

Traffic & Safety Study
W. National Avenue
S. 82nd Street to S. 76th Street

West Allis, Wisconsin

Project ID 2410-03-01

Submitted: January 30, 2017



**Traffic & Safety Study
W. National Avenue
S. 82nd Street to S. 76th Street
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Traffic & Safety Study
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INTRODUCTION

The City of West Allis plans to reconstruct a section of W. National Ave from S. 82nd Street to S. 76th Street. GRAEF has prepared this study to evaluate the safety and traffic operations along this corridor and identify improvements for the reconstruction project. The study includes a safety assessment, traffic forecasts, traffic signal warrant analysis, intersection operational analysis and recommendations.

STUDY AREA

The project includes the approximately 0.4 mile section of W. National Avenue from S. 82nd Street to S. 76th Street, as shown on Exhibit 1. W. National Avenue is a northeast/southwest two-lane undivided roadway with parking on both sides of the street and a posted speed limit of 30 miles per hour (mph). W. National Avenue has sidewalk on both sides of the street. The section of W. National Avenue from S. 73rd Street to S. 65th Street is a designated cross town connector bicycle route. The City's Bicycle and Pedestrian Master Plan shows a proposed bike lane for this section. Milwaukee County transit bus route 54 travels along W. National Avenue with stops at S. 81st Street, S. 79th Street, S. 78th Street and S. 76th Street intersections. According to the Wisconsin Department of Transportation (WisDOT), the Year 2014 annual average daily traffic (AADT) along W. National Avenue ranged from 14,900 vehicles per day (vpd) west of S. 83rd Street to 12,900 vpd east of S. 76th Street.

This section of W. National Avenue includes one traffic signal at S. 81st Street. The traffic signal at the W. National Avenue intersection with S. 84th Street is not part of the reconstruction project, but is included in this traffic study for coordination and traffic operational analysis purposes. The traffic signal controlled intersection at W. National Avenue & S. 76th Street is being reconstructed as part of the W. National Avenue 2410-00-07 project and therefore not included in this traffic study. These north/south roadways are described below.

S. 84th Street is a north-south four-lane undivided roadway north of W. National Avenue and a two-lane undivided roadway south of W. National Avenue. The posted speed limit along S. 84th Street is 30 mph north of W. National Avenue and 25 mph south of W. National Avenue. According to the WisDOT, the Year 2014 AADTs along S. 84th Street ranged from 12,000 vpd south of STH 59 (Greenfield Avenue) to 10,900 vpd south of W. National Avenue.

S. 81st Street is a north-south two-lane undivided roadway with parking on both sides of the street. The speed limit along S. 81st Street is 25 mph.

SAFETY ASSESSMENT

Crash History

The WisDOT provided crash summary for the most recent five year period (January 1, 2010 through December 31, 2014). It should be noted that property damage crashes with less than \$1,000 of damage do not need to be reported in Wisconsin. During the five years, 25 crashes were reported within the study area including zero fatalities and 10 injury crashes. For comparison purposes, crash rates for a roadway segment are calculated in units of crashes per 100 million vehicle miles traveled (100 MVMT). Table 1 summarizes the crashes for the project corridor.

**Table 1
Segment Crash Rates**

W. National Avenue	Year	Crash Severity			Total No. Crashes	Crash Rate ⁽¹⁾ 2010-2014	Statewide Crash Rate ⁽¹⁾ 2010-2014
		Fatal	Injury	Property Damage			
S. 82 th Street to west of S. 76 th Street	2010	0	1	1	2	X	X
	2011	0	2	4	6		
	2012	0	3	4	7		
	2013	0	1	3	4		
	2014	0	3	3	6		
Total	2010-2014	0	10	15	25	246	332

⁽¹⁾ Crash rate based on 100 million vehicles miles traveled (100 MVMT)

The annual crash rate for W. National Avenue from Year 2010 to 2014 was 246 crashes per HMVM. The Year 2010 to 2014 statewide crash rate was 332 crashes per HMVM. The Year 2011-2015 statewide crash rates are not available, and are expected to be published in February of 2017. Of the 25 total crashes within the project corridor, 15 occurred at intersections. Table 2 summarizes the types of crashes that occurred within the project corridor.

**Table 2
Crash Type Summary**

W. National Avenue Intersections	Type of Crash							Total
	Rear End	Sideswipe	Left-turn	Right Angle	Single Vehicle	Pedestrian	Bicycle	
S. 77 th Street	0	0	0	0	0	0	1	1
S. 78 th Street	0	0	1	0	0	0	0	1
S. 79 th Street	1	0	0	0	0	0	0	1
S. 80 th Street	1	0	1	1	0	0	1	4
S. 81 st Street	2	0	1	0	0	0	0	3
S. 82 nd Street	0	3	0	1	1	0	0	5
Intersection Total	4	3	3	2	1	0	2	15
Non-Intersection Total	3	0	1	0	6	0	0	10
Project Total	7	3	4	2	7	0	2	25

As shown in Table 2, rear end crashes was the highest types of intersection crashes. Single vehicle crashes were the highest crash type at non-intersections. In the five years there were no crashes involving pedestrians and two crashes involving bicycles. Both of the bicycle crashes occurred at intersections.

For comparison purposes, intersection crash rates are calculated in units of crashes per million entering vehicles (MEV) to account for traffic volumes. The intersection crash rates are shown in Table 3.

Table 3
Intersection Crash Rates

W. National Avenue Intersections	Crash Severity			Total Crashes (2010-2014)	Crash Rate (Crashes per Million Entering Vehicles)
	Fatal	Injury	Property Damage Only		
S. 77 th Street	0	1	0	1	0.04
S. 78 th Street	0	1	0	1	0.04
S. 79 th Street	0	0	1	1	0.04
S. 80 th Street	0	2	2	4	0.16
S. 81 st Street	0	1	2	3	0.12
S. 82 nd Street	0	2	3	5	0.20

Overall the crash rates shown in Table 3 are relatively low and no clear crash trends were found. As shown in Table 3, the W. National Avenue intersection with S. 82nd Street had the highest crash rate of 0.20 crashes per MEV.

EXISTING TRAFFIC

In September of 2016, GRAEF conducted turning movement traffic counts at the following study area intersections:

- W. National Avenue & S. 84th Street
- W. National Avenue & S. 81st Street

Based on the traffic counts, the weekday morning peak hour was identified to be 7:15 to 8:15 am and the weekday evening peak hour was identified to be 4:30 to 5:30 pm. The existing peak hour traffic volumes are shown on Exhibit 2. The traffic counts for the study area intersections are included in Appendix 1.

TRAFFIC FORECASTS

WisDOT developed annual average daily traffic (AADT) forecasts for the construction year (Year 2020), Year 2030 and design year (Year 2040). The daily traffic forecasts are shown on Exhibit 3 and summarized in Table 4.

Table 4
Daily Traffic Forecasts

W. National Avenue	Existing AADT	Annual Average Daily Traffic (AADT) Forecasts		
		Year 2020	Year 2030	Year 2040
West of S. 83 rd Street	12,000 (Year 2016)	12,200	12,800	13,400
East of S. 76 th Street	12,900 (Year 2014)	13,300	13,900	14,600

Source: Wisconsin Department of Transportation

The Year 2040 daily traffic forecasts for W. National Avenue range from 13,400 vehicles per day (vpd) west of S. 83rd Street to 14,600 vehicles per day (vpd) east of S. 76th Street. The design year peak hour traffic volumes for the study area intersections are shown on Exhibit 4. The WisDOT daily and peak hour intersection forecasts are included in Appendix 2.

CORRIDOR LEVEL OF SERVICE ASSESSMENT

Level of Service (LOS) is a quantitative measure that refers to the overall quality of traffic flow ranging from very good, represented by LOS 'A', to very poor, represented by LOS 'F'. The WisDOT Facilities of Development Manual (FDM) 11-20 Attachment 1.1 summarizes average daily traffic (ADT) and design hourly volume (DHV) ranges for LOS C to middle LOS E for a two-lane urban street based on the *2000 Highway Capacity Manual (HCM)*. Table 5 compares the design year traffic volumes for W. National Avenue to the level of service thresholds for a two-lane urban street.

Table 5
Two-Lane Urban Street Level of Service Thresholds

Design Year Traffic Volumes	W. National Avenue	Design Year ADT Threshold Ranges		
		LOS C	LOS D	Middle LOS E
Average Daily Traffic (ADT)	14,600	6,500 – 20,000	7,500 – 22,500	8,000 – 25,000
Design Hourly Volume (DHV)	1,500	1,086 – 2,260	1,170 – 2,475	1,216 – 2,700

Source: WisDOT FDM 11-20 Attachment 1.1

As shown in Table 5, the W. National Avenue design year ADT and DHV fall in the range of LOS C to middle LOS E. According to the WisDOT FDM 11-5-3 Table 3.1, a mid LOS 'E' (5.5) is the minimum acceptable peak hour operating conditions for a principal arterial such as W. National Avenue.

The adjacent signalized intersections at W. National Avenue & S. 84th Street and W. National Avenue & S. 76th Street meter traffic and control the level of service along this section of W. National Avenue. For urban corridors nearing capacity, the WisDOT FDM 11-5- 3.3 recommends considering incremental improvements to improve corridor operations. It is recommended for the City to optimize signal timings at the intersections immediately adjacent to the project limits to provide acceptable operations for W. National Avenue through movements. It is anticipated that this section of W. National Avenue will continue to operate at LOS D or better conditions.

TRAFFIC SIGNAL REMOVAL STUDY

As a part of the National Avenue traffic study GRAEF evaluated the removal of traffic signal at W. National Avenue and S. 81st Street. Traffic signals can contribute significantly to some types of intersection crashes and introduce delays to motorists on busy arterial roadways. Too many traffic signals can reduce the ability to provide good traffic flow progression. In order to determine if traffic conditions justify the removal of the traffic signal the design year (Year 2040) traffic volumes were compared to the warrants for traffic signal installation set forth in the 2009 Edition of the Manual on Uniform Traffic Control Devices (MUTCD). It was found that none of the eight signal warrants are expected to be met with the design year (Year 2040) traffic volumes, therefore a traffic signal is not justified based on volumes. The design year (Year 2040) traffic signal warrant analysis is provided in Appendix 3.

In the Traffic Operational Analysis section of this report, the intersection of W. National Avenue and S. 81st Street was analyzed under both traffic signal control and two-way stop control to compare operations and determine the appropriate traffic control.

If the traffic signal is selected for possible removal it is recommended to follow the MUTCD removal procedures. The MUTCD, section 4B.02 states that the removal of a traffic control signal should be accomplished using the following steps:

- A. *Determine the appropriate traffic control to be used after removal of the signal.*
- B. *Remove any sight-distance restrictions as necessary.*
- C. *Inform the public of the removal study.*
- D. *Flash or cover the signal heads for a minimum of 90 days, and install the appropriate stop control or other traffic control devices.*
- E. *Remove the signal if the engineering data collected during the removal study period confirms that the signal is no longer needed.*

TRAFFIC OPERATIONAL ANALYSIS

The study area intersections were analyzed using Synchro Version 9 software following procedures in the *Highway Capacity Manual* (HCM). All study area intersections were analyzed using procedures in HCM 2010, except at the W. National Avenue & S. 84th Street intersection which was analyzed using HCM 2000 due to nonstandard signal phasing.

Level of Service Definition

Level of Service is a quantitative measure that refers to the overall quality of flow at an intersection ranging from very good, represented by LOS 'A', to very poor, represented by LOS 'F'. For analysis and design purposes, Level of Service (LOS) 'D' was used to define acceptable peak hour operating conditions. Descriptions of the various levels of service for an intersection are summarized below:

LOS A is the highest level of service that can be achieved. Under this condition, intersection approaches appear quite open, turning movements are easily made, and nearly all drivers find freedom of operation. At signalized intersections, average delays are less than 10 seconds. At stop controlled intersections, average delays are less than 10 seconds.

LOS B represents stable operation. At signalized intersections, average vehicle delays are 10 to 20 seconds. At stop controlled intersections, average delays are 10 to 15 seconds.

LOS C still represents stable operation, but periodic backups of a few vehicles may develop behind turning vehicles. Most drivers begin to feel restricted, but not objectionably so. At signalized intersections, average vehicle delays are 20 to 35 seconds. At stop controlled intersections, average delays are 15 to 25 seconds.

LOS D represents increasing traffic restrictions as the intersection approaches instability. Delays to approaching vehicles may be substantial during short peaks within the peak period, but periodic clearance of long lines occurs, thus preventing excessive backups. At signalized intersections, average vehicle delays are 35 to 55 seconds. At stop controlled intersections, average delays are 25 to 35 seconds.

LOS E represents the capacity of the intersection. At signalized intersections, average vehicle delays are 55 to 80 seconds. At stop controlled intersections, average delays are 35 to 50 seconds.

LOS F represents jammed conditions where the intersection is over capacity and acceptable gaps for stop controlled intersections in the mainline traffic flow are minimal. At signalized intersections, average vehicle delays exceed 80 seconds. At stop controlled intersections, average delays exceed 50 seconds.

Table 6 - Intersection Level of Service (LOS) Designations

Level of Service (LOS)	Traffic Signals	Stop Controlled
	Average Delay per Vehicle (sec/veh)	Average Delay per Vehicle (sec/veh)
A	<10.0	<10.0
B	10.1 – 20.0	10.1 – 15.0
C	20.1 – 35.0	15.1 – 25.0
D	35.1 – 55.0	25.1 – 35.0
E	55.1 – 80.0	35.1 – 50.0
F	>80.0	>50.0

Existing Year Traffic Analysis

This section summarizes the traffic analysis for the existing year traffic with the existing geometrics and traffic control.

Existing (Year 2016) Traffic Analysis

The existing intersection geometrics and traffic control are shown on Exhibit 5. The existing traffic peak hour operating conditions with the existing geometrics are shown on Exhibit 6. The analysis is based on the existing signal timings. Signal timing plans are provided in Appendix 4. Based on the existing traffic analysis, all movements at the study area intersections currently operate acceptably at LOS D or better conditions during the peak hours. The existing traffic analysis is included in Appendix 5.

Design Year Traffic Analysis

This section summarizes the traffic analysis for the design year traffic.

Design Year (Year 2040) Traffic Analysis

The design year peak hour operating conditions is shown on Exhibit 7. The design year analysis is based on optimized signal timings. Based on the design year traffic analysis, the Eastbound and Northbound movements at the intersection W. National Avenue and S. 84th Street are expected to experience LOS E conditions during the

weekday morning peak hour. All other movements at the study area intersections are expected to operate acceptably at LOS D or better conditions during the peak hours.

The intersection of W. National Avenue and S. 84th Street was studied to determine if coordination would be beneficial when studying W. National Avenue and S. 81th Street. Due to the long signal cycle lengths required for W. National Avenue and S. 84th Street intersection, it was found that coordinating the intersection with the signal at W. National Avenue and S. 81th Street did not improve operations. Therefore if W. National Avenue and S. 81th Street is to remain signalized, it is recommended that both signalized intersections operate under fully actuated / uncoordinated control.

An alternate design year analysis was completed for the intersection of W. National Avenue and S. 81st analyzing the intersection under two-way stop control operations. The purpose of this analysis is to determine if the intersection would operate acceptably if the traffic signal is removed. The design year (Year 2040) alternate traffic control peak hour operating conditions is also shown on Exhibit 7. Based on the alternate traffic control, the southbound movement is expected to experience LOS E conditions during the evening peak hour. All other movements at the intersection are expected to operate acceptably at LOS D or better conditions during the peak hours.

The design year traffic analysis is included in Appendix 6.

RECOMENDED IMPROVEMENTS AND CONCLUSIONS

Based on the design year traffic analysis, select movements at the W. National Avenue intersection with S. 84th Street are expected to experience LOS E operations during the morning peak hour. No improvements are recommended at the intersection W. National Avenue and S. 84th Street since it is outside of the project limits.

At the intersection of W. National Avenue and S. 81th Street the side road delay is expected to be less than 40 seconds during the morning peak hour and 50 seconds during the evening peak hour under traffic signal or two-way stop control. Since the side road delay was comparable for both options and volumes were not found to warrant the traffic signal, is recommended to continue with the traffic signal removal process. The signal removal should follow the MUTCD, section 4B.02 removal procedures including informing the public, flashing or covering the signal heads for a trial period to confirm the signal is not needed. Once the traffic signal is removed the intersection would operate under two-way stop control.

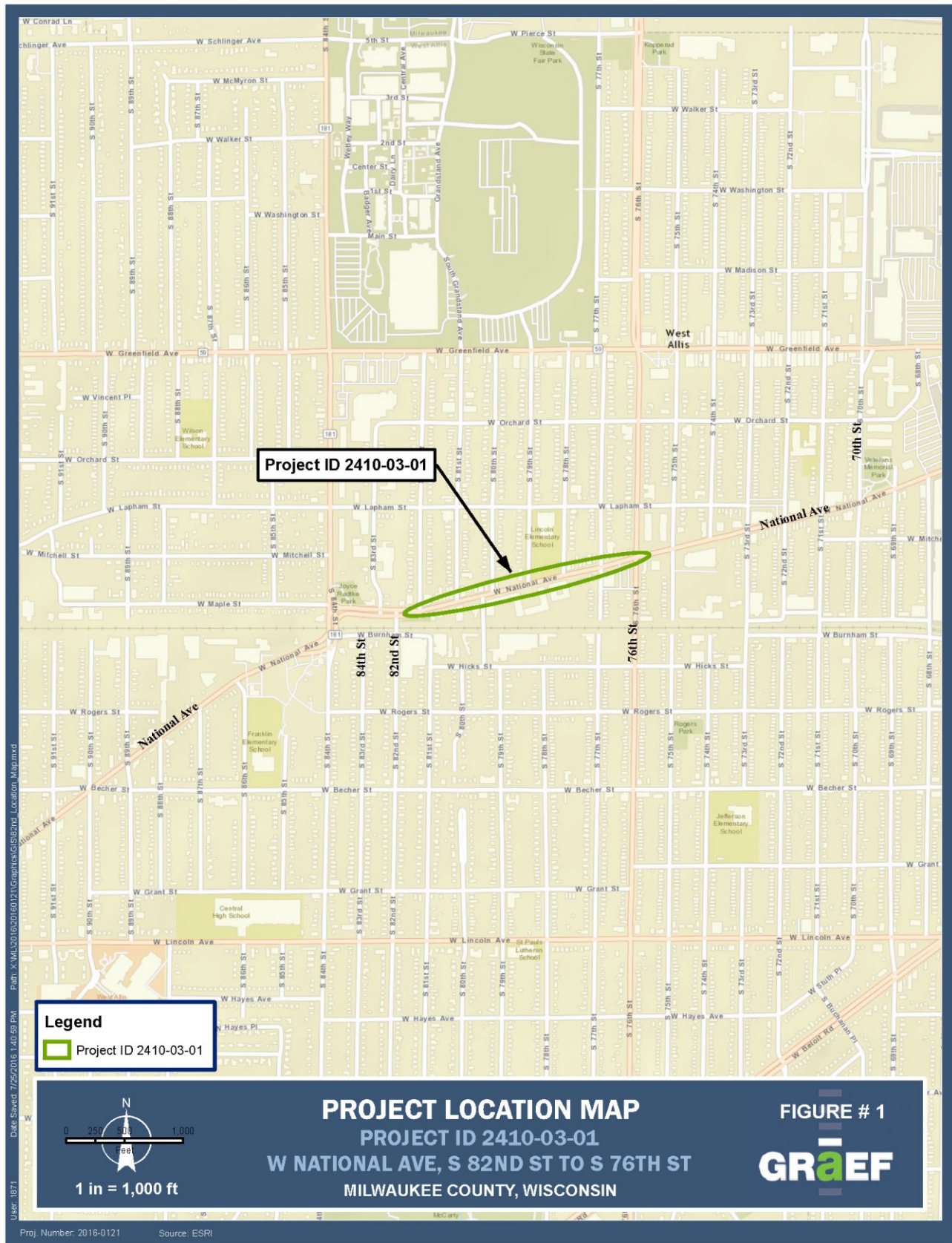
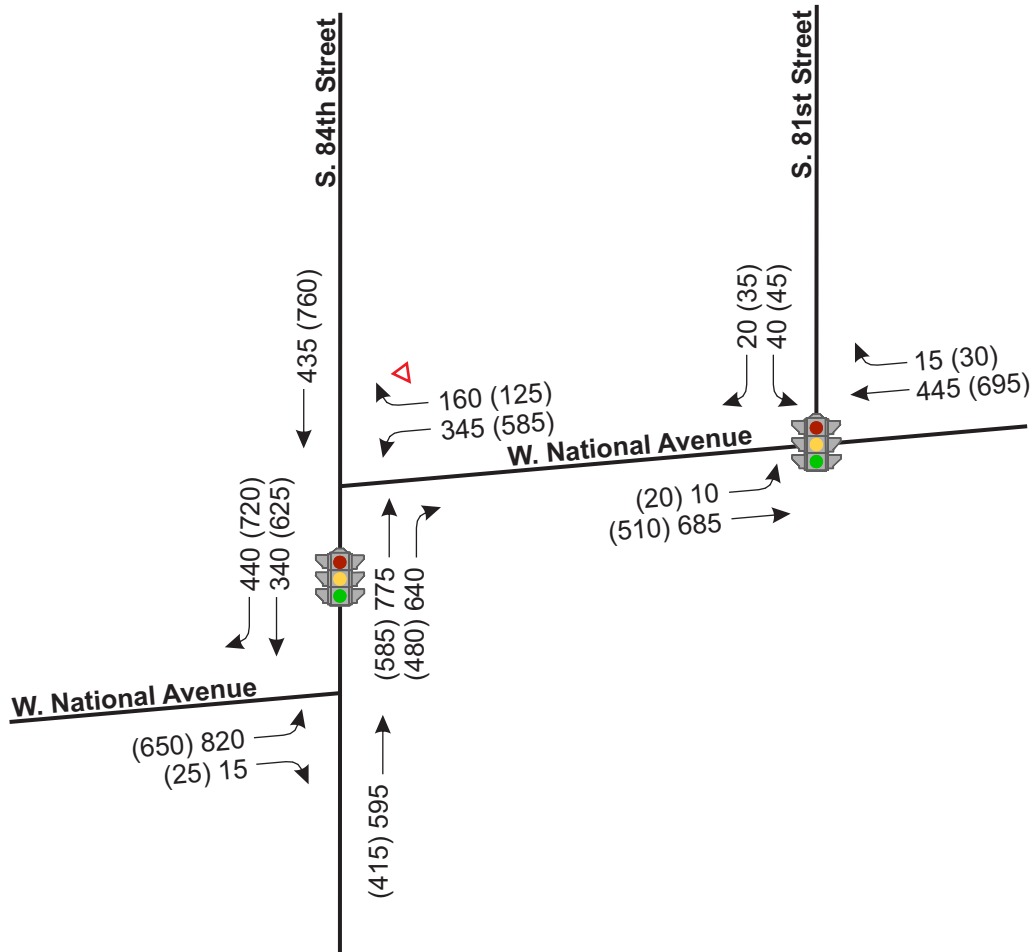




EXHIBIT 1
PROJECT LOCATION MAP
W. NATIONAL AVENUE (S. 82ND STREET TO S. 76TH STREET)
PROJECT ID 2410-03-01
WEST ALLIS, WISCONSIN





LEGEND

-  TRAFFIC SIGNAL
-  YIELD SIGN
- XXX WEEKDAY MORNING PEAK HOUR (7:15AM - 8:15AM) TRAFFIC VOLUME
- (XXX) WEEKDAY EVENING PEAK HOUR (4:30PM - 5:30PM) TRAFFIC VOLUME

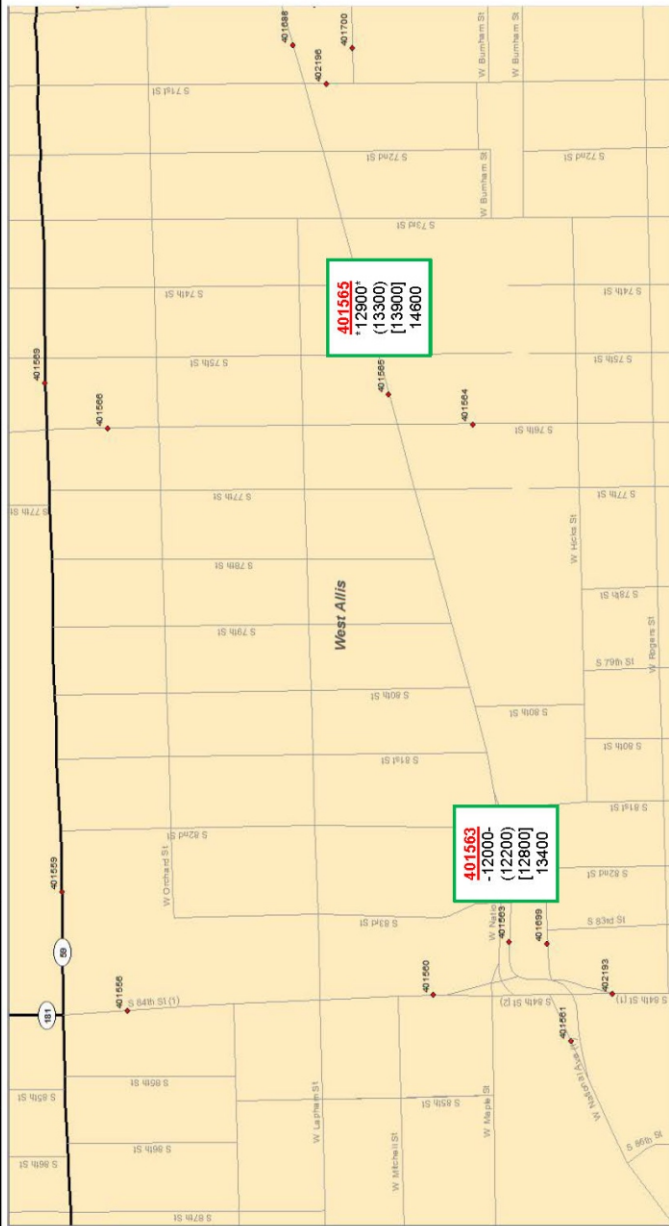


WisDOT TRAFFIC FORECAST REPORT
 PROJECT ID(S): 2410-03-01
 ROUTE(S): National Ave
 Region/COUNTY(IES): SE / Milwaukee
 LOCATION: 82nd St to 76th St
 COMPLETED: January 6, 2017
 Traffic Forecasting Section: Bureau of Planning and Economic Development; Division of Transportation Investment Management

Developed by: Brent DesRoches
 Phone: (262) 548-5611
 FAX #: (262) 548-4425
 E-Mail: brent.desroches@dot.wi.gov

Site(s)	Route(s)	Volume(s)	Site Growth %	K250	K100	K30	P	D(Dsgn. Hr.)	T(DHV)	T(PHV)	AADT	2D	3AX	2S1+2S2	3-S2	DBL-BTM	Total %
401563	National Ave	13390	0.50%	10.3	11.0	11.5	12.8	59/41	4.5	3.9	620	4.3	0.3	0.5	0.1	0.0	5.2%

Design Values (%)	
Volume(s)	13390
Site Growth %	0.50%
K250	10.3
K100	11.0
K30	11.5
P	12.8
D(Dsgn. Hr.)	59/41
T(DHV)	4.5
T(PHV)	3.9
AADT	620
2D	4.3
3AX	0.3
2S1+2S2	0.5
3-S2	0.1
DBL-BTM	0.0
Total %	5.2%



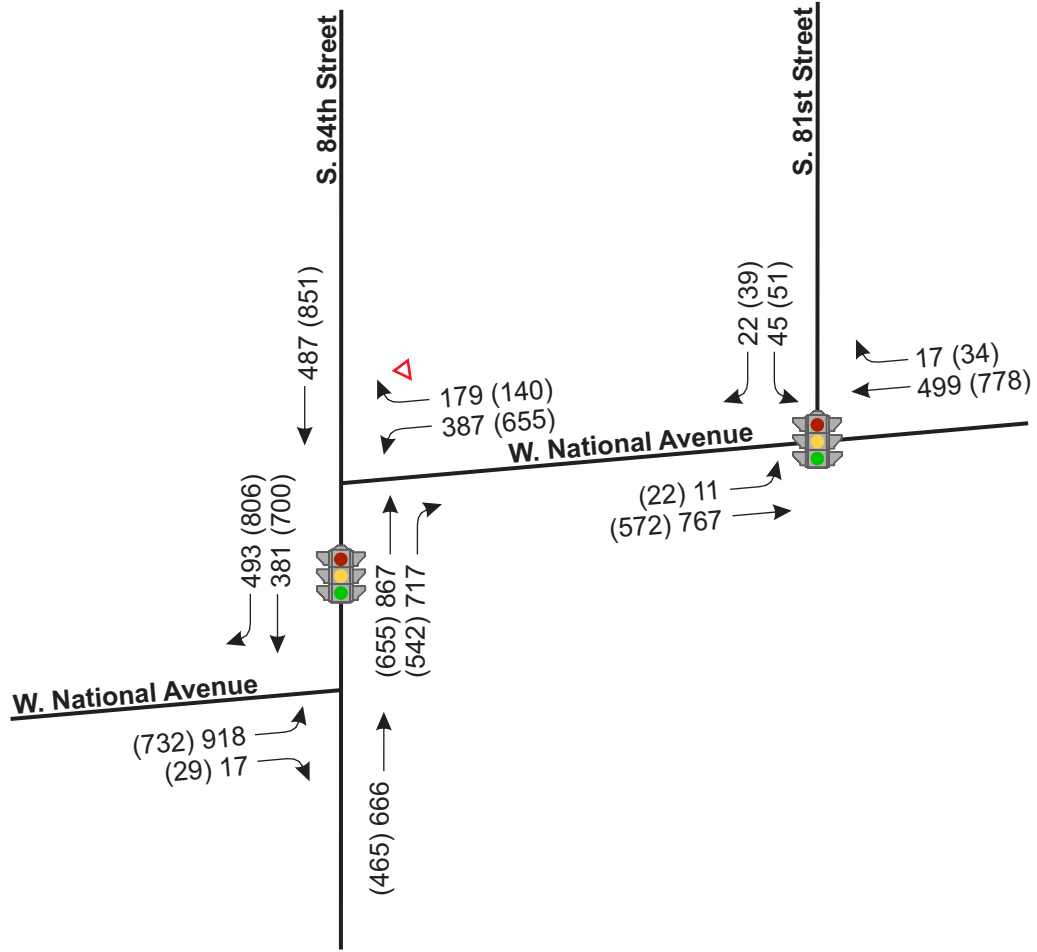
Site(s)	Route(s)	MC	CARS	SU2-4	BUSES	Full Vehicle Classification										
						SU2-6	SU3	SU4+	ST4-	ST5	ST6+	MU5-	MU6	MU7+		
401563	National Ave	0.7	78.4	15.8	1.0	3.2	0.2	0.2	0.5	0.1	0.1	0.0	0.0	0.0	0.0	0.0

Symbol	Count	Forecast
-000-	2016 Count	(000) 2020 AADT
'000'	2014 Count	(000) 2030 AADT
		000 2040 AADT

NOTES ON THE FORECAST:
 1. This project does not fall within any Wisconsin Travel Demand Model. No significant development is expected to occur in the area. This forecast is consistent with the forecast for 2410-00-07.
 2. Truck class data came from consultant provided 2016 short-term axle classification count data on National Ave between 78th and 79th St.
 3. National Ave is a Factor Group II (Urban - Other) roadway (indicating low to moderate fluctuation in traffic from a seasonal perspective). It is functionally classified as an Urban/Minor Arterial (16) for count purposes.
 4. Traffic Analysis Forecasting Information System (TAFIS) didn't contain data for these sites. The forecast used historical regression to generate the forecast values. Changes were made as needed.



**EXHIBIT 3
 DAILY TRAFFIC FORECASTS
 W. NATIONAL AVENUE (S. 82ND STREET TO S. 76TH STREET)
 PROJECT ID 2410-03-01
 WEST ALLIS, WISCONSIN**





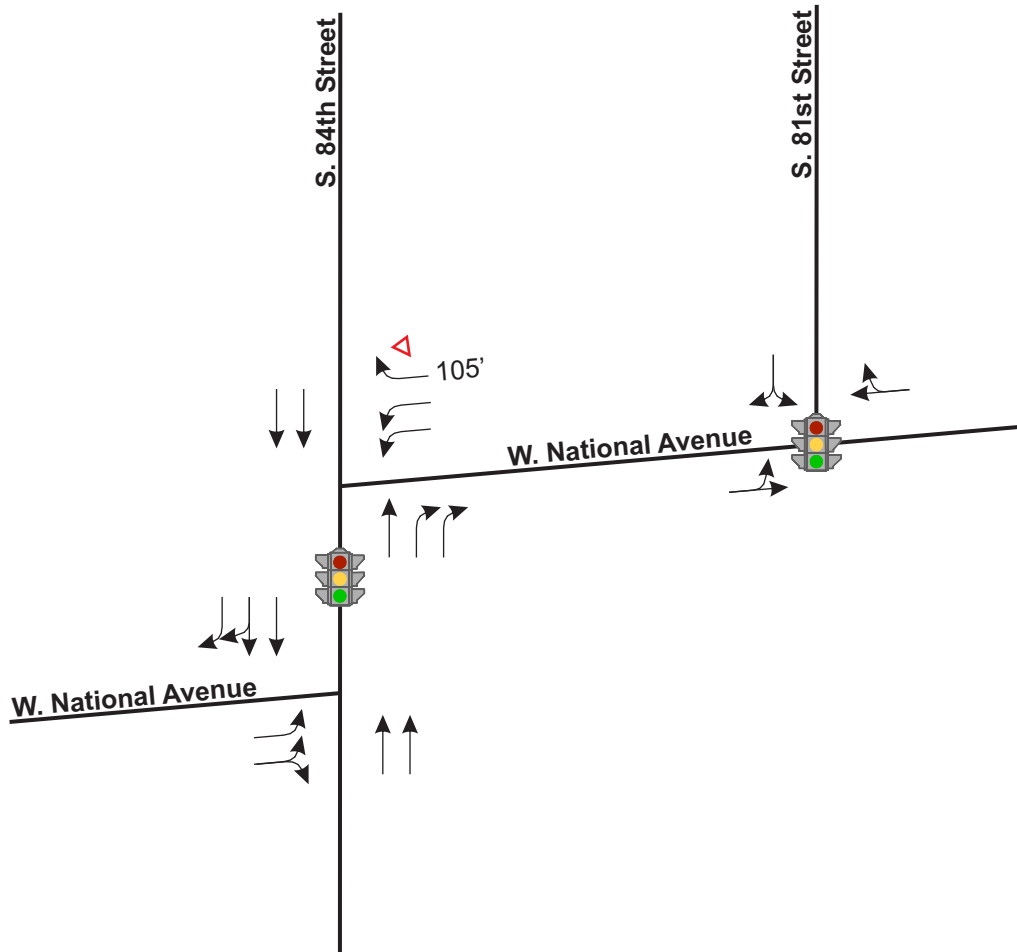
LEGEND	
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	YIELD SIGN
XXX	WEEKDAY MORNING PEAK HOUR (7:15AM - 8:15AM) TRAFFIC VOLUME
(XXX)	WEEKDAY EVENING PEAK HOUR (4:30PM - 5:30PM) TRAFFIC VOLUME

EXHIBIT 4
DESIGN YEAR (YEAR 2040) PEAK HOUR TRAFFIC VOLUMES
W. NATIONAL AVENUE (S. 82ND STREET TO S. 76TH STREET)
PROJECT ID 2410-03-01
WEST ALLIS, WISCONSIN




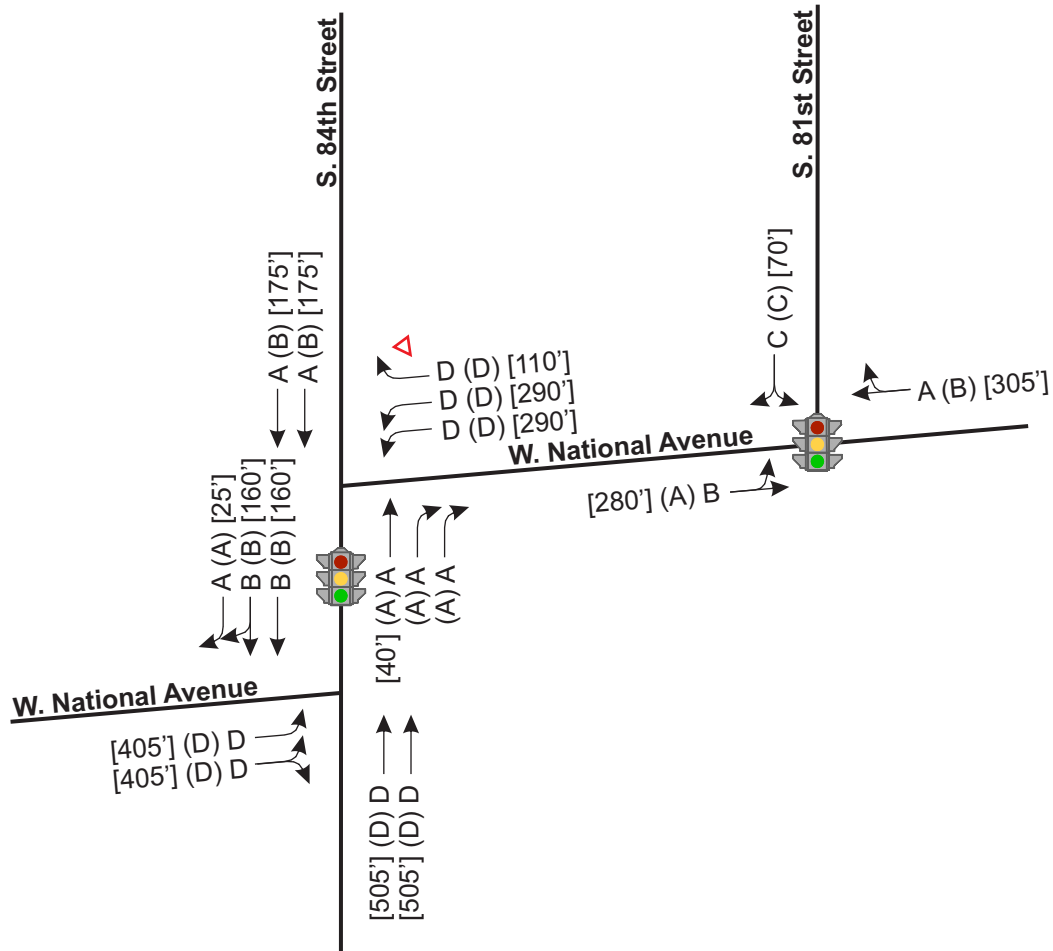
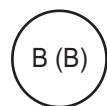
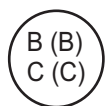


LEGEND	
	TRAFFIC SIGNAL
	YIELD SIGN
XXX	WEEKDAY MORNING PEAK HOUR (7:15AM - 8:15AM) TRAFFIC VOLUME
(XXX)	WEEKDAY EVENING PEAK HOUR (4:30PM - 5:30PM) TRAFFIC VOLUME

EXHIBIT 5
EXISTING INTERSECTION GEOMETRICS
W. NATIONAL AVENUE (S. 82ND STREET TO S. 76TH STREET)
PROJECT ID 2410-03-01
WEST ALLIS, WISCONSIN

**Intersection
Level of Service**



LEGEND

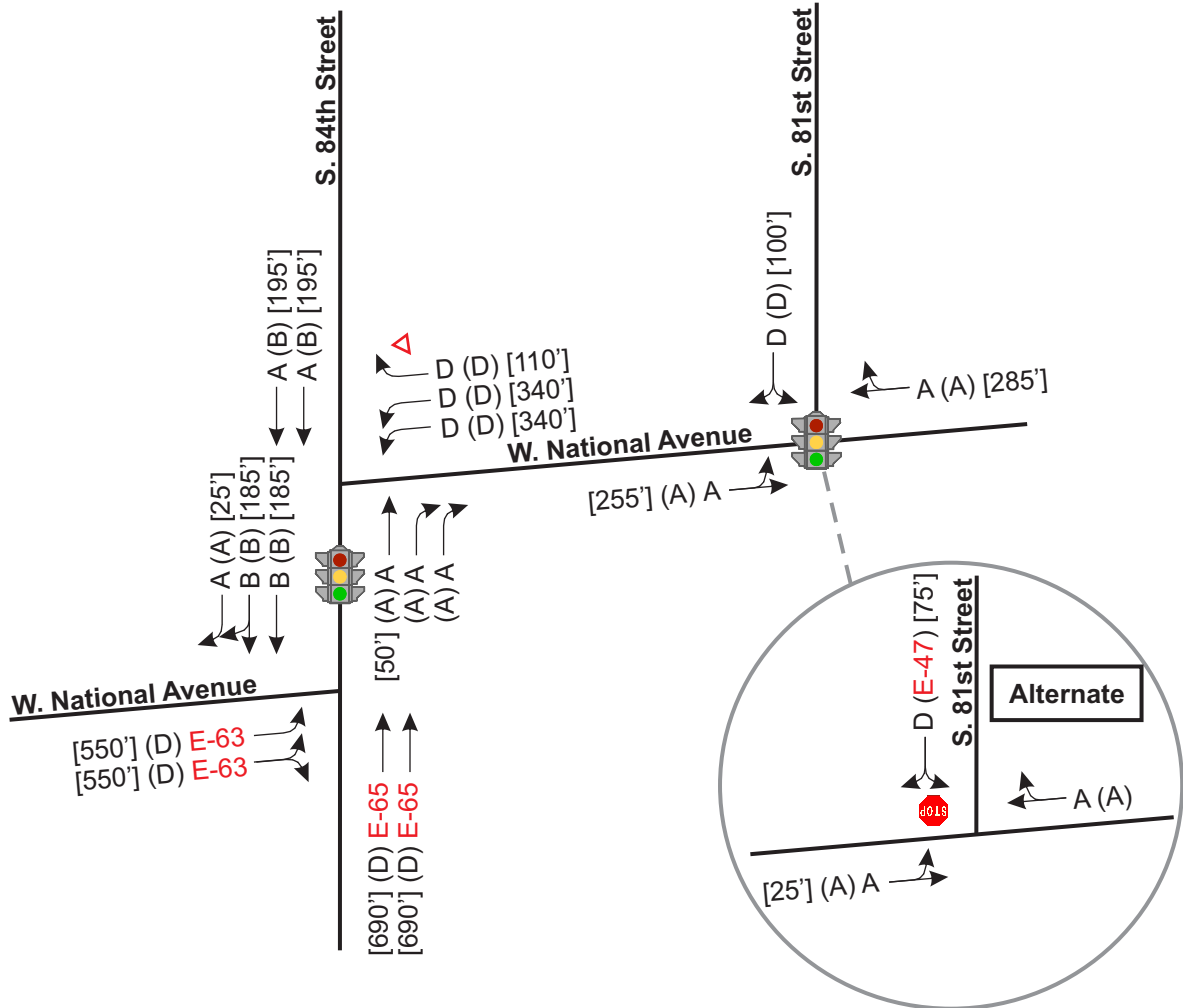
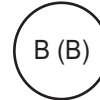
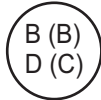
-  TRAFFIC SIGNAL
-  YIELD SIGN
- X WEEKDAY MORNING PEAK HOUR LEVEL OF SERVICE
- (X) WEEKDAY EVENING PEAK HOUR LEVEL OF SERVICE
- [XXX'] MAXIMUM 95TH PERCENTILE QUEUE LENGTH PER LANE (IN FEET)

NOTE: AVERAGE DELAY PER VEHICLE (IN SECONDS) IS PROVIDED FOR LOS E OR F MOVEMENTS




EXHIBIT 6
EXISTING (YEAR 2016) TRAFFIC OPERATIONS
W. NATIONAL AVENUE (S. 82ND STREET TO S. 76TH STREET)
PROJECT ID 2410-03-01
WEST ALLIS, WISCONSIN



**Intersection
Level of Service**



LEGEND

-  TRAFFIC SIGNAL
-  STOP SIGN
-  YIELD SIGN
- X WEEKDAY MORNING PEAK HOUR LEVEL OF SERVICE
- (X) WEEKDAY EVENING PEAK HOUR LEVEL OF SERVICE
- [XXX'] MAXIMUM 95TH PERCENTILE QUEUE LENGTH PER LANE (IN FEET)

NOTE: AVERAGE DELAY PER VEHICLE (IN SECONDS) IS PROVIDED FOR LOS E OR F MOVEMENTS

EXHIBIT 7
DESIGN YEAR (YEAR 2040) TRAFFIC OPERATIONS
W. NATIONAL AVENUE (S. 82ND STREET TO S. 76TH STREET)
PROJECT ID 2410-03-01
WEST ALLIS, WISCONSIN