

# WISCONSIN AVENUE EXTENSION

## MAIN STREET TO PILGRIM PARKWAY

CITY OF BROOKFIELD

VILLAGE OF ELM GROVE

WISCONSIN

November 2014

Revised February 2015

Review of Traffic Analysis & Design, Inc.

Traffic Impact Report

Dated: February 28, 2014

Supplemental Report September 28, 2015

By Wayne R. Higgins, PE, PTOE, TSOS  
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TES Job No. 14-E-24

The Traffic Analysis & Design, Inc. (TADI) Traffic Impact Analysis (TIA) for Extension of Wisconsin Ave from Main Street to Pilgrim Parkway was submitted to the Village of Elm Grove from the City of Brookfield. The Village of Elm Grove requested Traffic Engineering Services, Inc. (TES) staff to review and identify specific comments that report was submitted in February 2015.

The Traffic Analysis and Design, Inc. (TADI) three intersections studied include:

Bluemound Rd and Moorland Rd/Pilgrim Parkway

Pilgrim Parkway and Watertown Plank Road

Pilgrim Parkway and Ace Hardware north driveway at the proposed extension of Wisconsin Avenue

TES has added one intersection and two street segments for review

Bluemound Road and Terrace Drive/Westmoor Drive

Terrace Drive between Bluemound Road and Watertown Plank Road

Watertown Plank Road between Pilgrim Parkway and Terrace Drive

A review meeting was held at the City of Brookfield. Discussion at the meeting lead to TADI staff being directed by Brookfield to count the vehicles leaving Bakers Square, Mobil and Walgreen's driveways at Watertown Plank Road and then turn left at Pilgrim Road. This was to give an indication of the magnitude of impact on the retail businesses if left turns were prohibited. The August 6 Technical Memorandum summarized the results of the study. The following issues are yet to be addressed:

- Impact on Terrace Drive between Watertown Plank Road and Bluemound Road is approximately doubling the traffic if no left turn is implemented westbound at Pilgrim Parkway.
- Bluemound Rd and Terrace Drive intersection having increased traffic results in a negative impact to vehicles making turns at the intersection.
- U-turns eastbound on Bluemound at Terrace Drive are a safety problem now that added traffic magnifies. Shortening the turn bay by 25-feet to separate U-turns from intersection traffic is needed with or without the proposed changes at Watertown Plank Road and Pilgrim Parkway.
- A roundabout at Wisconsin Ave/Pilgrim Parkway/Ace Hardware Driveway is preferred alternative with no other changes to Pilgrim Parkway Traffic.

Respectfully submitted,



Wayne R. Higgins, PE, PTOE, TSOS

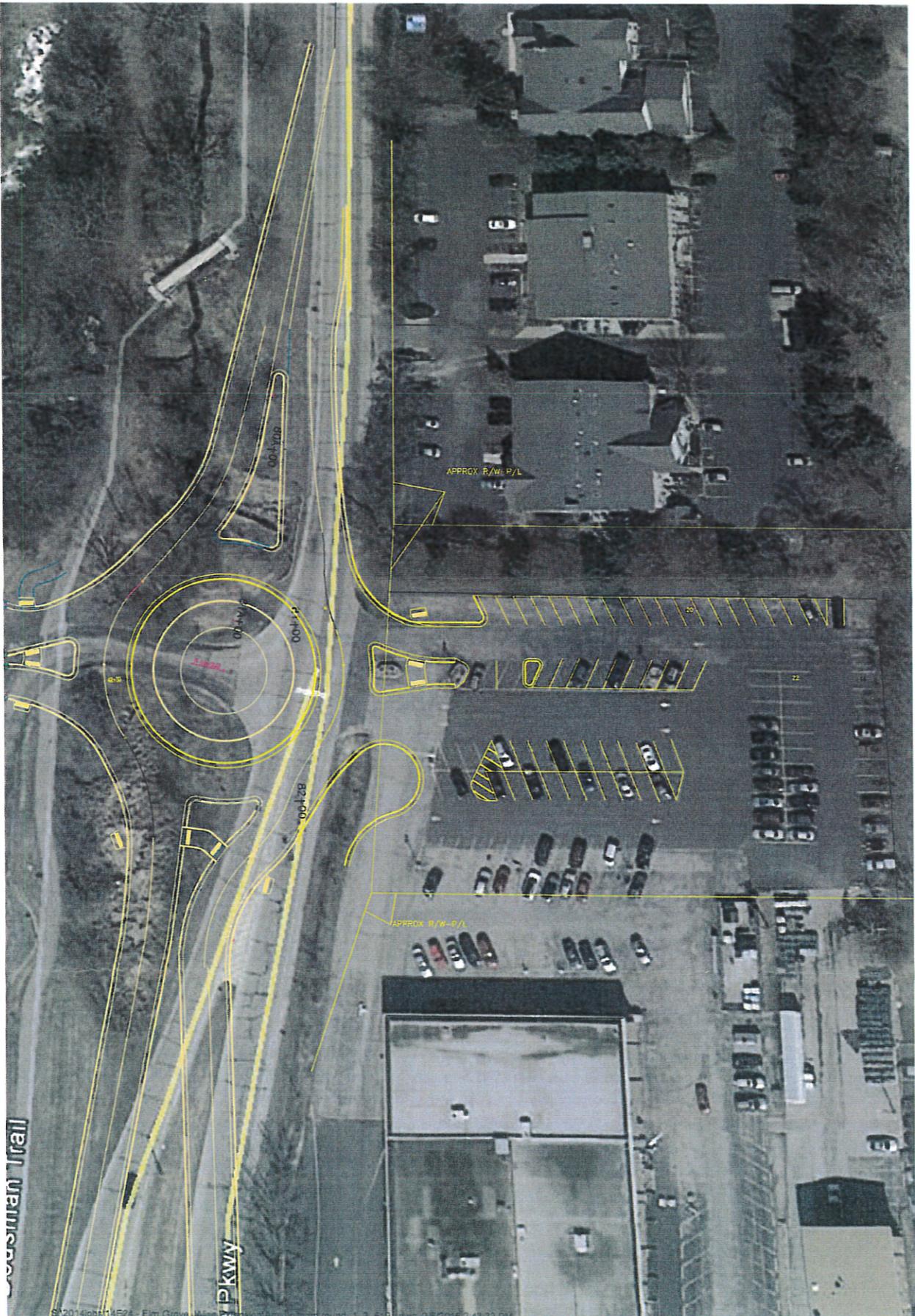
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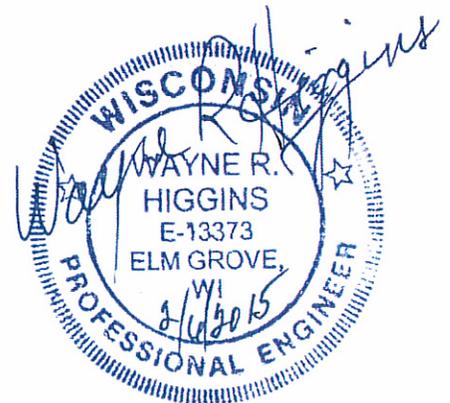
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The Traffic Analysis & Design, Inc. (TADI) TIA for Extension of Wisconsin Ave from Main Street to Pilgrim Parkway was submitted to the Village of Elm Grove from the City of Brookfield. The Village of Elm Grove requested Traffic Engineering Services, Inc. (TES) staff to review and identify specific comments that are given below on an overall evaluation and specifics for each Scenario. This report abbreviates the following names:

Moorland Rd is Moorland Road/CTH "O"

Bluemound Rd is Bluemound Road/USH 18

Ace Hardware is Ace Hardware north driveway to Pilgrim Parkway

North and South traffic is on Moorland Road south of Bluemound Rd and Pilgrim Parkway is north of Bluemound Rd.

The Traffic Analysis and Design, Inc. (TADI) three intersections studied include:

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Bluemound Road and Terrace Drive/Westmoor Drive

Terrace Drive between Bluemound Road and Watertown Plank Road

Watertown Plank Road between Pilgrim Parkway and Terrace Drive

No new development is proposed along Wisconsin Avenue west of Pilgrim Parkway as part of the TIA study. This assumption was given to the TADI author by the City of Brookfield staff. In checking with Dan Ertl at Brookfield, there is one lot west of Pilgrim Parkway on the north side of the Wisconsin Avenue right of way. The lot is however deemed to be undevelopable by the City standards. Therefore the City directed the study be completed with no new development.

The redistribution of traffic is based on existing area street traffic movements and volumes at Pilgrim Parkway & Watertown Plank Rd and Bluemound Rd & Moorland Rd/Pilgrim Parkway being redirected thru the new intersection of Pilgrim Parkway and Wisconsin Ave/Ace Hardware.

In my opinion the most significant element of the TIA that it is missing the resulting diversion of westbound traffic on Watertown Plank Rd approaching Pilgrim Parkway. In my opinion this will result in motorists selecting alternate routes for travel rather than traveling north to U-turn at new Wisconsin Ave intersection. . The westbound traffic may use Elm Grove Road, Sunny Slope Road and Terrace Drive to access Bluemound Road and then Moorland Rd via Bluemound Rd. The most significant impact will be to the residential neighborhood along Terrace Drive and safety of traffic operations at Terrace Drive/Westmoor Drive and Bluemound Road intersection.

Traffic crashes have been tabulated for Pilgrim Parkway and the intersection of Bluemound Rd and Terrace Drive.

Pilgrim Parkway, Exhibit TES 3-4A

Bluemound Road and Terrace Drive/Westmoor Drive, Exhibit TES 3-4B

Crash records for the past 2 ½ years were provided by the Elm Grove Police Department. These are shown graphically in Exhibit 3-4A for crashes along Pilgrim Parkway between Bluemound Rd and Ace Hardware access. The six 90 degree crashes northbound with westbound at Watertown Plank Rd warranted corrective action and additional All Red time was added to northbound traffic to reduce the incidence of these crashes. Traffic signal progression has been modified to favor the eastbound left turn or northbound through traffic from Bluemound Rd and Moorland Rd/Pilgrim Parkway based upon the higher volume by time of day and to assure there is no backup of traffic into Bluemound Rd. The

remaining crashes are due to lane changes and inattentive driving. This is not an unsafe intersection but does experience crash potential from inattentive drivers.

WisDOT provided two years of crash data for Bluemound Rd and Terrace Dr/Westmoor Dr intersection. Crash statistics do not currently show a problem. In viewing the video used for the turning movement count it was noted that many near misses were occurring at this intersection. The potential increase in traffic southbound on Terrace may have a corresponding increase in traffic crashes.

The impact of the proposed traffic diversion is estimated and analyzed in this report. Both Elm Grove Road and Sunny Slope Road have traffic signals at Bluemound Road and would likely accommodate any added traffic with no detrimental impact. The queues observed on southbound Sunny Slope Road make it most likely that motorists would use Terrace as their route of choice. Terrace Drive and Bluemound Road intersection is currently moderately congested; thus the focus of evaluation is on this intersection for diverted traffic. Existing traffic counts were taken on Terrace Drive for a week with road tube automatic counter. These volumes are shown in the attachments to this report. The intersection of Terrace Drive and Bluemound Road was counted manually from video counts for the AM and PM Peak Hours. The data collection has a different AM Peak hour; TES 7:15 to 8:15 and TADI 7:30 to 8:30. The traffic volume difference in the 7:15 to 8:30 AM period is 3.5% which is less than daily traffic variations. Therefore analysis is equivalent. Analysis of the AM and PM peak hour is shown in the Appendix and summarized as follows.

SUMMARY OF SYNCHRO ANALYSIS  
BLUEMOUND & TERRACE/WESTMOOR INTERSECTION

AM	NBLn	EBU	EBL	WBU	WBL	SBLn
2014 EXISTING						
VOLUME	12	46	33	0	3	76
CAPACITY (veh/hr)	35	293	244	252	134	268
Control Delay (sec)	169	20.2	22.7	0	32.6	25.5
LOS	F	C	C	A	D	D
95TH % QUEUE (veh)	1.4	0.7	0.6	0	0.1	1.5
2014 EXISTING + REDIRECT						
VOLUME	12	46	33	0	3	76
CAPACITY (veh/hr)	32	190	244	252	134	292
Control Delay (sec)	169	20.2	22.7	0	32.6	25.5
LOS	F	C	C	A	D	D
95TH % QUEUE (veh)	1.4	0.7	0.6	0	0.1	1.5
PM						
2014 EXISTING						
VOLUME	15	82	46	3	2	68
CAPACITY (veh/hr)	31	105	85	284	161	79
Control Delay (sec)	211.6	124.7	95.4	17.8	27.7	175.4
LOS	F	F	F	C	D	F
95TH % QUEUE (veh)	1.7	4.9	2.7	0	0	5
2014 EXISTING + REDIRECT						
VOLUME	12	82	33	3	2	154
CAPACITY (veh/hr)	91	16	85	284	161	111

Control Delay (sec)	5	2532	95.4	17.8	27.7	339
LOS	F	F	F	C	D	F
95TH % QUEUE (veh)	0.6	11.9	2.7	0	0	12.2

The above analysis shows that added traffic to Terrace Drive is not beneficial to the Village or especially the Terrace Drive area residents. It will also negatively impact Brookfield residents at this intersection. Poor LOS (Level of Service), PM volume exceeding capacity and potential for more eastbound U-turn crashes with southbound right turning traffic. The worst condition is the PM peak hour. None of the City of Brookfield traffic impact study takes into account diverted traffic from incidents on other arterials or freeway traffic diversion.

There are several traffic pattern changes scheduled over the next year for the Zoo Interchange traffic diversion. These will result in increased traffic volume on Bluemound Rd and correspondingly fewer gaps in traffic to permit local street traffic access to Bluemound Road.

WisDOT has installed an Adaptive Traffic Signal system for improved traffic flow on Bluemound Road from Sunny Slope Road to 84<sup>th</sup> Street/Glenview Avenue and on Moorland Rd from Greenfield Ave/STH 59 to McDonald's/Brookfield Square driveways. This system is being expanded in November 2014 to include Bluemound Rd & Moorland Rd/Pilgrim Parkway plus Watertown Plank Rd & Pilgrim Pkwy. This will improve traffic flow along the arterials and give Watertown Plank/North Shore Bank signals the continued opportunity to have multiple green periods within the system cycle. Currently the coordination is double cycling; green is provided for eastbound and westbound twice to one green on Bluemound Rd. The result is the traffic queue, traffic backup, westbound has been reduced with the shorter cycle length. This is completed by Time Based Coordination with time of day control. This will be the backup for the Adaptive Traffic Signal System on Watertown Plank Road.

TADI Exhibit "C" represents forecasted traffic in 20 years (2035) with existing roadway conditions. These exhibits have AM and PM peak hour traffic volumes. Exhibit "D" is forecasted traffic volumes adding Wisconsin Avenue to existing roadway conditions. Exhibit "E" is 2035 restricting right in and out for Watertown Plank and office access. With the closure of Watertown Plank Road at Pilgrim Pkwy the total of westbound traffic is moved to be a right turn. It is my opinion that conservatively one half of the left turns and all thru traffic westbound on Watertown Plank Road will divert to Elm Grove Road, Sunny Slope Road and Terrace Drive with the majority of the traffic using Terrace Drive. Exhibits have been prepared to show traffic volume and locations of driveways and intersections. They are as follows:

- o Exhibit TES 3-1 - Existing Local Access Details
- o Exhibit TES 3-2 - Existing Terrace Drive Traffic
- o Exhibit TES 4-5A - Terrace Drive Traffic Calculations with Redirected Route AM & PM Traffic.

Three methods of traffic control for the new intersection of Wisconsin Avenue/Ace Hardware Access and Pilgrim Parkway are defined: Two-Way STOP (eastbound and westbound) Traffic Signal or Roundabout.

**Scenario 1:** Existing conditions with the USH 18 resurfacing and without the Wisconsin Avenue extension ("no extension" scenario).

- This WisDOT intersection modification work on Bluemound Rd has been completed and existing conditions are improved from the original TIA. The 12/6/2010 analysis is the only existing conditions calculations to review. TADI Intersection number 200 is Pilgrim Parkway and Watertown Plank Road. There are changes to the phase assignments and timing from the existing condition analysis that are not included in the report.

- Intersection 200, Pilgrim Parkway and Watertown Plank, weekday peak hour traffic is 7:30-8:30 AM and 4:45-5:45 PM. There are changes in phase movements: controller uses phase 2 & 6 for northbound and southbound, Phase 3 and 4 are eastbound and westbound with eastbound moving first in the peak periods. Thus any unused time from eastbound green is added to westbound green and the shorter cycles relative to Bluemound results in reduced queue and motorist delay for eastbound and westbound traffic. The intersection operates at ½ the cycle of Moorland Rd & Pilgrim Parkway and Bluemound Road, i.e. each time the Bluemound Road intersection goes through the sequence of traffic movements the Watertown Plank Road intersection sequences twice.
- The coordination is set to assure eastbound left turn at Bluemound and northbound Moorland traffic does not back into Bluemound traffic flow. TIA delay and queue calculations are therefore not representing current conditions. WisDOT is planning to implement changes at Watertown Plank which includes adding video vehicle detection for all traffic. This detection for local control will be added to the adaptive control for traffic signal progression on Moorland Rd south to Greenfield Avenue/STH 59 and Bluemound Rd east to 84<sup>th</sup> Street/Glenview Avenue.

**Scenario 2:** Extension of Wisconsin Avenue to Pilgrim Parkway opposite the Ace Hardware access. Operate with two-way stop control.

- No analysis has been provided by TADI for this alternative. It is concurred that this alternative with or without changes to Watertown Plank Rd and Pilgrim Parkway would not be acceptable from a LOS or safety consideration.

**Scenario 3:** Extension of Wisconsin Avenue to Pilgrim Parkway opposite the Ace Hardware access. Operate with traffic signal control.

- No analysis has been provided by TADI for this alternative with no changes to geometry or traffic control at Watertown Plank Rd and Pilgrim Parkway. Further review of Scenario 4 will include traffic signal control..

**Scenario 4A & 4B**

**2035 Summary of critical lane movements at Wisconsin Ave with traffic signal.**

	EBL	WBL	WBTR	NBL- NBU	NBT	SBL	SBT
<b>300 AM</b>							
# OF LANES	1	1	1	1	2	1	2
Control Delay	26.5	24.6	16.3	18.7	6.3	15.4	15.6
95th % Queue (ft)	34	16	17	269	221	25	213
LOS	C	C	C	A	A	A	A
Turn Ln Length	150	wthru	n/a	225	n/a	150	n/a
				NBL- NBU		SBL	SBT
<b>300 PM</b>							
# OF LANES	1	1	1	2		1	1
Control Delay	37.7	29.1	11.3	17	4.4	20.1	26.5
95th % Queue (ft)	121	41	29	204	126	21	334
LOS	C	C	C	B	A	B	C
Turn Ln Length	150	wthru	n/a	225	n/a	150	n/a

**2035 Summary of critical lane movements at Wisconsin Ave. with roundabout.**

	EB	WBL	WBTR	NBL- NBU	NBT	SBL	SBT
<b>300 AM</b>							
# OF LANES	1		1		2		2
Control Delay	6.3		7	7.4	8.2	8.7	9.7
95th % Queue (ft)	0.2		0.1	2.2	2.7	2.1	2.6
LOS	A		A		A		A
Turn Ln Length	n/a	n/a	n/a	n/a	n/a	n/a	n/a
				NBL- NBU		SBL	SBT
<b>300 PM</b>							
# OF LANES	1		1		2		2
Control Delay	11.8		10.9	10.5	12.3	10.6	12.2
95th % Queue (ft)	1.5		0.7	3.7	4.9	3.1	3.9
LOS	B		B	B	B	B	B
Turn Ln Length	n/a	n/a	n/a	n/a	n/a	n/a	n/a

**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.

- In my opinion the most significant element of the TIA is the resulting diversion of westbound traffic on Watertown Plank Rd approaching Pilgrim Parkway. This will result in motorists selecting alternate routes for travel. The westbound traffic may use Elm Grove Road, Sunny Slope Rd and Terrace Drive to access Bluemound Road and then Moorland Rd via Bluemound Rd. The most significant impact will be to the residential neighborhood along Terrace Drive and LOS plus safety

of traffic operations at Terrace Drive/Westmoor Drive and Moorland Rd. This will reduce the northbound u-turns at Wisconsin Ave/Ace Hardware if westbound traffic is restricted at Pilgrim Parkway. This diversion will improve operations for a traffic signal or roundabout.

- The chart above compares the traffic signal impact to the roundabout. Design. The delays and resulting queues along Pilgrim Parkway and exiting Ace Hardware needed to be minimized. The roundabout does this very effectively.

**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.

- The redirection described in 4A applies to this scenario.
- The redirection of traffic will reduce the delay and queue calculation for AM & PM.
- The roundabout design includes 2 lanes northbound and southbound and single lane eastbound and westbound. A free flow right turn should be provided northbound to Ace Hardware and southbound to encourage traffic to use Wisconsin Ave.

**Scenario 5** has a major impact on parking for Ace Hardware and the Village approved agreement for off-site parking for the adjacent office to the north to meet parking requirements. Seasonal sales utilize the parking space in the northeast portion of the parking lot. This activity would have to relocate or be discontinued. There would be a loss in Village tax revenue from land acquisition for right of way. Though the roundabout has capacity to handle this redirected traffic it is not in my opinion of benefit to the Village.

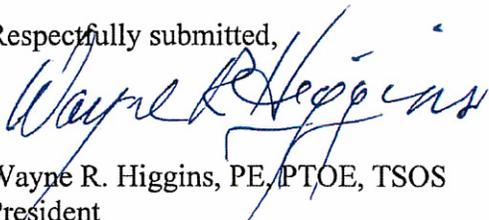
**Scenario 5A:** Extension of Wisconsin Avenue to Pilgrim Parkway and realignment of Watertown Plank Road across from Wisconsin Avenue to create a four-leg intersection. Operate with traffic signal control.

**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.

In general the study has no new traffic expected from development along Wisconsin Avenue and the focus of the study is on Pilgrim Parkway traffic operations. The assumption is that no traffic will take alternate routes. I disagree with this assumption and think westbound Watertown Plank Road traffic will have redirected traffic that may negatively impact streets in the Village. The traffic queue analysis for the new intersection impacts the property access to the north. This access needs to be addressed in a preliminary design with updated traffic volumes.

In conclusion, I find that the roundabout alternative at the extension of Wisconsin Ave opposite Ace Hardware driveways with Watertown Plank Road intersection with Pilgrim Rd could be designed for the least negative impact to Village residents and businesses. A concept design of a two lane roundabout is attached for reference. We have met with Stu Elliot and reviewed this alternative with no changes to access at Pilgrim Parkway and Watertown Plank Road. His comments are in a separate written response to Neil Palmer, Village President. It is recommended that the Village request WisDOT modify the median on Bluemound Road west leg of the Westmoor Drive and Terrace Drive intersection to reduce conflict with u-turning, cross traffic and left turns. By moving the end of the median 25-feet west it will enable eastbound u-turning vehicles to have greater separation from the intersection left turn and crossing maneuvers. Thus increasing safety for the intersection traffic.

Respectfully submitted,

A handwritten signature in blue ink that reads "Wayne R. Higgins". The signature is written in a cursive style and is positioned above the typed name.

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