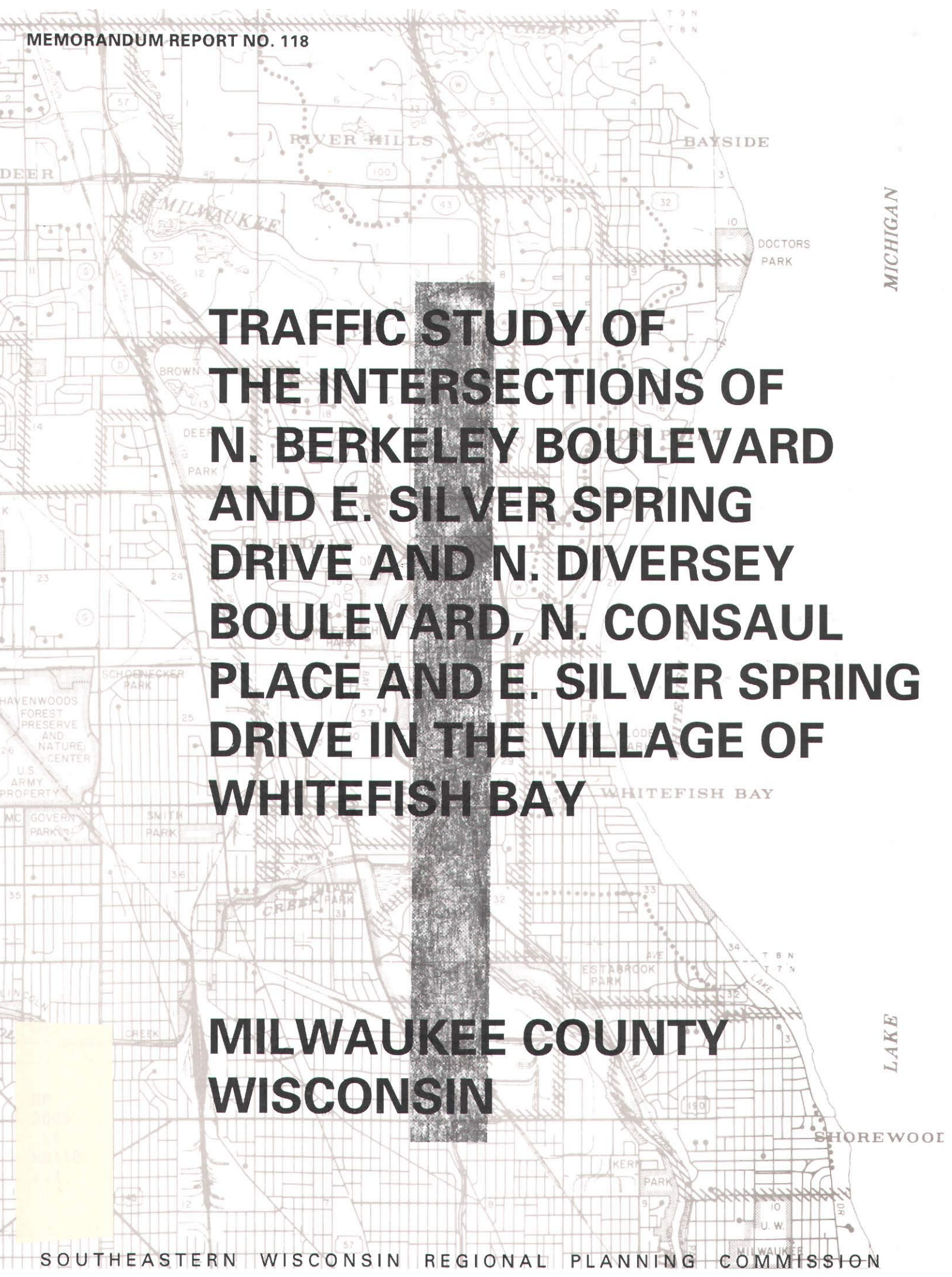
MEMORANDUM REPORT NO. 118



TRAFFIC STUDY OF THE INTERSECTIONS OF N. BERKELEY BOULEVARD AND E. SILVER SPRING DRIVE AND N. DIVERSEY BOULEVARD, N. CONSAUL PLACE AND E. SILVER SPRING DRIVE IN THE VILLAGE OF WHITEFISH BAY

MILWAUKEE COUNTY WISCONSIN

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

Special acknowledgement is due Mr. Robert E. Beglinger, SEWRPC Principal Engineer, and Mr. Matthew J. Smith, SEWRPC Engineer, for their contributions to the conduct of this study and the preparation of this report.

MEMORANDUM REPORT
NUMBER 118

TRAFFIC STUDY OF THE INTERSECTIONS OF N. BERKELEY BOULEVARD AND E. SILVER SPRING DRIVE AND N. DIVERSEY BOULEVARD, N. CONSAUL PLACE AND E. SILVER SPRING DRIVE IN THE VILLAGE OF WHITEFISH BAY

MILWAUKEE COUNTY, WISCONSIN

Prepared by the

Southeastern Wisconsin Regional Planning Commission
P. O. Box 1607
Old Courthouse
916 N. East Avenue
Waukesha, Wisconsin 53187-1607

The preparation of this publication was financed in part by planning funds provided by the Wisconsin Department of Transportation and the U. S. Department of Transportation, Federal Highway and Federal Transit Administrations.

November 1996

Inside Region $ 5.00
Outside Region $10.00

(This page intentionally left blank)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

SEWRPC Memorandum Report No. 118

TRAFFIC STUDY OF THE INTERSECTIONS OF N. BERKELEY BOULEVARD AND E. SILVER SPRING DRIVE AND N. DIVERSEY BOULEVARD, N. CONSAUL PLACE AND E. SILVER SPRING DRIVE IN THE VILLAGE OF WHITEFISH BAY

INTRODUCTION

In letters dated January 9 and February 19, 1996, the Village of Whitefish Bay requested that the Regional Planning Commission staff conduct traffic signal warrant analyses both at the intersection of E. Silver Spring Drive and N. Berkeley Boulevard and at the intersection of E. Silver Spring Drive, N. Diversey Boulevard, and N. Consaul Place. The request for this intersection analysis originated with an E. Silver Spring Drive business concerned about the difficulty which pedestrians experienced crossing E. Silver Spring Drive. The Commission staff surveyed and analyzed the traffic conditions at the two intersections in the summer of 1996, identified traffic operation problems at the intersections, and evaluated and recommended alternative actions to improve the operation of the two intersections.

INTERSECTION OF E. SILVER SPRING DRIVE AND N. BERKELEY BOULEVARD

Functional and Jurisdictional Classification

East and W. Silver Spring Drive is an arterial street with the principal function of carrying through traffic. At its intersection with N. Berkeley Boulevard, E. Silver Spring Drive is under the jurisdiction of the Village of Whitefish Bay. The recommended jurisdiction of E. Silver Spring Drive, under the currently adopted Milwaukee County Jurisdictional Highway System Plan, is that of a county trunk highway, as it principally serves to carry through traffic from municipality to municipality within Milwaukee County. Berkeley Boulevard, within the Village of Whitefish Bay, is a non-arterial land access street with the principal

function of providing access to abutting property, and is under the jurisdiction of the Village of Whitefish Bay.

Intersection Physical and Operational Characteristics

The intersection of E. Silver Spring Drive and N. Berkeley Boulevard is a "three-legged, tee" intersection as shown on Figure 1. Both intersecting roadways are constructed to urban cross-sections. North Berkeley Boulevard has an existing pavement width of 30 feet from curb face to curb face and a posted speed limit of 25 miles per hour. Parking is allowed on both the east and west sides of N. Berkeley Boulevard but not in the immediate vicinity of the intersection. An alley is located approximately 120 feet south of the intersection on both the east and west sides of the roadway.

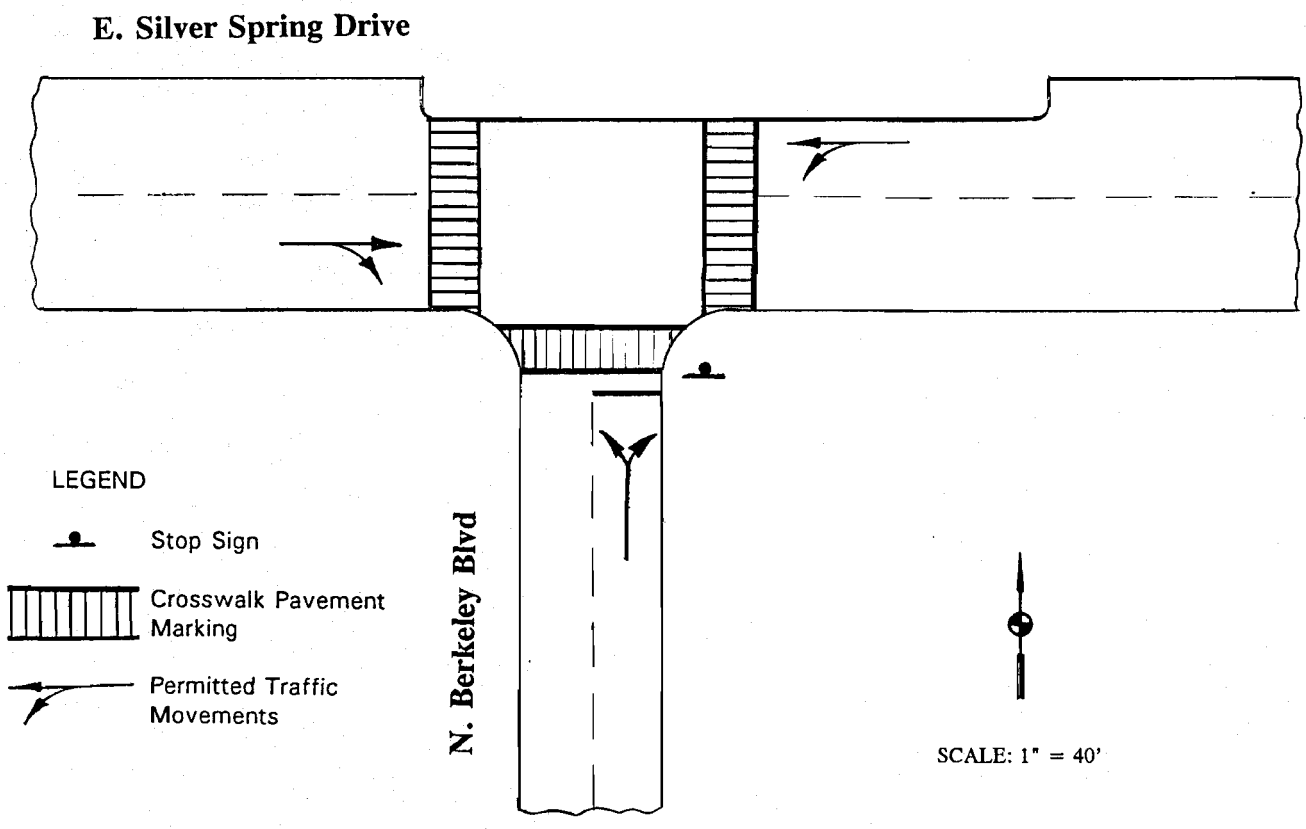
East Silver Spring Drive has a posted speed limit of 25 miles per hour and generally has an existing pavement width of 48 feet from curb face to curb face except in the area of the 130 foot pavement choker on the north side of E. Silver Spring Drive. This pavement choker extends from a point 20 feet west to a point 80 feet east of N. Berkeley Boulevard and reduces the existing pavement width to 40 feet from curb face to curb face. Parking is allowed on both the north and south sides of E. Silver Spring Drive in all areas where the pavement is 48 feet wide but only on the south side where the pavement is 40 feet wide. There are no commercial or private driveways on E. Silver Spring Drive between N. Santa Monica Boulevard and N. Diversey Boulevard.

The existing traffic control at the intersection of E. Silver Spring Drive and N. Berkeley Boulevard is provided by a stop sign on the northbound N. Berkeley Boulevard approach only.

It should be noted that the intersection of E. Silver Spring Drive and N. Berkeley Boulevard is located one block--about 350 feet--east of the intersection of E. Silver Spring Drive and N. Santa Monica Boulevard which is currently traffic signal controlled, and has pedestrian signals and crosswalk pavement markings on all four approaches.

Figure 1

EXISTING N. BERKELEY BLVD AND E. SILVER SPRING DRIVE INTERSECTION: 1996



Source: SEWRPC.

Traffic Volumes

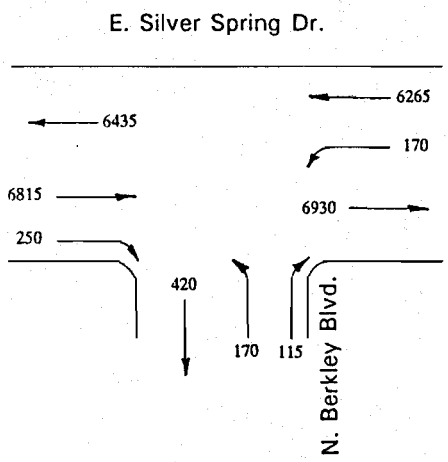
In order to evaluate the potential need for traffic control signals at this intersection under current operating conditions, the Commission staff conducted manual turning movement counts and 24 hour machine traffic counts in June, 1996. The manual turning movement volume data was collected from 6:00 a.m. to 6:00 p.m. This time period included both the morning and evening peak hours of traffic flow. Based upon the 24 hour machine traffic counts approximately 13,785 vehicles entered the intersection on an average weekday in 1996. Based upon the 12 hour manual turning movement counts, approximately 10,580 vehicles entered the intersection between 6:00 a.m. and 6:00 p.m. on an average weekday in 1996. The morning and evening peak hour manual turning movement counts are shown on Figure 2 along with the estimated 1996 average weekday turning movement volumes.

The hourly traffic volumes observed during an average weekday on E. Silver Spring Drive between N. Berkeley Boulevard and N. Diversey Boulevard is shown on Figure 3. Unlike many arterials in the Southeastern Wisconsin Region on which traffic typically experiences two very distinct peak hours, one in the morning and one in the evening, there are three peak hours on this segment of E. Silver Spring Drive: morning, midday, and evening peak hours. On an average weekday, traffic on this segment of E. Silver Spring Drive decreases only moderately after the morning peak hour. Traffic then increases significantly to another peak in the midday and then decreases moderately again in the midafternoon before increasing to another peak in the evening peak hour. While commuter traffic is largely responsible for the morning and evening peaks, the midday peak reflects the trip generation characteristics of shopping trips to and from the Village central business district and the Bay Shore Shopping Center.

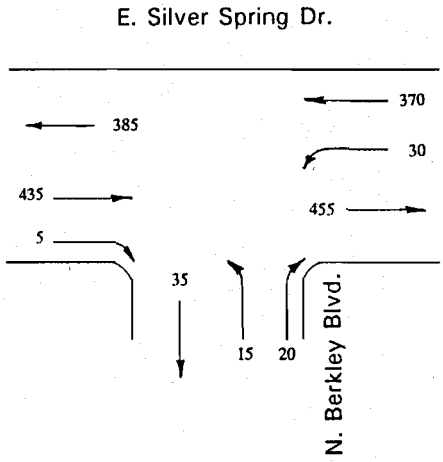
The 1996 manual turning movement count data indicated that turning movements accounted for about 4 percent of all movements at this intersection between 6:00 a.m. and 6:00 p.m. Similarly, during both the morning and evening peak hours, about 4 percent of all vehicles were observed turning. Vehicular delay observed on the northbound approach to the subject intersection was minimal, and vehicular queues did not exceed two vehicles.

Figure 2

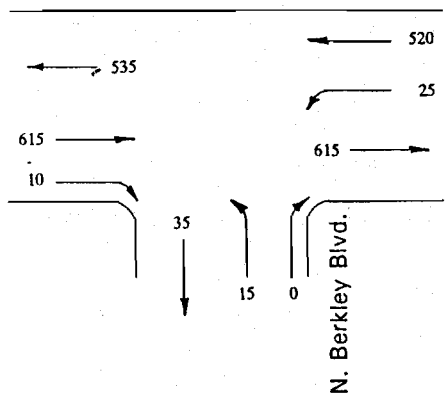
TURNING MOVEMENT TRAFFIC VOLUMES AT
N. BERKELEY BOULEVARD AND E. SILVER SPRING DRIVE: 1996



1996 Estimated Average Weekday
Turning Movement Volumes



1996 Morning Peak Hour
Turning Movement Volumes
8:00 a.m. to 9:00 a.m.



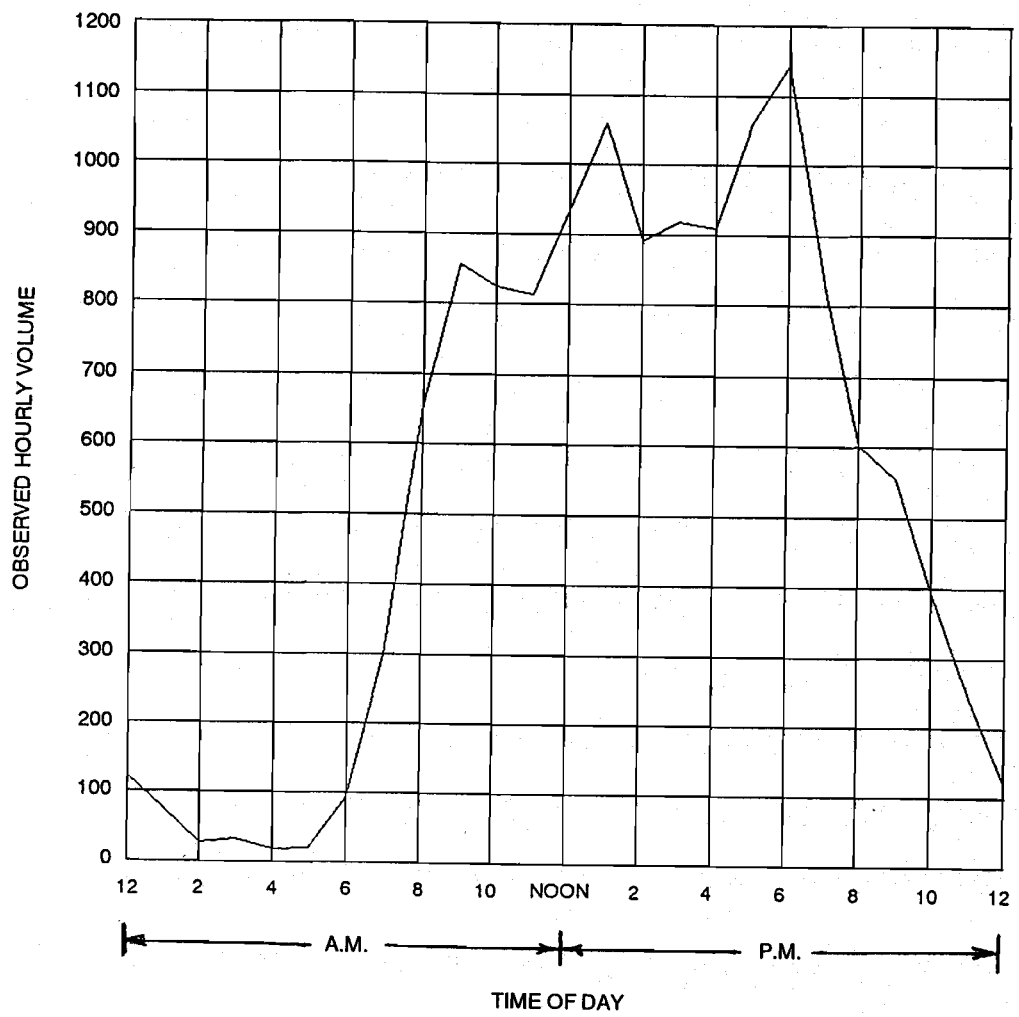
1996 Evening Peak Hour
Turning Movement Volumes
4:30 p.m. to 5:30 p.m.

Not to Scale

Source: SEWRPC.

Figure 3

HOURLY VARIATION IN AVERAGE WEEKDAY TRAFFIC
OBSERVED ON E. SILVER SPRING DRIVE EAST OF
N. BERKELEY BOULEVARD: JUNE, 1996



Source: SEWRPC.

Along with the traffic volume data, vehicular gap data were also collected from 11:00 a.m. to 2:00 p.m. These hours were observed to correspond to the those hours when both pedestrian activity and traffic volumes were observed to be heavy. It may be noted that, for the purposes of this study, a vehicular gap is the time interval during which no vehicle traveling in either direction on E. Silver Spring Drive crossed a designated point such as a crosswalk. Data on pedestrian activity will be presented later in this section.

Specifically, gap data were collected to determine the number of gaps in the E. Silver Spring Drive traffic stream at two different thresholds: 1) gaps having a minimum duration of eight seconds; and, 2) gaps having a minimum duration of 11 seconds. The 11 second gap includes adequate time for a pedestrian to cross E. Silver Spring Drive at a speed of four feet per second with perception and reaction time.[1] The number of gaps observed is shown in Table 1.

Comparison of the hourly gap data in Table 1 to the traffic volumes observed on E. Silver Spring Drive indicates that approximately 60 gaps occurred when the volume ranges from about 900 to 950 vehicles per hour. As the observed volumes increased to about 1,050, the number of gaps observed decreased to about 48. It should be noted that the existing traffic signals on E. Silver Spring Drive within the Village operate as an coordinated system and have a signal cycle length of 75 seconds. Because a 75 second cycle occurs 48 times during a one hour period, and because traffic on E. Silver Spring Drive is stopped during that part of the cycle apportioned to green time on the cross street thereby permitting pedestrians to cross, 48 represents the likely lower limit with respect to the number of gaps which would be long enough to permit pedestrians to cross E. Silver Spring Drive.

---

[1]It may be noted that although 11 seconds represents the minimum gap based upon generally accepted traffic engineering standards, many pedestrians were observed to reduce the gap required by crossing one lane at a time thereby eliminating the need for a gap of at least 11 seconds in the bi-directional traffic stream. That is, some pedestrians would cross the near traffic lane to a point near the center of the roadway even when there was traffic in the far traffic lane, and then cross the far traffic lane when a gap in traffic in that lane occurred.

Table 1

NUMBER OF ELEVEN SECOND GAPS OBSERVED IN THE E. SILVER SPRING DRIVE TRAFFIC STREAM AT ITS INTERSECTION WITH N. BERKELEY BOULEVARD DURING SELECTED HOURS ON A SUMMER WEEKDAY: 1996

Hour	Number of Gaps Observed Having a Minimum Duration of Eleven Seconds	E. Silver Spring Drive Traffic Volumes (Vehicles per Hour)
11:00 a.m. to Noon	66	935
Noon to 1:00 p.m.	48	1060
1:00 p.m. to 2:00 p.m.	57	890
Average	57	962

Source: SEWRPC.

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 from January 1, 1993, to December 31, 1995, for the intersection of E. Silver Spring Drive and N. Berkeley Boulevard was collected and analyzed. No motor vehicle or pedestrian accidents occurred at the intersection during the three-year period concerned.

Pedestrian Volumes

In addition to conducting manual vehicular turning movement counts, the Commission staff also counted pedestrians crossing E. Silver Spring Drive at its intersection with N. Berkeley Boulevard. The number of pedestrians observed crossing E. Silver Spring Drive at this intersection between the hours of 6:00 a.m. and 6:00 p.m. is set forth by hour in Table 2. The corresponding traffic volumes entering the intersection on E. Silver Spring Drive and which would conflict with the pedestrian crossings are also shown in Table 2.

Identification of Potential Traffic Problems

The inventory data were compared to traffic engineering and geometric design standards to determine if any potential traffic operational or safety problems or geometric design problems exist at the subject intersection. As previously noted, delay was observed to be minimal and no accidents occurred during the three year period reviewed.

As previously noted, a concern was raised by a business in the proximity of this intersection regarding the ability of pedestrians to cross E. Silver Spring Drive. In areas of high pedestrian activity, the existence of adequate gaps in the traffic stream is fundamental to safe and efficient pedestrian crossings. An adequate gap includes the time required for an individual to cross the roadway at a rate of four feet per second, and an additional three seconds for an individual to assess whether or not a sufficient gap is available and then make a decision to cross the roadway.

Because E. Silver Spring Drive has an effective pavement width of 32 feet (40 feet wide with an eight foot parking lane), a gap of 11 seconds is required in

Table 2

THE NUMBER OF PEDESTRIANS OBSERVED CROSSING E. SILVER SPRING DRIVE AT ITS INTERSECTION WITH N. BERKELEY BOULEVARD AND CONFLICTING E. SILVER SPRING DRIVE TRAFFIC VOLUMES BETWEEN THE HOURS OF 6:00 A.M. AND 6:00 P.M. ON AN AVERAGE WEEKDAY: JUNE, 1996

Time	Pedestrians Observed Crossing E. Silver Spring Drive	Conflicting Traffic Volumes Observed on E. Silver Spring Drive
6:00 a.m. to 7:00 a.m.	4	295
7:00 a.m. to 8:00 a.m.	9	655
8:00 a.m. to 9:00 a.m.	24	855
9:00 a.m. to 10:00 a.m.	26	825
10:00 a.m. to 11:00 a.m.	49	815
11:00 a.m. to Noon	21	935
Noon to 1:00 p.m.	45	1060
1:00 p.m. to 2:00 p.m.	57	890
2:00 p.m. to 3:00 p.m.	39	920
3:00 p.m. to 4:00 p.m.	37	910
4:00 p.m. to 5:00 p.m.	33	1060
5:00 p.m. to 6:00 p.m.	16	1145

Source: SEWRPC.

the traffic stream. Observation indicated that an average of approximately 57 gaps per hour had a minimum duration of 11 seconds and, thus, are of sufficient length to allow pedestrians to cross E. Silver Spring Drive between the hours of 11:00 a.m. to 2:00 p.m. on an average weekday, although only 48 such gaps were observed between noon and 1:00 p.m.

According to the Manual on Uniform Traffic Control Devices[2], at least one gap of sufficient length for safe pedestrian crossing per minute is desirable, or 60 gaps per hour. While observation indicates that this standard is generally met throughout an average weekday, there are hours during the day when the standard may not be met--specifically from 12:00 noon to 2:00 p.m. Thus it may be concluded that the provision of additional gaps in the E. Silver Spring Drive traffic stream having a minimum duration of 11 seconds would be desirable.

Alternative Actions Considered to Create Additional Gaps in the E. Silver Spring Drive Traffic Stream

Because of the limited number of gaps, consideration was given to means to create more gaps. The first action considered to create more gaps for pedestrians in the E. Silver Spring Drive traffic stream was to prohibit right turns on red from northbound N. Santa Monica Drive at its intersection with E. Silver Spring Drive between 6:00 a.m. to 6:00 p.m. Currently, right turns on red are prohibited between the hours of 7:00 a.m. to 9:00 a.m., and 3:00 p.m. to 5:00 p.m. at the intersection of N. Santa Monica Boulevard and E. Silver Spring Drive. The advantage of this action would be the provision of more gaps for pedestrians to cross E. Silver Spring Drive at its intersection with N. Berkeley Boulevard. The disadvantage of this action is that vehicles which currently turn right on red would incur additional delay. Because this action would be expected to provide additional gaps in the E. Silver Spring Drive traffic stream, it is recommended to be implemented at an estimated cost of $200.

---

[2]U.S. Department of Transportation, Federal Highway Administration, "Warrants for the Installation of Traffic Control Signals", Manual On Uniform Traffic Control Devices, 1988.

Another action considered to create more gaps for pedestrians was the installation of "CROSSWALK" signs at the crosswalks on E. Silver Spring Drive facing eastbound and westbound traffic. The advantage of such signing is that it alerts motorists to the existence and location of the crosswalks. Because motorists are required to stop for pedestrians in a marked crosswalk, this signing also alerts motorist to the potential need to stop. The disadvantage of this signing is that it may be "lost" in the signing and lighting of the surrounding commercial district. It is recommended that the installation of "CROSSWALK" signs facing east- and westbound E. Silver Spring Drive traffic be implemented at an estimated cost of $250.

Another action considered to create more gaps for pedestrians in the E. Silver Spring Drive traffic stream was the construction of a refuge island in the center of the roadway on both the east- and westbound intersection approaches. A four foot wide median island would provide refuge for pedestrians while crossing E. Silver Spring Drive. It would decrease the effective pavement width from 32 feet to 28 feet and the width of pavement to be crossed between areas of refuge from 32 feet to only 14 feet. The proposed islands would be similar to the islands constructed on N. Lake Drive at its intersection with E. Day Avenue in 1987 to assist pedestrians in crossing N. Lake Drive. The advantage of this action is that it would reduce the required gaps for pedestrians to safely cross the street from 11 to eight seconds thereby increasing the average number of gaps per hour of sufficient length to cross E. Silver Spring Drive between 11:00 a.m. and 2:00 p.m. from 57 to 114, as shown in Table 3, an increase 100 percent. A potential disadvantage to this action is that a fixed object would be located in the center of the roadway representing a potential traffic safety hazard and complicating snow removal efforts. Because this action may be expected to reduce the duration of gap required while simultaneously providing additional gaps of adequate duration in the E. Silver Spring Drive traffic stream, it is recommended to be implemented at an estimated cost of $1,150.

At the specific request of the Village, the installation of traffic signals was also considered. The installation of a traffic signal should be considered only if one or more of the warrants set forth in the Manual on Uniform Traffic Control Devices is met. A total of six traffic signal warrants were considered, one

Table 3

NUMBER OF EIGHT SECOND GAPS OBSERVED IN THE E. SILVER SPRING DRIVE TRAFFIC STREAM AT ITS INTERSECTION WITH N. BERKELEY BOULEVARD DURING SELECTED HOURS ON A SUMMER WEEKDAY: 1996

Hour	Number of Gaps Observed Having a Minimum Duration of Eight Seconds	E. Silver Spring Drive Traffic Volumes (Vehicles per Hour)
11:00 a.m. to Noon	117	935
Noon to 1:00 p.m.	114	1060
1:00 p.m. to 2:00 p.m.	111	890
Average	114	962

Source: SEWRPC.

related to traffic accidents, one related to pedestrian volumes and four related to traffic volumes. When the warrants are not satisfied, the installation of traffic signals may be expected to significantly increase delay and may have the potential to increase traffic accidents. If the assessment of the traffic signal warrants indicates that a warrant is satisfied, then the potential for an increase in traffic delay and accidents would be expected to be minimized.

Due to the absence of any traffic accidents at this intersection over the past three years, the warrant for the installation of traffic signals based upon the accident experience of the intersection is not met at the present time.

The second traffic signal installation warrant considered was the minimum pedestrian volume warrant. Under this warrant pedestrian volumes on a average day must exceed one of the following thresholds: 1) 100 or more for each of any four hours; or, 2) 190 or more pedestrians for any one hour; and, there must be fewer than 60 gaps per hour in the traffic stream of adequate length for pedestrians to cross during the same time period when the pedestrian volume criterion is satisfied. As shown in Table 2, the pedestrian volume crossing E. Silver Spring Drive at its intersection with N. Berkeley Boulevard was not observed to exceed 100 pedestrians in any hour on an average weekday in 1996. In addition, pedestrian crossings exceeded 50 in just one hour--1:00 p.m. to 2:00 p.m., although in one other hour--10:00 a.m. to 11:00 a.m.--the number of pedestrian crossings was within one pedestrian of 50. Therefore it may be concluded that the warrant for the installation of traffic signals based upon pedestrian volumes is not met at the present time.

The first traffic volume 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 higher volume minor street approach meet or exceed specified minimum volume requirements for any eight hours of an average weekday[3]. The minimum volume requirements at this intersection are

---

[3]Because right turns on red are permitted under Wisconsin Statutes, the Commission staff, along with many other public works and traffic engineering agencies in Southeastern Wisconsin, generally utilizes only one-half of the observed right turning volume when conducting traffic volume signal warrant analyses.

500 vehicles per hour on the E. Silver Spring Drive approaches and 150 vehicles per hour on the N. Berkeley Boulevard approach. Although the sum of the approach traffic volumes on both E. Silver Spring Drive approaches meets or exceeds the warrant traffic volume during each of the eight highest hours, the warrant is not met, as the traffic volume on the N Berkeley Boulevard approach does not exceed 20 vehicles, or 13 percent, of the warrant traffic volume during any of those hours. The findings of this analysis are summarized in Table 4.

The second traffic volume warrant considered--the interruption of continuous traffic warrant--is satisfied when the traffic volume on E. Silver Spring Drive--measured as the total on both approaches--exceeds 750 vehicles per hour for any eight hours, and when the traffic volume on N. Berkeley Boulevard exceeds 75 vehicles per hour for the same eight hours. Although E. Silver Spring Drive traffic volumes meet or exceed the warrant volume during each of the eight highest hours, the warrant is not met as the traffic volume on the N. Berkeley Boulevard approach does not exceed 20 vehicles, or 27 percent of the warrant volume during any of those hours. The findings of this analysis are summarized in Table 4.

The third warrant considered--the peak hour volume warrant--is satisfied when the number of vehicles per hour on E. Silver Spring Drive--measured as the total on both approaches--and the corresponding vehicles per hour on N. Berkeley Boulevard for any one hour--or any four consecutive 15-minute periods--of an average day are above the applicable curve on Figure 4. As shown on Figure 4, this warrant is not met, as the point of intersection of the corresponding traffic volumes falls below the single lane/single lane warrant curve in both of the morning and evening peak hours.

The fourth warrant considered--the four hour volume warrant--is satisfied when during each of any four hours of an average day, the number of vehicles per hour on E. Silver Spring Drive--measured as the total on both approaches--and the corresponding number of vehicles per hour on the N. Berkeley Boulevard approach are all above the curve on Figure 5 for the existing combination of approach lanes. As shown on Figure 5 this warrant is not met, as the point of intersection

Table 4

TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS AT THE INTERSECTION OF
N. BERKELEY BOULEVARD AND E. SILVER SPRING DRIVE IN THE VILLAGE OF WHITEFISH BAY

SIGNAL WARRANT 1--MINIMUM VEHICULAR VOLUME

NUMBER OF TRAFFIC LANES		SIGNAL WARRANT 1-- MINIMUM VEHICULAR VOLUMES[a]		OBSERVED TRAFFIC COUNTS								
MAJOR STREET	MINOR STREET	MAJOR STREET SUM OF BOTH APPROACHES	MINOR STREET HIGHEST APPROACH		HOUR NUMBER							
					1	2	3	4	5	6	7	8
1.....	1.....	500	150	MAJOR STREET	1,165	1,105	1,020	995	995	920	905	875
				MINOR STREET	15	20	15	20	15	20	15	10

[a] Because right-turns on red are permitted under Wisconsin Statutes, only one-half of the observed right turning volumes are utilized in the warrant analysis.

SIGNAL WARRANT 2--INTERRUPTION OF CONTINUOUS TRAFFIC

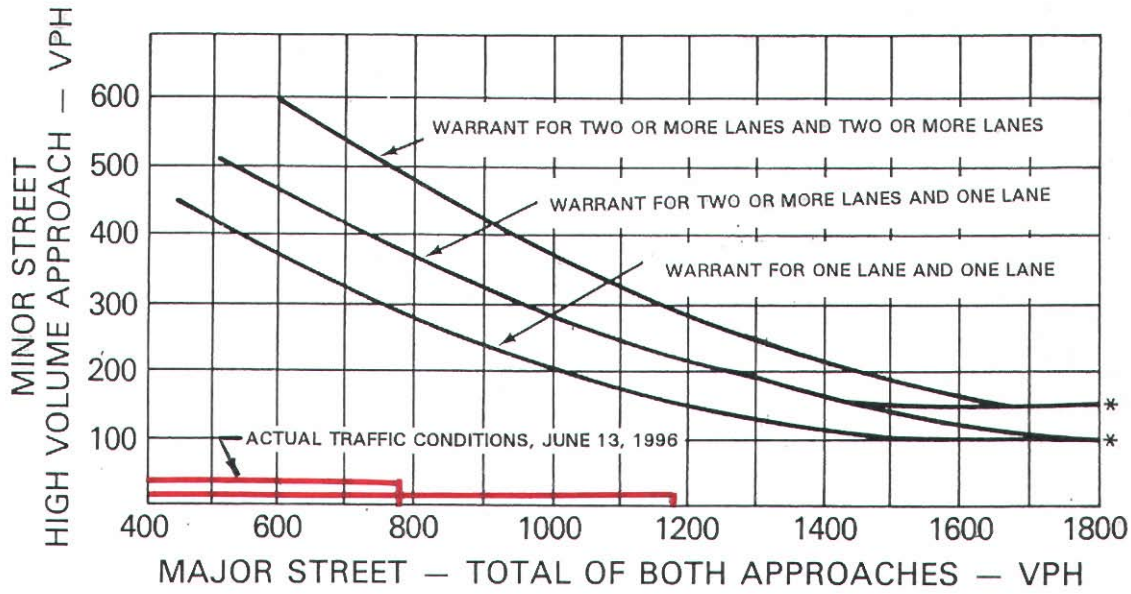
NUMBER OF TRAFFIC LANES		SIGNAL WARRANT 2-- MINIMUM VEHICULAR VOLUMES[a]		OBSERVED TRAFFIC COUNTS								
MAJOR STREET	MINOR STREET	MAJOR STREET SUM OF BOTH APPROACHES	MINOR STREET HIGHEST APPROACH		HOUR NUMBER							
					1	2	3	4	5	6	7	8
1.....	1.....	750	75	MAJOR STREET	1,165	1,105	1,020	995	995	920	905	875
				MINOR STREET	15	20	15	20	15	20	15	10

[a] Because right-turns on red are permitted under Wisconsin Statutes, only one-half of the observed right turning volumes are utilized in the warrant analysis.

Source: SEWRPC.

Figure 4

PEAK HOUR VOLUME WARRANT ANALYSIS OF THE INTERSECTION OF
N. BERKELEY BLVD and E. SILVER SPRING DRIVE IN THE VILLAGE OF WHITEFISH BAY



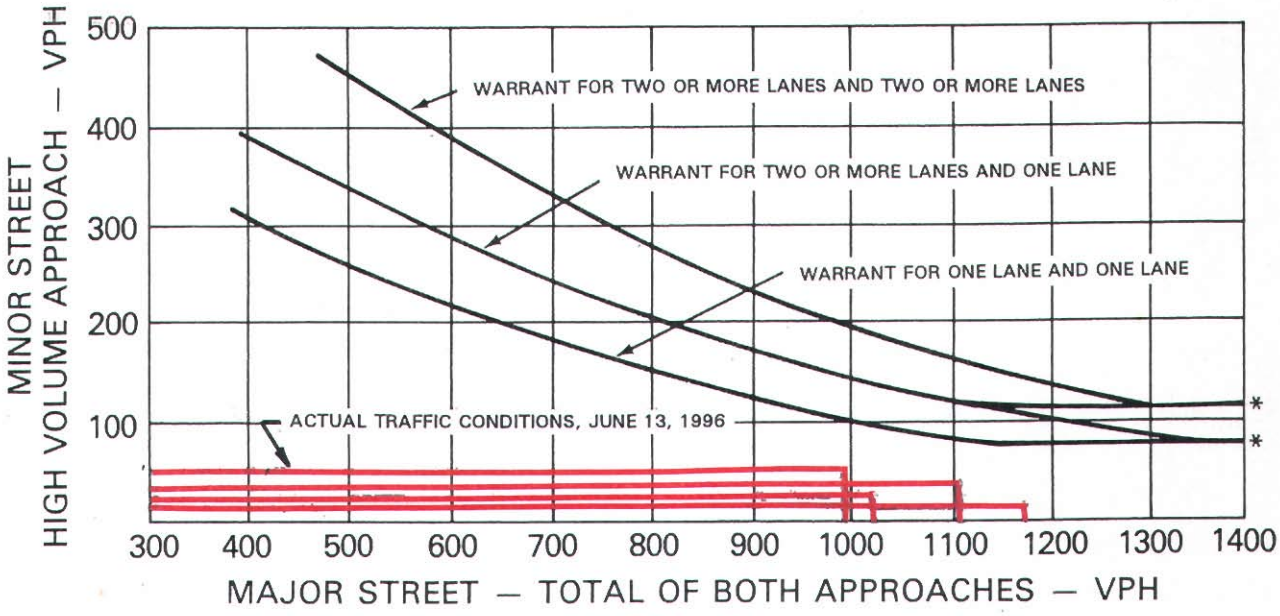
*NOTE: 150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Peak Hour	Vehicular Volumes		Remarks
	Major Street Sum of Both Approaches	Minor Street Highest Approach	
8:00 a.m. - 9:00 a.m.	770	20	The warrant is not met as the point of intersection falls below the "1 lane & 1 lane" curve.
4:30 p.m. - 5:30 p.m.	1,170	20	The warrant is not met as the point of intersection falls below the "1 lane & 1 lane" curve.

Source: Manual on Uniform Traffic Control Devices and SEWRPC.

Figure 5

FOUR HOUR VOLUME WARRANT ANALYSIS OF THE INTERSECTION OF
N. BERKELEY BLVD AND E. SILVER SPRING DRIVE IN THE VILLAGE OF WHITEFISH BAY



*NOTE: 115 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 80 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Four Highest Hours	Vehicular Volumes		Remarks
	Major Street Sum of Both Approaches	Minor Street Highest Approach	
11:00 a.m. - 12:00 p.m.	995	20	The warrant is not met as the point of intersection falls below the "1 lane & 1 lane" curve.
12:00 p.m. - 1:00 p.m.	1,020	15	The warrant is not met as the point of intersection falls below the "1 lane & 1 lane" curve.
4:00 p.m. - 5:00 p.m.	1,105	20	The warrant is not met as the point of intersection falls below the "1 lane & 1 lane" curve.
5:00 p.m. - 6:00 p.m.	1,165	15	The warrant is not met as the point of intersection falls below the "1 lane & 1 lane" curve.

Source: Manual on Uniform Traffic Control Devices and SEWRPC.

of the corresponding traffic volumes for each of four hours falls below the single lane/single lane warrant curve in each of the four highest hours.

Because none of the four traffic volume warrants for the installation of traffic signals at this intersection were satisfied, and because neither the accident warrant nor the pedestrian volume warrant was satisfied, it may be concluded that a traffic signal installation is not warranted at this intersection at this time, and that such installation may be expected to significantly increase delay and to potentially degrade traffic safety. Further, it may be noted that, while installation of a traffic signal would ensure regularly occurring gaps of at least 18 seconds to match the 75 second cycle length of adjacent signals, only 48 gaps--fewer than generally observed--would be provided during any one hour. Thus, the installation of a traffic signal may actually serve to reduce the number of gaps available to pedestrians in the E. Silver Spring Drive traffic stream during certain hours, particularly when vehicular volumes on E. Silver Spring Drive are below 900 vehicles per hour. Therefore, the installation of traffic signals is not recommended at the current time, as such installation may be expected to increase traffic delay and may degrade traffic safety.

Another action considered to create additional artificial gaps for pedestrians in the E. Silver Spring Drive traffic stream was the installation of multi-way stop signs. The installation of multi-way stop signs requires that a minimum of 500 vehicles per hour enter the intersection on all approaches for any eight hours on an average day. In addition, the combined pedestrian and vehicular volume from the minor street must average 200 units per hour for the same eight hours with average delay of at least 30 seconds per vehicle on the minor street during the peak hour. Also, the volume entering the intersection on the minor street should be a minimum of 67 percent of the volume entering the intersection on the major street.

Although a minimum of 500 vehicles entered the intersection in each of eight hours, the combined vehicular and pedestrian volume on the N. Berkeley Boulevard approach did not exceed 81 units in any hour, and thus the warrant is not satisfied. Further, the volume entering the intersection on N. Berkeley Boulevard is only about 2 percent of the volume entering on E. Silver Spring Drive. Thus,

the installation of stop signs on E. Silver Spring Drive would be expected to create substantial unwarranted delay for motorists on the E. Silver Spring Drive approaches, increase the potential for motorist disregard for the unwarranted stop signs, and may increase the potential for rear-end accidents.[4] Another potential traffic safety concern related to the installation of multi-way stop signs one block from a traffic signalized intersection is that westbound motorists may see the signals but not the stop signs and, therefore, fail to stop. Further, eastbound motorists, conditioned to expect traffic signals on E. Silver Spring Drive may not be alert for a second type of traffic control and fail to stop. Therefore, this action was recommended to be rejected.

Another action considered to create more gaps for pedestrians in the E. Silver Spring Drive traffic stream was the widening of the pavement choker along the north side of E. Silver Spring Drive from eight feet to ten feet. While this widening would reduce the effective pavement width, it would not significantly change the duration of the gap required for pedestrians to safely cross E. Silver Spring Drive. Therefore, this action was recommended to be rejected.

The final action considered was to eliminate the existing crosswalks at the intersection of E. Silver Spring Drive and N. Berkeley Boulevard, and install directional signing to route pedestrians one block west--about 350 feet-to the intersection of E. Silver Spring Drive and N. Santa Monica Boulevard. The advantage of this action is that pedestrians would be guaranteed one gap of at least 11 seconds every traffic signal cycle or every 75 seconds. The disadvantage of this alternative is that most pedestrians would not consider going at least

---

[4]In a 1991 study conducted by the Commission staff of the intersection of E. Hampton Road and N. Ardmore Avenue, the issue of pedestrian safety and their ability to safely cross a four-way stop traffic controlled intersection was a major concern. The central problem identified in that study was motorist disregard for the stop signs on the E. Hampton Road approaches evidenced by rolling stops and failure to yield to pedestrians in the crosswalk. The primary reason identified for motorist disregard of the stop signs on E. Hampton Road was that motorists on E. Hampton Road had to stop even when there are no vehicles on the N. Ardmore Avenue approaches and there is no apparent need to stop. This is a direct result of the fact that the traffic entering the intersection from N. Ardmore Avenue is only 15 percent of the traffic volume entering from E. Hampton Road.

350 feet out their way to reach their destination, and, thus, and enforcement problem would likely result. Therefore, this alternative action was recommended to be rejected from further consideration.

In the consideration of the recommended actions, it should be noted that the existing intersection has been operating very efficiently, and that pedestrians were observed crossing E. Silver Spring Drive with little or no difficulty. These observations were made when both pedestrian and vehicular traffic volumes were heavy. No traffic operational or traffic safety problems were identified. Further, this intersection is one block--about 350 feet--east of an intersection which is currently traffic signal controlled, and has pedestrian signals and crosswalks.

Conclusions and Recommendations

Comparison of the inventory data to generally accepted traffic engineering and geometric design standards indicated that no traffic operational or safety problems or geometric design problems exist at the subject intersection at the present time. No motor vehicle or pedestrian accidents occurred during the three year period from January 1, 1993, to December 31, 1995. Delay was observed to be minimal. However, it was noted that there are currently a relatively limited number of gaps of sufficient length to allow pedestrians to cross E. Silver Spring Drive and it was concluded that the provision of additional gaps in the E. Silver Spring Drive traffic stream would be desirable.

Seven actions were considered to artificially create additional gaps in the E. Silver Spring Drive traffic stream at N. Berkeley Boulevard. The first action recommended to be implemented was the prohibition of right turns on red between the hours of 6:00 a.m. and 6: 00 p.m. from northbound N. Santa Monica Drive at its intersection with E. Silver Spring Drive at an estimated cost of $100. The second action recommended for implementation was the installation of "CROSSWALK" signs facing east- and westbound E. Silver Spring Drive traffic at an estimated cost of $250. The third action was the construction of a refuge island in the center of the roadway on both the east- and westbound intersection approaches at an estimated cost of $1,150.

At the specific request of the Village, the installation of traffic signals was also considered. Six traffic signal warrants were evaluated including one related to traffic accidents, another related to pedestrian volumes and four related to traffic volumes. None of the warrants for the installation of traffic signals was met, and therefore, the installation of traffic signals was not recommended at this time. The consideration of implementing multi-way stop sign control at the subject intersection was also recommended to be rejected, as was the widening of the existing pavement choker. Finally, consideration of eliminating the existing crosswalks at the intersection and the routing of pedestrians to a traffic signal controlled intersection one block west was rejected.

INTERSECTION OF E. SILVER SPRING DRIVE, N. DIVERSEY BOULEVARD, AND N. CONSAUL PLACE

Functional and Jurisdictional Classification

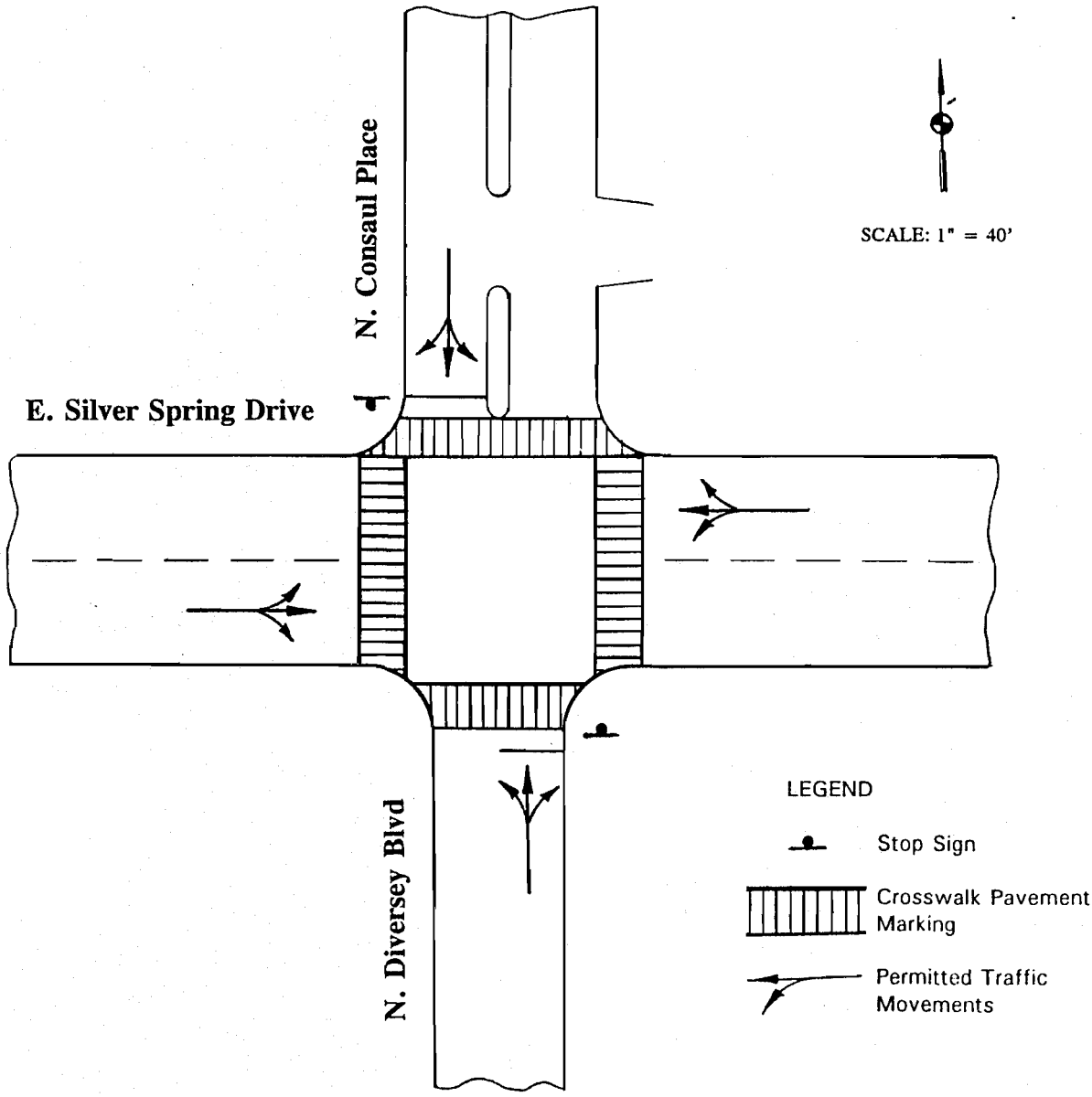
East and W. Silver Spring Drive is an arterial street with the principal function of carrying through traffic. At its intersection with N. Diversey Boulevard and N. Consaul Place, E. Silver Spring Drive is under the jurisdiction of the Village of Whitefish Bay. North Diversey Boulevard and N. Consaul Place are non-arterial land access streets under the jurisdiction of the Village of Whitefish Bay. The recommended jurisdiction of E. Silver Spring Drive, under the currently adopted Milwaukee County Jurisdictional Highway System Plan, is that of a county trunk highway as it principally serves to carry through traffic between municipalities within Milwaukee County.

Intersection Physical and Operational Characteristics

The intersection of E. Silver Spring Drive, N. Diversey Boulevard, and N. Consaul Place is a "four-legged" intersection as shown on Figure 6. Both intersecting roadways are constructed to urban cross-sections. North Consaul Place has a posted speed limit of 25 miles per hour and twin 20 foot wide pavements separated by a four foot wide concrete median. No parking is allowed on the east side of N. Consaul Place; however, parking is permitted on the west side of N. Consaul Place, beginning about 40 feet north of the stop line, and ending approximately 100 feet north. An alley and a driveway are located approximately 160 feet and 50 feet north of the intersection, respectively, on the east side of N. Consaul

Figure 6

EXISTING E. SILVER SPRING DRIVE INTERSECTION WITH
N. CONSAUL PLACE AND N. DIVERSEY BOULEVARD: 1996



Source: SEWRPC.

Place and an entrance to a public parking lot is located approximately 140 feet north of the intersection on the west side of N. Consaul Place.

North Diversey Boulevard has an existing pavement width of 30 feet from curb face to curb face and a posted speed limit of 25 miles per hour. Parking is allowed on both the east and west sides of N. Diversey Boulevard in the immediate vicinity of the intersection. An alley is located approximately 120 feet south of the intersection on both the east and west sides of the roadway.

East Silver Spring Drive, west of N. Diversey Boulevard, has an existing pavement width of 48 feet from curb face to curb face and a posted speed limit of 25 miles per hour. Parking is allowed on both the north and south sides of E. Silver Spring Drive west of N. Diversey Boulevard, and on the south side of E. Silver Spring Drive east of N. Diversey Boulevard. No parking is allowed on the north side of E. Silver Spring Drive between N. Consaul Place and a point approximately 100 feet to the east to accommodate a Milwaukee County Transit System bus stop. There are no commercial or private driveways on E. Silver Spring Drive between N. Berkeley Boulevard and N. Hollywood Avenue.

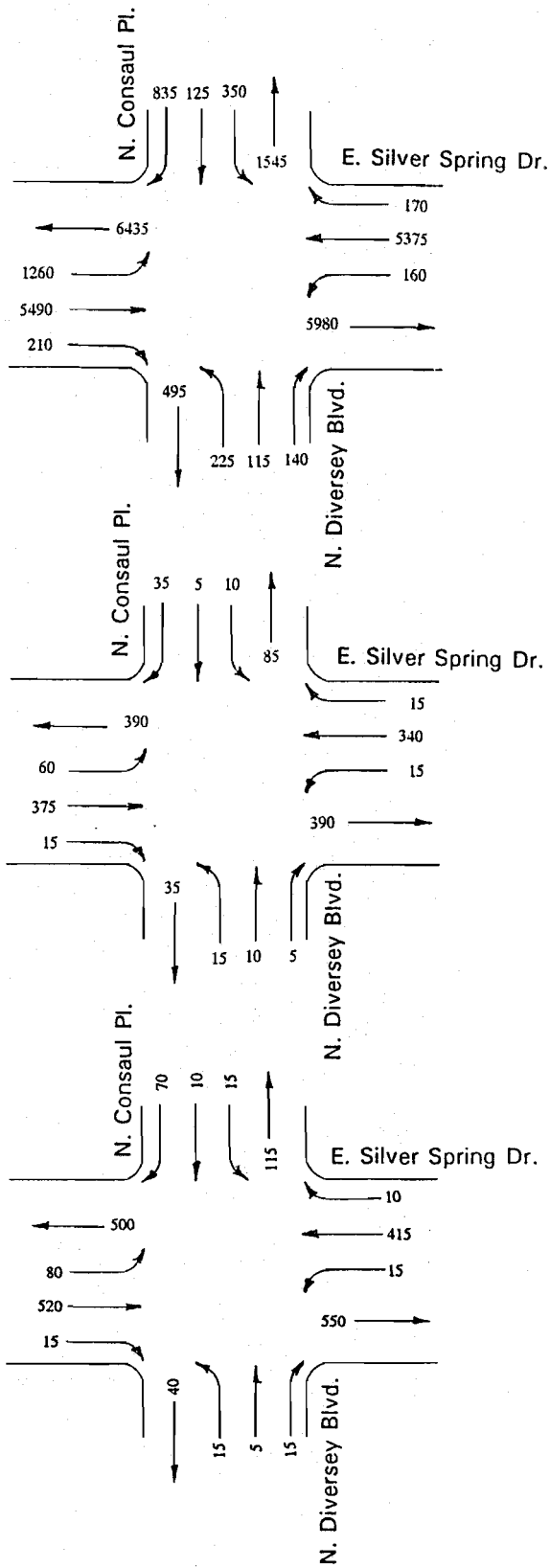
Traffic at the intersection of E. Silver Spring Drive, N. Diversey Boulevard, and N. Consaul Place is controlled by stop signs on the N. Diversey Boulevard and N. Consaul Place approaches.

Traffic Volumes

In order to evaluate the potential need for traffic control signals at this intersection under current operating conditions, the Commission staff conducted manual turning movement counts and 24 hour machine traffic counts in June, 1996. The manual turning movement volume data was collected from 6:00 a.m. to 6:00 p.m. This time period included both the morning and evening peak hours of traffic flow. Based upon the 24 hour machine traffic counts approximately 14,455 vehicles entered the intersection on an average weekday in 1996. Based upon the 12 hour manual turning movement counts, approximately 10,810 vehicles entered the intersection between 6:00 a.m. and 6:00 p.m. on an average weekday in 1996. The morning and evening peak hour manual turning movement counts are shown on Figure 7 along with the estimated 1996 average weekday turning movement volumes.

Figure 7

TURNING MOVEMENT TRAFFIC VOLUMES AT THE E. SILVER SPRING DRIVE INTERSECTION WITH N. CONSAUL PLACE AND N. DIVERSEY BOULEVARD: 1996



1996 Estimated Average Weekday Turning Movement Volumes

1996 Morning Peak Hour Turning Movement Volumes 8:00 a.m. to 9:00 a.m.

1996 Evening Peak Hour Turning Movement Volumes 5:00 p.m. to 6:00 p.m.

Not to Scale

Source: SEWRPC.

The number of vehicles during an average weekday crossing the crosswalks on E. Silver Spring Drive differ. The crosswalk to the west of the intersection has approximately 13,395 vehicles crossing it, while the crosswalk to the east of the intersection has about 11,685 vehicles crossing it.

The hourly traffic volumes observed during an average weekday on E. Silver Spring Drive between N. Berkeley Boulevard and N. Diversey Boulevard, as previously noted, is shown on Figure 3. As previously mentioned, unlike many arterials in the Southeastern Wisconsin Region on which traffic typically experiences two very distinct peak hours, one in the morning and one in the evening, there are three peak hours on this segment of E. Silver Spring Drive: morning, midday and evening peak hours. On an average weekday, traffic on this segment of E. Silver Spring Drive decreases only moderately after the morning peak hour. Traffic then increases significantly to another peak in the midday and then decreases moderately again in the midafternoon before increasing to another peak in the evening peak hour. While commuter traffic is largely responsible for the morning and evening peaks, the midday peak reflects the trip generation characteristics of shopping trips to and from the Village central business district and the Bay Shore Shopping Center.

The 1996 manual turning movement count data indicated that turning movements accounted for about 23 percent of all movements at this intersection between 6:00 a.m. and 6:00 p.m. During the morning peak hour, more than 19 percent of all vehicles were observed turning. The eastbound left-turn represented the highest turning movement observed during the morning peak hour at 60 vehicles. During the evening peak hour, about 20 percent of all vehicles were observed turning. The eastbound left-turn represented the highest turning movement observed during the evening peak hour at 80 vehicles.

Occasional vehicular delay was observed on the north- and southbound approaches during the evening peak hour. The maximum vehicular queue observed was four vehicles with some motorists experiencing up to 40 seconds of delay. The longer queues tended to dissipate entirely before the next queue developed. Thus, the intersection generally operated with modest delay.

Along with the traffic volume data, vehicular gap data were also collected from noon to 3:00 p.m. These hours were observed to correspond to the those hours when both pedestrian activity and traffic volumes were heavy at this intersection. It may be noted that, for the purposes of this study, a vehicular gap is the time interval during which no vehicle traveling in either direction on E. Silver Spring Drive crossed a designated point such as a crosswalk. Data on pedestrian activity will be presented later in this section.

Specifically, gap data were collected to determine the number of gaps in the E. Silver Spring Drive traffic stream at two different thresholds: 1) gaps having a minimum duration of eight seconds; and, 2) gaps having a minimum duration of 11 seconds. The 11 second gap includes adequate time for a pedestrian to cross E. Silver Spring Drive at a speed of four feet per second with perception and reaction time.[5] Because of the significant turning movement volumes at the intersection, the vehicular volume crossing the east crosswalk--11,685 vehicles per average weekday--was observed to be 1,710 vehicles per average weekday less than the volume crossing the west crosswalk--13,395 vehicles per average weekday, or about 13 percent. As a result, data on the number of gaps was collected for each crosswalk and is shown in Table 5.

Comparison of the hourly gap data in Table 5 to the traffic volumes observed on E. Silver Spring Drive indicates that about 60 gaps of at least 11 seconds in duration per hour were observed for E. Silver Spring Drive volumes in the 900 vehicle per hour range. This finding is substantiated by a similar finding observed at the intersection of E. Silver Spring Drive and N. Berkeley Boulevard. However, unlike the intersection of E. Silver Spring Drive and N. Berkeley Boulevard, more gaps were observed at this intersection when the volume exceeded 1,000 vehicle per hour. This may be attributed in large part to the arrival of

---

[5]It may be noted that although 11 seconds represents the minimum gap based upon generally accepted traffic engineering standards, many pedestrians were observed to reduce the gap required by crossing one lane at a time thereby eliminating the need for a gap of at least 11 seconds in the bi-directional traffic stream. That is, some pedestrians would cross the near traffic lane to a point near the center of the roadway even when there was traffic in the far traffic lane, and then cross the far traffic lane when a gap in that directional traffic stream presented itself.

Table 5

NUMBER OF ELEVEN SECOND GAPS OBSERVED IN THE E. SILVER SPRING DRIVE TRAFFIC STREAM AT ITS INTERSECTION WITH N. DIVERSEY BOULEVARD AND N. CONSAUL PLACE DURING SELECTED HOURS ON A SUMMER WEEKDAY: 1996

Hour	Number of Gaps Observed Having a Minimum Duration of Eleven Seconds		E. Silver Spring Drive Traffic Volumes (Vehicles per Hour)	
	East Crosswalk	West Crosswalk	East Crosswalk	West Crosswalk
Noon to 1:00 p.m.	72	63	780	1060
1:00 p.m. to 2:00 p.m.	52	60	775	890
2:00 p.m. to 3:00 p.m.	69	51	825	920
Average	64	58	793	957

Source: SEWRPC.

vehicles in platoons on the westbound approach which tended to create longer gaps between platoons.

Typically, as volumes increase, the number of gaps would be expected to decrease as was observed at the intersection of E. Silver Spring Drive and N. Berkeley Boulevard. As previously noted, the existing traffic signals on E. Silver Spring Drive within the Village operate as a coordinated system and have a signal cycle length of 75 seconds. Because a 75 second cycle occurs 48 times during a one hour period, and because traffic on E. Silver Spring Drive is stopped during that part of the cycle apportioned to green time on the cross street thereby permitting pedestrians to cross, 48 represents the likely lower limit with respect to the number of gaps which would be long enough to permit pedestrians to cross E. Silver Spring Drive.

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 from January 1, 1993 to December 31, 1995 for the intersection of E. Silver Spring Drive and N. Diversey Boulevard and N. Consaul Place was collected and analyzed. As shown in Table 6, a total of three vehicular accidents occurred at the intersection during the three-year period concerned, with no accidents in 1993, two in 1994, and one in 1995. None of the accidents involved a pedestrian and none involved a fatality. The accident in 1995, however, involved personal injuries.

Analysis of the three-year accident history data for the intersection concerned indicates that all three accidents were multiple vehicle accidents. Two of the three accidents, or 67 percent, were right-angle collisions. The third accident was a rear-end collision. Because fewer than three accidents occurred in a 12 month period, and because no more than two accidents had the same collision type, no pattern of accidents may be identified, and no severe traffic safety problem is indicated at the present time.

Table 6

INCIDENCE AND SEVERITY OF MOTOR VEHICLE ACCIDENTS AT THE INTERSECTION OF N. DIVERSEY BLVD, N. CONSAUL PLACE AND E. SILVER SPRING DRIVE BETWEEN JANUARY 1, 1993 AND DECEMBER 31, 1995[a]

Year	Injury	Property Damage	Total
January 1 to December 31, 1993	0	0	0
January 1 to December 31, 1994	0	2	2
January 1 to December 31, 1995	1	0	1
Total	1	2	3

[a] Any accident occurring within 150 feet of the intersection was considered an intersection accident.

Source: Village of Whitefish Bay Police Department and SEWRPC.

Pedestrian Volumes

In addition to conducting manual vehicle turning movement counts, the Commission staff also counted pedestrians crossing E. Silver Spring Drive at its intersection with N. Diversey Boulevard and N. Consaul Place. The number of pedestrians observed crossing E. Silver Spring Drive at this intersection between the hours of 6:00 a.m. and 6:00 p.m. is set forth for the east and west crosswalks by hour in Table 7. The corresponding traffic volumes on E. Silver Spring Drive which conflict with the pedestrian crossings at each crosswalk are also shown in Table 7.

Identification of Potential Traffic Problems

The inventory data were compared to traffic engineering and geometric design standards, and it was determined that no potential traffic operational or safety problems or geometric design problems existed at the subject intersection. As previously noted, delay was observed to be modest, and only three accidents occurred during the three year period reviewed.

As previously noted, a concern was raised by a business in the proximity of this intersection regarding the ability of pedestrians to cross E. Silver Spring Drive from the north to the south. In areas of high pedestrian activity, the existence of adequate gaps in the traffic stream is fundamental to safe and efficient pedestrian crossings. An adequate gap includes the time required for an individual to cross the roadway at a rate of four feet per second, and an additional three seconds for an individual to assess whether or not a sufficient gap is available and then make a decision to cross the roadway.

Because E. Silver Spring Drive has an effective pavement width of 32 feet (48 feet wide with two eight foot wide parking lanes), a gap of 11 seconds is required in the traffic stream. Observation indicated that an average of approximately 56 gaps per hour at the west crosswalk had a minimum duration 11 seconds and an average of approximately 61 gaps per hour at the east crosswalk had a minimum duration of 11 seconds, between the hours of 1:00 p.m. to 3:00 p.m. on average weekday, which are the peak hours of pedestrian and vehicle traffic.

Table 7

THE NUMBER OF PEDESTRIANS OBSERVED CROSSING E. SILVER SPRING DRIVE AT ITS INTERSECTION WITH N. DIVERSEY BOULEVARD AND N. CONSAUL PLACE AND CONFLICTING E. SILVER SPRING DRIVE TRAFFIC VOLUMES BETWEEN THE HOURS OF 6:00 A.M. AND 6:00 P.M. ON AN AVERAGE WEEKDAY: JUNE, 1996

Time	Pedestrians Observed Crossing West Crosswalk on E. Silver Spring Drive	Conflicting Traffic Volumes Observed at the West Crosswalk of E. Silver Spring Drive	Pedestrians Observed Crossing East Crosswalk on E. Silver Spring Drive	Conflicting Traffic Volumes Observed at the East Crosswalk of E. Silver Spring Drive
6:00 a.m. to 7:00 a.m.	5	295	2	205
7:00 a.m. to 8:00 a.m.	11	655	6	565
8:00 a.m. to 9:00 a.m.	8	855	4	670
9:00 a.m. to 10:00 a.m.	15	825	7	595
10:00 a.m. to 11:00 a.m.	16	815	7	670
11:00 a.m. to Noon	28	935	13	720
Noon to 1:00 p.m.	23	1060	11	780
1:00 p.m. to 2:00 p.m.	17	890	8	775
2:00 p.m. to 3:00 p.m.	36	920	18	825
3:00 p.m. to 4:00 p.m.	21	910	10	815
4:00 p.m. to 5:00 p.m.	27	1060	13	850
5:00 p.m. to 6:00 p.m.	16	1145	7	945

Source: SEWRPC.

According to the Manual on Uniform Traffic Control Devices at least one gap of sufficient length for safe pedestrian crossing per minute is desirable, or 60 gaps per hour. While observation indicates that throughout an average weekday this standard is generally met, there are hours during the day when it is not met. Thus, it may be concluded that the provision of additional gaps in the E. Silver Spring Drive traffic stream having a minimum duration of 11 seconds would be desirable.

Alternative Actions Considered to Create Additional Gaps in the E. Silver Spring Drive Traffic Stream

Because of the limited number of gaps, consideration was given to artificial means to create more gaps. The first action considered to create more gaps for pedestrians in the E. Silver Spring Drive traffic stream was to prohibit right turns on red from northbound N. Santa Monica Drive at its intersection with E. Silver Spring Drive between 6:00 a.m. to 6:00 p.m. Currently, right turns on red are prohibited between the hours of 7:00 a.m. to 9:00 a.m., and 3:00 p.m. to 5:00 p.m. at the intersection of N. Santa Monica Boulevard and E. Silver Spring Drive. The advantage of this action would be the provision of more gaps for pedestrians to cross E. Silver Spring Drive at its intersection with N. Diversey Boulevard and N. Consaul Place. The disadvantage of this action is that vehicles which currently turn right on red would incur additional delay. Because this action would be expected to provide additional gaps in the E. Silver Spring Drive traffic stream, it is recommended to be implemented at an estimated cost of $100.

Another action considered to create more gaps for pedestrians was the installation of "CROSSWALK" signs at the crosswalks on E. Silver Spring Drive facing eastbound and westbound traffic. The advantage of such signing is that it alerts motorists to the existence and location of the crosswalks. Because motorists are required to stop for pedestrians in a marked crosswalk, this signing also alerts motorist to the potential need to stop. The disadvantage of this signing is that it may be "lost" in the signing and lighting of the surrounding commercial district. It is recommended that the installation of "CROSSWALK" signs facing east- and westbound E. Silver Spring Drive traffic be implemented at an estimated cost of $250.

Another action considered to create more gaps for pedestrians in the E. Silver Spring Drive traffic stream was the construction of a refuge island in the center of the roadway on both the east- and westbound intersection approaches. A four foot wide median island would provide refuge for pedestrians while crossing E. Silver Spring Drive. It would decrease the effective pavement width from 32 feet to 28 feet and the width of pavement to be crossed between areas of refuge from 32 feet to only 14 feet. The proposed islands would be similar to the islands constructed on N. Lake Drive at its intersection with E. Day Avenue in 1987 to assist pedestrians in crossing N. Lake Drive. The advantage of this action is that it would reduce the required gaps for pedestrians to safely cross the street from 11 to eight seconds thereby increasing the average number of gaps per hour of sufficient length to cross E. Silver Spring Drive from 58 to a minimum of 108, as shown Table 8, an increase of about 186 percent. A potential disadvantage to this action is that a fixed object would be located in the center of the roadway representing a potential traffic safety hazard and complicating snow removal efforts. Because this action would be expected to reduce the duration of gap required while simultaneously providing additional gaps of adequate duration in the E. Silver Spring Drive traffic stream, it is recommended to be implemented at an estimated cost of $1,150.

At the specific request of the Village, the installation of traffic signals was also considered. The installation of a traffic signal should be considered only if one or more of the warrants set forth in the Manual on Uniform Traffic Control Devices be met. There was a total of six traffic signal warrants considered, one related to traffic accidents, one related to pedestrian volumes, and four related to traffic volumes. When the warrants are not satisfied the installation of traffic signals would be expected to significantly increase delay and may have the potential to increase traffic accidents. If the assessment of the traffic signal warrants indicates that a warrant is satisfied, then the impacts on delay and traffic safety would generally be expected to be minimized, except in the case of the accident warrant, when the desired improvement in traffic safety may also increase delay.

The warrant for the installation of traffic signals base upon the accident experience at an intersection requires that an adequate trial of less restrictive

Table 8

NUMBER OF EIGHT SECOND GAPS OBSERVED IN THE E. SILVER SPRING DRIVE TRAFFIC STREAM AT ITS INTERSECTION WITH N. DIVERSEY BOULEVARD AND N. CONSAUL PLACE DURING SELECTED HOURS ON A SUMMER WEEKDAY: 1996

Hour	Number of Gaps Observed Having a Minimum Duration of Eight Seconds		E. Silver Spring Drive Traffic Volumes (Vehicles per Hour)	
	East Crosswalk	West Crosswalk	East Crosswalk	West Crosswalk
Noon to 1:00 p.m.	138	114	780	1060
1:00 p.m. to 2:00 p.m.	108	112	775	890
2:00 p.m. to 3:00 p.m.	129	99	825	920
Average	125	108	793	957

Source: SEWRPC.

remedies with satisfactory observance and enforcement has failed to reduce the accident frequency; at least five accidents of types susceptible to correction by traffic signal control have occurred within a twelve month period; and certain vehicular and pedestrian volume requirements are satisfied.[6] Because only three traffic accidents were observed at this intersection during the three year period from January 1, 1993 to December 31, 1995, only two of which may be susceptible to correction by the installation of traffic signals, the warrant for the installation of traffic signals based upon the accident experience of the intersection was not met.

The second traffic signal installation warrant considered was the minimum pedestrian volume warrant. Under this warrant pedestrian volumes on a average day must exceed one of the following thresholds: 1) 100 or more for each of any four hours; or, 2) 190 or more pedestrians for any one hour; and, there must be fewer than 60 gaps per hour in the traffic stream of adequate length for pedestrians to cross during the same time period when the pedestrian volume criterion is satisfied. Summing the pedestrians observed in each crosswalk as shown in Table 6, the pedestrian volume crossing E. Silver Spring Drive at its intersection with N. Diversey Boulevard and N. Consaul Place was not observed to exceed 100 pedestrians in any hour on an average weekday in 1996. In addition, pedestrian crossings exceeded 50 in just one hour--2:00 p.m. to 3:00 p.m., and only exceeded 40 in one other hour--11:00 a.m. to noon. Therefore it may be concluded that the warrant for the installation of traffic signals based upon pedestrian volumes is not met at the present time.

The first traffic volume 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 higher volume minor street approach meet or exceed specified minimum volume requirements for any eight hours

---

[6]Accident types susceptible to correction by the installation of traffic signals include right-angle collisions; left- and right-turns into sideswipe collisions; and left-turns into head-on collisions as well as vehicular-pedestrian collisions.

of an average weekday[7]. The minimum volume requirements at this intersection are 500 vehicles per hour on the E. Silver Spring Drive approaches and 150 vehicles per hour on either the N. Diversey Boulevard or the N. Consaul Place approach. Although the sum of the approach traffic volumes on both E. Silver Spring Drive approaches meets or exceeds the warrant volume during each of the eight highest hours, the warrant is not met, as the traffic volume on the N. Consaul Place approach--the highest volume approach--does not exceed 75 vehicles or 50 percent of the warrant traffic volume during any of those hours. The findings of this analysis are summarized in Table 9.

The second traffic volume warrant considered--the interruption of continuous traffic warrant--is satisfied when the traffic volume on E. Silver Spring Drive--measured as the total on both approaches--exceeds 750 vehicles per hour for any eight hours, and when the traffic volume on either the N. Diversey Boulevard or the N. Consaul Place approach exceeds 75 vehicles per hour for the same eight hours. Although E. Silver Spring Drive traffic volumes meet or exceed the warrant volume during each of the eight highest hours, the warrant is not met as the traffic volume on the N. Consaul Place approach--the highest volume approach--satisfies the warrant volume of 75 vehicles during only three of the eight hours. However, it may be noted that traffic volumes on N. Consaul Place approach the traffic signal warrant for another four of the required eight hours. The findings of this analysis are summarized in Table 9.

The third warrant considered--the peak hour volume warrant--is satisfied when the number of vehicles per hour on E. Silver Spring Drive--measured as the total on both approaches--and the corresponding vehicles per hour on either the N. Diversey Boulevard or the N. Consaul Place approach for any one hour--or any four consecutive 15-minute periods--of an average day are above the applicable curve on Figure 8. As shown on Figure 8, this warrant is not met, as the point of

---

[7]Because right turns on red are permitted under Wisconsin Statutes, the Commission staff, along with many other public works and traffic engineering agencies in Southeastern Wisconsin, generally utilizes only one-half of the observed right turning volume when conducting traffic volume signal warrant analyses.

Table 9

TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS AT THE INTERSECTION OF
N. DIVERSEY BOULEVARD, N. CONSAUL PLACE AND E. SILVER SPRING DRIVE IN THE VILLAGE OF WHITEFISH BAY

SIGNAL WARRANT 1--MINIMUM VEHICULAR VOLUME

NUMBER OF TRAFFIC LANES		SIGNAL WARRANT 1--MINIMUM VEHICULAR VOLUMES[a]		OBSERVED TRAFFIC COUNTS								
MAJOR STREET	MINOR STREET	MAJOR STREET SUM OF BOTH APPROACHES	MINOR STREET HIGHEST APPROACH		HOUR NUMBER							
					1	2	3	4	5	6	7	8
1.....	1.....	500	150	MAJOR STREET	1,055	995	870	865	825	825	790	720
				MINOR STREET	65	70	75	70	75	70	75	35

[a] Because right-truns are permitted under Wisconsin Stautes, only one-half of the observed right-turning vloumes are utilized in the warrant analysis.

SIGNAL WARRANT 2--INTERRUPTION OF CONTINUOUS TRAFFIC

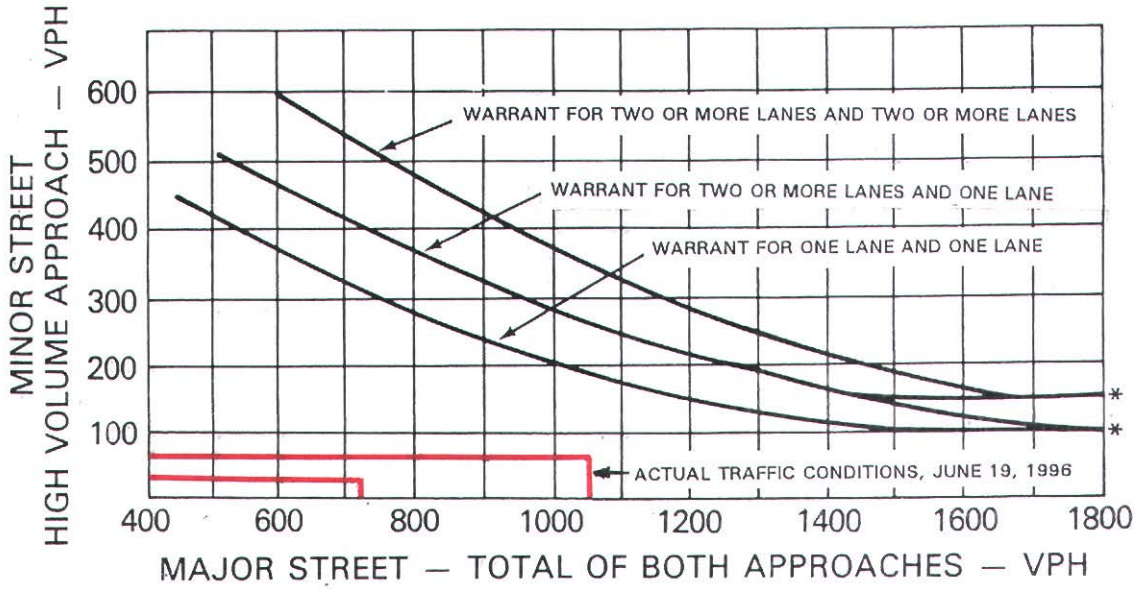
NUMBER OF TRAFFIC LANES		SIGNAL WARRANT 2--MINIMUM VEHICULAR VOLUMES		OBSERVED TRAFFIC COUNTS								
MAJOR STREET	MINOR STREET	MAJOR STREET SUM OF BOTH APPROACHES	MINOR STREET HIGHEST APPROACH		HOUR NUMBER							
					1	2	3	4	5	6	7	8
1.....	1.....	750	75	MAJOR STREET	1,055	995	870	865	825	825	790	720
				MINOR STREET	65	70	75	70	75	70	75	35

[a] Because right-truns are permitted under Wisconsin Stautes, only one-half of the observed right-turning vloumes are utilized in the warrant analysis.

Source: SEWRPC.

Figure 8

PEAK HOUR VOLUME WARRANT ANALYSIS OF THE INTERSECTION OF N. DIVERSEY BLVD, N. CONSAUL PLACE AND E. SILVER SPRING DRIVE IN THE VILLAGE OF WHITEFISH BAY



*NOTE: 150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

	Vehicular Volumes		
Peak Hour	Major Street Sum of Both Approaches	Minor Street Highest Approach	Remarks
8:00 a.m. - 9:00 a.m.	720	35	The warrant is not met as the point of intersection falls below the "1 lane & 1 lane" curve.
5:00 p.m. - 6:00 p.m.	1,055	65	The warrant is not met as the point of intersection falls below the "1 lane & 1 lane" curve.

Source: Manual on Uniform Traffic Control Devices and SEWRPC.

intersection of the corresponding traffic volumes falls below the single lane/single lane warrant curve in both of the morning and evening peak hours.

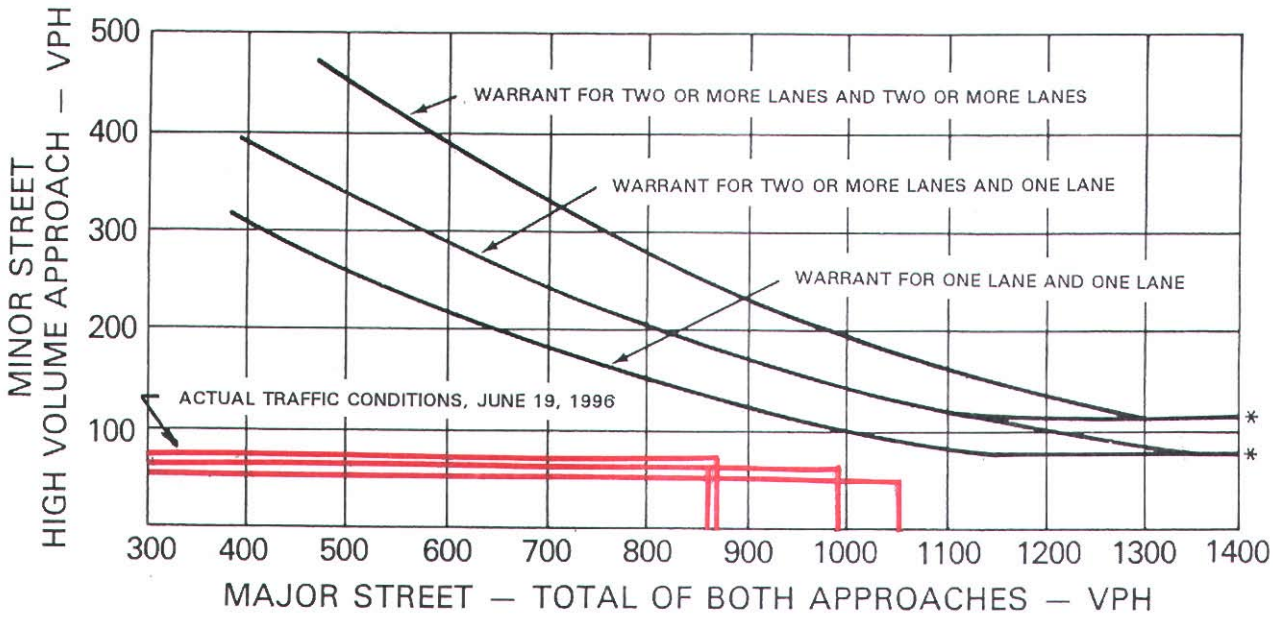
The fourth warrant considered--the four hour volume warrant--is satisfied when during each of any four hours of an average day, the number of vehicles per hour on E. Silver Spring Drive--measured as the total on both approaches--and the corresponding number of vehicles per hour on either the N. Diversey Boulevard or the N. Consaul Place approach are all above the curve on Figure 9 for the existing combination of approach lanes. As shown on Figure 9, this warrant is not met, as the point of intersection of the corresponding traffic volumes for each of four hours falls below the single lane/single lane warrant curve in each of the four highest hours.

Because none of the four traffic volume warrants for the installation of traffic signals at this intersection were satisfied, and because neither the accident warrant nor the pedestrian volume warrant was satisfied, it may be concluded that a traffic signal installation is not warranted at this intersection at this time. Further, it may be noted that, while installation of a traffic signal would ensure regularly occurring gaps of at least 18 seconds to match 75 second cycle length of adjacent signals, only 48 gaps--fewer than generally observed--would be provided during any one hour. Thus, the installation of a traffic signal may actually serve to reduce the number of gaps available to pedestrians in the E. Silver Spring Drive traffic stream. Therefore, the installation of traffic signals is not recommended at the current time, as such installation may be expected to increase traffic delay and may degrade traffic safety.

Another action considered to create additional artificial gaps for pedestrians in the E. Silver Spring Drive traffic stream was the installation of multi-way stop signs. The potential advantage of this action would be the creation of additional gaps. The installation of multi-way stop signs requires that a minimum of 500 vehicles per hour enter the intersection on all approaches for any eight hours on an average day. In addition, the combined pedestrian and vehicular volume from the minor street must average 200 units per hour for the same eight hours with average delay of at least 30 seconds per vehicle on the minor street during the peak hour. The combined vehicular and pedestrian volume on the N.

Figure 9

FOUR HOUR VOLUME WARRANT ANALYSIS OF THE INTERSECTION OF N. DIVERSEY BLVD, N. CONSAUL PLACE AND E. SILVER SPRING DRIVE IN THE VILLAGE OF WHITEFISH BAY



*NOTE: 115 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 80 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

	Vehicular Volumes		
Four Highest Hours	Major Street Sum of Both Approaches	Minor Street Highest Approach	Remarks
2:00 p.m. - 3:00 p.m.	865	70	The warrant is not met as the point of intersection falls below the "1 lane & 1 lane" curve.
3:00 p.m. - 4:00 p.m.	870	75	The warrant is not met as the point of intersection falls below the "1 lane & 1 lane" curve.
4:00 p.m. - 5:00 p.m.	995	70	The warrant is not met as the point of intersection falls below the "1 lane & 1 lane" curve.
5:00 p.m. - 6:00 p.m.	1,055	65	The warrant is not met as the point of intersection falls below the "1 lane & 1 lane" curve.

Source: Manual on Uniform Traffic Control Devices and SEWRPC.

Diversey Boulevard and N. Consaul Place approaches did not exceed 189 units in any hour, and thus the warrant is not satisfied. Further, because the entering volume proportion between E. Silver Spring Drive and N. Diversey Boulevard and N. Consaul Place exceeds the recommended proportion of 60 percent on the major route and 40 percent on the minor route (88 percent on E. Silver Spring Drive versus 12 percent on N. Diversey Boulevard and N. Consaul Place), the installation of stop signs on E. Silver Spring Drive would be expected to create substantial unwarranted delay for motorists on the E. Silver Spring Drive approaches, increase the potential for motorist disregard for the unwarranted stop signs, and may increase the potential for rear-end accidents.[8] Other potential traffic safety concerns related to the installation of multi-way stop signs one block from a traffic signalized intersection is that westbound motorists may see the signals but not the stop signs and, therefore, fail to stop. Eastbound motorists, conditioned to expect traffic signals on E. Silver Spring Drive may not be alert for a second type of traffic control and fail to stop. Therefore, this action was recommended to be rejected.

In the consideration of the recommended actions, it should be noted that the existing intersection has been operating very efficiently, and that pedestrians were observed crossing E. Silver Spring Drive with little or no difficulty. No traffic operational or traffic safety problems were identified. Further, some of the heaviest pedestrian volumes observed occurred during those hours when vehicle volumes were also heavy thereby indicating that those pedestrians who wish to cross E. Silver Spring Drive are not constrained by vehicular traffic.

---

[8]In a 1991 study conducted by the Commission staff of the intersection of E. Hampton Road and N. Ardmore Avenue, the issue of pedestrian safety and their ability to safely cross a four-way stop traffic controlled intersection was a major concern. The central problem identified in that study was motorist disregard for the stop signs on the E. Hampton Road approaches evidenced by rolling stops and failure to yield to pedestrians in the crosswalk. The primary reason identified for motorist disregard of the stop signs on E. Hampton Road was that motorists on E. Hampton Road had to stop even when there are no vehicles on the N. Ardmore Avenue approaches and there is no apparent need to stop. This is a direct result of the fact that the traffic entering the intersection from N. Ardmore Avenue is only 15 percent of the traffic volume entering from E. Hampton Road..

Conclusions and Recommendations

Comparison of the inventory data to generally accepted traffic engineering and geometric design standards indicated that no traffic operational or safety problems or geometric design problems exist at the subject intersection at the present time. Although three accidents were observed during the three year period from January 1, 1993, to December 31, 1995, none involved a pedestrian or a fatality. Delay was observed to be very modest. While observation indicated that throughout an average weekday there were generally 60 or more gaps per hour of sufficient length to allow pedestrians to cross E. Silver Spring Drive, there were hours when that threshold was not met. Thus, it was concluded that the provision of additional gaps in the E. Silver Spring Drive traffic stream would be desirable.

Five actions were considered to artificially create additional gaps in the E. Silver Spring Drive traffic stream. The first action recommended to be implemented was the prohibition of right turns on red between the hours of 6:00 a.m. and 6: 00 p.m. from northbound N. Santa Monica Drive at its intersection with E. Silver Spring Drive at an estimated cost of $100. The second action recommended for implementation was the installation of "CROSSWALK" signs facing east- and westbound E. Silver Spring Drive traffic at an estimated cost of $250.
The third action was the construction of a refuge island in the center of the roadway on both the east- and westbound intersection approaches at an estimated cost of $1,150.

At the specific request of the Village, the installation of traffic signals was also considered. Six traffic signal warrants were evaluated including one related to traffic accidents, another related to pedestrian volumes and four related to traffic volumes. Although the traffic volumes approach the volume warrant under the interruption of continuous traffic warrant, none of the warrants for the installation of traffic signals was met, and therefore, the installation of traffic signals was not recommended at this time. The consideration of implementing multi-way stop sign control at the subject intersection was also recommended to be rejected.

SUMMARY

In letters dated January 9 and February 19, 1996, the Village of Whitefish Bay requested that the Regional Planning Commission staff conduct traffic signal warrant analyses both at the intersection of E. Silver Spring Drive and N. Berkeley Boulevard and at the intersection of E. Silver Spring Drive and N. Diversey Boulevard and N. Consaul Place. The study was requested in response to citizen concerns that pedestrians experience difficulty crossing E. Silver Spring Drive.

Data concerning existing roadway physical and operational characteristics, average weekday traffic volumes, peak hour traffic volumes and turning movements, vehicular gaps, pedestrian volumes, and a history of motor vehicle accident patterns and frequencies were collected at the intersection of E. Silver Spring Drive and N. Berkeley Boulevard and at the intersection of E. Silver Spring Drive and N. Diversey Boulevard and N. Consaul Place.

The E. Silver Spring Drive and N. Berkeley Boulevard Intersection

The E. Silver Spring Drive and N. Berkeley Boulevard intersection is a "three-legged, tee" intersection with the intersecting roadways constructed as urban cross-sections. North Berkeley Boulevard and E. Silver Spring Drive have existing pavement widths of 30 feet and 48 feet respectively. There is a pavement choker on the north side of E. Silver Spring Drive extending from a point 20 feet west to a point 80 feet east of N. Berkeley Boulevard reducing the pavement width to 40 feet. The posted speed limit on both facilities is 25 miles per hour. Parking is allowed on both sides of N. Berkeley Boulevard except in the immediate vicinity of the intersection. Parking is allowed on both sides of E. Silver Spring Drive except in the area of the pavement choker where parking is permitted only on the south side. Traffic is controlled by a stop sign on the N. Berkeley Boulevard approach.

Based upon the 24 hour machine traffic counts conducted by the Commission staff, approximately 13,785 vehicles entered the intersection on an average weekday in 1996. Based upon the 12 hour manual turning movement counts, turning movements

accounted for about 4 percent of all movements at this intersection between 6:00 a.m. and 6:00 p.m., as well as during both the morning and evening peak hours. Gap data were collected during those hours when both pedestrian traffic and vehicle traffic was heavy to determine the number of gaps in the E. Silver Spring Drive traffic stream at two different thresholds: 1) gaps having a minimum duration of eight seconds; and, 2) gaps having a minimum duration of 11 seconds. The number of gaps observed with a duration of at least 11 seconds ranged from 48 to 66 per hour and averaged 57. The number of gaps observed with a duration of at least eight seconds ranged from 111 to 117 per hour and averaged 114.

Pedestrians observed crossing E. Silver Spring Drive at its intersection with N. Berkeley Boulevard were counted between the hours of 6:00 a.m. and 6:00 p.m. Volumes ranged from four to 57 pedestrians per hour.

Comparison of the inventory data to traffic engineering and geometric design standards indicated that no traffic operational or safety problems or geometric design problems exist at the subject intersection at the present time. No accidents occurred at the intersection during the three-year period from January 1, 1993, to December 31, 1995. Vehicular delay was minimal and queues did not exceed two vehicles. Thus, it was concluded that the intersection currently operates efficiently and no problems were identified. While observation indicated that throughout an average weekday there are generally 60 or more gaps per hour of sufficient length to allow pedestrians to cross E. Silver Spring Drive, there were hours when that threshold was not met. Thus, it was concluded that the provision of additional gaps in the E. Silver Spring Drive traffic stream would be desirable.

Seven actions were considered to artificially create additional gaps in the E. Silver Spring Drive traffic stream. The first action recommended to be implemented was the prohibition of right turns on red between the hours of 6:00 a.m. and 6: 00 p.m. from northbound N. Santa Monica Drive at its intersection with E. Silver Spring Drive at an estimated cost of $100. The disadvantage of this action is the additional delay incurred by northbound right-turning motorists. The second action recommended for implementation was the installation of "CROSSWALK" signs facing east- and westbound E. Silver Spring Drive traffic at an estimated

cost of $250. The disadvantage of this action is that the signing may be "lost" in the signing and lighting of the surrounding commercial district. The third action was the construction of a refuge island in the center of the roadway on both the east- and westbound intersection approaches at an estimated cost of $1,150. The disadvantage of this action is that a fixed object would be located in the center of the roadway creating a potential traffic safety hazard and complicating snow removal efforts.

At the specific request of the Village, the installation of traffic signals was also considered. Six traffic signal warrants were evaluated including one related to traffic accidents, another related to pedestrian volumes and four related to traffic volumes. None of the warrants for the installation of traffic signals was met, and therefore, the installation of traffic signals was not recommended at this time. The installation of multi-way stop sign control at the subject intersection was also considered and was recommended to be rejected, as was the widening of the existing pavement choker. Finally, the elimination of the existing crosswalks at the intersection and the routing of pedestrians to a traffic signal controlled intersection one block west was rejected.

The E. Silver Spring Drive, N. Diversey Boulevard, and N. Consaul Place Intersection

The intersection of E. Silver Spring Drive, N. Diversey Boulevard, and N. Consaul Place is a "four-legged" intersection with the intersecting roadways constructed to urban cross-sections. East Silver Spring Drive has an existing pavement width of 48 feet; N. Consaul Place has twin 20 foot wide pavements separated by a 5 foot wide concrete median; and, N. Diversey Boulevard has an existing pavement width of 30 feet. The posted speed limit on these facilities is 25 miles per hour. Parking is generally permitted every where except on the north side east side of N. Consaul Place; however, parking is prohibited on the north side of E. Silver Spring Drive between N. Consaul Place and the private entrance to Sendick's and on the west side of N. Consaul Place. Traffic is controlled by stop signs on the N. Diversey Boulevard and N. Consaul Place approaches.

Based upon the 24 hour machine traffic counts approximately 14,455 vehicles entered the intersection on an average weekday in 1996. Based upon the 12 hour

manual turning movement counts, turning movements accounted for about 23 percent of all movements at this intersection between 6:00 a.m. and 6:00 p.m. During the morning peak hour, more than 19 percent of all vehicles were observed turning. The eastbound left-turn represented the highest turning movement observed during the morning peak hour at 60 vehicles. During the evening peak hour, about 20 percent of all vehicles were observed turning. The eastbound left-turn represented the highest turning movement observed during the evening peak hour at 80 vehicles.

Gap data were collected during those hours when both pedestrian traffic and vehicle traffic was heavy to determine the number of gaps in the E. Silver Spring Drive traffic stream at two different thresholds: 1) gaps having a minimum duration of eight seconds; and, 2) gaps having a minimum duration of 11 seconds. Observation indicated that an average of approximately 58 gaps per hour at the west crosswalk had a minimum duration 11 seconds and an average of approximately 64 gaps per hour at the east crosswalk had a minimum duration 11 seconds. The number of gaps observed with a duration of at least eight seconds averaged about 108 gaps per hour at the west crosswalk, and about 125 gaps per hour at the east crosswalk.

A total of 3 accidents occurred at the intersection during the three-year period from January 1, 1993, to December 31, 1995, with no accidents in 1993, two in 1994, and one in 1995. While none of the accidents involved either a pedestrian or a fatality, the accident in 1995 was a personal injury accident.

Pedestrians observed crossing E. Silver Spring Drive at this intersection were counted between the hours of 6:00 a.m. and 6:00 p.m. Volumes ranged from two to 18 pedestrians per hour in the east crosswalk, and from 5 to 36 pedestrians per hour in the west crosswalk.

Comparison of the inventory data to traffic engineering and geometric design standards indicated that no traffic operational or safety problems or geometric design problems existed at the intersection at the present time. As previously noted, delay was observed to be modest and only three accidents occurred during the three year period reviewed, none of which involved either a pedestrian or a

fatality. While observation indicated that throughout an average weekday there were generally 60 or more gaps per hour of sufficient length to allow pedestrians to cross E. Silver Spring Drive, there were hours when that threshold was not met. Thus, it was concluded that the provision of additional gaps in the E. Silver Spring Drive traffic stream would be desirable.

Five actions were considered to artificially create additional gaps in the E. Silver Spring Drive traffic stream. The first action recommended to be implemented was the prohibition of right turns on red between the hours of 6:00 a.m. and 6: 00 p.m. from northbound N. Santa Monica Drive at its intersection with E. Silver Spring Drive at an estimated cost of $100. The disadvantage of this action is the additional delay incurred by northbound right-turning motorists. The second action recommended for implementation was the installation of "CROSSWALK" signs facing east- and westbound E. Silver Spring Drive traffic at an estimated cost of $250. The disadvantage of this action is that the signing may be "lost" in the signing and lighting of the surrounding commercial district. The third action was the construction of a refuge island in the center of the roadway on both the east- and westbound intersection approaches at an estimated cost of $1,150. The disadvantage of this action is that a fixed object would be located in the center of the roadway creating a potential traffic safety hazard and complicating snow removal efforts.

At the specific request of the Village, the installation of traffic signals was also considered. Six traffic signal warrants were evaluated including one related to traffic accidents, another related to pedestrian volumes and four related to traffic volumes. Although the traffic volumes approach the volume warrant under the interruption of continuous traffic warrant, none of the warrants for the installation of traffic signals was met, and therefore, the installation of traffic signals was not recommended at this time. The installation of multi-way stop sign control at the subject intersection was also considered and was recommended to be rejected.

In the consideration of the recommended actions, it should be noted that the existing intersections have been operating efficiently, and that pedestrians were observed crossing E. Silver Spring Drive. No traffic operational or traffic

safety problems were identified. Further, some of the heaviest pedestrian volumes observed occurred during those hours when vehicle volumes were also heavy thereby indicating that those pedestrians who wish to cross E. Silver Spring Drive are not constrained by vehicular traffic.

* * *