



Agenda
Public Works Standing Committee
March 13, 2018, 6:30 P.M.
Village Court Room
3930 North Murray Avenue, Shorewood, WI

1. Call to order
2. Discuss Updated Lake Drive Report, Analysis and Recommendations with Ayres Associates Traffic Engineer Kenneth Voigt
3. Adjournment

Notice that a possible quorum of the Pedestrian and Bicycle Safety Committee may occur as they are invited to attend this Public Works Standing Committee.

DATED at Shorewood, Wisconsin, this 8th day of March, 2018,

VILLAGE OF SHOREWOOD
Sara Bruckman
Village Clerk

It is possible that members of and possibly a quorum of members of other governmental bodies of the municipality may be in attendance at the above stated meeting to gather information; no action will be taken by any governmental body at the above stated meeting other than the governmental body specifically referred to above in this notice. Should you have any questions or comments regarding any items on this agenda, please contact the Village Manager's Office at 847-2700. Upon reasonable notice, efforts will be made to accommodate the needs of disabled individuals.

MEMORANDUM

To: Mr. Tyler Burkart, Village of Shorewood

From: Ken Voigt, P.E., Senior Transportation Engineer

Date: March 8, 2018

Project Number: 49-0074.00

Re: Lake Drive Lane Reduction Study – Capitol Drive to Edgewood Avenue

Ayres Associates has been retained by the Village of Shorewood to study the feasibility of reducing the number of directional peak hour traffic lanes on the segment of Lake Drive between Capitol Drive and Edgewood Avenue (southern Village limits) from a 2-lane to a 1-lane roadway. The goals of the lane reduction proposal are to reduce traffic speeds and enhance pedestrian and bicyclist safety. The Village had previously approved a similar peak hour lane reduction for the segment of Lake Drive between Capitol Drive and Kensington Boulevard (northern Village limits).

Existing Conditions

Lake Drive is currently a 44-foot wide street that operates with one lane in each direction except during morning and evening peak hour time periods when it prohibits directional peak hour on-street parking that allows Lake Drive to operate with 2 traffic lanes in the peak traffic direction. During the morning peak traffic period southbound on-street parking is prohibited during the 7:00 AM to 9:00 AM time period. Conversely, during the evening peak traffic period northbound on-street parking is prohibited during the 4:00 PM to 6:00 PM time period. During other times of the day on-street parking is allowed with a 2-hour duration.

Lake Drive at its intersection with Capitol Drive operates with a separate southbound through lane and a shared through/right turn lane. During all but the morning 7:00 to 9:00 AM time period these two lanes extend north of Capitol Drive a distance of 140 feet and south of Capitol Drive for a distance of approximately 75 feet. During the 7:00 to 9:00 AM time period southbound on-street parking is prohibited along the entire length of Lake Drive between the north and south Village Limits.

In comparison, the northbound approach of Lake Drive operates with separate left turn and through traffic lanes. During all but the evening 4:00 to 6:00 PM time period these two lanes extend south of Capitol Drive to Shorewood Boulevard, a distance of 750 feet and a distance of 75 feet north of Capitol Drive. During the 4:00 to 6:00 PM time period parking along the northbound side of Lake Drive is prohibited along the entire length of Lake Drive within the Village limits.

Lake Drive is classified as a connecting State Highway 32 with a posted speed limit of 30 mph. The Wisconsin Department of Transportation (WisDOT) policy currently provides ‘Highway Aid’ funds to the Village based on Lake Drive operation with one lane in each direction, no additional funding credits are provided to the Village for allowing Lake Drive to operate as two lanes in each direction during peak traffic periods. This policy was confirmed on February 20, 2018 and pertains to the entire length of Lake Drive within the Village Limits.

Traffic Volume

As part of this study Ayres Associates collected traffic volume and speed data on Lake Drive over a 24-hour period on Tuesday, October 4, 2016. The following summarizes the variation in daily traffic levels along the study segment of Lake Drive.

Table 1: Traffic Volume Change Along Lake Drive (2016)

<u>Location</u>	<u>24-Hour Volume</u>
• South of Edgewood Avenue	13,550 vpd
• South of Capitol Drive	15,400 vpd
• North of Capitol Drive	14,800 vpd
• North of Kensington Boulevard	13,900 vpd*

Note: * count taken in 2010

As shown on Table 1, daily traffic volumes along Capitol Drive are relatively consistent across the Capitol Drive intersection ranging between 15,400 vehicles per day (vpd) south of Capitol Drive to 14,800 vpd north of Capitol Drive. Table 1 also shows that Lake Drive daily volumes at the southern and northern Village limits range between 13,550 vpd to the south and 13,900 vpd to the north. From a peak hour perspective, which has the greatest impact on intersection traffic operation, recent year 2016 peak southbound volumes counted by Ayres Associates range between 1,230 vph to 1,315 vph across the Capitol Drive intersection during the morning peak hour with northbound evening peak hour volumes ranging between 1,100 vph to 1,135 vph along the study segment of Lake Drive. This hourly variation is not expected to significantly impact traffic operation conditions along Lake Drive.

A review of WisDOT traffic count data since 2007 indicates that daily traffic volume levels on Lake Drive have not changed over the last 10 years.

Traffic Speed

Traffic speed data was collected on Lake Drive south of Edgewood Avenue, which has a posted speed limit of 30 mph and is summarized on Table 2.

Table 2: Lake Drive Traffic Speeds South of Edgewood Avenue

<u>Direction of Travel</u>	<u>Average Speed</u>	<u>85th % Speed</u>	<u>% Exceeding Posted Speed</u>
Northbound	35-40 mph	39-46 mph	45-79 mph
Southbound	33-37 mph	38-43 mph	27-67 mph

Note: xx-yy, xx = speed in left lane, yy = speed in curb lane

As shown on Table 2, current traffic speeds exceed the existing 30 mph posted speed limit in both directions of travel on Lake Drive. Table 2 indicates that ‘85th percentile’ speeds range between 38 to 39 mph in the left lane and 43 to 46 mph in the curb lane.

As also shown on Table 2, the average speeds in the left lane average between 33 to 35 mph compared to curb lane speeds, which average between 37 to 40 mph. This pattern is particularly evident for traffic traveling in the north and southbound curb lanes where 67 to 79% of traffic is exceeding the speed limit. Fortunately, the curb lane volumes only comprise between 1 % to 24 % of the total traffic on Lake Drive except during the northbound evening peak hour traffic when it comprises approximately 44 percent of the northbound volume.

The Lake Drive traffic speed analysis indicates that existing traffic speeds are significantly exceeding the posted speed limit and that traffic speeds in the north and southbound curb lanes are higher than speeds in the center traffic lanes.

Traffic Safety

A general review of traffic related crashes along Lake Drive was conducted for the 5-year time period between 2013 and 2017. Table 3 indicates that crashes between Edgewood Avenue and Kensington Boulevard have shown an increase since 2015. Of those crashes, 34 crashes were identified as property damage only with the remaining 19 crashes resulting in injuries. There were no fatalities reported during the 2013 to 2017 time period.

Table 3: Annual Traffic Crashes on Lake Drive in the Village of Shorewood

<u>Year</u>	<u>Crashes</u>
2017	13
2016	16
2015	11
2014	7
2013	6

Table 4 summarizes the type of collisions experienced on the study segment of Lake Drive.

Table 4: Lake Drive Collision Patterns (2013-2017)

<u>Collision Type</u>	<u>Number of Crashes</u>
• Rear End	19
• Angle	12
• Sideswipe	5
• Struck a Tree	4
• Head-on	2
• Involved a Pedestrian	1
• Involved a Bicyclist	1
• Other	9

As shown on Table 4, the highest collision patterns on Lake Drive involved rear end crashes followed by angle crashes. This is not considered unusual for a street like Lake Drive.

Table 5 below summarizes the 5-year total number of crashes reported at each Lake Drive intersection between Edgewood Avenue and Kensington Boulevard.

Table 5: Lake Drive Intersection Crashes (2013 – 2017)

<u>Intersection</u>	<u>Crashes</u>
• Edgewood Avenue	8
• Shepard Avenue	1
• Menlo Boulevard	1
• Newton Avenue	3
• Beverly Road	1
• Shorewood Boulevard	5
• Capitol Drive	16
• Jarvis Street	8
• Wood Place	1
• Olive Street	1
• Lake Bluff Boulevard	1
• Kensington Boulevard	4

Table 5 indicates the highest traffic crash intersections were located at Capitol Drive with 16 crashes, approximately 3 crashes per year, followed by Edgewood Avenue and Jarvis Street both of which experienced 8 crashes, slightly more than 1 crash per year, over the same 5-year time period.

The traffic safety review also indicates 5 crashes occurred during the 7:00 AM to 9:00 AM time period, 25 crashes occurred during the midday 9:00 AM to 4:00 PM time period, and 15 crashes during the 4:00 PM to 6:00 PM time period with the remaining 8 crashes occurring during the 6:00 PM to 7:00 AM time period. Of those crashes, 19 crashes involved rear end collisions, 12 involved angle crashes, 5 involved sideswipe crashes and 4 involved vehicles striking a tree, 1 crash involved a pedestrian and 1 crash involved a bicyclist.

Lane Conversion Analysis

For reference purposes, Ayres Associates had conducted a previous study in 2010 for the Village of Whitefish Bay to convert the 2-lane peak hour operating roadway segment of Lake Drive north of Kensington Boulevard in the Village of Whitefish Bay to a 1-lane operation in each direction. The Whitefish Bay segment of Lake Drive carries similar traffic volume levels to those on the segment of Lake Drive in the Village of Shorewood. The purpose of that study also was to tame traffic speeds and enhance pedestrian safety. That lane conversion change has been successfully implemented by the Village of Whitefish Bay.

Since Lake Drive is a connecting State Highway (SH 32) the WisDOT has indicated that any change in peak hour parking restrictions will require an operational analysis of the Lake Drive intersection with Capitol Drive (SH 190) to confirm that the proposed lane reduction plan will not jeopardize existing traffic operating conditions.

Intersection operation is typically quantified based on its Level of Service (LOS) during peak traffic volume time periods. Level of Service is defined as the average amount of delay experienced by traffic entering an intersection over a 1-hour time period. Level of Service is categorized by grades of 'A' through 'F'. Most public agencies define acceptable intersection operation as LOS 'C' or 'D'. Table 6 provides a brief traffic operation summary of the different Levels of Service.

Table 6: Intersection Level of Service Descriptions

Level of Service (LOS)				
ALPHA LOS	NUMERIC LOS	SIGNALIZED DELAY (seconds/vehicle)	UNSIGNALIZED DELAY (seconds/vehicle)	DESCRIPTION
A	1.01 to 2.00	< 10	< 10	No Congestion, Minimal Delay
B	2.01 to 3.00	> 10 to 20	> 10 to 15	No Congestion
C	3.01 to 4.00	> 20 to 35	> 15 to 25	Minimal Congestion
D	4.01 to 5.00	> 35 to 55	> 25 to 35	Moderate Congestion
E	5.01 to 6.00	> 55 to 80	> 35 to 50	Severe Congestion
F	> 6.00	> 80	> 50	Extreme Congestion

Capitol Drive Intersection Operation: As part of this study, Ayres Associates collected morning and evening peak period intersection turning movement counts at the Lake Drive intersection with Capitol Drive. The traffic counts were taken during the morning 7:30 to 8:30 AM and evening 4:45 to 5:45 PM commuter traffic peak hours. Based on those traffic counts and existing traffic signal timings an analysis of peak period traffic operation was conducted and is summarized on Table 7.

Table 7: Peak Hour Operation of the Lake Drive Intersection with Capitol Drive.

Traffic Operation Conditions at Lake Drive and E Capitol Drive - HCM 2010 Methodology									
	Peak	MOE	Capitol Drive		Lake Drive		Lake Drive		Overall
			EBL	EBR	NBL	NBT	SBT	SBR	
Existing	AM Peak	LOS	C	C	B	A	D		D
		Queue (ft)	75	50	50	150	475		N/A
		Delay (sec)	23.2	26.3	19.3	9.6	49.4		38.0
	PM Peak	LOS	C	D	B	B	C		C
		Queue (ft)	150	50	75	650	275		N/A
		Delay (sec)	33.5	35.3	12.4	19.1	23.5		22.2

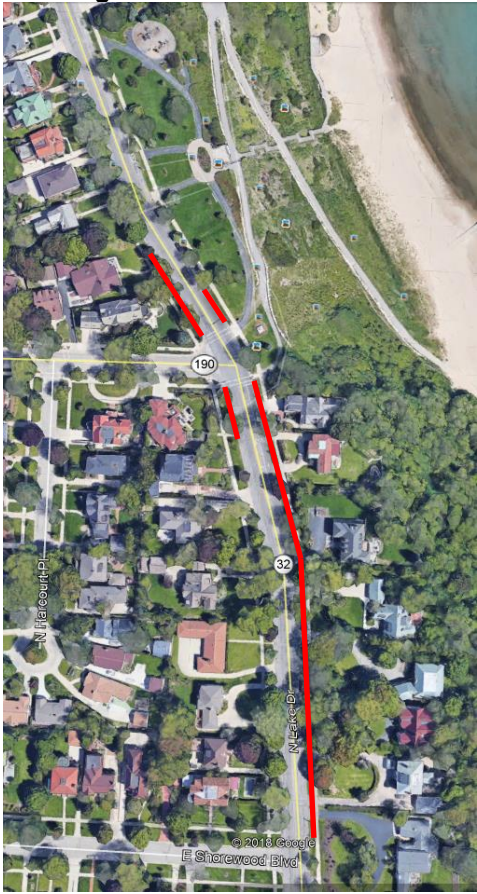
As shown on Table 7, all intersection traffic movements during both the morning and evening peak hours operate at Level of Service (LOS) 'C' or better except for the southbound through and right turn movements on Lake Drive during the morning peak hour and the eastbound right turn on Capitol Drive during the evening peak hour which operate at LOS 'D'.

Table 7 also indicates that southbound morning peak hour queuing, with the prohibition of on-street parking during the 7:30 to 8:30 AM peak traffic hour, extends a maximum of 475 feet on the southbound approach to Capitol Drive with maximum northbound queues on the Lake Drive approach to Capitol Drive extending a distance of 150 feet in the through traffic lane and 50 feet in the left turn lane. In comparison, during the evening peak hour southbound traffic on Lake Drive extends a maximum distance of 275 feet north of Capitol Drive with a maximum northbound queue of 650 feet in the through traffic lane and 75 feet in the left turn lane.

Based on the WisDOT requirement to not degrade intersection traffic operation, the Lake Drive approaches to Capitol Drive will need to continue to provide 2 traffic lanes on both the north and southbound approaches of Lake Drive during peak traffic conditions with sufficient on-street parking restrictions to accommodate the maximum intersection queuing distances. Figure 1 illustrates existing non-peak traffic period parking restrictions on Lake Drive at its intersection with Capitol Drive.

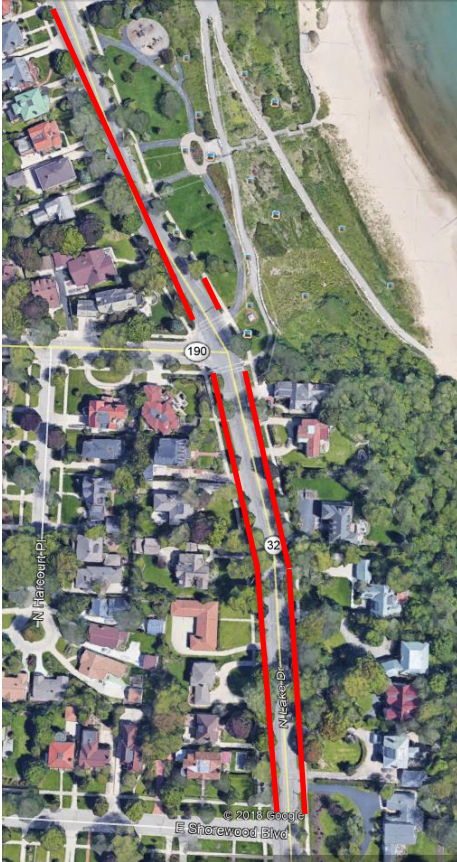
Figure 1: Lake Drive/Capitol Drive Parking Restrictions

Existing Non-Peak Hour Restrictions

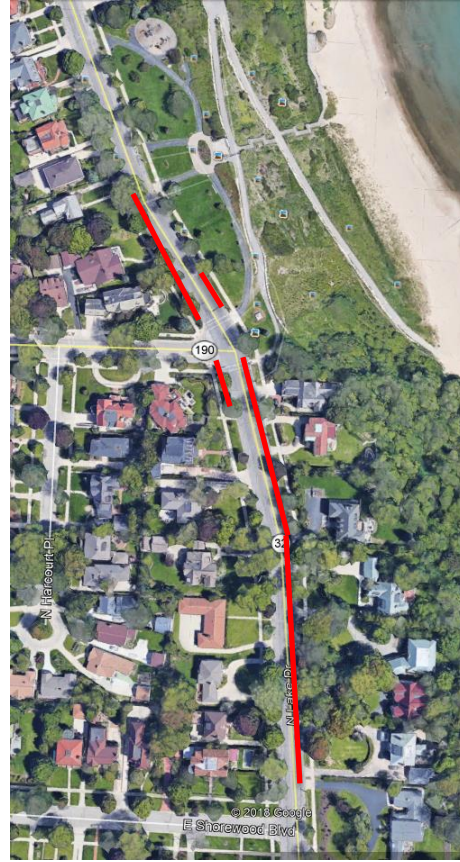


**Figure 2: Lake Drive/Capitol Drive Lane Reduction
Peak Hour Parking Restrictions**

7:00 to 9:00 AM No Parking



4:00 to 6:00 PM No Parking



As shown on Figure 2, southbound on-street parking should be prohibited a distance of 500 feet north of Capitol Drive during the 7:00 to 9:00 AM time period and 300 feet during the evening 4:00 to 6:00 PM peak hour. In order to safely allow the two southbound traffic lanes north of Capitol Drive to merge into a single lane south of Capitol Drive, on-street, parking south of Capitol Drive should be restricted for a distance of 750 feet to its intersection with Shorewood Boulevard. Northbound on-street parking should continue to be prohibited a distance of 750 feet south of Capitol Drive during the entire day. With only one northbound traffic lane south of Capitol Drive it is not necessary to change existing northbound on-street parking restrictions north of Capitol Drive.

Typical Residential Street Intersection: A qualitative traffic operation analysis was conducted to determine typical Lake Drive operation at its intersections with existing residential neighborhood streets under a lane reduction condition which is summarized on Table 8. For this analysis it was assumed Lake Drive at a typical residential street intersection could experience 15 morning and 25 evening northbound left turns and 20 morning and 25 evening southbound right

turns with the residential street carrying 15 morning and 25 evening left turns and 25 evening eastbound right turns and 25 morning and evening right turns.

Table 8: Peak Hour Lake Drive Operation at Typical Residential Street

Traffic Operation Conditions at Lake Drive and Menlo Boulevard - HCM 2010 Methodology									
Configuration	Peak	MOE	Menlo Blvd		Lake Drive		Lake Drive		Overall
			EBL	EBR	NBL	NBT	SBT	SBR	
Existing	AM Peak	LOS	F		B		A	A	A
		Queue (ft)	50		25		0	0	N/A
		Delay (sec)	61.0		13.9		0.0	0.0	1.5
	PM Peak	LOS	F		B	A	A		A
		Queue (ft)	50		25	0	0		N/A
		Delay (sec)	51.9		10.5	0.7	0.0		1.7
Future 2-Lane	AM Peak	LOS	F		B		A		A
		Queue (ft)	75		25		0		N/A
		Delay (sec)	79.4		13.8		0.0		1.9
	PM Peak	LOS	F		B		A		A
		Queue (ft)	100		25		0		N/A
		Delay (sec)	172.0		10.5		0.0		4.2

The analysis summary on Table 8 reports existing operation with a 2-lane southbound approach during the morning peak period and a 2-lane northbound approach during the evening peak hour, as well as intersection operation with one-lane approaches during both the morning and evening peak periods. Table 6 indicates that converting Lake Drive from 2-lane to 1-lane peak hour operation does not affect Lake Drive operation at its residential street intersections with traffic expected to continue to operate at LOS 'A' in the southbound direction and LOS 'B' in the northbound direction on Lake Drive. For operational purposes, northbound on-street parking should be prohibited during evening peak traffic hours at its intersections with east-west neighborhood streets. The length of northbound evening peak hour parking restrictions should allow northbound through traffic to safely bypass a northbound left turning vehicle waiting for a gap in southbound traffic to enter a residential street.

As noted from the Table 8 data, northbound and southbound traffic operation on Lake Drive is basically unaffected with conversion of Lake Drive from 2-lane to 1-lane peak hour operation with all traffic movements on Lake Drive operating at LOS 'B' or better under either condition. However, converting Lake Drive to a 1-lane roadway in each direction can be expected to increase evening peak hour queuing on residential street intersections by 25 feet for eastbound traffic turning left or right onto Lake Drive along with increases in eastbound morning and evening peak hour average vehicle delays.

Based on this analysis of the Lake Drive intersections with Capitol Drive and typical neighborhood streets, it is Ayres Associates professional opinion that changing the peak hour operation of Lake Drive from 2-lane to 1-lane is not expected to change or cause traffic to divert to other Village streets. This opinion is based on the fact that there is no incentive for motorists to avoid Lake Drive since it is expected that Lake Drive operation at its intersection with Capitol Drive will not change and that neighborhood street intersections will continue to operate as a 1-lane facility at Levels of Service 'A' and 'B' as it currently does under 2-lane peak hour operation.

Figure 3 provides an example of the 4:00 to 6:00 PM northbound parking restriction at a typical neighborhood street intersection with Lake Drive.

Figure 3: Typical Neighborhood Street Intersection 4:00 to 6:00 PM Parking Restriction on Northbound Lake Drive



Traffic Speed Impact: According to the ITE report, *'Designing Walkable Urban Thoroughfares: A Context Sensitive Approach'*, speed management on arterial streets can be accomplished through numerous techniques including speed enforcement, road diets, provision of on-street parking, narrowed travel lanes and speed actuated feedback signs.

The current width of Lake Drive is 44 feet from curb to curb allowing for 11-foot wide travel lanes in each during peak traffic time periods. During non-peak traffic periods, Lake Drive currently appears as a 22-foot wide street unless a vehicle is parked along the roadway curb. The 22-foot wide directional width perception on Lake Drive can encourage traffic speeding conditions.

Converting Lake Drive to a 1-lane roadway in each direction requires installation of a continuous white pavement edge line marking for a single 11-foot wide traffic lane and a dedicated 11-foot wide curb lane for on-street parking and bicycle riders. Under this condition, the curb lane can be signed as a bike route. It should not be striped as a bike lane which requires a 5-foot width in addition to the requirement for an 8-foot wide parking lane. The solid white lane line can influence driver roadway width perception and tame traffic speeds. Figure 4 illustrates how the lane marking transition from 2-lane operation south of Edgewood Avenue to 1-lane operation north of Edgewood Avenue.

Figure 4: Edgewood Avenue Pavement Marking Transition Example



It is recommended, for speed management purposes, that a permanent southbound radar speed feedback sign be installed on Lake Drive north of Marion Street and that a northbound radar speed feedback sign be installed south of Menlo Boulevard to tame traffic speeds.

Conclusions

1. Traffic volumes levels along the study segment of Lake Drive between Kensington Boulevard and Edgewood Drive are relatively consistent ranging between 14, 800 to 15,400 vpd across the Capitol Drive intersection. Peak hour volumes are also consistent along the study segment of Lake Drive.

2. Traffic is currently speeding on Lake Drive with 85th percentile traffic speeds between 38 to 43 mph with between 27 to 79 percent of the daily traffic exceeding the posted 30 mph speed limit.
3. The highest number of annual traffic crashes on the segment of Lake Drive within the village limits over the past 5 years was 16 crashes in 2016 of which 5 occurred at the Capitol Drive intersection.
4. On-street parking is currently prohibited along Lake Drive in the southbound direction from 7:00 to 9:00 AM and in the northbound direction from 4:00 to 6:00 PM. Two-hour parking is allowed along both sides of Lake Drive during the remainder of the day.
5. The Wisconsin Department of Transportation has indicated that converting Lake Drive (which is SH 32) operation to a 1-lane roadway in both directions during all times of the day should not be allowed to negatively impact peak hour traffic operation of the Lake Drive intersection with Capitol Drive.
 - a. A peak hour operational analysis was conducted for the Lake Drive intersections with Capitol Drive and a typical neighborhood street. That analysis indicates traffic operation on Lake Drive as a 1-lane facility will continue to operate at similar Levels of Service as experienced under 2-lane operation.
 - b. Lake Drive at its intersection with Capitol Drive, as previously shown on Figure 1, should continue to operate with two southbound and northbound approach lanes. In the northbound direction the lanes should be dedicated with a separate left turn lane and a through traffic lane. In the southbound direction Lake Drive should operate with a shared through/right turn lane and a separate through traffic lane. Southbound on-street parking during the morning peak hour will need to be restricted within 500 feet of its approach to Capitol Drive. South of Capitol Drive southbound on-street parking should be prohibited all day for a distance of approximately 750 feet to allow the two through lanes to merge to a single lane at Shorewood Boulevard. Likewise, northbound Lake Drive at its intersection with Capitol Drive should continue to prohibit all day on-street parking from Capitol Drive to Shorewood Boulevard. North of Capitol Drive northbound on-street parking can remain unchanged from existing conditions at Atwater Park.
 - c. Based on an operational analysis of the Lake Drive intersection with Capitol Drive and neighborhood street intersections, it is Ayres Associates professional opinion that changing the peak hour

operation of Lake Drive from 2-lane to 1-lane is not expected to change or cause traffic to divert to other Village streets. This opinion is based on the fact that Lake Drive operation does not change if converted to one lane operation (Level of Service 'A' and 'B' under either condition) at neighborhood street intersections plus operation of the Capitol Drive intersection will continue to operate as it does today. This means there is no incentive to cause drivers to divert to neighborhood streets to avoid congestion on Lake Drive.

- d. Lake Drive at its intersections with residential neighborhood streets should prohibit northbound 4:00 to 6:00 PM peak hour on-street parking on the east side of Lake Drive across from each residential street to allow northbound traffic to bypass northbound left turning vehicles. This evening peak hour parking restriction on Lake Drive would extend 50 feet north and south of each cross-street curb line as previously shown on Figure 3.
 - e. The WisDOT has reaffirmed on February 20th, 2018 that converting Lake Drive from 2-lane to 1-lane peak hour operation will not reduce the annual WisDOT 'Highway Aid' payment to the Village.
6. Traffic speeds on Lake Drive can be tamed by installing a continuous white edge lane line pavement marking along both sides of Lake Drive. The white edge line pavement marking should provide an 11-foot wide through traffic lane and an 11 foot-wide on-street parking/bike route curb lane.
7. In addition to the conversion of Lake Drive from a 2-lane to a 1-lane directional roadway, radar speed feedback signs should on installed to reinforce the 30 mph posted speed limit on Lake Drive. The speed feedback signs should be installed on northbound Lake Drive north of Marion Street with a southbound radar speed feedback sign installed south of Menlo Boulevard.