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## TECHNICAL MEMORANDUM

**To:** TJ Blitz  
Managing Principal  
Cresa Global, Inc.

**From:** Kelly Trac, P.E., PTOE, RSP<sub>1</sub>  
KL Engineering, Inc.

**Date:** August 3, 2022

**Subject:** Milwaukee Street & Sprecher Road Traffic Signal Warrant Analysis

### INTRODUCTION

KL Engineering completed a traffic analysis for the proposed four-story Sprecher and Milwaukee Development located at the southwest corner of the Milwaukee Street & Sprecher Road intersection in Madison, WI. This is a multifamily housing development, which includes 160 dwelling units with underground and surface parking. The City of Madison has requested a traffic signal warrant analysis be performed at the intersection evaluating existing conditions and those anticipated with the additional traffic generated by the proposed development. The City also requested that trip assignment be evaluated to determine ingress and egress patterns for development traffic.

The goals of this study are to:

- Determine the additional traffic that will be generated by the development, as well as probable ingress and egress routes.
- Review traffic signal warrants at the Milwaukee Street & Sprecher Road intersection under existing and projected development conditions to see if traffic control changes may be needed.

A project location map is provided in **Exhibit 1**.

### Study Area Roadways

Roadways adjacent to the proposed Sprecher and Milwaukee Development and their characteristics are summarized below:

- *Sprecher Road*
  - Four-lane urban divided minor arterial
  - Sidewalk present
  - Posted speed limit of 35 miles per hour (mph)
- *Milwaukee Street*
  - Four-lane urban divided collector
  - Sidewalk present
  - Posted speed limit of 35 mph
- *Driscoll Drive*
  - Two-lane urban undivided local roadway
  - Sidewalk present
  - Speed limit of 25 mph
- *New North/South Street (unnamed)*
  - Two-lane urban undivided local roadway (60' ROW)

- Right-in/right-out only connection to Milwaukee Street west of development
- Driscoll Drive will be extended east to form a T-intersection with this new street
- Will eventually connect to Sprecher Road south of development
- Speed limit of 25 mph

The intersection of Milwaukee Street & Sprecher Road is a four-leg intersection with all-way stop control (AWSC). The northbound and eastbound approaches consist of a left turn lane, an exclusive through lane, and a shared through/right lane. The southbound and westbound approaches consist of a left turn lane, two through lanes, and a right turn lane. There are bicycle lanes and pedestrian crosswalks present at all intersection approaches.

## PROPOSED DEVELOPMENT

The proposed 3.26-acre Sprecher and Milwaukee Development site consists of a new, four-story multi-family housing building. The project construction is proposed to start in the Winter/Spring of 2023 and be completed in the Spring of 2024. The site is surrounded by other residential properties and undeveloped land. RI Madison Apartments, a multi-family housing development, is being constructed in the northwest corner of the intersection. At the time of this study, the development has yet to be completed and traffic generated from this site was not included in this analysis.

The proposed building will include 160 dwelling units and has a footprint of 41,309 square feet. The development includes 93 underground parking stalls in the lower level of the building, 75 surface parking stalls, and 180 bicycle parking stalls onsite. Underground parking will be accessed from the northwest corner of the surface parking lot.

A proposed site plan is provided in **Exhibit 2**.

### **Proposed Access**

Three access points are proposed with the development:

- Two full access driveway connections with a new north/south roadway on the west side of the development
  - One driveway towards the north end of the development across from Driscoll Drive (approx. 160 feet south of Milwaukee Street)
  - One driveway at the south end of the development (approx. 440 feet south of Milwaukee Street)
- One driveway connection to Sprecher Road on the east side of the property (approx. 365 feet south of the Milwaukee Street & Sprecher Road intersection)
  - Will be a full access driveway until the new north/south street connection with Sprecher Road is made. At that point, driveway access will be limited to right-in/right-out only.

The proposed north/south roadway will provide a right-in/right-out connection with Milwaukee Street and is planned to provide full access at Sprecher Road once that connection is made.

## EXISTING TRAFFIC VOLUMES

KL Engineering conducted a thirteen-hour turning movement traffic count at the Milwaukee Street & Sprecher Road intersection on Wednesday, June 29, 2022 from 6:00 AM to 7:00 PM. The AM peak hour was observed to be 7:30 AM to 8:30 AM and the PM peak hour was observed to be 4:30 PM to 5:30 PM.

Based on the video footage from the traffic count, it was observed that there was minimal queueing and delay at the intersection. The northbound approach at Sprecher Road was observed to experience the most traffic, with queueing of up to 6 to 8 vehicles and delays of up to 30 seconds at times. Poor lane utilization, with drivers favoring the left lane due to the right lane ending north of the intersection, contributes to the queue.

The existing traffic volumes for the AM and PM peak hours are provided in **Exhibit 3**. See **Attachment A** for a full turning movement count summary.

## PROJECTED TRAFFIC

### *Trip Generation*

The Institute of Transportation Engineers (ITE) *Trip Generation Manual, 11<sup>th</sup> Edition* was used to estimate the number of trips generated by the proposed development. The resulting trip generation estimate is shown in **Table 1** below. The proposed development is projected to generate 717 weekday daily trips, 59 trips (14 in and 45 out) during the AM peak hour and 63 trips (38 in and 25 out) during the PM peak hour.

**Table 1. Trip Generation**  
Sprecher and Milwaukee Development

ITE Land Use	ITE Land Use Code	Size	Weekday Daily Trips (rate)	AM Peak			PM Peak		
				In (%)	Out (%)	Total (rate)	In (%)	Out (%)	Total (rate)
Multifamily Housing (Mid-Rise)	221	160 Dwelling Units	717 (4.48)	14 (23%)	45 (77%)	59 (0.37)	38 (61%)	25 (39%)	63 (0.39)
<b>Total New Trips:</b>			<b>717</b>	<b>14</b>	<b>45</b>	<b>59</b>	<b>38</b>	<b>25</b>	<b>63</b>

No linked or pass-by trips are expected to occur due to the nature of the development. With the available bicycle parking proposed onsite, trips generated from the development may be slightly lower due to multimodal trips via biking. Although this may be the case, no reductions were made to provide a more conservative trip generation estimate.

### *Trip Distribution and Assignment*

#### Trip Distribution

Based on expected regional travel patterns, the projected trip distribution of development traffic is as follows:

- 35% to/from the north on Sprecher Road
- 20% to/from the south on Sprecher Road
- 45% to/from the west on Milwaukee Street

#### Trip Assignment

The projected development trips were assigned to the transportation network according to the trip distribution parameters, along with consideration of the proposed underground parking access, proposed driveway locations, and access restrictions to/from Milwaukee Street.

The new north/south roadway proposed, just west of the development, will include right-in/right-out access only with Milwaukee Street. Due to the access constraint, there are three viable alternative routes to travel west from the development. These include the following (along with assumed traffic use percentages of these routes):

- Exit the development to Driscoll Drive, then turn right onto Rustic Drive. Turn left at the Milwaukee Street & Rustic Drive intersection (50% of traffic)
- Exit the development via the proposed north/south roadway to Milwaukee Street. Then perform a U-turn at the Milwaukee Street & Sprecher Road intersection (25% of traffic)
- Exit the development from the east driveway to travel northbound on Sprecher Road. Then turn left at the Milwaukee Street & Sprecher Road intersection (25% of traffic)

The trip distribution and assignment of development traffic from the proposed street connections to the roadway network are provided in **Exhibit 4**. The build traffic volumes, or those anticipated upon completion

of the development, were determined by adding the development trips (Exhibit 4) to the existing traffic volumes (Exhibit 3). Build traffic for the AM and PM peak hours at the Milwaukee Street & Sprecher Road intersection are provided in **Exhibit 5**.

### **TRAFFIC SIGNAL WARRANT INVESTIGATION**

A traffic signal warrant analysis for Milwaukee Street & Sprecher Road was completed in accordance with WisDOT and *Manual on Uniform Traffic Control Devices* (MUTCD) guidelines. The signal warrants were evaluated using the 100% volume threshold.

Of the nine traffic signal warrants, the warrants most likely to apply to the intersection are Warrant 1: Eight-Hour Vehicular Volume and Warrant 2: Four-Hour Volume. The intersection was evaluated using the warrants under existing traffic conditions and build traffic conditions (with anticipated development traffic).

Estimated hourly traffic volumes impacting the Milwaukee Street & Sprecher Road intersection from the proposed development were determined using the weekday daily trip generation data, along with the existing traffic volume hourly traffic distribution. 80% of the entering intersection AADT was assumed to occur between 6:00 AM and 7:00 PM (hours counted for analysis purposes).

No signal warrants were met under the existing traffic condition or the existing traffic conditions with proposed development traffic. In both cases, Warrant 2 is satisfied for two of the four required hours. Detailed traffic signal warrant reports for existing and build conditions are included in **Attachment B** and **Attachment C**, respectively.

### **CONCLUSION**

The proposed Sprecher and Milwaukee development is expected to increase the traffic volumes on the adjacent roadway network, including the Milwaukee Street & Sprecher Road intersection. Based on the analysis, signal warrants are not satisfied at the Milwaukee Street & Sprecher Road intersection under existing traffic conditions and will not be upon completion of the proposed development.

The Milwaukee Street & Sprecher Road intersection should continue to be monitored as development continues nearby to determine if intersection control changes are necessary. Several intersection control alternatives may be viable at this location as traffic increases including:

- Traffic Signal – *The intersection is set up for future signalization with trombone arms, cabinets, and other equipment that may be able to be used to operate a traffic signal.*
- Roundabout - *With the nearby access restrictions along Milwaukee Street and if future access restrictions along Sprecher Road were desired near the intersection, a roundabout at this location could help reduce use of other adjacent local streets and increase intersection safety.*

# Exhibits



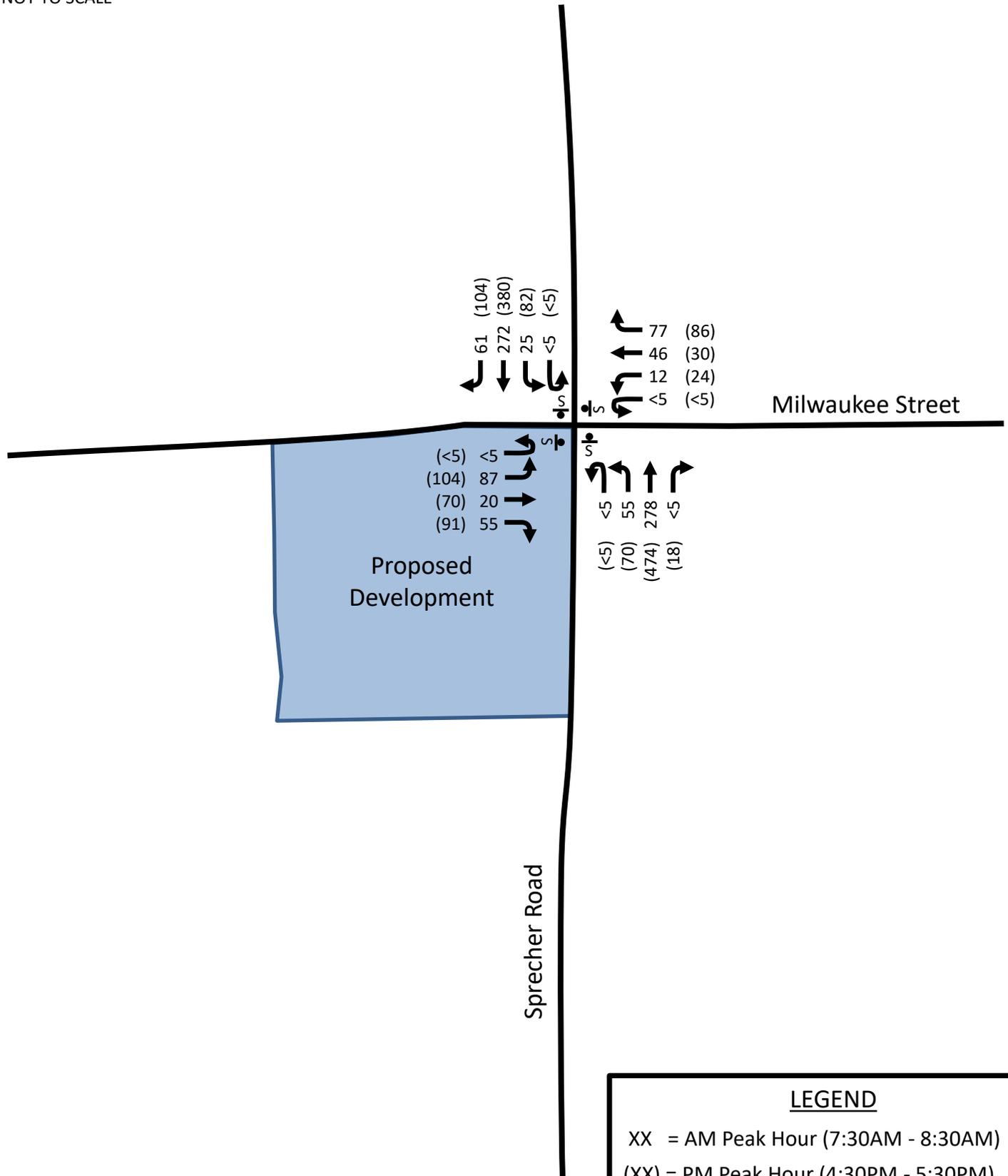
**LEGEND**

-  = Proposed Development
-  = Study Intersection



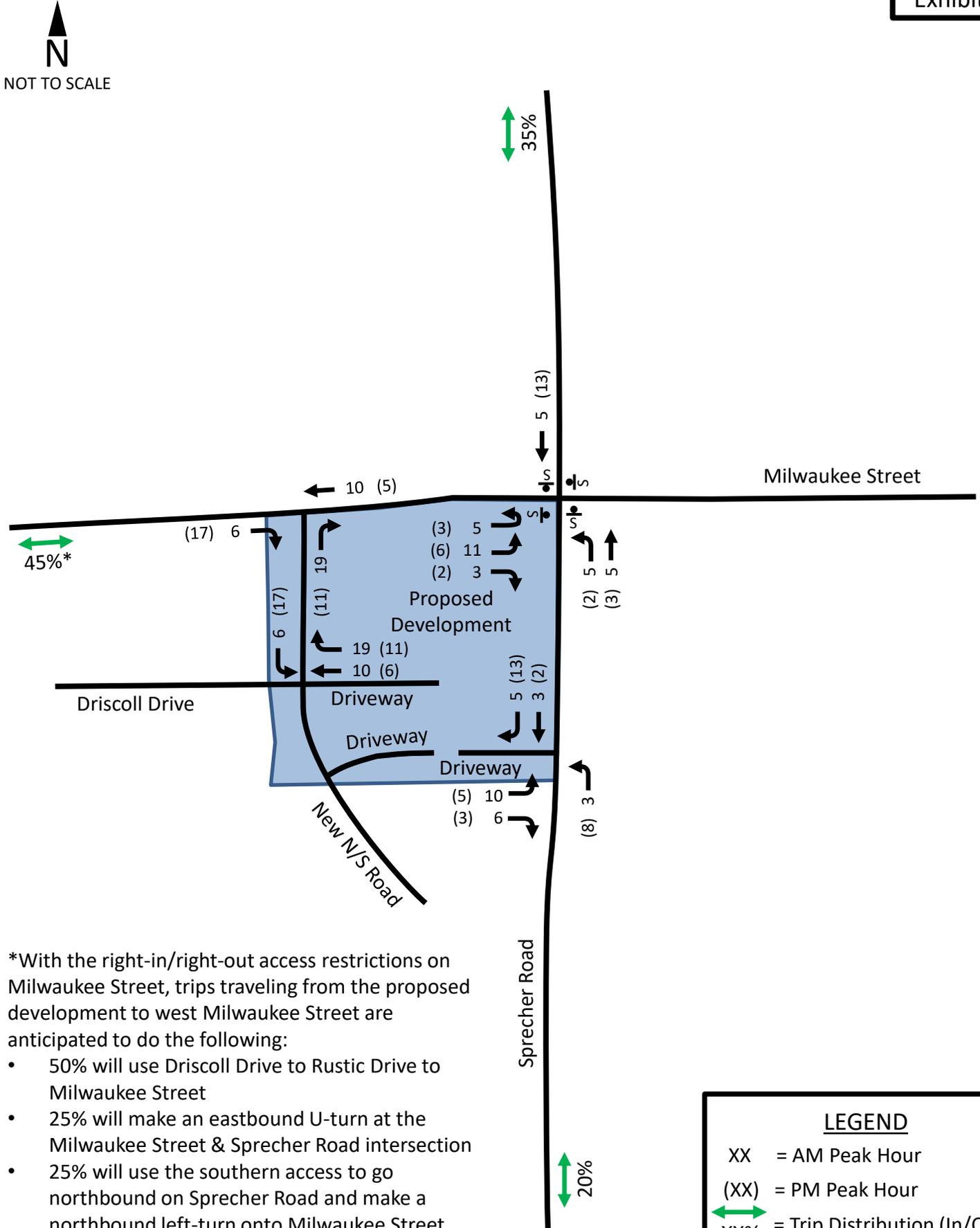


NOT TO SCALE



**LEGEND**

XX = AM Peak Hour (7:30AM - 8:30AM)  
 (XX) = PM Peak Hour (4:30PM - 5:30PM)  
 = Stop Sign



\*With the right-in/right-out access restrictions on Milwaukee Street, trips traveling from the proposed development to west Milwaukee Street are anticipated to do the following:

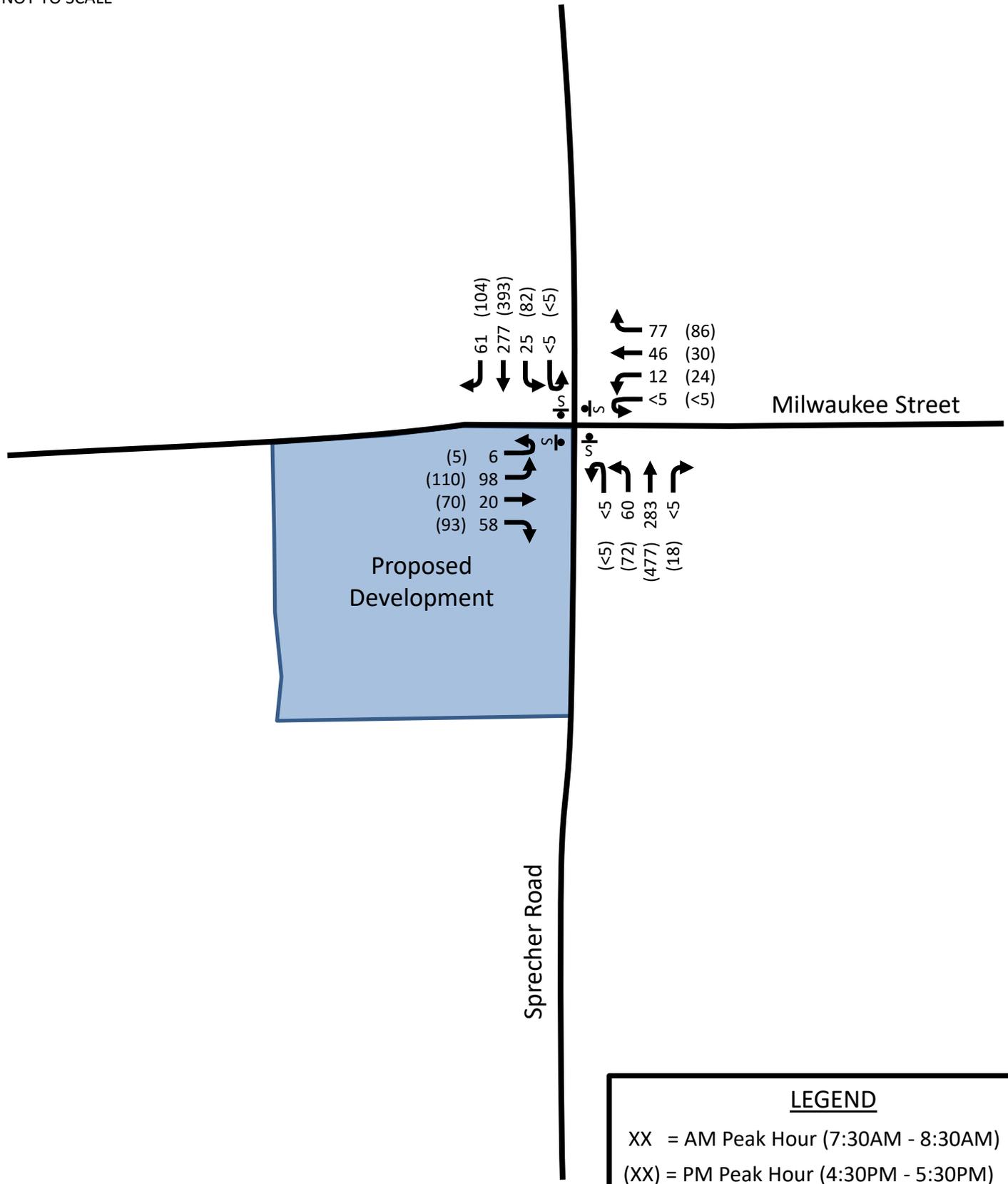
- 50% will use Driscoll Drive to Rustic Drive to Milwaukee Street
- 25% will make an eastbound U-turn at the Milwaukee Street & Sprecher Road intersection
- 25% will use the southern access to go northbound on Sprecher Road and make a northbound left-turn onto Milwaukee Street

**LEGEND**

- XX = AM Peak Hour
- (XX) = PM Peak Hour
- ↔ = Trip Distribution (In/Out)
- ⊙ = Stop Sign



NOT TO SCALE



**LEGEND**

XX = AM Peak Hour (7:30AM - 8:30AM)  
 (XX) = PM Peak Hour (4:30PM - 5:30PM)  
 = Stop Sign

# Attachment A

## Traffic Movement Count Summary

# Traffic Count Summary

Location: Sprecher Rd & Milwaukee St  
Madison, WI  
Date: Wednesday, June 29, 2022

Traffic Control: All Way Stop Control  
Hours Counted: 6:00 AM - 7:00 PM  
Counted By: G Kothbauer

## All Vehicles

### AM Peak

Roadway	Sprecher Rd					Milwaukee St					Sprecher Rd					Milwaukee St					Intersection					
Approach	Southbound					Westbound					Northbound					Eastbound					Sum	PHF				
Time	L	T	R	U	Peds	Bikes	L	T	R	U	Peds	Bikes	L	T	R	U	Peds	Bikes	L	T	R	U	Peds	Bikes	Sum	PHF
7:30 AM	5	67	15	0	0	0	4	13	24	0	0	0	11	84	0	0	0	0	20	5	20	0	0	0	268	0.91
7:45 AM	6	77	24	0	0	0	3	10	18	0	0	1	17	72	0	0	0	0	26	3	17	0	0	0	273	
8:00 AM	5	66	12	0	0	0	2	14	17	0	0	0	14	58	2	0	0	0	21	6	9	0	0	0	226	
8:15 AM	9	62	10	0	0	0	3	9	18	0	0	0	13	64	2	0	0	0	20	6	9	1	0	0	226	
<b>Movement Total</b>	<b>25</b>	<b>272</b>	<b>61</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>12</b>	<b>46</b>	<b>77</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>55</b>	<b>278</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>87</b>	<b>20</b>	<b>55</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>Total: 993</b>	
<b>Approach Total</b>	<b>358</b>					<b>135</b>					<b>337</b>					<b>163</b>										

### Mid Peak

Approach	Southbound					Westbound					Northbound					Eastbound					Intersection					
Time	L	T	R	U	Peds	Bikes	L	T	R	U	Peds	Bikes	L	T	R	U	Peds	Bikes	L	T	R	U	Peds	Bikes	Sum	PHF
12:00 PM	15	52	17	0	0	0	8	8	12	0	0	0	14	74	3	0	0	0	11	10	17	0	0	0	241	0.94
12:15 PM	19	73	16	0	0	0	1	5	15	0	0	0	13	70	5	0	0	0	15	7	17	0	0	0	256	
12:30 PM	10	50	12	0	0	0	4	6	8	0	0	0	9	69	2	0	0	0	23	8	17	0	0	0	218	
12:45 PM	14	65	15	0	0	0	1	6	12	0	0	0	11	71	6	0	0	0	15	14	14	0	0	0	244	
<b>Movement Total</b>	<b>58</b>	<b>240</b>	<b>60</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>14</b>	<b>25</b>	<b>47</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>47</b>	<b>284</b>	<b>16</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>64</b>	<b>39</b>	<b>65</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>Total: 959</b>	
<b>Approach Total</b>	<b>358</b>					<b>86</b>					<b>347</b>					<b>168</b>										

### PM Peak

Approach	Southbound					Westbound					Northbound					Eastbound					Intersection					
Time	L	T	R	U	Peds	Bikes	L	T	R	U	Peds	Bikes	L	T	R	U	Peds	Bikes	L	T	R	U	Peds	Bikes	Sum	PHF
4:30 PM	12	101	19	0	0	0	4	10	27	0	0	0	20	104	6	0	0	0	29	15	22	0	0	0	369	0.93
4:45 PM	23	83	29	0	0	0	5	4	27	0	0	0	17	144	4	0	0	0	36	17	25	0	0	0	414	
5:00 PM	25	91	30	0	0	0	8	8	18	0	0	0	13	113	3	0	0	0	17	15	26	0	0	0	367	
5:15 PM	22	105	26	0	0	0	7	8	14	0	0	0	20	113	5	0	0	0	22	23	18	0	0	0	383	
<b>Movement Total</b>	<b>82</b>	<b>380</b>	<b>104</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>30</b>	<b>86</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>70</b>	<b>474</b>	<b>18</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>104</b>	<b>70</b>	<b>91</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>Total: 1533</b>	
<b>Approach Total</b>	<b>566</b>					<b>140</b>					<b>562</b>					<b>265</b>										

## Heavy Vehicles

### AM Peak

Roadway	Sprecher Rd				Milwaukee St				Sprecher Rd				Milwaukee St			
Approach	Southbound				Westbound				Northbound				Eastbound			
Time	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	U
7:30 AM	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	2	3	0	0	2	0	0	1	0	0	0	1	1	1	0
8:00 AM	0	5	0	0	0	0	1	0	0	5	1	0	1	0	0	0
8:15 AM	0	1	1	0	0	1	1	0	0	1	0	0	1	2	1	0
<b>Movement Total</b>	<b>0</b>	<b>10</b>	<b>4</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>6</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>0</b>
<b>Approach Total</b>	<b>14</b>				<b>6</b>				<b>8</b>				<b>8</b>			
<b>Heavy Vehicle %</b>	<b>4%</b>				<b>4%</b>				<b>2%</b>				<b>5%</b>			

### Mid Peak

Approach	Southbound				Westbound				Northbound				Eastbound			
Time	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	U
12:00 PM	1	1	1	0	0	0	0	0	1	1	0	0	1	1	0	0
12:15 PM	1	2	2	0	0	0	0	0	1	0	0	0	1	0	0	0
12:30 PM	1	2	0	0	0	1	2	0	1	1	0	0	0	0	1	0
12:45 PM	1	2	0	0	0	1	1	0	1	0	0	0	0	1	0	0
<b>Movement Total</b>	<b>4</b>	<b>7</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>3</b>	<b>0</b>	<b>4</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>
<b>Approach Total</b>	<b>14</b>				<b>5</b>				<b>6</b>				<b>5</b>			
<b>Heavy Vehicle %</b>	<b>4%</b>				<b>6%</b>				<b>2%</b>				<b>3%</b>			

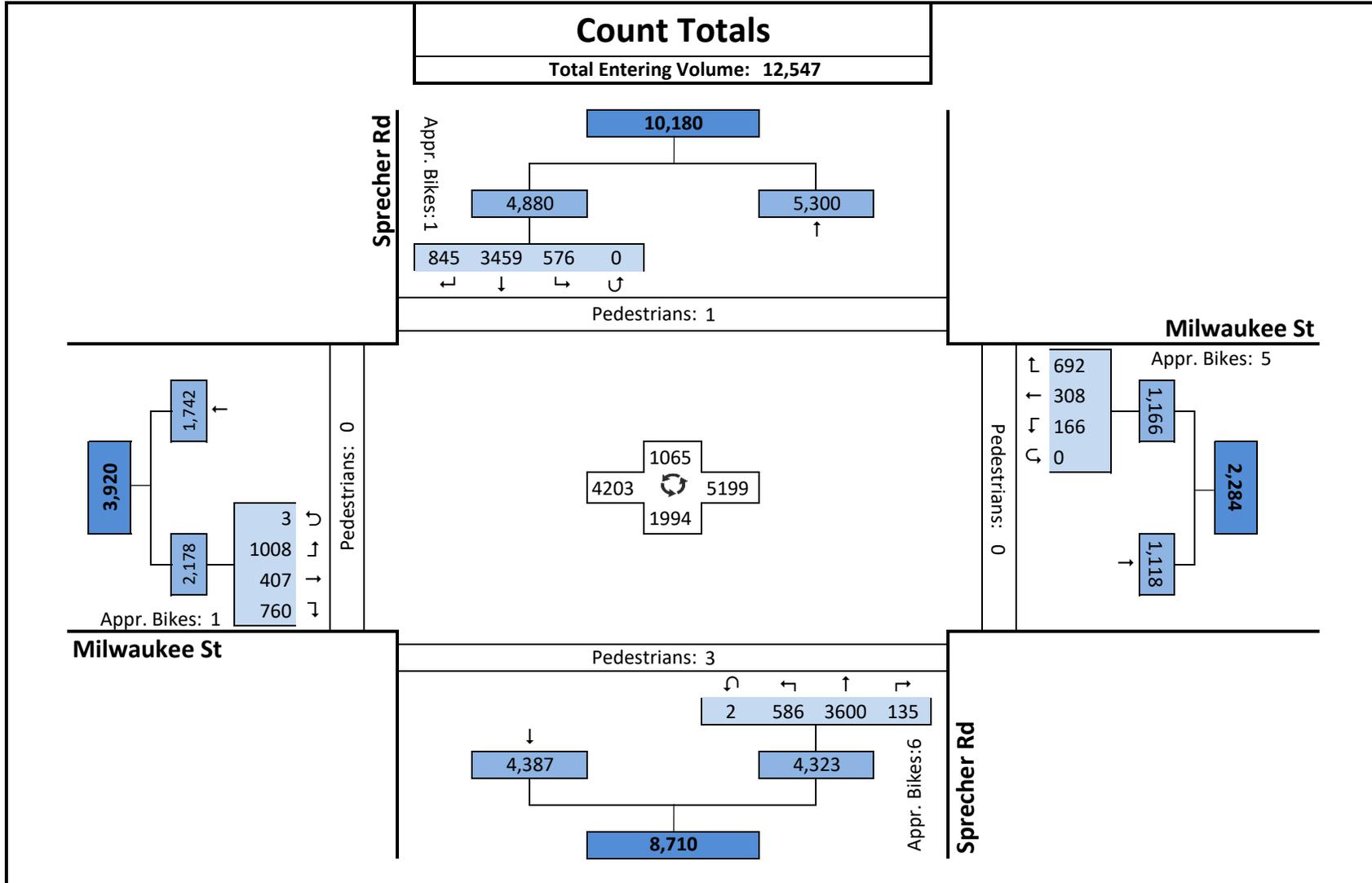
### PM Peak

Approach	Southbound				Westbound				Northbound				Eastbound			
Time	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	U
4:30 PM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	1	0	0	0	0	1	0	0	1	0	0	0	1	0	0
5:00 PM	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
5:15 PM	0	2	0	0	0	0	0	0	0	1	0	0	0	1	0	0
<b>Movement Total</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>
<b>Approach Total</b>	<b>4</b>				<b>1</b>				<b>3</b>				<b>2</b>			
<b>Heavy Vehicle %</b>	<b>1%</b>				<b>1%</b>				<b>1%</b>				<b>1%</b>			

# Turning Movement Diagram

Location: Sprecher Rd & Milwaukee St  
 Madison, WI  
 Date: Wednesday, June 29, 2022

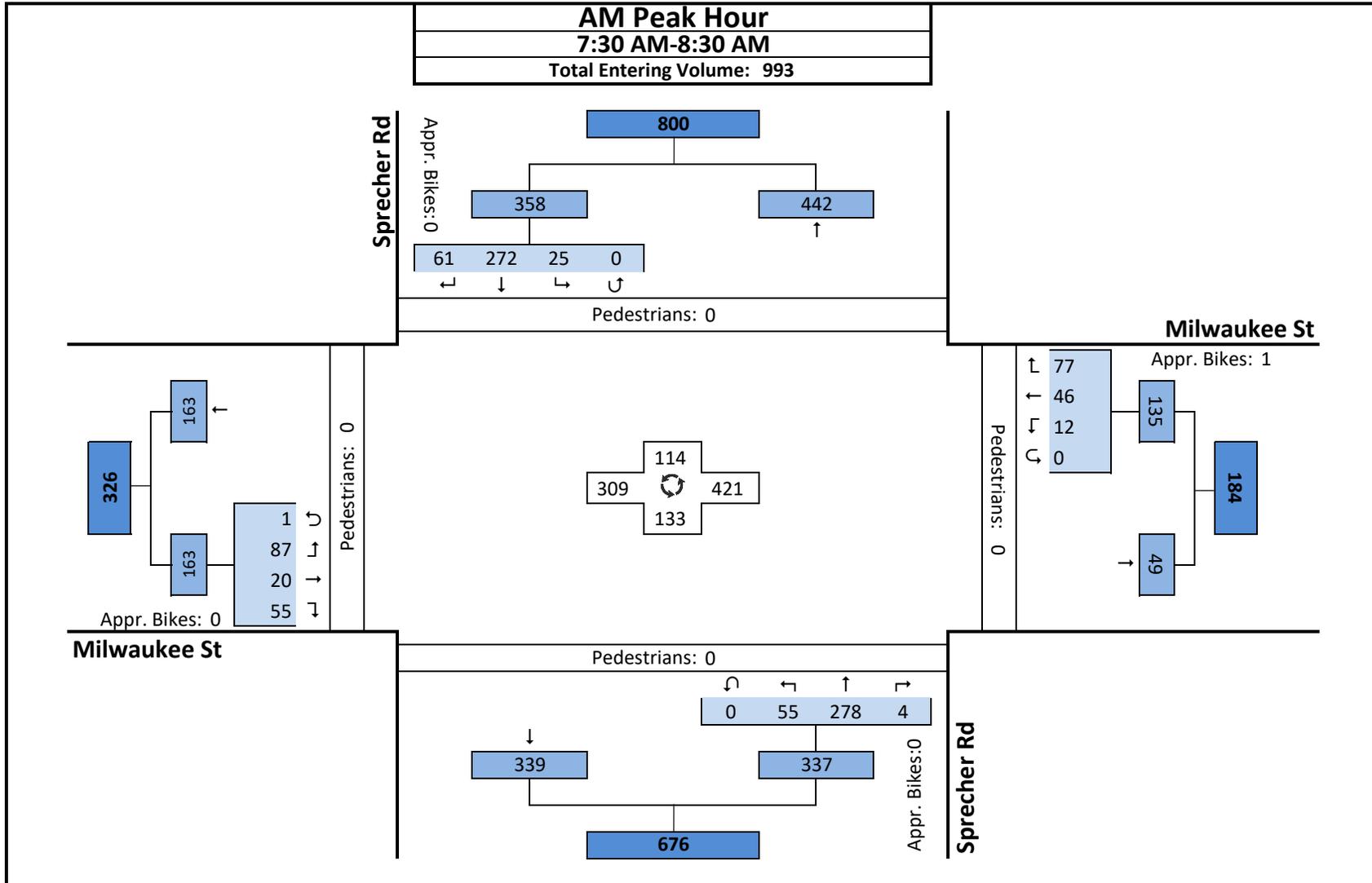
Traffic Control: All Way Stop Control  
 Hours Counted: 6:00 AM - 7:00 PM  
 Counted By: G Kothbauer



# Turning Movement Diagram

Location: Sprecher Rd & Milwaukee St  
 Madison, WI  
 Date: Wednesday, June 29, 2022

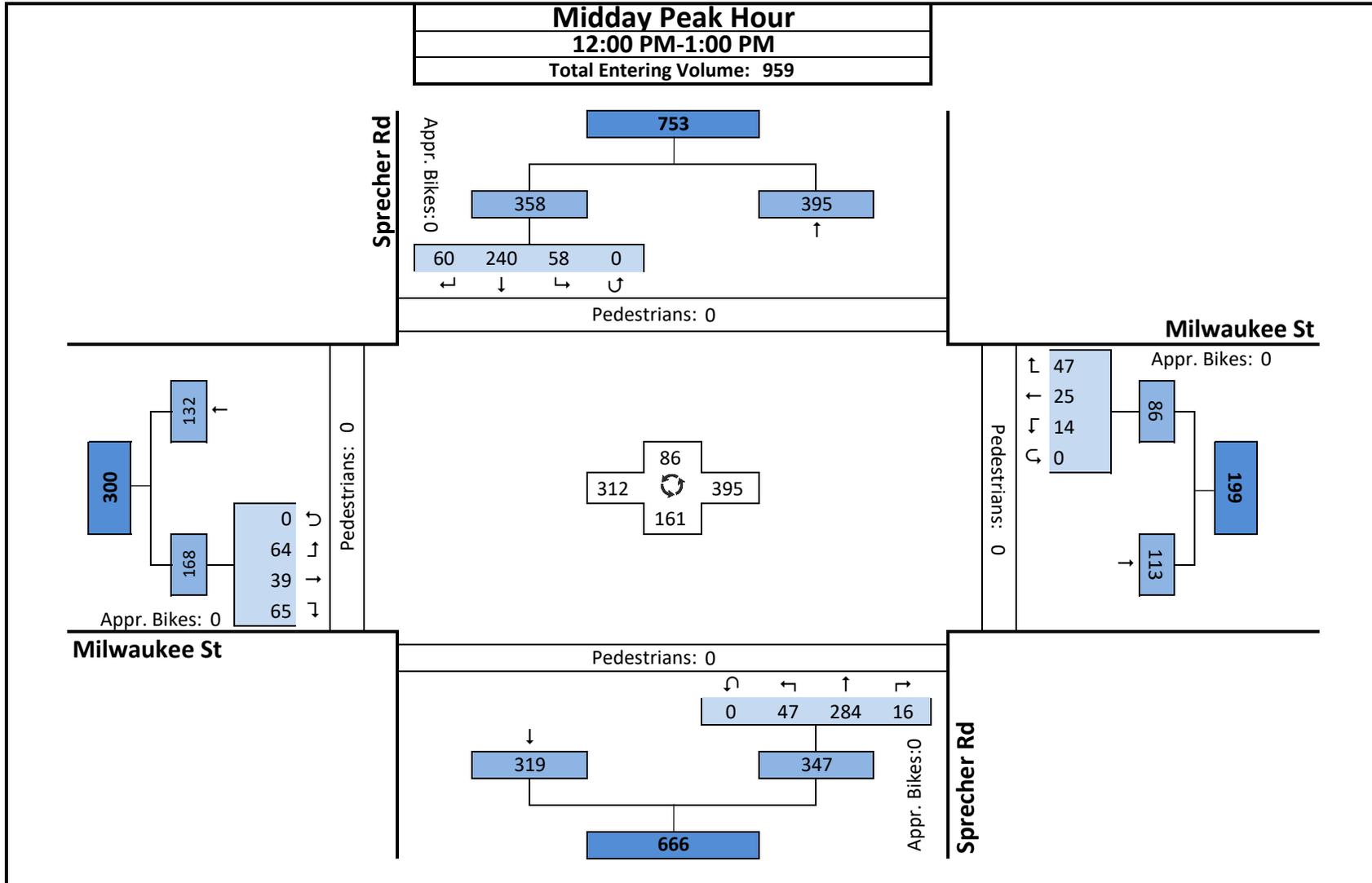
Traffic Control: All Way Stop Control  
 Hours Counted: 6:00 AM - 7:00 PM  
 Counted By: G Kothbauer



# Turning Movement Diagram

Location: Sprecher Rd & Milwaukee St  
 Madison, WI  
 Date: Wednesday, June 29, 2022

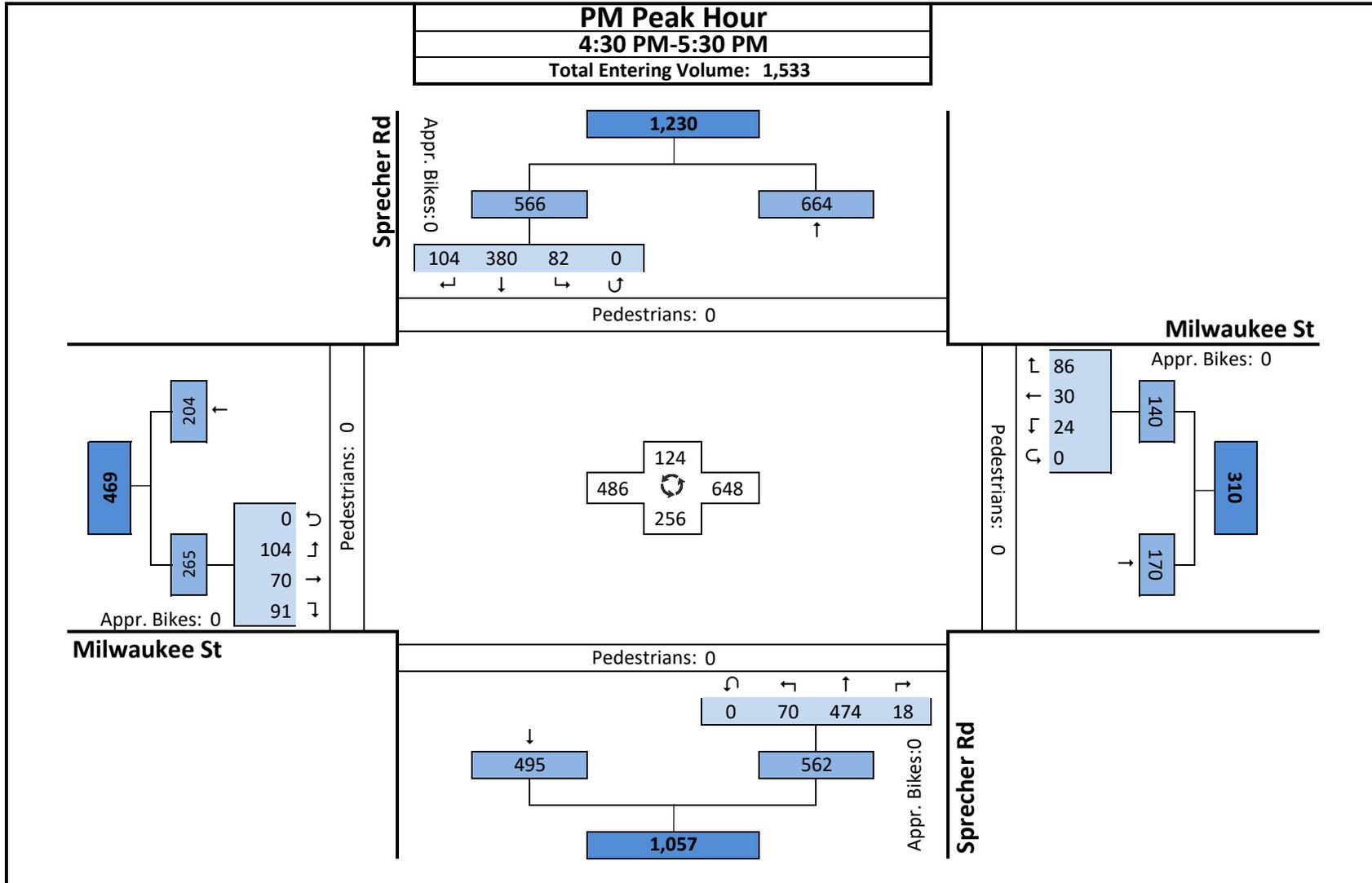
Traffic Control: All Way Stop Control  
 Hours Counted: 6:00 AM - 7:00 PM  
 Counted By: G Kothbauer



# Turning Movement Diagram

Location: Sprecher Rd & Milwaukee St  
 Madison, WI  
 Date: Wednesday, June 29, 2022

Traffic Control: All Way Stop Control  
 Hours Counted: 6:00 AM - 7:00 PM  
 Counted By: G Kothbauer



# Attachment B

## Traffic Signal Warrant Analysis Existing Traffic Volumes

# Wisconsin Department of Transportation Traffic Signal Warrant Summary Worksheet

**100%**

The Worksheet(s) attached are provided as an attachment to the Engineering Investigation Study for:

Intersection: Sprecher Road and Milwaukee Street  
 County: Dane  
 City: Madison

Major Street: Sprecher Road  
 Critical Approach Speed: 35 mph  
 Lanes: 2 or more lanes

Minor Street: Milwaukee Street  
 Critical Approach Speed: 35 mph  
 Lanes: 2 or more lanes

% Right Turns Included  
 From North (SB) 100%  
 From East (WB) 0%  
 From South (NB) 100%  
 From West (EB) 100%

In built-up area of isolated community of < 10,000 population? No  
 Total number of approaches at intersection? 4 or more  
 If it is a "T" intersection, inflate minor threshold to 150%? No  
 Manually set volume level? No

**Analysis based on EXISTING volume data.**

Date	Day of the Week	Time (HH:MM)			
		From	AM / PM	To	AM / PM
6/29/2022	Wednesday	6:00	AM	7:00	PM

<b>Warrant Evaluation Summary</b>	<b>Warrant Met:</b>
<b>Warrant 1: Eight - Hour Vehicular Volume</b>	<b>No</b>
Condition A: Minimum Vehicular Volume	No
Condition B: Interruption of Continuous Traffic	No
Condition C: Combination: 80% of A and B	No
<b>Warrant 2: Four-Hour Volume</b>	<b>No</b>
<b>Warrant 3: Peak Hour Volume</b>	<b>N/A</b>
<b>Warrant 4: Pedestrian Volume</b>	<b>N/A</b>
Criterion A: Four-Hour	
Criterion B: Peak-Hour	
<b>Warrant 5: School Crossing</b>	<b>N/A</b>
<b>Warrant 6: Coordinated Signal System</b>	<b>N/A</b>
<b>Warrant 7: Crash Experience</b>	<b>N/A</b>
<b>Warrant 8: Roadway Network</b>	<b>N/A</b>
<b>Warrant 9: Intersection Near a Grade Crossing</b>	<b>N/A</b>

**Warrant Analysis Conducted By:**

Name: Shelby Hiltgen  
 Agency: KL Engineering  
 Date: 7/6/2022

# Warrant 1: Eight - Hour Vehicular Volume

100%

Warrant Evaluated? Yes

Warrant Satisfied? No

Manually Set To:

Condition A : Min. Veh. Volume		
Volume Level	100%	80%
Major Rd. Req	600	480
Minor Rd. Req	200	160
Number of Hours	2	7

Satisfied? No

Condition B: Interruption of Continuous Traffic		
Volume Level	100%	80%
Major Rd. Req	900	720
Minor Rd. Req	100	80
Number of Hours	2	3

Satisfied? No

Condition C: Combination of A & B at 80%		
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Satisfied? No

6:00 AM		Enter Start Time (Military Time) (HH:MM)			Total
Time Period	From	To	Major Road: Both App. (VPH)	Minor Road: High App. (VPH)	
1	6:00	7:00	401	81	482
2	7:00	8:00	655	151	806
3	8:00	9:00	633	137	770
4	9:00	10:00	489	147	636
5	10:00	11:00	591	144	735
6	11:00	12:00	663	160	823
7	12:00	13:00	705	168	873
8	13:00	14:00	696	163	859
9	14:00	15:00	710	162	872
10	15:00	16:00	868	193	1061
11	16:00	17:00	1079	278	1357
12	17:00	18:00	998	240	1238
13	18:00	19:00	715	154	869
14	19:00	20:00	0	0	0
15	20:00	21:00	0	0	0
16	21:00	22:00	0	0	0

# Warrant 2: Four-Hour Volume

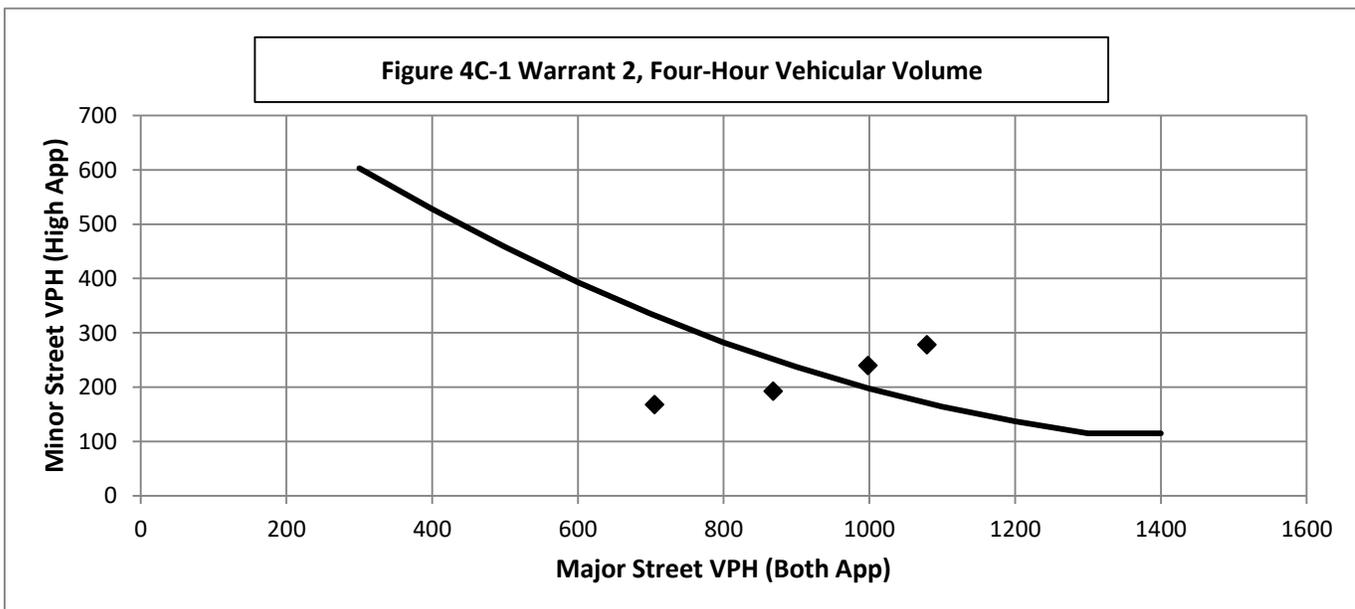
100%

Warrant Evaluated? Yes

Warrant Satisfied? No

Manually Set To:

Hour Start	16:00	17:00	15:00	12:00
Major Road Vol.	1079	998	868	705
Minor Road Vol.	278	240	193	168



## Warrant 3: Peak Hour Volume

**100%**

**Warrant Evaluated? No**

**Warrant Satisfied? N/A**

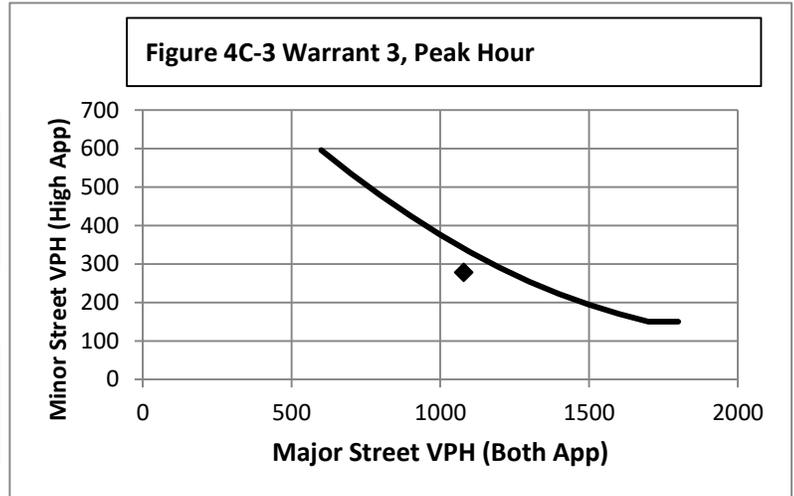
**Manually Set To:**

Condition justifying use of warrant:

Criteria		Met?
Delay on Minor Approach	5	
Volume on Minor Approach	150	
Total Entering Volume (veh/h)	800	

### Manually Set Peak Hour?

Peak Hour	Major Road Vol. (Both App.)	Minor Road Vol. (High App.)
16:00	1079	278



## Warrant 4: Pedestrian Volume

**100%**

**Warrant Evaluated? No**

**Warrant Satisfied? N/A**

**Manually Set To:**

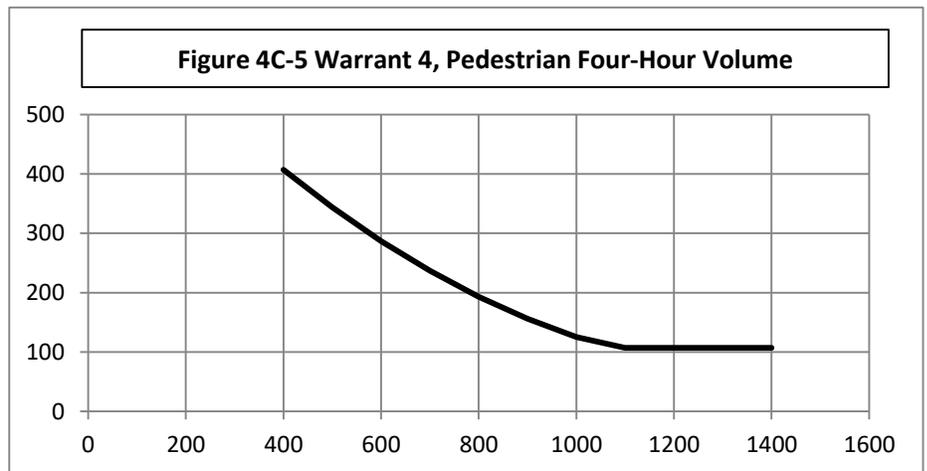
### Criterion A: Four Hour

Hour (Start)	Pedestrian Volume	Major Road Vol.
		0
		0
		0
		0

**Manually Set Major Rd Vol?**

**Avg. walk speed less than 3.5 ft/s?**

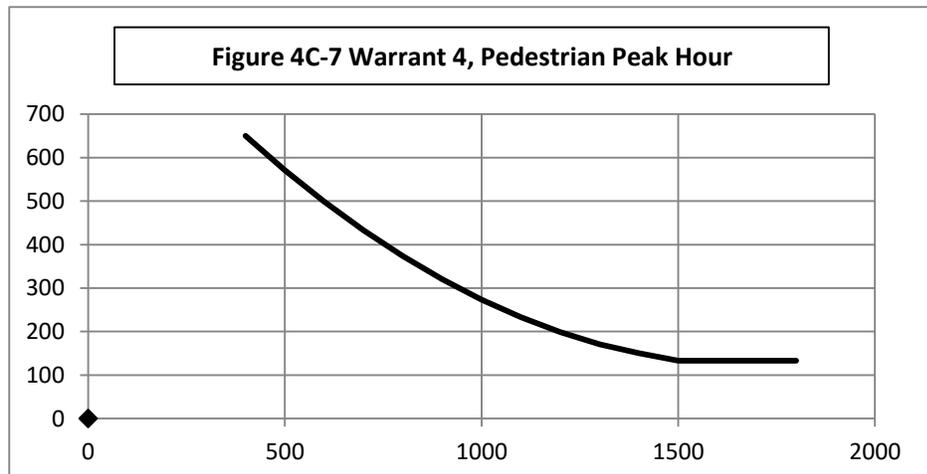
**Criterion A Satisfied?**



### Criterion B: Peak Hour

Peak Hour	Pedestrian Vol.	Major Road Vol.
0:00	0	0

**Criterion B Satisfied?**



## Warrant 5: School Crossing

**100%**

Warrant Evaluated? No

Warrant Satisfied? N/A

Manually Set To:

Criteria		Fulfilled?
1	There are a MINIMUM of 20 school children during the highest crossing hour.	
2	There are fewer adequate gaps in the major road traffic stream during the period when the school children are using the crossing than the number of minutes in the same period.	
3	The nearest traffic signal along the major road is located more than 300 ft away. Or, the nearest traffic signal is within 300 ft but the proposed traffic signal will not restrict the progressive movement of traffic.	

## Warrant 6: Coordinated Signal System

**100%**

Warrant Evaluated? No

Warrant Satisfied? N/A

Manually Set To:

Criteria		Fulfilled?
1	Signal spacing > 1000 ft	
2	On a one-way road or a road that has traffic predominantly in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.	
3	On a two-way road, adjacent signals do not provide the necessary degree of platooning and the proposed and the adjacent signals will collectively provide a progressive operation.	

## Warrant 7: Crash Experience

**100%**

Warrant Evaluated? No

Warrant Satisfied? N/A

Manually Set To:

Criteria		Met?	Fulfilled?
1	Adequate trial of other remedial measures has failed to reduce crash frequency.		
	Measures Tried:		
2	Five or more reported crashes, of types susceptible to correction by signal, have occurred within a 12 month period.	# of crashes per 12 months	
3	Warrant 1, Condition A (80%)	No	Yes
	Warrant 1, Condition B (80%)	No	
	Warrant 4, Criterion A (80%)	No	
	Warrant 4, Criterion B (80%)	Yes	

## Warrant 8: Roadway Network

**100%**

Warrant Evaluated? No

Warrant Satisfied? N/A

Manually Set To:

Criteria		Met?	Fulfilled?
1	Total entering volume of at least 1,000 veh/h during typical weekday peak hour	1357	Yes
	Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.		No
2	Total entering vol. of at least 1,000 veh/h for each of any 5 hrs of non-normal business day (Sat. or Sun.)		
	Hour		
	Volume		

Characteristics of Major Routes - Select yes if all intersecting routes have characteristic			Fulfilled?
1	Part of the road or highway system that serves as the principal roadway network for through traffic flow		
2	Rural or suburban highway outside of, entering, or traversing a city		
3	Appears as a major route on an official plan		

# Warrant 9: Intersection Near a Grade Crossing

100%

Warrant Evaluated? No

Warrant Satisfied? N/A

Manually Set To:

Adjustment Factors			Manually Set Peak Hour?				
Rail Traffic per Day	% High Occupancy Buses on Minor Road	% Tractor-Trailer Trucks on Minor Road	D	Peak Hour	Major Road Vol.	Minor Road Vol.	Adjusted Minor Vol.
1	0	0% to 2.5%	660	16:00	1079	278	93.13

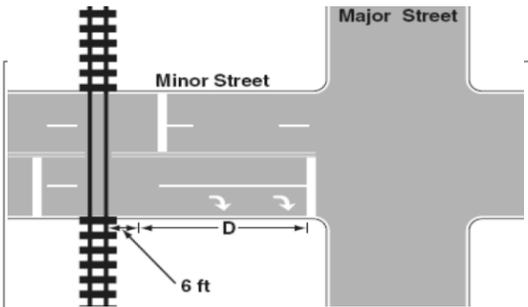
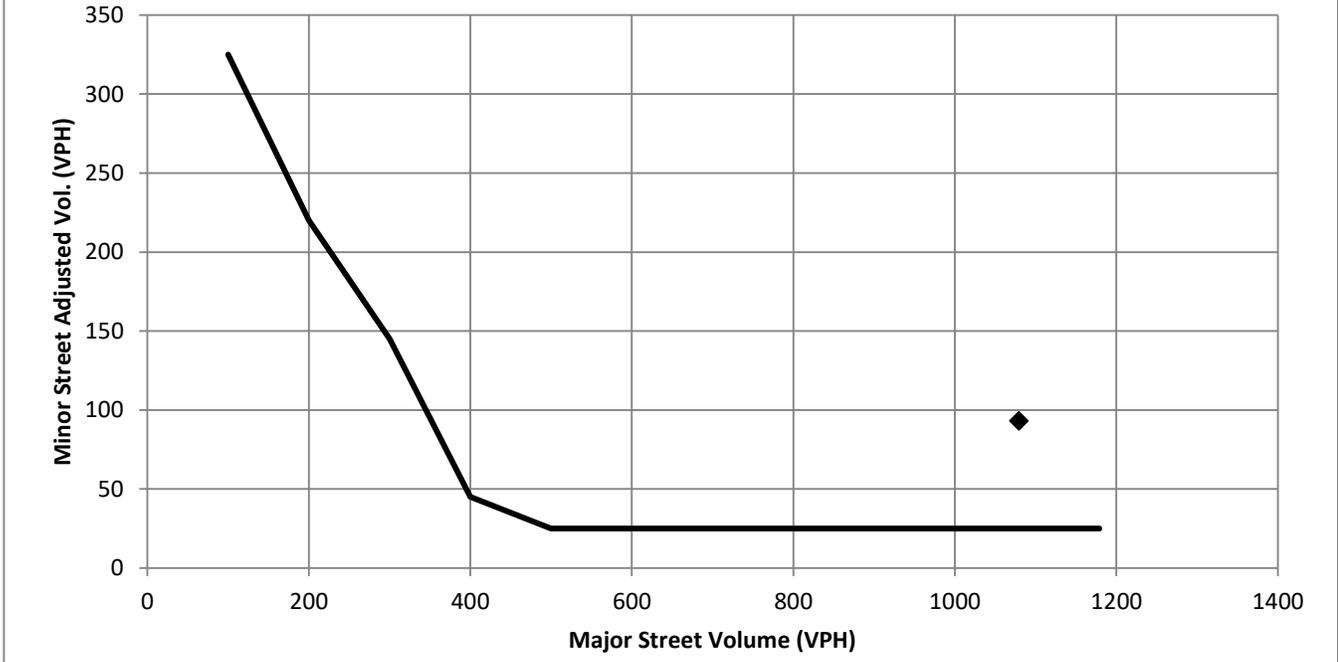


Figure 4C-10 Warrant 9, Intersection Near a grade Crossing (Two or More Approach Lanes at the Track Crossing)



Conclusions/Comments:

Updated: 12/6/2017

# Attachment C

## Traffic Signal Warrant Analysis Build Traffic Volumes

# Wisconsin Department of Transportation Traffic Signal Warrant Summary Worksheet

**100%**

The Worksheet(s) attached are provided as an attachment to the Engineering Investigation Study for:

Intersection: Sprecher Road and Milwaukee Street  
 County: Dane  
 City: Madison

Major Street: Sprecher Road  
 Critical Approach Speed: 35 mph  
 Lanes: 2 or more lanes

Minor Street: Milwaukee Street  
 Critical Approach Speed: 35 mph  
 Lanes: 2 or more lanes

% Right Turns Included From North (SB) 100% From East (WB) 0% From South (NB) 100% From West (EB) 100%	In built-up area of isolated community of < 10,000 population? No Total number of approaches at intersection? 4 or more If it is a "T" intersection, inflate minor threshold to 150%? No Manually set volume level? No
--	---

**Analysis based on EXISTING volume data.**

Date	Day of the Week	Time (HH:MM)			
		From	AM / PM	To	AM / PM
6/29/2022	Wednesday	6:00	AM	7:00	PM

<b>Warrant Evaluation Summary</b>	<b>Warrant Met:</b>
<b>Warrant 1: Eight - Hour Vehicular Volume</b>	<b>No</b>
Condition A: Minimum Vehicular Volume	No
Condition B: Interruption of Continuous Traffic	No
Condition C: Combination: 80% of A and B	No
<b>Warrant 2: Four-Hour Volume</b>	<b>No</b>
<b>Warrant 3: Peak Hour Volume</b>	<b>N/A</b>
<b>Warrant 4: Pedestrian Volume</b>	<b>N/A</b>
Criterion A: Four-Hour	
Criterion B: Peak-Hour	
<b>Warrant 5: School Crossing</b>	<b>N/A</b>
<b>Warrant 6: Coordinated Signal System</b>	<b>N/A</b>
<b>Warrant 7: Crash Experience</b>	<b>N/A</b>
<b>Warrant 8: Roadway Network</b>	<b>N/A</b>
<b>Warrant 9: Intersection Near a Grade Crossing</b>	<b>N/A</b>

**Warrant Analysis Conducted By:**

Name: Shelby Hiltgen  
 Agency: KL Engineering  
 Date: 7/12/2022

# Warrant 1: Eight - Hour Vehicular Volume

100%

Warrant Evaluated? Yes

Warrant Satisfied? No

Manually Set To:

Condition A : Min. Veh. Volume		
Volume Level	100%	80%
Major Rd. Req	600	480
Minor Rd. Req	200	160
Number of Hours	3	9

Satisfied? No

Condition B: Interruption of Continuous Traffic		
Volume Level	100%	80%
Major Rd. Req	900	720
Minor Rd. Req	100	80
Number of Hours	2	5

Satisfied? No

Condition C: Combination of A & B at 80%		
---	--	--

Satisfied? No

6:00 AM		Enter Start Time (Military Time) (HH:MM)			Total
Time Period	From	To	Major Road: Both App. (VPH)	Minor Road: High App. (VPH)	
1	6:00	7:00	408	86	494
2	7:00	8:00	667	161	828
3	8:00	9:00	645	145	790
4	9:00	10:00	499	154	653
5	10:00	11:00	601	153	754
6	11:00	12:00	675	169	844
7	12:00	13:00	718	177	895
8	13:00	14:00	708	173	881
9	14:00	15:00	722	172	894
10	15:00	16:00	883	205	1088
11	16:00	17:00	1098	294	1392
12	17:00	18:00	1016	254	1270
13	18:00	19:00	727	164	891
14	19:00	20:00	0	0	0
15	20:00	21:00	0	0	0
16	21:00	22:00	0	0	0

# Warrant 2: Four-Hour Volume

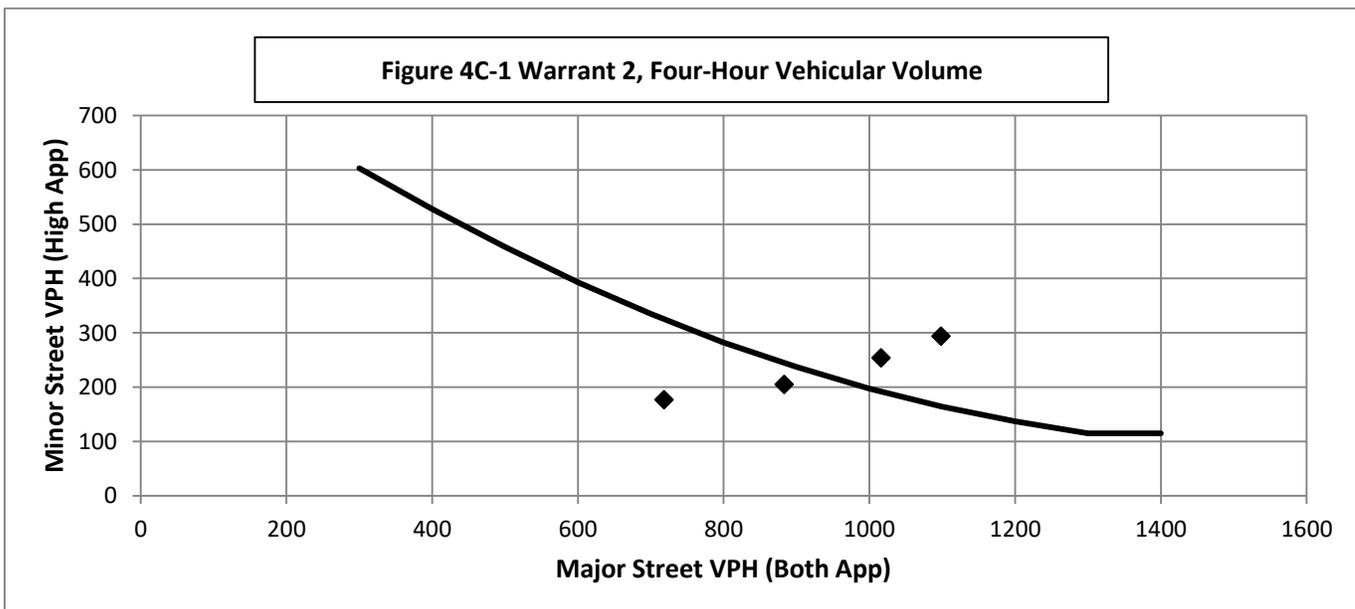
100%

Warrant Evaluated? Yes

Warrant Satisfied? No

Manually Set To:

Hour Start	16:00	17:00	15:00	12:00
Major Road Vol.	1098	1016	883	718
Minor Road Vol.	294	254	205	177



## Warrant 3: Peak Hour Volume

**100%**

**Warrant Evaluated? No**

**Warrant Satisfied? N/A**

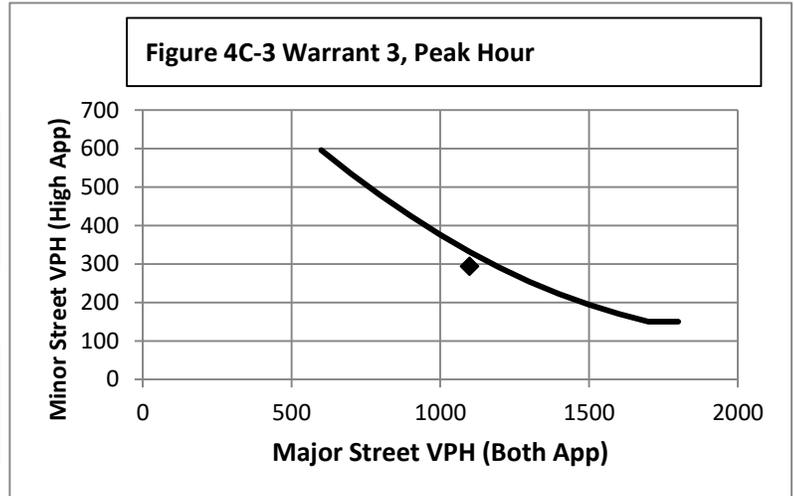
**Manually Set To:**

Condition justifying use of warrant:

Criteria		Met?
Delay on Minor Approach	5	
Volume on Minor Approach	150	
Total Entering Volume (veh/h)	800	

### Manually Set Peak Hour?

Peak Hour	Major Road Vol. (Both App.)	Minor Road Vol. (High App.)
16:00	1098	294



## Warrant 4: Pedestrian Volume

**100%**

**Warrant Evaluated? No**

**Warrant Satisfied? N/A**

**Manually Set To:**

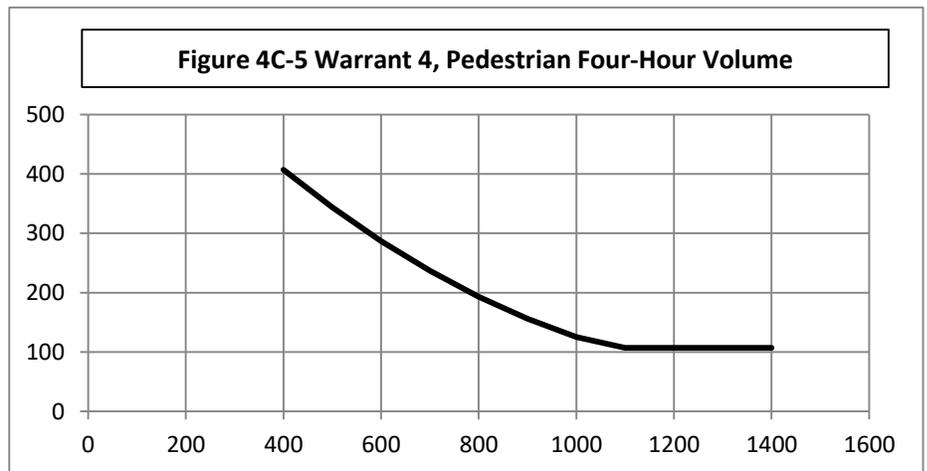
### Criterion A: Four Hour

Hour (Start)	Pedestrian Volume	Major Road Vol.
		0
		0
		0
		0

**Manually Set Major Rd Vol?**

**Avg. walk speed less than 3.5 ft/s?**

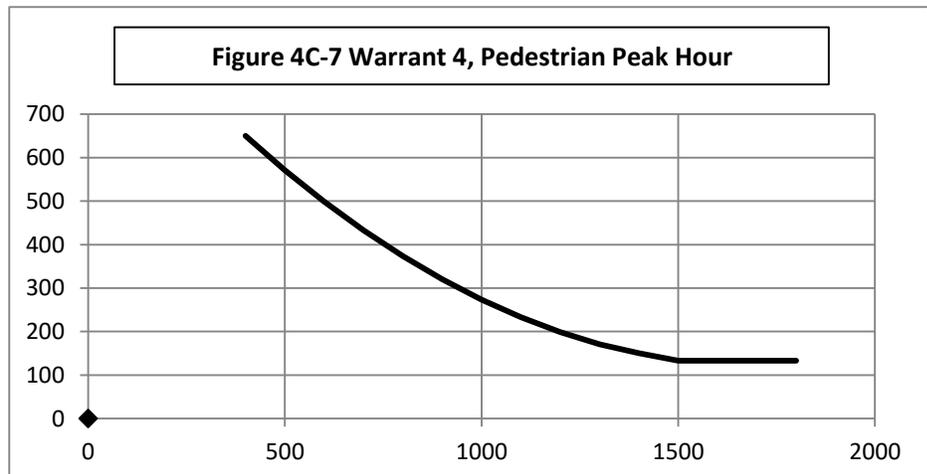
**Criterion A Satisfied?**



### Criterion B: Peak Hour

Peak Hour	Pedestrian Vol.	Major Road Vol.
0:00	0	0

**Criterion B Satisfied?**



## Warrant 5: School Crossing

**100%**

**Warrant Evaluated? No**

**Warrant Satisfied? N/A**

**Manually Set To:**

Criteria		Fulfilled?
1	There are a MINIMUM of 20 school children during the highest crossing hour.	
2	There are fewer adequate gaps in the major road traffic stream during the period when the school children are using the crossing than the number of minutes in the same period.	
3	The nearest traffic signal along the major road is located more than 300 ft away. Or, the nearest traffic signal is within 300 ft but the proposed traffic signal will not restrict the progressive movement of traffic.	

## Warrant 6: Coordinated Signal System

**100%**

**Warrant Evaluated? No**

**Warrant Satisfied? N/A**

**Manually Set To:**

Criteria		Fulfilled?
1	Signal spacing > 1000 ft	
2	On a one-way road or a road that has traffic predominantly in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.	
3	On a two-way road, adjacent signals do not provide the necessary degree of platooning and the proposed and the adjacent signals will collectively provide a progressive operation.	

## Warrant 7: Crash Experience

**100%**

**Warrant Evaluated? No**

**Warrant Satisfied? N/A**

**Manually Set To:**

Criteria		Met?	Fulfilled?
1	Adequate trial of other remedial measures has failed to reduce crash frequency.		
	Measures Tried:		
2	Five or more reported crashes, of types susceptible to correction by signal, have occurred within a 12 month period.	# of crashes per 12 months	
3	Warrant 1, Condition A (80%)	Yes	Yes
	Warrant 1, Condition B (80%)	No	
	Warrant 4, Criterion A (80%)	No	
	Warrant 4, Criterion B (80%)	Yes	

## Warrant 8: Roadway Network

**100%**

**Warrant Evaluated? No**

**Warrant Satisfied? N/A**

**Manually Set To:**

Criteria		Met?	Fulfilled?
1	Total entering volume of at least 1,000 veh/h during typical weekday peak hour	1392	Yes
	Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.		No
2	Total entering vol. of at least 1,000 veh/h for each of any 5 hrs of non-normal business day (Sat. or Sun.)		
	Hour		
	Volume		

Criteria	Characteristics of Major Routes - Select yes if all intersecting routes have characteristic	Fulfilled?
1	Part of the road or highway system that serves as the principal roadway network for through traffic flow	
2	Rural or suburban highway outside of, entering, or traversing a city	
3	Appears as a major route on an official plan	

# Warrant 9: Intersection Near a Grade Crossing

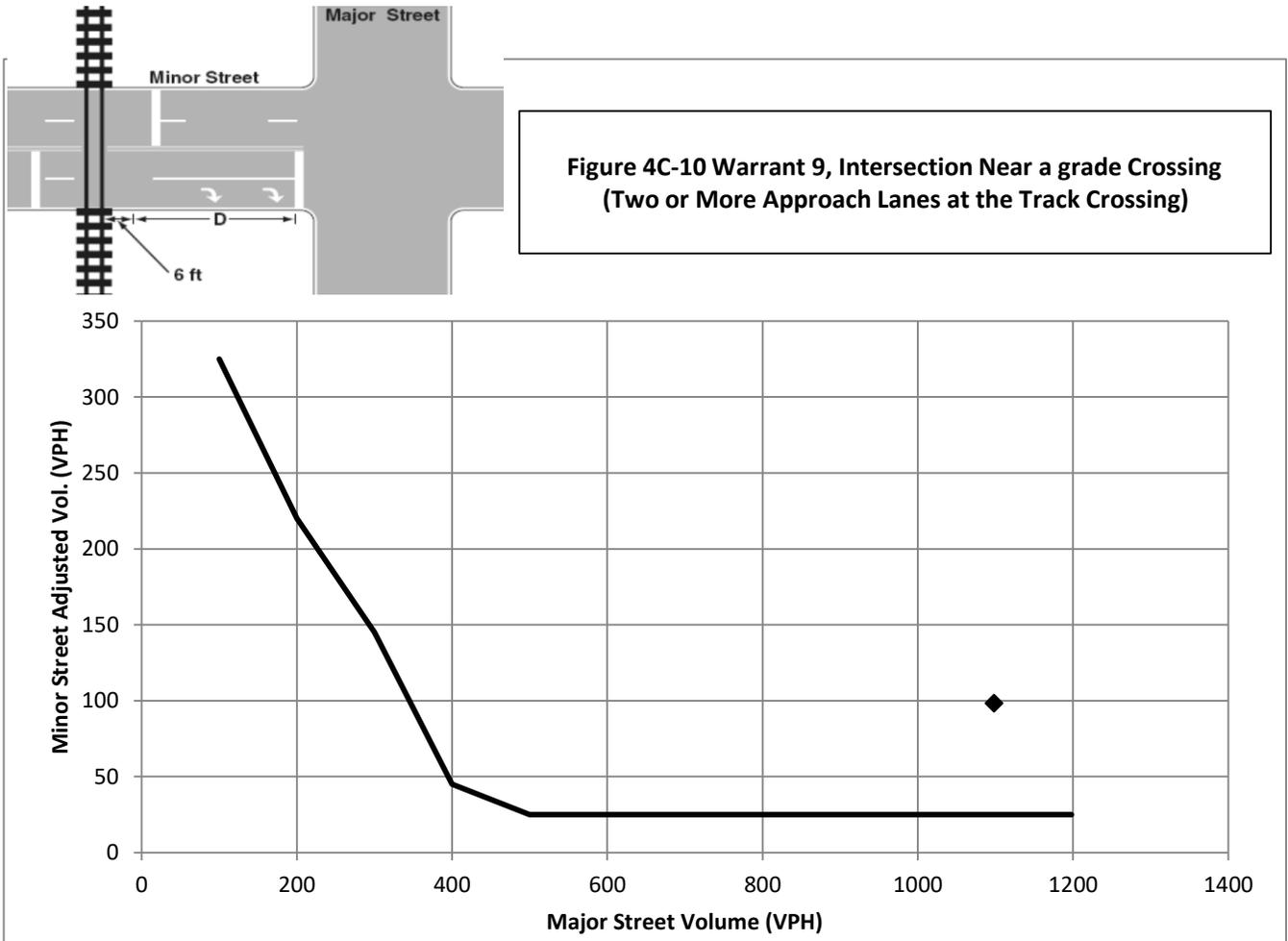
100%

Warrant Evaluated? No

Warrant Satisfied? N/A

Manually Set To:

Adjustment Factors			Manually Set Peak Hour?				
Rail Traffic per Day	% High Occupancy Buses on Minor Road	% Tractor-Trailer Trucks on Minor Road	D	Peak Hour	Major Road Vol.	Minor Road Vol.	Adjusted Minor Vol.
1	0	0% to 2.5%	660	16:00	1098	294	98.49



Conclusions/Comments:

Updated: 12/6/2017