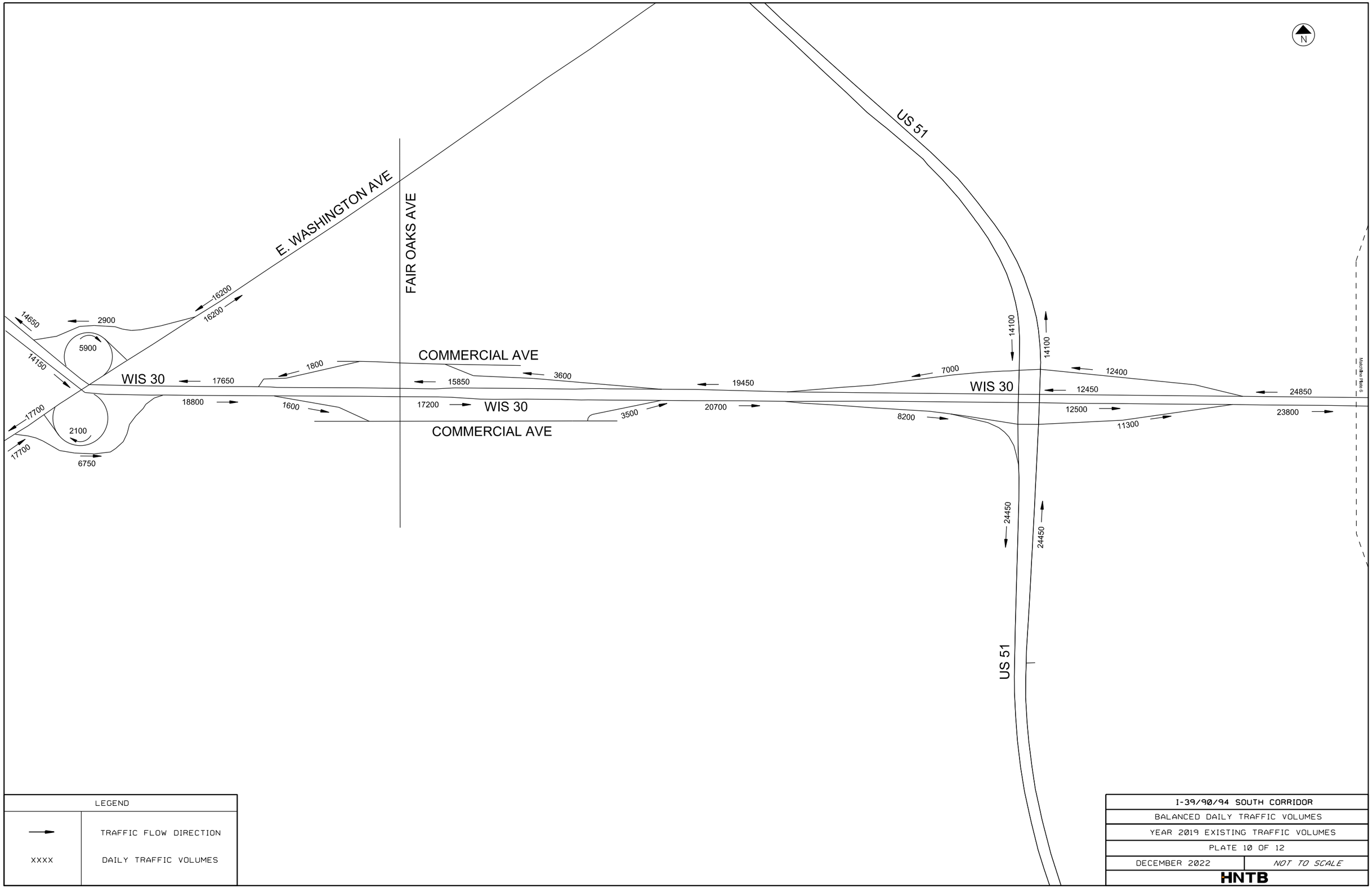
7550

7550

Machine Plate 9

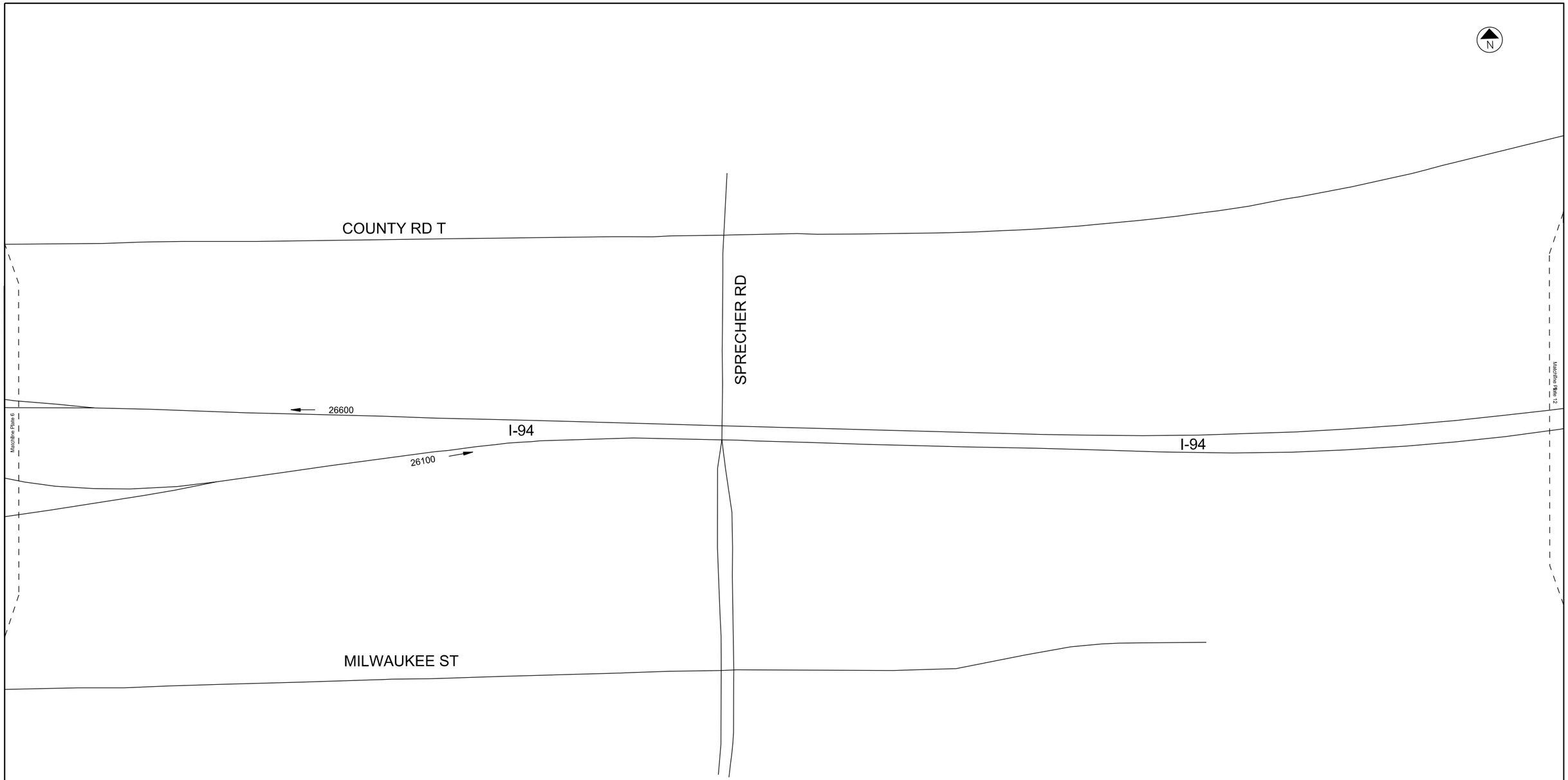
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 9 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 10 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 11 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

N

3050

3050

CTH TT

22900

2900

I-94

22900

20000

6600

19900

3000

I-94

6200

Match line Plate 11

CTH N

COMMERCE PKWY

GASTON RD

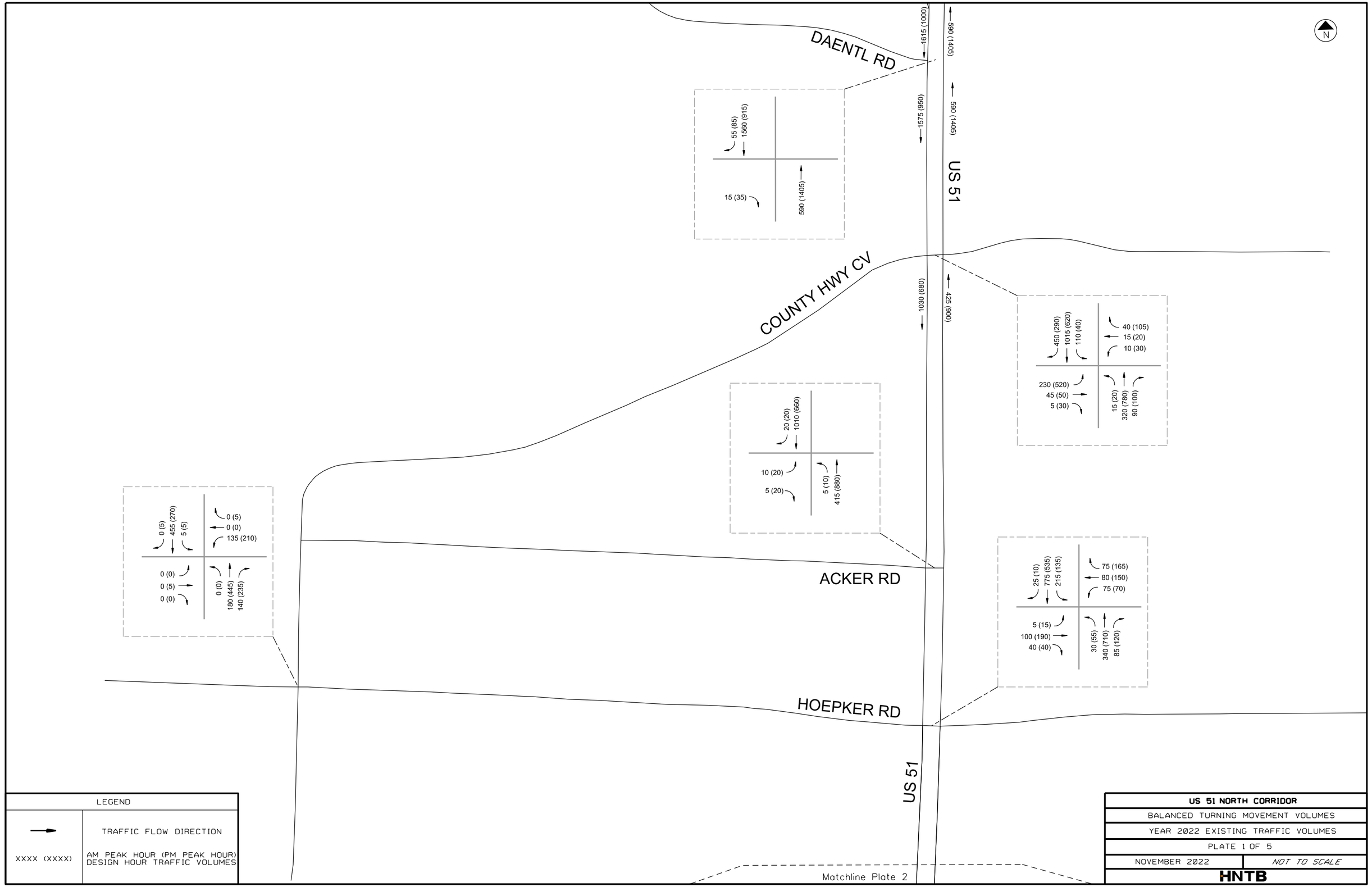
5350

5350

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2019 EXISTING TRAFFIC VOLUMES	
PLATE 12 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Attachment L3
US 51 North Existing Year Volume Exhibits



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 NORTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2022 EXISTING TRAFFIC VOLUMES	
PLATE 1 OF 5	
NOVEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 1

N

US 51

HANSON RD

730 (630)

520 (825)

695 (560)
195 (85)

65 (125)
35 (70)

390 (760)
130 (65)

25 (5)
705 (625)

5 (5)
5 (10)

25 (5)
515 (820)

AMELIA EARHART DR

US 51

Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 NORTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2022 EXISTING TRAFFIC VOLUMES	
PLATE 2 OF 5	
NOVEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 2

N

US 51

RIEDER RD

655 (545)
55 (90)
91 (92)
449 (733)
41 (122)

0 (0)
655 (545)
0 (0)
0 (0)
490 (855)
0 (0)

PIERSTORFF ST

655 (545)
490 (855)

155 (35)
465 (485)
35 (25)
10 (25)
100 (45)
45 (55)
30 (170)
15 (70)
10 (125)
240 (50)
450 (660)
30 (75)

US 51

KINSMAN ST

520 (665)
720 (785)

Matchline Plate 4

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 NORTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2022 EXISTING TRAFFIC VOLUMES	
PLATE 3 OF 5	
NOVEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 3

US 51

N STOUGHTON SERVICE RD

ANDERSON ST

MENDOTA ST

US 151

ROWLAND AVE

SCHMEDEMAN AVE

REINDAHL AVE

WRIGHT ST

N FAIR OAKS AVE

MAC ARTHUR RD

N STOUGHTON SERVICE RD

US 51

COMMERCIAL AVE

US 151

Matchline Plate 5

70 (60) 420 (575) 30 (30)
20 (20) 25 (35) 45 (65)
75 (120) 30 (40) 190 (430)
430 (290) 625 (645) 20 (45)

655 (1070)
1075 (980)

10 (15)
10 (20) 1365 (1140)
645 (1580)

240 (165) 265 (565) 150 (340)
215 (275) 1060 (925) 320 (410)
125 (220) 470 (1295) 50 (65)
75 (70) 735 (485) 360 (600)

10 (30) 15 (10) 15 (15)
10 (15) 1480 (1410) 70 (120)
5 (30) 835 (1980) 105 (185)
105 (170) 5 (5) 15 (65)

1595 (1610)
930 (2175) 50 (60)
15 (20)

635 (1040)
1170 (1155)

35 (85) 70 (220) 25 (60)
45 (45) 1230 (940) 80 (115)
75 (40) 530 (1390) 5 (25)
25 (20) 245 (75) 85 (135)

1375 (1155)
645 (1560) 20 (20)
5 (20)

50 (20) 555 (930) 30 (90)
55 (140) 25 (30) 110 (205)
15 (50) 20 (40) 60 (130)
95 (95) 1100 (965) 165 (255)

15 (10) 25 (25)
15 (25) 1340 (1090)
20 (30) 620 (1555)

15 (10) 25 (25)
15 (25) 1330 (1090) 15 (25) 15 (15)
20 (30) 620 (1535) 5 (15)
10 (15) 5 (5)

5 (10) 5 (0) 10 (70)
25 (25) 100 (90) 45 (30)
5 (0) 70 (100) 5 (10)
5 (5) 0 (0) 15 (50)

725 (1265)
1360 (1315)

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 NORTH CORRIDOR

BALANCED TURNING MOVEMENT VOLUMES

YEAR 2022 EXISTING TRAFFIC VOLUMES

PLATE 4 OF 5

NOVEMBER 2022 | *NOT TO SCALE*

HNTB

Matchline Plate 4

US 51

WIS 30

WIS 30

CORPORATE DR

US 51

N

50 (60)
675 (1205)
355 (200)
0 (0)
915 (575)
460 (510)
1005 (1115)

510 (570)
1270 (775)
640 (720)
535 (1275)
2090 (2170)
1860 (2570)

1480 (1520)
110 (260)
30 (70)
0 (0)
610 (650)
1435 (1555)
425 (1015)

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 NORTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2022 EXISTING TRAFFIC VOLUMES	
PLATE 5 OF 5	
NOVEMBER 2022	*NOT TO SCALE*
HNTB	

DAENTL RD

11900

12260

COUNTY HWY CV

6280

7530

ACKER RD

HOEPKER RD

US 51

Matchline Plate 2

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

US 51 NORTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2022 EXISTING TRAFFIC VOLUMES	
PLATE 1 OF 5	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 1

N

US 51

HANSON RD

6880

6500

AMELIA EARHART DR

US 51

Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

US 51 NORTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2022 EXISTING TRAFFIC VOLUMES	
PLATE 2 OF 5	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 2

N

US 51

RIEDER RD

PIERSTORFF ST

6810

6490

US 51

KINSMAN ST

7520

6860

Matchline Plate 4

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

US 51 NORTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2022 EXISTING TRAFFIC VOLUMES	
PLATE 3 OF 5	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 3

N

US 51

N STOUGHTON SERVICE RD

US 151

ANDERSON ST

11690

12390

MENDOTA ST

20110

20740

22600

18150

ROWLAND AVE

SCHMEDEMAN AVE

REINDAHL AVE

16170

13980

MAC ARTHUR RD

11610

13180

WRIGHT ST

N STOUGHTON SERVICE RD

US 51

US 151

N FAIR OAKS AVE

COMMERCIAL AVE

14820

13390

Matchline Plate 5

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

US 51 NORTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2022 EXISTING TRAFFIC VOLUMES	
PLATE 4 OF 5	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 4

N

US 51

WIS 30

5920

9820

7450

8910

WIS 30

25550

21730

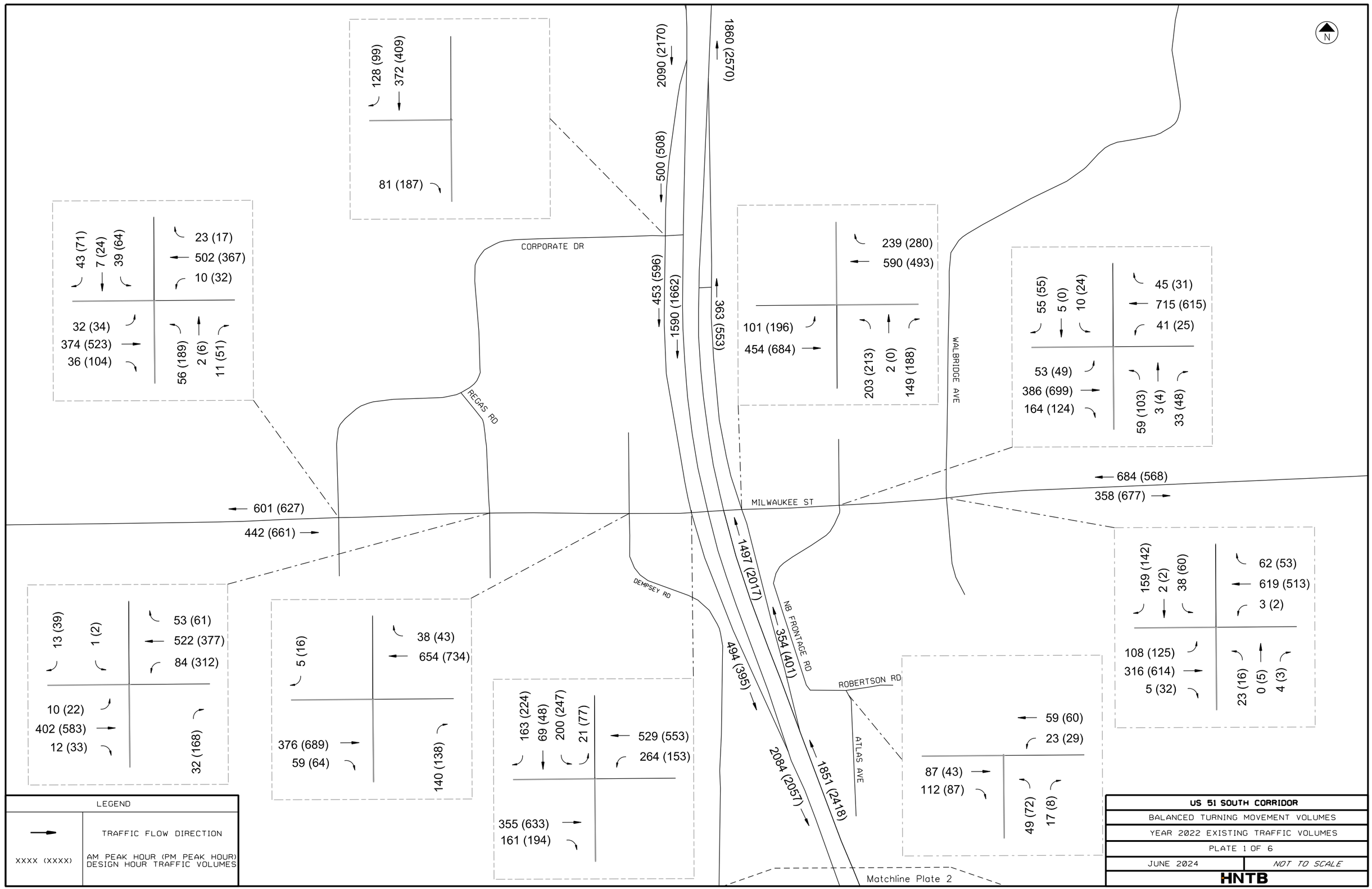
CORPORATE DR

US 51

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

US 51 NORTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2022 EXISTING TRAFFIC VOLUMES	
PLATE 5 OF 5	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Attachment L4
US 51 South Existing Year Volume Exhibits


N
128 (99)
372 (409)
81 (187)
2090 (2170)
1880 (2570)
500 (508)
CORPORATE DR
453 (596)
1590 (1662)
363 (553)
239 (280)
590 (493)
101 (196)
454 (684)
203 (213)
2 (0)
149 (188)
WALBRIDGE AVE
55 (55)
5 (0)
10 (24)
45 (31)
715 (615)
41 (25)
53 (49)
386 (699)
164 (124)
59 (103)
3 (4)
33 (48)
43 (71)
7 (24)
39 (64)
23 (17)
502 (367)
10 (32)
32 (34)
374 (523)
36 (104)
56 (189)
2 (6)
11 (51)
REGAS RD
684 (568)
358 (677)
MILWAUKEE ST
601 (627)
442 (661)
1497 (2017)
DEMPSEY RD
NB FRONTAGE RD
354 (401)
494 (395)
ROBERTSON RD
ATLAS AVE
2084 (2057)
1851 (2418)
159 (142)
2 (2)
38 (60)
62 (53)
619 (513)
3 (2)
108 (125)
316 (614)
5 (32)
23 (16)
0 (5)
4 (3)
59 (60)
23 (29)
87 (43)
112 (87)
49 (72)
17 (8)
13 (39)
1 (2)
53 (61)
522 (377)
84 (312)
10 (22)
402 (583)
12 (33)
32 (168)
5 (16)
38 (43)
654 (734)
376 (689)
59 (64)
140 (138)
163 (224)
69 (48)
200 (247)
21 (77)
529 (553)
264 (153)
355 (633)
161 (194)
Matchline Plate 2
LEGEND
TRAFFIC FLOW DIRECTION
XXXX (XXXX)
AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES
US 51 SOUTH CORRIDOR
BALANCED TURNING MOVEMENT VOLUMES
YEAR 2022 EXISTING TRAFFIC VOLUMES
PLATE 1 OF 6
JUNE 2024
NOT TO SCALE
HNTB

Matchline Plate 1

COTTAGE COURT RD

403 (478)

1448 (1940)

279 (330)

ATLAS AVE

COTTAGE GROVE RD

1260 (886)

523 (1082)

724 (540)

454 (750)

251 (412)

1833 (1645)

539 (458)

1727 (2270)

DEMPSEY RD

CLAIRE ST

LUMBERMAN'S TRL

58 (60)
32 (26)
170 (174)
165 (132)
658 (464)
14 (32)
38 (51)
409 (686)
7 (13)
8 (16)
32 (37)
24 (42)

825 (612)
50 (57)
579 (873)
24 (29)
12 (16)
57 (61)

0 (2)
1 (7)
8 (8)
12 (11)
770 (509)
400 (318)
1 (2)
497 (799)
138 (133)
105 (158)
6 (3)
140 (251)

91 (86)
188 (244)
229 (295)
1091 (752)
174 (183)
471 (875)

132 (196)
2 (7)
24 (110)
74 (60)
1184 (786)
2 (40)
145 (111)
498 (916)
16 (92)
4 (65)
0 (9)
1 (56)

Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR

BALANCED TURNING MOVEMENT VOLUMES

YEAR 2022 EXISTING TRAFFIC VOLUMES

PLATE 2 OF 6

JUNE 2024 | *NOT TO SCALE*

HNTB

Matchline Plate 2

5 (8) 4 (2) 14 (16)
5 (19)
323 (311)
17 (28)
3 (4)
260 (259)
2 (6)
4 (9) 1 (7) 18 (40)

341 (342)
160 (166)
282 (289)
10 (26)
4 (16) 32 (142)

2372 (2103)
1727 (2270)

BLOSSOM LN

302 (281) 1834 (1634) 236 (188)
199 (322)
157 (135)
246 (210)
129 (202)
129 (165)
56 (64)
42 (92) 1399 (1746) 197 (290)

81 (89) 4 (9)
13 (13)
521 (578)
67 (59)
495 (584)

332 (328)
265 (269)

BUCKEYE RD

522 (431)
371 (582)

5 (16) 165 (176)
4 (5)
8 (21)
10 (44) 32 (153)

ALLIS AVE

SSM HEALTH

FRONTAGE RD E

CAMDEN RD

FRONTAGE RD W

122 (45) 102 (49)
40 (101)
0 (7)
1 (2) 70 (147)

0 (0) 0 (1) 0 (1)
0 (4)
480 (408)
42 (19)
2 (2)
315 (517)
182 (74)
54 (183) 0 (1) 56 (64)

26 (66) 102 (128)
13 (76)
2 (9)
5 (10) 56 (78)

8 (19) 2 (4)
5 (2)
97 (54)
77 (15)
69 (145)

76 (72) 148 (22)
54 (163)
2 (3)
56 (85) 59 (14)

FARM & FLEET

5 (10) 99 (127)
1 (9)
17 (56)
21 (55) 60 (79)

2136 (1908)
1638 (2128)

56 (166)
207 (36)

HELGESEN RD

Matchline Plate 4

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR
BALANCED TURNING MOVEMENT VOLUMES
YEAR 2022 EXISTING TRAFFIC VOLUMES
PLATE 3 OF 6
JUNE 2024 | *NOT TO SCALE*
HNTB

Matchline Plate 3

CAMDEN RD

2136 (1908)

1638 (2128)

PFLAUM RD

630 (407)
443 (489)

429 (630)
632 (383)

632 (424)
6 (9)
470 (504)
4 (4)
2 (3)
18 (8)

SERVICE LN

FRONTAGE RD W

FRONTAGE RD E

SEIFORTH RD

20 (16)
6 (3)
13 (14)
5 (21)
603 (389)
26 (17)
20 (20)
418 (466)
5 (3)
7 (2)
3 (1)
43 (28)

87 (75)
13 (27)
16 (81)
54 (110)
551 (358)
21 (23)
24 (23)
462 (480)
2 (9)
0 (0)
3 (1)
41 (24)

397 (611)
32 (19)
575 (361)
97 (42)
87 (71)
57 (22)

1804 (2099)

1764 (1998)

TOMPKINS DR

65 (67)
0 (0)
13 (8)
52 (53)
427 (624)
5 (5)
59 (33)
657 (382)
134 (71)
7 (22)
4 (13)
2 (13)

24 (16)
13 (7)
6 (14)
30 (45)
47 (17)
31 (18)

314 (178)
1503 (1613)
319 (117)
168 (295)
164 (131)
167 (287)
238 (267)
147 (119)
134 (199)
148 (182)
1232 (1566)
384 (250)

Matchline Plate 5

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2022 EXISTING TRAFFIC VOLUMES	
PLATE 4 OF 6	
JUNE 2024	*NOT TO SCALE*
HNTB	

Matchline Plate 4

N

3 (5)
20 (43)
1 (3)
77 (125)
123 (98)
31 (36)

318 (290)
1401 (1741)
85 (68)
46 (100)
166 (225)
233 (531)
119 (289)
135 (159)
111 (306)
269 (184)
1599 (1609)
682 (290)

84 (156)
1 (6)
1 (0)
2 (1)
331 (641)
8 (16)
172 (83)
676 (349)
54 (85)
30 (59)
1 (1)
11 (21)

27 (13)
326 (546)
12 (31)
13 (54)
25 (20)
607 (337)

FEMRITE DR

32 (45)
65 (123)
123 (95)
630 (604)
31 (39)
300 (631)

FEMRITE DR

COPPS AVE

BROADWAY AVE

662 (649)

331 (670)

BROADWAY SR

DUTCH MILL RD

339 (600)

632 (357)

BROADWAY AVE

1745 (2578)

2550 (2083)

1209 (1353)
536 (1225)
489 (243)
1 (0)
330 (375)
800 (570)
2061 (1840)

820 (618)

2861 (2410)

2010 (1923)

BELTLINE

866 (1600)

514 (872)

334 (598)
5 (2)
629 (350)
59 (20)
7 (60)
3 (7)

1817 (2151)

1154 (2011)

1846 (1542)

700 (1169)
166 (431)
1362 (1304)
1 (5)
454 (842)
1499 (1106)
347 (436)

Matchline Plate 6

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2022 EXISTING TRAFFIC VOLUMES	
PLATE 5 OF 6	
JUNE 2024	*NOT TO SCALE*
HNTB	

Matchline Plate 5

DUTCH MILL RD

VOGES RD

204 (397)
323 (171)

TERMINAL DR

TERMINAL DR
157 (99)
84 (133)

TRIANGLE ST

714 (1748)
1552 (1005)

7 (8)	22 (36)	26 (27) 150 (91) 0 (2)
6 (10) 78 (123)		0 (1) 2 (1)

149 (98)	684 (1673)	321 (240)
68 (125) 20 (18) 14 (17)		16 (10) 1471 (964) 65 (31)

307 (453)
11 (12)
16 (58)

34 (43) 5 (2) 1 (2)		1 (12) 194 (378) 9 (7)
28 (49) 312 (153) 66 (87)		106 (102) 1 (4) 10 (16)

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR

BALANCED TURNING MOVEMENT VOLUMES

YEAR 2022 EXISTING TRAFFIC VOLUMES

PLATE 6 OF 6

JUNE 2024 | *NOT TO SCALE*

HNTB

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	EXISTING YEAR 2022 DAILY DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2022 EXISTING TRAFFIC VOLUMES	
PLATE 1 OF 6	
JANUARY 2023	*NOT TO SCALE*
HNTB	

Matchline Plate 1

N

3278

COTTAGE COURT RD

ATLAS AVE

3577

COTTAGE GROVE RD

3648

DEMPSEY RD

CLAIRE ST

LUMBERMAN'S TRL

4693

21770

Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	EXISTING YEAR 2022 DAILY DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2022 EXISTING TRAFFIC VOLUMES	
PLATE 2 OF 6	
JANUARY 2023	*NOT TO SCALE*
HNTB	

Matchline Plate 2

N

23714

21770

BLOSSOM LN

BUCKEYE RD

CAMDEN RD

FRONTAGE RD W

FRONTAGE RD E

21340

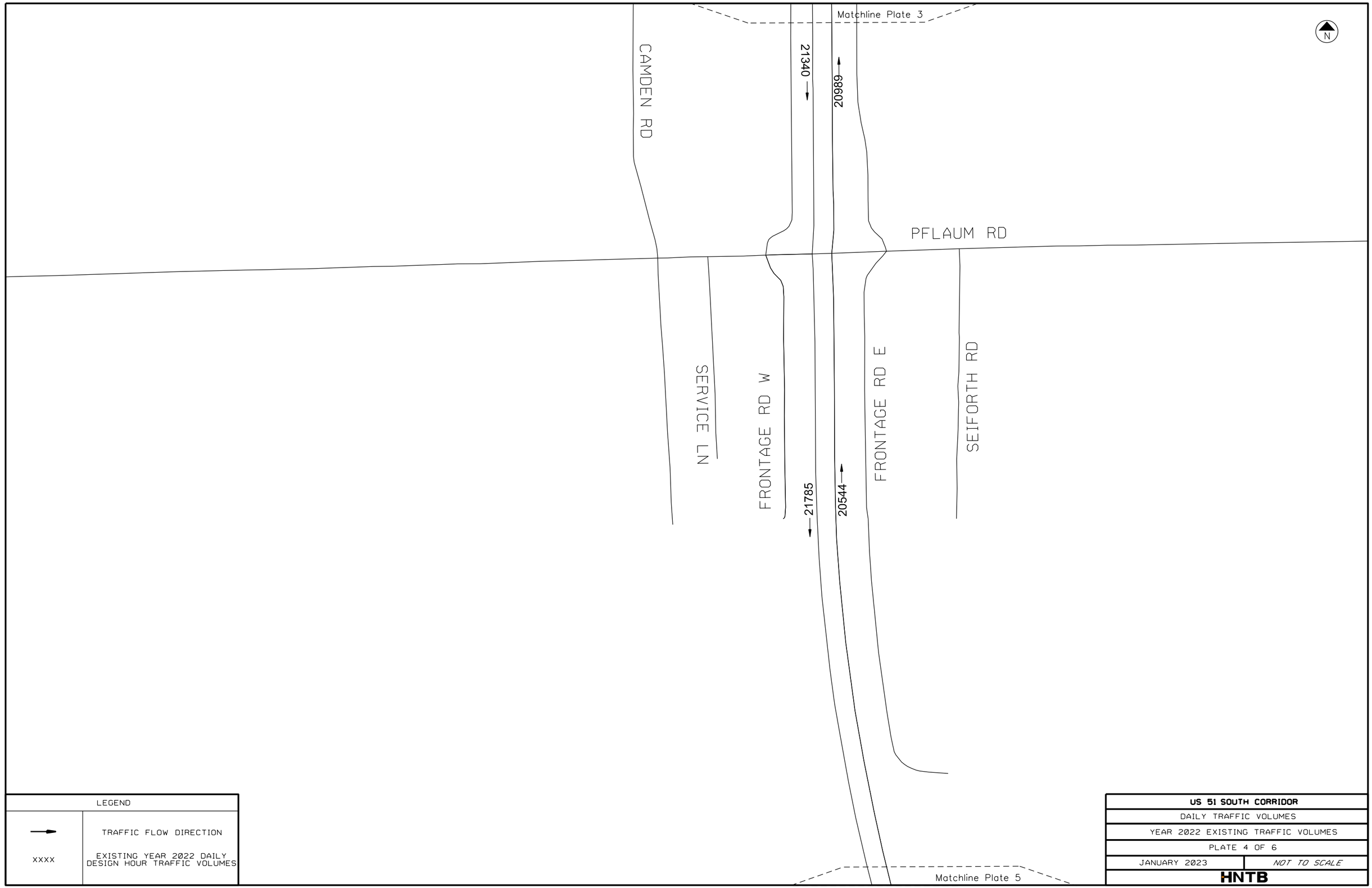
20989

HELGESEN RD

Matchline Plate 4

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	EXISTING YEAR 2022 DAILY DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2022 EXISTING TRAFFIC VOLUMES	
PLATE 3 OF 6	
JANUARY 2023	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	EXISTING YEAR 2022 DAILY DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2022 EXISTING TRAFFIC VOLUMES	
PLATE 4 OF 6	
JANUARY 2023	*NOT TO SCALE*
HNTB	

Matchline Plate 4

N

FEMRITE DR

COPPS AVE

BROADWAY AVE

BROADWAY SR

DUTCH MILL RD

BROADWAY AVE

COLLINS CT

22253

25724

8351

22541

BELTLINE

7188

23100

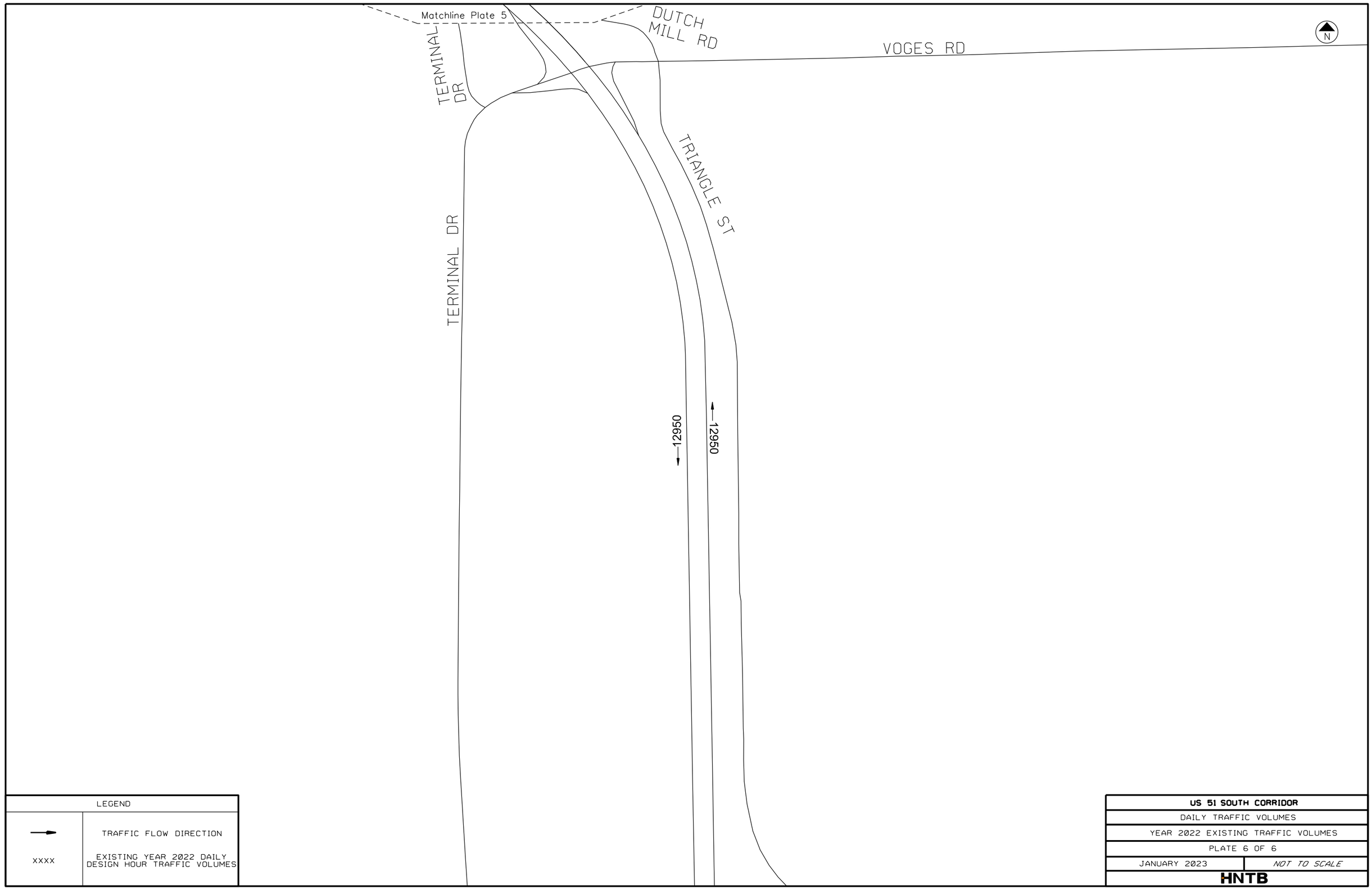
16799

16707

Matchline Plate 6

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	EXISTING YEAR 2022 DAILY DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2022 EXISTING TRAFFIC VOLUMES	
PLATE 5 OF 6	
JANUARY 2023	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	EXISTING YEAR 2022 DAILY DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2022 EXISTING TRAFFIC VOLUMES	
PLATE 6 OF 6	
JANUARY 2023	*NOT TO SCALE*
HNTB	

Attachment M1

Interstate North Existing Plus Committed Future Year 2050 Forecast Volume Exhibits

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

BALANCED TURNING MOVEMENT VOLUMES

YEAR 2050 FUTURE E+C TRAFFIC VOLUMES

PLATE 1 OF 5

FEBRUARY 2023 | *NOT TO SCALE*

HNTB

Matchline Plate 3

Matchline Plate 5

N

WIS 33

I-39/90/94

I-39

CTH U

CASCADE MOUNTAIN RD

ARCO DR/
KINNEY RD

WIS 78

Matchline Plate 1

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2050 FUTURE E+C TRAFFIC VOLUMES	
PLATE 2 OF 5	
FEBRUARY 2023	*NOT TO SCALE*
HNTB	

Matchline Plate 4

Matchline Plate 2

N

US 12

WHITLOCK ST

WIS 23

CTH P

COMMERCE ST

GASSER RD

MEADOWVIEW DR

I-90/94

3020 (3600)
3305 (3250)
430 (375)
490 (440)
2530 (3160)
2875 (2875)
230 (255)
240 (370)

295 (295) 10 (20) 580 (650)
615 (620)
445 (360)
5 (5)
260 (300)
385 (480)
10 (25)

5 (5) 95 (135) 160 (225)
250 (150)
155 (95)
550 (560)
10 (5)
105 (160)
45 (30)
45 (35) 125 (110) 555 (620)

335 (280) 0 (0) 155 (160)
620 (525)
100 (155)
680 (790)
140 (215)

180 (135)
560 (520)
250 (240)
585 (710)
160 (160) 0 (0) 70 (95)

200 (295) 365 (390) 170 (215)
130 (150)
145 (145)
255 (315)
190 (240)
135 (180)
330 (405)
375 (405) 595 (615) 250 (390)

680 (780)
450 (290)
620 (825)

95 (110)
1220 (1410)
270 (330)
600 (595)
450 (290)
785 (575)
1050 (875)
3105 (3130)
2770 (3530)
2835 (2800)
2050 (2225)
2210 (2700)
2525 (3000)
3100 (3100)
2720 (3280)
315 (300)
560 (830)
110 (170)
195 (280)
450 (660)

815 (770)
110 (170)
1295 (1230)

1490 (1510)
1265 (1430)
245 (280)
460 (360)
1020 (1150)
1030 (1150)

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

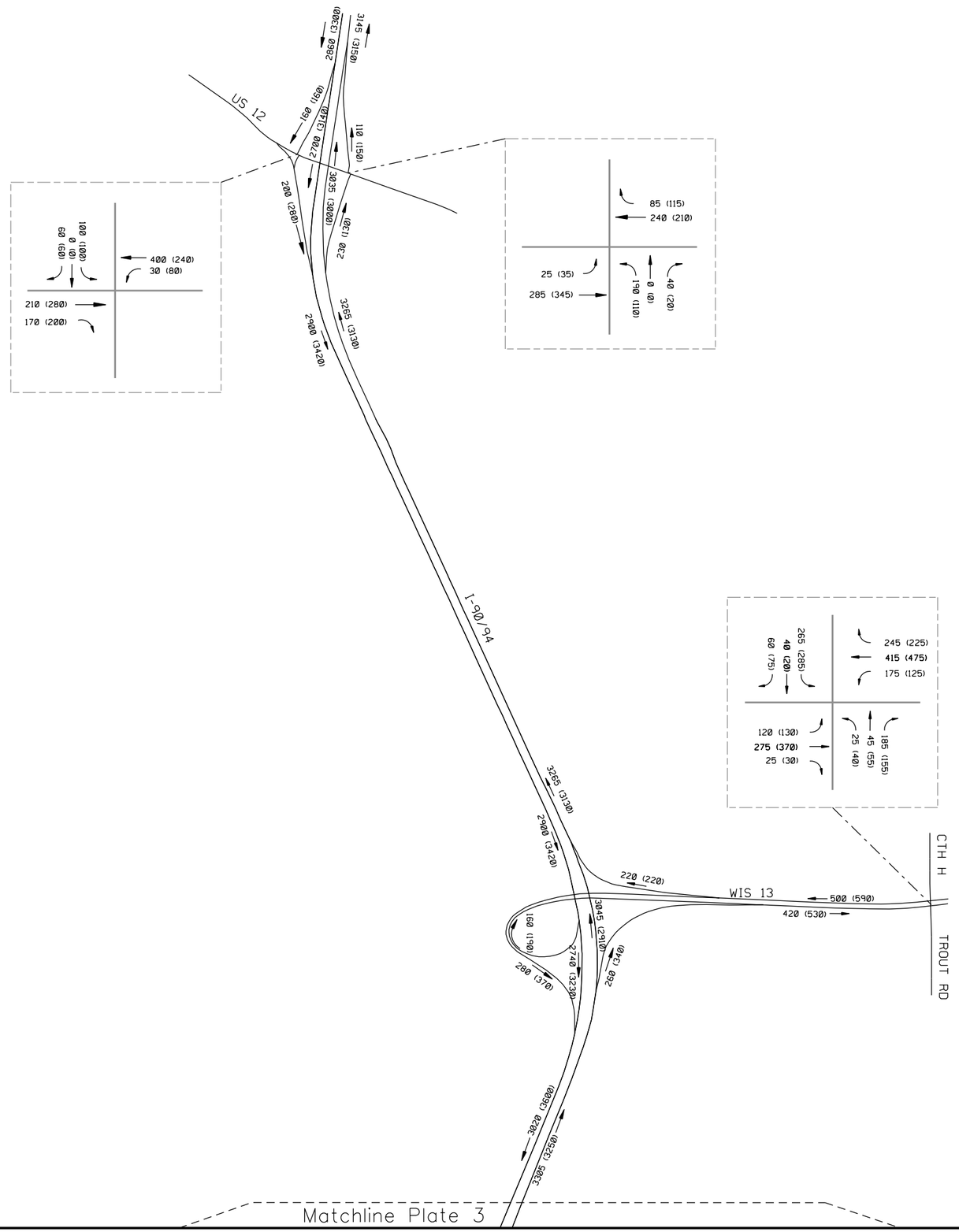
BALANCED TURNING MOVEMENT VOLUMES

YEAR 2050 FUTURE E+C TRAFFIC VOLUMES

PLATE 3 OF 5

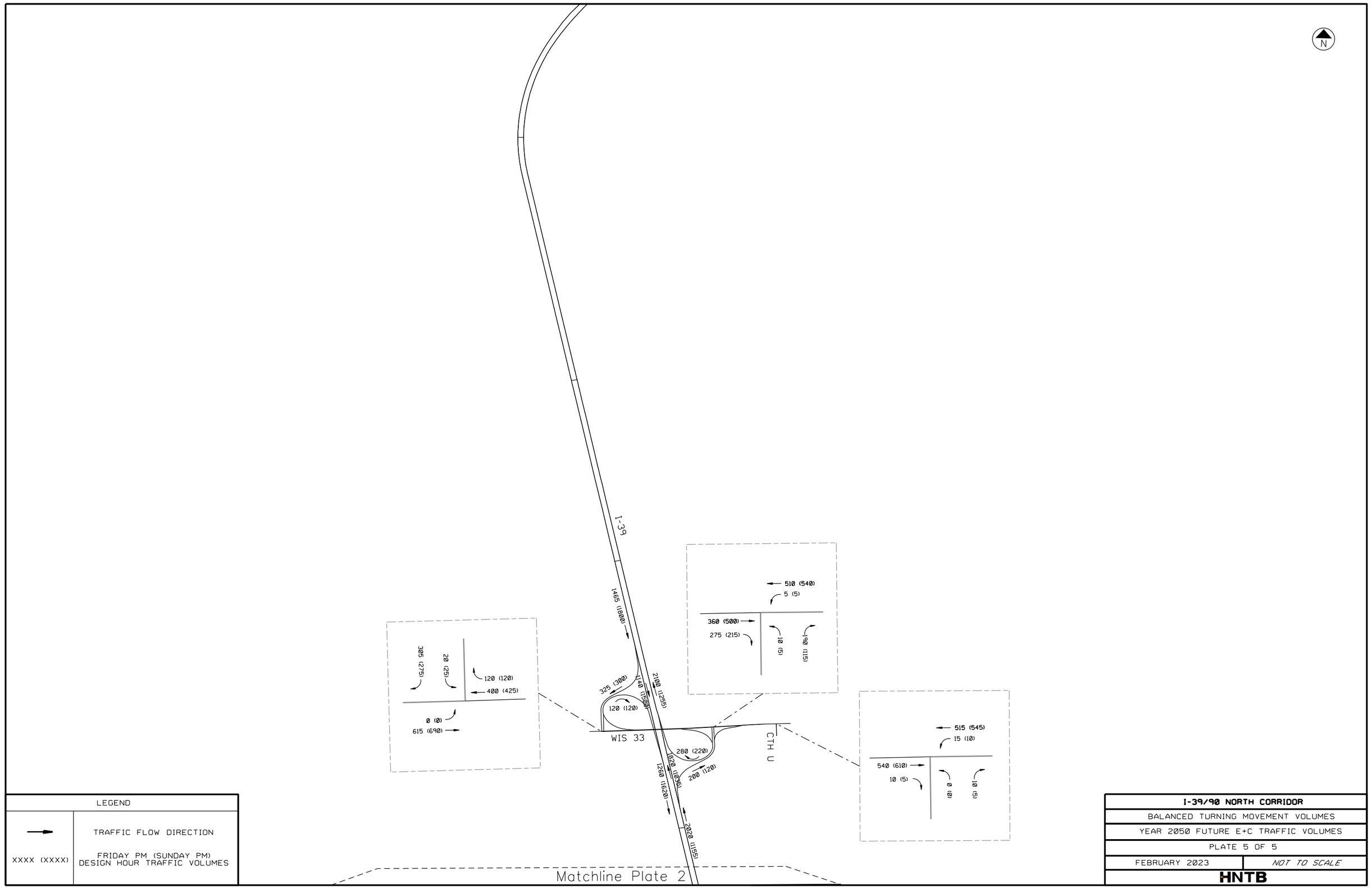
FEBRUARY 2023 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2050 FUTURE E+C TRAFFIC VOLUMES	
PLATE 4 OF 5	
FEBRUARY 2023	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

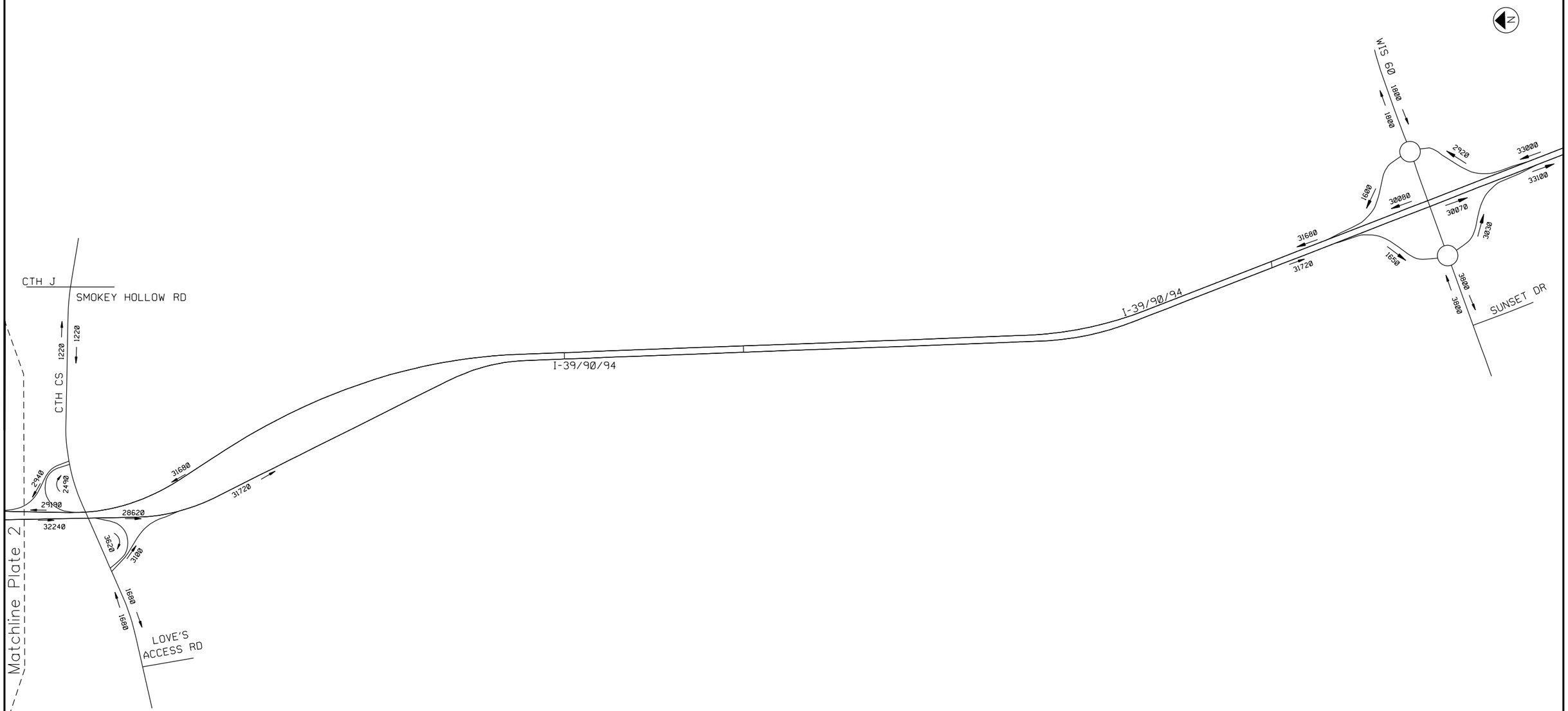
BALANCED TURNING MOVEMENT VOLUMES

YEAR 2050 FUTURE E+C TRAFFIC VOLUMES

PLATE 5 OF 5

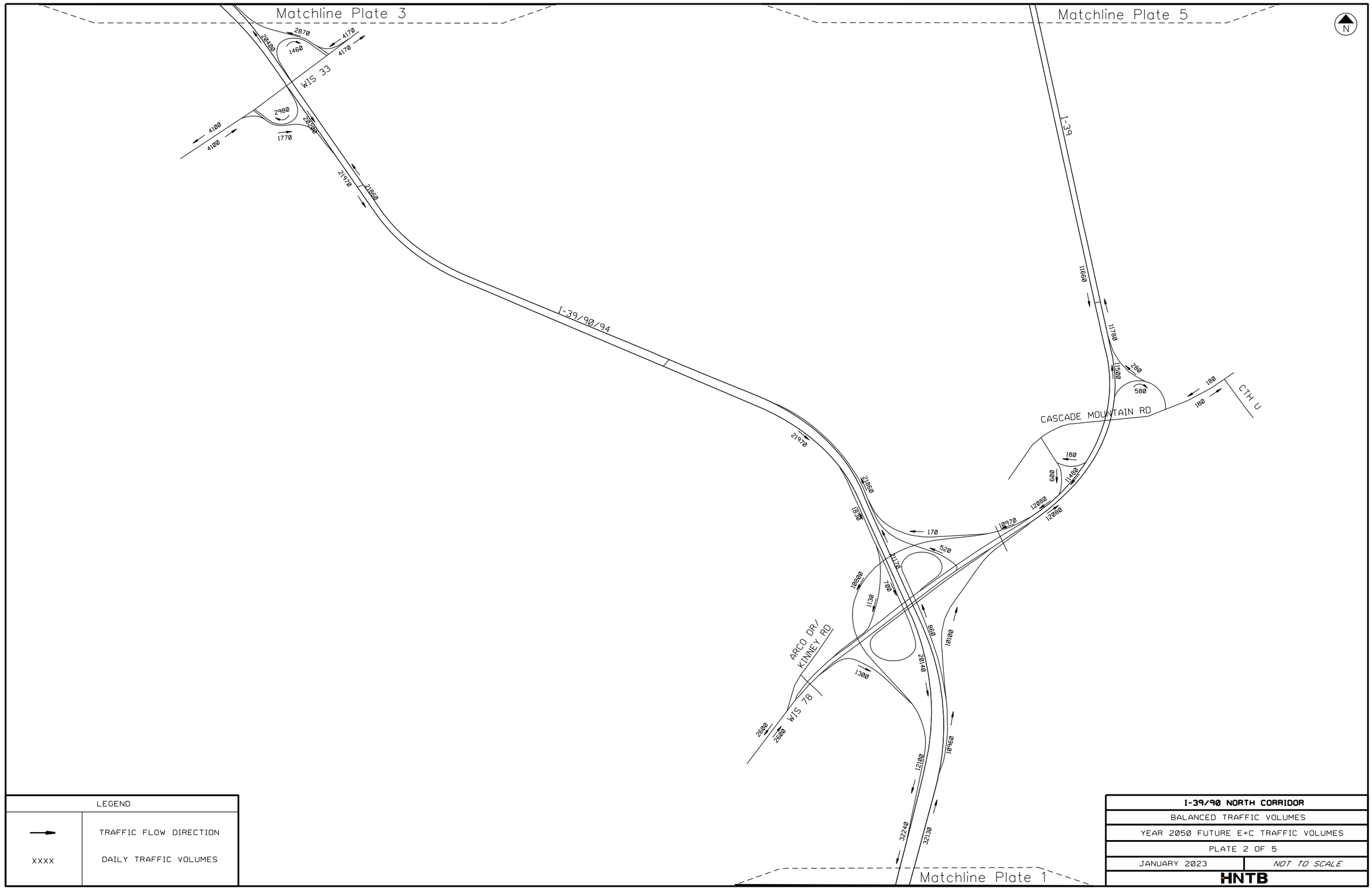
FEBRUARY 2023 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 FUTURE E+C TRAFFIC VOLUMES	
PLATE 1 OF 5	
JANUARY 2023	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

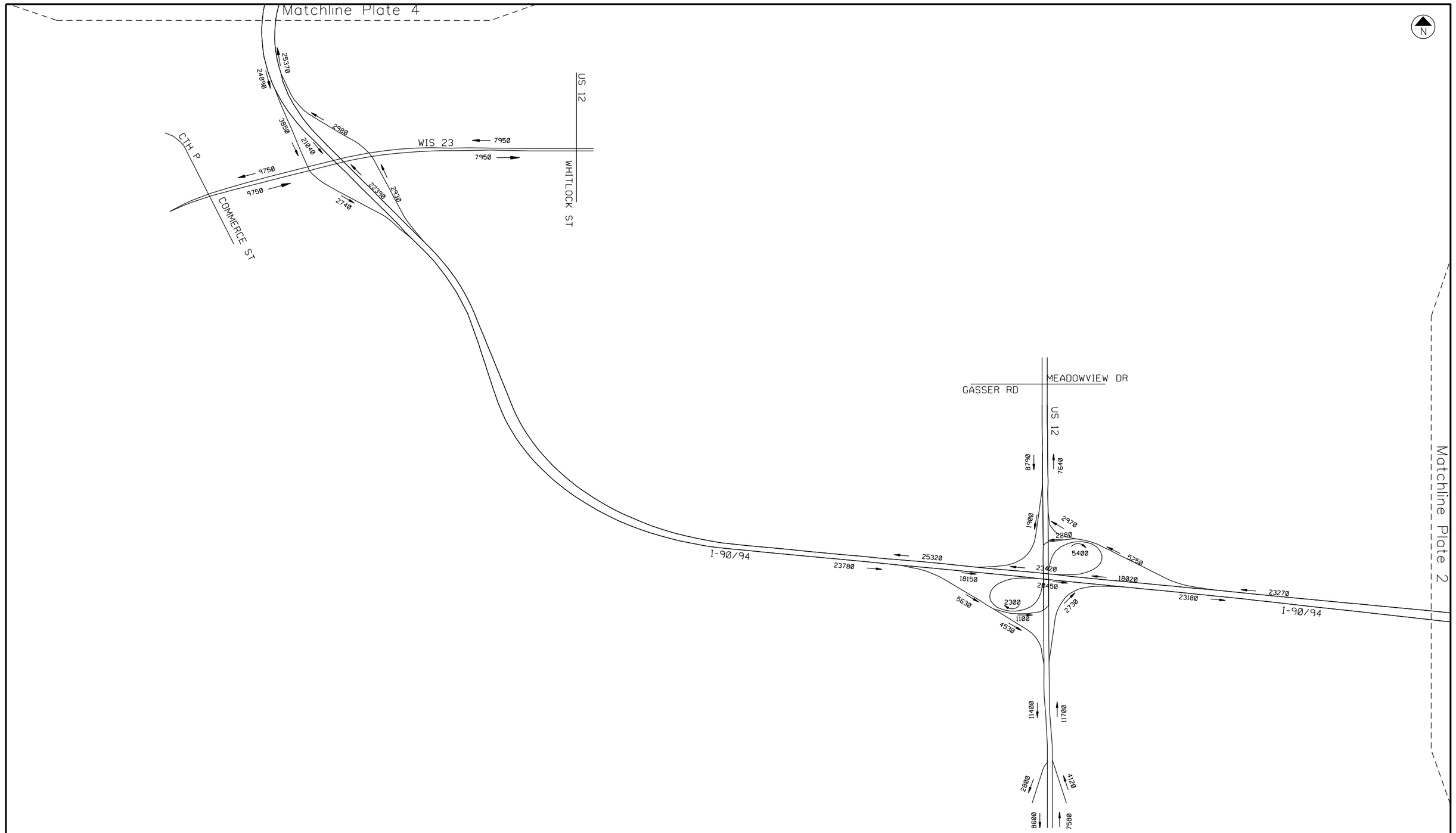
BALANCED TRAFFIC VOLUMES

YEAR 2050 FUTURE E+C TRAFFIC VOLUMES

PLATE 2 OF 5

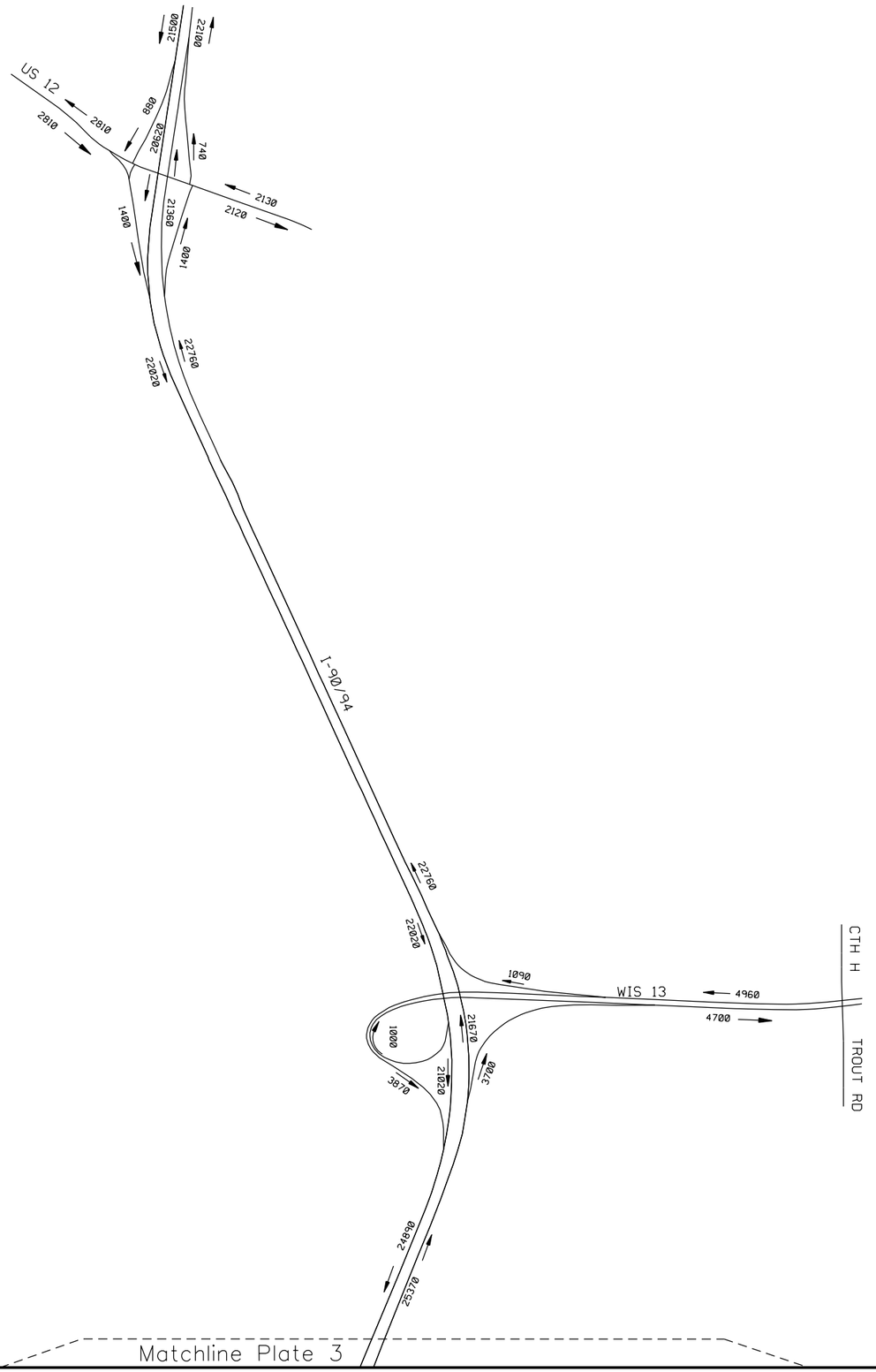
JANUARY 2023 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 FUTURE E+C TRAFFIC VOLUMES	
PLATE 3 OF 5	
JANUARY 2023	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

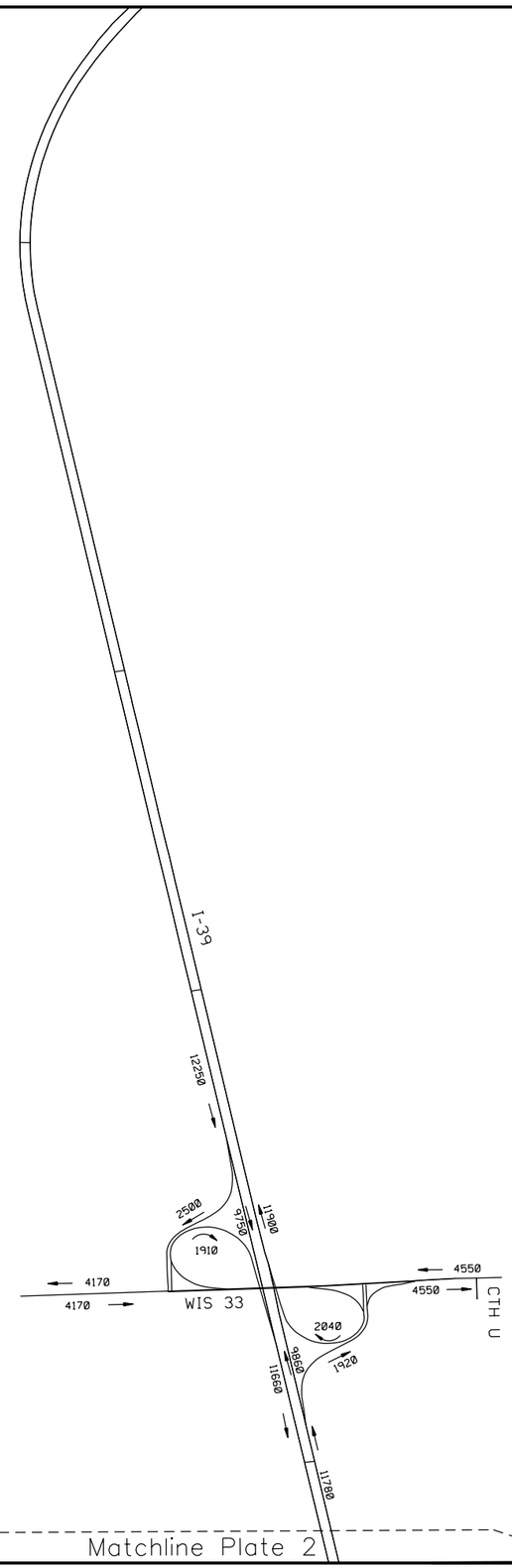
BALANCED TRAFFIC VOLUMES

YEAR 2050 FUTURE E+C TRAFFIC VOLUMES

PLATE 4 OF 5

JANUARY 2023 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 FUTURE E+C TRAFFIC VOLUMES	
PLATE 5 OF 5	
JANUARY 2023	*NOT TO SCALE*
HNTB	

Attachment M2

Interstate South Existing Plus Committed Future Year 2050 Forecast Volume Exhibits

N

I-39/90/94

1890 (3065)

2155 (2205)

HICKORY LN

MORRISONVILLE RD

250 (230)

1905 (1975)

255 (295)

CTH V

1635 (2770)

385 (790)

785 (520)

EVCO CIR

2690 (2495)

2020 (3560)

I-39/90/94

HICKORY LN

Matchline Plate 2

78 (55)
20 (9)
150 (146)
73 (99)
489 (346)
83 (78)
23 (61)
467 (512)
17 (13)
7 (4)
4 (11)
49 (124)

176 (199)
834 (465)
76 (96)
426 (596)
183 (258)
3 (0)
199 (532)

37 (59)
7 (6)
31 (105)
8 (126)
781 (477)
57 (62)
46 (184)
522 (903)
57 (41)
192 (128)
6 (14)
40 (71)

91 (74)
2 (0)
156 (156)
554 (449)
463 (274)
346 (536)
320 (246)

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 1 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 1

N

I-39/90/94

2690 (2495)

2020 (3560)

315 (295)

260 (395)

2430 (2100)

1705 (3265)

945 (980)

I-39/90/94

3375 (3080)

2835 (4310)

CTH CV

PEPSI WAY

1130 (1045)

TIERNEY XING

DALMORE RD

WIS 19

LIUNA WAY

250 (405) 0 (0) 280 (740)
60 (70)
1390 (1320)
35 (20)
145 (180)
920 (1270)
5 (10)
45 (35) 0 (0) 35 (40)

40 (150)
175 (260)
1445 (1260)
0 (0)
1235 (2050)

225 (205)
1900 (1590)
90 (90)
685 (1445)

435 (385) 140 (110)
235 (585)
1690 (1410)
120 (295)
565 (1150)

880 (875)
145 (100)
20 (15)
745 (1250)
130 (185) 80 (170)

90 (140) 0 (0) 170 (255)
1530 (1380)
370 (210)
605 (1280)
575 (770)

1010 (1080)
705 (1260)
915 (915) 215 (130)

Matchline Plate 3

Matchline Plate 4

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR
BALANCED TRAFFICVOLUMES
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES
PLATE 2 OF 12
DECEMBER 2022 — NOT TO SCALE
HNTB

Matchline Plate 2

Matchline Plate 4

I-39/90/94

US 51

3375 (3080)

2835 (4310)

1780 (1515)

870 (1790)

1630 (1355)

225 (110)

325 (900)

545 (890)

150 (160)

1160 (485)

2685 (4150)

2215 (2595)

295 (775)

650 (665)

2390 (3375)

2865 (3260)

770 (1000)

1110 (435)

195 (275)

3160 (4375)

3060 (3535)

DAENTL RD

1205 (800)

50 (50)

570 (1625)

65 (90)

2485 (1045)

35 (75)

850 (2350)

2165 (1170)

765 (1900)

US 51

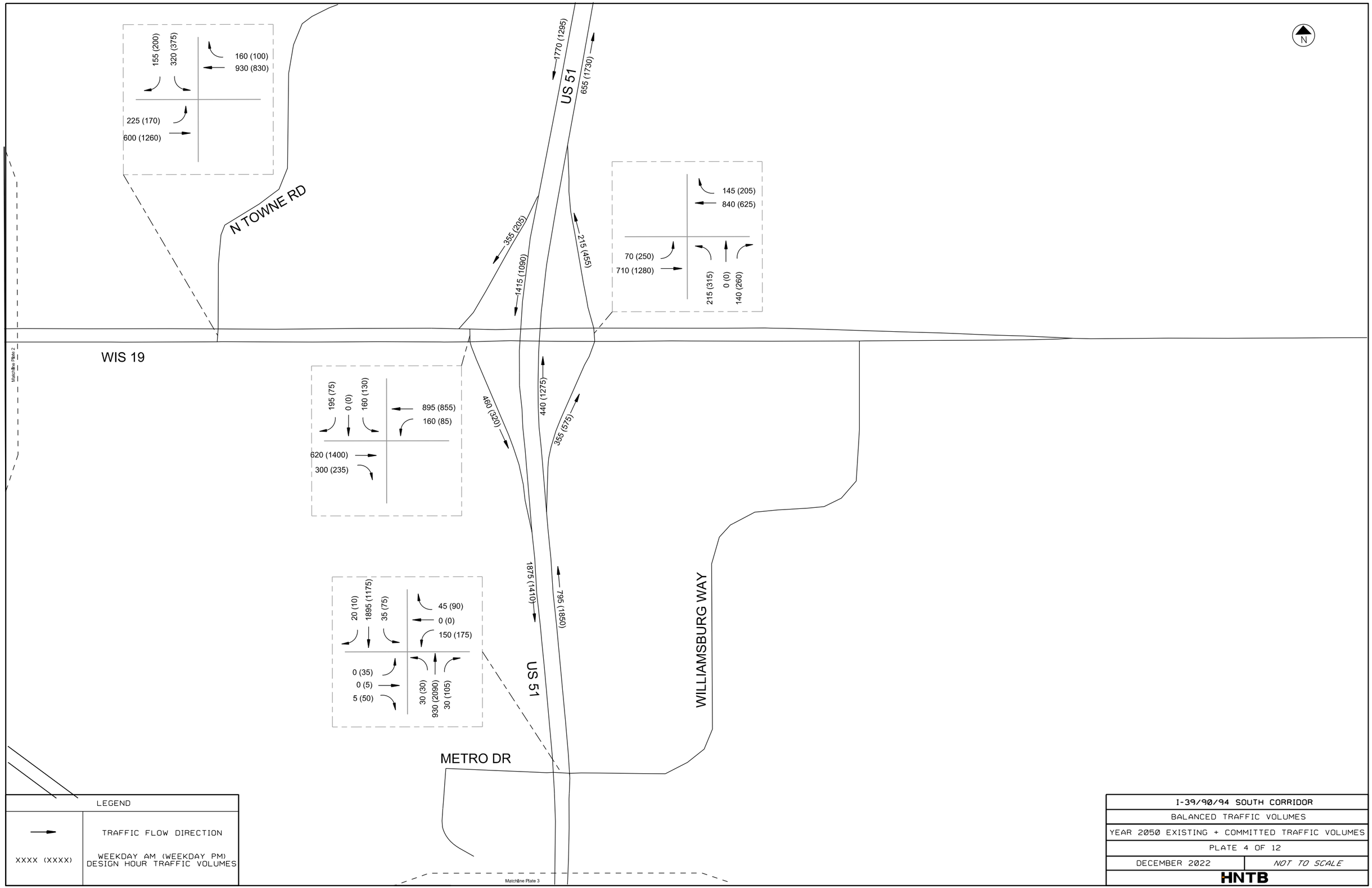
I-39/90/94

Matchline Plate 5

N

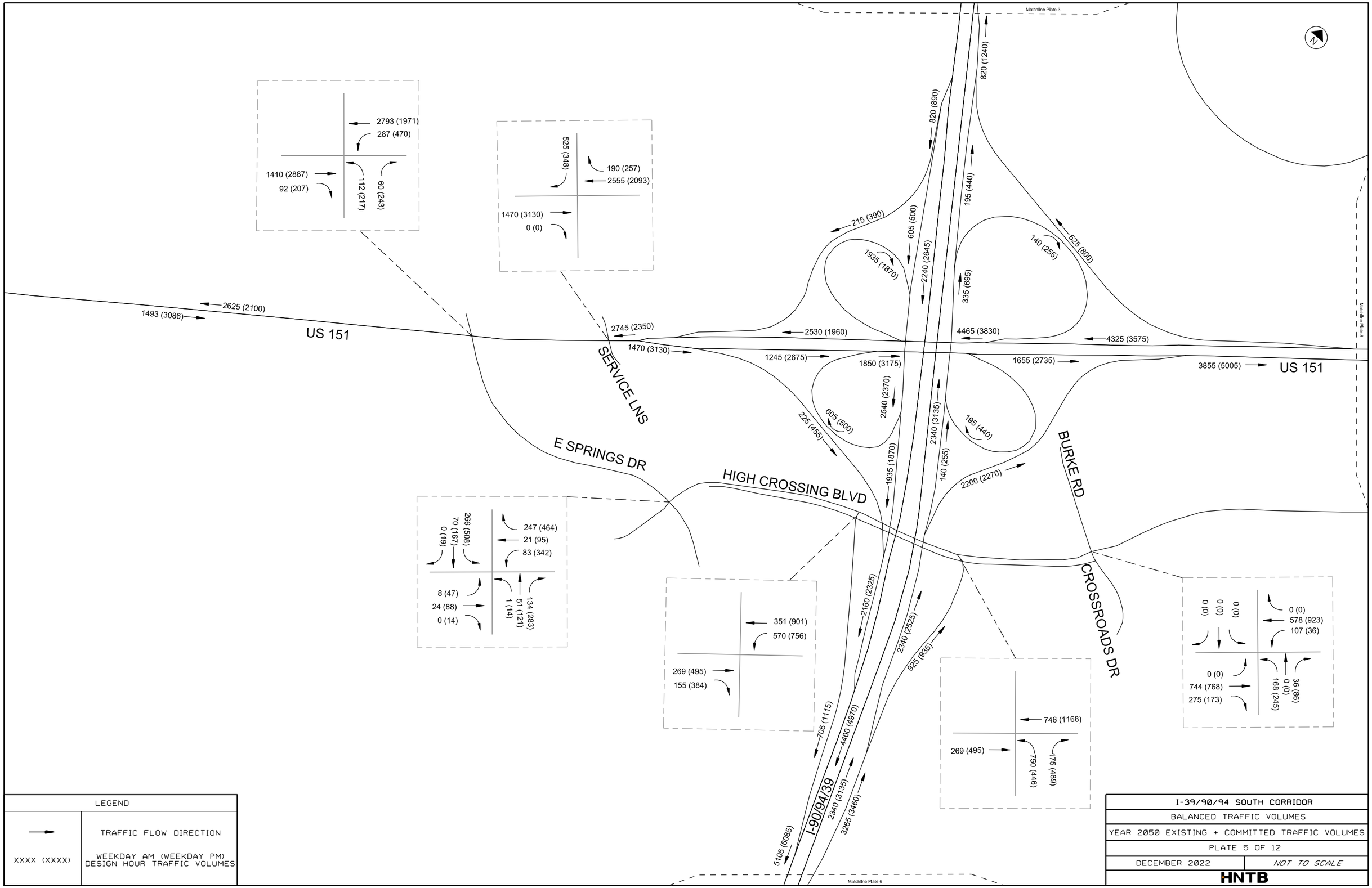
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR
BALANCED TRAFFIC VOLUMES
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES
PLATE 3 OF 12
DECEMBER 2022 | *NOT TO SCALE*
HNTB



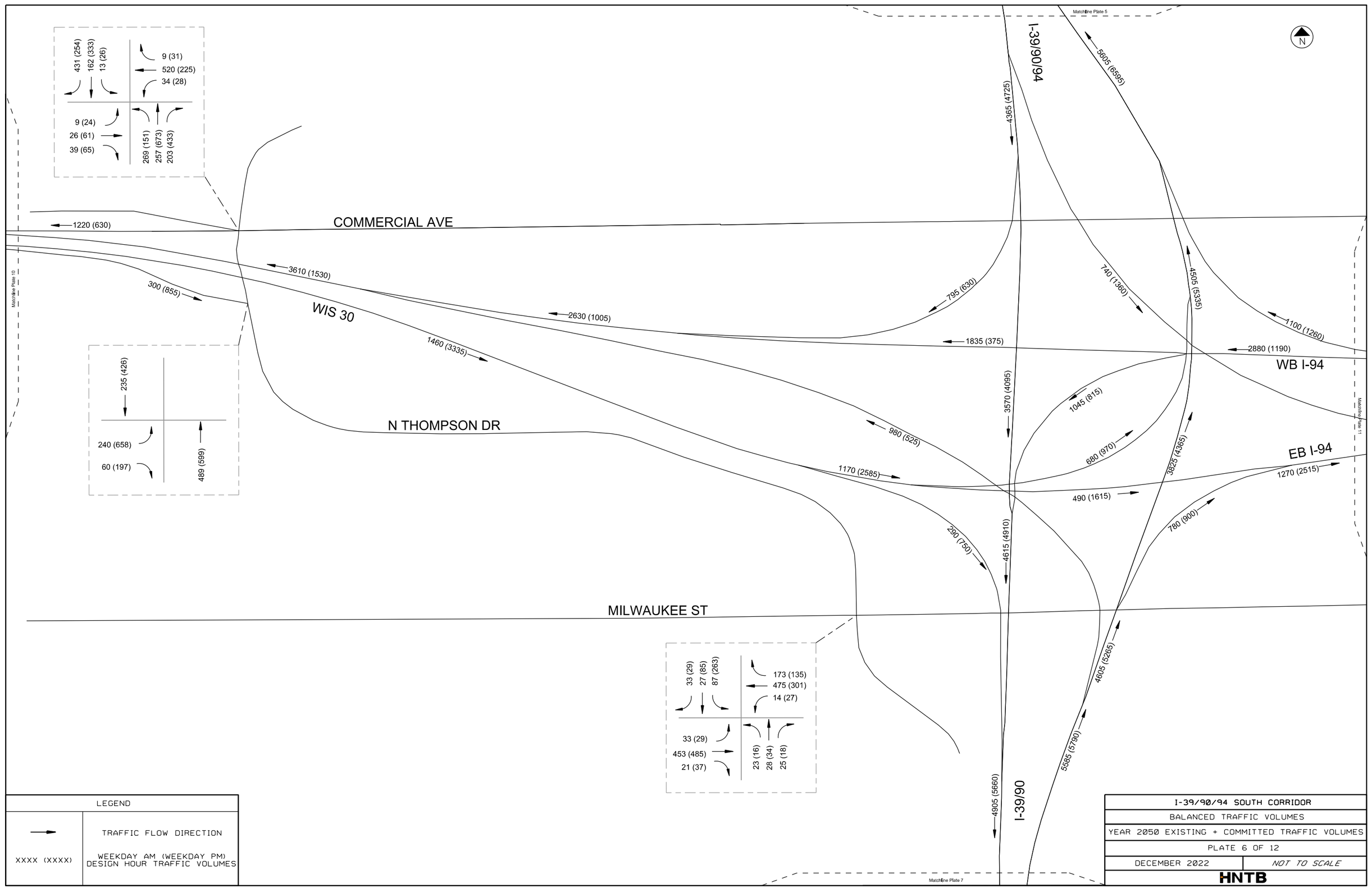
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 4 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



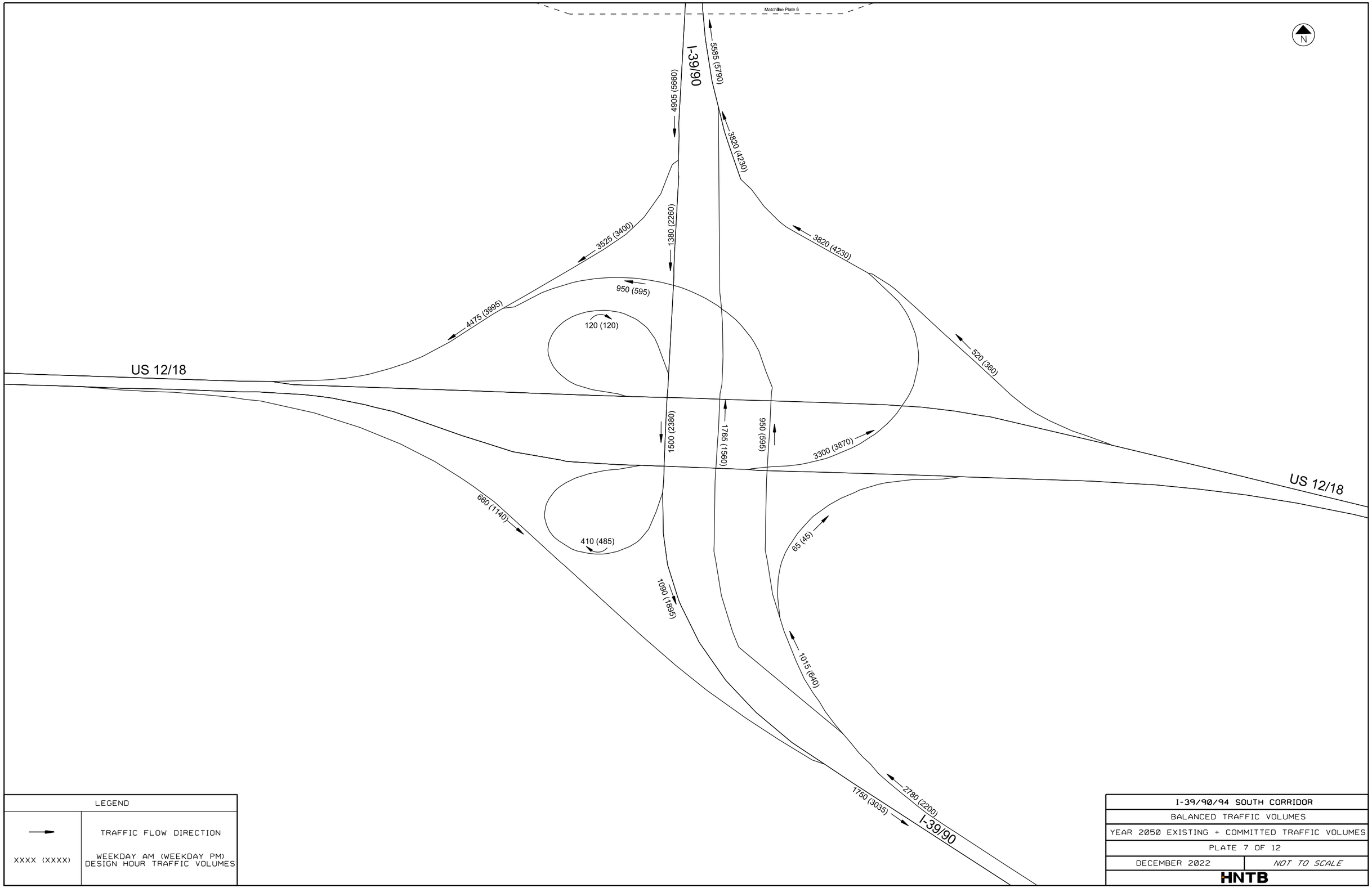
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 5 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 6 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 7 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

AMERICAN PKWY

EASTPARK BLVD

93 (30)
630 (847)
3 (47)
11 (32)
41 (12)
179 (297)
56 (68)
19 (15)
203 (493)
948 (182)
1244 (641)
146 (287)

555 (1210)
440 (220)
250 (205)
150 (190)
690 (425)
4950 (4375)
4395 (3165)
4245 (2975)
4935 (3400)
US 151

US 151
3470 (4770)
385 (235)
1250 (465)
2220 (4305)
230 (875)
2450 (5180)

380 (1105)

HIGH CROSSING BLVD

444 (170)
304 (93)
94 (399)
0 (0)
207 (182)
43 (23)
285 (269)
200 (604)
103 (172)
145 (167)
363 (156)
86 (102)

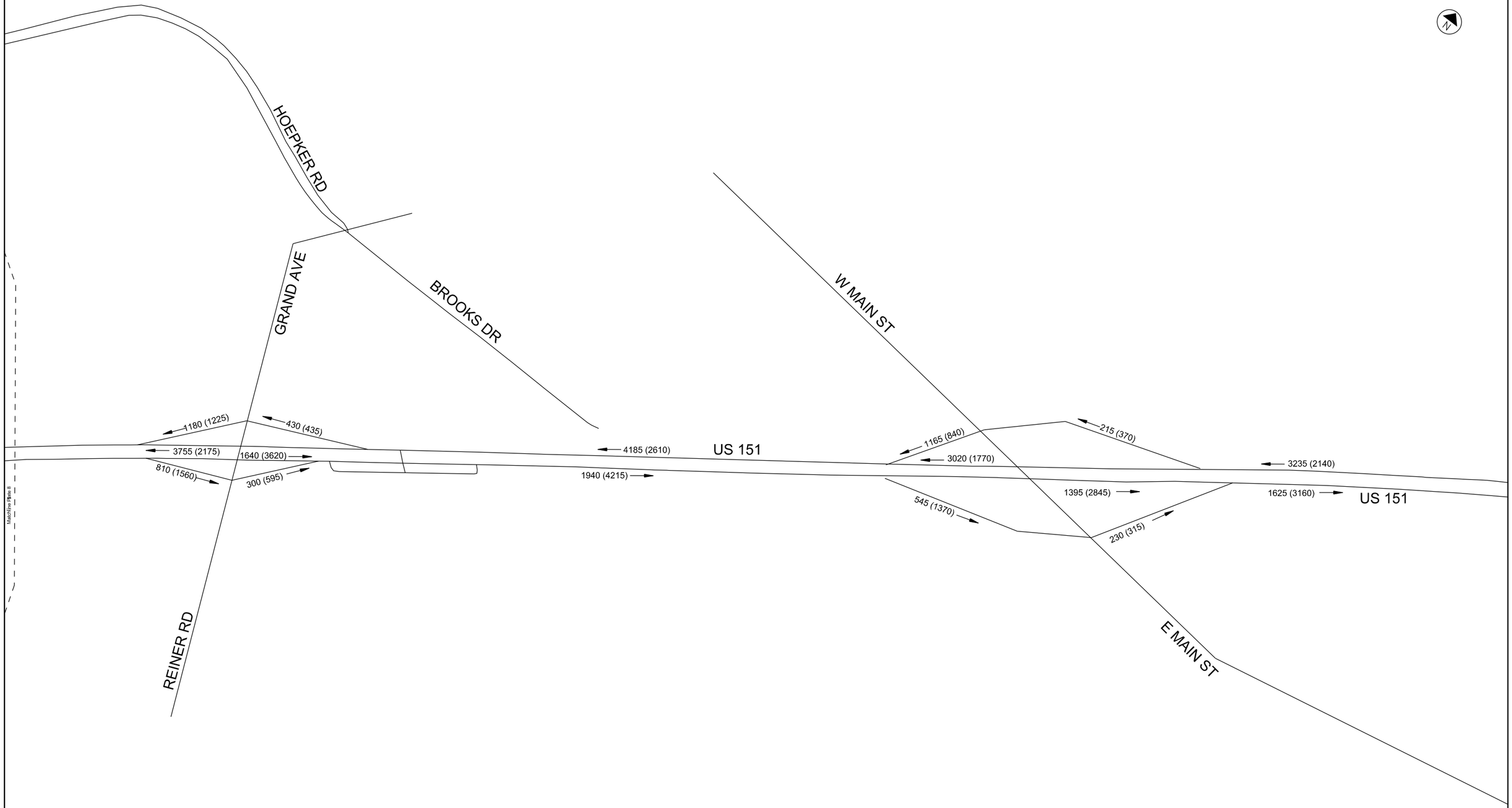
NELSON RD

Matchline Plate 5

Matchline Plate 9

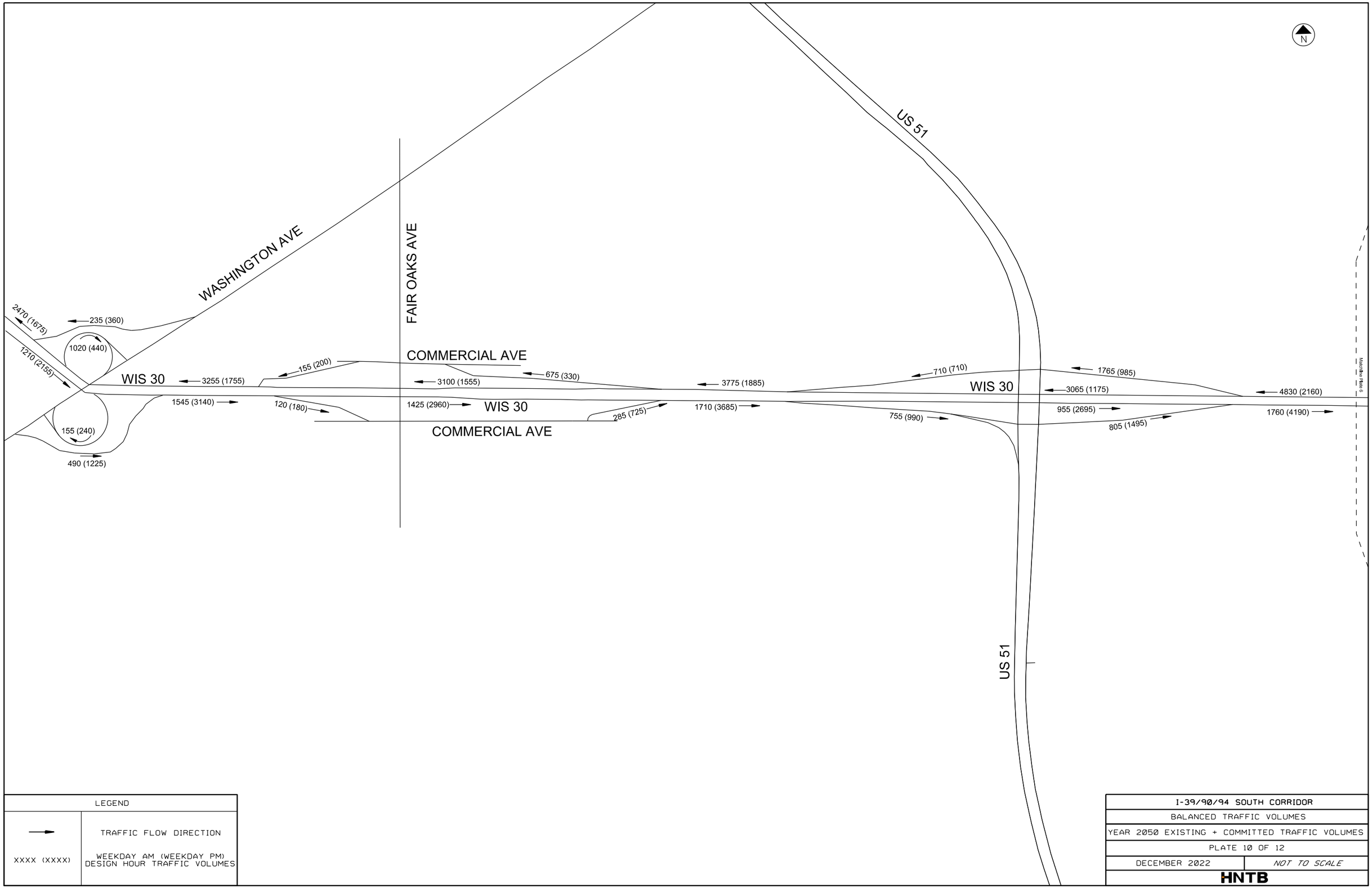
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 8 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



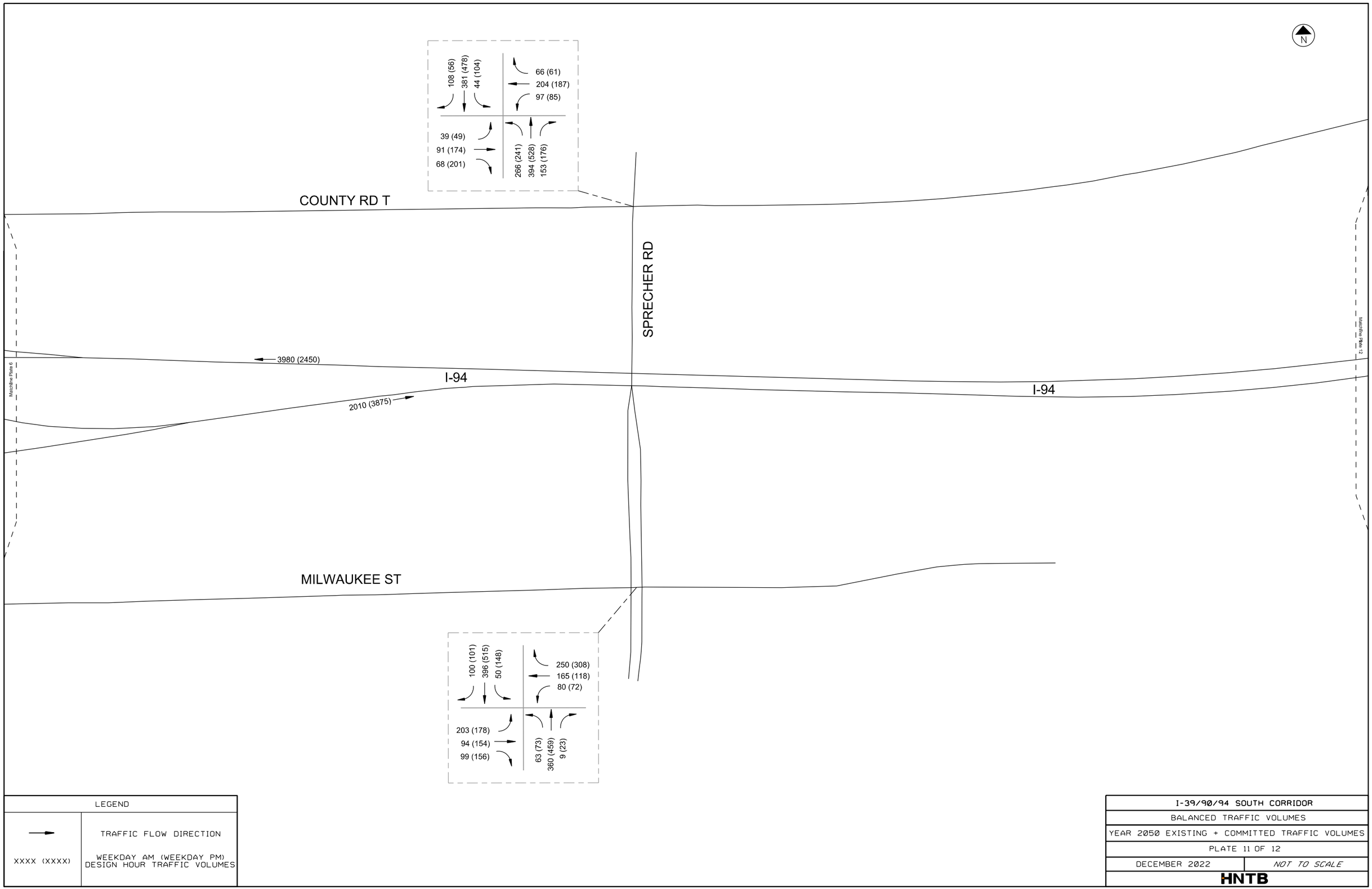
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 9 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



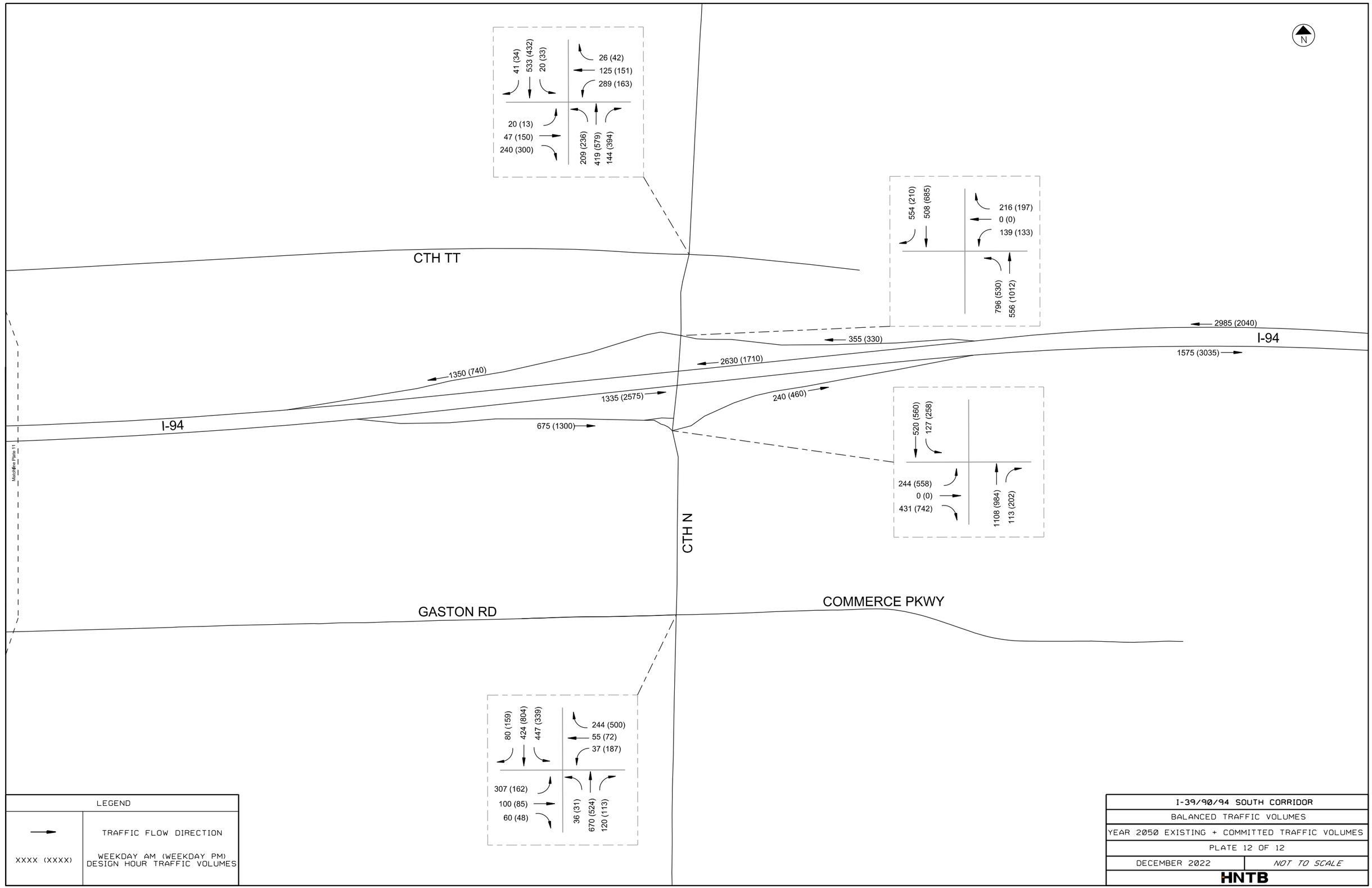
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

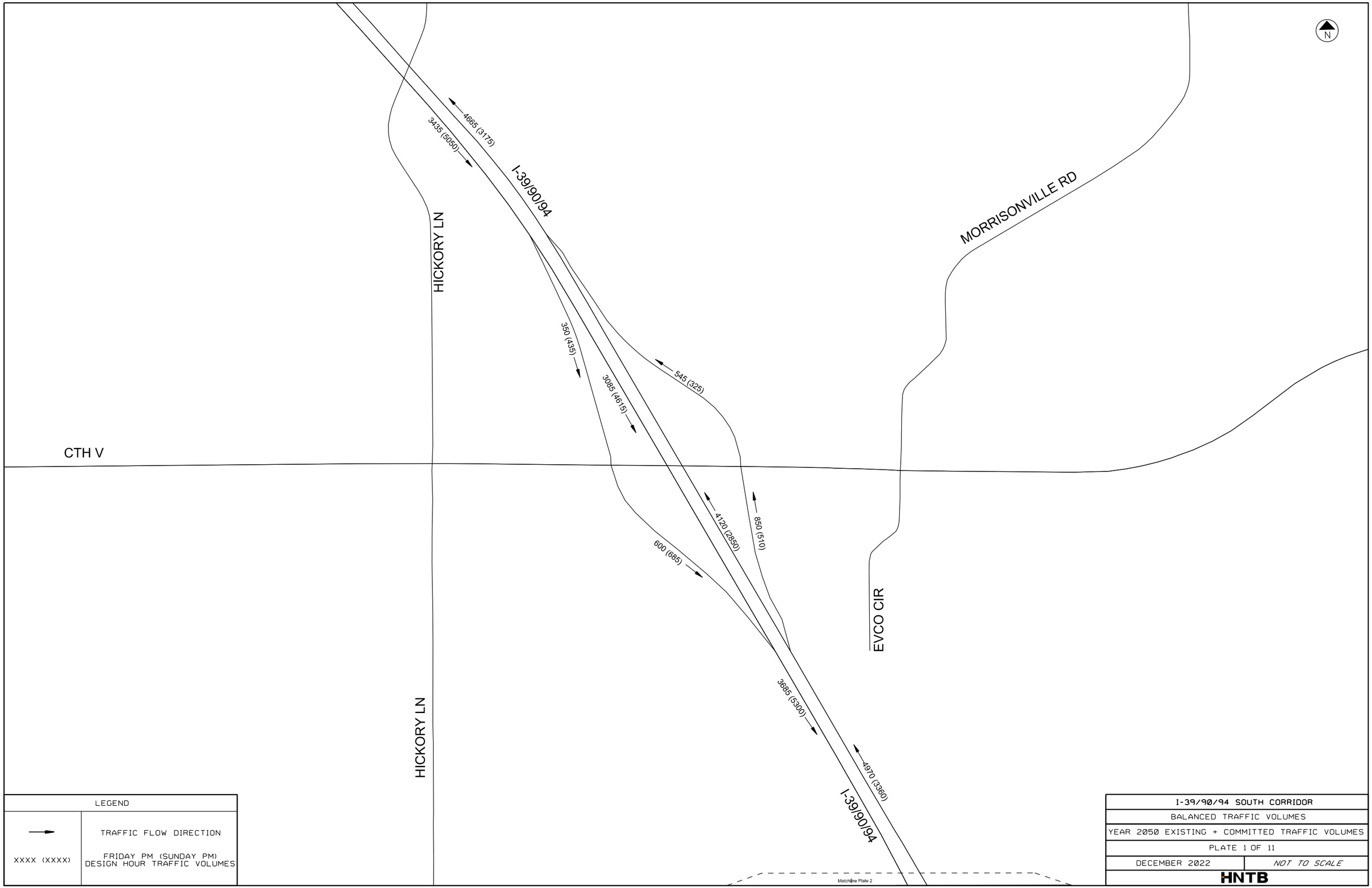
I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 10 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 11 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	


N
CTH TT
I-94
I-94
GASTON RD
COMMERCE PKWY
CTH N
41 (34)
533 (432)
20 (33)
26 (42)
125 (151)
289 (163)
20 (13)
47 (150)
240 (300)
209 (236)
419 (579)
144 (394)
554 (210)
508 (685)
216 (197)
0 (0)
139 (133)
796 (530)
556 (1012)
2985 (2040)
355 (330)
1575 (3035)
2630 (1710)
1350 (740)
1335 (2575)
240 (460)
675 (1300)
520 (560)
127 (258)
244 (558)
0 (0)
431 (742)
1108 (984)
113 (202)
80 (159)
424 (804)
447 (339)
244 (500)
55 (72)
37 (187)
307 (162)
100 (85)
60 (48)
36 (31)
670 (524)
120 (113)
LEGEND
TRAFFIC FLOW DIRECTION
XXXX (XXXX)
WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED TRAFFIC VOLUMES
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES
PLATE 12 OF 12
DECEMBER 2022
NOT TO SCALE
HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 1 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 1

N

3685 (5300)

4970 (3360)

I-39/90/94

CTH CV

TIERNEY XING

DALMORE RD

365 (440)

630 (405)

3320 (4980)

WIS 19

LIUNA WAY

4340 (2955)

1125 (730)

PEPSI WAY

1160 (750)

I-39/90/94

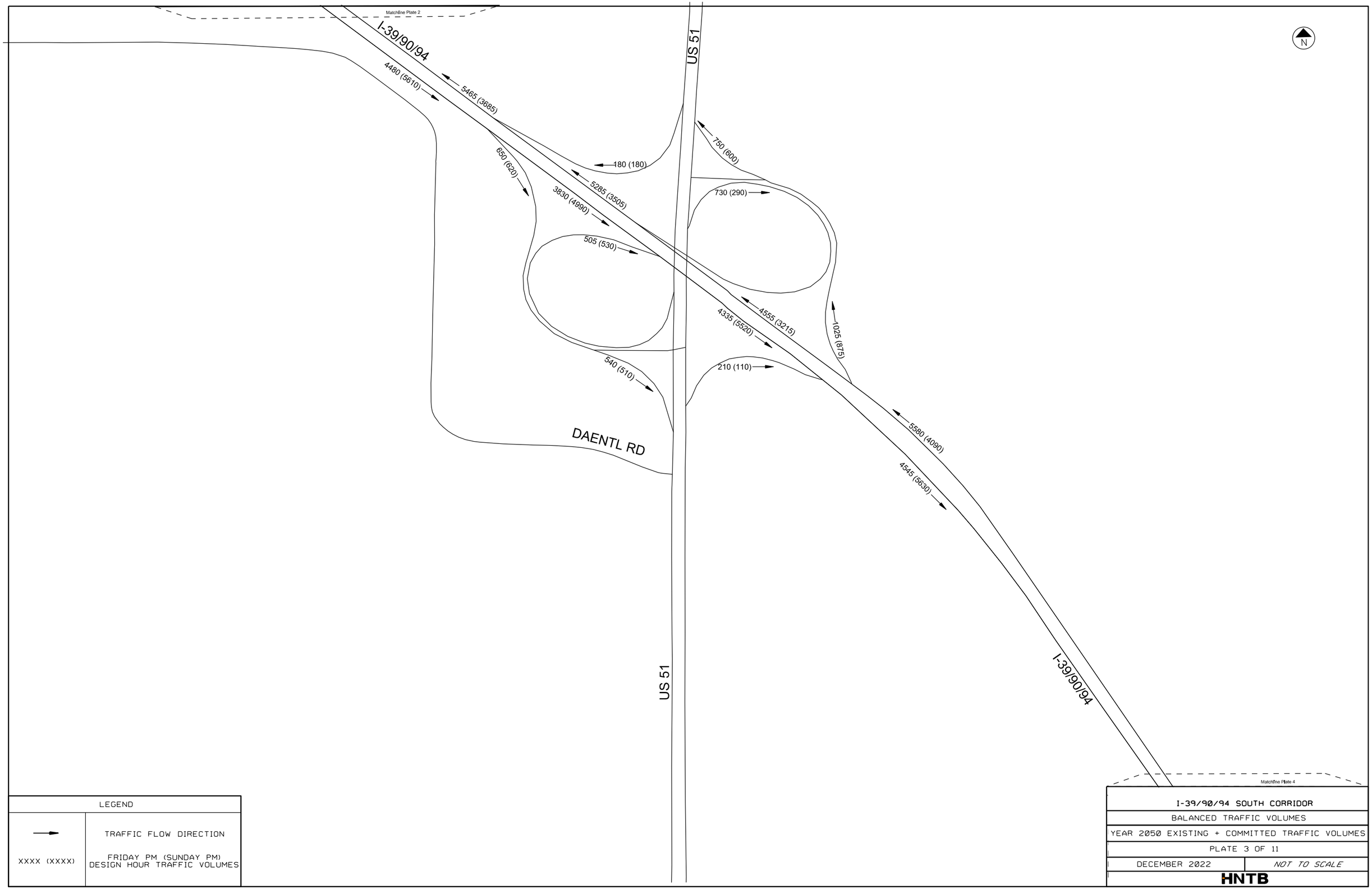
4480 (5610)

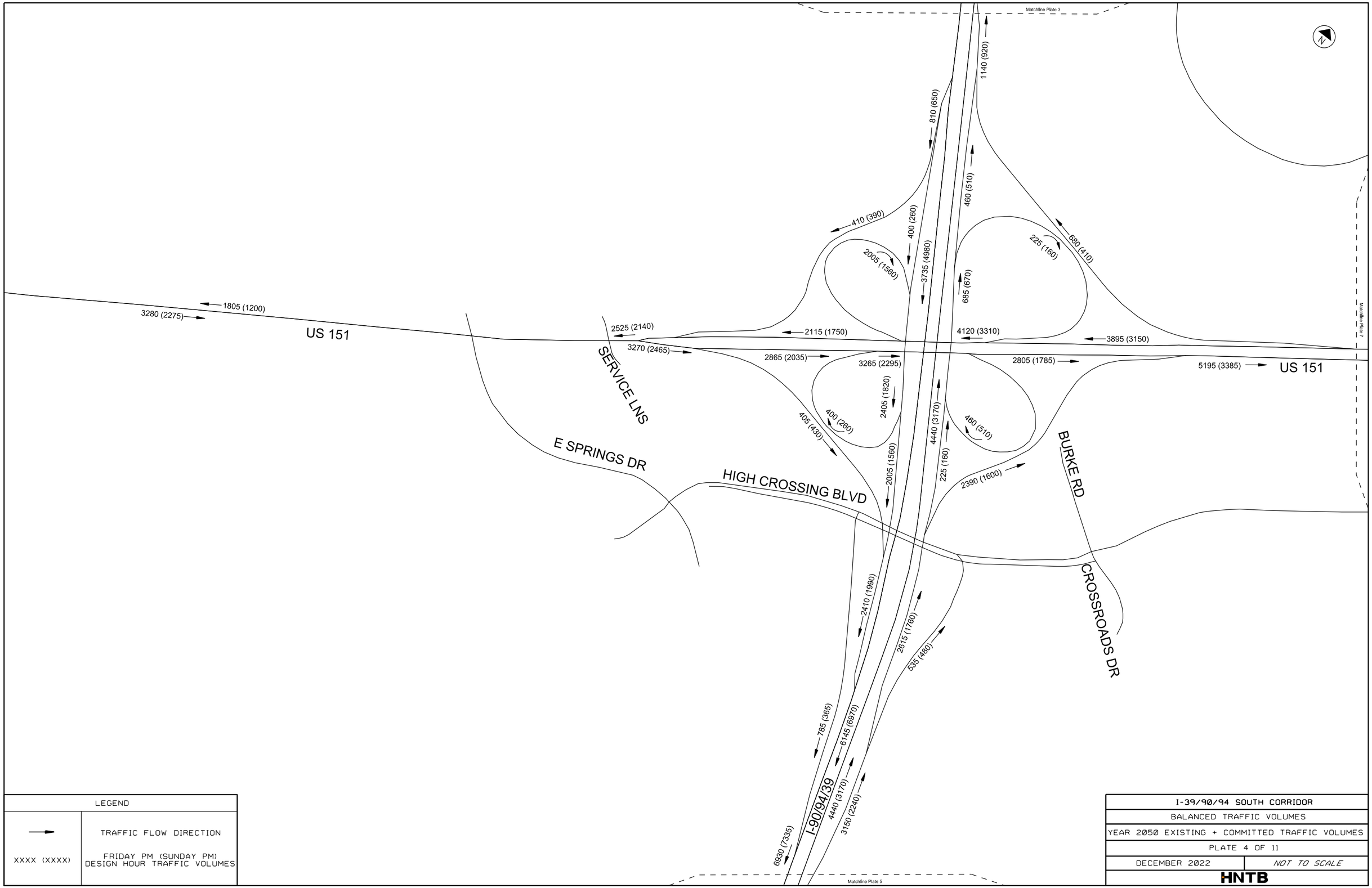
5465 (3685)

Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

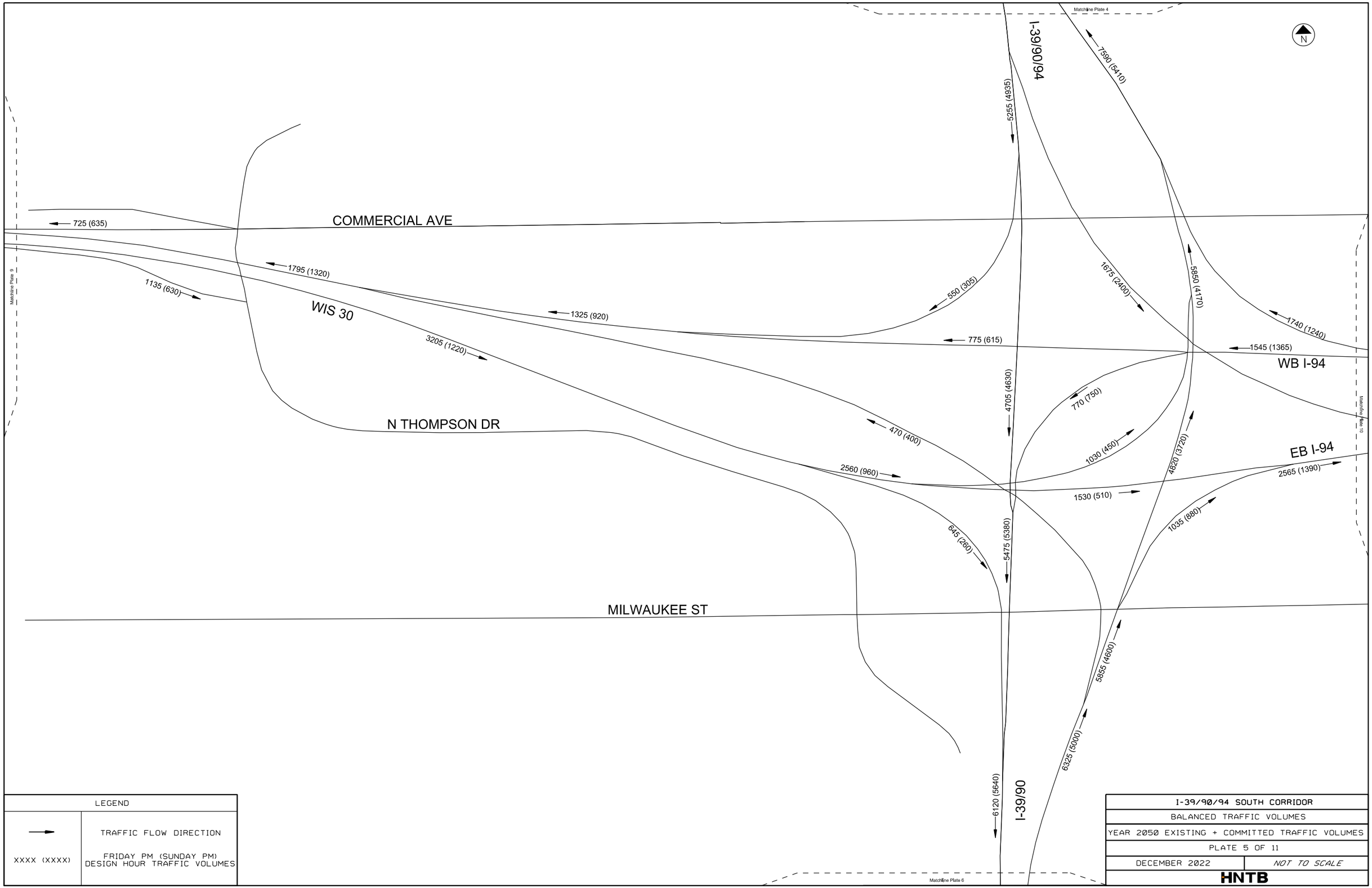
I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 2 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	


Matchline Plate 2
I-39/90/94
US 51
4480 (5610)
5465 (3685)
650 (620)
180 (180)
750 (600)
5285 (3505)
3830 (4990)
730 (290)
505 (530)
4555 (3215)
4335 (5520)
1025 (875)
540 (510)
210 (110)
DAENTL RD
5580 (4090)
4545 (5630)
US 51
I-39/90/94
Matchline Plate 4
N
LEGEND
TRAFFIC FLOW DIRECTION
XXXX (XXXX)
FRIDAY PM (SUNDAY PM)
DESIGN HOUR TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED TRAFFIC VOLUMES
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES
PLATE 3 OF 11
DECEMBER 2022
NOT TO SCALE
HNTB



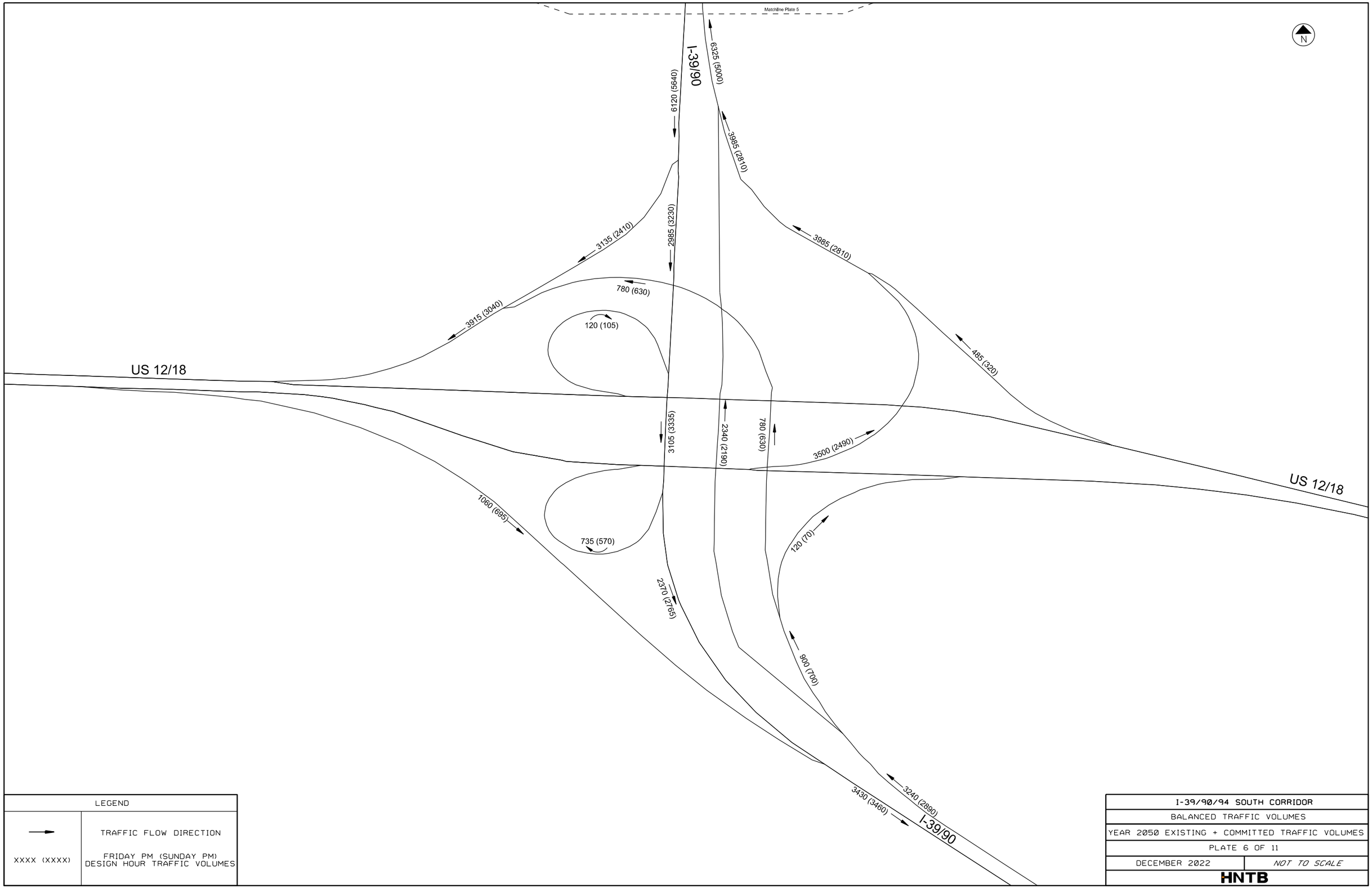
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 4 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 5 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR
BALANCED TRAFFIC VOLUMES
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES
PLATE 6 OF 11
DECEMBER 2022 — *NOT TO SCALE*
HNTB

AMERICAN PKWY

EASTPARK BLVD

1070 (390)

195 (135)

140 (90)

180 (50)

335 (225)

4575 (3560)

3505 (3170)

3325 (3120)

3660 (3345)

US 151

US 151

4940 (3260)

255 (125)

4235 (2790)

4895 (3145)

705 (470)

660 (355)

840 (405)

HIGH CROSSING BLVD

NELSON RD

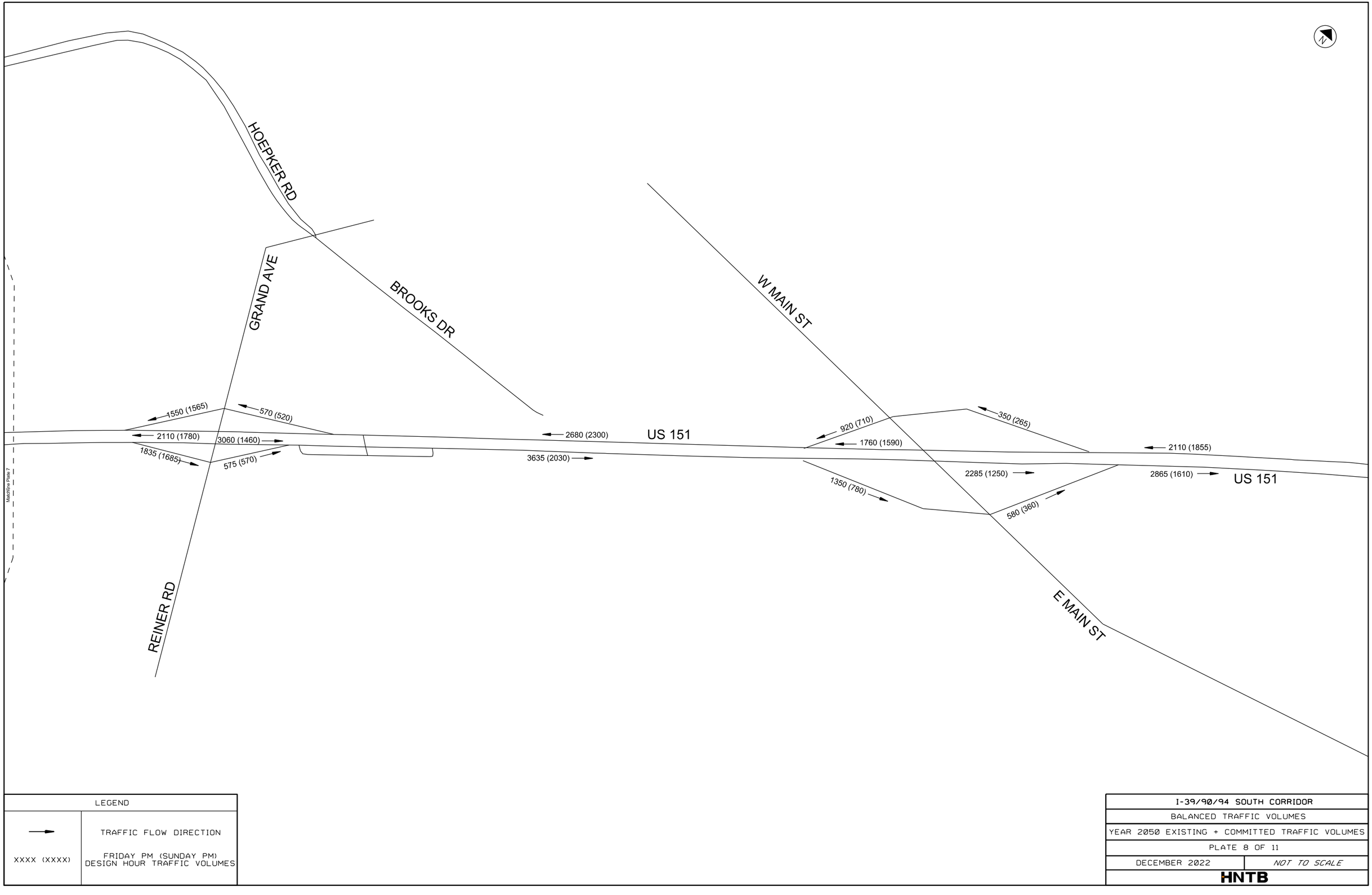
Matchline Plate 6

Matchline Plate 8

N

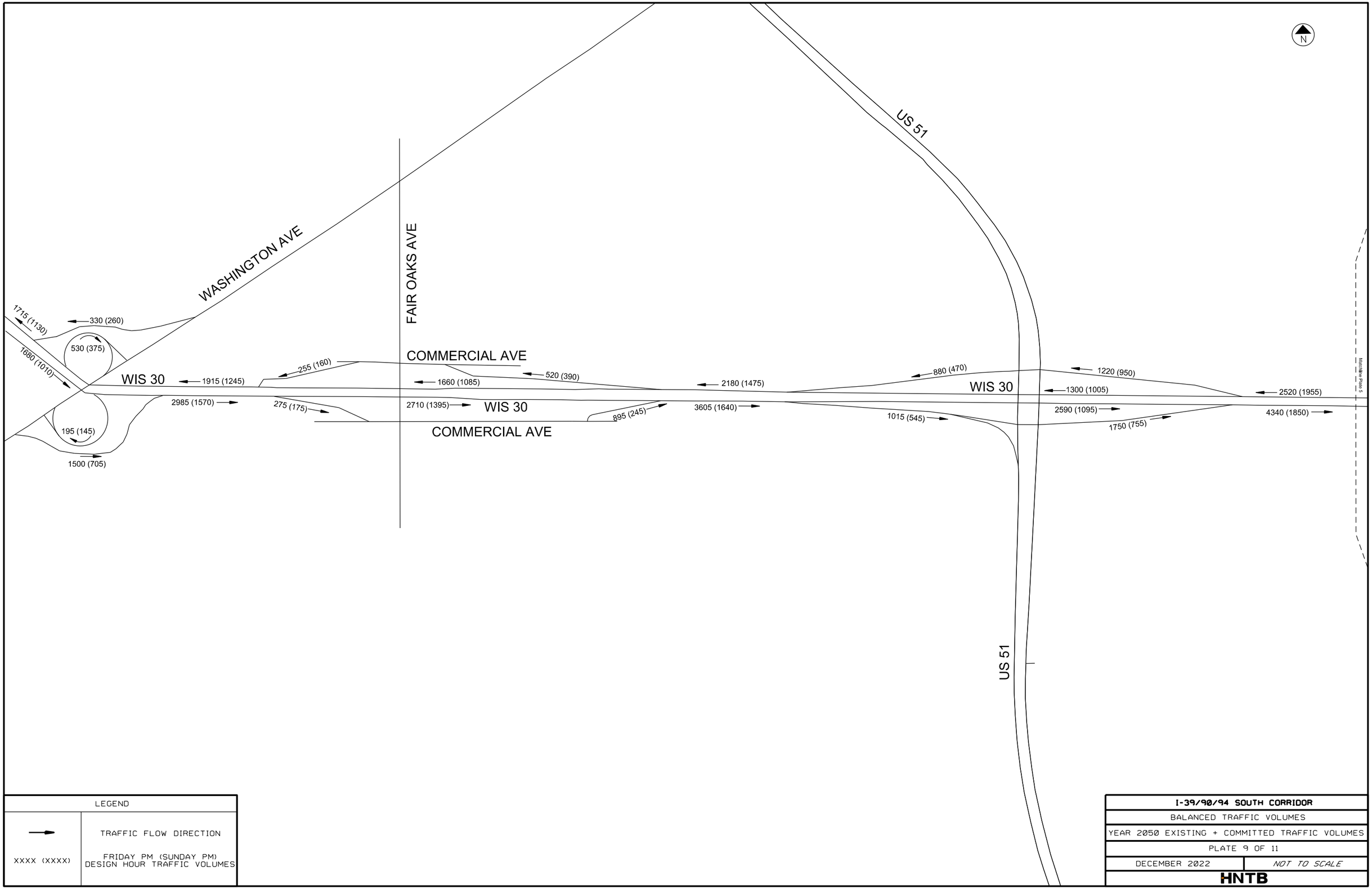
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 7 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 8 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR

BALANCED TRAFFIC VOLUMES

YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES

PLATE 9 OF 11

DECEMBER 2022 | *NOT TO SCALE*

HNTB

N

COUNTY RD T

SPRECHER RD

Match line Plate 5

Match line Plate 11

3285 (2605)

I-94

4240 (3790)

I-94

MILWAUKEE ST

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 10 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

N

CTH TT

970 (820)

2315 (1785)

415 (405)

2730 (2190)

I-94

3465 (3010)

2930 (2580)

535 (430)

I-94

1310 (1210)

Matchline Plate 10

CTH N

GASTON RD

COMMERCE PKWY

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 11 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

N

I-39/90/94

HICKORY LN

MORRISONVILLE RD

CTH V

EVCO CIR

34100

33700

3000

3900

30700

6600

6600

7000

7000

30200

7000

7400

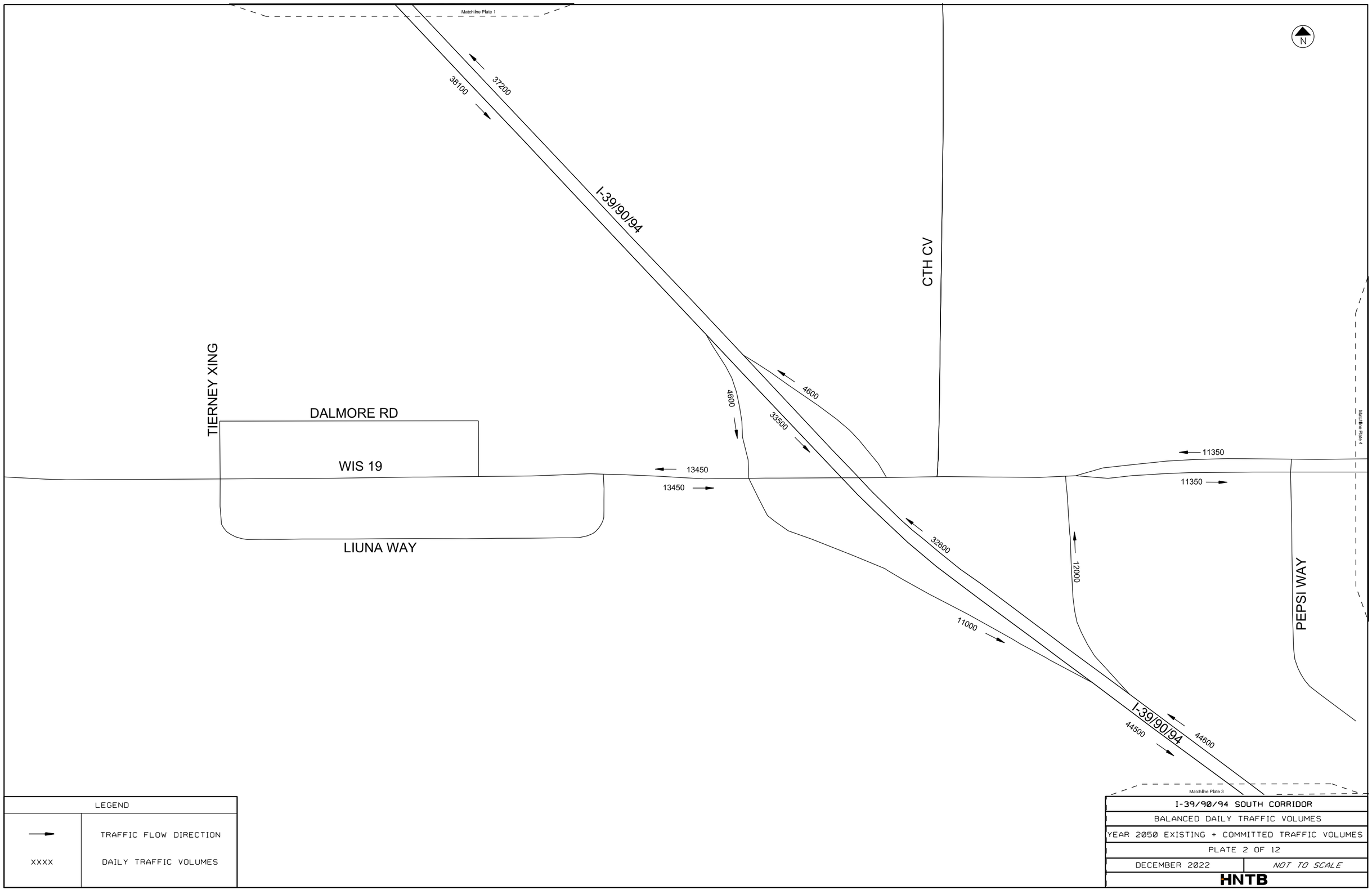
38100

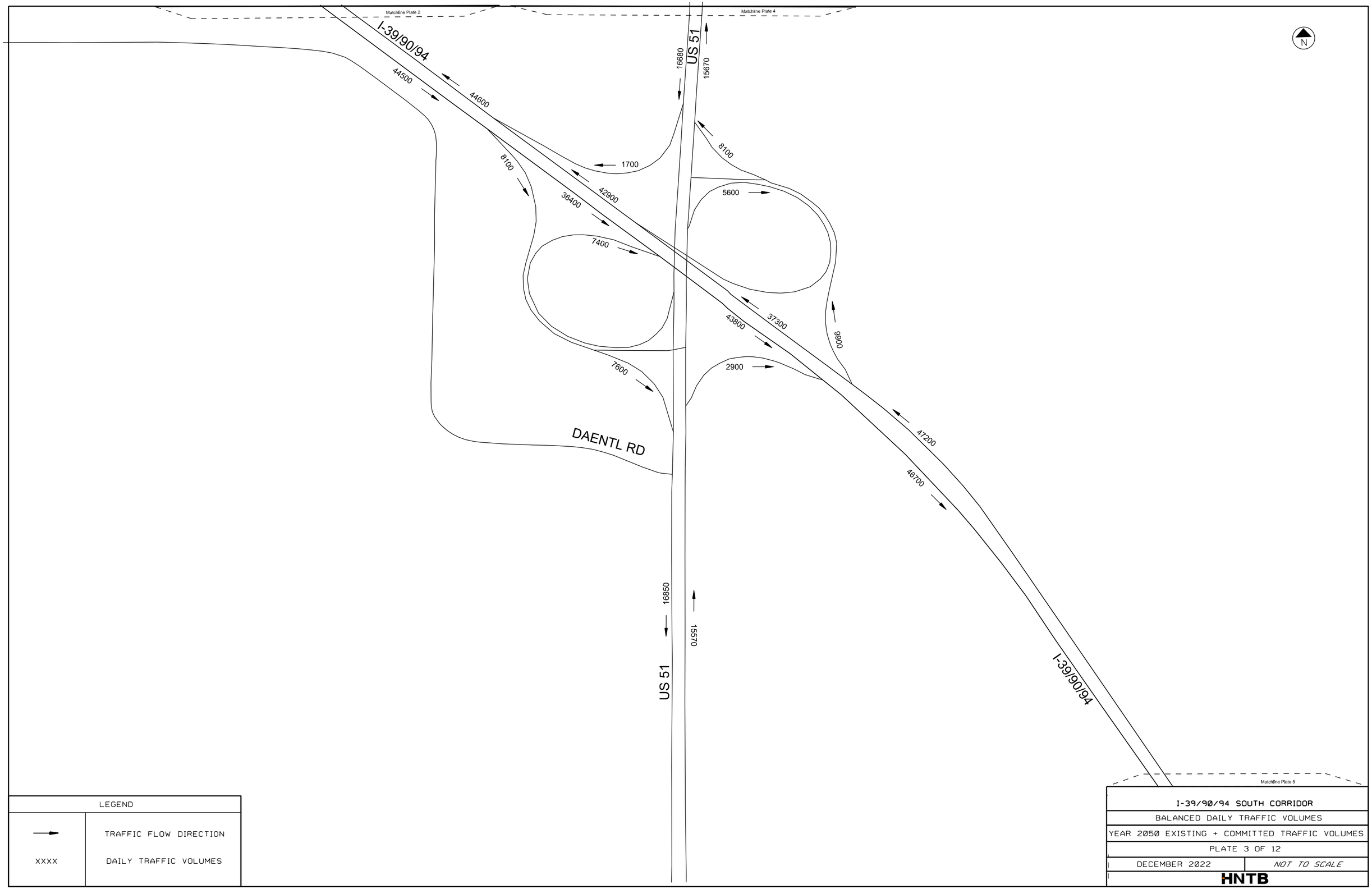
37200

Matchline Plate 2

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 1 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	


Matchline Plate 1
N
38100
37200
I-39/90/94
CTH CV
TIERNEY XING
DALMORE RD
WIS 19
LIUNA WAY
4600
4600
33500
13450
13450
11350
11350
Matchline Plate 4
32600
12000
PEPSI WAY
11000
I-39/90/94
44500
44600
Matchline Plate 3
LEGEND
TRAFFIC FLOW DIRECTION
XXXX
DAILY TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED DAILY TRAFFIC VOLUMES
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES
PLATE 2 OF 12
DECEMBER 2022
NOT TO SCALE
HNTB


Matchline Plate 2
Matchline Plate 4
I-39/90/94
US 51
16680
15670
44500
44600
8100
1700
8100
42900
36400
5600
7400
37300
43500
9900
7600
2900
DAENTL RD
47200
46700
16850
15570
US 51
I-39/90/94
N
Matchline Plate 5
LEGEND
TRAFFIC FLOW DIRECTION
XXXX
DAILY TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED DAILY TRAFFIC VOLUMES
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES
PLATE 3 OF 12
DECEMBER 2022
NOT TO SCALE
HNTB

N

N TOWNE RD

US 51

13300

13600

3900

9400

4200

12050

9350

WIS 19

12050

9350

Matchline Plate 2

7600

9400

6000

17000

15400

US 51

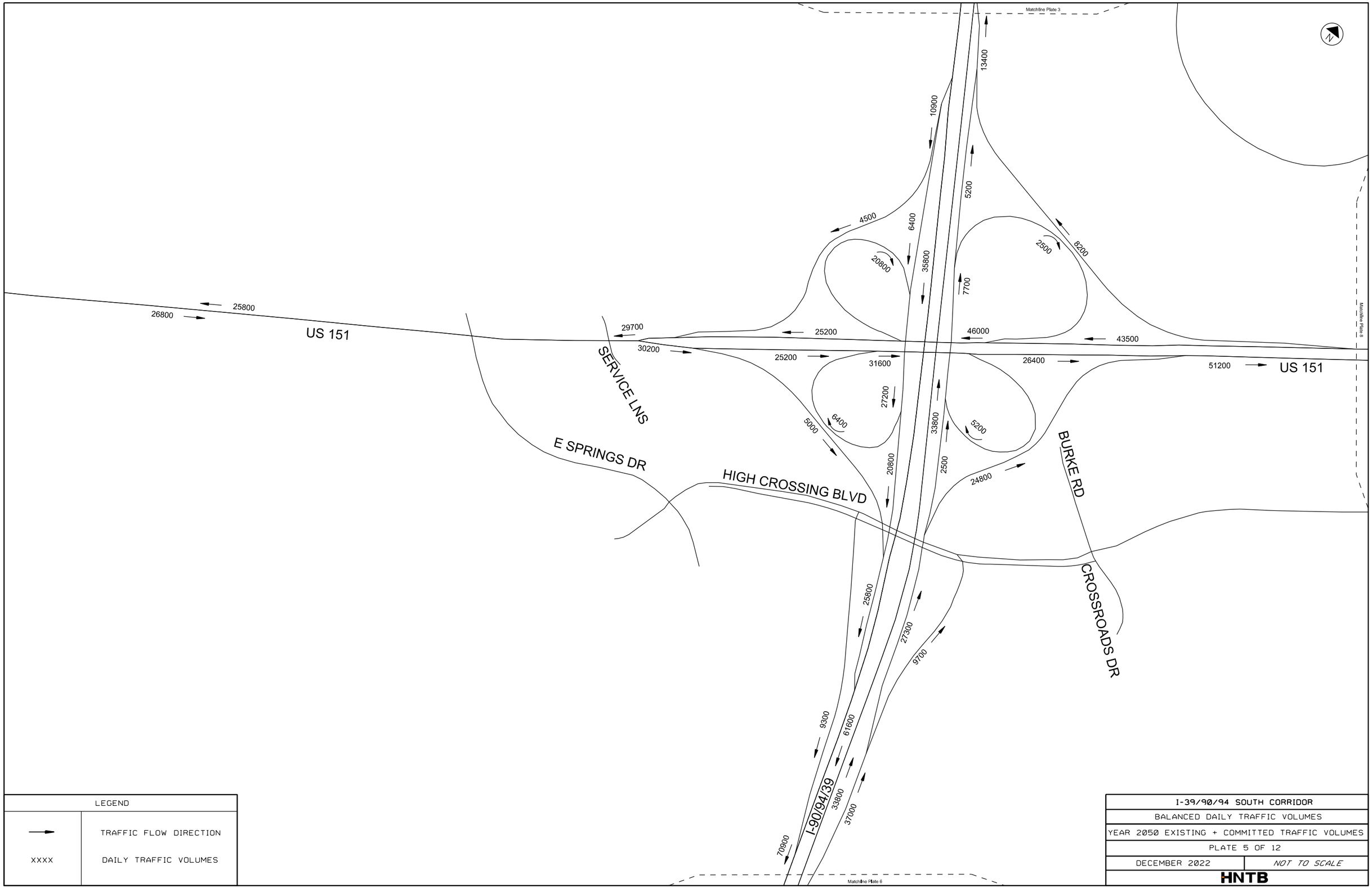
WILLIAMSBURG WAY

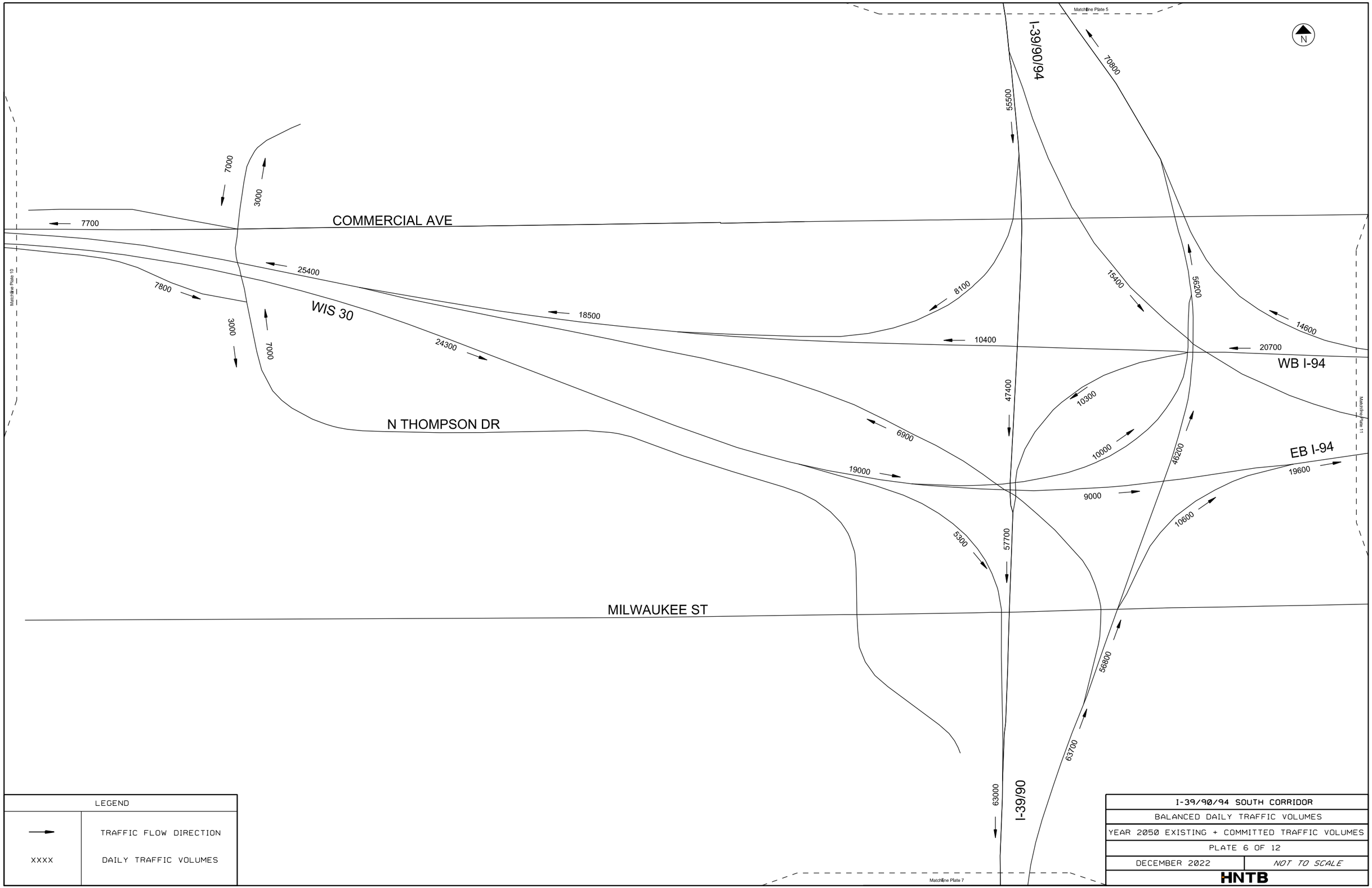
METRO DR

Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 4 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	


Matchline Plate 3
N
13400
10900
5200
4500
6400
35800
20800
2500
8200
7700
26800
25800
US 151
29700
30200
25200
46000
43500
25200
31600
26400
51200
US 151
Matchline Plate 5
SERVICE LNS
27200
6400
5000
33800
5200
20800
2500
24800
BURKE RD
E SPRINGS DR
HIGH CROSSING BLVD
CROSSROADS DR
25800
27300
9700
9300
61600
I-90/94/39
33800
37000
70900
Matchline Plate 6
LEGEND
TRAFFIC FLOW DIRECTION
XXXX
DAILY TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED DAILY TRAFFIC VOLUMES
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES
PLATE 5 OF 12
DECEMBER 2022
NOT TO SCALE
HNTB


Matchline Plate 5
I-39/90/94
70800
55500
7000
3000
7700
COMMERCIAL AVE
Matchline Plate 10
25400
7800
WIS 30
3000
7000
18500
8100
15400
56200
14600
24300
10400
20700
WB I-94
47400
10300
N THOMPSON DR
6900
10000
46200
EB I-94
19000
19600
9000
10600
5300
57700
MILWAUKEE ST
56800
63700
63000
I-39/90
Matchline Plate 7
Matchline Plate 11
N
LEGEND
TRAFFIC FLOW DIRECTION
XXXX
DAILY TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED DAILY TRAFFIC VOLUMES
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES
PLATE 6 OF 12
DECEMBER 2022
NOT TO SCALE
HNTB

Matchline Plate 6

N

I-39/90

63700

63000

42900

25200

37800

42900

9900

47700

900

4700

53450

US 12/18

53450

26100

20800

9900

38200

19250

US 12/18

19250

10500

5400

900

20700

10800

31200

31600

I-39/90

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 7 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

AMERICAN PKWY

EASTPARK BLVD

US 151

US 151

HIGH CROSSING BLVD

NELSON RD

Matchline Plate 5

Matchline Plate 9

51700

41200

10500

3400

2300

1200

5700

40000

45700

47600

3600

38400

9200

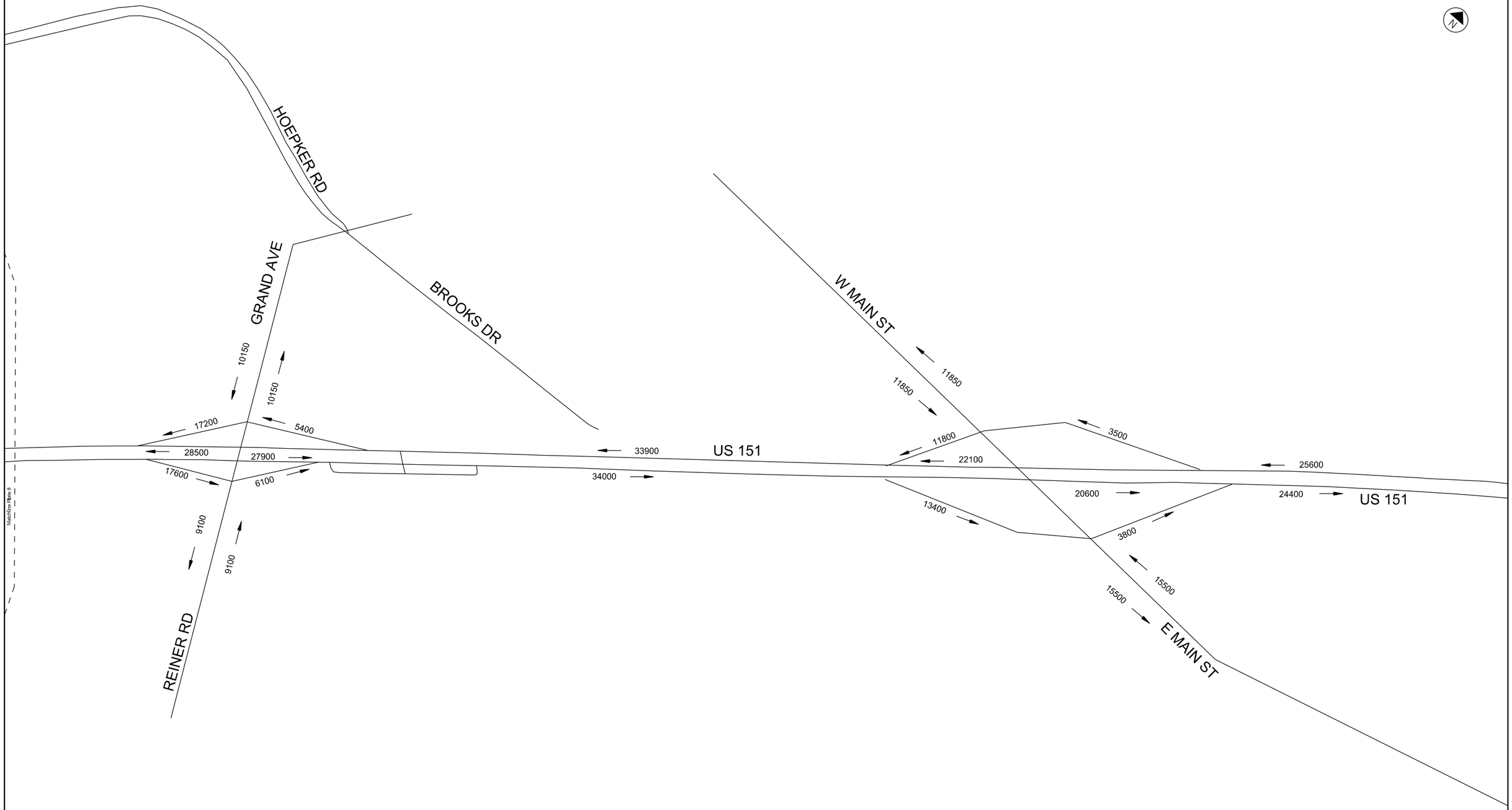
7100

45500

8300

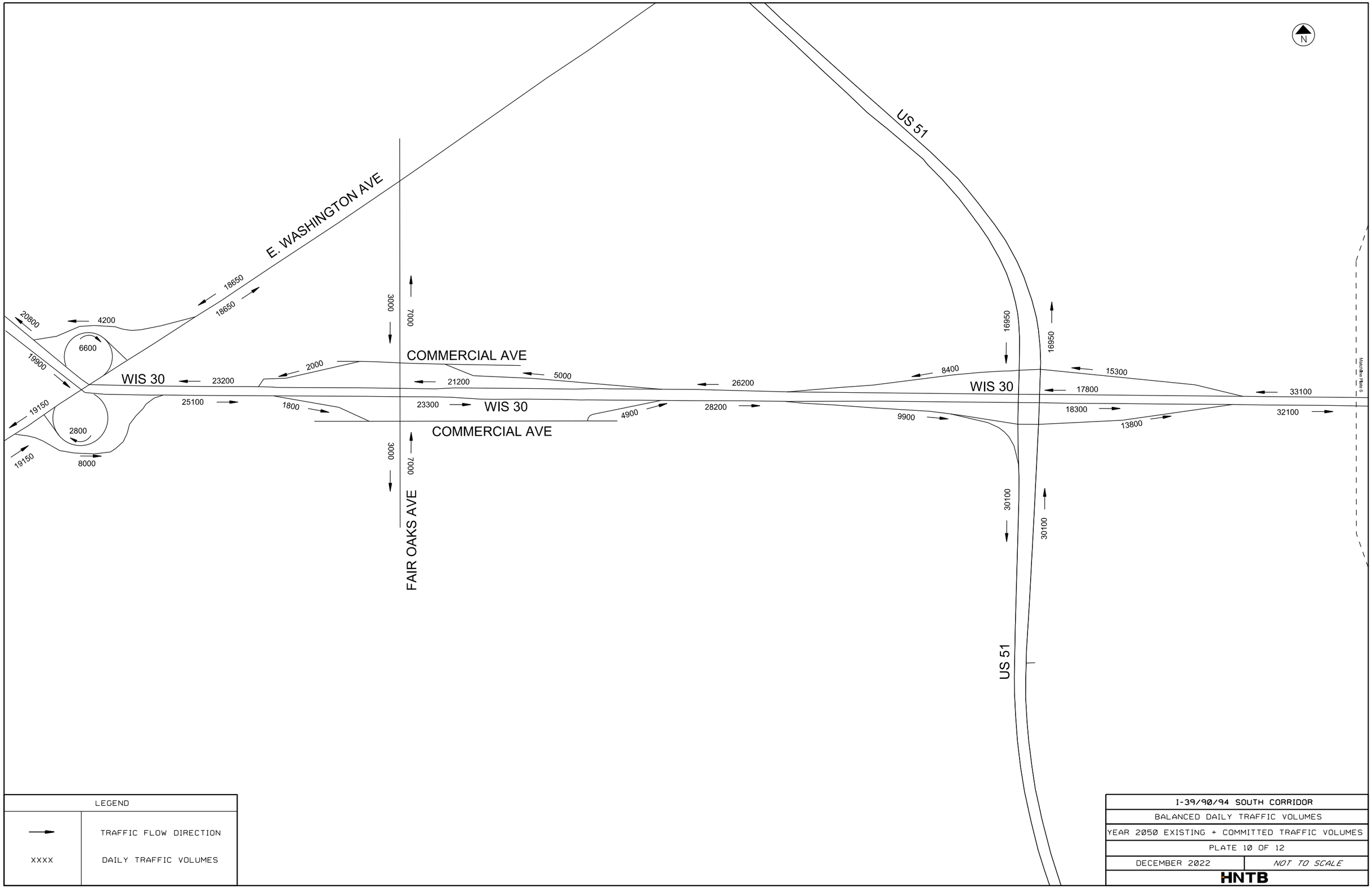
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 8 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



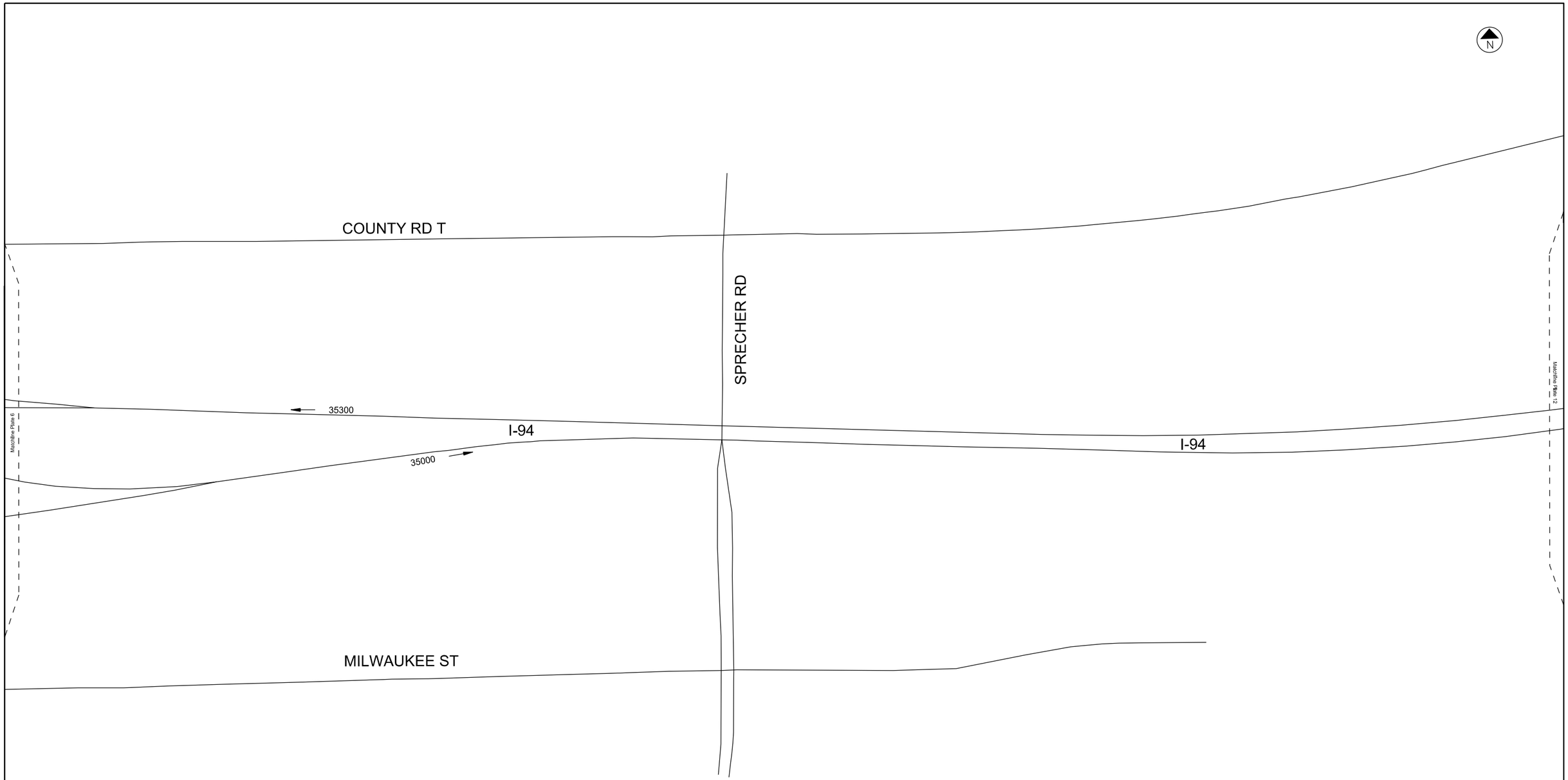
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 9 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 10 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 11 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

N

CTH TT

4500

4500

I-94

11000

24300

10700

24300

3800

3800

28100

28100

I-94

Match line Plate 11

CTH N

GASTON RD

COMMERCE PKWY

8000

8000

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 12 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Attachment M3

US 51 North Existing Plus Committed Future Year 2050 Forecast Volume Exhibits

DAENTL RD

COUNTY HWY CV

ACKER RD

HOEPKER RD

US 51

2045 (1235)
765 (1765)
765 (1765)
1995 (1170)
1290 (795)
560 (1170)

70 (110)
1975 (1125)
20 (45)
765 (1765)

580 (385)
1275 (730)
140 (55)
45 (110)
15 (20)
10 (30)
300 (640)
60 (60)
5 (35)
20 (25)
420 (1015)
120 (130)

25 (25)
1265 (770)
15 (35)
10 (35)
10 (15)
545 (1135)

0 (5)
555 (345)
5 (5)
0 (5)
5 (5)
185 (270)
0 (0)
0 (5)
0 (0)
0 (0)
245 (570)
190 (300)

30 (15)
975 (615)
270 (175)
115 (210)
120 (195)
110 (80)
5 (20)
135 (245)
55 (45)
40 (70)
435 (920)
110 (150)

Matchline Plate 2

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 NORTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 1 OF 5	
MAY 2023	*NOT TO SCALE*
HNTB	

Matchline Plate 1

N

US 51

HANSON RD

960 (730)

635 (1010)

895 (630)
245 (110)

110 (205)

55 (100)

475 (935)
160 (75)

35 (5)
915 (725)

5 (10)

10 (15)

40 (5)
630 (1000)

AMELIA EARHART DR

US 51

Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

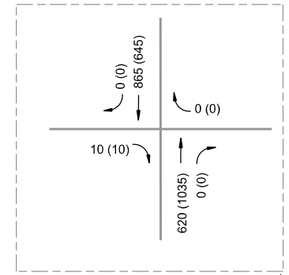
US 51 NORTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 2 OF 5	
MAY 2023	*NOT TO SCALE*
HNTB	

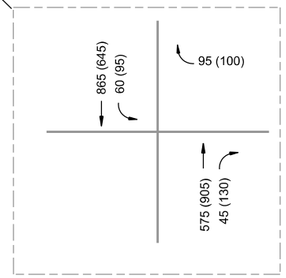
Matchline Plate 2

N

US 51

RIEDER RD



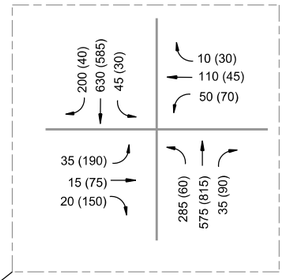


PIERSTORFF ST

875 (955)

620 (1035)

US 51



KINSMAN ST

700 (805)

685 (965)

Matchline Plate 4

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 NORTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 3 OF 5	
MAY 2023	*NOT TO SCALE*
HNTB	

Matchline Plate 3

US 51

N STOUGHTON SERVICE RD

ANDERSON ST

MENDOTA ST

US 151

ROWLAND AVE

SCHMEDEMAN AVE

REINDAHL AVE

WRIGHT ST

MAC ARTHUR RD

N STOUGHTON SERVICE RD

US 51

N FAIR OAKS AVE

US 151

COMMERCIAL AVE

Matchline Plate 5

95 (70)
560 (700)
45 (35)
20 (25)
30 (40)
45 (75)
95 (145)
35 (50)
350 (500)
470 (340)
780 (795)
25 (55)

955 (1275)
1275 (1190)

10 (15)
10 (25)
1665 (1365)
775 (1865)

355 (205)
370 (640)
230 (430)
270 (335)
1235 (1105)
365 (460)
160 (265)
555 (1525)
60 (75)
85 (80)
845 (590)
410 (710)

10 (30)
15 (15)
15 (15)
10 (20)
1710 (1615)
85 (145)
5 (35)
1015 (2360)
130 (220)
150 (255)
10 (10)
25 (100)

1870 (1900)
1135 (2595)
60 (70)
15 (20)

795 (1175)
1340 (1380)

35 (90)
80 (235)
25 (65)
55 (55)
1490 (1120)
100 (135)
85 (45)
595 (1590)
5 (30)
40 (30)
380 (115)
135 (215)

1675 (1380)
770 (1845)
20 (20)
5 (20)

65 (25)
690 (1050)
40 (100)
75 (190)
30 (45)
150 (270)
30 (75)
25 (60)
95 (190)
105 (125)
1235 (1115)
180 (280)

15 (10)
30 (30)
20 (30)
1630 (1300)
20 (35)
735 (1835)

15 (10)
30 (30)
20 (30)
1625 (1305)
15 (30)
15 (15)
20 (35)
740 (1815)
5 (15)
10 (15)
5 (5)

5 (10)
5 (0)
15 (85)
30 (40)
115 (110)
55 (45)
5 (0)
105 (140)
5 (15)
10 (10)
0 (0)
30 (100)

935 (1510)
1520 (1520)

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 NORTH CORRIDOR

BALANCED TURNING MOVEMENT VOLUMES

YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES

PLATE 4 OF 5

MAY 2023 | *NOT TO SCALE*

HNTB

Matchline Plate 4

N

US 51

WIS 30

WIS 30

CORPORATE DR

US 51

65 (70)
870 (1440)
400 (235)
0 (0)
1050 (660)
555 (590)
1120 (1285)

620 (660)
1450 (895)
735 (825)
635 (1475)
2485 (2540)
2140 (2965)

1785 (1795)
135 (305)
35 (80)
0 (0)
700 (745)
1640 (1795)
500 (1170)

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 NORTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 5 OF 5	
MAY 2023	*NOT TO SCALE*
HNTB	

DAENTL RD

16950

15570

COUNTY HWY CV

9500

8800

ACKER RD

HOEPKER RD

US 51

Matchline Plate 2

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

US 51 NORTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 1 OF 5	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 1

N

US 51

HANSON RD

9500

8200

AMELIA EARHART DR

US 51

Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

US 51 NORTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 2 OF 5	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 2

N

US 51

RIEDER RD

PIERSTORFF ST

9170

9230

US 51

KINSMAN ST

8940

8860

Matchline Plate 4

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

US 51 NORTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 3 OF 5	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 3

N

US 51

N STOUGHTON SERVICE RD

US 151

ANDERSON ST

14000

13880

MENDOTA ST

25200

25690

26000

21910

ROWLAND AVE

SCHMEDEMAN AVE

REINDAHL AVE

18510

17110

MAC ARTHUR RD

13100

14500

WRIGHT ST

N STOUGHTON SERVICE RD

US 51

US 151

N FAIR OAKS AVE

COMMERCIAL AVE

16200

15000

Matchline Plate 5

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

US 51 NORTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 4 OF 5	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 4

N

US 51

WIS 30

7270

11760

8770

10680

WIS 30

30470

26480

CORPORATE DR

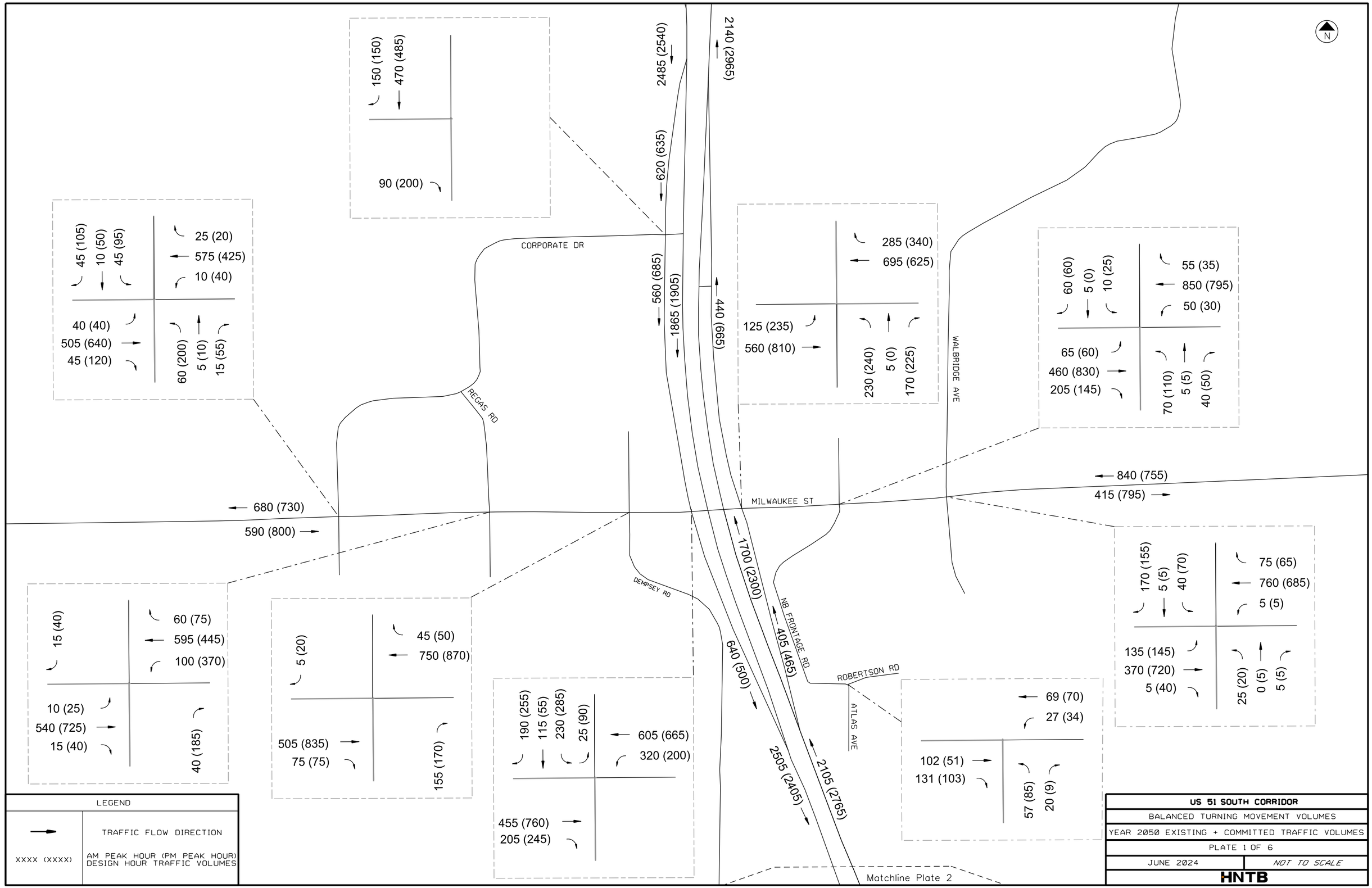
US 51

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

US 51 NORTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 5 OF 5	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Attachment M4

US 51 South Existing Plus Committed Future Year 2050 Forecast Volume Exhibits



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 1 OF 6	
JUNE 2024	*NOT TO SCALE*
HNTB	

Matchline Plate 1

N

COTTAGE COURT RD

500 (550)

1605 (2215)

350 (385)

ATLAS AVE

COTTAGE GROVE RD

1390 (1030)

600 (1225)

810 (635)

500 (805)

65 (75) | 35 (35) | 185 (210)

180 (150)

735 (540)

15 (35)

45 (55)

445 (735)

10 (15)

10 (20) | 40 (40) | 30 (45)

310 (490)

2195 (1915)

605 (535)

1955 (2600)

DEMPSEY RD

CLAIRE ST

LUMBERMAN'S TRL

905 (705)

55 (65)

635 (960)

25 (30)

25 (20) | 65 (65)

0 (5) | 5 (10) | 10 (10)

15 (15)

830 (580)

440 (370)

5 (5)

535 (865)

160 (155)

130 (185) | 10 (5) | 170 (300)

110 (100) | 240 (285)

285 (345)

1175 (865)

215 (205)

500 (970)

150 (220) | 5 (10) | 30 (120)

80 (65)

1305 (920)

5 (45)

155 (120)

565 (1035)

20 (100)

5 (70) | 0 (15) | 5 (70)

Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 2 OF 6	
JUNE 2024	*NOT TO SCALE*
HNTB	

Matchline Plate 2

N

5 (10) | 5 (5) | 15 (20) | 5 (20) | 385 (395) | 20 (30)
5 (5) | 285 (280) | 5 (10) | 5 (10) | 5 (10) | 20 (45)

405 (425) | 170 (180)
310 (315) | 10 (30) | 5 (20) | 35 (150)

2800 (2450)

1955 (2600)

355 (330) | 2170 (1900) | 275 (220) | 215 (360) | 165 (155) | 265 (235)
140 (215) | 145 (180) | 60 (70) | 55 (120) | 1600 (2025) | 235 (355)

85 (95) | 5 (10) | 15 (15) | 560 (655)
70 (65) | 585 (690)

BLOSSOM LN

395 (415)
295 (295)

BUCKEYE RD

560 (500)
445 (690)

5 (17) | 175 (193)
4 (6) | 9 (22) | 11 (49) | 36 (164)

ALLIS AVE

SSM HEALTH

FRONTAGE RD E

0 (0) | 0 (5) | 0 (5) | 0 (5) | 515 (475) | 45 (20)
5 (5) | 385 (615) | 200 (80) | 60 (195) | 0 (5) | 60 (70)

130 (50) | 115 (55)
45 (113) | 0 (8) | 1 (2) | 75 (157)

CAMDEN RD

FRONTAGE RD W

2 (4) | 9 (22) | 6 (2) | 109 (61)
82 (5) | 74 (155)

28 (71) | 115 (136)
15 (85) | 2 (10) | 6 (11) | 66 (92)

FARM & FLEET

2495 (2205)

1890 (2500)

85 (80) | 160 (25) | 60 (175) | 5 (5)
65 (95) | 65 (15)

5 (11) | 112 (135)
1 (10) | 18 (60) | 24 (62) | 71 (93)

65 (180)
225 (40)

HELGESEN RD

Matchline Plate 4

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR
BALANCED TURNING MOVEMENT VOLUMES
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES
PLATE 3 OF 6
JUNE 2024 | *NOT TO SCALE*
HNTB

Matchline Plate 3

CAMDEN RD

730 (525)
10 (10)
505 (540)
5 (5)
5 (5)
20 (10)

2495 (2205)

1890 (2500)

PFLAUM RD

730 (510)
475 (525)

525 (765)
740 (450)

20 (20)
10 (5)
15 (15)
5 (25)
700 (485)
30 (20)
20 (20)
450 (500)
5 (5)
10 (5)
5 (5)
45 (30)

SERVICE LN

95 (80)
15 (30)
20 (85)
65 (125)
645 (455)
25 (25)
25 (25)
495 (515)
5 (10)
0 (0)
5 (5)
45 (25)

FRONTAGE RD W

FRONTAGE RD E

SEIFORTH RD

485 (745)
40 (20)
675 (425)
110 (45)
100 (75)
65 (25)

2120 (2395)

2065 (2375)

TOMPKINS DR

31 (23)
14 (7)
6 (15)
39 (50)
54 (25)
36 (23)

360 (215)
1770 (1850)
365 (140)
200 (340)
195 (180)
205 (330)
255 (285)
160 (125)
145 (215)
180 (210)
1435 (1875)
450 (290)

70 (70)
0 (0)
15 (10)
60 (60)
520 (755)
5 (5)
65 (35)
765 (445)
145 (75)
10 (25)
5 (15)
5 (15)

Matchline Plate 5

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR

BALANCED TURNING MOVEMENT VOLUMES

YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES

PLATE 4 OF 6

JUNE 2024 | *NOT TO SCALE*

HNTB

Matchline Plate 4

N

FEMRITE DR

COPPS AVE

BROADWAY AVE

BROADWAY SR

DUTCH MILL RD

FEMRITE DR

BROADWAY AVE

BELTLINE

Matchline Plate 6

790 (780)
480 (860)
2230 (3235)
2985 (2490)
920 (705)
2465 (2415)
3420 (2925)
1120 (1960)
665 (1110)
2160 (2570)
1430 (2385)
2235 (1890)
630 (1095)
925 (560)

5 (5)
20 (45)
35 (5)
165 (135)
140 (110)
35 (40)

360 (330)
1665 (1975)
95 (90)
70 (165)
220 (270)
440 (920)
130 (325)
340 (280)
125 (340)
315 (235)
1865 (1885)
805 (370)

90 (170)
5 (10)
5 (0)
5 (5)
610 (1120)
15 (30)
200 (95)
980 (550)
60 (95)
30 (65)
5 (5)
15 (25)

16 (43)
31 (105)
47 (23)
599 (990)
48 (40)
877 (520)

35 (50)
150 (130)
140 (105)
755 (730)
35 (45)
445 (815)

1470 (1700)
760 (1535)
545 (270)
15 (10)
360 (425)
980 (705)
2440 (2220)

890 (1380)
230 (580)
1605 (1550)
15 (15)
540 (1005)
1815 (1375)
420 (515)

620 (1090)
10 (5)
920 (550)
80 (25)
10 (65)
5 (10)

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR

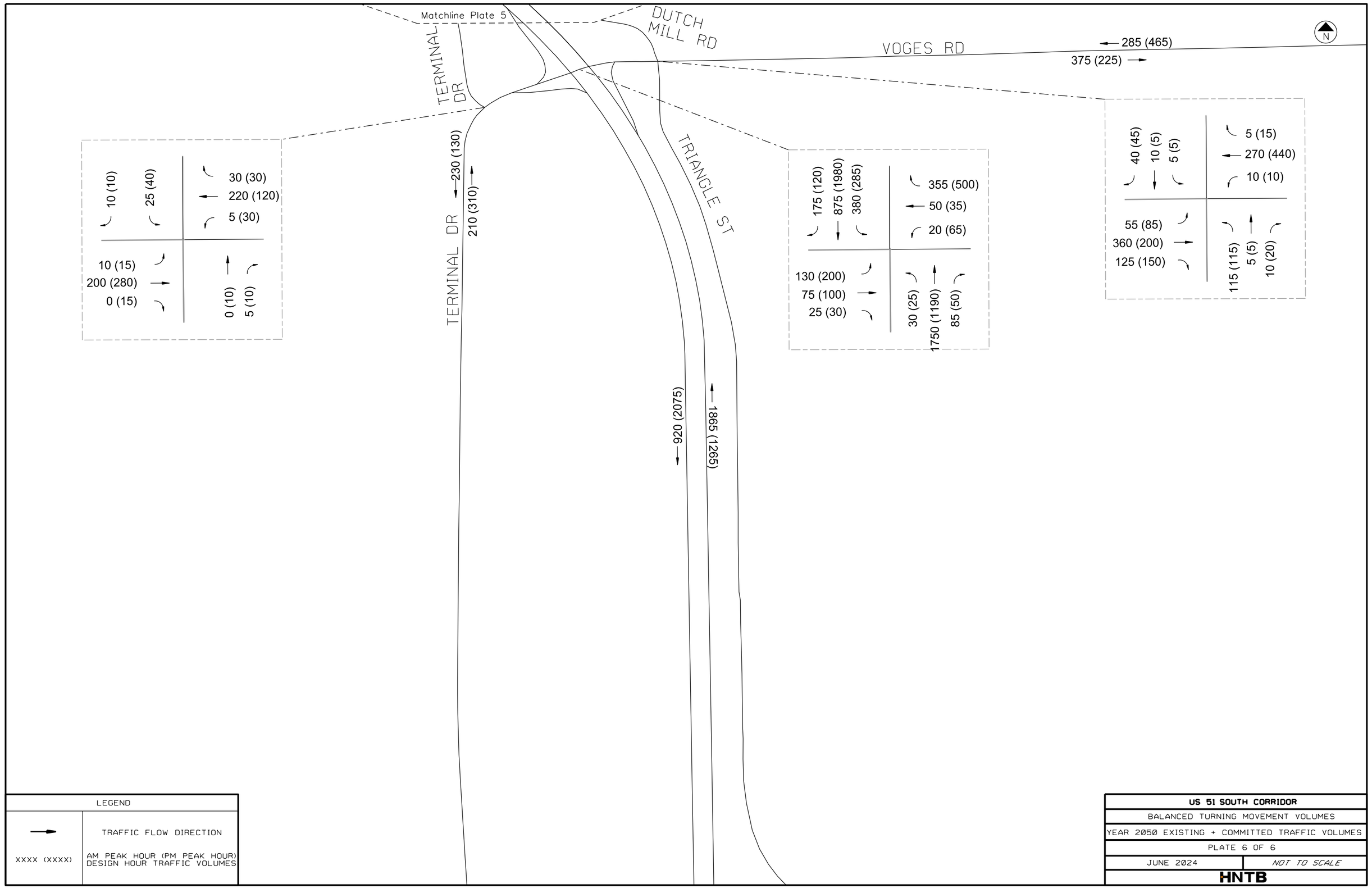
BALANCED TURNING MOVEMENT VOLUMES

YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES

PLATE 5 OF 6

JUNE 2024 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	AM PEAK HOUR (PM PEAK HOUR) DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 6 OF 6	
JUNE 2024	*NOT TO SCALE*
HNTB	

N
30500
26500
10400
CORPORATE DR
7700
7400
REGAS RD
WALBRIDGE AVE
MILWAUKEE ST
DEMPSEY RD
6700
6500
NB FRONTAGE RD
26800
25600
Matchline Plate 2
LEGEND
TRAFFIC FLOW DIRECTION
XXXX
EXISTING YEAR 2022 DAILY DESIGN HOUR TRAFFIC VOLUMES
US 51 SOUTH CORRIDOR
DAILY TRAFFIC VOLUMES
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES
PLATE 1 OF 6
APRIL 2023
NOT TO SCALE
HNTB

Matchline Plate 1

N

4300

COTTAGE COURT RD

ATLAS AVE

4700

COTTAGE GROVE RD

4600

DEMPSEY RD

CLAIRE ST

LUMBERMAN'S TRL

5400

26000

Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	EXISTING YEAR 2022 DAILY DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 2 OF 6	
APRIL 2023	*NOT TO SCALE*
HNTB	

Matchline Plate 2

N

27600

26000

BLOSSOM LN

BUCKEYE RD

CAMDEN RD

FRONTAGE RD W

FRONTAGE RD E

25000

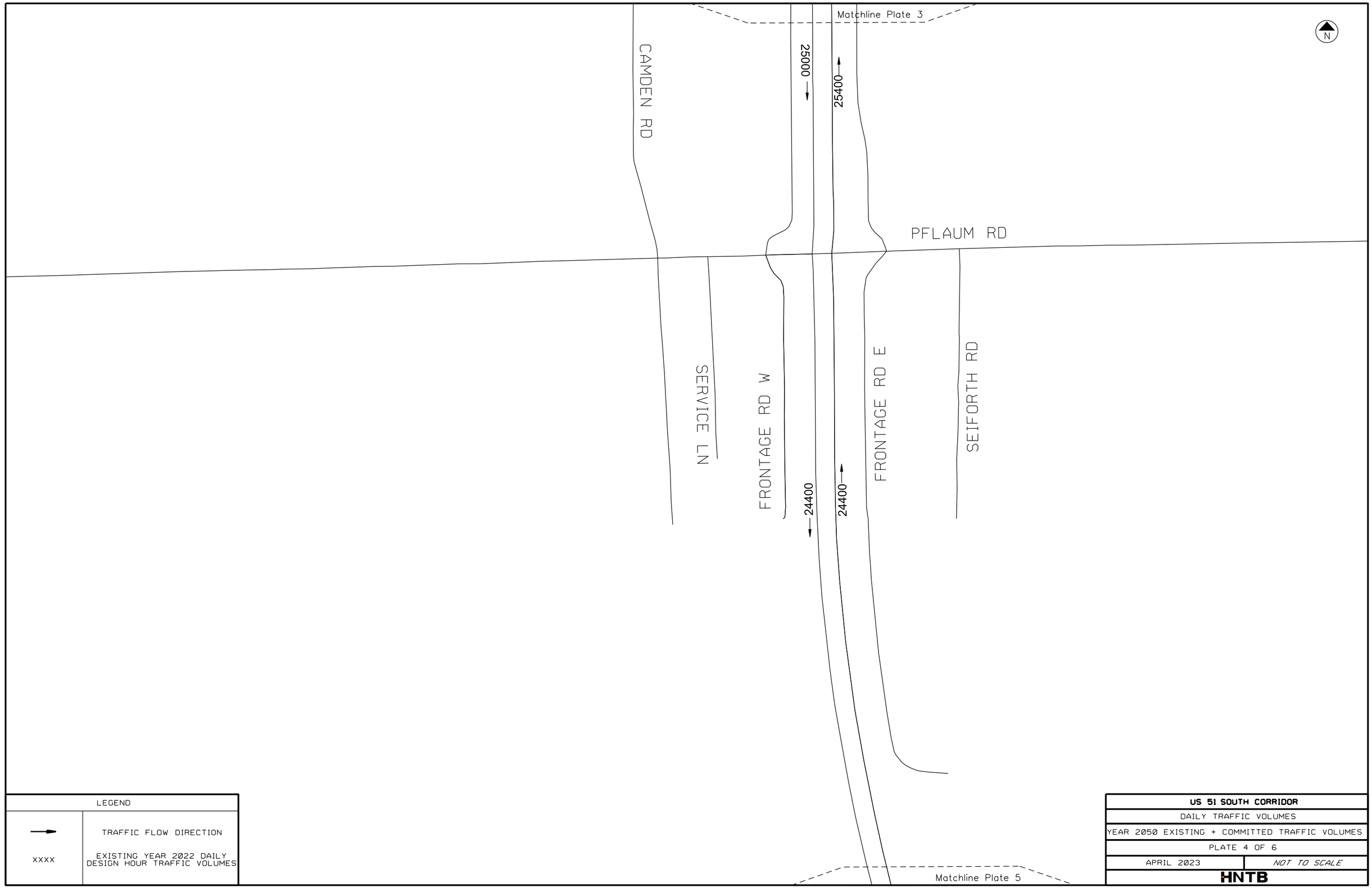
25400

HELGESEN RD

Matchline Plate 4

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	EXISTING YEAR 2022 DAILY DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 3 OF 6	
APRIL 2023	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	EXISTING YEAR 2022 DAILY DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 4 OF 6	
APRIL 2023	*NOT TO SCALE*
HNTB	

Matchline Plate 4

N

FEMRITE DR

COPPS AVE

BROADWAY AVE

BROADWAY SR

DUTCH MILL RD

BROADWAY AVE

COLLINS CT

28400

30300

9500

28000

BELTLINE

9100

27300

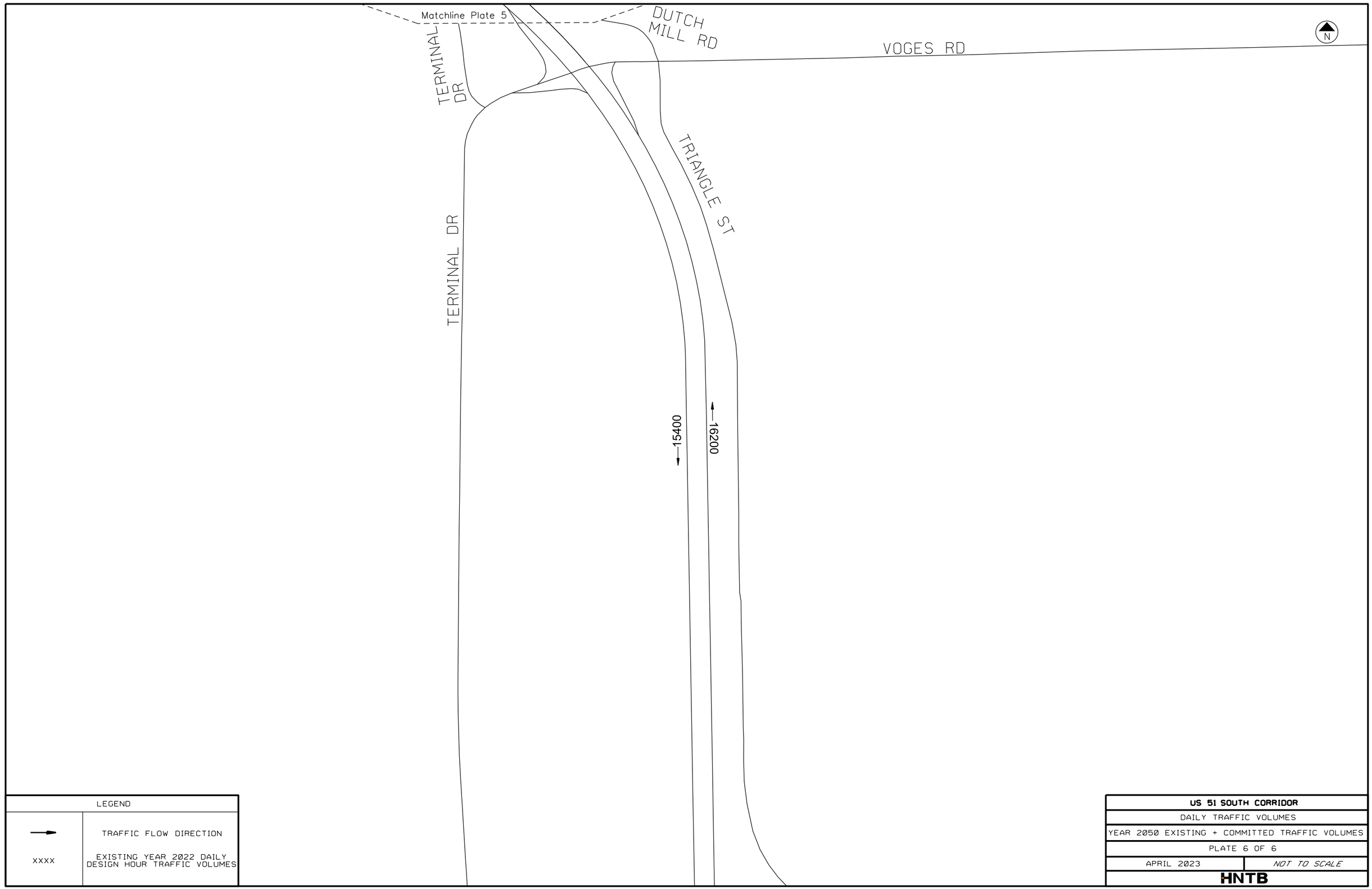
20800

20300

Matchline Plate 6

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	EXISTING YEAR 2022 DAILY DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 5 OF 6	
APRIL 2023	*NOT TO SCALE*
HNTB	

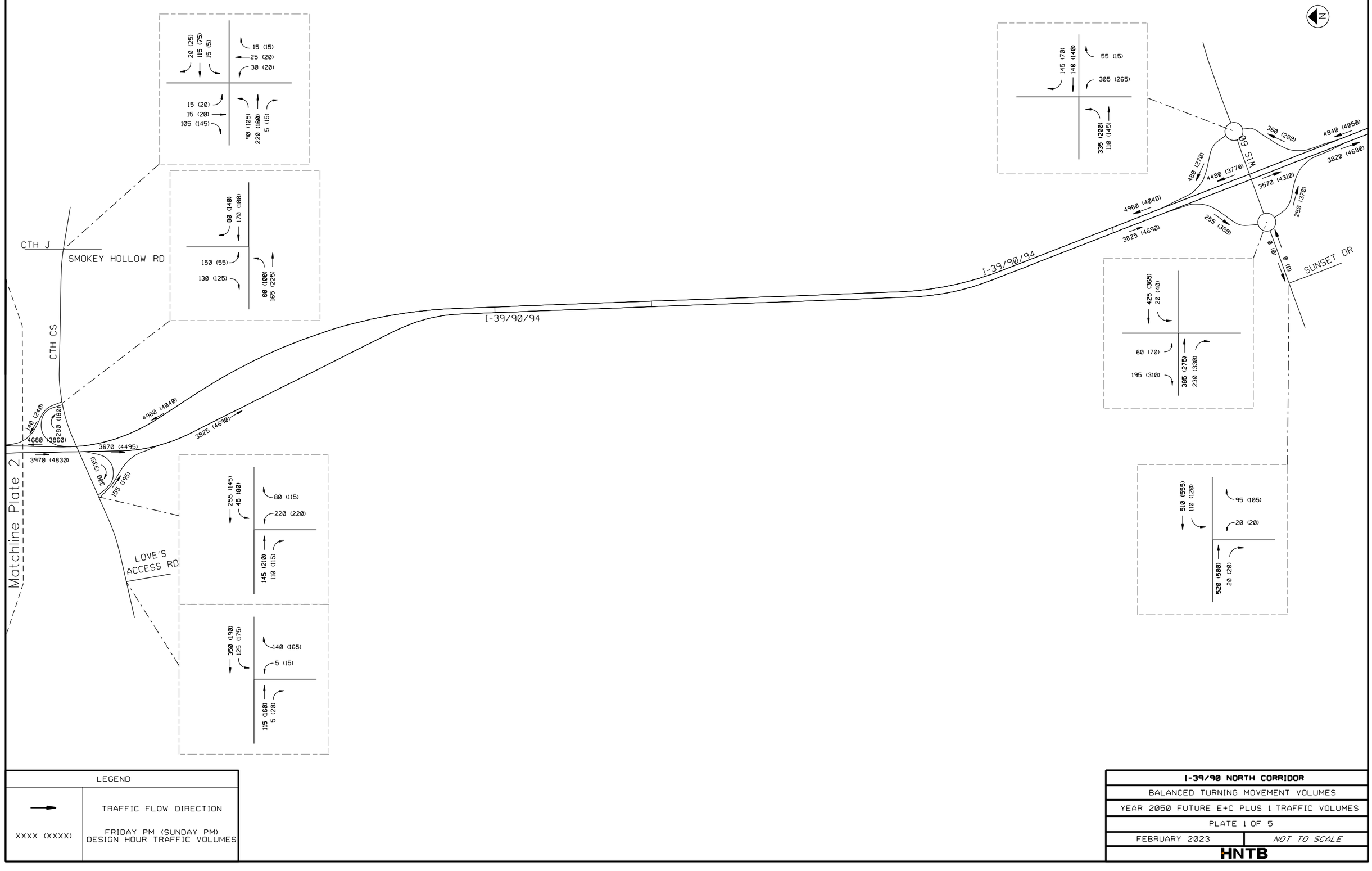


LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	EXISTING YEAR 2022 DAILY DESIGN HOUR TRAFFIC VOLUMES

US 51 SOUTH CORRIDOR	
DAILY TRAFFIC VOLUMES	
YEAR 2050 EXISTING + COMMITTED TRAFFIC VOLUMES	
PLATE 6 OF 6	
APRIL 2023	*NOT TO SCALE*
HNTB	

Attachment N1

Interstate North Existing Plus Committed 'Plus 1' Future Year 2050 Forecast Volume Exhibits



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

BALANCED TURNING MOVEMENT VOLUMES

YEAR 2050 FUTURE E+C PLUS 1 TRAFFIC VOLUMES

PLATE 1 OF 5

FEBRUARY 2023 | *NOT TO SCALE*

HNTB

Matchline Plate 3

Matchline Plate 5

N

WIS 33

I-39/90/94

I-39

CTH U

CASCADE MOUNTAIN RD

ARCO DR/
KINNEY RD

WIS 78

Matchline Plate 1

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2050 FUTURE E+C PLUS 1 TRAFFIC VOLUMES	
PLATE 2 OF 5	
FEBRUARY 2023	*NOT TO SCALE*
HNTB	

Matchline Plate 4

N

US 12

WHITLOCK ST

WIS 23

CTH P

COMMERCE ST

3620 (3490)
3180 (3770)
370 (325)
480 (400)
2810 (3445)
3140 (3080)
380 (420)
320 (485)

280 (270)
10 (20)
570 (635)
600 (605)
475 (400)
10 (5)
250 (290)
355 (425)
15 (25)

5 (5)
100 (145)
170 (235)
260 (160)
110 (95)
575 (585)
15 (5)
110 (170)
45 (35)
45 (40)
130 (115)
580 (645)

255 (225)
0 (0)
115 (100)
690 (615)
105 (165)
645 (730)
215 (320)

220 (150)
535 (520)
260 (250)
500 (580)
260 (260)
0 (0)
120 (160)

195 (285)
400 (420)
165 (210)
125 (150)
145 (145)
250 (310)
185 (235)
130 (175)
325 (395)
365 (395)
430 (580)
250 (380)

GASSER RD

MEADOWVIEW DR

US 12

975 (1125)
1045 (1355)

675 (780)
540 (365)
615 (895)

300 (345)
430 (460)
540 (365)
820 (580)
970 (825)
3520 (3500)
3130 (3930)
3220 (3155)
2400 (2575)
2500 (3005)
2815 (3305)
3370 (3400)
3020 (3600)
315 (300)
630 (925)
140 (245)
205 (295)
490 (680)

I-90/94

I-90/94

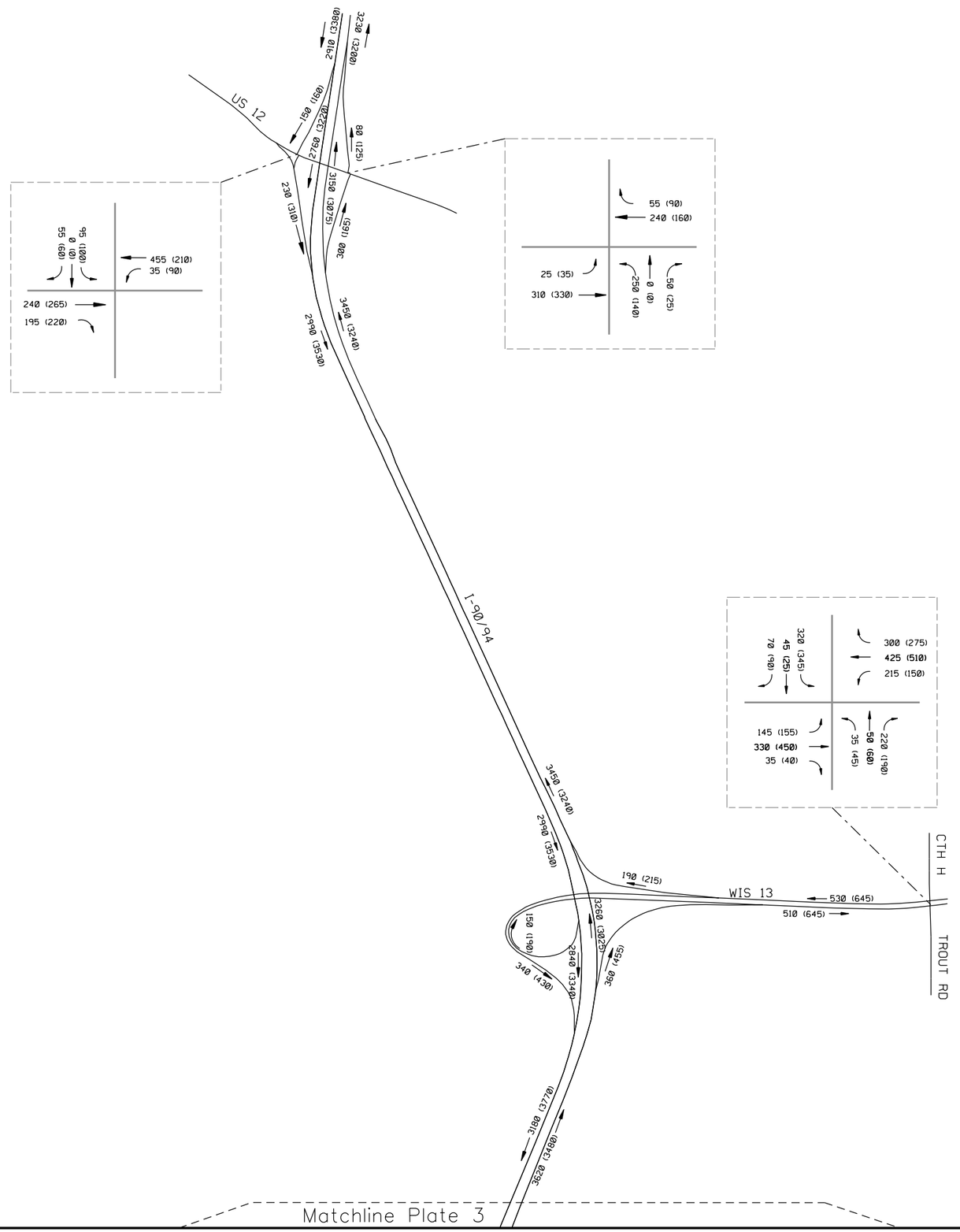
900 (845)
140 (245)
1295 (1230)

1500 (1525)
1390 (1525)
280 (315)
465 (365)
1110 (1210)
1036 (1160)

Matchline Plate 2

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR	
BALANCED TURNING MOVEMENT VOLUMES	
YEAR 2050 FUTURE E+C PLUS 1 TRAFFIC VOLUMES	
PLATE 3 OF 5	
FEBRUARY 2023	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

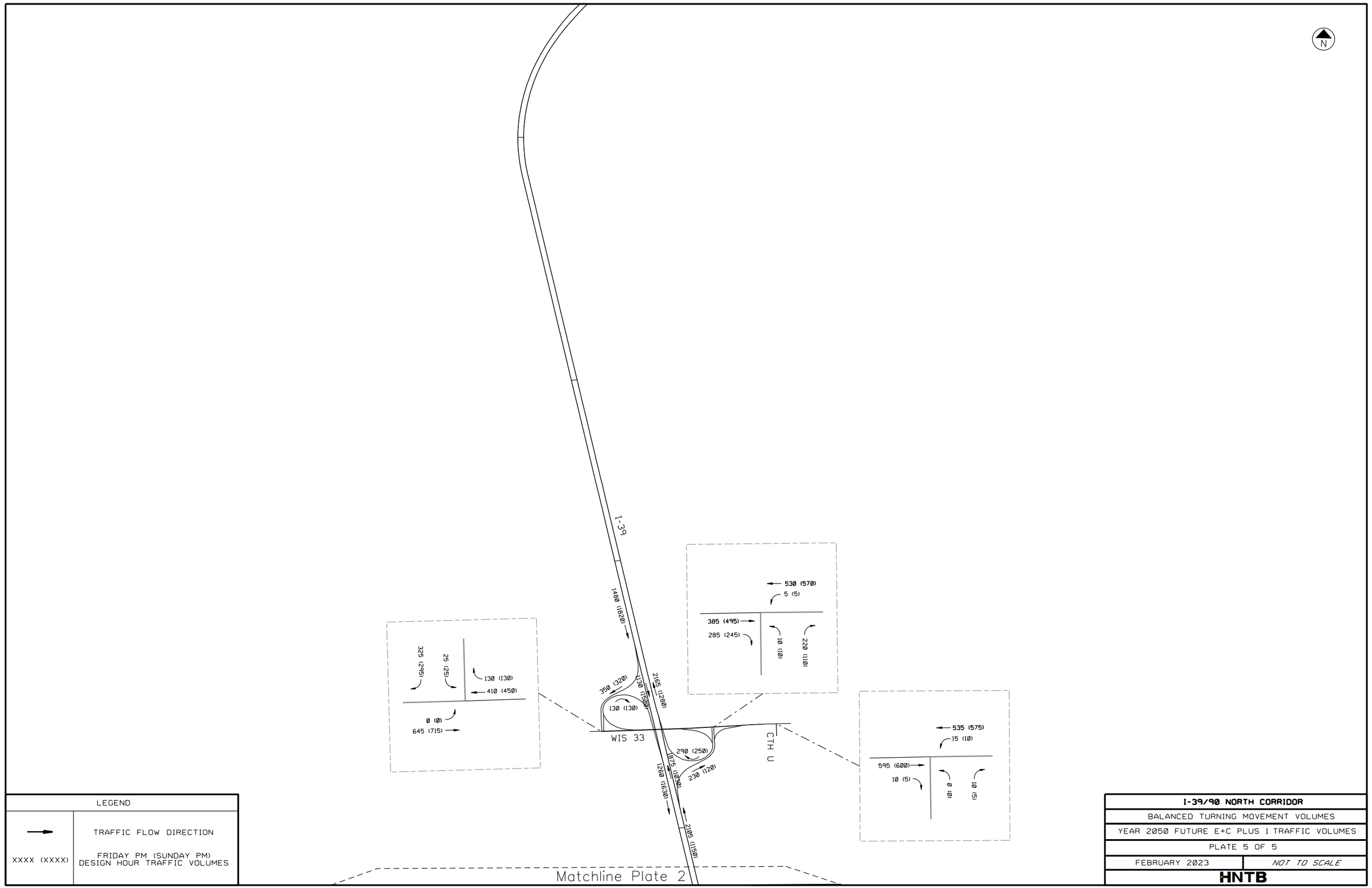
BALANCED TURNING MOVEMENT VOLUMES

YEAR 2050 FUTURE E+C PLUS 1 TRAFFIC VOLUMES

PLATE 4 OF 5

FEBRUARY 2023 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

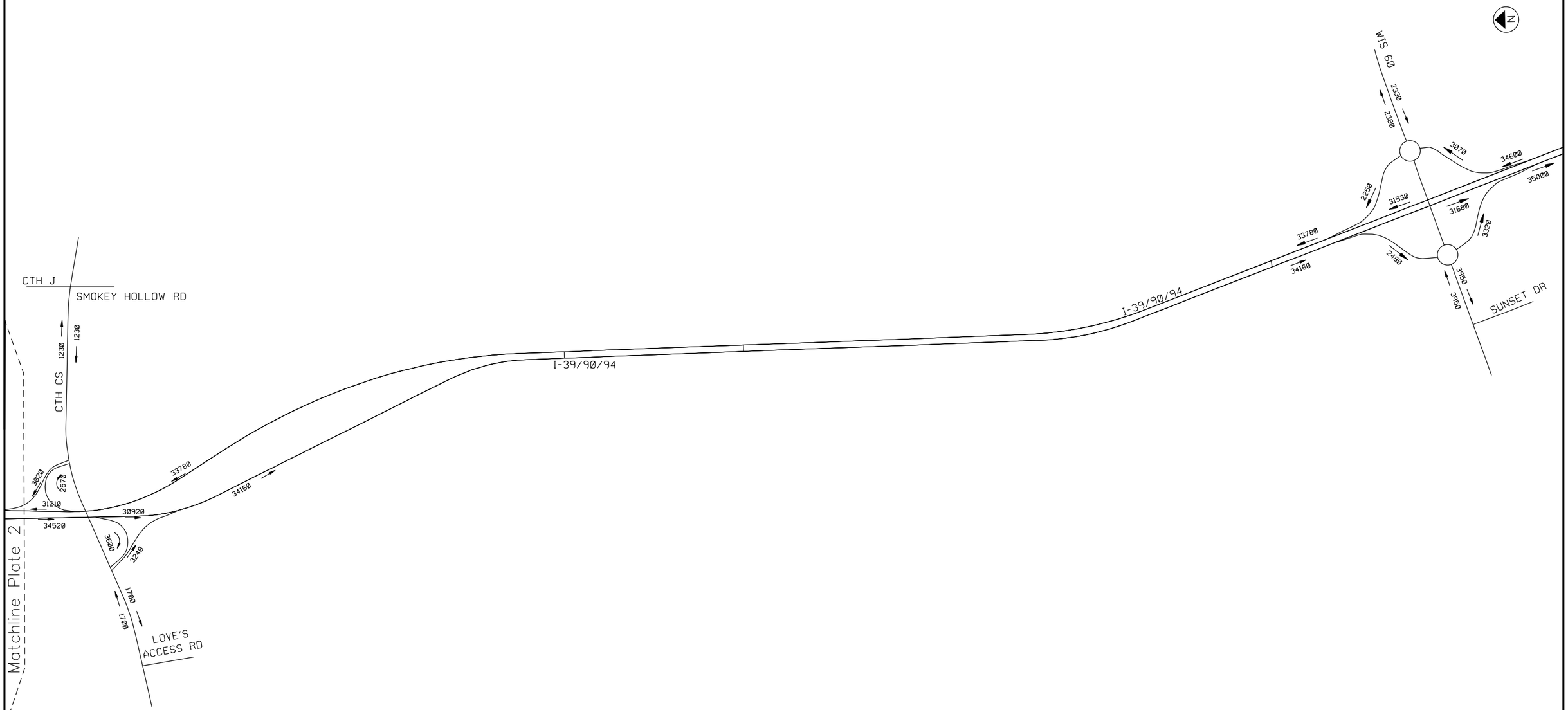
BALANCED TURNING MOVEMENT VOLUMES

YEAR 2050 FUTURE E+C PLUS 1 TRAFFIC VOLUMES

PLATE 5 OF 5

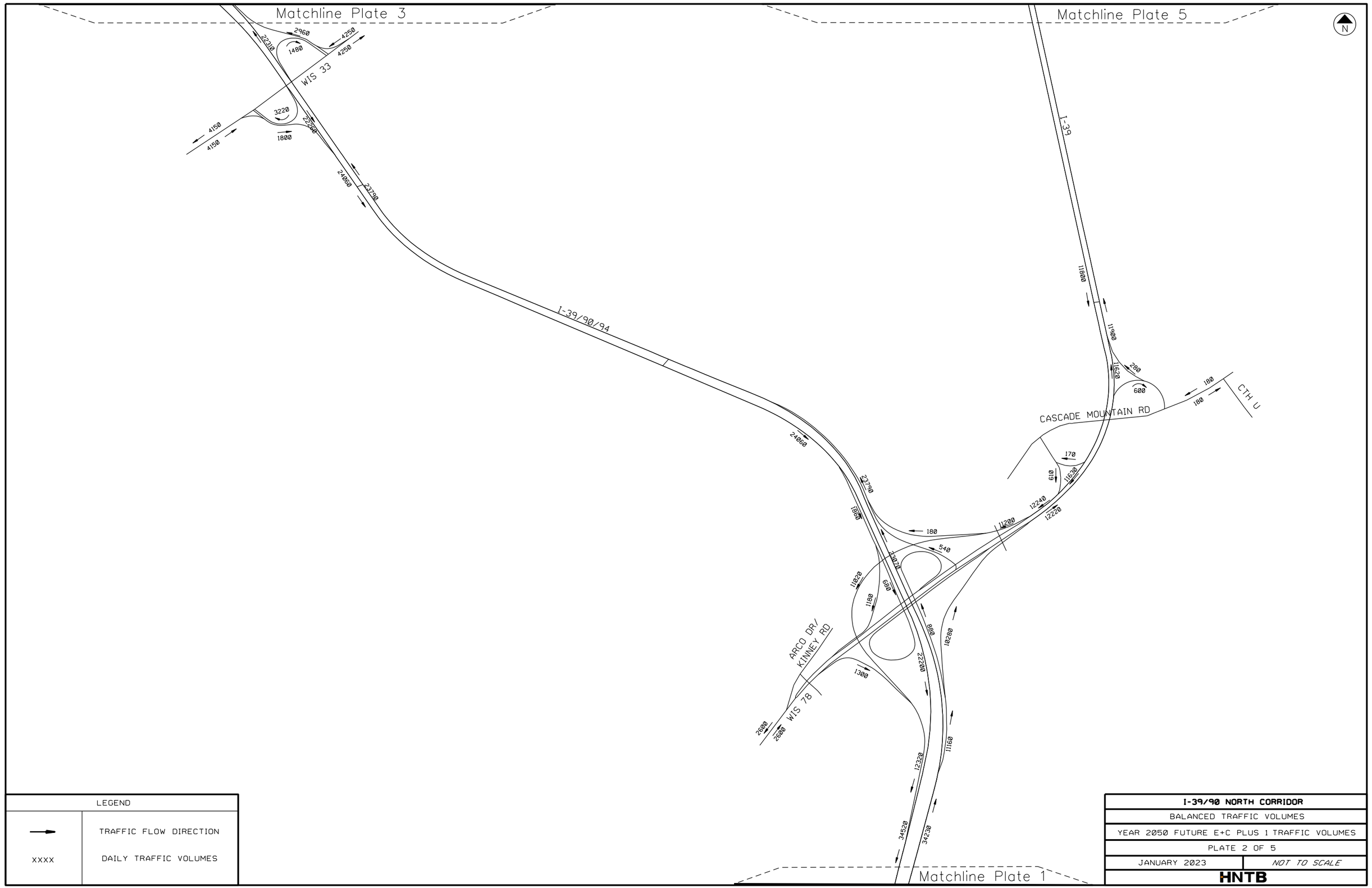
FEBRUARY 2023 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 FUTURE E+C PLUS 1 TRAFFIC VOLUMES	
PLATE 1 OF 5	
JANUARY 2023	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 FUTURE E+C PLUS 1 TRAFFIC VOLUMES	
PLATE 2 OF 5	
JANUARY 2023	*NOT TO SCALE*
HNTB	

Matchline Plate 4

N

US 12

WHITLOCK ST

WIS 23

CTH P

COMMERCE ST

26950
25810
3050
3680
22750
9460
9460
10190
10190
23270
4730
3730

MEADOWVIEW DR

GASSER RD

US 12

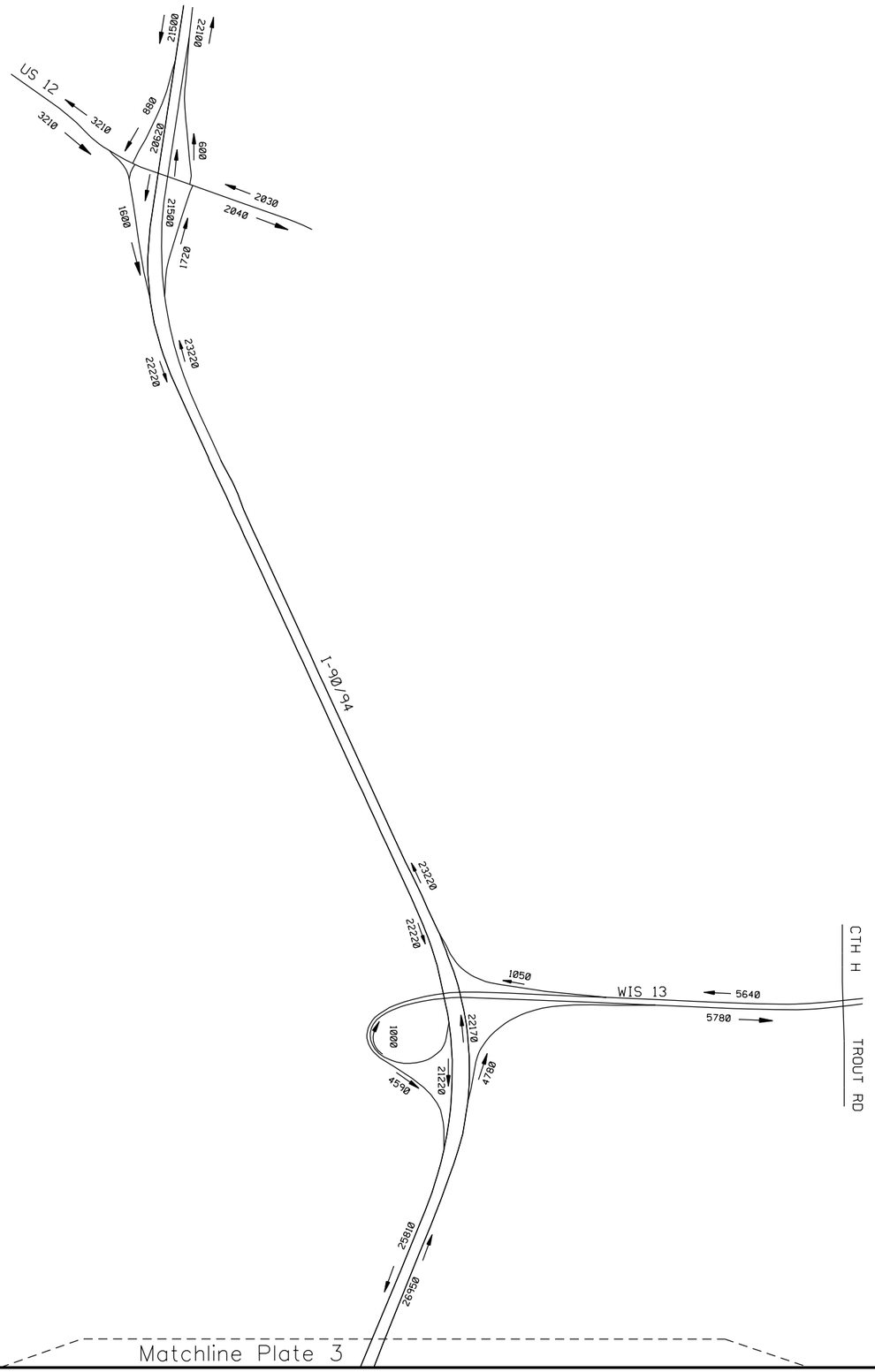
8030
8239
1950
2120
2700
5600
4820
28000
26490
26050
20280
22580
20450
25270
25480
6210
2300
2900
1500
4710
I-90/94
I-90/94

6911
11808
3170
4190
8020
7610

Matchline Plate 2

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 FUTURE E+C PLUS 1 TRAFFIC VOLUMES	
PLATE 3 OF 5	
JANUARY 2023	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

BALANCED TRAFFIC VOLUMES

YEAR 2050 FUTURE E+C PLUS 1 TRAFFIC VOLUMES

PLATE 4 OF 5

JANUARY 2023 | *NOT TO SCALE*

HNTB

N

I-39

12450

2740

9710

12030

2090

4250

4250

WIS 33

4620

4620

CTH U

2180

9820

2050

11800

11900

Matchline Plate 2

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

BALANCED TRAFFIC VOLUMES

YEAR 2050 FUTURE E+C PLUS 1 TRAFFIC VOLUMES

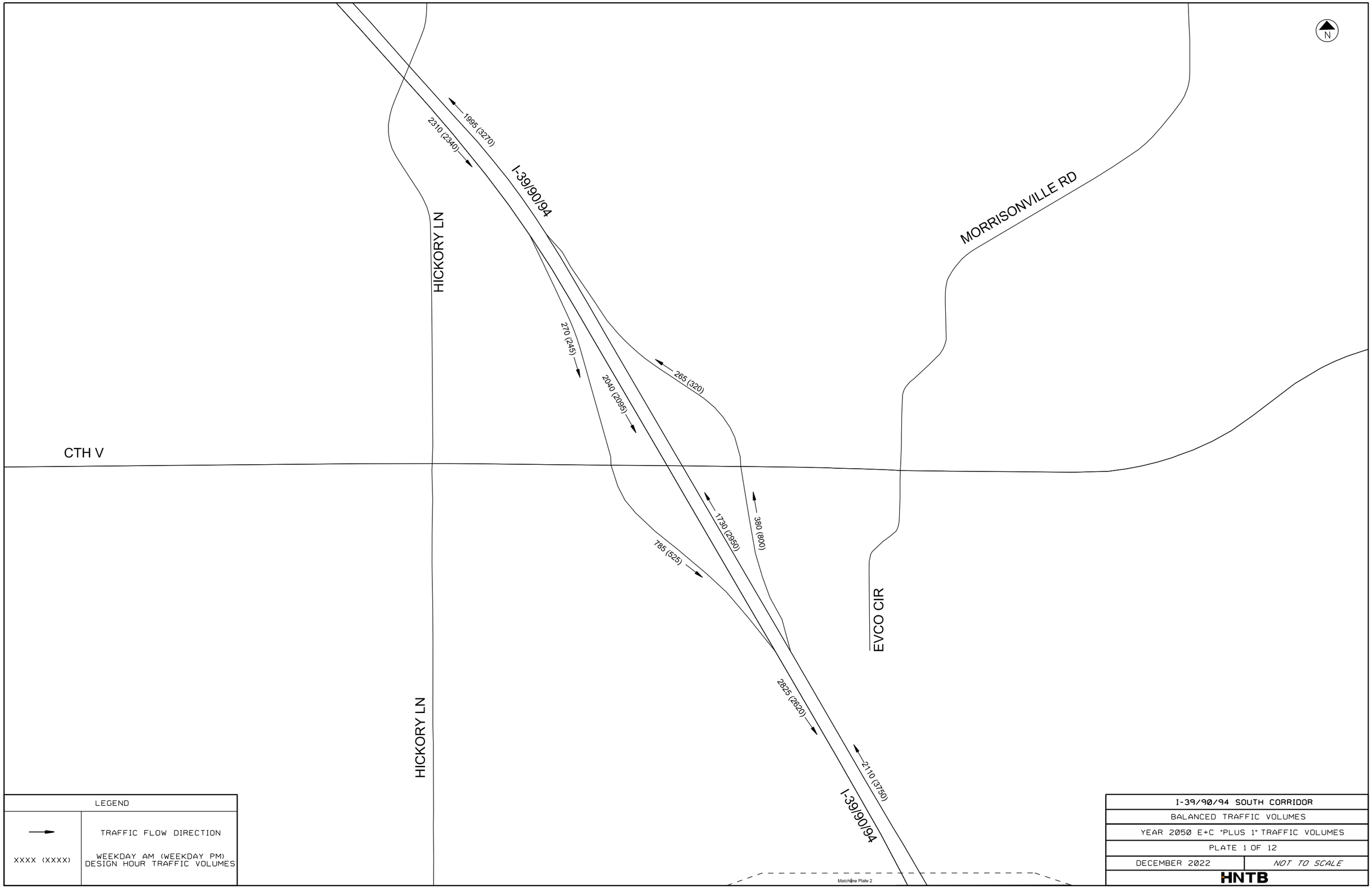
PLATE 5 OF 5

JANUARY 2023 | *NOT TO SCALE*

HNTB

Attachment N2

Interstate South Existing Plus Committed 'Plus 1' Future Year 2050 Forecast Volume Exhibits



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 1 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 1

2825 (2620)

2110 (3750)

I-39/90/94

CTH CV

TIERNEY XING

DALMORE RD

WIS 19

LIUNA WAY

270 (405)

320 (305)

2555 (2215)

Matchline Plate 4

1790 (3445)

1130 (1050)

955 (980)

PEPSI WAY

I-39/90/94

3510 (3195)

2920 (4495)

Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR

BALANCED TRAFFICVOLUMES

YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES

PLATE 2 OF 12

DECEMBER 2022 | *NOT TO SCALE*

HNTB

Matchline Plate 2

Matchline Plate 4

I-39/90/94

US 51

3510 (3195)

2920 (4495)

1790 (1560)

860 (1800)

545 (910)

150 (160)

1160 (455)

2770 (4335)

2350 (2740)

300 (785)

660 (680)

2470 (3550)

3010 (3420)

770 (1020)

1110 (405)

200 (280)

DAENTL RD

3240 (4570)

3210 (3700)

2165 (1170)

765 (1905)

US 51

I-39/90/94

Matchline Plate 5

N

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR

BALANCED TRAFFIC VOLUMES

YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES

PLATE 3 OF 12

DECEMBER 2022 | *NOT TO SCALE*

HNTB

N

N TOWNE RD

US 51

1770 (1315)

650 (1735)

350 (200)

1420 (1115)

210 (455)

WIS 19

Matchline Plate 2

465 (325)

440 (1280)

355 (580)

1885 (1440)

795 (1860)

US 51

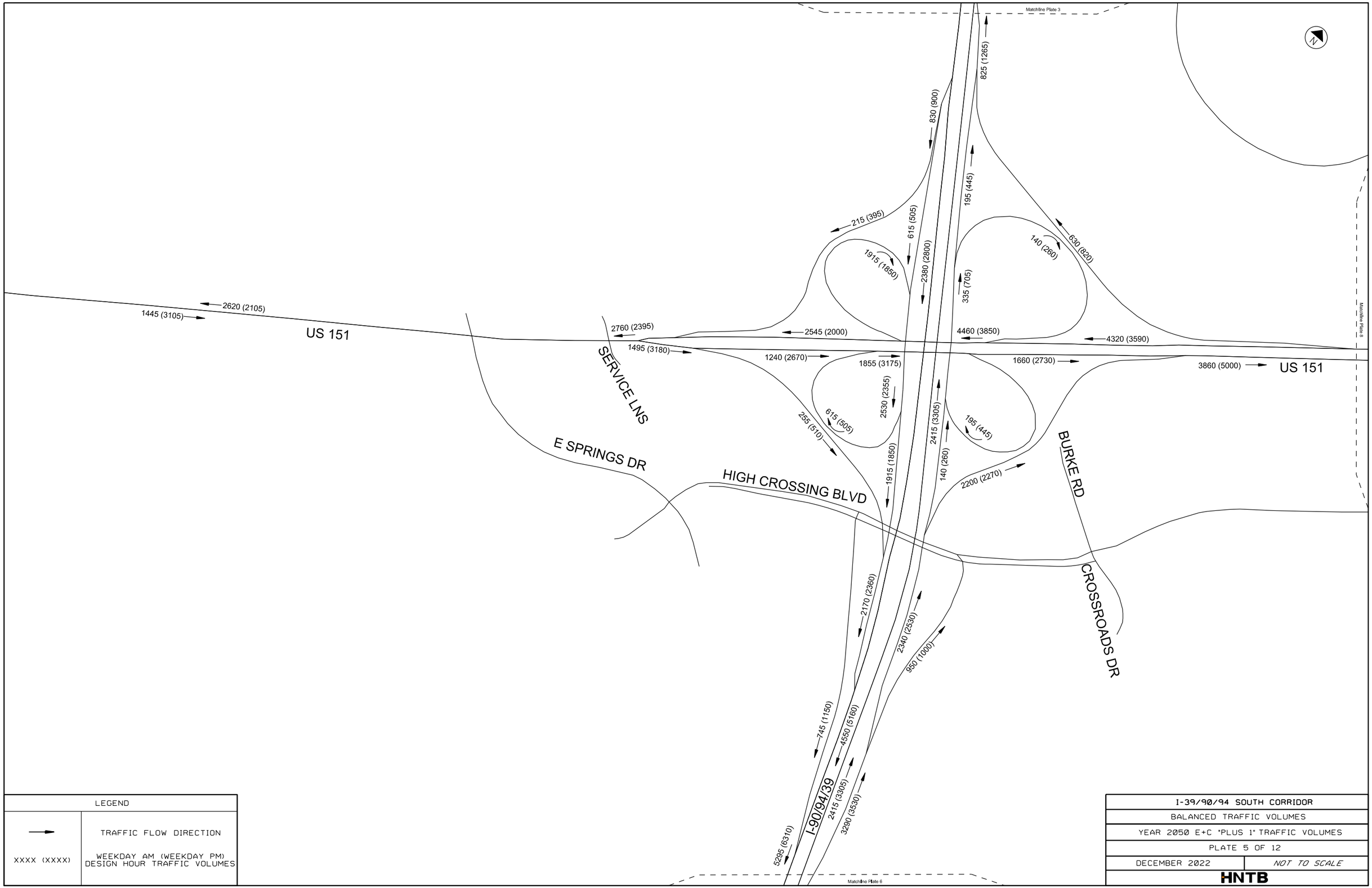
WILLIAMSBURG WAY

METRO DR

Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 4 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 5 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 5

Matchline Plate 10

Matchline Plate 11

Matchline Plate 7

N

I-39/90/94

COMMERCIAL AVE

WIS 30

N THOMPSON DR

MILWAUKEE ST

EB I-94

WB I-94

I-39/90

1210 (630)

3590 (1600)

300 (845)

2600 (1045)

1480 (3365)

800 (675)

1800 (370)

4540 (4925)

5705 (6835)

755 (1385)

4585 (5565)

1120 (1270)

2890 (1210)

3740 (4250)

1090 (840)

990 (555)

700 (980)

1165 (2560)

3885 (4585)

1250 (2520)

465 (1580)

785 (940)

315 (805)

4830 (5090)

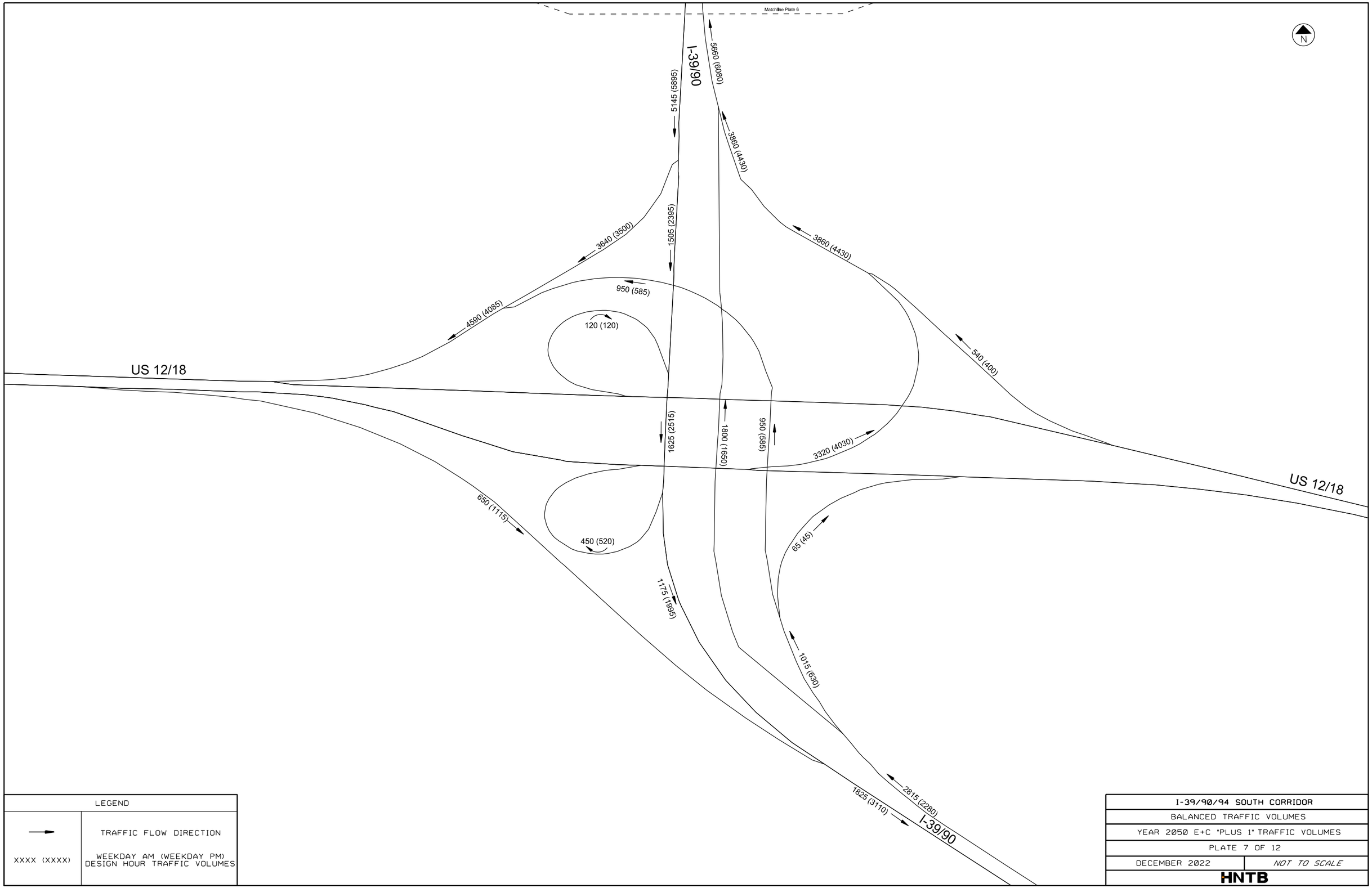
4670 (5525)

5660 (6080)

5145 (5895)

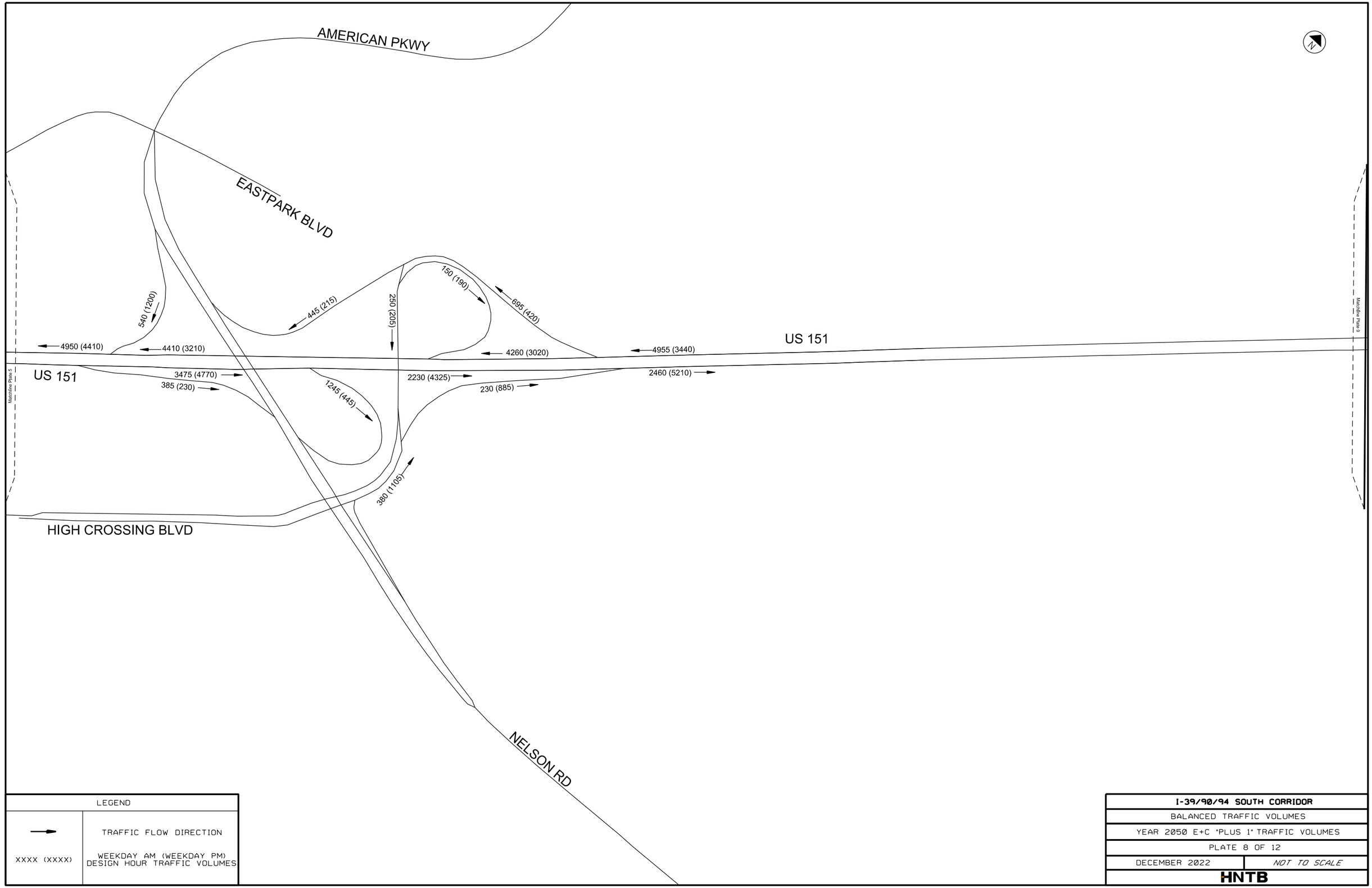
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 6 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 7 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 8 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

HOEPKER RD

GRAND AVE

BROOKS DR

W MAIN ST

1180 (1245)

430 (435)

3775 (2195)

1650 (3645)

4205 (2630)

US 151

1170 (845)

210 (370)

3035 (1785)

3245 (2155)

810 (1565)

300 (590)

1950 (4235)

1400 (2845)

1630 (3165)

US 151

550 (1390)

230 (320)

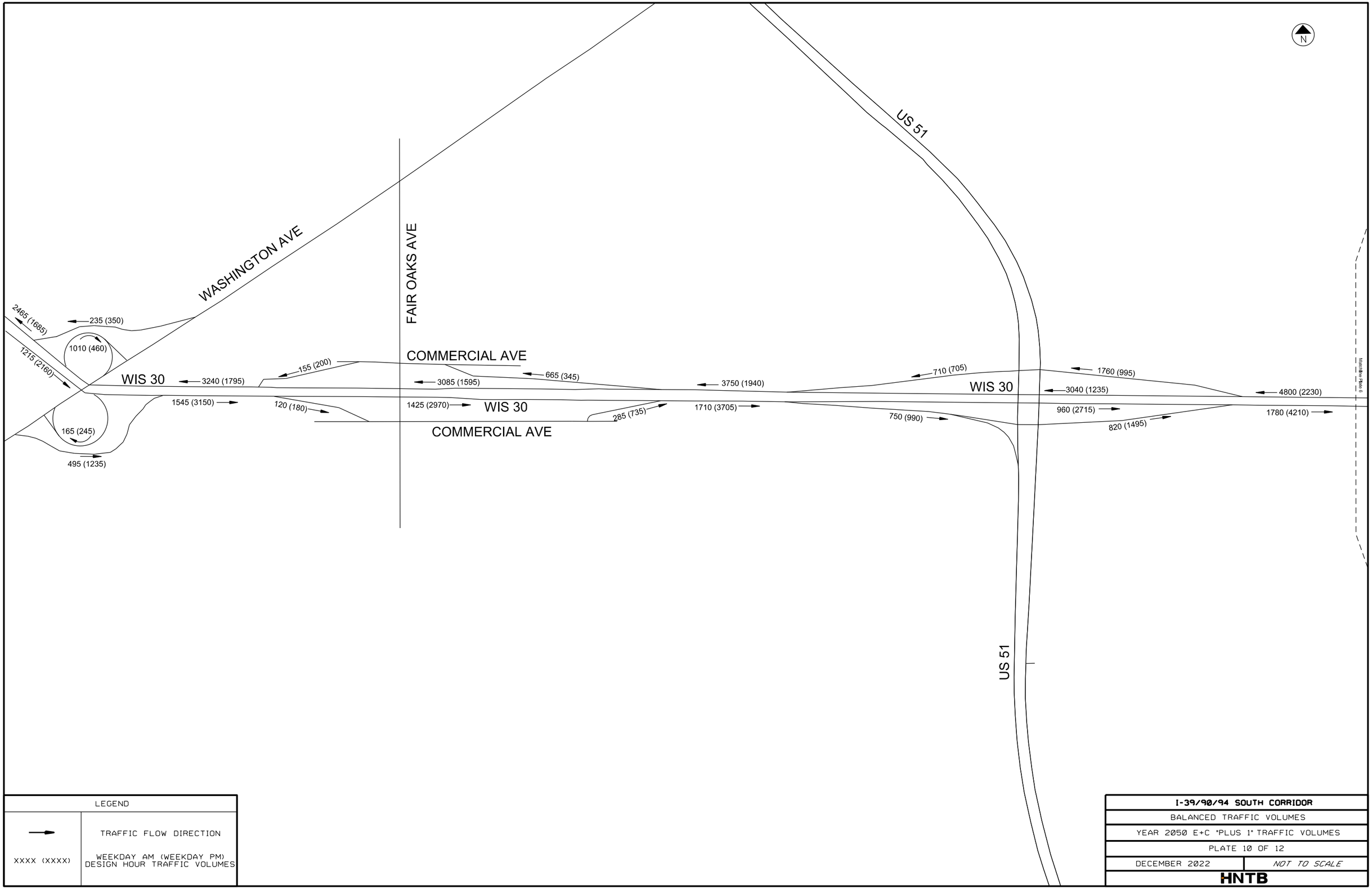
Machine Plate 9

REINER RD

E MAIN ST

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 9 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR

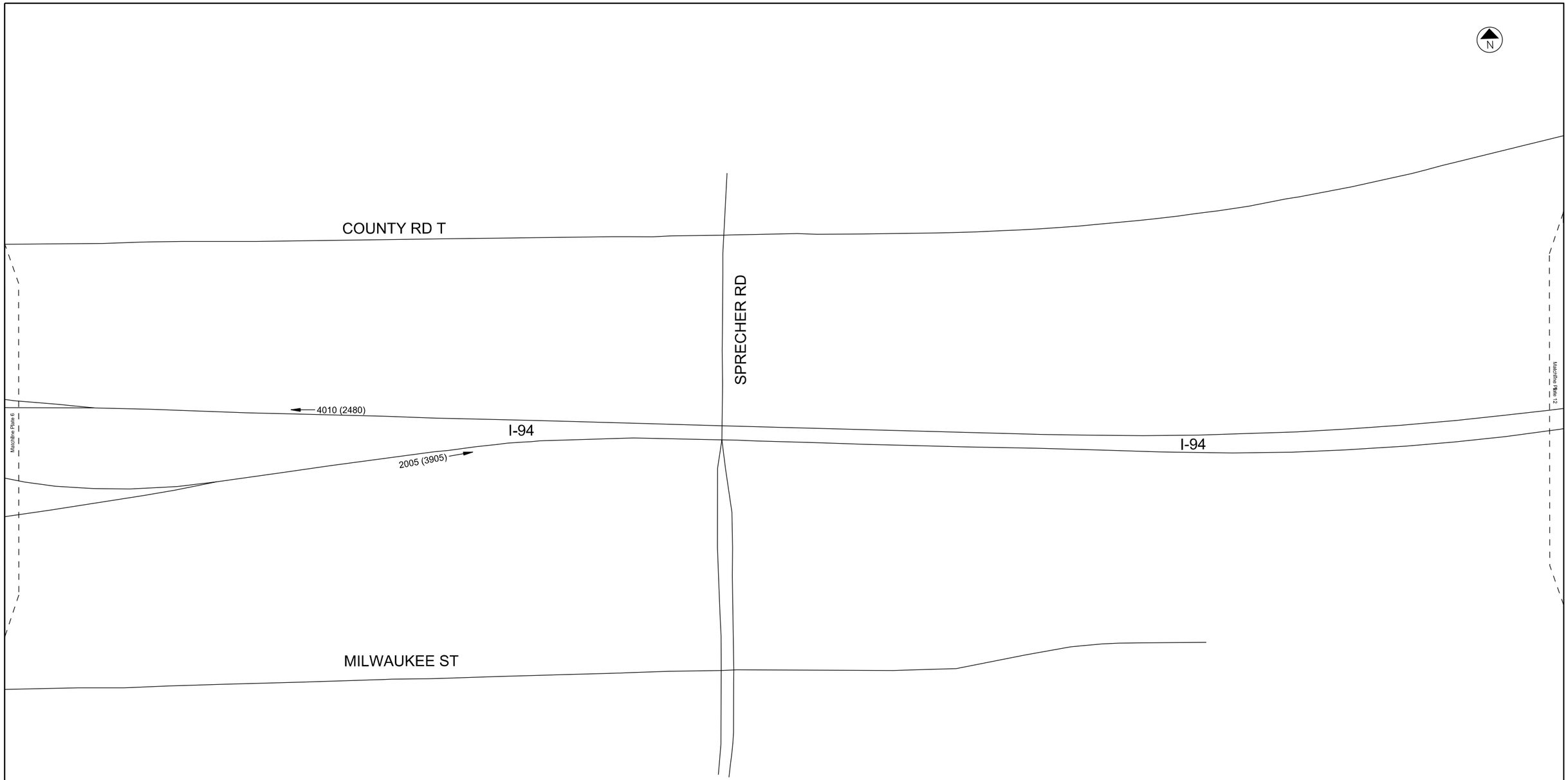
BALANCED TRAFFIC VOLUMES

YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES

PLATE 10 OF 12

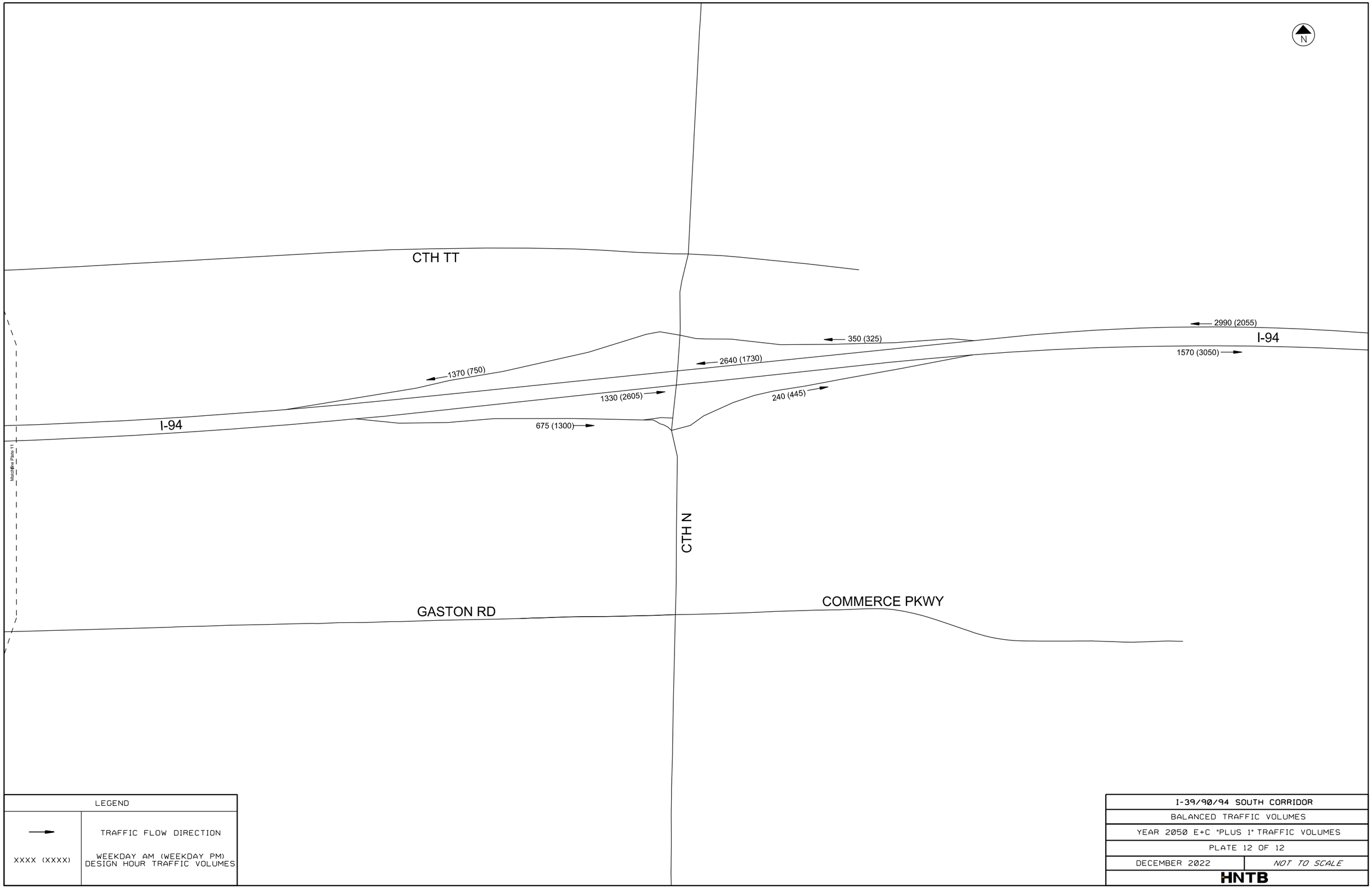
DECEMBER 2022 | *NOT TO SCALE*

HNTB



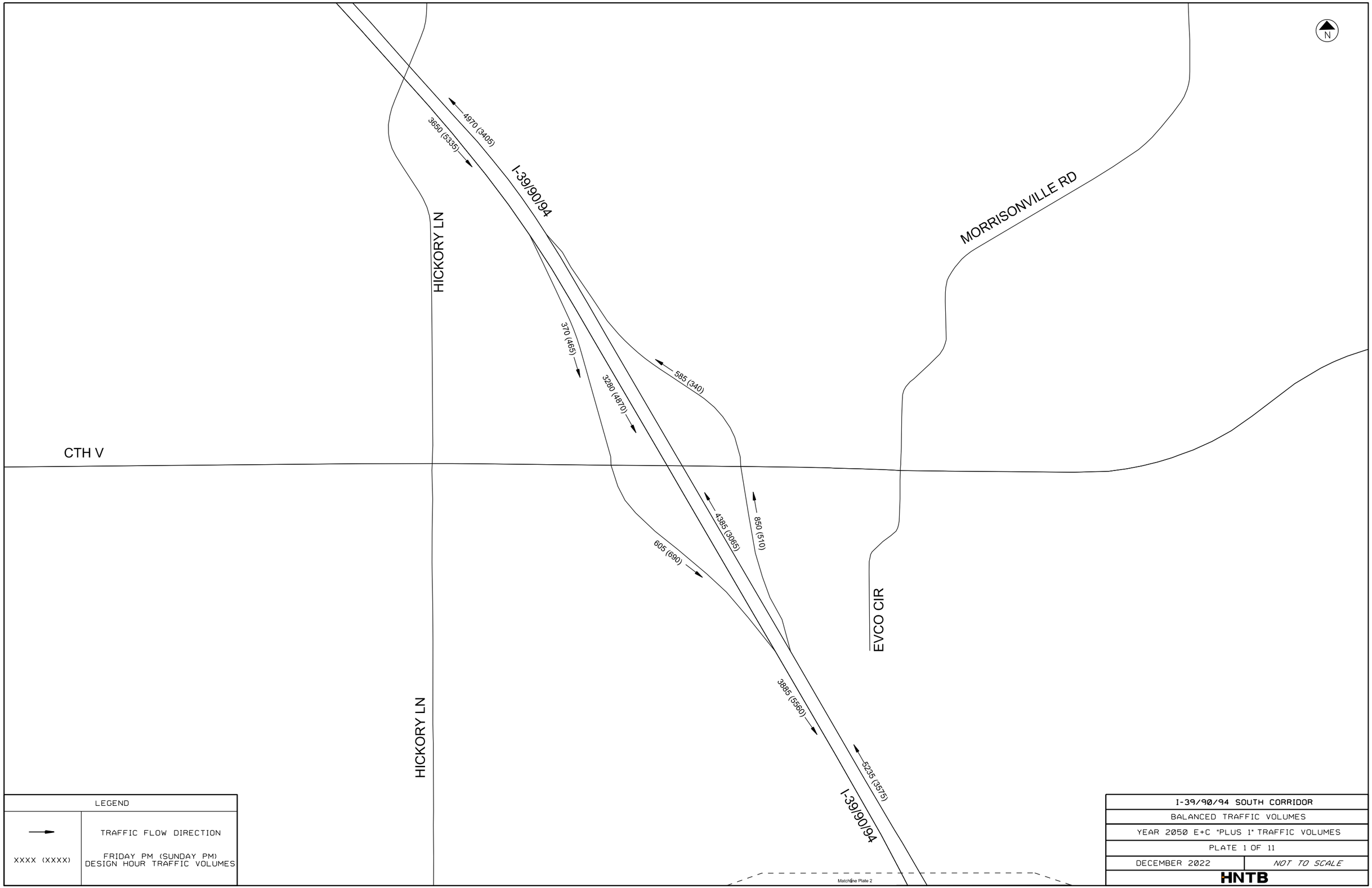
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 11 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 12 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 1 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 1

N

5235 (3575)

3885 (5560)

I-39/90/94

CTH CV

TIERNEY XING

DALMORE RD

WIS 19

LIUNA WAY

375 (460)

650 (420)

3510 (5100)

4585 (3155)

1120 (740)

1180 (740)

PEPSI WAY

I-39/90/94

4690 (5840)

5705 (3895)

Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR

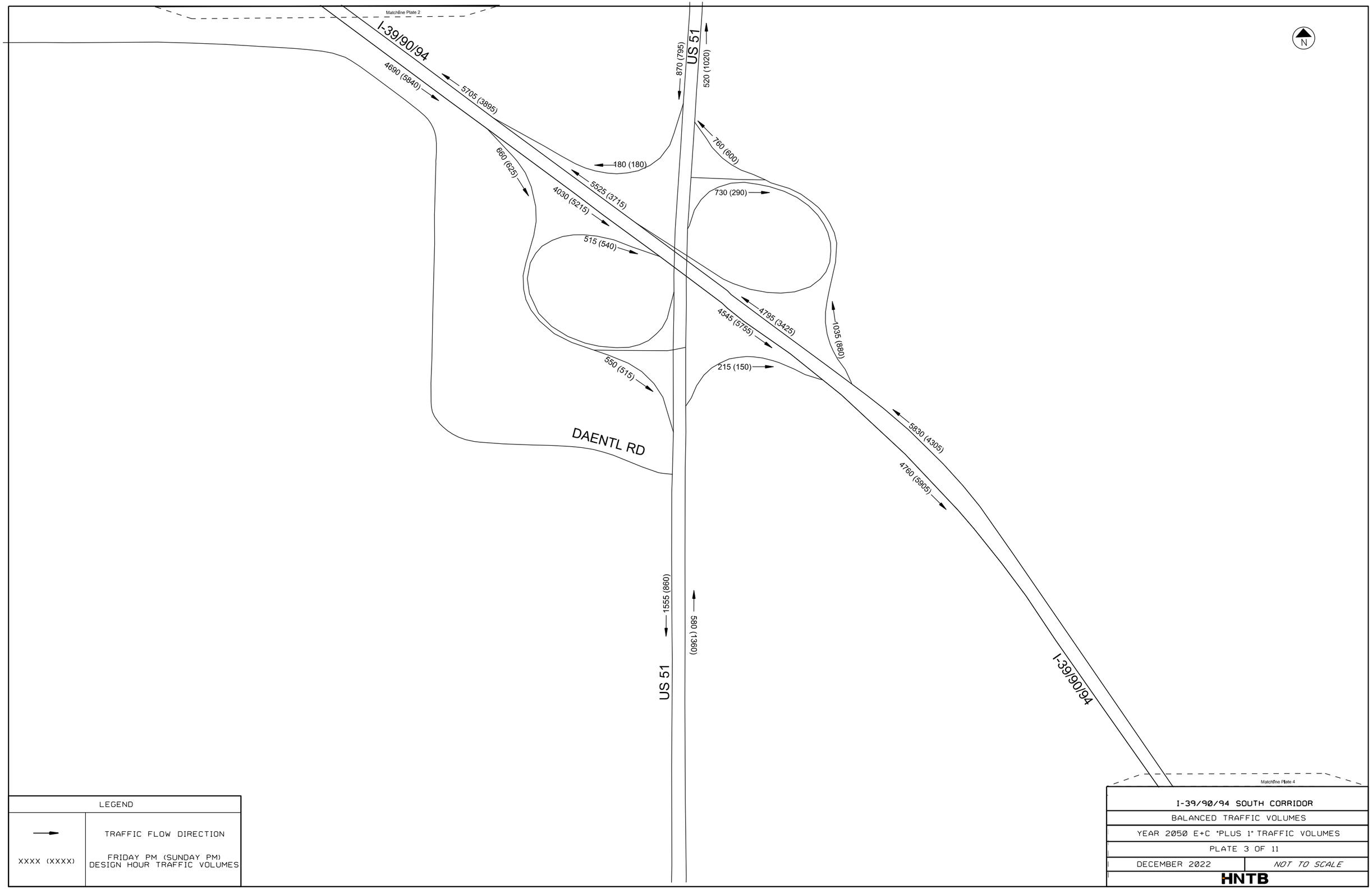
BALANCED TRAFFIC VOLUMES

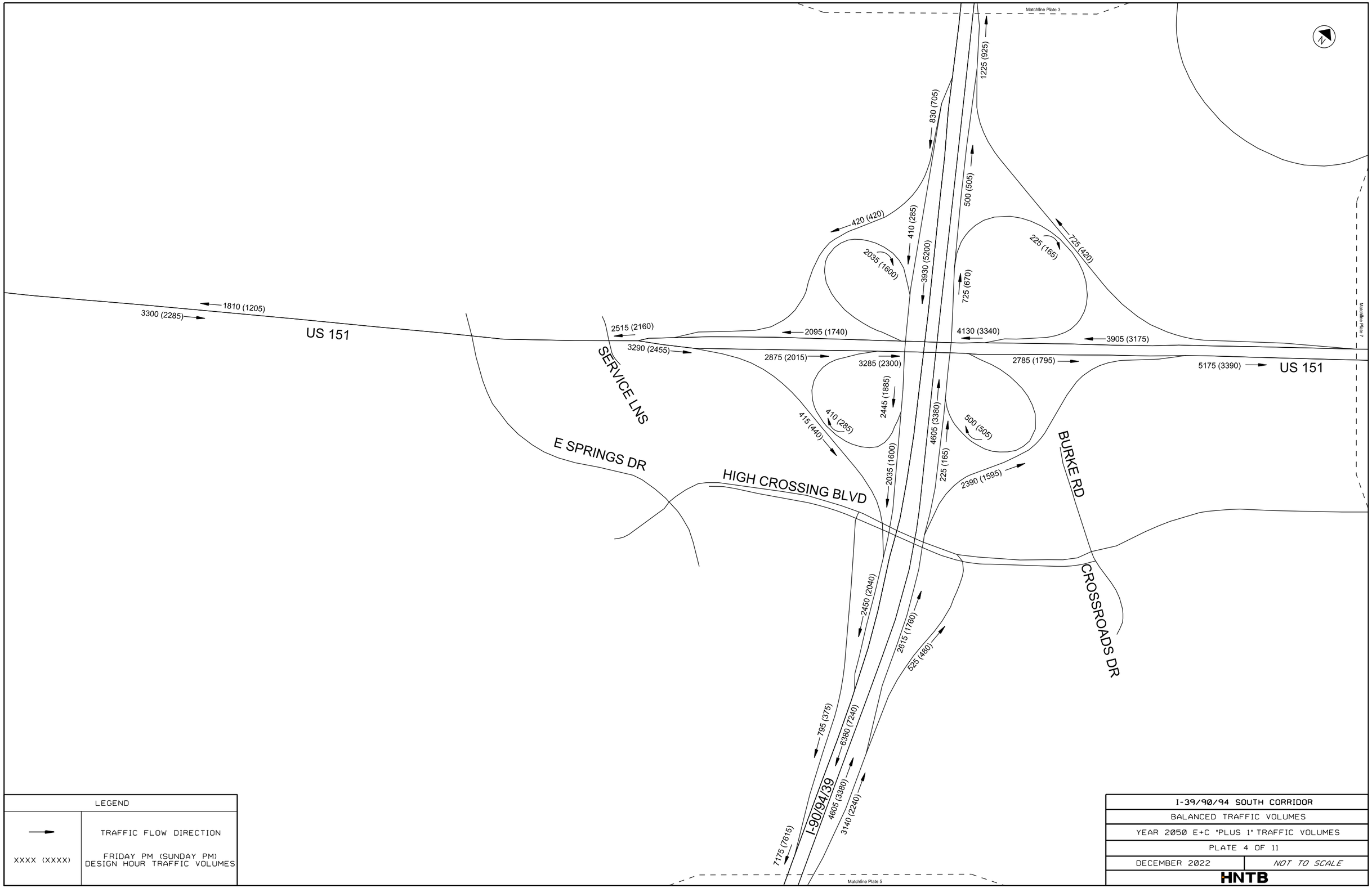
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES

PLATE 2 OF 11

DECEMBER 2022 | *NOT TO SCALE*

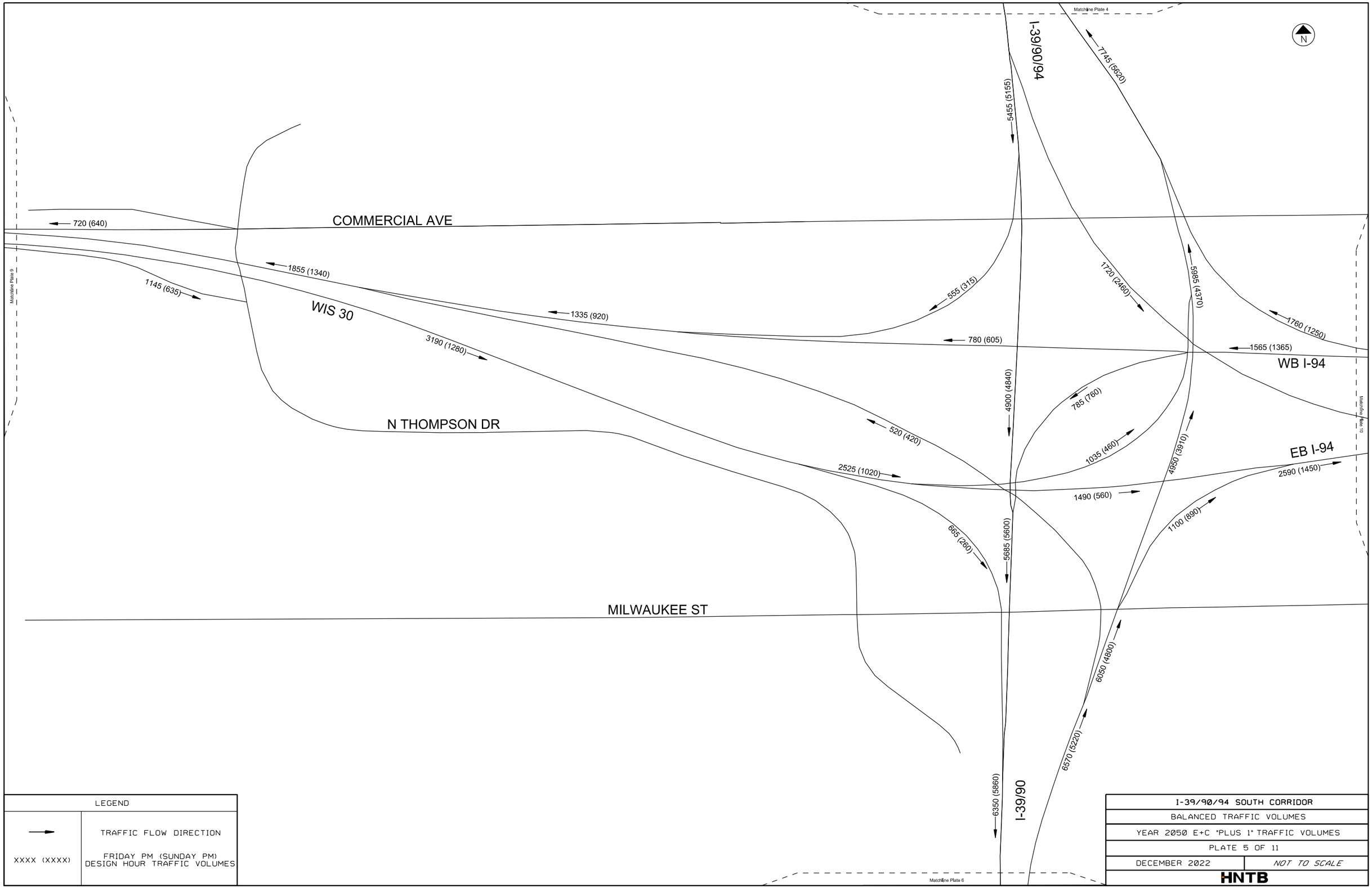
HNTB


Matchline Plate 2
I-39/90/94
4690 (5840)
5705 (3895)
660 (625)
4030 (5215)
5525 (3715)
180 (180)
870 (795)
US 51
520 (1020)
760 (600)
730 (290)
515 (540)
4795 (3425)
4545 (5755)
1035 (880)
550 (515)
215 (150)
5830 (4305)
4760 (5905)
DAENTL RD
1555 (860)
580 (1360)
US 51
I-39/90/94
Matchline Plate 4
N
LEGEND
TRAFFIC FLOW DIRECTION
XXXX (XXXX)
FRIDAY PM (SUNDAY PM)
DESIGN HOUR TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED TRAFFIC VOLUMES
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES
PLATE 3 OF 11
DECEMBER 2022
NOT TO SCALE
HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 4 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 E+C *PLUS 1* TRAFFIC VOLUMES	
PLATE 5 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 5

N

I-39/90

6570 (5220)

6350 (5860)

4110 (2895)

3230 (2515)

3120 (3345)

4110 (2895)

760 (600)

3990 (3115)

120 (110)

510 (340)

US 12/18

3240 (3455)

2460 (2325)

760 (600)

3600 (2555)

US 12/18

1035 (685)

765 (585)

120 (70)

2475 (2870)

880 (670)

3340 (2995)

3510 (3555)

I-39/90

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 E+C *PLUS 1* TRAFFIC VOLUMES	
PLATE 6 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

AMERICAN PKWY

EASTPARK BLVD

1085 (400)

190 (135)

140 (90)

185 (50)

330 (225)

4630 (3595)

3545 (3195)

3360 (3145)

3690 (3370)

US 151

US 151

4935 (3265)

240 (125)

4245 (2800)

4930 (3170)

690 (465)

685 (370)

870 (420)

HIGH CROSSING BLVD

NELSON RD

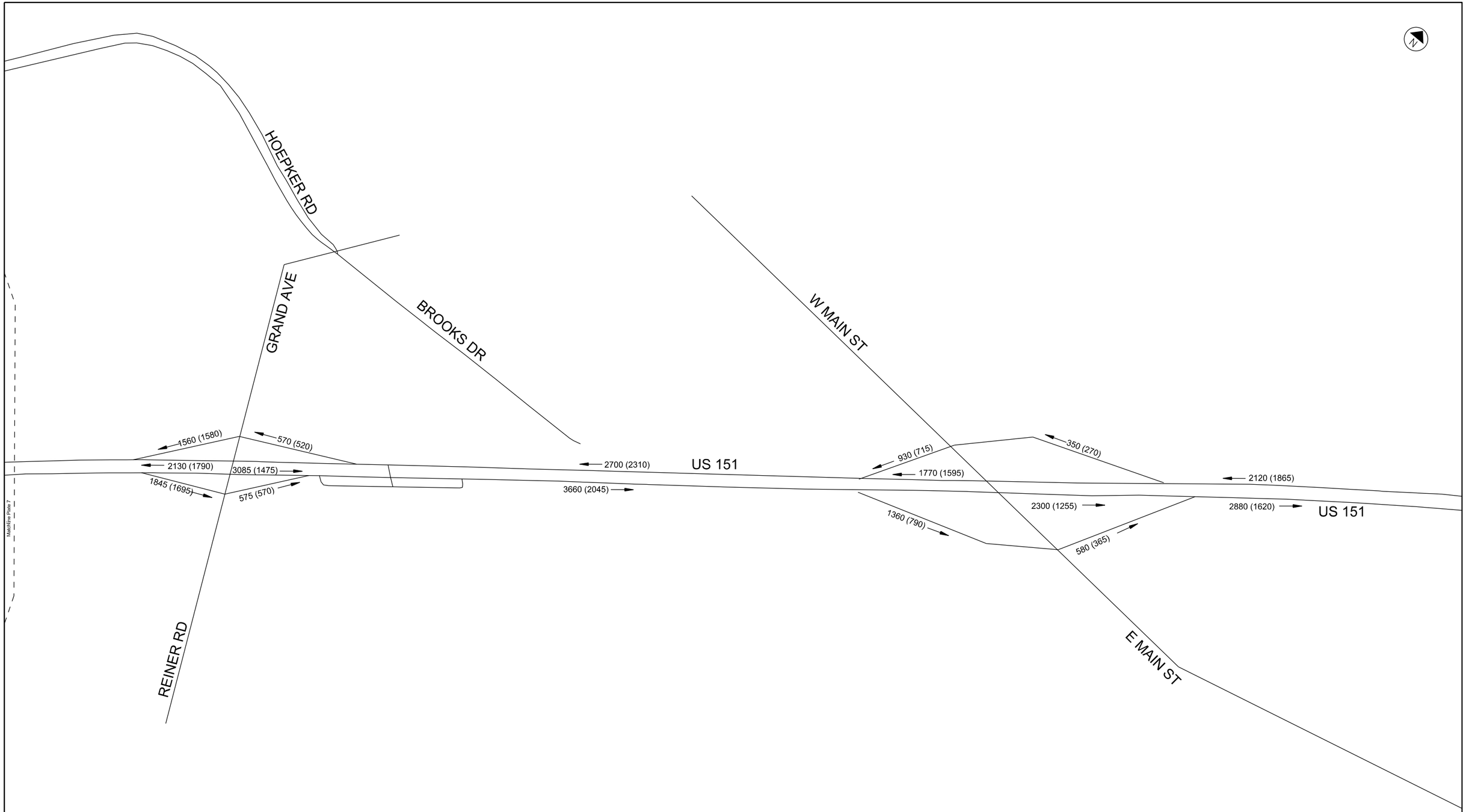
Match line Plate 6

Match line Plate 8

N

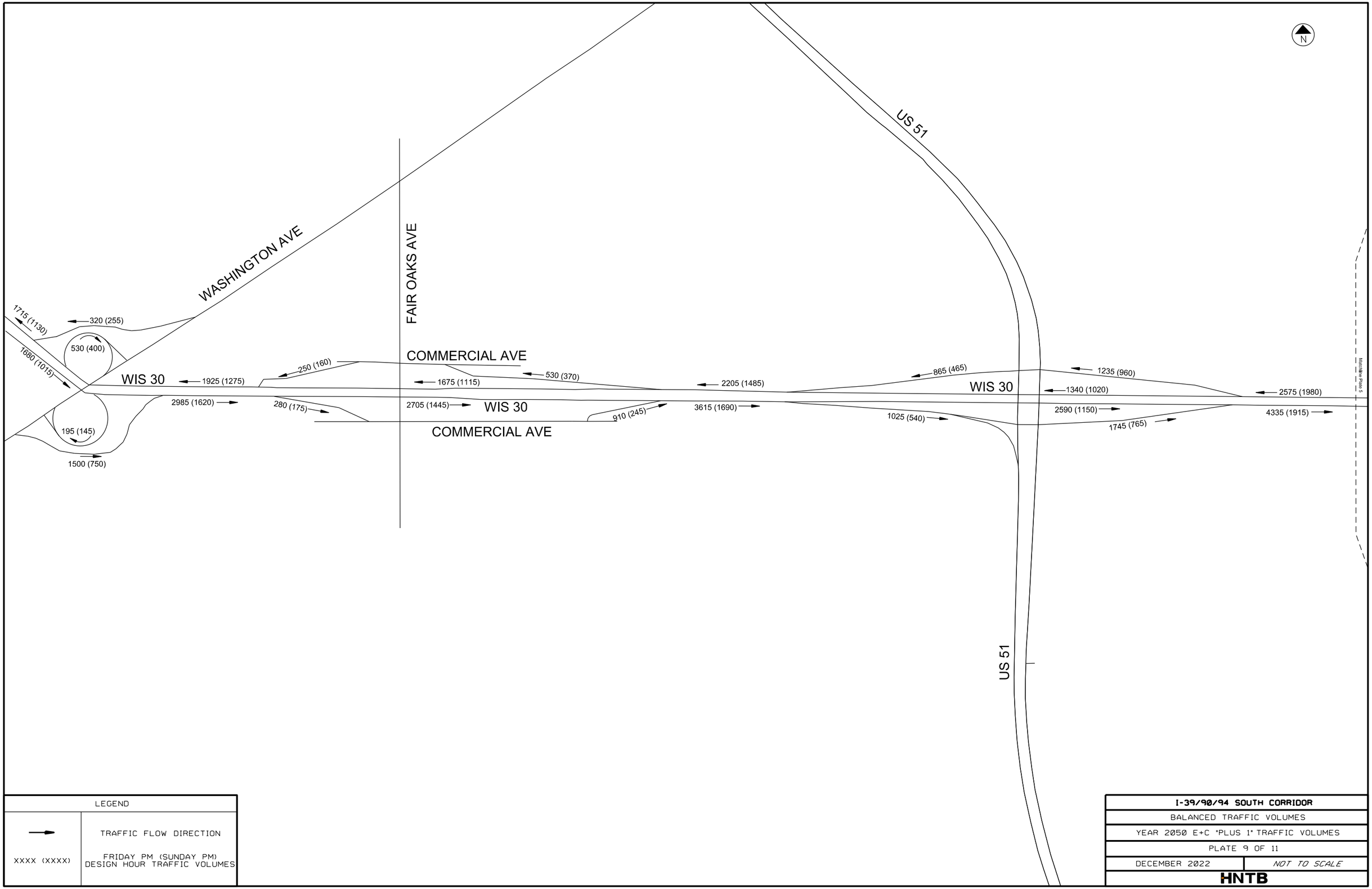
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 7 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 8 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR

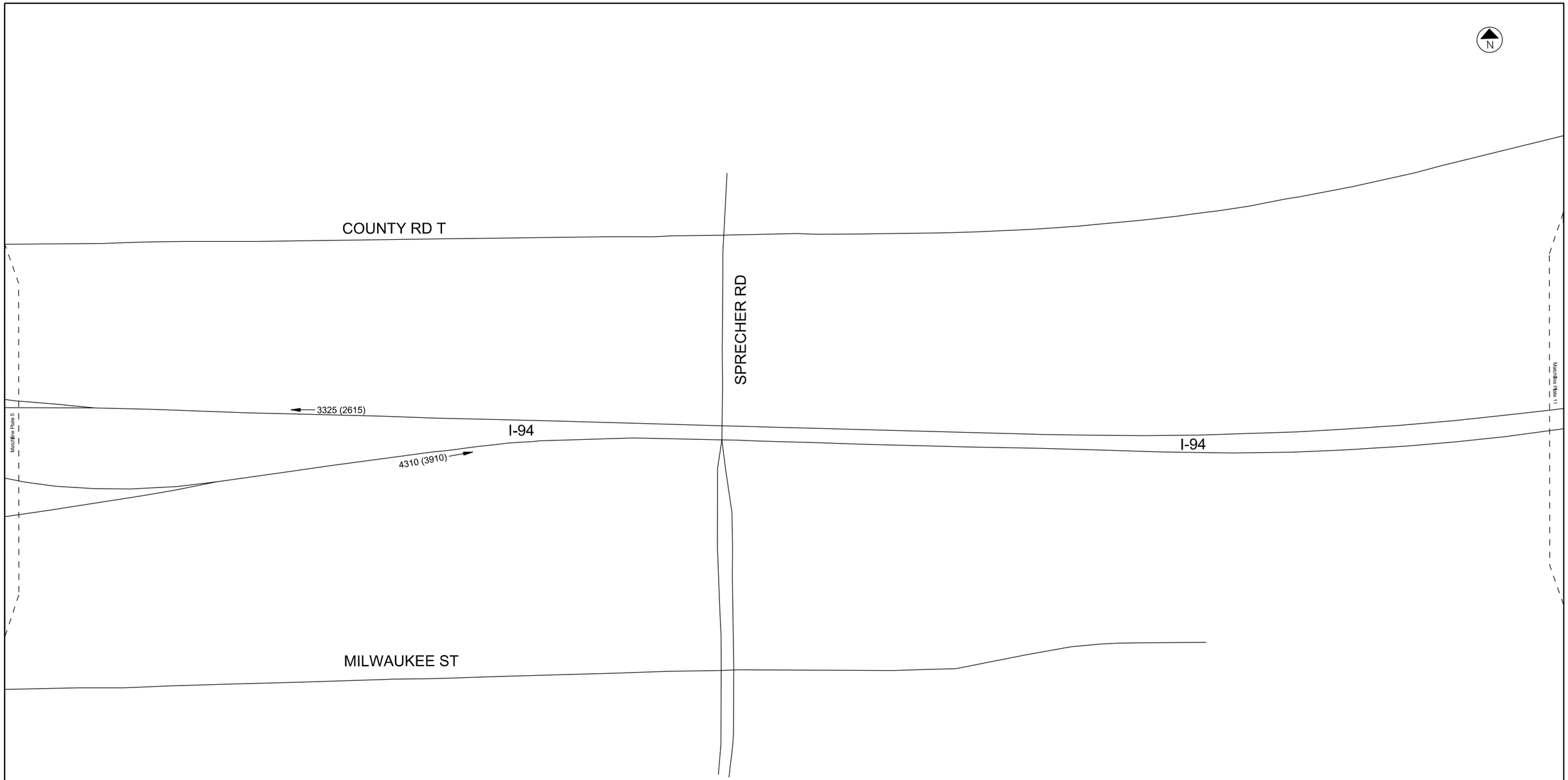
BALANCED TRAFFIC VOLUMES

YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES

PLATE 9 OF 11

DECEMBER 2022 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 10 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

N

CTH TT

I-94

1000 (830)

2325 (1785)

405 (400)

2730 (2185)

I-94

3495 (3085)

2970 (2675)

525 (410)

1340 (1235)

Matchline Plate 10

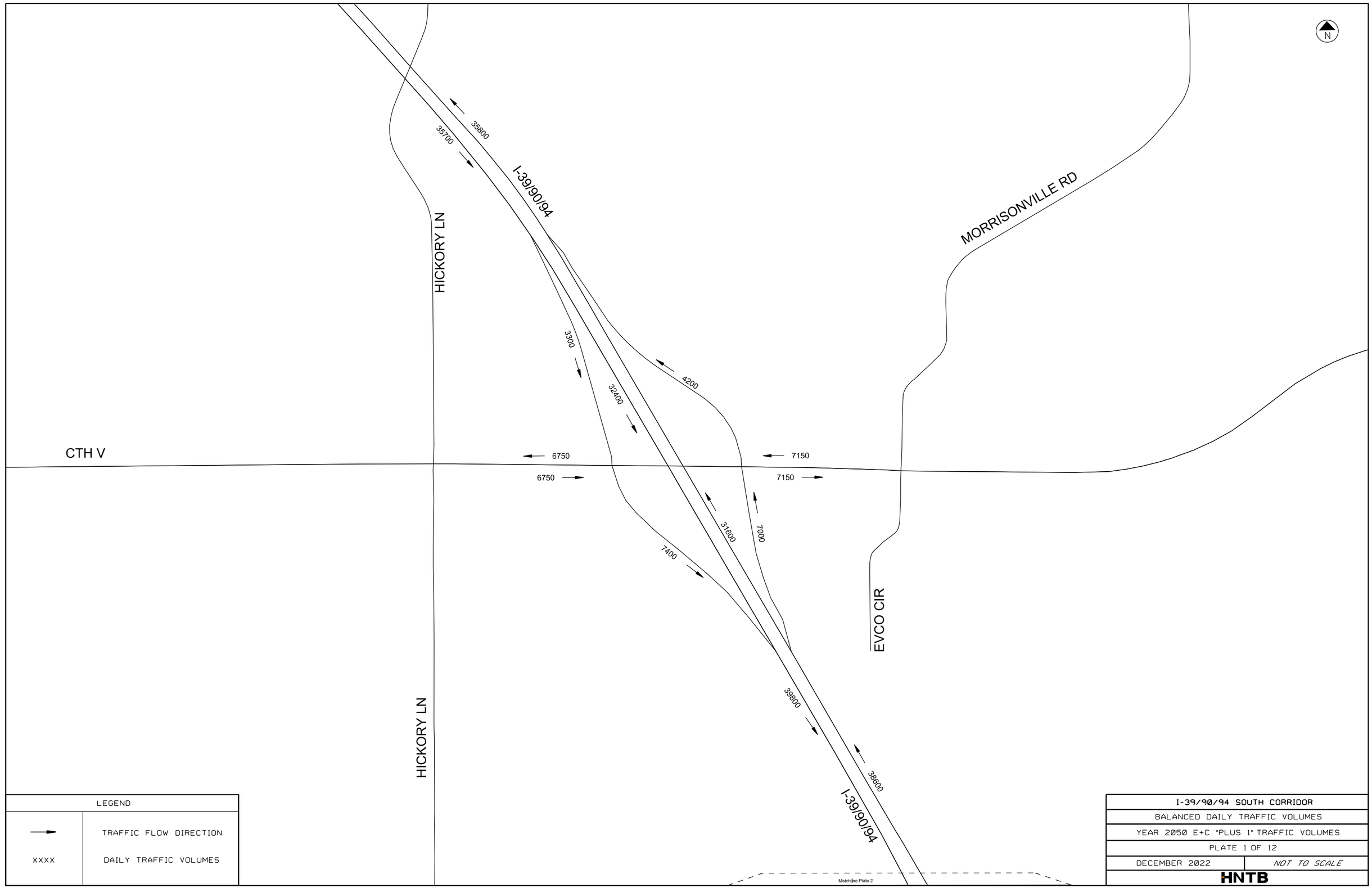
CTH N

GASTON RD

COMMERCE PKWY

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 11 OF 11	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 1 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 1

N

39800

38600

I-39/90/94

CTH CV

TIERNEY XING

DALMORE RD

WIS 19

LIUNA WAY

4700

4600

35100

13500

13500

11400

11400

Matchline Plate 4

34000

12100

PEPSI WAY

11000

I-39/90/94

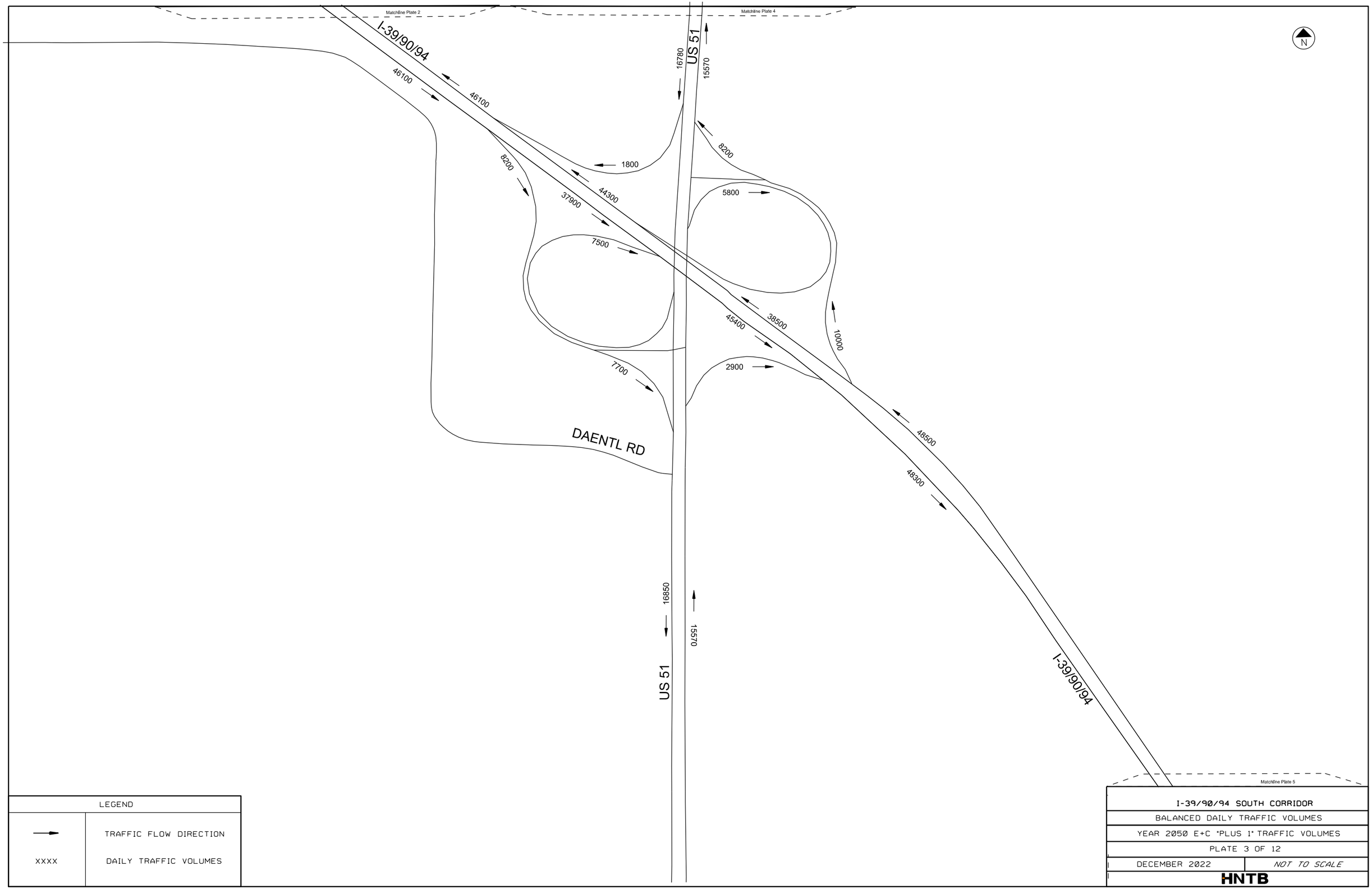
46100

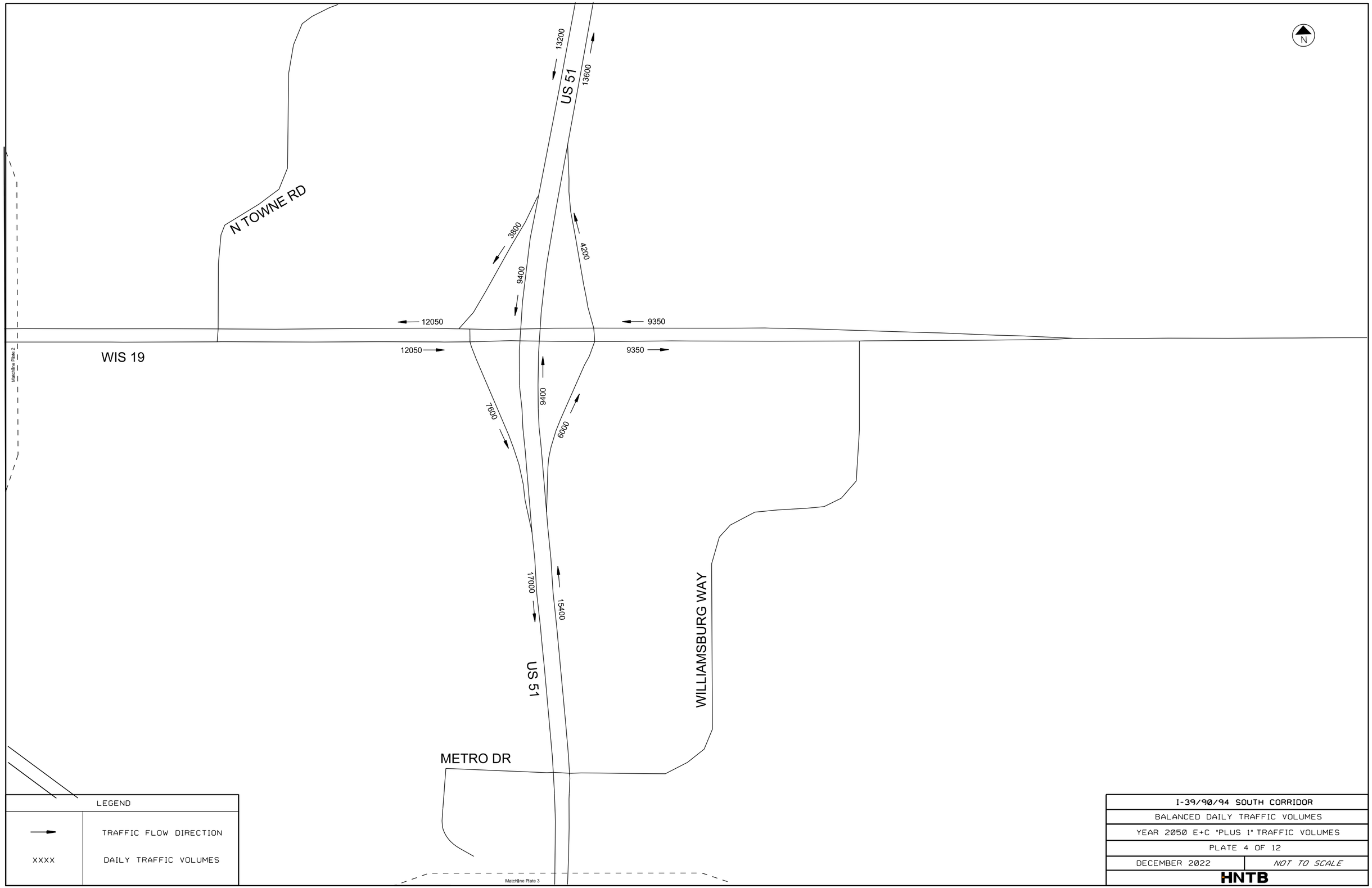
46100

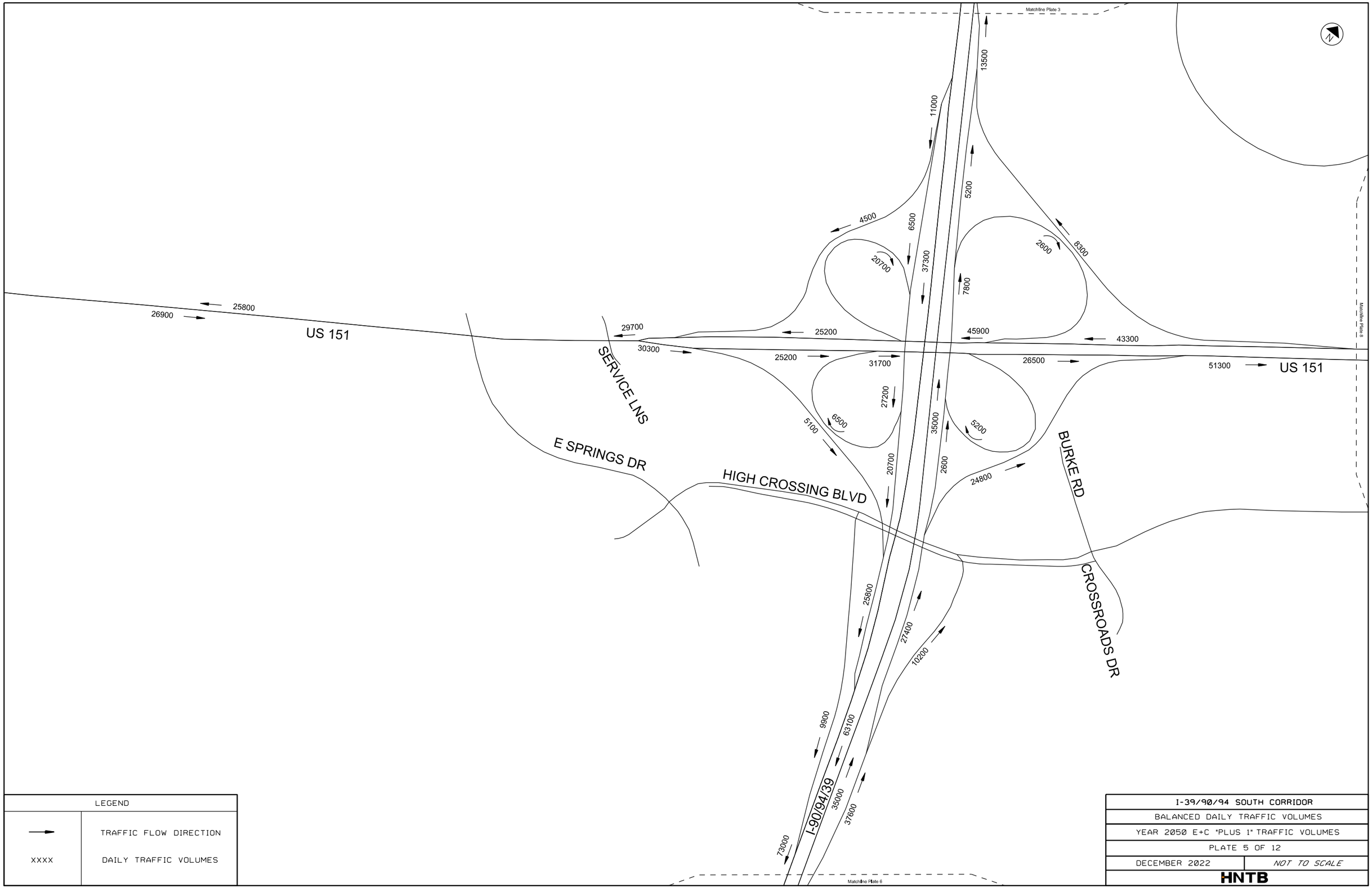
Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 2 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	


Matchline Plate 2
Matchline Plate 4
I-39/90/94
US 51
46100
46100
16780
15570
8200
1800
8200
44300
37900
5800
7500
38500
45400
10000
2900
7700
48500
48300
DAENTL RD
16850
15570
US 51
I-39/90/94
Matchline Plate 5
N
LEGEND
TRAFFIC FLOW DIRECTION
XXXX
DAILY TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED DAILY TRAFFIC VOLUMES
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES
PLATE 3 OF 12
DECEMBER 2022
NOT TO SCALE
HNTB


N
N TOWNE RD
US 51
13200
13600
3800
9400
4200
12050
9350
WIS 19
12050
9350
Matchline Plate 2
7600
9400
6000
17000
15400
US 51
WILLIAMSBURG WAY
METRO DR
Matchline Plate 3
LEGEND
TRAFFIC FLOW DIRECTION
XXXX
DAILY TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED DAILY TRAFFIC VOLUMES
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES
PLATE 4 OF 12
DECEMBER 2022
NOT TO SCALE
HNTB


Matchline Plate 3
N
13500
11000
5200
4500
6500
37300
20700
2600
8900
7800
26900
25800
US 151
29700
30300
25200
45900
43300
25200
31700
26500
51300
US 151
Matchline Plate 5
SERVICE LNS
27200
6500
5100
35000
5200
E SPRINGS DR
HIGH CROSSING BLVD
20700
2600
24800
BURKE RD
CROSSROADS DR
25800
27400
10200
9900
63100
I-90/94/39
35000
37600
73000
Matchline Plate 6
LEGEND
TRAFFIC FLOW DIRECTION
XXXX
DAILY TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED DAILY TRAFFIC VOLUMES
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES
PLATE 5 OF 12
DECEMBER 2022
NOT TO SCALE
HNTB

Matchline Plate 5

Matchline Plate 10

Matchline Plate 11

Matchline Plate 7

I-39/90/94

COMMERCIAL AVE

WIS 30

N THOMPSON DR

WB I-94

EB I-94

MILWAUKEE ST

I-39/90

7700
21300
23400
25500
18600
8400
57400
72600
15600
57900
14700
10200
20700
24500
6900
49000
10500
10200
47700
19100
8900
19500
10600
5400
59500
58300
65200
64900

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 6 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Matchline Plate 6

N

I-39/90

65200

64900

43900

26400

38500

43900

9900

48400

900

4900

53850

US 12/18

53850

27300

21300

9900

39000

19400

US 12/18

19400

10400

5600

900

21700

10800

32100

32100

I-39/90

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 7 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

AMERICAN PKWY

EASTPARK BLVD

45600

45900

10200

3400

2300

1200

5700

51600

41400

40200

45900

US 151

US 151

47600

3700

38600

7000

45600

9000

8200

HIGH CROSSING BLVD

45600

45900

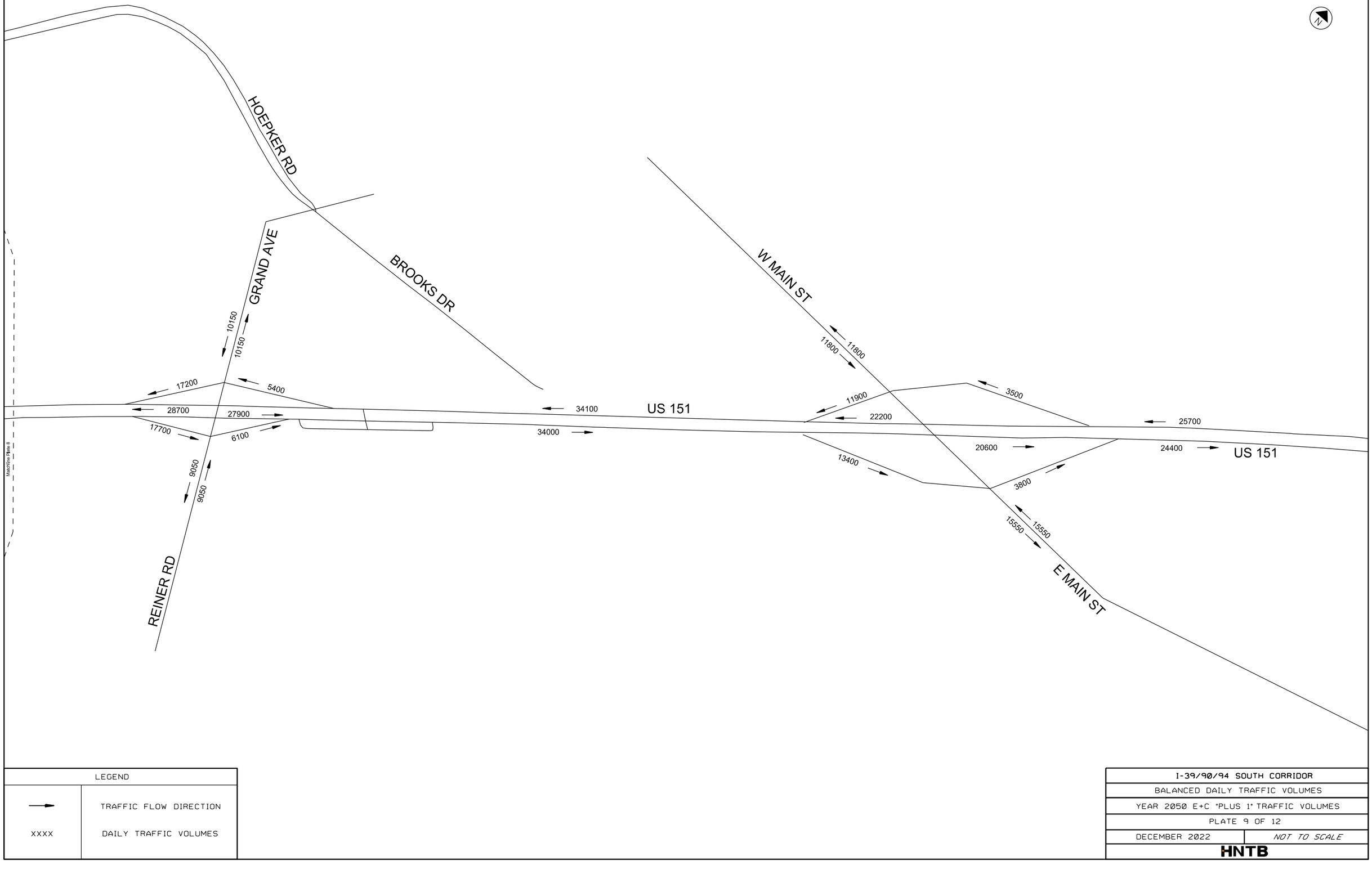
NELSON RD

Mainline Plate 5

Mainline Plate 9

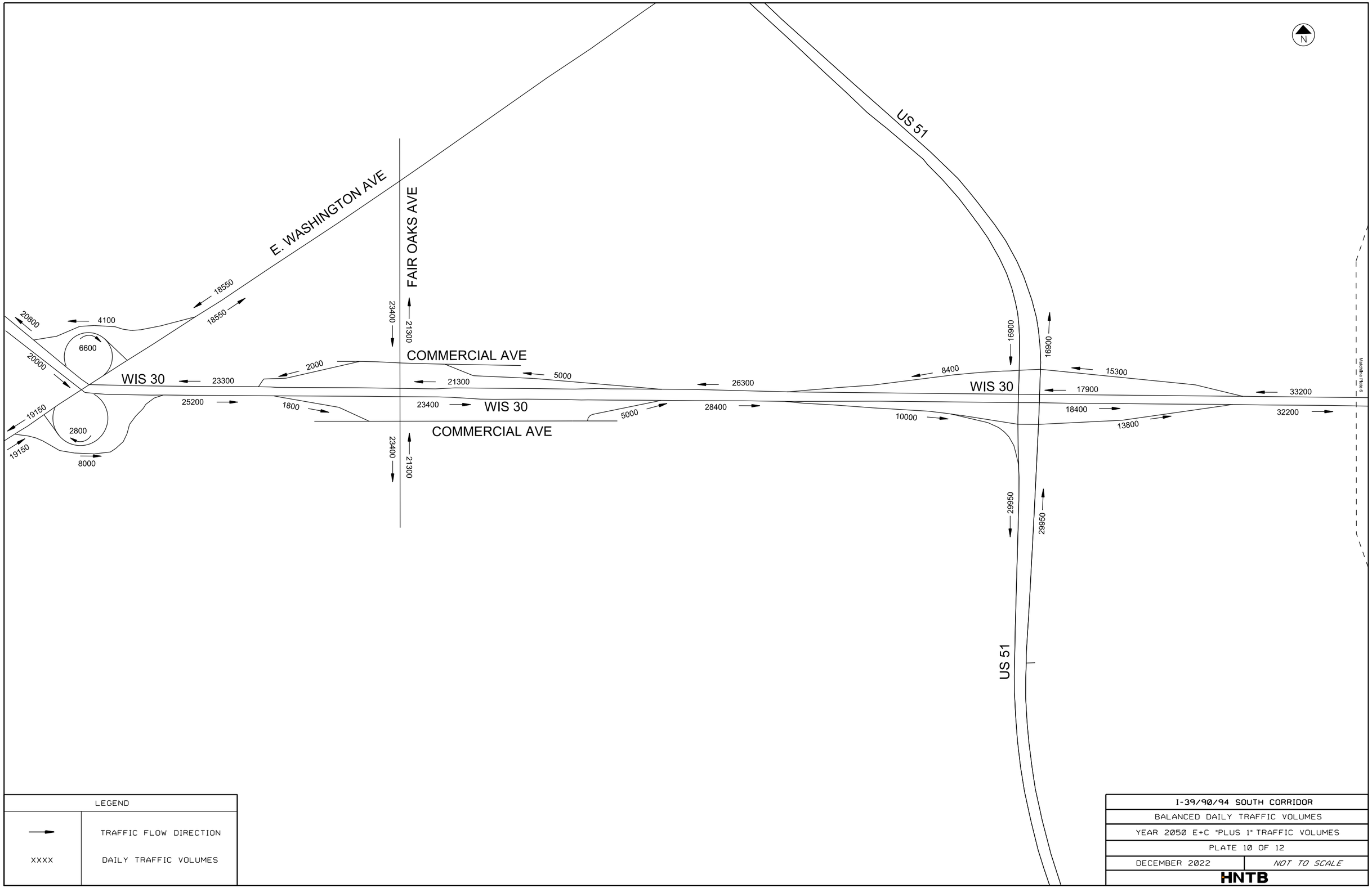
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 8 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 9 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 10 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

N

COUNTY RD T

SPRECHER RD

Matchline Plate 6

Matchline Plate 12

35400

I-94

35100

I-94

MILWAUKEE ST

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 11 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

N

4500

4500

CTH TT

28200

3800

I-94

28200

24400

11000

24400

3800

I-94

10700

Match line Plate 11

CTH N

COMMERCE PKWY

GASTON RD

8000

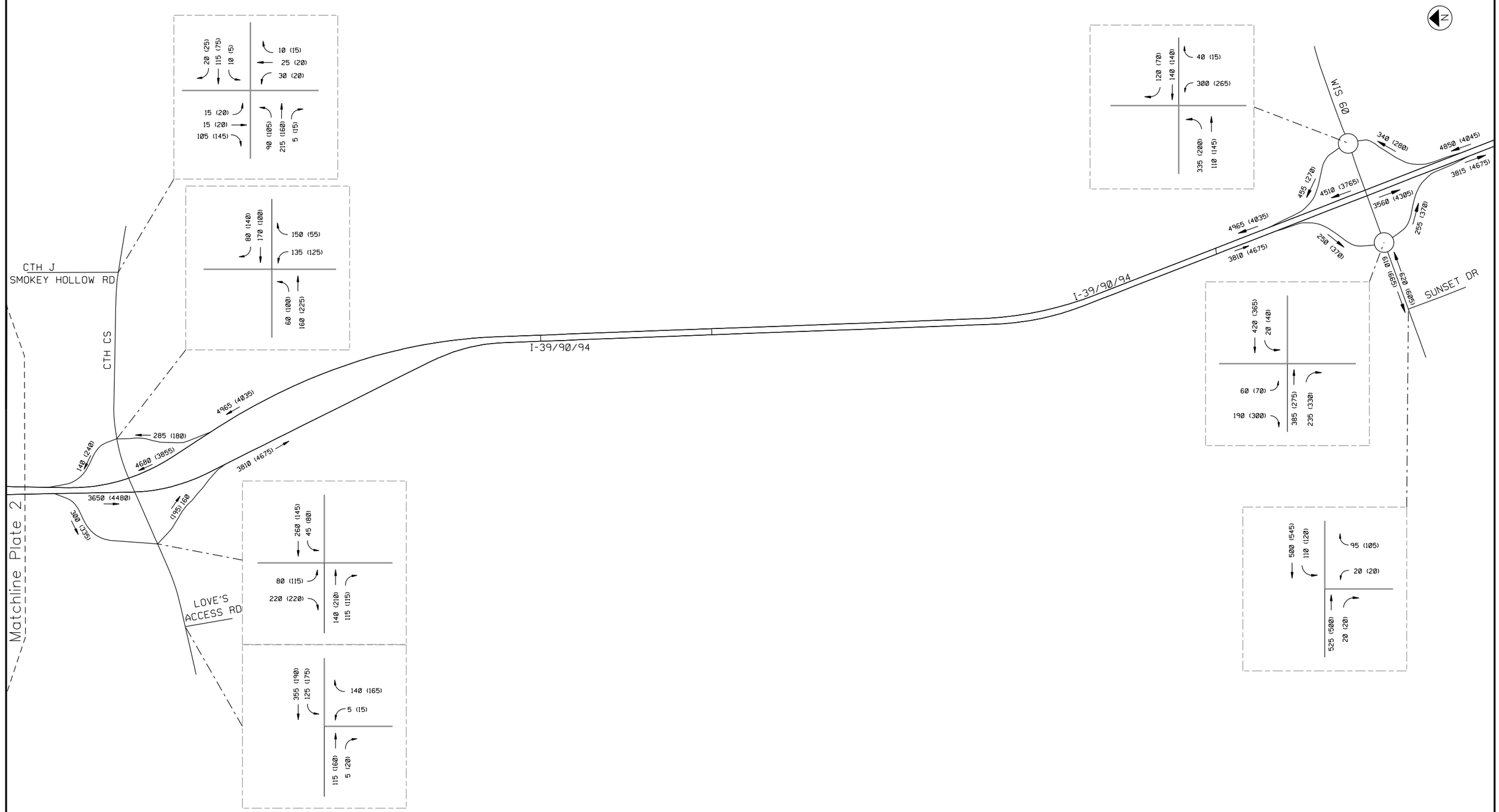
8000

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 E+C "PLUS 1" TRAFFIC VOLUMES	
PLATE 12 OF 12	
DECEMBER 2022	*NOT TO SCALE*
HNTB	

Attachment O

Interstate North Preferred Build Future Year 2050 Forecast Volume Exhibits



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

BALANCED TURNING MOVEMENT VOLUMES

YEAR 2050 FUTURE PREFERRED TRAFFIC VOLUMES

PLATE 1 OF 5

FEBRUARY 2024 | *NOT TO SCALE*

HNTB

Matchline Plate 3

Matchline Plate 5

N

WIS 33

450 (440)
2320 (2360)
180 (200)
290 (350)
730 (2290)
300 (270)
3030 (3520)
3100 (3160)

455 (505)
10 (10)
385 (425)
290 (260)
30 (60)
260 (290)

425 (415)
310 (340)
155 (175)
0 (0)
25 (25)
25 (25)
620 (690)

I-39/90/94

3100 (3160)

10 (15)
230 (235)
10 (10)
15 (15)
0 (0)
30 (25)
30 (30)
415 (225)
10 (10)
15 (15)
15 (0)
30 (25)

I-39

1260 (1630)
2100 (1135)

CASCADE MOUNTAIN RD

CTH U

55 (35)
15 (15)
5 (5)
5 (5)
5 (5)
5 (5)

3030 (3520)

375 (410)
65 (50)
195 (155)
65 (50)
415 (255)
165 (160)

CASCADE MOUNTAIN RD

2980 (3460)
50 (60)
10 (20)
1250 (1630)
2100 (1135)
3030 (3140)
1000 (1350)
290 (285)
260 (205)
990 (1085)
455 (265)
2720 (3225)
2980 (3935)
1695 (1820)
225 (240)

130 (130)
435 (435)
5 (0)
15 (25)
565 (410)
5 (0)
0 (0)
0 (5)
15 (5)

ARCO DR/
KINNEY RD

570 (565)
580 (415)
230 (210)
2950 (3465)
3215 (3275)
1000 (1350)

WIS 78

30 (25)
260 (260)
70 (80)
410 (225)
180 (200)
45 (40)

0 (0)
435 (435)
20 (2)
130 (151)
0 (0)
455 (285)

3950 (4815)
4820 (4095)

Matchline Plate 1

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

BALANCED TURNING MOVEMENT VOLUMES

YEAR 2050 FUTURE PREFERRED TRAFFIC VOLUMES

PLATE 2 OF 5

FEBRUARY 2024 | *NOT TO SCALE*

HNTB

Matchline Plate 4

Matchline Plate 2

N

US 12

WHITLOCK ST

WIS 23

CTH P

COMMERCE ST

I-90/94

GASSER RD

MEADOWVIEW DR

US 12

I-90/94

3180 (3770)
3620 (3490)
370 (325)
280 (345)
480 (400)
320 (485)
3140 (3090)
360 (420)

280 (270) 10 (20) 570 (635)
600 (605)
475 (400)
10 (5)
250 (290)
355 (425)
15 (25)

220 (150)
535 (520)
260 (250)
500 (580)
260 (260) 0 (0) 120 (150)

5 (5) 100 (145) 170 (235)
260 (160)
110 (95)
575 (585)
15 (5)
110 (170)
45 (35)
45 (40) 130 (115) 580 (645)

255 (225) 0 (0) 111 (100)
690 (615)
105 (165)
645 (730)
215 (320)

195 (285) 400 (420) 185 (210)
125 (150)
145 (145)
250 (310)
185 (235)
130 (175)
325 (395)
365 (395) 430 (580) 250 (380)

675 (780)
540 (365)
820 (580) 615 (895)

975 (1125)
1045 (1355)
300 (345)
430 (460)
1120 (925)
3520 (3500)
3130 (3930)
2500 (3005)
970 (825)
2400 (2575)
3370 (3400)
3020 (3600)
520 (595)
630 (925)
490 (680)
295 (295)
1390 (1525)
1500 (1525)
280 (315)
1110 (1210)
465 (365)
1035 (1180)

900 (845) 315 (300)
140 (245)
1295 (1230)

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

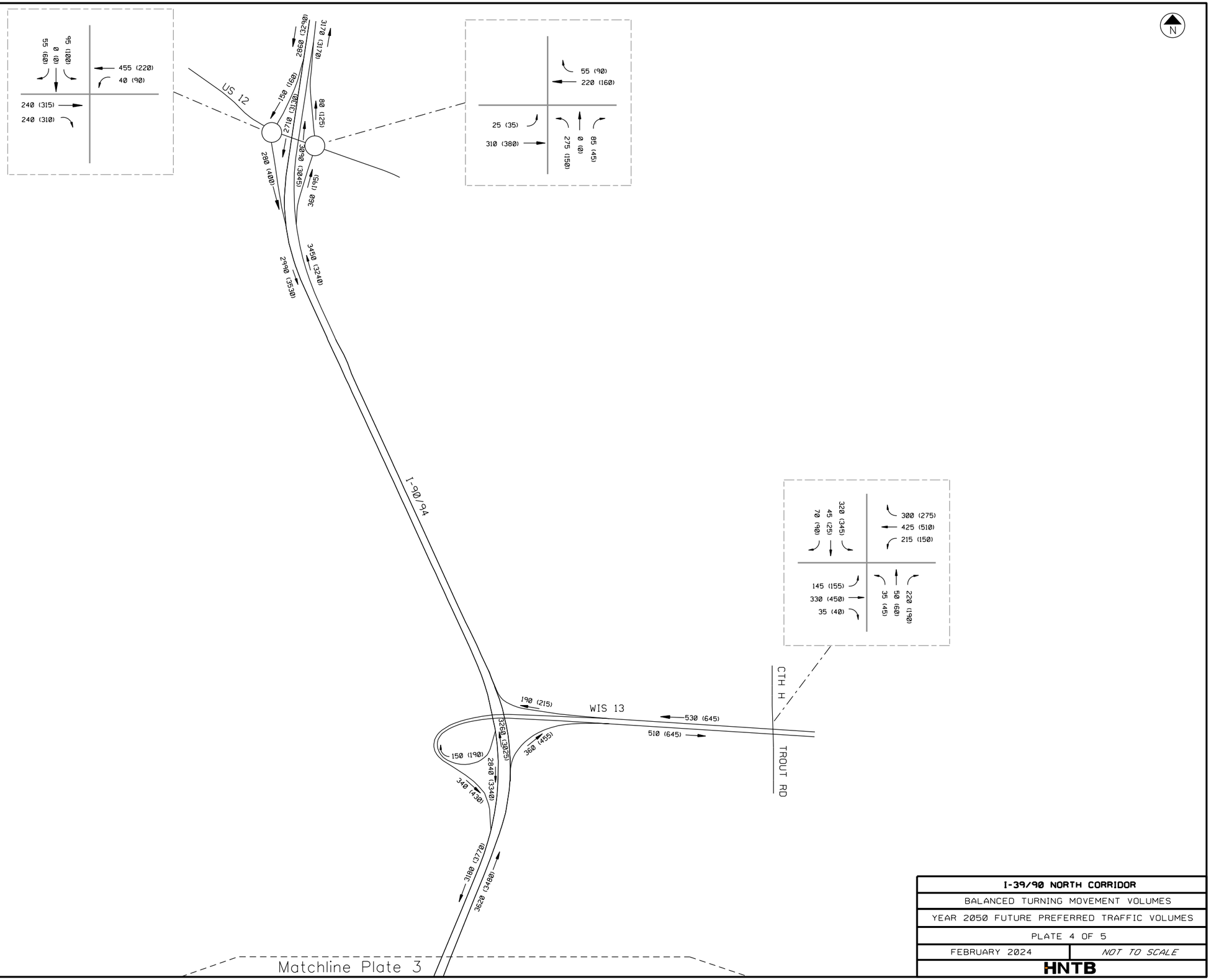
BALANCED TURNING MOVEMENT VOLUMES

YEAR 2050 FUTURE PREFERRED TRAFFIC VOLUMES

PLATE 3 OF 5

FEBRUARY 2024 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

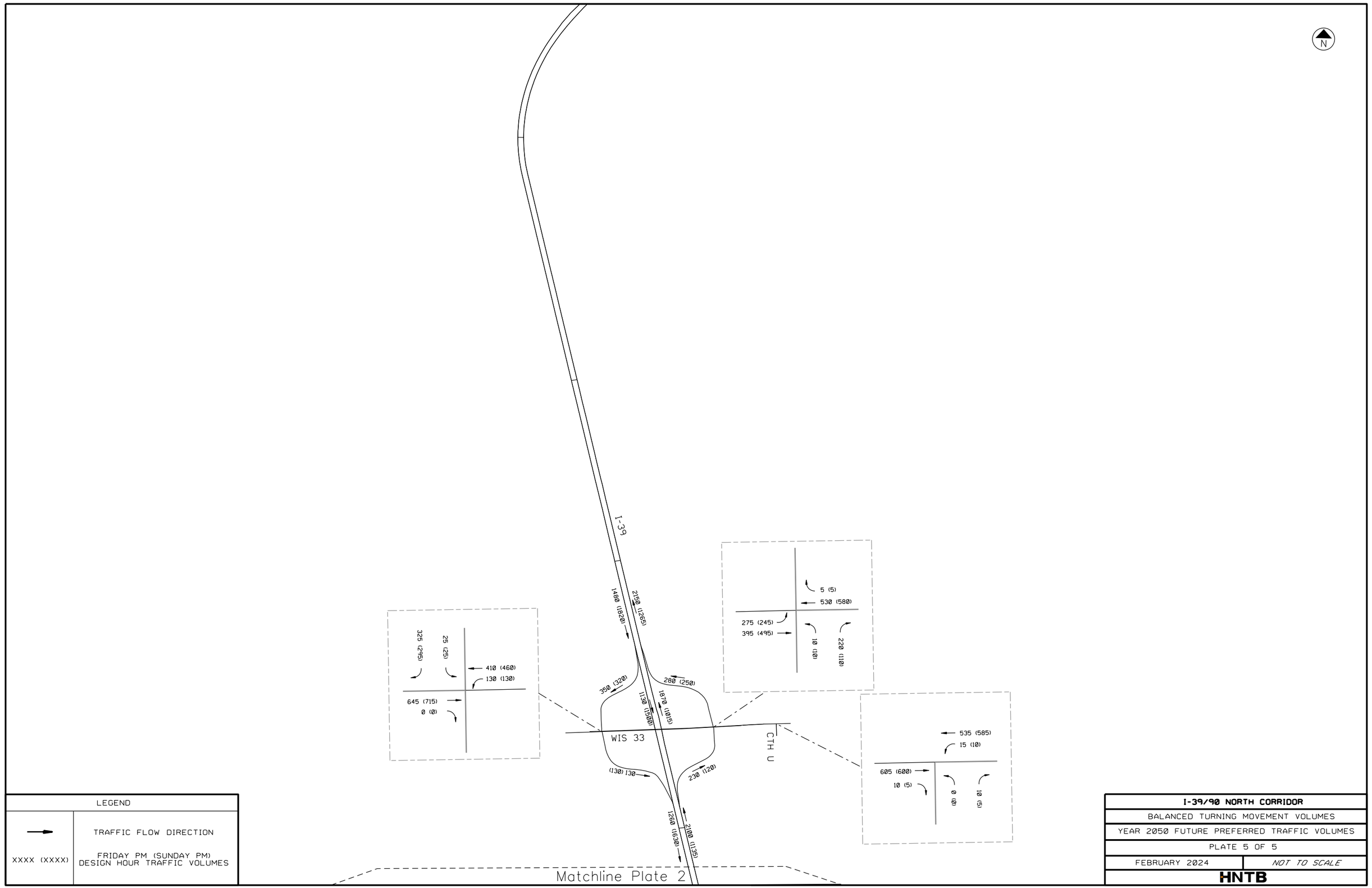
BALANCED TURNING MOVEMENT VOLUMES

YEAR 2050 FUTURE PREFERRED TRAFFIC VOLUMES

PLATE 4 OF 5

FEBRUARY 2024 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

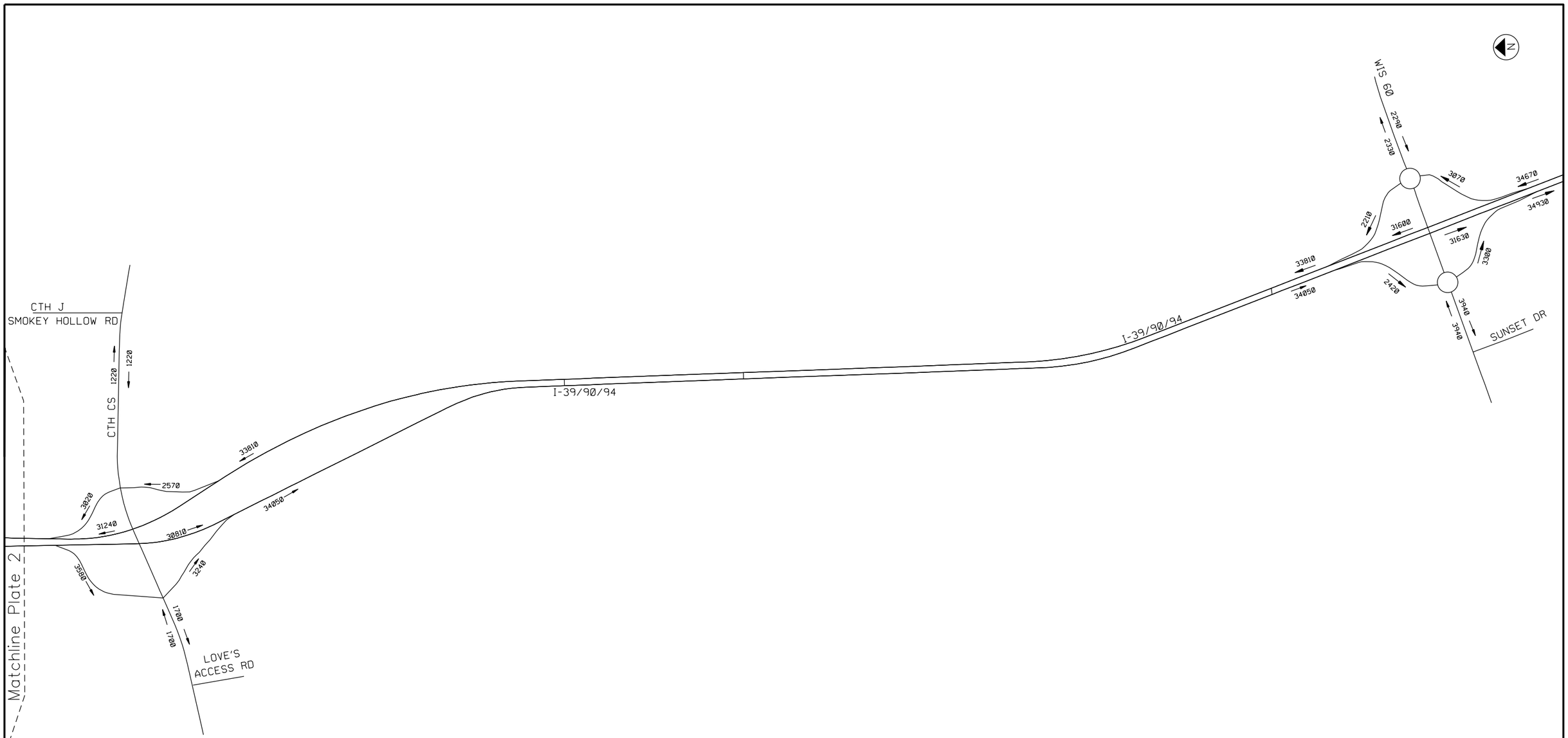
BALANCED TURNING MOVEMENT VOLUMES

YEAR 2050 FUTURE PREFERRED TRAFFIC VOLUMES

PLATE 5 OF 5

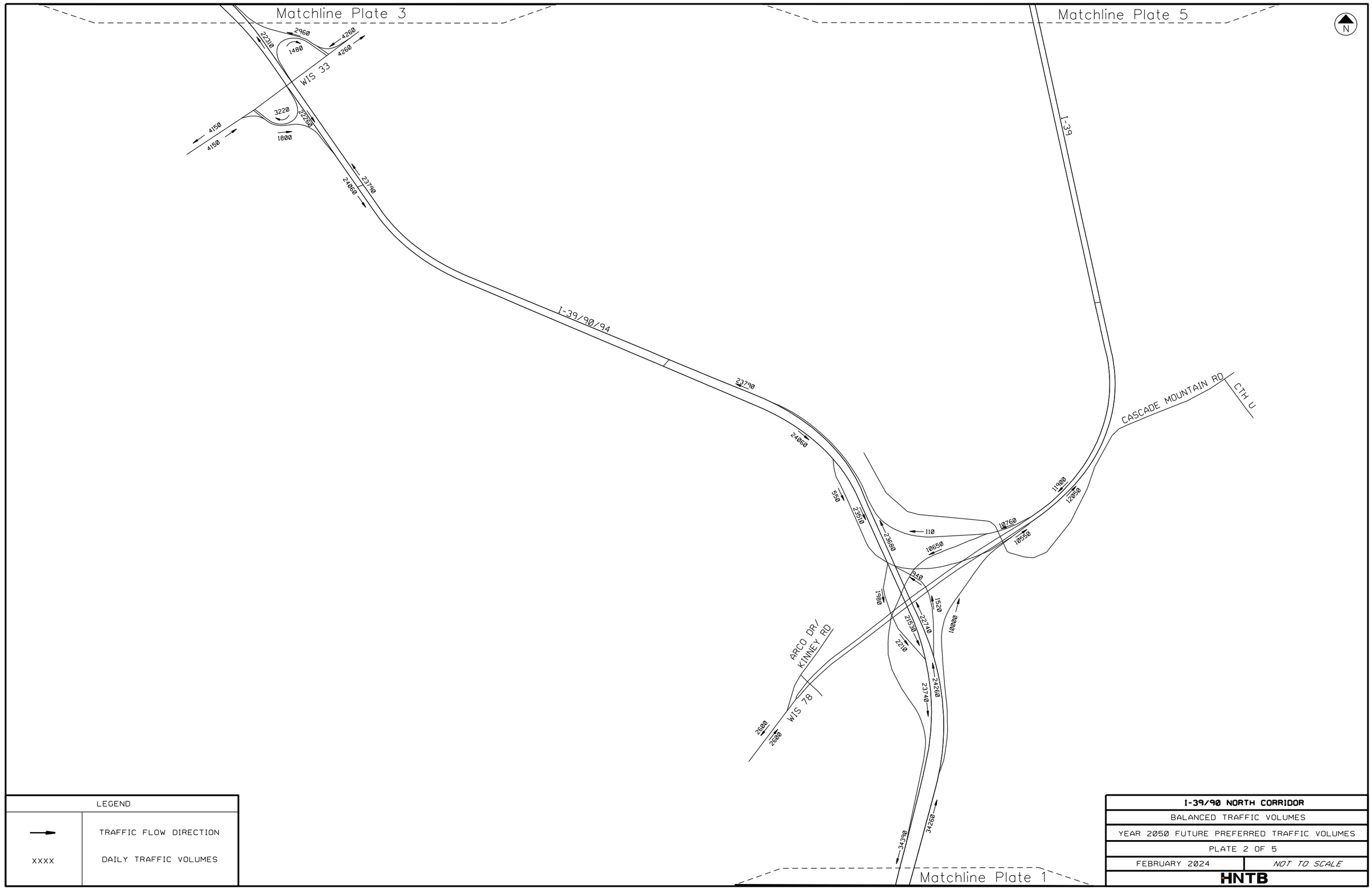
FEBRUARY 2024 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 FUTURE PREFERRED TRAFFIC VOLUMES	
PLATE 1 OF 5	
FEBRUARY 2024	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 FUTURE PREFERRED TRAFFIC VOLUMES	
PLATE 2 OF 5	
FEBRUARY 2024	*NOT TO SCALE*
HNTB	

Matchline Plate 4

N

US 12

WHITLOCK ST

WIS 23

CTH P

COMMERCE ST

26950
25810
3680
3050
22750
9460
9460
10190
10190
23270
4730
3730

MEADOWVIEW DR

GASSER RD

US 12

8030
6320
1960
2120
2700
4820
7550
5600
28000
26490
20280
20450
25270
25480
6210
1500
2300
5200
4710
2900
I-90/94
I-90/94
1190
8080
3170
4190
8030
7610

Matchline Plate 2

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

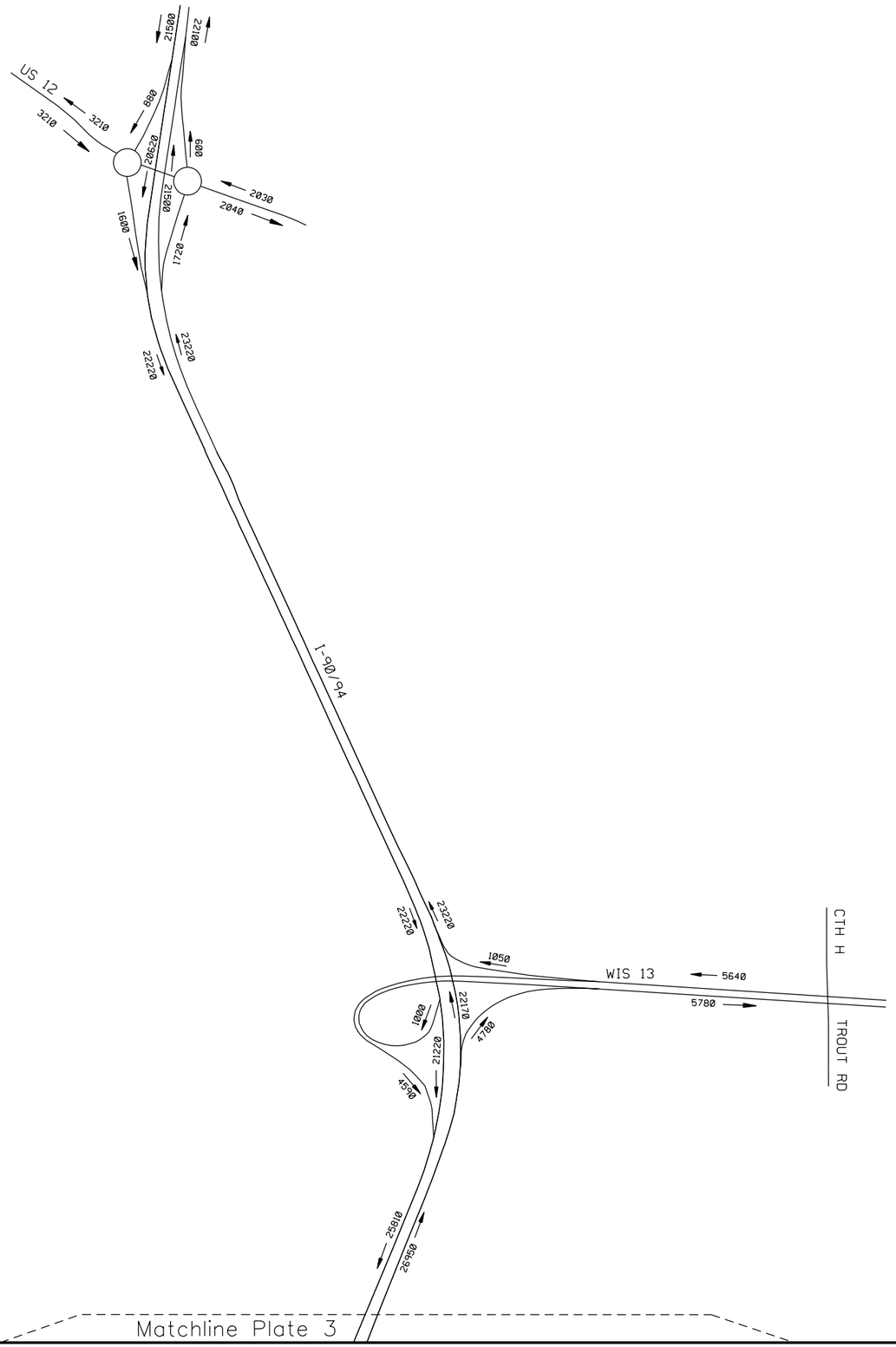
BALANCED TRAFFIC VOLUMES

YEAR 2050 FUTURE PREFERRED TRAFFIC VOLUMES

PLATE 3 OF 5

FEBRUARY 2024 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR

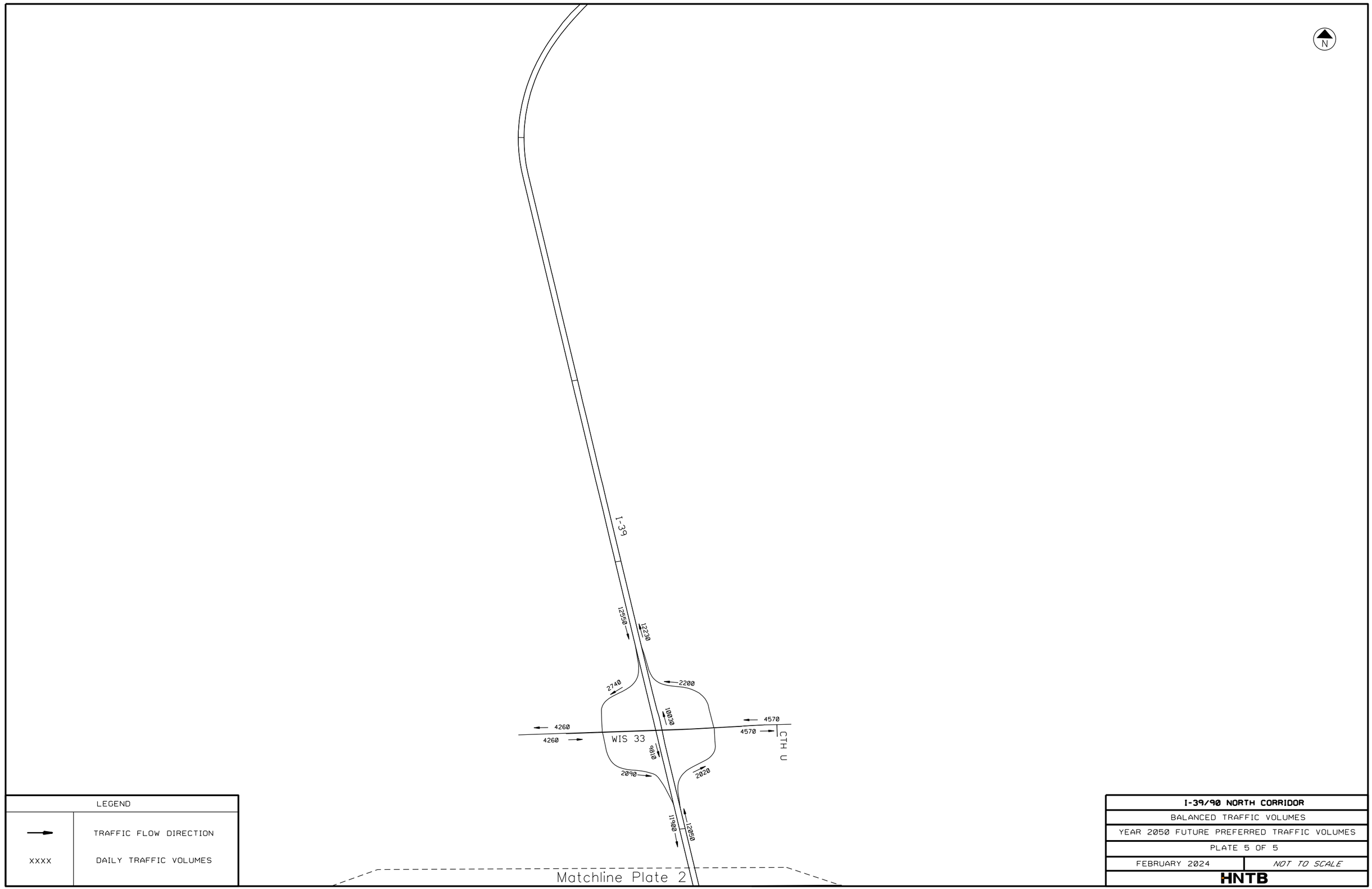
BALANCED TRAFFIC VOLUMES

YEAR 2050 FUTURE PREFERRED TRAFFIC VOLUMES

PLATE 4 OF 5

FEBRUARY 2024 | *NOT TO SCALE*

HNTB

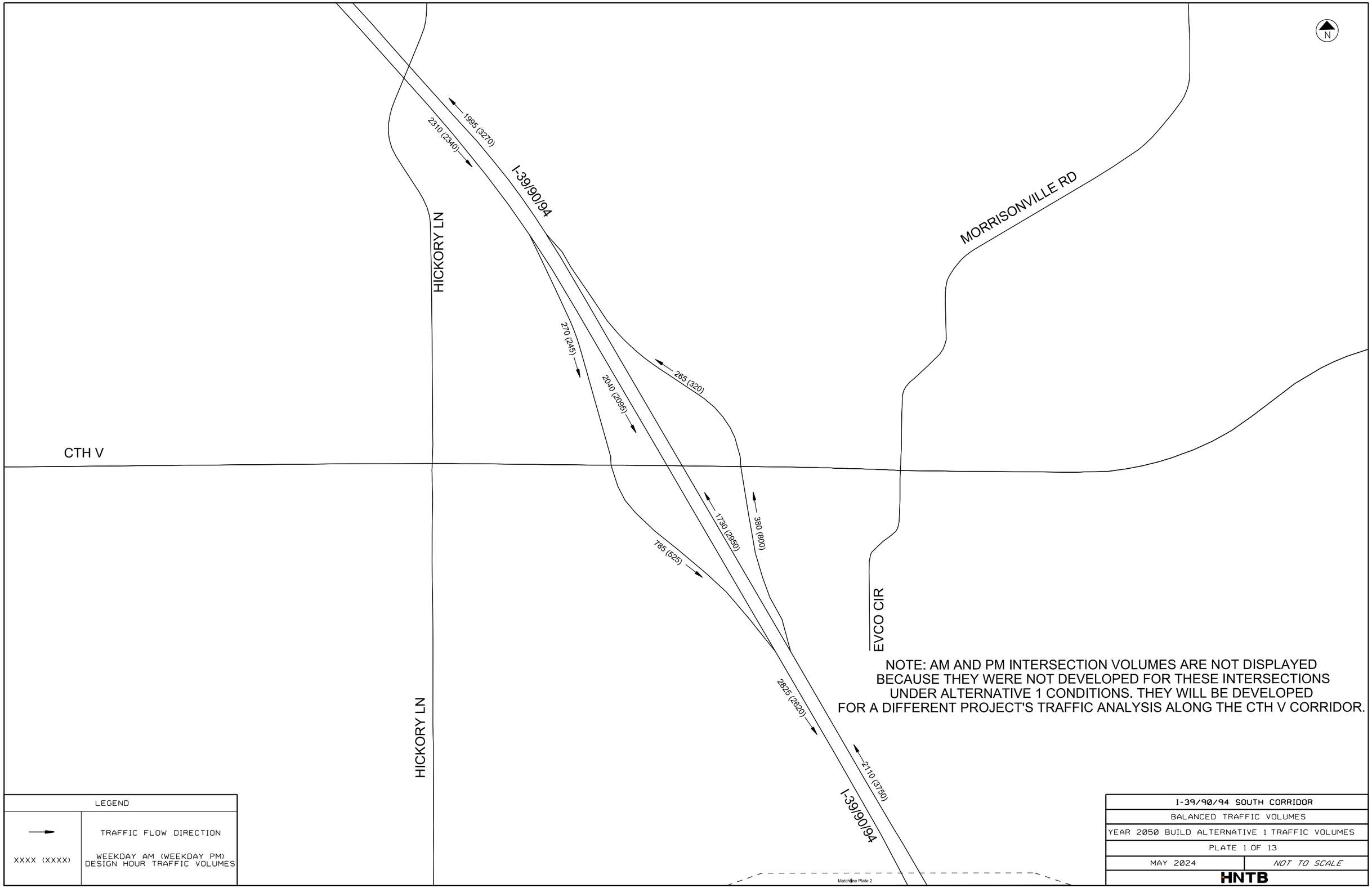


LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	DAILY TRAFFIC VOLUMES

I-39/90 NORTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 FUTURE PREFERRED TRAFFIC VOLUMES	
PLATE 5 OF 5	
FEBRUARY 2024	*NOT TO SCALE*
HNTB	

Attachment P

Interstate South Preferred Build Future Year 2050 Forecast Volume Exhibits



NOTE: AM AND PM INTERSECTION VOLUMES ARE NOT DISPLAYED BECAUSE THEY WERE NOT DEVELOPED FOR THESE INTERSECTIONS UNDER ALTERNATIVE 1 CONDITIONS. THEY WILL BE DEVELOPED FOR A DIFFERENT PROJECT'S TRAFFIC ANALYSIS ALONG THE CTH V CORRIDOR.

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 1 OF 13	
MAY 2024	*NOT TO SCALE*
HNTB	

Matchline Plate 1

N

2825 (2620)

2110 (3750)

I-39/90/94

270 (410)
0 (0)
290 (745)
65 (70)
1525 (1345)
45 (20)
165 (210)
1110 (1340)
5 (10)
40 (35)
0 (0)
30 (40)

TIERNEY XING

DALMORE RD

WIS 19

LIUNA WAY

45 (155)
175 (260)
1590 (1280)
0 (0)
1430 (2125)

185 (310)

235 (215)

2640 (2310)

460 (355)
160 (100)
95 (310)
935 (825)
175 (300)
620 (1155)
850 (665)
190 (290)
230 (145)

CTH CV

0 (20)
0 (5)
0 (10)
25 (5)
920 (930)
120 (120)
15 (15)
815 (1255)
180 (130)
110 (185)
5 (0)
60 (170)

Matchline Plate 4

1765 (1540)
1335 (2105)
95 (20)
5 (5)

70 (110)
0 (0)
115 (200)
1695 (1430)
550 (415)
680 (1255)
660 (855)

1875 (3535)

975 (1055)

1270 (1100)

PEPSI WAY

I-39/90/94

3615 (3365)

3145 (4635)

Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR

BALANCED TRAFFICVOLUMES

YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES

PLATE 2 OF 13

MAY 2024 | *NOT TO SCALE*

HNTB

Matchline Plate 2

Matchline Plate 4

I-39/90/94

3615 (3365)

3145 (4635)

US 51

2170 (1695)

880 (2300)

2030 (1505)

210 (75)

265 (1260)

615 (1040)

140 (190)

1000 (325)

2615 (3040)

295 (590)

990 (955)

2710 (3855)

3605 (3995)

825 (1115)

950 (275)

240 (350)

3535 (4970)

3845 (4345)

DAENTL RD

1250 (625)

50 (50)

510 (1800)

2200 (900)

750 (2150)

US 51

2200 (900)

750 (2150)

I-39/90/94

Matchline Plate 5

N

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR

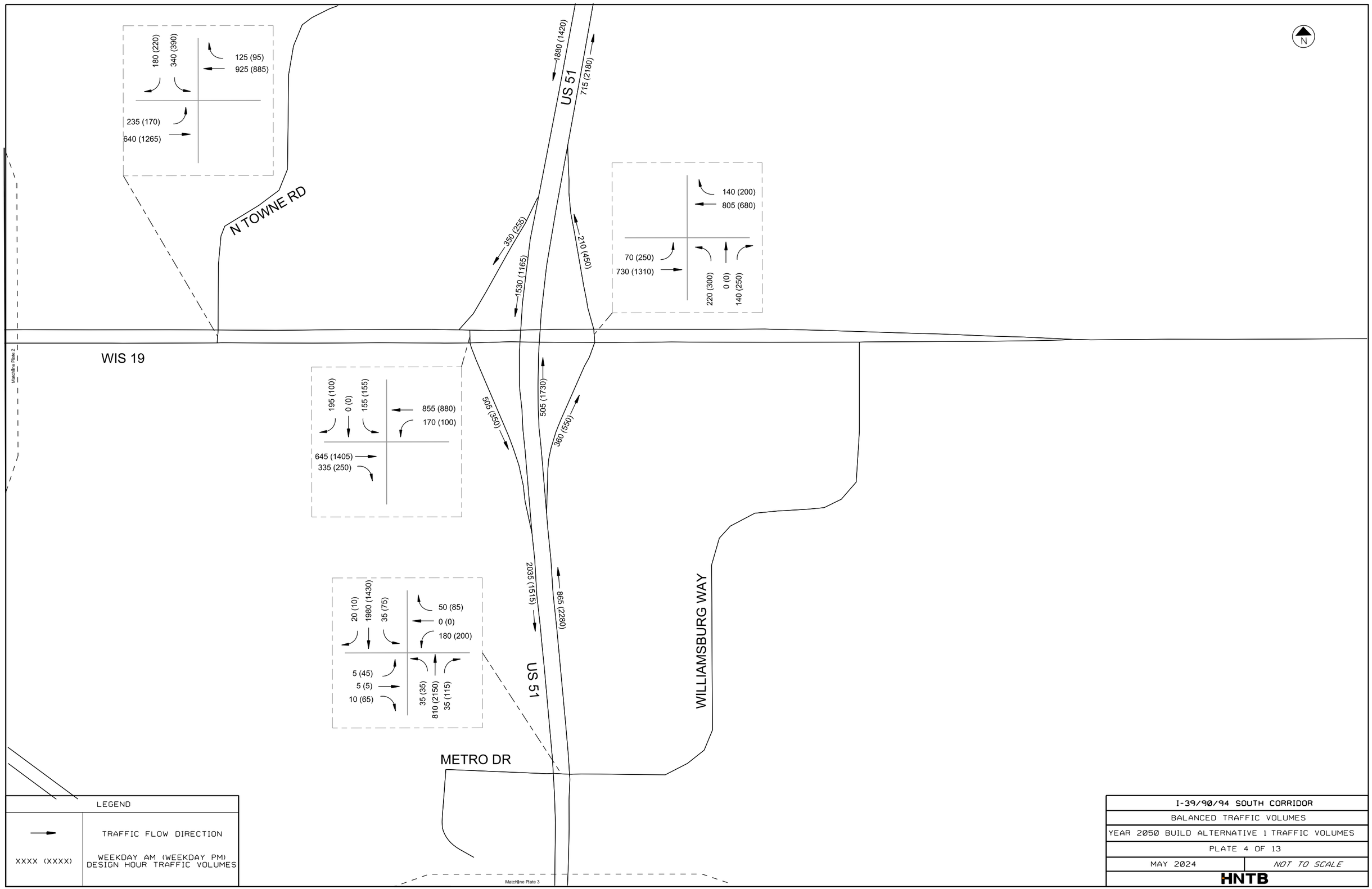
BALANCED TRAFFIC VOLUMES

YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES

PLATE 3 OF 13

MAY 2024 | *NOT TO SCALE*

HNTB


N
N TOWNE RD
180 (220)
340 (390)
125 (95)
925 (885)
235 (170)
640 (1265)
US 51
1880 (1420)
715 (2180)
350 (255)
1530 (1165)
210 (450)
140 (200)
805 (680)
70 (250)
730 (1310)
220 (300)
0 (0)
140 (250)
WIS 19
Matchline Plate 2
195 (100)
0 (0)
155 (155)
855 (880)
170 (100)
645 (1405)
335 (250)
505 (350)
505 (1730)
360 (550)
2035 (1515)
865 (2280)
20 (10)
1980 (1430)
35 (75)
50 (85)
0 (0)
180 (200)
5 (45)
5 (5)
10 (65)
35 (35)
810 (2150)
35 (115)
US 51
WILLIAMSBURG WAY
METRO DR
Matchline Plate 3
LEGEND
TRAFFIC FLOW DIRECTION
XXXX (XXXX)
WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED TRAFFIC VOLUMES
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES
PLATE 4 OF 13
MAY 2024
NOT TO SCALE
HNTB

Matchline Plate 3

HOEPKER RD

PORTAGE RD

I-90/94/39

HANSON RD

EASTPARK BLVD

Matchline Plate 6

3845 (4345)
275 (220)
3535 (4970)
170 (245)
3570 (4125)
3365 (4725)
500 (560)
415 (535)
3985 (4680)
3865 (5285)

20 (5)
0 (0)
255 (215)
780 (695)
270 (255)
270 (475)
145 (280)

165 (235)
760 (710)
5 (10)
520 (680)
290 (240)
0 (0)
210 (320)

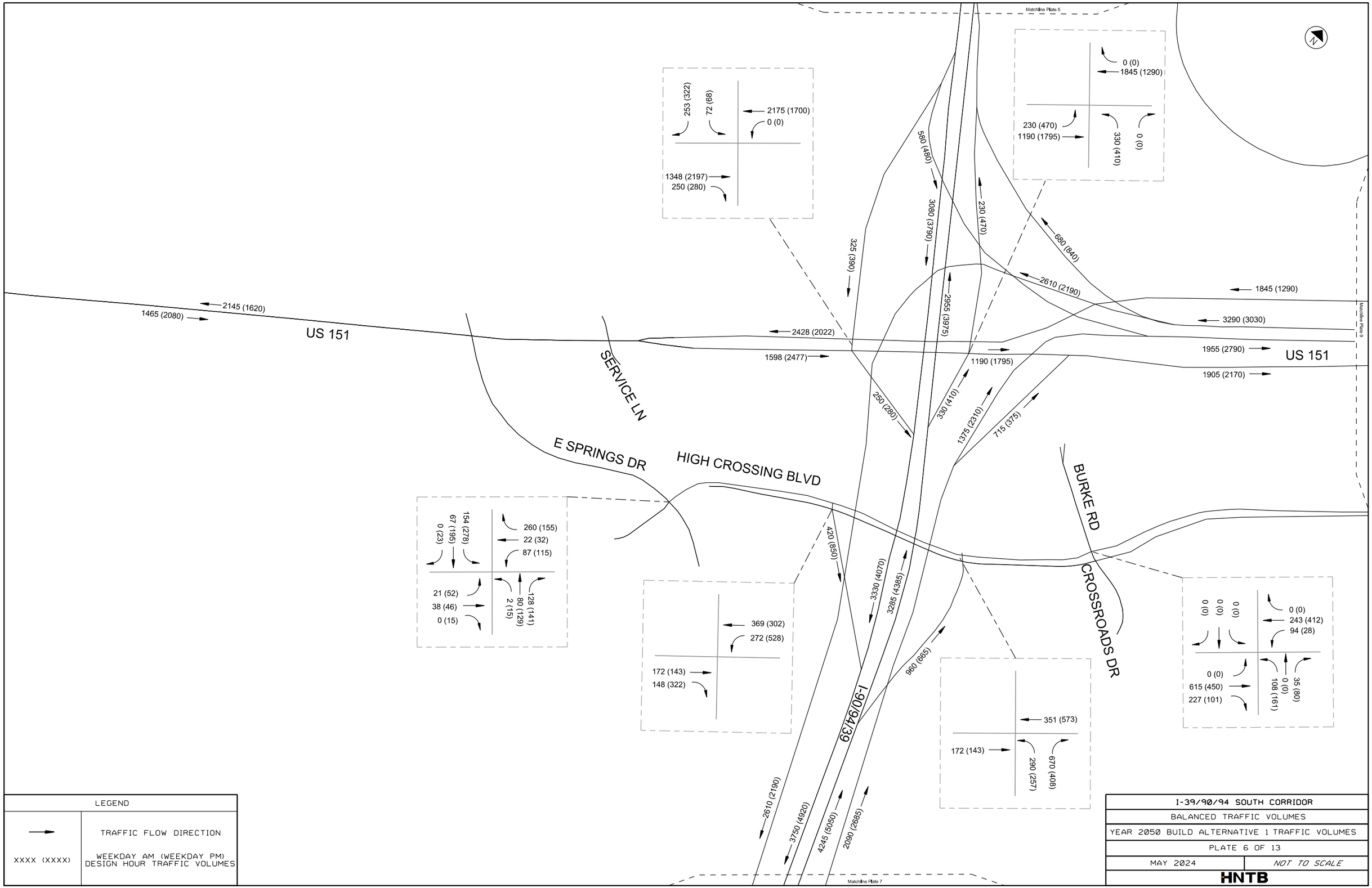
55 (45)
25 (15)
5 (15)
15 (15)
770 (685)
25 (50)
50 (80)
505 (835)
175 (85)
100 (215)
40 (65)
50 (120)

45 (75)
185 (75)
90 (220)
210 (325)
100 (180)
610 (325)

N

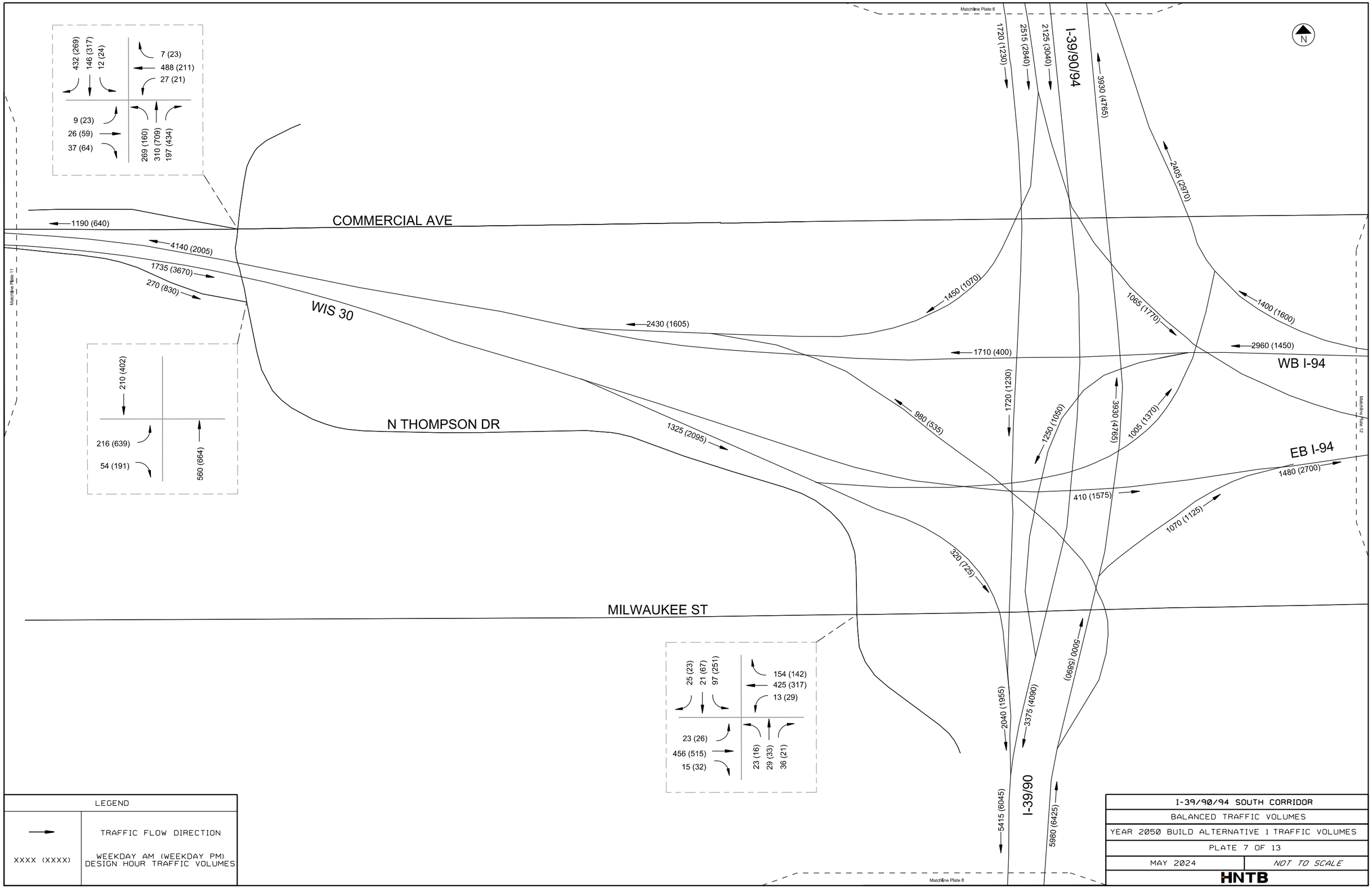
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 5 OF 13	
MAY 2024	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 6 OF 13	
MAY 2024	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 7 OF 13	
MAY 2024	*NOT TO SCALE*
HNTB	

Matchline Plate 7

N

I-39/90

5980 (6425)

5415 (6045)

1505 (2290)

3910 (3755)

4185 (4760)

950 (570)

4860 (4325)

180 (225)

US 12/18

540 (440)

1685 (2515)

1795 (1665)

950 (570)

3645 (4320)

US 12/18

630 (1115)

490 (520)

70 (45)

1195 (1995)

1020 (615)

2815 (2280)

1825 (3110)

I-39/90

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 8 OF 13	
MAY 2024	*NOT TO SCALE*
HNTB	

AMERICAN PKWY

EASTPARK BLVD

US 151

US 151

HIGH CROSSING BLVD

NELSON RD

Matchline Plate 8

Matchline Plate 10

1845 (1290)

245 (635)

785 (520)

3290 (3030)

635 (730)

2655 (2300)

1600 (655)

4255 (2955)

1955 (2790)

5040 (3475)

1905 (2170)

600 (1530)

2555 (4320)

2785 (5340)

1305 (640)

230 (1020)

34 (30)
35 (84)
20 (95)
78 (14)
297 (65)
0 (0)
5 (20)
66 (479)
92 (30)
142 (156)
113 (128)
0 (0)

45 (3)
700 (1014)
907 (744)
330 (76)
21 (5)
65 (569)

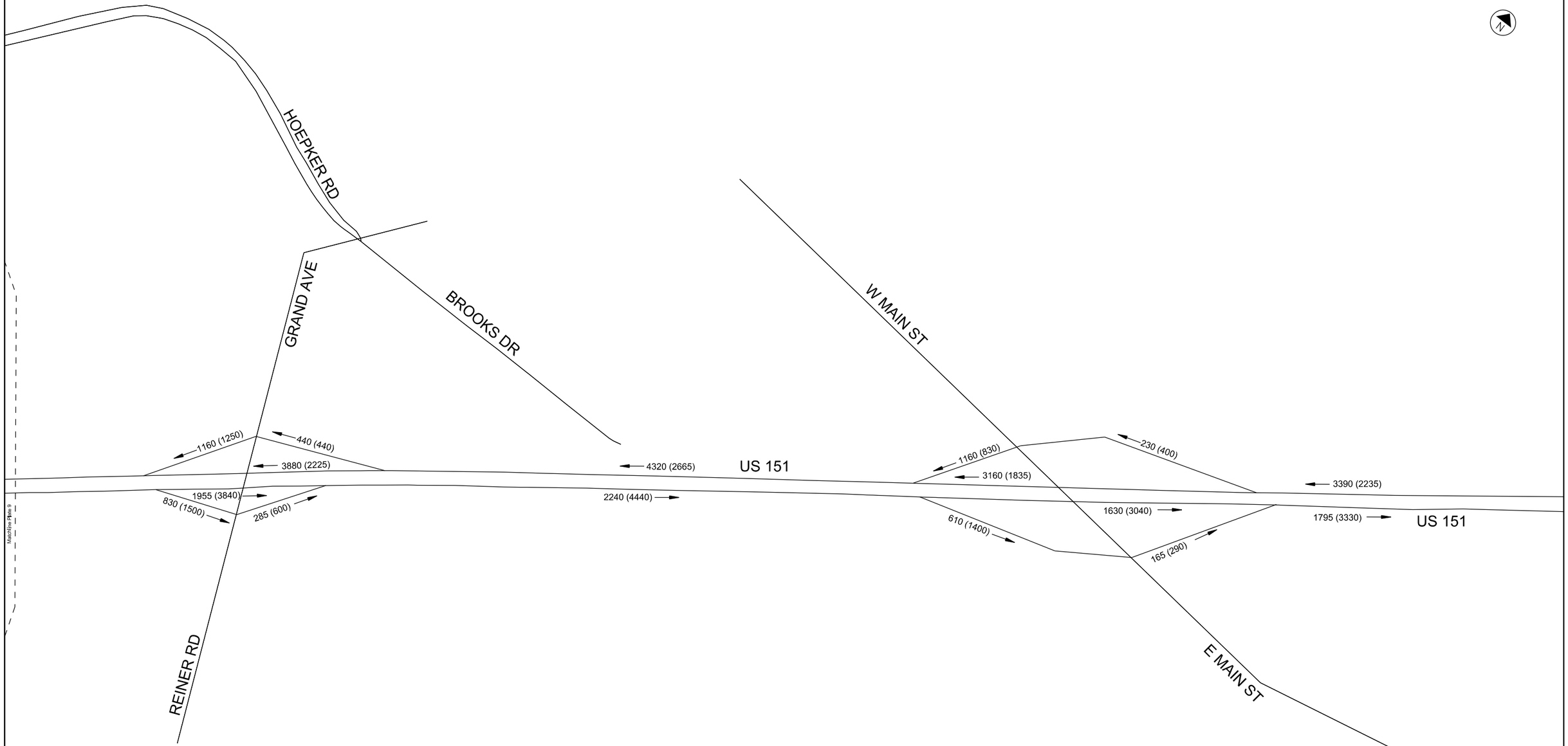
107 (43)
15 (71)
5 (0)
0 (31)
320 (75)
552 (285)
168 (155)
133 (339)
78 (80)
96 (123)
87 (98)
226 (514)

333 (231)
150 (589)
766 (480)
0 (0)
539 (160)
80 (431)
284 (422)

600 (988)
165 (595)
467 (295)
0 (0)
318 (225)
280 (377)
770 (525)

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

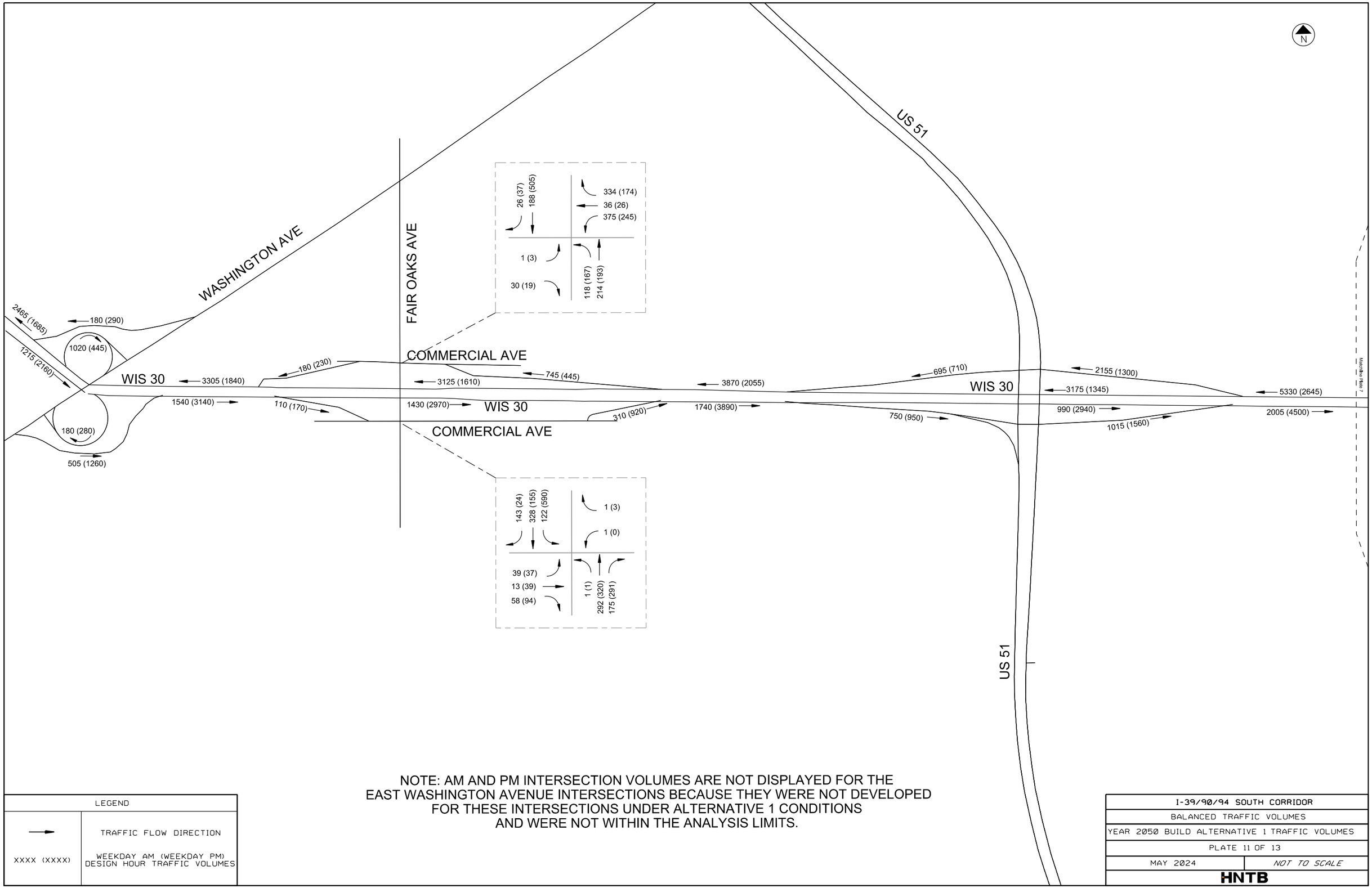
I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 9 OF 13	
MAY 2024	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

NOTE: AM AND PM INTERSECTION VOLUMES ARE NOT DISPLAYED BECAUSE THEY WERE NOT DEVELOPED FOR THESE INTERSECTIONS UNDER ALTERNATIVE 1 CONDITIONS AND WERE NOT WITHIN THE ANALYSIS LIMITS.

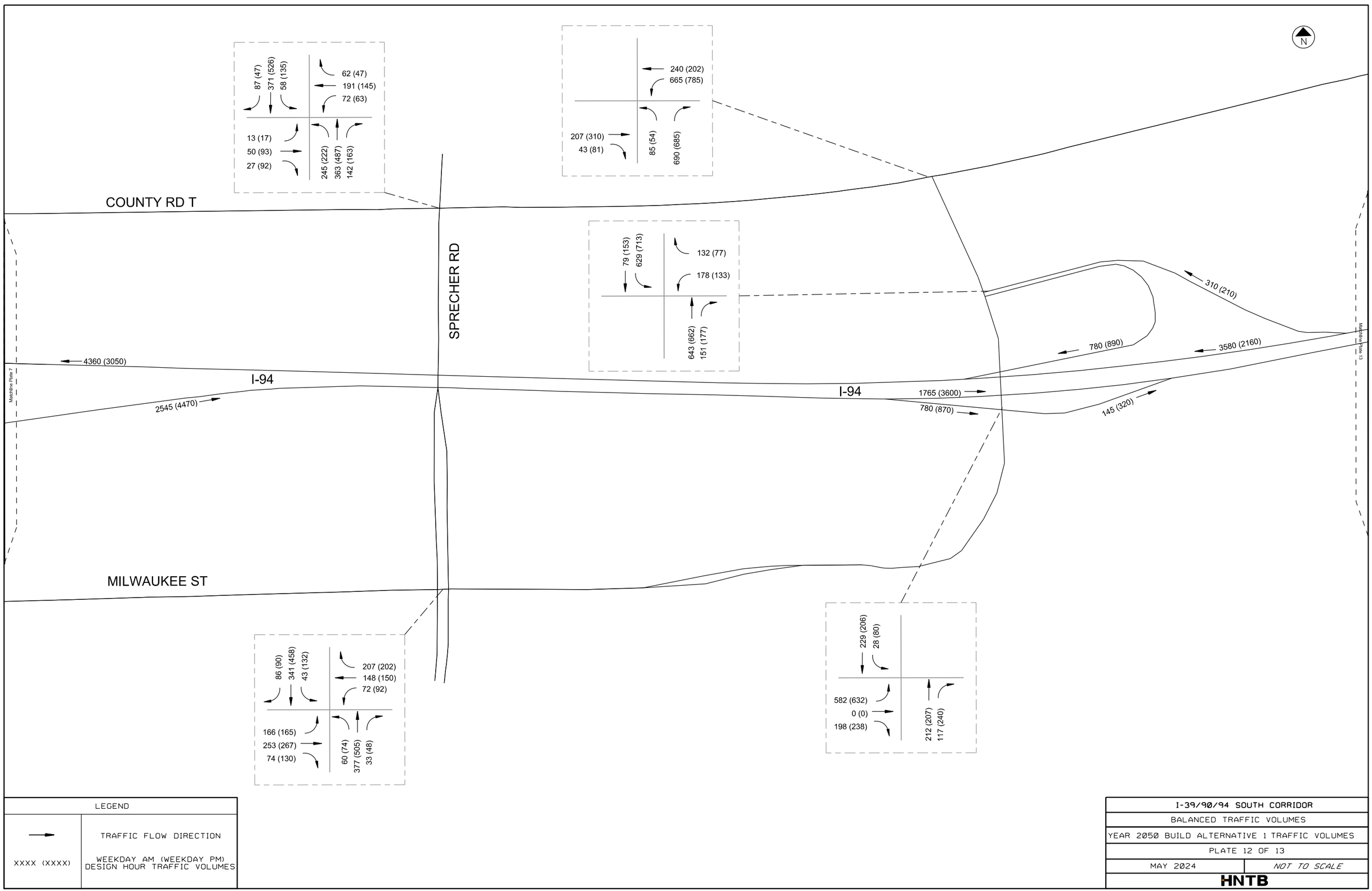
I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 10 OF 13	
MAY 2024	*NOT TO SCALE*
HNTB	



NOTE: AM AND PM INTERSECTION VOLUMES ARE NOT DISPLAYED FOR THE EAST WASHINGTON AVENUE INTERSECTIONS BECAUSE THEY WERE NOT DEVELOPED FOR THESE INTERSECTIONS UNDER ALTERNATIVE 1 CONDITIONS AND WERE NOT WITHIN THE ANALYSIS LIMITS.

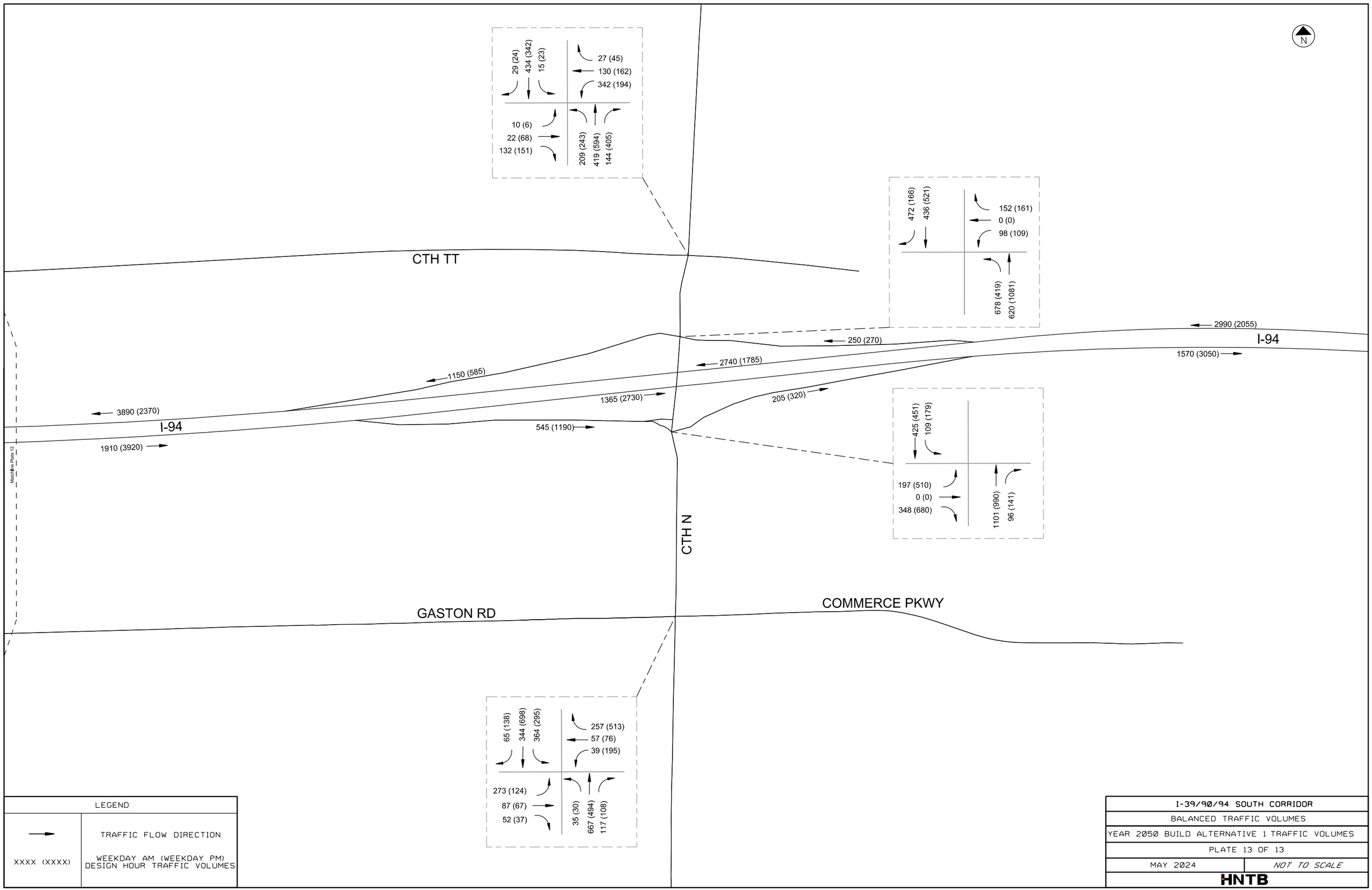
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

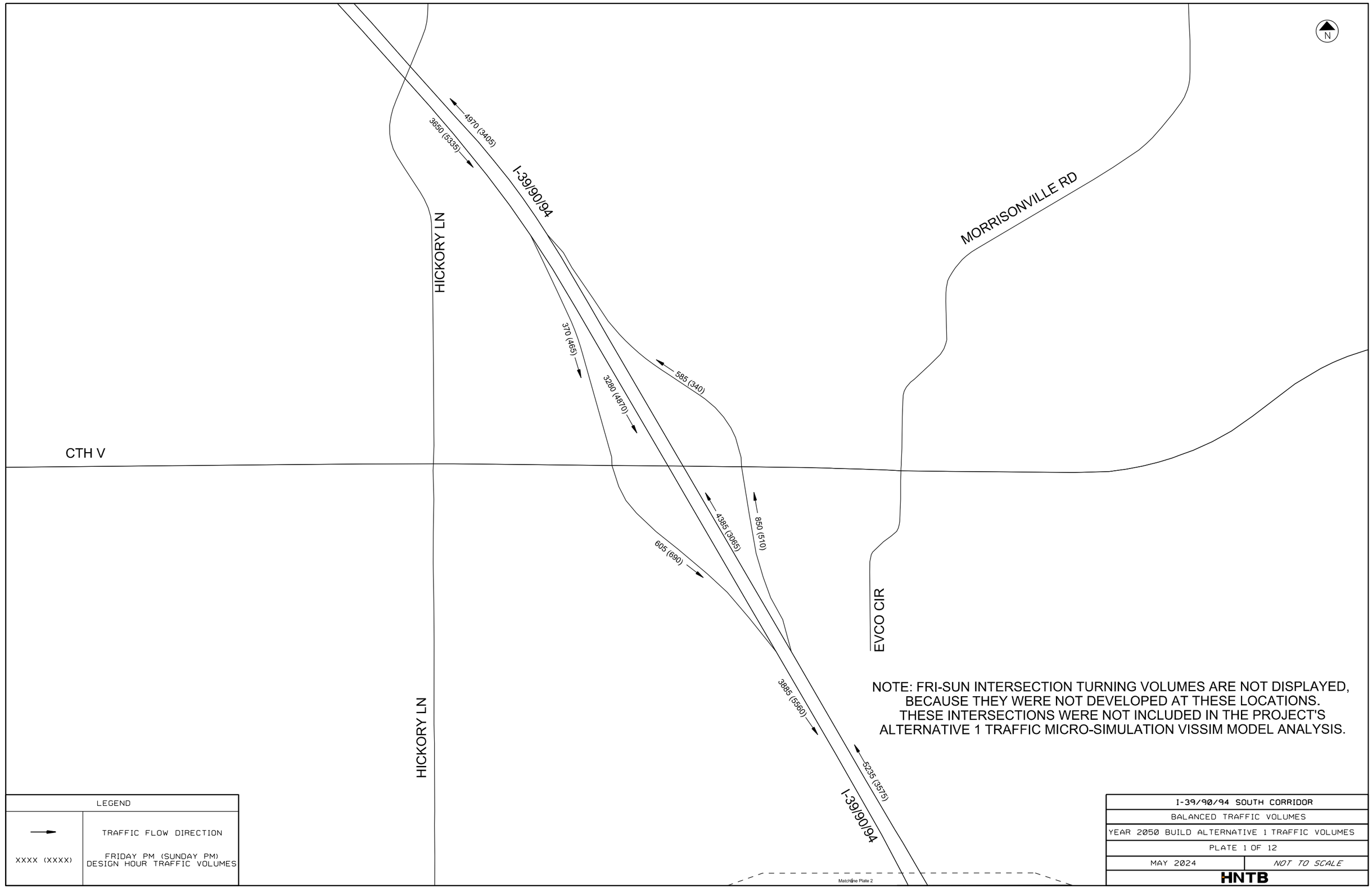
I-39/90/94 SOUTH CORRIDOR
BALANCED TRAFFIC VOLUMES
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES
PLATE 11 OF 13
MAY 2024 | *NOT TO SCALE*
HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 12 OF 13	
MAY 2024	*NOT TO SCALE*
HNTB	


N
CTH TT
29 (24)
434 (342)
15 (23)
27 (45)
130 (162)
342 (194)
10 (6)
22 (68)
132 (151)
209 (243)
419 (594)
144 (405)
472 (166)
436 (521)
152 (161)
0 (0)
98 (109)
678 (419)
620 (1081)
2990 (2055)
I-94
1570 (3050)
250 (270)
2740 (1785)
1150 (585)
1365 (2730)
205 (320)
3890 (2370)
I-94
1910 (3920)
545 (1190)
425 (451)
109 (179)
197 (510)
0 (0)
348 (680)
1101 (990)
96 (141)
CTH N
GASTON RD
COMMERCE PKWY
65 (138)
344 (698)
364 (295)
257 (513)
57 (76)
39 (195)
273 (124)
87 (67)
52 (37)
35 (30)
667 (494)
117 (108)
LEGEND
TRAFFIC FLOW DIRECTION
XXXX (XXXX)
WEEKDAY AM (WEEKDAY PM) DESIGN HOUR TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED TRAFFIC VOLUMES
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES
PLATE 13 OF 13
MAY 2024
NOT TO SCALE
HNTB



NOTE: FRI-SUN INTERSECTION TURNING VOLUMES ARE NOT DISPLAYED, BECAUSE THEY WERE NOT DEVELOPED AT THESE LOCATIONS. THESE INTERSECTIONS WERE NOT INCLUDED IN THE PROJECT'S ALTERNATIVE 1 TRAFFIC MICRO-SIMULATION VISSIM MODEL ANALYSIS.

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 1 OF 12	
MAY 2024	*NOT TO SCALE*
HNTB	

Matchline Plate 1

N

5235 (3575)

3885 (5560)

I-39/90/94

CTH CV

TIERNEY XING

DALMORE RD

WIS 19

LIUNA WAY

455 (275)

250 (365)

3635 (5195)

4780 (3300)

1300 (930)

PEPSI WAY

1130 (865)

I-39/90/94

6080 (4230)

4765 (6060)

Matchline Plate 3

NOTE: FRI-SUN INTERSECTION TURNING VOLUMES ARE NOT DISPLAYED BECAUSE THEY WERE NOT DEVELOPED AT THESE LOCATIONS.
THESE INTERSECTIONS WERE NOT INCLUDED IN THE PROJECT'S ALTERNATIVE 1 TRAFFIC MICRO-SIMULATION VISSIM MODEL ANALYSIS.

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR

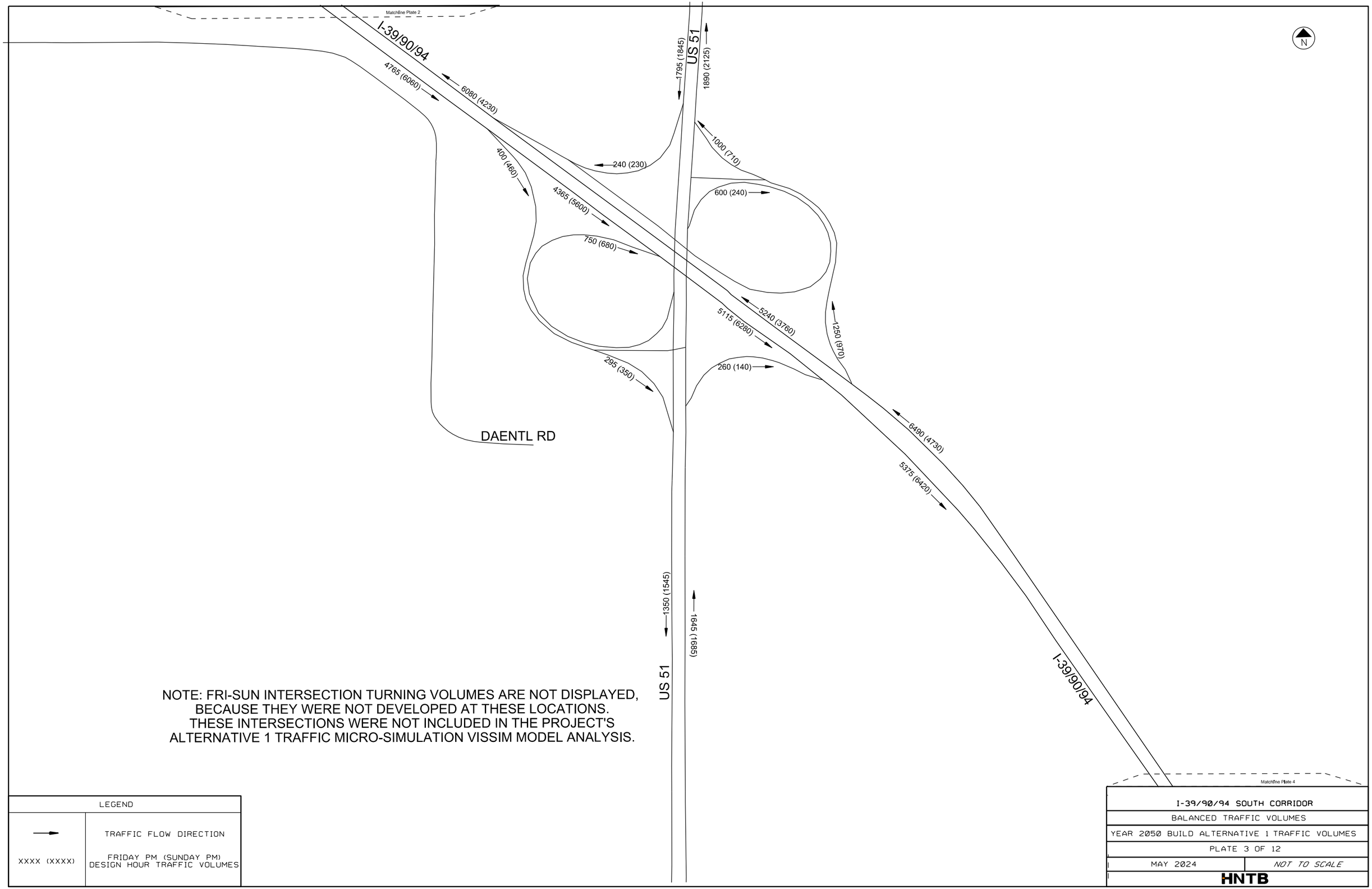
BALANCED TRAFFICVOLUMES

YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES

PLATE 2 OF 12

MAY 2024 | *NOT TO SCALE*

HNTB



NOTE: FRI-SUN INTERSECTION TURNING VOLUMES ARE NOT DISPLAYED, BECAUSE THEY WERE NOT DEVELOPED AT THESE LOCATIONS. THESE INTERSECTIONS WERE NOT INCLUDED IN THE PROJECT'S ALTERNATIVE 1 TRAFFIC MICRO-SIMULATION VISSIM MODEL ANALYSIS.

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR

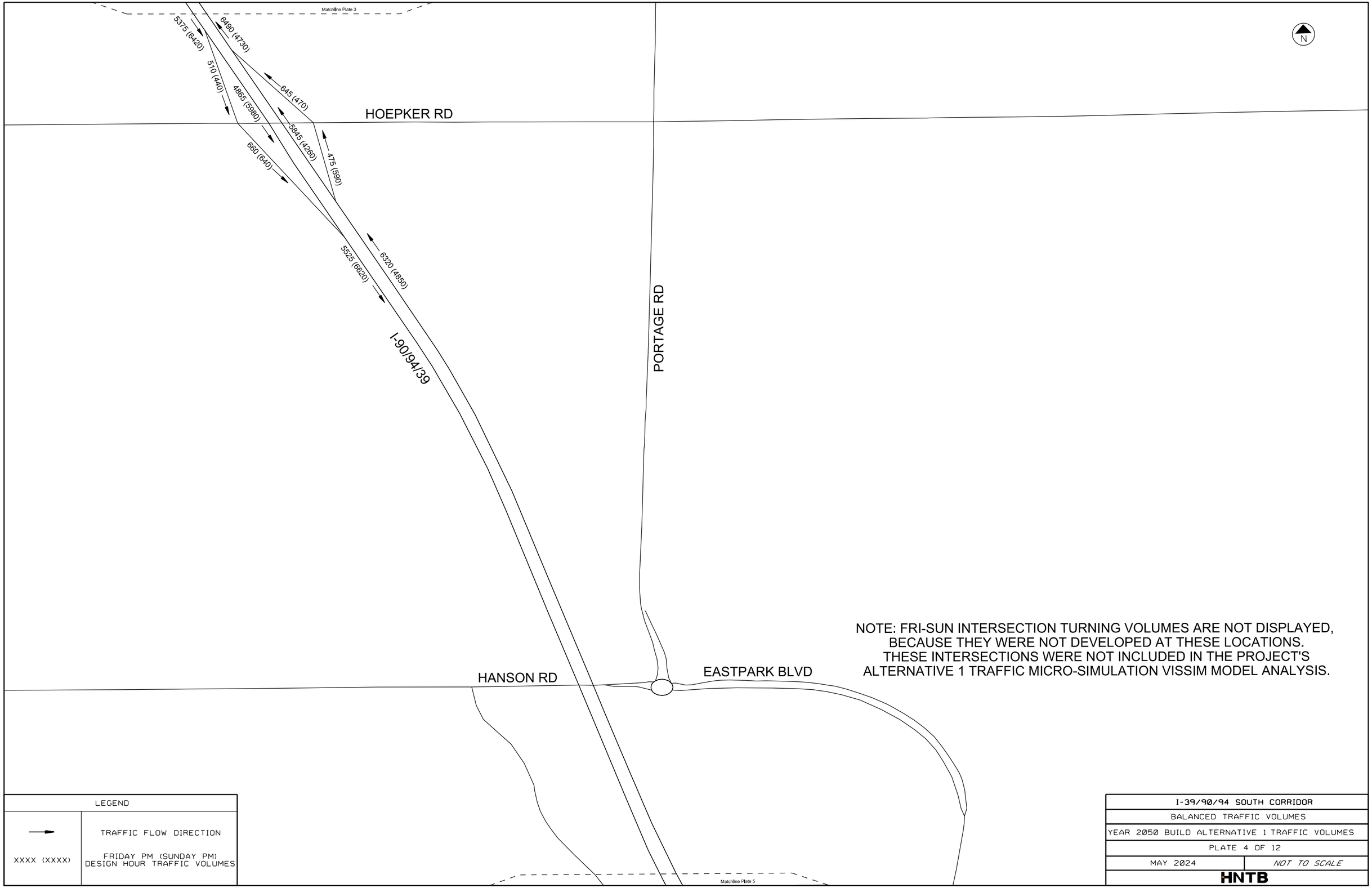
BALANCED TRAFFIC VOLUMES

YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES

PLATE 3 OF 12

MAY 2024 | *NOT TO SCALE*

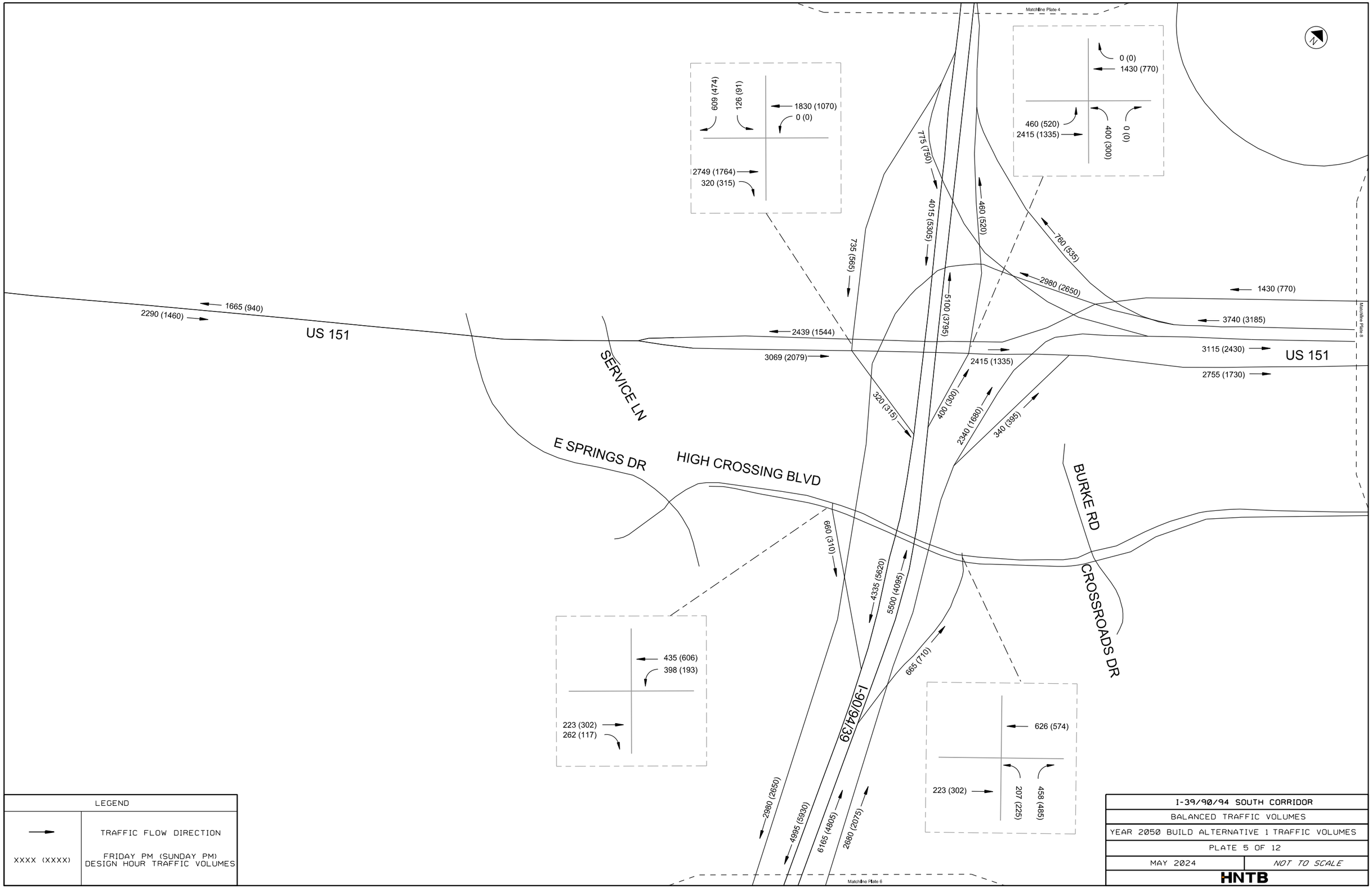
HNTB



NOTE: FRI-SUN INTERSECTION TURNING VOLUMES ARE NOT DISPLAYED, BECAUSE THEY WERE NOT DEVELOPED AT THESE LOCATIONS. THESE INTERSECTIONS WERE NOT INCLUDED IN THE PROJECT'S ALTERNATIVE 1 TRAFFIC MICRO-SIMULATION VISSIM MODEL ANALYSIS.

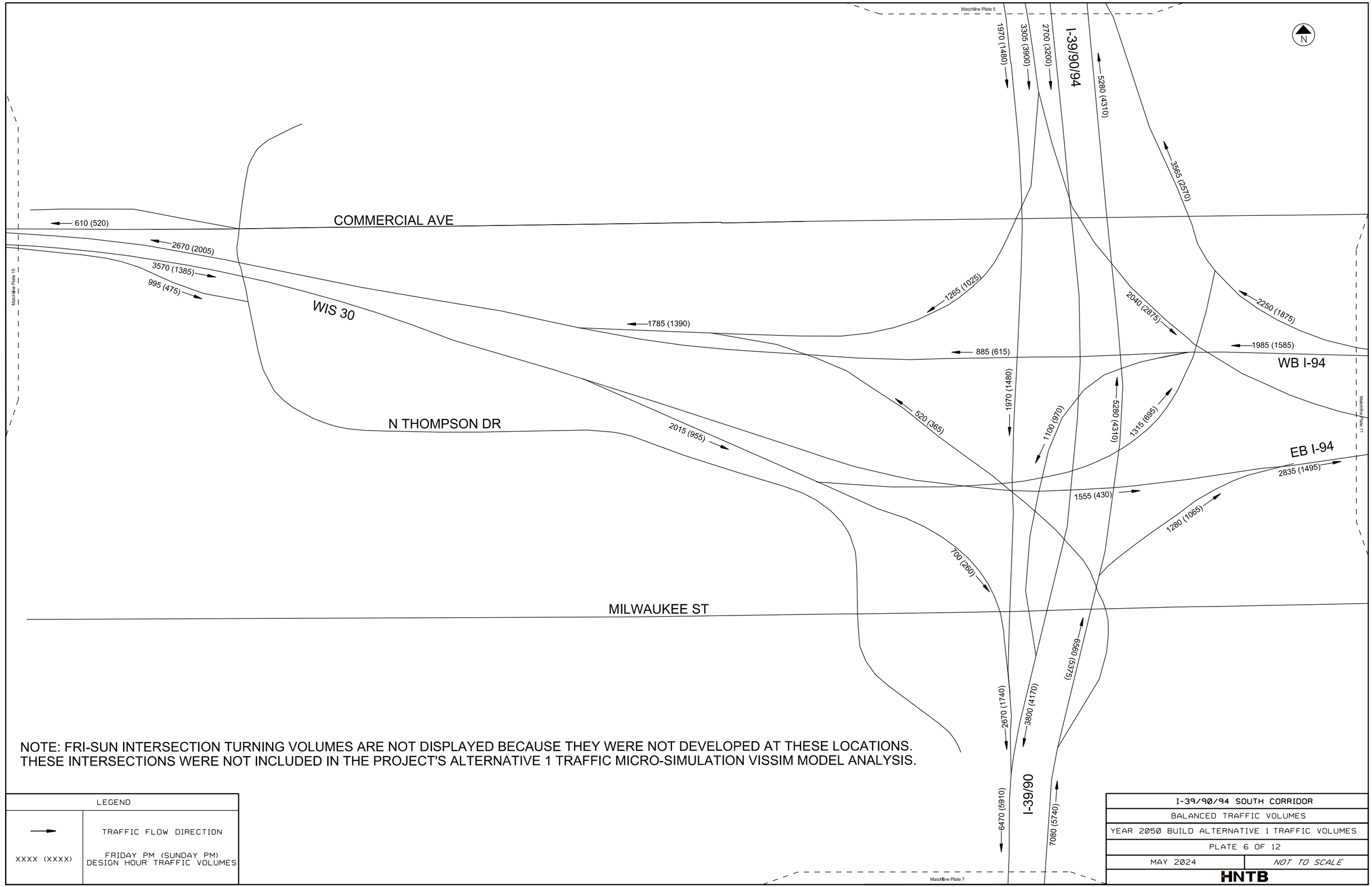
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 4 OF 12	
MAY 2024	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 5 OF 12	
MAY 2024	*NOT TO SCALE*
HNTB	



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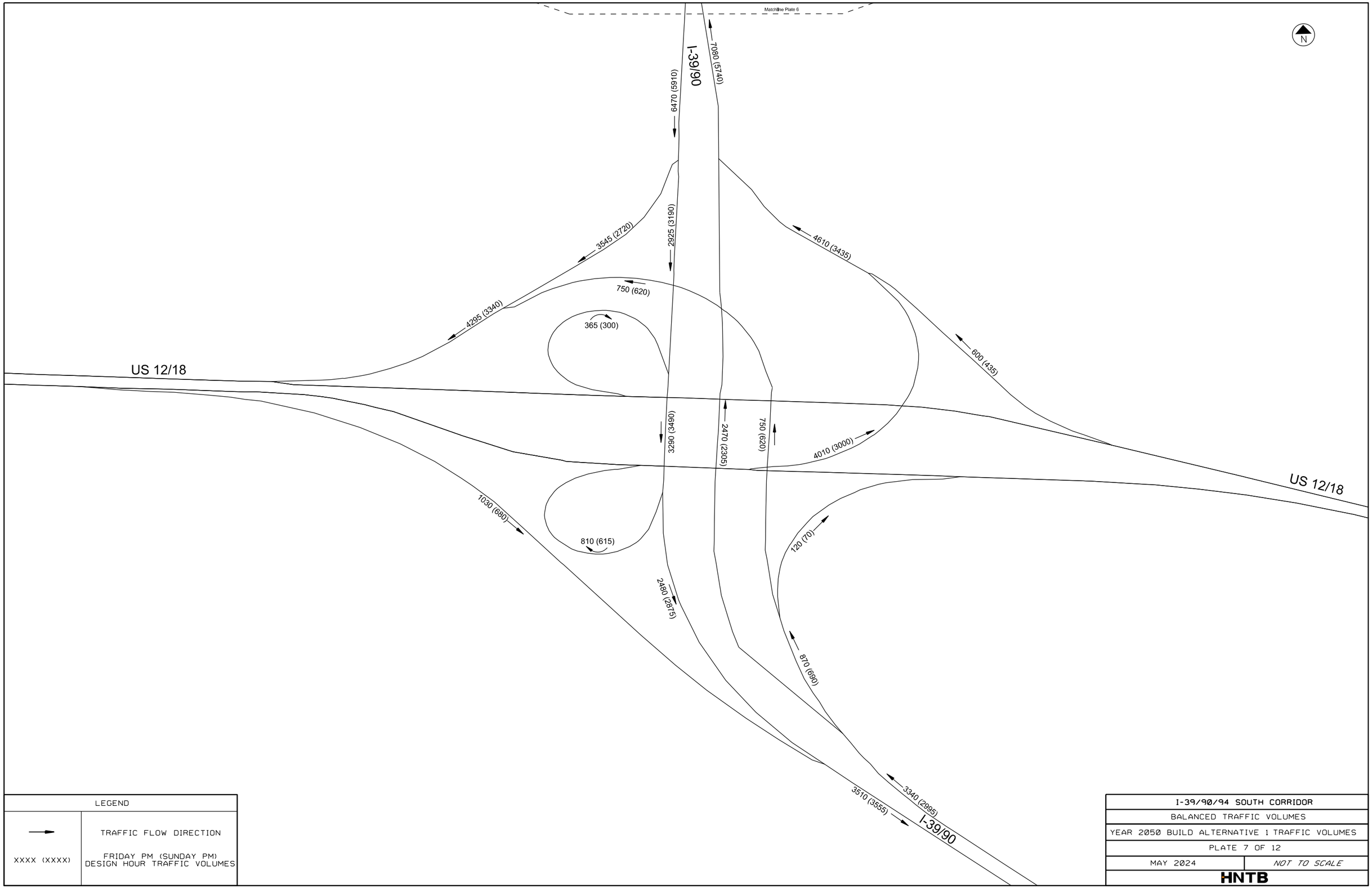
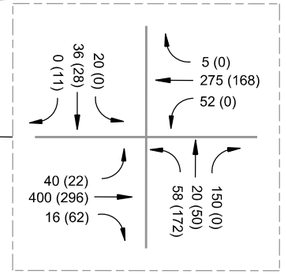
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

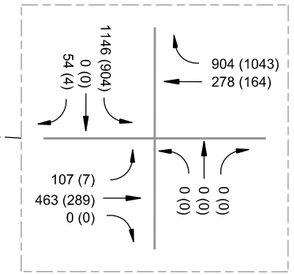
I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 6 OF 12	
MAY 2024	*NOT TO SCALE*
HNTB	


Matchline Plate 6
N
I-39/90
7080 (5740)
6470 (5910)
2925 (3190)
3545 (2720)
4610 (3435)
750 (620)
4295 (3340)
365 (300)
600 (435)
US 12/18
3290 (3490)
2470 (2305)
750 (620)
4010 (3000)
US 12/18
1030 (680)
120 (70)
810 (615)
2480 (2875)
870 (690)
3510 (3555)
3340 (2995)
I-39/90
LEGEND
TRAFFIC FLOW DIRECTION
XXXX (XXXX)
FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED TRAFFIC VOLUMES
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES
PLATE 7 OF 12
MAY 2024
NOT TO SCALE
HNTB

AMERICAN PKWY

EASTPARK BLVD





1430 (770)

415 (260)

375 (225)

US 151

3740 (3185)

995 (265)

2745 (2920)

1015 (510)

3760 (3430)

4135 (3655)

US 151

3115 (2430)

2755 (1730)

1770 (1045)

4885 (3475)

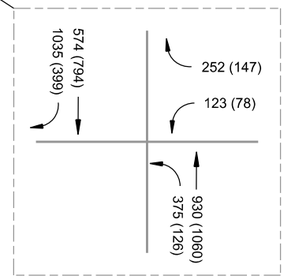
5535 (3815)

985 (685)

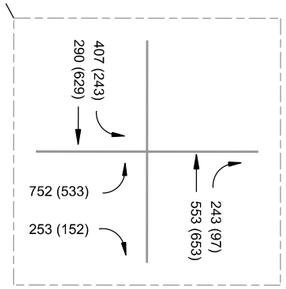
650 (340)

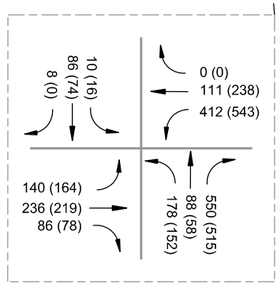
Matchline Plate 5

Matchline Plate 9



HIGH CROSSING BLVD

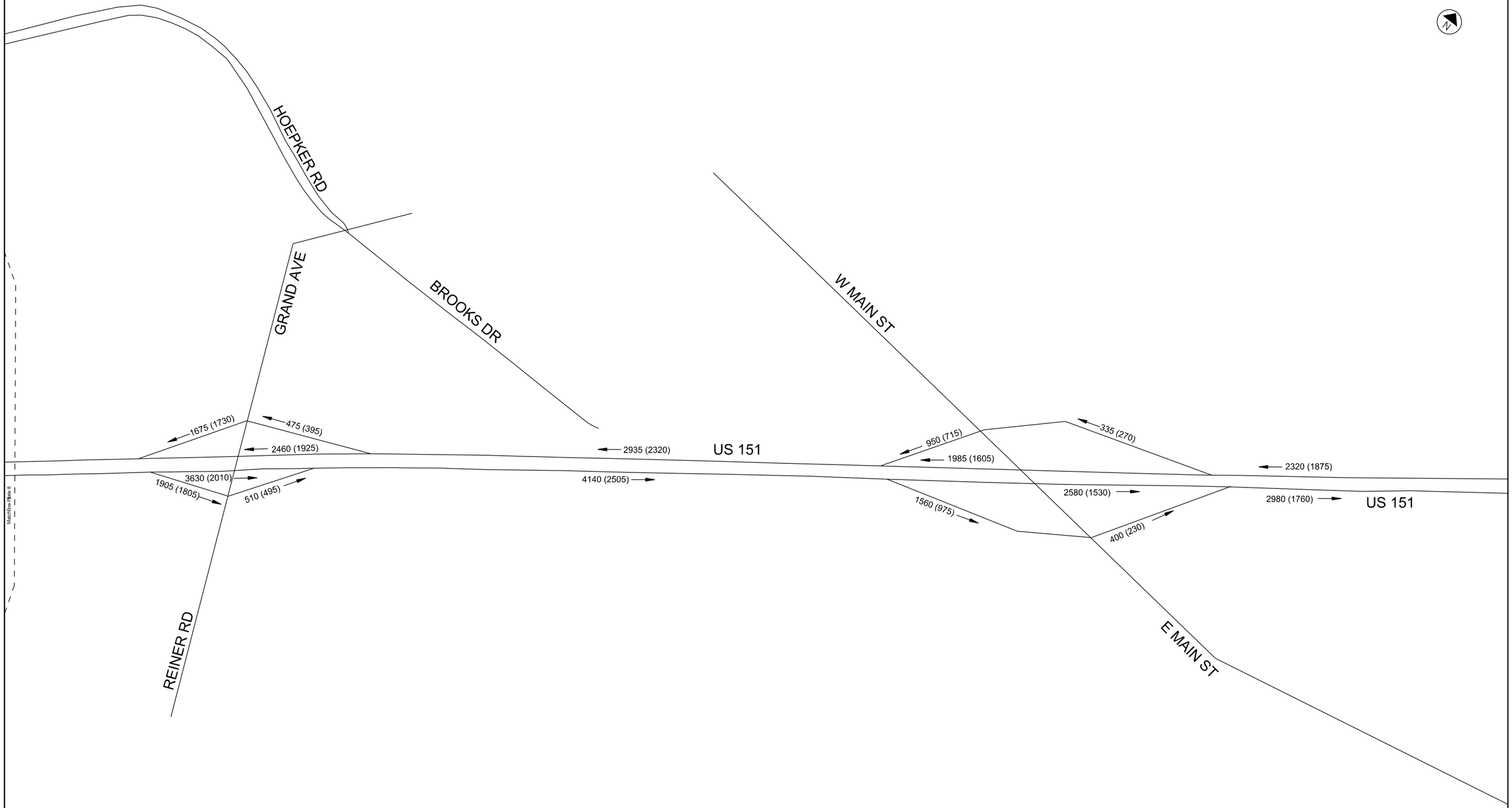




NELSON RD

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 8 OF 12	
MAY 2024	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

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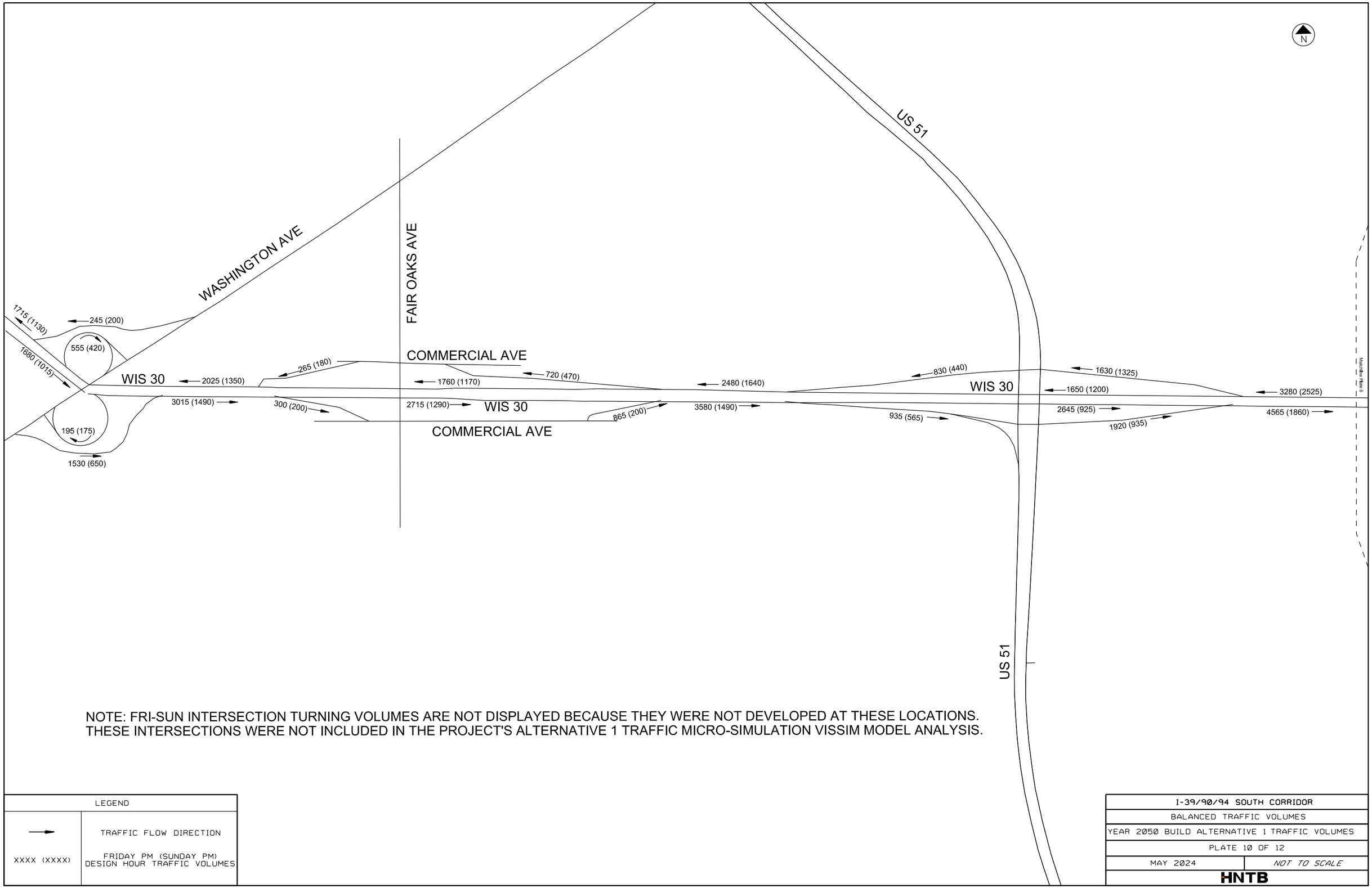
I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 9 OF 12	
MAY 2024	*NOT TO SCALE*
HNTB	



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LEGEND	
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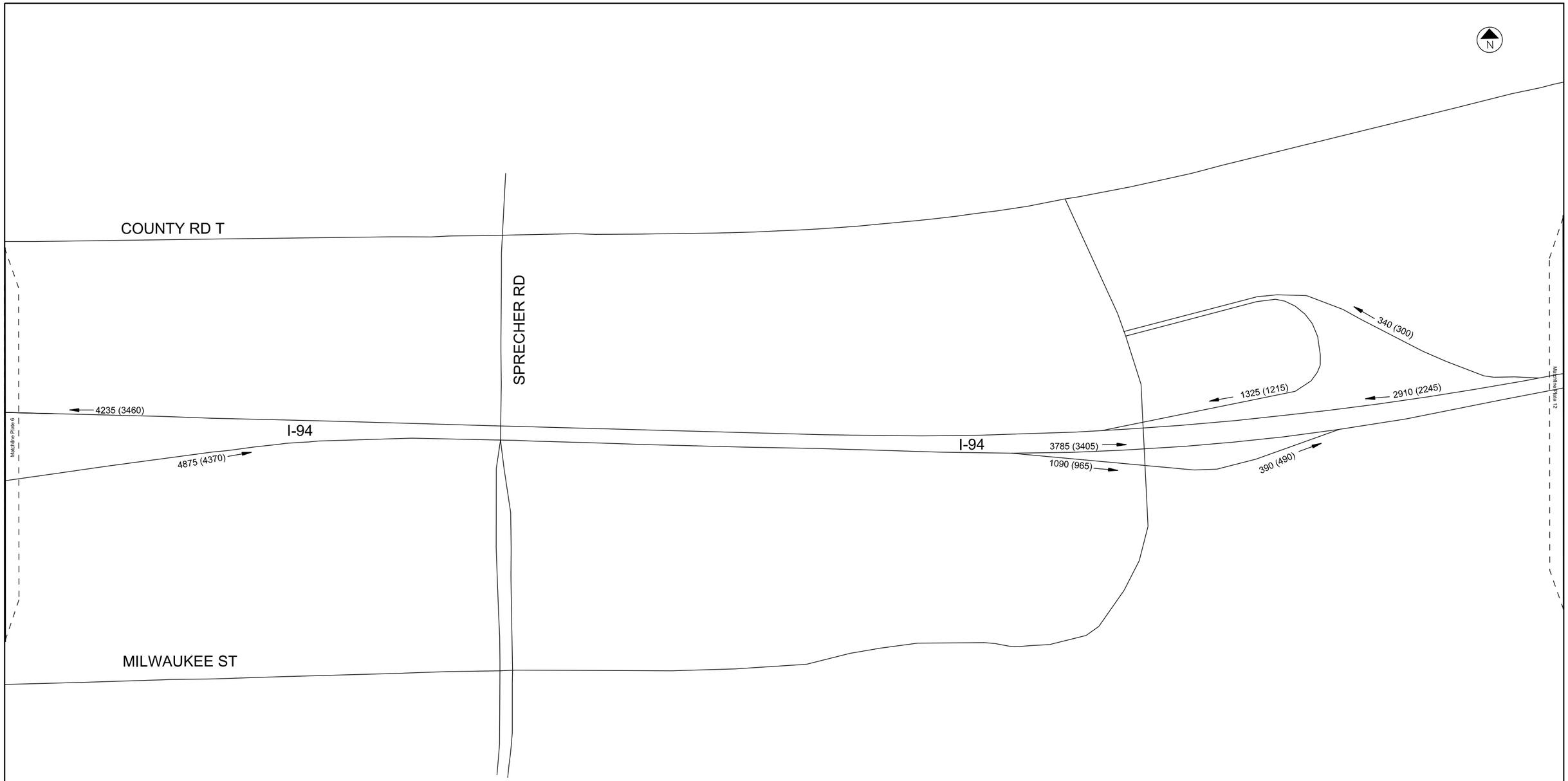
I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 10 OF 12	
MAY 2024	*NOT TO SCALE*
HNTB	



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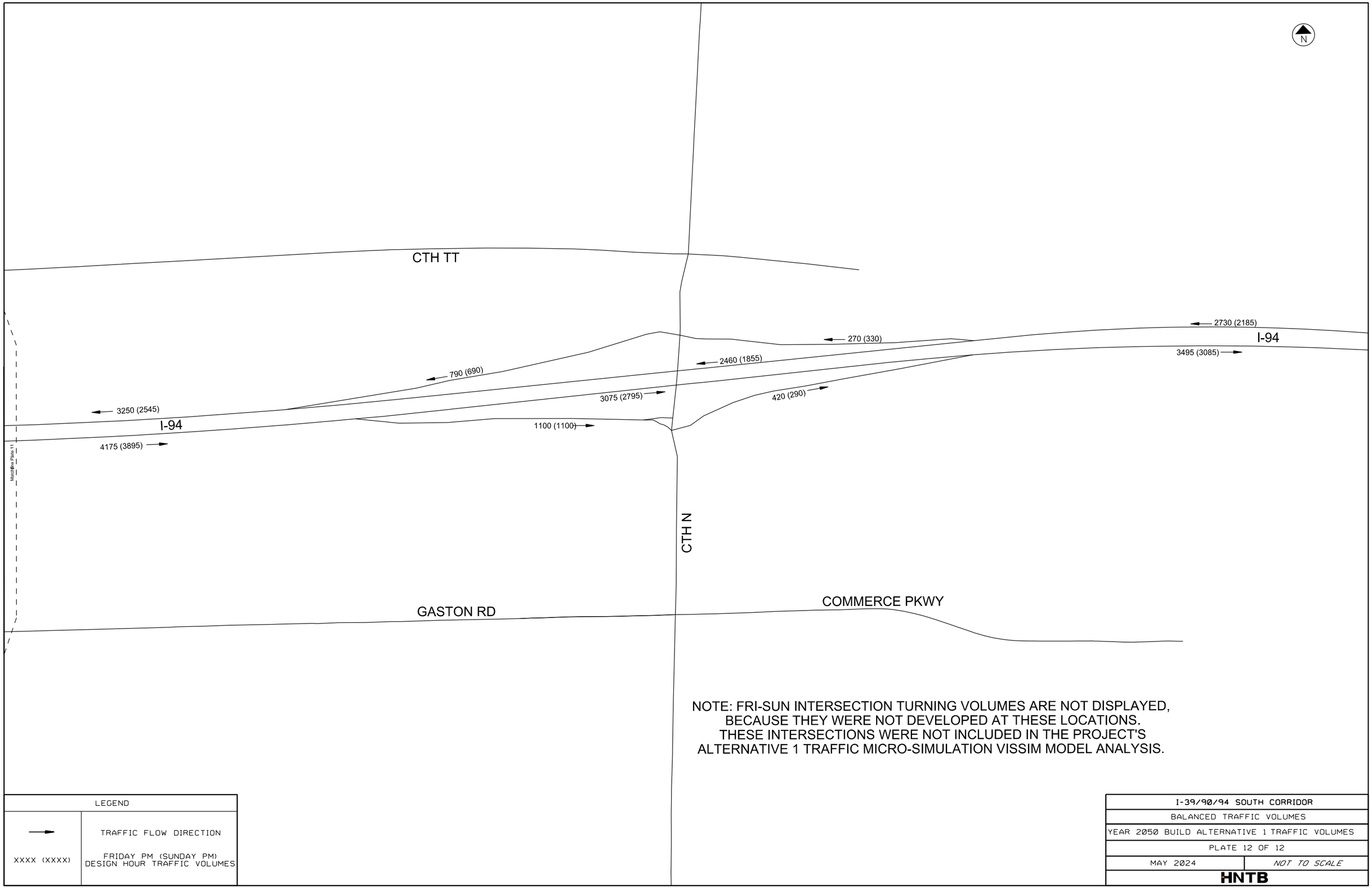
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 11 OF 12	
MAY 2024	*NOT TO SCALE*
HNTB	



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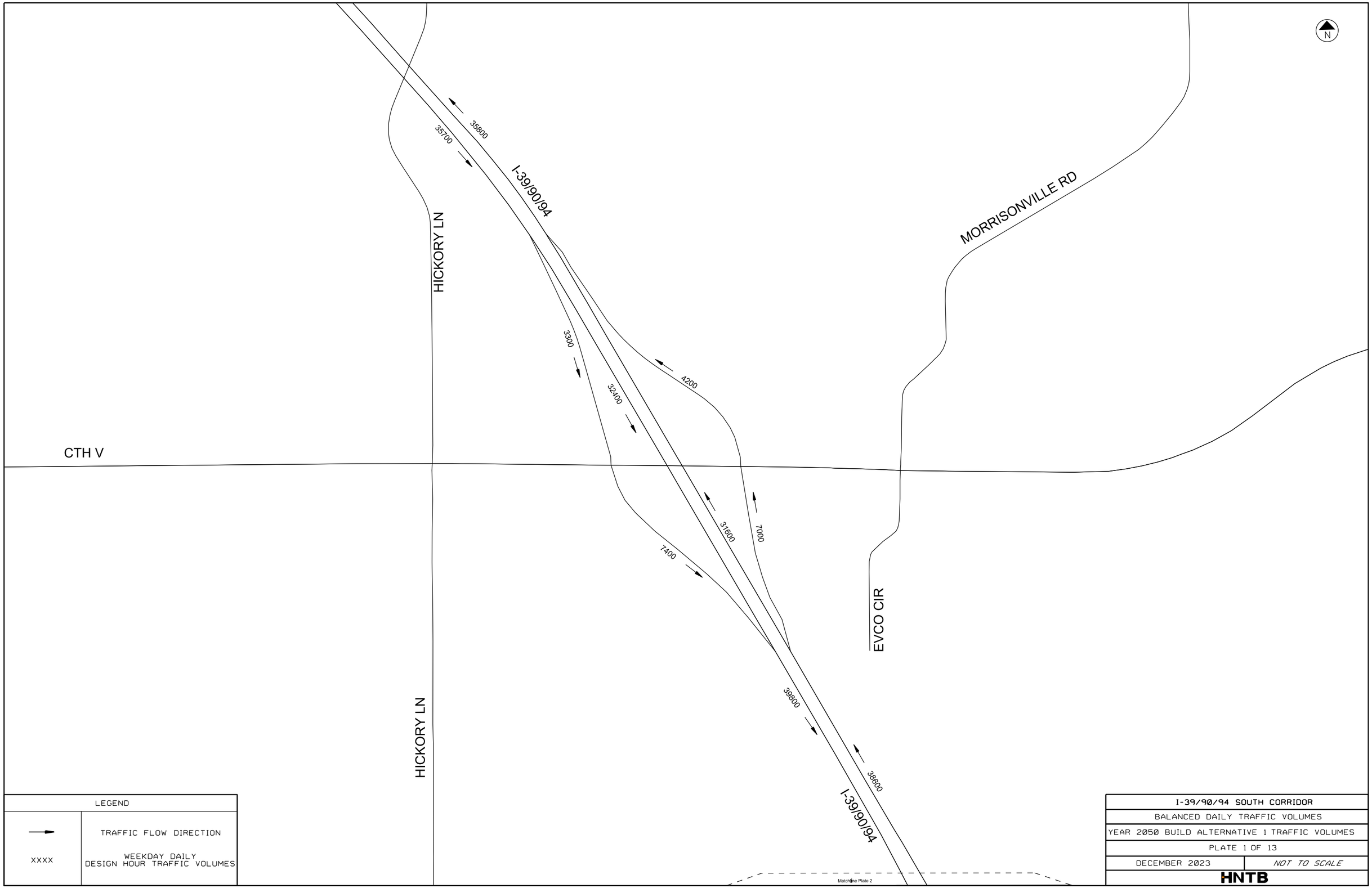
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX (XXXX)	FRIDAY PM (SUNDAY PM) DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 12 OF 12	
MAY 2024	*NOT TO SCALE*
HNTB	


N
I-39/90/94
35800
35700
HICKORY LN
MORRISONVILLE RD
3300
4200
32400
CTH V
31600
7000
7400
EVCO CIR
39800
38600
I-39/90/94
HICKORY LN
Matchline Plate 2
LEGEND
TRAFFIC FLOW DIRECTION
XXXX
WEEKDAY DAILY
DESIGN HOUR TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED DAILY TRAFFIC VOLUMES
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES
PLATE 1 OF 13
DECEMBER 2023
NOT TO SCALE
HNTB

Matchline Plate 1

39800

38600

I-39/90/94

3400

3200

36400

TIERNEY XING

DALMORE RD

WIS 19

LIUNA WAY

CTH CV

35400

13400

11200

PEPSI WAY

I-39/90/94

47600

48800

Matchline Plate 4

Matchline Plate 3

N

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	WEEKDAY DAILY DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR

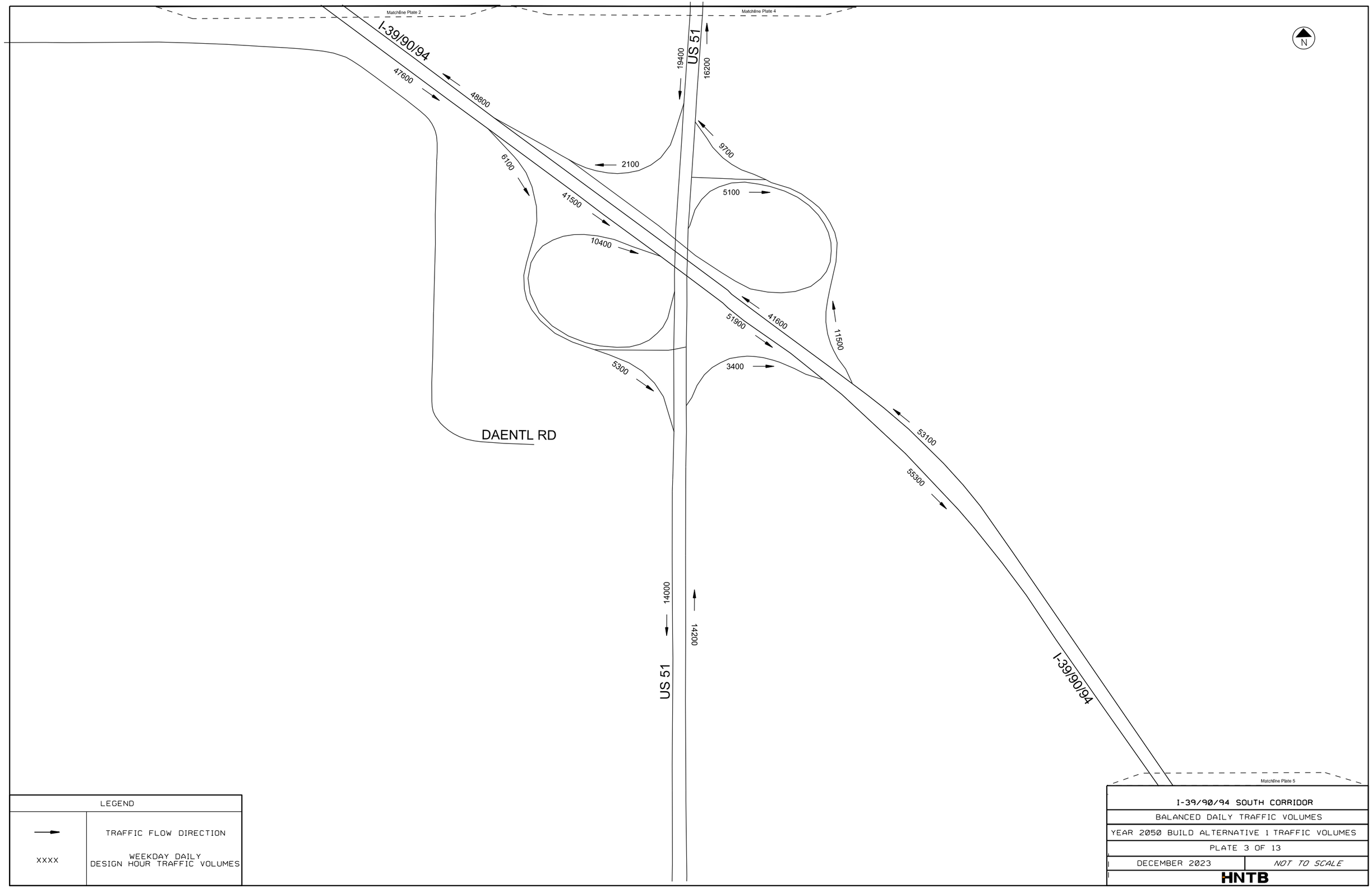
BALANCED DAILY TRAFFIC VOLUMES

YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES

PLATE 2 OF 13

DECEMBER 2023 | *NOT TO SCALE*

HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	WEEKDAY DAILY DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR

BALANCED DAILY TRAFFIC VOLUMES

YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES

PLATE 3 OF 13

DECEMBER 2023 | *NOT TO SCALE*

HNTB

N

N TOWNE RD

US 51

15200

13600

4000

11200

3900

WIS 19

Matchline Plate 2

7400

9700

5400

18600

15100

US 51

WILLIAMSBURG WAY

METRO DR

Matchline Plate 3

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	WEEKDAY DAILY DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 4 OF 13	
DECEMBER 2023	*NOT TO SCALE*
HNTB	

Matchline Plate 3

55900
53100
4400
5400
50900
47700
5700
6200
56600
53900

HOEPKER RD

PORTAGE RD

I-90/94/39

HANSON RD

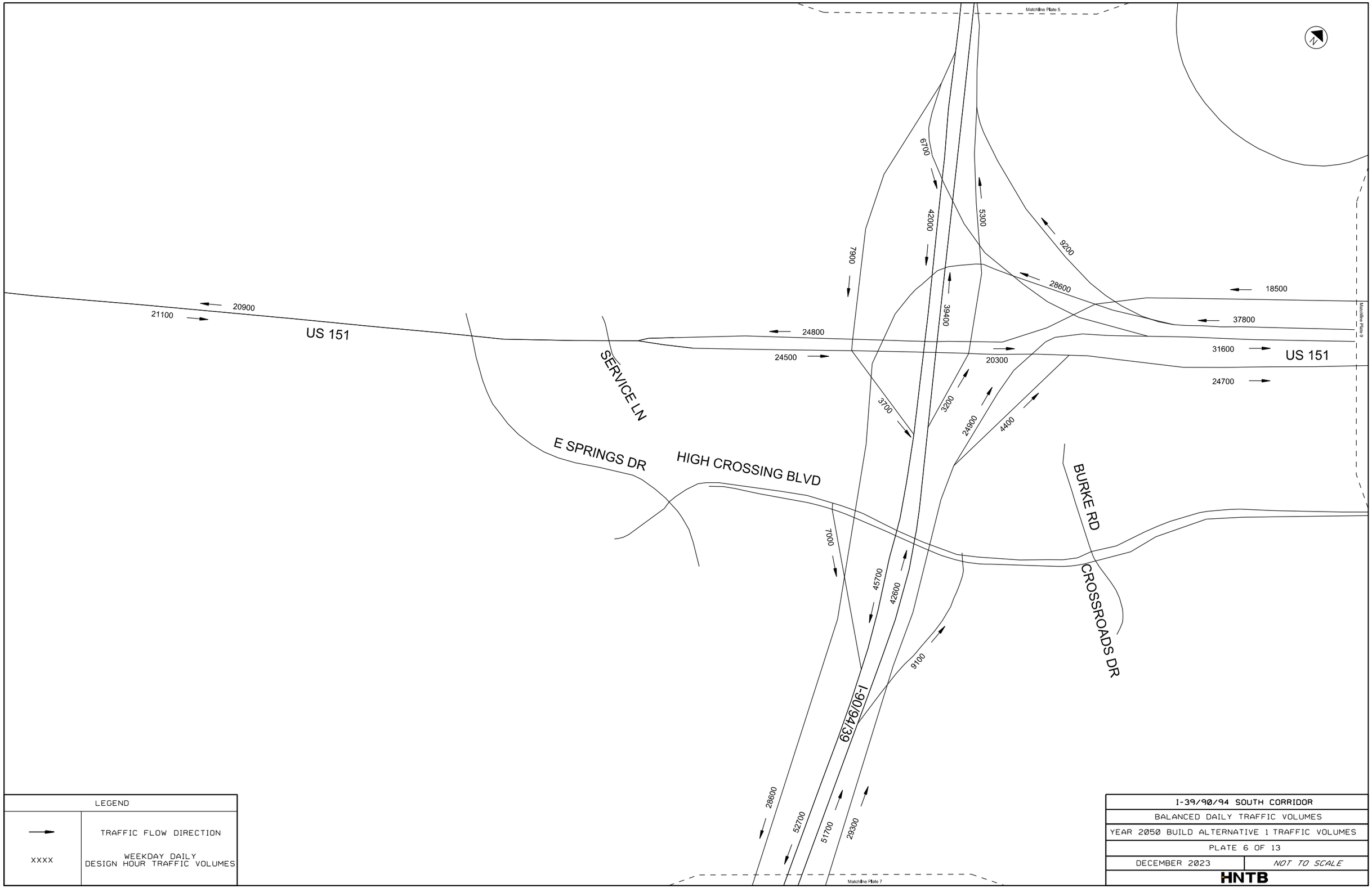
EASTPARK BLVD

Matchline Plate 6

N

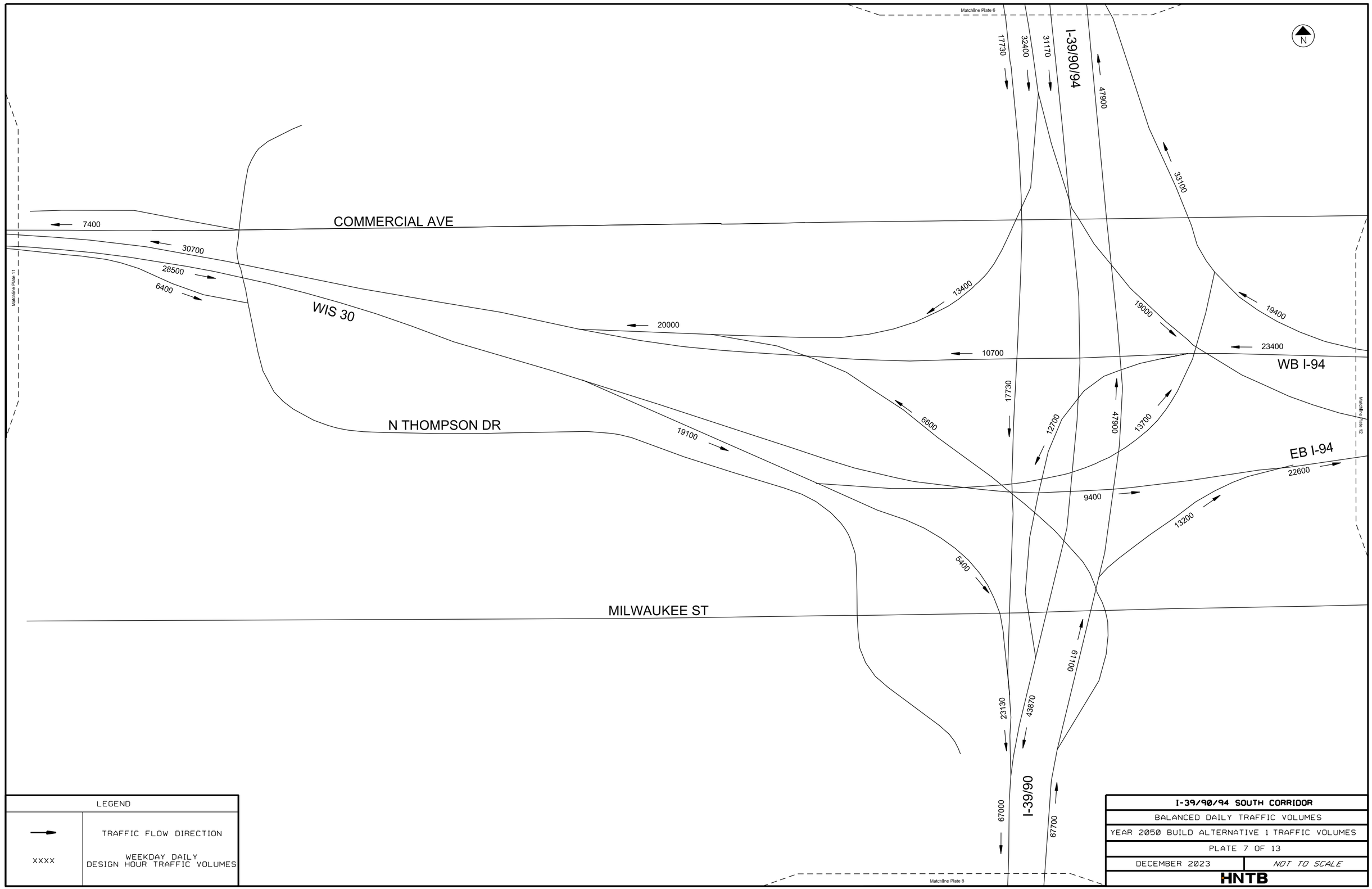
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	WEEKDAY DAILY DESIGN HOUR TRAFFIC VOLUMES

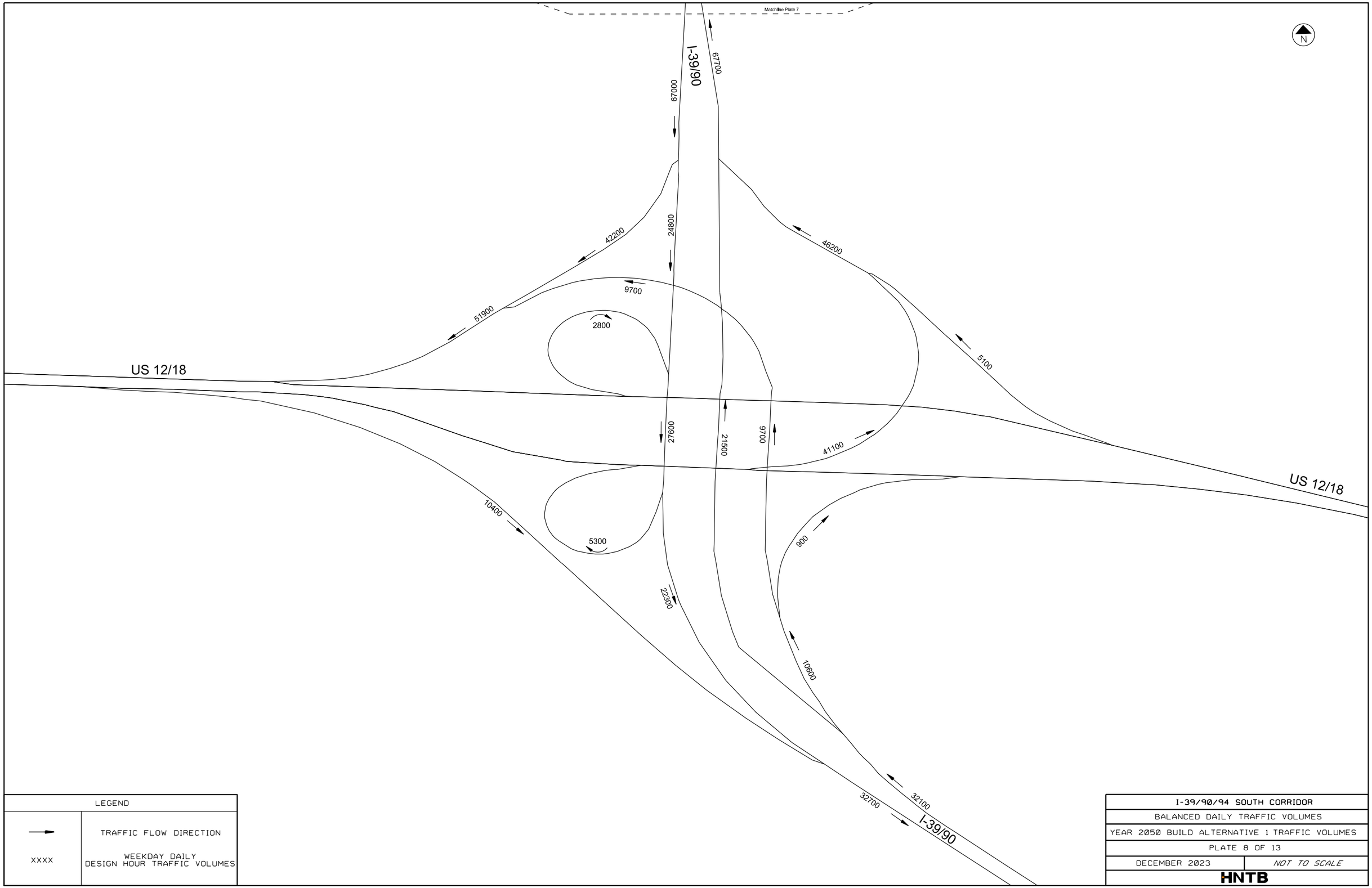
I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 5 OF 13	
DECEMBER 2023	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	WEEKDAY DAILY DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 6 OF 13	
DECEMBER 2023	*NOT TO SCALE*
HNTB	


Matchline Plate 6
Matchline Plate 11
Matchline Plate 12
Matchline Plate 8
N
I-39/90/94
17730
32400
31170
47900
33100
COMMERCIAL AVE
7400
30700
28500
6400
WIS 30
13400
20000
19400
19000
10700
23400
WB I-94
17730
6600
N THOMPSON DR
19100
12700
47900
13700
EB I-94
22600
9400
13200
5400
MILWAUKEE ST
61100
23130
43870
I-39/90
67000
67700
LEGEND
TRAFFIC FLOW DIRECTION
XXXX
WEEKDAY DAILY
DESIGN HOUR TRAFFIC VOLUMES
I-39/90/94 SOUTH CORRIDOR
BALANCED DAILY TRAFFIC VOLUMES
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES
PLATE 7 OF 13
DECEMBER 2023
NOT TO SCALE
HNTB



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	WEEKDAY DAILY DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 8 OF 13	
DECEMBER 2023	*NOT TO SCALE*
HNTB	

AMERICAN PKWY

EASTPARK BLVD

US 151

18500

3200

6500

37800

9200

15300

28600

43900

31600

50400

US 151

24700

11900

43500

50600

12800

7100

HIGH CROSSING BLVD

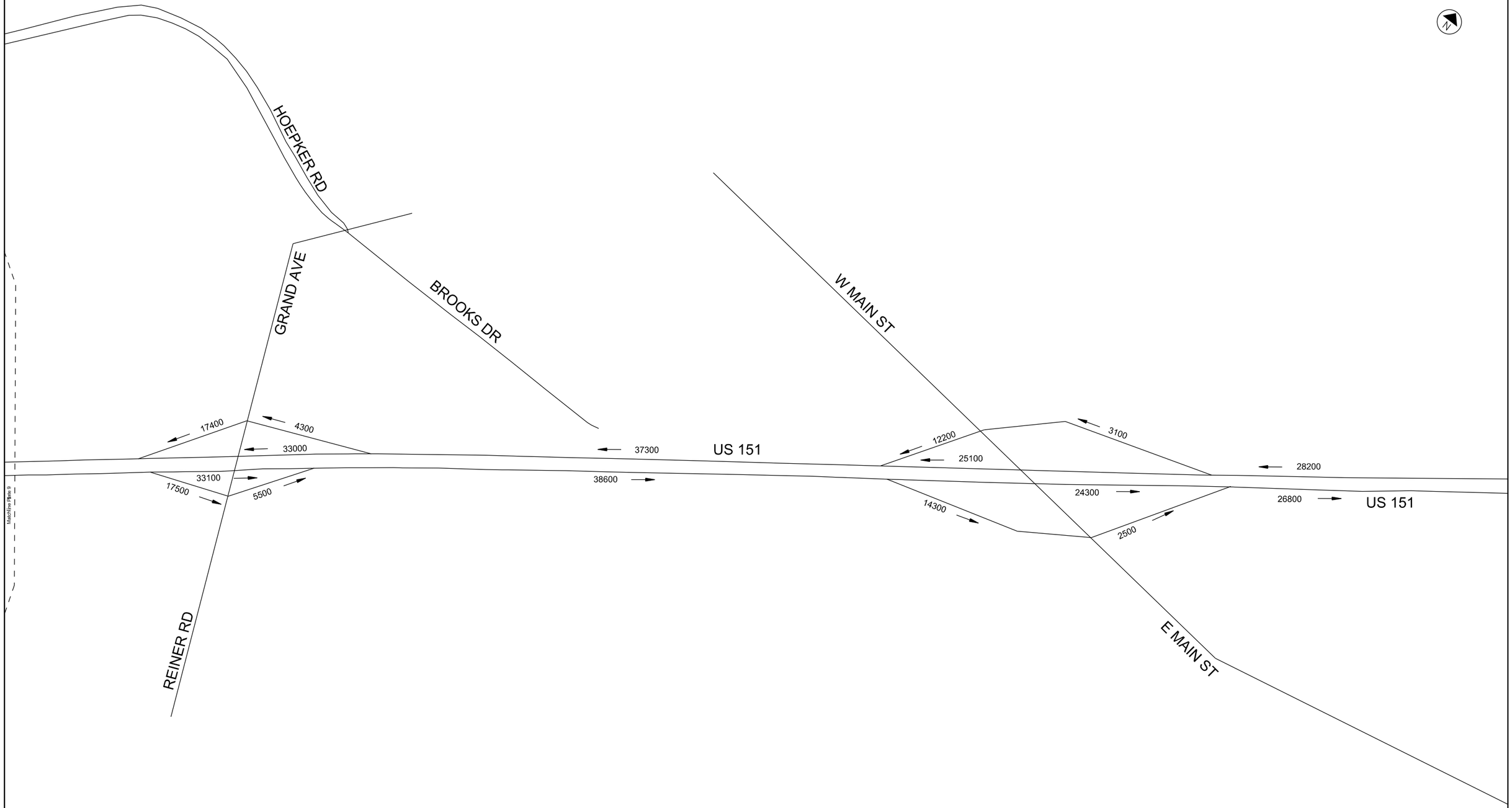
NELSON RD

Matchline Plate 8

Matchline Plate 10

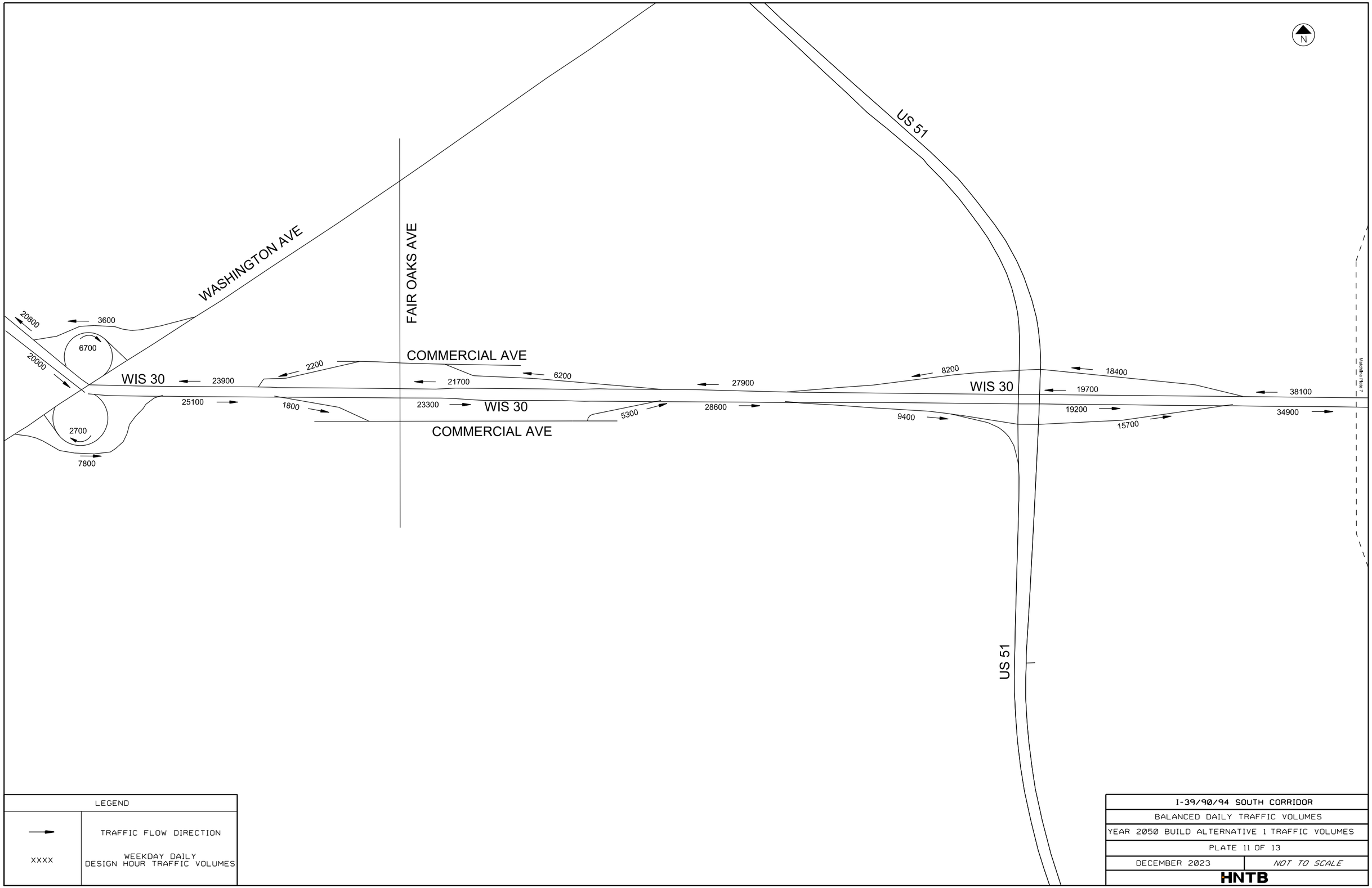
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	WEEKDAY DAILY DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 9 OF 13	
DECEMBER 2023	*NOT TO SCALE*
HNTB	



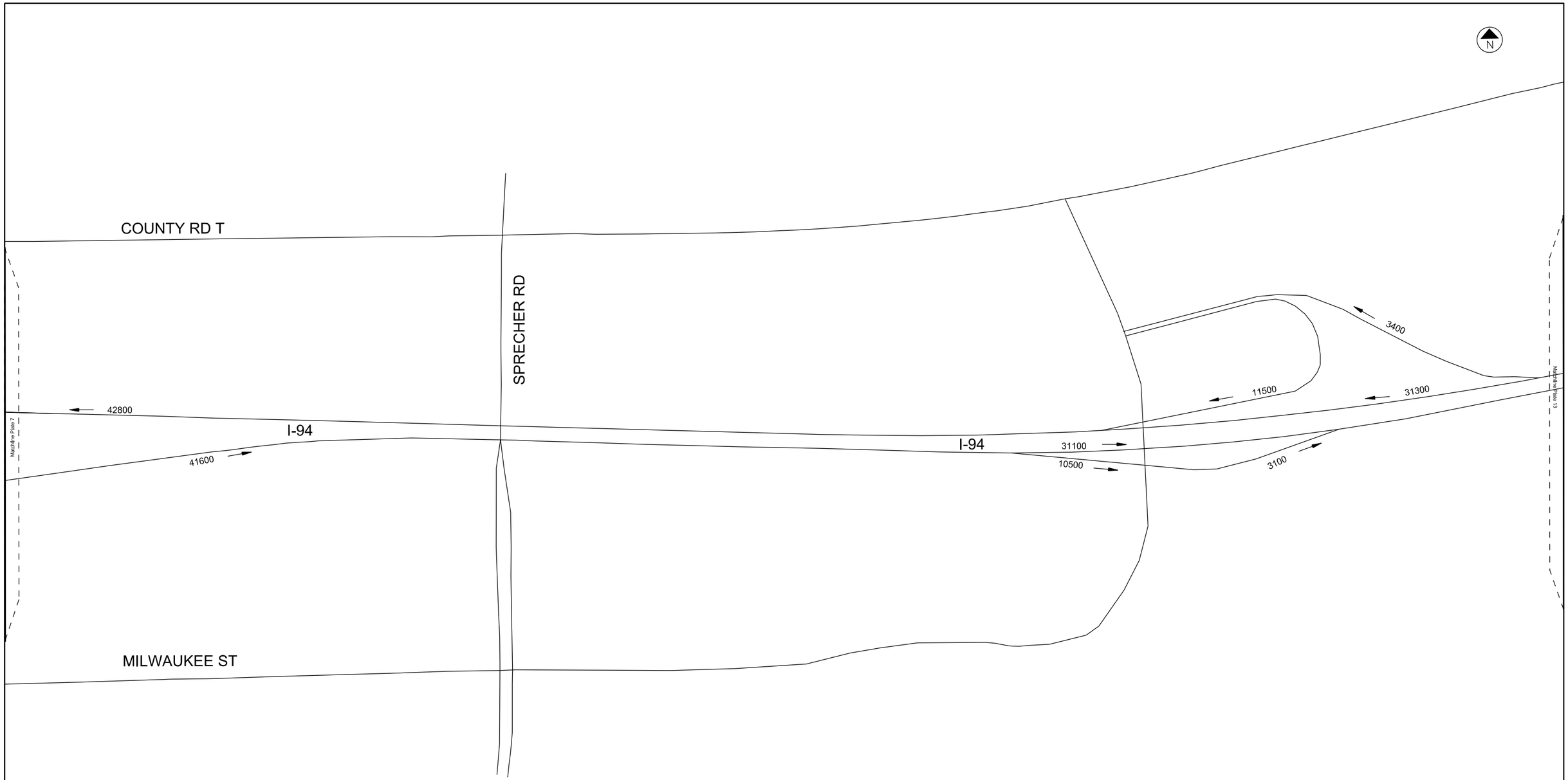
LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	WEEKDAY DAILY DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 10 OF 13	
DECEMBER 2023	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	WEEKDAY DAILY DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 11 OF 13	
DECEMBER 2023	*NOT TO SCALE*
HNTB	



LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	WEEKDAY DAILY DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 12 OF 13	
DECEMBER 2023	*NOT TO SCALE*
HNTB	

N

CTH TT

28200

I-94

28200

2400

25800

8900

25400

2800

34700

I-94

8800

34200

Match line Plate 12

CTH N

GASTON RD

COMMERCE PKWY

LEGEND	
→	TRAFFIC FLOW DIRECTION
XXXX	WEEKDAY DAILY DESIGN HOUR TRAFFIC VOLUMES

I-39/90/94 SOUTH CORRIDOR	
BALANCED DAILY TRAFFIC VOLUMES	
YEAR 2050 BUILD ALTERNATIVE 1 TRAFFIC VOLUMES	
PLATE 13 OF 13	
DECEMBER 2023	*NOT TO SCALE*
HNTB	

MEMORANDUM

Safety Analysis Methodology

Date:	November 21, 2022
Topic:	Safety Analysis Methodology
From:	CDMCT

1. Introduction

This document is intended to provide guidance of project specific IHSDM predictive safety models to be developed as part of the Interstate 39/90/94 (I-39/90/94) and Stoughton Road (United States Highway 51 [US 51]) studies and coordinated by the corridor manager.

2. IHSDM Software Version

The Interactive Highway Safety Design Model (IHSDM) software should be used for the predictive safety analysis. The software version and configuration files should remain consistent across models.

- Software version
  - Use IHSDM version 16 for model development and analysis
- Configuration files
  - Use IHSDM XML configuration files from the (upcoming) August 2022 Facilities Development Manual (FDM) update. This will incorporate 2021 crash rates.
  - The upcoming FDM update may add functionality for IHSDM version 17, but as noted above version 16 should be used.

3. IHSDM Modeling Standards

Basic guidelines for IHSDM modeling are outlined in this section. The analysis years and model input methods should remain consistent across models. Some specific non-traditional situations are also defined in this section, if other non-traditional elements arise guidance will be added.

- Analysis years
  - 10-year analysis, starting with the one year after construction is complete.
  - 20-year analysis shall also be conducted to provide further insight into benefit-cost analysis.
  - IHSDM will interpolate between any two values to determine the interim year volumes.
  - Design teams shall interpolate between build forecast volumes to be accurate, do not interpolate between a no build and build volume CDMCT to provide No Build and Build growth rates as defined below.
- Empirical-Bayes (EB) Method

    - EB Method will not be used for this project
- Non-traditional interchanges with IHSDM (if needed)
    - Use calibrated models and apply crash modification factors (CMF)
    - Diverging Diamond Interchanges (DDI) should be modeled as traditional diamond interchange with user defined CMF's (0.374 FI and 0.649 PD) applied at the ramp terminal intersections
    - Single Point Urban Interchanges (SPUI) should be modeled as a traditional diamond interchange with user defined CMF's (0.62 Total) applied for both ramp terminal intersections.
    - Approaches for modeling other non-traditional interchanges or intersections should be coordinated with Bureau of Traffic Operations (BTO)
- Rumble strips
    - It is assumed the existing model will include rumble strips where they are present in the field. Rumble strips are denoted in the shoulder inputs and shall be included within the model using the rumble strip checkbox.
    - If locations within the corridor exist without rumble strips and rumble strips are being introduced as part of the project as part of alternatives analyses, then the IHSDM model should be set up without using the rumble strip checkbox but rather utilize crash modification factor 3422[1].
- High volume hour calculations
    - There is a built-in function to calculate high volume hour sections, but this does not consider the unique volume profile seen in this corridor. For this reason, the high volume hour sections should be calculated outside of IHSDM and then imported.
    - This corridor has peaks during the Summer on Friday and Sunday, a volume profile should be used to calculate the proportion of high volume hours. This profile will be derived by segment teams from continuous count data provided by the corridor manager.
    - This data is defined based on station range. The station ranges should match those of the average daily traffic (ADT) as well as where the number of through lanes change.
    - IHSDM does not count auxiliary lanes as through lanes for this calculation. These lanes should be designated as acceleration or deceleration lanes in the model, a specific 'auxiliary' designation is not currently available.
- Model development and coding
    - Models may be developed using either a location based methodology or a Site Set methodology for ramp terminal intersections. Terminals that are anticipated to have alternatives that move the center point of the intersection by more than 100 feet should consider using location based analysis to capture the safety benefits in the reconstructed area.
    - A clear zone width of 30' should be used.

[1] *https://www.cmfclearinghouse.org/detail.cfm?facid=3422. Accessed November 2022.*

  - Alignments and cross sections will be developed by the segment's design team, for all build alternatives and the base condition.
  - A request was put in by the geometrics team for any available alignments from past projects, which will be pieced together for IHSDM by the design teams.
  - Profiles can be struck as vertical is not an applicable CMF in the freeway mainline Highway Safety Model (HSM) methods.
  - ADT's and projected growth rates will be provided by the corridor manager.
- Model review
  - Design teams shall submit existing crash analysis, IHSDM model inputs, IHSDM result summaries, and the design recommendation.

4. Safety Analysis Documentation Requirements

A signed safety certification document (SCD) is not a requirement for the corridor analysis because the project is a reconstruction with capacity expansion. In place of the SCD, a safety technical memorandum is to be completed for each project segment. The memorandum should cover key components of the SCD and include the following sections:

1) Network Screening of Safety Sites of Promise
   a. Develop a report from the Safety Certification Mapping (SCM) tool for segments. Segment teams shall access through WisTransPortal.
   b. Develop readable maps and tables that highlight project segments with crash rate flags.
2) Diagnosis of Safety Sites of Promise
   a. Develop tables, maps, and/or charts that summarize existing crash trends in the corridor using 2017-2021 crash data. The crash data for 2021 has been published on WisTransportal.
      i. Segment teams to obtain crash data from WisTransportal.
      ii. The crash vetting spreadsheet is not a requirement.
      iii. The review of individual crash reports is not a requirement.
      iv. Intersection crash diagrams are not required for the overall segment safety analysis. Each intersection will be further evaluated during the Intersection Control Evaluation (ICE) process.
      v. The total number of animal crashes shall be noted in the safety documentation. The animal crashes will be removed from all subsequent analysis.
3) Countermeasure identification
   a. The Safety Certification Worksheet (SCW) is not required, as it may be cumbersome for this project. The design teams are encouraged to use a format that best conveys existing safety concerns and how the build alternatives mitigate these issues.
4) Safety Evaluation of Alternatives using IHSDM predictive analysis.

a. Include predictive crash summaries by each severity type and total crash costs for the No Build and Build alternatives. Use the most current version of crash costs available as detailed within FDM 11-38.
b. Provide a summary table which should be formatted to allow for direct comparison of sub-corridor alternatives. For instance, interchange alternatives should be separated from mainline alternatives.
c. A benefit costs analysis should be completed using the IHSDM Economic Analysis Module. This analysis will be based on the predictive crash analysis years, which in this case is both 10 and 20 years.

MEMORANDUM

VISSIM Analysis Methodology

Date:	July 8, 2022
Topic:	VISSIM Analysis Methodology
From:	CDMCT

1. Introduction

This document is intended to provide guidance of project specific VISSIM microsimulation models to be developed as part of the Interstate 39/90/94 (I-39/90/94) and Stoughton Road (United States Highway 51 [US 51]) studies and coordinated by the corridor manager. There are four project teams that will be developing project specific VISSIM models:

- I-39/90/94 North Segment
- I-39/90/94 South Segment
- US 51 North/Central Segment
- US 51 South Segment

In general, guidance and processes described in the Wisconsin Department of Transportation's (WisDOT) Traffic Engineering and Operations Safety Manual (TEOpS) Chapter 16 will be followed by all project teams. This document provides more detailed guidance on specific VISSIM model inputs, methodologies, and assumptions specific to these study corridors for consistency and ease of model peer review and acceptance. Any model inputs or parameters not discussed as part of this document shall follow guidance from TEOpS Chapter 16.

The use of VISTRO or Synchro shall follow guidance from TEOpS Chapter 16 when analyzing the operations of intersections or as a supplement to aid in signal timing updates to support VISSIM.

This version of this document (version 1 – dated 7/8/2022) is intended to provide a high level overview of items that will be expanded on as part of a subsequent version and allow the project teams, WisDOT staff, and others as needed to review and provide feedback.

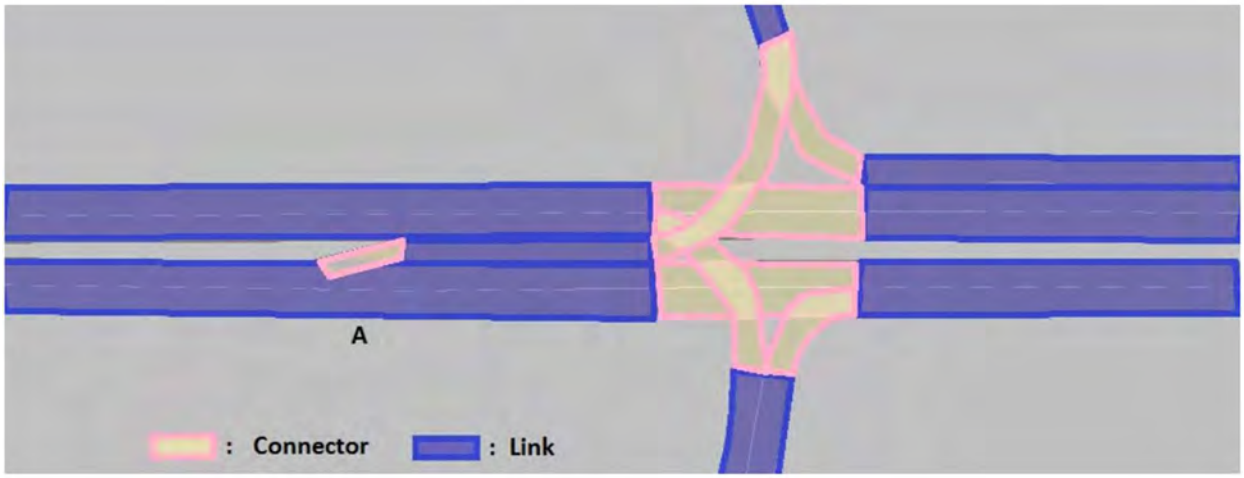
2. Software Version and Base Network

- All project and peer review teams to utilize the same version of VISSIM throughout the duration of the study
- I-39/90/94 south segment utilized VISSIM version 2020 SP10; recommend utilization of the same version for I-39/90/94 north segment and US 51 segments
  - Note that WisDOT now supports VISSIM version 2022 SP04 as of 4/21/2022
- All segment models to utilize the WisDOT base file to begin model development
  - Identifies Wisconsin specific vehicle fleet, distributions, and default speed profiles

3. Model Geometrics and Coding

- Ramp merge/diverge
  - I-39/90/94 models shall utilize "parallel" style ramp coding technique
    - Acceleration and deceleration lane shall be coded to encompasses the full length of the taper
- Intersection turn lanes
  - See recommended intersection coding technique as shown in Figure 1

Figure 1: Intersection Coding Example



Source: WSDOT Protocol for VISSIM Simulation (Figure 9 – page 37, report page 28)

- I-39/90/94 models shall include ramp terminal intersections at locations where the ramp terminal may impact operations of the mainline. See Section 5 for specific location details.
- Reduced speed areas shall be placed associated with advisory speeds on ramps and on connectors at intersections for left and right turn movements
- Desired speed decision points shall be placed associated with signed speed limits in the field

4. Driving Behaviors

- I-39/90/94 models:
  - Utilize Wiedemann 99 car following model for basic segments and cooperative behaviors (merge/weaves), and adjust behavior parameters as needed (see TEOpS 16-20 Attachment 6.3 for recommended ranges)
  - Utilize Wiedemann 74 for ramp terminal intersections
- US 51 models:

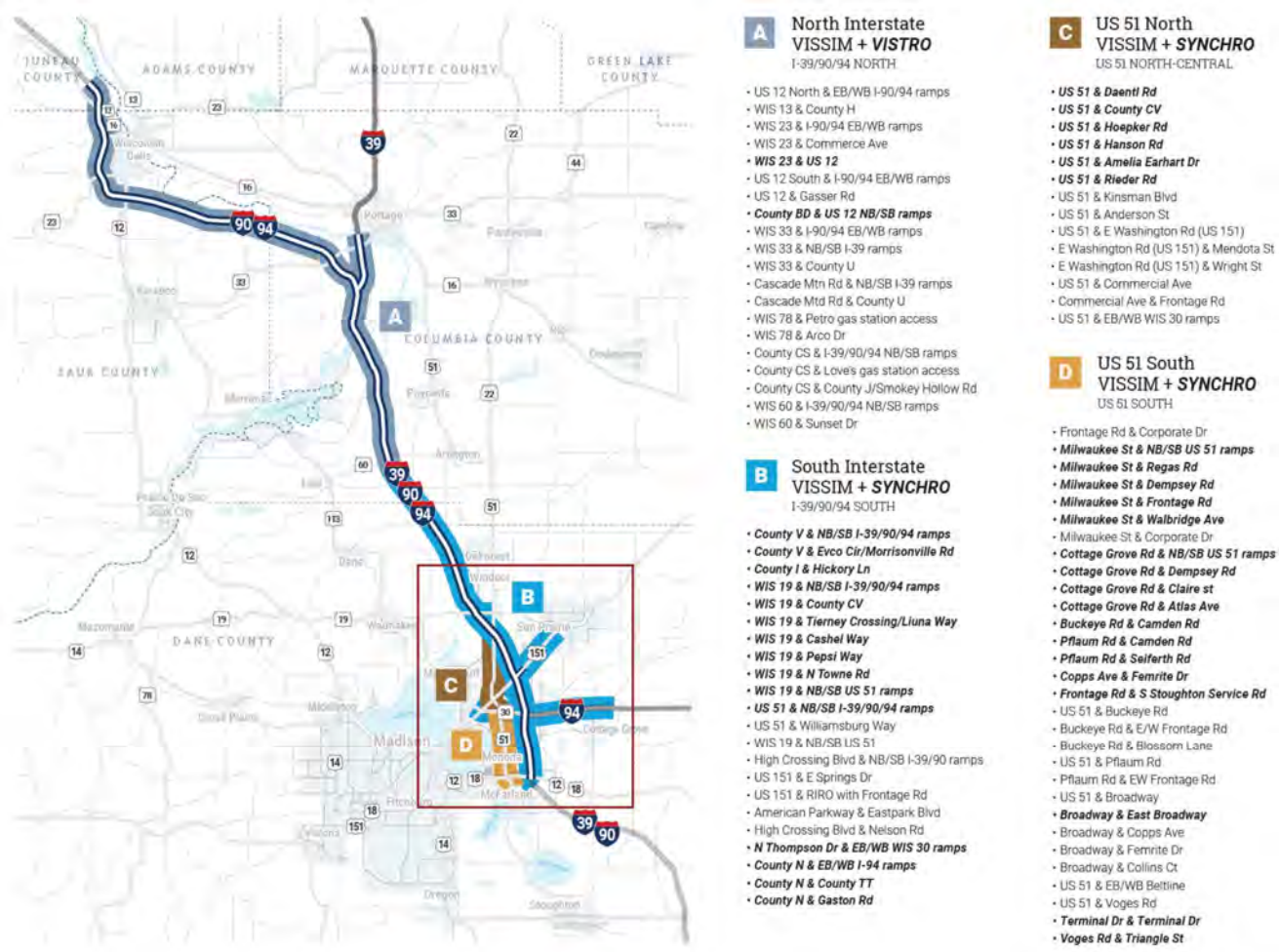
- Utilize Wiedemann 74 car following model and adjust behavior parameters as needed (see TEOpS 16-20 Attachment 6.3 for recommended ranges)

5. Spatial Limits

Spatial limits for each project team have been defined using a shared Google Earth kmz developed by the corridor manager. Figure 2 below shows the overall layout of the limits of the four design segment's VISSIM models.

- The Interstate north and south segment limits are separated by the approximate seven-mile gap between CTH V and STH 60 interchanges. The Interstate north team will include the STH 60 interchange.
- The Interstate south segment will include the US 51 interchange ramps, excluding the ramp terminals. The Interstate south segment will also include STH 30 west of the Interstate excluding the US 51 ramp terminals.
- The US 51 north and central segment VISSIM model will include the intersections with US 151 and STH 30. The ramp gores and mainline operations of STH 30 will be analyzed by the Interstate south team. The US 51 north and central segment VISSIM model includes the mainline US 51 segment south of WIS 30 including the northern ramp gores but terminates north of the interchange of US 51 with Milwaukee Street and does not include the Milwaukee Street intersections.
- The US 51 south segment VISSIM model limits extend from the Buckeye Road interchange south through the Beltline interchange and terminate at the Voges/Terminal Drive intersection. The Cottage Grove Road and Milwaukee Street interchanges will be modeled utilizing deterministic software and will follow HCM7 methodologies. The US 51/Stoughton Road mainline and the interchange merge and diverge areas will be modeled in HCS and the intersections along Cottage Grove Road and Milwaukee Street will be modeled in Synchro. Substantial operational issues were not found in the previous study along US 51/Stoughton Road at these interchanges and the alternatives for the current study are not anticipated to need microsimulation to effectively analyze the operations in and around these interchange areas. An example would be with US 51/Stoughton Road southbound at the Cottage Grove Road interchange, which was recently reconstructed and is unlikely to change.

Figure 2: VISSIM Model Spatial Limits



Based on discussions on May 18, 2022 with FHWA staff, the determination to include specific intersections within the VISSIM model shall rely on analysis to verify there are no adverse impacts from the intersection's operations on the mainline lanes. Each project team shall provide documentation detailing the factors used to exclude ramp terminal or adjacent intersections from the VISSIM models. A summary is available below by analysis segment and a map is shown in Figure 2. Figure 3 through Figure 6 show the complex areas in the Madison area that have adjacent or overlapping analysis limits.

- The Interstate north VISSIM model includes the following intersections:
  - WB I-90/94 ramp terminal at US 12 (north)
  - EB I-90/94 ramp terminal at US 12 (north)
  - WIS 13 and CTH H

- WB I-90/94 ramp terminal at WIS 23
- EB I-90/94 ramp terminal at WIS 23
- WIS 23 and Commerce Avenue
- US 12 (south) and Gasser Road
- WB I-90/94 ramp terminal at US 12 (south)
- EB I-90/94 ramp terminal at US 12 (south)
- WB I-90/94 ramp terminal at WIS 33
- EB I-90/94 ramp terminal at WIS 33
- NB I-39 ramp terminal at WIS 33
- SB I-39 ramp terminal at WIS 33
- WIS 33 & CTH U
- NB I-39 ramp terminal & Cascade Mtn Rd
- SB I-39 ramp terminal & Cascade Mtn Rd
- Cascade Mtn Rd & County U
- WIS 78 & Petro gas station access
- WIS 78 & Arco Dr
- WB I-39/90/94 ramp terminal at CTH CS
- EB I-39/90/94 ramp terminal at CTH CS
- CTH CS & Love's gas station access
- CTH CS & CTH J/Smokey Hollow Rd
- WB I-39/90/94 ramp terminal at WIS 60
- EB I-39/90/94 ramp terminal at WIS 60
- WIS 60 & Sunset Dr

- Interstate South VISSIM model includes the following intersections:
  - SB I-39/90/94 ramp terminal at WIS 19
  - US 51 & Williamsburg Way
  - WIS 19 & NB US 51 ramp terminal
  - WIS 19 & SB US 51 ramp terminal
  - US 151 (East Washington Avenue) right-in, right-outs with Frontage Road/Annamark Drive
  - US 151 and East Springs Drive
  - American Pkwy and Eastpark Drive
  - Nelson Rd and High Crossing Boulevard
  - SB I-39/90/94 ramp terminal at High Crossing Boulevard
  - NB I-39/90/94 ramp terminal at High Crossing Boulevard

- US 51(Stoughton Road) North VISSIM model includes the following intersections:
  - US 51 and Kinsman Boulevard
  - US 51 and Anderson Street
  - US 51 and US 151 (East Washington Avenue)
  - US 151 and Mendota Street
  - US 151 and Wright Street
  - US 51 and Commercial Avenue
  - Commercial Avenue/Lexington Street/Service Road intersection
  - WB STH 30 ramp terminal at US 51
  - EB STH 30 ramp terminal at US 51
- US 51 (Stoughton Road) South VISSIM model includes the following intersections:
  - US 51 and Buckeye Road
  - Buckeye Road and West Frontage Road
  - Buckeye Road and East Frontage Road
  - US 51 and Pflaum Road
  - Pflaum Road and West Frontage Road
  - Pflaum Road and East Frontage Road
  - US 51 and Broadway
  - Broadway and Copps Avenue
  - Broadway and Femrite Drive/Collins Court/Service Drive
  - WB US 12/18 (Beltline) ramp terminal at US 51
  - EB US 12/18 (Beltline) ramp terminal at US 51
  - US 51 and Terminal Drive/Voges Road
  - Terminal Drive intersection
  - Voges Road and S Dutch Mill Road/Triangle Street

Figure 3: STH 19/US 51 Study Intersections

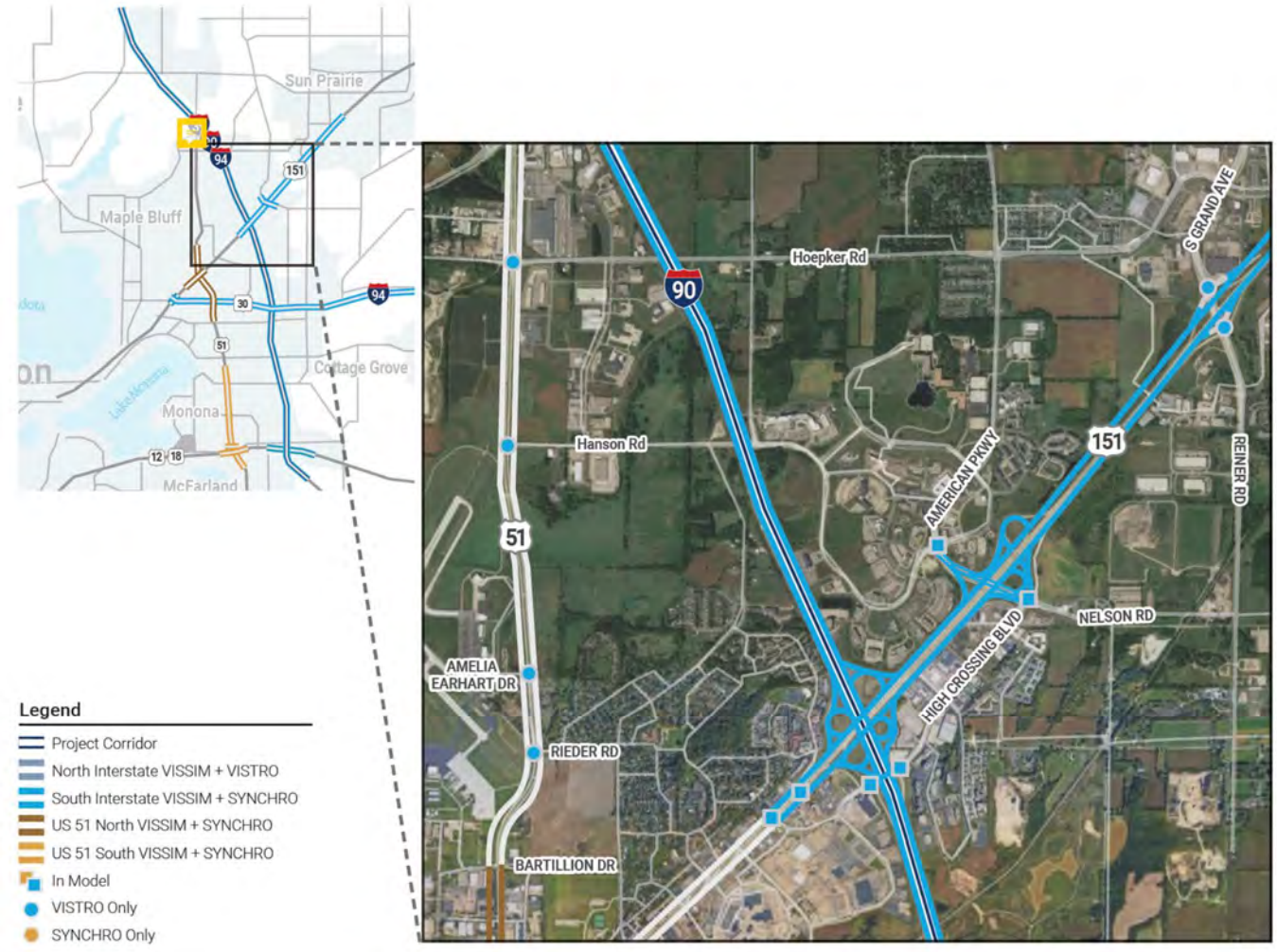


Figure 4: US 151 Study Intersections

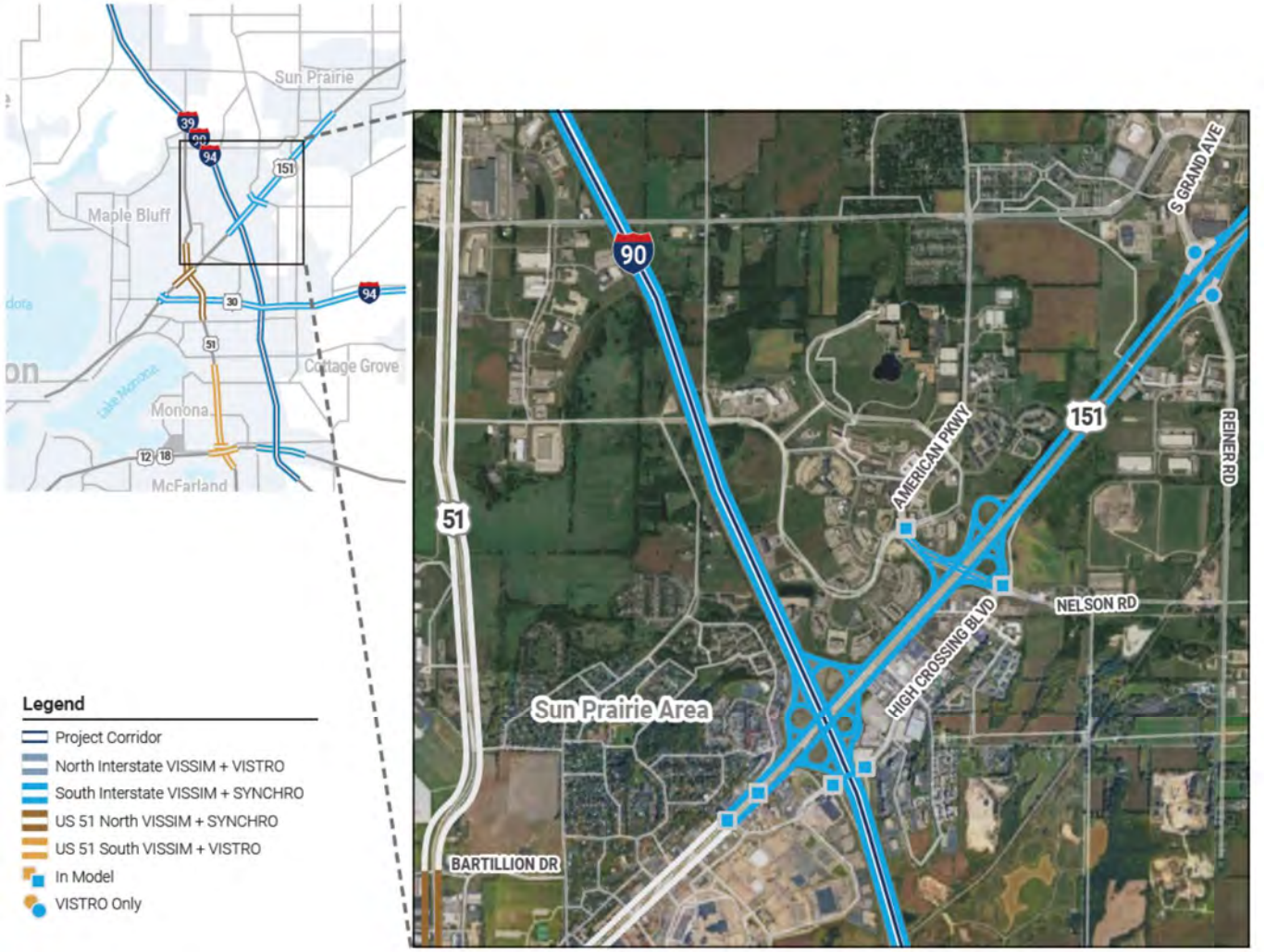


Figure 5: US 51 at East Washington and STH 30 Study Intersections

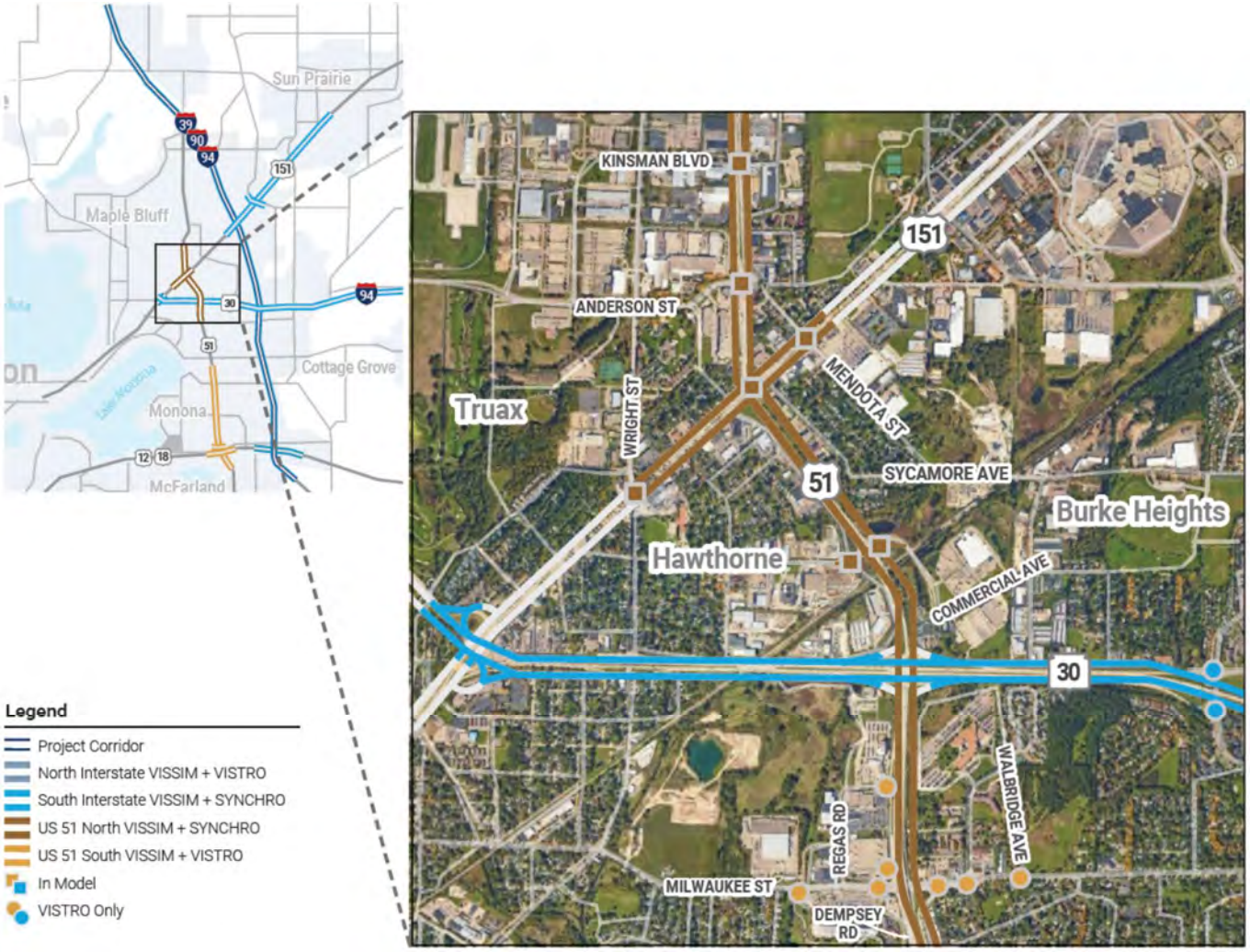
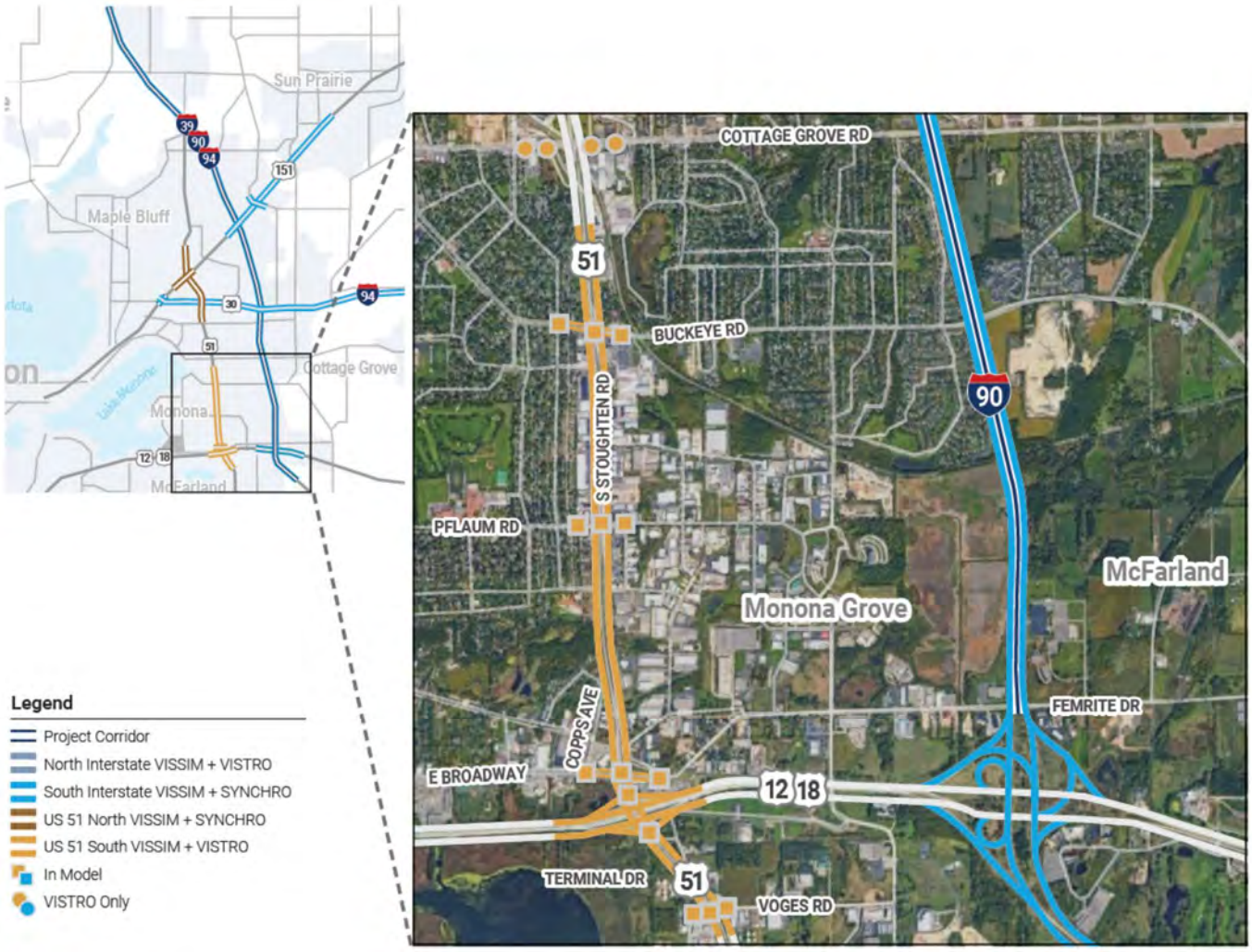


Figure 6: South Stoughton Road intersections



6. Typical Day Clusters and Temporal Limits

The traffic counts and travel times that represent a 'typical day' will be determined for each design segment through a cluster analysis. This process is coordinated through the corridor manager and is described in more detail within the Representative Day Methodology document.

The result of the 'typical day' analysis is a group of days that have similar traffic operational characteristics and form the range of operational metrics including auto and truck volumes, travel times and delays that the VISSIM model is validated to.

Model temporal analysis periods vary for each project team as follows:

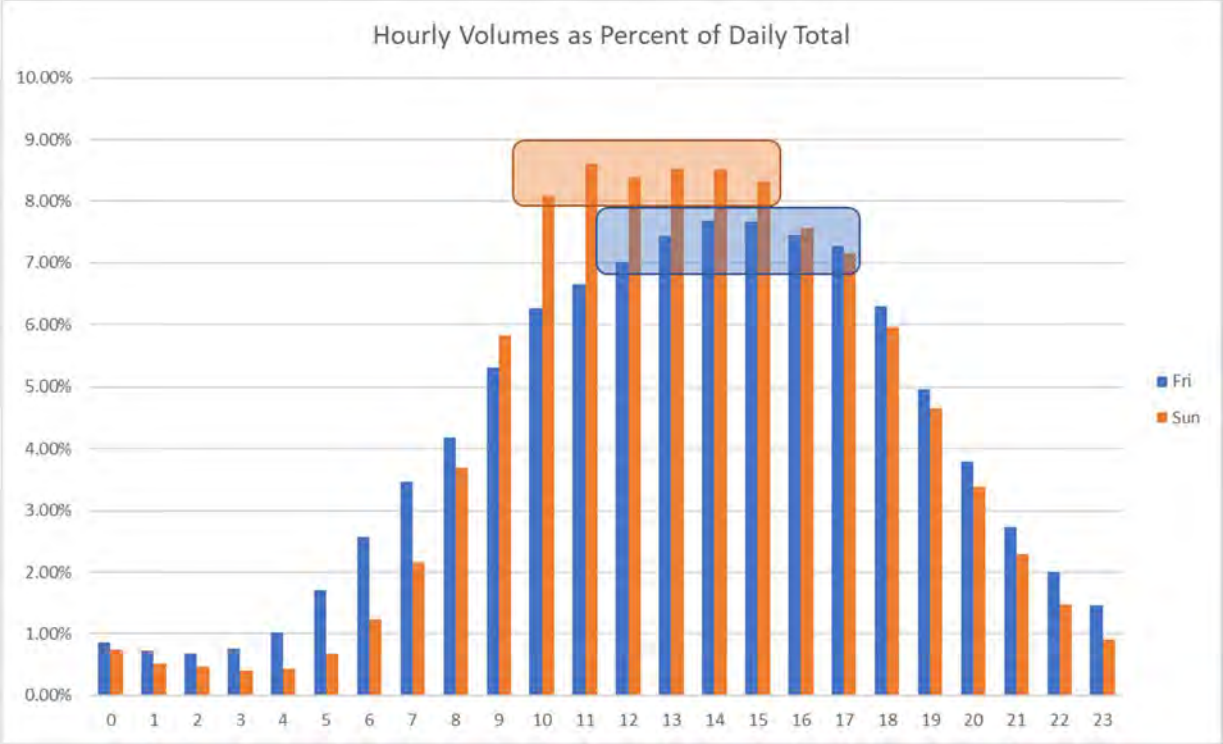
- I-39/90/94 north segment – Friday PM and Sunday PM only
- I-39/90/94 south segment – Weekday AM, Weekday PM, Friday PM, and Sunday PM
- US 51 north/central segment – Weekday AM and PM peak hours only
- US 51 south segment – Weekday AM and PM peak hours only

The exact analysis hours shall be based on continuous count site traffic data (CCS). The period shall encompass the duration of existing congestion or the project team shall provide documentation detailing the factors used to develop a shorter set of analysis hours.

6.1. I-39/90/94 North Segment Temporal Limits

The I-39/90/94 design team evaluated the traffic count data within their specific project limits as shown in Figure 7 and determined the hours of analysis to be Fridays between 12 PM and 6 PM and Sundays between 10 AM and 4 PM. Additional details regarding the determination of the temporal limits is available in the document "Design Considerations and Representative Day."

Figure 7 Hourly Volumes for Interstate North segment



6.2. I-39/90/94 South Segment

Four peak periods as determined by the previous I-90 Madison-Tomah Study and I-90 Vissim are being modeled:

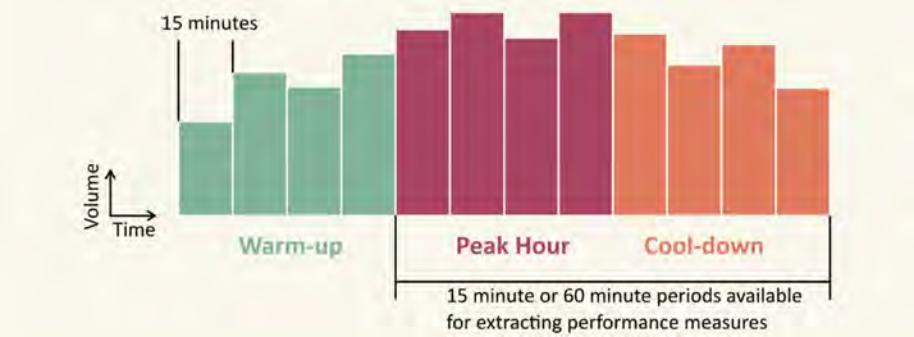
- Weekday AM (6-9 AM)
- Weekday PM (3-6 PM)
- Summer Friday PM (3-6 PM)
- Summer Sunday PM (1-4 PM)

The simulation will include **three hours** (warm-up, peak, and cool-down) for each peak period being evaluated as illustrated in **Figure 8**. The terms “warm-up”, “peak”, and “cool-down” are simply labels for each hour within the simulation; performance measures can be extracted anytime after the warm-up is complete. The longest end-to-end distance within the south segment limits suggests that approximately the first 30 to 60 minutes of the simulation is the “warm-up” time required before volumes in the model reflect peak hour conditions.

Field speed heatmap data demonstrates that a three-hour simulation captures existing typical congestion for AM, PM and FRI peak periods. For SUN, the congestion is highly variable in both location and duration. Previous analyses suggested that a 9-10 hour simulation would be needed to cover all future year FRI/SUN congestion. This is; however, neither practical nor useful due to time/budget constraints and the fact that one congested hour looks the same as 10 congested hours.

The Vissim model objective is to estimate the **level** of congestion rather than duration of congestion. A different type of model would be required to estimate the duration of congestion such as a spreadsheet estimate, meso, macro, etc. Additional information is available in the document "Design Considerations and Representative Day."

Figure 8. Example Vissim Simulation Duration and Flow Profile



(for illustration purposes only)

6.3. US North Segment

The US 51 North segment VISSIM analysis includes weekday AM and PM peak hour models. The segment team utilized available Streetlight data to formulate an AM and PM seed matrix to represent the existing traffic distributions along US 51. Ten random seed VISSIM model runs were utilized and the average output of the ten seeds was used for calibration purposes.

6.4. US 51 South Segment

Warm-up and cool down periods shall be incorporated by each project team to include:

- The warm-up period shall be at least double the free-flow travel time from one end of the network to the other
- The cool down period shall be incorporated that adequately models the dissipation of existing congestion

7. StreetLight Data

StreetLight is a data analysis company that processes cellular phone data to estimate the movement of people. StreetLight's data is processed such that individual phone users are not identifiable, thus maintaining privacy. StreetLight data provides subscribers with access to various transportation-specific data elements including custom origin to destination traffic volumes and travel times by specific days and times. StreetLight also combines other data sets such as US Census information to estimate the purpose of the trips.

- Corridor manager will develop StreetLight zone sets that can be utilized by each project team
- Each project team has access to the StreetLight online platform and is responsible for running analyses specific to their model
- Each project team shall utilize Streetlight data as part of their existing origin-destination matrix estimation (ODME) procedure
    - Data shall be utilized for days included in the typical clusters
    - Day types shall match temporal analysis periods
    - Day parts shall match hours within each temporal analysis period

8. Vehicle Inputs and Types

Vehicle input and vehicle type requirements include:

- Traffic volumes shall be input into the models in 15 minute intervals
- I-39/90/94 models shall utilize passenger car, single unit trucks, and tractor trailer trucks vehicle types
    - Vehicle classification data may be used to modify vehicle profile data including incorporating personal vehicles towing boats and trailers
    - Slow and fast vehicle types are likely necessary to match field lane utilization percentages
- US 51 models shall utilize passenger car and truck vehicle types (single unit and tractor trailer combined)
    - Slow and fast vehicle types are unlikely to be needed as part of an arterial model

9. Speed Distributions

Speed distribution requirements include:

- Existing speed distributions developed for the Interstate south segment shall be used as a starting point for the Interstate north model. WisDOT default speed distributions may be used as a starting point for the US 51 models. Speed distribution values can be modified for specific segments based on segment characteristics such as weaving or merge/diverge by each project team based on NPMRDS data and documented appropriately
- Utilize separate car and truck speed distributions

10. Calibration

Follow TEOpS Chapter 16-20 Attachment 6.3 (VISSIM Calibration Parameters) for global and local parameter typical ranges

11. Validation

I-39/90/94 models shall be validated based on the following metrics:

- Hourly traffic volumes (mainlines, ramps, and turning movements)
- Sub-hour (15 min) travel times (logical segments of 1.5 miles or more)
  - Each project team shall gather speed and travel time data from the National Performance Measures Research Data Set (NPMRDS)
- Sub-hour (15 min) spot speeds
- Sub-hour (15 min) lane utilization

- US 51 models shall be validated based on the following metrics:
  - Hourly turning movement volumes
  - Sub-hour (15 min) travel times (logical segments of 1.5 miles or more)
  - Intersection queues (based on field observation)

12. Performance Measures

VISSIM microsimulation analysis is intended to provide the design teams with the following performance measures:

- Vehicle volumes and density for use in accessing level of service. This data shall be collected such as to provide analysis for mainline, merge, diverge and weave segment analysis.
- Spot speeds by lane by 15 minute period for further processing to developing speed contour maps of the corridor.
- Travel times between key locations throughout the corridor by 15 minute period.

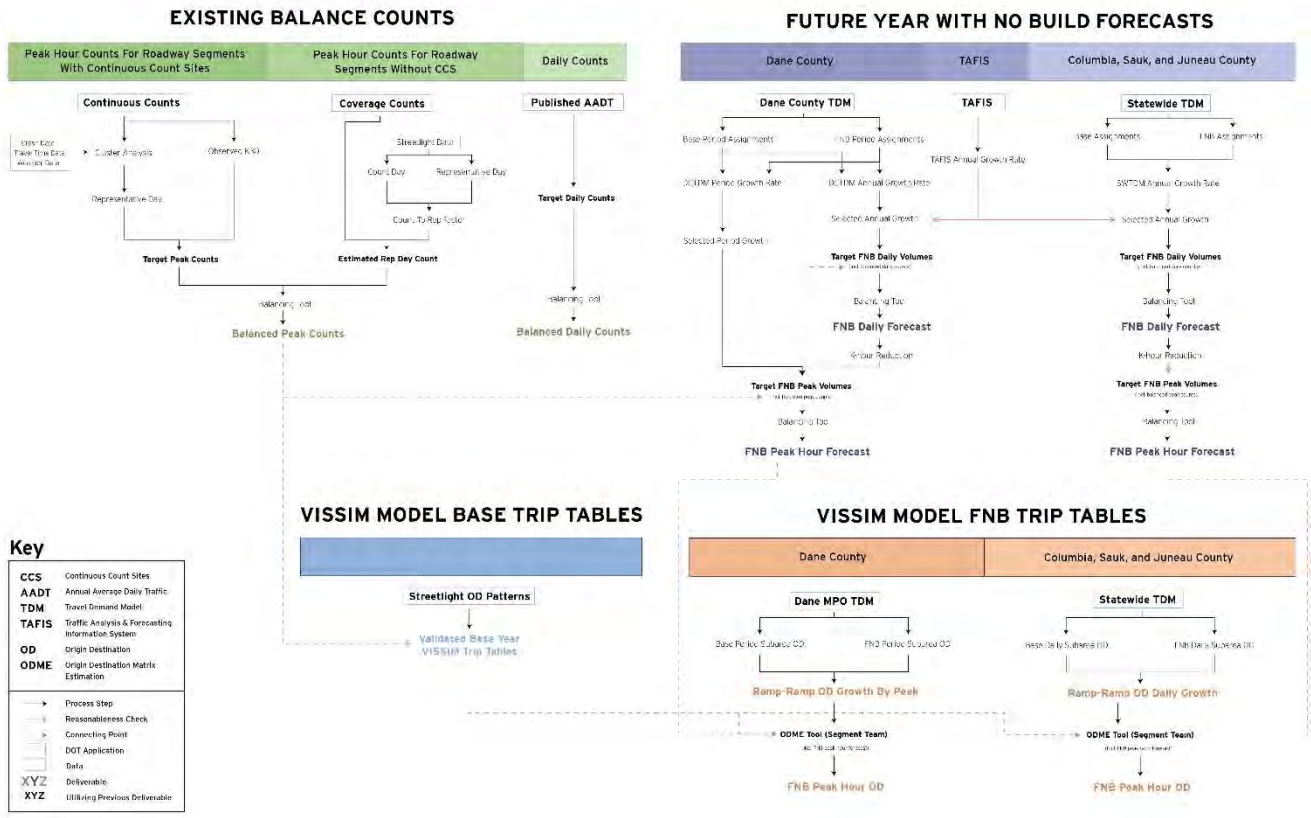
13. Traffic Forecasts

Traffic forecasts shall be provided to the project teams as peak hour line diagrams and demand model generated trip tables. Project teams shall develop required VISSIM model demands for all analysis hours to be consistent with the provided peak hour forecasts. This process is outlined in the "Traffic Forecasting Methodology."

The demand model generated trip tables provide ramp to ramp movements for the Interstate segments and external to external movements for the Stoughton Road segments. The demand model tables include base year, future no build and future build outputs. Segments within Dane County shall receive peak period tables from the Dane County travel demand model. Columbia, Juneau and Sauk county segments shall receive daily trip table information from the Wisconsin statewide travel demand model.

Figure 9 below shows a flow chart of the VISSIM model future trip table development process described in this section. The demand model tables shall be used in conjunction with the peak hour line diagram values to generate trip tables for use within VISSIM through the use of an origin-destination matrix estimation (ODME) process. The validated base year VISSIM tables form the basis for future year VISSIM tables. The change in demands as projected by the demand models between ramps or externals is applied to the validated base year VISSIM trip table to form a future year seed table. That future year seed table is then processed through the ODME to align with the forecasted future year peak hour forecasts.

Figure 9. VISSIM Model Future No Build Trip Tables' Flow Chart



14. Documentation

Each project team shall submit corresponding reports with existing and subsequent future year model peer review submittals which details model specific edits/calibration, ODME, and validation results.

MEMORANDUM

I-39/90/94 Interstate North and South Segments - Future No Build Traffic Operations

Date:	4/18/2024
Topic:	Interstate North and South Segments – No Build Traffic Operations
From:	Tim Flynn, HNTB Corporation

This technical memorandum provides an overview of the year 2050 future no build level of service (LOS) traffic operations conducted for the I-39/90/94 North and South Segment Corridor Study. Further details about the analyzed limits, methodology, and results of the year 2050 no build traffic operations can be found in Appendix A (*I-39/90/94 South Segment No Build Traffic Operations*) and Appendix B (*I-39/90/94 North Segment No Build Traffic Operations*).

The Interstate North corridor study area extends from US 12/16 in the north to WIS 60 in the south. The Interstate South corridor study area extends from CTH V in the north to US 12/18 (Madison Beltline) in the south.

Level of service (LOS) serves as a planning-level measure of congestion and traffic operations on a transportation system. The measures of LOS range from A to F with LOS A having the least congestion and LOS F having the most congestion. For purposes of this project, LOS C was deemed an acceptable freeway LOS for rural areas, and LOS D was deemed acceptable for urban areas. This is based on the "Design Considerations and Representative Day Methodology" memo that cites the WisDOT Facilities Development Manual (FDM), Section 11.5-3.2.1. The Interstate North Segment is considered rural, and the Interstate South Segment is considered urban. Therefore, for the North Segment, a freeway LOS C or better was considered acceptable, and for the South Segment, a freeway LOS D or better was considered acceptable.

The Highway Capacity Manual 7th Edition (HCM 7) methodology was used to define the basic, merge, diverge, and weave segments along the freeway facilities. Table 1 shows the density-based LOS scale for the freeways and individual segments.

Table 1. HCM 7th Edition - Density-Based LOS Definition

LOS	Basic Freeway Segment Density (pc/mi/ln)	Merge/Diverge Density (pc/mi/ln)
A	≤ 11	≤ 10
B	> 11-18	> 10 – 20
C	> 18-26	> 20 – 28
D	> 26-35	> 28 – 35
E	> 35-45	> 35 - 45
F	> 45 or any segment $v_{d/c}$>1.00	> 45

Table 2 summarizes the year 2050 No Build peak hour traffic LOS operations. The Highway Capacity Software (HCS) Version 2022 was used for these analyses. The key is below, which describes the coloring used for Table 2.

	Better than acceptable LOS operations (LOS A or B in North Segment; LOS A, B, or C in South Segment)
	At the acceptable LOS operations (LOS C in North Segment; LOS D in South Segment)
	Worse than acceptable LOS operations but not LOS F (LOS D or E in North Segment; LOS E in South Segment)
	Failing LOS operations (LOS F in North or South Segments)

Table 2. Future 2050 No-Build Level of Service Summary

Interstate Corridor (North/South)	Highway	I-39/90/94 Location (Interchange to Interchange)	LEVEL OF SERVICE (LOS) SUMMARY							
			AM		PM		FRI		SUN	
			SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB
Interstate North (LOS C or better is acceptable)	I-90/94	N of US 12/WIS 16	--	--	--	--	D	E	F	D
		US 12/WIS 16 to WIS 13	--	--	--	--	D	E	F	D
		WIS 13 to WIS 23	--	--	--	--	D	E	F	E
		WIS 23 to US 12	--	--	--	--	D	D	F	D
		US 12 to WIS 33	--	--	--	--	D	E	D	D
		WIS 33 to I-39	--	--	--	--	D	D	D	D
	I-39/90/94	I-39 to Rest Area	--	--	--	--	C	D	D	C
		Rest Area TO CTH CS	--	--	--	--	C	D	D	C
		CTH CS to WIS 60	--	--	--	--	C	D	D	C
Interstate South (LOS D or better is acceptable)		WIS 60 to CTH V	B	B	B	B/C	C	D	D	B/C
		CTH V to WIS 19	B	B	B	C	C	D	E	C
		WIS 19 to US 51	C	B	C	D	D	F	E	C
		US 51 to US 151	C	C	C	D	D	F	E	C
		US 151 to Badger Interchange	C	C/D	D	D	F	F	E	C
	I-39/90	Badger Interchange to Beltline Interchange	E	E	E	E	F	F	E	D
	I-94/WIS 30	Fair Oaks to US 51	B	D	D	B	D/E	C	B	B
		US 51 to Thompson	B	F	E	B/C	E	C	B	B
		Thompson to Badger Int.	B	D/E	D	B/C	D	C	A/B	B
		Badger Int. to CTH N	B	C	C	B	C	C	C	B
	US 151	SB I-90 to NB I-90	D	B	F	B/C	F	C	C	B
		NB I-90 to American Pkwy	D	C	D	C	D	D	C	B
		American Pkwy to Grand Ave	D	A/B	C	C/D	C/D	C	C	B
		Grand Ave to Main St	C	A	B	C	B	B	B	B
		North of Main St	--	A/B	--	C	--	C	--	B
	NB US 151 CD	From NB I-90	--	F	--	F	--	F	--	B/C
		Diverge to NB US 151	--	F	--	F	--	F	--	A
	SB US 151 CD	SB US 151 to NB US 151	F	--	F	--	C	--	B/C	--
		South of Weave	E	--	E	--	F	--	D	--

Table 2 shows the year 2050 No Build Friday PM and Sunday PM peak hour traffic operations for the North Segment and the weekday AM, weekday PM, Friday PM, and Sunday PM peak hour traffic operations for the

South Segment.

Table 2 shows that there are several unacceptable year 2050 No Build traffic operations in the Interstate corridor. Unacceptable traffic operations include LOS D or worse in the North Segment and LOS E or worse in the South Segment. Every I-39/90/94 segment in the North Segment observes unacceptable LOS D conditions or worse along at least one direction during the Friday PM or Sunday PM peak hour. Along the South Segment, every I-39/90/94 segment except between WIS 60 and CTH V observes unacceptable LOS E conditions or worse under year 2050 No Build conditions. In addition, several locations along the I-94/WIS 30, US 151, and US 151 C-D corridors also observe unacceptable LOS E conditions or worse under year 2050 No Build conditions.

Appendix A – I-39/90/94 South Segment No Build Traffic Operations

MEMORANDUM

I-39/90/94 Corridor Study

Date:	03/09/2023
Topic:	Future No-Build LOS
From:	I-39/90/94 South Segment Team

This memo provides an overview of the 2050 future no-build conditions level of service (LOS). The following sections describe the analyzed limits, methodology, limitations, and results.

1. HCS Model Development

The 2050 future no-build models inherited the core components of the 2019 existing year model:

- Highway Capacity Software (HCS) Version 2022
- Spatial limits as shown in Figure 1
- Temporal limits of four peak periods
  - Weekday **AM**: 6-9 AM
  - Weekday **PM**: 3-6 PM
  - Summer Friday PM (**FRI**): 3-6 PM
  - Summer Sunday PM (**SUN**): 1-4 PM
- The no-build models inherit the parameters from the existing conditions model.

1.1. Committed Improvements

The no-build model incorporates the infrastructure changes on I-39/90, listed below, that were completed in the year 2021. There are no other committed projects included in the models beyond those listed here:

I-39/90 & US 12/18 Beltline Interchange (BIC) configuration – Lane layout is shown in Exhibit 1. Reconfiguration within the HCS model limits includes:

- Expansion from 3 lanes to 5 lanes on SB I-39/90 between the Wisconsin Southern Railroad bridge and the exit to WB US 12/18.
- Reconfiguration to allow 3 lanes from US 12/18 to join NB I-29/90. Within the interchange core, NB I-39/90 drops from 3 lanes to 2 lanes to accommodate the US 12/18 merge – *the HCS no-build model starts at the 3-lane basic segment downstream of the merge due to HCS limitations discussed in Section 2.2.*
- NB I-39/90 includes consecutive lane drops to go from 5 lanes to 3 lanes to tie into existing conditions at the Wisconsin & Southern Railroad bridge – *not included in the HCS model.*

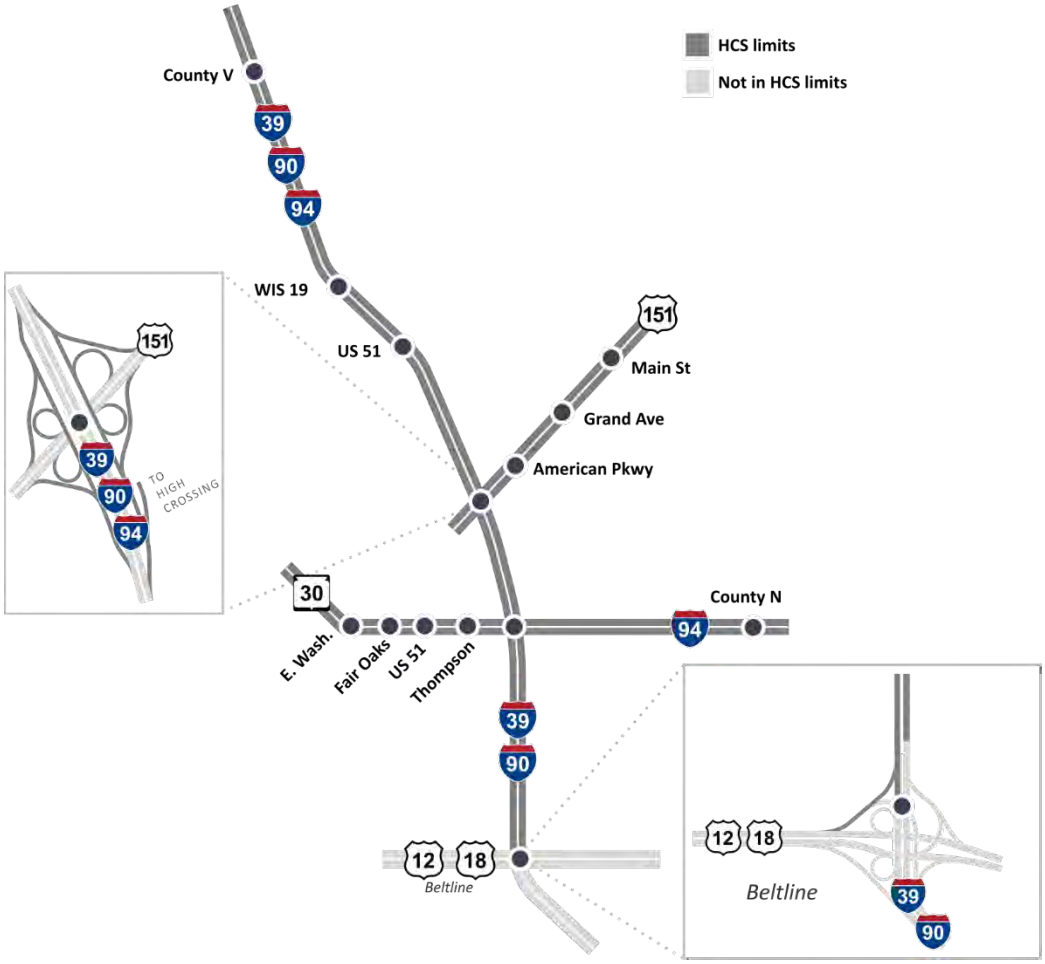


Figure 1: LOS Analysis Limits

2. Level of Service

2.1. Methodology

The Highway Capacity Manual 7th Edition (HCM 7) methodology was used to define the new segments along I-90. Peak hour volumes were obtained from the 2050 no-build forecast provided by the CDMCT. The flow profile of the future peak hour is assumed flat, while the warm-up and cool-down periods follow the same trend as the existing conditions. The existing Vissim OD matrix was used as a basis to estimate the future no-build OD. The 15-minute volumes and truck percentages were derived from the OD estimation. Model parameters were inherited from the existing conditions, one of which is the driver population factor. Same as existing, the driver population factor for AM and PM peaks was assumed to be “balanced mix” while FRI and SUN peaks were assumed to have a “mostly unfamiliar” driver population.

2.2. Results and Limitations

Table 1 shows the density-based LOS scale for the urban freeway facilities. Table 2 summarizes the LOS results for select locations for each peak period. A full set of results for all segments is shown in Exhibit 2. Exhibit 3 demonstrates LOS comparisons for 2019 and 2050 for all segments and peak periods. Table 2 contains the following performance measures:

- ***Density & LOS*** – The density-based LOS results reflect the 15-minute analysis period with the maximum density. All performance measures are reported for this same time period. The maximum density for each influence area within the peak and cool-down hours, time periods #5 through #12, is reported. The inclusion of the cool-down hour was crucial to account for queues spilling back onto the upstream segments in the subsequent time periods. During the oversaturated segment evaluation, all unserved vehicles within one analysis period get added to the following period. Given that the future no-build volumes are at or exceeding capacity at multiple locations, adding the cool-down hour results better represents the LOS and queues.

  For segments analyzed as merge/diverge influence areas, the density in the ramp influence area is reported when the freeway average density is less than 45 pc/mi/ln. For all other segments, the freeway average density is reported.

- ***d/c*** – The demand-to-capacity ratio was exported from HCS for the freeway (F) for all influence areas. For the merge/diverge influence areas, the d/c ratio for the ramp (R) was also reported.

- ***% Demand Met*** – The percent of demand met is based on the HCS volumes served (v) and target volumes (d). The root normalized square error (RNSE) was computed to validate the served volumes. The % of demand met shown in red indicates an RNSE ≥ 3.0, meaning that HCS results might not reflect the effects of the entire traffic demand.

- ***LOS Summary*** – The summary column combines all information in the table into one letter. It shows the reported density-based LOS and the upper bound LOS when the density is within 1.0 pc/mi/ln of LOS boundary (ex. LOS C/D). When the location is on the border between LOS letters, this can indicate that any minimal increase in volumes or shift in flow profiles could result in worse LOS. For the influence areas that experience d/c >= 1.0, the LOS was replaced with "F" based on the HCM 7 guidance, regardless of the density-based LOS. The asterisk next to the LOS (ex. LOS F*) indicates RNSE >= 3.0.

Table 1. Density Based LOS Definition

HCM 7th Edition Density-Based 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 – 45***
F	**> 45**	**> 45***

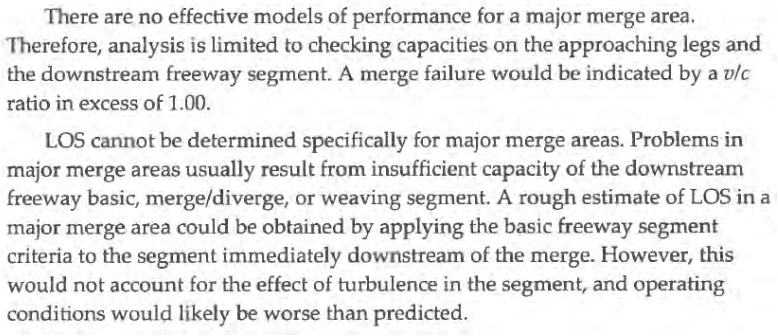
(*) 43 for Weave

Table 2. Level of Service Summary

Corridor	Location	LOS Summary				Density (pc/mi/ln) & LOS				d/c								% Demand Met			
		AM	PM	FRI	SUN	AM	PM	FRI	SUN	AM		PM		FRI		SUN		AM	PM	FRI	SUN
										F	R	F	R	F	R	F	R				
NB I-39/90/94	**BIC - Badger**	**E**	**E**	**F***	D	**39 E**	**42 E**	**56 F**	32 D	**0.94**		**0.97**		**1.09**		0.86		100%	100%	**85%**	100%
	Badger - US 151	C/D	D	**F***	C	25 C	31 D	**36 E**	23 C	0.73		0.83		**1.01**		0.70		100%	100%	**91%**	100%
	Diverge to US 151	D	D	**F***	B	28 D	30 D	30 D	19 B	0.72	0.87	0.82	0.87	**1.01**	0.88	0.70	0.58	100%	100%	**91%**	100%
	US 151 - US 51	C	D	**F***	C	19 C	27 D	**41 E**	24 C	0.57		0.76		**1.01**		0.71		100%	100%	**95%**	100%
	US 51 - WIS 19	B	D	**F***	C	17 B	26 D	**39 E**	21 C	0.52		0.75		**1.01**		0.65		100%	100%	**93%**	100%
	WIS 19 - County V	B	C	D*	C	13 B	21 C	33 D	19 C	0.40		0.62		**0.92**		0.59		100%	100%	**94%**	100%
	North of County V	B	B/C	D*	B/C	12 B	17 B	30 D	18 B	0.38		0.54		0.87		0.56		100%	100%	**95%**	100%
SB I-39/90/94	**North of County V**	B	B	C	D	12 B	14 B	19 C	33 D	0.37		0.43		0.59		0.88		100%	100%	100%	100%
	County V - WIS 19	B	B	C	**E**	15 B	15 B	21 C	**37 E**	0.46		0.47		0.64		**0.92**		100%	100%	100%	100%
	WIS 19 - US 51	C	C	D	**E**	19 C	19 C	27 D	**41 E**	0.57		0.57		0.76		**0.97**		100%	100%	100%	100%
	US 51 - US 151	C	C	D	**E**	19 C	21 C	29 D	**42 E**	0.54		0.63		0.80		**0.98**		100%	100%	99%	100%
	US 151 - Badger	C	D	**F***	**E**	24 C	30 D	**67 F**	**39 E**	0.65		0.81		0.86		**0.94**		100%	100%	**90%**	100%
	Merge from Badger	D	D	**F***	D	31 D	34 D	**56 F**	31 D	0.82	0.16	**0.94**	0.37	**1.01**	0.32	**0.96**	0.14	100%	100%	**91%**	100%
	Badger - BIC	**E**	**E**	**F***	**E**	**36 E**	**39 E**	**38 E**	**40 E**	0.83		**0.94**		**1.02**		**0.96**		100%	100%	**91%**	100%
EB I-94/WIS 30	**Fair Oaks - US 51**	B	D	**D/E**	B	14 B	33 D	35 D	14 B	0.39		0.77		0.81		0.38		100%	100%	100%	100%
	US 51 - Thompson	B	**E**	**E**	B	14 B	**38 E**	**41 E**	16 B	0.45		0.86		**0.94**		0.44		100%	100%	100%	100%
	Thompson - Badger	B	D	D	A/B	11 B	27 D	27 D	11 A	0.36		0.76		0.77		0.35		100%	100%	100%	100%
	Badger - County N	B	C	C	C	12 B	21 C	24 C	20 C	0.37		0.65		0.71		0.63		100%	100%	100%	100%
WB I-94/WIS 30	**County N - Badger**	C	B	C	B	20 C	13 B	20 C	14 B	0.62		0.40		0.61		0.45		100%	100%	100%	100%
	Badger - Thompson	**D/E**	B/C	C	B	35 D	18 B	20 C	13 B	0.88		0.48		0.53		0.36		100%	100%	100%	100%
	Thompson - US 51	**F**	B/C	C	B	**44 F**	20 B	23 C	15 B	**0.96**		0.53		0.61		0.42		100%	100%	100%	100%
	US 51 - Fair Oaks	D	B	C	B	30 D	15 B	23 C	11 B	0.72		0.42		0.71		0.31		100%	100%	100%	100%
NB US 151	**SB I-90 - NB I-90**	B	B/C	C	B	11 B	19 B	21 C	13 B	0.42		0.49		0.54		0.37		100%	100%	100%	100%
	NB I-90 - AM Pkwy	C*	C*	D*	B	19 C	24 C	29 D	16 B	0.44		0.57		0.60		0.44		**88%**	**90%**	**87%**	100%
	AM Pkwy - Grand Ave	A/B	C*/D*	C*	B	11 A	26 C	24 C	16 B	0.34		0.75		0.70		0.51		95%	**90%**	**86%**	100%
	Grand Ave - Main St	A	C*	B*	B	9 A	19 C	17 B	11 B	0.28		0.59		0.51		0.36		100%	**88%**	**85%**	100%
	North of Main St	A/B	C*	C*	B	10 A	20 C	19 C	13 B	0.33		0.62		0.54		0.42		100%	**84%**	**80%**	100%
SB US 151	**Main St - Grand Ave**	C	B	B	B	21 C	14 B	15 B	12 B	0.65		0.45		0.47		0.37		100%	100%	100%	100%
	Grand Ave - AM Pkwy	D	C	C/D	C	31 D	23 C	26 C	21 C	0.80		0.62		0.69		0.57		100%	100%	100%	100%
	AM Pkwy - NB I-90	D	D	D	C	30 D	31 D	33 D	20 C	0.68		0.75		0.77		0.51		100%	100%	100%	100%
	NB I-90 - SB I-90	D	**F**	**F**	C	31 D	28 D	33 D	22 C	**0.99**		**1.06**		**1.15**		0.83		100%	100%	100%	100%
NB US 151 CD	**From NB I-90**	**F***	**F***	**F***	B/C	**97 F**	**99 F**	**110 F**	17 B	0.80		0.71		0.82		0.54		**80%**	**88%**	**67%**	100%
	Diverge to NB US 151	**F***	**F***	**F***	A	11 B	11 B	10 A	9 A	**1.12**	**1.27**	**1.18**	**1.28**	**1.29**	**1.39**	0.87	**0.94**	**83%**	**79%**	**72%**	100%
SB US 151 CD	**SB US 151 - NB US 151**	**F**	**F**	C	B/C	28 C	28 C	23 C	19 B	**1.22**		**1.23**		**0.91**		0.88		97%	95%	100%	100%
	South of Weave	**E**	**E**	**F***	D	**36 E**	**36 E**	32 D	28 D	**0.90**		**0.90**		**1.03**		0.78		96%	99%	**82%**	100%

Overall, the 2050 no-build models suggest that due to increased demand, the corridors experience several bottlenecks and failing segments along with longer queues during all peak periods. LOS F conditions in the no-build model generally occur due to over-capacity connections on freeway adjacent to I-90 for the AM and PM peaks. For FRI and SUN peaks, LOS F conditions generally occur due to over-capacity ramps and basic freeway sections that accommodate both commuter and recreational traffic. In addition, the 2050 no-build traffic volumes push d/c ratios over 1.0 and cause LOS F conditions at key locations. This could lead to congestions spilling back from key bottlenecks. The project limits are suspected to experience capacity values lower than the HCM's theoretical value, suggesting that HCS might be over-estimating LOS. In addition to the HCS limitations identified for existing conditions (complex weaves, lane imbalances, one-lane CD, and limited demand), two other limitations have been encountered while analyzing no-build conditions:

- Analyzing a major merge. With the reconfiguration of the BIC, a lane was added to the on-ramp from US 12/18 to NB I-39/90 (2 to 3 lanes). It is to be noted that HCS cannot model on-ramps with more than 2 lanes. In addition, HCM 7 cannot reliably evaluate major merges, as shown in Figure 2. Due to software limitations, the NB I-90 corridor starts at the 3-lane basic segment downstream of this major merge. HCM 7 recommends using a microsimulation software to analyze such segments.



There are no effective models of performance for a major merge area. Therefore, analysis is limited to checking capacities on the approaching legs and the downstream freeway segment. A merge failure would be indicated by a *v/c* ratio in excess of 1.00.

LOS cannot be determined specifically for major merge areas. Problems in major merge areas usually result from insufficient capacity of the downstream freeway basic, merge/diverge, or weaving segment. A rough estimate of LOS in a major merge area could be obtained by applying the basic freeway segment criteria to the segment immediately downstream of the merge. However, this would not account for the effect of turbulence in the segment, and operating conditions would likely be worse than predicted.

Figure 2. HCM Chapter 14 Section 4 (Major Merge)

- Oversaturation conditions at the first segment or time period. If the demand exceeds capacity on the first segment of the facility or on any segment during the first analysis period, the HCS results are expected to be unreliable due to constraining the model and limiting the throughput to the segment's capacity (ex. NB and SB I-90, BIC - Badger during the FRI peak). These locations may require unconstrained sensitivity analysis or additional time periods to capture the entire demand downstream of the bottlenecks.

Taking into consideration all software limitations, the LOS results reported from HCS should be used with caution. The following section discusses the general results on each of the corridors:

- ***I-39/90/94*** – Going northbound, the demand on the BIC to Badger, first segment of the facility, exceeds capacity during the FRI peak resulting in unreliable HCS LOS results for the downstream segments. The d/c of segments between BIC to WIS 19 is mostly greater than one indicating LOS F conditions. The corridor experience LOS E in the weekday PM peak between the BIC and Badger and LOS D between the Badger and WIS 19. Existing field conditions and future volumes suggest that the NB I-90 off-ramp to NB US 151 CD is expected to exceed capacity in 2050 during the AM and PM peak periods causing congestion backing up on the I-90 mainline. The HCS over-estimated the density-based LOS at this location due to various reasons such as lane utilization, capacity estimates, and capacity drop phenomenon. Going southbound, the corridor is anticipated to experience LOS E starting at County V all the way to the BIC on summer Sundays with demand approaching capacity at most locations. During the FRI peak, the demand on the BIC to Badger segment exceeds capacity in the first analysis period indicating unreliable HCS LOS results. The consecutive merges from the Badger ramps are expected to be over capacity and are ultimately constrained by the downstream 3-lane segment between the Badger and the BIC. This bottleneck results in backups to US 151 and beyond.
- ***I-94/WIS 30*** – Going eastbound, the existing bottleneck at the weave between US 51 and Thompson Dr is expected to get worse in the PM and FRI peaks. Traffic volumes in 2050 are approaching capacity causing LOS E with potential backups upstream. Going westbound, the weave between Thompson Dr and US 51 fails in the AM peak causing spill backs to the Badger.
- ***US 151*** – Going northbound, the reported results suggest acceptable conditions; however, this is an over-estimation of conditions for certain locations, especially at the merge from NB I-90 during AM, PM, and FRI peaks. The NB I-90 ramp is over capacity reaching d/c of 1.46 in the FRI peak which is constraining the downstream segments from experiencing the entire traffic demand. The demand on the off-ramp to Grand Ave is at capacity as well causing LOS F at the diverge influence area and potential backups upstream. Going southbound, the main bottleneck is at the weave between SB I-90 and NB I-90 ramps with d/c ratios approaching 1.15 during the FRI peak. Although the reported density-based LOS is D, this weave is expected to experience LOS F causing queues to spill back to Grand Ave.
- ***US 151 CD*** – Going northbound, the key bottleneck is at the diverge to NB US 151 in the AM, PM, and FRI peaks, same as existing. Although the reported HCS LOS is A/B, the demand on the diverge influence as well as the off-ramp exceeds capacity causing failures on the upstream diverge to High Crossing Blvd as well as the CD mainline causing potential queue spill backs onto the NB I-90 mainline. Going southbound, the demand on the weave between SB US 151 on-ramp and NB US 151 off-ramp and the downstream basic segment is nearing/exceeding capacity for all peak periods except for SUN resulting in LOS E/F. The following merge from NB US 151 adds a lane to the CD and reports LOS C or better; however, this segment is anticipated to have worse LOS due to imbalanced lane utilizations where all the SB US 151 on-ramp volume tend to stay in the left lane anticipating a downstream lane drop after the merge onto SB I-90.

The HCS reported results suggest that HCS may over-estimate LOS on multiple segments along the interstate and connecting freeways in the Madison area. Considering d/c ratios as well as % demand met provides better insight on the corridor operations and congestions. Due to multiple HCS limitations and oversaturation conditions, it is recommended to confirm the LOS results by conducting an analysis in a different tool.

Appendix B – I-39/90/94 North Segment No Build Traffic Operations

MEMORANDUM

I-39/90/94 Corridor Study

Date:	3/9/2023
Topic:	HCS LOS Methodology – North Segment
From:	Neal Styka, P.E., RSP1, PTOE, Kapur & Associates

This memo provides an overview of the existing conditions (2021) and 2050 future no build level of service (LOS) conducted for the I-39/90/94 Corridor Study - North Segment and follows the format of the South Segment Memo. The Highway Capacity Software (HCS) Version 2022 was used for these analyses. The following sections describe the analyzed limits, methodology, and results.

1. Level of Service

The level of service (LOS) serves as a planning-level indicator of congestion, driver discomfort, frustration, and increased travel time on the transportation system. **Figure 1** shows the differences between levels of service, ranging from A to F. Roadways are typically designed to provide LOS that balances driver's desire against financial resources and environmental impacts. The WisDOT Facilities Development Manual (FDM), Section 11.5-3.2.1 sets LOS C as acceptable in rural areas, such as this segment of the I-39/90/94 corridor.

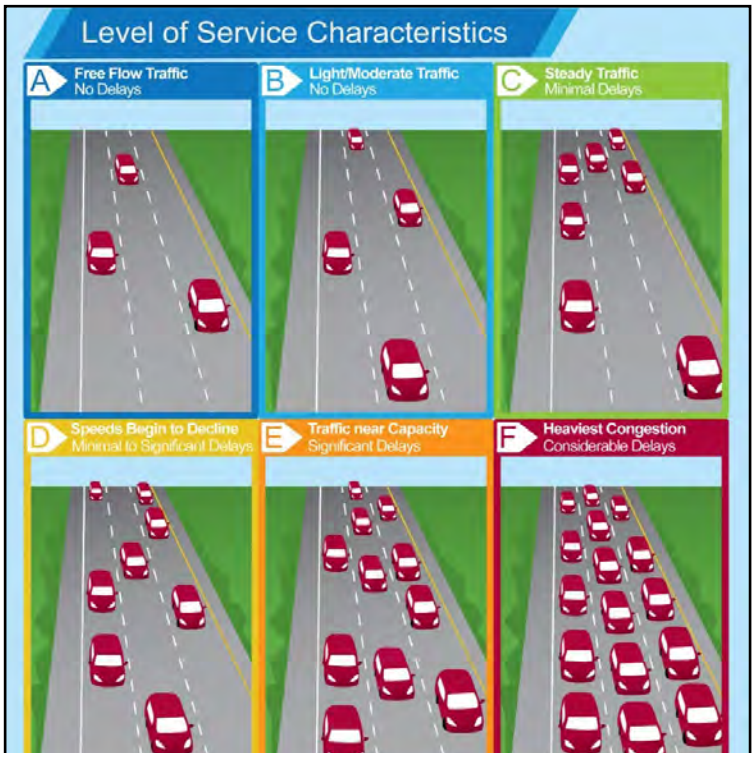


Figure 1. Level of Service

The LOS analysis builds on the work previously done on the I-90 Madison to Tomah Needs Study conducted in 2019. The HCS models for the I-39/90/94 corridor were carried over from that previous study and updated for this study.

1.1. Analysis Limits

The HCS model limits contain the Interstate and connecting freeways in the Wisconsin Dells area as shown in **Figure 2**:

- ***I-39/90/94*** – extending from the WIS 60 Interchange to the I-39/WIS 78 Split (Petro Interchange)
- ***I-90/94*** – From the I-39/WIS 78 Split (Petro Interchange) to the WIS 16/US 12 Interchange

  Two HCS Models were made from this corridor. The first extends from WI 60 to WIS 33 (South Section) and second extends from WI 33 to WIS 16/US 12 (North Section).

The HCS models were created for the Friday and Sunday peak periods. The volumes were based on the representative days, Friday June 21st, 2021, and Sunday August 6th, 2021. The technical memorandum, "Representative Day Methodology" explains why those two days were chosen. Each peak period extended for 3 hours with 15-minute analysis periods. The peak hours were the middle hour of the 3 time periods and are defined as follows:

- Summer Friday PM (**FRI**): 11 AM-1 PM
- Summer Sunday PM (**SUN**): 1-4 PM

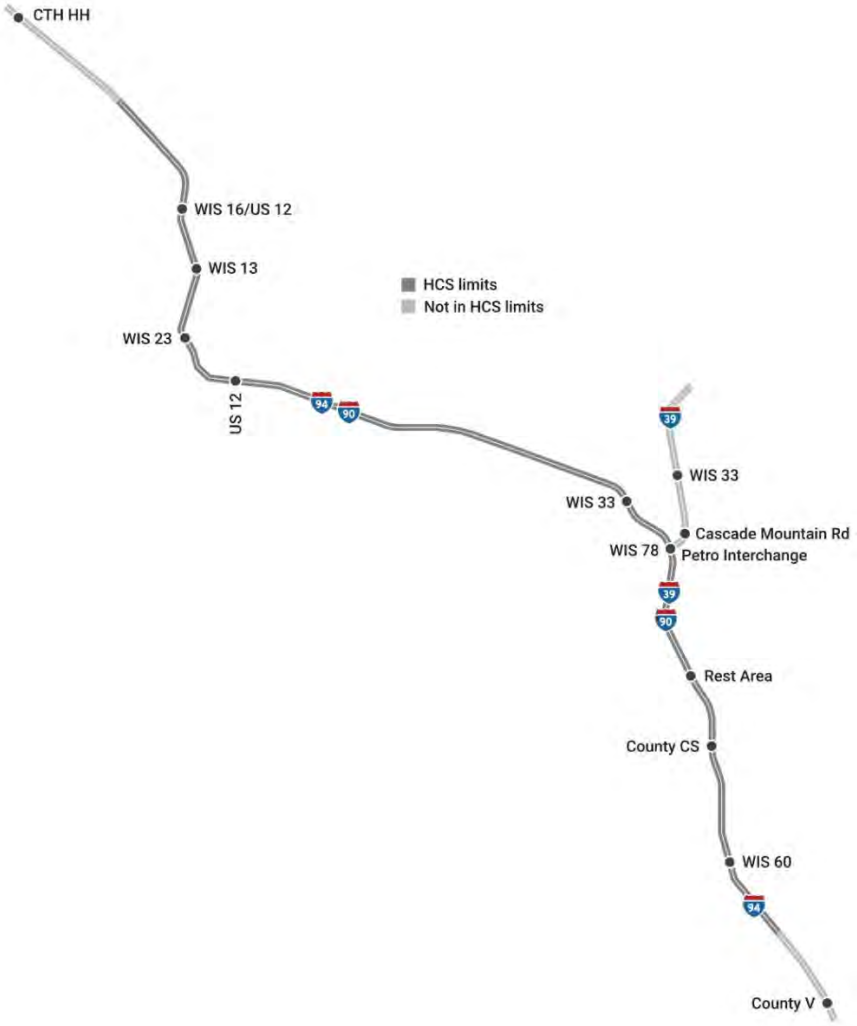


Figure 2. North Segment Analysis Limits

1.2. Methodology and Results

The Highway Capacity Manual 7th Edition (HCM 7) methodology was used to define the basic, merge, diverge, and weave segments along the freeway facilities. Model inputs including volumes and truck percentages required for the LOS analysis were obtained from the 2021 existing year data collection. Model parameters were inherited from the previous study models and adjusted as needed for the purpose of this study.

The peak hour volumes and truck percentages were derived from the Vissim origin destination (OD) models and 15-minute flow profiles. The hour before and the hour after the peak hour were multiplied by a ratio of that hour's volumes compared to the peak hour volumes. These non-peak hour volumes were taken from the Continuous Count Station (CCS) on the same representative days as the target volumes. ATR Site 110002 was used for the South Section between WIS 60 and WIS 33 including the WIS 78 Interchange, and ATR Site 560001 was used for analysis between WIS 33 and the WIS 16/US 12 Interchange. The ratios can be seen in **Table 1**. The Friday ratios for the different time periods are generally in similar ranges from 92-98% of the peak hour, except for eastbound I-90/94 traffic in the southern section on Friday from 3-4 PM. In that period, it was 0.4% higher than the peak hour. Sunday volumes primarily fall within the same range as Friday. The exception is in the northern section which has 0.5% increase in volumes between 11 AM and 12 PM hour compared to the peak hour and 74% compared to the peak hour volumes between 1 PM and 2 PM.

The Friday, 3-4 PM period, where the volumes are slightly higher than the peak hour, was compared to Fridays in June, July, and August for the same hours. Four out of the 13 Fridays in June, July, and August also had a volume that was higher than the 3-4 PM hour. The higher volume on Sunday at 11 AM is consistent with all 13 Sundays, and the lower Sunday southbound volume between 1 and 2 PM is lower than all the other summer volumes in that period. The next two closest in value are 87% and 88%. The peak hour at the CCS differs from the overall peak hour of the representative day. The peak hour of the representative day includes all segments, ramps, and intersections of the study area and not just the two CCSs located within this study area.

Table 1. Percentage Difference Between Adjacent Hour and Peak Hour

			South Section (Site 110002)		North Section (Site 560001)	
Day	Direction	Time	Volume	% Difference to Peak Hour	Volume	% Difference to Peak Hour
Friday	EB 90/94 -SB 39	1:00 PM	3904	95.62%	2316	94.38%
Friday	EB 90/94 -SB 39	2:00 PM	4083		2454	
Friday	EB 90/94 -SB 39	3:00 PM	4098	100.37%	2258	92.01%
Friday	WB 90/94-NB 39	1:00 PM	3201	94.70%	2512	91.61%
Friday	WB 90/94-NB 39	2:00 PM	3380		2742	
Friday	WB 90/94-NB 39	3:00 PM	3278	96.98%	2617	95.44%
Sunday	EB 90/94 -SB 39	11:00 AM	4239	95.82%	2813	96.60%
Sunday	EB 90/94 -SB 39	12:00 PM	4424		2912	
Sunday	EB 90/94 -SB 39	1:00 PM	3252	73.51%	2802	96.22%
Sunday	WB 90/94-NB 39	11:00 AM	3498	100.46%	2686	97.71%
Sunday	WB 90/94-NB 39	12:00 PM	3482		2749	
Sunday	WB 90/94-NB 39	1:00 PM	3376	96.96%	2623	95.42%

At the Rest Area, the volumes for the entrance and exit ramps were taken from the Vissim OD model. However, no truck percentages were provided. For the sake of this analysis, a value of 10% was assumed on the ramps and the percentage of trucks on the freeway was left unchanged from the previous segment.

The HCM 7 defines LOS on a freeway facility based on density and differentiates between the density thresholds on urban and rural freeway facilities. **Table 2** shows the density-based LOS scale for the rural freeway facilities and individual segments. Density-based LOS, speeds, and demand-to-capacity ratios were exported from the HCS models for each of the corridors and directions. **Tables 3 & 4** summarizes the LOS results for mainline freeway segments between interchanges for existing conditions and a future no build scenario. The results show the lowest LOS of the peak hour. A full set of results exported from the HCS models are in **Appendix 1 - Existing 2021 HCS Summaries and Appendix 2 - Future 2050 No-Build HCS Summaries**.

Table 2. HCM 7th Edition - Density Based LOS Definition

LOS	Basic Rural Freeway Facility Density (pc/mi/ln)	Basic Freeway Segment Density (pc/mi/ln)	Merge/Diverge Density (pc/mi/ln)
A	≤ 6	≤ 11	≤ 10
B	> 6 - 14	> 11-18	> 10 – 20
C	> 14 - 22	> 18-26	> 20 – 28
D	> 22 - 29	> 26-35	> 28 – 35
E	> 29 - 39	> 35-45	> 35 - 45
F	> 39 or any segment $v_{d/c}$>1.00	> 45 or any segment $v_{d/c}$>1.00	> 45

Table 3. Existing 2021 Level of Service Summary

I-39/90/94 Location (Interchange to Interchange)	**Existing**											
	SUN						**FRI**					
	SB/EB			**NB/WB**			**SB/EB**			**NB/WB**		
	Density	**LOS**	**d/c**	**Density**	**LOS**	**d/c**	**Density**	**LOS**	**d/c**	**Density**	**LOS**	**d/c**
N of US 12/WIS 16	28.6	D	0.80	24.6	C	0.73	23	C	0.7	26.9	D	0.77
US 12/WIS 16 to WIS 13	31.1	D	0.84	25.4	C	0.74	24.3	C	0.72	28.8	D	0.81
WIS 13 to WIS 23	33.8	D	0.88	27.6	D	0.78	26.2	D	0.76	29.3	D	0.81
WIS 23 to US 12	36.5	E	0.91	26.3	D	0.76	24.7	C	0.73	26.9	D	0.77
US 12 to WIS 33	28.8	D	0.81	25.3	C	0.75	22.3	C	0.68	28.6	D	0.8
WIS 33 to I-39	29.3	D	0.82	25.2	C	0.74	24.2	C	0.72	27.1	D	0.78
I-39 to REST AREA	25.0	C	0.74	20.4	C	0.63	20.9	C	0.64	26.2	D	0.76
REST AREA TO CTH CS	25.5	C	0.75	20.4	C	0.63	20.5	C	0.64	26.2	D	0.76
CTH CS to WIS 60	24.6	C	0.73	20.4	C	0.63	20.5	C	0.63	28	D	0.79

Overall, the HCS results show that most of the corridor operates at LOS D or better in all existing peak periods. However, the segment between WIS 23 and US 12 travelling eastbound on a peak Sunday operates at LOS E. Based on the FDM standards, LOS C is the lowest acceptable LOS for a rural freeway. Based on the speed data collected from the National Performance Management Research Dataset (NPMRDS), the biggest reduction in freeway speeds on a Sunday occurred south of the US 12 entrance ramps in part due to the frequency in which crashes occur (see the *I-39/90/94 North Segment Sunday Peak Period Modeling Memo* dated March 3, 2023). However, the HCS analysis shows the reduction in LOS directly north of the US 12 exit ramps suggesting that the congestion may already be forming before causing a reduction in speeds.

Both Sunday northbound/westbound and Friday southbound/eastbound corridors, which are the non-peak directions, experienced LOS D around the WIS 12, WIS 23, and WIS 13 interchanges which are the primary interchanges serving the Wisconsin Dells.

On Fridays the entire corridor basic freeway segments between interchanges experienced LOS D. The density on some of these segments is very close to the threshold of becoming LOS E. The segments between the diverge and merge movements experienced LOS C or D.

Table 4. Future 2050 No-Build Level of Service Summary

I-39/90/94 Location (Interchange to Interchange)	Future No Build														
	SUN									FRI					
	SB/EB Unconstrained*			SB/EB-Metered			NB/WB			SB/EB			NB/WB		
	Density	LOS	d/c	Density	LOS	d/c	Density	LOS	d/c	Density	LOS	d/c	Density	LOS	d/c
N of US 12/WIS 16				52.7	F	0.91	32.8	D	0.87	28.8	D	0.81	36.5	E	0.92
US 12/WIS 16 to WIS 13				58.6	F	0.87	33.6	D	0.88	30.2	D	0.83	39.1	E	0.94
WIS 13 to WIS 23				37.5	F	1	36.1	E	0.91	31.9	D	0.85	38.1	E	0.93
WIS 23 to US 12				37.1	F	1.01	33.1	D	0.87	28	D	0.79	33.7	D	0.88
US 12 to WIS 33	36.6	E	0.92	33.6	D	0.92	30.8	D	0.84	26.4	D	0.77	36.5	E	0.92
WIS 33 to I-39	35.2	E	0.9	32.6	D	0.9	28.4	D	0.8	28.2	D	0.8	31.1	D	0.84
I-39 to REST AREA	29.2	D	0.82	23.2	D	0.82	23.2	C	0.7	24	C	0.71	30.7	D	0.84
REST AREA TO CTH CS	29.8	D	0.82	23.2	D	0.82	23.2	C	0.7	23.5	C	0.71	30.7	D	0.84
CTH CS to WIS 60	27.9	D	0.79	23	D	0.79	23	C	0.69	23	C	0.69	32.6	D	0.87

*The SB/EB Unconstrained model begins south the eastbound I-90/94 exit ramp to US 12

Overall, the 2050 No-Build scenario has lower LOS as a result of the increased demand. The bottlenecks and failing conditions that were observed in the existing conditions were exacerbated.

Looking at a future no-build scenario, Sunday southbound/eastbound would experience LOS F beginning at the first segment. Only the first 15-minute period was not oversaturated. After that period, all the other periods are oversaturated and operations breakdown. This situation continued south to the I-39/WIS 78 interchange.

The Highway Capacity Manual (HCM) in Chapter 12 defines breakdown "as a sudden drop in speed of at least 25% below the free-flow speed for a sustained period of at least 15-minutes." The speeds in these segments drop from the upper 50-60 MPH range to around 25-35 MPH and stay in that range for at least 15 minutes. Once this bottleneck is formed, queues begin to form and the flow rate discharging from the bottleneck is less than the original prebreakdown flow. The HCM uses an average value of a 7% reduction to estimate the rate at which queues will form and dissipate once the demand is lower than the capacity. This methodology is applied within the HCS. The limitations of this methodology include:

- When the first or last segment's demand to capacity ratio exceeds 1.
- Multiple or overlapping breakdowns or bottlenecks.
- Queue spill back from off-ramps where demand exceeds capacity.
- Vehicles using an alternative route or vehicles leaving before or after the analysis period.
- Queue discharge rates vary with location and magnitude of prebreakdown flow.

To better understand what the LOS would be if the full demand was being met, a separate model was created south of US 12. The model starts south the eastbound I-90/94 exit ramp to US 12 and continued south to the southern limits of the North Section. The LOS for this scenario is shown in the SB/EB-Unconstrained column. The SB/EB-Metered column shows the LOS if the full demand is not able to be met and the segments upstream of I-39/WIS 78 are oversaturated creating a bottleneck.

Friday southbound in the 2050 No-Build scenario would experience worse operations in the northern section north of the I-39/WIS 78 interchange in large part due to there being only 2 lanes instead of 3 lanes in each direction as there is south of the I-39/WIS 78 Interchange.

Overall, the Sunday northbound/westbound corridor in a future no-build scenario would experience acceptable LOS south of I-39/WIS 78. North of I-39/WIS 78 it would operate at LOS D, except for the segment between WIS 13 and WIS 23 where it would operate at LOS E. This segment was the worst in the existing conditions due to the increase of volume from the WIS 23 entrance ramp, which is the largest increase of volume north of WIS 33.

In the Friday northbound/westbound 2050 No-Build scenario, LOS in the basic segment south of the US 12 exit ramp is expected to operate at LOS E for 2 of the 12 time periods analyzed. The remaining 10 periods are expected to operate at LOS D. The lower LOS in the 2 time periods is caused by fluctuations in the demand volume that increase the density and push the LOS over D/E threshold. The basic segment between US 12 and WIS 23 is expected to operate at LOS D. The improved LOS from the segment upstream is a result of fewer vehicles entering the freeway from the US 12 entrance ramps than exiting resulting in a lower volume. The lower volume in this basic segment provides a density of 33.7 pc/mi/ln (LOS D) which is slightly below the LOS D/E threshold of 35 pc/mi/ln. More vehicles enter westbound I-90/94 from WIS 23 than exit, thereby decreasing the LOS over the LOS D/E threshold.

1.3. Summary and Future Analysis

The results of the HCS analysis for the existing year conditions showed that in peak periods the LOS drops below the acceptable standard of LOS C, especially for the peak directions. In the future if volumes grow as they are expected to without any improvements, operations will decline, and the majority of the North Section of I-39/90/94 will operate below acceptable standards. Additionally, some segments will operate with a LOS F and significant queuing will occur.

To better understand freeway operations, especially in the oversaturated conditions, more analysis is necessary. The HCS reported results suggest that HCS may over-estimate LOS on multiple segments along the interstate due to recurring congestion on Sundays that cause incidents and the high demand in the Wisconsin Dells area. Evaluating the LOS in a different tool such as Vissim can supplement the HCS representation of existing field conditions.

WISCONSIN DOT

I-39/90/94 North Segment

2050 Preferred Build Alternative Vissim Models

June 24, 2024

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The appendices to this report are not included due to file size constraints. Please contact David Schmidt, P.E.,WisDOT Study Manager, (608) 246-3867, david2.schmidt@dot.wi.gov to request a copy of these appendices.

1 Introduction

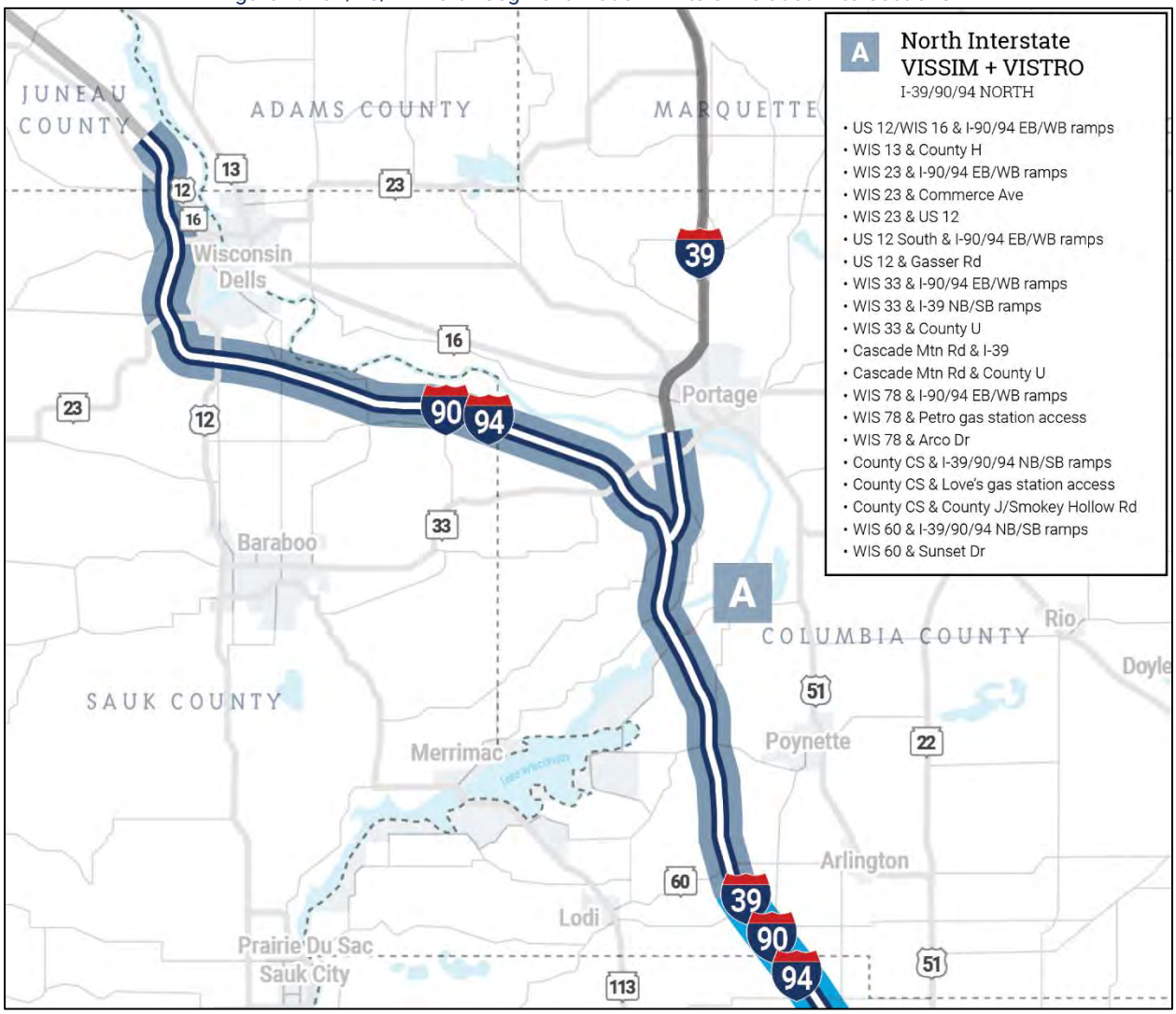
The I-39/90/94 North segment project is a rural freeway corridor that experiences peak traffic conditions during summer Friday afternoons in the northbound direction and Sunday afternoons in the southbound direction. Summer Friday afternoons do not experience reoccurring traffic delays, while summer Sundays have reoccurring traffic delays forming from the I-39/90/94 system interchange. Traffic delays on Sundays are often coupled with vehicular crashes.

The freeway traffic operations of the I-39/90/94 North segment between WIS 60 and US 12/WIS 16 are evaluated using Vissim microsimulation modeling. The 2050 Preferred Build alternative model results for representative Friday and Sunday peak hours are detailed in this report. The 2050 Future with Existing and Committed (2050 FEC) and existing model calibration and validation were detailed in a previous report.

The Vissim models cover the freeway project limits, including the I-39/90/94 system interchange and several service interchanges accessing Wisconsin Dells and Portage. (See **Figure 1**.) Service interchange ramp terminals are included in the model, but the operation results are reported separately using Vistro. The 2050 FEC Vissim models, which were the basis for these 2050 Preferred Build alternative models, were calibrated using WisDOT microsimulation guidelines to a representative summer Friday afternoon peak (2-3 PM) and a summer Sunday afternoon peak (12-1 PM).

The content of the microsimulation report includes updates from the 2050 FEC model, 2050 Preferred Build results, and simulation observations.

Figure 1: I-39/90/94 North Segment Model Limits & Included Intersections



Source: I-39/90/94 Corridor Management

2 Model Development and Validation

The previously submitted I-39/90/94 North Segment Existing Vissim Calibration & Validation report details the data collection, model development and calibration, and model validation. Minor changes to that methodology were outlined in the previously submitted I-39/90/94 North Segment 2050 FEC Vissim report. The 2050 Preferred Build model uses the same methodology as the 2050 FEC model. Volume and geometry updates were made to the 2050 FEC model to create the 2050 Preferred Build model.

One difference between the 2050 Preferred Build methodology and previous models is using Vissim's scenario management feature. This feature eliminates minor network inconsistencies that can occur when working on scenarios in separate model files. It also allows consistency in the base network used for the Friday and Sunday peak hour scenarios. The only differences between the Friday and Sunday models are the vehicle inputs, vehicle compositions, static vehicle routes, and signal timings; all other elements are the same between scenarios.

3 2050 Volumes and Inputs

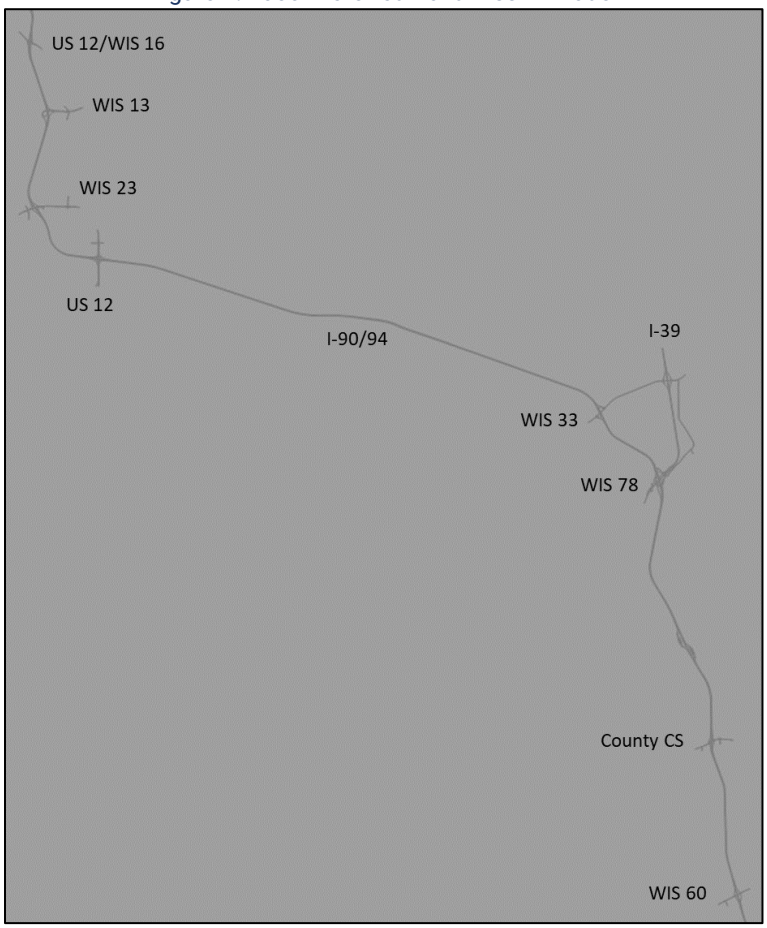
The balanced 2050 Preferred Build alternative volumes are provided in **Appendix A.**

Traffic demand was loaded using Origin-Destination (O-D) matrices, which were then converted to a combination of vehicle inputs and static routes. The I-39/90/94 North Segment Existing Vissim Calibration & Validation report provides more details on the O-D matrix estimation and vehicle input development.

4 Model Updates

Multiple interchanges in the corridor have changes to their ramp configuration or ramp terminals in the Preferred Build alternative. Two interchanges have no alterations between the 2050 FEC and 2050 Preferred Build: WIS 60 and WIS 23. The existing parclo interchange at WIS 60 was recently reconstructed into a diamond interchange with roundabouts at both ramp terminals. The diamond interchange at WIS 23 will remain the same. In the Preferred Build alternative a signalized driveway is added along WIS 23 to represent a Kwik Trip development. This development uses provided signal timings and a partial route to direct a percentage of through trips on WIS 23 to “visit Kwik Trip” by turning into the driveway and back out again to continue on their journey. All other interchanges in the model limits are discussed below. **Figure 2** shows the interchanges included in the 2050 Preferred Build Vissim model.

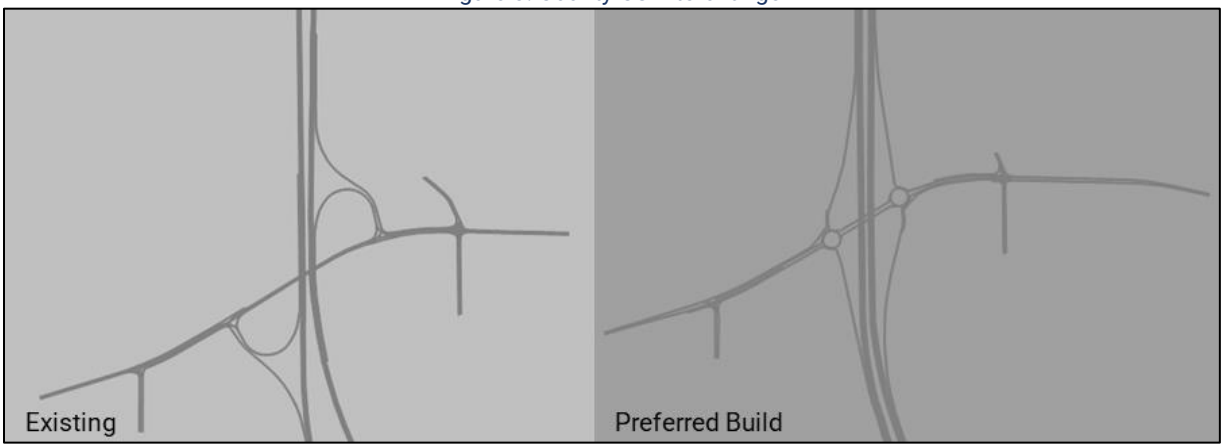
Figure 2: 2050 Preferred Build Vissim Model



4.1 County CS Interchange

The County CS interchange changed from the existing parclo into a diamond interchange with roundabouts at both ramp terminals. **Figure 3** compares the existing conditions to the Preferred Build alternative.

Figure 3: County CS Interchange

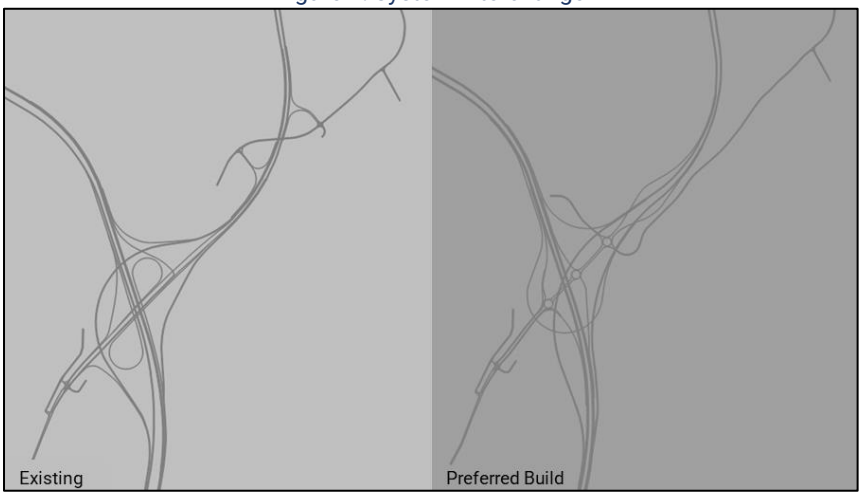


4.2 I-39/90/94 System Interchange & Cascade Mountain Rd

The I-39/90/94 system interchange and Cascade Mountain Rd interchange were previously separated into two interchanges: the system interchange and the Cascade Mountain Rd interchange at I-39. The Preferred Build alternative combines these two interchanges in the existing system interchange area. **Figure 4** compares the existing conditions to the Preferred Build alternative.

Direct-connect ramps are available for freeway movements on I-90/94 and I-39 north of the Cascade Mountain Rd roundabout. A diamond interchange with roundabouts at both ramp terminals allows access between I-90/94 and WIS 78. Cascade Mountain Rd has been changed from a parclo interchange on I-39 to a roundabout intersection on WIS 78.

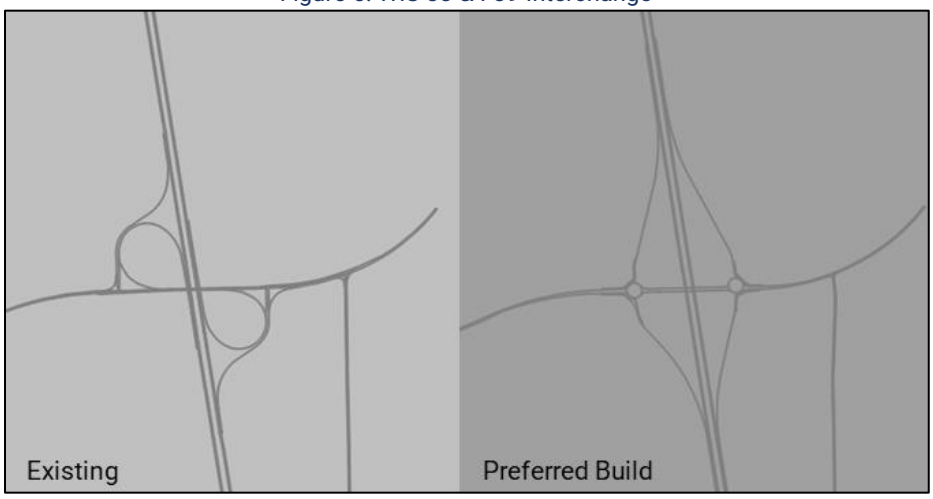
Figure 4: System Interchange



4.3 WIS 33 & I-39 Interchange

The WIS 33 interchange changed from the existing parclo into a diamond interchange with roundabouts at both ramp terminals. The Vissim model was started before the current design was proposed, which is why right-turn bypass lanes are included at this interchange. Right-turn bypass lanes are not included at these roundabouts in the current design. **Figure 5** compares the existing conditions to the Preferred Build alternative.

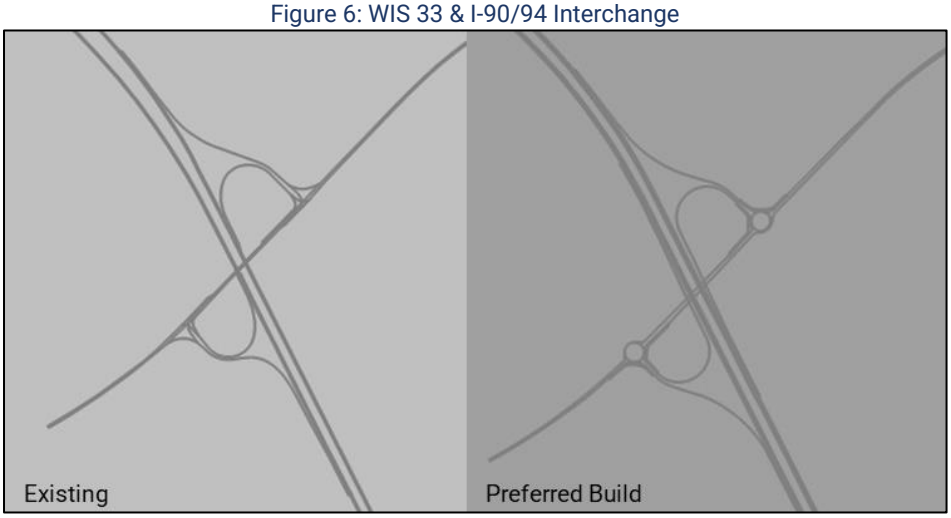
Figure 5: WIS 33 & I-39 Interchange



4.4 WIS 33 & I-90/94 Interchange

The WIS 33 interchange kept the existing parclo interchange but added roundabouts at both ramp terminals. **Figure 6** compares the existing conditions to the Preferred Build alternative.

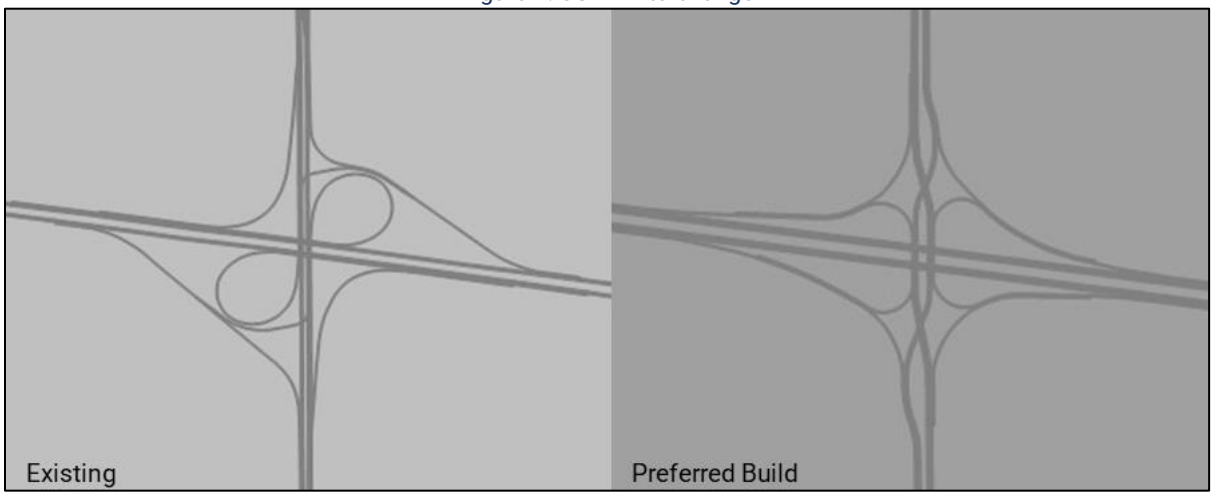
Figure 6: WIS 33 & I-90/94 Interchange



4.5 US 12 Interchange

The US 12 interchange changed from the existing parclo into a diverging diamond interchange. **Figure 7** compares the existing conditions to the Preferred Build alternative.

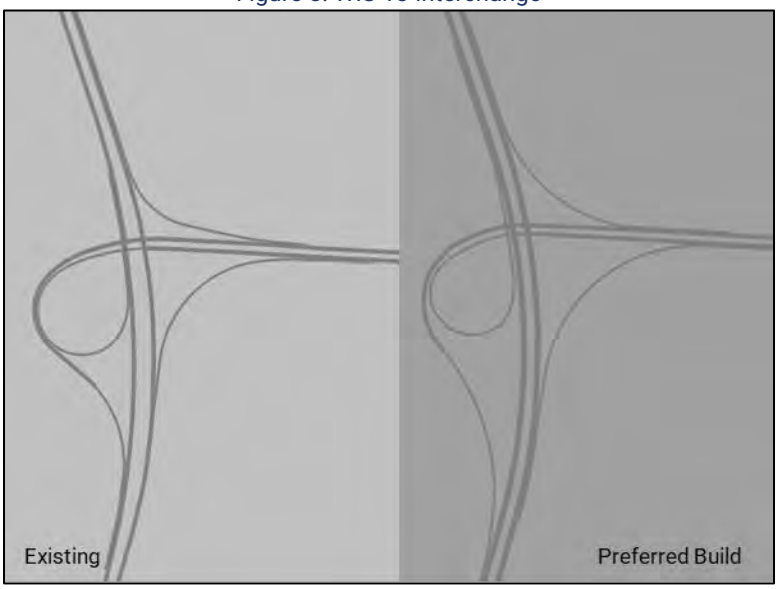
Figure 7: US 12 Interchange



4.6 WIS 13 Interchange

The WIS 13 interchange kept the existing trumpet configuration and updated the ramp curvature to accommodate higher design speeds. **Figure 8** compares the existing conditions to the Preferred Build alternative.

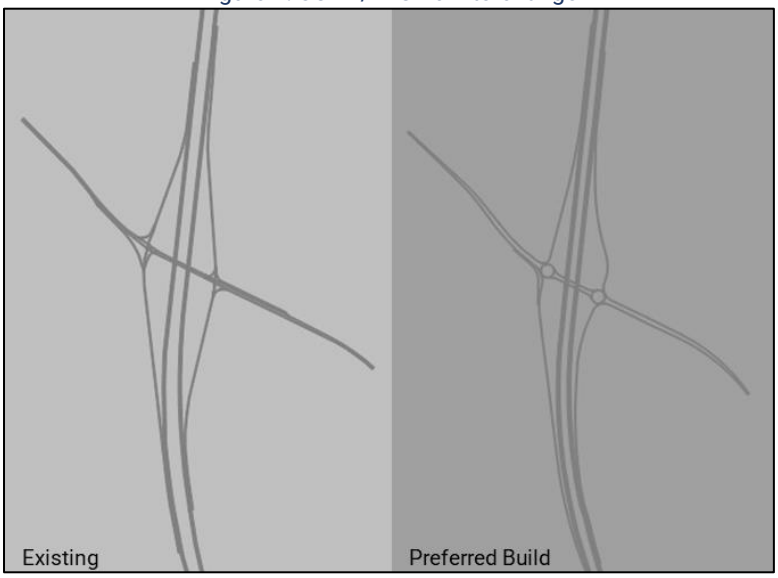
Figure 8: WIS 13 Interchange



4.7 US 12/WIS 16 Interchange

The US 12/WIS 16 interchange kept the existing diamond interchange and added roundabouts at both ramp terminals. **Figure 9** compares the existing conditions to the Preferred Build alternative.

Figure 9: US 12/WIS 16 Interchange



5 Results

The following section reports the 2050 Preferred Build model results compared to the 2050 FEC and existing model.

5.1 Traffic Volume

The 2050 Preferred Build model meets tier-one volume calibration for three corridors on Friday and two corridors on Sunday. On Friday, I-90/94 WB, I-39 NB, and I-39 SB meet tier-one calibration; I-90/94 EB meets tier-two calibration. On Sunday, I-39 NB, and I-39 SB meet tier-one calibration; I-90/94 EB and I-90/94 WB meet tier-two calibration. Traffic volume tables comparing the 2050 Preferred Build model results and targets are in **Appendix B**.

5.2 Travel Speed

Figure 10 through **Figure 13** show the 2050 Preferred Build model speeds compared with the 2050 FEC and existing models. Generally, the Preferred Build model has higher speed than both the 2050 FEC and existing models; this is due to the additional lane throughout the I-90/94 corridor.

The operational issues in the 2050 FEC and existing models are similar between Friday and Sunday. Both days experienced occasional mainline friction from diverging and merging vehicles at US 12/WIS 16, WIS 13, WIS 23, US 12, and WIS 33 interchanges. This friction can be seen in minor to major dips in the speed graphs for the 2050 FEC and existing models. The 2050 Preferred Build model addresses these issues by modernizing the acceleration and deceleration lanes at interchanges. This improvement can be seen in the following graphs, represented by a consistent free-flow speed for the Preferred Build, while the 2050 FEC and existing models experience reduced travel speeds.

The Friday and Sunday 2050 Preferred Build model produced eastbound speeds higher than the 2050 FEC and existing models throughout the eastbound I-90/94 corridor.

For most of the westbound I-90/94 corridor, the Friday and Sunday 2050 Preferred Build model produced westbound speeds higher than the 2050 FEC and existing models. The westbound speeds are similar in the section between County CS and the I-39/90/94 system interchange.

Figure 10: I-90/94 EB Friday Speed Comparison

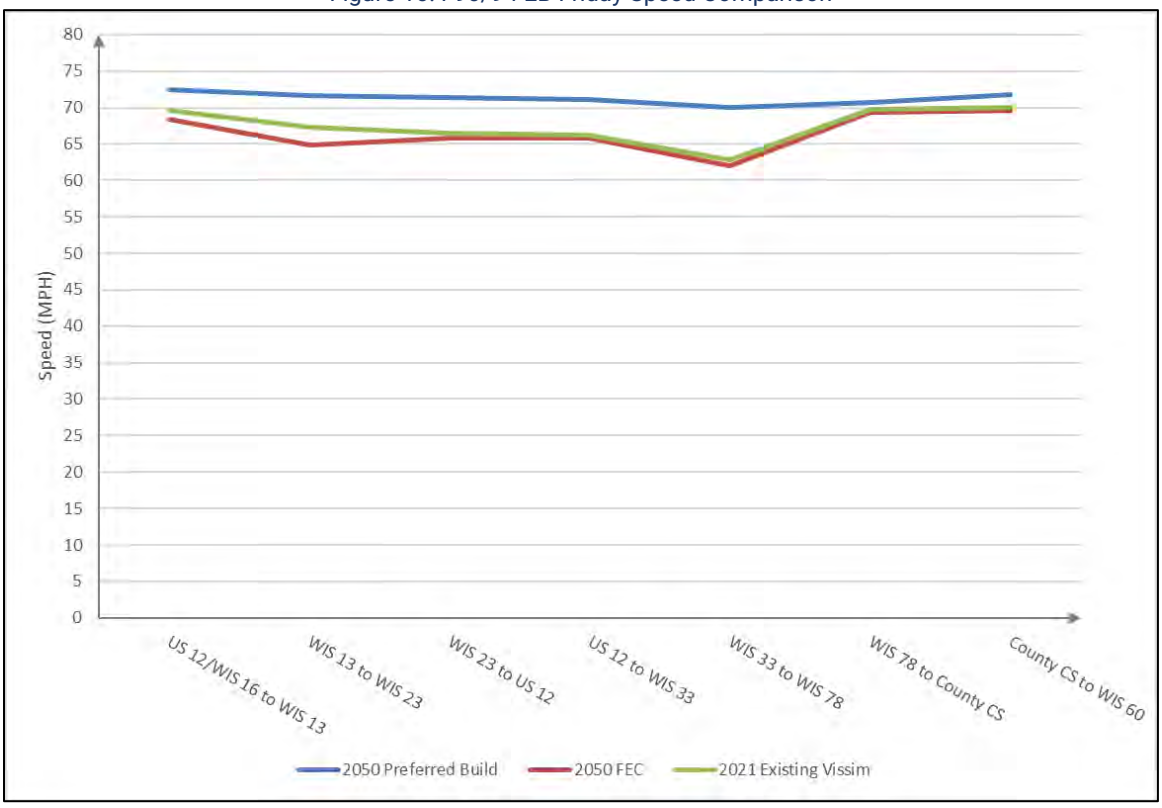


Figure 11: I-90/94 WB Friday Speed Comparison

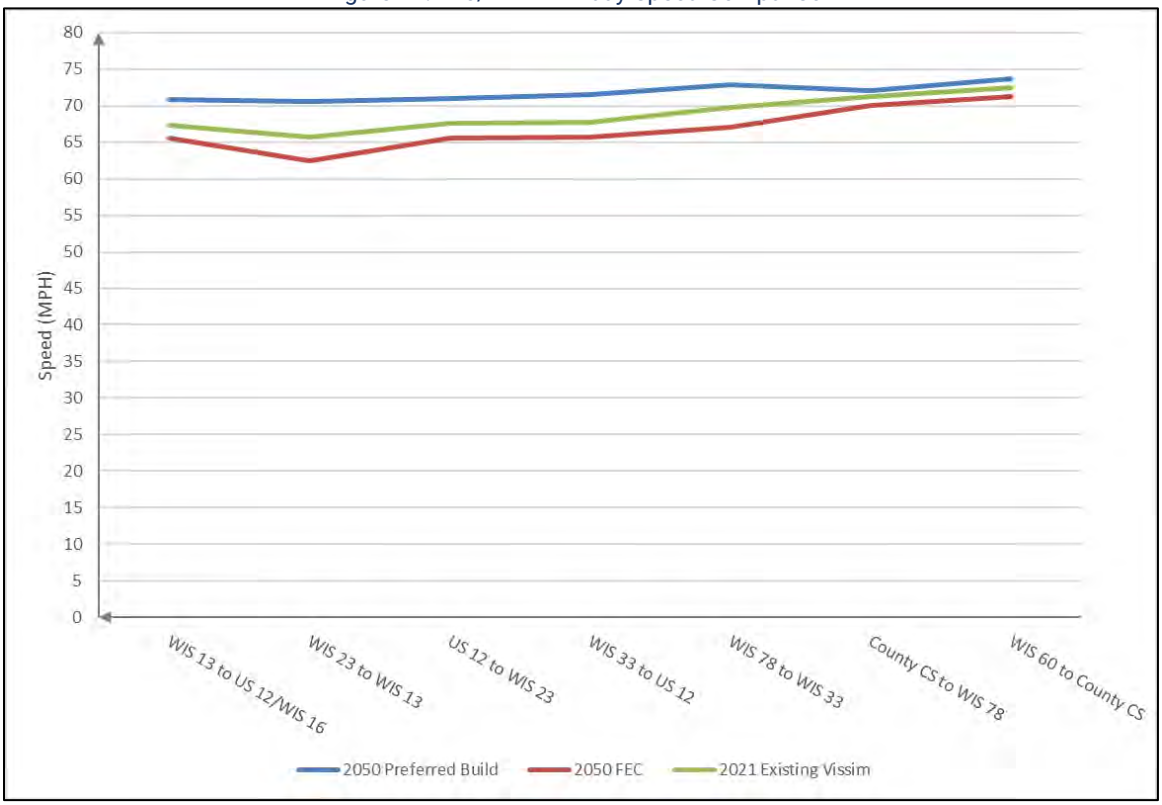


Figure 12: I-90/94 EB Sunday Speed Comparison

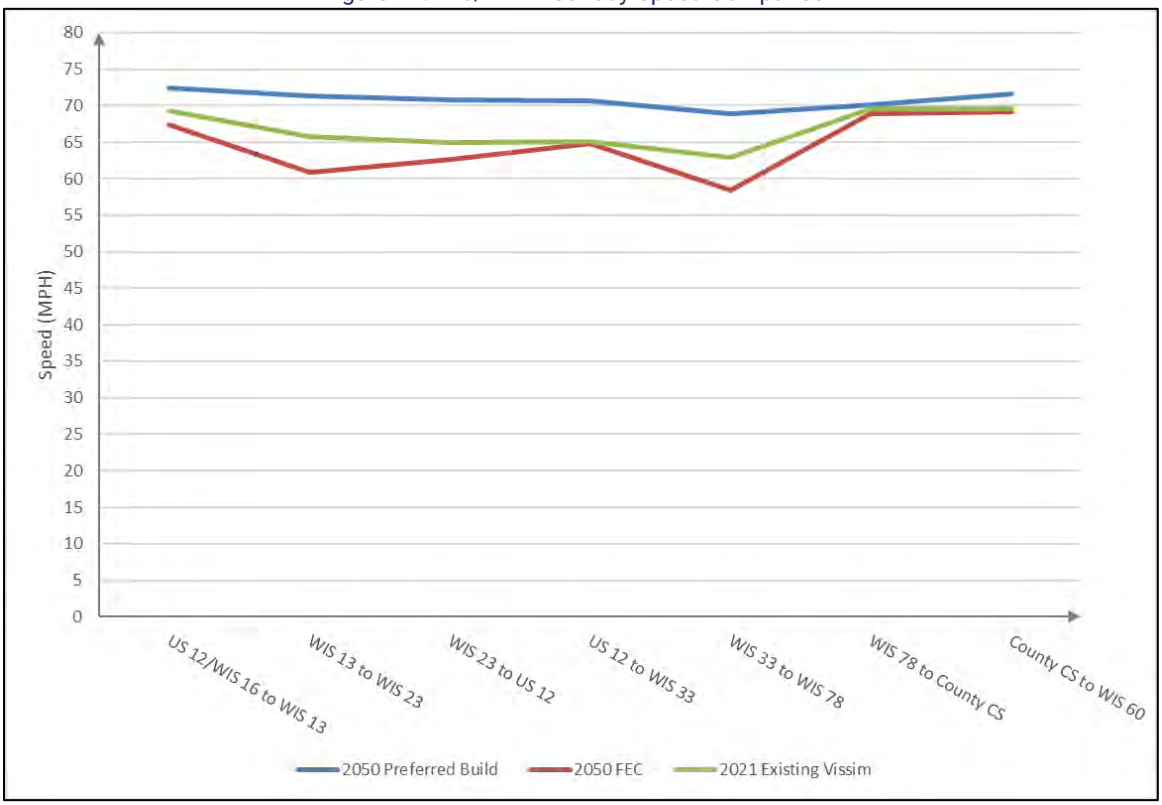
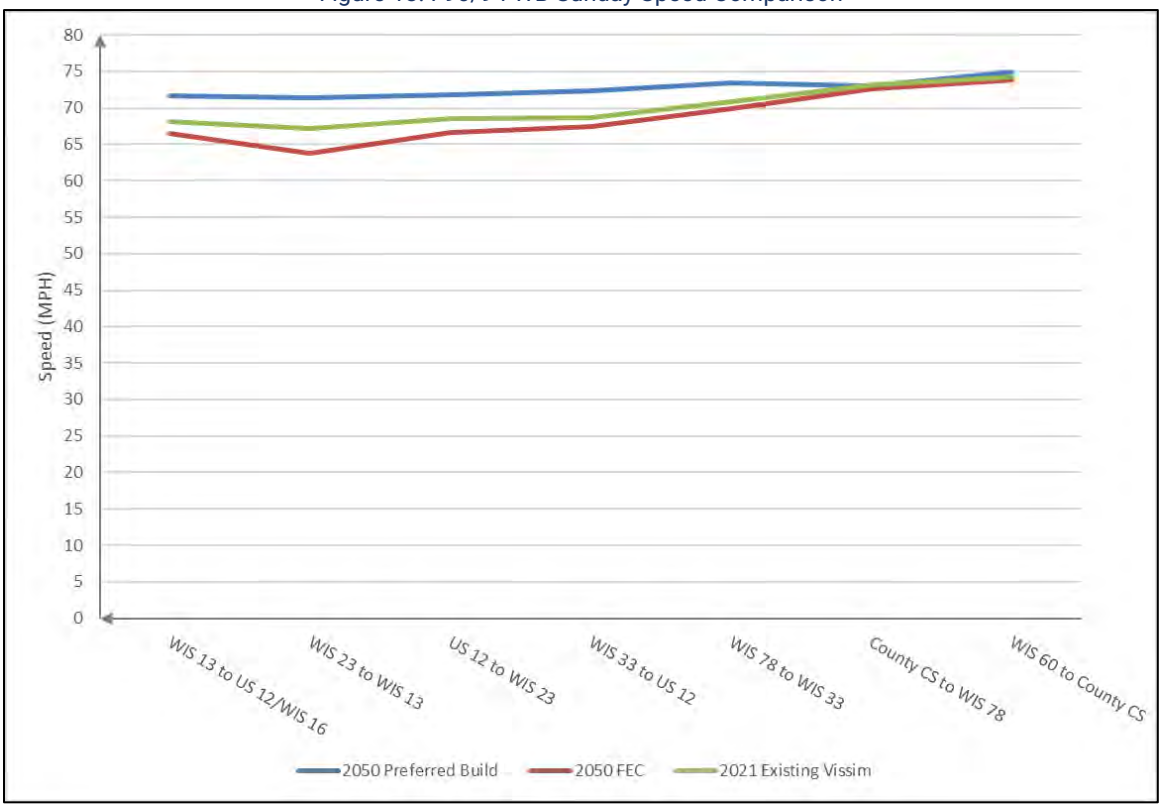


Figure 13: I-90/94 WB Sunday Speed Comparison



5.3 Travel Time

Table 1 and **Table 2** compare the Friday and Sunday travel times between the 2050 Preferred Build, 2050 FEC, and existing models. Overall, the Preferred Build model has shorter travel times than the 2050 FEC and existing models.

Table 1: Friday Travel Time Comparison

Direction	Segment	Distance (mi)	Preferred Build VISSIM (min)	2050 FEC VISSIM (min)	Exist VISSIM (min)	% Difference	
						Preferred Build vs. FEC	Preferred Build vs. Existing
I-90/94 Eastbound	US 12/WIS 16 – System Interchange	23.7	20.0	21.7	21.4	-7.6%	-6.4%
	System Interchange – WIS 60	10.1	8.7	8.9	8.9	-2.2%	-2.0%
I-90/94 Westbound	System Interchange – US 12/WIS 16	22.5	19.0	20.7	20.1	-8.2%	-5.7%
	WIS 60 – System Interchange	11.4	9.4	9.7	9.5	-2.6%	-1.3%

The Friday 2050 Preferred Build model has shorter travel times on I-90/94 than the 2050 FEC and existing models. The most significant improvement is between the northern project limits and the system interchange in both directions, with a range of 6-8% shorter travel times. There is also an improvement between the system interchange and the southern project limits in both directions, but it is not as significant of a change, with a range of 1-2% shorter travel times.

Table 2: Sunday Travel Time Comparison

Direction	Segment	Distance (mi)	Preferred Build VISSIM (min)	2050 FEC VISSIM (min)	Exist VISSIM (min)	% Difference	
						Preferred Build vs. FEC	Preferred Build vs. Existing
I-90/94 Eastbound	US 12/WIS 16 – System Interchange	23.7	20.1	22.2	21.8	-9.5%	-8.0%
	System Interchange – WIS 60	10.1	8.8	8.9	8.9	-1.4%	-1.4%
I-90/94 Westbound	System Interchange – US 12/WIS 16	22.5	18.7	20.2	19.7	-7.3%	-4.9%
	WIS 60 – System Interchange	11.4	9.2	9.3	9.3	-1.3%	-1.1%

Like the Friday model, the Sunday 2050 Preferred Build model has shorter travel times on I-90/94 than the 2050 FEC and existing models. The most significant improvement is between the northern project limits and the system interchange in both directions, with a range of 5-9% shorter travel times. There is also an improvement between the system interchange and the southern project limits in both directions, but it is not as significant of a change, with around 1% shorter travel times.

5.4 Lane Utilization

Table 3 and **Table 4** show the lane utilization percentages of the Friday and Sunday 2050 Preferred Build models. Similar to the 2050 FEC and existing models, there is a high left lane utilization through the corridor; this is due to the high percentage of trucks. The eastbound I-90/94 corridor has 17-18% trucks on Friday and 11-13% on Sunday. The westbound I-90/94 corridor has 16-18% trucks on Friday and 11-12% on Sunday. A high percentage of trucks in the corridor means heavy vehicles are often present in both the right and center lanes, leaving the left lane(s) open for faster vehicles to pass. When vehicles are passing frequently in a corridor like this, the left lane will be well utilized. **Table 5** and **Table 6** show the lane utilization percentages of the Friday and Sunday 2050 FEC models, these are taken directly from the previously submitted 2050 FEC Vissim report.

Table 3: 2050 Preferred Build Friday Lane Utilization Summary

Dir	Location	Lane	Time			
			2:00 PM	2:15 PM	2:30 PM	2:45 PM
I-90/94 Eastbound	South of Rest Areas	Left	26%	26%	25%	25%
		L-Center	28%	29%	28%	28%
		R-Center	25%	25%	25%	26%
		Right	21%	21%	22%	22%
	East of US 12	Left	40%	39%	38%	39%
		Center	35%	36%	37%	36%
		Right	25%	25%	25%	25%
I-90/94 Westbound	South of Rest Areas	Left	33%	34%	33%	33%
		L-Center	28%	29%	29%	28%
		R-Center	20%	19%	19%	19%
		Right	19%	19%	19%	20%
	East of US 12	Left	37%	37%	37%	38%
		Center	37%	36%	37%	37%
		Right	27%	26%	27%	26%

Table 4: 2050 Preferred Build Sunday Lane Utilization Summary

Dir	Location	Lane	Time			
			12:00 PM	12:15 PM	12:30 PM	12:45 PM
I-90/94 Eastbound	South of Rest Areas	Left	26%	26%	25%	26%
		L-Center	28%	28%	28%	28%
		R-Center	24%	25%	25%	24%
		Right	22%	22%	22%	22%
	East of US 12	Left	38%	39%	38%	38%
		Center	36%	35%	36%	36%
		Right	26%	26%	26%	26%
I-90/94 Westbound	South of Rest Areas	Left	33%	33%	33%	33%
		L-Center	30%	30%	30%	30%
		R-Center	19%	19%	19%	19%
		Right	18%	18%	18%	18%
	East of US 12	Left	38%	38%	38%	38%
		Center	37%	37%	37%	37%
		Right	25%	26%	26%	25%

Table 5: 2050 FEC Friday Lane Utilization Summary

Dir	Location	Lane	Data	Time			
				2:00 PM	2:15 PM	2:30 PM	2:45 PM
I-90/94 Eastbound	South of Rest Areas	Left	ATR	39%	39%	39%	39%
			VISSIM	34%	34%	35%	34%
			RNSE	2.3	2.6	2.0	2.3
		Center	ATR	40%	39%	40%	40%
			VISSIM	38%	38%	36%	38%
			RNSE	0.6	0.5	1.5	0.9
		Right	ATR	21%	21%	22%	21%
			VISSIM	27%	28%	29%	28%
			RNSE	***4.0***	***4.3***	***4.7***	***4.4***
	East of USH 12	Left	ATR	57%	57%	57%	58%
			VISSIM	54%	54%	53%	55%
			RNSE	1.3	1.1	1.3	0.9
		Right	ATR	43%	43%	43%	42%
			VISSIM	46%	46%	47%	45%
			RNSE	1.5	1.2	1.5	1.1
I-90/94 Westbound	South of Rest Areas	Left	ATR	36%	36%	36%	36%
			VISSIM	39%	38%	38%	37%
			RNSE	1.5	1.1	0.9	0.3
		Center	ATR	39%	38%	39%	38%
			VISSIM	36%	35%	36%	36%
			RNSE	1.7	1.6	1.5	1.1
		Right	ATR	25%	25%	25%	25%
			VISSIM	26%	26%	26%	27%
			RNSE	0.3	0.6	0.9	1.0
	East of USH 12	Left	ATR	55%	55%	55%	55%
			VISSIM	55%	55%	56%	55%
			RNSE	0.3	0.2	0.1	0.2
		Right	ATR	45%	45%	45%	45%
			VISSIM	45%	45%	44%	45%
			RNSE	0.3	0.2	0.1	0.2

Table 6: 2050 FEC Sunday Lane Utilization Summary

Dir	Location	Lane	Data	Time			
				12:00 PM	12:15 PM	12:30 PM	12:45 PM
I-90/94 Eastbound	South of Rest Areas	Left	ATR	38%	38%	37%	37%
			VISSIM	35%	34%	35%	35%
			RNSE	1.2	2.2	1.0	1.1
		Center	ATR	39%	38%	39%	39%
			VISSIM	38%	38%	37%	38%
			RNSE	0.4	0.3	0.9	0.7
		Right	ATR	24%	23%	24%	23%
			VISSIM	27%	29%	28%	27%
			RNSE	2.0	***3.1***	2.4	2.3
	East of USH 12	Left	ATR	64%	64%	63%	63%
			VISSIM	55%	55%	55%	55%
			RNSE	***3.0***	2.5	2.4	2.5
		Right	ATR	36%	36%	37%	37%
			VISSIM	45%	45%	45%	45%
			RNSE	***4.1***	***3.4***	***3.2***	***3.2***
I-90/94 Westbound	South of Rest Areas	Left	ATR	45%	46%	45%	45%
			VISSIM	43%	43%	42%	42%
			RNSE	1.0	0.9	1.4	1.3
		Center	ATR	36%	36%	36%	36%
			VISSIM	33%	33%	34%	34%
			RNSE	1.3	1.1	0.8	0.8
		Right	ATR	19%	19%	19%	19%
			VISSIM	24%	24%	24%	24%
			RNSE	***3.4***	2.9	***3.2***	***3.1***
	East of USH 12	Left	ATR	57%	58%	58%	58%
			VISSIM	55%	55%	54%	56%
			RNSE	0.7	0.8	1.0	0.7
		Right	ATR	43%	42%	42%	42%
			VISSIM	45%	45%	46%	44%
			RNSE	0.8	0.9	1.1	0.8

6 Observations

The following section reports the project team's observations of the 2050 Preferred Build models.

6.1 Friday Observations

The project team observed the 2050 Preferred Build Friday peak hour model; overall, the model appears to operate without significant issues.

6.1.1 Intersections

There is one set of roundabouts that develops queues. The interchange of WIS 33 and I-39 was often seen to have queueing issues, but these issues did not affect adjacent intersections or the I-39 mainline. The majority of the queuing is seen on WIS 33. There are also queues on the ramps, but they are not substantial. As stated earlier, the right-turn bypass lanes are in the Vissim model, but are not included in the current design. **Figure 14** and **Figure 15** show a couple of instances of queueing at these roundabouts. The presence of a queue at this interchange is consistent with our Sidra analysis. The Sidra 95th percentile queues at the SB ramp terminal on the eastbound approach reach 11 vehicles during the Friday peak hour. The NB ramp terminal had Sidra 95th percentile queues on the westbound approach of 7 vehicles.

Figure 14: WIS 33 & I-39 Exit Ramps – Friday

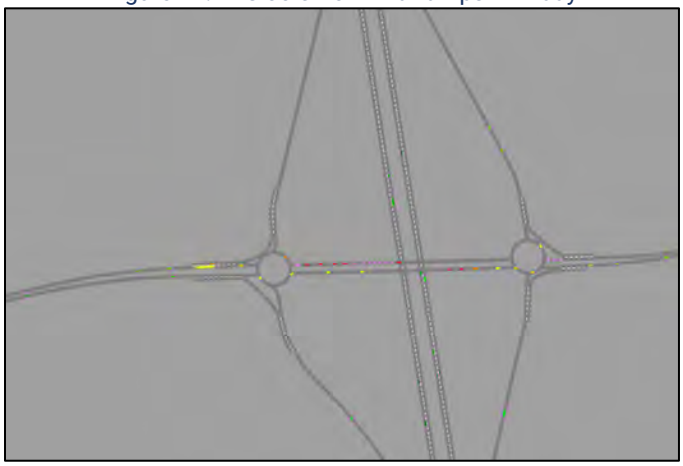
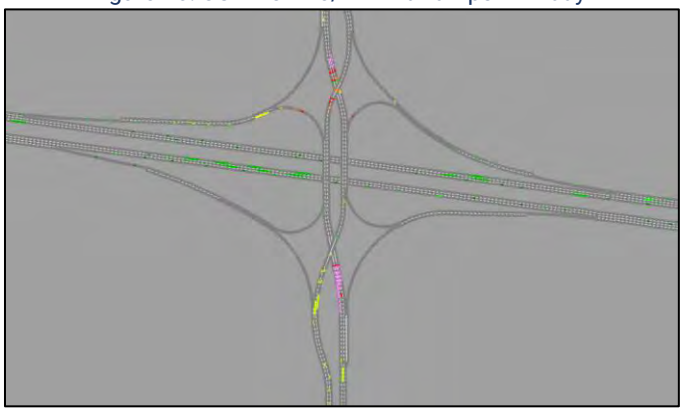


Figure 15: WIS 33 & I-39 Exit Ramps – Friday

The DDI at US 12 and I-90/94 is one intersection with queues throughout the model. The queue is not constant, but a queue does consistently form and dissipate. The northbound approach regularly queues, but vehicles can clear the intersection within 1-2 light cycles. The queuing is made worse when there are many trucks at the intersection. The northbound queue can be seen in **Figure 16**, this represents a typical queue during the peak hour. The Vistro analysis reports a 95th percentile queue of 12-18 vehicles for the NB approach. This is under the condition that 80-90% of NB-WB traffic uses the far-left lane at this intersection, if 100% of NB-WB traffic used the far-left lane the 95th percentile queue jumps to 34 vehicles. A second left-turn lane from NB-WB may be needed based on these results, this can be decided during preliminary design.

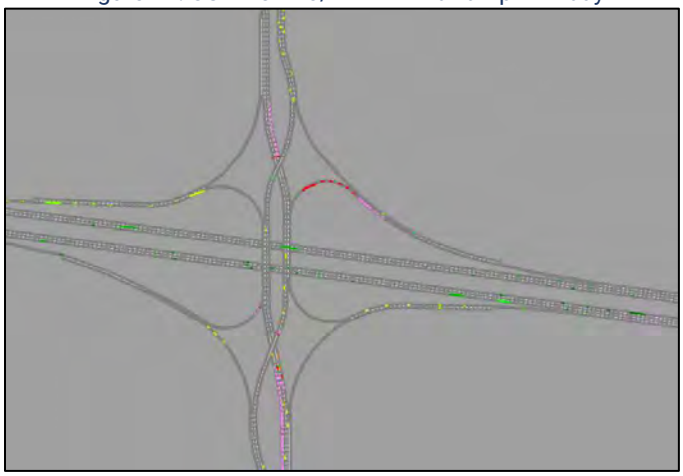
Figure 16: US 12 & I-90/94 Exit Ramps – Friday



6.1.2 Ramps

There were no ramps that operated poorly or had excessive queuing, and our previous Vistro analyses supports this. The US 12 and I-/90/94 interchange shown in **Figure 17** shows a queue on the WB exit ramp that occasionally presents itself but clears up shortly after starting. The Vistro analysis reports a 95th percentile queue of 7 vehicles for the WBL movement.

Figure 17: US 12 & I-90/94 WB Exit Ramp – Friday



6.1.3 Mainline

The mainline was observed to operate without issues in the Friday Preferred Build model. The 2050 FEC model had some mainline friction near the US 12/WIS 16, WIS 13, WIS 23, US 12, and WIS 33 at I-90/94 interchanges. In the 2050 FEC model, diverging or merging vehicles occasionally caused temporary flair-ups of congestion at these locations, but the model

recovered pretty quickly once the merging/diverging vehicle made its desired lane change. This issue is not present in the Preferred Build model due to the modernization of the deceleration and acceleration links at interchange areas.

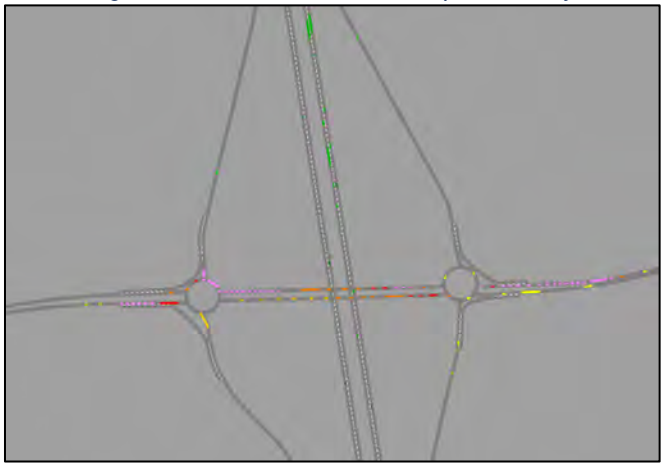
6.2 Sunday Observations

The project team observed the 2050 Preferred Build Sunday peak hour model; overall, the model operates without significant issues.

6.2.1 Intersections

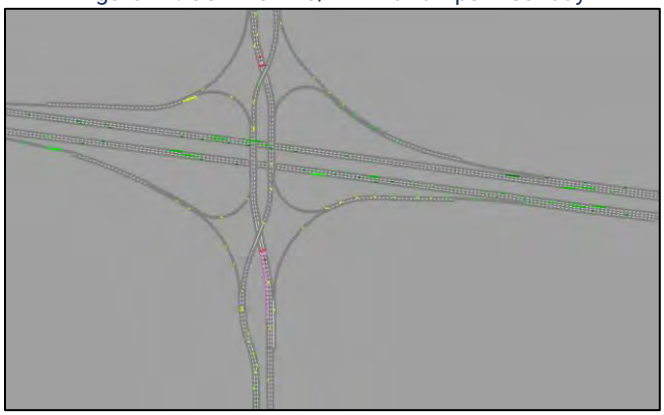
There is one set of roundabouts that develops queues. The interchange of WIS 33 and I-39, seen in **Figure 18**, was often seen to have queueing issues. These queues did not affect adjacent intersections or the I-39 mainline. The majority of the queuing is seen on WIS 33. There are also queues on the ramps, but they are not substantial. As stated earlier, the right-turn bypass lanes are in the Vissim model, but are not included in the current design. The presence of a queue at this interchange is consistent with our Sidra analysis. The Sidra 95th percentile queues at the SB ramp terminal on the eastbound approach reach 18 vehicles during the Sunday peak hour. The NB ramp terminal had Sidra 95th percentile queues on the westbound approach of 11 vehicles.

Figure 18: WIS 33 & I-39 Exit Ramps – Sunday



The DDI at US 12 and I-90/94 is one intersection with queues throughout the model. The queue is not constant, but a queue does consistently form and dissipate. The northbound approach regularly queues, but vehicles can clear the intersection within 1-2 light cycles. The queuing is made worse when there are many trucks at the intersection. The northbound queue can be seen in **Figure 19**, this represents a typical queue during the peak hour. The Vistro analysis reports a 95th percentile queue of 5-10 vehicles for the NB approach. This is under the condition that 80-90% of NB-WB traffic is using the far-left lane at this intersection, if 100% of NB-WB traffic used the far-left lane the 95th percentile queue jumps to 25 vehicles. A second left-turn lane from NB-WB may be needed based on these results, this can be decided during preliminary design.

Figure 19: US 12 & I-90/94 Exit Ramps – Sunday

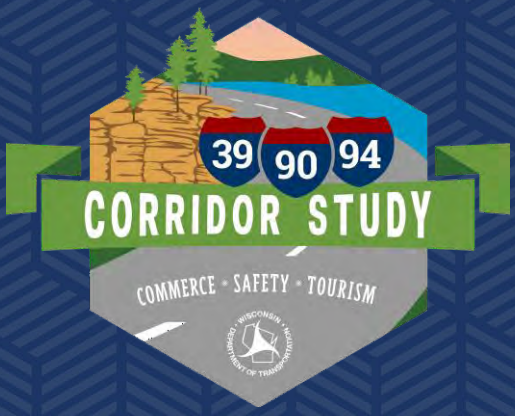


6.2.2 Ramps

All ramps had acceptable operations, which is supported by our previous Vistro analyses.

6.2.3 Mainline

The mainline operated without issues in the Sunday Preferred Build alternative. The 2050 FEC model had some mainline friction near the US 12/WIS 16, WIS 13, WIS 23, US 12, and WIS 33 at I-90/94 interchanges. In the 2050 FEC model, diverging or merging vehicles occasionally caused temporary flair-ups of congestion at these locations, but the model recovered pretty quickly once the merging/diverging vehicle made its desired lane change. This issue is not present in the Preferred Build model due to the modernization of the deceleration and acceleration links at interchange areas.



I-39/90/94 Corridor Study

Technical Memorandum

Preferred Alternative IHSDM Analysis (North Segment)

May 2024

Wisconsin Department of Transportation

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The appendices to this report are not included due to file size constraints. Please contact David Schmidt, P.E., WisDOT Study Manager, (608) 246-3867, david2.schmidt@dot.wi.gov to request a copy of these appendices.

1. Overview

1.1. Methodology

This technical memorandum summarizes the predictive analysis methodology and results used to assess the safety performance of the alternative Interstate 39/90/94 Corridor Study (North Segment) preferred alternative. The predictive analysis was performed using Interactive Highway Safety Design Model (IHSDM) software. This model used the same methodology and predictive analysis approach as the I-39/90/94 Future No Build model and is consistent with the analysis procedures outlined in the November 2022 version of the **Safety Analysis Methodology** document. Information regarding IHSDM functionality, geometric inputs, and analysis outlined in the **I-39/90/94 Corridor Study: Future No Build IHSDM Analysis (North Segment)** technical memorandum is applicable to the preferred alternative analysis documented in this memorandum dated March 17, 2023. The future no build memorandum was reviewed and approved by Wisconsin Department of Transportation (WisDOT) in March of 2023.

1.2. Future No Build vs. Preferred Alternative IHSDM Model Limits

The I-39/90/94 north segment preferred alternative IHSDM analysis limits remain the same as the future no build conditions analysis, which is approximately 40 miles, including 10.6 miles of the I-39/90/94 freeway mainline, approximately 3.2 miles of the I-39 freeway mainline, and 25.9 miles of the I-90/94 freeway mainline. The southern limit of the model is at WIS 60. The south segment study team will evaluate the freeway mainline from the WIS 60 overpass and south. The remaining model limits branch at the WIS 78 system interchange. The I-90/94 western limit of the model is just north of Dees Road and the I-39 northern limit is Levee Road.

Note, a slight discrepancy in corridor length between models is due to the speed change lane lengths in IHSDM crash prediction analysis reports accounting for both directions of the freeway. The future no build IHSDM model reports a total length of approximately 42 miles rather than the 40 miles shown above. Details regarding this discrepancy can be found in the **US 12 IHSDM Alternative Analysis Technical Memorandum** submitted and approved by WisDOT in January 2024. This does not affect any of the crash predictions or the crash totals shown in any table in the future no build report.

Note, the geometric design plans for the north segment preferred alternative have a different stationing system than the one used for the future no build model. The preferred alternative IHSDM model includes the preferred alternative geometric design elements and new stationing. Every effort was made to “match” the stations from the future no build IHSDM model to the new preferred alternative IHSDM model stations for comparison purposes. It should be noted that portions of the corridor mainline have been realigned to meet current design standards for the preferred alternative improvements and this may affect some of the segment analysis limits.

Note, geometric design improvements for the preferred alternative analysis cause traffic to redistribute through the area. Therefore, the Annual Average Daily Traffic (AADT) 2050 volume forecasts for the future no build and preferred alternative analyses vary slightly. The date of the forecast used for each model is documented below.

This technical memorandum describes the geometric improvements to the I-39/90/94 corridor north segment. The improvements are listed below:

- An additional through lane has been added to the entire length of the I-90/94 and I-39/90/94 mainline corridor in both directions. The updated I-90/94 mainline west of the I-39/WIS 78/Petro system interchange (Petro system IC) will go from a 4-lane cross-section to a 6-lane cross-section, and the I-39/90/94 mainline east of the Petro system IC will go from a 6-lane cross-section to an 8-lane cross-section. The I-39 mainline north of the Petro system IC will remain a 4-lane cross-section.

- The I-39/WIS 78/Petro system interchange will have completely updated system ramps with a new system ramp from I-90/94 eastbound to I-39 northbound, and new service ramps from I-39 to WIS 78.
- The I-39 at Cascade Mountain Road interchange will be completely removed, and a rerouted Cascade Mountain Road will be accessible at a roundabout controlled intersection on WIS 78.
- Table 1-1 below shows the updates or modernization of future no build interchange ramp configurations and ramp terminal traffic control in the preferred alternative design.

Ramp configuration and traffic control				
	Future No Build		Preferred Alternative	
Location	Ramp Configuration	Terminal Traffic Control	Ramp Configuration	Terminal Traffic Control
I-90/94 & US 12-WIS 16	Diamond	TWSC*	Updated Diamond	RAB**
I-90/94 & WIS 13	Trumpet	None	Updated Trumpet	None
I-90/94 & WIS 23	Diamond	Traffic Signal	Updated Diamond	Traffic Signal
I-90/94 & US 12	Parclo^	Traffic Signal	DDI^^	Traffic Signal
I-90/94 & WIS 33	Parclo	TWSC	Updated Parclo	TWSC
I-90/94 & WIS 78	Loop ramps/partial diamond	None	Diamond	RAB
I-39/90/94 & County CS	Parclo	TWSC	Updated Diamond	RAB
I-39 & WIS 33	Parclo	TWSC	Diamond	RAB
I-39 & Cascade Mtn Rd	Parclo	TWSC	Rerouted road to WIS 78	RAB

*Two-way stop control, **Roundabout, ^Partial Cloverleaf, ^^ Diverging Diamond Interchange

Table 1-1 Ramp configuration and traffic control (Future No Build and Preferred Alternative)

- February 2024 Annual Average Daily Traffic (AADT) 2050 volume forecasts and related traffic data for the additional lane and improved interchanges have been included in the preferred alternative model. January 2023 Annual Average Daily Traffic (AADT) 2050 volume forecasts were utilized for the in the future no build model.
- In order to compare the future no build conditions IHSDM model results to the preferred alternative IHSDM model, each model was divided into "influence areas" by segment and future no build crash prediction evaluations have been completed for the year 2050.
- For comparison purposes, the "unbalanced lanes" segment in the future no build model will be analyzed separately for the year 2050 as described in the **I-39/90/94 Corridor Study: Future No Build IHSDM Analysis (North Segment)** technical memorandum and the results will be added to the future no build mainline segment crash prediction discussed above. The preferred alternative no longer includes unbalanced lanes. The corresponding segments were analyzed as a separate segment in the preferred alternative model and will be added to the preferred alternative mainline segment crash prediction.
- Although median cable barriers were recorded in the existing and future no build conditions IHSDM models, they are not included in the preferred alternative models. Perpetuating cable barrier systems should be evaluated within the design process on a case-by-case basis. The existing cable barrier systems were installed systemically to address existing cross median crashes and each system will need to be investigated further during the design process. Other barrier types required by the improved roadway design are included in the IHSDM model.
- The November 2022 version of the **Safety Analysis Methodology** memorandum, Section 3 – IHSDM Modeling Standards discusses rumble strips and states that "*If locations within the corridor exist*

without rumble strips and rumble strips are being introduced as part of the project as part of alternative analyses, then the IHSDM model should be set up without using the rumble strip checkbox but rather utilize crash modification factor 3422[1]*.*" The future no build mainlines had rumble strips in all locations outside of bridges and interchange ramp areas. The preferred alternative mainline also has rumble strips present in all locations outside bridges and interchange ramp areas as described in FDM 11-15-1.8.1.1 and shown in SDD 13A05-06b. Therefore, in the IHSDM model, the checkbox was used to denote rumble strip locations rather than applying the CMF noted in the Safety Analysis Methodology memorandum.

These changes are discussed further in the following sections. A comparison of the safety performance results from the IHSDM models for the preferred alternative and the future no build condition is outlined in more detail in Section 5 of this memorandum.

The north and south corridor IHSDM analysis teams have coordinated regarding modeling methodologies, best practices, and segment analysis limits for the future no build model as well as the preferred alternative model.

2. Geometrics

A committed project to apply a high friction surface treatment (HFST) on the westbound side of the County H bridge just north of WIS 13 is planned for 2025. This improvement was included in the future no build model. This improvement is not a geometric change but was coded in IHSDM with a user defined Crash Modification Factor (CMF). A committed WisDOT project at the I-39/90/94 and WIS 60 service interchange which is expected to be completed in 2024 was also included in the future no build model. Details about the WIS 60 project added to the future no build model can be found in the in the **I-39/90/94 Corridor Study: Future No Build IHSDM Analysis (North Segment)** technical memorandum submitted and approved by WisDOT in March 2023.

The I-39/90/94 mainline and interchanges will be reconstructed as part of the preferred alternative model, therefore, the HFST and corresponding CMF at the County H bridge was not carried through from the future no build model. The updated WIS 60 interchange design was included in the preferred alternative model. Construction of a new bridge over the Wisconsin River (WRB) is anticipated to begin in 2024 and be completed by the end of 2027. The design for this bridge and adjacent segments has been obtained and the details have been entered into the preferred alternative model. IHSDM crash predictions for the WRB segment have been included in the analysis results for the preferred alternative mainline analysis.

A diagram illustrating the overall IHSDM modeling limits for both the future no build and preferred alternative models are shown in Figure 2-1.

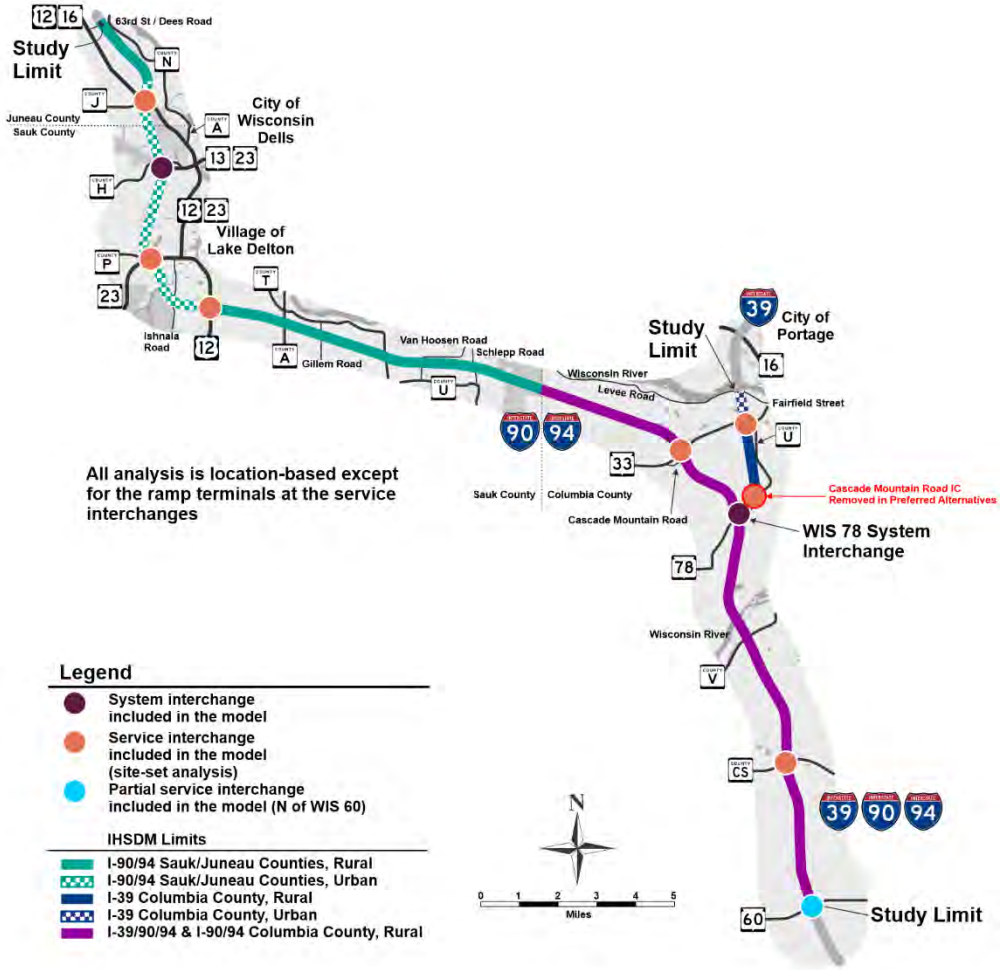

Figure 2-1 Study Limits for the I-39/90/94 North Segment Safety Analysis (Future No Build and Preferred Alternative)

The preferred alternative of a diverging diamond interchange (DDI) at I-90/94 & US 12 is considered a non-traditional interchange. The **Safety Analysis Methodology** memorandum states that "*Diverging Diamond Interchanges (DDI) should be modeled as traditional diamond interchange with user defined CMF's (0.374 FI and 0.649 PD) applied at the ramp terminal intersections*". This is the crash prediction analysis methodology that was used in the IHSDM model for the ramp terminals at this location. Proposed improvements can be seen in Figure 2-2 in the illustration below:

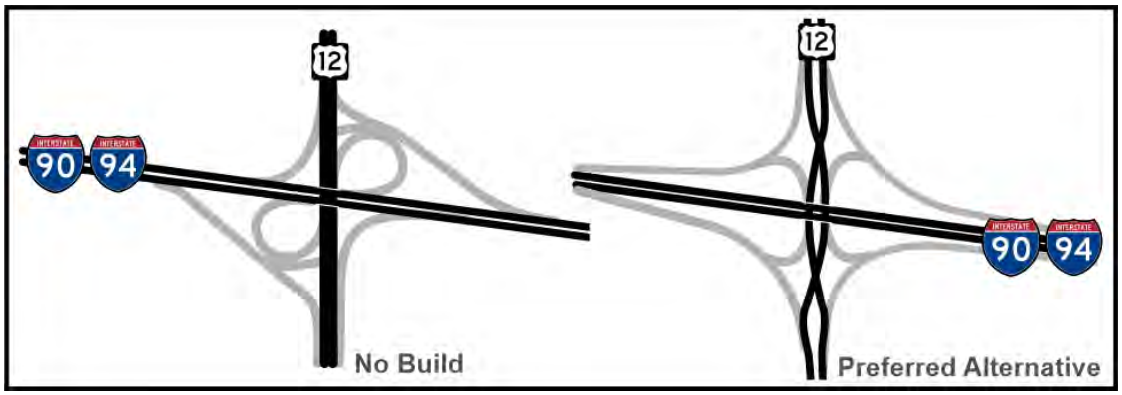

Figure 2-2 Illustration of Future No Build and Preferred Alternative Roadway Designs)

The preferred alternative design for the I-39/WIS 78/Petro System Interchange (Petro System IC) removes and reroutes Cascade Mountain Road; the existing Cascade Mountain Road interchange is eliminated. Access to Cascade Mountain Road is provided via a new roundabout controlled intersection on WIS 78. In addition, the preferred alternative includes new ramps to and from WIS 78 to I-39 to provide access from the freeway to Cascade Mountain Road. Improved system ramps have also been designed and there are new connection points to both I-39 and the I-90/94_I-39/90/94 mainlines. There will be new single-lane RAB ramp terminals at the I-90/94 & WIS 78 interchange. Proposed improvements can be seen in Figure 2-3 in the illustration below:

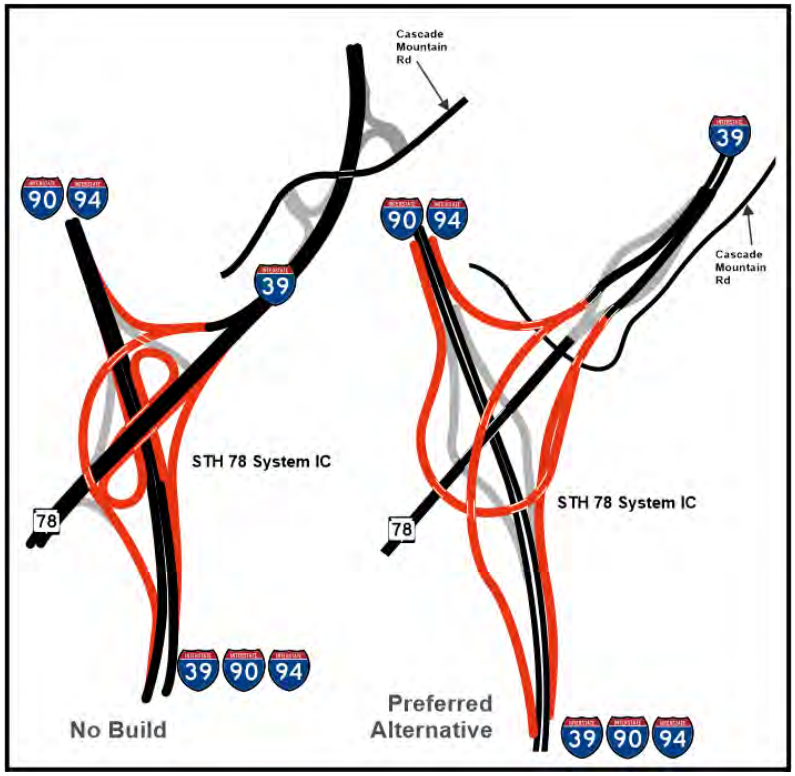

Figure 2-3 Illustration of Future No Build and Preferred Alternative Roadway Designs

As shown in Table 1-1, several ramp terminals will be converted to single lane roundabouts (RAB). IHSDM v16 does not have analysis capabilities for a RAB ramp terminal type. WisDOT Bureau of Traffic Operations (BTO) was consulted to determine how to best handle IHSDM analysis for this situation. It was determined that it would be best to evaluate those locations using the RAB intersection type rather than applying a CMF to the two-way stop control (TWSC) ramp terminal type since the IHSDM model will use State of Wisconsin Calibration factors for the RAB intersection type. Documentation of this discussion can be found in Appendix D. This ramp terminals analysis methodology applies to the preferred alternative for the following interchange ramp terminals I-90/94 & US 12-WIS 16, I-39 & WIS 33, I-90/94 & WIS 78 and I-39/90/94 & County CS. The new intersection of WIS 78 & Cascade Mountain Road also used intersection RAB IHSDM analysis.

Geometric input data for the future no build model can be found in the **I-39/90/94 Corridor Study: Future No Build IHSDM Analysis (North Segment)** technical memorandum submitted and approved by WisDOT in March 2023. The preferred alternative mainline, ramps, and ramp terminals updated geometric input data can be found in Appendix A.

Mainline alignments were provided in detail drawings that are included in Appendix A, in Land XML files for importing into the IHSDM model software, as well as in a map-based viewable format. Below are links to the I-90/94, I-39/90/94, and I-39 mainline KML (Keyhole Markup Language) and KMZ files (zipped versions of KML files) that are openable in software such as Google Earth for viewing the alignments and stationing. An example of the stations viewed in Google Earth using the KML/KMZ files are shown in Figure 2-4, Figure 2-5, and Figure 2-6. As mentioned in Section 1.2 above, the stations for the future no build alignment and the preferred alternative alignments are not the same. Using the KML/KMZ files together, the alignment stations can be "matched" for a comparable analysis.

- Alignment KMZ File, Columbia County (Future No Build)
- Alignment KMZ File, Juneau & Sauk Counties (Future No Build)
- Alignment KML Files, Columbia County (Preferred Alternative)
- Alignment KML Files, Juneau & Sauk Counties (Preferred Alternative)

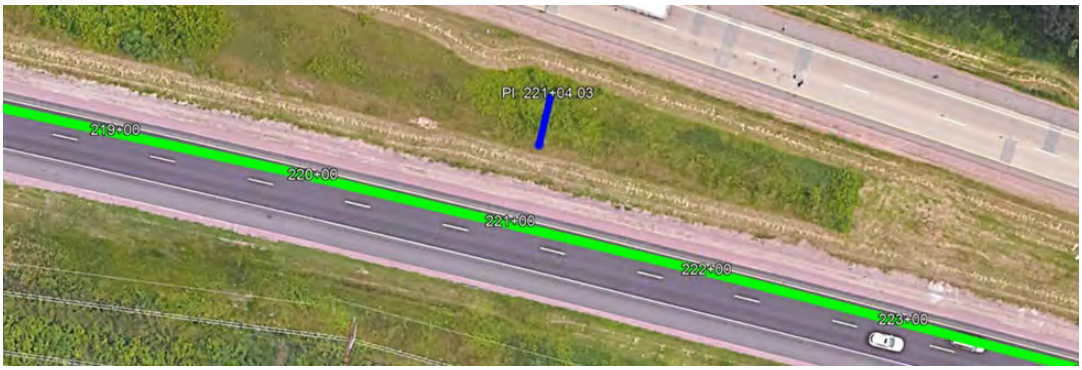

Figure 2-4 Example of Future No Build I-90/94 Alignment Viewable in Google Earth

Figure 2-5 Example of Preferred Alternative I-90/94 Alignment Viewable in Google Earth

Figure 2-6 Example of Future No Build and Preferred Alternative I-90/94 Alignments both Viewable in Google Earth

3. Traffic

Forecasted traffic volumes were developed by the CDMCT and WisDOT and were provided to the north segment study team for use in the future no build conditions. The balanced forecast volumes that were provided included 2050 AADT volumes along with 2050 peak hour volumes for weekdays. These forecasted volumes were provided for all mainline and ramp segments throughout the study limits.

Forecasted traffic volumes using redistributed traffic were developed by the CDMCT and WisDOT for the year 2050 and were provided to the north segment study team for use in the predictive safety analysis for the preferred alternative condition. The year 2050 AADT data were input into the preferred alternative model for each freeway mainline segment, ramp, and ramp terminal intersection. Schematics and tables showing the 2050 AADT forecast volumes that were used as input data for the preferred alternative IHSDM model are included in Appendix B.

4. High Volume Hours

The balanced 2050 AADT traffic volumes and spreadsheet tools developed for the existing conditions IHSDM modeling effort were utilized to develop 2050 high-volume hour inputs for both the future no build and the preferred alternative models. Since the preferred alternative includes an additional mainline lane in both directions along the entire length of the corridor the high-volume hours decreased to zero percent along the I-90/94 and I-39/90/94 mainlines within the study area. The high volume hours for the I-39 segment in Columbia County are expected to remain at zero percent in the 2050 preferred alternative conditions.

Tables showing the high volume hour outputs for each freeway corridor are included in Appendix C. Example high volume hour calculations are also shown in Appendix C for preferred alternative conditions, which utilized the same calculation methodology as the future no build conditions analysis.

5. Preliminary Results

The preferred alternative IHSDM model for the north segment evaluated the I-39/90/94 freeway corridor as well as the I-90/94 and I-39 freeway corridors using the Predictive Method to estimate the predicted number of crashes throughout each corridor. Per discussion between CDMCT and the WisDOT BTO State Traffic Safety Engineers, it was determined that only a one-year window with 2050 forecasts would be used to evaluate crash prediction between the future no build and preferred alternative IHSDM models for this study. While there is value to conducting an analysis for 10- or 20-years, there are data elements (including traffic forecasts for interim years, construction phasing, etc.) that do not exist and would require substantial additional effort to incorporate a second set of traffic volumes into IHSDM. Conducting a 10- or 20-year analysis would be beneficial at a point in the future during the project's development process when construction dates are more reasonably known; updating IHSDM with accompanying traffic forecasts and construction phasing would be appropriate to discuss at that time (sometime following the environmental document's Record of Decision and approval of project funding). The current predictive safety analysis, however, will proceed using a one-year window with 2050 forecasts. Documentation of this discussion and WisDOT's comments are in a correspondence dated March 22, 2024 can be found in Appendix D.

During the development of interchange type alternatives, IHSDM crash prediction analysis was performed for two interchanges, I-90/94 & US 12 and I-90/94 & WIS 13, to evaluate potential improvement alternatives for each interchange, including their ramp configuration and ramp terminal traffic control. The evaluation method used for these two locations included both location based and site set IHSDM analysis. WisDOT southwest region and BTO provided comments and concurrence on the I-90/94 & US 12 IHSDM analysis for alternative selection in February 2024. The I-90/94 & WIS 13 ISHDM analysis was reviewed by WisDOT southwest region and BTO and were coordinating with the analysis team, but the technical memorandum was not finalized for this location due to the preferred alternative being selected prior to completion of the report.

IHSDM predictive safety analysis was also used to evaluate ramp terminal traffic control alternative for Phase II Intersection Control Evaluation (ICE) purposes as required by the FDM 11-25-3. Phase II ICE reports were completed for I-39 & WIS 33, I-90/94 & WIS 33, and I-39/90/94 & County CS. The IHSDM analysis only considered the ramp terminals and did not include evaluation of the ramps. The ramp terminals were analyzed in IHSDM using site set analysis methods. Phase II ICE reports with the IHSDM evaluation results were submitted by the north segment team for evaluation by WisDOT and CDMCT. Those reports and resultant WisDOT communication are not included in this report but can be found on BOX at this link:
https://app.box.com/folder/158368542314?s=7wo0rhprjzs4ryzsxr2spuago7jp88bn

In order to compare the IHSDM crash prediction results, both the future no build and preferred alternative IHSDM models were divided into "influence area segments". Influence area segments clip the IHSDM models into areas that include multiple components of updated ramps, ramp terminals, mainline configuration, speed change lanes and system ramps (where applicable) allowing for a comprehensive comparison.

For both the north and south segment corridors, there were areas with major changes in roadway geometric design including removal and/or new construction of interchanges, ramps, intersections, and collector-distributor roads. Direct comparison of the IHSDM crash prediction results of the preferred alternative IHSDM model against the results from the future no build IHSDM model would not give reasonable crash prediction comparisons with designs that have multiple components to improve existing operation and safety deficiencies.

Figure 5-1 and Figure 5-2 on the following pages show the "influence area" segments that will be used in the North Segment corridor comparison of the future no build IHSDM crash prediction results to the preferred alternative IHSDM crash prediction results.

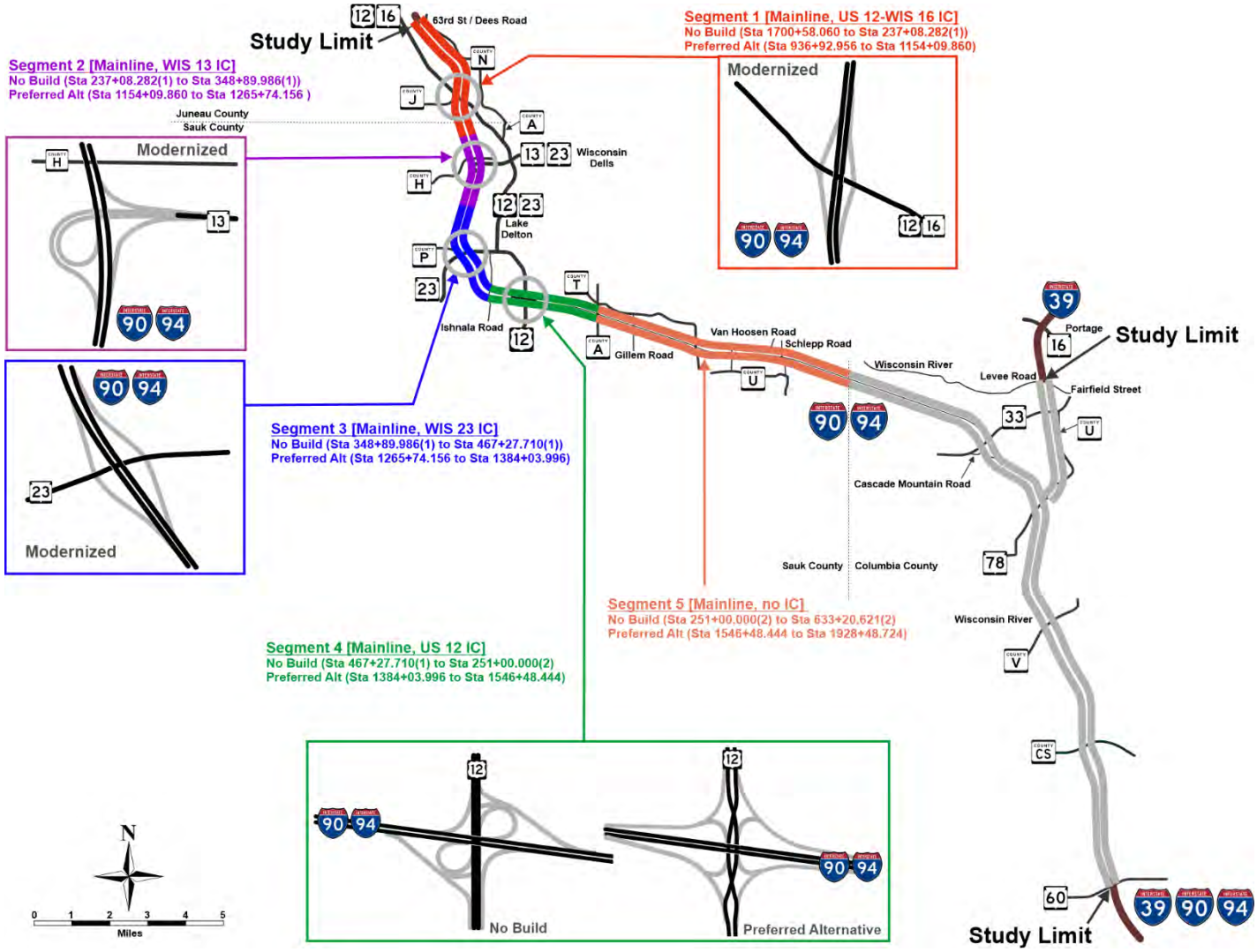

Figure 5-1 Influence Area Segments – Juneau-Sauk Counties

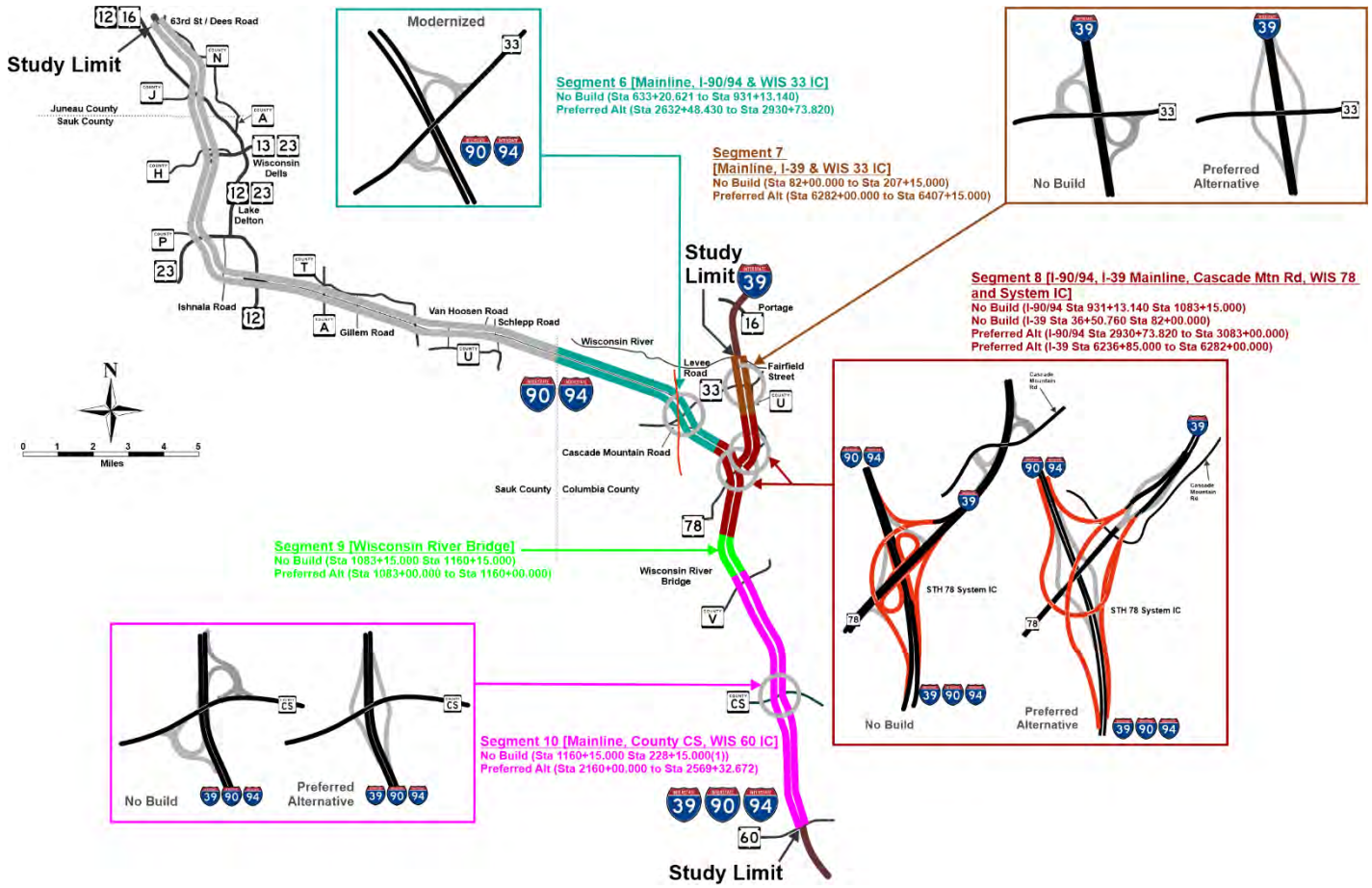

Figure 5-2 Influence Area Segments – Columbia County

To assess how changes in geometrics and traffic volumes associated with the preferred alternative may affect safety performance within the study limits, each "influence area segment" was analyzed in IHSDM to calculate the predicted crashes for that segment. The mainline sections are classified as either speed change crashes or freeway crashes, depending on where they occurred on the roadway. Speed change crashes occur on the mainline in the ramp entrance and exit areas whereas freeway crashes occur outside of those locations on the mainline freeway lanes. Figure 5-3 illustrates where mainline and speed change crashes occur. Ramp predicted crashes occur only on the ramp sections, and ramp terminal crashes occur within a 250-foot radius of each terminal.

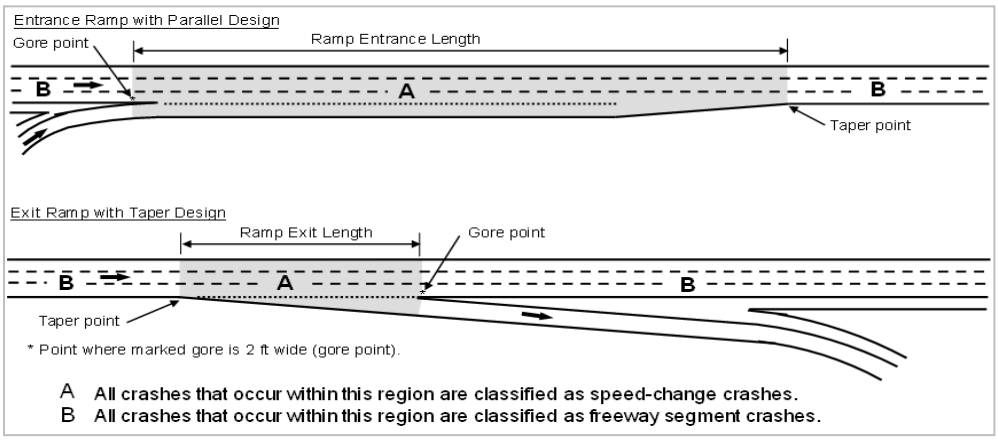

Figure 5-3 Definition of Freeway and Speed-Change Segments

The mainline, speed change lanes and ramps were analyzed with IHSDM location based methodology and the ramp terminals were analyzed separately using IHSDM site set analysis methods. IHSDM analyses were completed for the year 2050 and crash prediction evaluation reports for individual mainlines with speed change lanes, interchange ramps and ramp terminals for both the future no build conditions and the preferred alternative conditions can be found in Appendix E. Individual components analyzed in IHSDM were summed to give a crash prediction for each "influence area" and crash prediction summary tables for each "influence area" for the year 2050 can be found in Section 5.1.

Segment 8, shown in Figure 5-2, includes a portion of I-90/94 northwest of the system interchange, a portion of I-39 north of the system interchange, the system interchange itself, and the WIS 78 interchange. The segments analyzed as "unbalanced lanes" in the future no build report are also included in Segment 8. This "influence area" encompasses the future no build Cascade Mountain Road interchange as well as the future no build connection of the I-39 mainline to WIS 78. The preferred alternative design removes and reroutes Cascade Mountain Road thus eliminating that interchange. Access to Cascade Mountain Road will now be provided via a new roundabout controlled intersection at WIS 78 and Cascade Mountain Road. The preferred alternative improvements include new ramps to and from WIS 78 to I-39 to provide access from the freeway to WIS 78 and Cascade Mountain Road. Improved system ramps have also been designed and there are new connection points to both I-39 and the I-90/94_I-39/90/94 mainlines. Segmenting the analysis in this manner will allow all appropriate movements within this area to be included in the crash prediction analysis comparison.

Segment 9 isolates the Wisconsin River bridge segment (WRB) that will be reconstructed in a committed project prior to construction of the preferred alternative improvements on the remainer of the I-39/90/94 corridor. This segment will be analyzed separately in the IHSDM model. Results for both the future no build conditions and the preferred alternative conditions at this mainline location will be shown in Table 5-1 in Section 5.1.

5.1. Influence Area Segments: Mainline, Ramp, and Ramp Terminal Analysis

All crash results are shown by corridor "influence areas segment" as illustrated in Figure 5-1 and Figure 5-2 and as indicated in Table 5-1.

Freeway							Predicted Crashes		
Influence Area	Segment Includes Interchange	Future No Build Start Station	Future No Build End Station	Preferred Alternatives Start Station	Preferred Alternatives End Station	Effective Length^ (mi)	Future No Build Conditions (2050) One year analysis	Preferred Alternatives Conditions (2050) One year analysis	Percent Difference
Juneau-Sauk Counties I-90/94 Freeway Segments									
Segment 1 (I-90/94)	US 12 - WIS 16	1700+58.060	237+08.282(1)	936+92.956	1154+09.86	4.11	29.69	29.54	-0.5%
Segment 2 (I-90/94)	WIS 13	237+08.282(1)	348+89.986(1)	1154+09.86	1265+74.156	2.11	18.14	16.60	-8.5%
Segment 3 (I-90/94)	WIS 23	348+89.986(1)	467+27.710(1)	1265+74.156	1384+03.996	2.24	37.36	37.13	-0.6%
Segment 4 (I-90/94)	US 12	467+27.710(1)	251+00.000(2)	1384+03.996	1546+48.444	3.07	34.05	35.78	5.1%
Segment 5 (I-90/94)	--	251+00.000(2)	633+20.621(2)	1546+48.444	1928+48.724	7.23	48.32	44.69	-7.5%
Juneau-Sauk Counties I-90/94 Freeway Segments						**18.78**	**167.56**	**163.74**	**-2.3%**
Columbia County I-90/94, I-39/90/94, and I-39 Freeway Segments									
Segment 6 (I-90/94)	WIS 33	633+20.621	931+13.140	2632+48.430	2930+73.820	5.65	40.90	39.81	-2.7%
Segment 7 (I-39)	WIS 33	82+00.000	207+15.000	6282+00.000	6407+15.000	2.37	13.76	16.91	22.9%
Segment 8 * (I-39, I-90/94, I-39/90/94)	WIS 78, System IC, and Cascade Mtn Rd	36+50.000	1160+15.000	6236+85.000	3083+00.000	3.74	33.20	40.79	22.9%
Segment 9 (I-39/90/94)	Wisconsin River Bridge	1083+15.000	1160+15.000	1083+00.000	1160+00.000	1.46	15.76	14.91	-5.4%
Segment 10 (I-39/90/94)	County CS	1160+15.000	228+15.000(1)	2160+00.000	2569+32.672	7.75	79.03	78.96	-0.1%
Columbia County I-90/94, I-39/90/94, and I-39 Freeway Segments						**20.96**	**182.64**	**191.38**	**4.8%**
Grand Total									
Corridor (All Segments) - Mainline, Speed Change, Ramps, Ramp Terminals						**39.74**	**350.20**	**355.12**	**1.4%**

*Includes Unbalanced Lanes predicted crashes
^Effective length includes Mainline and Speed-Change Segments. Speed Change lane effective length accounts for 1/2 length shown in evaluation report for comparative effective length.

Table 5-1 Evaluation Results: "Influence Area" Segment Predicted Crashes

When considering the entire study area, comparison of the year 2050 predicted crashes shows an increase in overall predicted crashes from the future no build conditions to the preferred alternative conditions, however 7 of the 10 "influence area segments" show a decrease in predicted crashes. This is based on the sum of the "influence area segments" year 2050 predicted crash totals presented in Table 5-1. Segment 4 showed an increase in crashes at the ramp terminals of I-90/94 & US 12 due to the new traffic pattern at the signals for a DDI. Segment 7 had an increase in crashes in the speed change lanes and ramp terminals due to the new ramp connection taper lengths as well as the RABs at the ramp terminals of I-39 & WIS 33. Segment 8 crash prediction decreases along the mainline, but increased at the speed change lanes, ramps, and ramp terminals; this segment includes a new ramp from I-90/94 EB to I-39 NB, a new ramp configuration with RAB terminals at I-90/94 & WIS 78 and 2 new ramps from I-39 to and from WIS 78. Segment 8 also includes the rerouted Cascade Mountain Road to a new RAB controlled intersection with WIS 78. Note for segment 8, the preferred alternative geometric design eliminates the Cascade Mountain Road interchange which has an extremely high existing crash rate.

In addition to the relative difference between the total number of predicted crashes, crash severity was analyzed for each of the preferred alternative "influence area segments" and compared against the future no build results. Table 5-2 provides crash prediction results by crash severity.

Freeway "Influence Area" Evaluated	Future No Build Year 2050 Total Predicted Crashes	Crash Severity			Preferred Alternatives Year 2050 Total Predicted Crashes	Crash Severity		
		FI Crashes	PDO Crashes	FI/PDO %		FI Crashes	PDO Crashes	FI/PDO %
Segment 1 Predicted Crashes	29.69	9.58	20.11	32/68	29.54	9.10	20.41	31/69
Segment 2 Predicted Crashes	18.14	5.54	12.60	31/69	16.60	5.11	11.49	31/69
Segment 3 Predicted Crashes	37.36	13.42	23.93	36/64	37.13	13.61	23.51	37/63
Segment 4 Predicted Crashes	34.05	12.28	21.80	36/64	35.78	10.16	25.60	28/72
Segment 5 Predicted Crashes	48.32	14.79	33.52	31/69	44.69	13.27	31.42	30/70
Juneau-Sauk Counties Corridor Totals	**167.56**	**55.60**	**111.96**	**33/67**	**163.74**	**51.26**	**112.44**	**31/69**
Segment 6 Predicted Crashes	40.90	13.10	27.80	32/68	39.81	12.13	27.68	30/70
Segment 7 Predicted Crashes	13.76	4.59	9.16	33/67	16.91	3.98	12.93	24/76
Segment 8 Predicted Crashes	33.20	10.44	22.75	31/69	40.79	10.59	30.20	26/74
Segment 9 Predicted Crashes	15.76	4.90	10.85	31/69	14.91	4.51	10.40	30/70
Segment 10 Predicted Crashes	79.03	23.78	55.23	30/70	78.96	22.16	56.81	29/71
Columbia County Corridor Totals	**182.64**	**56.81**	**125.80**	**31/69**	**191.38**	**53.37**	**138.02**	**28/72**
I-90/94, I-39, I-39/90/94 Corridor Totals	**350.20**	**112.41**	**237.76**	**32/68**	**355.12**	**104.63**	**250.47**	**29/71**

Table 5-2 Evaluation Results: "Influence Area" Segments Predicted Crash Severity

The number of Fatal and Injury (FI) crashes for all evaluation "influence area segments" within the study area is predicted to decrease by 6.9 percent for the year 2050 evaluation.

The number of predicted injury crashes for the Juneau-Sauk Counties I-90/94 mainline are estimated to decrease by 7.8 percent for the year 2050. For Columbia County I-90/94, I-39/90/94 and I-39, the year 2050 predicted crashes are estimated to increase by approximately 5 percent, however the FI crashes are predicted to decrease by 6 percent for the evaluation period.

In general, the ratio of FI crashes to PDO crashes decreases between the future no build conditions and the preferred alternative conditions for each of the freeway "influence area segments" evaluated.

Table 5-3 shows the mainline, speed change, ramps and ramp terminals predicted crashes and crash severity for each "influence area segment". The mainline, ramp and ramp terminal analyses for each individual corridor and interchange IHSDM evaluation reports can be found in Appendix E. The future no build crash prediction evaluation reports are in Appendix E-1 and the preferred alternative crash prediction evaluation reports are in Appendix E-2. Detailed evaluation result summary tables can be found in Appendix F.

Freeway Evaluated	Future No Build Year 2050 Total Predicted Crashes	Crash Severity			Preferred Alternatives Year 2050 Total Predicted Crashes	Crash Severity		
		FI Crashes	PDO Crashes	FI/PDO %		FI Crashes	PDO Crashes	FI/PDO %
Seg 1 (Juneau/Sauk Counties) mainline	25.59	8.31	17.28	32/68	22.78	7.89	14.88	35/65
Seg 1 (Juneau/Sauk Counties) speed change	2.42	0.67	1.75	28/72	2.74	0.73	2.01	27/73
Seg 1 (Juneau/Sauk Counties) ramps	0.48	0.22	0.26	46/56	0.69	0.31	0.36	45/55
Seg 1 (Juneau/Sauk Counties) ramp terminals	1.20	0.38	0.82	31/69	3.33	0.17	3.16	5/95
Segment 1 Totals	**29.69**	**9.58**	**20.11**	**32/68**	**29.54**	**9.10**	**20.41**	**31/69**
Seg 2 (Juneau/Sauk Counties) mainline	14.05	4.22	9.83	30/70	11.73	3.48	8.25	30/70
Seg 2 (Juneau/Sauk Counties) speed change	2.87	0.81	2.06	28/72	2.94	0.82	2.12	28/72
Seg 2 (Juneau/Sauk Counties) ramps	1.22	0.51	0.71	42/58	1.93	0.81	1.12	42/58
Segment 2 Totals	**18.14**	**5.54**	**12.60**	**31/69**	**16.60**	**5.11**	**11.49**	**31/69**
Seg 3 (Juneau/Sauk Counties) mainline	17.10	5.42	11.68	32/68	14.75	4.32	10.43	29/71
Seg 3 (Juneau/Sauk Counties) speed change	1.74	0.52	1.22	30/70	3.79	1.04	2.75	27/73
Seg 3 (Juneau/Sauk Counties) ramps	1.23	0.53	0.69	43/57	1.29	0.55	0.74	43/27
Seg 3 (Juneau/Sauk Counties) ramp terminals	17.29	6.95	10.34	40/60	17.30	7.70	9.59	45/55
Segment 3 Totals	**37.36**	**13.42**	**23.93**	**36/54**	**37.13**	**13.61**	**23.51**	**37/53**
Seg 4 (Juneau/Sauk Counties) mainline	19.58	6.06	13.52	31/69	17.16	5.09	12.07	30/70
Seg 4 (Juneau/Sauk Counties) speed change	2.61	0.75	1.86	29/71	3.07	0.90	2.17	29/71
Seg 4 (Juneau/Sauk Counties) ramps	4.37	1.90	2.49	43/56	3.34	1.30	2.03	39/61
Seg 4 (Juneau/Sauk Counties) ramp terminals	7.49	3.57	3.93	48/52	12.21	2.87	9.33	24/76
Segment 4 Totals	**34.05**	**12.28**	**21.80**	**36/64**	**35.78**	**10.16**	**25.60**	**28/72**
Seg 5 (Juneau/Sauk Counties) mainline	48.32	14.79	33.52	31/69	44.69	13.27	31.42	30/70
Seg 5 (Juneau/Sauk Counties) speed change	--	--	--	--	--	--	--	--
Segment 5 Totals	**48.32**	**14.79**	**33.52**	**31/69**	**44.69**	**13.27**	**31.42**	**30/70**
Juneau-Sauk Counties Corridor Totals	**167.56**	**55.60**	**111.96**	**33/67**	**163.74**	**51.26**	**112.44**	**31/69**
Seg 6 (Columbia County) mainline	35.04	10.87	24.17	31/69	33.26	9.76	23.50	29/71
Seg 6 (Columbia County) speed change	1.76	0.52	1.24	29/71	2.65	0.73	1.92	28/72
Seg 6 (Columbia County) ramps	1.88	0.77	1.12	41/59	1.56	0.65	0.91	42/58
Seg 6 (Columbia County) ramp terminals	2.22	0.94	1.27	42/58	2.34	0.99	1.35	42/58
Segment 6 Totals	**40.90**	**13.10**	**27.80**	**32/68**	**39.81**	**12.13**	**27.68**	**30/70**
Seg 7 (Columbia County-I-39) mainline	8.18	2.52	5.66	31/69	8.33	2.36	5.97	28/72
Seg 7 (Columbia County-I-39) speed change	1.27	0.38	0.89	30/70	2.40	0.69	1.72	29/71
Seg 7 (Columbia County-I-39) ramps	2.31	0.97	1.33	42/58	1.11	0.48	0.62	43/57
Seg 7 (Columbia County-I-39) ramp terminals	2.00	0.72	1.28	36/64	5.07	0.45	4.62	9/91
Segment 7 Totals	**13.76**	**4.59**	**9.16**	**33/67**	**16.91**	**3.98**	**12.93**	**24/76**
Seg 8 (Columbia County) mainline	23.18	7.32	15.83	32/68	21.83	6.44	15.39	30/70
Seg 8 (Columbia County-I39) speed change	2.00	0.47	1.53	24/76	6.61	1.73	4.89	26/74
Seg 8 (Columbia County) ramps	7.87	2.53	5.35	32/68	6.56	1.95	4.60	30/70
Seg 8 (Columbia County) ramp terminals	0.15	0.11	0.04	76/34	5.79	0.47	5.32	8/92
Segment 8 Totals	**33.20**	**10.44**	**22.75**	**31/69**	**40.79**	**10.59**	**30.20**	**26/74**
Seg 9 (Columbia County-WRB) mainline	15.76	4.90	10.85	31/39	14.91	4.51	10.40	30/70
Seg 9 (Columbia County-WRB) speed change	--	--	--	--	--	--	--	--
Segment 9 Totals	**15.76**	**4.90**	**10.85**	**31/69**	**14.91**	**4.51**	**10.40**	**30/70**
Seg 10 (Columbia County) mainline	65.52	19.19	46.33	29/71	63.38	18.60	44.78	29/71
Seg 10 (Columbia County) speed change	9.98	2.69	7.28	27/73	10.75	2.84	7.91	26/74
Seg 10 (Columbia County) ramps	1.34	0.56	0.77	42/58	1.05	0.45	0.61	43/57
Seg 10 (Columbia County) ramp terminals	2.19	1.34	0.85	61/39	3.78	0.27	3.51	7/93
Segment 10 Totals	**79.03**	**23.78**	**55.23**	**30/70**	**78.96**	**22.16**	**56.81**	**28/72**
Columbia County Corridor Totals	**182.64**	**56.81**	**125.80**	**31/69**	**191.38**	**53.37**	**138.02**	**28/72**
I-90/94, I-39, I-39/90/94 Corridor Totals	**350.20**	**112.41**	**237.76**	**32/68**	**355.12**	**104.63**	**250.47**	**29/71**

Table 5-3 Evaluation Results: "Influence Area" Predicted Crashes Segment Summary by Mainline, Speed Change, Ramps, Ramp Terminals

5.2. IHSDM Analysis Conclusions

Predictive safety analyses were performed along the I-39/90/94 North Segment freeway corridor for the year 2050 preferred alternative and future no build alternative. The results of the I-39/90/94, I90/94 and I-39 predicted crashes are provided in Table 5-3 and the evaluation reports are in Appendix E. The North Segment corridor predictive safety analysis showed an overall increase in crashes of 1.4% between the preferred alternative and future no build conditions. However, the fatal and injury crashes for the corridor decreased by approximately 7 percent with the

improvements made for the preferred alternative conditions. The ratio of fatal and injury crashes to property damage only crashes also decreased.

Only 3 out of 10 “influence area segments” had an increased number of predicted crashes for the year 2050. Those three “influence area segments” include:

- Segment 4 showed an increase in total crashes of 5% but has a 17% decrease in overall injury crashes.
- Segment 7 had a 13 % decrease in injury crashes but had an overall increase of 23% in total predicted crashes for the “influence area”.
- Segment 8, which includes the Petro System Interchange and the addition of one new system ramp and 2 new service ramps along with a newly designed I-90/94 & WIS 78 service interchange showed an overall increase of predicted crashes of 23 %.

I-39/90/94 Corridor Study

Technical Memorandum

I-90 South Segment Vissim Future Build

July 2024

Wisconsin Department of Transportation

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The appendices to this report are not included due to file size constraints. Please contact David Schmidt, P.E., WisDOT Study Manager, (608) 246-3867, david2.schmidt@dot.wi.gov to request a copy of these appendices.

1. Introduction

This document contains detailed data and results regarding the I-39/90/94 South Segment Vissim model for the preferred build corridor alternative (Alternative 1).

A project location map is shown in Figure 1. Spatial limits of the Vissim model are shown in Exhibit 1.

Analysis of the alternative scenario builds upon the previously completed work documented in the *I-90 South Segment Vissim Future No-Build Report*. Future year 2050 was analyzed using projected volumes and forecast data provided by the Corridor Design Management and Consistency Team (CDMCT). Technical details related to forecasting are in Section 2 and Appendices A and B. Traffic volumes are discussed in Section 2 and shown in Exhibits 2, 3, and 4.

The focus of this report is evaluating the traffic operations along the freeway system. Results and comparisons are summarized in Section 3.

The WisDOT Traffic Engineering Operations and Safety Manual (TEOpS) Chapter 16 provides a rigorous framework and peer review process for conducting traffic microsimulation. All TEOpS criteria are still satisfied as summarized in Section 4. The build alternative model peer review is documented in Appendix H.

Figure 1. Project Location Map

Traffic microsimulation requires extensive data inputs and attention to detail in order to produce a useful model. The build Vissim model required several simplifying assumptions that are discussed throughout this document.

- ❖ Simplifying assumptions are denoted by this bullet symbol: ❖

This report follows the nomenclature suggested by the TEOpS Section 16-20-2.2 to refer to the future conditions with the proposed project improvements as "**Build (ALT)**".

1.1. Vissim Model Development

The 2050 future build ALT model inherited the core components of the 2050 no-build FEC model:

- PTV Vissim software version 2020 SP 10
- Spatial limits as shown in Exhibit 1
- Temporal limits of four peak periods
    - Weekday **AM**: 6-9 AM
    - Weekday **PM**: 3-6 PM
    - Summer Friday PM (**FRI**): 3-6 PM
    - Summer Sunday PM (**SUN**): 1-4 PM
- ❖ The build Vissim model inherits the model driver behavior parameters from the no-build model. Exhibit 5 shows the freeway driver behavior parameters used in the build model. No adjustments were made for the build scenario.
- ❖ The I-90 South Segment build ALT model is an unconstrained model. The model assumes additional capacity improvements at the I-39/90 and US 12/18 Beltline Interchange (BIC) in order to fully accommodate the peak hour traffic demands. Section 3 discusses demand-to-capacity and volume-to-capacity results. Any geometric changes to the BIC within the build ALT Vissim model are for modeling purposes only and not part of any WisDOT studies or plans. Improvements to the BIC are not in the scope of the I-39/90/94 Corridor Study. Modeling assumptions at the BIC are further discussed in Section 1.2.1.

1.2. Proposed Alternatives

The future no-build year 2050 traffic operational analyses showed that the existing freeway system has limited capacity to efficiently accommodate increased traffic demand and will experience undesirable congestions. To increase capacity and improve operations and safety, several alternatives have been proposed along the I-39/90/94 mainline and at each of the service and system interchanges.

Due to the complexity and level of effort required to develop microsimulation models, the WisDOT Traffic Engineering Operations and Safety Manual (TEOpS) Chapter 16-20 recommends narrowing down the number of alternatives prior to developing the Vissim models using high-level analyses. HCS, Vistro, Sidra, and Vissim software were used to conduct preliminary analyses and help screen different alternatives. In addition to traffic operations, other factors were considered including safety, costs, impacts, and risks to select a preferred alternative at each interchange. A memo was completed in September 2023 discussing further the Vissim modeling approach for the build conditions that optimized the level of effort to help achieve the project purpose and meet the schedule. The *Build Vissim Modeling Approach Memo* is in Appendix C.

The individual preferred alternatives at each interchange were combined into a preferred "corridor" alternative, Corridor ALT 1, that was evaluated in Vissim. This memo covers the modeling and results of corridor ALT 1 only. Table 1 lists the proposed alternatives at each of the interchanges as well as the new interchanges proposed at I-39/90/94 & Hoepker Road and at I-94 & Milwaukee Street Extension (MKE).

Table 1. Proposed Build Alternatives

	Interchange	Proposed Alternative
●	County V*	Diamond (Alt 1)
●	WIS 19	U Flyover (Alt 5)
●	US 51	Parclo (Alt 1)
☆	*Hoepker*	Tight Diamond (Alt 1)
●	US 151	Directional (Alt 1)
●	Badger	Full Modernization (Alt 5)
☆	*MKE*	Parclo (Alt 1)
●	BIC*	Current Config + 3rd NBT

*Proposed improvements are not part of this study. For Vissim modeling purposes, several assumptions were made at these interchanges to complete the build ALT 1 Vissim model.

☆ Proposed new interchange.

Appendix D contains the concept drawings of the alternatives. Exhibit 1 shows a schematic of the build ALT 1. In addition to these interchange improvements, other capacity improvements were proposed at the locations below:

- **I-39/90/94 Corridor**
  - *Badger – County V,* an additional general purpose (GP) lane is proposed along the NB and SB I-39/90/94 corridor.
- **I-94/WIS 30 Corridor**
  - *Badger – US 51,* a third general purpose (GP) lane is added on WB WIS 30 from the Badger merges and extends just west of the US 51 bridge where the lane drops. For EB WIS 30, the lane add starts at the same location and drops at the Badger core.
  - *Thompson Dr – US 51*, two-lane exits (one exit-only and one shared) are proposed at the WB WIS 30 diverge to US 51, as well as the EB WIS 30 diverge to Thompson Dr. The two lanes from the EB on-ramp are extended to the diverge to Thompson Dr where one lane drops into the exit ramp and the second lane drops into the diverge to I-90.
- **US 151 Corridor**
  - *Nelson Rd – Grand Ave,* an auxiliary lane is recommended for the SB US 151. For NB US 151, the fourth lane merging from E Wash Ave drops into the diverge to Grand Ave where a two-lane exit (one exit-only and one shared) is proposed.

1.2.1. Future Beltline Interchange Capacity Constraints

The current BIC configuration does not have sufficient capacity to accommodate the increased future traffic demand under the build ALT conditions and will experience undesirable congestion. Since this interchange is at the beginning of the Vissim model, bottlenecks forming at this location will prohibit the downstream locations from

experiencing the full traffic demand. Although improvements at the BIC is not part of this study, added capacity was required to unconstrain the model. Appendix E includes a sensitivity analysis that compares a constrained model to the final build ALT unconstrained model.

- **I-39/90 & US 12/18 (Beltline) –** a 3rd lane was added on the EB US 12/18 to NB I-39/90 and SB I-39/90 to WB US 12/18 ramps. The model still includes the NB I-39/90 mainline 3-to-2 lane drop at the BIC core where the 2-lane mainline merges with the 3-lane on-ramp into a 5-lane section that continues to the Badger interchange. For SB I-39/90, starting from the 5-lane section between the Badger and the BIC, a 6th lane is added for about 1,500 ft to the right to achieve a 3-lane exit-only diverge.

1.2.2. Implementation in Vissim

Incorporating the proposed improvements in the build ALT Vissim model required adjusting lane change distances (LCD) and driver behavior parameters to accommodate the geometric changes. Although the build ALT geometry is significantly different from the existing conditions, the general approach aimed to maintain as much of the existing calibrated parameters as possible to allow consistency between the scenarios. Applying LCD and behavior types by link and lane followed a similar methodology as the existing year model and using engineering judgement based on comparable locations. For example, connectors at all high-volume major diverges used long LCD distributions and emergency stop distance similar to the high-volume major diverges in the existing year model such as the SB I-39/90 diverge to WB US 12/18. Appendix H contains details about the LCD testing at major diverges. While the existing year model distributions were applicable to almost all locations, the new US 151 and Nelson Rd interchange required one additional LCD distribution.

- **500 – 2,000 ft total** – The new weave (link #848) west of the SB US 151 and Nelson Rd ramp terminal that splits to NB/ SB I-90 and E Wash Ave uses this distribution. This distribution allows traffic to anticipate their exit at least two intersections upstream while providing more flexibility as it spreads out the points of congestion by allowing vehicles to change lanes over a wider range of distances. The distribution better accommodates the different traffic demands and volumes based on the peak periods without over-constraining the model. The magnitude and location of queues were sensitive to how early vehicles anticipate their exits and start position themselves upstream. Various LCD values were tested to achieve more realistic lane utilization and queues expected from the turning volumes and the OD patterns. Appendix H, Attachment 1-2 contains detailed information about the LCD values tested.

While no new driving behaviors were introduced, Table 2 highlights how existing calibrated parameters were translated to the build ALT model. Exhibit 5 demonstrates the driving behavior by lane along the freeway system.

Table 2. Build ALT Driving Behavior Parameters

Corridor & Location	Parameter	Notes on Vissim Implementation
Global	Lane Behavior	All improved/new freeway locations use either 'Basic' or 'Coop I' driving behavior to be more conservative. Using aggressive cooperative behavior (Coop II) was limited to locations with no proposed improvement that were inherited from the existing year model (ex. WIS 30 weaves b/w E Wash and Fair Oaks). One new arterial location (link #848, SB US 151 CD from Nelson) used aggressive CD weave behavior similar to the existing I-39/90/94 & US 151 CD weaves.
I-39/90/94 – North of County V	Lane Selection Type	In the existing model, links #200-201 and #132-133, north of County V, used the rural driving behavior with lane selection type B in the middle lane (lane 2 of 3). This pushed slower traffic to the right as trucks tend to favor the right lane. With adding a 4th GP lane in the build model, the 2nd middle lane was assigned to use selection type B as well (lanes 2 and 3).
I-39/90/94 CD	Lane Selection Type	Free Lane selection (FLS) was assigned across all lanes on the CD system due to the high weaving volumes and to facilitate necessary lane changes.
	Slow Recovery	The Collector-Distributor (CD) system along I-39/90/94 was treated similar to the freeway mainline due to high posted speed limits and long distances between ramps. The CD system was assumed to have slow recovery parameters similar to the mainline freeway. This is also a conservative assumption regarding potential capacity of the CD system.

2. Build Traffic Forecasting Methodology

This section discusses how the Travel Demand Model (TDM) and the CDMCT forecasts and growth rates were used to develop the future year 2050 build volumes for the warm-up, peak, and cool down hours in the Vissim model. Volumes and OD developments are discussed in Sections 2.1 and 2.2.

2.1. Peak Hour Volumes

The balanced peak hour volumes on the mainline and ramps were provided by the CDMCT for the entire corridor limits (see Appendix A).

The CDMCT also provided exponential growth rates on the intersection approaches to develop future year turning movement volumes. The growth rates were applied to the existing year turning movement volumes and then balanced to meet the target mainline and ramp peak hour volumes. Exhibit 2 shows the Build ALT 1 2050 peak hour volumes. Exhibit 4 shows the peak hour weaving diagrams.

2.1.1. Warm-Up and Cool-Down Volume

The simulation model includes a 3-hour period. The first and third hours are referred to as warm-up and cool-down hours, respectively. Warm-Up and Cool-Down volumes were derived from the Vissim OD for all peak periods. The estimation of the Vissim OD is discussed in Section 2.2.2.

2.2. Origin-Destination Matrix Estimation

Build ALT 1 origin-destination (OD) matrix estimation adapted TEOpS 16-5 processes for project-specific factors. Appendix B displays the OD matrix estimation process in a flow chart used for the I-90 South Segment Vissim model. The process included the following steps and was repeated for each scenario (AM, PM, FRI, and SUN):

2.2.1. Peak Hour OD

1. **Create a seed OD matrix**. The seed matrix is an initial estimate of how 2050 no-build OD volumes may change in the future if ALT 1 was implemented. Changes in OD were based on outputs from the Dane County Travel Demand Model (TDM) for the no-build and build scenarios. CDMCT provided peak period (three hour) OD matrices from the TDM. The TDM is best suited to estimate peak period volumes and is not calibrated to the hourly level, and therefore changes in the TDM OD were calculated on a three hour basis.

   The TDM growth included consideration of the difference method, ratio method, and average method. The growth method applied to each OD pair was based on engineering judgement, but typically used the average method to avoid extreme growth. “Growth” could be positive or negative due to potential for traffic re-routing due to new interchanges.

   The selected TDM growth method was then applied to the Vissim peak period (three hour) FEC OD to obtain an estimate for the Vissim build ALT 1 peak period. An hourly OD matrix was estimated by applying a three hour-to-one hour ratio derived from the Vissim FEC hourly OD matrices.

   a. Due to the inclusion of two new interchanges in the build scenario, estimating the seed matrix involved separate processes for existing OD pairs not involving the new interchanges and for new OD pairs involving the new interchanges. Each of these processes results in a partial estimate of the overall seed OD matrix. See flow chart in Appendix B for details of the processes. Electronic files for the OD estimation are also available upon request.
   b. Due to the reconfiguration of the American Parkway and Nelson Road area in ALT 1, the zones in the area were grouped for estimating purposes due to uncertainty in the TDM level of detail in this area. After estimating OD to and from the grouped zones, the grouped OD was split based on forecasted turn volumes at the Eastpark Boulevard and American Family Drive intersections.

2. **Apply manual adjustments.** In cases where the TDM Build 2050 OD pair had no volume, the OD seed matrix was adjusted to use the FEC 2050 OD pair (i.e. year 2050 FEC OD = year 2050 Build OD). This adjustment assumes that in cases where the TDM build 2050 OD has no volume compared to the FEC OD, the future build traffic will at least be as much as it is in the FEC. In addition, the following assumptions and adjustments were made:
   - No ramp-to-ramp volume between US 51 and Hoepker Road interchanges.
   - No u-turn OD pairs at ramps (i.e. SB Grand Ave to NB Main St).
   - NB on-ramp volume from WIS-19 was rerouted onto the new u-ramp configuration.

3. **Run an OD estimation algorithm with the seed matrix and target volumes as inputs.** PTV Visum software with the least squares algorithm was used.
4. **Finalize the OD matrix.** Manual adjustments to the Visum output were applied as necessary to meet forecast targets, which then resulted in the final future year 2050 build ALT 1 peak period OD.

2.2.2. Warm-Up, Cool-Down, and Heavy Vehicle OD

2.2.2.1. Warm-Up and Cool-Down OD

The simulation model includes a three hour period. The first and third hours are referred to as warm-up and cool-down hours respectively, or "off-peak" hours.

- ❖ Estimating future year simulation off-peak hours used a ratio-based approach to simplify the process. The off-peak OD are assumed to follow similar trends as the no-build FEC 2050.

Developing off-peak OD involved the following steps:

1. **Calculate FEC off-peak to peak ratios** for each OD pair where:

   FEC ratio = [FEC off-peak OD] / [FEC peak hour OD]

   For OD pairs involving new zones, the FEC ratio is calculated for an existing zone that is analogous to the new zone. See Section 2.3 for a discussion of analogous zones.

2. **Apply FEC ratios to the peak hour OD**:

   *off-peak OD = [FEC ratio] * [final peak hour build ALT 1 OD]*

2.2.2.2. Heavy Vehicle OD

Estimating ALT 1 heavy vehicles OD used a ratio-based approach to simplify the process. The heavy vehicle OD is assumed to follow similar trends as the no-build FEC OD. The estimation process for heavy vehicle OD is the same as the Warm-Up and Cool-Down OD with the steps repeated for Single-Units (SU) and Tractor-Trailers (TT) for all hours of all scenarios (AM, PM, FRI, and SUN).

2.3. Flow Profiles

Volumes in Vissim were input in 15 minute increments, termed the 'flow profile.' Using sub-hourly inputs allowed the model to reflect local peaking characteristics at each on-ramp, as well as the ability to model peaks that occur at 'off-clock' hour times (e.x. 7:30-8:30 AM instead of the network 7:00-8:00 AM peak).

- ❖ For existing zones, the corresponding existing year flow profile was used.
- ❖ For new and grouped zones, the existing year profile of an analogous zone was used. See Exhibit 1 for a map of build ALT 1 Zones.
  - Zone 17 (EB Milwaukee Street on-ramp) uses the flow profile of Zone 19 (EB County N on-ramp).
  - Zone 23 (WB Milwaukee Street on-ramp) uses the flow profile of Zone 21 (WB County N on-ramp).

- Zone 49 (NB Hoepker Road on-ramp) uses the flow profile of Zone 51 (NB US 51 to NB I-39/90/94 on-ramp).
- Zone 65 (SB Hoepker Road on-ramp) uses the flow profile of Zone 62 (SB US 51 to SB I-39/90/94 on-ramp).
- Zones 90 and 91 (American Family Drive & Eastpark Boulevard) use the flow profile of existing Zone 77 (WB Eastpark Boulevard).
- Zone 92 (Nelson Road) uses the flow profile of existing Zone 75 (NB High Crossing Boulevard at American Parkway).

3. Build Model Results & Comparisons

The results section is organized to provide an overview comparing the existing year 2019, future no-build 2050, and future build 2050 performance measures. Then, results for each peak period (AM, PM, FRI, and SUN) are discussed in more details. Exhibits 6 through 10, listed below, include detailed results of the existing and future models:

- **Exhibit 6** – Volume Validation
- **Exhibit 7** – Travel Time Results
- **Exhibit 8** – Travel Time Comparisons
- **Exhibit 9** – LOS Results
- **Exhibit 10** – Speed Comparisons

All simulation results are based on the average of 10 runs. The same random seeds used in the existing and no-build models were used in the build ALT model. Random seed values were obtained from TEOpS 16-20-7.

3.1. Volume Validation

The build ALT 1 model was validated against criteria established in the WisDOT Traffic Engineering Operations and Safety Manual (TEOpS) Chapter 16, Section 20-9.1.2. The TEOpS mentions that “due to future congestion, the microsimulation model may not be able to sufficiently capture the true design year traffic demand within the analysis period, specifically for the no-build or FEC conditions.” Therefore, the model is not required to pass the volume validation tests, the tests merely indicate how well the network accommodates forecasted demand.

As shown in Table 3 and Table 4 as well as Exhibit 6, the build ALT Vissim model passes all validation tests for links and turns. Appendix F shows the volume validation details for all runs.

While not required after passing Tier 1, the model also passes link volumes Tier 2 tests for all peaks and directions. Unlike the FEC model, no diffused vehicles were recorded in any of the peak periods, but the SUN peak had a couple of unreleased vehicles at the SB US 151 on-ramp from Grand Ave (less than 10 vehicles in only two simulation runs). The one-lane on-ramp is reaching capacity with the 2050 build ALT 1 volumes (1,730 vph, d/c = 0.93). The model still passes the volume validation criteria for the peak hour and since the number is very minimal and does not happen in every simulation run, this has no significant effect on the downstream operations.

The build ALT 1 Vissim model is unconstrained on the south end, at the BIC, as discussed in Section 1.2.1. Appendix E shows how without the unconstrained assumptions, locations downstream of the BIC do not experience their full demand and volumes do not validate. This would result in a less-conservative test of how well ALT 1 could accommodate potential future traffic demands.

Table 3. Link Volume Validation Summary (Peak Hour Results, 60 minutes)

		Tier 1 RMSPE % (<5% passes)			
Corridor		**AM**	**PM**	**FRI**	**SUN**
I-39/90/94	NB	3.5%	1.7%	2.2%	1.7%
	SB	2.0%	1.5%	1.2%	2.2%
I-94/WIS 30	EB	2.1%	1.1%	0.9%	2.0%
	WB	1.7%	1.7%	2.1%	1.4%
US 151	NB	4.6%	1.4%	2.9%	3.2%
	SB	1.8%	1.3%	0.9%	4.6%

Note: TEOpS does not require build ALT model to pass tests. Build ALT test results indicate how well the network accommodates peak hour demand.

Table 4. Turn Volume Validation Tier 2 Summary (Peak Hour Results, 60 minutes)

	Tier 2 % RNSE <3.0 (> 75% passes)			
	AM	**PM**	**FRI**	**SUN**
Intersection Turns	100%	100%	100%	100%

3.2. Travel Time

Table 5 shows travel time results obtained from the existing, no-build and build Vissim models during the peak hour for the peak directions. Travel times were obtained every 15 minutes and the table shows the range of values obtained within the peak hour. Compared to the no-build, all corridors and peaks show improvement in travel times where the future build ALT travel times are expected to be similar to the existing year travel times.

The limits of the end-to-end corridor travel time segments in the build model matched the limits in the existing and no-build models for all corridors except for the US 151. While the total distance of the travel time segment is conserved, the location and configurations are different. In the existing and no-build models, the travel time segment included only the freeway section of US 151. In the build model, the segment includes part of the E Wash Ave including the ramp terminals at I-39/90/94. This explains the longer travel time for the SB US 151 in the PM peak compared to the existing year conditions.

Table 5. Travel Time Summary Results (minutes)

		Travel Time Segment				
		SB US 151 Main St to I-39/90/94 (3.9 mi)	**WB I-94/WIS 30** County N to E. Wash (7.4 mi)	**NB I-39/90/94** BIC to County V (16.0 mi)	**EB I-94/WIS 30** E. Wash to County N (7.3 mi)	**SB I-39/90/94** County V to BIC (16.3 mi)
AM (7 - 8)	EX 2019	3.9 – 4.1	6.7 – 6.8			
	FEC 2050	8.2 – 12.7	6.8 – 7.0			
	ALT 1 2050	4.4	6.8 – 6.9			
PM (4 - 5)	EX 2019	3.8 – 4.0		13.8 – 13.9	6.6	
	FEC 2050	4.9 – 10.0		15.4 – 22.1	6.7	
	ALT 1 2050	4.7 – 4.8		13.8 – 13.9	6.5 – 6.6	
FRI (4 - 5)	EX 2019			14.0 – 14.1		
	FEC 2050			30.4 – 32.0		
	ALT 1 2050			13.7 – 13.8		
SUN (2 - 3)	EX 2019					14.1 –14.2
	FEC 2050					21.0 – 22.8
	ALT 1 2050					13.8 – 13.9

Notes:
- Results show the simulated range of travel times during the peak hour, evaluated every 15 minutes.
- If a range is not shown, the travel time results were the same for all 15-minute periods.
- Grey cells indicate off-peak directions. See Exhibit 7 and Exhibit 8 for all travel times results and comparisons.

- Cells are highlighted based on the ratio of travel time (tt) compared to EX 2019, using the upper end of the range:

tt_{FEC} / tt_{EX}
> 1.0 – 1.5
> 1.5 – 2.5
> 2.5

3.3. Queues

While quantitative checks are only required if queues are a primary validation measure of effectiveness (MOE), Table 6 shows a queue summary for a few of the major movements of the improved Nelson Rd and US 151 interchange and the adjacent intersection. Queues were evaluated for every 120 seconds (about one cycle length for most intersections) based on outputs from the nodes and queue counters. The 95th percentile queue was calculated using all 120 seconds intervals in the 3-hour simulation period over 10 runs.

All queues seem to be contained within the turn bay lengths with some occasional spillbacks that could be expected based on the seed-to-seed variance; however, these queues are short-lived and recover quickly within 15 minutes. The seed-to-seed variance indicates that the results may be sensitive to assumptions regarding forecasted volumes, hourly and sub-hourly flow profiles. At the Eastpark Blvd and American Family Dr intersection, the SBL and EBT queues could extend about 50 ft (~ two vehicle lengths) longer than the adjacent turn bays which could result in vehicles occasionally getting stuck in the queue based on the lane utilization. No diffused vehicles were reported in the model which means all vehicles were able to change lanes in less than 60 seconds. Appendix H, Attachment 1-2 contains an example of vehicle trajectories and queues for the SBL movement.

Table 6. Queue Summary Results

Intersection	Approach	Turn	Length (ft)			95th Percentile Queue (ft)			
			Link	Turn Bay	Adj Turn Bay	AM	PM	FRI	SUN
Eastpark Blvd & American Family Dr	Eastpark Blvd	WBT	520	-	-	175	100	175	100
		WBR	-	310	-	125	75	125	100
	American Family Dr	SBL	-	700	360	200	200	400	300
	Eastpark Blvd	EBT	490	-	260	100	100	300	175
Nelson Rd & SB US 151	Nelson Rd	EBL	-	350	-	125	200	175	125
		EBT	530	-	-	50	25	75	225
		EBR	-	350	-	175	225	250	125
Nelson Rd & NB US 151	NB US 151 Ramp	NBL	-	500	500	325	275	375	275
	Nelson Rd	WBT	1000	-	280	50	50	100	175
		WBL	-	550	-	175	225	275	125

Notes:
- Results show the 95th percentile queue of 120 sec intervals over 10 simulation runs rounded to the nearest vehicle length (25 ft).
- Values in orange indicate that the adjacent right/left turn bay is about 50 ft (~ two vehicle lengths) shorter than the reported queue length and vehicles could occasionally get stuck in the queue.

3.4. Level of Service

The Highway Capacity Manual 7th Edition (HCM 7) methodology was used to report the level of service (LOS) from the Build ALT Vissim model. The HCM 7 defines LOS on freeways based on density for influence areas. Table 7 shows the density-based LOS scale. Influence areas (basic, merge, diverge, or weave) were determined following the HCM 7 freeway analysis methodology (chapters 12-14).

Table 7. HCM 7 LOS Scale

HCM 7th Edition Density-Based LOS Scale (pc/mi/ln)		
LOS	Basic Freeway [1]	Merge/Diverge/ Weave [2]
A	≤ 11	≤ 10
B	> 11 – 18	> 10 – 20
C	> 18 – 26	> 20 – 28
D	> 26 – 35	> 28 – 35
E	**> 35 – 45**	**> 35 – 45***
F	**> 45**	**> 45***

(*) 43 for Weave

[1] The Basic Freeway scale is also used for Major Merge and Lane Add/Drop locations.

[2] The Diverge scale is also used for Major Diverge locations.

Within the Vissim model limits, some special merge and diverge configurations were encountered including, major merge, major diverge, lane add, and lane drop. A major merge/diverge is an area where a major multilane high-speed ramp joins/exits the freeway. A lane add/drop occurs where the freeway mainline changes its number of lanes (adding or dropping a lane). As suggested by the HCM 7, LOS for these special cases were estimated using the density of all lanes in the adjoining segment with the criteria as mentioned in the footnotes of Table 7.

LOS summary results for each peak period can be found in Sections 3.5 through 3.8. A full set of results is shown in Exhibit 9. Each LOS table contains the following performance measures:

- ***Average Density & LOS*** – The LOS for each influence area is based on the average maximum traffic density. The density was obtained from the Vissim output results for every 15 minutes of the whole 3-hour simulation period of each run. The maximum traffic density of each run was reported and the average maximum traffic density of 10 simulation runs is shown in the LOS results table.

- ***SD Density*** – The density standard deviation (SD) shows the seed-to-seed variation of the maximum traffic density for the 10 simulation runs.

- ***Upper CI Density & LOS*** – The upper confidence interval (95% CI) was evaluated for density and LOS to show the range of results produced by Vissim. This shows that some simulation runs may experience LOS worse than the reported average LOS. The Upper CI is calculated as: *[average] + [critical stat] * [SD] / sqrt(n runs)* where the critical z-statistic is 1.96 for a 95% confidence with 10 simulation runs.

- ***v/c*** – The volume-to-capacity ratio was evaluated for the peak hour using the Vissim simulated volumes (v) and the estimated capacity (c). The v/c was constrained to a maximum of 1.

    - ❖ An estimated capacity of 1900 pc/mi/ln was used to compute v/c and d/c ratios.

- ***d/c*** – The demand-to-capacity ratio was also evaluated for the peak hour using the balanced target volumes (demand, d) for each mainline or ramp segment. The d/c ratio is constrained by the adjacent upstream/downstream influence areas for non-basic influence areas (merge/diverge/weave). The reported d/c for merge/diverge influence areas is the maximum d/c value from the ramp, immediate upstream, or downstream segment. For weaves, the d/c is the maximum of the on-ramp, off-ramp, or weave segment. For basic influence areas, the d/c ratio is reported for the segment itself.

- ***% Demand Met*** – The percent of demand met is based on the peak hour simulated volumes (v) and target volumes (d). The root normalized square error (RNSE) was computed to validate the simulated volumes. The % demand met shown in red indicates an RNSE ≥ 3.0, meaning that simulated results might not reflect effects of the entire traffic demand.

- ***LOS Summary*** – The summary column shows both the average and upper CI LOS for each influence area when different. When the average and upper CI are different, this can indicate that the location is on the border between LOS letters, or in the case of a wider range, that congestion may be highly variable.

3.5. AM Peak

Table 8 shows the AM peak LOS results of the build ALT model for select locations. Exhibit 9 contains LOS results for the entire simulation limits. Results show that the I-90 corridor is expected to operate at LOS C or better on average whereas the I-94/WIS 30 and US 151 corridors are expected to operate at LOS D or better within the proposed improvements limits. The upper CI shows the same LOS as the average for all locations in Table 8, indicating minimal seed-to-seed variance.

Speed heatmaps shown in Figure 2 and Figure 3 demonstrate the speed improvements expected in the build alternative scenario compared to the existing year and future no-build models.

Table 8. Level of Service Summary - AM Peak

Corridor	Location	# Lanes	LOS Summary	Density & LOS					v/c	d/c	% Demand Met
				Average		SD	Upper CI				
NB I-39/90/94	**BIC - Badger**	5	C	24	C	0.7	24	C	0.70	0.72	97%
	Badger - US 151	4	C	21	C	0.6	21	C	0.60	0.61	98%
	US 151 - Hoepker	4	B	17	B	0.4	17	B	0.53	0.54	98%
	Hoepker - US 51	4	B	15	B	0.5	15	B	0.48	0.50	97%
	US 51 - WIS 19	4	B	17	B	1.0	18	B	0.72	0.74	96%
	NB I-90 CD										
	CD: from WB I-94 / to NB US 151	2	B	16	B	0.5	16	B	0.55	0.55	98%
	CD: Merge from NB I-90	2	C	21	C	0.7	21	C	0.58	0.60	96%
SB I-39/90/94	**WIS 19 - US 51**	4	C	19	C	0.7	19	C	0.54	0.54	99%
	US 51 - Hoepker	4	B	17	B	0.5	17	B	0.76	0.76	100%
	Hoepker - US 151	4	B	17	B	0.5	17	B	0.55	0.55	100%
	US 151 - Badger	3	B	15	B	0.5	15	B	0.45	0.45	100%
	Badger - BIC	5	C	23	C	2.6	25	C	0.66	0.64	100%
	SB I-90 CD										
	CD: from SB US 151	2	C	26	C	0.6	26	C	0.74	0.74	100%
	CD: Diverge to I-94/WIS 30	3	B	19	B	0.4	19	B	0.50	0.49	100%
	CD: from SB US 151 / to WB WIS 30	2	B	17	B	0.4	17	B	0.58	0.58	99%
WB I-94/WIS 30	**MKE St - Badger**	3	D	28	D	1.4	29	D	0.81	0.81	100%
	Merge from I-90	3	D	29	D	2.0	30	D	0.74	0.75	98%
	Thompson Dr - US 51	3	D	30	D	1.5	31	D	0.82	0.83	99%
	3-2 Lane Drop	2	D	31	D	1.6	32	D	0.84	0.85	99%
SB US 151	**North of Main St**	2	D	31	D	4.2	34	D	**0.94**	**0.94**	99%
	Grand Ave - E Wash Ave	3	C	24	C	0.9	25	C	0.79	0.79	100%
	Diverge to NB I-90	3	C	24	C	0.6	24	C	0.74	0.74	100%

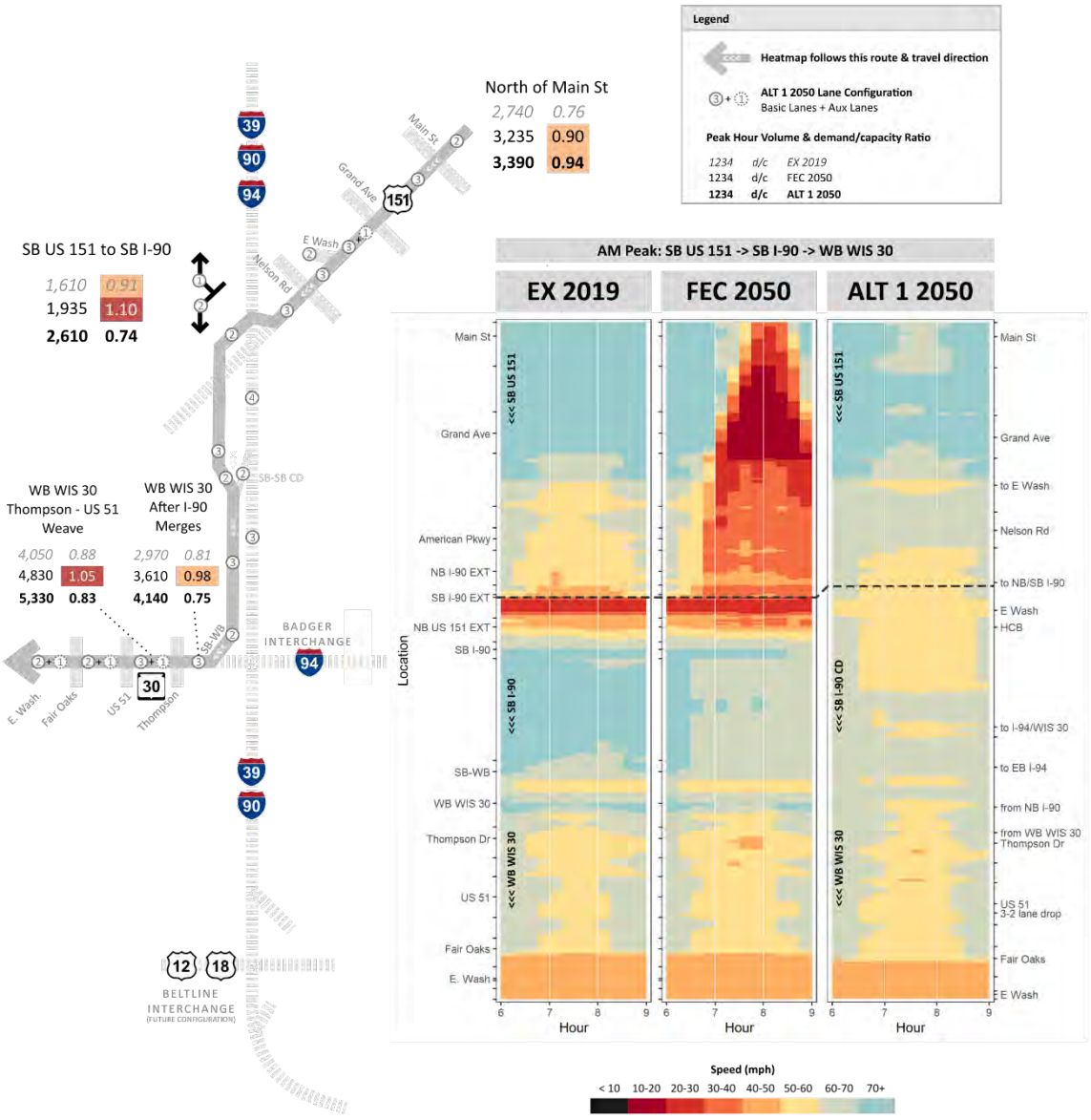

Figure 2. AM Peak Speed Heatmap Comparisons - SB US 151 to WB WIS 30

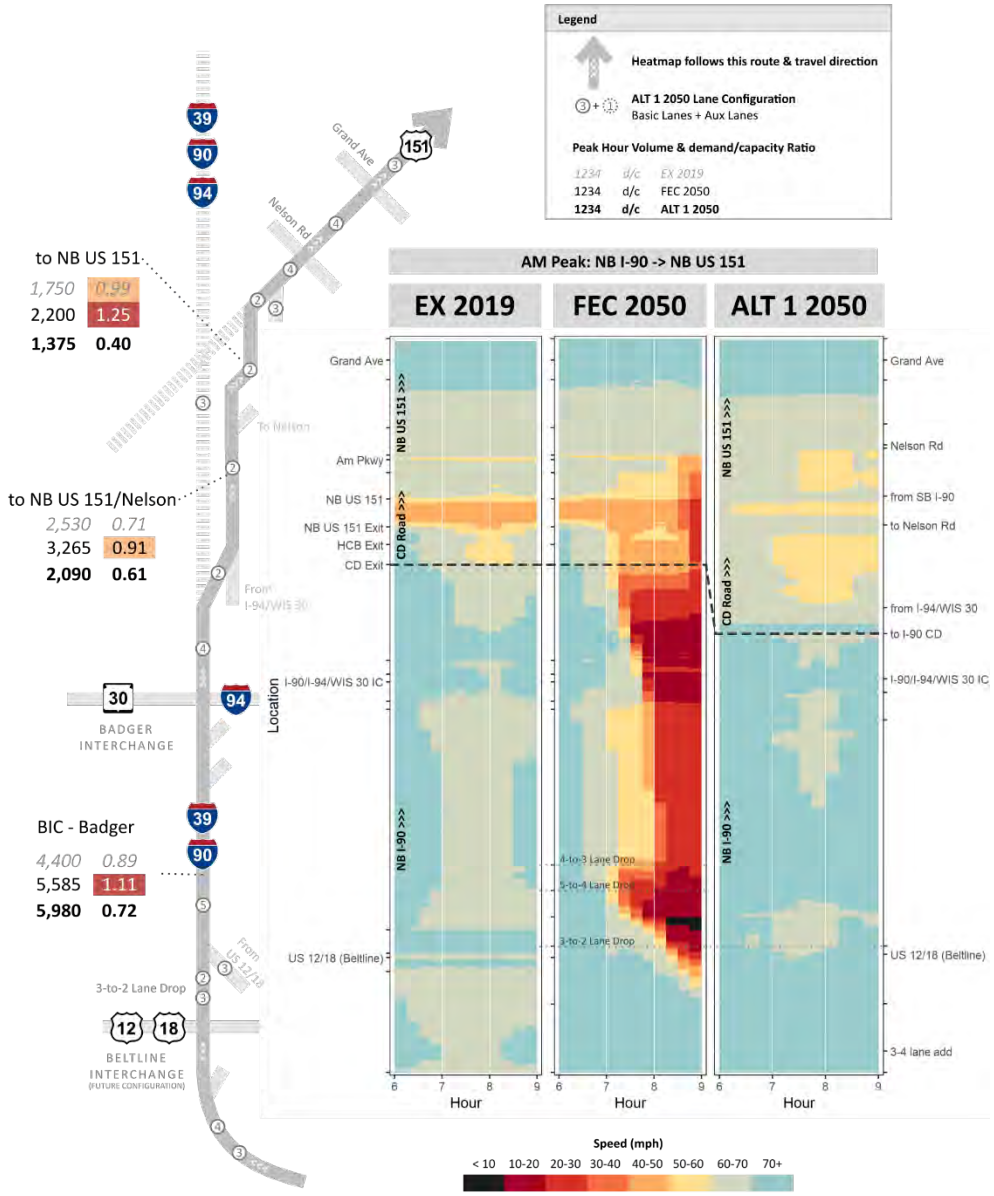

Figure 3. AM Peak Speed Heatmap Comparisons - NB I-90 to NB US 151

3.6. PM Peak

Table 9 shows the PM peak LOS results of the build ALT 1 model for select locations. Exhibit 9 contains LOS results for the entire simulation limits. Results show that the I-90 and I-94/WIS 30 corridors are expected to operate at LOS C or better on average whereas the US 151 corridor is expected to operate at LOS D or better within the proposed improvements limits. The upper CI in Table 9 shows the same LOS as the average, indicating minimal seed-to-seed variation.

Speed heatmaps shown in Figure 4 and Figure 5 demonstrate the speed improvements expected in the build alternative scenario compared to the existing year and future no-build models.

Table 9. Level of Service Summary - PM Peak

Corridor	Location	# Lanes	LOS Summary	Density & LOS					v/c	d/c	% Demand Met
				Average		SD	Upper CI				
NB I-39/90/94	**BIC - Badger**	5	C	24	C	0.6	24	C	0.76	0.76	99%
	Badger - US 151	4	C	23	C	0.4	23	C	0.72	0.72	99%
	US 151 - Hoepker	4	C	21	C	0.6	21	C	0.72	0.73	99%
	Hoepker - US 51	4	B	20	B	0.6	20	B	0.67	0.68	99%
	US 51 - WIS 19	4	B	19	B	0.4	19	B	0.63	0.63	98%
	NB I-90 CD										
	CD: from WB I-94 / to NB US 151	2	B	20	B	0.7	20	B	0.73	0.74	100%
	CD: Merge from NB I-90	2	C	25	C	0.6	25	C	0.73	0.74	99%
SB I-39/90/94	**WIS 19 - US 51**	4	B	17	B	0.4	17	B	0.53	0.53	100%
	US 51 - Hoepker	4	B	18	B	0.4	18	B	0.75	0.76	100%
	Hoepker - US 151	4	B	20	B	0.3	20	B	0.64	0.63	100%
	US 151 - Badger	3	C	20	C	0.4	20	C	0.63	0.63	99%
	Badger - BIC	5	C	23	C	0.5	23	C	0.71	0.72	99%
	SB I-90 CD										
	CD: from SB US 151	2	C	22	C	0.8	22	C	0.62	0.62	100%
	CD: Diverge to I-94/WIS 30	3	B	16	B	0.5	16	B	0.41	0.41	100%
	CD: from SB US 151 / to WB WIS 30	2	B	19	B	0.5	19	B	0.64	0.64	99%
EB I-94/WIS 30	**US 51 - Thompson Dr**	2	B	19	B	0.4	19	B	0.54	0.54	100%
	Badger - MKE St	3	B	12	B	0.4	12	B	0.28	0.28	99%
	East of County N	2	D	27	D	1.4	28	D	0.86	0.86	100%
NB US 151	**Merge from SB I-90**	2	C	26	C	0.8	26	C	0.76	0.77	99%
	Merge from E Wash	3	C	20	C	0.6	20	C	0.76	0.77	99%
	Merge from Grand Ave	3	D	30	D	2.3	31	D	0.80	0.81	98%
	North of Main St	2	D	28	D	0.8	28	D	**0.91**	**0.92**	99%

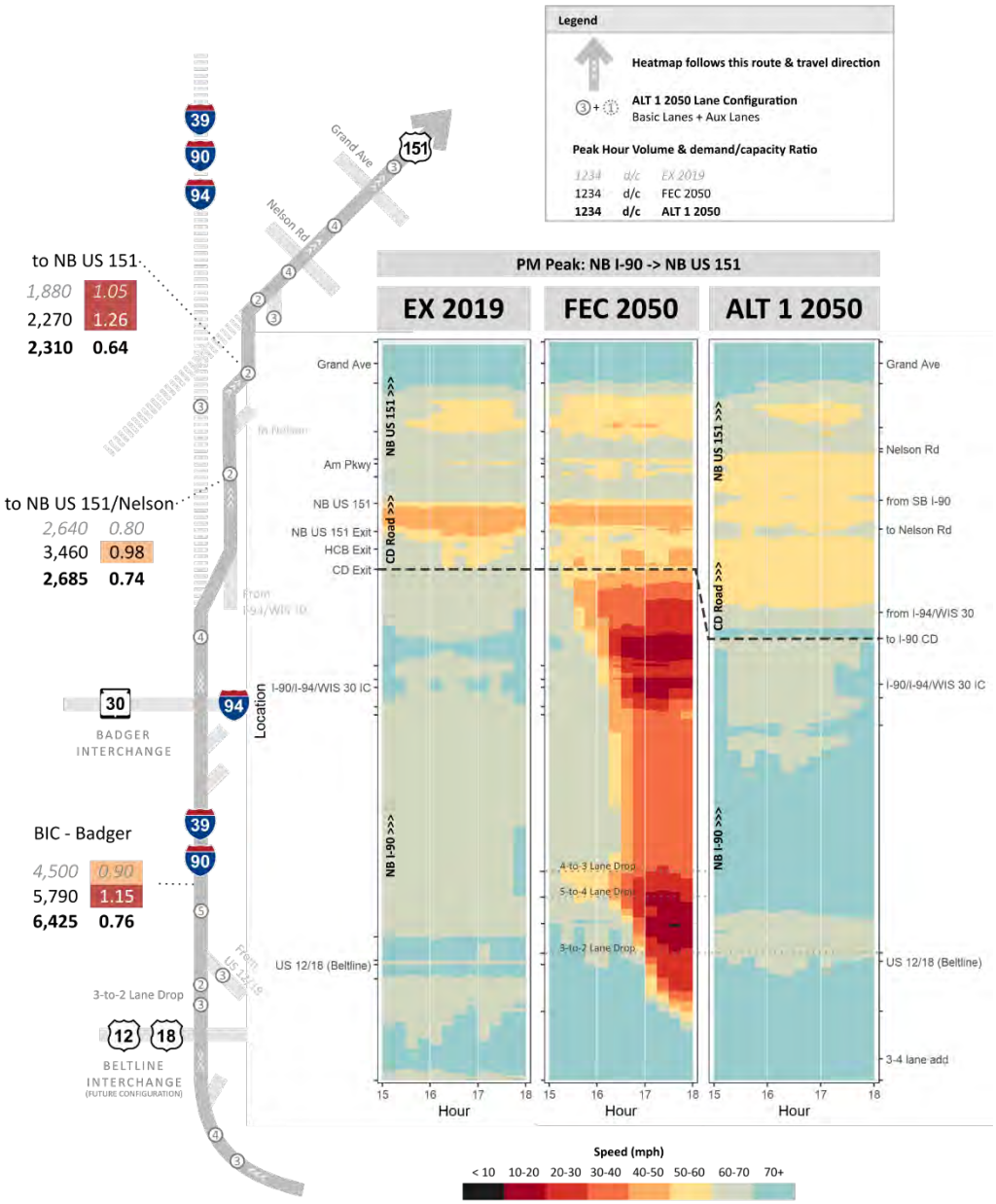

Figure 4. PM Peak Speed Heatmap Comparisons - NB I-90 to NB US 151

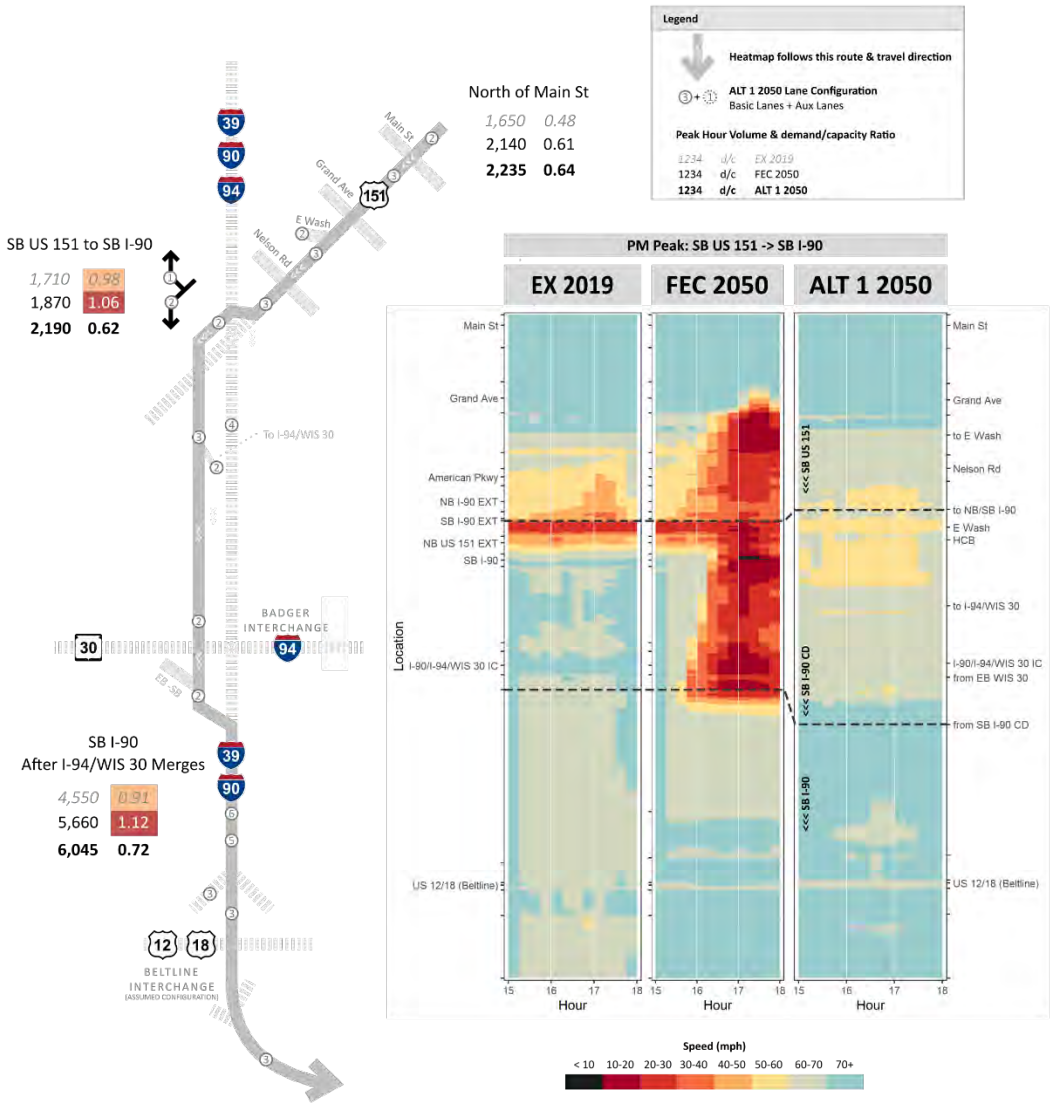

Figure 5. PM Peak Speed Heatmap Comparisons - SB US 151 to SB I-90

3.7. FRI Peak

Table 10 shows the FRI peak LOS results of the build ALT model for select locations. Exhibit 9 contains LOS results for the entire simulation limits. The 95th percentile results show that the corridors are generally expected to operate at LOS D or better within the proposed improvements limits.

Build 2050 FRI traffic volumes are approaching capacity with high d/c ratios for the key location listed below. Adding auxiliary lanes at these locations helped improve the 95th percentile LOS from E to C by providing longer distances to merge without having a downstream lane drop.

- **NB I-39/90/94**
  - *Merge from I-90 CD (I-94/WIS 30)*
  - *Merge from SB US 151/E Wash*

Speed heatmaps shown in Figure 6 and Figure 7 demonstrate the speed improvements expected in the build alternative scenario compared to the existing year and future no-build models.

- With unconstraining the build Vissim model at the BIC, all downstream locations seem to experience the full demand. In the case where no capacity is to be added, a key bottleneck is anticipated to form at the EB US 12/18 to NB I-39/90 ramp due to build volumes exceeding capacity of the 2-lanes (4010 veh/hr, d/c = 1.12). This will prohibit the volume from reaching downstream segments and results will seem better than expected. Appendix E shows how having the 2-lane on-ramp results in congestion at the beginning of the network and never recovers before the end of the simulation. The volume on the ramp and downstream locations was not met (RNSE ~ 5) similar to the no-build FEC results. Figure 6 shows the FEC bottleneck at the NB I-39/90 BIC to Badger transition (5-to-4 and 4-to-3 lane drops) starts right at the beginning of the simulation and never recovers. While the speeds and LOS downstream seem acceptable (generally 60-70mph and LOS D or better), the % demand met was as low as 67% at some locations. The magnitude of congestion and downstream effects could be similar in the build model with the current BIC configuration.

Table 10. Level of Service Summary - FRI Peak

Corridor	Location	# Lanes	LOS Summary	Density & LOS					v/c	d/c	% Demand Met
				Average		SD	Upper CI				
NB I-39/90/94	**BIC - Badger**	5	C	25	C	0.5	25	C	0.81	0.82	99%
	Badger - US 151	4	C	25	C	0.6	25	C	0.76	0.77	99%
	Merge from I-94/WIS 30	5	C	25	C	0.6	25	C	0.80	0.81	100%
	Merge from E Wash Ave	4	C	23	C	0.7	23	C	0.76	0.76	100%
	US 151 - Hoepker	4	C	26	C	0.6	26	C	0.83	0.83	100%
	Hoepker - US 51	4	C	24	C	0.6	24	C	0.84	0.84	100%
	US 51 - WIS 19	4	C	23	C	0.6	23	C	0.79	0.79	99%
	NB I-90 CD										
	CD: from WB I-94 / to NB US 151	2	C	26	C	0.7	26	C	0.81	0.80	100%
	CD: Merge from NB I-90	2	C	25	C	0.5	25	C	0.73	0.73	99%
SB I-39/90/94	**Merge from WIS 19**	4	C	25	C	0.9	26	C	0.71	0.71	100%
	WIS 19 - US 51	4	C	23	C	0.8	23	C	0.71	0.71	100%
	US 51 - Hoepker	4	C	22	C	0.9	23	C	0.71	0.71	100%
	Hoepker - US 151	4	C	22	C	0.7	22	C	0.73	0.73	100%
	Merge from High Crossing	4	C	27	C	0.5	27	C	0.75	0.74	100%
	US 151 - Badger	3	B	18	B	0.2	18	B	0.56	0.55	100%
	Badger - BIC	5	C	24	C	0.6	24	C	0.76	0.76	100%
	SB I-90 CD										
	CD: from SB US 151	2	D	32	D	0.9	33	D	0.85	0.84	100%
	CD: Diverge to I-94/WIS 30	3	C	23	C	1.0	24	C	0.58	0.56	100%
	CD: from SB US 151 / to WB WIS 30	2	B	22	B	0.8	22	B	0.74	0.75	99%
EB I-94/WIS 30	**US 51 - Thompson Dr**	2	B	19	B	0.6	19	B	0.56	0.55	100%
	Badger - MKE St	3	B	12	B	0.3	12	B	0.28	0.28	100%
	East of County N	2	D	31	D	1.0	32	D	**0.97**	**0.98**	99%
WB I-94/WIS 30	**MKE St - Badger**	3	D	29	D	2.6	31	D	0.80	0.80	100%
	Merge from I-90	3	C	21	C	0.6	21	C	0.49	0.50	98%
	Thompson Dr - US 51	3	B	20	B	0.4	20	B	0.51	0.52	98%
	3-2 Lane Drop	2	C	20	C	0.5	20	C	0.43	0.44	97%
NB US 151	**Merge from SB I-90**	2	D	31	D	1.9	32	D	0.83	0.85	97%
	Merge from E Wash	3	C	24	C	0.5	24	C	0.83	0.85	99%
	Merge from Grand Ave	3	C/D	28	C	2.3	29	D	0.76	0.76	99%
	North of Main St	2	C/D	26	C	1.2	27	D	0.83	0.83	100%
SB US 151	**North of Main St**	2	C	21	C	0.4	21	C	0.67	0.67	100%
	Grand Ave - E Wash Ave	3	C	21	C	0.9	22	C	0.89	**0.90**	100%
	Diverge to NB I-90	3	D	30	D	2.2	31	D	0.85	0.84	100%

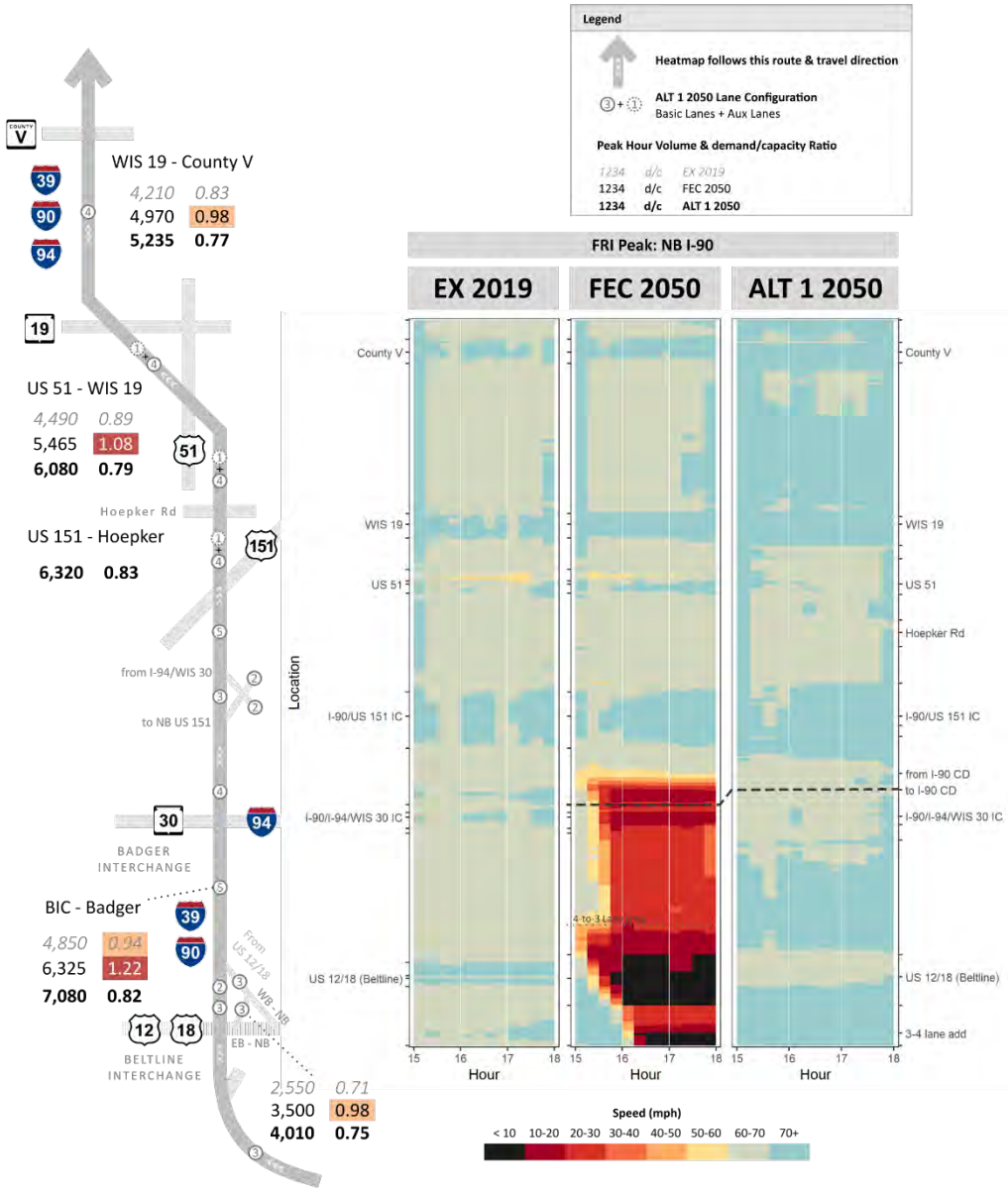

Figure 6. FRI Peak Speed Heatmap Comparisons - NB I-90

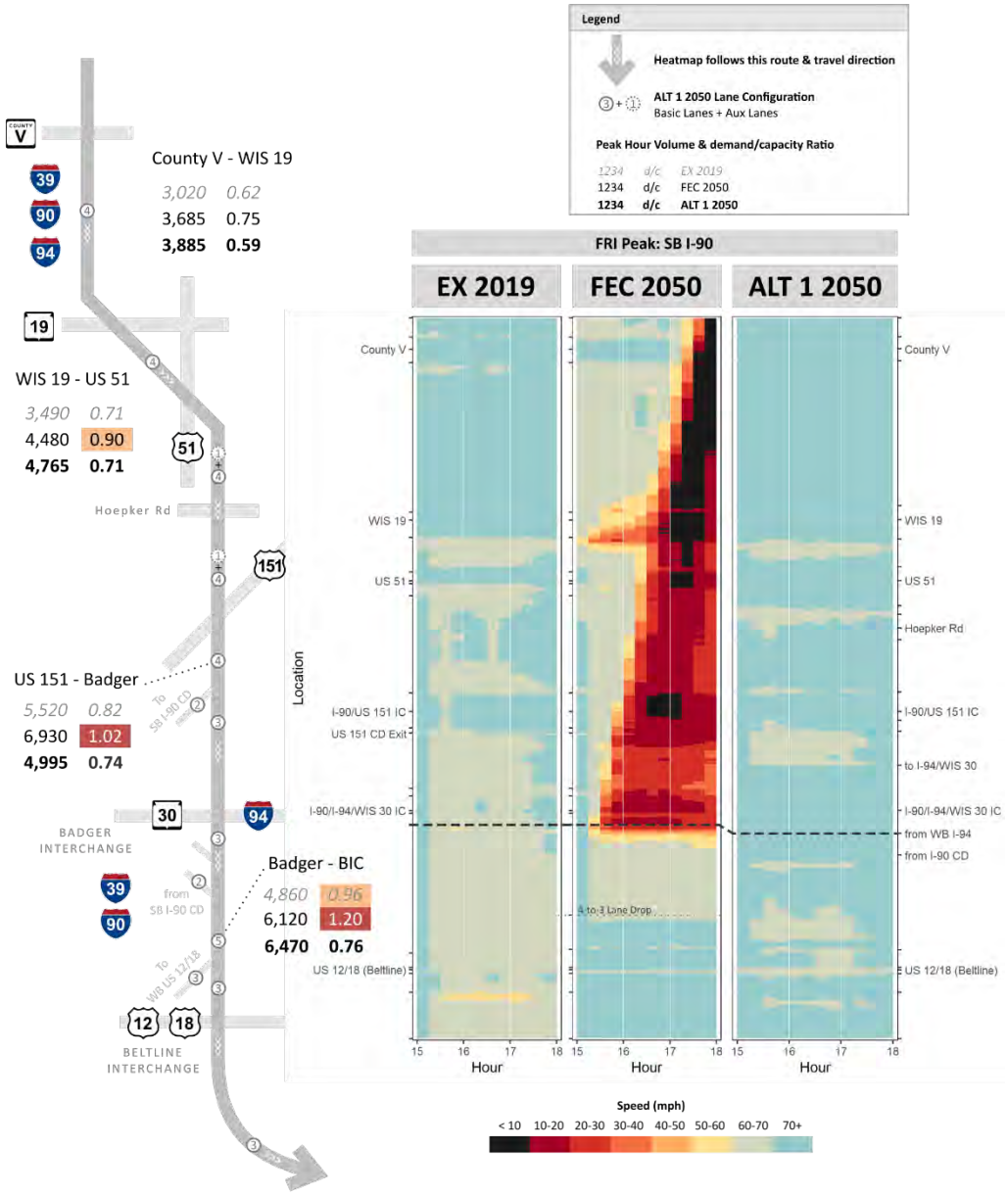

Figure 7. FRI Peak Speed Heatmap Comparisons - SB I-90

3.8. SUN Peak

Table 11 shows SUN LOS results from the build ALT model for select locations. Exhibit 9 contains LOS results for the entire simulation limits. The 95th percentile results show that the corridors are expected to operate at LOS D or better within the proposed improvements limits.

Build 2050 SUN traffic volumes are approaching capacity with high d/c ratios for the key location listed below. Adding an auxiliary lane at this location helped improve the 95th percentile LOS from E to C by providing longer distances to merge without having a downstream lane drop.

- **SB I-39/90/94**
  - *Merge from Hoepker Rd*

Speed heatmaps shown in Figure 8 demonstrate the speed improvements expected in the build alternative scenario compared to the existing year and future no-build models.

Table 11. Level of Service Summary - SUN Peak

Corridor	Location	# Lanes	LOS Summary	Density & LOS						v/c	d/c	% Demand Met
				Average		SD	Upper CI					
SB I-39/90/94	**Merge from WIS 19**	4	D	29	D	1.3	30	D		0.87	0.87	99%
	WIS 19 - US 51	4	D	27	D	1.1	28	D		0.87	0.87	99%
	US 51 - Hoepker	4	C	25	C	0.8	25	C		0.81	0.82	99%
	Hoepker - US 151	4	C	24	C	0.6	24	C		0.83	0.85	98%
	Merge from High Crossing	4	D	30	D	3.0	32	D		0.84	0.85	98%
	US 151 - Badger	3	C	19	C	0.4	19	C		0.61	0.62	99%
	Badger - BIC	5	C	20	C	0.3	20	C		0.67	0.67	100%
	SB I-90 CD											
	CD: from SB US 151	2	C	25	C	0.9	26	C		0.72	0.72	100%
	CD: Diverge to I-94/WIS 30	3	B	18	B	0.6	18	B		0.48	0.48	100%
	CD: from SB US 151 / to WB WIS 30	2	C	27	C	1.0	28	C		0.85	0.87	97%
SB US 151	**North of Main St**	2	B	17	B	0.7	17	B		0.52	0.52	100%
	Grand Ave - E Wash Ave	3	B	17	B	0.4	17	B		**0.93**	**0.93**	100%
	Diverge to NB I-90	3	C	22	C	0.8	22	C		0.72	0.72	100%

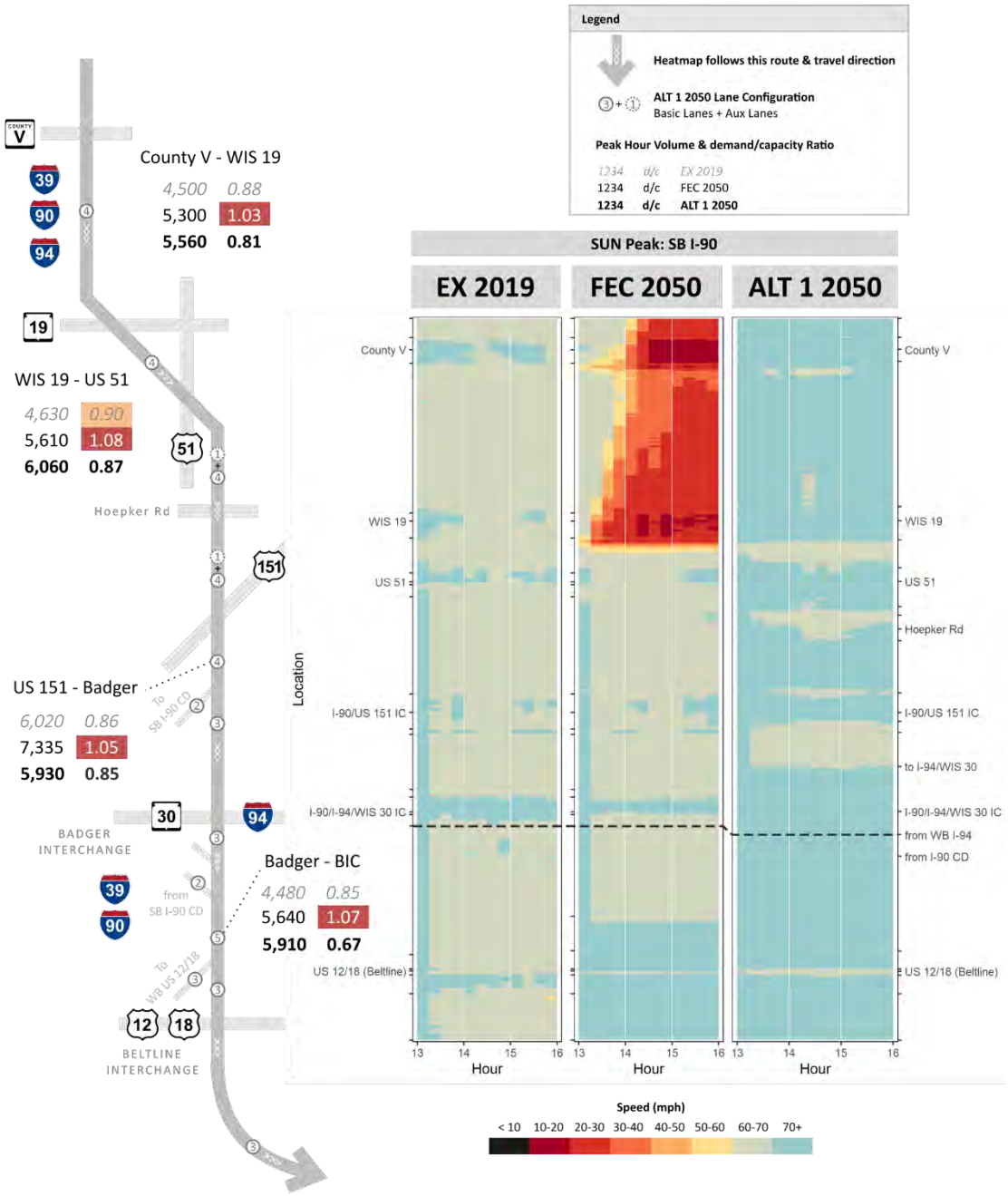

Figure 8. SUN Peak Speed Heatmap Comparisons - SB I-90

4. TEOpS Qualitative Tests & Summary

TEOpS 16-20-9.1.2 requires qualitative checks of the future build simulation model, using the same metrics as the existing year simulation. Table 12 lists the checks and describes how the model passes each check. Exhibit 10 compares the average speed heatmaps as a qualitative check to ensure changes in speeds between the models are reasonable. Appendix G displays the simulated heatmaps by random seed.

Table 12. Qualitative Validation Tests (TEOpS 16-20 Table 8.4)

			I-90 South Segment Model Observations				
Measure of Effectiveness	**Criteria**	**Validation Acceptance Threshold**	**AM**	**PM**	**FRI**	**SUN**	**Comments**
Queues	All Critical Queue Locations	Visually realistic for intersection queues. Quantitative checks required if queues are a primary validation MOE.	✓	✓	✓	✓	Changes in queues appear reasonable between the FEC 2050 and build ALT 2050 scenarios for existing intersection. For new intersections, queues appear reasonable based on visual inspection and high-level evaluation as discussed in Section 3.3.
Bottlenecks	Replication of Real-World Bottlenecks	Visually realistic for intersection queues and freeway bottlenecks	✓	✓	✓	✓	Changes in congestion appear reasonable between the FEC 2050 and build ALT 2050 scenarios. Locations that are at- or above-capacity in the no-build would be expected to experience less congestion with the added capacity. Locations that are near-capacity in the no-build with no proposed improvements are expected to experience similar congestion as the no-build. The model is unconstrained at the BIC and thus no congestion is shown at the interchange.
Routing	All Routes	Represents field conditions and driver behavior. Acceptance of quantitative results require WisDOT approval.	✓	✓	✓	✓	Future year OD patterns were created through the process discussed in Section 2.2 and Appendix B. This process adjusts the FEC OD matrix by using future OD growth patterns in the TDM and target volumes for links and turns. OD changes appear to produce reasonable shifts in traffic.
Lane Use	All Critical Lane Utilization Locations	Visually realistic. Quantitative checks encouraged for areas where lane usage has a significant influence on operations.	✓	✓	✓	✓	While it is possible the build ALT scenario may alter lane utilization compared to the no-build, the lane utilization assumptions were not changed. Lane change distances for the new geometry used comparable locations from the existing year model.
Freeway Merging	All Merge Locations	Visually realistic	✓	✓	✓	✓	Future year model inherited the same merge coding and driver behaviors established in the existing year model for consistency.
Vehicle Types and Truck Percentages	All Locations	Represents field conditions.	✓	✓	✓	✓	Future year model used the same truck percentages as the FEC scenario. While this assumes that truck percentages will not change in the future, special truck forecasts were not part of the project scope. The model uses the draft WisDOT Vissim .inpx file containing vehicle types derived from Wisconsin data (WisDOT Defaults_v1.2.inpx). Each vehicle type of PC, SU and TT included “fast” and “slow” variants for calibration purposes.

In summary, this report presents the technical documentation for the I-90 South Segment Vissim future year 2050 build ALT 1 model. Performance measures, including LOS and speed heatmaps, were evaluated to demonstrate how the future traffic operations are affected by the proposed improvements. Overall, the corridors are expected to operate at LOS D or better within the proposed improvements limits.

- The Vissim build ALT 1 model is an unconstrained model. The model assumes additional capacity improvements at the I-39/90 and US 12/18 Beltline Interchange (BIC) in order to fully accommodate the peak hour traffic demands. While the improvements to the BIC are not in the scope of the I-39/90/94 Corridor Study, unconstraining the model at the BIC better helps determine the magnitude of improvements the proposed alternatives could have on the freeway system. Modeling assumptions at the BIC are further discussed in Section 1.2.1 and Appendix E. In the case where no improvements are to be applied to the BIC, bottlenecks forming at EB US 12/18 to NB I-39/90 on-ramp will prohibit the downstream locations from experiencing the full traffic demand and the reported LOS results would seem better than expected. Bottlenecks forming at the SB I-39/90 diverge to WB 12/18 could spill back upstream to the Badger interchange and mask any improvements made by the proposed alternative resulting in LOS worse than expected.

With the completion of the peer review and approval of the model, documented in Appendix H, the build ALT 2050 LOS results will be incorporated in the Safety Operations and Engineering (SO&E) document as well as the Interstate Access Justification Report (IAJR) document.

I-39/90/94 Corridor Study

Technical Memorandum

Preferred Alternative IHSDM Analysis (South Segment)

June 12, 2024

Wisconsin Department of Transportation

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The appendices to this report are not included due to file size constraints. Please contact David Schmidt, P.E., WisDOT Study Manager, (608) 246-3867, david2.schmidt@dot.wi.gov to request a copy of these appendices.

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1. Overview

1.1. Methodology

This technical memorandum summarizes the predictive analysis methodology and results used to assess the relative safety performance of preferred alternative conditions along the south segment of the Interstate (I) 39/90/94 corridor. The predictive analysis was performed using Interactive Safety Design Model (IHSDM) software. This Preferred Alternative IHSDM model used the same methodology and predictive analysis approach as the I-39/90/94 No Build IHSDM model and is consistent with the November 2022 version of the **Safety Analysis Methodology** document. The study information regarding IHSDM functionality, geometric inputs, and analysis outlined in the **I-39/90/94 Corridor Study: Existing Conditions IHSDM Analysis (South Segment)** technical memorandum are applicable to the future no build and the preferred alternatives analysis documented in this memorandum. The future no build conditions memorandum was reviewed and approved by Wisconsin Department of Transportation (WisDOT) staff and the corridor design management and controls team (CDMCT) in March of 2023.

1.2. Future No Build versus Preferred Alternative

The analysis limits of the I-39/90/94 south segment remain the same as the existing and future no build conditions analysis, which includes approximately 25 miles of the I-39/90 freeway mainline from 2 miles south of the United States Highway (US) 12/18/Madison Beltline Highway (Beltline) at Siggelkow Road to the northern limit at the WIS 60 interchange. For reference, overview exhibits of the model limits for existing, future no build, and preferred alternative conditions shown in **Appendix A**.

This technical memorandum describes the modifications made to the study's future no build conditions model to have it represent the preferred alternative conditions. The primary changes include:

- Reconstruction of the I-39/90 mainline with 12-foot shoulders and an additional a general-purpose lane in each direction along the present freeway alignment from north of the Beltline interchange through the WIS 60 interchange at the northern model limit.
- Adding Collector-Distributor (C-D) lanes along I-39/90 between the I-94/WIS 30 and US 151 interchanges.
- Adding a proposed new diamond interchange at I-39/90/94 and Hoepker Road.
- Adding a proposed new partial cloverleaf interchange at I-94 and Milwaukee Street.
- Adding auxiliary lanes at several locations between the Beltline and WIS 19 interchanges.
- Updated 2050 Annual Average Daily Traffic (AADT) volumes and related traffic data for the additional general purpose lane and improved interchanges have been included in the preferred alternative IHSDM model.
- Future no build crash prediction evaluations have been completed for the year 2050, and segmenting the study corridor into "influence areas" for comparison of the preferred alternatives conditions to the future no build conditions has been completed.

These changes are discussed further in the following sections. The relative safety performance results of the No Build model compared to the Existing Conditions model are outlined in more detail in Section 5 of this memorandum.

The north and south segment teams have coordinated regarding modeling methodologies, best practices, and segment analysis limits for the No Build model as well as the preferred alternatives model. It should be noted that a new stationing system was considered for the south segment preferred alternative IHSDM model due to WisDOT's preference to follow west to east stationing along I-90 for preliminary design of the preferred alternative. For the purposes of the IHSDM modeling the stationing being used for preliminary design was adjusted to follow the original future no build IHSDM model setup to allow for more efficient model development and comparison between the no build and build IHSDM model sets, which contain substantial changes in geometry.

1.3. Preferred Alternative Overview

The following subsections provide an overview of the preferred alternative throughout the south segment. This section is intended to provide background on the preferred alternative and is not intended to explain why the preferred alternative was chosen, which can be found in the environmental document and intersection control evaluation (ICE) reports prepared for the study. **Appendix B** includes exhibits detailing the conceptual layouts and stationing for the preferred alternative.

1.3.1. Mainline I-39/90

The existing mainline in Dane County is a 6-lane divided freeway, which widens to eight lanes for 2.5 miles between the I-94/WIS 30 (Badger) and US 151 interchanges. WisDOT evaluated several modernization alternatives and identified the Modernization, plus Added General-Purpose Lane as the preferred alternative for the I-39/90/94 mainline. This alternative would reconstruct the Interstate with 12-foot shoulders and add a general-purpose lane in each direction along the present freeway alignment.

To address capacity and safety concerns, such as weaving movements between interchanges, this alternative would add 4 C-D lanes between the Badger and US 151 interchanges, and auxiliary lanes at several locations between the US 12/18 Interchange and WIS 19 Interchange.

1.3.2. I-39/90 and I-94/WIS 30 (Badger) Interchange

The Badger Interchange is a four-legged system interchange where I-39/90 meets I-94 to the east of the interchange and WIS 30 to the west. This interchange has multiple safety concerns including substandard curves and left-hand entrance and exit ramps.

The preferred alternative reconstructs the existing interchange with added modernization features, such as replacing deteriorating pavement and bridges, moving all ramps to the right-hand side of mainline, improving ramp lengths and bridge clearances, expanding shoulders, etc.

1.3.3. Proposed I-94 and Milwaukee Street Interchange

The existing Milwaukee Street dead ends near East Hill Parkway and does not cross I-94. The city of Madison requested WisDOT evaluate a new interchange for the proposed extension of Milwaukee Street at I-94 as it is

recommended in several Neighborhood Development Plans. WisDOT previously reconstructed I-94 in the early 2010's and constructed bridges as an overpass for a future Milwaukee Street extension.

A partial cloverleaf was identified as the preferred alternative that utilizes a traditional diamond for the eastbound (EB) ramps and a loop ramp for the westbound (WB) entrance ramp. The WB configuration allows more distance (compared to a traditional diamond) for traffic to weave between the proposed new Milwaukee Street entrance ramp and the Badger interchange.

1.3.4. US 151 System Interchange Area

The US 151 System Interchange Area is made up of the US 151 system interchange, the American Parkway service interchange, and High Crossing Boulevard service interchange. One preferred alternative was identified for the entire US 151 System Interchange Area to address traffic operations and weaving issues.

1.3.4.1. I-39/90/94 and US 151 System Interchange

The existing US 151 Interchange is a cloverleaf design. The current configuration of the northbound (NB) exit ramps from I-94/WIS 30 to US 151/High Crossing Boulevard interchanges require traffic to merge up to four lanes to reach their destination, leading to heavy congestion and safety concerns. Backups from the US 151 southbound (SB) to I-39/90/94 SB movement block the I-39/90/94 NB to US 151 SB and American Parkway to US 151 SB merges. East Washington Avenue, a commercial hub, is also located west of the US 151 interchange.

The preferred alternative reconstructs the interchange such that the freeway-to-freeway movements between I-39/90/94 and US 151 are free-flow movements while a diamond interchange is embedded at East Washington Avenue to provide local access and slow traffic from the freeway portion of US 151 as it enters the commercial area of East Washington Avenue.

1.3.4.2. US 151 and American Parkway Interchange

The existing American Parkway service interchange is located on US 151 northeast of the US 151 system interchange. The preferred alternative relocates the American Center entrance of US 151 from American Parkway and Nelson Road to Eastpark Boulevard through a diamond interchange while maintaining the Nelson Road/American Parkway access to High Crossing Boulevard.

1.3.4.3. I-39/90/94 and High Crossing Boulevard Interchange

The existing High Crossing Boulevard Interchange is a half diamond interchange with access to/from the south. The exit ramps from I-39/90/94 experience heavy congestion and high crash levels due to weaving movements from I-94/WIS 30 traffic. The preferred alternative maintains a half diamond interchange, but better separates the ramps to/from the south to address congestion and safety concerns.

1.3.5. Proposed I-39/90/94 and Hoepker Road Interchange

Hoepker Road is an overpass on I-39/90/94. The city of Madison requested WisDOT to evaluate an interchange at Hoepker Road, which would provide access to ongoing business and residential development, including the American Family campus and UW Health hospital east of the corridor.

WisDOT identified a diamond interchange configuration as the preferred alternative as it is the most familiar interchange type with motorists and the ramps are easiest for freight vehicles to navigate.

1.3.6. I-39/90/94 Service Interchanges

There are four service interchanges along the I-39/90/94 corridor's south segment: US 51, WIS 19, County V, and WIS 60. The preferred alternative for each is described in the following subsections. High Crossing Boulevard is also is a service interchange, but is within the US 151 system interchange area described in Section 1.3.4.

1.3.6.1. I-39/90/94 and US 51 Interchange

The existing US 51 Interchange is a partial cloverleaf interchange with slow speed free-flow movements between the Interstate and US 51 that do not meet current design standards. The preferred alternative retains the partial cloverleaf configuration while adding C-D roads along NB and SB US 51 and combining the NB merges and SB merges along the Interstate, reducing the number of conflict points along the mainline.

1.3.6.2. I-39/90/94 and WIS 19 Interchange

The WIS 19 Interchange is next to a railroad crossing and there are five signalized intersections on WIS 19 between Tierney Crossing and Pepsi Way, including the County CV intersection that is located between the NB ramp terminal intersections. The existing interchange and the County CV intersection experience poor operations and safety concerns.

WisDOT identified the U-ramp interchange alternative as the preferred alternative as it best addresses safety as well as existing and future travel demands. This alternative improves capacity on WIS 19 from four lanes to six lanes, while reducing the number of signalized intersections.

1.3.6.3. I-39/90/94 and County V Interchange

WisDOT is not recommending a preferred alternative for further study due to a large gas station/convenience store development just west of the Interchange being implemented. The development will likely generate substantial traffic demand and require improvements to the interchange. The new development is expected to reconstruct the interchange before construction could occur for this project. For the purposes of the predictive safety analysis, the interchange ramps are included in the model to capture the effect of speed change lanes along the freeway; however, the ramp terminals are not included in the analysis.

1.3.6.4. I-39/90/94 and WIS 60 Interchange

Construction on the WIS 60 Interchange, located in Columbia County, began in summer 2022 and is anticipated to be complete in summer 2024. The construction also includes the removal of the existing partial cloverleaf interchange configuration and reconstruction to a full diamond interchange with dual-lane roundabouts at the ramp terminal intersections. This project will replace the I-39/90/94 bridges over WIS 60. Section 2 describes how WIS 60 is being handling in the IHSDM modeling effort for this study.

1.3.7. I-39/90 and Beltline System Interchange

The Beltline Interchange, although apart of the I-39/90/94 south segment study area and IHSDM model limits, is being evaluated in a separate Madison Beltline Study. A preferred interchange alternative is not identified at this interchange for the I-39/90/94 Corridor Study.

2. Geometrics

2.1. Model Limits

Figures 2.1-1 and 2.1-2 show overview schematics of the Preferred Alternative and IHSDM model limits.

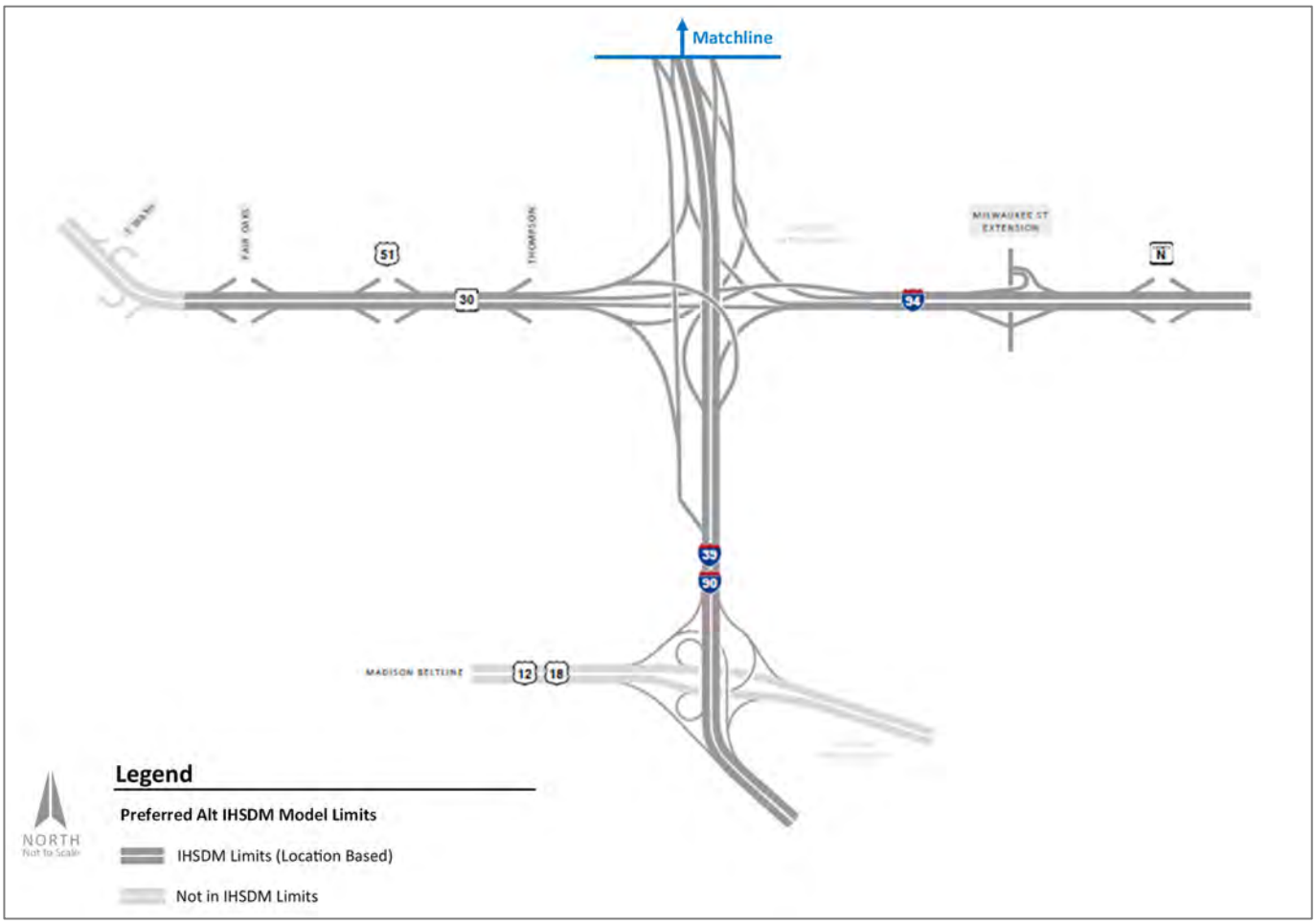

Figure 2.1-1 Preferred Alternative IHSDM Model Limits: South End

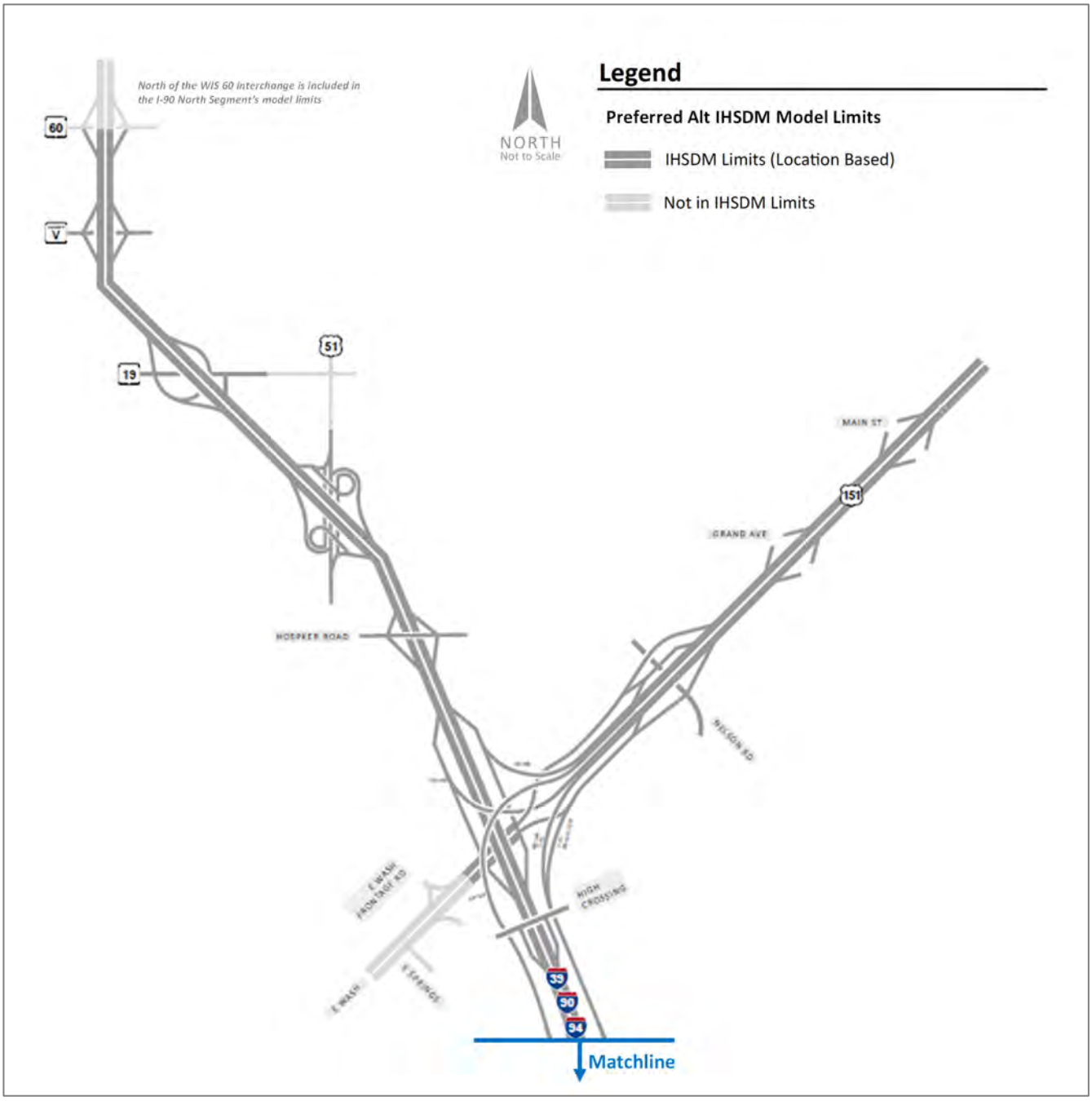

Figure 2.1-2 Preferred Alternative IHSDM Model Limits: North End

The WisDOT project at the I-39/90/94 and WIS 60 service interchange was included as a committed project for modeling future no build conditions. The south segment study's future no build IHSDM model includes coding for the geometrics of each of the service ramps and the I-39/90/94 mainline north of WIS 60; however, the northern terminus for the south segment study team's mainline evaluations is at the WIS 60 overpass. The north segment study team will evaluate the freeway mainline from the WIS 60 overpass and north.

2.2. Conceptual Layouts

The preferred alternative conceptual layouts, as described in Section 1.3, and stationing are included in **Appendix B** and an example stationing exhibit at the proposed I-39/90/94 and Hoepker Road interchange is shown in Figure 2.2-1. It should be noted that crossroads, such as Hoepker Road in Figure 2.2-1, are shown for visual purposes only in the conceptual layouts and coded for visual purposes only in the IHSDM model. Section 2.3 describes the site set analyses performed to analyze predictive safety performance of ramp terminal intersections.

Figure 2.2-1 Example Conceptual Layout with Stationing

Appendix B includes additional geometric information that includes anticipated barrier location exhibits, naming conventions exhibits for ramps and C-D roads, and geometric input spreadsheets for the freeway mainline sections. An example barrier location exhibit is shown in Figure 2.2-2 and an example system ramp naming convention exhibit is shown in Figure 2.2-3.

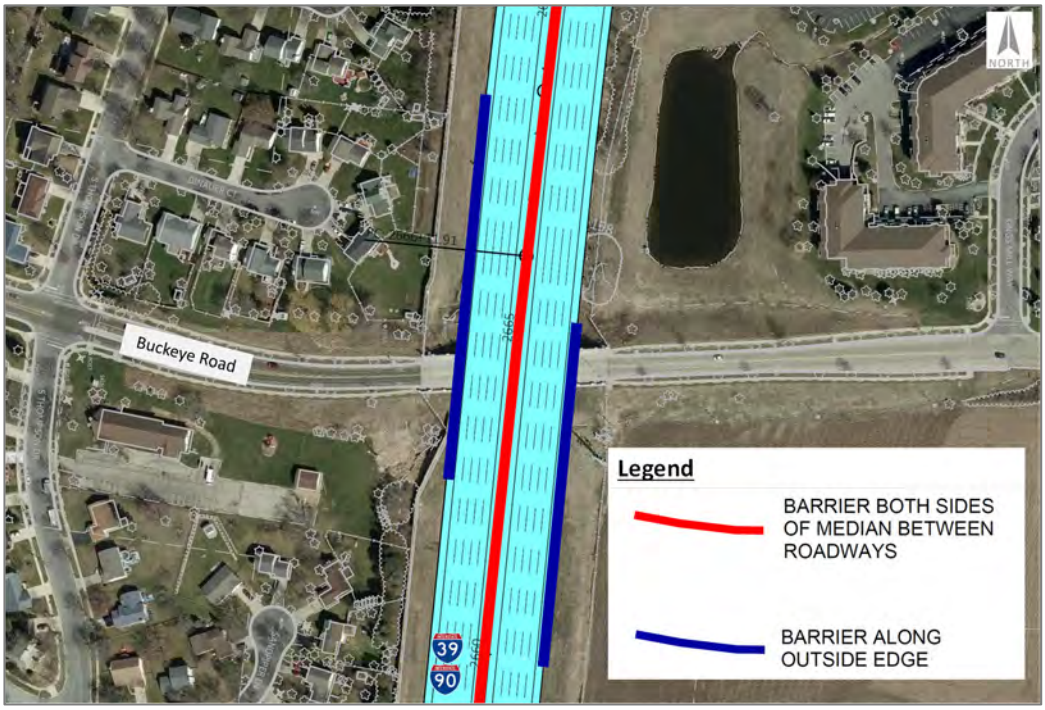

Figure 2.2-2 Example Roadway Barrier Exhibit at Bridge over Buckeye Road

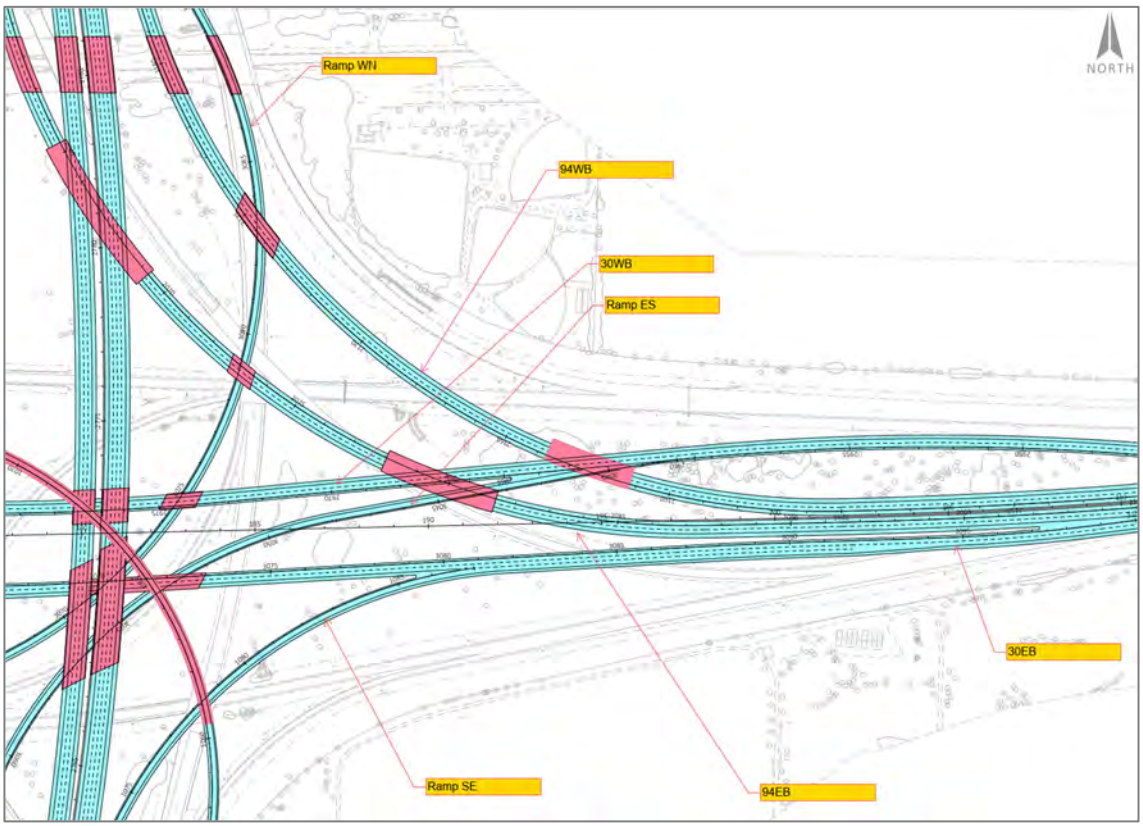

Figure 2.2-3 Example System Ramp Naming Convention Exhibit at Badger Interchange

2.3. Site Set Analyses

During development of the preferred alternatives designs, IHSDM crash prediction analysis was used to evaluate ramp terminal traffic control alternatives for Phase II Intersection Control Evaluation (ICE) purposes as required by the WisDOT Facilities Development Manual (FDM) 11-25-3. The Phase II ICE reports have been prepared for the following locations:

- I-39/90/94 and US 151/East Washington Avenue
- US 151 and American Parkway
- I-39/90/94 and Hoepker Road
- I-94 and Milwaukee Street

These IHSDM analyses only considered the ramp terminals and did not include evaluation of the ramps or adjacent intersections. Although not required for Phase I ICE analyses, IHSDM crash prediction analysis was completed for the I-39/90/94 ramp terminal intersections at High Crossing Boulevard, US 51, and WIS 19. The ramp terminals were analyzed in IHSDM using site set analysis methods. Phase II ICE reports with the IHSDM evaluation results were submitted by the South Segment team for evaluation by WisDOT and CDMCT starting in January 2024. Those reports and resultant WisDOT communication are not included in this report but can be found on BOX in this folder: https://wisdot.box.com/s/mi0h6u6um8qd3gmmt8j1yhi7jzsbmufo (*IH 39_90_94 Interstate Corridor > South Segment > Traffic-IJR > IntersectionControlEval*). Geometric inputs for the site set analyses are included in **Appendix B**.

3. Traffic

3.1. Future No Build

Forecasted traffic volumes were developed by the CDMCT and WisDOT and were provided to the south segment study team for use in the predictive safety analysis. The balanced forecast volumes that were provided included 2050 No Build AADT volumes along with 2050 No Build peak hour volumes for weekdays, Fridays, and Sundays. These forecasted volumes were provided for all mainline and ramp segments throughout the study limits. At the intersection level, average annual growth rates were provided for crossroads. These growth rates were applied to existing conditions AADT volumes to develop the 2050 No Build AADTs for use in the intersection site set analyses.

Generally, the annual average No Build growth rate forecast along the I-39/90/94 corridor within the south segment study area ranged from 0.25 to approximately 2.00 percent, depending on the location along the mainline. Crossroad growth rates were observed to follow a similar trend. Traffic along I-39/90/94 is projected to reach up to 141,700 vehicles per day (vpd) between the I-94/WIS 30 (Badger) interchange and the US 151 interchange, which has an increase of approximately 26 percent over the existing (2019) conditions volume of about 112,500 vpd. Traffic along US 151 between American Parkway and I-39/90/94 is projected to have substantial growth with increases from 72,300 to 102,900 vpd (an increase of 42 percent). Schematics and tables showing the 2050 No Build AADT forecast volumes input into the No Build IHSDM model are included in **Appendix C**. The daily traffic forecast volumes provided by CDMCT are included in **Appendix E**.

3.2. Preferred Alternative

Forecasted traffic volumes using redistributed traffic were developed by the CDMCT and WisDOT for the year 2050 and were provided to the south segment study team for use in the predictive safety analysis for the preferred alternatives conditions. At the intersection level, the south segment team estimated daily volumes along crossroads from peak hour trends for the purposes of preferred alternative ramp terminal/intersection site set analyses. These estimated daily intersection volumes were reviewed and approved by the CDMCT.

The year 2050 AADT data were input into the preferred alternatives model for each freeway mainline segment, ramp, and ramp terminal intersection site set. Schematics and tables showing the 2050 AADT forecast volumes that were used as input data for the preferred alternatives IHSDM model's mainline, ramp, and C-D road segments are included in **Appendix C**. The daily volumes developed for the site set analyses are also included in **Appendix C**. The daily traffic forecast volumes provided by CDMCT are included in **Appendix E**.

In general, the preferred alternative AADT volumes are higher and patterns are different than the future no build volumes due to the added capacity, proposed new interchanges, and system interchange reconfigurations. Table 3.2-1 shows a comparison between future no build and preferred alternative AADT volumes at locations between interchanges throughout the I-39/90 freeway corridor. The preferred alternative AADT volumes are projected to be 3 to 8 percent higher than the No Build AADT volumes south of the Badger interchange and north of the US 51 interchange. Between the Badger and US 51 interchange, the preferred alternative AADT volumes are projected to be 15 to 18 percent higher than the No Build AADT volumes.

Location along I-39/90	2050 No Build AADT (vpd)	2050 Preferred Alt AADT (vpd)	Absolute Difference	Percent Difference
South of Beltline	62,800	64,800	+2,000	+3%
Beltline to Badger	126,700	134,700	+8,000	+6%
Badger to US 151	141,700	104,400 - 162,300[1]	+20,600[1]	+15%[1]
US 151 to Hoepker	93,900	110,500	+16,600	+18%
Hoepker to US 51	93,900	108,400	+14,500	+15%
US 51 to WIS 19	89,100	96,400	+7,300	+8%
WIS 19 to County V	75,300	78,400	+3,100	+4%
County V to WIS 60	67,800	71,500	+3,700	+5%

[1] Lower end of range represents I-39/90/94 core without C-D Roads. Higher end of volume range includes C-D Roads. Difference calculations are based on the higher range volumes compared to the No Build.

Table 3.2-1 No Build vs Preferred Alternative 2050 AADT Comparison along I-39/90

Table 3.2-2 shows a comparison between future no build and preferred alternative AADT volumes at locations between interchanges throughout the WIS 30 and I-94 freeway corridors. Daily volumes are projected to increase by 12 to 20 percent where geometric changes are made between WIS 30/US 51 and I-94/Milwaukee Street. Daily volumes are projected to be reduced by 2 percent along I-94 between the proposed Milwaukee Street interchange and the County N interchange due to the addition of the Milwaukee Street interchange.

Location along WIS 30 and I-94	2050 No Build AADT (vpd)	2050 Preferred Alt AADT (vpd)	Absolute Difference	Percent Difference
EWA to Fair Oaks	48,300	49,000	+700	+1%
Fair Oaks to US 51	54,400	56,500	+2,100	+4%
US 51 to Thompson	65,200	73,000	+7,800	+12%
Thompson to Badger	49,700	59,200	+9,500	+19%
Badger to Milwaukee	70,300	84,400	+14,100	+20%
Milwaukee to County N	70,300	68,900	-1,400	-2%
East of County N	56,200	56,400	+200	+<1%

Table 3.2-2 No Build vs Preferred Alternative 2050 AADT Comparison along WIS 30 and I-94

Table 3.2-3 shows a comparison between future no build and preferred alternative AADT volumes at locations between interchanges throughout the US 151 freeway corridor. Daily volumes are projected to increase by 9 to 12 percent along US 151 from I-39/90/94 through WIS 19.

Location along US 151	2050 No Build AADT (vpd)	2050 Preferred Alt AADT (vpd)	Absolute Difference	Percent Difference
I-39/90/94 to American	102,900	43,200 - 112,600[1]	+9,700[1]	+9%[1]
American to Grand	91,200	101,000	+9,800	+11%
Grand to Main	67,900	75,900	+8,000	+12%
Main to WIS 19	50,000	55,000	+5,000	+10%

[1] Lower end of range represents US 151 core without C-D Roads. Higher end of volume range includes C-D Roads. Difference calculations are based on the higher range volumes compared to the No Build.

Table 3.2-3 No Build vs Preferred Alternative 2050 AADT Comparison along US 151

4. High-Volume Hours

The balanced 2050 AADT traffic volumes and spreadsheet tools developed for the existing conditions IHSDM modeling effort were used to develop 2050 high-volume hour inputs for the No Build model and Preferred Alternative model. With the addition of mainline capacity and interchange improvements throughout the south segment study area, the high-volume hours were substantially decreased along the I-39/90 mainline. Table 4-1 shows a comparison between future no build and preferred alternative high volume hour proportions at locations between interchanges along the I-39/90 corridor.

Location along I-39/90	2050 No Build High Volume Hour Proportion	2050 Preferred Alt High Volume Hour Proportion	Absolute Difference	Percent Difference
South of Beltline	0.00	0.00	--	--
Beltline to Badger	0.79	0.22	-0.57	-72%
Badger to US 151	0.65	0.04[1]	-0.61[1]	-94%[1]
US 151 to Hoepker	0.43	0.14	-0.29	-67%
Hoepker to US 51	0.43	0.25	-0.18	-42%
US 51 to WIS 19	0.38	0.13	-0.25	-66%
WIS 19 to County V	0.15	0.00	-0.15	-100%
County V to WIS 60	0.15	0.00	-0.15	-100%

[1] The high-volume hours are only applicable to freeways, therefore the values in this table represent the I-39/90/94 core without C-D Roads.

Table 4-1 No Build vs Preferred Alternative 2050 High-Volume Hour Comparison along I-39/90

Decreases in high-volume hours are also projected along the US 151, WIS 30, and I-94 freeway corridors where capacity improvements are proposed. Tables 4-2 and 4-3 show comparisons between future no build and preferred alternative high volume hour proportions at locations between interchanges along the WIS 30/I-94 and US 151 corridors, respectively.

Location along WIS 30 and I-94	2050 No Build High Volume Hour Proportion	2050 Preferred Alt High Volume Hour Proportion	Absolute Difference	Percent Difference
EWA to Fair Oaks	0.15	0.17	+0.02	+13%
Fair Oaks to US 51	0.37	0.40	+0.03	+8%
US 51 to Thompson	0.50	0.00	-0.50	-100%
Thompson to Badger	0.18	0.00	-0.18	-100%
Badger to Milwaukee	0.09	0.15	+0.06	+67%
Milwaukee to County N	0.09	0.07	-0.02	-22%
East of County N	0.39	0.40	+0.01	+3%

Table 4-2 No Build vs Preferred Alternative 2050 High-Volume Hour Comparison along WIS 30 and I-94

Location along US 151	2050 No Build High Volume Hour Proportion	2050 Preferred Alt High Volume Hour Proportion	Absolute Difference	Percent Difference
I-39/90/94 to American	0.63	0.00[1]	-0.63[1]	-100%[1]
American to Grand	0.41	0.17	-0.24	-59%
Grand to Main	0.09	0.17	+0.08	+89%
Main to WIS 19	0.17	0.31	+0.14	+82%

[1] The high-volume hours are only applicable to freeways, therefore the values in this table represent the US 151 core without C-D Roads.

Table 4-3 No Build vs Preferred Alternative 2050 High-Volume Hour Comparison along US 151

Tables showing the high volume hour outputs for each freeway corridor are included in **Appendix C**. Example high volume hour calculations are also shown in **Appendix D** for preferred alternatives conditions, which utilized the same calculation methodology as the future no build conditions analysis.

5. Preliminary Results

5.1. Methodology

The preferred alternatives conditions IHSDM analysis for the south segment evaluated the I-39/90/94 freeway corridor as well as the WIS 30/I-94 and US 151 freeway corridors using the Predictive Method to estimate the predicted number of crashes throughout each corridor. Per discussion between CDMCT and the WisDOT Bureau of Transportation Operations (BTO) State Traffic Safety Engineers, it was determined that the typical process for safety analysis outlined in WisDOT FDM 11-38 is not intended for WisDOT Majors studies like the I-39/90/94 corridor. However, using IHSDM does provide a means to provide quantitative analysis for Safety, Operations and Engineering and Interstate Access Justification Reports for FHWA review. The typical application of IHSDM to calculate a benefit/cost ratio for smaller projects is not completely relevant for this Majors study. While there is value to conducting an analysis for 10- or 20-years, there are data elements (including traffic forecasts for interim years, construction phasing, etc.) that do not exist and would require substantial additional effort in order to incorporate a second set of traffic volumes into IHSDM. Conducting a 10- or 20-year analysis would be beneficial at a point in the future during the project's development process when construction dates are more reasonably known; updating IHSDM with accompanying traffic forecasts and construction phasing would be appropriate to discuss at that time (sometime following the environmental document's Record of Decision and approval of project funding). The current predictive safety analysis, however, will proceed using a one-year window with 2050 forecasts. Documentation of this discussion and WisDOT's comments are in a correspondence dated March 22, 2024 can be found in **Appendix E**.

For consistent evaluation comparison methods for both the North Segment and South Segment Corridors, using mainline "influence areas" will allow for a better comparison between the future no build IHSDM crash prediction results and the preferred alternatives IHSDM crash prediction results. For both the North Segment and South Segment Corridors, there were areas with major changes in roadway design along the corridor including removal and/or new construction of interchanges, ramps, intersections, and C-D roads. Direct comparison of the IHSDM crash prediction results of the preferred alternatives against the results from the future no build conditions would not give reasonable crash prediction comparisons with such varied designs. Therefore, the overall modeling limits are segmented into "influence areas" that include multiple components of updated ramps, ramp terminals, mainline configuration, speed change lanes, C-D roads, and system ramps (where applicable) to make a more reasonable comparison.

Figures 5.1-1 and 5.1-2 show the "influence area" segments used in the South Segment Corridor comparison of the future no build IHSDM crash prediction results to the preferred alternatives IHSDM crash prediction results. Table 5.1-1 that follows shows the limits and contents of the 13 influence areas.

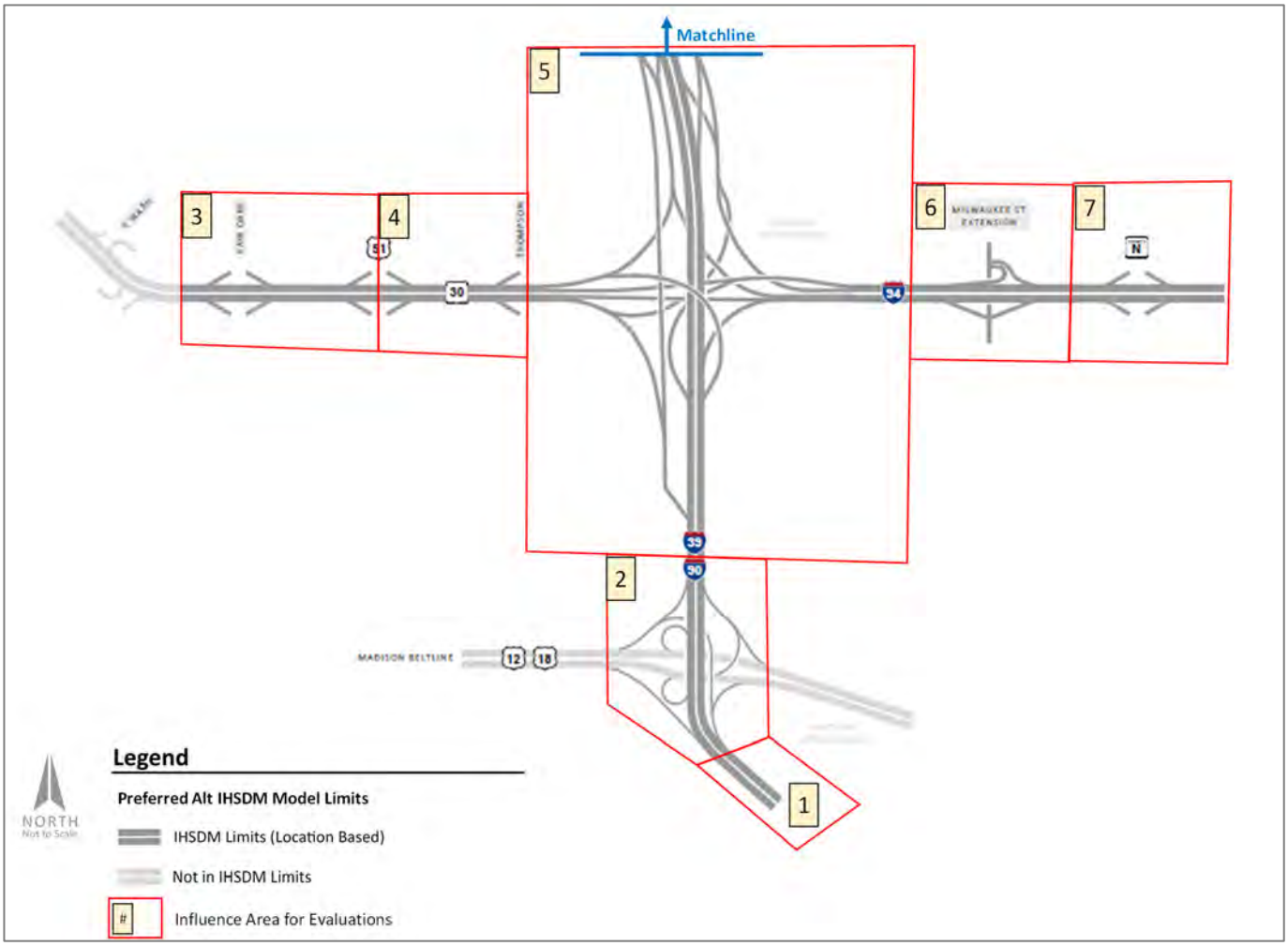

Figure 5.1-1 IHSDM Influence Areas for Evaluations: South End

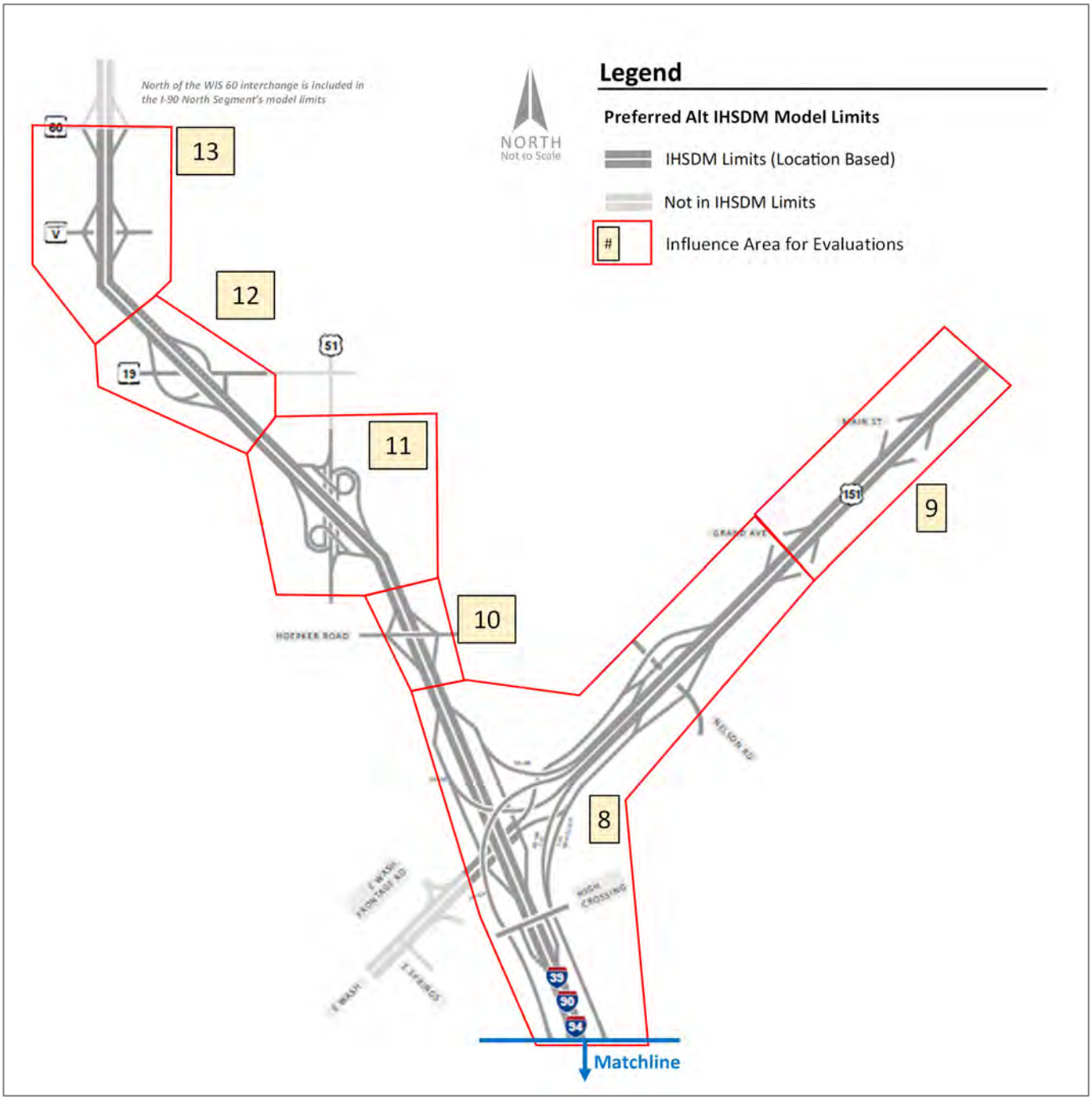

Figure 5.1-2 IHSDM Influence Areas for Evaluations: North End

Influence Area	Location Description	Freeway Mainline Station Ranges			Number of C-D Road Segments		Number of Ramps		Number of Intersections	
		Freeway	No-Build	Pref Alt	No Build	Pref Alt	No Build	Pref Alt	No Build	Pref Alt
1	I-39/90 South of BIC	I-39/90	2435+00 to 2505+66		0	0	0	0	0	0
2	I-39/90 within BIC	I-39/90	2505+66 to 2585+77		0	0	8	8	0	0
3	WIS 30: Fair Oaks to US 51	WIS 30	40+00 to 91+25		0	0	6	6	0	0
4	WIS 30: US 51 to Badger	WIS 30	91+25 to 140+47		0	0	4	4	0	0
5	I-39/90 & Badger interchange area	I-39/90/94	2585+77 to 2838+58		0	4	8	8	0	0
		WIS 30/I-94	140+47 to 243+90							
6	I-94 & Milwaukee St interchange	I-94	243+90 to 290+17		0	0	0	4	0	2
7	I-94 east of Milwaukee St	I-94	290+17 to 467+32		0	0	4	4	0	0
8	I-39/90/94 & US 151 interchange area	I-39/90/94	2838+58 to 2965+94		0	4	19	16	3	6
		US 151	21+50 to 145+71	33+00 to 145+71*						
9	US 151: North of Grand Ave	US 151	145+71 to 236+13		0	0	6	6	0	0
10	I-39/90/94 & Hoepker Rd interchange	I-39/90/94	2965+94 to 3060+81		0	0	0	4	0	2
11	I-39/90/94 & US 51 interchange area	I-39/90/94	3060+81 to 3131+74		0	0	6	8	2	2
12	I-39/90/94 & WIS 19 interchange area	I-39/90/94	3131+74 to 3179+61		0	0	4	5	4	2
13	I-39/90/94 North of WIS 19 interchange	I-39/90/94	3179+61 to 3748+00		0	0	6	6	0	0
Totals			*36.9 miles*	*36.8 miles**	*0*	*8*	*71*	*79*	*9*	*14*

**Note: difference in station ranges evaluated between future no build conditions and preferred alternative conditions is due to the introduction of ramp terminals at the I-39/90/94 and US 151/East Washington Avenue interchange. A site set analysis in the preferred alternative for the ramp terminals replaces the station ranges evaluated along US 151 in the no build condition.*

Table 5.1-1 IHSDM Influence Area Limits and Contents

To assess how the changes in geometrics and traffic volumes associated with the preferred alternative may affect safety performance within the study limits, each segment or "influence area" was analyzed in IHSDM to calculate the predicted crashes for that segment. The mainline sections are classified as either speed change crashes or freeway crashes, depending on where they occurred on the roadway. Speed change crashes occur on the mainline in the ramp entrance and exit areas whereas freeway crashes occur outside of those locations on the mainline freeway lanes. C-D Road predicted crashes occur only on the C-D Road sections, ramp predicted crashes occur only on the ramp sections, and ramp terminal crashes occur within a 250-foot radius of each terminal. The mainline, speed change lanes, C-D Roads, and ramps were analyzed with IHSDM location based methodology and the ramp terminals were analyzed separately using IHSDM site set analysis methods. The Total crashes, Fatal/Injury (FI) crashes, and Property Damage Only (PDO) crashes were summarized for the year 2050 for each "influence area". Totals for each category for the South Segment were summarized as well.

The influence areas were generally developed to encompass full interchanges, allowing for direct safety performance comparisons of proposed interchange and mainline improvements within specific sections of the corridor. For example, influence areas 6 and 10 were set up to cover the limits of the proposed new interchanges at I-94 and Milwaukee Street and I-39/90/94 and Hoepker Road, respectively. Influence areas 11 and 12 were set up to cover the I-39/90/94 and US 51 and I-39/90/94 and WIS 19 interchanges, respectively. The system interchanges at US 151 and WIS 30/I-94 (Badger) are larger than other influence areas to cover C-D Roads and the nearby US 151 and American Parkway service interchange.

Due to the added infrastructure at the system interchanges and new proposed interchanges included in the south segment's preferred alternative, the south segment team reviewed predicted crashes in terms of crashes per mile and crashes per lane mile. This review is intended to capture the predicted safety benefits of the additional infrastructure in a way similar to a crash rate; rather than just comparing the raw predicted number of crashes in between the preferred alternative and no build conditions. Comparing only the raw predicted number of crashes may not fully capture the potential safety improvements of the added infrastructure in the south segment, which is predicted to increase crash frequency and reduce crash rates. These trends are discussed further in Section 5.2.

Tables 5.1-2 and 5.1-3 show the differences in mileage and lane-miles between the future no build and preferred alternative conditions for the overall study area. These tables include all mainline freeway and speed-change lane sections, C-D Roads, and ramps.

Evaluation Category	No Build Total Length (mi)	Preferred Alt Total Length (mi)	Absolute Difference	Percent Difference
Mainline Freeway + Speed Change Lanes	36.9	36.8	-0.1	0%
Ramps	24.7	31.5	+6.9	+28%
C-D Roads	2.2	9.8	+7.6	+349%
Total	61.7	75.8	+14.0	+23%

Table 5.1-2 No Build vs Preferred Alternative: Roadway Length Comparison

Evaluation Category	No Build Total Lane-Miles	Preferred Alt Total Lane-Miles	Absolute Difference	Percent Difference
Mainline Freeway	216.1	259.2	+43.0	+20%
Mainline Speed Change Lanes	2.1	2.4	+0.4	+17%
Ramps	30.9	41.0	+10.1	+33%
C-D Roads	3.2	20.1	+16.9	+534%
Total	252.3	322.7	+70.4	+28%

Table 5.1-3 No Build vs Preferred Alternative: Roadway Lane-Mile Comparison

Across all evaluation types (excluding site sets) the preferred alternative contains 14 more miles and about 70 more lane-miles of roadway compared to the future no build condition. This equates to a 23 percent increase in roadway infrastructure and a 28 percent increase in lane-miles with the preferred alternative's proposed condition.

Table 5.1-4 shows the difference in mileage and lane-miles between the future no build and preferred alternative conditions by influence area, excluding intersections. Values shaded gray have absolute differences of less than 5 percent.

Influence Area	Location Description	Total Roadway Mileage				Total Lane Miles			
		No Build	Pref Alt	Abs Diff	% Diff	No Build	Pref Alt	Abs Diff	% Diff
1	I-39/90 South of BIC	1.34	1.34	0.00	0.0%	8.37	8.37	0.00	0.0%
2	I-39/90 within BIC	5.56	5.56	0.00	0.0%	15.89	15.98	0.09	0.6%
3	WIS 30: Fair Oaks to US 51	2.15	2.16	0.01	0.4%	6.34	6.48	0.15	2.3%
4	WIS 30: US 51 to Badger	2.02	2.02	0.00	0.1%	6.15	9.09	2.94	47.7%
5	I-39/90 & Badger interchange area	9.98	17.83	7.85	78.7%	48.45	69.73	21.28	43.9%
6	I-94 & Milwaukee St interchange	0.88	1.89	1.02	116.2%	5.26	5.90	0.64	12.3%
7	I-94 east of Milwaukee St	4.50	4.50	0.00	0.0%	21.74	22.09	0.35	1.6%
8	I-39/90/94 & US 151 interchange area	12.42	14.13	1.71	13.8%	38.83	49.77	10.94	28.2%
9	US 151: North of Grand Ave	3.17	3.17	0.00	0.1%	9.88	9.89	0.01	0.1%
10	I-39/90/94 & Hoepker Rd interchange	1.67	3.18	1.50	89.8%	10.22	17.69	7.48	73.2%
11	I-39/90/94 & US 51 interchange area	3.55	5.29	1.75	49.3%	8.89	14.69	5.81	65.3%
12	I-39/90/94 & WIS 19 interchange area	2.06	2.77	0.71	34.4%	6.37	8.80	2.43	38.1%
13	I-39/90/94 North of WIS 19 interchange	12.43	11.92	-0.51	-4.1%	65.89	84.18	18.30	27.8%
Total		61.7	75.8	14.0	22.7%	252.3	322.7	70.4	27.9%

Note: Values shaded gray have absolute percent differences of less than 5 percent

Table 5.1-4 No Build vs Preferred Alternative: Mileage Comparison by Influence Area

The comparison of mileage and lane-miles between the future no build and preferred alternative indicates the following:

- There is minimal change in mileage for over half (7 of the 13) influence areas.
- The lane miles increase by 20 percent or more for over half (7 of the 13) influence areas, with the greatest percentage increases seen in the proposed new Hoepker interchange area (influence area 10), the US 51 interchange area (influence area 11), and the WIS 30/Badger interchange area (influence areas 4 and 5).

- The greatest increase in mileage is in the Badger interchange area (influence area 5), which includes an increase in 7.8 miles of roadway infrastructure.
- The greatest increases in lane mileage are in the Badger interchange area (influence area 5) with an increase in 21.3 miles of roadway infrastructure and along the corridor north of WIS 19 with an increase in 18.3 miles of roadway infrastructure.
- The I-39/90/94 and US 151 interchange area (influence area 8) has the third highest amount of lane mileage but sees a more modest increases in overall mileage due to the full cloverleaf configuration with C-D Roads that exists at the US 151 system interchange today.

5.2. Summary of Preliminary Results

The following series of tables provide crash prediction results for cumulative 2050 predicted crashes (Table 5.2-1), crashes per mile (Table 5.2-2), and crashes per lane-mile (Table 5.2-3). All of the IHSDM evaluation reports for the No Build and Preferred Alternative IHSDM models are included in **Appendix F** and **Appendix G**, respectively, and additional summary tables are included in **Appendix H**.

Influence Area	Location Description	Total Predicted Crashes (excluding intersections)				Predicted FI Crashes (excluding intersections)				Predicted PDO Crashes (excluding intersections)			
		No-Build	Pref Alt	Abs Diff	% Diff	No-Build	Pref Alt	Abs Diff	% Diff	No-Build	Pref Alt	Abs Diff	% Diff
1	I-39/90 South of BIC	15.0	16.3	1.3	8.7%	4.4	4.7	0.3	7.1%	10.7	11.6	1.0	9.3%
2	I-39/90 within BIC	46.1	53.8	7.8	16.8%	20.3	26.1	5.8	28.3%	25.8	27.8	2.0	7.8%
3	WIS 30: Fair Oaks to US 51	13.4	24.7	11.2	83.7%	4.8	9.4	4.6	95.2%	8.6	15.3	6.7	77.9%
4	WIS 30: US 51 to Badger	17.1	40.1	23.0	134.1%	6.1	14.9	8.8	145.2%	11.0	25.1	14.1	127.8%
5	I-39/90 & Badger interchange area	177.1	200.3	23.2	13.1%	54.5	62.7	8.2	15.0%	122.6	137.5	15.0	12.2%
6	I-94 & Milwaukee St interchange	13.2	19.5	6.3	48.2%	3.9	6.9	3.0	77.2%	9.2	12.6	3.3	36.1%
7	I-94 east of Milwaukee St	35.8	37.5	1.7	4.8%	11.8	12.4	0.6	4.8%	23.9	25.1	1.2	4.8%
8	I-39/90/94 & US 151 interchange area	129.4	175.0	45.6	35.2%	44.4	65.0	20.7	46.6%	85.0	110.0	25.0	29.4%
9	US 151: North of Grand Ave	27.3	29.1	1.8	6.7%	9.4	9.7	0.3	3.2%	17.9	19.5	1.5	8.6%
10	I-39/90/94 & Hoepker Rd interchange	40.7	45.5	4.8	11.8%	12.0	14.5	2.5	20.4%	28.7	31.0	2.3	8.2%
11	I-39/90/94 & US 51 interchange area	31.6	39.5	7.9	24.8%	10.2	13.6	3.3	32.6%	21.4	25.9	4.5	21.2%
12	I-39/90/94 & WIS 19 interchange area	15.8	22.6	6.7	42.5%	5.2	7.7	2.6	49.2%	10.7	14.8	4.2	39.2%
13	I-39/90/94 North of WIS 19 interchange	130.1	128.2	-2.0	-1.5%	36.5	35.0	-1.5	-4.0%	93.7	93.1	-0.5	-0.6%
Total		692.6	831.8	139.3	20.1%	223.5	282.6	59.1	26.4%	469.1	549.4	80.3	17.1%

Table 5.2-1 Cumulative Predicted Crashes (2050)

The results in Table 5.2-1 indicate an increase in overall total predicted crashes between the No Build and Preferred Alternative for total, FI, and PDO crashes ranging from 17 to 26 percent. Influence areas 13 sees decreases in predicted total and FI crashes while all other influence areas see an increase in predicted crashes. However, due to the Preferred Alternative's substantial increase in mileage (23 percent increase) and lane-mileage (28 percent

increase) compared to the future no build condition, the predictive safety results are better represented by reviewing crashes per mile and crashes per lane-mile.

Table 5.2-2 shows predicted crashes per mile.

Influence Area	Location Description	Total Predicted Crashes per Mile (excluding intersections)				Predicted FI Crashes per Mile (excluding intersections)				Predicted PDO Crashes per Mile (excluding intersections)			
		No-Build	Pref Alt	Abs Diff	% Diff	No-Build	Pref Alt	Abs Diff	% Diff	No-Build	Pref Alt	Abs Diff	% Diff
1	I-39/90 South of BIC	11.2	12.2	1.0	8.7%	3.27	3.50	0.2	7.1%	8.0	8.7	0.7	9.3%
2	I-39/90 within BIC	8.3	9.7	1.4	16.8%	3.65	4.69	1.0	28.3%	4.6	5.0	0.4	7.8%
3	WIS 30: Fair Oaks to US 51	6.2	11.4	5.2	82.9%	2.23	4.34	2.1	94.4%	4.0	7.1	3.1	77.1%
4	WIS 30: US 51 to Badger	8.5	19.8	11.3	133.9%	3.01	7.37	4.4	145.0%	5.5	12.4	7.0	127.6%
5	I-39/90 & Badger interchange area	17.7	11.2	-6.5	-36.7%	5.47	3.52	-1.9	-35.6%	12.3	7.7	-4.6	-37.2%
6	I-94 & Milwaukee St interchange	15.0	10.3	-4.7	-31.5%	4.46	3.66	-0.8	-18.0%	10.5	6.6	-3.9	-37.0%
7	I-94 east of Milwaukee St	8.0	8.3	0.4	4.8%	2.62	2.75	0.1	4.9%	5.3	5.6	0.3	4.8%
8	I-39/90/94 & US 151 interchange area	10.4	12.4	2.0	18.9%	3.57	4.60	1.0	28.8%	6.8	7.8	0.9	13.8%
9	US 151: North of Grand Ave	8.6	9.2	0.6	6.6%	2.95	3.05	0.1	3.1%	5.7	6.1	0.5	8.5%
10	I-39/90/94 & Hoepker Rd interchange	24.3	14.3	-10.0	-41.1%	7.18	4.56	-2.6	-36.6%	17.1	9.8	-7.4	-43.0%
11	I-39/90/94 & US 51 interchange area	8.9	7.5	-1.5	-16.4%	2.89	2.56	-0.3	-11.1%	6.0	4.9	-1.1	-18.8%
12	I-39/90/94 & WIS 19 interchange area	7.7	8.1	0.5	6.0%	2.51	2.79	0.3	11.0%	5.2	5.4	0.2	3.6%
13	I-39/90/94 North of WIS 19 interchange	10.5	10.8	0.3	2.7%	2.93	2.94	0.0	0.1%	7.5	7.8	0.3	3.7%
Weighted Average		11.2	11.0	-0.2	-2.1%	3.62	3.73	0.1	3.0%	7.6	7.3	-0.3	-4.6%

Table 5.2-2 Predicted Crashes Per Mile (2050)

The results in Table 5.2-2 indicate overall decreases in predicted crashes per mile between the future no build and preferred alternative for total and PDO crashes ranging from 2 to 5 percent and overall increases in predicted FI crashes per mile of about 3 percent. Substantial decreases by over 30 percent in predicted total crashes per mile are seen in influence areas 5, 6, and 10 along with decreases of 16 percent in influence area 11. Increases in predicted total crashes per mile by over 5 percent are seen in influence areas 1, 2, 3, 4, 8, and 9.

Table 5.2-3 shows predicted crashes per lane-mile.

Influence Area	Location Description	Total Predicted Crashes per Lane Mile (excluding intersections)				Predicted FI Crashes per Lane Mile (excluding intersections)				Predicted PDO Crashes per Lane Mile (excluding intersections)			
		No-Build	Pref Alt	Abs Diff	% Diff	No-Build	Pref Alt	Abs Diff	% Diff	No-Build	Pref Alt	Abs Diff	% Diff
1	I-39/90 South of BIC	1.79	1.95	0.16	8.7%	0.52	0.56	0.04	7.1%	1.27	1.39	0.12	9.3%
2	I-39/90 within BIC	2.90	3.37	0.47	16.2%	1.28	1.63	0.35	27.6%	1.62	1.74	0.12	7.2%
3	WIS 30: Fair Oaks to US 51	2.12	3.80	1.68	79.5%	0.76	1.45	0.69	90.8%	1.36	2.36	1.00	73.9%
4	WIS 30: US 51 to Badger	2.78	4.41	1.63	58.5%	0.99	1.64	0.65	66.0%	1.79	2.76	0.97	54.2%
5	I-39/90 & Badger interchange area	3.65	2.87	-0.78	-21.4%	1.13	0.90	-0.23	-20.1%	2.53	1.97	-0.56	-22.0%
6	I-94 & Milwaukee St interchange	2.50	3.30	0.80	32.0%	0.74	1.17	0.43	57.9%	1.76	2.13	0.37	21.3%
7	I-94 east of Milwaukee St	1.64	1.70	0.05	3.1%	0.54	0.56	0.02	3.2%	1.10	1.14	0.03	3.1%
8	I-39/90/94 & US 151 interchange area	3.33	3.52	0.18	5.5%	1.14	1.31	0.16	14.4%	2.19	2.21	0.02	1.0%
9	US 151: North of Grand Ave	2.76	2.94	0.18	6.6%	0.95	0.98	0.03	3.1%	1.81	1.97	0.15	8.5%
10	I-39/90/94 & Hoepker Rd interchange	3.99	2.57	-1.41	-35.5%	1.18	0.82	-0.36	-30.5%	2.81	1.75	-1.05	-37.5%
11	I-39/90/94 & US 51 interchange area	3.56	2.68	-0.87	-24.5%	1.15	0.92	-0.23	-19.8%	2.40	1.76	-0.64	-26.7%
12	I-39/90/94 & WIS 19 interchange area	2.48	2.56	0.08	3.2%	0.81	0.88	0.07	8.1%	1.67	1.69	0.01	0.8%
13	I-39/90/94 North of WIS 19 interchange	1.98	1.52	-0.45	-22.9%	0.55	0.42	-0.14	-24.9%	1.42	1.11	-0.32	-22.2%
Weighted Average		2.75	2.58	-0.17	-6.1%	0.89	0.88	-0.01	-1.1%	1.86	1.70	-0.16	-8.4%

Table 5.2-3 Predicted Crashes Per Lane-Mile (2050)

The results in Table 5.2-3 indicate overall decreases in predicted crashes per lane-mile between the future no build and preferred alternative for total, FI, and PDO crashes ranging from 1 to 9 percent. Substantial decreases by over 20 percent in predicted crashes per lane-mile are seen in influence areas 5, 10, 11, and 13. Increases in predicted total crashes per lane-mile by over 5 percent are seen in influence areas 1, 2, 3, 4, 6, 8, and 9.

Table 5.2-4 provides a summary of predicted crashes for the overall corridor by cumulative totals, crashes per mile, and crashes per lane-mile.

2050 Analysis Type	Total Predicted Crashes (excluding intersections)				Predicted FI Crashes (excluding intersections)				Predicted PDO Crashes (excluding intersections)			
	No-Build	Pref Alt	Abs Diff	% Diff	No-Build	Pref Alt	Abs Diff	% Diff	No-Build	Pref Alt	Abs Diff	% Diff
Cumulative Predicted Crashes	692.6	831.8	139.3	20.1%	223.5	282.6	59.1	26.4%	469.05	549.37	80.32	17.1%
Predicted Crashes per Mile	11.2	11.0	-0.2	-2.1%	3.62	3.73	0.11	3.0%	7.60	7.25	-0.35	-4.6%
Predicted Crashes per Lane-Mile	2.7	2.6	-0.2	-6.1%	0.89	0.88	-0.01	-1.1%	1.86	1.70	-0.16	-8.4%
Note: The preferred alternative increases roadway mileage by 23% and lane-mileage by 28% within the south segment study area.												

Table 5.2-4 Comparison of Predicted 2050 Crashes by Analysis Type

Additionally, predicted crash rates (predicted crashes per hundred million vehicle miles traveled) were reviewed along each freeway mainline section throughout the study corridor. These crash rates are calculated as two-way crash rates within each influence area and were calculated using the freeway and speed change lane segment predicted crash totals (C-D roads, ramps, and intersections are excluded). Table 5.2-5 shows comparisons of the predicted total crash rates and predicted FI crash rates.

Influence Area	Location Description	Freeway	Weighted Average 2050 AADT (vpd)		Predicted Total Crash Rate (freeway mainline only)				Predicted FI Crash Rate (freeway mainline only)			
			No-Build	Pref Alt	No-Build	Pref Alt	Abs Diff	% Diff	No-Build	Pref Alt	Abs Diff	% Diff
1	I-39/90 South of BIC	**I-39/90**	62,800	64,800	48.96	51.56	2.60	5.3%	14.25	14.79	0.54	3.8%
2	I-39/90 within BIC	**I-39/90**	54,965	55,039	50.10	53.12	3.02	6.0%	16.07	15.88	-0.19	-1.2%
3	WIS 30: Fair Oaks to US 51	**WIS 30**	46,205	47,724	62.50	57.67	-4.83	-7.7%	21.44	19.87	-1.57	-7.3%
4	WIS 30: US 51 to Badger	**WIS 30**	50,425	57,569	66.04	71.52	5.49	8.3%	22.15	23.33	1.18	5.3%
5	I-39/90 & Badger interchange area	**I-39/90/94**	126,083	109,234	67.93	57.30	-10.64	-15.7%	20.57	16.97	-3.60	-17.5%
		WIS 30/I-94	49,925	46,110	51.04	60.72	9.68	19.0%	16.84	18.65	1.82	10.8%
6	I-94 & Milwaukee St interchange	**I-94**	70,300	67,393	58.48	55.76	-2.72	-4.7%	17.39	16.61	-0.78	-4.5%
7	I-94 east of Milwaukee St	**I-94**	62,945	62,655	42.66	42.36	-0.30	-0.7%	13.87	13.74	-0.13	-0.9%
8	I-39/90/94 & US 151 interchange area	**I-39/90/94**	90,864	96,460	66.51	56.06	-10.45	-15.7%	20.28	16.66	-3.61	-17.8%
		US 151	82,355	60,455	62.50	61.37	-1.13	-1.8%	19.90	18.60	-1.30	-6.5%
9	US 151: North of Grand Ave	**US 151**	56,874	64,343	59.77	57.96	-1.82	-3.0%	18.23	17.16	-1.07	-5.9%
10	I-39/90/94 & Hoepker Rd interchange	**I-39/90/94**	93,791	103,047	66.20	61.81	-4.39	-6.6%	19.56	18.94	-0.62	-3.2%
11	I-39/90/94 & US 51 interchange area	**I-39/90/94**	84,869	87,321	64.38	57.73	-6.64	-10.3%	19.68	16.79	-2.89	-14.7%
12	I-39/90/94 & WIS 19 interchange area	**I-39/90/94**	68,103	72,743	53.91	51.51	-2.40	-4.5%	15.89	14.62	-1.26	-7.9%
13	I-39/90/94 North of WIS 19 interchange	**I-39/90/94**	69,635	73,089	46.23	43.33	-2.90	-6.3%	12.77	11.65	-1.12	-8.7%
Weighted Average (along I-39/90 mainline only)			83,397	83,783	58.04	51.67	-6.37	-11.0%	17.11	14.87	-2.24	-13.1%
Weighted Average (along WIS 30/I-94 mainline only)			57,272	56,652	50.72	52.77	2.05	4.0%	16.51	16.86	0.35	2.1%
Weighted Average (along US 151 mainline only)			71,502	62,138	61.70	59.85	-1.86	-3.0%	19.37	17.94	-1.43	-7.4%

Table 5.2-5 Comparison of Predicted 2050 Crash Rates (Freeway Mainline Only)

The results in Table 5.2-5 indicate overall decreases in predicted total and FI crash rates for most influence areas. The weighted average predicted crash rate for the I-39/90 corridor shows a 11 percent reduction and in total predicted crash rate and a 13 percent reduction in predicted FI crash rate along the freeway mainline core. Locations with proposed C-D roads in influence areas 5 and 8 see relatively higher reductions (16 to 18 percent) in predicted crash rates than other parts of the corridor. Predicted crash rates are shown to be lower in the areas with proposed new interchanges (influence areas 6 and 10) due to lower freeway mainline core volumes in the area between

offramps and onramps. Increases in predicted crash rates are shown along WIS 30/I-94 from US 51 to I-39/90 and along I-39/90 around the Beltline interchange.

The predictive safety analysis for intersections is handled through the site set analyses in IHSDM. For these intersection analyses, a mileage value or lane-mileage value is not available or applicable. For comparison purposes between the future no build and preferred alternative, the cumulative total of predicted crashes for the study intersections was compared. The predicted crash results for intersections are shown in Table 5.2-6.

Influence Area	Location Description	# of Intersections Analyzed		Total Predicted Intersection Crashes				Predicted FI Intersection Crashes			
		No-Build	Pref Alt	No-Build	Pref Alt	Abs Diff	% Diff	No-Build	Pref Alt	Abs Diff	% Diff
1	I-39/90 South of BIC	0	0	0.00	0.00	--	--	0.00	0.00	--	--
2	I-39/90 within BIC	0	0	0.00	0.00	--	--	0.00	0.00	--	--
3	WIS 30: Fair Oaks to US 51	0	0	0.00	0.00	--	--	0.00	0.00	--	--
4	WIS 30: US 51 to Badger	0	0	0.00	0.00	--	--	0.00	0.00	--	--
5	I-39/90 & Badger interchange area	0	0	0.00	0.00	--	--	0.00	0.00	--	--
6	I-94 & Milwaukee St interchange	0	2	0.00	17.8	17.8	--	0.00	2.0	2.0	--
7	I-94 east of Milwaukee St	0	0	0.00	0.00	--	--	0.00	0.00	--	--
8	I-39/90/94 & US 151 interchange area	3	6	15.0	33.4	18.4	122.6%	7.8	12.8	5.1	65.1%
9	US 151: North of Grand Ave	0	0	0.00	0.00	--	--	0.00	0.00	--	--
10	I-39/90/94 & Hoepker Rd interchange	0	2	0.00	5.2	5.2	--	0.00	1.6	1.6	--
11	I-39/90/94 & US 51 interchange area	2	2	4.9	3.6	-1.3	-26.0%	2.1	1.7	-0.4	-19.0%
12	I-39/90/94 & WIS 19 interchange area	4	2	30.2	14.1	-16.1	-53.4%	11.4	5.7	-5.7	-50.3%
13	I-39/90/94 North of WIS 19 interchange	0	0	0.00	0.00	--	--	0.00	0.00	--	--
Total		9	14	50.0	74.1	24.0	48.0%	21.2	23.8	2.6	12.1%

Table 5.2-6 Predicted Intersection Crashes by Influence Area

Table 5.2-6 shows predicted crash reductions at the US 51 and WIS 19 ramp terminal intersections in influence areas 11 and 12, respectively. At US 51 the NB and SB C-D Roads improve the predicted safety performance of the ramp terminal intersections by removing entering volume from each intersection. At WIS 19 the preferred alternative interchange concept removes two intersections from WIS 19, which reduces conflict points, increases spacing between intersections, and improves predicted safety performance. At High Crossing Boulevard in influence area 8, crashes are predicted to decrease based on projected traffic volume shifts; however, these decreases are outweighed by increases in predicted crashes due to the three additional ramp terminal intersections being added within influence area 8 described in the following paragraph.

Predicted crash increases coincide with seven added intersections in influence areas 6, 8, and 10. These added intersections include two ramp terminal intersections at I-94/Milwaukee Street (influence area 6), two ramp

terminal intersections at I-39/90/94 and US 151/East Washington Avenue (influence area 8), one ramp terminal intersection at US 151/American Parkway (influence area 8, SB ramp terminal), and two ramp terminal intersections at I-39/90/94 and Hoepker Road (influence area 10).

5.3. Analysis Limitations

As discussed in Section 1.1, the study information regarding IHSDM functionality, geometric inputs, and analysis outlined in the **I-39/90/94 Corridor Study: Existing Conditions IHSDM Analysis (South Segment)** technical memorandum are applicable to the future no build and the preferred alternatives analysis documented in this memorandum. The traffic operations limitations outlined in Section 5 of the existing conditions memo are important to consider when considering the future no build crash prediction results. The freeway congestion, intersection queuing, and nonrecurring congestion are anticipated to be substantially worse in the future no build condition compared to the existing conditions. These operational aspects each have limitations in the HSM, indicating that the No Build model may be underestimating the number of predicted crashes.

There are several areas in both future no build conditions and the preferred alternative conditions where projected 2050 traffic volumes for system ramps or C-D roads are exceeding model limits. This indicates that predicted crash results, while still able to be reported in IHSDM, may not be reliable beyond the SPF's AADT limits. The system interchanges within the corridor each have ramps with 2050 AADT volumes that exceed the SPF AADT limits for both the no build and preferred alternative conditions, as shown in Table 5.3-1.

Influence Area	Location Description	No Build			Preferred Alternative		
		Location	SPF AADT Limit (vpd)	2050 AADT (vpd)	Location	SPF AADT Limit (vpd)	2050 AADT (vpd)
2	I-39/90 within BIC	Beltline EB to NB Ramp	32,000	38,200 to 42,900	Beltline EB to NB Ramp	32,000	41,500 to 46,200
		Beltline SB to WB Ramp	32,000	37,800 to 47,700	Beltline SB to WB Ramp	32,000	42,200 to 51,900
5	I-39/90 & Badger interchange area				Badger WN (EB to NB) Ramp	18,000	19,100
					I-94 C-D Road (EB)	32,000	32,400
					I-94 C-D Road (WB)	32,000	33,100
8	I-39/90/94 & US 151 interchange area	US 151 SB to I-39/90/94 SB Ramp	18,000	20,800	US 151 ES (US 151 SB to I-39/90/94 SB) Ramp and C-D Road	32,000	35,100 to 37,800
		I-39/90/94 NB to US 151 NB Ramp	18,000	24,800			
		I-39/90/94 NB C-D Road at US 151	32,000	37,000			
		I-39/90/94 SB C-D Road at US 151	18,000	20,800			

Table 5.3-1 Locations where 2050 AADT Exceeds SPF AADT Limits

The preferred alternative at US 151/East Washington Avenue includes 4 thru lanes in each direction (8 lanes total) at the I-39/90/94 ramp terminal intersections. An 8-lane cross section is beyond the limits of the Type D4 site set analysis. An urban 4SG site set was evaluated and tested for both 6-lane and 8-lane cross sections along US 151/East Washington Avenue (similar to how roundabout-controlled ramp terminals are evaluated in other parts of the corridor). The urban 4SG site set results showed predicted crashes that were lower than Type D4 site set with a 6-lane cross sections. For the purposes of this study's analysis that Type D4 site set with 6 lanes was used to evaluate the predictive safety performance of the I-39/90/94 and US 151/East Washington Avenue ramp terminals. The results for this site set included in **Appendix G** include the 4SG and D4 analyses.

There is a ramp connection loading error to be aware of for future users of the preferred alternative IHSDM model. The “I-94 CD Road (South Badger) EB” under the Badger interchange and two ramps under the “Rmp-151-ES” under the I-39/90/94 and US 151 interchange require connections to be made upon unarchiving a model for the first time. Once the connections are added locally then the issues is resolved for future use of the model. Correspondence with IHSDM support on this issue and comment replies to peer review to show exactly how to reconnect the 3 ramp connections are included in **Appendix E**.