City of Madison, Wisconsin

N. Sherman Ave

Operations and Safety Analysis from Fordem Avenue to Trailsway

Background

North Sherman Avenue is a standard arterial street located in the north side of the Madison metropolitan area. North Sherman Avenue skirts the corporate limits of the Village of Maple Bluff with the Maple Bluff/Madison corporate limits running along the centerline of N Sherman Ave from the intersection of N Sherman and Fordem Ave, extending north approximately 1,360 feet to the intersection of N Sherman Ave and Commercial Ave. At this intersection, N Sherman Ave enters the Village of Maple Bluff, and the Village has jurisdiction over the roadway from Commercial Ave, extending north approximately 1,200 feet to the north right-of-way line of the Wisconsin and Southern railroad corridor. The section of N Sherman Ave between the railroad corridor and Northport Dr (STH 113), a distance of approximately 1.4 miles, lies within the City of Madison.

This project is a transportation study of the total 1.6 mile N. Sherman Ave corridor from Fordem Ave. to Trailsway and is designed to include a review of safety and operations with recommendations to improve both.

Introduction

The purpose of this study is to analyze N Sherman Ave. and identify treatments that address existing neighborhood, business, bicycle, pedestrian, and motor-vehicle conditions with the intent to create an improved corridor in the neighborhood and to downtown Madison.

An initial neighborhood meeting was held on October 11th, 2012 to learn from local residents and property owners about operational problems and experiences using N Sherman Ave. The meeting discussed citizen generated ideas to improve the safety and function of N Sherman Ave. District 12 Alderperson, Satya Rhodes-Conway, along with City of Madison Traffic Engineering (TE) staff and Madison Police Department (MPD) officers were present at the meeting and TE staff presented current conditions including traffic volume, speed, and crash data. The concerns and ideas of residents were noted. The main topics of concern were the following: high traffic speeds, lack of bicycling facilities, and concerns for pedestrian's safety while crossing N Sherman Ave.

After reviewing residents' concerns and analyzing the street operational characteristics, Madison Traffic Engineering staff proposes a package of improvements to N Sherman Avenue including:

1) Reconfiguring the street cross-section from the existing four lane street to a two lane street with a center left turn lane and bike lanes, often referred to as TWLTL
2) Installing pedestrian refuge islands at high pedestrian crossing locations along the project corridor.

The purpose of this report is to provide information on the ways these modifications will affect and improve the safety and function of N Sherman Ave.

Existing Conditions

Existing Cross-Section. The existing cross-section of N Sherman Ave is shown below in Figure 1.

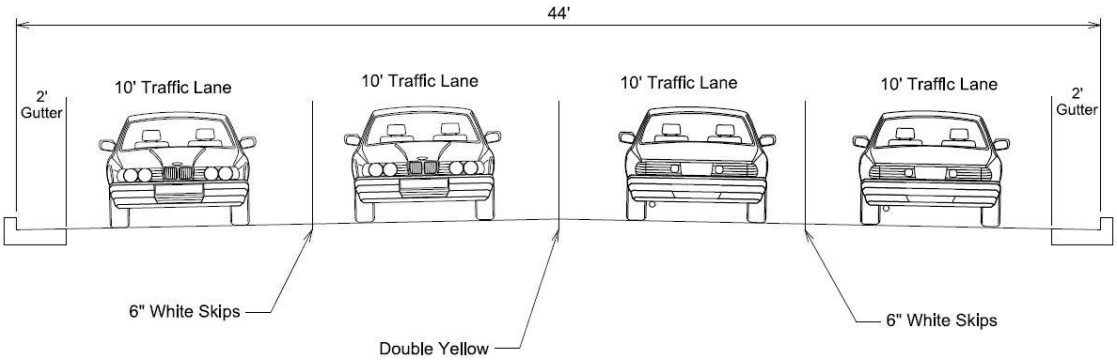

Figure 1. Existing lane configuration of N Sherman Ave

- N Sherman Ave is currently 44 feet wide with four traffic lanes—2 lanes traffic in each direction.
- No bicycle facilities are provided. Bicyclists can use the travel lanes on N Sherman Ave or the sidewalks.
- Pedestrians are accommodated within the corridor with sidewalks on both sides of the street.
- Traffic signals are in place at the N Sherman Ave intersections of Commercial Ave, Aberg Ave, and Schlimgen Ave/MacPherson St.
- A mid-block pedestrian activated rectangular rapid flash beacon (RRFB) was installed in 2012 between Roth St and Aberg Ave to accommodate pedestrians crossing N Sherman Ave between Sherman Glen Apartments and Northgate Shopping Center.
- Permanent radar speed display boards have been installed in both directions near Shabazz City High School.
- Pedestrian crossing islands and enhanced crosswalk markings were added at the N Sherman Ave intersections of Trailsway, Windom Way, and at the entrances to Warner Park/North Town Shopping Center. The latter also has overhead "Yield to Pedestrians in Crosswalks" signs.

Traffic Volume. North Sherman Ave is a standard arterial street. Current traffic volume data shows between 15,000 and 17,000 vehicles per average weekday, with the highest volume between Aberg Ave and Roth St.

Speed Limits. The posted speed limit on N Sherman Ave is 30 mph. An existing school zone speed limit area is posted along the frontage of Shabazz City High School. Within the school zone, the speed limit is 20 mph when children are present.

Crash Data. The previous five years' crash history of N Sherman Ave from Trailsway to Fordem Ave was studied. There were a total of 128 crashes—of which 38% involved motor vehicle drivers turning left from N Sherman Ave. The two most common scenarios of those types of crashes were the left-turning vehicle being struck by oncoming traffic and the left-turning vehicle getting rear-ended. These are common crash types on roadways without designated facilities for left-turning vehicles. Crash types and injuries are summarized in Table 1.

Table 1: Types of Sherman Avenue Crashes from January 2007 through December 2011.

Type of Crash	Total # of Crashes	Number of crashes with injuries
Left turn from Sherman	49	23
Right turn from Sherman	16	4
Left turn from minor street	24	10
Right turn from minor street	5	1
Bike/Pedestrian Related	5	2
Rear-end (not involving turns)	11	6
Ran stop sign	18	6
Totals	**128**	**52**

Source: City of Madison Traffic Engineering Division

There was one pedestrian fatality on N Sherman Ave in the past ten years. In 2003, a vehicle turning north onto N Sherman Ave from Vahlen St struck a pedestrian in the Sherman Ave crosswalk.

Truck Route. North Sherman Ave provides limited service to trucks as a truck route between Aberg Ave and Commercial Ave. The remaining segments of N Sherman Ave are not posted as truck routes and trucks can only use these segments if they are making a delivery or pickup in the area. In these instances, by ordinance, trucks are required to take the shortest route to and from the posted truck route system.

Proposed Solution. To address the concerns of high speed traffic, lack of safe and sustainable pedestrian crossings, lack of bicycle facilities, and to reduce crashes and improve safety, Traffic Engineering staff propose converting N Sherman Ave from its current four lane cross-section to a three lane section. This cross-section would provide one traffic lane in each direction, a center two way left turn lane (TWLTL) and bike lanes located next to the curb and gutter.

TWLTLs are a treatment which have been successfully used to reduce rear-end, head-on, and turning-related crashes elsewhere and is applicable to N Sherman Ave. The proposed three lane cross-section is expected to reduce turning-related crashes because vehicles are removed from the primary travel lane while drivers wait for an acceptable gap to turn. This treatment can also lead to a reduction in rear-end and sideswipe collisions. TWLTLs provide spatial separation between opposing lanes of traffic, which can lead to a reduction in head-on collisions.

Staff have provided below some of the history of TWLTLs in Madison as well as considered the concerns identified by neighborhood residents and other corridor stakeholders.

History of TWLTLs in the City of Madison

1994 N Sherman Ave Report

Converting N Sherman Ave to a three-lane street with a center two-way left turn lane (TWLTL) is not a new concept—the idea was first considered for N Sherman Ave. in 1994. At that time, policy makers and residents were not confident the concept had merit because the concept of

three-lane conversions was new to the region, and the city had not yet gained experience in making these types of changes. A traffic study/report was prepared by Traffic Engineering using results from national research and the city's own analysis. The recommendation of the report was to re-mark the N Sherman Ave traffic lanes as a TWLTL street for a one year trial period. The proposal did not move forward based on concerns of neighborhood residents and businesses related to traffic speed, volume, and safety. Largely because there were no TWLTL streets in Madison, these issues could not be fully addressed with local experience and the proposal was filed.

2001 N Sherman Ave

Subsequent to the 1994 consideration, in 2001 the same citizen concerns about speeding traffic, and pedestrian and bicyclist safety were again raised. In this instance, from July 30th, 2001 to November 27th, 2001, a test TWLTL configuration was installed using construction barrels between Roth St and 100 feet south of Aberg Ave.

Reaction to the test was not overwhelming in either support or opposition. Traffic volumes and speeds were generally unchanged, and only one crash (unrelated to the TWLTL) occurred. The test was terminated by the Pedestrian-Bicycle-Motor Vehicle Commission. The results of the test were inconclusive due to the short period of time the trial was in effect and due to the lack of data. One of the more frequently voiced concerns raised during this test were concerns from the business community that a TWLTL conversion would reduce traffic volume, worsen safety, and negatively impact business conditions for properties served by N Sherman Ave.

Post-2001 and More Recent Madison Examples

Since 2001, TWLTL lane marking configurations have been successfully installed across the United States and on several Madison streets including:

- N Thompson Drive in 2001
- Schroeder Road in 2007
- Watts Road in 2010
- University Avenue between Allen Ave and Breese Terrace in 2011

As noted previously in the 2001 Sherman Ave trial discussion, concerns were raised by the business community that reductions in traffic volume on streets that have been converted to three-lane sections would hurt commerce. None of the recently converted streets has had a significant reduction in traffic volume, nor has seen a significant change in the average travel speed. These concerns are discussed in greater detail below.

Stakeholder Concerns

Traffic Volume

Volume data for existing Madison streets converted from a four lane street to a three lane TWLTL cross-section shows no significant change in the volume of traffic (see Figure 2 below). These streets include: Thompson Drive (from STH 30 to Lien Rd), Schroeder Road (from Gammon Rd. to about Saybrook Rd), University Avenue (from Allen St to Breese Terrace), and Watts Road from (Gammon Rd to Struck St.) Odana Rd was converted from a four lane street to a two lane street with parking and bike lanes with no center left turn lane (from Segoe Rd to Midvale Blvd.) The daily traffic volume trends on these streets are shown in Figure 2.

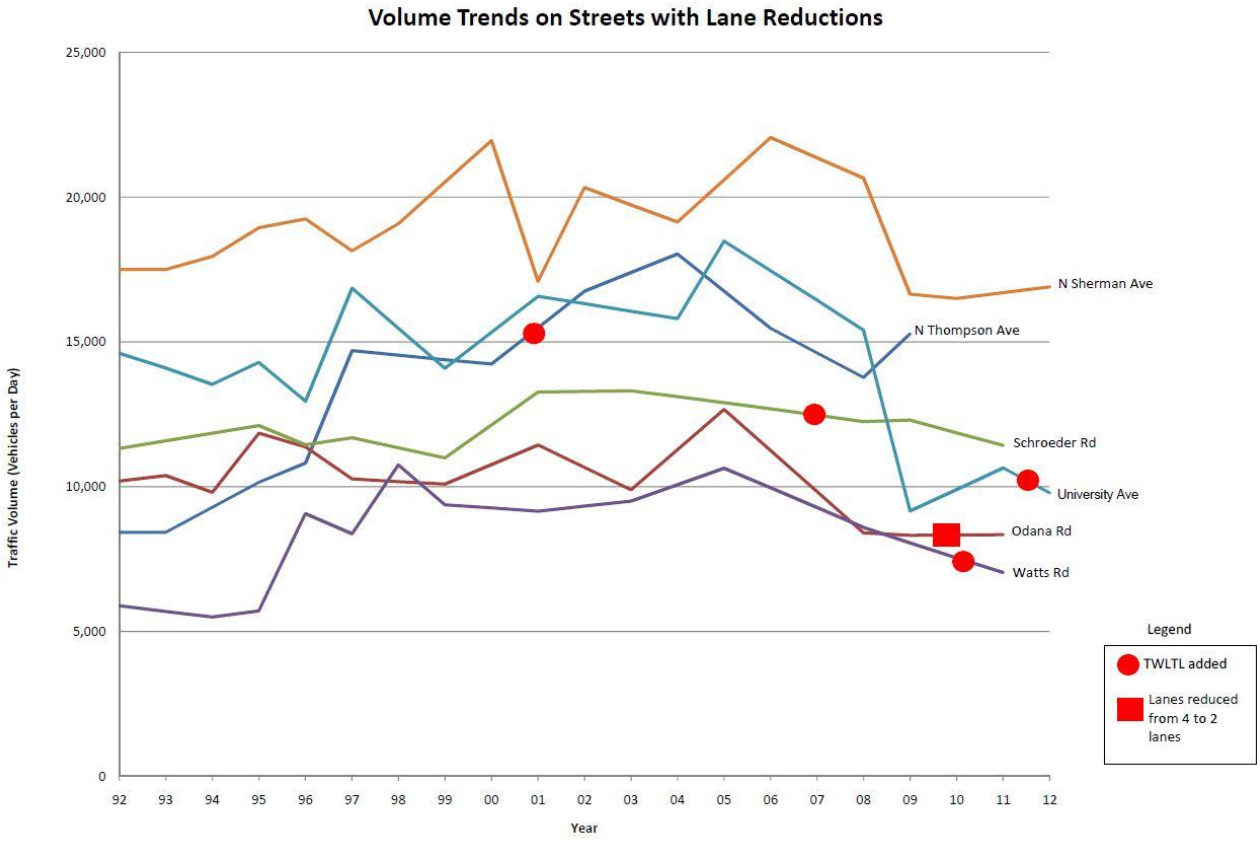

Figure 2. Traffic volume trends on Madison streets with lane reductions.

The existing, average weekday traffic is around 17,000 vehicles per day (vpd) on N Sherman Ave between Aberg Ave and Roth St. Volumes on other sections of N Sherman Ave are about 14,000 vpd.

Signalized Intersections. There are three signalized intersections within the study area—Commercial Ave, Aberg Ave, and Schlimgen Ave. The Aberg Ave intersection serves the highest volume of traffic of the three intersections, and because the TWLTL maintains only one lane of thru traffic, traffic delays can be expected to increase there during the peak hour traffic periods.

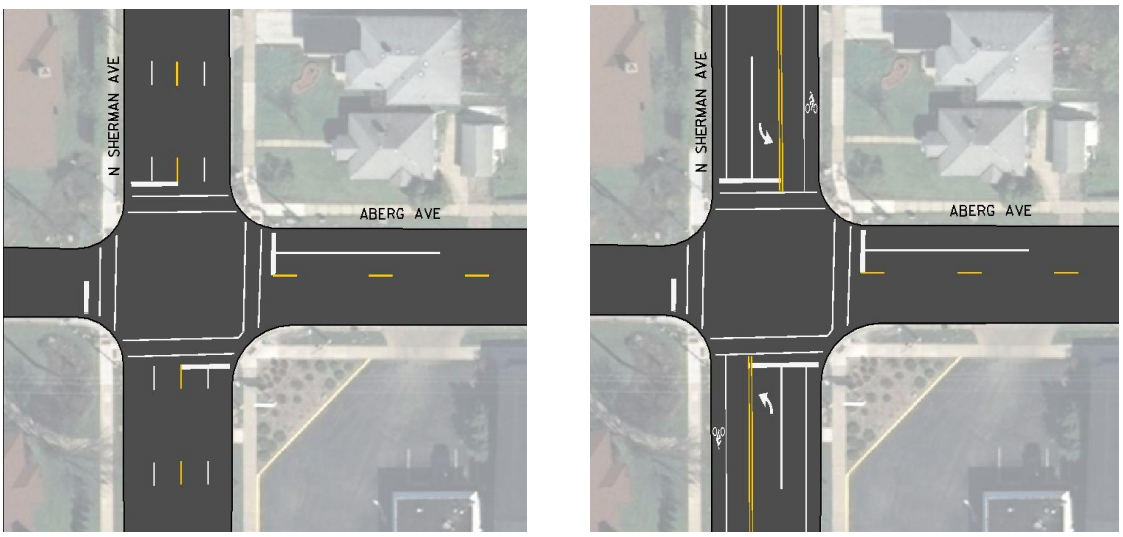

Figure 3. Existing markings (left) and proposed TWLTL markings (right) at Aberg Ave & Sherman Ave intersection.

Traffic delay and queuing is expected to increase for northbound Sherman Ave traffic between the hours of 8:00 am and 9:00 am and between 4:30 pm and 6:30 pm---the PM peak hour being 5:00 pm to 6:00 pm.

During the AM peak hour, southbound traffic is relatively unaffected, and the level of service remains at LOS C[1]. This is because the southbound left turn lane accommodates the heavier southbound to eastbound left-turn demand. The northbound through traffic, operating with one less through traffic lane, experiences increased delay, with 50th percentile queues extending approximately 400 feet to the south.

During the PM peak hour, southbound traffic conditions remain unaffected—largely because traffic patterns shift during the afternoon hours, and inbound (southbound) traffic is reduced, while traffic heading out of the city (northbound) increases. During the PM peak hour, the northbound traffic LOS drops from B to D, with the 50th percentile queue extending approximately 500 feet to the south.

It is clear that the reduction of the second through traffic lane, by direction, impacts the operation of the signalized intersection of Aberg and Sherman. However, the traffic model projections are based on existing traffic data, and Staff expects that due to the added delay, some through traffic (i.e. commuter traffic) will elect to use the more convenient Packers Ave. This will decrease traffic demand during the morning and afternoon peak traffic periods, and as a result, the projected delay and queue extensions are anticipated to be less than modeled. Traffic volumes are not expected to be impacted or reduced during non-peak traffic hours, as delay and queues should be minimal.

[1]) Per the FHWA LOS is a qualitative assessment of a road's operating conditions. For local government planning purposes, level of service is an indicator of the extent or degree of service provided by, or proposed to be provided by, a facility based on and related to the operational characteristics of the facility. Level of service indicates the capacity per unit of demand for each public facility. 2) This term refers to a standard measurement used by transportation officials which reflects the relative ease of traffic flow on a scale of A to F, with free-flow being rated LOS-A and congested conditions rated as LOS-F.

The anticipated reduction in traffic volume will have a positive impact on the overall livability of the adjoining properties, and at the same time, it will encourage the use of alternate modes of transportation. In particular, the volume of bicycle traffic is expected to increase with the provision of bicycle infrastructure and improved safety within the corridor.

Unsignalized Intersections and Driveways. A concern among residents living along N Sherman Ave is that the conversion from four lanes to three lanes will make access to/from driveways more difficult. The presence of gaps in the main street traffic stream largely determines how well a driveway or side street operates. Concerns are that traffic that is currently using two lanes per direction will now combine into one lane, and this then reduces the gaps available in the traffic stream. However, consider that drivers often do not prefer to travel side-by-side, so the reduction in acceptable gaps is often not as severe as feared. Also, consider that the reduction in number of lanes to cross will decrease the complexity of the crossing maneuver and left turns out of driveways will be easier overall, as the maneuver can be made in two stages using the center left turn lane.

Other improvements that a TWLTL provide include the ability to see gaps in traffic easier, fewer lanes of traffic to cross, traffic moving at more uniform speed and having more consistent vehicle platoons. This more uniform traffic speed and the removal of left-turn vehicles from the through travel lane which currently causes weaving of traffic, will improve overall operation.

Speed

Twenty-four hour traffic speed data was collected at two locations on N Sherman Ave, in October of 2012. The 85th percentile speed[2] at 509 N Sherman Ave (between Michigan Ct and Commercial Dr) was 39.5 mph, and 36.5 mph at 1510 N Sherman Ave (between Logan St and Farragut St.) These speeds are considered higher than average for a Madison street with a posted speed limit of 30 mph and warrant efforts to reduce speeding.

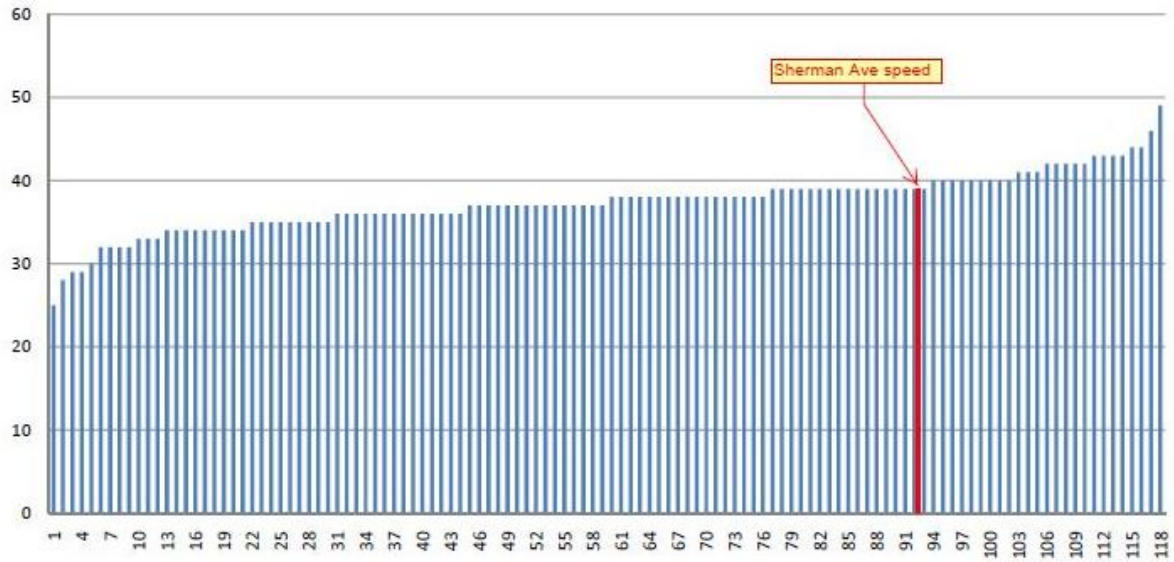

Figure 4. Speeds of Sherman Avenue compared to other Madison streets with a posted 30 mph speed limit.

[22] 85th Percentile speed is the speed at or below which 85% of the traffic is traveling.

The 85th percentile speed on Odana Rd went from 39 mph to 37 mph after its cross-section conversion, and the 85th percentile speed on Schroeder Rd was reduced from 41 mph to 39 mph after its conversion to a TWLTL. While there is no "before" speed data for University Ave, the current 85th percentile speed after installation of TWLTL with islands is 34 mph.

Converting from a four lane street to a TWLTL street with bicycle lanes is expected to reduce vehicle speeds because faster drivers will be unable to pass slower drivers. Before and after speed data from streets in Madison in which the lane configuration was changed shows that the lane configuration did not have a major impact on driver speeds. These streets had lower overall traffic volumes at the onset, so after the conversion to three lanes faster drivers were not impeded by slower drivers. Because N Sherman Ave carries a much higher volume of traffic, an overall reduction in speed is expected to occur.

Complete Streets-Bicycle Traffic

A "complete street" is a street which provides access and mobility for all forms of transportation including pedestrians, bicyclists, transit and motorists. Complete streets have been shown to improve safety, lower transportation costs, provide alternatives to private motor vehicle use, encourage health through walking and biking, create a sense of place, improve social interaction, and generally improve adjacent property values (Complete Streets FAQ, 2010). Lack of dedicated bicycle facilities on N Sherman Avenue was a major concern expressed at the neighborhood meeting in October 2012 and has also been a longstanding concern of the City. Providing bicycle facilities is part of the goals outlined in the "Northport-Warner Park-Sherman Neighborhood Plan", which was adopted by the Common Council on November 3rd, 2009.

Under existing conditions, people choose to either: ride their bikes in the street with traffic, ride on the sidewalk, avoid N Sherman Ave altogether or not bicycle at all. According to counts conducted by Alta Planning and Design in 2011, there are estimated to be 447 bike trips and 321 pedestrian trips per day on N Sherman Ave between Fordem Ave and Trailsway, and 52% of the bicycle trips are made on the sidewalk. Many riders who use the street expressed that they feel unsafe and have had negative experiences with motorists. Bicycling on the sidewalk, while legally permitted where buildings do not directly abut the sidewalk, can be problematic for pedestrians as the shared space is too narrow for multimodal use. Bicycling on sidewalks is also less safe for bicyclists, as drivers turning onto and off of N Sherman Ave at intersections and driveways typically do not look for bicyclists approaching on the sidewalk.

The safest solution for these problems is dedicated bicycle facilities. Converting the street to a street with a TWLTL will allow for four foot wide bike lanes outside of the gutter section—the City of Madison standard width for bike lanes, which is shown in Figure 5.

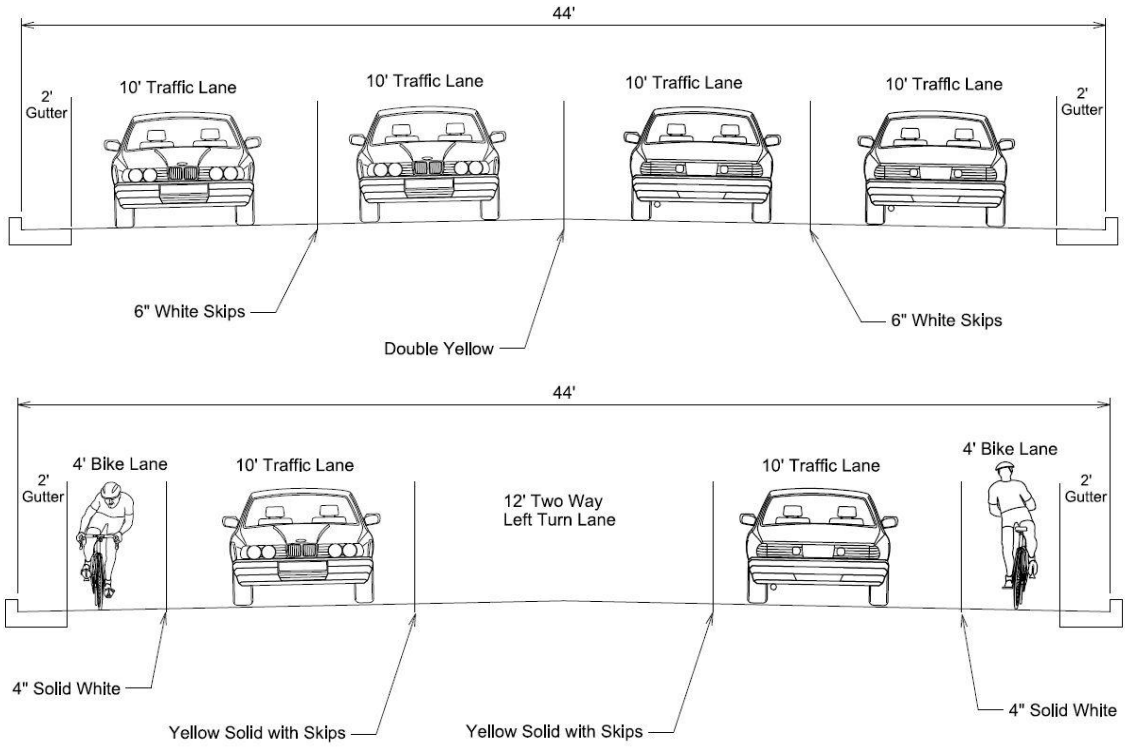

Figure 5. Sherman Cross Section existing (top) and with proposed TWLTL (bottom)

Some people have raised concerns that if bike lanes are included on N Sherman Avenue the proposed shared-use path projects in the area will not be built. This is not the case. Bike lanes on N Sherman Ave, the proposed Sherman Flyer Path along the rail corridor from Johnson/Fordem to approximately Steensland/Sheridan, and the proposed path between Roth and Commercial are complimentary projects—not mutually exclusive projects. Each serves different users, destinations, and trip purposes. Each is desirable in its own right, and the completion of one does not diminish or preclude the need and desirability of the others.

Impact on Crashes

As discussed above, the most common type of crash on N Sherman Ave are crashes that involved a vehicle attempting to turn left from N Sherman Ave. These are the types of crashes that a TWLTL configuration will minimize. With a TWLTL, vehicles that are travelling in the through traffic lane will no longer encounter a left-turning vehicle, stopped in traffic, waiting for a gap in the oncoming traffic to turn left. Also, drivers turning left from the center two-way left turn lane will not feel pressure to accept insufficient gaps in the oncoming traffic when traffic queues and waits behind them. Data from Minnesota indicate that three lane roadways have a crash rate 27% lower than the rate for four lane undivided roadways (Preston, 1998).

TWLTL's also reduce weaving and will reduce associated conflict points. A conflict point is the point at which a street user crossing, merging with, or diverging from a street or driveway conflicts with another street user. It is any point where the paths of two through or turning vehicles diverge, merge, or cross (see Figures 4 and 5 below).

Conflict points are important because they are associated with increased levels of roadway crashes. A motorist can safely negotiate only so many conflict points within a given area. Reducing conflict points has been shown to significantly reduce the crash rate at case study

locations (T. J.Simodynes, *The Effects of Reducing Conflict Points On Reducing Accident Rates*, October 1998).

Other safety-related factors include the type of conflict points that are reduced—different types of conflict points have different propensities for crashes. Studies of hundreds of crashes at more than 1,300 driveways in three different communities in Illinois found that left-turning vehicles (exiting and entering) are involved in the majority of driveway related crashes (Paul Box and Associates, 1998).

Figures 6 and 7 compare traffic conflict points associated with a driveway on a four-lane undivided roadway and on a three lane roadway with a TWLTL.

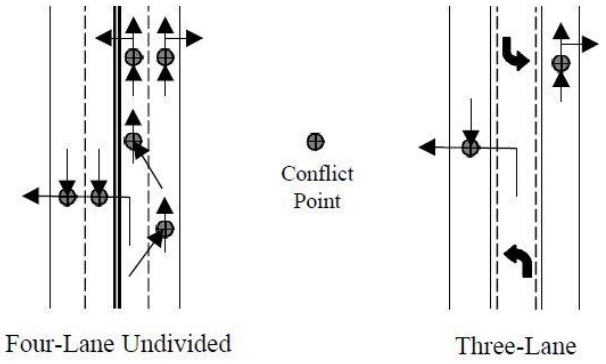

Figure 6. Mid-Block Driveway Conflict Points (Six versus Two)

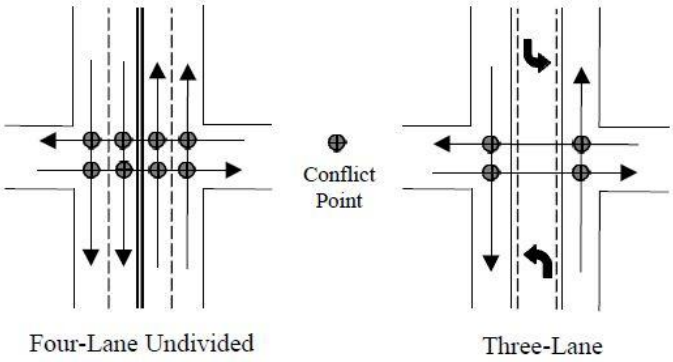

Figure 7. Intersection Conflict Points (Through Traffic Only) (Eight versus Four)

Of the four city of Madison streets that were converted to TWLTL streets, there has been no increase in crashes. However, the before and after crash rates are so low and the sample size of crash data is too small to make any definite, statistically significant conclusions at these locations.

Bus Stops

An additional area of concern that people raised for the City to consider if it moves forward with the TWLTL is how will the location of bus stops impact the flow of traffic? Since there will be only

one through lane in each direction, any vehicle which needs to slow or stop in traffic (i.e. buses, garbage trucks, etc.) will cause a slow-down in traffic. With a six foot bike lane and a 10-foot traffic lane, a bus will use approximately 9.5 feet of the lane width, which leaves approximately 6.5 feet for vehicles to pass without encroaching into the TWLTL. The average passenger car is 6 feet wide, so motorists will have to slow down but will be able to pass without encroaching significantly into the TWLTL (shown graphically in Figure 8). This is not unlike similar situations throughout the urban area serviced by high quality transit, motorists adjust and operate cooperatively with transit vehicles with little problem.

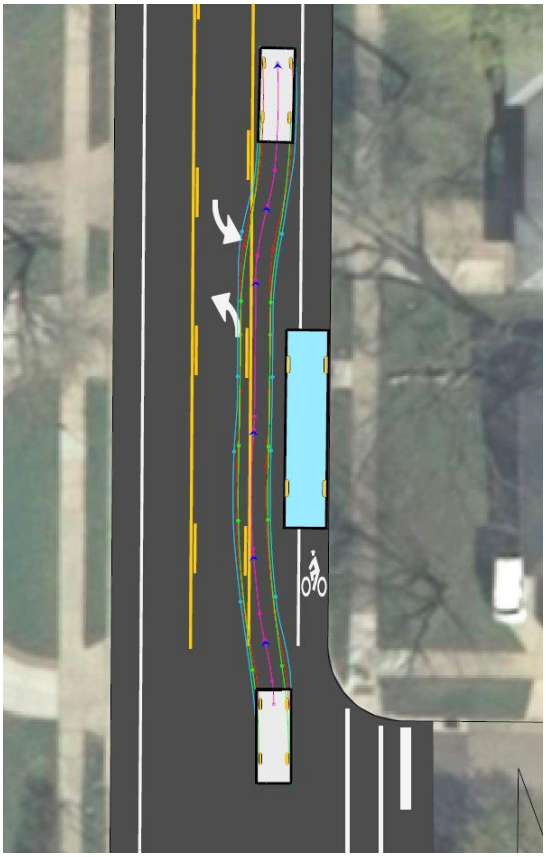

Figure 8. Car Passing Stopped Bus

University Ave between Allen St and Breese Terrace is an example of a TWLTL street with bike lanes and bus stops. Any vehicle can legally pass a slowing or stopped vehicle by using the TWLTL as long as they yield to traffic already in that lane. In the case of buses, these vehicles will be stopped for only short periods of time. No Metro buses have layovers on Sherman Ave, so the stopped time would only be the time needed to load and unload passengers. With fifteen-minute headways during their busiest time, only four buses travel in each direction during the peak hour. Any school buses or delivery vehicles that currently load or unload on Sherman Ave should be directed to move to the nearest side street or another off-street location if possible.

North Sherman Ave has been identified as a potential Bus Rapid Transit (BRT) corridor. The BRT would not add a significant number of new bus stops to N Sherman Ave. The TWLTL configuration should not adversely affect the use of N Sherman Ave for BRT nor would BRT use of N Sherman Ave with a TWLTL adversely affect traffic conditions in general.

Pedestrian Islands

One of the most significant modifications the TWLTL allows the City to implement is pedestrian safety islands, shown in Figure 9.

Figure 9. Pedestrian Safety Island

The addition of a center turn lane allows room for pedestrian islands. A common complaint in regards to N Sherman Ave is the difficulty pedestrians, particularly senior citizens and youth, have in crossing the four lanes of N Sherman Ave traffic, and making N Sherman Ave more pedestrian friendly through pedestrian islands is another important goal of the 2009 Neighborhood Plan. Along with the reduction in the number of lanes to cross, pedestrian islands will allow for a two-stage crossing of the street. It will also allow the City to install median located pedestrian crossing warning signs, which are more visible than side/terrace mounted traffic signing or overhead signs. Five locations for pedestrian islands have been identified, including:

- at the existing rectangular rapid flashing beacon (RRFB) between Roth St and Aberg Ave
- between Steensland Drive and Boyd Avenue
- on the north side of the Logan Street intersection
- on the north side of the Farragut Street intersection
- on the south side of the Sachtjen Street intersection

The difficulty in crossing a four lane street is apparent when pedestrians use the existing RRFB between Roth St and Aberg Ave. There have been instances both reported and observed when drivers in one lane of traffic in one direction will yield but drivers in the second lane of traffic in the same direction will not—this creates a dangerous situation for pedestrians and is referred to as a multiple threat pedestrian crash (see Figure 10 below.)

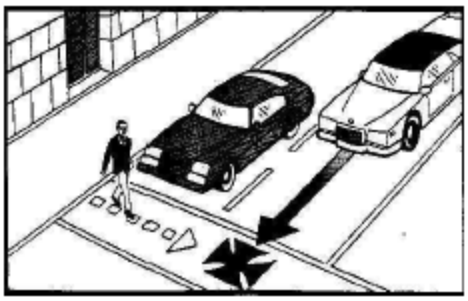

Figure 10. Multiple Threat Pedestrian Involved Crash

Pedestrian safety islands are expected to greatly improve safety and motorist compliance of the RRFB as well as the general legal requirement to yield to pedestrians in crosswalks when there is only one lane of traffic in each direction.

Parking

Currently, parking is only allowed from 6:00 p.m. to 7:00 a.m. on the majority of both sides of N. Sherman Avenue. However, the parking is infrequently used. As an example, several nights at 8:00 p.m. there have been less than five vehicles parked on N Sherman Avenue from Fordem Avenue to Trailsway. Elimination of parking is not anticipated to create an excessive hardship.

Cost

In order to install a TWLTL, the existing pavement markings will need to be removed and new, epoxy TWLTL markings installed. The total cost of new epoxy pavement markings from Fordem Avenue to Trailsway is approximately $65,000. Cost sharing with the Village of Maple Bluff will need to be determined. Additional concrete pedestrian islands cost approximately $4,000-$5,000 per island. Five possible island locations have been identified. The cost of new signs is approximately $15,000. The total cost of the project is $65,000 + $4,000*(5) + $15,000 = $100,000. which will need a budget amendment or budgeted for in the 2014 budget.

Conclusion

The three-lane TWLTL with bike lanes is a viable street configuration for N Sherman Ave and has been used successfully across both the United States and Madison. The potential safety improvements for all users, along with ability to add dedicated bike facilities and pedestrian crossing islands, are compelling reasons to implement this proposal and the benefits clearly outweigh the delay problems it may cause during peak hour periods.

Therefore, it is Staff's recommendation that the N. Sherman Ave cross-section be modified and space reallocated with the addition of a two-way left turn lane or TWLTL. This proposal will require the approval of the City of Madison, and the Village of Maple Bluff. Should the Village of Maple Bluff decide not to participate in this project, it is recommended that the City proceed with the TWLTL from the city limits starting north of the railroad tracks to approximately the intersection of Trailsway and N Sherman Ave.

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