

TRAFFIC ENGINEERING STUDY OF MILWAUKEE AVENUE (STH 36) BETWEEN THE CENTRAL BUSINESS DISTRICT AND THE NORTHERN CORPORATE LIMITS OF THE CITY OF BURLINGTON

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MEMORANDUM REPORT NUMBER 36

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BETWEEN THE CENTRAL BUSINESS DISTRICT AND THE NORTHERN
CORPORATE LIMITS OF THE CITY OF BURLINGTON**

RACINE COUNTY, WISCONSIN

Prepared by the
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SEWRPC Memorandum Report No. 36

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BETWEEN THE CENTRAL BUSINESS DISTRICT AND THE
NORTHERN CORPORATE LIMITS OF THE CITY OF BURLINGTON

INTRODUCTION

On October 15, 1987, the City of Burlington requested the Commission staff to conduct a traffic engineering study of the segment of Milwaukee Avenue (STH 36) between the fringe of the City of Burlington central business district at Commerce Street and the northern corporate limits of the City.

Over the past several years, local elected officials and residents of the City of Burlington have become increasingly concerned about the traffic congestion and safety problems being experienced on this arterial facility, particularly at the approaches to streets and driveways which intersect this segment of STH 36. Plans for the future development of the City and current proposals for such development, including the Bear Meadows subdivision, indicate that these traffic problems may be expected to increase in the future.

This memorandum report presents the findings and recommendations of the requested traffic engineering study. The report describes the traffic problems which currently exist on this segment of STH 36; identifies and evaluates alternative traffic engineering actions which may be expected to abate these traffic problems; and recommends traffic engineering measures for implementation which may be expected to alleviate existing traffic problems.

EXISTING CONDITIONS

Essential to the identification of existing traffic problems is the collection of data concerning existing roadway physical and operational characteristics; average weekday and peak hour traffic volumes and turning movements; traffic operating speeds; and a history of motor vehicle accident patterns and frequencies.

Jurisdictional Classification

Milwaukee Avenue between Commerce Street-Pine Street and the southern terminus of Wegge Road is a connecting highway and is part of the state trunk highway system. A connecting highway is a state highway marked, signed, and routed over a local street providing continuity for the route of the state trunk highway through a municipality. Maintenance of the connecting highway is a city responsibility, while the State is responsible for construction and operation. Therefore, approval of the Wisconsin Department of Transportation is required prior to the City undertaking any action substantially altering the use or capacity of this segment of Milwaukee Avenue. Such actions requiring approval include the implementation of traffic control measures such as prohibiting turning movements, installing or modifying traffic control devices, and modifying intersection geometrics. Milwaukee Avenue north of the southern

terminus of Wegge Road is a state trunk highway under the sole jurisdiction of the State. The Wisconsin Department of Transportation is, therefore, responsible for its construction, operation, and maintenance.

Roadway Physical and Operational Characteristics

Milwaukee Avenue between Commerce Street-Pine Street and the southern terminus of Wegge Road, is constructed to an urban cross-section with curb and gutter and storm sewer, and has a pavement width of 48 feet. Milwaukee Avenue between the southern terminus of Wegge Road and the northern city corporate limits, is constructed to a rural cross-section with road ditches and has a pavement width of 24 feet and two 10-foot-wide paved shoulders, adequate to provide two traffic lanes.

On the urban section of Milwaukee Avenue parking is generally permitted, thereby limiting the traffic carrying capacity of this segment of Milwaukee Avenue to two traffic lanes. The two minor exceptions along this segment of Milwaukee Avenue where parking is prohibited, are the segments between Commerce Street-Pine Street and the Fox River and between Paul Street and the southern end of Wegge Road.

Traffic on Milwaukee Avenue is controlled only at its intersection with Commerce Street and Pine Street; the intersection being controlled by three-way stop signs. All cross-street traffic along the segment of Milwaukee Avenue concerned is stop sign-controlled. The posted speed limits along this segment of Milwaukee Avenue are 25 miles per hour between Commerce Street-Pine Street and Bridge Street; 30 miles per hour between Bridge Street and Grove Street; and 35 miles per hour between Grove Street and the City northern corporate limits.

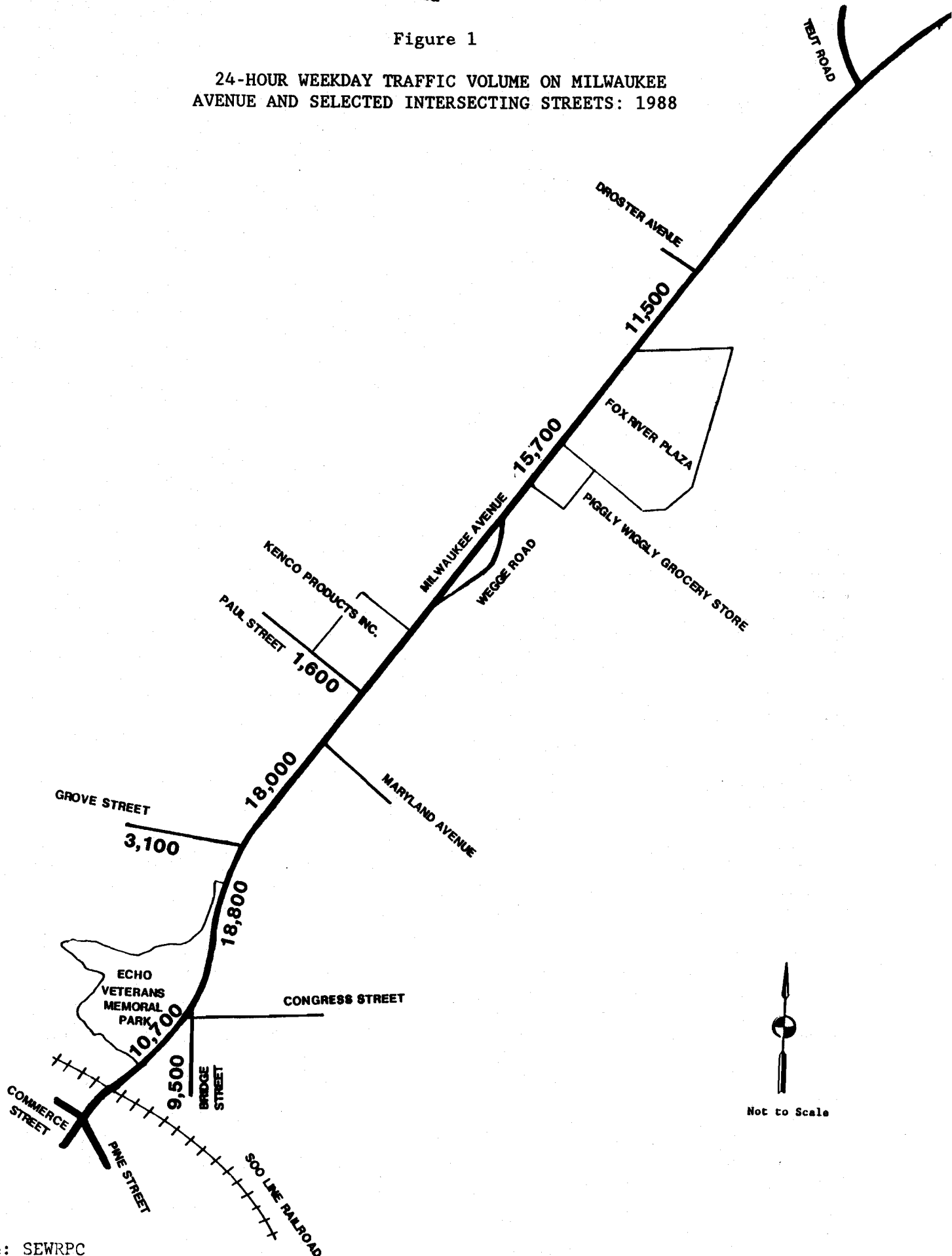
Traffic Volumes

As shown on Figure 1, the traffic volumes on Milwaukee Avenue range from about 18,800 vehicles per average weekday immediately northeast of Bridge Street, to a low of 10,700 vehicles between Commerce Street and Bridge Street. The current traffic volume on Bridge Street south of Milwaukee Avenue is about 9,500 vehicles per average weekday. The current traffic volume on Grove Street west of Milwaukee Avenue is about 3,100 vehicles per average weekday. Estimated current average weekday traffic volume on Paul Street north of Milwaukee Avenue is about 1,600 vehicles per average weekday. These estimates of current average weekday traffic volumes are based upon counts conducted by the Wisconsin Department of Transportation in November 1987, and by the Regional Planning Commission in March 1988.

The number of traffic lanes provided on an arterial facility largely, although not entirely, establishes its traffic-carrying capacity. On-street parking may be prohibited during peak traffic periods, or all day, to provide additional traffic lanes. A two-traffic-lane urban arterial generally has a design capacity of about 13,000 vehicles per day; a four-lane undivided arterial has a design capacity of about 17,000 vehicles per day; a four-lane divided arterial has a design capacity of about 25,000 vehicles per day; and a six-lane divided arterial has a design capacity of about 35,000 vehicles per day. Generally, two traffic lanes are provided along the study segment of Milwaukee Avenue. Also affecting urban arterial design capacity are the characteristics of its intersections, including intersection approach

Figure 1

24-HOUR WEEKDAY TRAFFIC VOLUME ON MILWAUKEE AVENUE AND SELECTED INTERSECTING STREETS: 1988



Not to Scale

pavement width, including provision of exclusive turn lanes; parking within 200 feet of the intersection; type and operation of traffic control; percentage of right and left turns at intersections; and percentage of trucks and buses in the traffic stream.

Urban arterials carrying average weekday traffic volumes exceeding their design capacity may be expected to experience significant delays at controlled intersections; reduced speeds between intersections; and increased accident rates. The reduced speeds and intersection delays on urban arterials carrying average weekday traffic volumes equaling or exceeding their design capacity will generally occur only during the morning and evening peak traffic hours, and, in some cases, during the midday. Milwaukee Avenue carries average weekday traffic equal to or over its design capacity, not only during the morning and evening peak traffic hours, but throughout the midday hours as well. During evening and early morning hours, there will generally be little, if any, traffic congestion and delay. Also, on most urban arterial streets, weekend traffic peaks will be less than weekday traffic peaks.

Generally, arterials carrying traffic volumes substantially exceeding design capacity will experience vehicle delays at signalized intersections of about 35 seconds during peak traffic periods, with delays to some vehicles of about 120 seconds. Vehicles may have to wait through more than one traffic signal red phase to clear the intersection, particularly left-turning vehicles. Also, between controlled intersections, arterials carrying traffic volumes greater than their design capacity may be expected to experience restrictions on operating speed and on the ability of vehicles to maneuver. Travel times on such arterials may typically increase by one-third over the average travel times on uncongested facilities.

Arterials carrying traffic volumes equaling or approaching design capacities may typically experience vehicle delays at signalized intersections during peak traffic periods of about 20 to 30 seconds, with delays to some vehicles approaching 90 seconds. The average travel times on such arterials will typically increase by up to one-third over the average travel times on uncongested facilities.

Arterials operating under design capacity will experience little vehicle back-up at signalized intersections, and no vehicles will have to wait through more than one red traffic signal phase. The average delay to each vehicle at signalized intersections will be 5 to 15 seconds.

Between Bridge Street and the Fox River Plaza, Milwaukee Avenue carries average weekday traffic volumes which substantially exceed roadway design capacity. Between Commerce-Pine Street and Bridge Street, Milwaukee Avenue carries traffic volumes approaching design capacity. Thus, the provision of additional traffic lanes on this study segment of Milwaukee Avenue is currently warranted.

The historic growth trends since 1970 in average weekday traffic volume on the segment of Milwaukee Avenue concerned and intersecting streets is shown in Table 1. The historic growth trend in traffic volume on Milwaukee Avenue (STH 36) varies along the length of the study segment. South of Bridge Street, average weekday traffic is estimated to have increased by only about

Table 1

AVERAGE WEEKDAY TRAFFIC VOLUME ON
MILWAUKEE AVENUE AND SELECTED INTERSECTING
STREETS IN THE CITY OF BURLINGTON: 1970-1988

Location	Year								Total Increase 1970-1988	Annual Growth Rate
	1970	1972	1975	1978	1981	1984	1987	1988		
Milwaukee Avenue										
South of Bridge Street.....	9,525	9,065	9,600	9,310	10,440	9,890	11,800	10,670	12.0	0.6
North of Grove Street.....	9,240	8,910	9,250	--	9,880	13,400	17,790	17,950	94.3	3.8
North of Corporate Limits...	7,945	8,790	8,530	--	--	9,080	--	11,520	45.0	2.1
Bridge Street										
South of Milwaukee Avenue...	2,985	3,800	5,450	5,880	6,690	8,060	9,230	9,510	218.6	6.6
Grove Street										
West of Milwaukee Avenue....	1,690	2,150	2,180	--	--	2,530	3,050	3,060	81.1	3.4

Source: Wisconsin Department of Transportation and SEWRPC.

12 percent since 1970, or less than one percent annually. North of Grove Street average weekday traffic volume on Milwaukee Avenue is estimated to have increased by nearly 95 percent since 1970, with most of that increase occurring since 1981. North of the city corporate limits, the average weekday volume on Milwaukee Avenue has increased relatively steadily, with an estimated total increase of 45 percent since 1970. Average weekday traffic volumes on Bridge Street south of Milwaukee Avenue and Grove Street west of Milwaukee Avenue exhibited increases from 1970 to 1988 of approximately 220 percent and 80 percent, respectively.

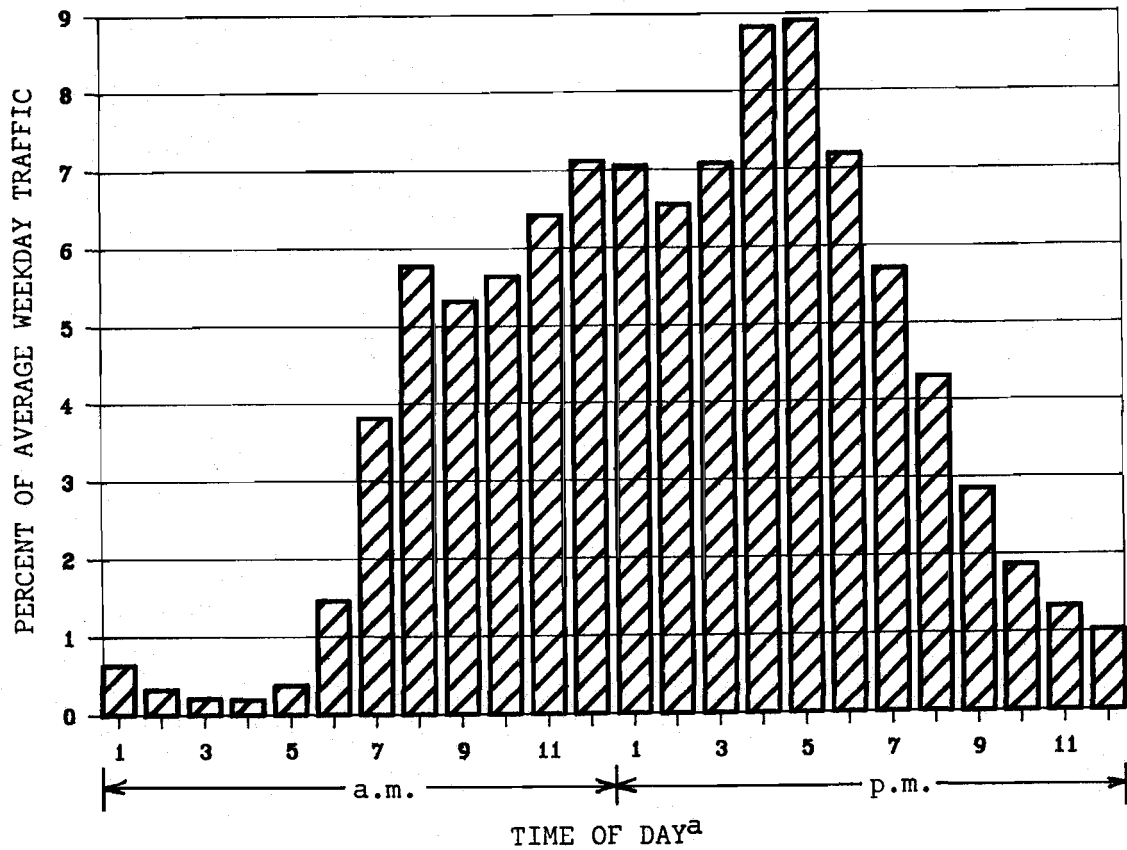
Figure 2 indicates the hourly distribution of average weekday traffic volume on Milwaukee Avenue between Grove Street and Commerce Street. Hourly traffic volumes in the early morning hours between 12:00 midnight and 5:00 a.m. are very low, representing less than 1 percent of average weekday traffic volume. After 5:00 a.m. hourly traffic volumes increase rapidly to an early morning peak of about 6 percent of average weekday traffic volume during 7:00 to 8:00 a.m.. Hourly traffic volumes then decline for the next few hours and then increase to a late morning-early afternoon peak of about 7 percent of the average weekday traffic volume during 11:00 a.m. to 12:00 noon. Hourly traffic again declines for the next few hours and then increases to an all day peak of 9 percent of the average weekday traffic volume during the hours 3:00 to 4:00 p.m. and 4:00 to 5:00 p.m.. Traffic volume then declines steadily each hour to the end of the day.

The pattern exhibited by the hourly distribution of traffic occurs as a result of work-related trips being made during the morning peak traffic hour of 7:00 to 8:00 a.m., shopping, social-recreation, and personal business trips being made during the midday; and a combination of these types of trips being made during the afternoon peak traffic hour of 4:00 to 5:00 p.m.. This pattern is typical of arterial facilities which serve retail activity. The evening peak traffic hour and period are of primary concern because this is when traffic volumes on the roadway are greatest.

The Regional Planning Commission conducted hourly turning movement traffic volume counts from 6:00 a.m. to 6:00 p.m. at the Milwaukee Avenue intersections with Bridge Street, Grove Street, Paul Street and the driveways to the Fox River Plaza. The 6:00 a.m. to 6:00 p.m. time period includes the previously identified morning and afternoon peak traffic hours and accounts for approximately 80 percent of the total average weekday traffic volume. These traffic count data were necessary to investigate intersection operating conditions and to evaluate the potential need for traffic signal devices at the major intersections with Milwaukee Avenue. Shown on Figure 3 are estimated 24-hour weekday turning movement volumes at each intersection along this stretch of Milwaukee Avenue, as estimated from the 6:00 a.m. to 6:00 p.m. count data. Heavy turning movements constituting more than 10 percent of the traffic on Milwaukee Avenue exist at its Bridge Street intersection, and at both Fox River Plaza driveways. The southbound traffic stream on Milwaukee Avenue at its intersection with Bridge Street has a heavy left-turn movement of about 4,170 vehicles per weekday, or about 45 percent of the total southbound traffic stream. This left turning traffic conflicts with the stream of 4,950 northbound vehicles per weekday on Milwaukee Avenue at this location. The principal traffic movement on northbound Bridge Street at its intersection with Milwaukee Avenue is the right turn movement onto Milwaukee Avenue of

Figure 2

HOURLY VARIATION IN WEEKDAY TRAFFIC VOLUME
ON MILWAUKEE AVENUE NORTH OF GROVE STREET: 1987

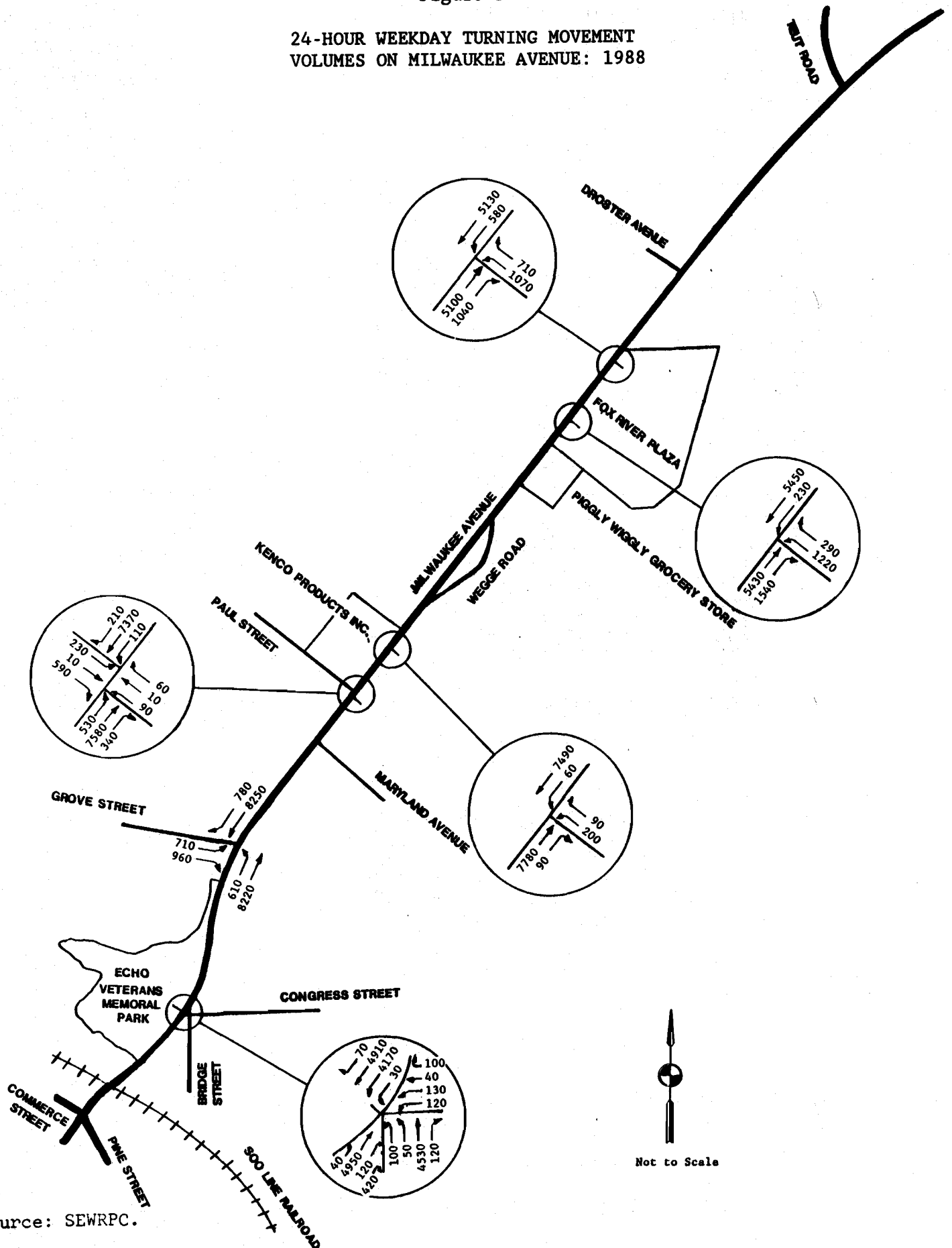


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Times shown are for hour ending.

Source: Wisconsin Department of Transportation.

Figure 3

24-HOUR WEEKDAY TURNING MOVEMENT
VOLUMES ON MILWAUKEE AVENUE: 1988



about 4,530 vehicles per weekday, which constitutes nearly 95 percent of the traffic stream. This traffic moves northbound on Milwaukee Avenue, merging with the 4,950 vehicles per weekday traveling northbound on Milwaukee Avenue across the Bridge Street intersection.

Heavy turning movements are also made to and from Milwaukee Avenue at both Fox River Plaza driveways. The principal turn movements at the southern Fox River Plaza driveway are the northbound Milwaukee Avenue right turns into Fox River Plaza and the westbound left turns out of Fox River Plaza, with 1,540 and 1,220 vehicles per average weekday, respectively. The northbound right turns into Fox River Plaza and the westbound left turns out of the Plaza at the northern Fox River Plaza driveway are also relatively high with 1,040 vehicles per average weekday making northbound right turns into the Plaza and 1,070 vehicles per average weekday making westbound left turns out of the Plaza. Morning peak hour (7:30 to 8:30 a.m.) and afternoon peak hour (3:30 to 4:30 p.m.) turning movements to and from Milwaukee Avenue are shown on Figures 4 and 5.

Capacity analyses of the Milwaukee Avenue intersections with Bridge Street, Grove Street, Paul Street, and the driveways to the Fox River Plaza were conducted to identify existing traffic congestion and delay problems. At the intersection of Milwaukee Avenue and Bridge Street, which is controlled by a stop sign on Bridge Street and Congress Street, the left-turn movements from Bridge Street and Congress Street to southbound Milwaukee Avenue exceed design capacity and approach maximum capacity during 12 hours of the day. These left-turn movements, however, represent less than 2 percent of the total number of vehicles entering the intersection on an average weekday. All other traffic movements at the intersection were operating within design capacity.

At the intersection of Milwaukee Avenue and Grove Street, the eastbound left turn movement, representing 4 percent of the total number of vehicles entering the intersection on an average weekday, exceeds design capacity during 11 hours of the day and exceeds maximum capacity during the afternoon peak traffic hour of 3:30 to 4:30 p.m.. This problem may be attributed to the heavy traffic on, and lack of gaps in, Milwaukee Avenue traffic.

At the intersection of Paul Street and Milwaukee Avenue, the eastbound left turn movement, representing 1 percent of the total number of vehicles entering the intersection on an average weekday, exceeds design capacity for 10 hours of the day. In addition several of the motorists in driveways on the southeast side of Milwaukee Avenue north of Paul Street, experience similar capacity problems and delay due to the lack of adequate gaps in traffic on Milwaukee Avenue.

At both driveways to the Fox River Plaza, the left-turn egress movement from both of the driveways exceeds design capacity for seven hours of the day, with the left turn movement at the southern driveway exceeding maximum capacity between 4:30 and 5:30 p.m..

Average Vehicle Operating Speeds

A traffic speed study on Milwaukee Avenue was conducted by the Regional Planning Commission on March 23 and 24, 1988. Most of the vehicles on Milwaukee Avenue and, particularly, in the vicinity of the Fox River Plaza entrances,

Figure 4

TURNING MOVEMENT VOLUMES DURING THE 7:30 A.M. TO
8:30 A.M. MORNING PEAK HOUR ON MILWAUKEE AVENUE: 1988

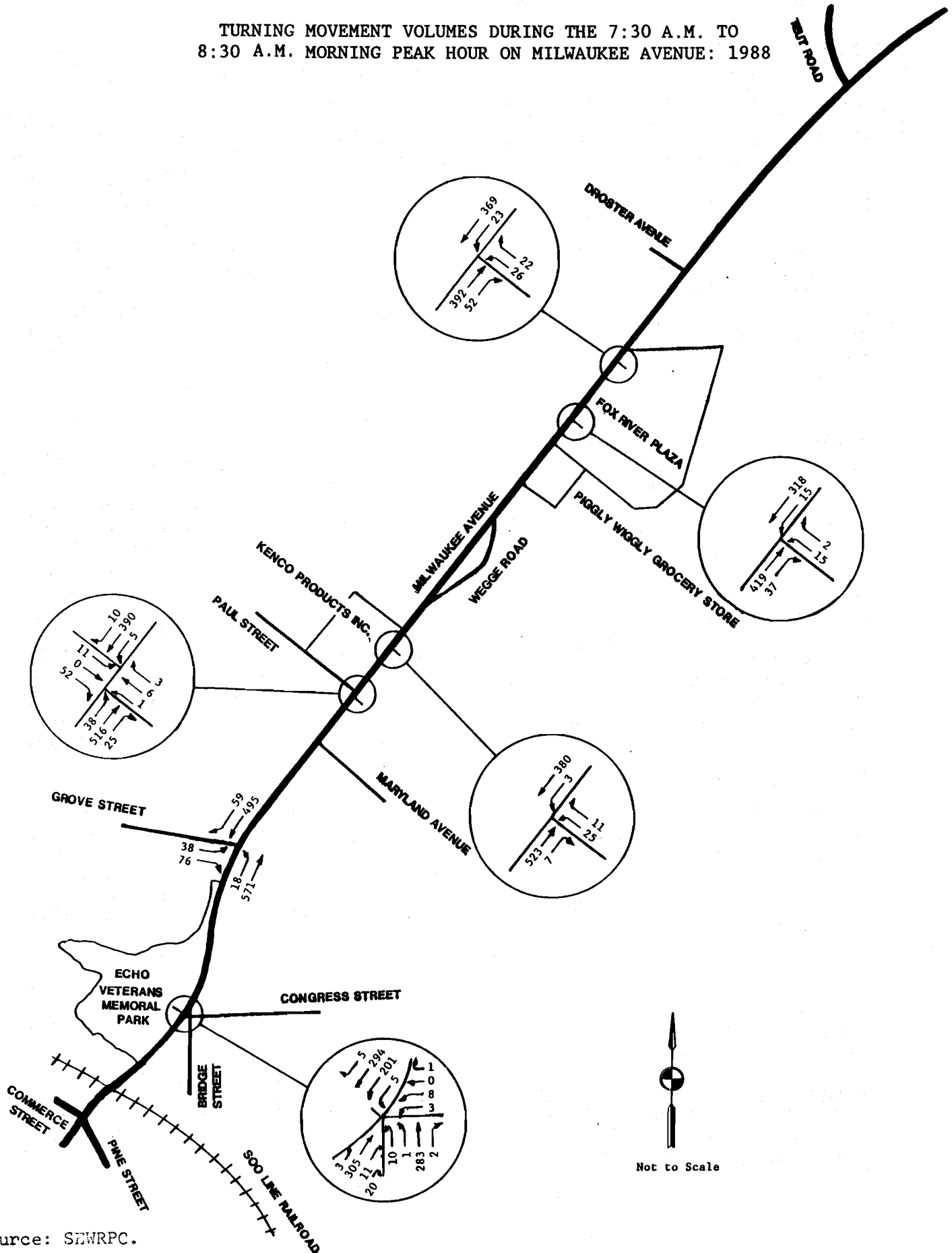
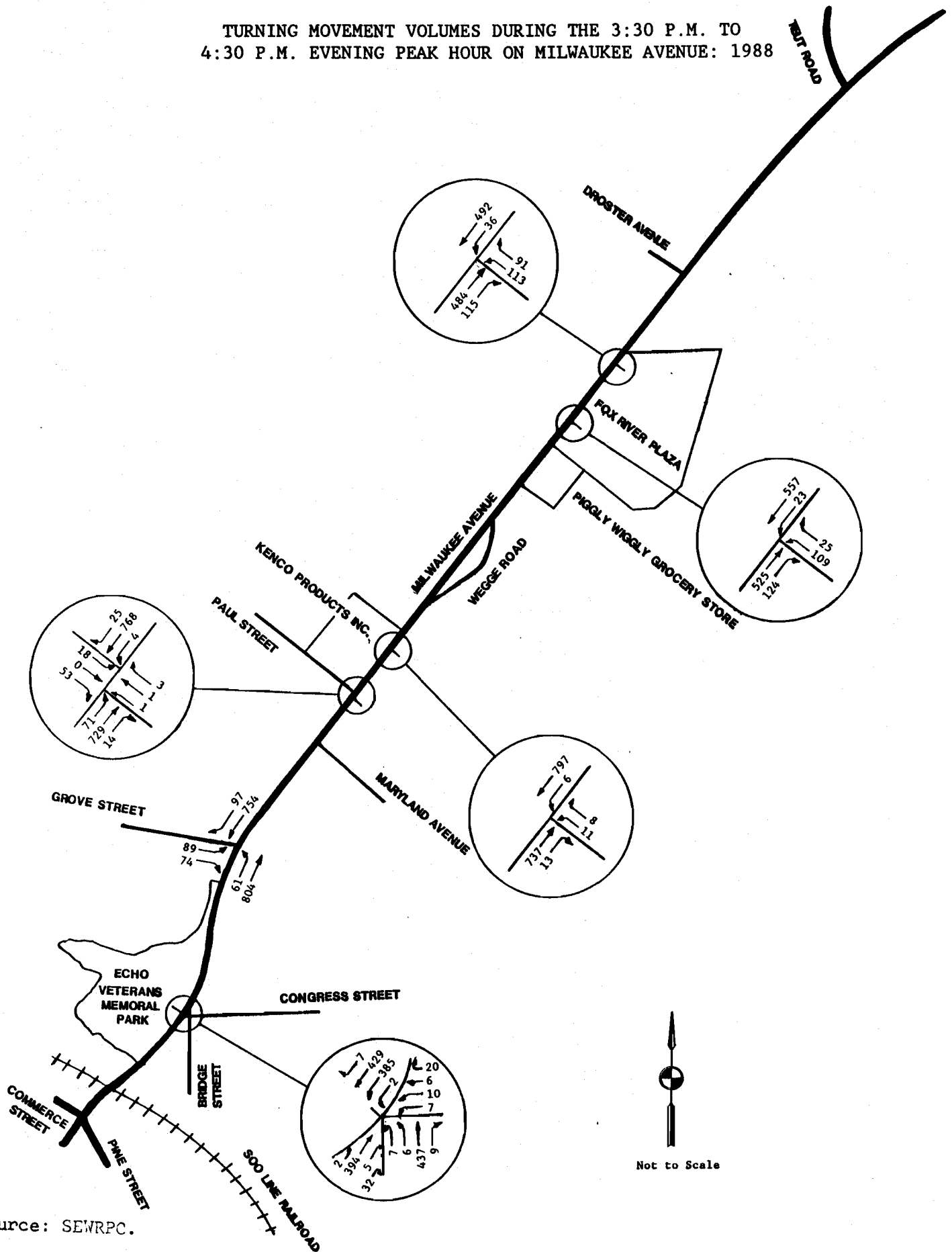


Figure 5

TURNING MOVEMENT VOLUMES DURING THE 3:30 P.M. TO
4:30 P.M. EVENING PEAK HOUR ON MILWAUKEE AVENUE: 1988



were found to be traveling below the posted 35 mph speed limit north of Paul Street. The average travel speed on Milwaukee Avenue in the vicinity of the Fox River Plaza was 31 miles per hour (mph), and the average travel speed on Milwaukee Avenue immediately north of Paul Street was 27 mph. The 85th percentile speed--the speed at which 85 percent of traffic is travelling at or below--was measured to be 35 miles per hour and 29 miles per hour on Milwaukee Avenue in the vicinity of the Fox River Plaza entrances and north of Paul Street, respectively. The "10 mph pace"--that is, the 10 mph increment of speed range including the largest number of vehicles--was found to be 27 miles per hour to 36 miles per hour with 75 percent of the traffic in the vicinity of the Fox River Plaza entrances; and to be 22 miles per hour to 31 miles per hour with 91 percent of the traffic north of Paul Street.

Traffic Accidents

The incidence and location of traffic accidents provides another important measure of the efficiency and operating characteristics of an arterial facility such as Milwaukee Avenue. The motor vehicle accident history for the study segment of Milwaukee Avenue is shown on Table 2 and Figures 6, 7, and 8. A total of 21 accidents occurred on the study segment in 1985, 17 accidents occurred in 1986, and 28 accidents occurred in 1987.

As shown on Figure 6 and on Table 2, of the 21 accidents reported on Milwaukee Avenue in 1985, one occurred at the intersection with Commerce Street, four occurred at the intersection with Bridge Street; three occurred at the intersection with Grove Street; and the remaining 13 accidents were reported as midblock accidents. Of the 17 accidents reported in 1986, two occurred at the intersection with Bridge Street; and the remaining 15 accidents were reported as midblock accidents. Of the 28 accidents reported in 1987, two occurred at the intersection with Commerce Street; four occurred at the intersection with Bridge Street; one occurred at the intersection with Paul Street; and the remaining 21 accidents were reported as midblock accidents. The highest incidence of accidents were midblock accidents between the north end of Wegge Road and Teut Road, in the vicinity of Fox River Plaza. Twenty-one accidents were reported between the north end of Wegge Road and Teut Road over the three year period.

Another measure used to identify accident problem locations is the accident rate at intersections. This rate considers not only the frequency of accidents, but also the volume of traffic entering an intersection. The highest annual intersection accident rate on the study segment of Milwaukee Avenue occurred in 1985 at the Bridge Street intersection, 0.70 accident per million vehicles entering the intersection. The next highest intersection accident rate occurred in 1985 at the Grove Street intersection, with 0.61 accidents per million vehicles entering the intersection.

The locations along the segment of Milwaukee Avenue concerned which may be considered problem locations are those where the incidence of accidents is high, as well as those which have exhibited substantial increases in accidents from year to year. The principal accident problem locations identified in the study were the midblock stretch of Milwaukee Avenue between the north end of Wegge Road and Droster Avenue, with a total of 21 accidents reported over the three-year study period; the midblock stretch of Milwaukee Avenue between Paul Street and the south end of Wegge Road, with a total of 12 accidents reported

Table 2

INCIDENCE AND SEVERITY OF MOTOR VEHICLE ACCIDENTS ON THE STUDY SEGMENT
OF MILWAUKEE AVENUE BETWEEN COMMERCE STREET AND TEUT ROAD: 1985-1987

Intersection	1985			1986			1987			Total		
	Injury	Property Damage	Total	Injury	Property Damage	Total	Injury	Property Damage	Total	Injury	Property Damage	Total
Milwaukee Avenue and: Commerce Street/ Pine Street.....	--	1	1	--	--	--	--	2	2	--	3	3
Between Commerce Street and Bridge Street.....	1	--	1	--	1	1	1	1	2	2	2	4
Bridge Street/ Congress Street.....	1	3	4	1	1	2	1	3	4	3	7	10
Between Bridge Street and Grove Street.....	--	2	2	--	--	--	2	2	4	2	4	6
Grove Street.....	--	3	3	--	--	--	--	--	--	--	3	3
Between Grove Street and Paul Street.....	--	2	2	--	1	1	2	2	4	2	5	7
Paul Street.....	--	--	--	--	--	--	1	--	1	1	--	1
Between Paul Street and Wegge Road.....	2	2	4	3	3	6	--	1	1	5	6	11
Between Wegge Road and Teut Road.....	1	3	4	2	5	7	5	5	10	8	13	21
Total	5	16	21	6	11	17	12	16	28	23	43	66

Source: Wisconsin Department of Transportation and SEWRPC.

Figure 6

LOCATION OF ON-STREET MOTOR VEHICLE ACCIDENTS
REPORTED ON THE STUDY SEGMENT OF MILWAUKEE AVENUE: 1985

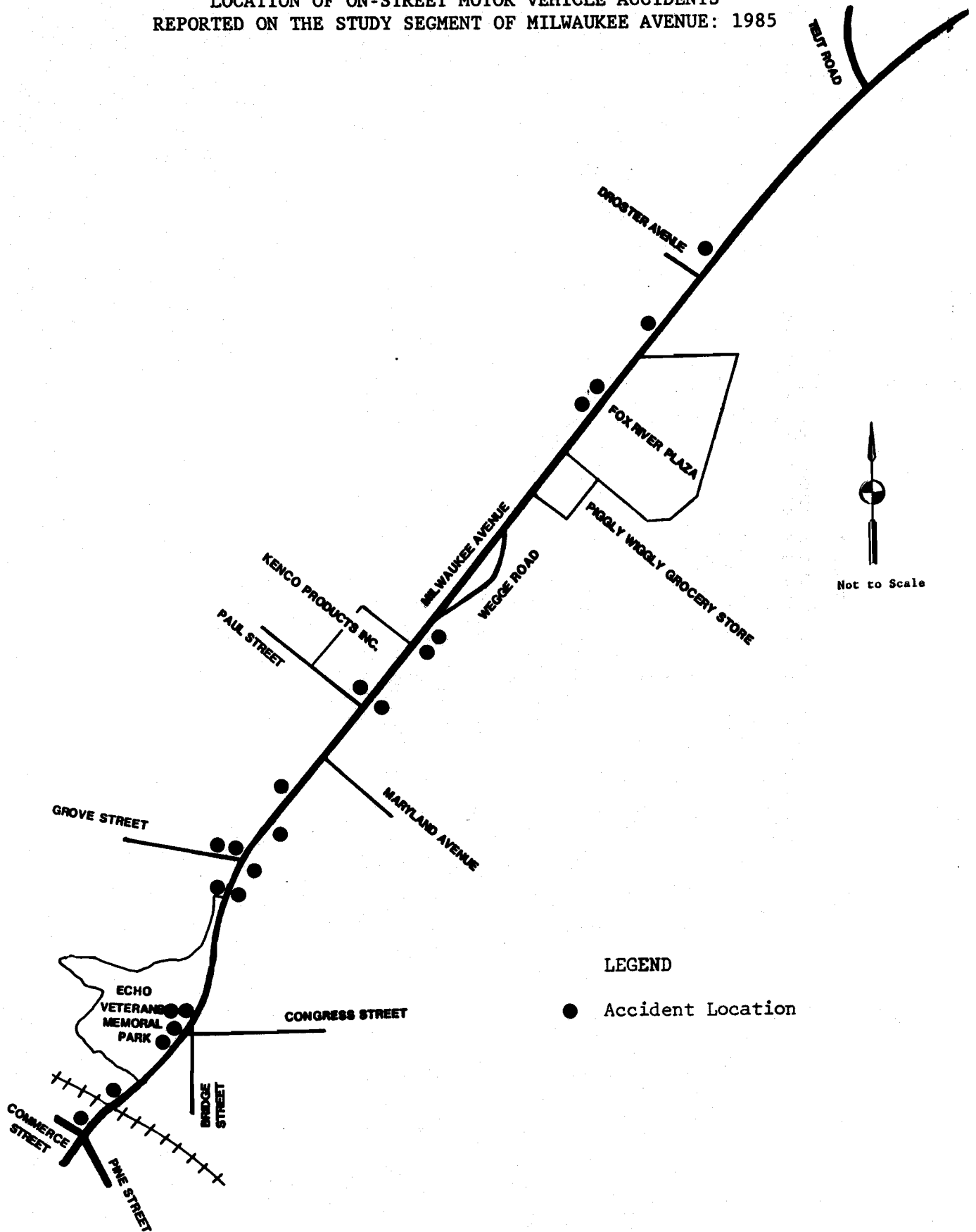


Figure 7

LOCATION OF ON-STREET MOTOR VEHICLE ACCIDENTS
REPORTED ON THE STUDY SEGMENT OF MILWAUKEE AVENUE: 1986

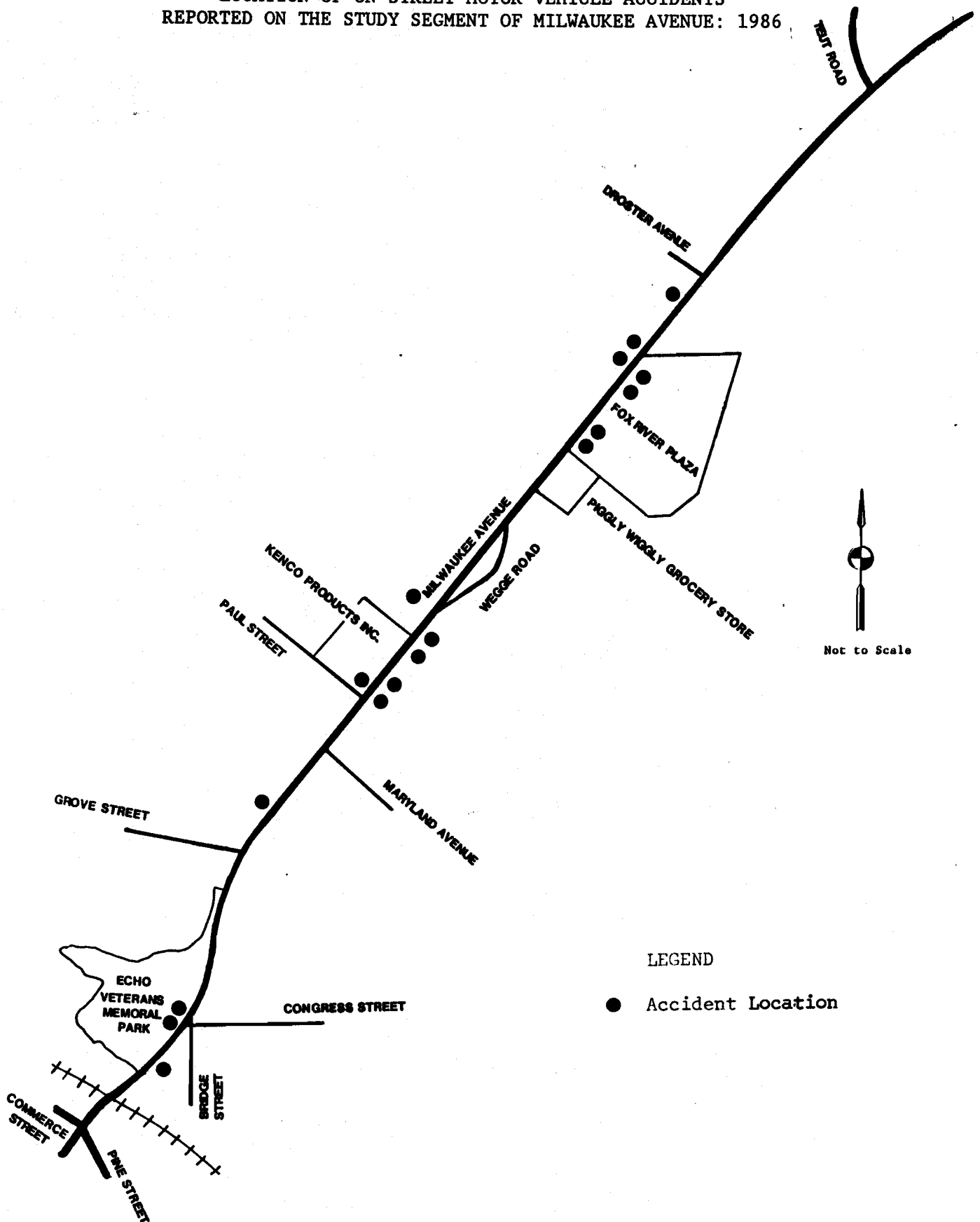
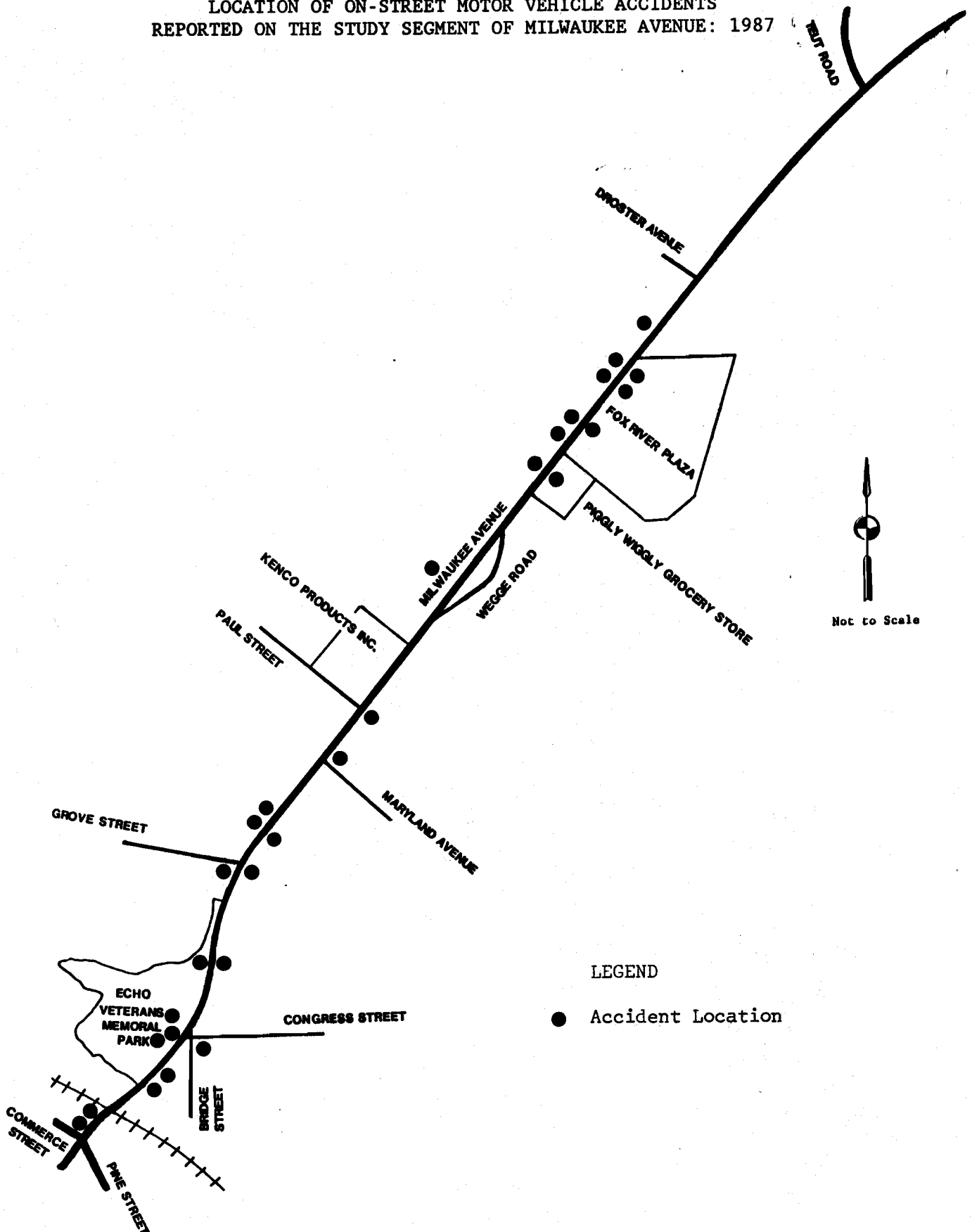


Figure 8

LOCATION OF ON-STREET MOTOR VEHICLE ACCIDENTS
REPORTED ON THE STUDY SEGMENT OF MILWAUKEE AVENUE: 1987



over the three-year study period; and the intersection of Bridge Street and Milwaukee Avenue, with a total of 10 accidents reported over the three-year period.

POTENTIAL INCREASES IN TRAFFIC FROM PROPOSED DEVELOPMENTS

The Commission was requested to specifically consider as a part of this study the estimated traffic impact of three proposed developments, the Bear Meadows subdivision, a proposed shopping mall and convenience store, and a proposed motel-convention center. The Bear Meadows subdivision, as approved by the City Plan Commission would include 67 single-family homes and nine four-unit condominiums. Regional Planning Commission studies indicate that a typical single-family residence generates approximately 10 vehicle trips to and from the residence on an average weekday, including vehicle trips by visitors and by service and delivery personnel, as well as by residents, while each condominium dwelling unit generates approximately six vehicle trips to and from the condominium building. Application of these trip generation rates indicates that the proposed development may be expected to generate approximately 900 vehicle trips on an average weekday. During the morning peak traffic hour, the Bear Meadows subdivision may be expected to generate about 20 vehicle trips to the subdivision and 50 vehicle trips out from the subdivision. During the afternoon peak traffic hour the planned subdivision may be expected to generate about 60 vehicle trips in to the subdivision and 30 trips out of the subdivision. Based upon an estimate that all of the vehicle trips generated by the planned subdivision would travel to and from Milwaukee Avenue via Paul Street, average weekday traffic volumes on Paul Street at the intersection with Milwaukee Avenue would increase from 1,600 vehicles per average weekday currently to about 2,500 vehicles per average weekday, or a 50 percent increase. Average weekday traffic volumes on Milwaukee Avenue south of Paul Street, may be expected to increase from between 10,700 and 18,800 vehicles per average weekday to between 11,000 and 19,400 vehicles per average weekday. Average weekday traffic volumes on Milwaukee Avenue north of Paul Street may be expected to increase from about 15,700 vehicles per average weekday to approximately 16,000 vehicles per average weekday.

A shopping mall and convenience store-car wash is presently being proposed adjacent to the existing Firestone Store at 2720 Milwaukee Avenue. The proposed development would have about 25,000 square feet of retail uses, 2,500 square feet of convenience store with gas pumps and a car wash, and the existing 5,850 square feet of the Firestone Store. Regional Planning Commission studies indicate that a typical 24-hour convenience store with gas pumps generates approximately 900 vehicle trips per 1,000 feet of gross floor area per average weekday. A shopping mall may be expected to generate approximately 40 vehicle trips per 1,000 square feet of gross floor area per average weekday. Application of these vehicle trip generation rates indicates that the proposed development may be expected to generate approximately 3,400 vehicle trips on an average weekday. It should be noted that not all trips generated by convenience stores and shopping malls are new trips. Rather, some trips may be expected to be attracted to the site from that traffic passing by on Milwaukee Avenue for another purpose. An example of these trips would be a trip beginning at home and having a primary destination of work, with the motorist stopping for fuel. It is estimated that 25 percent and 45 percent of the vehicle trips generated per average weekday by the shopping mall and

convenience store, respectively, will be from the pass-by traffic. Thus, of the 3,400 total vehicle trips expected to be generated per average weekday by this development, 1,280 vehicle trips per average weekday may be expected to come from traffic already on Milwaukee Avenue, and 2,120 vehicle trips per average weekday may be expected to be new trips; and, therefore, represents additional traffic on Milwaukee Avenue. Average weekday traffic on Milwaukee Avenue south of the development is estimated to increase from between 11,000 and 19,400 vehicles per average weekday--including existing traffic and estimated traffic from Bear Meadows subdivision--to between 11,740 and 20,880 vehicles per average weekday.

An approximately 12-acre parcel of land located south of the Fox River Plaza, east of Milwaukee Avenue, and north of the city landfill has been proposed for the development of a motel-convention center with an estimated 360 rooms. This proposed motel-convention center may be expected to generate about 2,170 vehicle trips per average weekday. Based on the assumption that the main entrance to the motel-convention center would be located on Milwaukee Avenue with additional entrance provided to the south via Maryland Avenue, average weekday traffic on Milwaukee Avenue south of the motel-convention center may be expected to increase from between 11,740 and 20,880 vehicles per average weekday (including existing traffic and estimated traffic from the Bear Meadows subdivision and the proposed shopping development and convenience store) to between 12,500 and 22,400 vehicles per average weekday.

ANALYSIS AND RECOMMENDATIONS

A short-range plan of recommended traffic engineering improvements to abate existing traffic congestion and safety problems is presented in this section of the memorandum. For each identified problem, a number of alternative traffic control measures was considered.

Milwaukee Avenue From Commerce-Pine Street to Southern Terminus of Wegge Road
The identified problems along this segment of Milwaukee Avenue, which is constructed to an urban cross-section with a pavement width of 48 feet curb-to-curb, consist of traffic congestion and accidents. The problems are a result of traffic being generally limited to one lane in each direction as on-street curb parking is generally permitted. Left-turning vehicles at times block all traffic movement in one direction. The need exists for additional traffic carrying capacity on this entire roadway segment, but particularly between Bridge Street and the southern terminus of Wegge Road, as existing traffic volumes of 18,000 to 18,800 vehicles per average weekday substantially exceed the design capacity of 13,000 vehicles per average weekday for a two-traffic-lane arterial roadway. Between Bridge Street and Commerce-Pine Street, existing traffic volumes of 10,700 vehicles per average weekday are approaching the design capacity of the existing two-traffic-lane roadway. As noted earlier, the proposed Bear Meadows subdivision may be expected to increase traffic volume on Milwaukee Avenue between Commerce-Pine Street and the southern terminus of Wegge Road by 300 to 600 vehicles per average weekday, the proposed shopping mall and convenience store-car wash may be expected to increase such traffic by another 740 to 1,480 vehicles per average weekday; and the proposed motel-convention center may be expected to increase such traffic by another 760 to 1,520 vehicles per average weekday.

It is recommended that, to alleviate the traffic congestion and accident problems on this arterial segment, on-street parking be prohibited. The estimated cost to the City of Burlington to install "No Parking" signs and to install pavement marking which will delineate four traffic lanes is approximately \$3,900. The advantage of parking prohibition is the resultant increase in roadway capacity from two traffic lanes to four traffic lanes, which may be expected to alleviate traffic congestion and, as well, reduce traffic accidents. In addition, traffic accidents may be expected to be decreased as the conflicts between through vehicle traffic and parked vehicles would be eliminated and sight distance would be improved at Milwaukee Avenue intersections. The disadvantage of the recommended parking prohibition is the attendant loss of on-street parking for businesses located along this segment of Milwaukee Avenue. A total of 178 parking spaces would be eliminated. Alternative off-street parking would, however, generally be available. If implementation of the recommended parking prohibition is found to be not feasible, an option would be to permit parking, as shown in Figure 9, at the existing 20 spaces between Pine Street and 250 feet south of Bridge Street, as this stretch of roadway carries traffic volumes approaching, but not exceeding, design capacity; and to permit parking at selected midblock spaces between Bridge Street and the southern terminus of Wegge Road on weekends, and on weekdays from 6:00 p.m. to 6:00 a.m..

Milwaukee Avenue and Bridge Street-Congress Street Intersection

The identified problems at this intersection consist of traffic congestion and accidents, with problems of excessive delay for the northbound left-turn and right-turn movements on Bridge Street and, as well, southbound Milwaukee Avenue traffic. The accident-related problems at this intersection consist of a total of 10 accidents reported in the calendar years 1985 through 1987, of which five accidents involved southbound left-turning vehicles. The traffic engineering actions recommended to abate the identified traffic problems include the installation of actuated traffic signals; the installation of pavement markings at the intersection to provide an exclusive southbound left-turn lane; and the prohibition of left turns from driveways within 100 feet of the intersection.

To alleviate the accident problems and improve traffic operating conditions at the intersection of Milwaukee Avenue and Bridge Street, the installation of traffic-actuated signals is recommended, at an estimated capital cost to the City of Burlington of \$60,000 and an annual operation and maintenance cost of \$2,000. The existing traffic volumes at the intersection meet the warrants for the installation of traffic signals as set forth in the Manual on Uniform Traffic Control Devices.¹ These warrants are based upon accepted engineering standards related to traffic volume, accidents, delay, and pedestrian activity. The advantage of traffic signal installation is that it may be expected to allow the northbound left-turn and right-turn movements on Bridge Street, and all other movements at the intersection, to operate at or under design

¹U. S. Department of Transportation, Federal Highway Administration, "Warrants for the Installation of Traffic Signals and Stop and Yield Signs," Manual on Uniform Traffic Control Devices, 1978.

PARKING PROHIBITIONS ON STUDY SEGMENT OF MILWAUKEE AVENUE:
EXISTING AND OPTION TO RECOMMENDED PLAN ^a



^aRecommended plan would prohibit parking at all times between Commerce-Pine Street and southern terminus of Wegge Road.

capacity with existing traffic volumes as well as with the added traffic volumes from the Bear Meadows subdivision, the proposed shopping mall and convenience store, and the proposed motel-convention center. The disadvantages include a possible increase in rear-end accidents on the highway and the creation of queues that block nearby driveways. Another disadvantage associated with this alternative is that traffic on Milwaukee Avenue which now generally experiences no delay at the intersection may be expected to experience delays of about six seconds per vehicle upon traffic signal installation, assuming traffic signal progression would be provided with the traffic signals to be recommended to be installed along Milwaukee Avenue.

It is also recommended, as shown in Figure 10, that pavement markings and signing at the intersection of Milwaukee Avenue and Bridge Street be installed to provide a southbound exclusive left-turn lane and a southbound through lane, at an estimated cost to the City of Burlington of \$3,600. The recommended pavement markings should serve to reduce vehicle conflicts and accidents.

With the installation of traffic signals, it is also recommended that left turns be prohibited at the one driveway located within 100 feet of the intersection: a Clark Oil Service Station driveway. The estimated cost to the City of Burlington of this action is \$100 for sign installation. It should be noted that the turn prohibitions will improve the safety and efficiency of the signalized intersection, and alternative driveways to Bridge Street and Milwaukee Avenue exist for service station traffic seeking to travel southbound on Milwaukee Avenue.

Milwaukee Avenue and Grove Street Intersection: The identified problem at this intersection consists of traffic congestion with excessive delays for Grove Street eastbound to northbound left-turning traffic. To abate this traffic congestion, it is recommended, as shown on Figure 11, that traffic signals be installed and that pavement markings be provided at the intersection to provide two southbound traffic lanes and a northbound combined left-turn and through traffic lane and an additional northbound through lane.

The provision of new pavement markings at the intersection to provide one northbound shared left-turn and through lane and one northbound through lane and two southbound through lanes is recommended, at an estimated cost to the City of Burlington of \$2,500. Currently, the traffic lanes marked at the intersection in the northbound direction include an exclusive left-turn lane and a through lane; and in the southbound direction, a through lane. The existing exclusive left-turn lane requires all northbound through vehicles to shift to the outside lane and then back to the inner lane. Traffic volume counts conducted by Commission staff in 1988 revealed a maximum of 65 northbound vehicles per hour turning left at this intersection, which is substantially fewer than the 100 vehicles per hour warrant for providing an exclusive left-turn lane, rather than a shared left-turn and through lane. Consequently, installing the new pavement marking may be expected to increase the capacity of the intersection.

The installation of semi-actuated traffic signals, at an estimated capital cost to the City of Burlington of \$55,000 and an annual operation and maintenance cost of \$2,000, is also recommended. The advantage of this alternative

Figure 10

ALTERNATIVE ROADWAY IMPROVEMENT FOR THE INTERSECTION
OF MILWAUKEE AVENUE AND BRIDGE STREET-CONGRESS STREET

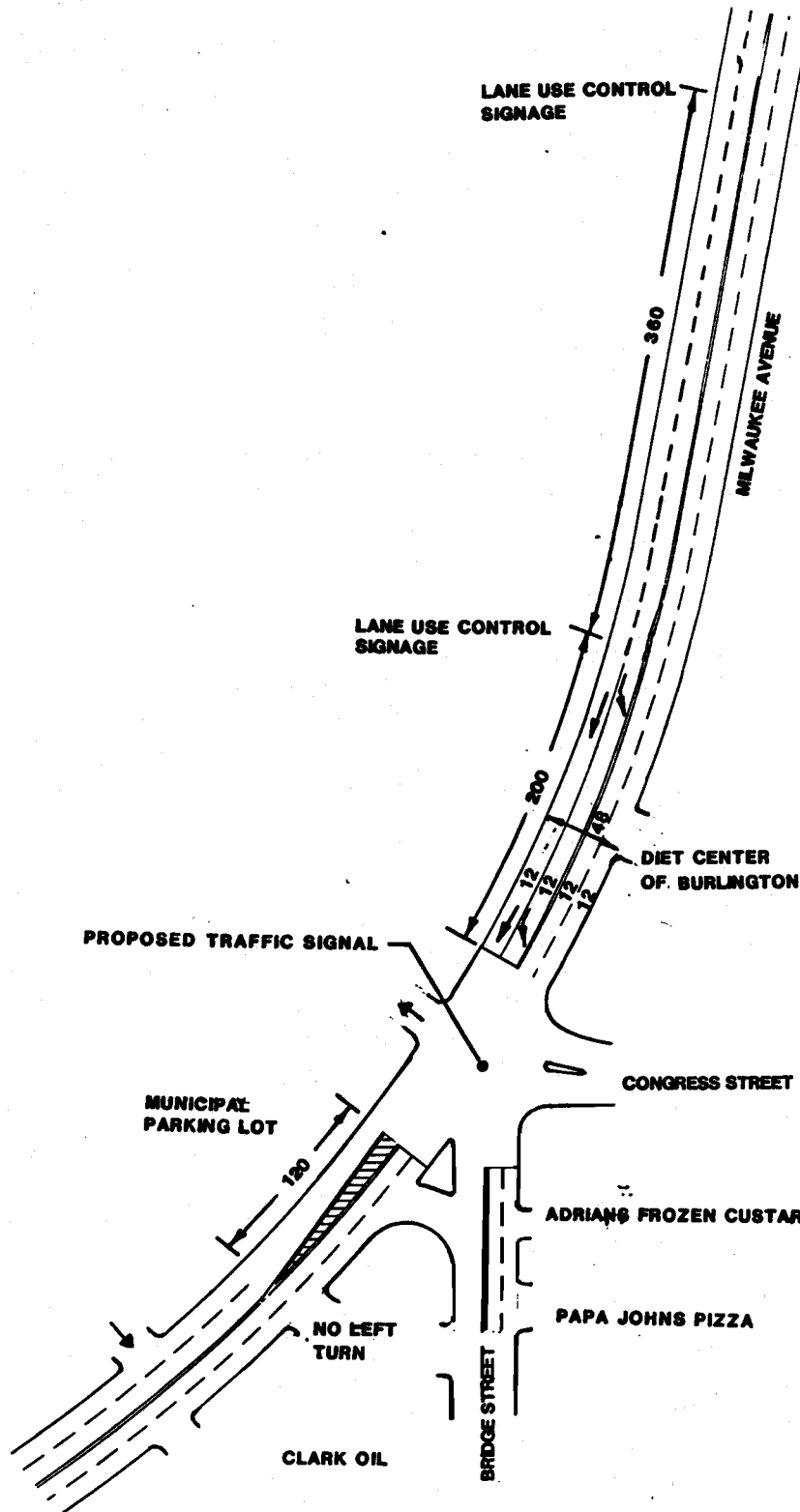
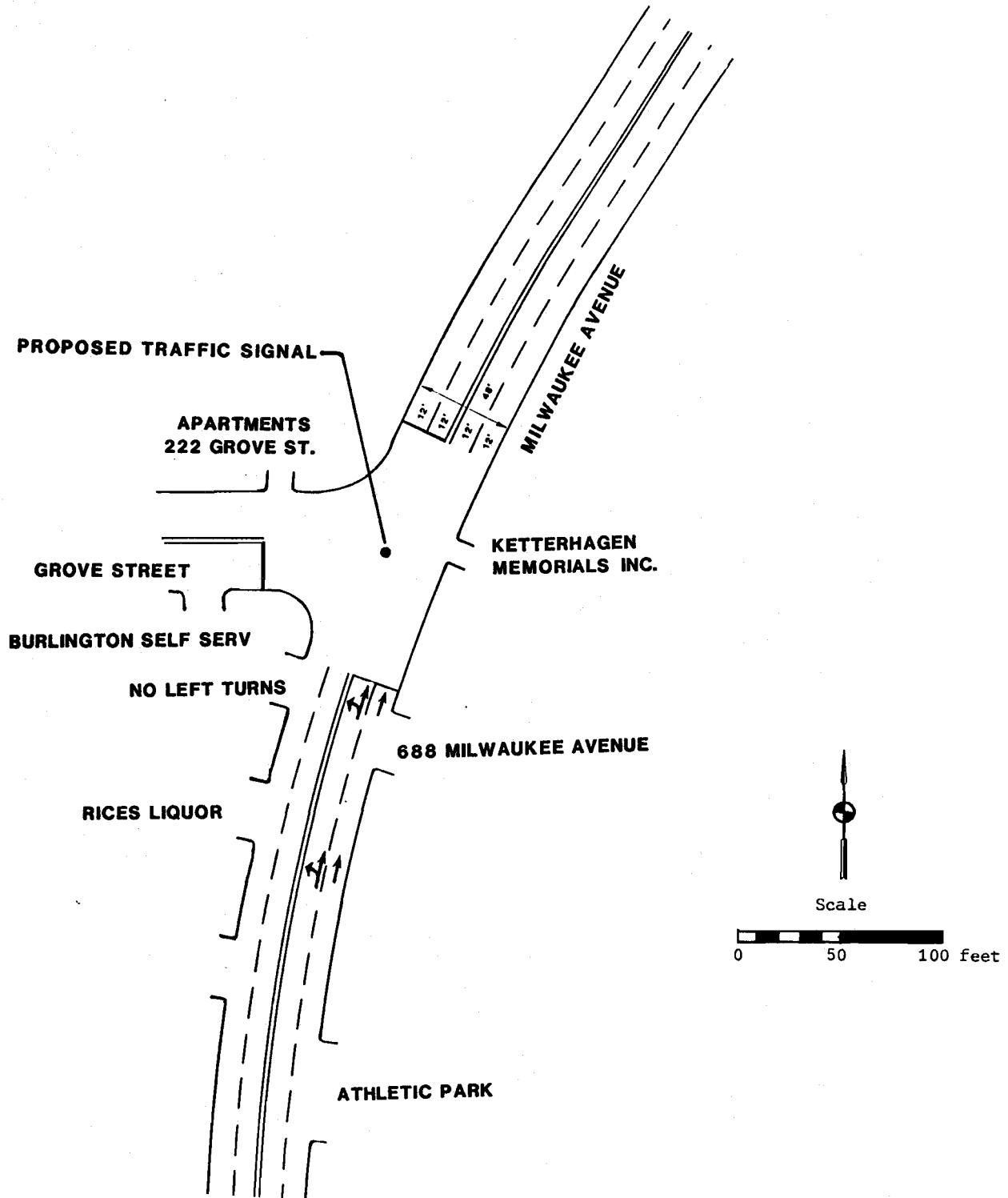


Figure 11

ALTERNATIVE ROADWAY IMPROVEMENT FOR THE
INTERSECTION OF MILWAUKEE AVENUE AND GROVE STREET



is that it should allow the eastbound left-turn movement on Grove Street to operate at or under design capacity, along with all other traffic movements at the intersection. The existing traffic volumes at the intersection meet the warrants for the installation of traffic signals. A potential disadvantage of the recommended traffic signals is a potential increase in rear-end accidents and the creation of queues that block nearby driveways. Another disadvantage is that Milwaukee Avenue traffic, which currently experiences generally no delay at the intersection, may be expected to experience delays of about three seconds per vehicle with the traffic signals, assuming progression is provided with the other traffic signals recommended to be installed along Milwaukee Avenue.

In addition, with the installation of the pavement markings and traffic signals, it is recommended that left turns be prohibited at the Burlington Self Serv service station driveway located within 100 feet of the intersection. The estimated cost to the City of Burlington of this action is \$100, and the turn prohibitions may be expected to improve the efficiency and operation of the intersection. Alternative driveways for such left-turning traffic exist for the Burlington Self Serv service station. Two other driveways are located within 100 feet of the intersection: one at Ketterhagen Memorials, Inc., and the other at 688 Milwaukee Avenue. Alternative driveways do not exist for left-turning traffic from these businesses; consequently, left-turn prohibitions are not recommended.

Milwaukee Avenue and Paul Street Intersection: The identified problems at this intersection include traffic congestion and excessive delay on Paul Street for eastbound-to-northbound left-turning traffic, and the related exacerbated congestion and accident problems that may be expected with the development of the Bear Meadows subdivision. It may be expected that both the number and duration of gaps in traffic on Milwaukee Avenue will increase as a result of the recommended signal installation at the intersection of Milwaukee Avenue and Grove Street, thus reducing the delay experienced by motorists on Paul Street. One traffic management action considered to alleviate these problems was the installation of traffic signals. However, neither existing traffic volumes nor the recent accident history at the intersection warrant the installation of traffic signals at this time.

Traffic volumes are expected to increase at the intersection as the Bear Meadows subdivision develops. It is, therefore, recommended that the need for traffic signals at this intersection be reviewed on a periodic basis to monitor changes in traffic volumes, traffic delays, and the accident history at the intersection. It may be noted that the Commission staff would estimate that, upon the development of about 10 percent of the Bear Meadows subdivision, traffic signals may be expected to be warranted based upon traffic volumes. Should it be determined that signals are needed in the future, it is recommended that semi-actuated traffic signals be installed, at an estimated capital cost of \$55,000, and an estimated \$2,000 annually for maintenance; and that the signals would be interconnected with adjacent signals to provide progression on Milwaukee Avenue. The advantage of signal installation is that the eastbound-to-northbound left-turn movement on Paul Street would operate at or under design capacity, along with all other traffic movements at the intersection. The disadvantages include a potential increase in rear-end accidents and creation of queues that block nearby driveways. Another disadvantage is

an estimated average delay of about one second per vehicle to Milwaukee Avenue traffic which currently experiences no delay at the intersection, assuming progression would be provided at the other traffic signals recommended to be installed along Milwaukee Avenue.

If traffic signals are installed in the future at this intersection, it is recommended that the north driveway to the White Fox Den Restaurant be converted to two-way operation and be relocated to be aligned opposite Paul Street to constitute the eastern approach of the intersection, as shown in Figure 12, at an estimated cost to the City of Burlington of \$3,500. The advantage of this alternative is a reduction in the number of possible conflict points. The disadvantages include the removal of five parking spaces in the White Fox Den parking lot.

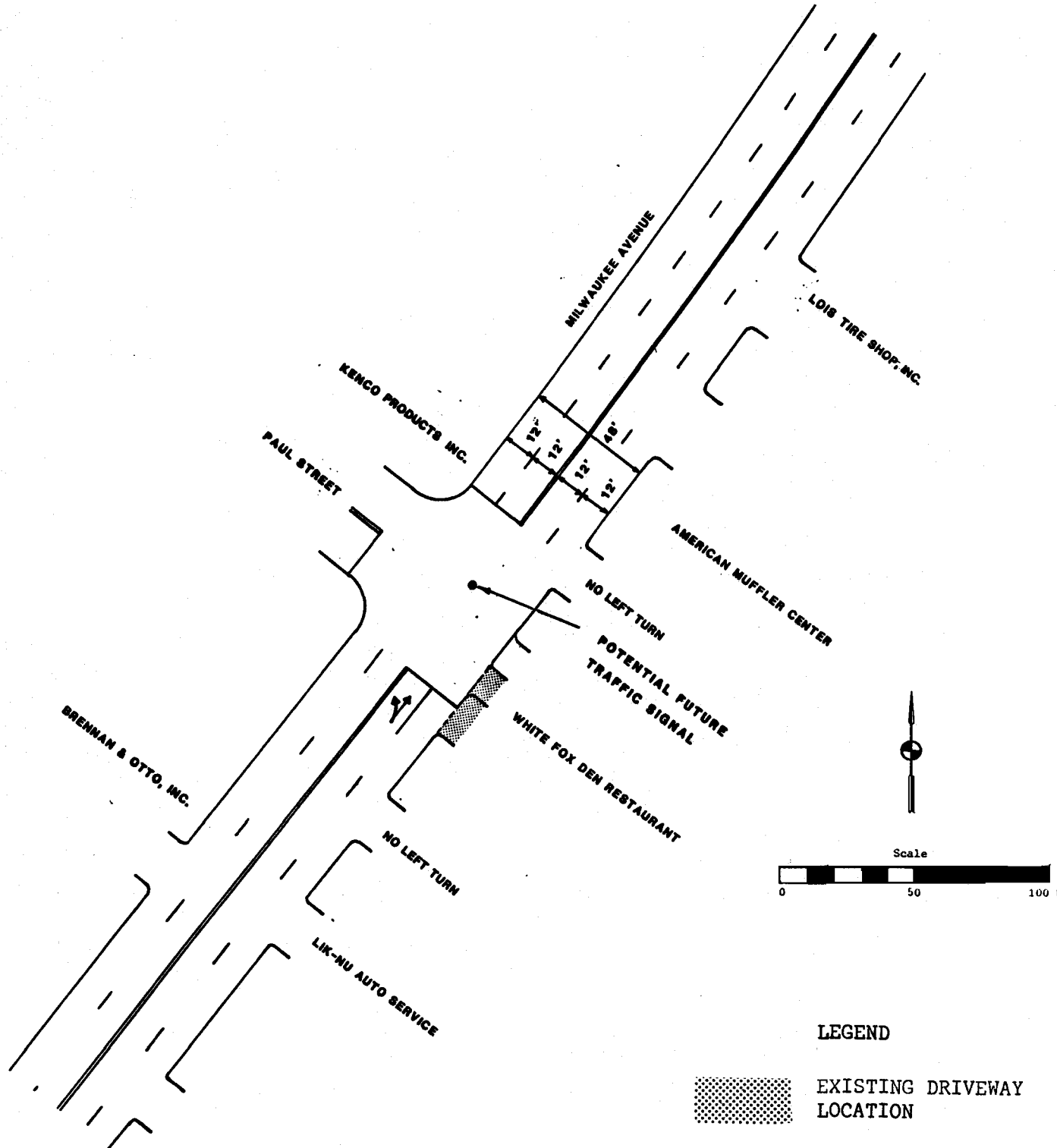
In addition, if traffic signals are installed in the future at this intersection, it is recommended that left turns be prohibited at the two driveways located within 100 feet of the intersection, the White Fox Den southern driveway, and the American Muffler Center southern driveway. The estimated cost to the City of Burlington of this action is \$200 for sign installation. It should be noted that the turn prohibitions will improve the safety and efficiency of the signalized intersection, and alternative driveways to Milwaukee Avenue exist for the traffic seeking to travel southbound on Milwaukee Avenue.

Commercial Access Between the Northern End of Wegge Road and Droster Avenue: The identified problems along this segment of Milwaukee Avenue are traffic congestion and, particularly, traffic accidents, with a total of 21 accidents reported in calendar years 1985 through 1987, of which 14 involved vehicles turning left into the commercial driveways on Milwaukee Avenue. The number of accidents has been increasing each year, with four in 1985, seven in 1986, and 10 in 1987. The Fox River Plaza driveways to Milwaukee Avenue are particularly experiencing traffic congestion. The traffic engineering actions recommended to alleviate these problems include converting the two existing Fox River Plaza two-way driveways to a pair of one-way driveways, installing pavement markings to provide exclusive left-turn lanes into the Fox River Plaza; installing signing and visual cues in advance of the driveways; and installing a semi-actuated traffic signal at the southern Fox River Plaza driveway. The Wisconsin Department of Transportation may not be expected to fund any of these recommendations, even though it has sole responsibility for this segment of STH 36, because of Department policy against funding improvements at private driveways if the improvement is necessary to address a condition created by the abutting development.

It is recommended that the existing two-way driveways at the Fox River Plaza be converted to one way driveways. The southern driveway would become one-way outbound and the northern driveway would become one-way inbound. The cost to the City of Burlington of the construction of a traffic island at both driveways to guide vehicles and discourage motorists from entering or exiting from the wrong driveway is estimated at about \$5,800. The advantage of this alternative is a reduction in the number of possible conflict points at each driveway. The disadvantage of this alternative is that some motorists may use the wrong driveway for entering or exiting the Fox River Plaza.

Figure 12

ALTERNATIVE ROADWAY IMPROVEMENT FOR THE
INTERSECTION OF PAUL STREET AND MILWAUKEE AVENUE



The second action recommended to abate the problems on this segment involves providing an exclusive left-turn lane into the Fox River Plaza. As shown in Figure 13, the left-turn lane would be provided for southbound left-turning vehicles at the northern Fox River Plaza access point. Presently, vehicles must go around left-turning vehicles by using the paved shoulder. The pavement markings would be repainted to provide a northbound and a southbound through lane and an exclusive left-turn lane. The cost to the City of Burlington of the painting of the lanes would be about \$3,400. The advantages of this alternative are an anticipated reduction in the number of accidents by shadowing the left-turning vehicles from the through traffic.

The third action recommended to abate the problems on this segment involves the installation of visual cues, including flashing beacons and warning signs, to alert approaching motorists to the Fox River Plaza driveways, at an estimated cost to the City of Burlington of \$1,200. The advantages of this action are a reduction in accident frequency and severity, particularly with respect to rear end conflicts.

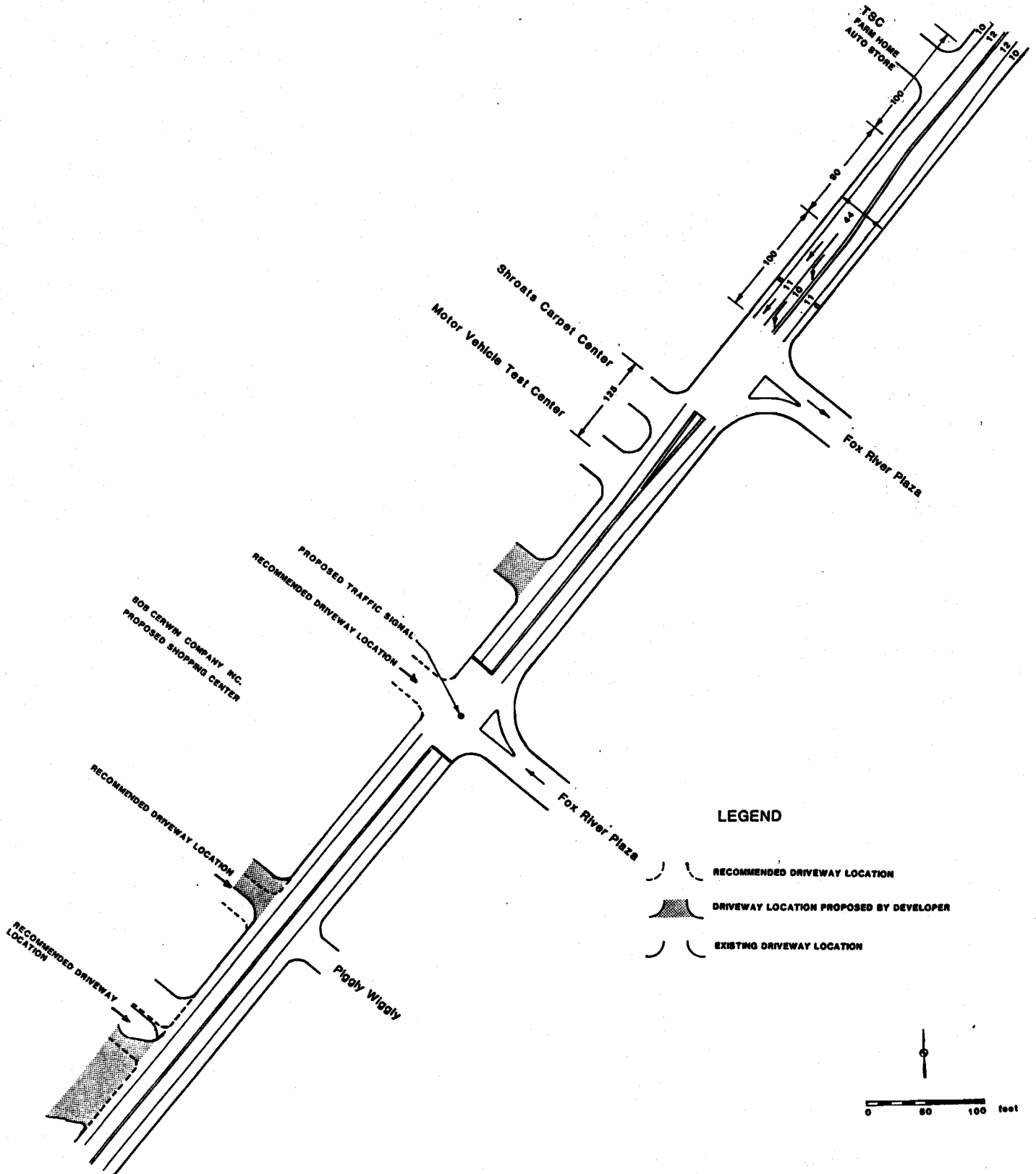
A further action recommended to abate the identified problems on this segment of roadway is the installation of a semi-actuated traffic signal at the southern entrance to the Fox River Plaza at an estimated cost to the City of Burlington of \$55,000 and an annual operation and maintenance cost of about \$2,000. The southern driveway would meet traffic signal warrants with existing traffic volumes after being converted to outbound only. The north driveway would not meet warrants after being converted to inbound only. The advantages of the traffic signals are that they should allow the westbound left-turn movement out of the driveway to operate under design capacity, along with all other traffic movements at the traffic signal. The traffic signal will also provide adequate gaps in Milwaukee Avenue traffic at other commercial driveway locations along this segment of Milwaukee Avenue. In addition, the proposed shopping mall at 2720 Milwaukee Avenue should be encouraged to provide one access point opposite the southern Fox River Plaza driveway to constitute the western approach to the signalized intersection. The disadvantages include a possible increase in rear-end accidents on the highway and the creation of queues that block nearby driveways. In addition, Milwaukee Avenue traffic, which currently experiences generally no delay at the Fox River Plaza driveways, would experience an average delay of about five seconds.

Milwaukee Avenue from Bridge Street-Congress Street Intersection to Fox River Plaza Southern Driveway: It is recommended that, to reduce travel time and increase operating speeds on the study segment of Milwaukee Avenue, two of the proposed three traffic signals along Milwaukee Avenue be interconnected to provide for proper traffic progression: the two traffic signals that would be close enough to be interconnected are at Bridge Street and Grove Street. The travel time from Commerce Street-Pine Street to Droster Avenue may be expected to increase from about 2.6 minutes with an average travel speed of about 28 miles per hour currently; to about 2.7 minutes with an average travel speed of about 27 miles per hour after the first three signals are installed.

As stated earlier, the need for signals at Paul Street should be monitored. If the signal at Paul Street is installed in the future, it would be close enough to be interconnected with Grove Street and the Fox River Plaza south driveway traffic signals, permitting all four traffic signals to be intercon-

Figure 13

ALTERNATIVE ROADWAY IMPROVEMENT FOR THE INTERSECTION
OF FOX RIVER PLAZA DRIVEWAY AND MILWAUKEE AVENUE



nected. The fourth traffic signal may be expected to increase travel time along the entire study segment of Milwaukee Avenue to about 2.8 minutes with an average speed of about 26 miles per hour. The cost to the City of Burlington to interconnect all four traffic signals would be an estimated \$4,100.

Milwaukee Avenue from Commerce Street-Pine Street to Droster Avenue: Another action which was considered to alleviate the existing accident problems on the study segment of Milwaukee Avenue involves reducing the number of driveways to one driveway per 300 feet of frontage for one property, with driveways spaced 150 feet apart and aligned with driveways on the opposite side of the street or staggered 300 feet apart. The properties affected would include the American Muffler Center; Lik-Nu Auto Service; Clark Oil; White Fox Den Restaurant; Lois Tire Shop, Inc.; Pizza Hut; Lynch Chevrolet Pontiac Sales, Inc; Bob Cerwin Company, Inc.; Miller Ford Mercury, Inc.; and Stan's Glass and Radiator Service, Inc. The advantages of this alternative would be a reduction in the accident potential on this segment of Milwaukee Avenue by reducing the number of conflict points on Milwaukee Avenue. The disadvantages associated with reducing access points to properties include an increase in traffic volumes on the driveways and a resultant increase in the frequency of conflicts at the driveways. It is not recommended that this alternative be implemented immediately since the access rights would need to be purchased after negotiations with individual property owners. Such access limitations, however, should be considered for future development and redevelopment along Milwaukee Avenue such as the proposed shopping development at 2720 Milwaukee Avenue. As shown in Figure 13, it is recommended that the northern driveway to the proposed shopping development be aligned with the existing Fox River Plaza driveway to constitute the western approach to the proposed signalized intersection, and to ensure that it will be a minimum of 150 feet from the existing Motor Vehicle Test Center driveway. The proposed central driveway to the shopping development should be aligned with the northern Piggly Wiggly driveway. The southern driveway to the convenience store would be narrowed to 35 feet and located 150 feet south of the central driveway.

LONG-RANGE IMPROVEMENT PLAN

The short-range traffic engineering actions herein recommended were designed to abate existing traffic problems and maximize efficiency and safety without resorting to capital-intensive construction. However, it must be recognized that there is a limit to the improvement in the level of service that can be obtained through the implementation of low cost traffic engineering actions. Ultimately, when the limits of the capacity and safety enhancements provided by traffic engineering actions are reached, it becomes necessary to consider the implementation of more capital-intensive construction or reconstruction alternatives to meet expected increases in future travel demand.

The adopted regional transportation system and county jurisdictional highway system plans recommend a number of roadway improvements to abate future traffic problems on this segment of Milwaukee Avenue. Milwaukee Avenue is recommended to carry four traffic lanes between Bridge Street and the northern corporate limits, which would entail widening. In addition, an inner bypass utilizing a combination of new streets and existing streets is proposed to be developed along the eastern, southern, and western areas of the City. As part

of the revision of the Racine County jurisdictional highway system plan now underway, the Commission staff, at the request of the City of Burlington and the County Jurisdictional Highway System Planning Committee, is investigating alternatives to these currently recommended long-range improvements in the long-range plan, including alternatives of an outer bypass and major improvements to Milwaukee Avenue.

SUMMARY

On October 15, 1987, the City Engineer of the City of Burlington requested the Commission staff to conduct a traffic engineering study of the segment of Milwaukee Avenue (STH 36) between the City of Burlington central business district and the northern corporate limits of the City. This report presents the findings and recommendations of that study.

In 1988, average weekday traffic volumes on Milwaukee Avenue ranged from a high of 18,800 vehicles on the segment immediately northeast of Bridge Street, to a low of 10,700 vehicles on the segment between Commerce Street-Pine Street and Bridge Street. Average weekday traffic volume on Bridge Street south of Milwaukee Avenue, was recorded at 9,500 vehicles. Average weekday traffic volume on Grove Street, west of Milwaukee Avenue, was recorded at 3,100 vehicles. Average weekday traffic volume on Paul Street, north of Milwaukee Avenue, was recorded at 1,600 vehicles.

Capacity analyses of the Milwaukee Avenue intersections with Bridge Street, Grove Street, Paul Street, and the driveways to the Fox River Plaza were conducted to identify existing traffic congestion and excessive delay problems. The left turn movements at five locations were found to be operating below an acceptable level of service for several hours of an average weekday: the northbound left turn from Bridge Street, the eastbound left turn from Grove Street, the eastbound left turn from Paul Street, and the westbound left turns from both driveways at the Fox River Plaza. All other traffic movements at the intersections of Milwaukee Avenue with Bridge Street, Grove Street, Paul Street, and the driveways to the Fox River Plaza were operating at acceptable levels of service with minimal delays and back-ups.

The incidence and location of traffic accidents provides an important measure of the efficiency and operating characteristics of an arterial facility such as Milwaukee Avenue. A total of 21 accidents occurred on the study segment in 1985, 17 accidents occurred in 1986, and 28 accidents occurred in 1987. The principal accident problem locations identified in the study were the midblock stretch of Milwaukee Avenue between the north end of Wegge Road and Droster Avenue, with a total of 21 accidents reported over the three-year study period; the midblock stretch of Milwaukee Avenue between Paul Street and the south end of Wegge Road, with a total of 12 accidents reported over the three-year study period; and the intersection of Bridge Street and Milwaukee Avenue, with a total of 10 accidents reported over the three-year period.

Recently, the City of Burlington Plan Commission approved the construction of the Bear Meadows Subdivision, proposed to accommodate 67 single family homes and nine condominium buildings, each with four dwelling units. The proposed development may be expected to generate approximately 900 vehicle trips on an average weekday. It was estimated that all of the trips generated by the

planned subdivision would travel to and from Milwaukee Avenue via Paul Street, thereby increasing traffic volumes on Paul Street at the intersection with Milwaukee Avenue from 1,600 vehicles per average weekday currently, to about 2,500 vehicles per average weekday, an approximately 50 percent increase. Also, a shopping development and convenience store-car wash is presently being proposed adjacent to the existing Firestone Store at 2720 Milwaukee Avenue. The proposed development would have about 25,000 square feet of retail shops; 2,500 square feet of convenience store with gas pumps and a car wash; and the existing 5,850 square feet of the Firestone Store. The proposed development is expected to generate approximately 2,120 new trips on an average weekday. In addition, an approximately 12-acre parcel of land located south of the Fox River Plaza, east of Milwaukee Avenue, and north of the city landfill has been proposed for the development of a motel-convention center with an estimated 360 rooms. This proposed motel-convention center may be expected to generate about 2,170 vehicle trips per average weekday.

To abate the identified existing roadway capacity and accident problems, a number of alternative traffic control measures were evaluated, and a set of recommended actions was identified, as set forth in Table 3.

The identified problems along the portion of the study segment of Milwaukee Avenue between Pine-Commerce Street and the southern terminus of Wegge Road, which is constructed to an urban cross-section with a pavement width of 48 feet curb-to-curb, consist of traffic congestion and accidents. The problems are a result of traffic being generally limited to one lane in each direction as on-street curb parking is generally permitted. Left-turning vehicles at times block all traffic movement in one direction. The need exists for additional traffic carrying capacity on this entire roadway segment, but particularly between Bridge Street and the southern terminus of Wegge Road, as existing traffic volumes of 18,000 to 18,800 vehicles per average weekday substantially exceed the design capacity of 13,000 vehicles per average weekday for a two-traffic-lane arterial roadway. Between Bridge Street and Commerce-Pine Street, existing traffic volumes of 10,700 vehicles per average weekday are approaching the design capacity of the existing two-traffic-lane roadway. As noted earlier, the proposed Bear Meadows subdivision may be expected to increase traffic volume on Milwaukee Avenue between Commerce-Pine Street and the southern terminus of Wegge Road by 300 to 600 vehicles per average weekday; the proposed shopping development may be expected to increase such traffic by another 740 to 1,480 vehicles per average weekday; and the proposed motel-convention center may be expected to increase such traffic by another 760 to 1,520 vehicles per average weekday. The traffic engineering action proposed to alleviate the congestion is to prohibit parking on the entire segment, with the option of allowing parking at all times at the existing 20 spaces between Pine Street-Commerce Street and 250 feet south of Bridge Street, and allowing parking at selected midblock spaces between Bridge Street and Wegge Road on weekends, and weekdays from 6:00 p.m. to 6:00 a.m.

The identified problems at the intersection of Milwaukee Avenue and Bridge Street-Congress Street consist of traffic congestion and accidents, with problems of excessive delay for the northbound left-turn and right-turn movements on Bridge Street and, as well, southbound Milwaukee Avenue traffic. The accident-related problems at this intersection consist of a total of 10 accidents reported in the calendar years 1985 through 1987, of which 5 accidents

Table 3

SUMMARY OF TRAFFIC ENGINEERING IMPROVEMENTS AND ROADWAY
CONSTRUCTION ACTIONS RECOMMENDED TO SOLVE EXISTING TRAFFIC
PROBLEMS ON MILWAUKEE AVENUE FROM PINE STREET TO DROSTER AVENUE^a

Location	Recommendation	Estimated Cost	Funding Source
Short-Range Plan Milwaukee Avenue Between Commerce-Pine Street and Wegge Road....	<ul style="list-style-type: none"> o Prohibit parking to provide four traffic lanes. Subtotal	\$ 3,900 \$ 3,900	City of Burlington
At Bridge Street.....	<ul style="list-style-type: none"> o Install traffic-actuated signals. o Install pavement markings to provide a southbound left-turn lane. o Prohibit left turns from driveways within 100 feet of major intersections. Subtotal	\$ 60,000 3,600 100 \$ 63,700	City of Burlington
At Grove Street.....	<ul style="list-style-type: none"> o Install traffic-actuated signals. o Install pavement markings to provide two lanes of traffic in both directions on Milwaukee Avenue. o Prohibit left turns from driveways within 100 feet of major intersections. Subtotal	\$ 55,000 2,500 100 \$ 57,300	City of Burlington
Between Wegge Road and Droster Avenue.....	<ul style="list-style-type: none"> o Install pavement markings to provide left-turn lane into Fox River Plaza driveway. o Convert Fox River Plaza two-way driveways to two one-way driveways. o Install traffic-actuated signals. o Install visual cues in advance of mall driveways. Subtotal	\$ 3,400 5,800 55,000 1,200 \$ 65,400	City of Burlington and owners of abutting land
Between Bridge Street and Fox River Plaza Driveway.....	<ul style="list-style-type: none"> o Interconnect traffic signals. Subtotal	\$ 4,100 \$ 4,100	City of Burlington
--	Total	\$194,400	--

^aPotential short-term future improvements for the intersection of Paul Street and Milwaukee Avenue were also identified. These improvements were not warranted under existing conditions, but may be needed in the near future because of the development of the Bear Meadows subdivision. It was recommended that the need for these improvements be monitored periodically. These improvements include the installation of traffic-actuated signals; relocation of a White Fox Den Restaurant driveway to align with Paul Street; and prohibition of left turns at selected driveways within 100 feet of the intersection. The total estimated capital cost of these improvements is \$58,700, of which \$55,000 is attributable to the traffic signals, \$3,500 to driveway realignment, and \$200 for the left-turn prohibition.

involved southbound left-turning vehicles. The traffic engineering actions recommended to abate the identified traffic problems include the installation of actuated traffic signals; the installation of pavement markings at the intersection to provide an exclusive southbound left-turn lane; and the prohibition of left turns from the Clark Oil Service Station driveway within 100 feet of the intersection.

The identified problem at the intersection of Milwaukee Avenue and Grove Street consists of traffic congestion with excessive delays for Grove Street eastbound to northbound left-turning traffic. To abate this traffic congestion, it is recommended that traffic signals be installed and pavement markings be provided at the intersection to provide one shared northbound left-turn and through lane, one northbound through lane, and two southbound through lanes; and left turns be prohibited from the Burlington Self Serv service station driveway within 100 feet of the intersection.

The identified problems at the intersection of Milwaukee Avenue and Paul Street include traffic congestion and excessive delay on Paul Street for eastbound to northbound left-turning traffic, and the related exacerbated congestion and accident problems that may be expected with the development of the Bear Meadows subdivision. It is expected that both the number and duration of gaps in traffic on Milwaukee Avenue will increase slightly as a result of the signal installation at the intersection of Milwaukee Avenue and Grove Street, thus reducing the delay experienced by motorists on Paul Street. One traffic management action considered to alleviate these problems was the installation of traffic signals. However, neither existing traffic volumes nor the recent accident history at the intersection warrant the installation of traffic signals at this time.

Traffic volumes are expected to increase at the intersection as the Bear Meadows subdivision develops. It is, therefore, recommended that the need for traffic signals at this intersection be reviewed on a periodic basis to monitor changes in traffic volumes, traffic delays, and the accident history at the intersection.

If traffic signals are determined to be installed in the future, the north driveway to the White Fox Den Restaurant should be converted to two-way operation and relocated to be the eastern approach of the intersection; and left turns should be prohibited from the southern White Fox Den driveway and the southern American Muffler Center driveway.

The identified problems along Milwaukee Avenue from the north end of Wegge Road to Droster Avenue are traffic congestion and, particularly, traffic accidents, with a total of 21 accidents reported in calendar years 1985 through 1987, of which 14 involved vehicles turning left into the commercial driveways on Milwaukee Avenue. The number of accidents has been increasing each year, with four in 1985, seven in 1986, and 10 in 1987. The Fox River Plaza driveways to Milwaukee Avenue are particularly experiencing traffic congestion. The traffic engineering actions recommended to alleviate these problems include converting the two existing Fox River Plaza two-way driveways to a pair of one-way driveways, installing of pavement markings to provide an exclusive left-turn lane into the Fox River Plaza; installing signing and

visual cues in advance of the driveways; and installing a semi-actuated traffic signal at the southern Fox River Plaza driveway.

It is recommended that, to reduce travel time and increase operating speeds on the study segment of Milwaukee Avenue, two of the three proposed traffic signals along Milwaukee Avenue be interconnected to provide traffic progression: the two traffic signals that would be close enough to be interconnected are at Bridge Street and Grove Street. The need for traffic signals at Paul Street should be periodically reviewed. If the fourth traffic signal is eventually installed, all four traffic signals should be interconnected.

Another action which was considered to alleviate the existing accident problem on the study segment of Milwaukee Avenue involves reducing the number of driveways to one driveway per 300 feet of frontage for one property, with driveways spaced 150 feet apart and aligned with driveways on the opposite side of the street or staggered 300 feet apart. The properties affected would include the American Muffler Center; Lik-Nu Auto Service; Clark Oil; White Fox Den Restaurant; Lois Tire Shop, Inc.; Pizza Hut; Lynch Chevrolet Pontiac Sales, Inc.; Bob Cerwin Company, Inc.; Miller Ford Mercury, Inc.; and Stan's Glass and Radiator Service, Inc. It is not recommended that this alternative be implemented immediately, since the access rights would need to be purchased after negotiations with individual property owners. Such access limitations, however, should be considered for future development or redevelopment along Milwaukee Avenue such as the proposed shopping development at 2720 Milwaukee Avenue. It is recommended that the northern driveway to the proposed shopping development be aligned with the existing Fox River Plaza driveway to constitute the western approach to the proposed signalized intersection, and to ensure that it will be a minimum of 150 feet from the existing Motor Vehicle Test Center driveway. The proposed central driveway to the shopping development should be aligned with the northern Piggly Wiggly driveway. The southern driveway to the convenience store would be narrowed to 35 feet and located 150 feet south of the central driveway.

These short-range traffic engineering actions herein recommended were designed to abate existing traffic problems and maximize efficiency and safety without resorting to capital-intensive construction. However, it must be recognized that there is a limit to the improvement in the level of service that can be obtained through the implementation of low cost traffic engineering actions. Ultimately, when the limits of the capacity and safety enhancements provided by traffic engineering actions are reached, it becomes necessary to consider the implementation of more capital-intensive construction or reconstruction alternatives to meet expected increases in future travel demand.

The adopted regional transportation system and county jurisdictional highway system plans recommend a number of roadway improvements to abate future traffic problems on this segment of Milwaukee Avenue. Milwaukee Avenue is recommended to carry four traffic lanes between Bridge Street and the northern corporate limits, which would entail widening. In addition, an inner bypass utilizing a combination of new streets and existing streets is proposed to be developed along the eastern, southern, and western areas of the City. As part of the revision of the Racine County jurisdictional highway system plan now underway, the Commission staff, at the request of the City of Burlington and the County Jurisdictional Highway System Planning Committee, is investigating

alternatives to these currently recommended long-range improvements, including alternatives of an outer bypass and major improvements to Milwaukee Avenue.