CITY OF BURLINGTON

Administration Department
300 N. Pine Street, Burlington, WI, 53105
(262) 342-1161 – (262)763-3474 fax
www.burlington-wi.gov

AGENDA
COMMITTEE OF THE WHOLE
Tuesday, July 19, 2016 at 6:30 p.m.
Common Council Chambers - 224 East Jefferson Street

Mayor Jeannie Hefty
Edward Johnson, Alderman, 1st District
John Ekes, Alderman, 1st District
Ruth Dawidziak, Alderman, 2nd District
Bob Grandi, Alderman, 2nd District
Tom Vos, Council President, Alderman, 3rd District
Jon Schultz, Alderman, 3rd District
Thomas Preusker, Alderman, 4th District
Todd Bauman, Alderman, 4th District

1. Call to Order – Roll Call

2. Citizen comments

3. Approval of minutes for July 5, 2016 *(T. Vos)* ……*p. 2*

4. **Topic:** Motion 16-849 to consider approving Phases 3 and 4 of the Phase Burlington Community Pool Project. …… *p. 7*

5. **Topic:** Discussion regarding the intersection at Milwaukee Avenue and Pine Street. ……..….*p. 8*

6. **Adjourn** *(J. Schultz)*

Note: *If you are disabled and have accessibility needs or need information interpreted for you, please call the City Clerk's Office at 262-342-1161 at least 24 hours prior to the meeting.*

COMMITTEE OF THE WHOLE **ITEM NUMBER: 3**

DATE: July 19, 2016

SUBJECT: July 5, 2016 Committee of the Whole Minutes

SUBMITTED BY: Diahnn Halbach, City Clerk

BACKGROUND/HISTORY:
The attached minutes are from the July 5, 2016 Common Council meeting.

BUDGET/FISCAL IMPACT:
N/A

RECOMMENDATION:
Staff recommends approval of the attached minutes from the July 5, 2016 Committee of the Whole meeting.

TIMING/IMPLEMENTATION:
This item is scheduled for final consideration at the July 19, 2016 Common Council meeting.

ATTACHMENTS:
Committee of the Whole Minutes

CITY OF BURLINGTON
City Clerk
300 N. Pine Street, Burlington, WI, 53105
(262) 342-1171 – (262) 763-3474 fax
www.burlington-wi.gov

CITY OF BURLINGTON
Committee of the Whole Minutes
Jeannie Hefty, Mayor
Diahnn Halbach, City Clerk
Tuesday, July 5, 2016

1. **Call to Order/Roll Call**

Mayor Jeannie Hefty called the meeting to order at 6:30 p.m. starting with roll call. Aldermen present: Ed Johnson, Bob Grandi, Ruth Dawidziak, Tom Vos, Jon Schultz, Tom Preusker and Todd Bauman. Excused: John Ekes.

Also present: City Administrator Carina Walters, Director of Administrative Services Megan Watkins, City Attorney John Bjelajac, DPW Director James Bergles, Building Inspector Gregory Guidry, and Police Chief Mark Anderson.

2. **Citizens Comments and Questions**

Thomas Binger, Assistant District Attorney for Kenosha County, introduced himself and stated that he would be running for District Attorney for Racine County in the upcoming August election.

3. **Approval of Minutes from June 21, 2016**

A motion was made by Dawidziak with a second by Grandi to approve the minutes from June 21, 2016. With all in favor, the motion carried to approve the minutes.

4. **Topic:** Discussion and update regarding the Burlington Community Pool Project.

Mayor Hefty introduced the discussion topic and handed it over to City Administrator, Carina Walters for further information.

Walters explained that there would be an overview of Phase 1 – Site Assessment, as well as an update on Phase 2 in respect to the pool study and next steps. Walters stated that Phase 1 has been completed and would be reviewed further in tonight's discussion and then introduced Scott Hoffman, and Jean Otter as presenters.

Hoffman, Treasurer for the pool, gave a brief history of the pool and reviewed the new Pool Board structure. Hoffman stated that the pool board formerly comprised of four members from each of the four service clubs – Jaycees, Kiwanis, Lions and Rotary, but that over the years, participation had declined greatly and it became difficult to find volunteers. Hoffman stated that in discussions with their attorney, who oversees the 501C non-profit that runs the pool, suggested a nine-person board – one member from each of the four services clubs, an appointee from the Wagner Foundation, a Mayor-appointed Common Council member, and three at-large members. Hoffman further stated that it is their goal to raise enough money to be able to afford the continued operations of the pool, including things such as salaries, chemicals, and repairs; however, it is also their goal to bring this to referendum in order to cover all the costs of building a new pool. Hoffman further stated that marketing efforts to improve awareness of the pool location is also being made.

Alderman Bob Grandi gave an overview of the Phase 1 – Site Assessment. Grandi stated that three separate soil borings were completed and that the overall quality of the soil is good which gives the ability to be flexible for possible relocation of the pool and building. Grandi further reviewed the findings of the study of the current pool structures. The study revealed that these structures are at or near the end of their lifespans, with numerous cracks and filtration issues and pumps that are heavily corroded. Grandi further stated that the pool heater was termed "barely operational" and is in need of replacement, plus there are issues with the pool enclosure, which houses the bathrooms, changing rooms and showers, as well as the fencing, the parking lot and even the playground equipment. Grandi added that there are also power lines that go over the playground, insufficient ADA compliant access in numerous areas, inadequate parking, and lack of privacy in the showers. Grandi stated that overall, the study showed that a remodel of the current pool is not worth the time or money.

Jean Otter then reviewed Phase 2 – Preliminary Design, which included potential options of what the pool could actually look like including many features such as splash pads, lap swim, zero depth pool, an aqua climb, resistance currents, a community room, etc. Otter stated that the objective is to include features and options that attract all ages, from toddlers to adults, and that Ayers and Associates are currently in the process of drafting three different designs which would be reviewed at the July 19, 2016 Committee of the Whole meeting. Otter further stated that they are seeking input and dialog from the community as well and that Ayers would be hosting an online website for interactive communication with the community, as well as communication via social media such as Facebook.

Grandi inquired as to when the public could view the tentative plans and give input. Walters responded that information would be ready by the end of August, which would be in time for the Pool Party; however there hasn't been a date set for a community wide workshop , which will be determined once the collective bodies can narrow down some options proceeding the July 19, 2016 Joint Committee Meeting.

Vos inquired about the cost of the pool stating that earlier on it was discussed that it would cost approximately $3.5 million to rebuild the pool. Vos wanted to know how or when an actual cost would be determined and if that cost would be known prior to going to referendum or if it is the intention to ask for this amount via refenderum before a final proposal is received. Walters responded stating that this can be done one of two ways. The first being that a "not-to-exceed" cap is put into place and that is the amount that the City would have to work with. The other option is to wait until we have a little bit more solid information which should be received very shortly from Ayers with some cost estimates and options. Hoffman added that Ayers will also be providing a business plan that will determine what future costs will be to continue operations of the pool and when those numbers are received, it will be up to council to determine if that is a number that can be worked with.

Schultz stated concern regarding the management plan for the pool and felt that this is a criticial element that needs to be included in the discussion in order to determine whether or not the future costs to operate the pool can be sustained. Schultz further stated that if this discussion doesn't take place until sometime in September, that it might be too tight of schedule to include this referendum in the November election.

Schultz also stated concern about the cost of memberships to residents and that not only will their property taxes be affected, but they would be expected to pay to use the pool. Schultz felt that there is an entire class of people who will not be able to afford pool memberships.

Schultz also inquired about the community pool in Grays Lake, stating concern that they are having financial problems because of the cost of operations and asked staff to consider looking further into the issues of what's happening in Grays Lake in order to go into this with eyes wide open and understand the risks associated with it and to see if there are specific problems that they are facing that we can avoid. Grandi suggested researching pools that are also viable and successful. Schultz stated that no matter what, we just to need to make sure we get this right because we only get once chance and if it's done wrong, the city will be on the hook for a lot of money for a long time.

Alderman Preusker stated that questions still remain regarding design, management, and ongoing sales that will be needed in order to generate revenue.

Alderman Johnson suggested that the discussion on this topic come to an end.

5. **Topic:** Discussion to consider laying a 75 feet by 24 feet section of asphalt between 32114 Droster Avenue and the entrance to Lois Stor-all in the Town of Burlington.

   Mayor Hefty introduced the discussion topic and then handed it over to DPW Director, Jim Bergles, for further information. Bergles explained that Droster Avenue is a dead end street west of Milwaukee Avenue and that the City owns approximately 450 feet of it, while Lois Stor-all owns the remaining 104 feet. Between these two pieces is a section of City roadway that has failed and is partial gravel, which is approximately 75 feet long by 24 feet wide. Bergles explained that Lois Stor-all wishes to asphalt their section and has asked the City to consider paving the City owned section. Bergles further reviewed the cost stating that the estimated city cost to pave a 75 foot by 24 foot road section is $4,059 at $20.50 per square yard, but because this project was not budgeted for, it would come out of the City's General Fund.

   Alderman Schultz stated that if it's a city road, it should be paved.

6. **Topic:** Resolution 4798(17) – to consider approving a master agreement for municipal engineering services with Kapur and Associates, Inc.

   Mayor Hefty introduced Resolution 4798(17) and then handed it over to Walters for further information.

   Walters explained the background history of the City's relationship with Kapur, stating that the City began contracting with Kapur for municipal engineering services in 2000. Walters further stated that in 2013, the City released a Request for Proposals for engineering services and although nine were received, Kapur was retained due to being the most qualified engineering firm and then contracted a three-year master agreement from 2013-2016. The current proposed term for 2016-2017 would begin July 1, 2016 and would allow for the option to annually renew until December 31, 2019. Walters further stated the proposed contract shows an overall 1.5% increase for years 2017-2019.

7. **Topic:** Motion 16-845 to consider approving the 2015 Annual Audit.

   Mayor Hefty introduced Motion 16-845 and then handed it over to City Treasurer Steve DeQuaker for further information. DeQuaker introduced Patrick Romenesko, CPA for the City of Burlington.

Romenesko reviewed the annual report and highlighted three specific areas which included the Infrastructure Fund Deficit Balance, the Fund Balance of the General Fund, and New Reporting for Pensions.

8. **Topic:** Motion 16-846 to consider approving an Airport Hangar Lease with Burlington Aero Group at 1364 Mike Taxiway.

   Mayor Hefty introduced Motion 16-846 and opened it up for discussion. There was no discussion.

9. **Topic:** Motion 16-847 to consider approving an Airport Hangar Lease with MJJ Holding at 711 Airport Road.

   Mayor Hefty introduced Motion 16-847 and opened it up for discussion. There was no discussion.

10. **Adjourn**

    A motion was made by Grandi with a second by Preusker to adjourn the meeting. With all in favor, the meeting adjourned at 8:03 pm.

Minutes respectfully submitted by:

_____

Diahnn C. Halbach
City Clerk
City of Burlington

COMMITTEE OF THE WHOLE **NUMBER: 4**

DATE: July 19, 2016

SUBJECT: **MOTION 16-849** regarding the Approval of Phase 3 and Phase 4 with Ayres Associates for the Burlington Community Pool Project.

SUBMITTED BY: Carina Walters, City Administrator and Alderman Bob Grandi

---

BACKGROUND/HISTORY:
On April 27 the Common Council approved a contract with Ayres Associates for the feasibility of the Burlington Community Pool. At that time, Phase 1 (Site Assessment) and Phase 2 (Preliminary Design were approved. Council also directed staff to bring forward each deliverable outlined in the contract and each phase needing independent approval. This evening staff is seeking Council consideration for approval of Phase 3 Pool Management Plan and Phase 4 Referendum Education and Assistance from Ayres Associates.

During your July 5 Committee of the Whole discussion Alderman Bob Grandi, Scott Hoffman, Jeanne Otter and City Administrator, Carina Walters made a presentation to the Committee discussing the final deliverable of the Phase 1 (Site Assessment) and an update to the preliminary stages of Phase 2 (Preliminary Design).

In response to several questions raised during the Committee of the Whole meeting, staff is drafting a long term lease agreement between the Pool Board and City that outline fiduciary and management operations of the pool. Both Pool Board and the City will need to approve the document.

In order to create a detailed management plan, Ayres Associates, will need a preliminary design to work with. Therefore, prior to this evenings Committee of the Whole, Meeting there was a Joint Workshop of the Common Council, Pool Board and Park Board facilitated by Ayres Associates, to discuss three to four preliminary design concepts and high level operating costs providing a sense until the management plan is created.

As the Council is looking for this detail, Phase 3 needs to be approved and Phase 4 needs approval allowing Ayres to simultaneously create the referendum materials for the November 8 referendum.

BUDGET/FISCAL IMPACT:
Phase 3 Pool Management Plan will cost $12,992
Phase 4 Referendum Education and Assistance will Cost $12, 208
Totaling $25,200
Phase One and Two cost approximately $60,000

RECOMMENDATION:
Staff is looking for the approval of Phase 3 and Phase 4 regarding the Burlington Community Pool.

TIMING/IMPLEMENTATION:
This item is scheduled for final approval at the August 2, 2016 Common Council Meeting.

ATTACHMENTS:
None

COMMITTEE OF THE WHOLE **NUMBER: 5**

DATE: July 19, 2016

SUBJECT: **DISCUSSION** regarding the Milwaukee Avenue and Pine Street intersection.

SUBMITTED BY: Carina Walters, City Administrator

BACKGROUND/HISTORY:
Since late 2000, the City has received several requests to modify the Milwaukee Avenue and N. Pine Street intersection. Requests include: alleviating traffic, signalization and pedestrian safety. Most recently, cars have been getting stuck in the queue trying to turn left on to Pine Street, in which the signal timing was modified. This evening Stephanie Olsen of Traffic Analysis and Design and City Engineer Tom Foht will provide a history of studies relating to the intersection, what recommendations have been made and implemented, recommendations still for Council consideration, and what direction the Council want to take.

BUDGET/FISCAL IMPACT:
N/A

RECOMMENDATION:
Staff is seeking for Council direction on how to proceed with the intersection of Milwaukee Avenue and Pine Street.

TIMING/IMPLEMENTATION:
This item is scheduled for discussion on the July 19, 2016 Committee of the Whole meeting

ATTACHMENTS:
Traffic Analysis and Design study from 2012.

TRAFFIC
ANALYSIS &
DESIGN, INC.

PROVIDING TRAFFIC ENGINEERING SOLUTIONS

TECHNICAL MEMORANDUM

Date: January 18, 2012

To: Tom Foht, P.E.
Kapur & Associates, Inc.

From: Stephanie Olsson, P.E., PTOE
Tammi Czewski, P.E., PTOE
Traffic Analysis & Design, Inc.

Subject: Downtown Burlington Corridors – Signal Optimization

1.0 PURPOSE OF REPORT AND STUDY OBJECTIVES

Traffic Analysis & Design, Inc. prepared optimized signal timings for the City of Burlington's downtown area street system in March 2008. These optimized plans incorporated downtown improvements that included the construction of Bridge Street, the conversion of several streets from one-way to two-way operation, and the rerouting of STH 11 and STH 83 through the downtown area. Since the timings were last updated, the Burlington Bypass was completed south of the City, reducing the amount of traffic traveling through the downtown area.

The City of Burlington requested that Traffic Analysis & Design, Inc. collect new traffic volume data at the downtown area intersections and prepare updated coordinated timing plans to provide optimized timing plans in the downtown area. This report documents the procedures, findings and conclusions of the 2011/2012 traffic analysis.

2.0 DATA COLLECTION

Traffic turning movement counts were conducted at most of the signalized intersections throughout the downtown area in early November 2011. New counts were not collected at several intersections along Milwaukee Avenue since field reviews of these intersections indicated acceptable operation without public complaints.

Table 1 summarizes the study intersections evaluated in this report, the date of the turning movement counts, and current traffic control. Exhibit 1 shows the location of these intersections

N36 W7505 Buchanan Street
Cedarburg, WI 53012
Ph: 262.377.1845
Fax: 262.377.4381

throughout downtown Burlington. Exhibit 2 shows the compiled peak hour traffic counts at these intersections.

Table 1
Study Intersection Peak Hour Turning Movement Counts

Intersection	AM Peak Hour	PM Peak Hour	Traffic Control
Adams Street & Bridge Street	7-9 AM November 9, 2011	4-6 PM November 7, 2011	Traffic Signal
Milwaukee Avenue & Falcon Ridge Drive/ K-Mart	7-9 AM May 2, 2007	4-6 PM May 2, 2007	Traffic Signal
Milwaukee Avenue & Grove Street/ Walgreen's	7-9 AM October 4, 2007	4-6 PM October 4, 2007	Traffic Signal
Milwaukee Avenue & Bridge Street	7-9 AM May 2, 2007	4-6 PM May 2, 2007	Traffic Signal
Milwaukee Avenue & Commerce/Pine Street	7-9 AM November 8, 2011	4-6 PM November 3, 2011	Traffic Signal
Milwaukee Avenue & Chestnut Street	7-9 AM November 8, 2011	4-6 PM November 3, 2011	One-way Stop Sign Control
Pine Street & Chestnut Street	7-9 AM November 4, 2011	4-6 PM November 2, 2011	Two-way Stop Sign Control
Bridge Street & Jefferson Street	7-9 AM November 9, 2011	4-6 PM November 7, 2011	Traffic Signal
Bridge Street & Pine Street	7-9 AM November 2, 2011	4-6 PM November 1, 2011	Traffic Signal
Pine Street & Jefferson Street	6 AM- Noon November 3, 2011	Noon-6 PM November 2, 2011	Traffic Signal
State Street & Main Street	7-9 AM November 4, 2011	4-6 PM November 8, 2011	Traffic Signal
Pine Street & State Street	7-9 AM April 19, 2007	4-6 PM May 3, 2007	Two-way Stop Sign Control
Pine Street & Adams Street	6 AM- Noon November 3, 2011	Noon-6 PM November 1, 2011	Traffic Signal

Twelve hours of turning movement counts were collected at the Pine Street intersections with Jefferson Street and Adams Street. The additional count data was collected at these intersections in order to determine if traffic signal warrants are met with the post-bypass traffic volumes through the downtown area.

3.0 EXISTING CONDITIONS OPERATIONS

Existing Peak Hour Capacity/LOS Analysis

The study area intersections were analyzed based on the procedures set forth in the *2000 Highway Capacity Manual* (HCM). Intersection operation is defined by "level of service". Level of Service (LOS) is a quantitative measure that refers to the overall quality of flow at an intersection ranging from very good, represented by LOS 'A', to very poor, represented by LOS 'F'. For the purpose of this study, LOS D was used to define acceptable peak hour operating conditions. Descriptions of the various levels of service are as follows:

LOS A is the highest level of service that can be achieved. Under this condition, intersection approaches appear quite open, turning movements are easily made, and nearly all drivers find freedom of operation.

LOS B represents stable operation.

LOS C still represents stable operation, but periodic backups of a few vehicles may develop behind turning vehicles. Most drivers begin to feel restricted, but not objectionably so.

LOS D represents increasing traffic restrictions as the intersection approaches instability. Delays to approaching vehicles may be substantial during short peaks within the peak period, but periodic clearance of long lines occurs, thus preventing excessive backups.

LOS E represents the capacity of the intersection.

LOS F represents jammed conditions where the intersection is over capacity and acceptable gaps for unsignalized intersections in the mainline traffic flow are minimal.

The study intersections were analyzed with the existing traffic volumes from Exhibit 2, plus the existing geometrics and optimized timing plans recommended and implemented from the March 2008 signal optimization study (Exhibit 3). As shown on the LOS table on Exhibit 4, all movements at the study area intersections operate at LOS D or better conditions except for the following:

Pine Street/Adams Street – the Synchro model reports that the westbound right-turn movement operates at LOS F during the weekday morning peak hour and at LOS E during the weekday evening peak hour. Since an appropriate amount of green time is being allocated to this movement, the poor LOS results are caused by the low post-bypass traffic volumes and the current offsets which are affecting the arrival patterns of upstream traffic to this signal.

Bridge Street/Adams Street – the Synchro model reports that the northbound left-turn movement operates at LOS E during the weekday morning peak hour. Only five vehicles per hour were counted for this movement. Similar to above, the poor LOS results are caused by the low traffic volumes (which cause the movement to be skipped often during the peak hours) and the current offsets which are affecting the arrival patterns of upstream traffic to this signal.

The 95th percentile maximum back of queues for each traffic movement at the study intersections are shown on Exhibit 5.

Engineer's Field Review and Council Member Emails

Based on an engineer's field review of the study intersections, the following notes were made for each study intersection that reflects observed traffic operation, citizen complaints, and potential mitigation strategies.

Milwaukee Avenue/Falcon Ridge – No issues noted at this intersection

Milwaukee Avenue/Grove Street – No issues noted at this intersection

Milwaukee Avenue/Bridge Street – No issues noted at this intersection

Milwaukee Avenue/Pine Street – Traffic traveling southwest on Milwaukee Avenue and turning left onto southeast bound Pine Street share the same lane as southwest bound through traffic on Milwaukee Avenue. While waiting for gaps in opposing traffic on Milwaukee Avenue, this left-turn temporarily blocks southwest bound through traffic on Milwaukee Avenue. The following potential improvements were analyzed:

- Add an exclusive left-turn lane on southwest bound Milwaukee Avenue. For proper lane alignment, this improvement would require the removal or restriction of downstream parking spaces between Pine Street and Chestnut Street on Milwaukee Avenue.
- Restrict southwest bound left-turn movements at this intersection. Based on 2011 traffic counts, only 10 vehicles make this left-turn during the weekday morning peak hour and only 30 vehicles make this left-turn during the weekday evening peak hour. The left-turns would be accommodated at the Milwaukee Avenue/Chestnut Street intersection. However, this moves the left turn issue from one intersection to another.
- A left turn arrow for southwest bound Milwaukee Avenue. Since the approach has a shared left turn lane, left turn vehicles may not benefit from the arrow unless they are stationed at the beginning of the queue at this approach.

Traffic traveling northwest on Pine Street and turning right onto northeast bound Milwaukee Avenue have an exclusive right-turn lane, but it has only approximately 50 feet of effective turn storage space, which can accommodate only about two vehicles at a time. It is difficult for vehicles to enter the right turn lane when "trapped" behind a northwest bound through or left-turning vehicle in a queue. Mitigating this issue would be to extend the effective turn storage area by removing additional parking spaces on northwest bound Pine Street south of Milwaukee Avenue.

Milwaukee Avenue/Chestnut Street – A non-injury vehicle-pedestrian traffic crash occurred on the southeast leg of this intersection. The crash occurred when a northeast bound vehicle on Milwaukee Avenue turned right onto southeast bound Chestnut Street and struck a pedestrian.

It has also been reported that it can be difficult to make a left turn from the stop-controlled approach on southeast bound Chestnut Street to northeast bound Milwaukee Avenue. The volume of traffic currently making this movement is low (15 vehicles during the peak hours), and Synchro reports that this volume of traffic can make the turn at an acceptable LOS C or better during the peak hours. This indicates that sight distance may be the issue at this intersection rather than available gaps in the Milwaukee Avenue traffic flow. It is expected that most southeast bound traffic traveling to northeast bound Milwaukee Avenue chooses to turn left at the traffic signal at Milwaukee Avenue/Pine Street.

Pine Street/Jefferson Street – After the Burlington Bypass was constructed, traffic volumes through this intersection may have reduced enough to no longer warrant traffic signal control. A 12-hour turning movement traffic count was collected at this intersection so that a signal warrant study could be conducted to determine the validity of the existing traffic signal.

Pine Street/Adams Street – After the Burlington Bypass was constructed, traffic volumes through this intersection may have reduced enough to no longer warrant traffic signal control. A 12-hour

turning movement traffic count was collected at this intersection so that a signal warrant study could be conducted to determine the validity of the existing traffic signal.

Pine Street/Bridge Street/Robert Street – A non-functioning loop detector on northbound Pine Street is causing Pine Street to receive its maximum green time rather than switching to other phases to accommodate traffic demand. This detector has been fixed.

Bridge Street/Adams Street – No issues noted at this intersection

Bridge Street/Jefferson Street – Current left-turn traffic volumes from westbound on Jefferson Street to southbound on Bridge Street may not justify the protected-permitted left-turn phase currently in operation. Eliminating this left-turn phase will improve the efficiency of this intersection by providing increased green time for other phases at the intersection.

State Street/Main Street – Reported citizen complaints include left-turn delays and overall delays at this intersection. Based on the Synchro traffic models, all traffic operates acceptably at LOS C or better during the peak hours. However, some complaints could be related to unjustified left-turn phases (the northbound left-turn volumes are too low for a left-turn phase) or faulty vehicle detection.

It is noted that pedestrian crossing was a concern noted in the comments from Council. All clearance intervals and pedestrian crossing timings (Walk and Flash/Don't Walk) will be evaluated and reprogrammed to comply with current Manual on Uniform Traffic Control Devices (MUTCD) standards.

4.0 IMPROVEMENT ANALYSIS

Clearance Interval Recalculations

All clearance interval timings (yellow and red times) were updated at the study intersections. Clearance intervals were calculated based on approach speed limits and the distance a vehicle must cross from the stop bar to the far side of the travelled way or crosswalk. The calculations were based on current (2009) MUTCD standards. In many cases, clearance intervals were increased over previous timing plans. In particular, clearance timings were increased for the western railroad crossing approaches at the Bridge Street intersections with Jefferson Street and Adams Street to reflect the stop bar placement behind the railroad tracks and not directly at the intersection approach. The longer clearance intervals here promote traffic safety by allowing enough time for approaching vehicles to cross the stop bar and clear the intersection before opposing traffic gets a green indication. It is noted that updating the clearance intervals resulted in some movements LOS to decrease, however, all movements are expected to operate at acceptable levels, LOS D or better during the peak hours.

Traffic volumes along Milwaukee Avenue are much higher than on the other four routes throughout the downtown area. Therefore, it was determined that Milwaukee Avenue (route #1) would require a different cycle length than the other routes in order to best minimize delays and promote progression along the corridor. Due to the overlapped nature of the remaining arterials, a single cycle length for the remainder of the downtown area was found to be the most beneficial to operation based on delay and queuing.

Pedestrian Timing Recalculations

The Walk and Flash/Don't Walk timings at each study intersection were also recalculated based on current MUTCD standards. Recent changes to the MUTCD result in longer pedestrian clearance times due to decreased walk speeds (3.5 feet per second instead of 4.0 feet per second)

and other factors. Each study intersection has pedestrian signal heads and push buttons that are activated only when a pedestrian pushes the button for crossing a particular approach. To keep the signals in coordination during pedestrian calls, however, the cycle lengths and split times for each approach with pedestrian crossings must be long enough to accommodate the pedestrian clearance times. This was possible at all intersections except at the Bridge Street intersections with Jefferson Avenue and Adams Street, where the wider Bridge Street cross-section requires longer Flash/Don't Walk times. The longer pedestrian clearance intervals require a longer cycle length than what was ultimately chosen for the corridor. Therefore, at the Bridge Street intersections, all pedestrian calls will result in adequate Walk and Flash/Don't Walk times for pedestrians to cross the intersections, but the signal will exit coordination during each pedestrian call. It is noted that updating the pedestrian clearance intervals resulted in some movements LOS to decrease, however, all movements are expected to operate at acceptable levels, LOS D or better during the peak hours.

Priority Route Determination

Optimized timing plans were developed for the downtown intersection area to better accommodate the reduced traffic volumes caused as a result of the Burlington Bypass constructed around the City of Burlington. The optimized plans were developed to progress traffic along the main traffic routes through the downtown area. The following five routes were evaluated, and reflect the main traffic flow patterns in the area. The routes are listed below in order of priority (highest traffic flow to lowest) and also shown on Exhibit 6:

- Route #1 - Milwaukee Avenue/STH 36 (from Chestnut Street to Falcon Ridge)
- Route #2 – State Street-Bridge Street-Pine Street (State Street from Main Street to Bridge Street, then Bridge Street from Adams Street through Pine Street)
- Route #3 – Bridge Street (from Milwaukee Avenue to Pine Street)
- Route #4 – Pine Street-Adams Street (Pine Street from Milwaukee Avenue to Adams Street, then Adam Street from Pine Street to Bridge Street)
- Route #5 – Pine Street (from Milwaukee Avenue to Bridge Street)

Optimum Cycle Length Determination

The optimal cycle lengths were determined first by the minimum split times required for the updated clearance intervals and pedestrian timings for each individual intersection, and then by factors such as delays, queues, and the progression of vehicles along each priority route in the downtown area. Based on the evaluation of these factors, an 80-second cycle length was chosen along the Milwaukee Avenue corridor for both the AM and PM peak hours. This cycle length was increased from previous studies to better accommodate the increased clearance interval times and pedestrian crossing times while still maintaining good progression of vehicles along the corridor.

Due to the decreased traffic volumes throughout the rest of the downtown area, it is recommended that the existing cycle lengths be reduced to provide snappier and more efficient signal operation during peak times. Lowering the cycle length to 70 seconds during the AM and PM peak hours accomplishes this while still providing for all pedestrian crossing times at all study intersections except for the Bridge Street intersections with Jefferson Avenue and Adams Street. Note this is how the Bridge Street intersection currently operate.

Phase Split and Offset Optimization

Once the cycle lengths were determined, phase splits were adjusted so that the actuated mainline phases were timed long enough to accommodate pedestrian calls (where feasible), and all other phases accommodated traffic volumes with acceptable queues and delays at LOS D or better during the peak hours. Offsets were then optimized along the priority corridors to provide the best progression (the highest priority corridors were designed to have the best progression) of vehicles along each route. The time-space diagrams and simulation models from the Synchro and SimTraffic analysis software were used to verify results along each progressed route. The proposed traffic signal cycle lengths, max splits, and offsets are shown on Exhibit 7.

Optimized Peak Hour Capacity/LOS Analysis

As shown in the LOS table on Exhibit 8, the optimized timing plans are expected to improve operations so that all movements at the study intersections operate at LOS D or better conditions during the peak hours. The resulting 95th percentile queues for the optimized condition are shown on Exhibit 9.

Optimized Measures of Effectiveness

Table 2 below reports the overall system operation for optimized conditions compared to existing conditions. Three measures of effectiveness (MOEs) have been reported to quantify the expected change in operation:

Total Delay (hr) – Total Delay is the lane group Control Delay plus the Queue Delay. Control delay is stopped delay times a constant of 1.3. Stopped delay is the sum of all time slices where the vehicles are stopped or traveling at less than 6.8 mph. Queue delay is an analysis of the effects of queues and blocking on short links and short turning bays.

Vehicle Stops (#) – The number of stops vehicles make per hour.

Performance Index – The performance index is calculated based on total delay and vehicle stop occurring along the corridor. Performance index is used to compare scenarios. A lower performance index indicates more efficient operation.

Table 2
Comparison MOEs: Overall Network Performance

Network MOEs	AM Peak Hour			PM Peak Hour		
	Existing	Optimized	Change (%)	Existing	Optimized	Change (%)
Total Delay (hours)	35	32	-9%	56	52	-7%
Total Stops	5115	4734	-7%	8198	7518	-8%
Performance Index	49.0	44.7	-9%	78.3	73.4	-6%

Source: Synchro Network MOEs

As shown in Table 2, the optimized timing plans are expected to improve network-wide operations by an overall nine percent during the weekday AM peak hour and by an overall six percent during the weekday PM peak hour. The system analysis indicates that the proposed traffic signal timing changes are expected to improve operation of the downtown Burlington transportation system.

The arterial MOEs were evaluated to determine performance improvements to progression along the priority corridors. The comparison Performance Index values for each priority route evaluated in this study are compared between existing and optimized conditions in Table 3.

Table 3
Comparison MOEs: Priority Route Performance

Arterial Performance Index	AM Peak Hour			PM Peak Hour		
	Existing	Optimized	Change (%)	Existing	Optimized	Change (%)
Route #1	14.0	11.9	-15%	30.3	27.7	-9%
Route #2	6.7	5.8	-13%	8.9	8.0	-10%
Route #3	11.2	9.9	-12%	14.9	13.9	-7%
Route #4	11.3	9	-20%	14.8	12.3	-17%
Route #5	5.8	5.8	0%	10.3	8.7	-16%

Source: Synchro Arterial MOEs

As shown, arterial performance on the Milwaukee Avenue corridor (Route #1) is expected to improve by an overall 15 percent during the AM peak hour and by nine percent during the PM peak hour. The remaining routes within the downtown area are expected to improve by up to 20 percent during the AM peak hour and by up to 17 percent during the weekday PM peak hour.

5.0 ALTERNATIVES ANALYSIS

An alternatives analysis was conducted to address additional issues raised at the study intersections that could not be mitigated by optimization and progression throughout the downtown area.

Eliminating Unnecessary Left-turn Phasing

The study intersections were evaluated to determine which intersections could benefit from the elimination of left-turn phasing. When activated, the left-turn arrow turns on for a minimum amount of green time plus yellow and all-red time, regardless of the traffic volumes turning during that phase. At most intersections, left-turn traffic volumes are high enough to utilize the green time provided. Two intersections with left-turn phasing that have left-turn volumes low enough to be eliminated include the following:

Bridge Street/Jefferson Street – The existing westbound Jefferson Street to southbound Bridge Street left-turn movement is negligible (less than three vehicles) during the peak hours. This movement currently has a protected-permitted left-turn phase that could be eliminated, resulting in permitted left turns for westbound Jefferson Street traffic.

This intersection also has a protected left-turn phase for northbound Bridge Street left turns onto westbound Jefferson Avenue. Only about 5-10 vehicles make this turn during the peak hours. This protected left-turn phase is in place to prevent vehicles from making a left-turn movement during train crossings. The northbound protected left-turn arrows could be removed and replaced with "No Left Turn" blank-out signs that turn on during the train crossings. For added safety, "No Right Turn" blank-out signs could be installed on the southbound Bridge Street approach.

Bridge Street/Adams Street – The existing southbound Bridge Street to eastbound Jefferson Avenue has relatively low traffic volumes (40-50 vehicles per hour) during the peak hours. This movement currently has a protected-permitted left-turn phase that could be eliminated, resulting in permitted left-turns for southbound Bridge Street traffic. Opposing traffic from northbound Bridge Street is also relatively low (85-120 vehicles per hour) during the peak hours, so there are expected to be enough gaps in traffic to accommodate all left-turns during the permitted phase.

This intersection also has a protected left-turn phase for northbound Bridge Street left turns onto westbound Adams Street. Only about five vehicles make this turn during the peak hours. Similar to Bridge Street/Jefferson Street, this protected left-turn phase is in place to prevent vehicles from making a left-turn movement during train crossings. The northbound protected left-turn arrows could be removed and replaced with "No Left Turn" blank-out signs that turn on during the train crossings. For added safety, "No Right Turn" blank-out signs could be installed on the southbound Bridge Street approach.

State Street/Main Street – This intersection has northbound and southbound protected-permitted left-turn phases for Main Street traffic turning onto State Street. The southbound Main Street approach has heavy left-turn volumes, but the northbound approach is relatively light with only about 65 left-turns occurring during the peak hours. While all movements at this intersection operate acceptably at LOS C or better during the peak hours, public complaints have been received regarding left-turn delays and overall delays. Eliminating the northbound left-turn phase could reduce the perception of delay for other vehicles, and provide additional green time to the southbound through movements, if needed. Note: The concern over left-turn delays and overall delays may be a result of failure with the loop detection on Main Street or State Street. Prior to implementing the optimized timing plans, it is recommended that the signal and detection equipment are functioning properly at all study intersections.

The elimination of the above left-turn phasing was evaluated to determine the expected LOS and overall operational improvements to the downtown area signal system. The intersection phasing, signal timings, expected 95th percentile queues, and expected LOS are shown on Exhibit 10. As shown, the Bridge Street intersections with Jefferson Street and Adams Street, and the State Street intersection with Main Street are expected to operate acceptably at LOS C or better for all traffic movements during the peak hours with the eliminated left-turn phasing described above.

Eliminating Unwarranted Traffic Signals

Since the Burlington Bypass was constructed, traffic volumes throughout most of the downtown area have been reduced. At some intersections, the volume reductions are enough that traffic signals may no longer be warranted. A signal warrant analysis was conducted for both the Pine Street intersections with Jefferson Avenue and Adams Street to determine if these signals would be good candidates for signal removals. The warrant studies were based on traffic volume warrants from the 2009 *Manual on Uniform Traffic Control Devices* (MUTCD).

Chapter 4C of the 2009 *Manual on Uniform Traffic Control Devices* (MUTCD) outlines the standards for determining the need for traffic signals at a particular location. For a traffic signal to be installed, at least one of the following warrants must be satisfied. The nine signal warrants are listed below:

- Warrant 1, Eight-Hour Vehicular Volume
- Warrant 2, Four-Hour Vehicular Volume
- Warrant 3, Peak Hour
- Warrant 4, Pedestrian Volume
- Warrant 5, School Crossing
- Warrant 6, Coordinated Signal System
- Warrant 7, Crash Experience
- Warrant 8, Roadway Network
- Warrant 9, Intersection Near a Grade Crossing

For this study, Warrants 1 and 2 were considered controlling factors for signal installation or validation. Warrant 3, Peak Hour, is applied in unusual cases where high-occupancy facilities attract or discharge large numbers of vehicles over a short time, Warrant 4, Pedestrian Volume, applies to locations where there are large pedestrian volumes (100 or more for four hours or 190 per day), and Warrant 5, School Crossing, applies to locations where crossing school children are factors for installing a signal. Warrant 6, Coordinated Signal System, applies to signals that are in place to improve or assist with progression along a corridor and Warrant 7, Crash Experience is related to signal installations that could correct an existing crash problem. Warrant 8, Roadway Network, applies to locations that include both a major route and high entering traffic volumes, and Warrant 9, Intersection Near a Grade Crossing, is related to signals installed to provide traffic control and safety at grade crossings.

The left-turn conflict analysis, which is defined in the WisDOT Facilities Development Manual (FDM), was also evaluated, but does not indicate the need for traffic signal control. The left-turn conflict analysis is used primarily as an indicator for left-turn phasing at an intersection. Warrants 1, 2, 3 and the left-turn conflict analysis are described below:

Warrant 1, Eight Hour Vehicular Volume *states that a traffic signal may be considered if either Condition A or Condition B volume thresholds from the MUTCD Table 4C-1 are met for at least eight hours of an average day.*

For situations where neither condition A nor condition B are met, 80 percent of both conditions A and B can be met after adequate trials of remedial measures are taken.

Warrant 2, Four Hour Volume *is satisfied if during any four hours of an average day the major street and minor street volumes fall above the MUTCD Figure 4C-1 or 4C-2 four-hour curve.*

Left-turn Conflict Analysis *is met if the product of the major street left-turn volume and opposing through plus right-turn movements exceed 100,000 (one left-turn lane and two opposing through lanes) or 80,000 (one left-turn lane and one opposing through lane). This warrant is mainly used to determine the need for left-turn phasing at a signalized intersection.*

Pine Street/Jefferson Street – The traffic volumes at this intersection do not meet Warrant 1 or Warrant 2 volume threshold requirements for any hour of the day. Therefore, signals are not warranted at this intersection. The signal warrant analysis results and expected LOS with two-way stop control (stop signs on Jefferson Street) are shown on Exhibit 11. As shown, traffic operations with stop sign control are expected to result in LOS C or better conditions for all traffic movements during the peak hours.

Pine Street/Adams Street – The traffic volumes at this intersection only meet volume thresholds for two hours of the day for Warrant 1. None of the hours meet volume thresholds for Warrant 2. Therefore, signals are not warranted at this intersection. The signal warrant analysis results and expected LOS with one-way stop control (stop signs on Adams Street) are shown on Exhibit 12. As shown, traffic operations with stop sign control are expected to result in LOS C or better conditions for all traffic movements during the peak hours.

Resolving Left-Turn Blocking Issues at Milwaukee Avenue/Pine Street

Several alternatives were evaluated to mitigate the issue of southwest bound left-turn traffic blocking the southwest bound through traffic in the single shared left-turn/through lane at the Milwaukee Avenue/Pine Street intersection. These alternatives (most of which were also evaluated in the 2008 signal optimization study) are discussed below:

- Not Recommended: Reversing the southwest bound lanes to include an exclusive left-turn lane and shared through/right-turn lane. This option is not recommended since it provides an exclusive lane for a low volume left-turn movement (10-30 left-turn vehicles during the peak hours) and requires the high-volume right-turn movement (110-180 vehicles during the peak hours) to share a lane with the through volumes. This would result in inefficient lane utilization for the southwest bound movements.
- Not Recommended: Constructing an additional lane on the southwest bound Milwaukee Avenue approach to include the existing right turn lane, the existing through lane, plus a left-turn lane. This improvement is not recommended since it requires additional right-of-way that would be difficult to gain due to the location of existing buildings and sidewalks along Milwaukee Avenue.
- Recommended Option 1: Re-allocate existing southwest bound lanes on Milwaukee Avenue so that there is a shared right-turn/through lane and a shared left-turn/through lane. Downstream Milwaukee Avenue is already wide enough to accommodate two southbound lanes, but one lane is currently being utilized by on-street parking. The on-street parking on Milwaukee Avenue would therefore need to be eliminated between Pine Street and Chestnut Street for this alternative, and possibly also south of Chestnut Street in order to maintain proper alignment for southbound traffic.
- Recommended Option 2: Restrict southwest bound left-turn movements at this intersection. All left-turns can reroute to the Milwaukee Avenue intersection with Chestnut Street. The combined southwest bound left-turns at Chestnut Street would still be relatively low: 20 vehicles during the AM peak hour (about one vehicle every three minutes) and 60 vehicles during the PM peak hour (about one vehicle every minute). Since the left-turn vehicles have an exclusive left-turn lane at this intersection, they can wait for gaps in northeast bound traffic without blocking through movements on Milwaukee Avenue. No additional right-of-way would be needed for this improvement and no additional parking would need to be restricted. However, this would add volume to a turning movement at an intersection with poor sight distance.

The recommended geometrics, expected LOS and expected 95th percentile queues for the recommended options are shown on Exhibit 13.

Combination of Improvements (Preferred Alternative)

The City of Burlington staff reviewed the previous analysis and alternatives and recommended a combination of alternatives to be studied in a final traffic scenario. These include:

- Eliminate unnecessary left-turn phasing (as detailed above) at Bridge Street/Jefferson Street, Bridge Street/Adams Street, and State Street/Main Street.
- Eliminate the unwarranted traffic signal at Pine Street/Jefferson Street (signal will remain at Pine Street/Adams Street).
- Include a lagging left-turn phase for southwest bound traffic on Milwaukee Avenue at Pine Street. This improvement may provide some benefit to blocked vehicles during each signal cycle. However, if left turn vehicles are not present during the left turn phase, the lane may still be blocked.

The resulting LOS table is shown on Exhibit 14 and the queues are shown on Exhibit 15. The recommended geometrics and signal timings for the preferred combination of alternatives are shown on Exhibit 16.

Table 4 shows the comparison MOEs between the existing signal timings and the "preferred" combination of alternatives. As shown, the preferred alternative improvements and timing plans are expected to improve network-wide operations by an overall 11 percent during both the weekday AM and PM peak hours. The system analysis indicates that the preferred alternative is expected to improve operation of the downtown Burlington transportation system.

Table 4
Comparison MOEs: Overall Network Performance

Network MOEs	AM Peak Hour			PM Peak Hour		
	Existing	Preferred	Change (%)	Existing	Preferred	Change (%)
Total Delay (hours)	35	30	-14%	56	50	-11%
Total Stops	5115	4778	-7%	8198	7078	-14%
Performance Index	49.0	43.7	-11%	78.3	69.4	-11%

Source: Synchro Network MOEs

Table 5 shows the arterial MOEs which determine performance improvements to progression along the priority corridors. As shown, arterial performance on the Milwaukee Avenue corridor (Route #1) is expected to improve by an overall 11 percent during the AM peak hour and by 16 percent during the PM peak hour. The remaining routes within the downtown area are expected to improve by up to 26 percent during the AM peak hour and by up to 22 percent during the weekday PM peak hour.

Table 5
Comparison MOEs: Priority Route Performance

Arterial Performance Index	AM Peak Hour			PM Peak Hour		
	Existing	Preferred	Change (%)	Existing	Preferred	Change (%)
Route #1	14.0	12.5	-11%	30.3	25.4	-16%
Route #2	6.7	5.6	-16%	8.9	7.7	-13%
Route #3	11.2	9.1	-19%	14.9	13.1	-12%
Route #4	11.3	8.4	-26%	14.8	11.6	-22%
Route #5	5.8	5.7	-2%	10.3	8.8	-15%

Source: Synchro Arterial MOEs

6.0 RECOMMENDATIONS

The following is a summary of the preferred improvements recommended for the City of Burlington downtown area intersections. The preferred combination of improvements (shown on Exhibit 16) was selected by choosing the improvement alternatives that best addressed the comments of the City and field review.

Time of Day Plans

According to previous traffic reports, the signal system reverts to flash control from 7:30 p.m. to 6:00 a.m. each day. Flash operation this early may not provide for adequate traffic flow or safety through the intersection during area events such as school football games, festivals, etc. that may occur throughout the year. It is recommended that the time of day plans be changed so that the signal system remains fully actuated (runs "free") throughout the day with the exception of a

coordinated time timing plan for the AM peak period (to run from 6:00-10:00 a.m.) and the PM peak period (to run from 3:00-6:00 p.m.).

Milwaukee Avenue/Chestnut Street

Pedestrian safety was noted as a concern at this intersection. Possible mitigation strategies to increase pedestrian safety could include the following:

- Enforcement of existing pedestrian treatments
- Evaluate site distance for this intersection and remove parking spaces if necessary to meet design standards. Kapur and Associates has evaluated the sight distance at this intersection.

Milwaukee Avenue/Pine Street

Install a southwest bound protected-permitted lagging left-turn phase on Milwaukee Avenue in order to better prevent left-turn vehicles from blocking the through vehicles in the shared left-turn/through lane on Milwaukee Avenue. Optimize the cycle length, splits, and offsets as shown on Exhibit 16.

Pine Street/Jefferson Street

Remove traffic signals and install stop signs on the Jefferson Street east and westbound approaches to the intersection. Based on a signal warrant study, traffic volumes at this intersection are no longer high enough to meet warrants for traffic signal control.

Pine Street/Adams Street

Optimize the cycle length, splits, and offsets as shown on Exhibit 16.

Bridge Street/Jefferson Street

Eliminate the westbound left-turn phasing since traffic volumes for this movement do not warrant separate phasing. Also eliminate the northbound protected-only left-turn phase, but install "No Left Turn" blank out signs for the northbound Bridge Street approach to be activated during train crossings. For additional safety during train crossings, also install "No Right Turn" blank out signs for the southbound Bridge Street approach. Optimize the cycle length, splits, and offsets for the eliminated left-turn phase conditions as shown on Exhibit 16.

Bridge Street/Adams Street

Eliminate the southbound left-turn phasing since traffic volumes for this movement do not warrant separate phasing. Also eliminate the northbound protected-only left-turn phase, but install "No Left Turn" blank out signs for the northbound Bridge Street approach to be activated during train crossings. For additional safety during train crossings, also install "No Right Turn" blank out signs for the southbound Bridge Street approach. Optimize the cycle length, splits, and offsets for the eliminated left-turn phase conditions as shown on Exhibit 16.

Bridge Street/Pine Street/Robert Street

Optimize the cycle length, splits, and offsets as shown on Exhibit 16.

State Street/Main Street

Eliminate the northbound left-turn phasing since traffic volumes for this movement does not warrant separate phasing. Optimize the cycle length, splits, and offsets for the eliminated left-turn phase conditions as shown on Exhibit 16.

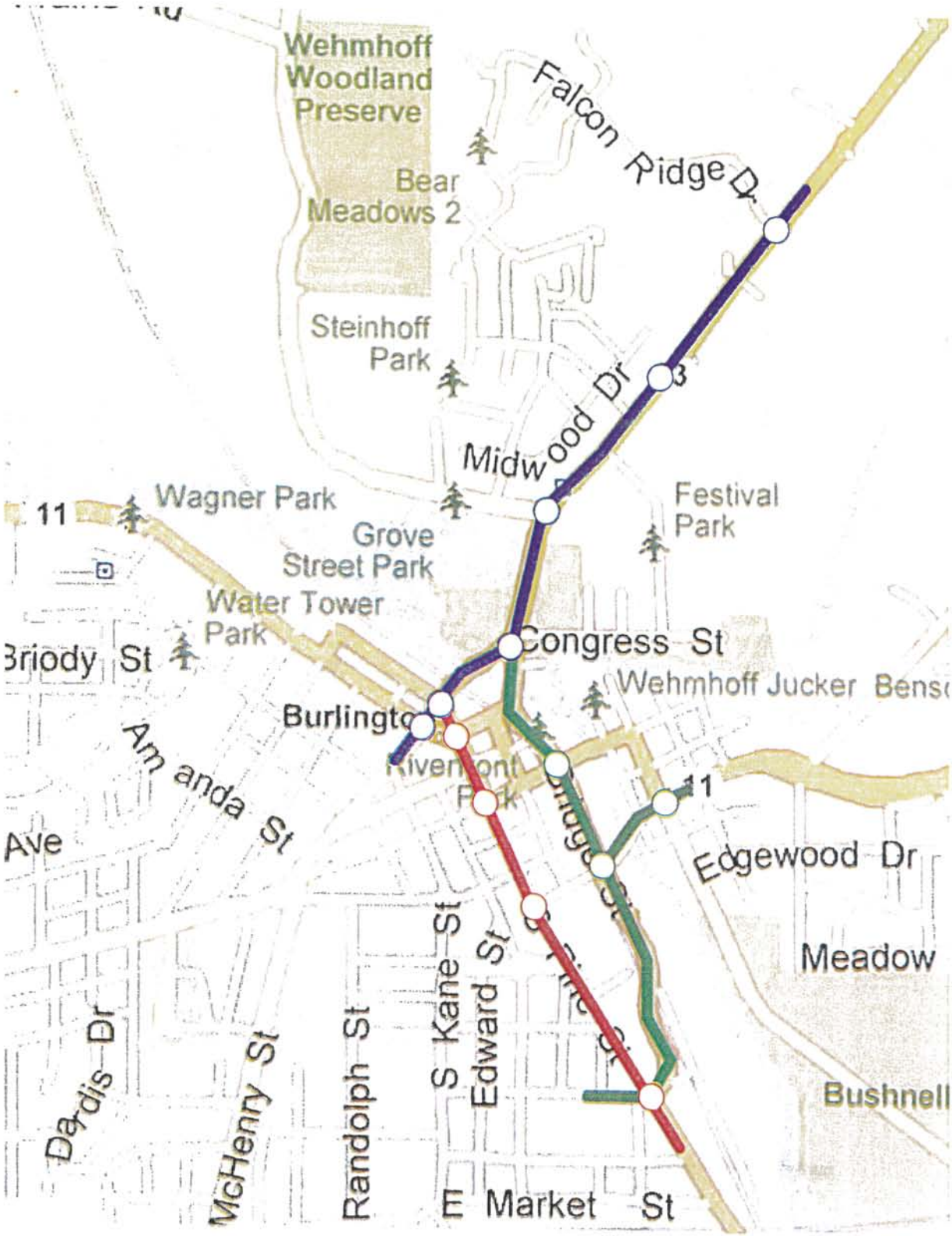
General Recommendation for Downtown Signal Systems

The traffic signals in downtown Burlington are fully actuated signals which means these signals are demand responsive. It is recommended that the City consider to let all signals in the

downtown study area operate in fully actuated mode between 6pm and 6am instead of operated in "flash" mode. This is expected to address complaints that signals should operate later on evenings with special events such as football games. Operating signals in fully actuated mode through the nighttime hours is the current standard of the WisDOT.

7.0 CONCLUSION

All study area intersections are expected to operate at acceptable levels from a delay standpoint with the recommended improvements and alternative options in place. In addition, both the overall operation of the downtown Burlington area and the main travelled routes are expected to improve from a system operation standpoint.



TRAFFIC ANALYSIS & DESIGN, INC.

EXHIBIT DATE: 01-18-12

LEGEND

- MILWAUKEE AVENUE CORRIDOR/STUDY INTERSECTIONS
- PINE STREET CORRIDOR/STUDY INTERSECTIONS
- BRIDGE STREET CORRIDOR/STUDY INTERSECTIONS

EXHIBIT 1
PROJECT LOCATION MAP
BURLINGTON, WISCONSIN

TRAFFIC ANALYSIS & DESIGN, INC.

EXHIBIT DATE: 01-18-12

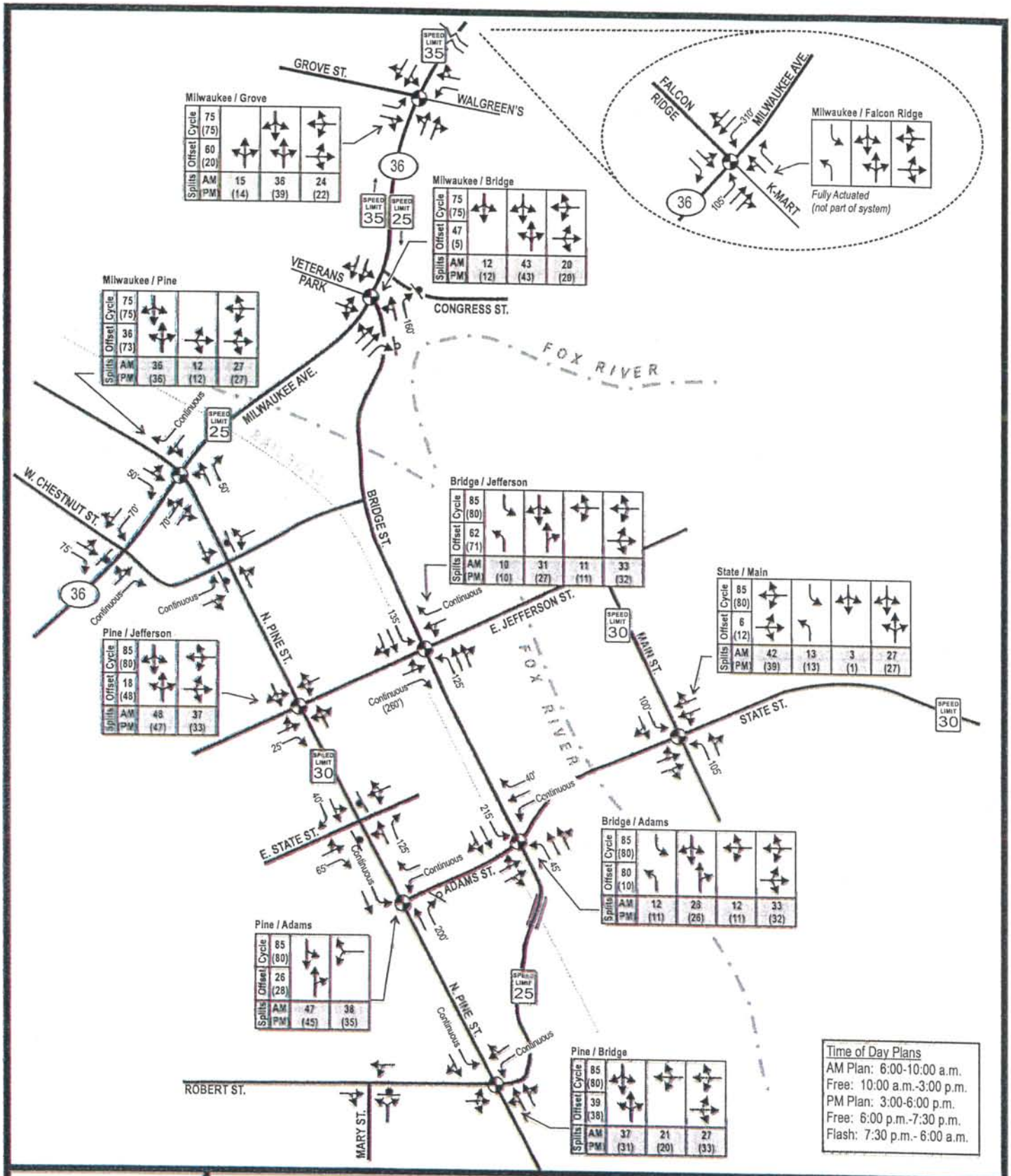
LEGEND

- TRAFFIC SIGNAL
- STOP SIGN
- XX WEEKDAY MORNING PEAK HOUR TRAFFIC (7:45-8:45 PM)
- (XX) WEEKDAY EVENING PEAK HOUR TRAFFIC (4:15-5:15 PM)

N

NOT TO SCALE

EXHIBIT 2
YEAR 2011 EXISTING PEAK HOUR TRAFFIC VOLUMES



TRAFFIC ANALYSIS & DESIGN, INC.

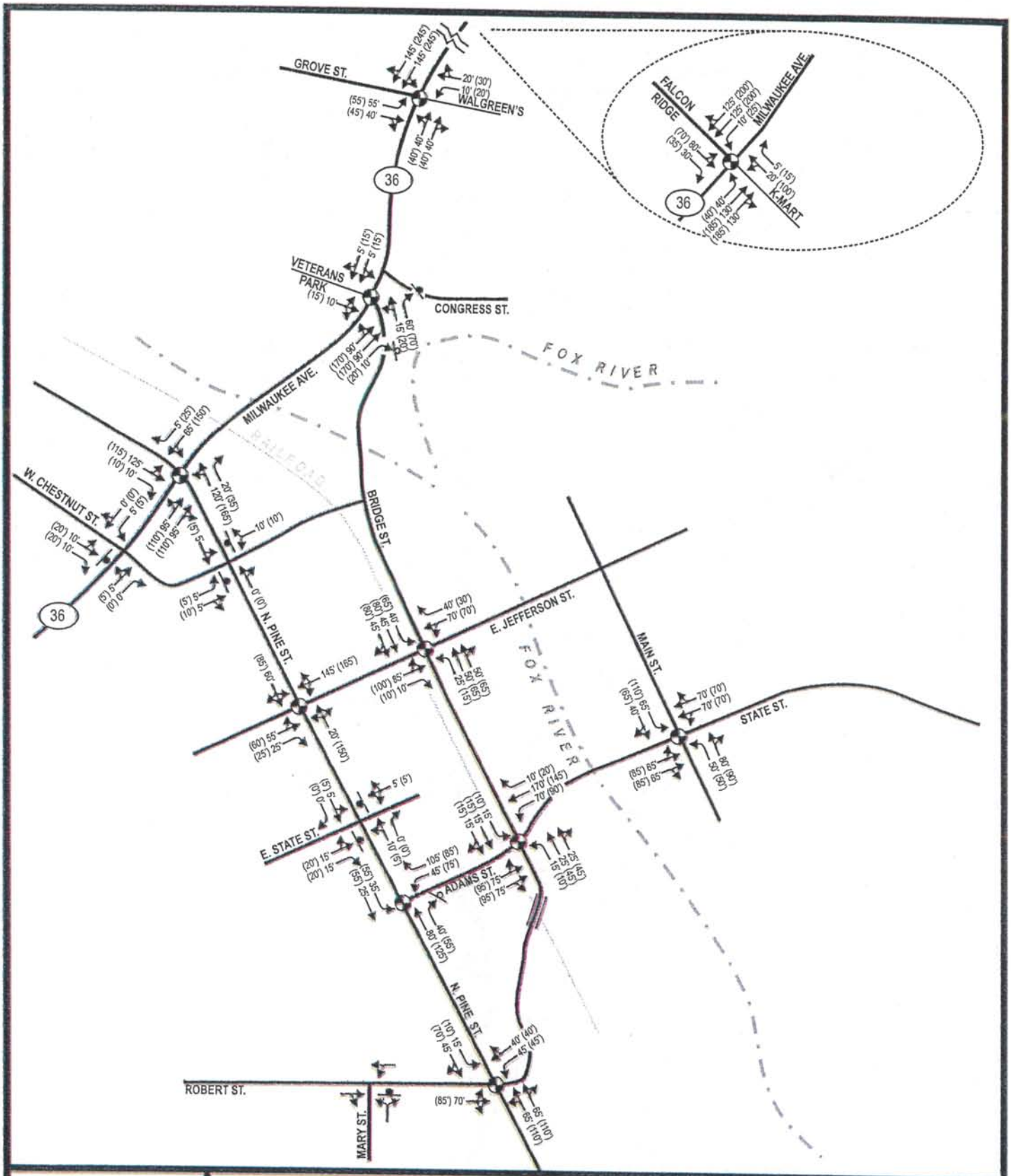
EXHIBIT DATE: 01-18-12

EXHIBIT 3
EXISTING GEOMETRICS AND SIGNAL TIMING

Year 2011 Existing Traffic Volumes Peak Hour Operating Conditions
Existing 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
Milwaukee Avenue (N/S) & Chestnut Street (E/W)	One-way Stop	AM	B	B	B	-	-	-	A	A	A	A	A	A
		PM	C	C	C	-	-	-	A	A	A	A	A	A
Milwaukee Avenue (N/S) & Pine Street (E/W)	Signal	AM	C	C	B	C	C	C	A	A	A	A	A	A
		PM	C	C	B	C	C	C	B	B	B	B	B	A
Milwaukee Avenue (N/S) & Bridge Street (E/W)	Signal	AM	C	C	C	C	C	C	A	A	A	A	A	A
		PM	C	C	C	C	C	C	B	B	B	A	A	A
Milwaukee Avenue (N/S) & Grove Street (E/W)	Signal	AM	C	C	C	C	C	C	A	A	A	B	B	B
		PM	C	C	C	C	C	C	A	A	A	B	B	B
Milwaukee Avenue (N/S) & Falcon Ridge (E/W)	Signal	AM	C	C	C	C	C	C	A	A	A	A	A	A
		PM	C	C	C	D	D	C	A	B	B	A	B	B
Pine Street (N/S) & Chestnut Street (E/W)	Two-way Stop	AM	B	A	A	A	-	A	-	A	A	A	A	-
		PM	B	A	A	B	-	B	-	A	A	A	A	-
Pine Street (N/S) & Jefferson Street (E/W)	Signal	AM	C	C	C	C	C	C	A	A	A	A	A	A
		PM	C	C	C	D	D	D	B	B	B	A	A	A
Pine Street (N/S) & Adams Street (E/W)	Signal	AM	-	-	-	C	-	F*	-	A	B	A	A	-
		PM	-	-	-	C	-	E*	-	A	B	A	A	-
Pine Street (N/S) & Robert Street/ Bridge Street (E/W)	Signal	AM	D	D	D	B	B	B	A	A	A	A	A	A
		PM	D	D	D	C	C	C	B	B	B	A	A	A
Bridge Street (N/S) & Jefferson Street (E/W)	Signal	AM	C	C	C	C	C	C	D	B	B	A	A	A
		PM	C	C	C	C	C	B	D	B	B	A	B	B
Bridge Street (N/S) & Adams Street (E/W)	Signal	AM	C	C	C	C	C	B	E*	A	A	A	A	A
		PM	C	C	C	B	C	B	D	A	A	A	A	A
Main Street (N/S) & State Street (E/W)	Signal	AM	B	B	B	A	A	A	C	C	C	C	C	C
		PM	A	A	A	B	B	B	C	C	C	C	C	C

** The existing signal timings provide enough green time for efficient movement of all traffic volumes at the study intersections. The poor LOS values shown in the table above are related to the offsets and arrival of vehicles from the upstream intersections, which are inefficient now that traffic volumes in downtown Burlington are much lower than in 2008.*



TRAFFIC ANALYSIS & DESIGN, INC.

EXHIBIT DATE: 01-18-12

LEGEND

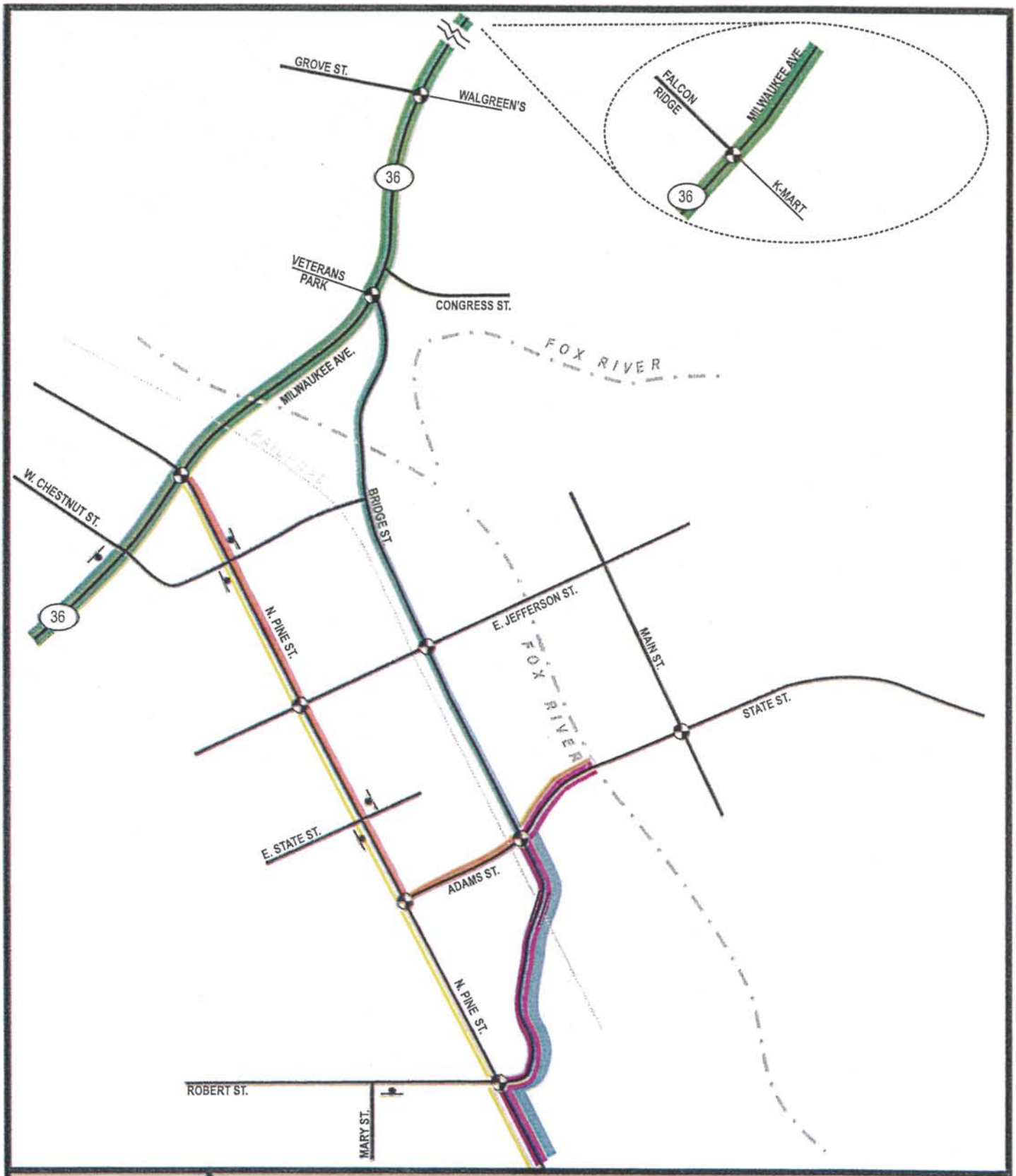
- TRAFFIC SIGNAL
- STOP SIGN
- YIELD SIGN
- EXISTING LANE CONFIGURATION

XX' WEEKDAY MORNING PEAK HOUR 95TH PERCENTILE QUEUE (IN FEET)
(XX') WEEKDAY EVENING PEAK HOUR 95TH PERCENTILE QUEUE (IN FEET)

N

NOT TO SCALE

EXHIBIT 5
YEAR 2011 EXISTING CONDITIONS: 95TH PERCENTILE QUEUES



TRAFFIC ANALYSIS & DESIGN, INC.

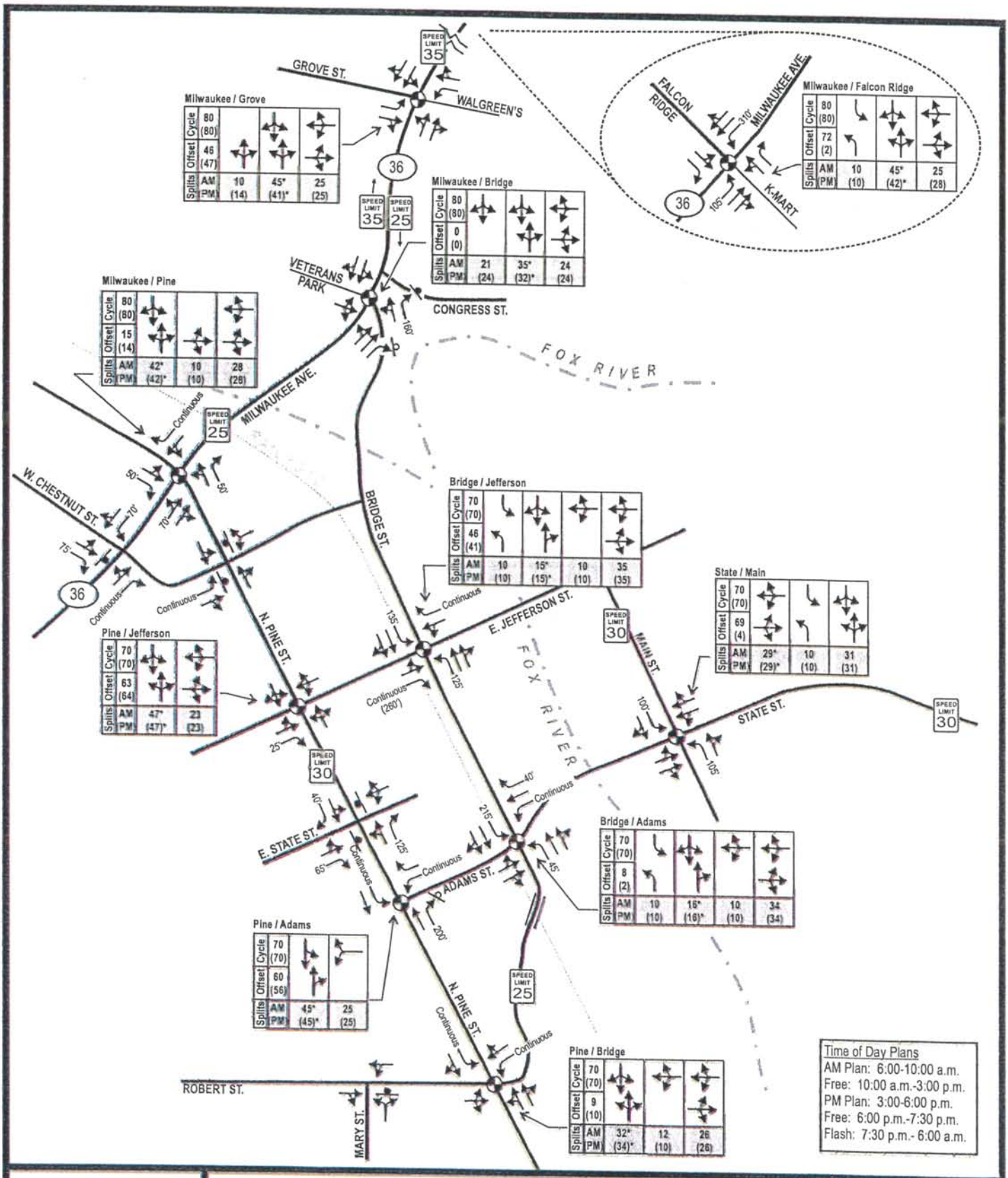
EXHIBIT DATE: 01-18-12

LEGEND

- TRAFFIC SIGNAL
- STOP SIGN

- ROUTE #1: MILWAUKEE AVENUE CORRIDOR
- ROUTE #2: STATE STREET-BRIDGE STREET-PINE STREET
- ROUTE #3 BRIDGE STREET CORRIDOR
- ROUTE #4 PINE STREET-ADAMS STREET
- ROUTE #5 PINE STREET CORRIDOR

EXHIBIT 6
DOWNTOWN TRAFFIC ROUTES



TRAFFIC ANALYSIS & DESIGN, INC.

EXHIBIT DATE: 01-18-12

LEGEND

- TRAFFIC SIGNAL
- STOP SIGN
- YIELD SIGN
- * COORDINATED PHASE (EXCESS GREEN TIME TO THIS PHASE)
- EXISTING LANE CONFIGURATION
- SIGNAL PHASE DIAGRAM

N

NOT TO SCALE

EXHIBIT 7
EXISTING GEOMETRICS AND OPTIMIZED SIGNAL TIMING

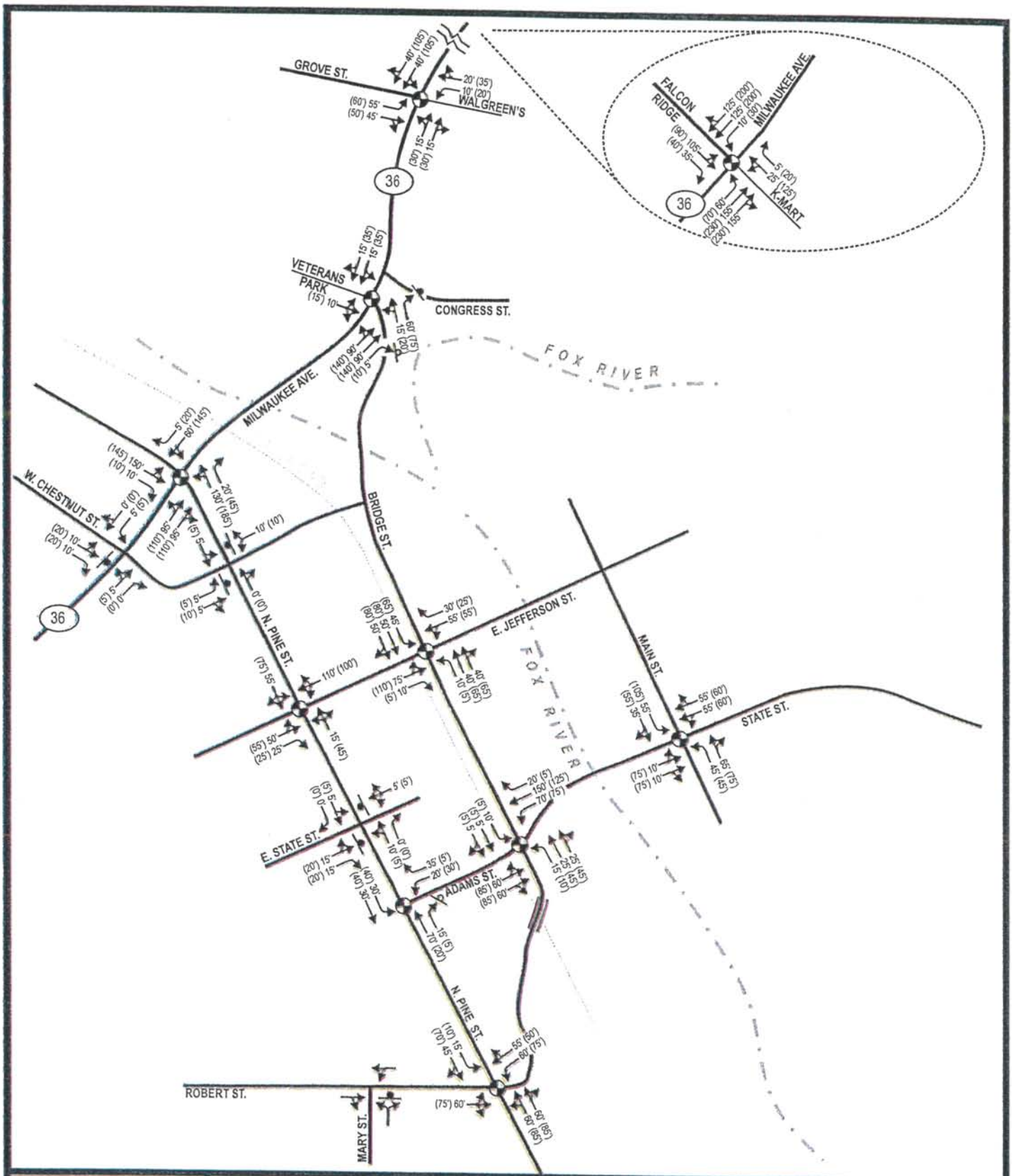
Year 2011 Existing Traffic Volumes Peak Hour Operating Conditions
Optimized Signal Timings

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
Milwaukee Avenue (N/S) & Chestnut Street (E/W)	One-way Stop	AM	B	B	B	-	-	-	A	A	A	A	A	A
		PM	C	C	C	-	-	-	A	A	A	A	A	A
Milwaukee Avenue (N/S) & Pine Street (E/W)	Signal	AM	C	C	B	D	D	C	B	B	B	A	A	A
		PM	C	C	B	D	D	C	B	B	B	B	B	A
Milwaukee Avenue (N/S) & Bridge Street (E/W)	Signal	AM	C	C	C	C	C	C	A	A	A	A	A	A
		PM	C	C	C	C	C	C	B	B	A	A	A	A
Milwaukee Avenue (N/S) & Grove Street (E/W)	Signal	AM	C	C	C	C	C	C	A	A	A	A	A	A
		PM	C	C	C	C	C	C	A	A	A	A	A	A
Milwaukee Avenue (N/S) & Falcon Ridge (E/W)	Signal	AM	D	C	C	C	C	C	A	A	A	A	A	A
		PM	C	C	C	D	D	C	B	B	B	A	B	B
Pine Street (N/S) & Chestnut Street (E/W)	Two-way Stop	AM	B	A	A	A	-	A	-	A	A	A	A	-
		PM	B	A	A	B	-	B	-	A	A	A	A	-
Pine Street (N/S) & Jefferson Street (E/W)	Signal	AM	C	C	C	C	C	C	A	A	A	A	A	A
		PM	C	C	C	C	C	C	A	A	A	A	A	A
Pine Street (N/S) & Adams Street (E/W)	Signal	AM	-	-	-	C	-	D	-	A	A	A	A	-
		PM	-	-	-	B	-	A	-	A	A	A	A	-
Pine Street (N/S) & Robert Street/ Bridge Street (E/W)	Signal	AM	C	C	C	D	C	C	A	A	A	A	A	A
		PM	C	C	C	C	B	B	A	A	A	A	A	A
Bridge Street (N/S) & Jefferson Street (E/W)	Signal	AM	C	C	B	B	B	B	C	B	B	A	B	B
		PM	C	C	C	B	B	B	C	B	B	B	B	B
Bridge Street (N/S) & Adams Street (E/W)	Signal	AM	C	C	C	C	C	C	D	A	A	A	A	A
		PM	C	C	C	B	B	B	D	A	A	A	A	A
Main Street (N/S) & State Street (E/W)	Signal	AM	A	A	A	A	A	A	C	C	C	C	C	C
		PM	A	A	A	A	A	A	C	C	C	C	C	C

TRAFFIC ANALYSIS & DESIGN, INC

EXHIBIT DATE: 01-18-12

EXHIBIT 8
YEAR 2011 OPTIMIZED CONDITIONS PEAK HOUR LOS/CAPACITY ANALYSIS



TRAFFIC ANALYSIS & DESIGN, INC.

EXHIBIT DATE: 01-18-12

LEGEND

- TRAFFIC SIGNAL
- STOP SIGN
- YIELD SIGN
- EXISTING LANE CONFIGURATION

XX' WEEKDAY MORNING PEAK HOUR 95TH PERCENTILE QUEUE (IN FEET)
(XX') WEEKDAY EVENING PEAK HOUR 95TH PERCENTILE QUEUE (IN FEET)

N

NOT TO SCALE

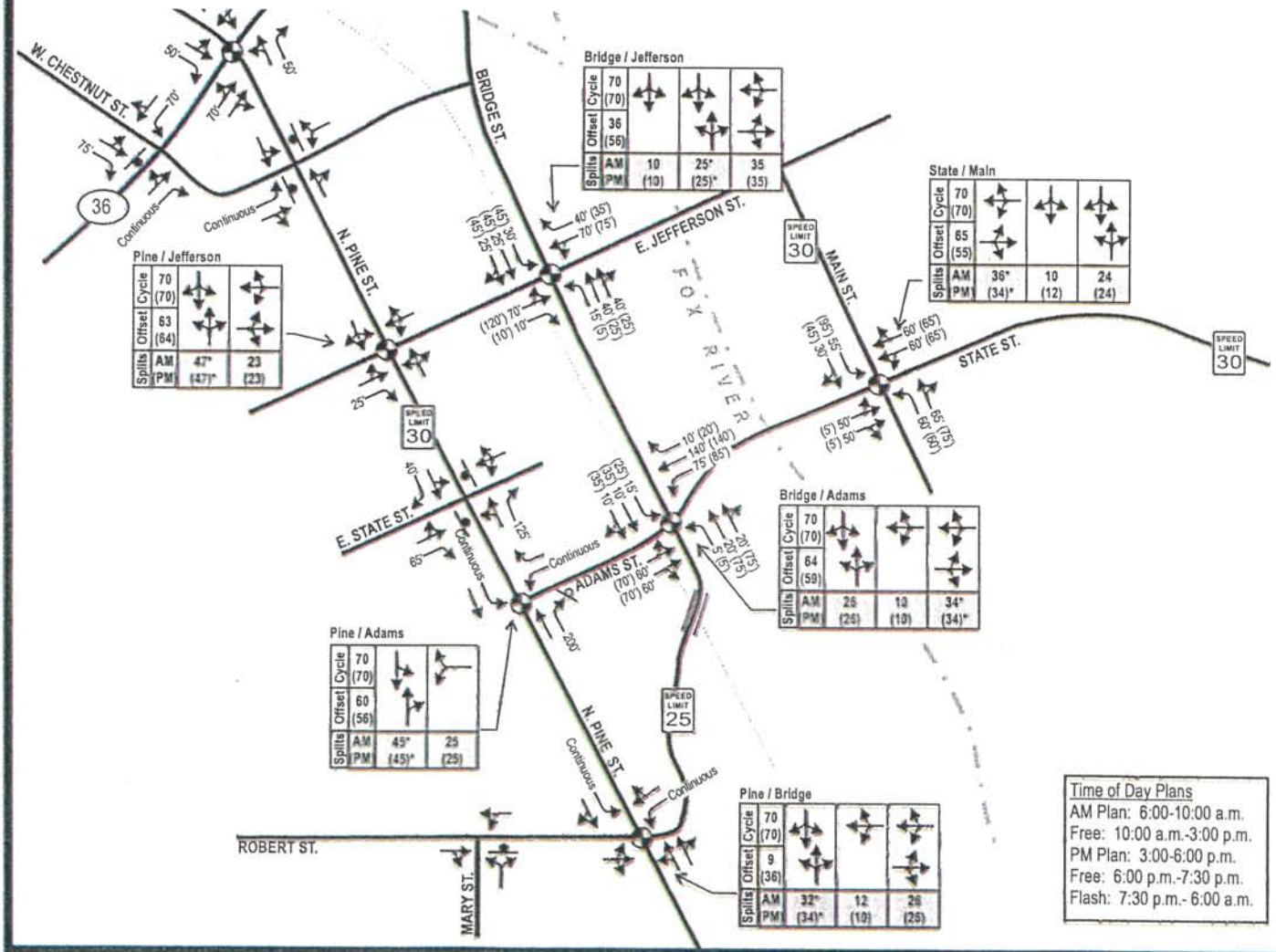
EXHIBIT 9
YEAR 2011 OPTIMIZED CONDITIONS: 95TH PERCENTILE QUEUES

Year 2011 Existing Traffic Volumes Peak Hour Operating Conditions
Optimized Signal Timings - Eliminated Left-Turns

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
Bridge Street (N/S) & Jefferson Street (E/W)	Signal	AM	C	C	B	C	C	C	B	B	B	A	A	A
		PM	C	C	C	C	C	C	A	A	A	A	A	A
Bridge Street (N/S) & Adams Street (E/W)	Signal	AM	C	C	C	B	B	B	A	A	A	A	A	A
		PM	B	B	B	C	B	B	C	B	B	B	A	A
Main Street (N/S) & State Street (E/W)	Signal	AM	A	A	A	A	A	A	C	C	C	C	C	C
		PM	A	A	A	A	A	A	C	C	C	B	B	B

Eliminated LT Phases:

1. *NB and WB LT Phases at Bridge/Jefferson*
2. *NB and SB LT Phases at Bridge/Adams*
3. *NB LT Phase at State/Main*



Time of Day Plans
AM Plan: 6:00-10:00 a.m.
Free: 10:00 a.m.-3:00 p.m.
PM Plan: 3:00-6:00 p.m.
Free: 6:00 p.m.-7:30 p.m.
Flash: 7:30 p.m.- 6:00 a.m.

TRAFFIC ANALYSIS & DESIGN, INC.

EXHIBIT DATE: 01-18-12

LEGEND

- TRAFFIC SIGNAL
- STOP SIGN
- YIELD SIGN
- XX'(XX') WEEKDAY AM/PM 95TH PERCENTILE QUEUES
- * COORDINATED PHASE (EXCESS GREEN TIME TO THIS PHASE)
- EXISTING LANE CONFIGURATION
- SIGNAL PHASE DIAGRAM

N

EXHIBIT 10
ALTERNATIVES ANALYSIS: ELIMINATING LEFT-TURN PHASING

TRAFFIC SIGNAL WARRANT ANALYSIS SUMMARY (WARRANTS 1 - 3)

2011 Existing Traffic

Pine Street & Jefferson Street

VOLUME SUMMARY		
For Warrant 1		
Percent Right Turns -->		100%
START TIME	MAJOR	MINOR
6-7am	93	63
7-8am	188	113
8-9am	287	164
9-10am	281	122
10-11am	311	111
11am-12pm	357	190
12-1pm	384	166
1-2pm	360	142
2-3pm	389	173
3-4pm	471	169
4-5pm	441	160
5-6pm	418	144
12:00 AM	0	0
12:00 AM	0	0
12:00 AM	0	0
12:00 AM	0	0

Warrant 1 (Eight Hour Volume - 100% Factor)

Conditions	Major	Minor	Met?	Hours Met?
Condition A	500	150	NO	0
Condition B	750	75	NO	0
Condition C			NO	0
1A	400	120		
1B	600	60		

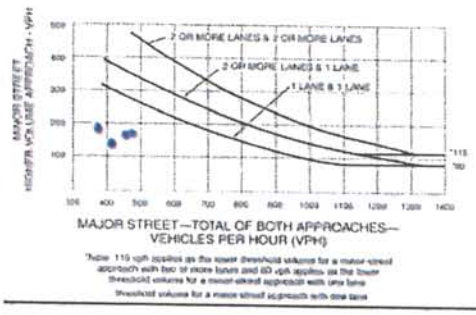
Volumes	Major	Minor
◉	NB/SB	EB/WB
○	SB Th+Rt	NB Lt
○	NB Th+Rt	SB Lt

VOLUME SUMMARY		
For Warrants 2 and 3		
Percent Right Turns -->		100%
Start Time	MAJOR	MINOR
6-7am	93	63
7-8am	188	113
8-9am	287	164
9-10am	281	122
10-11am	311	111
11am-12pm	357	190
12-1pm	384	166
1-2pm	360	142
2-3pm	389	173
3-4pm	471	169
4-5pm	441	160
5-6pm	418	144
12:00 AM	0	0
12:00 AM	0	0
12:00 AM	0	0
12:00 AM	0	0

Warrant 2 (Four Hour Volume)
(100% Factor)

Met?
NO

Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume

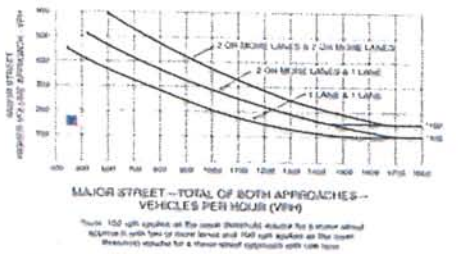


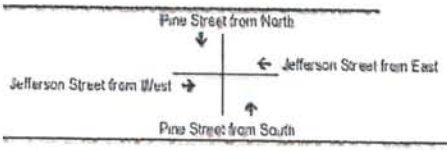
CONDITIONS	
< 10,000 Population	No
Major Street Speed > 40 mph	No
Major Street Lanes	One
Minor Street Lanes	One
T-Intersection (Y/N)	No

Warrant 3 (Peak Hour Volume)
(100% Factor)

Met?
NO

Figure 4C-3. Warrant 3, Peak Hour





Left-Turn Conflict Analysis

Opp. Thru	x	Lt Turn	Threshold	Met?	Hours Met
SB Th+Rt		NB Lt	80,000	NO	0
NB Th+Rt		SB Lt	80,000	NO	0

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
Pine Street (N/S) & Jefferson Street (E/W)	Two-way Stop	AM	B	B	B	B	B	B	A	A	A	A	A	A
		PM	C	C	C	C	C	C	A	A	A	A	A	A

TRAFFIC ANALYSIS & DESIGN, INC.

EXHIBIT DATE: 01-18-12

EXHIBIT 11
WARRANT ANALYSIS: PINE STREET & JEFFERSON STREET

TRAFFIC SIGNAL WARRANT ANALYSIS SUMMARY (WARRANTS 1 - 3)

2011 Existing Traffic

Pine Street & Adams Street

VOLUME SUMMARY		
For Warrant 1		
Percent Right Turns -->		100%
START TIME	MAJOR	MINOR
6-7am	213	95
7-8am	429	191
8-9am	423	166
9-10am	389	140
10-11am	441	143
11am-12pm	526	147
12-1pm	540	134
1-2pm	518	143
2-3pm	571	233
3-4pm	712	232
4-5pm	673	211
5-6pm	550	198
12:00 AM	0	0
12:00 AM	0	0
12:00 AM	0	0
12:00 AM	0	0

Warrant 1 (Eight Hour Volume - 100% Factor)

Conditions	Major	Minor	Met?	Hours Met?
Condition A	600	200	NO	2
Condition B	900	100	NO	0
Condition C			NO	0
1A	480	160		
1B	720	80		

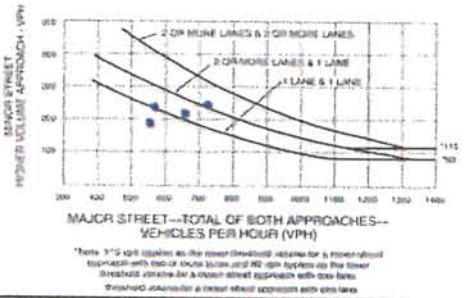
Volumes	Major	Minor
◉	NB/SB	EB/WB
○	SB Th+Rt	NB Lt
○	NB Th+Rt	SB Lt

VOLUME SUMMARY		
For Warrants 2 and 3		
Percent Right Turns -->		100%
Start Time	MAJOR	MINOR
6-7am	213	95
7-8am	429	191
8-9am	423	166
9-10am	389	140
10-11am	441	143
11am-12pm	526	147
12-1pm	540	134
1-2pm	518	143
2-3pm	571	233
3-4pm	712	232
4-5pm	673	211
5-6pm	550	198
12:00 AM	0	0
12:00 AM	0	0
12:00 AM	0	0
12:00 AM	0	0

Warrant 2 (Four Hour Volume)
(100% Factor)

Met?
NO

Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume

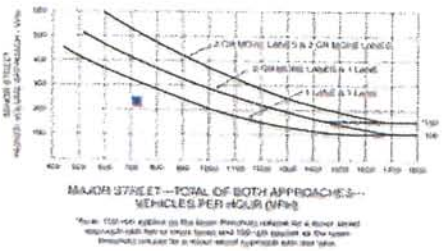


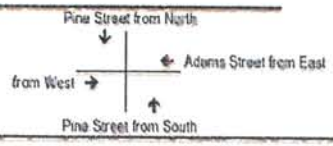
CONDITIONS	
< 10,000 Population	No
Major Street Speed > 40 mph	No
Major Street Lanes	Two or more
Minor Street Lanes	Two or more
T-Intersection (Y/N)	No

Warrant 3 (Peak Hour Volume)
(100% Factor)

Met?
NO

Figure 4C-3. Warrant 3, Peak Hour





Left-Turn Conflict Analysis

Opp. Thru	x	Lt Turn	Threshold	Met?	Hours Met
SB Th+Rt		NB Lt	100,000	NO	0
NB Th+Rt		SB Lt	100,000	NO	0

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
Pine Street (N/S) & Adams Street (E/W)	One-way Stop	AM	-	-	-	B	-	A	-	A	A	A	A	-
		PM	-	-	-	C	-	B	-	A	A	A	A	-

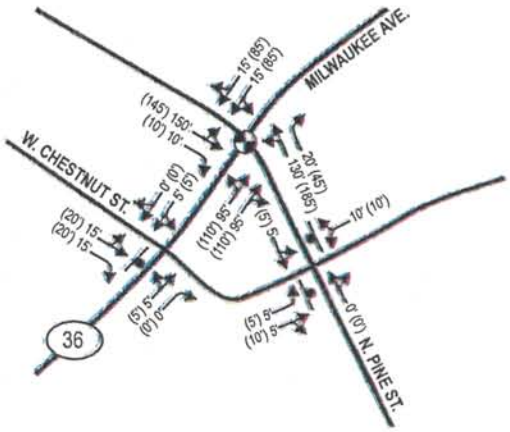
TRAFFIC ANALYSIS & DESIGN, INC.

EXHIBIT DATE: 01-18-12

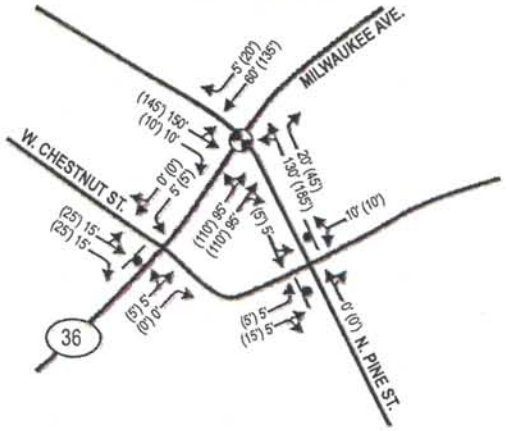
EXHIBIT 12
WARRANT ANALYSIS: PINE STREET & ADAM STREET

Year 2011 Existing Traffic Volumes Peak Hour Operating Conditions
Optimized Signal Timings - Milwaukee/Pine Left Turn Option 1

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
Milwaukee Avenue (N/S) & Chestnut Street (E/W)	One-way Stop	AM	B	B	B	-	-	-	A	A	A	A	A	A
		PM	C	C	C	-	-	-	A	A	A	A	A	A
Milwaukee Avenue (N/S) & Pine Street (E/W)	Signal	AM	C	C	B	D	D	C	B	B	B	A	A	A
		PM	C	C	B	D	D	C	B	B	B	A	A	A
Pine Street (N/S) & Chestnut Street (E/W)	Two-way Stop	AM	B	A	A	A	-	A	-	A	A	A	A	-
		PM	B	A	A	B	-	B	-	A	A	A	A	-



Option 1: Reallocate existing southwest bound lanes on Milwaukee Avenue to include a shared through/right-turn lane and a shared left-turn/through lane. Requires removal of on-street parking on



Option 2: Restrict southwest bound left turns at Milwaukee Avenue/Pine Street. These turns can be accommodated at Milwaukee Avenue/Chestnut Street.

Year 2011 Existing Traffic Volumes Peak Hour Operating Conditions
Optimized Signal Timings - Milwaukee/Pine Left Turn Option 2

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
Milwaukee Avenue (N/S) & Chestnut Street (E/W)	One-way Stop	AM	B	B	B	-	-	-	A	A	A	A	A	A
		PM	C	C	C	-	-	-	A	A	A	A	A	A
Milwaukee Avenue (N/S) & Pine Street (E/W)	Signal	AM	C	C	B	D	D	C	B	B	B	A	A	A
		PM	C	C	B	D	D	C	B	B	B	A	A	A
Pine Street (N/S) & Chestnut Street (E/W)	Two-way Stop	AM	B	A	A	B	-	B	-	A	A	A	A	-
		PM	B	B	B	B	-	B	-	A	A	A	A	-

TRAFFIC ANALYSIS & DESIGN, INC.

EXHIBIT DATE: 01-18-12

LEGEND

- TRAFFIC SIGNAL
- STOP SIGN
- YIELD SIGN
- PROPOSED LANE CONFIGURATION

XX' WEEKDAY MORNING PEAK HOUR 95TH PERCENTILE QUEUE (IN FEET)
(XX') WEEKDAY EVENING PEAK HOUR 95TH PERCENTILE QUEUE (IN FEET)

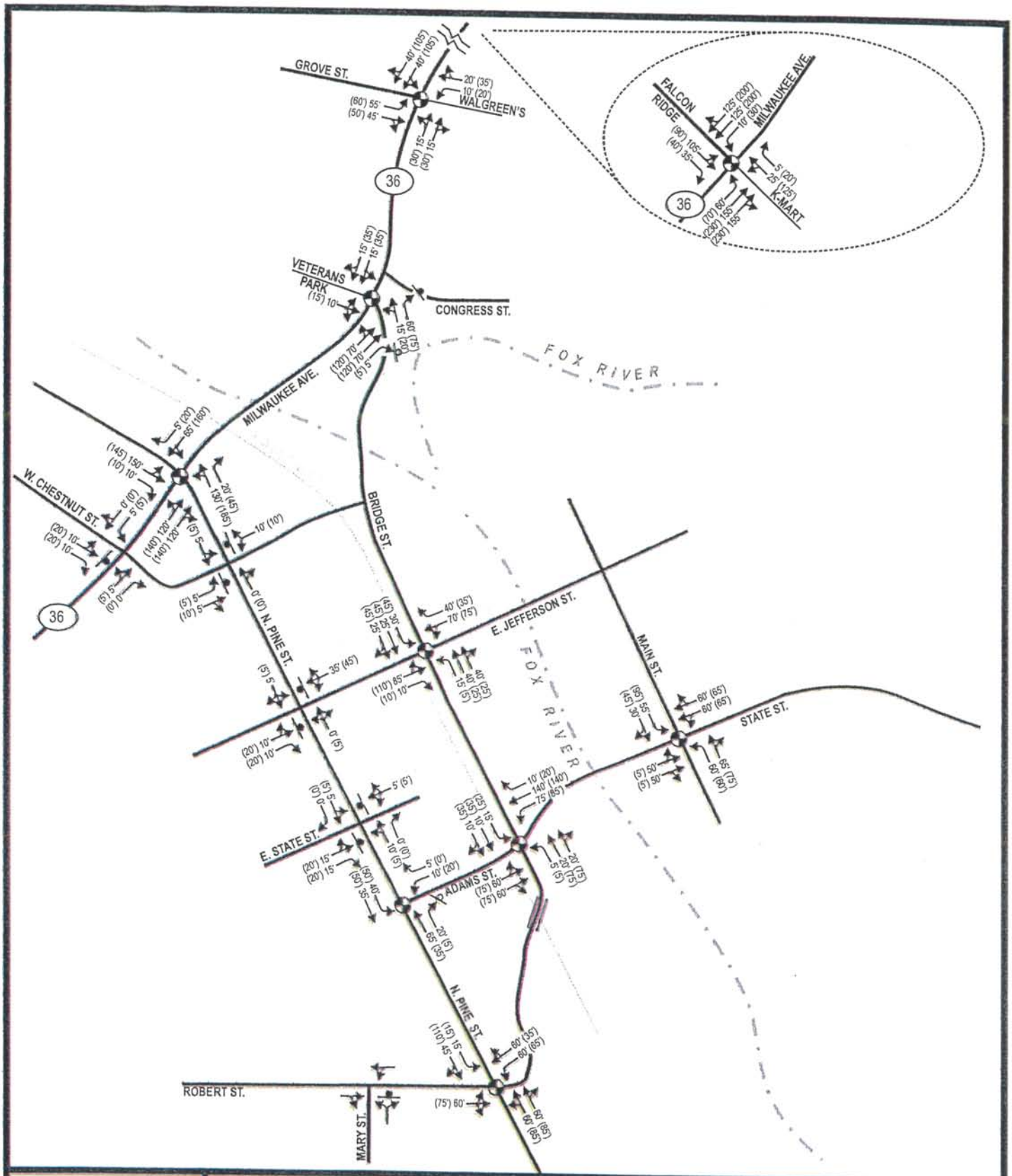
N

NOT TO SCALE

EXHIBIT 13
ALTERNATIVES ANALYSIS: LEFT-TURN OPTIONS FOR MILWAUKEE/PINE

Year 2011 Existing Traffic Volumes Peak Hour Operating Conditions
Combination of Improvements (Preferred Alternative)

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
Milwaukee Avenue (N/S) & Chestnut Street (E/W)	One-way Stop	AM	B	B	B	-	-	-	A	A	A	A	A	A
		PM	C	C	C	-	-	-	A	A	A	A	A	A
Milwaukee Avenue (N/S) & Pine Street (E/W)	Signal	AM	C	C	B	D	D	C	B	B	B	A	A	A
		PM	C	C	B	D	D	C	B	B	B	A	A	A
Milwaukee Avenue (N/S) & Bridge Street (E/W)	Signal	AM	C	C	C	C	C	C	A	A	A	A	A	A
		PM	C	C	C	C	C	C	B	B	A	A	A	A
Milwaukee Avenue (N/S) & Grove Street (E/W)	Signal	AM	C	C	C	C	C	C	A	A	A	A	A	A
		PM	C	C	C	C	C	C	A	A	A	A	A	A
Milwaukee Avenue (N/S) & Falcon Ridge (E/W)	Signal	AM	D	C	C	C	C	C	A	A	A	A	A	A
		PM	C	C	C	D	D	C	B	B	B	A	B	B
Pine Street (N/S) & Chestnut Street (E/W)	Two-way Stop	AM	B	A	A	A	-	A	-	A	A	A	A	-
		PM	B	A	A	B	-	B	-	A	A	A	A	-
Pine Street (N/S) & Jefferson Street (E/W)	Two-way Stop	AM	B	B	B	B	B	B	A	A	A	A	A	A
		PM	C	C	C	C	C	C	A	A	A	A	A	A
Pine Street (N/S) & Adams Street (E/W)	Signal	AM	-	-	-	B	-	A	-	A	A	A	A	-
		PM	-	-	-	B	-	A	-	A	A	A	A	-
Pine Street (N/S) & Robert Street/ Bridge Street (E/W)	Signal	AM	C	C	C	C	C	C	A	A	A	A	A	A
		PM	C	C	C	B	B	B	A	A	A	A	B	B
Bridge Street (N/S) & Jefferson Street (E/W)	Signal	AM	C	C	C	C	C	C	B	B	B	A	A	A
		PM	C	C	C	C	C	C	A	A	A	A	A	A
Bridge Street (N/S) & Adams Street (E/W)	Signal	AM	C	C	C	B	B	B	A	A	A	A	A	A
		PM	C	C	C	C	B	C	B	B	B	B	A	A
Main Street (N/S) & State Street (E/W)	Signal	AM	A	A	A	A	A	A	C	C	C	C	C	C
		PM	A	A	A	A	A	A	C	C	C	B	B	B



TRAFFIC ANALYSIS & DESIGN, INC.

EXHIBIT DATE: 01-18-12

LEGEND

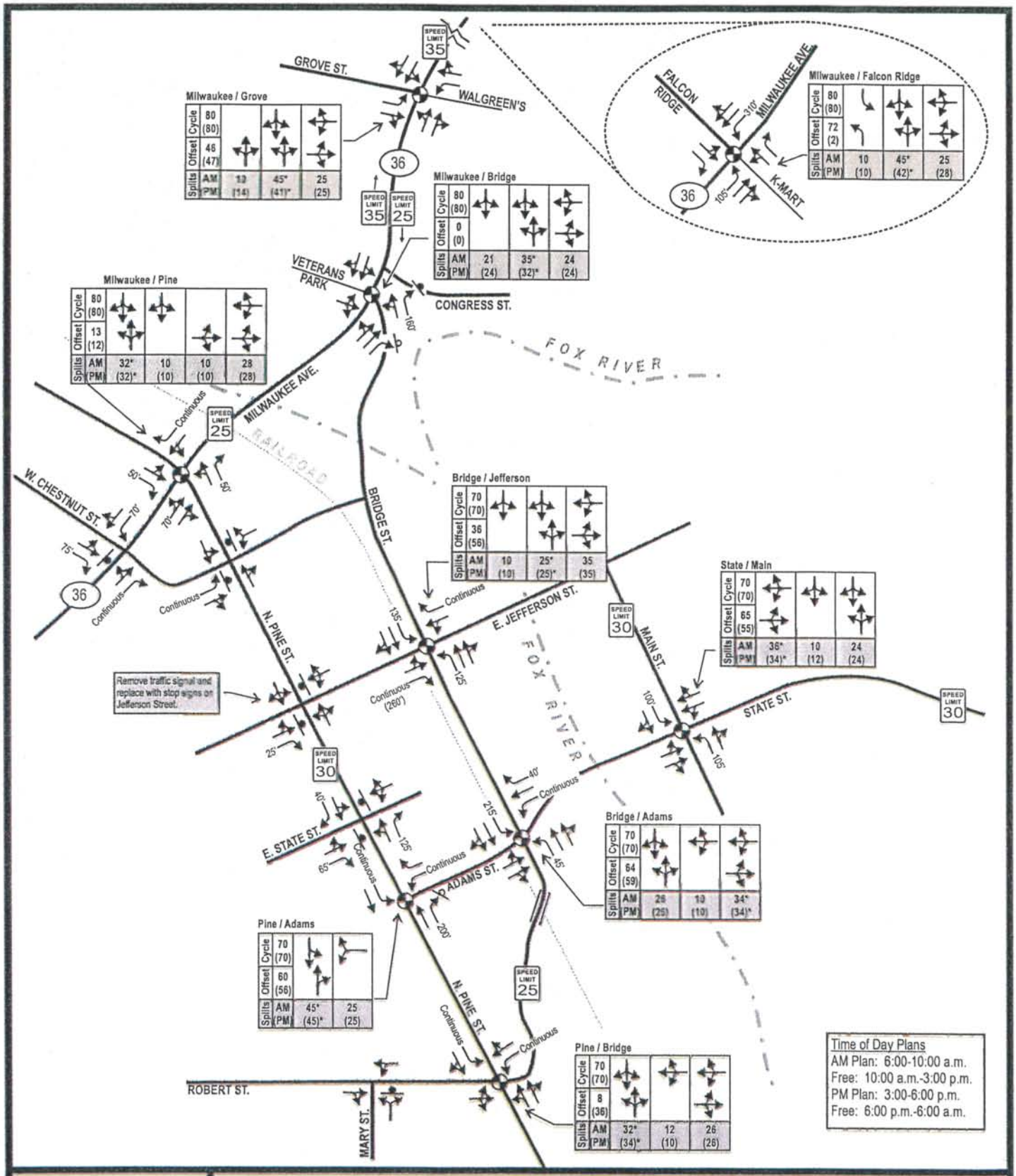
- TRAFFIC SIGNAL
- STOP SIGN
- YIELD SIGN
- EXISTING LANE CONFIGURATION

XX' WEEKDAY MORNING PEAK HOUR 95TH PERCENTILE QUEUE (IN FEET)
(XX') WEEKDAY EVENING PEAK HOUR 95TH PERCENTILE QUEUE (IN FEET)

N

NOT TO SCALE

EXHIBIT 15
PREFERRED ALTERNATIVE: 95TH PERCENTILE QUEUES



TRAFFIC ANALYSIS & DESIGN, INC.

EXHIBIT DATE: 01-18-12

EXHIBIT 16
PREFERRED ALTERNATIVE: RECOMMENDED IMPROVEMENTS