CITY OF JANESVILLE
Wisconsin's Park Place

Intersection Analysis

for

East Centerway/North Garfield Avenue/East Milwaukee Street

Department of Public Works

Engineering Division

October 2024

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Executive Summary

E Milwaukee Street (Atwood Avenue to Ringold Street) is scheduled for reconstruction as part of the 2025 Street Rehabilitation Program. The scope of work is a complete reconstruction, which includes the total replacement of the curb and gutter, base aggregate, and asphalt pavement. During the design process, the Engineering Division reviews opportunities to implement changes to address known safety concerns. For the E. Milwaukee Street corridor, the Engineering Division is recommending modifications at the E Centerway/N Garfield Avenue/E Milwaukee Street intersection to improve safety.

The 2022 City of Janesville Road Safety Plan lists the E Milwaukee Street/N Garfield Avenue intersection as having the highest crash rate across the City. The Engineering Division has evaluated options for improving safety and implemented various strategies to address this safety concern. However, in its current configuration, there are limited ways to reduce conflicts and improve safety. With the E. Milwaukee Street project being a complete reconstruction, it provides the opportunity to consider intersection alternatives and roadway realignments that will reduce conflict points and improve safety. Two alternatives were developed, which consist of the following:

- Alternative No. 1: Realign E Milwaukee St.(east of N Garfield Ave.) to E Centerway, as depicted on Attachment No. 1
- Alternative No. 2: Realign E Centerway (east of N Garfield Ave) to E Milwaukee St., as depicted on Attachment No. 2

The recommendation is to realign the intersection as shown in Alternative No. 1 and to convert the intersection of E Centerway and N Garfield Avenue to all-way stop control for the following reasons:

- The intersection modifications will improve safety by reducing conflict points, confusion, and the potential for crashes.
- Alternative No. 1 will accommodate all truck turning movements.
- Alternative No. 1 offers the most effective and efficient traffic movements, compared to Alternative No. 2

Background

The existing intersection has unique geometry and unusual traffic control due to the closely spaced intersections on Garfield Avenue at E Centerway and E Milwaukee Street (see Figure 1). In 2018, a raised island was installed on E Centerway to guide traffic traveling eastbound to E Milwaukee St. The intent was to slow traffic down, reduce the skew of the approach to turn onto E Milwaukee Street, and reinforce the requirement for drivers to stop.

With the current two-way stop control on E Centerway at N Garfield Ave and the two-way stop control on N Garfield at E Milwaukee, drivers on E Centerway are evaluating gaps in both directions on N Garfield Ave. The stop condition for northbound traffic on N Garfield Ave at E Milwaukee Street creates uncertainty for drivers on E Centerway when judging whether it is safe to proceed. Additionally, for northbound traffic on N Garfield Ave, the proximity of the E Centerway intersection may distract drivers from focusing on westbound traffic on E Milwaukee Street. This may contribute to the northbound and westbound angle crashes at the N Garfield Ave and E Milwaukee Street intersection.

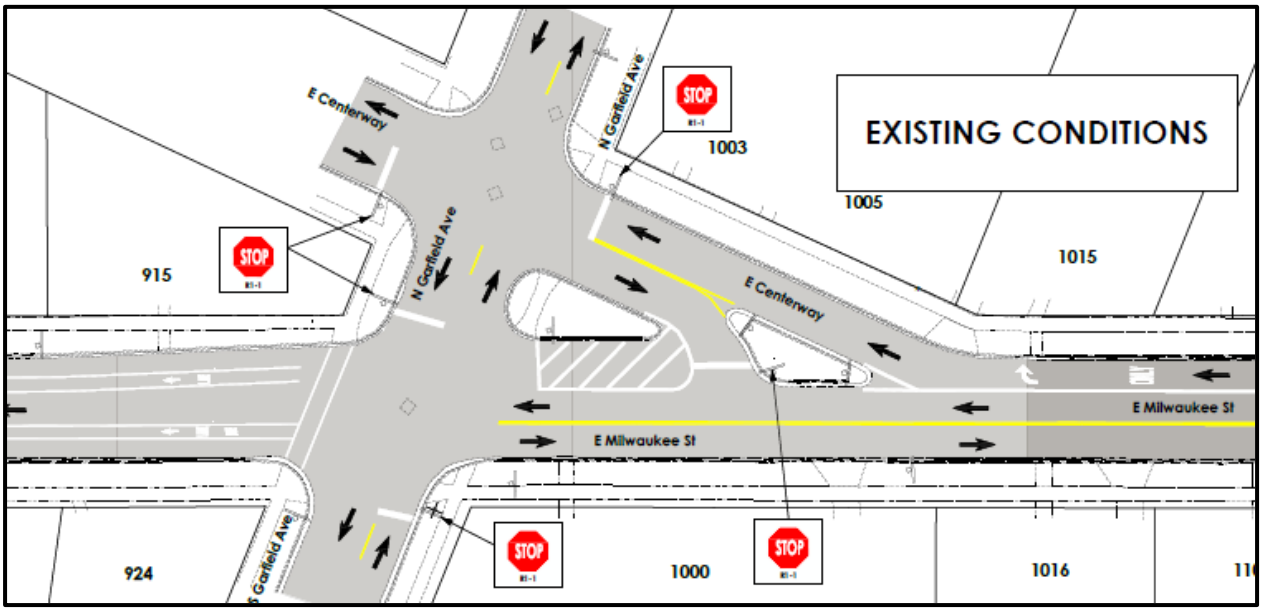


Figure 1. Existing Condition of the E Centerway/N Garfield Ave/E Milwaukee St intersection

In 2022, a City-wide Road Safety Plan was prepared, which reviewed crashes at all intersections throughout the City. Based on a five-year summary of crash data from 2016 to 2020, the local intersection of Garfield Avenue and E Milwaukee Street was identified as having the highest crash rate in the City of Janesville.

In 2023, the Engineering Division completed a traffic study of the E Centerway/N Garfield Ave/E Milwaukee Street intersection. This included reviewing intersection turning movements (Attachment No. 3), crash history, and existing intersection traffic control. The intersection was evaluated to consider adding All-Way Stop control to reduce the potential for crashes; however, the existing intersection geometry and the close proximity of the intersections did not support the addition of All-Way Stop control. Adding more control would be inefficient in its current configuration because it would require double stops and create queueing through closely spaced intersections. Ideally, the existing geometry should be modified to reduce the number of intersections and conflict points through this complicated intersection. For these reasons, the Engineering Division developed two intersection alternatives to consider as part of the 2025 reconstruction, including roadway realignments and traffic control changes.

Alternative Analysis

The intersection alignment alternatives reduce the number of intersections and conflict points and allow for an all-way stop control evaluation. The two alternatives include the following realignments:

- Alternative No. 1: Realign E Milwaukee St (east of N Garfield Ave) to E Centerway, as depicted in Attachment No. 1
- Alternative No. 2: Realign E Centerway (east of N Garfield Ave) to E Milwaukee St, as depicted in Attachment No. 2

Traffic Control Analysis: All-Way Stop Evaluation

The City follows the Manual on Uniform Traffic Control Devices (MUTCD) when evaluating intersection traffic control recommendations. The MUTCD defines five warrants for All-Way Stop Control (AWSC), including crash history, sight distance, and 8-hour volumes.

The All-Way Stop Control warrant that applies to this analysis is Warrant A: Crash Criteria which is met with either of the following conditions for a four-leg intersection:

- Five or more reported crashes in a 12-month period or
- Six or more reported crashes in a 36-month period that were of a type susceptible to correction by the installation of all-way stop control

Table 1 provides an overview of the crashes, and Attachment No. 4 is a collision diagram that maps the crashes.

Table 1. Crash History Overview

Year	Crashes	Injuries	Correctable by AWSC and Realignment
2021	6	2	4
2022	5	1	5
2023	5	1	4
2024 (Jan-Oct 5)	6	0	6
Totals	22	4	19

As shown in Table 1, six crashes from 2024 and 15 from the last 36 months (2022-2024) are susceptible to correction by implementing All-Way Stop control with either intersection alignment alternative. This exceeds both MUTCD criteria of five or more reported crashes in a 12-month period and six or more reported crashes in a 36-month time period that are susceptible to correction with All-Way Stop control.

To understand the operational impacts of the all-way stop condition, the Engineering Division compared the level of service (LOS) and queueing between the existing condition and the Alternative No. 1 realignment. Level of service is defined in terms of seconds of delay that a vehicle experiences at an intersection. Attachment No. 5 summarizes LOS for unsignalized intersections and provides the LOS and queueing results of the existing condition and Alternative No. 1.

The Engineering Division recommends implementing all-way stop control with both intersection alternatives for the following reasons:

- Both alternatives meet All-Way Stop Control Warrant A: Crash Criteria as outlined in Section 2b.13 of the MUTCD, 11th Edition
- The operations are acceptable with all-way stop control with all movements operating at LOS C or better.

Alignment Analysis

The following provides an overview of the advantages and disadvantages of each intersection alignment alternative. It assumes the addition of all-way stop control at the four-legged intersection within each alternative.

Alternative No. 1: Realign E Milwaukee Street to E Centerway

Alternative No. 1 involves removing the free-flow movement on E Milwaukee St. and redirecting all traffic through the intersection of E Centerway and N Garfield Ave. As stated above, the intersection would be controlled by all-way stop control. Westbound traffic on E Milwaukee St. would stop at N Garfield Ave., turn left, and then make a free-flow right turn onto E Milwaukee St. to resume westbound travel. The proposed design is shown in Figure 2 and Attachment No. 1, and the redirected turning movements are shown in Attachment No. 6.

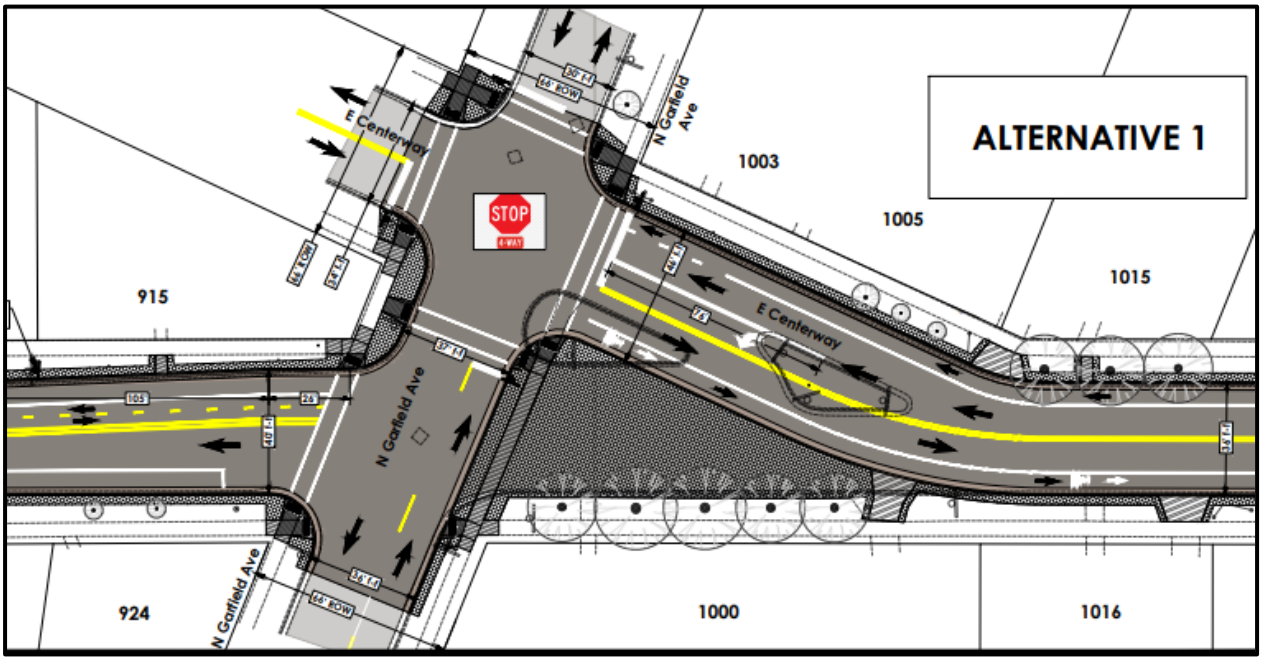


Figure 2. Alternative No. 1 Intersection Realignment

Alternative No. 1 offers the following advantages:

- All traffic enters one all-way stop-controlled intersection,
- Removes 18 points of conflict,
- Reduces confusion to the traveling public when determining who has the right-of-way and who must yield to oncoming traffic,
- Allows a free flow right turn movement onto E Milwaukee Street with minimal motor vehicle conflict.
    - The traffic volume of the northbound to westbound left turn from N Garfield Ave. to E Milwaukee St. is very low in the peak hour. This means minimal conflict between the southbound to westbound right turn movement and the northbound to westbound left turn movement to proceed west on E Milwaukee St.
- The west leg of E Milwaukee St. is a one-way street in the westbound direction for motor vehicle traffic. This means there is no entering traffic from the E Milwaukee St. approach at the T-intersection with N Garfield Ave. Vehicular queuing in the northbound direction on N Garfield Ave. will not impede entering traffic on E Milwaukee St. because there is none.
- All truck turning movements can be accommodated in the proposed design, as shown in Attachment No. 7.
- The level of service (LOS) for the all-way stop condition at the N Garfield Ave. and E Centerway intersection is projected to be LOS B, with an average overall delay of 13.1

seconds per vehicle (spv) in the AM peak hour and 10.8 spv in the PM peak hour. See Attachment No. 5 for LOS and queueing data for all movements.

- Police, Fire, Transit, and Operations agree that the proposed design will improve safety without impeding operations. Operations staff also provided feedback that removing the median island will improve plowing operations. The Fire Department commented that it will improve access for fire truck response and improve emergency response times.

Alternative No. 1 has the following disadvantages:

- Stop control interrupts the free-flow movement on E Milwaukee St, and westbound traffic would be required to make a left-turn/right-turn jog through the realigned intersections to get back onto E Milwaukee St.
- During the AM peak hour, vehicles are projected to queue approximately 80 feet (~4 vehicles) in the westbound left turn lane. The intersection design will accommodate that queue length without blocking the through/right turn lane.
- The additional delay and realignment may redirect traffic and/or impact drivers' routes to the downtown area.

<u>Alternative No. 2: Realign E Centerway to E Milwaukee Street</u>

Alternative No. 2 involves removing E Centerway, east of N Garfield Ave., and redirecting all traffic through the intersection of E Milwaukee St. and N Garfield Ave. The intersection of E Milwaukee and N Garfield would be controlled with all-way stop control (AWSC). Westbound traffic wanting to continue onto E Centerway would stop at N Garfield Ave, turn right, and turn left onto E Centerway to resume westbound travel. Eastbound traffic on E Centerway would stop at N Garfield Ave., turn right, stop at E. Milwaukee St, then turn left to resume eastbound travel. The proposed design is shown in Figure 3 and Attachment No. 2, and the redirected turning movements are shown in Attachment No. 8.

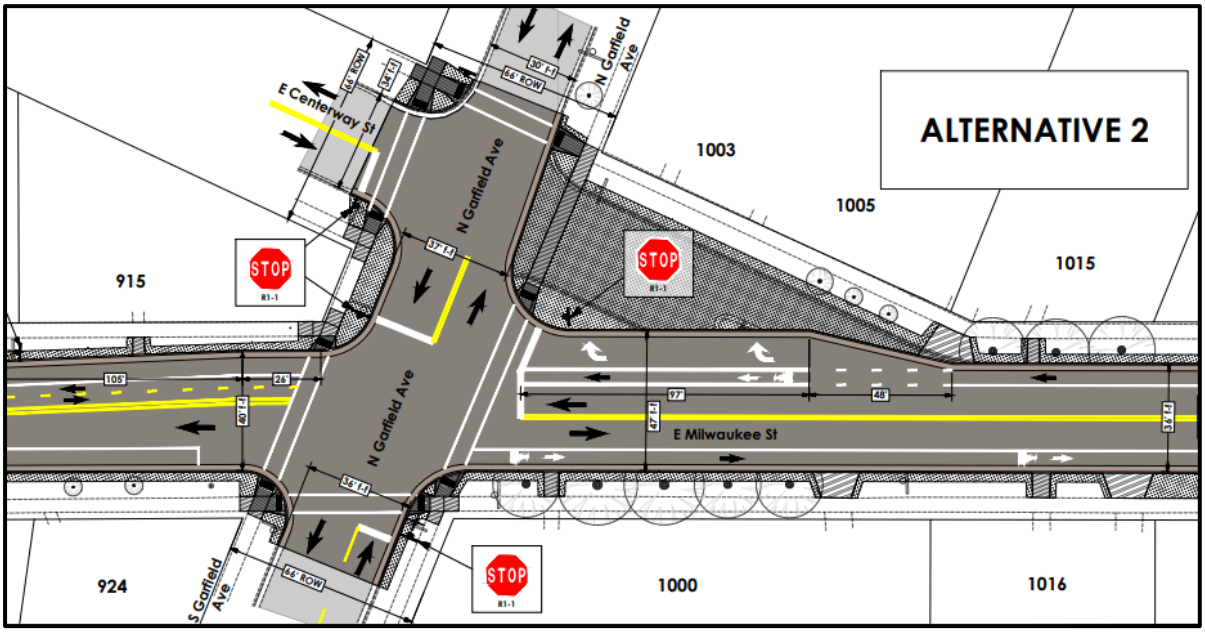


Figure 3. Alternative No. 2 Intersection Realignment

Alternative No. 2 offers the following advantages:

- All traffic enters one all-way-stop controlled intersection,
- Removes 27 points of conflict,
- Reduces confusion to the traveling public when determining who has the right-of-way and who must yield to oncoming traffic,
- Does not realign E Milwaukee Street,
- The level of service (LOS) for the all-way stop condition at the N Garfield Ave. and E Milwaukee St. intersection is expected to be similar to the LOS for Alternative No. 1, which is LOS B (traffic modeling was not completed for this alternative).

Alternative No. 2 has the following disadvantages:

- The E Centerway approach, on the west leg of the intersection, consists of 2-way traffic, which will increase delay and decrease the LOS at the N Garfield Ave and E Centerway intersection:
    - Southbound vehicles on N Garfield Ave may queue through the intersection with E Centerway, creating a challenge for eastbound traffic on E Centerway to turn right onto N Garfield Ave and for westbound traffic to turn left onto E Centerway (for the redirected traffic from E Milwaukee St). There is only enough room to store one vehicle in the southbound direction on N Garfield Ave at the E Milwaukee Street intersection before blocking the intersection with E Centerway.
    - Eastbound traffic on E Centerway would experience a “double-stop” to proceed east. They would stop at N Garfield Ave and again at E Milwaukee St before turning left.
- The redirection of E Centerway traffic does not allow a free-flow movement to get back to E Centerway without vehicle conflict. It requires a left turn for the westbound direction.
- Alternative No. 2 does not accommodate truck turning movements between E Centerway and E Milwaukee St, via N Garfield Ave, without crossing over into oncoming traffic or having issues with curb lines. Attachment No. 9 illustrates the truck turning movements through the intersection.
- Stop control interrupts the free-flow movement on E Milwaukee St., and traffic on E Centerway will be required to make a left-turn/right-turn jog (or vice versa) through the realigned intersections to get back onto E Centerway.
- During the AM peak hour, vehicles are projected to queue approximately 80 feet (~4 vehicles) in the westbound through lane. The intersection design will accommodate that queue length without blocking the right-turn lane.
- The additional delay and realignment may redirect traffic and/or impact drivers' routes to the downtown area.

Recommendation

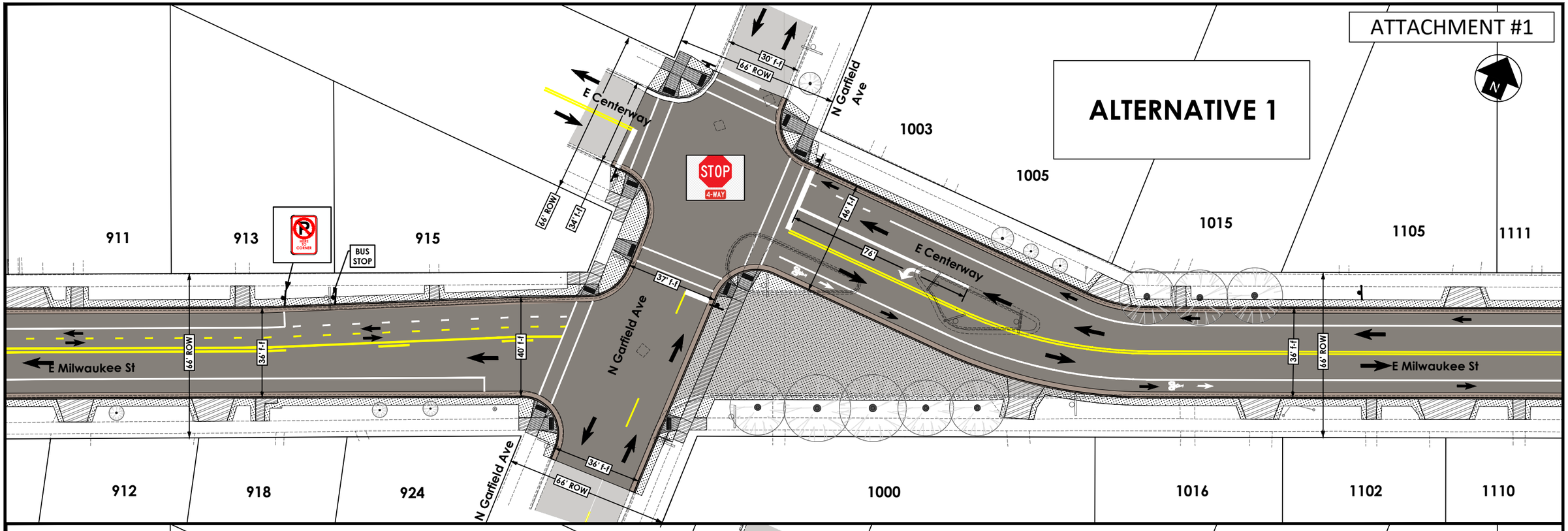
The primary advantage of Alternative No. 1 is the lack of inbound traffic on the west leg of E. Milwaukee Street and the free-flow right-turn movement that allows westbound Milwaukee Street traffic to return to the corridor with minimal conflict. This advantage makes Alternative No. 1 the most effective and efficient way to redirect traffic to a single intersection. Additionally, E Centerway and E Milwaukee Street are designated truck routes, and Alternative No. 1 can accommodate all truck-turning movements.

The recommendation is to realign the intersection as shown in Alternative No. 1 and to convert the intersection of E Centerway and N Garfield Avenue to all-way stop control for the following reasons:

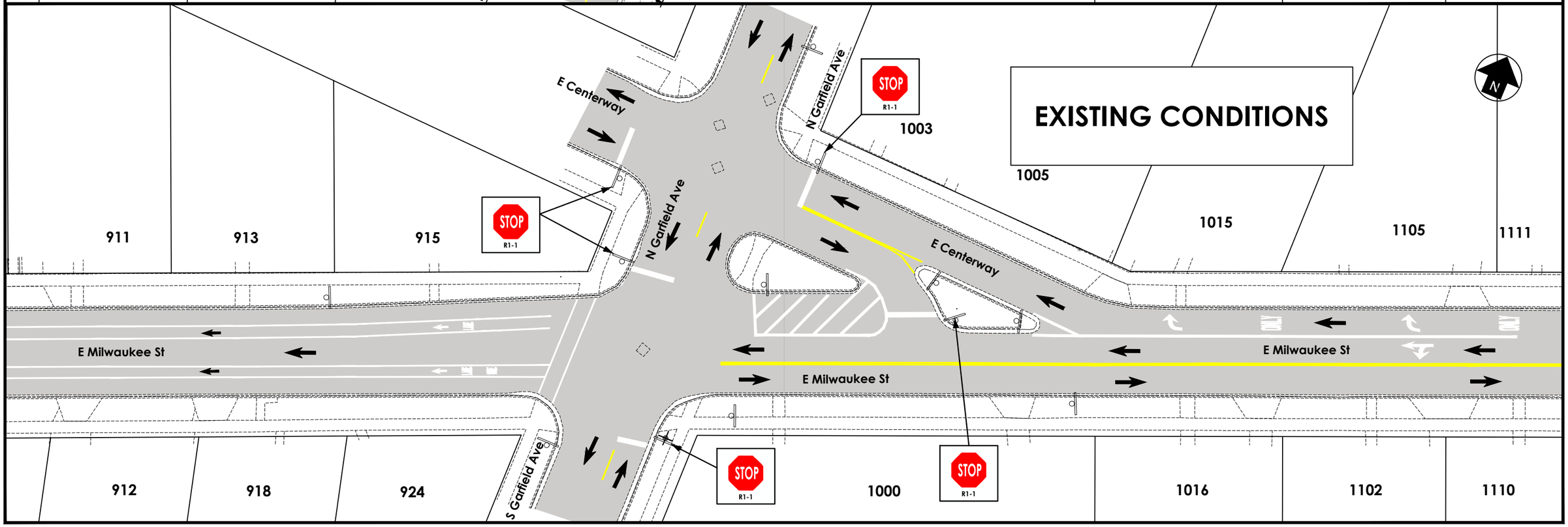
- The intersection modifications will improve safety by reducing conflict points, confusion, and the potential for crashes.
- Alternative No. 1 will accommodate all truck turning movements.
- Alternative No. 1 offers the most effective and efficient traffic movements, compared to Alternative No. 2, due to the free-flow right-turn movement and the lack of inbound traffic on the west leg of E. Milwaukee St.

ATTACHMENT #1

ALTERNATIVE 1

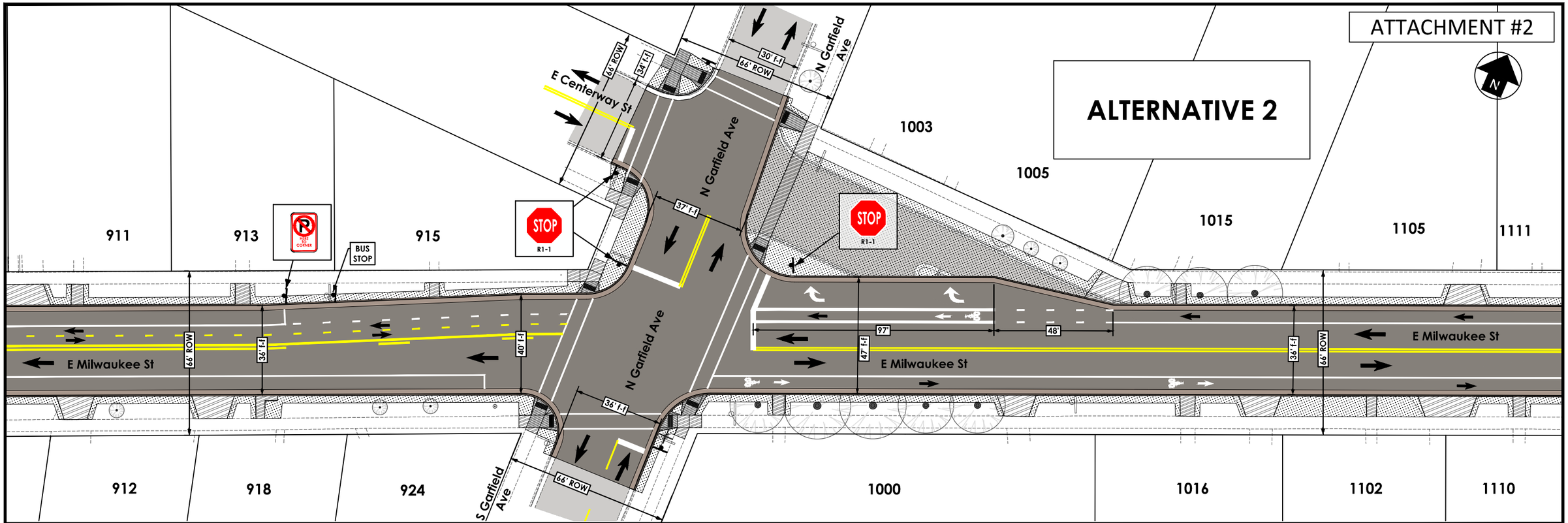


EXISTING CONDITIONS

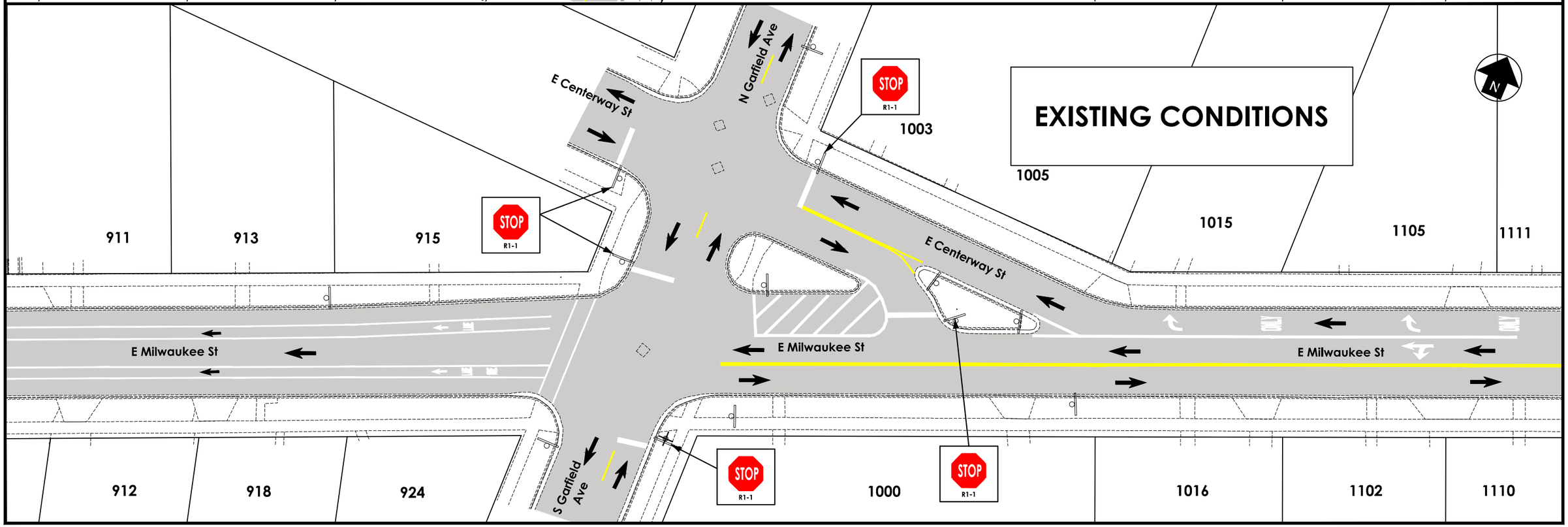


ATTACHMENT #2

ALTERNATIVE 2

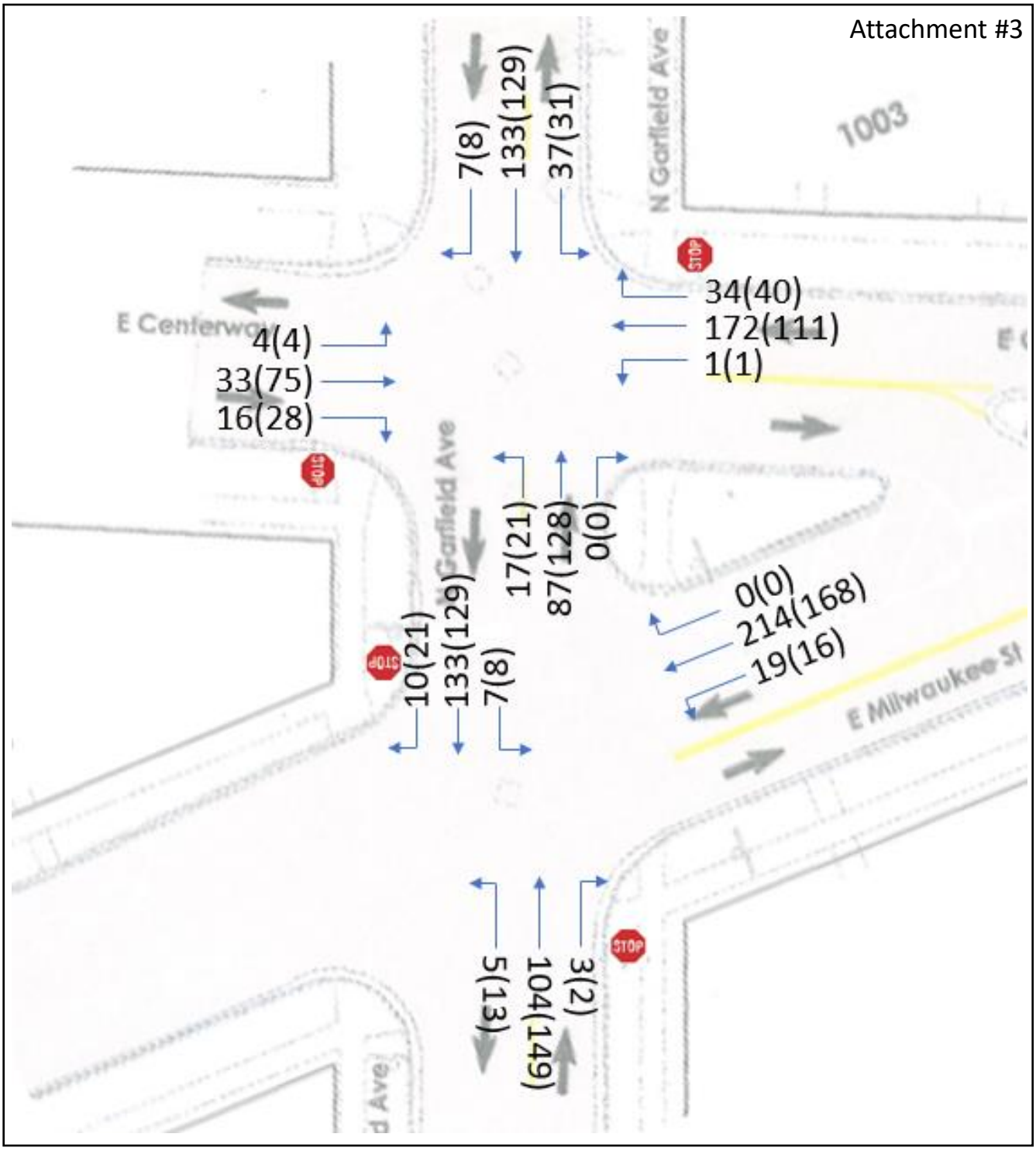


EXISTING CONDITIONS



Street Rehabilitation 2025 2025-6
Improvement Plan

Attachment #3



PEAK HOUR TURNING MOVEMENTS

E CENTERWAY & N GARFIELD AVENUE

&

N GARFIELD AVENUE & E MILWAUKEE STREET

EXISTING CONDITION

LEGEND

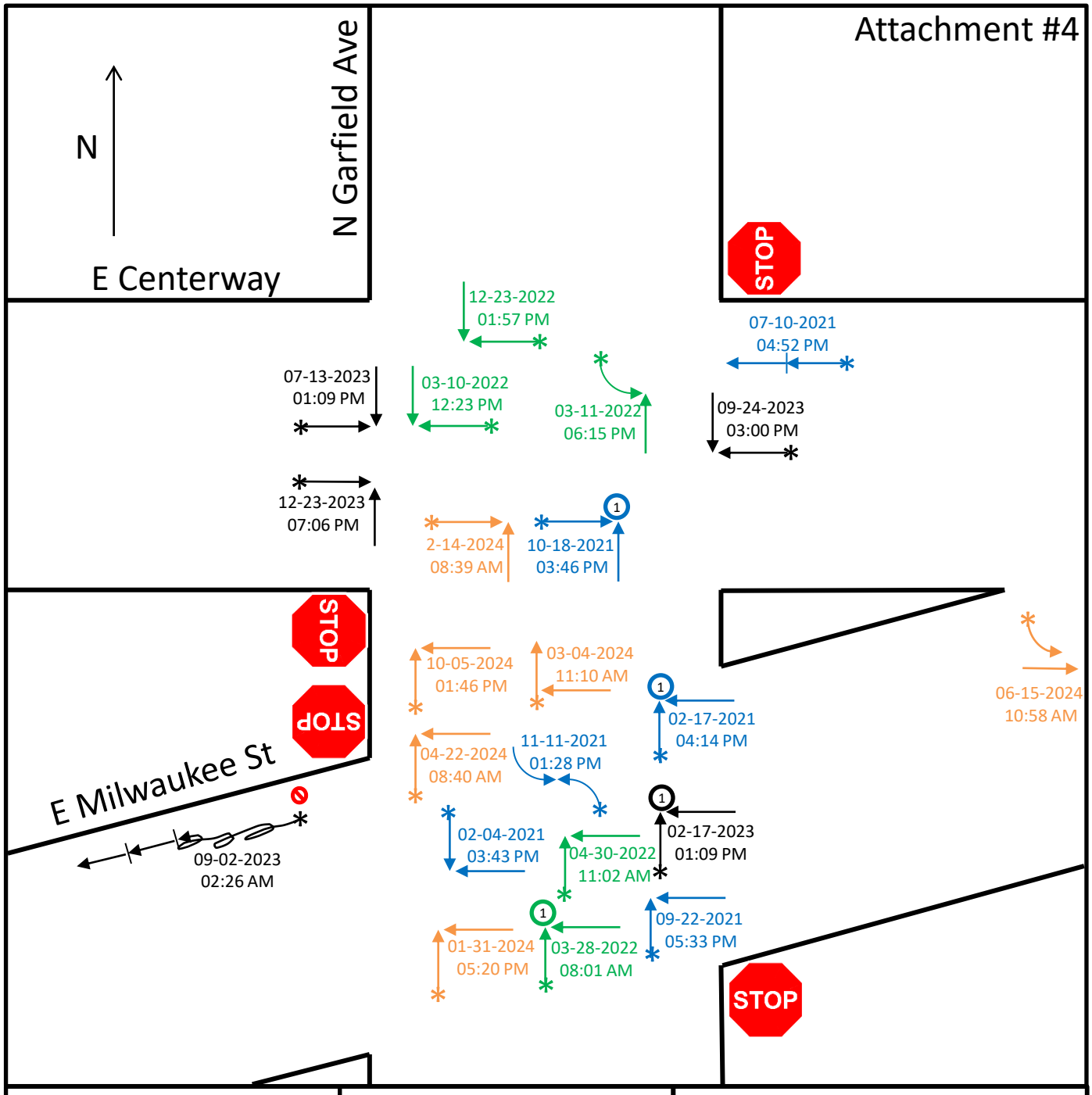
STOP All-Way Stop STOP Isolated Stops

XX AM Peak – 7:30am-8:30am

(XX) PM Peak – 3:00pm-4:00pm

ATTACHMENT #3	CITY OF JANESVILLE ENGINEERING DIVISION

Attachment #4



Symbols	Types of Collisions
Intoxicated Driver	Rear End
Moving Vehicle	Head On
Backing Vehicle	Side Swipe
Non-Involved Vehicle	Out Of Control
Pedestrian	Left Turn
Parked Vehicle	Right Angle
Fixed Object	
Fatal Crash	
Injury Crash	
Vehicle at Fault	

Intersection:
Centerway/Garfield/Milwaukee
Period: 01/01/2021
From: 10/05/2024

Crash Year

2021	2023
2022	2024

Attachment #5

Garfield Avenue with Centerway Street and Milwaukee Street Traffic Analysis

LOS & Queue Results

July 10, 2024

Table 1: Level of Service Descriptions

LOS	Control Delay/Vehicle (sec/veh)	Unsignalized Intersection - Traffic Flow Description	Relative Delay
A	≤10	Free-flow traffic operations at avearge travel speeds. Vehicles completely unimpeded in ability to maneuver.	Short Delays
B	> 10 - 15	Reasonably unimpeded traffic operations at average travel speeds. Vehicle maneuverability slightly restricted. Low traffic delays.	
C	> 15 - 25	Stable traffic operations. Lane changes becoming more restricted. Travel speeds reduced to half of average free flow travel speeds. Longer intersection delays.	
D	> 25 - 35	Small increases in traffic flow can cause increased delays. Delays likely attributable to increased traffic and less acceptable gaps in traffic at two-way stop intersections.	Moderate Delays
E	> 35 - 50	Significant delays. Travel speeds reduced to one-third of average free flow travel speed.	
F	> 50	Extremely low speeds. Intersection congestion. Long delays. Extensive traffic queues at intersections.	Long Delays

Source: Highway Capacity Manual, Transportation Research Board, Washington, D.C., 2010

Table 2
Year 2024 Existing Traffic Peak Hour Operating Conditions
With Existing Geometrics and Traffic Control

Intersection	Peak Hour	Metric	Level of Service (LOS) per Movement by Approach												I/S LOS & Delay
			Eastbound			Westbound			Northbound			Southbound			
			↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙	
Node 100: Garfield Ave. & Centerway St. *Two-Way Stop Control*		*Lanes->*	*1*			*1*			*1*			*1*			
	AM	LOS	B			C			A			A			A
		Delay	13.1			18.9			7.6			7.5			9.3
		Queue	25'			75'			25'			25'			
	PM	LOS	B			B			A			A			A
		Delay	13			13.8			7.6			7.5			6.7
		Queue	25'			30'			25'			25'			
Node 200: Garfield Ave. & Milwaukee St. [1] *One-Way Stop Control*		*Lanes->*	-			*1*			*1*			*1*			
	AM	LOS	-			A			B			B			A
		Delay	-			0.7			13.1			14			7.5
		Queue	-			0'			25'			35'			
	PM	LOS	-			A			B			B			A
		Delay	-			0.7			12.5			12.1			8.1
		Queue	-			0'			30'			25'			

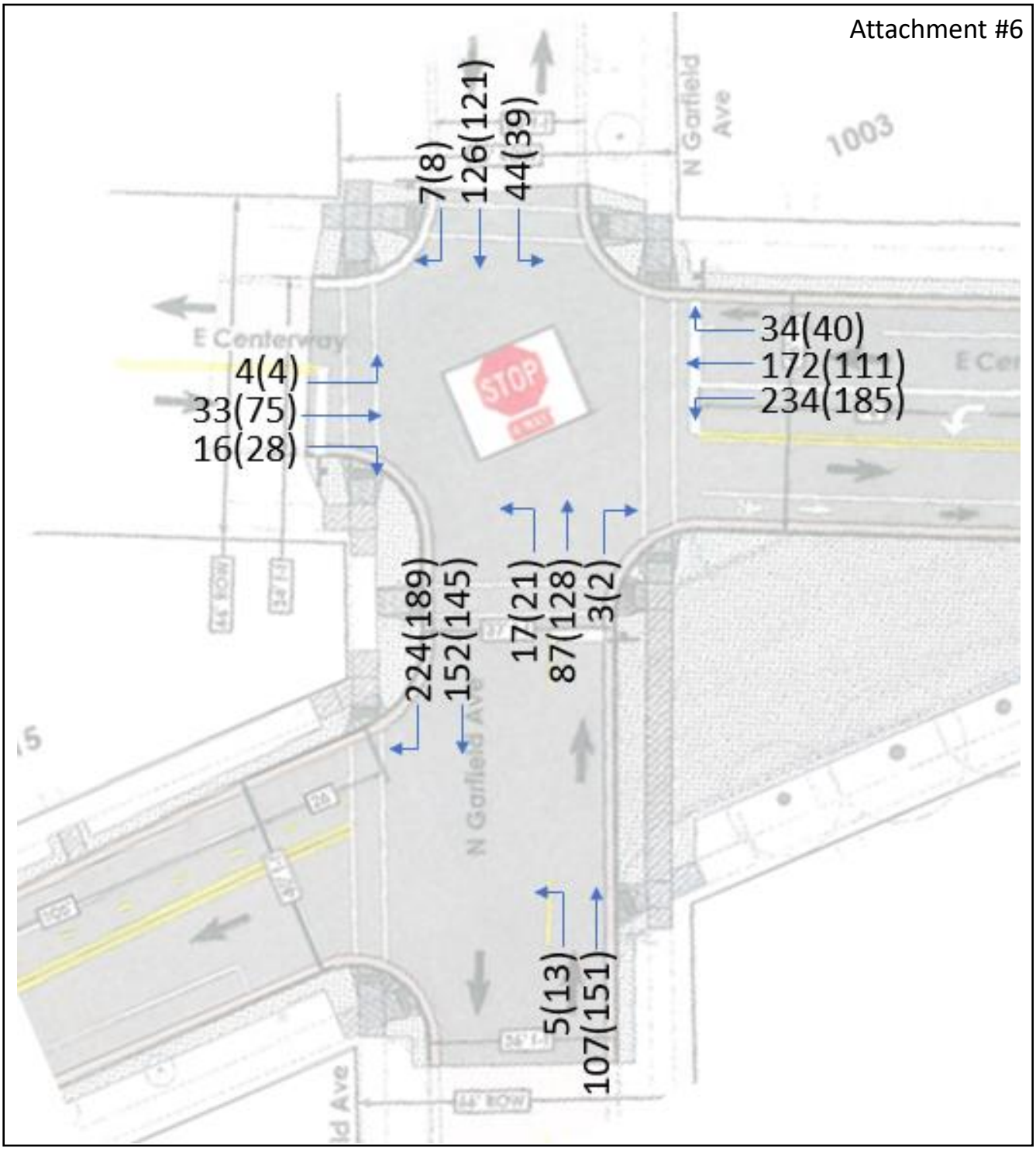
(-) indicates a movement that is prohibited or does not exist; (*) indicates a freeflow movement.
Delay is reported in seconds. Queue is the maximum of the 50th & 95th percentile queue, measured in feet.
1) Delay is reported from HCM 2000 since HCM 6 does not report this type of lane configuration (4-Leg with one-way street approach).

Table 3
Year 2024 Redirected Traffic Peak Hour Operating Conditions
for Alt. 1 Geometry and Traffic Control

Intersection	Peak Hour	Metric	Level of Service (LOS) per Movement by Approach												I/S LOS & Delay
			Eastbound			Westbound			Northbound			Southbound			
			↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙	
Node 100: Garfield Ave. & Centerway St. *All-Way Stop Control*		*Lanes->*	*1*			*1*	*1*		*1*			*1*			
	AM	LOS	A			C	B		B			B			B
		Delay	9.7			16	12.5		10.9			12.4			13.1
		Queue	25'			80'	55'		25'			45'			
	PM	LOS	A			B	B		B			B			B
		Delay	9.7			12.3	10.1		10.5			10.7			10.8
		Queue	25'			40'	25'		25'			30'			
Node 200: Garfield Ave. & Milwaukee St. [1] *One-Way Stop Control*		*Lanes->*	-			-			*1*			*1*			
	AM	LOS	-			-			A			*			A
		Delay	-			-			0.4			*			0.1
		Queue	-			-			0'			*			
	PM	LOS	-			-			A			*			A
		Delay	-			-			0.7			*			0.2
		Queue	-			-			25'			*			

(-) indicates a movement that is prohibited or does not exist; (*) indicates a freeflow movement.
Delay is reported in seconds. Queue is the maximum of the 50th & 95th percentile queue, measured in feet.
1) Delay is reported from HCM 2000 since HCM 6 does not report this type of lane configuration.

Attachment #6



PEAK HOUR TURNING MOVEMENTS

E CENTERWAY & N GARFIELD AVENUE

&

N GARFIELD AVENUE & E MILWAUKEE STREET

LEGEND

All-Way Stop Isolated Stops

XX AM Peak – 7:30am-8:30am

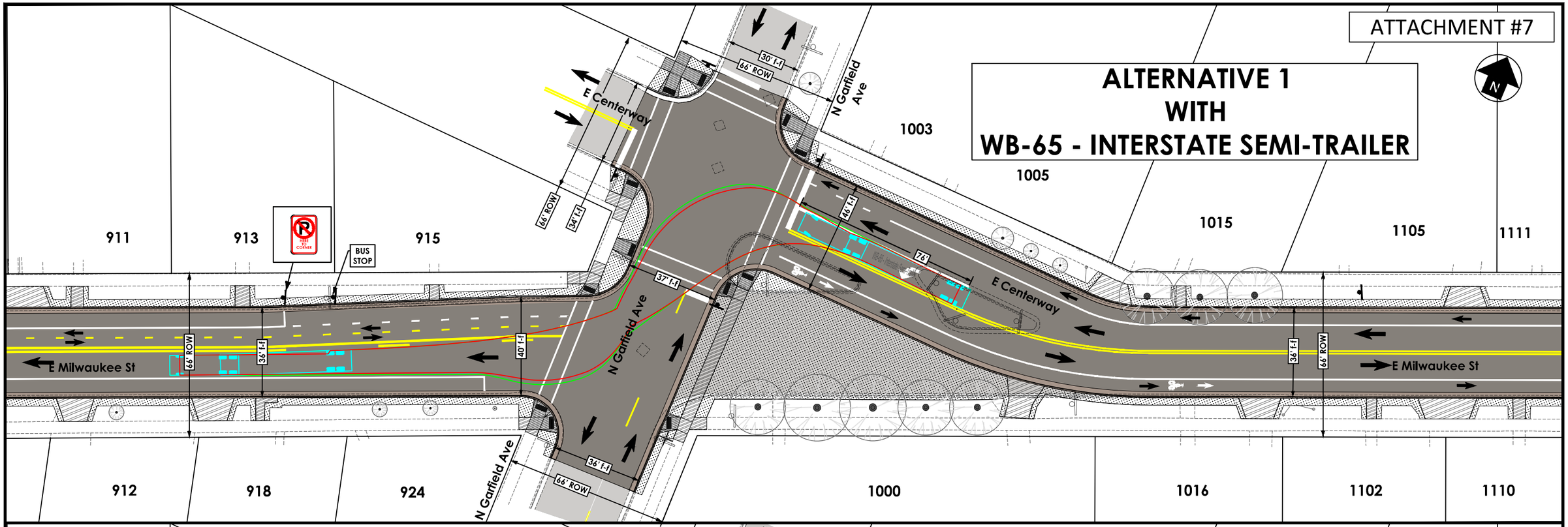
(XX) PM Peak – 3:00pm-4:00pm

ALTERNATIVE 1

ATTACHMENT #6	CITY OF JANESVILLE ENGINEERING DIVISION

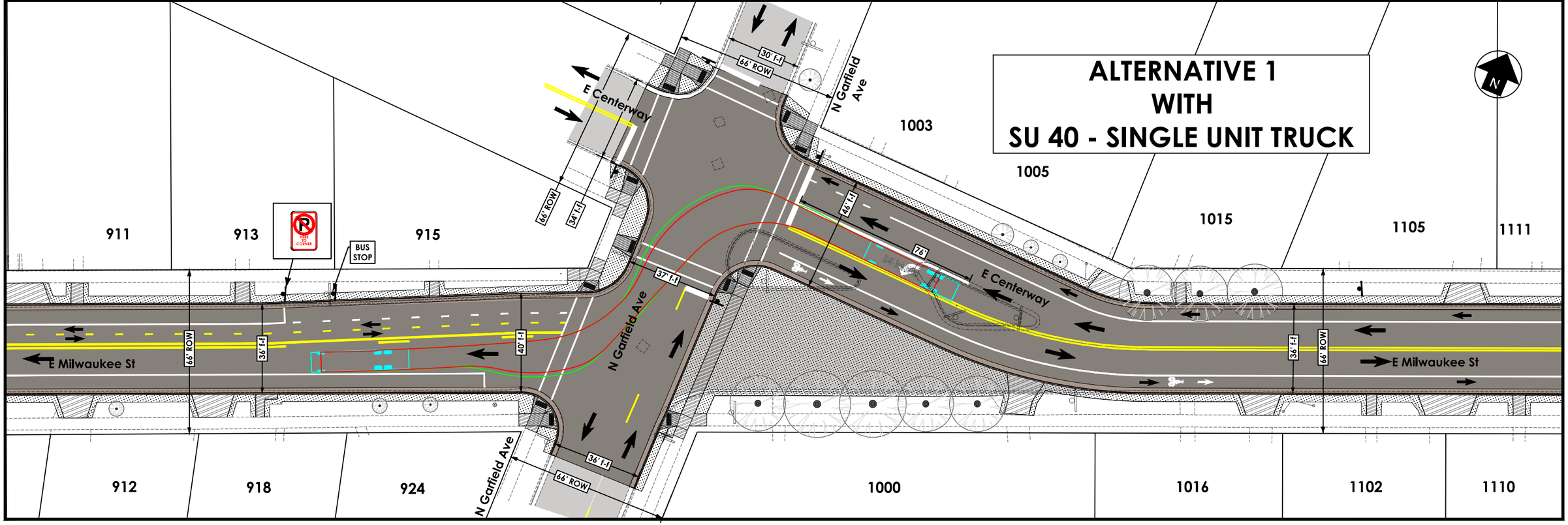
ATTACHMENT #7

ALTERNATIVE 1
WITH
WB-65 - INTERSTATE SEMI-TRAILER



ATTACHMENT #7

ALTERNATIVE 1
WITH
SU 40 - SINGLE UNIT TRUCK



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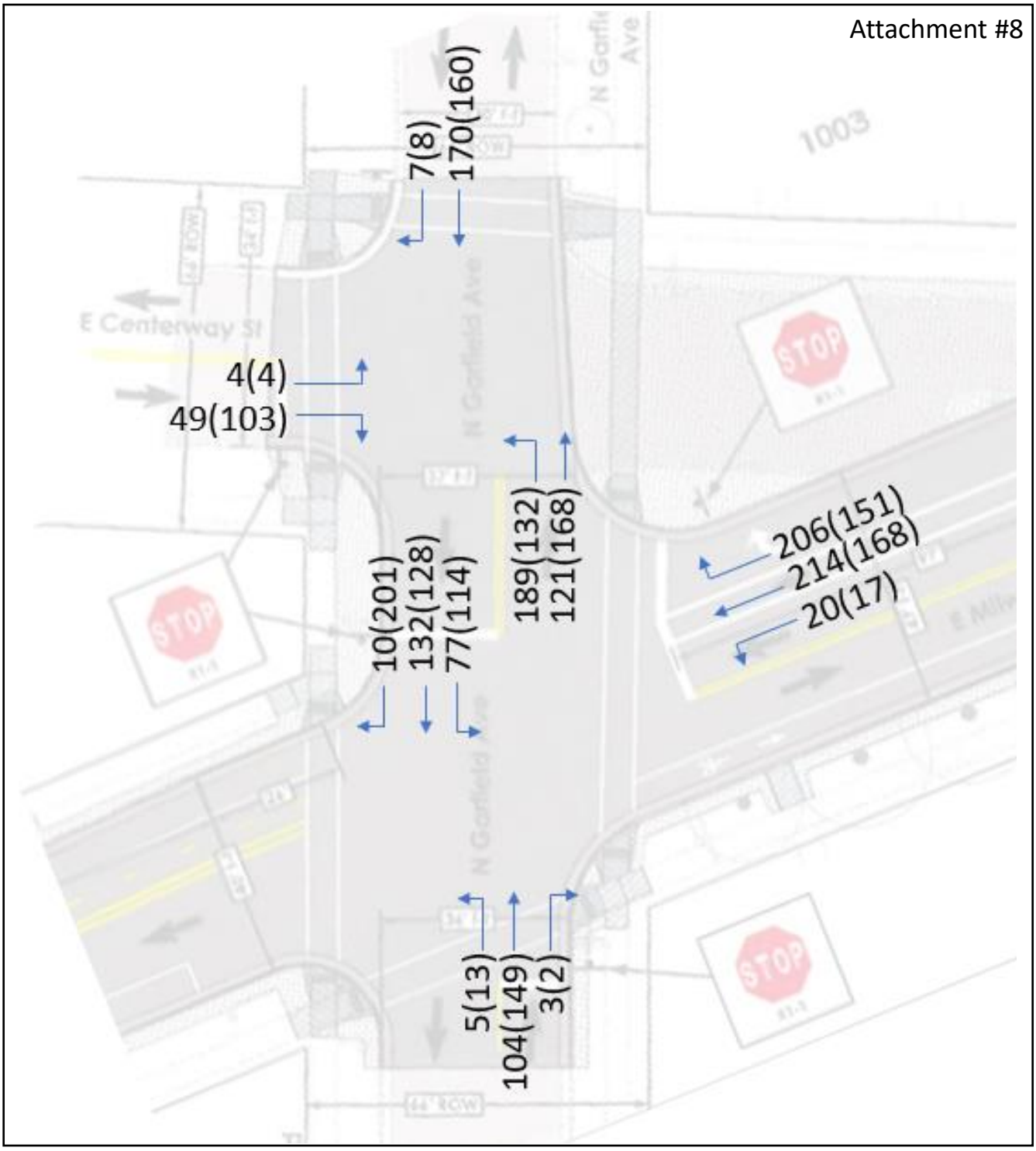


PEAK HOUR TURNING MOVEMENTS

E CENTERWAY & N GARFIELD AVENUE

&

N GARFIELD AVENUE & E MILWAUKEE STREET

LEGEND

All-Way Stop Isolated Stops

XX AM Peak – 7:30am-8:30am

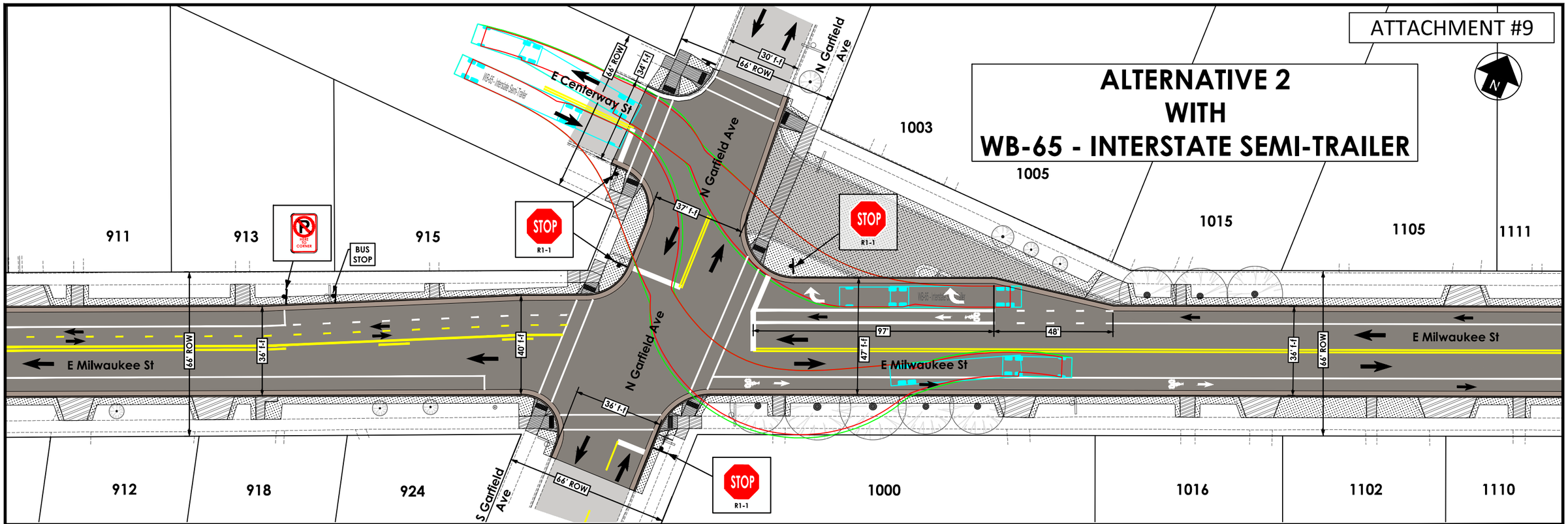
(XX) PM Peak – 3:00pm-4:00pm

ALTERNATIVE 2

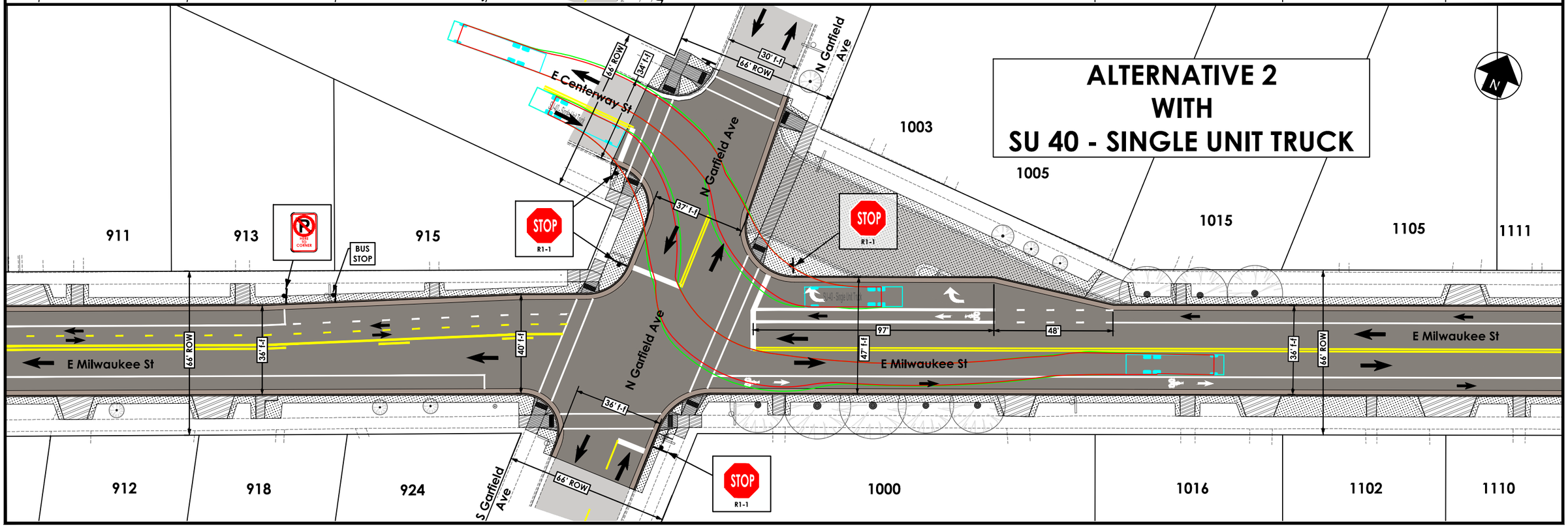
ATTACHMENT #8	CITY OF JANESVILLE ENGINEERING DIVISION

ATTACHMENT #9

ALTERNATIVE 2
WITH
WB-65 - INTERSTATE SEMI-TRAILER



ALTERNATIVE 2
WITH
SU 40 - SINGLE UNIT TRUCK



Street Rehabilitation 2025 2025-6
Improvement Plan