

**ANALYSIS OF TRAFFIC
ENGINEERING ACTIONS
PROPOSED BY CITY OF
CEDARBURG STAFF
FOR S. WASHINGTON
AVENUE (STH 57/STH 143)**

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**MEMORANDUM REPORT
NUMBER 72**

**ANALYSIS OF TRAFFIC ENGINEERING ACTIONS
PROPOSED BY CITY OF CEDARBURG STAFF FOR
S. WASHINGTON AVENUE (STH 57/STH 143)**

OZAUKEE COUNTY, WISCONSIN

Prepared by the

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SEWRPC Staff Memorandum

ANALYSIS OF TRAFFIC ENGINEERING ACTIONS PROPOSED BY CITY OF CEDARBURG STAFF FOR S. WASHINGTON AVENUE--STH 57/STH 143

INTRODUCTION

On March 5, 1990, the City of Cedarburg requested the Commission staff to review and comment upon several traffic management actions being considered for implementation on S. Washington Avenue--STH 57-STH 143--in the central business district of the City of Cedarburg. The actions being considered were the installation of traffic signals at the intersection of W. Western Road and Washington Avenue--STH 57; the addition of flashing amber crosswalk beacons at certain locations along S. Washington Avenue--STH 57-STH 143--between E. Hamilton Road and N. Sheboygan Street; and additional parking restrictions at certain locations on S. Washington Avenue--STH 57-STH 143. This staff memorandum presents the findings and recommendations of the Commission staff review.

INTERSECTION OF S. WASHINGTON AVENUE--STH 57--AND W. WESTERN ROAD

Central 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, and a history of motor vehicle and pedestrian accident patterns and frequencies.

Jurisdictional Classification

S. Washington Avenue--STH 57--at its intersection with W. Western Road is a connecting highway and is, as such, an integral 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 municipal responsibility, while the State is responsible for construction and operation. Therefore, approval of the Wisconsin Department of Transportation

is required prior to the City's undertaking any action substantially altering the use or capacity of the intersection of W. Western Road and S. Washington Avenue--STH 57. Such actions requiring approval include such actions as prohibiting turning movements, installing and modifying traffic control devices, and modifying intersection geometrics.

Intersection Physical and Operational Characteristics

The intersection of S. Washington Avenue--STH 57--and W. Western Road is a "T" intersection, and both streets are constructed to an urban cross-section with curb and gutter and storm sewer. The approach pavement width for both the north and south legs of S. Washington Avenue--STH 57--is 40 feet with one 12-foot-wide traffic lane and an adjacent 8-foot-wide parking lane provided in each direction. The west leg of the intersection on W. Western Road is 36 feet wide, which provides eastbound traffic with exclusive left- and right-turn lanes. Westbound traffic is provided a single traffic lane with an adjacent parking lane. Lane configurations and widths are shown in Figure 1.

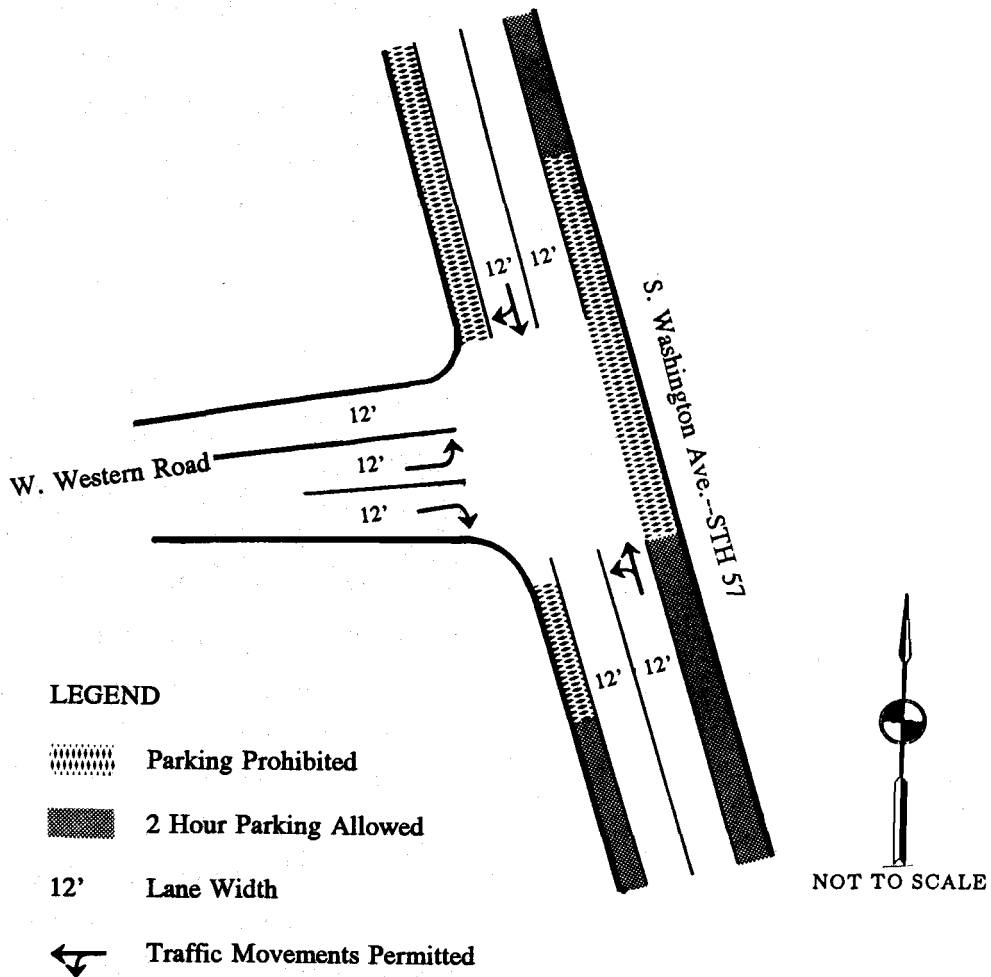
Parking is permitted on both approaches of S. Washington Avenue--STH 57 to W. Western Road. On W. Western Road parking is not allowed on the south side and is prohibited on the north side from S. Washington Avenue--STH 57--for approximately 100 feet to the west. Parking locations and the duration of parking allowed are also shown in Figure 1.

Traffic Volumes

Traffic at the intersection of S. Washington Avenue--STH 57--and W. Western Road is controlled by a stop sign on the W. Western Road approach. Based on 24-hour machine counts conducted by the Commission staff, the average weekday traffic volume on S. Washington Avenue--STH 57--in May 1990 was approximately 20,540 vehicles per average weekday just south of W. Western Road; and 5,700 vehicles per average weekday on W. Western Road. The Commission staff also conducted turning movement counts at the intersection from 6:00 a.m. to 8:00 p.m. This time period included the morning and afternoon hours of peak traffic flow and accounted for approximately 82 percent of the 24-hour average weekday traffic volume. These count data were necessary to evaluate current intersection operating conditions and to analyze the potential need for

Figure 1

LANE CONFIGURATION AND WIDTHS AT THE INTERSECTION
OF W. WESTERN ROAD AND S. WASHINGTON AVENUE--STH 57



Source: SEWRPC.

traffic control signals at this location. Shown on Figure 2 are the turning movements recorded at the intersection of S. Washington Avenue--STH 57--and W. Western Road during the morning hour of peak traffic flow; the turning movement volumes for the evening hour of peak traffic flow; and the estimated 24-hour turning movement volumes. It should be noted that, during the hours of peak traffic flow, a significant percentage of the northbound traffic stream turns left onto W. Western Road. During the morning hour of peak traffic flow, approximately 155 vehicles, or about 40 percent of the total northbound traffic stream turns left; and during the evening hour of peak traffic flow, approximately 210 vehicles, or about 22 percent of the northbound traffic stream turns left onto W. Western Road.

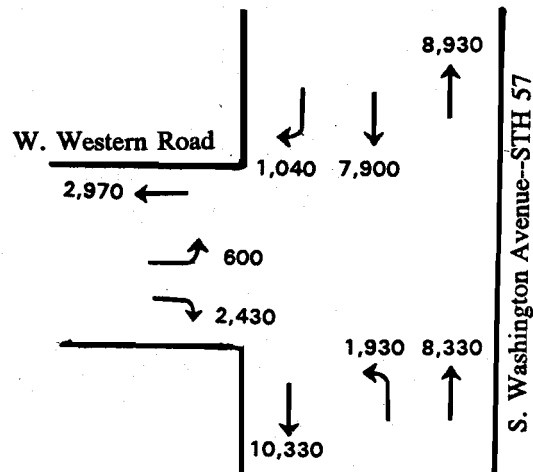
A capacity analysis of the intersection was conducted to determine the extent of congestion and delay. During the morning hour of peak traffic flow the motorists attempting to turn left from W. Western Road to northbound S. Washington Avenue--STH 57--may be expected to experience an average delay of approximately 16 seconds per vehicle; while motorists turning right from W. Western Road may be expected to experience an average delay of approximately six seconds. During the evening hour of peak traffic flow motorists turning left onto northbound S. Washington Avenue--STH 57--may be expected to experience an average delay of approximately 30 seconds per vehicle; while motorists turning right onto southbound S. Washington Avenue--STH 57--may be expected to experience an average delay of about six seconds. Motorists turning left onto northbound S. Washington Avenue--STH 57--from W. Western Road may be expected to encounter substantial delay throughout most of the day. However, this traffic represents less than 3 percent of the total traffic entering the intersection. Traffic on S. Washington Avenue--STH 57--may be expected to experience little or no delay throughout the day.

Traffic Accidents

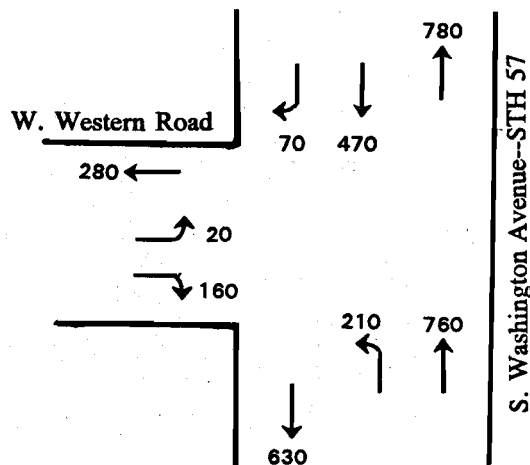
The incidence and pattern of traffic accidents can provide an indication of the efficiency and operating characteristics of an intersection. A three-year motor vehicle accident history for the intersection of S. Washington Avenue--STH 57--at W. Western Road was collected and analyzed. As shown in Table 1, a total of 14 accidents occurred at the intersection during the three year

Figure 2

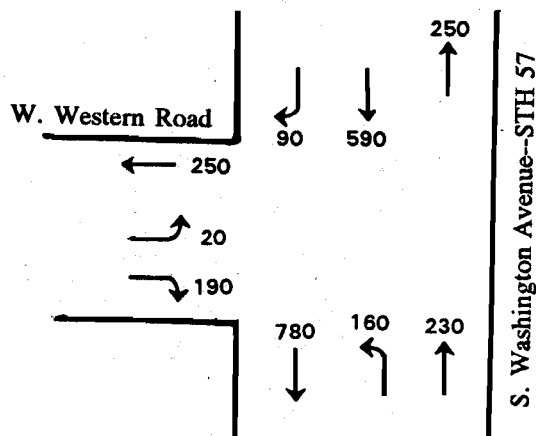
TRAFFIC VOLUME BY MOVEMENT AT W.
WESTERN ROAD AND S. WASHINGTON AVENUE--STH 57:1990



24-Hour Traffic Volume By Movement: 1990



Evening Hour of Peak Traffic Volume
By Movement: 1990



Morning Hour of Peak Traffic Volume
By Movement: 1990

Source: SEWRPC.

Table 1

**INCIDENCE AND SEVERITY OF MOTOR VEHICLE ACCIDENTS AT THE
INTERSECTION OF WASHINGTON AVENUE AND WESTERN ROAD: 1988-1990**

Location	1988			1989			1990			Total		
	Injury	Property Damage	Total	Injury	Property Damage	Total	Injury	Property Damage	Total	Injury	Property Damage	Total
Washington Avenue and Western Road..	2	2	4	1	3	4	1	5	6	4	10	14

Source: SEWRPC.

Table 2

TRAFFIC SIGNAL WARRANTS

SIGNAL WARRANT 1-MINIMUM VEHICULAR VOLUME

MINIMUM VEHICULAR VOLUMES	NUMBER OF TRAFFIC LANES		TRAFFIC VOLUMES		HOUR NUMBER								
	MAJOR STREET	MINOR STREET	MAJOR STREET SUM BOTH APPROACHES	MINOR STREET HIGHEST APPROACH		1	2	3	4	5	6	7	8
	1.....	1.....	500	150	MAJOR STREET								
2 OR MORE	1.....	600	150		1455	1375	1371	1204	1197	1148	1141	1016	
2 OR MORE	2 OR MORE	600	200	MINOR									
1.....	2 OR MORE	500	200	STREET	108	122	102	119	130	118	108	115	

WARRANT 2-INTERRUPTION OF CONTINUOUS TRAFFIC

INTERRUPTION OF CONTINUOUS TRAFFIC	NUMBER OF TRAFFIC LANES		TRAFFIC VOLUMES		HOUR NUMBER									
	MAJOR STREET	MINOR STREET	MAJOR STREET SUM BOTH APPROACHES	MINOR STREET HIGHEST APPROACH		1	2	3	4	5	6	7	8	
1.....	1.....	750	75	MAJOR										
2 OR MORE	1.....	900	75	STREET	1455	1375	1371	1204	1197	1148	1141	1016		
2 OR MORE	2 OR MORE	900	100	MINOR										
1.....	2 OR MORE	750	100	STREET	108	122	102	119	130	118	108	115		

Note all right-turn movements have been reduced by 50 percent.

Source: SEWRPC.

period concerned, with four accidents in 1988, four in 1989, and six in 1990. None of the accidents involved a fatality. Two accidents in 1988, one in 1989, and one in 1990 involved personal injuries. Two of the four personal injury accidents involved a pedestrian or bicyclist struck while crossing W. Western Road.

In addition to the three-year accident history at the S. Washington Avenue--STH 57--and W. Western Road intersection, an additional three-year accident history of pedestrian-vehicle accidents was compiled for S. Washington Avenue--STH 57-STH 143--between E. Hamilton Road and N. Sheboygan Road. During that three-year period--from 1988 through 1990--five pedestrian-vehicular accidents occurred. In 1988 two pedestrian-vehicular accidents occurred; one occurred in 1989; and two in 1990. Two of these accidents--one in 1988 and one in 1990--occurred at the intersection of S. Washington Avenue--STH 57--and W. Western Road.

TRAFFIC SIGNALIZATION

A traffic management action being considered by the City to provide traffic on W. Western Road with increased opportunities to safely enter the S. Washington Avenue--STH 57--traffic stream and to reduce the delay for eastbound left-turning motorists is the installation of traffic signals at the intersection of W. Western Road and S. Washington Avenue--STH 57. The installation of a traffic signal requires that one or more of the warrants set forth in the Manual On Uniform Traffic Control Devices¹ be met. It should be noted that, although meeting one of the warrants is a necessary condition for traffic signal installation, meeting the warrant should not be considered a mandate for installation. The impacts of the signal installation must be evaluated and installation considered only if the operation of the intersection is thereby improved. Because of the significant traffic volumes and the pattern of right-

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, 1989.

angle collisions at this intersection, the staff considered three warrants. Two of these warrants are related to traffic volumes and the third is related to the accident experience at the intersection.

The first warrant considered--the minimum vehicular volume warrant--is satisfied if the sum of the current traffic volumes on the major approaches and the corresponding volumes on the minor street approaches meet or exceed specified minimum volume requirements for eight hours of an average weekday. The minimum volume requirements at this intersection are 500 vehicles per hour on the major street and 200 vehicles per hour on the minor street.² This warrant is not met, as W. Western Road traffic volumes are substantially less than the warrant volume.

The second warrant considered--the interruption of continuous traffic warrant--is satisfied when the traffic volume on S. Washington Avenue--STH 57--exceeds 750 vehicles per hour for any eight hours, and when the traffic volume on W. Western Road exceeds 100 vehicles per hour for the same eight hours. This warrant is met on both S. Washington Avenue--STH 57--and W. Western Road.

The third warrant considered--the accident experience warrant--considers the number and type of traffic accidents which have occurred at the intersection. This warrant is satisfied when five or more accidents of a type susceptible to correction by the installation of traffic signals have occurred within a 12 month period. Analysis of the three-year accident history data for the intersection concerned indicates that four of the 14 accidents, or 29 percent, were right angle collisions, and three, or 21 percent, were sideswipes. These accidents are a result of motorists attempting to enter the S. Washington Avenue--STH 57--traffic stream from W. Western Road. Both accident types potentially

²Because right turns on red are permitted under Wisconsin Statutes, the Wisconsin Department of Transportation reduces the volume making right turns by one-half. This policy may be waived in certain situations such as intersections with a severely restricted sight distance. The Commission staff, in recognition of this policy, included only half the right-turning volume on the eastbound and southbound approaches in its analysis of the volume-related warrants.

indicate the difficulty motorists on W. Western Road have in entering the S. Washington Avenue--STH 57--traffic stream, particularly the difficulty in completing a left turn from W. Western Road onto northbound S. Washington Avenue--STH 57. Two rear end accidents occurred on the south leg of the intersection and suggest 1) substantial turning and opposing through volumes; and 2) driver inattentiveness.

Two of the four traffic accidents in 1988 at the intersection can be considered to be correctable by the installation of a traffic signal; one of the four accidents in 1989 may be considered to be so correctable; and three of the six accidents in 1990 may be considered to be so correctable. Because five or more correctable traffic accidents did not occur during any 12 month period considered, the accident experience warrant is not satisfied. However, the warrant was nearly satisfied between May 1989 and August 1990, when four traffic accidents occurred which can be considered susceptible to correction by signalization. Further, three of these accidents occurred in 1990, a substantial increase compared to 1989. The collision diagrams for each year are shown in Appendix A.

As already noted, the interruption of continuous traffic warrant is met at the intersection, as shown in Table 2; and the number and type of accidents nearly satisfied the accident experience warrant. Because the volume warrant--the interruption of continuous traffic--is met, it may be concluded that a traffic signal installation is warranted at this intersection.

The advantages of the installation of a traffic signal at this intersection include: 1) the provision of gaps at regular intervals to accommodate both east- and northbound left turns; and 2) a potential improvement in traffic safety by reducing right angle collisions. Pedestrian signals may be included to enhance pedestrian safety as well.

The disadvantages of the installation of a traffic signal at this intersection include the delay incurred by motorists who previously did not have to stop at the intersection. Motorists on S. Washington Avenue--STH 57--may be expected to incur 7 to 12 seconds of delay, or an estimated total of 3.6 vehicle hours

of delay, in the evening peak hour. Delay on all approaches may be expected to approximate 10 seconds per vehicle, or an estimated total of 5.0 vehicle hours of delay. In addition, signalization may be expected to increase the fuel consumption and pollutant emissions of those vehicles which are required to stop. Finally, the installation of traffic signals at this intersection may cause additional rear end accidents.

Because of the gaps in the traffic stream which would be provided by the signals for left-turning motorists; and because of the potential to reduce certain types of accidents, the City should request the Wisconsin Department of Transportation to install traffic signals at this intersection. The cost of the recommended signalization is estimated as \$65,000.

EXCLUSIVE LEFT-TURN LANE

The provision of exclusive left-turn lanes should be considered whenever the number of left turns on an intersection approach exceeds 10 percent of the approach volume. On the northbound approach of this intersection, left-turning traffic represents 23 percent of the total traffic volume. The advantage of providing an exclusive left-turn lane for northbound S. Washington Avenue--STH 57--would be that it would separate the through traffic from the left-turning traffic, thereby reducing delay and improving traffic safety. The disadvantage of the provision of an exclusive left-turn lane would be that on-street parking would have to be prohibited on the east side of S. Washington Avenue between Spring Street and a point approximately 100 feet north of W. Western Road. This would result in a loss of approximately eight parking spaces. It is recommended that provision of an exclusive left-turn lane be considered for the northbound approach to the intersection of S. Washington Avenue--STH 57--and W. Western Road whether signals are installed or not. The cost of such a lane is estimated as \$4,400.

FLASHING AMBER BEACONS

Pedestrian-Vehicular Accidents

The City staff also requested that the Commission staff comment upon the potential use of flashing amber crosswalk beacons between E. Hamilton Road and N. Sheboygan Road. There is little evidence that flashing warning beacons are effective when used to warn of intermittent conditions, such as the presence of pedestrians in an urban environment. Some studies have shown that vehicle speeds actually increase after the installation of flashing warning beacons,³ and have concluded that it is futile to expect warning beacons to override the judgement of motorists as to what is safe and unsafe behavior. Moreover, with time, flashing beacons tend to become part of the background environment and are unnoticed by motorists who regularly use the route. In addition, pedestrians may gain a false sense of security through the use of flashers and, as a result, pedestrian-vehicular accidents may actually increase. Also, the use of flashing amber beacons is not recommended or encouraged in The Manual on Uniform Traffic Control Devices or in Federal Highway Administration guidelines.⁴ Therefore, the Commission staff does not recommend the installation of flashing amber beacons at any crosswalk on the study segment of S. Washington Avenue--STH 57-STH 143.

Because there were five pedestrian-vehicular accidents on the study segment in 1988, 1989, and 1990, including two accidents in 1988; one in 1989; and two in 1990, the Commission staff did review the accidents to determine if a pattern existed. The staff also reviewed the location of existing crosswalks and attendant signing to identify any potential improvements that would alleviate the pedestrian-vehicular accident problem.

Analysis of these accidents indicated that: 1) while there were no fatalities, all the pedestrians involved sustained injuries; 2) four of these accidents occurred during the late morning through early afternoon hours of the day, and

³Burrett, B. E., R. C. Buchanan, and E. T. Kalovoda, "School Zone Flashers--Do They Really Slow Traffic?" ITE Journal 60 (January 1990), pp. 29-31.

⁴"Model Pedestrian Safety Program--Users' Guide," Federal Highway Administration, Washington, D. C., June 1978.

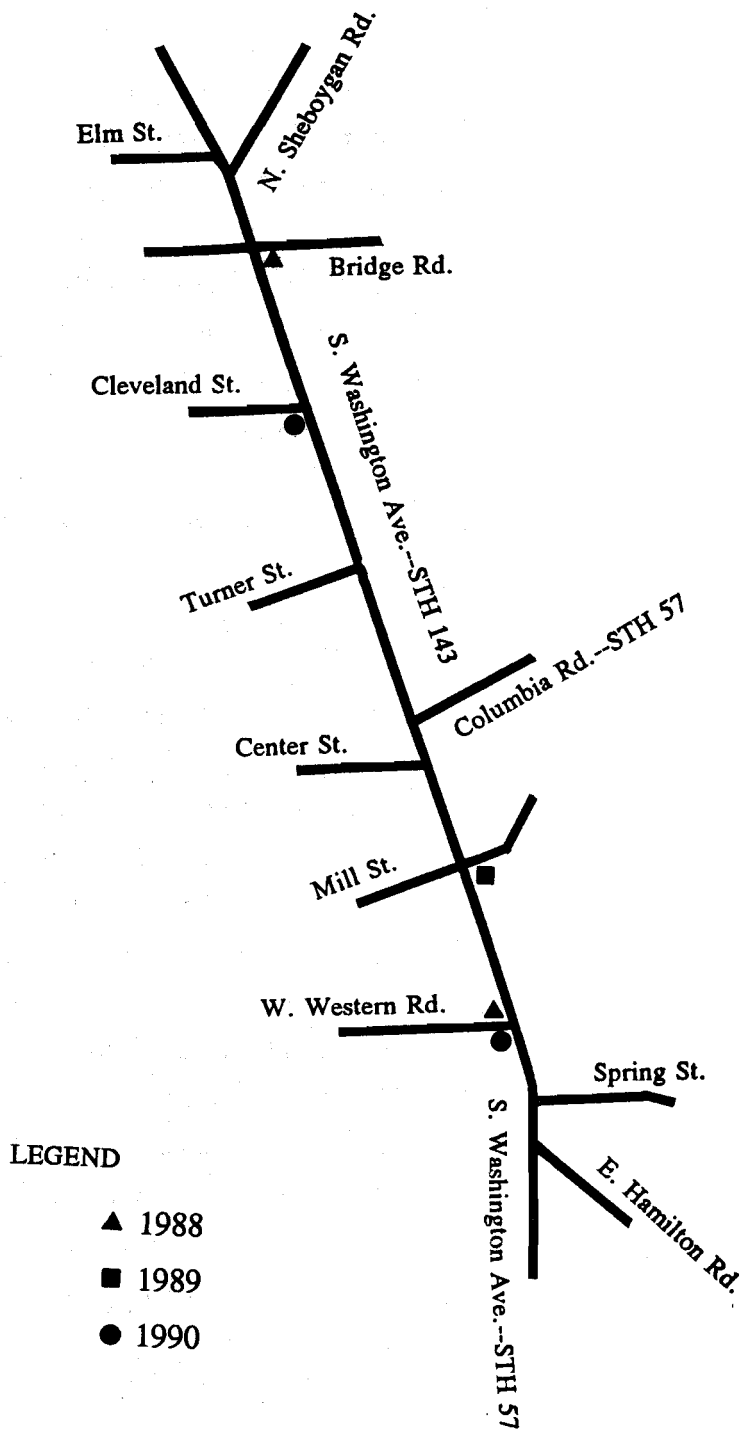
one occurred during the late afternoon hours; 3) four of the accidents involved adult pedestrians with an average age of approximately 69 years, and one accident involved an 11 year old child; and 4) all five accidents occurred while the pedestrian was crossing the street. Three of the accidents involved vehicles which were in the process of completing left turns, and two accidents involved vehicles making a right turn. It may be concluded that the pedestrians involved expected the motorists involved to yield the right-of-way as required by law. However, the pattern of accidents suggests that the motorists involved were preoccupied with the heavy volume of opposing or merging traffic. Although the vehicle was stopped, the motorist was apparently intently searching for a gap in the opposing traffic stream and reacted quickly to take advantage of the first acceptable gap as it occurred without again searching for pedestrians. Because three of the five pedestrian-vehicular accidents on the study segment were of the same type, the staff evaluated a number of alternative actions which the City of Cedarburg might consider to improve pedestrian safety.

Shown on Figure 3 are the locations where the pedestrian-vehicular accidents occurred on S. Washington Avenue--STH 57-STH 143--within the three year period considered. As already noted, two of the pedestrian-vehicular accidents occurred at the intersection of S. Washington Avenue--STH 57--and W. Western Road. The remainder of these accidents occurred at various locations. Thus, it may be concluded that no particular location is more hazardous than any other, with the exception of the S. Washington Avenue--STH 57--and W. Western Road intersection which, with two pedestrian-vehicular accidents on the W. Western Road approach may be modestly more hazardous than other locations. The installation of traffic signals, including pedestrian signals, may be expected to improve pedestrian safety at this intersection.

Currently there are 17 painted crosswalks on the 0.6-mile-long segment of S. Washington Avenue--STH 57-STH 143--between E. Hamilton Road and N. Sheboygan Road. These crosswalks are located at seven stop-sign controlled intersections, at two signalized intersections, and at one midblock location. In addition, several advance pedestrian warning signs are used in conjunction with

Figure 3

LOCATION OF PEDESTRIAN INVOLVED
MOTOR-VEHICLE ACCIDENTS: 1988-1990



NOT TO SCALE

Source: SEWRPC.

pedestrian crossing signs. Shown in Figure 4 are the locations of the painted crosswalks on the study segment of S. Washington Avenue--STH 57-STH 143--and the locations of the advance warning signs and pedestrian crossing signs.

Pedestrian and Motorist Education

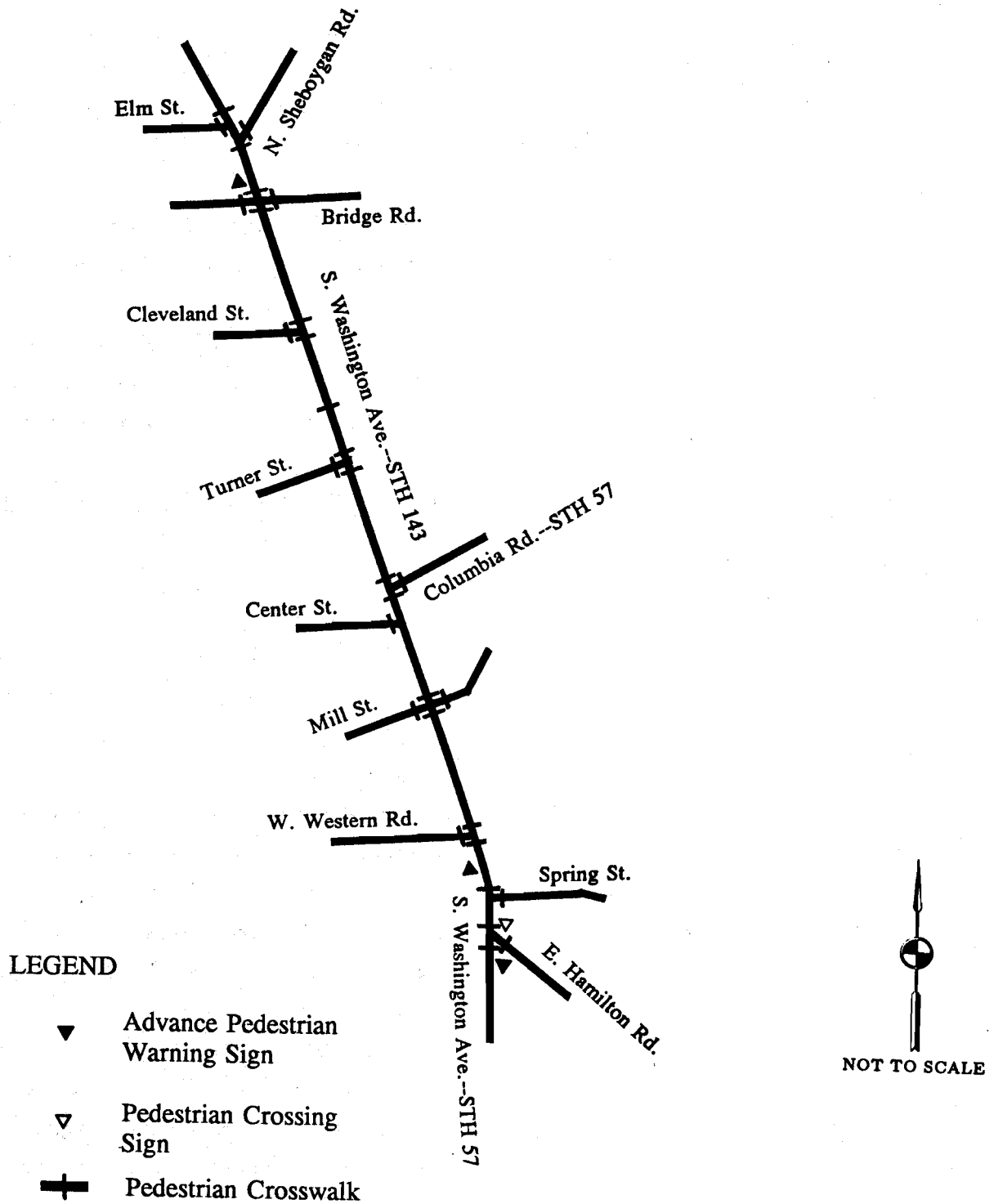
The first alternative action considered to alleviate the prevalent "vehicle turn with an attention conflict" type of accident is pedestrian and motorist education. Printed advertisements, posters, and pamphlets can be obtained and provided to community groups, businesses, and retirement communities. The advantage of this action is to emphasize to both motorists and pedestrians the danger in dividing their attention in this situation and to instill proper search behavior. This action is known to have been effective in other municipalities.

It is recommended that this action be implemented. The cost is estimated at \$1,000.

Additional education of pedestrians and motorists can also be provided by law enforcement personnel. Law enforcement personnel can be temporarily stationed at selected intersections along S. Washington Avenue--STH 57-STH 143--and can, through the observation of motorist behavior, ticket those motorists who fail to yield to pedestrians the right-of-way. In addition, law enforcement personnel can observe those pedestrians exhibiting unsafe behavior and instruct them in safe pedestrian behavior. Additional education and enforcement is an effective method of improving pedestrian safety. Therefore, it is recommended that the City consider increasing its law enforcement along the roadway segment concerned, particularly between the hours of 10:00 a.m. and 4:00 p.m. The disadvantages of this action include the potential for decreased compliance in the absence of a police officer, the diversion of police personnel from other duties, and the cost of law enforcement activity. The cost of this action is estimated at \$2,300 per year for about 75 hours of enforcement.

Figure 4

LOCATION OF PEDESTRIAN CROSSWALKS ON
S. WASHINGTON AVENUE--STH 57-STH 143: 1990



Source: SEWRPC.

Improve Crosswalk Pavement Markings

The second alternative action considered to alleviate the prevalent accident type on the study segment was to improve the visibility of the crosswalks between E. Hamilton Road and N. Sheboygan Road using epoxy pavement markings to provide a more visible reminder to motorists of the potential for the presence of pedestrians. Because the crosswalk at the Community Center is a mid-block crosswalk and may thus be unexpected by motorists, a ladder pattern, as shown in Figure 5, was considered to delineate the crosswalk at this location.

The advantage of epoxy pavement markings are increased visibility year-round of the crosswalks and a life expectancy of the markings measured in years compared to months for paint. The advantage of the ladder pattern for the mid-block crosswalk at the Community Center is increased visibility compared to the standard crosswalk delineation. The disadvantage of this action is the increased cost of the material compared to typical pavement marking paint.

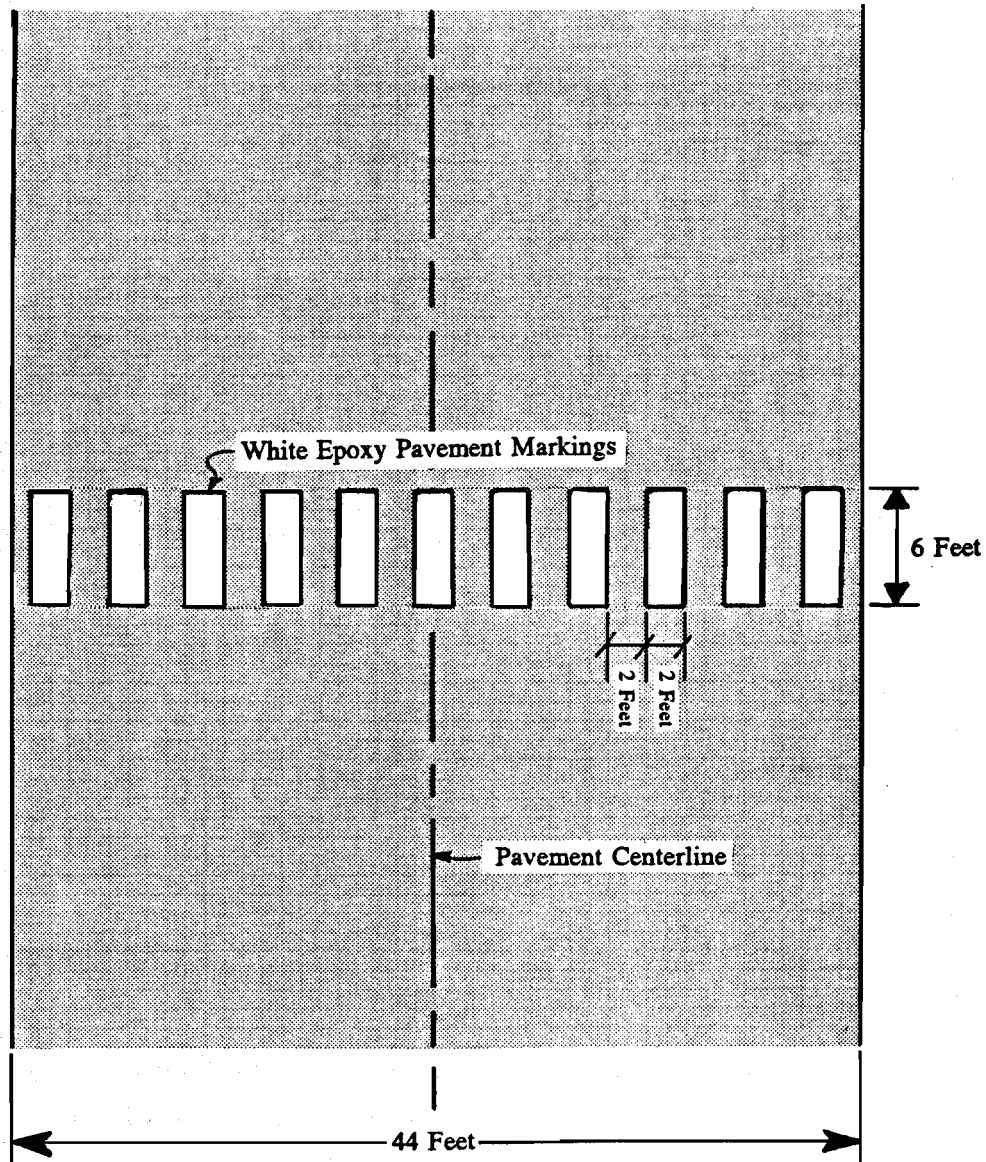
It is recommended that this action be implemented, as existing pavement markings require replacement. The cost is estimated at \$3,280.

Pedestrian Advance Warning and Crossing Signs

An additional alternative action considered to alert motorists to the presence and unexpected entry of pedestrians into the roadway is the placement of pedestrian advance warning "Pedestrian Crossing" signs. To alert motorists to the pedestrian crosswalk located at the Community Center, the installation of two pedestrian advance warning signs approximately 150 feet north and south of the crossing of S. Washington Avenue--STH 143--and two pedestrian crossing signs adjacent to the crosswalk facing northbound and southbound traffic, respectively, were considered. Additional locations where pedestrian crossing signs were considered for installation include the northbound and southbound approaches to the S. Washington Avenue--STH 57--intersection with W. Western Road; on the eastbound approach to the S. Washington Avenue--STH 143--intersection with Cleveland Street; and the east- and westbound approaches to the S. Washington Avenue--STH 57--intersection with Mill Street. These signs would provide additional information to the motorist on intersection approaches from which pedestrians have been struck.

Figure 5

LADDER PAVEMENT MARKING OF
CROSSWALK LOCATED AT COMMUNITY CENTER



Source: SEWRPC.

It is recommended that this action be implemented. The total cost is estimated at \$450.

Parking Prohibitions

An additional action considered to improve the ability of pedestrians and motorists to see and recognize each other, and to determine the other's intended actions is the prohibition of parking within 50 feet of a pedestrian crosswalk. The advantage of parking restrictions at crosswalk locations is to enable the motorist to identify a pedestrian prior to the pedestrian's entry into the street, thereby providing the motorist with increased reaction time to determine whether a conflict with the pedestrian will occur. The disadvantage of increasing parking restrictions is the loss of some of the available parking on S. Washington Avenue--STH 57--STH 143. Specifically, six parking spaces, including one on the northbound S. Washington Avenue--STH 57--approach at W. Western Road, one on the northbound approach on S. Washington Avenue--STH 143--at Turner Street, two on northbound S. Washington Avenue--STH 143, and one each on southbound S. Washington Avenue--STH 143--at the midblock crosswalk located at the Community Center and one located on the southbound S. Washington Avenue--STH 143--approach at Cleveland Street would be lost. These six parking spaces account for about 4 percent of the total spaces available on this section of roadway. Parking restrictions within 50 feet of a pedestrian crosswalk may be expected to significantly increase pedestrian safety. This action is recommended for implementation. The total cost is estimated at \$600.

Inappropriate Use of Pedestrian Crossing Sign: A pedestrian crossing sign identified as being inappropriately used is located approximately 250 feet south of Bridge Road on northbound S. Washington Avenue--STH 143. Pedestrian crossing signs, as recommended by The Manual on Uniform Traffic Control Devices, should be used to assist motorists in identifying the specific point of crossing and, when used, should be located immediately adjacent to the crossing location. This pedestrian crossing sign is not located near a crosswalk and is, therefore, inappropriately used. It is recommended that this sign be replaced with a pedestrian advance warning sign. The cost of this action is estimated as \$50.

Additional Measures Considered But Rejected

The following additional actions were considered for implementation but rejected; 1) the installation of pedestrian crossing advance warning signs at each end of the study segment on S. Washington Avenue--STH 57-STH 143; 2) the installation of "Pedestrian Crossing" signs at all the crosswalks within the study segment between E. Hamilton Road and N. Sheboygan Road; and 3) the installation of pedestrian crossing signs at selected additional crosswalk locations.

The use of advance warning signs at each end of the study segment was rejected because of the substantial traffic entering the study segment from the side streets which would not see the signs. Pedestrian crossing signs as recommended in The Manual on Uniform Traffic Control Devices should be used only at locations that are unusually hazardous or at locations where the crossing is not readily apparent. The crosswalks within the study segment at which pedestrian crossing signs have not been recommended do not warrant the use of pedestrian crossing signs.

SUMMARY

On March 5, 1990, City of Cedarburg officials requested that the Southeastern Wisconsin Regional Planning Commission consider and comment upon certain traffic management actions being considered by the City, including the installation of traffic signals at the intersection of S. Washington Avenue--STH 57--and W. Western Road; and the installation of flashing amber lights at selected crosswalks on S. Washington Avenue--STH 57-STH 143--between E. Hamilton Road and N. Sheboygan Road.

South Washington Avenue--STH 57-STH 143--between E. Hamilton Road and N. Sheboygan Road is constructed to a two-lane urban cross-section with curb and gutter, and parking is generally allowed throughout the study segment. South Washington Avenue--STH 57-STH 143--is a connecting highway and, as such, is a part of the state trunk highway system. Approval of the Wisconsin Department of Transportation is, therefore, required prior to the City's undertaking any

action substantially altering the use or capacity of this segment of S. Washington Avenue--STH 57-STH 143.

Capacity analyses of the intersection of S. Washington Avenue--STH 57 and W. Western Road were conducted to identify existing traffic congestion and excessive delay problems. The left-turn movement from eastbound W. Western Road onto northbound S. Washington Avenue--STH 57 was found to suffer delay during 12 hours of the day. However, the traffic involved represents less than 3 percent of the traffic entering the intersection during the 14-hour period when the traffic volumes were recorded. Analysis of existing traffic count data indicated that the volumes at this intersection meet the "interruption of continuous flow" warrant for the installation of traffic signals.

A three-year traffic accident history for the intersection of S. Washington Avenue--STH 57 and W. Western Road was compiled to provide an indication of the operating efficiency and operational characteristics of the intersection in the three-year study period. The history indicated that 14 accidents occurred at the intersection in the three-year period: four in 1988, four in 1989, and six in 1990. Because five or more accidents did not occur within any 12 month period which could be considered to be susceptible to correction by the installation of traffic signals, the accident experience warrant for signalization was not satisfied.

A pedestrian-vehicular accident history of S. Washington Avenue--STH 57-STH 143--between E. Hamilton Road and N. Sheboygan Street was also compiled to determine the number and severity of pedestrian-involved motor vehicle accidents. The history indicated that five pedestrian-involved accidents occurred in the three year period: two in 1988, one in 1989, and two in 1990. The predominant type of pedestrian-involved traffic accident was the "vehicle turn with an attention conflict," with three of the five accidents being of this type. The incidence of this type of accident indicates that motorists are intently preoccupied with entering the high volume S. Washington Avenue--STH 57-STH 143--traffic stream and, therefore, not identifying pedestrians simultaneously crossing the street.

The installation of traffic signals at the intersection of W. Western Road and S. Washington Avenue--STH 57--is recommended to address the congestion and vehicular accident problems which exist at this intersection. The provision of an exclusive left-turn lane for the northbound approach of S. Washington Avenue--STH 57--is also recommended whether or not the intersection is signalized. Although traffic on S. Washington Avenue--STH 57--may be expected to experience increased delay with increased fuel consumption, and increased pollutant emissions at the intersection as a result of signalization, increased gaps for left-turning vehicles and improved traffic safety provided may be expected to offset the disadvantages. The provision of the northbound left-turn lane would require the prohibition of parking on the east side of S. Washington Avenue--STH 57--between Spring Street and a point approximately 100 feet north of W. Western Road.

The installation of flashing amber beacons at selected locations along S. Washington Avenue--STH 57--STH 143 is not recommended. This action is not recommended because studies indicate that such beacons are ineffective as warnings of intermittent conditions; may actually increase vehicle speeds under such conditions; and may give pedestrians a false sense of security.

To address the City's concern with pedestrian safety and because three of the five pedestrian-vehicular accidents were the same type, a number of alternative actions were considered. The alternatives recommended to the City for consideration and the estimated cost of implementation are set forth in Table 3.

Three additional alternatives actions were considered but rejected. These included: 1) installation of pedestrian crossing advance warning signs at each end of the study segment on S. Washington Avenue--STH 57--STH 143; 2) installation of pedestrian crossing signs at all crosswalks within the study segment; and 3) installation of pedestrian crossing signs at selected additional crosswalk locations.

Table 3

ALTERNATIVE ACTIONS RECOMMENDED FOR
CONSIDERATION TO INCREASE PEDESTRIAN SAFETY

Recommendations	Estimated Cost
Pedestrian and motorist education.....	\$1,000
Increase law enforcement by approximately 75 hours on a random basis.....	2,300
Re-mark the existing crosswalks with epoxy pavement markings and re-mark the crosswalk at the Community Center in a ladder pattern.....	3,280
Locate "Pedestrian Crossing" signs at the crosswalks on the north and south approaches to the Washington Avenue--STH 57--intersection with W. Western Road; the eastbound intersection approach at Washington Avenue--STH 57--and Cleveland Street; the east- and westbound intersection approaches at Washington Avenue-- STH 57--and Mill Street; and at the north- and southbound approaches at the crosswalk located at the Community Center. Locate additional advance "Pedestrians" warning signs 150 feet north and south of the crosswalk at the Community Center.....	450
Improve pedestrian and motorist visibility by prohibiting parking within 50 feet of crosswalks..	600
Replace inappropriately used "Pedestrian Crossing" sign 250 feet south of Bridge Road with advance "Pedestrian Crossing" sign.....	50

Source: SEWRPC.

APPENDICES

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COLLISION DIAGRAM

Southeastern Wisconsin Regional Planning Commission

INTERSECTION W. Western Road & S. Washington Avenue (STH 57)

PERIOD 1988

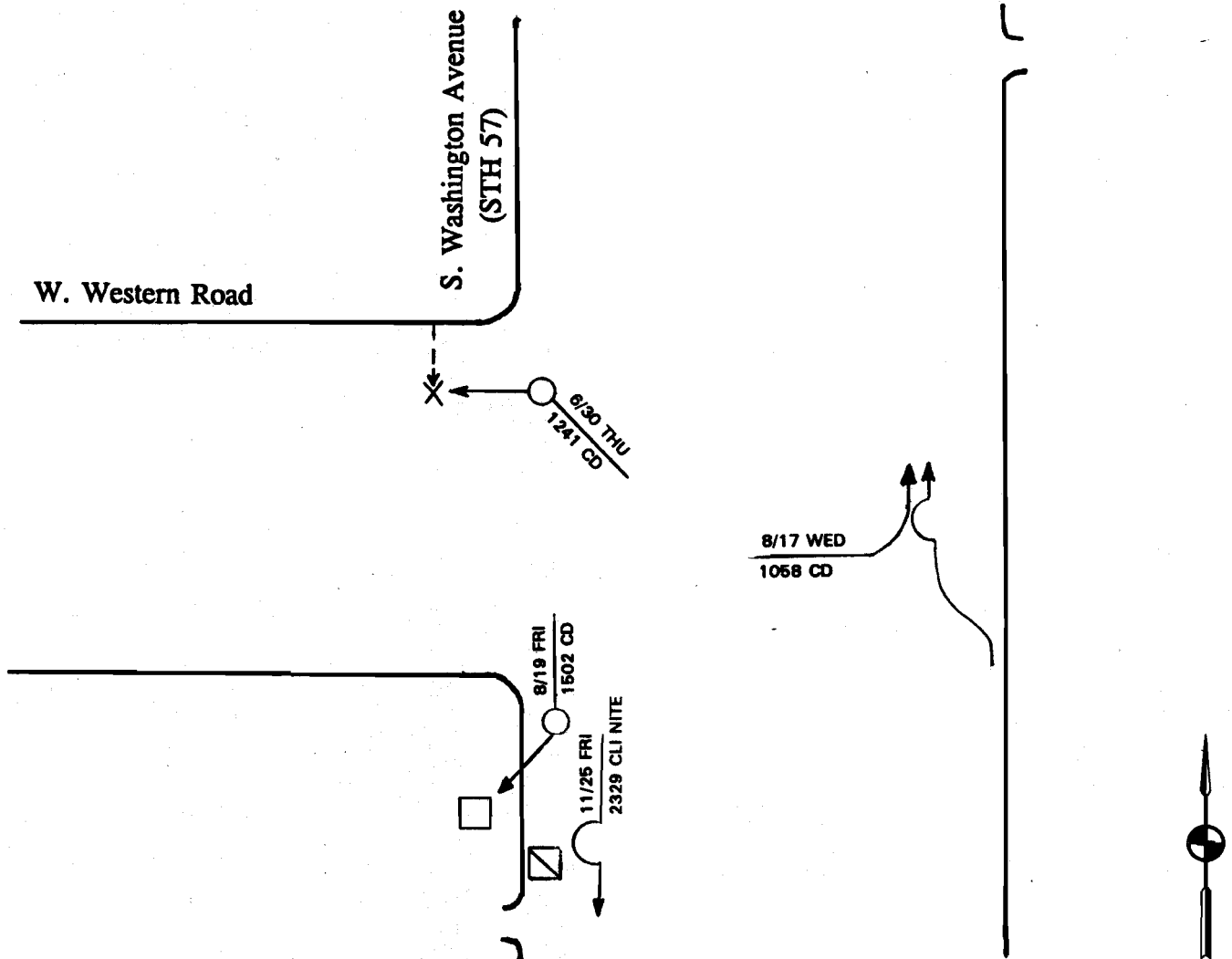
FROM

TO

MUNICIPALITY Cedarburg

PREPARED BY

SEWRPC



SHOW FOR EACH ACCIDENT	LEGEND		SUMMARY			
1. Time, Day & Date	SYMBOLS Moving vehicle Backing vehicle Non-involved vehicle Pedestrian Bicycle Parked vehicle Fixed object Fatal accident Injury accident	TYPES OF COLLISION Rear end Head on Side swipe Out of control Left turn Right angle	Type	Day	Night	Total
2. Pavement: D = Dry I = Icy W = Wet			Fatal	--	--	--
3. Weather C = Clear; F = Fog; R = Rain; SL = Sleet; SN = Snow; CL = Cloudy			Pedestrian Injury	1	--	1
4. NITE - If between dusk and dawn.			Other Injury	1	--	1
			Property Damage Only	1	1	2
			Total	3	1	4

COLLISION DIAGRAM

Southeastern Wisconsin Regional Planning Commission

INTERSECTION W. Western Road & S. Washington Avenue (STH 57)

PERIOD 1989

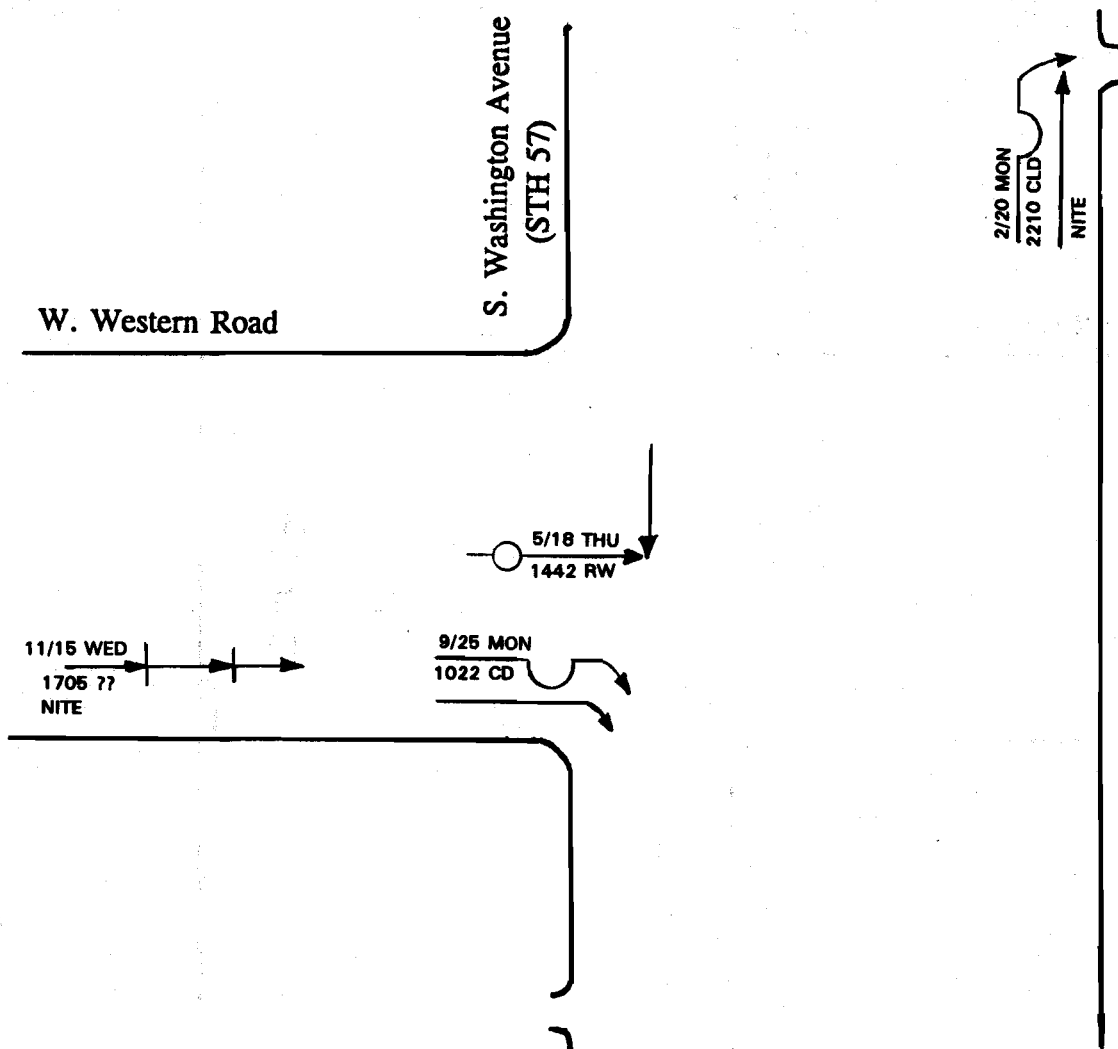
FROM

TO

MUNICIPALITY Cedarburg

PREPARED BY

SEWRPC



SHOW FOR EACH ACCIDENT	LEGEND		SUMMARY			
	SYMBOLS	TYPES OF COLLISION	Type	Day	Night	Total
1. Time, Day & Date	← Moving vehicle	← ← Rear end	Fatal	--	--	--
2. Pavement: D = Dry I = Icy W = Wet	←>>> Backing vehicle	← ← Head on	Pedestrian Injury	--	--	--
3. Weather C = Clear; F = Fog; R = Rain; SL = Sleet; SN = Snow; CL = Cloudy	← Non-involved vehicle	← Side swipe	Other Injury	1	--	1
4. NITE - If between dusk and dawn.	X Pedestrian	← Out of control	Property Damage Only	1	2	3
	○ Bicycle	← Left turn	Total	2	2	4
	◻ Parked vehicle	← Right angle				
	◻ Fixed object					
	● Fatal accident					
	○ Injury accident					

COLLISION DIAGRAM

Southeastern Wisconsin Regional Planning Commission

INTERSECTION W. Western Road & S. Washington Avenue (STH 57)

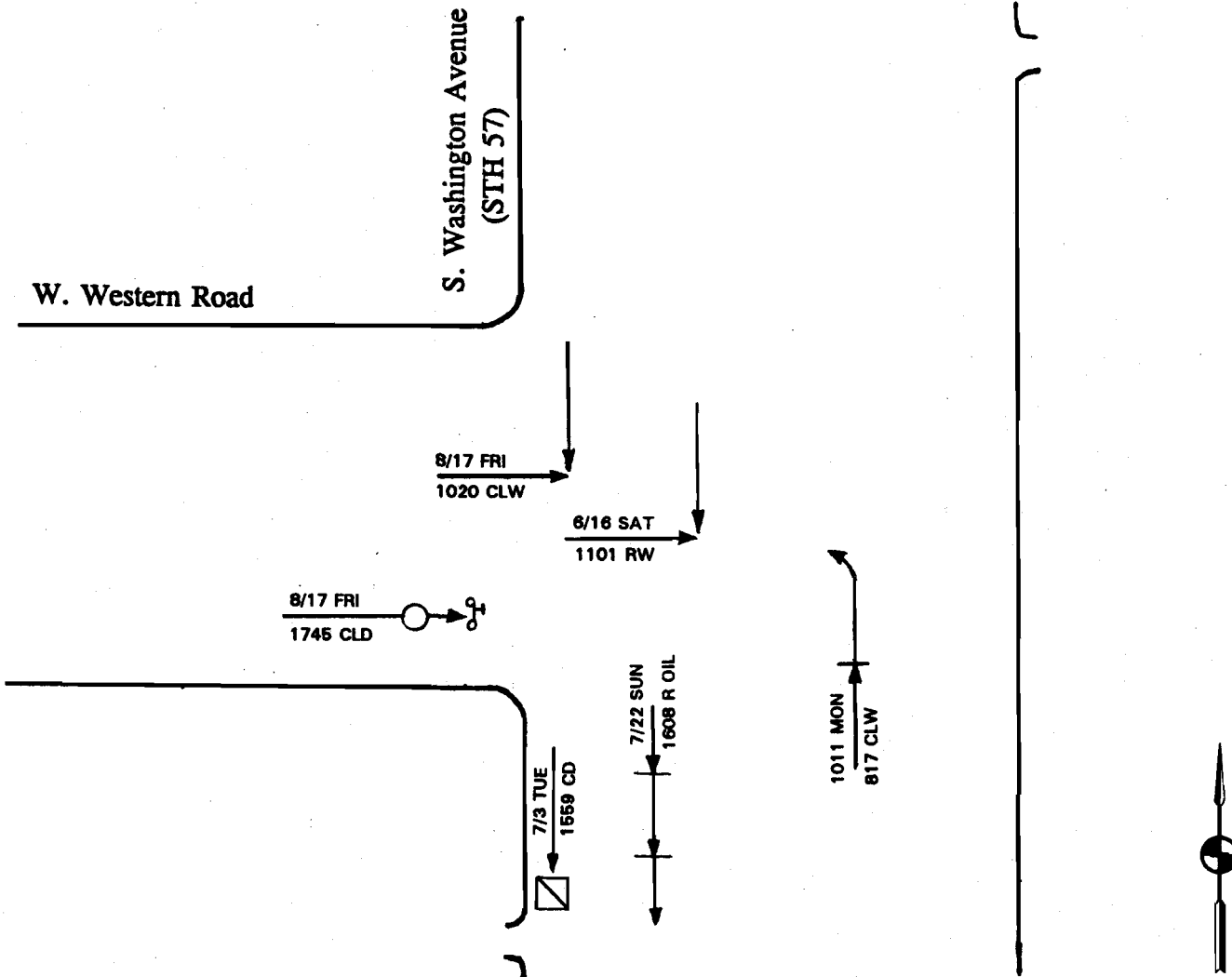
PERIOD 1990

FROM

TO

MUNICIPALITY Cedarburg

PREPARED BY SEWRPC



SHOW FOR EACH ACCIDENT	LEGEND		SUMMARY			
1. Time, Day & Date	SYMBOLS Moving vehicle Backing vehicle Non-involved vehicle Pedestrian Bicycle Parked vehicle Fixed object Fatal accident Injury accident	TYPES OF COLLISION Rear end Head on Side swipe Out of control Left turn Right angle	Type	Day	Night	Total
2. Pavement: D = Dry I = Icy W = Wet			Fatal	--	--	--
3. Weather C = Clear; F = Fog; R = Rain; SL = Sleet; SN = Snow; CL = Cloudy			Pedestrian Injury	--	--	--
4. NITE - If between dusk and dawn.			Other Injury	1	--	1
			Property Damage Only	5	--	5
			Total	6	--	6