



Date: February 28, 2014

Technical Memorandum

To: Jeff Chase, P.E.
City of Brookfield Engineering Department

From: Michael May, P.E., PTOE

cc List:

Subject: Wisconsin Avenue Extension
Main Street to Pilgrim Parkway
Brookfield, Wisconsin

PART A – INTRODUCTION

The City of Brookfield is planning for the future extension of Wisconsin Avenue from its current terminus at Main Street to the east at Pilgrim Parkway. The Wisconsin Avenue extension will serve as a relief route to Bluemound Road, a major parallel arterial.

A traffic analysis report was prepared in March of 2011 to determine recommended improvements for design year operations at the Pilgrim Parkway intersection with the Wisconsin Avenue Extension, to compare seven scenarios prepared by the City of Brookfield for the Pilgrim Parkway corridor to ensure safe and efficient traffic flow with and without the extension, and to ensure the Pilgrim Parkway corridor operates well.

The March of 2011 identified that those improvement scenarios that maintained a traffic signal and full access at the existing Pilgrim Parkway & Watertown Plank Road intersection function poorly due to long traffic queues and short intersection spacing at Pilgrim Parkway/Moorland Road & USH 18.

At the request of the City of Brookfield, this technical memorandum has been performed to reevaluate impacts of the working improvement scenarios identified in the March of 2011 report due to recent changes to adjacent land use. The reevaluation includes the use of updated traffic counts and reflects revisions that have since occurred to industry manuals and standards (MUTCD, HCM, etc.) and state of the practice. Trips for the Wisconsin Avenue extension were reassigned based on SEWRPC modeling for the IH 94 interchange feasibility study and Calhoun South Neighborhood Land Use & Transportation Plan. Revised improvements for the working improvement scenarios are identified.

TADI

PART B – STUDY OVERVIEW

B1. Study Area

The study area intersections include the following, as shown in Exhibit A:

- Pilgrim Road/Moorland Road & Bluemound Road (north leg);
- Pilgrim Road & Watertown Plank Road/Office Access
- Pilgrim Road & Ace Hardware/Office Access

Exhibit B shows the existing transportation detail for these. More specifically, the exhibit illustrates existing intersection lane configurations, intersection traffic controls, posted speed limits, and approximate intersection spacing.

B2. Working Scenarios

The City of Brookfield had previously identified seven potential scenarios for the Wisconsin Avenue extension. The following is a list of the scenarios:

- *Scenario 1:* Existing conditions without the Wisconsin Avenue extension (“no extension” scenario).
- *Scenario 2:* Extension of Wisconsin Avenue to Pilgrim Parkway opposite the Ace Hardware access. Operate with two-way stop control.
- *Scenario 3:* Extension of Wisconsin Avenue to Pilgrim Parkway opposite the Ace Hardware access. Operate with traffic signal control.
- *Scenario 4A:* Extension of Wisconsin Avenue to Pilgrim Parkway opposite the Ace Hardware access. Operate with traffic signal control but remove traffic signal at Watertown Plank Road.
- *Scenario 4B:* Extension of Wisconsin Avenue to Pilgrim Parkway opposite the Ace Hardware access. Operate with roundabout control but remove traffic signal at Watertown Plank Road.
- *Scenario 5A:* Extension of Wisconsin Avenue to Pilgrim Parkway and realignment of Watertown Plank Road across from Wisconsin Avenue to create a four-leg intersection. Operate with traffic signal control.
- *Scenario 5B:* Extension of Wisconsin Avenue to Pilgrim Parkway and realignment of Watertown Plank Road across from Wisconsin Avenue to create a four-leg intersection. Operate with roundabout control.

Scenarios 1, 2 and 3, which maintained a traffic signal and full access at the existing Pilgrim Parkway & Watertown Plank Road intersection, were shown to function poorly due to long traffic queues and short intersection spacing at Pilgrim Parkway/Moorland Road & USH 18.

Scenarios 4A & 4B and scenarios 5A & 5B were retained.

B3. Turning Movement Volumes

The Wisconsin Department of Transportation (WisDOT) conducted weekday turning movement traffic counts at Pilgrim Parkway/Moorland Road & Bluemound Road in June of 2013. TADI conducted weekday turning movement traffic counts at Pilgrim Parkway & Watertown Plank Road in mid-November of 2012. The counts at the Pilgrim Parkway & Ace Hardware/Office Access intersection are from the original March of 2011 traffic study.

The Year 2035 forecasted traffic volumes under no build (no Wisconsin Avenue extension) are shown in Exhibit C. Volumes at the intersections were balanced higher based on the Pilgrim Parkway/Moorland Road & Bluemound Road intersection.

The Year 2035 forecasted traffic volumes under Scenario 1 (with Wisconsin Avenue extension) are shown in Exhibit D. Traffic on the Wisconsin Avenue extension was estimated based on the traffic that is expected to divert from Bluemound Road onto Wisconsin Avenue.

The Year 2035 forecasted traffic volumes under Scenario 4 (with Wisconsin Avenue extension, with restrictions at Watertown Plank Road) are shown in Exhibit E.

The Year 2035 forecasted traffic volumes under Scenario 5 (with Wisconsin Avenue extension, with relocated Watertown Plank Road) are shown in Exhibit F.

PART C – SCENARIOS 4A & 4B ANALYSIS & RECOMMENDED IMPROVEMENTS

Recall that both Scenarios 4A and 4B include the extension of Wisconsin Avenue to Pilgrim Parkway opposite the Ace Hardware access and removing the traffic signal at the existing Watertown Plank Road/Office Access intersection. Scenario 4A includes traffic signal control at the Wisconsin Avenue Extension/Ace Hardware intersection while Scenario 4B includes roundabout control.

Based on the analysis, it was determined that the following improvements, shown in [Exhibit G](#), are recommended to accommodate the Year 2035 Scenario 4A and 4B traffic volumes. The Scenario 4 peak hour operating conditions are shown in [Exhibit H](#) while the Scenario 4 expected maximum queues are shown in [Exhibit I](#). *Improvements are for jurisdictional consideration and are not legally binding.*

Pilgrim Parkway/Moorland Road & Bluemound Road

- Maximize the storage length of the southbound left-turn and right-turn lanes, noting that the approach storage lengths shown in [Exhibit G](#) are desirable but may not fit due to the close intersection spacing to Watertown Plank Road.

Pilgrim Parkway & Watertown Plank Road/Office Access

- The intersection cannot operate safely or efficiently with full access. Therefore, it is recommended to provide three-quarters (left-in/right-in/right-out) access to Watertown Plank Road and right-in/right-out access to the office parking lot.
- Provide two lanes on the Pilgrim Parkway northbound approach, including one through lane and one shared through/right-turn lane. Consideration may also be given to providing a northbound right-turn lane.

- Provide four lanes on the Pilgrim Parkway southbound approach, including one left-turn lane, two through lanes and one shared through/right-turn lane.
 - *Scenario 4A (Traffic Signal)*: The shared through/right-turn lane is recommended to be continuous to the Wisconsin Avenue Extension/Ace Hardware intersection to accommodate northbound-to-southbound U-turn traffic at the Wisconsin Avenue Extension/Ace Hardware intersection.
 - *Scenario 4B (Roundabout)*: The shared through/right-turn lane is recommended to be at least 200-feet long.
- Restrict Watertown Plank Road to left-in/right-in/right-out only.
 - Westbound traffic destined for the office building on the west side of Pilgrim Parkway may proceed northbound and gain access off of the Wisconsin Avenue Extension or by performing a U-turn.
 - Westbound traffic destined for Bluemound Road or Moorland Road may proceed northbound and perform a U-turn maneuver at the Wisconsin Avenue Extension/Ace Hardware access – OR – may travel west on Wisconsin Avenue to Main Street – OR – may revise their trip by utilizing Terrace Drive or Sunnyslope Road to gain access to Bluemound Road.
- Restrict the office access to right-in/right-out only. Affected motorists may utilize access to the Wisconsin Avenue Extension to gain access to Pilgrim Parkway and Watertown Plank Road.
- Remove the traffic signal control. Install stop signs to control the Watertown Plank Road/Office Access approaches.

Pilgrim Parkway & Wisconsin Avenue Extension/Ace Hardware Access

- *Scenario 4A (Traffic Signal)*:
 - Construct a median along Pilgrim Parkway of sufficient width to accommodate U-turn maneuvers and traffic signal pole placement.
 - Provide three lanes on the Pilgrim Parkway northbound approach, including one left-turn lane, one through lane and one shared through/right-turn lane. North of the intersection, on Pilgrim Parkway, provide a 325-foot minimum tangent of the outside through lane then taper down to one lane. Note that the northbound median-side left-turn lane is expected to accommodate a high volume of U-turn traffic.
 - Provide three lanes on the Pilgrim Parkway southbound approach, including one left-turn lane, one through lane and one shared through/right-turn lane. The shared through/right-turn lane is recommended to be at least 350-feet long.
 - Provide one left-turn lane and one shared/through right-turn lane on the Ace Hardware westbound approach.

- Provide three lanes on the Wisconsin Avenue Extension eastbound approach, including one left-turn lane, one through lane and one right-turn lane. Prohibit eastbound right-turns on red to safely and efficiently accommodate the northbound-to-southbound U-turn movement.
- Install traffic signal control, including northbound protected-permitted left-turn signal heads with flashing yellow arrows. The southbound left-turn movement is recommended to operate with flashing yellow arrows. The signal was assumed to run at half the cycle length of the Bluemound Road corridor (70-seconds AM, 90-seconds PM). The northbound left-turn was modeled as a “leading” phase during the weekday morning peak and a “lagging” phase during the weekday evening peak to best progress traffic along Pilgrim Parkway.
- Consider adaptive signal control as WisDOT improves the Bluemound Road corridor.
- *Scenario 4B (Roundabout):*
 - Construct a two-lane modern roundabout.
 - Provide two lanes, striped as one shared left-turn/through lane and one shared through/right-turn lane, on the Pilgrim Parkway northbound approach. North of the intersection, provide a 200-foot minimum tangent of the outside through lane then taper down to one lane. Note that the central island-side lane must be designed to accommodate a high volume of U-turn traffic.
 - Provide two lanes, striped as one shared left-turn/through lane and one shared through/right-turn lane, on the Pilgrim Parkway southbound approach. The shared through/right-turn lane is recommended to be at least 100-feet long.
 - Provide one shared left-turn/through/right-turn lane on the Ace Hardware westbound approach.
 - Provide one shared left-turn/through lane and one right-turn lane on the Wisconsin Avenue Extension approach.
 - Consider installing queue detection in the southbound travel lanes between the Wisconsin Avenue Extension and Bluemound Road to minimize the chance of southbound traffic at the Bluemound Road signal from spilling back into the roundabout. Note that this is not expected to occur based on the modeling but can be considered as an operational measure to ensure the roundabout does not become gridlocked. This improvement will require WisDOT approval, and it is unlikely WisDOT will allow the green time on Bluemound Road to be reduced as a result of the queue detection.

The Pilgrim Parkway/Moorland Road & Bluemound Road intersection is expected to operate with undesirable LOS E/F conditions with queues in the peak hours that extend through the Watertown Plank Road intersection. With three-quarters access and the traffic signal removal at the existing Watertown Plank Road intersection, acceptable storage and room for queue spillback from the Bluemound Road intersection is expected to be accommodated with this scenario,

making for safer conditions than currently exist. Additionally, the Pilgrim Road intersections with Watertown Plank Road and Wisconsin Avenue are expected to operate desirably at LOS D or better conditions.

PART D – SCENARIOS 5A & 5B ANALYSIS & RECOMMENDED IMPROVEMENTS

Recall that both Scenarios 5A and 5B include the extension of Wisconsin Avenue to Pilgrim Parkway and realignment of Watertown Plank Road across from Wisconsin Avenue to create a four-leg intersection. The existing Watertown Plank Road alignment is assumed to be cul-de-sac'd with no access to Pilgrim Parkway, though right-in/right-out access where the existing Watertown Plank Road alignment ties into Pilgrim Parkway could be considered for public or private access. The existing office access opposite Watertown Plank Road was assumed to be converted to right-in/right-out only. Recall that Scenario 5A includes traffic signal control at the Wisconsin Avenue Extension/Watertown Plank Road intersection while Scenario 5B includes roundabout control.

Based on the analysis, it was determined that the following improvements, shown in [Exhibit J](#), are recommended to accommodate the Year 2035 Scenario 5A and 5B traffic volumes. The Scenario 5 peak hour operating conditions are shown in [Exhibit K](#) while the Scenario 5 expected maximum queues are shown in [Exhibit L](#). *Improvements are for jurisdictional consideration and are not legally binding.*

Pilgrim Parkway/Moorland Road & Bluemound Road

- Maximize the storage length of the southbound left-turn and right-turn lanes, noting that the approach storage lengths shown in [Exhibit J](#) are desirable but may not fit due to the close intersection spacing to Watertown Plank Road.

Pilgrim Parkway & Watertown Plank Road/Office Access

- The existing Watertown Plank Road alignment is assumed to be cul-de-sac'd with no access to Pilgrim Parkway, though right-in/right-out access to the existing Watertown Plank Road alignment could be considered.
- Provide two through lanes on the Pilgrim Parkway northbound approach
- Provide three lanes on the Pilgrim Parkway southbound approach, including two through lanes and one shared through/right-turn lane. The shared through/right-turn lane is recommended to be at least 200-feet long.
- Restrict the office access to right-in/right-out only. Affected motorists may utilize access to the Wisconsin Avenue Extension to gain access to Pilgrim Parkway and Watertown Plank Road.
- Remove the traffic signal control. Install stop signs to control the office access approach.

Pilgrim Parkway & Wisconsin Avenue Extension/Ace Hardware Access

- *Scenario 5A (Traffic Signal):*

- Construct a median along Pilgrim Parkway of sufficient width to accommodate traffic signal pole placement.
- Provide four lanes on the Pilgrim Parkway northbound approach, including one left-turn lane, two through lanes and one right-turn lane. North of the intersection, provide a 325-foot minimum tangent of the outside through lane then taper down to one lane.
- Provide three lanes on the Pilgrim Parkway southbound approach, including one left-turn lane, one through lane and one shared through/right-turn lane. The shared through/right-turn lane is recommended to be at least 300-feet long.
- Provide two lanes on the realigned Watertown Plank Road westbound approach, including one left-turn lane and one shared through/right-turn lane.
- Provide three lanes on the Wisconsin Avenue Extension eastbound approach, including one left-turn lane, one through lane and one right-turn lane.
- Install traffic signal control, including northbound protected-permitted left-turn signal heads with flashing yellow arrows. The southbound left-turn movement is recommended to operate with flashing yellow arrows. The signal was assumed to run at half the cycle length of the Bluemound Road corridor (70-seconds AM, 90-seconds PM). The northbound left-turn was modeled as a “leading” phase during the weekday morning peak and a “lagging” phase during the weekday evening peak to best progress traffic along Pilgrim Parkway.
- Consider adaptive signal control as WisDOT improves the Bluemound Road corridor.
- *Scenario 5B (Roundabout):*
 - Construct a two-lane modern roundabout.
 - Provide two lanes, striped as one shared left-turn/through lane and one shared through/right-turn lane, on the Pilgrim Parkway northbound approach. North of the intersection, provide a 200-foot minimum tangent of the outside through lane then taper down to one lane.
 - Provide two lanes, striped as one shared left-turn/through lane and one shared through/right-turn lane, on the Pilgrim Parkway southbound approach. The shared through/right-turn lane is recommended to be at least 100-feet long.
 - Provide one shared left-turn/through/right-turn lane on the Watertown Plank Road westbound approach.
 - Provide one shared left-turn/through/right-turn lane on the Wisconsin Avenue Extension approach.
 - Consider installing queue detection in the southbound travel lanes between the Wisconsin Avenue Extension and Bluemound Road to minimize the chance of southbound traffic at the Bluemound Road signal from spilling back into the roundabout. Note that this is not expected to occur based on the modeling but can

be considered as an operational measure to ensure the roundabout does not become gridlocked. This improvement will require WisDOT approval, and it is unlikely WisDOT will allow the green time on Bluemound Road to be reduced as a result of the queue detection.

The Pilgrim Parkway/Moorland Road intersection with Bluemound Road is expected to operate with undesirable LOS E/F conditions with queues in the peak hours that extend through the office access intersection. With three-quarters access and the traffic signal removal at the existing Watertown Plank Road intersection, acceptable storage and room for queue spillback from the Bluemound Road intersection is expected to be accommodated with this scenario, making for safer conditions than currently exist. Additionally, the Pilgrim Road intersections with Watertown Plank Road and Wisconsin Avenue are expected to operate desirably at LOS D or better conditions.

PART E – CONCLUSION

After consideration of the eight factors explored as part of the March of 2011 report – safety, operations, right-of-way impacts, access, pedestrians/bicycles, operation and maintenance costs, construction cost, and practical feasibility – it is realized that Scenarios 5A (signal) and 5B (roundabout) are likely to be the most intrusive scenarios due to property takings required, right-of-way and access costs (approximately double), and overall construction cost (approximately one-half to one million dollars).

Based on the professional opinion of the engineers at Traffic Analysis & Design, Inc., signalized Scenario 4A is expected to be the best option for Pilgrim Parkway for the following reasons:

- Operates acceptably and with queues that can be accommodated with design;
- Provides a metering effect on Pilgrim Parkway to minimize chances of queue spillback;
- Results in the least right-of-way and access impact and cost;
- Maintains the existing Watertown Plank Road and provides three-quarters access to it;
- Provides for visually-impaired pedestrians and keeps on-street bicyclists on the street;
- Provides for lower pavement marking maintenance costs and for less confusion in cases of pavement markings being covered by snow;
- Is the least cost scenario; and
- Is expected to be the most practically feasible alternative.

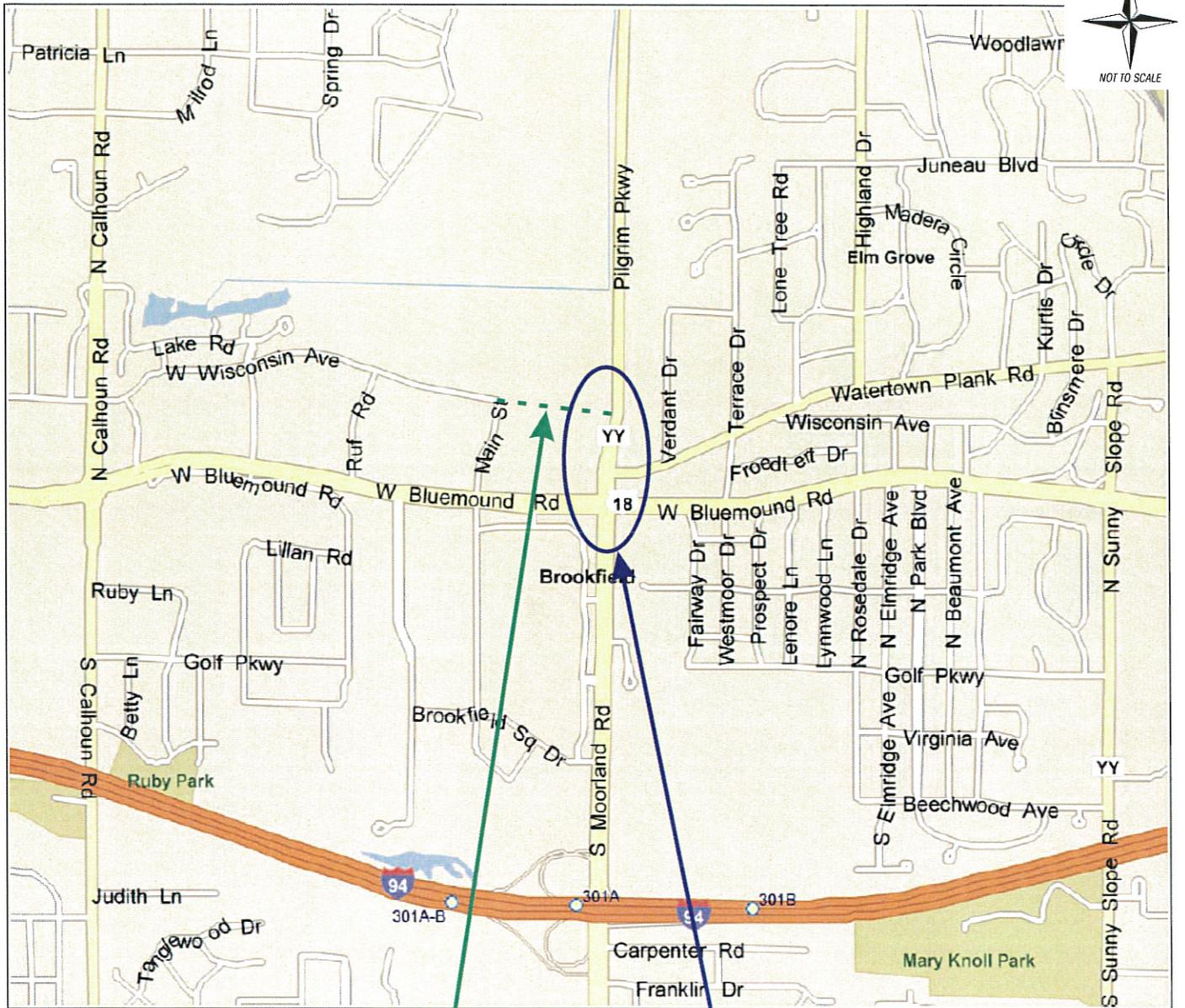
The improvements outlined herein are expected to provide for better signal spacing, better queue storage north of Bluemound Road, improved overall operations, and a safer traveling environment than exists today. Further, the extension of Wisconsin Avenue will provide relief to the Bluemound Road corridor.

As stated previously in this technical memorandum, improvements are for jurisdictional consideration and are not legally binding. TADI will work with the City of Brookfield to

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accomplish its goal for a safe, efficient, cost-effective and practical solution to the Pilgrim Parkway corridor.

Should any questions or comments arise regarding this memorandum, please feel free to contact Michael May, P.E. PTOE (414-807-1912, mmay@tadi-us.com).



**Wisconsin Avenue
Extension**

**Study Area
Intersections**

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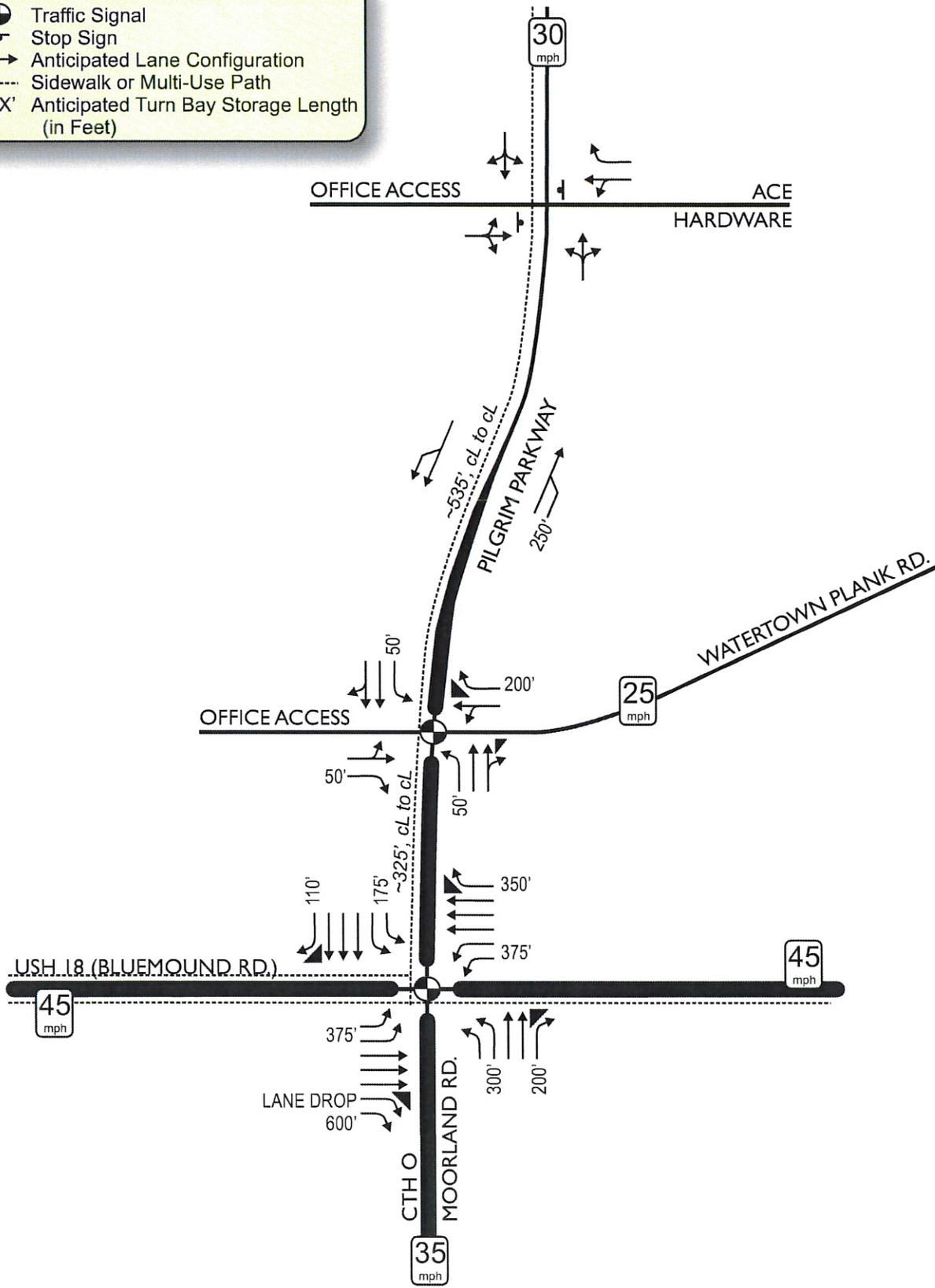
**EXHIBIT A
STUDY AREA MAP**

CITY OF BROOKFIELD, WISCONSIN



LEGEND

-  Traffic Signal
-  Stop Sign
-  Anticipated Lane Configuration
-  Sidewalk or Multi-Use Path
-  XX' Anticipated Turn Bay Storage Length (in Feet)



02-28-2014

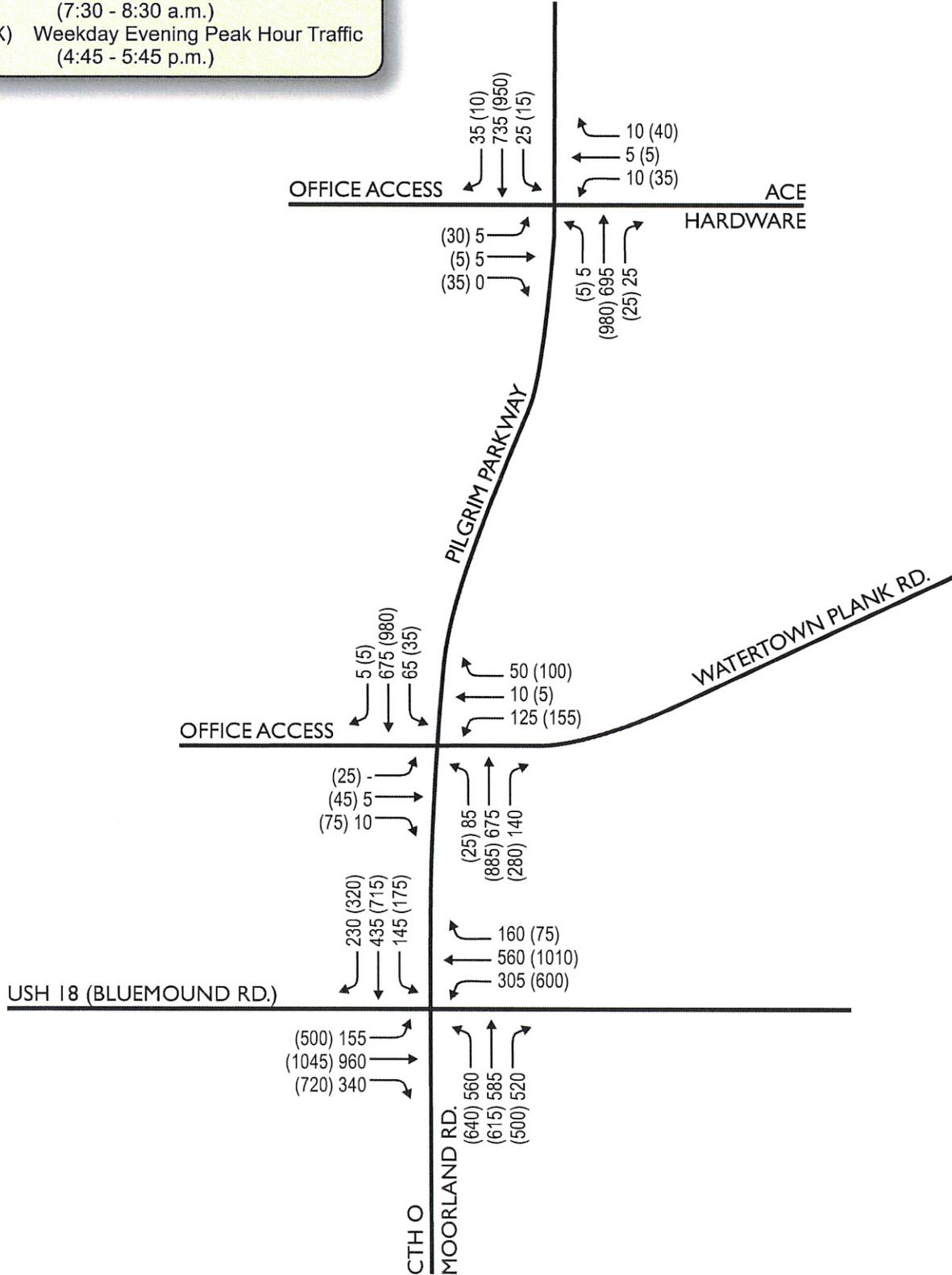
**EXHIBIT B
EXISTING TRANSPORTATION DETAIL**

CITY OF BROOKFIELD, WISCONSIN



LEGEND

- XX Weekday Morning Peak Hour Traffic (7:30 - 8:30 a.m.)
- (XX) Weekday Evening Peak Hour Traffic (4:45 - 5:45 p.m.)



TRAFFIC ANALYSIS & DESIGN, INC.

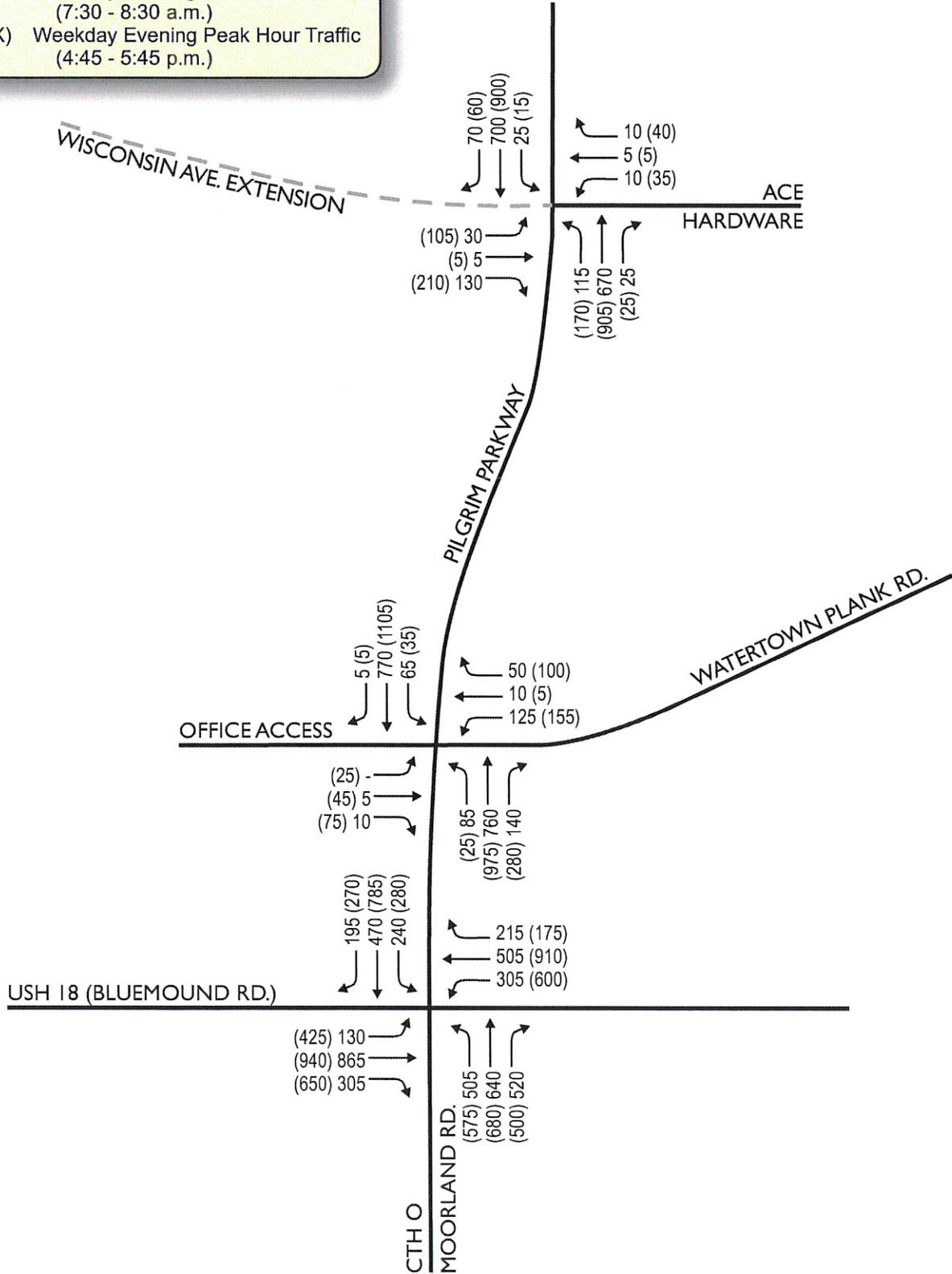
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**EXHIBIT C
YEAR 2035 FORECAST TRAFFIC - NO BUILD**

CITY OF BROOKFIELD, WISCONSIN

LEGEND

- XX Weekday Morning Peak Hour Traffic (7:30 - 8:30 a.m.)
- (XX) Weekday Evening Peak Hour Traffic (4:45 - 5:45 p.m.)

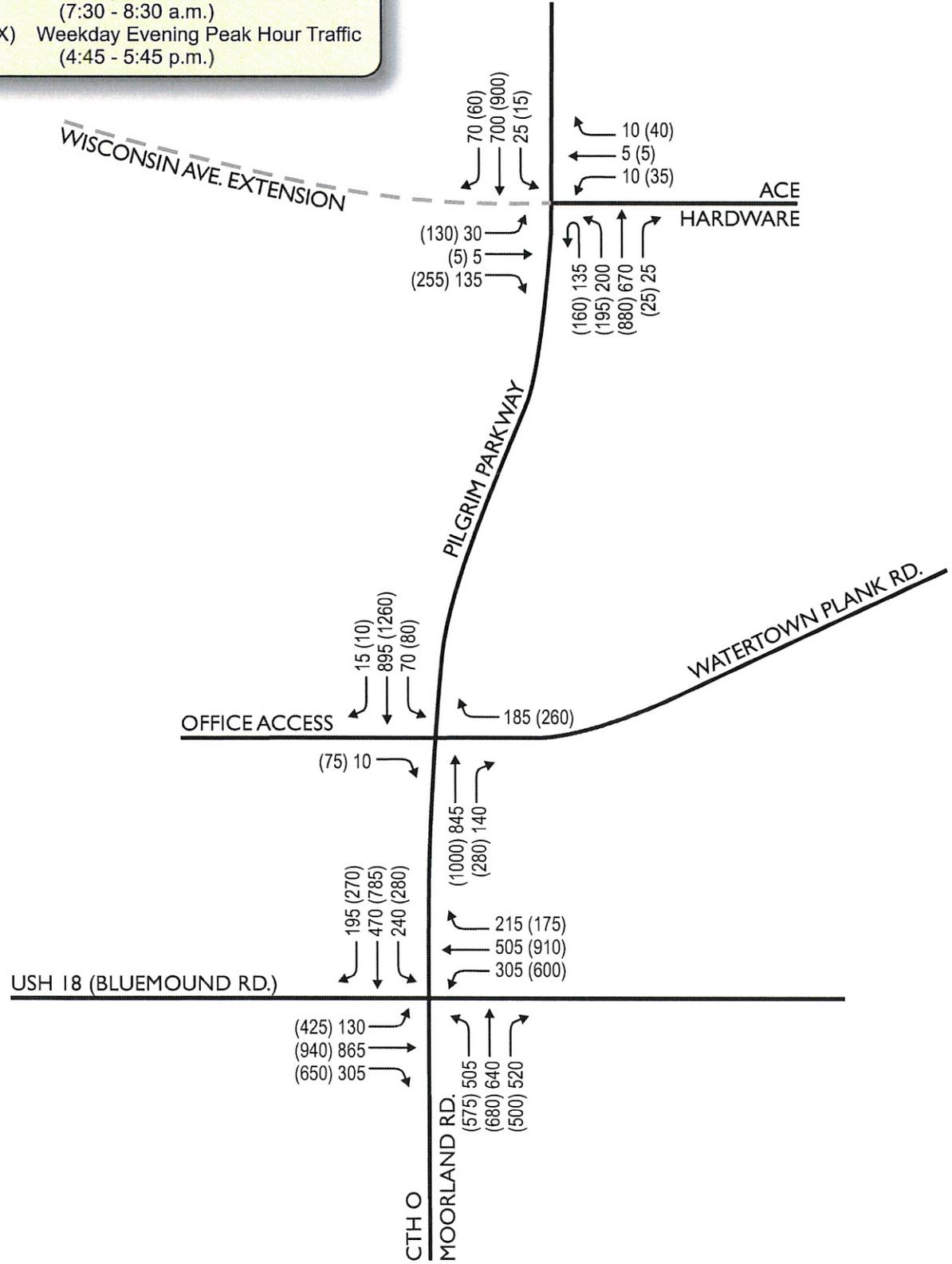


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EXHIBIT D
YEAR 2035 FORECAST TRAFFIC - SCENARIO 1
WISCONSIN EXTENDED
CITY OF BROOKFIELD, WISCONSIN

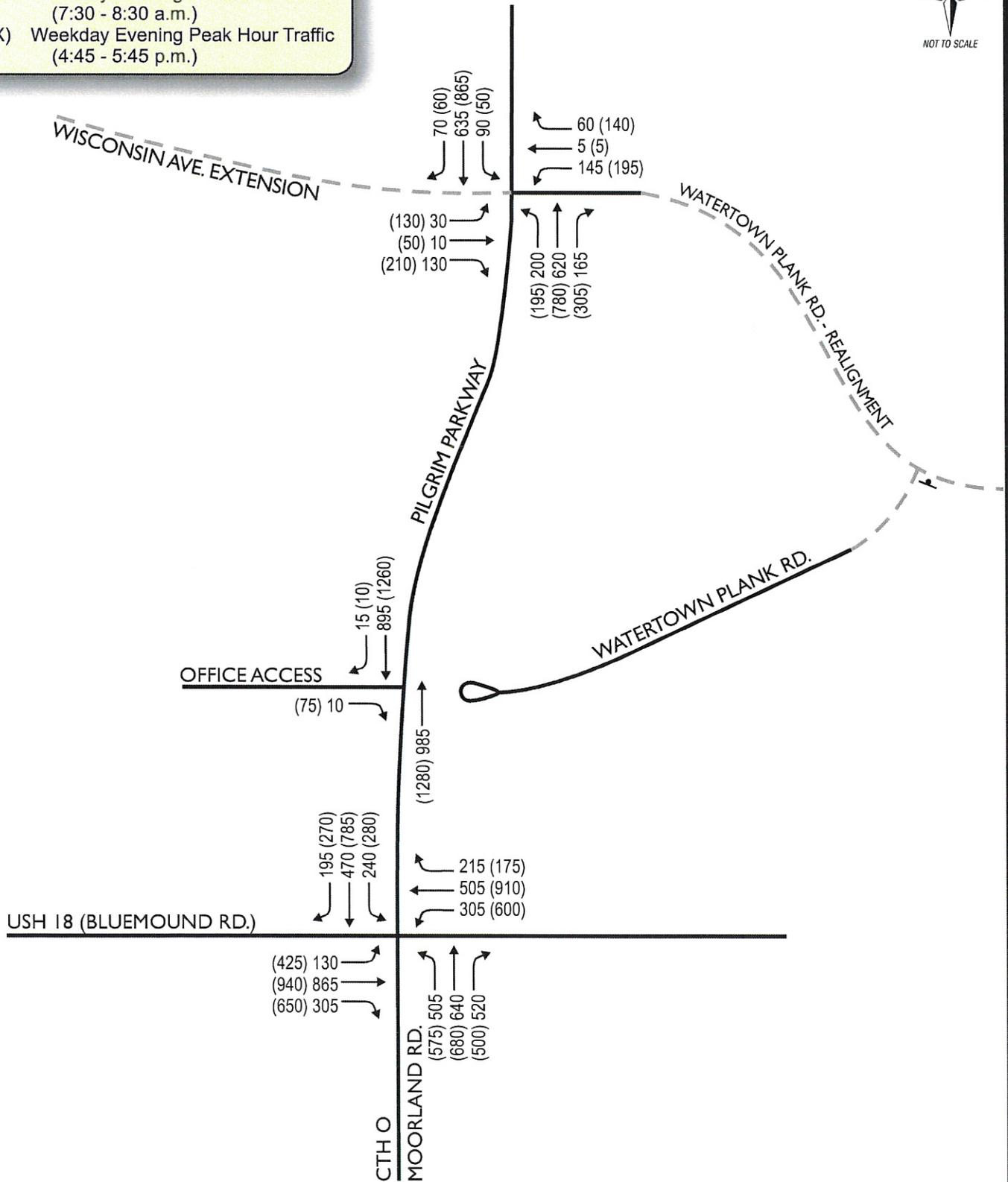
LEGEND

- XX Weekday Morning Peak Hour Traffic (7:30 - 8:30 a.m.)
- (XX) Weekday Evening Peak Hour Traffic (4:45 - 5:45 p.m.)



LEGEND

- XX Weekday Morning Peak Hour Traffic (7:30 - 8:30 a.m.)
- (XX) Weekday Evening Peak Hour Traffic (4:45 - 5:45 p.m.)



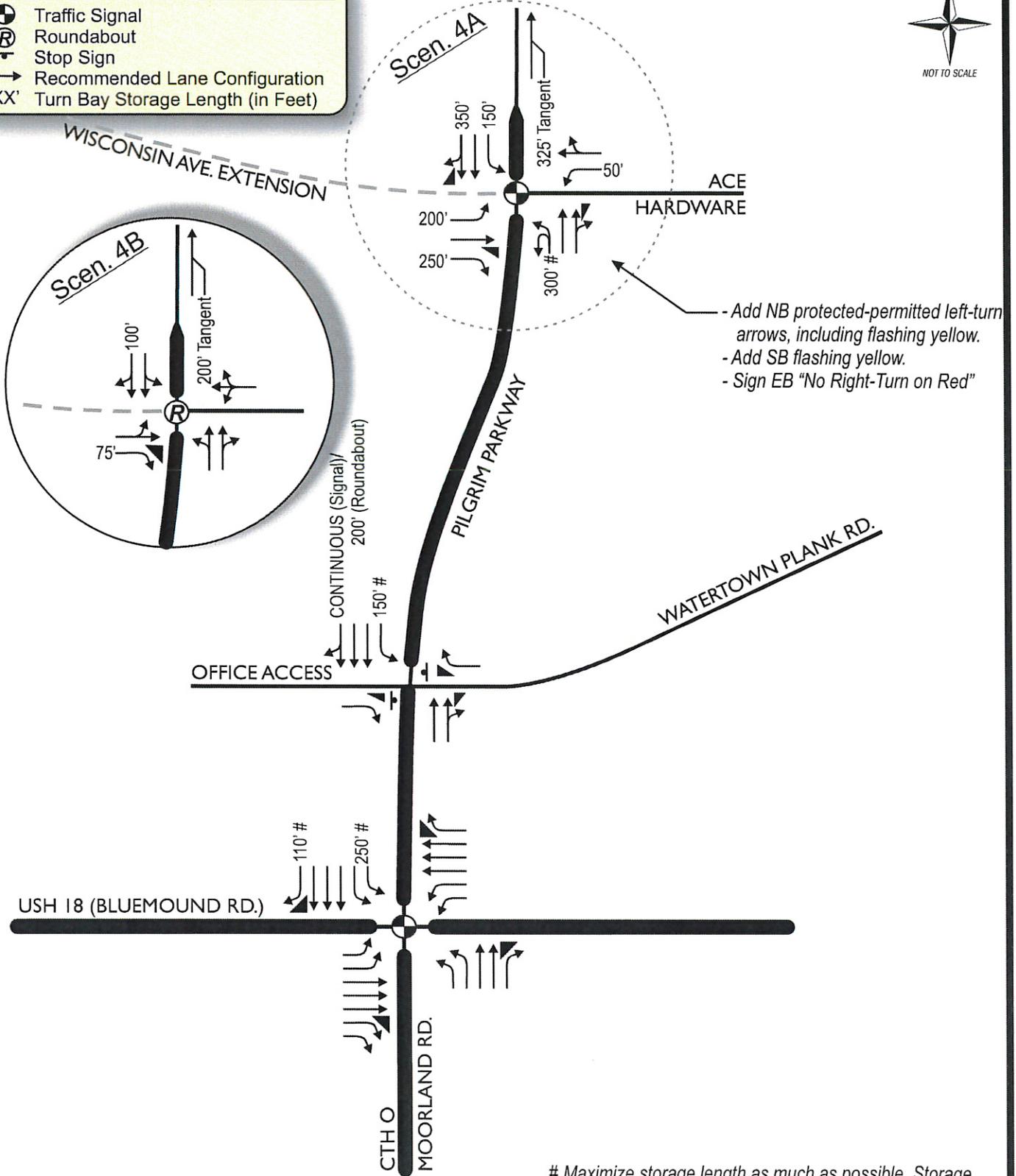
02-28-2014

EXHIBIT F
YEAR 2035 FORECAST TRAFFIC - SCENARIO 5
WISCONSIN EXTENDED, REALIGNED WATERTOWN PLANK
CITY OF BROOKFIELD, WISCONSIN



LEGEND

- ⊙ Traffic Signal
- Ⓜ Roundabout
- ⊥ Stop Sign
- Recommended Lane Configuration
- XX' Turn Bay Storage Length (in Feet)



- Add NB protected-permitted left-turn arrows, including flashing yellow.
- Add SB flashing yellow.
- Sign EB "No Right-Turn on Red"

Maximize storage length as much as possible. Storage may be prohibitive due to overall roadway design.



02-28-2014

EXHIBIT G
SCENARIO 4 RECOMMENDED IMPROVEMENTS
WISCONSIN EXTENDED, RESTRICTIONS AT WATERTOWN PLANK
CITY OF BROOKFIELD, WISCONSIN

**Year 2035 Scenario 4 Peak Hour Operating Conditions
With Recommended Geometrics and Traffic Control**

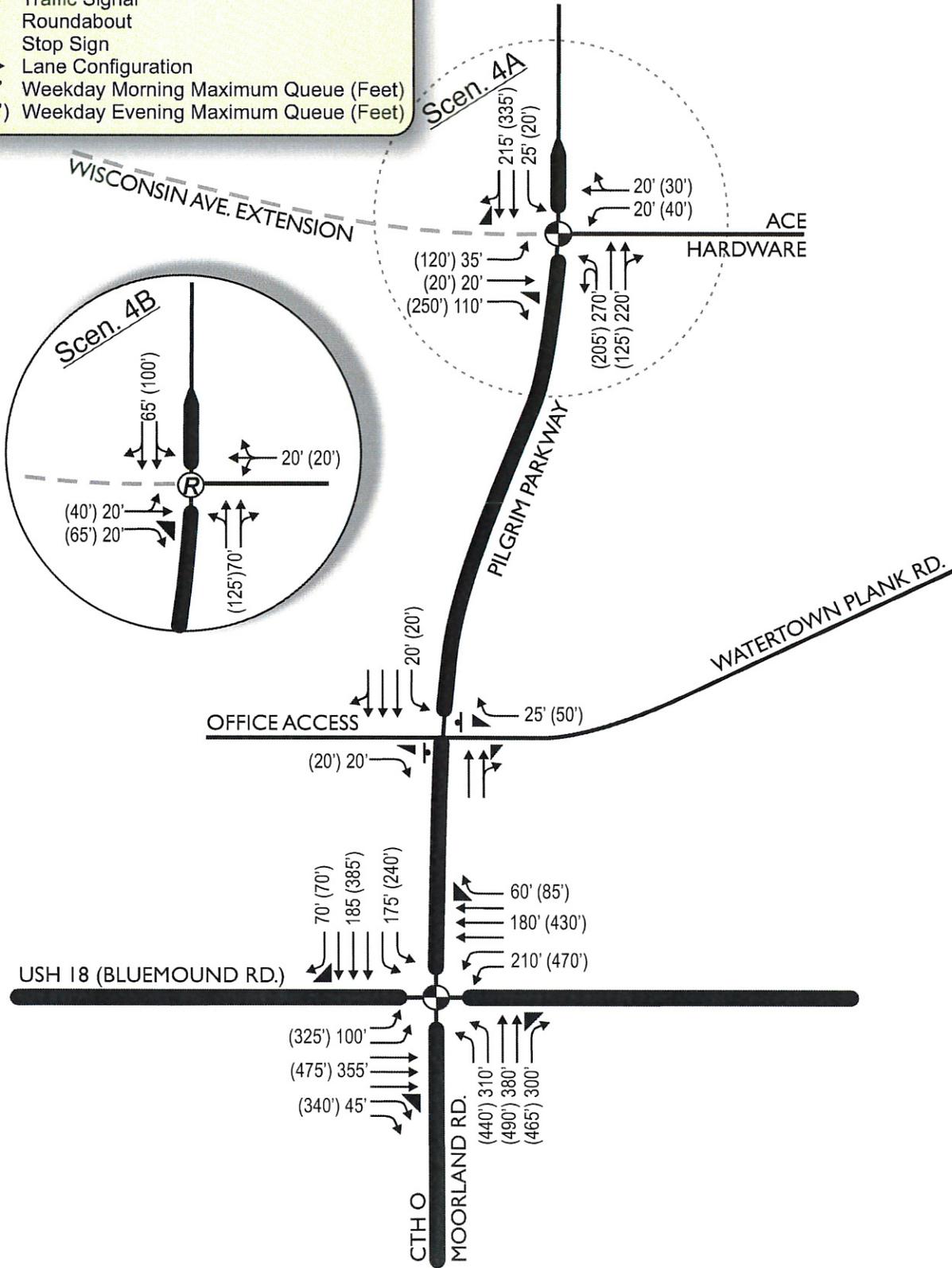
Intersection	Traffic Control	Peak Hour	Level of Service per Movement by Approach											
			Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Pilgrim Parkway/Moorland Road & Bluemound Road	Traffic Signal	AM	E	D	B	E	D	D	D	D	F	E	E	B
		PM	E	E	D	E	D	B	F	E	D	E	E	C
Pilgrim Parkway & Watertown Plank Road/Office Access	Two-Way Stop Sign	AM	-	-	B	-	-	B	-	*	*	A	*	*
		PM	-	-	B	-	-	B	-	*	*	A	*	*
Pilgrim Parkway & Wisconsin Avenue Extension/Ace Hardware	Traffic Signal	AM	C	C	C	C	C	C	A	A	A	A	B	B
		PM	C	C	D	C	C	C	B	A	A	B	C	C
	Roundabout	AM	A	A	A	A	A	A	A	A	A	A	A	A
		PM	B	B	C	B	B	B	B	B	B	B	B	B

Notes: (-) indicates a movement that is not possible or is prohibited.
(*) indicates a movement that is not controlled or is free-flow.



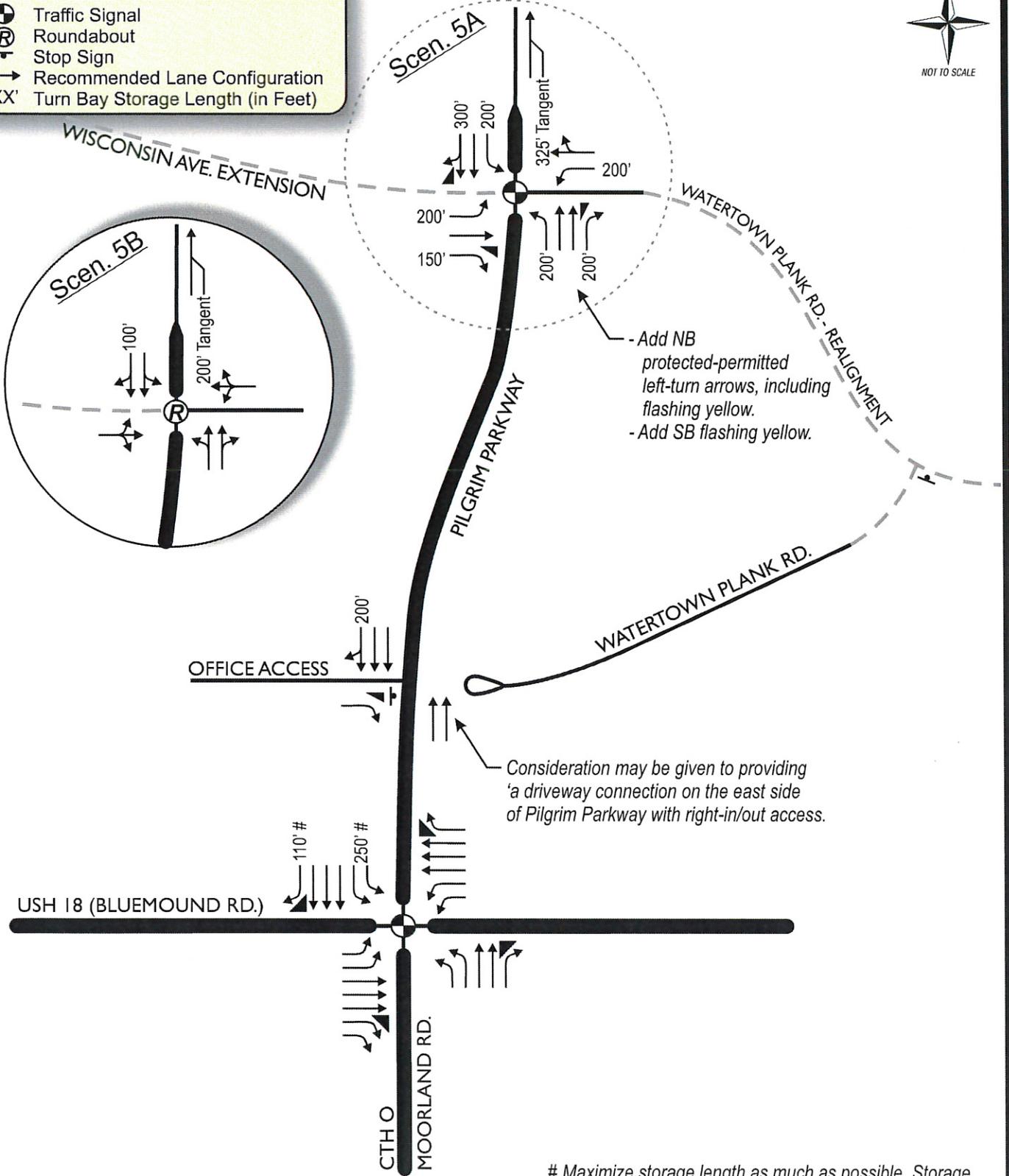
LEGEND

- ⊕ Traffic Signal
- Ⓜ Roundabout
- ⊥ Stop Sign
- Lane Configuration
- XX' Weekday Morning Maximum Queue (Feet)
- (XX') Weekday Evening Maximum Queue (Feet)



LEGEND

- ⊕ Traffic Signal
- Ⓜ Roundabout
- ⊥ Stop Sign
- Recommended Lane Configuration
- XX' Turn Bay Storage Length (in Feet)



- Add NB protected-permitted left-turn arrows, including flashing yellow.
 - Add SB flashing yellow.

Consideration may be given to providing 'a driveway connection on the east side of Pilgrim Parkway with right-in/out access.

Maximize storage length as much as possible. Storage may be prohibitive due to overall roadway design.



02-28-2014

EXHIBIT J
SCENARIO 5 RECOMMENDED IMPROVEMENTS
WISCONSIN EXTENDED, REALIGNED WATERTOWN PLANK
CITY OF BROOKFIELD, WISCONSIN

**Year 2035 Scenario 5 Peak Hour Operating Conditions
With Recommended Geometrics and Traffic Control**

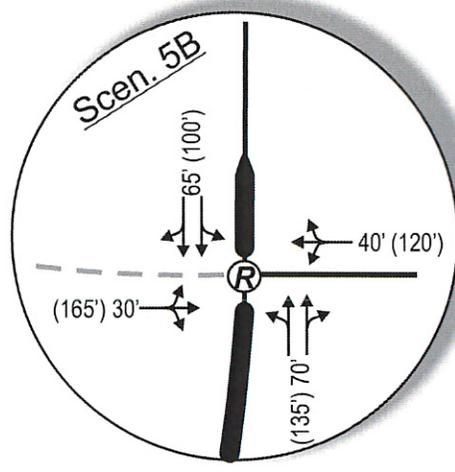
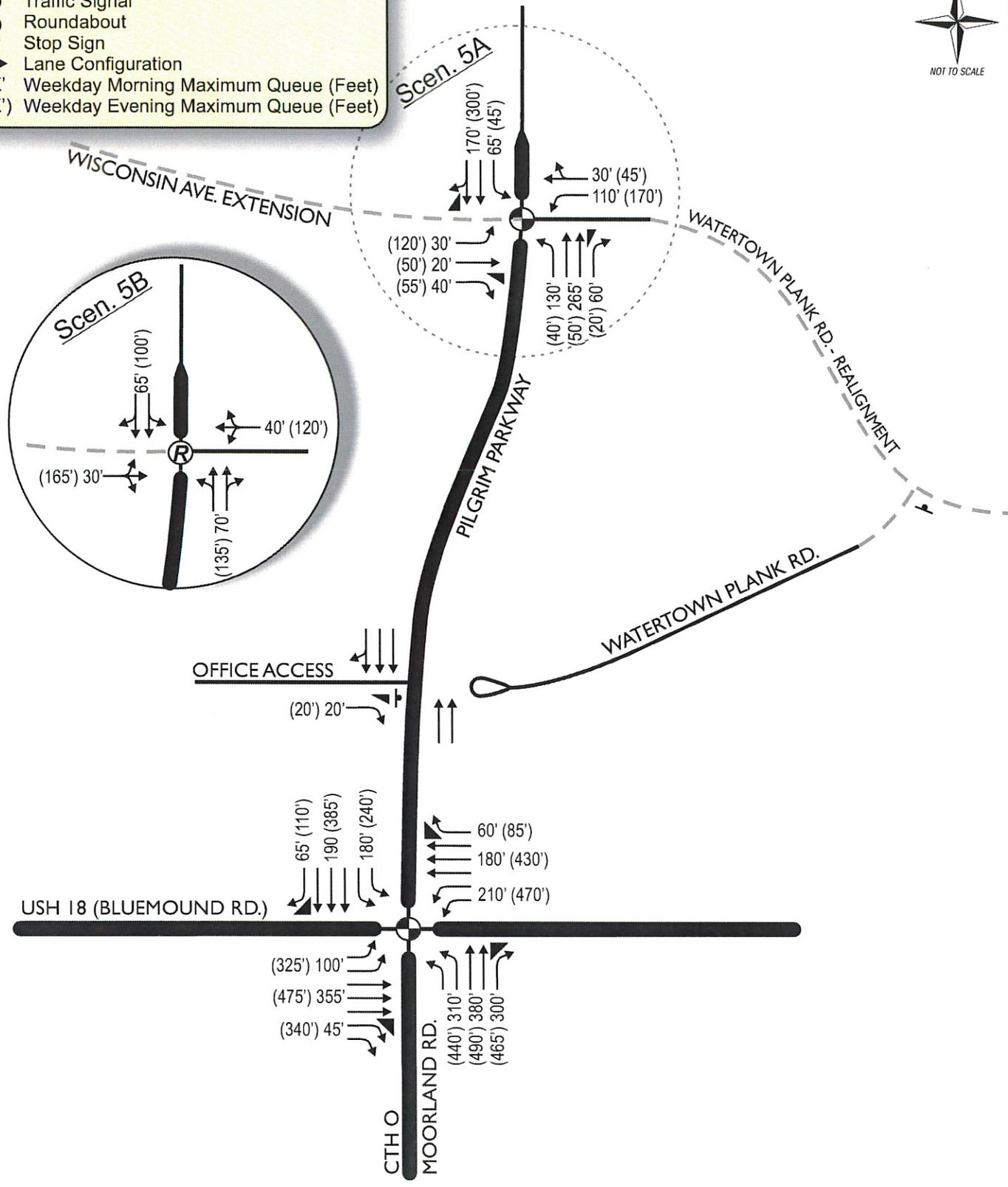
Intersection	Traffic Control	Peak Hour	Level of Service per Movement by Approach											
			Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Pilgrim Parkway/Moorland Road & Bluemound Road	Traffic Signal	AM	E	D	B	E	D	D	D	D	F	E	E	B
		PM	E	E	D	E	D	B	F	E	D	E	E	C
Pilgrim Parkway & Watertown Plank Road/Office Access	Two-Way Stop Sign	AM	-	-	B	-	-	-	-	*	*	-	*	*
		PM	-	-	B	-	-	-	-	*	*	-	*	*
Pilgrim Parkway & Wisconsin Avenue Extension/Ace Hardware	Traffic Signal	AM	C	C	C	C	C	C	A	A	A	B	B	B
		PM	D	C	C	C	C	C	C	A	A	B	C	C
	Roundabout	AM	A	A	A	B	B	B	A	A	A	A	A	A
		PM	D	D	D	C	C	C	B	B	B	B	B	B

Notes: (-) indicates a movement that is not possible or is prohibited.

(*) indicates a movement that is not controlled or is free-flow.

LEGEND

-  Traffic Signal
-  Roundabout
-  Stop Sign
-  Lane Configuration
- XX' Weekday Morning Maximum Queue (Feet)
- (XX') Weekday Evening Maximum Queue (Feet)



02-28-2014

EXHIBIT L
SCENARIO 5 YEAR 2035 EXPECTED MAXIMUM QUEUES

CITY OF BROOKFIELD, WISCONSIN



Date: August 6, 2015

Technical Memorandum

To: Jeff Chase, P.E.
City of Brookfield Engineering Department

From: Michael May, P.E., PTOE
John Bieberitz, P.E. PTOE

cc List:

Subject: Origin-Destination Study for Watertown Plank Road
Brookfield, Wisconsin

PART A – INTRODUCTION

The City of Brookfield is planning for the future extension of Wisconsin Avenue from its current terminus at Main Street to the east at Pilgrim Parkway. The Wisconsin Avenue extension will serve as a relief route to Bluemound Road, a major parallel arterial.

A traffic analysis report was prepared in March of 2011 to determine recommended improvements for design year operations at the Pilgrim Parkway intersection with the Wisconsin Avenue Extension, to compare seven scenarios prepared by the City of Brookfield for the Pilgrim Parkway corridor to ensure safe and efficient traffic flow with and without the extension, and to ensure the Pilgrim Parkway corridor operates within acceptable levels.

The March of 2011 report identified that those improvement scenarios that maintained a traffic signal and full access at the existing Pilgrim Parkway & Watertown Plank Road intersection functioned poorly due to long traffic queues and short intersection spacing at Pilgrim Parkway/Moorland Road & USH 18. A subsequent technical memorandum was prepared in February of 2014 that confirmed the same result based on updated traffic counts. The recommended improvements include restricting Pilgrim Parkway & Watertown Plank Road to left-in/right-in/right-out and removing the existing traffic signal, and installing a new traffic signal (or roundabout) at Pilgrim Parkway & Wisconsin Avenue/Ace Hardware north driveway.

The Village of Elm Grove has expressed concern about the impact to businesses on Watertown Plank Road – particularly the south side of the road – of restricting Pilgrim Parkway & Watertown Plank Road to left-in/right-in/right-out. At the request of the City of Brookfield, TADI performed an origin-destination (O-D) study to better understand the traffic impacts the

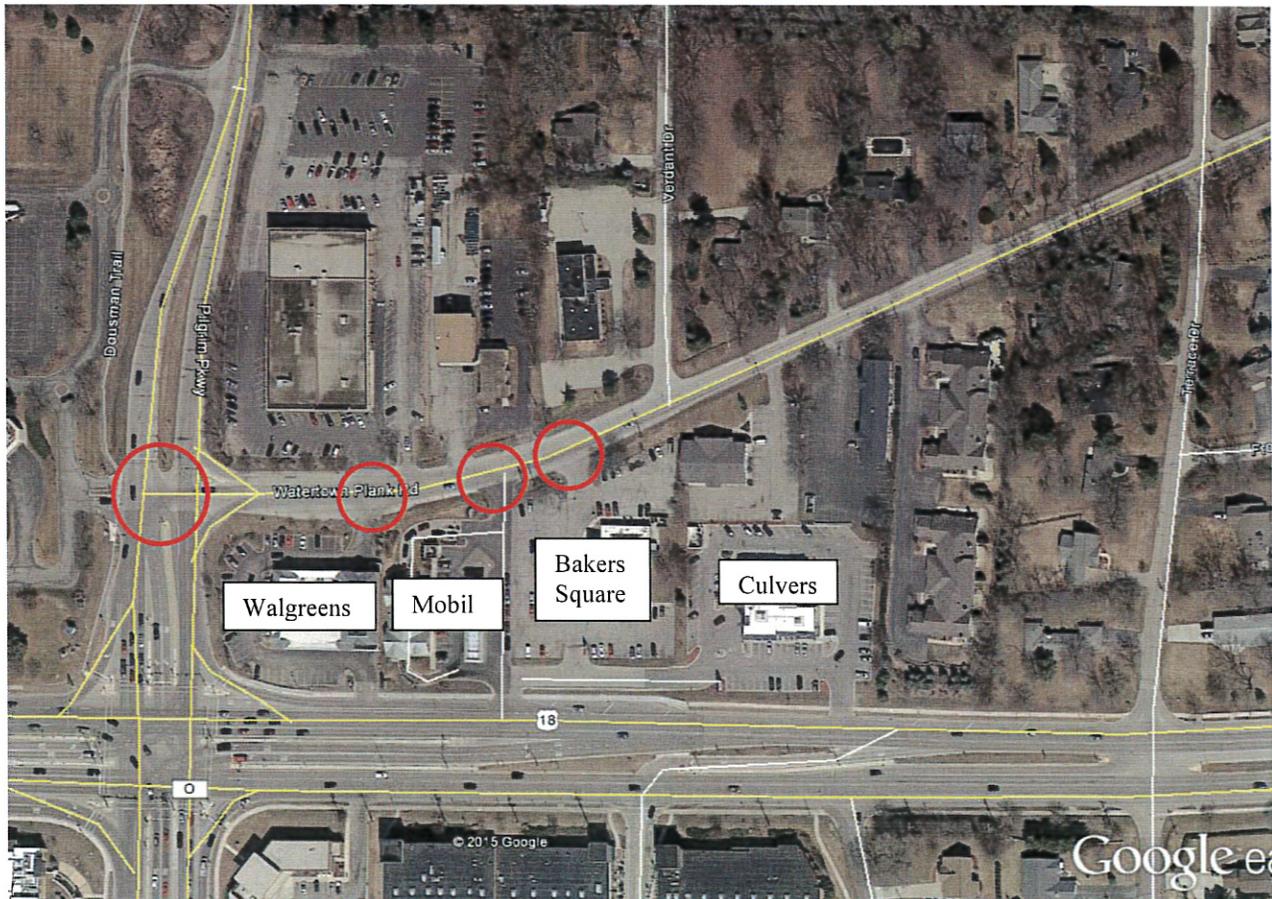
TADI

recommended intersection restriction may have on businesses along the south side of Watertown Plank Road.

PART B – DATA COLLECTION

TADI positioned high-definition video cameras along Watertown Plank Road to capture westbound movements at Pilgrim Parkway and movements from three driveways along the south side of Watertown Plank Road: Walgreens, Mobil, and Bakers Square. The cameras collected video from 3:00 to 6:00pm on Wednesday, July 15th, 2015 under clear weather conditions. By playing the videos simultaneously in reverse, TADI traced those vehicles making a westbound-to-southbound left-turn at Pilgrim Parkway & Watertown Plank Road to the three driveways previously described. Below are an aerial of the driveways (Figure 1) and a table with the O-D results (Figure 2)

Figure 1: Aerial of Study Area



Source: GoogleMaps, accessed 8-5-2015

Figure 2: Origin-Destination Volumes, 15-Minute Intervals

Start Time	WB Left onto Pilgrim from Watertown Plank (Destination)	NB Left onto Watertown Plank from Walgreens (Origin)	NB Left onto Watertown Plank from Mobil (Origin)	NB Left onto Watertown Plank from Bakers Square (Origin)
3:00pm	7	3	4	0
3:15pm	5	1	4	0
3:30pm	10	2	7	1
3:45pm	10	3	6	1
4:00pm	8	5	2	1
4:15pm	4	0	2	2
4:30pm	8	3	3	2
4:45pm	8	2	6	0
5:00pm	9	3	2	4
5:15pm	9	2	4	3
5:30pm	8	2	5	1
5:45pm	10	3	4	3

PART C – SUMMARY OF IMPACT

The weekday evening peak hour identified in the previous studies was 4:45pm to 5:45pm. The results of the O-D study for the same hour show a total of 34 westbound left-turns at Pilgrim Parkway & Watertown Plank Road with 9 of those turns originating from Walgreens, 17 from Mobil, and 8 from Bakers Square.

The 34 westbound left-turns at Pilgrim Parkway & Watertown Plank Road constitute approximately 22-percent of the estimated 155 total vehicles desiring to make the movement in Year 2035 (see February of 2014 study, Exhibit C). It is uncertain what portion of the 34 vehicles can be expected to make a southbound left-turn, through, or right-turn movement at Bluemound Road & Pilgrim Parkway/Moorland Road.

With the recommended improvements identified for Pilgrim Parkway, the left-turn movements originating from Mobil (17 vehicles) and Bakers Square (8 vehicles) may gain access to Bluemound Road or southbound Moorland Road via their individual driveways, via the Culvers access located east of Bakers Square, or by making a U-turn at the recommended Pilgrim Parkway & Wisconsin Avenue/Ace Hardware intersection. The left-turn movements originating from Walgreens (9 vehicles) may gain access to Bluemound Road or southbound Moorland

Road via its individual driveway or by making a U-turn at the recommended Pilgrim Parkway & Wisconsin Avenue/Ace Hardware intersection.

PART D – CONCLUSION

Based on the past traffic analysis and this additional data, TADI recommends moving forward with the improvements identified in the February of 2014 study, which include restricting Pilgrim Parkway & Watertown Plank Road to left-in/right-in/right-out and removing the existing traffic signal, and installing a new traffic signal (or roundabout) at Pilgrim Parkway & Wisconsin Avenue/Ace Hardware.