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MEMORANDUM REPORT NUMBER 42

TRAFFIC ENGINEERING STUDY OF GRANDVIEW BOULEVARD—CTH T—FROM NORTHVIEW ROAD TO FATIMA DRIVE

WAUKESHA COUNTY, WISCONSIN

Prepared by the

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

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SEWRPC Memorandum Report No. 42

TRAFFIC ENGINEERING STUDY OF GRANDVIEW BOULEVARD --CTH T--FROM THE INTERSECTION OF GRANDVIEW BOULEVARD AND NORTHVIEW ROAD TO FATIMA DRIVE

INTRODUCTION

On July 1, 1988, the Highway and Transportation Committee of Waukesha County requested the Commission staff to conduct a traffic engineering study of the segment of Grandview Boulevard--CTH T--between Northview Road and Fatima Drive.

With the increased development in the area, local business owners and elected officials of both the City of Waukesha and the Town of Pewaukee have become increasingly concerned about traffic congestion and safety problems being experienced on this arterial facility, particularly at the driveway approaches which intersect this segment of CTH T; and at the interchange of Grandview Boulevard with IH 94. Plans for the future development of the City of Waukesha and the Town of Pewaukee indicate that these traffic problems may be expected to increase in the future.

This memorandum report presents the findings and recommendations of the requested traffic engineering study. The report describes the traffic problems which currently exist on this segment of CTH T; identifies and evaluates alternative short- and intermediate-range traffic engineering actions which may be expected to abate some of these existing traffic problems; and recommends traffic engineering measures for implementation in the short- and intermediate-range which may be expected to provide some abatement of existing traffic problems. A forecast of year 2010 average weekday traffic volumes which may be expected to use the study segment is presented, and potential long-range traffic problems are identified. Alternative long-range improvements designed to abate the forecast future traffic problems are proposed and evaluated, and a recommended improvement presented.

EXISTING CONDITIONS

Grandview Boulevard between Northview Road and Fatima Drive is an arterial highway and is part of the county trunk highway system of Waukesha County. As an arterial highway, the primary function of Grandview Boulevard is to serve through traffic. A secondary function is to provide access to abutting properties. As part of the county trunk highway system, Grandview Boulevard is under the jurisdiction of Waukesha County, and the County is responsible for the construction, operation, and maintenance of this facility.

Roadway Physical and Operational Characteristics

Grandview Boulevard--CTH T--between Northview Road and Silvernail Road has been constructed as an undivided urban cross-section with a curb-to-curb width of 48 feet. It has been widened on the southbound and northbound approaches, respectively, at its intersections with Northview Road and with Silvernail

Road to provide exclusive left-turn lanes 12 feet wide. Between Silvernail Road and the eastbound IH 94 on- and off-ramps, Grandview Boulevard has been constructed as an undivided rural cross-section 48 feet wide, and has been widened at the intersection with Silvernail Road to provide an exclusive leftturn and right-turn lane, each 12 feet in width on the southbound approach. The Grandview Boulevard and Silvernail Road intersection was reconstructed in 1987 and now provides exclusive left-turn lanes on all approaches. From the IH 94 eastbound on- and off-ramps to a point about 115 feet north of the IH 94 overpass, Grandview Boulevard is constructed to a rural cross-section with road ditches and a pavement width of 24 feet with two eight-foot-wide crushed aggregate shoulders. From about 115 feet north of the IH 94 overpass to about 265 feet north of the south General Electric Medical Systems complex driveway, Grandview Boulevard is constructed to a cross-section consisting of one 11foot-wide lane for southbound through traffic; one 11-foot-wide lane for southbound to westbound turning movements; one 11-foot-wide lane for northbound through traffic; and one 11-foot-wide lane for merging westbound IH 94 to northbound Grandview Boulevard traffic. Exclusive left-turn lanes are also provided for northbound left turns at the entrance to the westbound IH 94 onramp, Golf Road, and the south entrance to the General Electric Medical Systems complex driveway. In addition, a three-foot-wide bituminous concrete shoulder is provided on the east side of Grandview Boulevard and an eightfoot-wide crushed aggregate shoulder is provided on the west side of Grandview Boulevard. From about 265 feet north of the south General Electric Medical Systems complex driveway north to Fatima Drive, Grandview Boulevard is constructed to a rural cross-section with road ditches and a pavement width of 24 feet with two eight-foot-wide crushed aggregate shoulders.

In the segment concerned, Grandview Boulevard is intersected by Northview Road, Silvernail Road, Golf Road, and Fatima Drive. In addition, a full interchange is provided at the intersection of Grandview Boulevard with IH 94. In September 1987 construction of a westbound IH 94 to northbound Grandview Boulevard off-ramp was completed. The addition of this ramp provided westbound IH 94 to northbound Grandview Boulevard traffic with a merge lane to northbound Grandview Boulevard. In addition, the existing IH 94 westbound off-ramp to Grandview Boulevard was modified for exclusive use by vehicles traveling from westbound IH 94 to southbound Grandview Boulevard.

Parking is prohibited at all times along the entire study segment of Grandview Boulevard--CTH T. Thus, there are four through traffic lanes provided between Northview Road and the eastbound IH 94 on- and off-ramps. There are two through traffic lanes provided between the eastbound IH 94 on- and off-ramps and Fatima Drive.

The traffic on Grandview Boulevard at its intersections with Northview Road and with Silvernail Road is controlled by fully actuated traffic signals. Traffic at the intersections of Grandview Boulevard with Golf Road and on Fatima Drive is controlled by a "Stop" sign on Golf Road and a "Stop" sign on Fatima Drive. Traffic on the westbound IH 94 off-ramp to southbound Grandview Boulevard is controlled by a "Yield" sign. In the southwest quadrant of the interchange, traffic on the eastbound IH 94 off-ramp to northbound Grandview Boulevard is controlled by "Stop" signs at the ramp intersection with Grandview Boulevard, while the off-ramp carrying eastbound IH 94 traffic to southbound Grandview Boulevard continues through, becoming a second southbound

through lane at its junction with Grandview Boulevard and, thus, has no control. In the northeast quadrant of the interchange, traffic on the westbound IH 94 off-ramp to northbound Grandview Boulevard is provided with a merge lane with northbound Grandview Boulevard. This lane is 11 feet wide and remains full-width to a point approximately 30 feet north of the south General Electric Medical Systems complex driveway, where it begins to taper back to one 12-foot-wide lane for northbound through traffic. At the taper point, traffic is merged into the through northbound lane and is advised by a pictograph sign that the lane tapers. Northbound through traffic is advised of merging traffic by a "Merging Traffic on Right" sign.

The posted speed limit along the segment of Grandview Boulevard concerned is 35 miles per hour from Northview Road to approximately 600 feet north of the south General Electric Medical Systems complex driveway. The posted speed limit between this point and Fatima Drive is 45 miles per hour.

Traffic Volumes

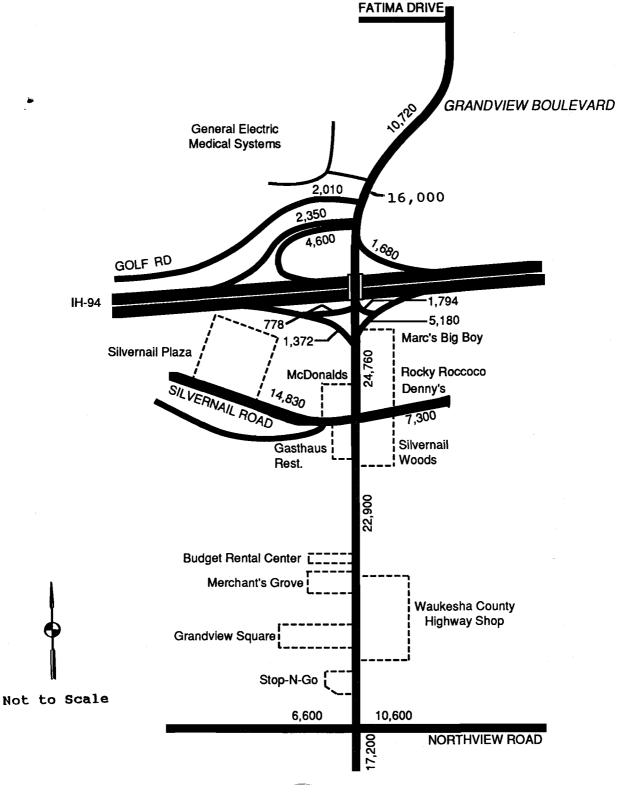
As shown on Figure 1, the average weekday traffic volumes on Grandview Boulevard in 1988 ranged from about 10,700 vehicles per average weekday north of the southern General Electric Medical Systems complex driveway to about 24,700 vehicles per average weekday between Silvernail Road and the IH 94 interchange. Between Silvernail Road and Northview Road, the average weekday traffic approximated 22,900 vehicles. In 1988, the traffic on Silvernail Road west of Grandview Boulevard approximated 14,800 vehicles per average weekday; and on Silvernail Road east of Grandview Boulevard, 7,300 vehicles per average weekday. The traffic volume on Northview Road in 1988 approximated 6,600 vehicles per average weekday west of Grandview Boulevard and 10,600 vehicles per average weekday east of Grandview Boulevard. In 1988, the traffic on Grandview Boulevard south of Northview Road approximated 17,200 vehicles per average weekday.

In 1988, approximately 7,000 vehicles per average weekday used the eastbound IH 94 on-ramp, while approximately 2,350 vehicles used the westbound IH 94 on-ramp. The westbound IH 94 off-ramp to northbound Grandview Boulevard carried approximately 1,700 vehicles per average weekday, while the westbound IH 94 to southbound Grandview Boulevard off-ramp carried approximately 4,600 vehicles per average weekday. Approximately 2,150 vehicles per average weekday utilized the eastbound off-ramp. These estimates of average weekday traffic volumes are based upon counts conducted in October through December 1988 by the Wisconsin Department of Transportation and the Regional Planning Commission.

The number of traffic lanes provided on an arterial facility largely, although not entirely, establishes its traffic-carrying capacity. A two-traffic-lane urban arterial generally has a design capacity of about 13,000 vehicles per average weekday; a four-lane undivided arterial has a design capacity of about 17,000 vehicles per average weekday; a four-lane divided arterial has a design capacity of about 25,000 vehicles per average weekday; and a six-lane divided arterial has a design capacity of about 35,000 vehicles per average weekday. Also affecting urban arterial design capacity are the characteristics of its intersections, including intersection approach pavement width, including provision of exclusive turn lanes; parking within 200 feet of the intersection;

Figure 1

24-HOUR WEEKDAY TRAFFIC VOLUME ON GRANDVIEW
BOULEVARD AND SELECTED INTERSECTING STREETS: 1988



Source: Wisconsin Department of Transportation and SEWRPC.

type and operation of traffic control; percentage of right and left turns at intersections; and percentage of trucks and buses in the traffic stream.

Based on a comparison of the 1988 average weekday traffic volumes on Grandview Boulevard to design capacities, the segment of Grandview Boulevard between Northview Road and Golf Road was operating in excess of design capacity; and the segment of Grandview Boulevard between Golf Road and Fatima Drive was operating at about design capacity.

Urban arterials carrying average weekday traffic volumes exceeding design capacity may be expected to experience significant delays at controlled intersections; reduced speeds between intersections; and increased accident rates. The reduced speeds and intersection delays on urban arterials carrying average weekday traffic volumes equaling or exceeding their design capacity will generally occur only during the morning and evening peak traffic hours and, in some cases, during the midday. During evening and early morning hours, there will generally be little, if any, traffic congestion and delay. Also, on most urban arterial streets, weekend traffic peaks will generally be less than weekday traffic peaks.

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

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

Vehicles using arterials operating under design capacity will experience little vehicle backup at signalized intersections, and no vehicles will have to wait through more than one red traffic signal phase. The average delay to vehicles at signalized intersections will typically range from 5 to 15 seconds.

The historical growth trends since 1968 in average weekday traffic volume on the segment of Grandview Boulevard concerned and on intersecting streets is shown in Table 1. The historic growth trend in traffic volume on Grandview Boulevard--CTH T--varies along the length of the study segment. On the segment of Grandview Boulevard north from Northview Road to Silvernail Road, average weekday traffic has increased by about 230 percent since 1968, or by more than 6 percent annually. However, since 1985 average weekday traffic has increased by 10 percent, or only about 3 percent annually. North of Silvernail Road,

Table 1

EXISTING WEEKDAY TRAFFIC VOLUMES ON GRANDVIEW
BOULEVARD AND SELECTED STREETS WITHIN THE PERIOD 1968-1988

	Year								
Location	1968	1970	1973	1976	1979	1982	1985	1988	(percent)
Grandview Boulevard Northview Road									
to Silvernail Road Silvernail Road to IH 94 General Electric Driveway	6,898 4,745	5,020 5,000	11,130 9,550	11,280 10,112	14,620 13,540	16,240 14,640	20,760 18,580	22,900 24,760	6.2 8.6
to Fatima Road				3,760	6,270	4,530	8,740	10,720	9.1
Northview Road East of Grandview Boulevard West of Grandview Boulevard			6,210 3,770	4,630 4,650	10,940 5,720	10,720 7,260	11,610 3,580	10,600 6,600	3.6 3.8
Silvernail Road East of Grandview Boulevard West of Grandview Boulevard	952 1,944	1,810 1,710	2,460 2,880	1,700 2,180	2,040 	4,620 	7,520 11,440	7,300 14,830	10.7 10.7
Interstate Highway 94 Eastbound Off-Ramp Eastbound On-Ramp Westbound Off-Ramp Westbound On-Ramp	 	 	 	 	 	1,770 4,350 4,120 1,960	2,150 5,730 5,640 2,560	2,150 6,980 6,280 ^a 2,350	3.3 8.2 7.3 3.1
Golf Road West of Grandview Boulevard				440				2,010	13.5

aIncludes both ramps westbound off to northbound and southbound Grandview Boulevard.

Source: Wisconsin Department of Transportation and SEWRPC.

average weekday traffic on Grandview Boulevard has increased by about 400 percent since 1968, or more than 8 percent annually.

The average weekday traffic volume on the off- and on-ramps at the interchange of IH 94 with Grandview Boulevard has also increased. The average weekday traffic utilizing the eastbound on-ramp has increased by approximately 60 percent since 1982. The average weekday traffic traveling westbound on IH 94 and exiting to Grandview Boulevard has increased by about 52 percent since 1982. The average weekday traffic on the eastbound off-ramp and the westbound onramp has increased by approximately 21 and 20 percent, respectively, since 1982. Average weekday traffic on Silvernail Road east and west of Grandview Boulevard has increased by more than 600 percent since 1968, or more than 10 percent annually. Average weekday traffic on Northview Road east and west of Grandview Boulevard has increased by about 70 percent since 1973, or about 4 percent annually. Located midway between the westbound IH 94 on-ramp and the southernmost General Electric Medical Systems complex driveway, the average weekday traffic on Golf Road immediately west of Grandview Boulevard has increased approximately 350 percent since 1976, or almost 14 percent annually.

Figure 2 indicates the hourly distribution of average weekday traffic volumes on Grandview Boulevard between Northview Road and Silvernail Road. Hourly traffic volumes in the early morning hours between 12:00 a.m. and 5:00 a.m. are very low, with each hour constituting less than 1 percent of the average weekday traffic volume. After 5:00 a.m., hourly traffic volumes increase rapidly to an early morning peak hour between 7:00 a.m. and 8:00 a.m., constituting about 8 percent of average weekday traffic volume. Hourly traffic volumes then decline for the next few hours and then increase to a late morning-early afternoon peak of about 7 percent of the average weekday traffic volume between 12:00 p.m. and 1:00 p.m. Hourly traffic volumes again decline for the next few hours and then increase to the daily peak of 8.3 percent of the average weekday traffic volume between 5:00 p.m. and 6:00 p.m. Traffic volumes then decline steadily each hour to the end of the day.

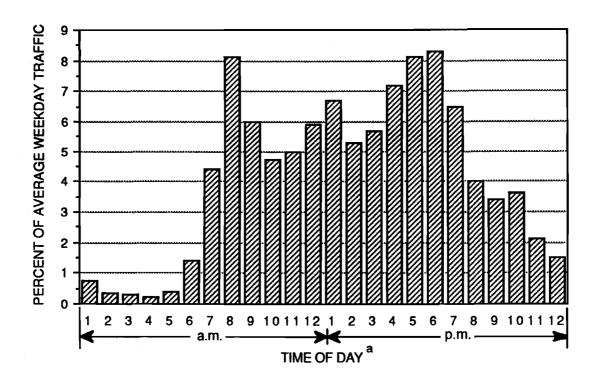
The pattern exhibited by the hourly distribution of traffic occurs as a result of work-related trips being made during the morning peak traffic hour of 7:00 a.m. to 8:00 a.m.; shopping, social recreation, and personal business trips being made during the midday; and a combination of these types of trips being made during the afternoon peak hour of 4:30 to 5:30 p.m. This pattern is typical of arterial facilities in southeastern Wisconsin. The evening peak traffic hour and period are of primary concern because this is when traffic volumes on the roadway are greatest.

In order to determine intersection operating conditions, the Regional Planning Commission in 1988 conducted hourly turning movement traffic volume counts from 6:00 a.m. to 8:00 p.m. at the Grandview Boulevard intersection with Northview Road and Silvernail Road. The 6:00 a.m. to 8:00 p.m. time period includes the previously identified morning and afternoon peak traffic hours and accounts for more than 80 percent of the total average weekday traffic volume.

Shown on Figure 3 are the 24-hour weekday turning movement volumes at the intersections of Grandview Boulevard and Northview Road, and Grandview Boulevard and Silvernail Road, as estimated from the 6:00 a.m. to 8:00 p.m. count

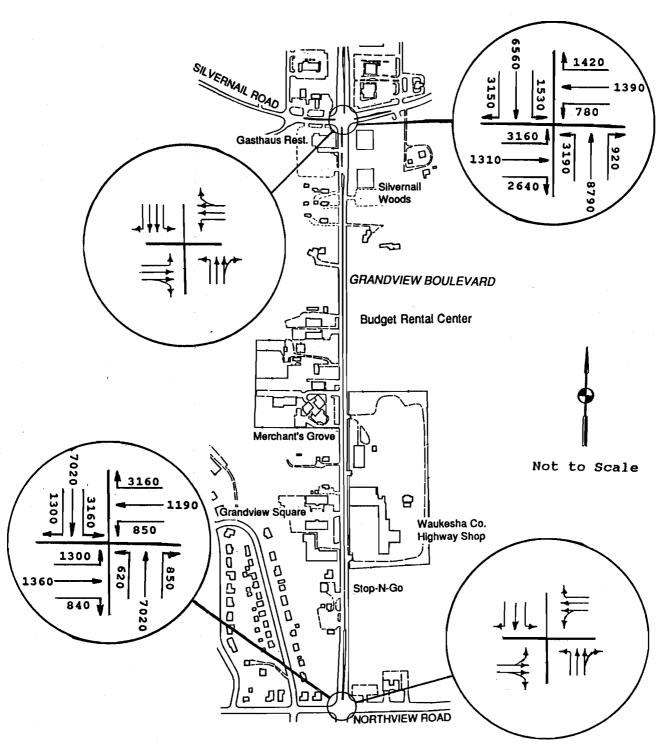
Figure 2

HOURLY VARIATION IN WEEKDAY TRAFFIC VOLUME ON GRANDVIEW BOULEVARD SOUTH OF SILVERNAIL ROAD: 1988



a Times shown are for hour ending

Figure 3
24-HOUR TURNING MOVEMENT VOLUMES AT SELECTED INTERSECTIONS ON GRANDVIEW BOULEVARD: 1988



data. It may be noted that heavy turn movements existed between Northview Road and Grandview Boulevard north of Northview Road. Of the estimated 22,940 vehicles per average weekday on Grandview Boulevard immediately north of its intersection with Northview Road, approximately 8,920 vehicles, or 39 percent, made turning movements to and from Northview Road, and the remaining 14,020 vehicles, or 61 percent, travel directly through the intersection on Grandview Boulevard.

Turning movement traffic counts were also taken during the 4:30 p.m. to 5:30 p.m. hour of peak traffic flow at the intersections. Figure 4 shows the turning movement volumes during this evening peak hour for the intersection of Northview Road with Grandview Boulevard, and the intersection of Silvernail Road with Grandview Boulevard. At the intersection of Northview Road with Grandview Boulevard, the highest volume movement was the southbound through movement of about 700 vehicles. At the intersection of Silvernail Road with Grandview Boulevard, the highest volume movement was the southbound Grandview Boulevard through movement of about 750 vehicles.

During the evening hour of peak traffic flow, heavy turn movements existed at the intersection of Silvernail Road with Grandview Boulevard. Of the estimated 2,920 vehicles entering the intersection, approximately 1,350 vehicles, or 46 percent, made turning movements to and from Silvernail Road, and the remaining 1,570 vehicles, or 54 percent, traveled directly through the intersection.

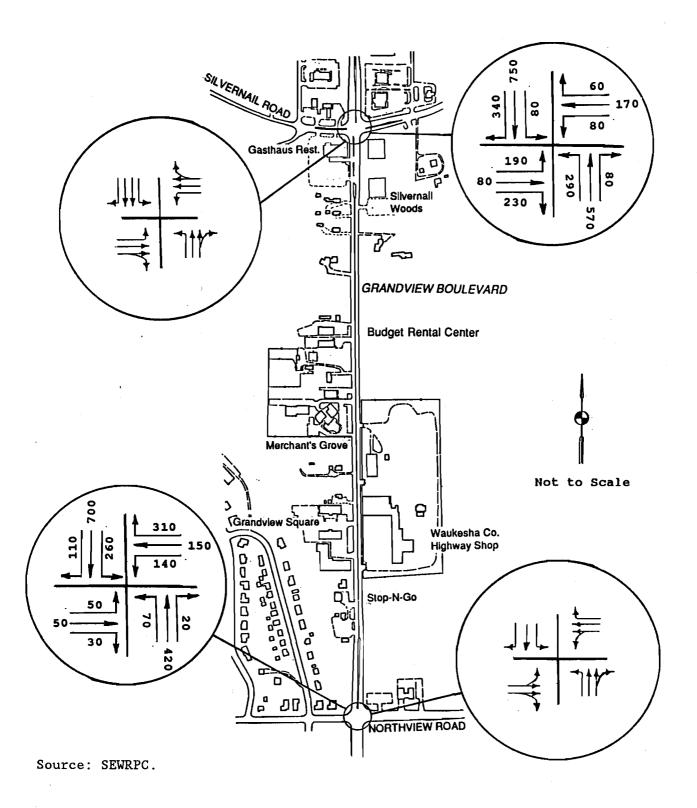
Capacity analyses of the Grandview Boulevard intersections with Northview Road and Silvernail Road, and of each on- and off-ramp at the interchange of IH 94 with Grandview Boulevard, were conducted for the evening hour of peak traffic flow to identify existing traffic congestion and delay problems. At the intersection of Grandview Boulevard and Northview Road, the southbound through movement on Grandview Boulevard was determined to be operating at design capacity. The measured delay on this approach was determined to range from 16 seconds to 21 seconds, with an average delay of approximately 18.5 seconds. All other traffic movements at the intersection were operating under design capacity.

At the intersection of Grandview Boulevard and Silvernail Road, the Grandview Boulevard southbound through movement was determined to be operating at design capacity during the evening hour of peak traffic flow. The measured delay was determined to range from 16 seconds to 25 seconds, with an average delay of approximately 20.5 seconds. In addition, the northbound left-turn movement and the westbound through and right-turn movements were also identified as operating at design capacity during the evening peak hour. These relatively low-volume movements on the westbound approach operate at design capacity because of the nominal amount of green time allocated to this approach during each signal cycle, resulting in significant delay. Allocation of additional green time to this approach, however, would degrade the operation of the other three approaches at the intersection. The remaining traffic movements at the intersection were found to be operating under design capacity.

Traffic volume counts were conducted at the freeway on- and off-ramps in the IH 94-Grandview Boulevard interchange by the Wisconsin Department of Transportation and the Regional Planning Commission, also in 1988. Approximately 500 vehicles used the westbound IH 94 to southbound Grandview Boulevard off-ramp

Figure 4

TURNING MOVEMENT TRAFFIC VOLUMES DURING THE EVENING PEAK
HOUR AT SELECTED INTERSECTIONS ON GRANDVIEW BOULEVARD: 1988



during the evening peak hour of traffic flow at this off-ramp, which occurs between 5:00 p.m. and 6:00 p.m. During this same peak traffic hour, approximately 75 vehicles used the westbound IH 94 to northbound Grandview Boulevard off-ramp. The eastbound IH 94 off-ramp carried approximately 105 vehicles, 30 of these vehicles turned left to travel north on Grandview Boulevard, while 75 vehicles continued south onto Grandview Boulevard. Approximately 260 vehicles and 670 vehicles used the westbound and eastbound on-ramps, respectively, during the evening peak hour. Of the 670 vehicles using the eastbound on-ramp, 380 used the northern entrance and approximately 285 vehicles used the southern entrance. Figure 5 shows the peak hour traffic volumes for the interchange ramps.

Capacity analyses conducted at the terminus of the westbound IH 94 to south-bound Grandview Boulevard off-ramp indicated that current traffic volumes exceed design capacity and equal maximum capacity; and significant delays and extensive vehicle queues result. Delays of up to 110 seconds were observed, with an average delay of approximately 90 seconds. The number of vehicles observed in the queues ranged from 28 to 40. These conditions were typical over more than half of the peak hour. Figure 6 shows the extent of the queue on the off-ramp. It should also be noted that citizens have reported that queues occasionally are even more lengthy, extending dangerously onto the freeway main line itself.

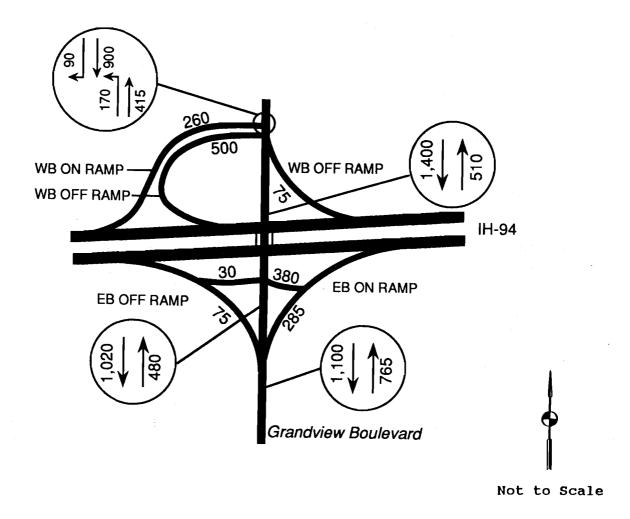
Capacity analyses were also performed for the remaining on- and off-ramps, and existing traffic volumes were determined to be under design capacity on the on- and off-ramps. This included the left-turn movement from southbound Grand-view Boulevard to the IH 94 eastbound on-ramp. During the evening hour of peak traffic flow, about 380 southbound left-turning vehicles must find gaps between the opposing 480 vehicles traveling northbound on Grandview Boulevard.

Traffic volume counts were also taken by the Commission in 1988 at the entrance and exits to the major traffic generators located along Grandview Boulevard. Turning movement traffic counts were taken from 6:00 a.m. to 9:00 a.m. and from 11:00 a.m. to 6:00 p.m. at the north entrance to the Stopn-Go convenience store and the south entrance to the Waukesha County Highway Shop. Turning movement traffic counts were also taken from 11:00 a.m. to 6:00 p.m. at the driveway to Grandview Square, the north and south driveways at Merchants' Grove, the north driveway at the Waukesha County Highway Shop, the driveway at Budget Rental Center, and the Grandview Boulevard entrances at the Gasthaus Restaurant and the Silvernail Woods Office Park. These counts were taken to determine the volume of traffic being generated by businesses within the study area, to determine the operating conditions of the entrances and exits to these businesses, and to evaluate the potential need for turn lane improvements on Grandview Boulevard. Shown on Figure 7 are the locations of these driveways and the 4:30 p.m. to 5:30 p.m. hour of peak traffic flow turning movements for the selected traffic generators located along this section of Grandview Boulevard.

Approximately 120 vehicles enter and exit the Merchants' Grove office and retail-service complex. Forty of these vehicles turn left out of the complex and travel northbound; 51 turn right from the complex and travel southbound; nine vehicles make left turns into the complex, and 20 vehicles turn right into the complex. The Grandview Square offices generate approximately 63

Figure 5

TRAFFIC VOLUMES DURING THE 5:00 P.M. TO 6:00 P.M. EVENING PEAK HOUR AT THE INTERCHANGE OF IH 94 WITH GRANDVIEW BOULEVARD: 1988



Source: Wisconsin Department of Transportation and SEWRPC.

Figure 6
WESTBOUND IH 94 OFF-RAMP LENGTH OF QUEUE: 1988

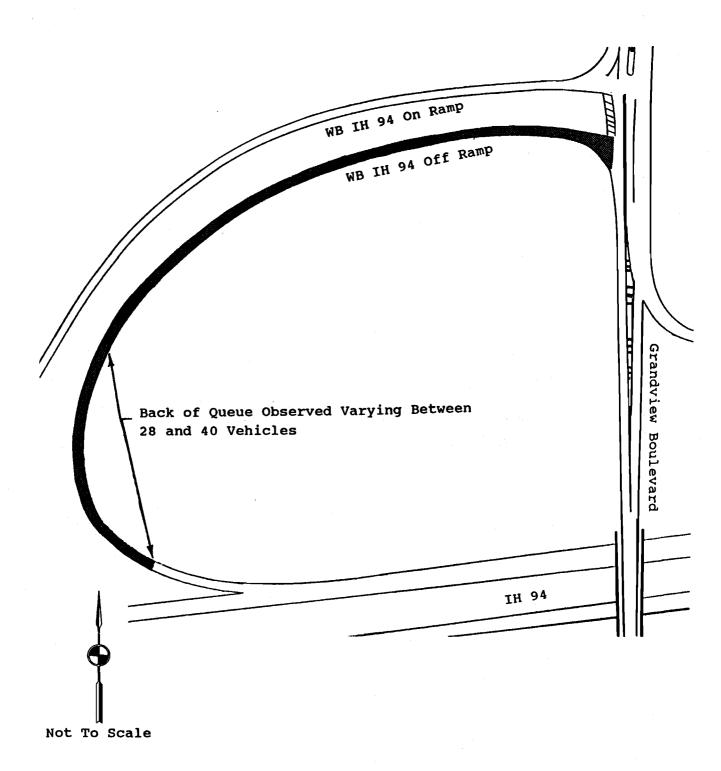
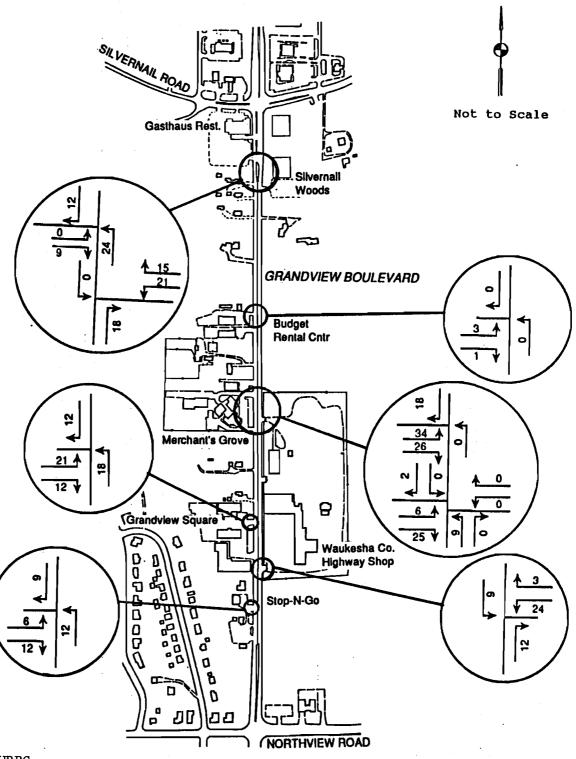


Figure 7

TURNING MOVEMENT TRAFFIC VOLUMES DURING THE EVENING PEAK HOUR ON GRANDVIEW BOULEVARD: 1988



vehicles during the evening hour of peak traffic flow. Twenty-one of these vehicles exit turning left to travel northbound; 12 vehicles exit turning right to travel southbound; 12 enter turning right from the north; and 18 enter turning left from the south. The remaining traffic generators sampled along this section of Grandview Boulevard contributed 190 vehicles. Forty-five vehicles entered making left turns across two opposing lanes of traffic; 54 vehicles exited making left turns across two opposing lanes of traffic and merged with northbound Grandview Boulevard traffic; 51 vehicles entered making right turns; and 40 vehicles exited making right turns onto Grandview Boulevard.

In addition to the peak period traffic counts taken at the southern driveway to the General Electric Medical Systems complex, Commission staff in 1989 conducted a survey to determine the destination of motorists exiting the complex between 2:30 p.m. and 6:00 p.m. The survey was conducted to determine the number of vehicles that could potentially be diverted from Grandview Boulevard by opening a driveway directly to Golf Road on the west side of the General Electric Medical Systems complex. Shown on Figure 8 are the results of the survey taken from 2:30 p.m. to 6:00 p.m.; and the number of vehicles generated by the General Electric Medical Systems complex and how these vehicles exited onto Grandview Boulevard. Approximately 1,340 vehicles were observed exiting the General Electric Medical Systems complex and traveling south on Grandview Boulevard. Twenty of these vehicles, or about 1.5 percent, turn west onto Golf Road, and approximately 110 vehicles, or about 8.3 percent, enter the westbound IH 94 on-ramp. Of the remaining 1,210 southbound vehicles generated by the General Electric Medical Systems complex, approximately 480, or about 40 percent, turn left onto the eastbound IH 94 on-ramp; and approximately 730 vehicles, or about 60 percent, continue southbound on Grandview Boulevard.

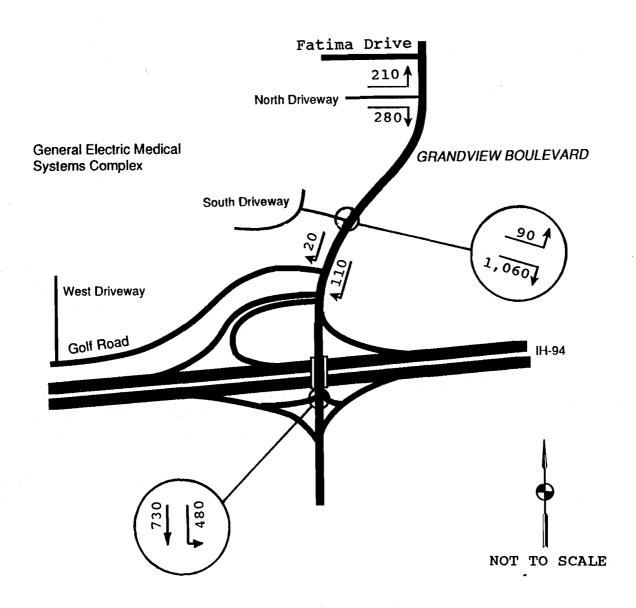
The most difficult maneuver to execute at a driveway is an exiting left-turn movement onto the major street. Motorists executing this maneuver on Grandview Boulevard must find a gap in the through traffic of about 8.0 seconds. Commission staff measured the average gap between vehicles on Grandview Boulevard as approximately 2.7 seconds during the evening hour of peak traffic flow. A gap of acceptable length was observed to occur only every 62 seconds. The left-turn movements from the abutting land use concerned onto Grandview Boulevard from each driveway, therefore, encounter significant delay.

Left-turn movements into a driveway is largely dependent on the gaps in the opposing stream and are thus a function of the volume and speed of opposing vehicles. To execute a left turn off Grandview Boulevard, a gap of approximately 6.0 seconds must be found in the opposing traffic stream. Commission staff measured the average gap in the southbound traffic on Grandview Boulevard as approximately 4.2 seconds. A gap of acceptable length was found to occur every 26 seconds. Generally, vehicles waiting to turn left from the northbound traffic stream can be expected to suffer delay and an increased potential for rear end collisions, and to momentarily reduce the capacity of the lanes in the direction they are traveling.

The southernmost entrance to the Waukesha County Highway Shop and the Grandview Boulevard entrance to the Silvernail Woods office complex are the only two driveways into which southbound traffic may turn left during the evening hour of peak traffic flow. For the average automobile to perform a left-turn

Figure 8

TURNING MOVEMENTS OF VEHICLES ORIGINATING AT THE GENERAL ELECTRIC MEDICAL SYSTEMS COMPLEX: FROM 2:30 P.M. TO 6:00 P.M.: 1988



maneuver off Grandview Boulevard, a gap of approximately 6.0 seconds needs to be found in the opposing northbound Grandview Boulevard traffic stream. The average gap in the northbound traffic stream was determined to be approximately 4.0 seconds, and the average delay for motorists turning left approximately 7.3 seconds.

Operating Speeds

A spot speed study on Grandview Boulevard was conducted by the Regional Planning Commission on November 10, 1988, during the off-peak hours of 9:00 a.m. to 11:30 a.m. The average travel speed on Grandview Boulevard between these two intersections was 38.6 miles per hour for vehicles traveling northbound; and 39.4 miles per hour for vehicles traveling southbound on Grandview Boulevard, or slightly higher than the posted speed limit of 35 miles per hour. The 85th percentile speed--the speed at or below which 85 percent of traffic is traveling--was measured to be 42.7 miles per hour and 44.5 miles per hour for northbound and southbound Grandview Boulevard traffic, respectively. The "10 mile per hour pace"--that is, the 10 mile per hour increment of speed range including the largest number of vehicles--was found to be 34 miles per hour to 43 miles per hour, with 76 percent of the traffic traveling north on Grandview Boulevard and 32 miles per hour to 41 miles per hour, with 72 percent of the traffic traveling south on Grandview Boulevard.

Traffic Accidents

The incidence and location of traffic accidents provides another important measure of the efficiency and operating characteristics of an arterial facility such as Grandview Boulevard. A three-year motor vehicle accident history for the study segment of Grandview Boulevard is shown in Table 2 and Figures 9, 10, and 11. A total of 56 accidents occurred on the study segment in 1986; 52 accidents occurred in 1987; and 41 accidents occurred in 1988. Collision diagrams are provided in Appendix A.

As shown in Figure 9 and Table 2, of the 56 accidents reported on Grandview Boulevard in 1986, four occurred at the intersection of Grandview Boulevard with Northview Road; 20 accidents occurred at its intersection with Silvernail Road; six accidents occurred at the entrance and exits to the eastbound IH 94 on- and off-ramps; three accidents occurred at the entrance and exit to the westbound IH 94 on- and off-ramps; and the remaining 23 accidents were reported as midblock accidents, with 15 of these accidents occurring between Northview Road and Silvernail Road.

Of the 52 accidents reported in 1987, seven occurred at the intersection with Northview Road; 12 occurred at Silvernail Road; eight were reported at the IH 94 eastbound on- and off-ramps; 13 occurred at the IH 94 westbound on- and off-ramps; and the remaining 12 accidents were reported as midblock accidents, with nine of these accidents occurring between Northview Road and Silvernail Road.

Of the 41 accidents reported in 1988, six occurred at the intersection of Grandview Boulevard with Northview Road; six occurred at Silvernail Road; 13 occurred at the eastbound IH 94 on- and off-ramps; nine accidents occurred at the IH 94 westbound on- and off-ramps; and the remaining seven were reported as midblock accidents, with four of these accidents occurring between Northview Road and Silvernail Road.

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Table 2

INCIDENCE AND SEVERITY OF MOTOR VEHICLE ACCIDENTS ON THE STUDY SEGMENT OF GRANDVIEW BOULEVARD BETWEEN NORTHVIEW ROAD AND FATIMA DRIVE

	1986_			1987			1988			Total		
Intersection	Injury	Property Damage	Total	Injury	Property Damage	Total	Injury	Property Damage	Total	Injury	Property Damage	Total
Grandview Boulevard									,			
Northview Road	1] ,		,	,	-	_	_		_		
Silvernail Road	=	15	20	3	9	.,	3	3	6	7	10	17
Eastbound IH 94 Off- and On-Ramps	1 3	19	6	3		12		6	6	8	30	38
Westbound IH 94 Off- and On-Ramps		4	5	6	💃	8		13	13	4	23	27
] - -	3	3	•	1 ′	13	'	4	9	11	14	25
lidblock												
Between Northview Road												
and Grandview Square	l	1 1	1 1		, ,	2		, ,	,			4
Between Grandview Square	1	•	-		•	2		• !			4	4
and Silvernail Road	3	11	14		7	7		2	2	- 2	21	24
IH 94 Overpass		1	1				1	1	3	1	21	24
Between Westbound IH-94 Off-	ı	_	-				•	•	2	-		,
and On-Ramps and the South		l										
General Electric Driveway		3	3		2	2					5	5
Between the South General Electric	1 1	_	-		_	-						
Driveway and Fatima Drive	2	2	4		1 1	1	***	1	1	2		6
					_	-			•	-	· •	·
Total												
Intal	13	43	56	14	38	52	9	32	41	36	113	149

Figure 9

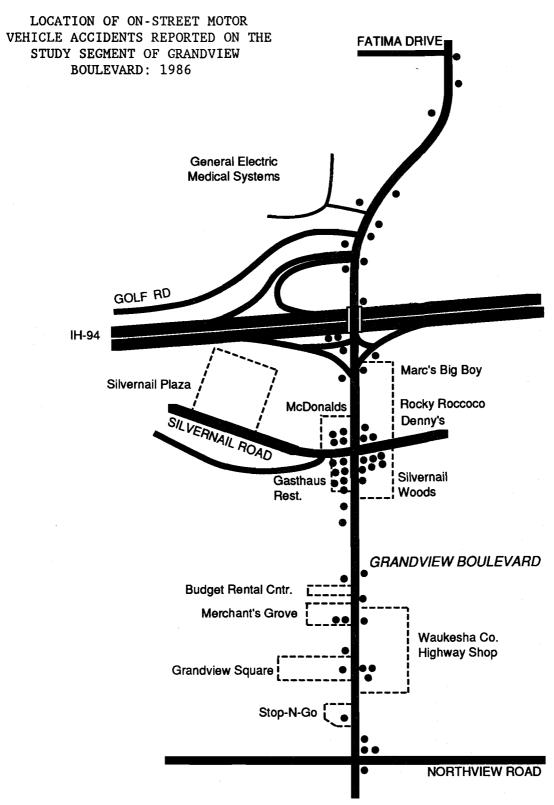


Figure 10

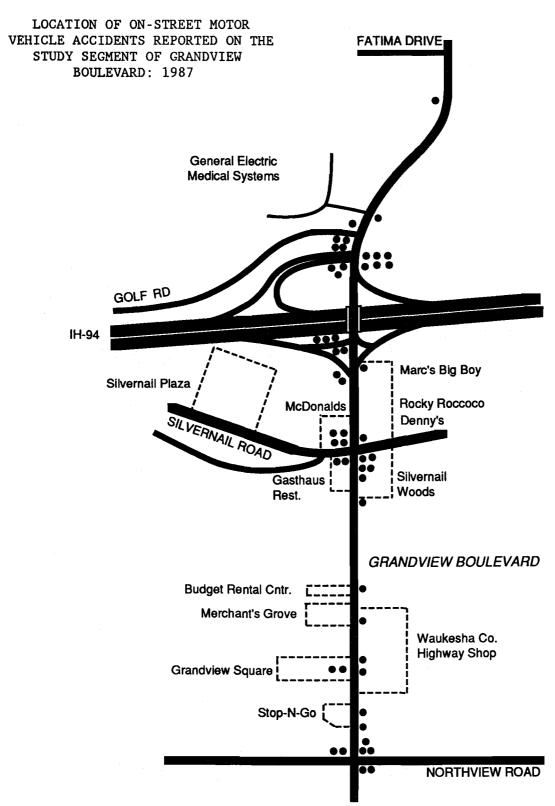
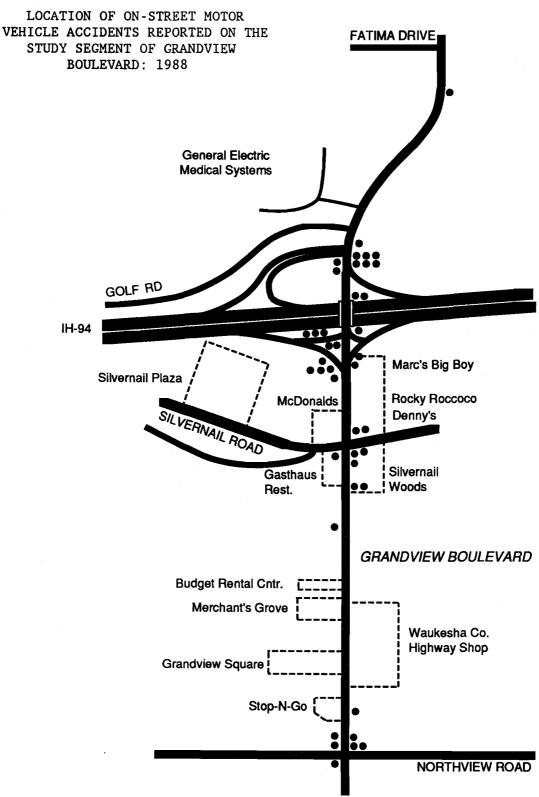


Figure 11



The locations experiencing the most accidents during the three-year period from 1986 through 1988 were: 1) the intersections of Silvernail Road and Grandview Boulevard; 2) the IH 94 on- and off-ramps at their Grandview Boulevard termini; 3) the midblock segment of Grandview Boulevard between Grandview Square and Silvernail Road; and 4) the intersection of Northview Road and Grandview Boulevard. However, reconstruction of the intersection of Grandview Boulevard and Silvernail Road in 1987 has resulted in the substantial reduction of accident frequency from 20 accidents in 1986 to 12 in 1987 and only six in 1988. Construction in 1987 of a new westbound IH 94 off-ramp to northbound Grandview Boulevard and the subsequent removal of the traffic signal at the site of the former westbound IH 94 off-ramp resulted in a modest reduction in accident frequencies at the westbound IH 94 off-ramp intersection with Grandview Boulevard from 13 accidents in 1987 to nine in 1988.

Another measure used to identify accident problem locations is the accident rate at intersections and midblock. The accident rate at intersections considers not only the frequency of accidents, but also the volume of traffic entering an intersection. The highest intersection accident rates on the study segment of Grandview Boulevard found in the three-year study period occurred at the Silvernail Road and Grandview Boulevard intersection and at the intersection of the westbound IH 94 on- and off-ramps with Grandview Boulevard. The highest accident rate at these respective intersections was 1.24 accidents per million vehicles entering the intersection and 1.17 accidents per million vehicles entering the intersection over the three-year period. The next highest intersection accident rate occurred at the intersection of the eastbound IH 94 on- and off-ramps with Grandview Boulevard, with 1.07 accidents per million vehicles entering the intersection over the three-year period.

Midblock accident rates consider the frequency of accidents, number of vehicles traveling the segment, and the segment length. The highest annual midblock accident rate was 220 accidents per 100 million vehicle miles of travel between Silvernail Road and Grandview Square over the three-year period.

The locations along the study segment which may be considered problem locations are those where the frequency and/or rate of accidents appear relatively high compared to the accident experience at other locations; and at locations which have experienced increases in accident frequency. Such accident problem locations include the intersections of Grandview Boulevard and the east- and westbound on- and off-ramps and the midblock segment of Grandview Boulevard between Grandview Square and Silvernail Road, and the intersection of North-view Road and Grandview Boulevard.

Analysis of the accidents occurring at the intersection of Grandview Boulevard and the eastbound IH 94 on- and off-ramps indicates that eight of the 22 accidents from 1986 through 1988 occurred at night. Fourteen of the accidents involved vehicles which were southbound on Grandview Boulevard. Five of those accidents were rear end accidents; four accidents involved vehicles traveling in the same direction where one of the vehicles was changing lanes; and two of the accidents involved right angle collisions. Neither weather nor roadway conditions appears to have contributed significantly to the number of accidents at this location. All 14 accidents potentially suggest: 1) excessive speed; 2) lack of driver awareness of the intersection or a sight distance problem; 3) substantial turning and opposing through volumes; and 4) with

respect to the rear end collisions, a need to provide an exclusive left-turn lane from southbound Grandview Boulevard to eastbound IH 94. Ten of the accidents at this location involved northbound vehicles, half of which involved right angle collisions. Two accidents involved rear end collisions. These 10 accidents suggest excessive speed or sight distance problems.

An analysis of the accidents occurring at the intersection of Grandview Boulevard and the westbound IH 94 on- and off-ramps may indicate that poor night time visibility contributed to the incidence of accidents at this location, as 14 of the 25 accidents which occurred from 1986 through 1988 occurred at night. It should be noted that the City of Waukesha installed street lighting at this location in December 1988 to address this problem. Other geometric and operational improvements occurred in September 1987 with the construction of a westbound off-ramp to northbound Grandview Boulevard and the removal of the traffic signal at the off-ramp. In the last two months of 1987 and in 1988, a total of 14 accidents occurred, 10 of which were right angle collisions and three of which involved vehicles attempting to merge into the southbound Grandview Boulevard traffic stream from the westbound off-ramp. The 14 accidents suggest excessive speed, high volumes, and lack of motorist awareness of the abrupt change in direction at the ramp terminus.

Analysis of the accidents occurring from 1986 to 1988 at the intersection of Grandview Boulevard and Northview Road indicate a concentration of six accident in the right-turn lane on the westbound approach. Five of the six accidents were rear end collisions and three of the accidents resulted in injuries. This accident pattern suggests that there is doubt as to whether the lead vehicle intends to yield the right-of-way and stop, or to proceed without stopping.

Analysis of the accidents occurring on Grandview Boulevard between Grandview Square and Silvernail Road indicates that six of the 24 accidents occurring from 1986 through 1988 occurred at night. Fifteen of the 24 accidents were rear end collisions and three of the accidents were right angle collisions. Of the 24 total accidents, 19 were related to driveways along this segment. These 19 accidents indicate excessive speed, and substantial through and turning volumes.

ANALYSIS AND RECOMMENDATIONS

This section of the memorandum presents a short-range plan consisting of traffic engineering improvements which may provide some limited abatement of existing traffic congestion and accident problems, and which can be implemented within a short time frame. Also, a long-range plan consisting of recommended major roadway improvements is presented which is intended to fully abate existing and probable future traffic problems.

Short-Range Highway Improvement Plan

The short-range plan element for Grandview Boulevard consists primarily of low cost traffic engineering improvement measures such as traffic signing, pavement marking, and minor reconstruction. The following analysis addresses the previously identified existing traffic problems along the study segment of Grandview Boulevard with respect to short-term actions.

Grandview Boulevard and Eastbound IH 94 On- and Off-Ramp Intersection: The principal problem identified at this intersection is an accident problem. As previously noted, the most discernible accident problems were rear end collisions and lane changing.

A recommended traffic management action to further reduce the lane changing problem at this location is the delineation of traffic lanes with pavement markings. An eight-inch solid white line can be used at critical areas where is is advisable to discourage lane changing. It is recommended that an eight-inch solid white line be used to separate the southbound through traffic lane from the added lane for eastbound IH 94 traffic to southbound Grandview Boulevard and extend approximately 100 feet beyond the point of tangency between the off-ramp and the southbound lane. In addition, the gore, or neutral area, should be painted with eight-inch solid white transverse markings for special emphasis. It is recommended that this alternative traffic management action be implemented, at an estimated cost of \$600.

A recommended traffic management action to alleviate the lane changing problem is the installation of advisory signing on the eastbound to southbound leg of the eastbound IH 94 off-ramp bearing the "Added Lane (From Right)" symbol. The advantage of installing this advisory signing is to inform motorists that they have direct entry into a separate lane and that they need not merge into southbound traffic at the ramp terminal. It is recommended that this alternative control measure be implemented, at an estimated cost of \$200.

A recommended traffic management action to further alleviate accident problems at this location is increased law enforcement activity on a random basis. The advantage of this alternative traffic management action is increased motorist compliance with the posted speed limit. The slower speeds provide motorists more time to respond to unexpected conditions. A potential disadvantage is the diversion of law enforcement personnel from other locations in order to implement this action. It is recommended that this alternative control measure be implemented, at a cost of \$2,250 per year.

Other alternative control measures considered but rejected included reducing the speed limit and construction of a left-turn lane in the southbound direction. A reduction in the speed limit was rejected because motorist compliance with the existing higher speed limit is not good and, thus, there may be expected to be even less compliance with a lower speed limit. Construction of a southbound left-turn lane was rejected because proximity of the structure over IH 94 and the on-ramp entrance--approximately 200 feet--prohibit correct design of a separate lane. A length of 240 feet is the absolute minimum necessary to provide a left-turn lane, with a desirable length of 440 feet. In addition, it should be noted that the Wisconsin Department of Transportation has programmed a highway improvement with completion anticipated in 1993 for the reconstruction of the interchange and of Grandview Boulevard over IH 94 to provide a four-traffic-lane divided roadway. This project may be expected to resolve existing traffic problems, and contribute to the resolution of future traffic problems, at this interchange. The implementation of the programmed highway improvement should be undertaken as soon as possible because this facility is operating over its design capacity now and operating conditions may be expected to deteriorate as traffic volumes increase.

Grandview Boulevard and Westbound IH 94 Off-Ramp Intersection: The principal problems identified at this location were an accident problem and a capacity problem. As previously noted, 25 accidents occurred here over the three-year study period, with right angle collisions occurring most often. Analysis of accidents at this intersection indicate that 14 collisions occurred at night. In December 1988 the City of Waukesha installed street lighting at this intersection. While sufficient time has not elapsed to determine whether installation of these lights will decrease the incidence of accidents at this location, local businessmen have commented that the street lighting has significantly improved night visibility at this location.

The capacity problem at this location is on the westbound to southbound off-ramp approach. During the evening peak hour, approximately 500 vehicles from the westbound IH 94 off-ramp enter the southbound Grandview Boulevard traffic stream immediately north of the westbound IH 94 off-ramp consists of approximately 900 vehicles. To perform a right-turn maneuver off the off-ramp onto Grandview Boulevard, a gap of about 5.0 to 6.0 seconds is required. The average gap in the southbound traffic stream is approximately 4 seconds; as a result vehicles queue on the off-ramp. Commission staff have observed queues of between 28 to 40 vehicles during the evening peak hour and found the average vehicle delay to be approximately 90 seconds and the maximum delay was 110 seconds.

As noted previously, the Wisconsin Department of Transportation has programmed a highway improvement with anticipated completion by 1993 for the reconstruction of the interchange and of Grandview Boulevard over IH 94 to provide a four-traffic-lane divided roadway. This project may be expected to resolve existing and future traffic problems at this interchange. A number of alternative short-range traffic engineering actions were, however, considered to alleviate the capacity problem identified at this location in the interim. The first alternative considered was to open an existing driveway on the west side of the General Electric Medical Systems complex property to remove traffic from Grandview Boulevard. This alternative was rejected because the potential reduction in southbound Grandview Boulevard traffic between 2:30 p.m. and 6:00 p.m.--when travel demand is greatest--is estimated to be about 130 vehicles, or approximately 5.5 percent of the total 2,400 southbound vehicles during this time period. This reduction is modest and thus, the impact on existing and future traffic problems would be modest as well.

Another short-range traffic engineering action considered but rejected was minor reconstruction of the westbound off-ramp including increasing the radius and the length of the acceleration lane at the ramp terminus. This minor

¹This estimate of vehicle diversion is based on: 1) the location of on-site parking and the internal street system at the General Electric Medical Systems complex property; and 2) a survey of the vehicular travel patterns of vehicles exiting the General Electric Medical Systems complex property conducted by the Commission staff identifying vehicles which exited the General Electric Medical Systems complex property, headed south on Grandview Boulevard, and then turned right onto either Golf Road or the westbound IH 94 on-ramp.

reconstruction may be expected to direct the motorist in the proper southbound direction, thus facilitating the merging maneuver with southbound Grandview Boulevard traffic by more closely matching the speeds of the merging traffic streams. This alternative was rejected because it is not expected to provide additional gaps in the southbound Grandview Boulevard traffic stream, and, thus, provide only modest improvement in the operation of this intersection, particularly during the evening peak hour.

Another short-range traffic engineering action considered to alleviate the problems at this intersection was the installation of traffic signals at the intersection of Golf Road and Grandview Boulevard. The advantages of this action would be the provision of gaps in Grandview Boulevard traffic for traffic using the westbound IH 94 to southbound Grandview Boulevard off-ramp and for vehicles exiting Golf Road as well. The disadvantages of this alternative include substantial delay to Grandview Boulevard traffic and the potential for an increase in accidents at the traffic signal, particularly rear end accidents. Therefore, this alternative was rejected.

The Wisconsin Department of Transportation is considering re-installing the traffic signals which were removed in 1987 at the intersection of the west-bound IH 94 to southbound Grandview Boulevard off-ramp and Grandview Boulevard. The objective of this action would be to ensure that vehicles on the off-ramp do not queue onto the IH 94 main line. However, it should be noted that this action would result in substantial delay to Grandview Boulevard traffic and potentially may result in an increase in rear end accidents at this location.

Grandview Boulevard Between Northview Road and Silvernail Road: The principal problems identified on this roadway segment are insufficient capacity, delay, and accidents exiting driveways. The average weekday traffic volume of 22,900 vehicles on this segment is substantially greater than the 17,000 vehicles per average weekday design capacity. The most discernible accident patterns were rear end and right angle collisions.

An alternative traffic management action considered to preserve existing roadway capacity is to prohibit right turns on red on the eastbound approach of the Grandview Boulevard-Silvernail Road intersection. The advantage of this alternative traffic management action is to provide additional gaps in the southbound traffic stream, thereby reducing the time that northbound left-turning vehicles block one lane of Grandview Boulevard and increasing the time that both northbound lanes are available to through traffic. Motorists exiting the driveways south of Silvernail Road may also expect to benefit from this measure. A potential disadvantage of this alternative traffic management action may be a nominal reduction in the operation of the eastbound approach at the intersection of Grandview Boulevard and Silvernail Road; however, this approach is currently operating under design capacity. It is recommended that this alternative control measure be implemented, at a cost of \$200.

Another alternative traffic action considered to preserve existing capacity is the careful management of the extent and location of additional access along the study segment. The advantage of this action is to minimize the length of time that a lane may be blocked by a vehicle waiting to complete a turning maneuver and thus reducing the roadway width from two lanes to one in one direction of travel. In addition, ample distance is provided between adjacent driveways to prevent conflict between accelerating motorists exiting from a driveway and motorists decelerating to enter the next driveway. It is recommended that this alternative traffic management action be implemented at no cost.

An alternative traffic management action considered to alleviate problems of traffic accidents on the study segment is the modification of selected driveways to consolidate adjacent driveways on the shared property line by constructing a new driveway on the property line and closing the existing driveways. An advantage of this alternative traffic management action would be to significantly reduce the number of access points along the study segment. Thus, the number of locations which motorists must simultaneously monitor for traffic decreases and the distance between such locations increases. The number of potential vehicular conflict points is also reduced. Implementation of this alternative requires the agreement of the property owners. Such consolidated driveways could be constructed on the joint property lines between the Merchants' Grove and Blue and Koepsell properties, and the Midwest Accounting and Budget Rental Center properties. It is recommended that this alternative traffic management action be implemented, at an estimated cost of \$7,500.

Additional driveway consolidation is possible between the "Sharpest Cut" and the "Century 21/Stop-N-Go" properties. The three driveways currently serving these businesses are connected by on-site parking lots and could, therefore, be served by a single driveway. This driveway could be the existing center driveway, provided an easement is granted to the Sharpest Cut property or a new driveway located on the joint property line between the Sharpest Cut property and the Century 21 and Stop-N-Go property. The southernmost and northernmost driveways would be closed. It is recommended that this alternative traffic management action be implemented, at an estimated cost of \$1,000.

It should be noted that the parcel of land on which the existing Century 21 and Stop-N-Go buildings are located was rezoned for general business in May 1988 as the initial step in redevelopment of this parcel. This parcel has 210 feet of frontage on N. Grandview Boulevard, 90 feet less than the 300 feet considered necessary to permit a second access point. It is recommended that, during the final plan approval process, the City of Waukesha Plan Commission take action to limit access to this parcel to a single driveway on N. Grandview Boulevard. Implementation of this recommendation would serve to help implement the driveway consolidation recommended previously, particularly if the access is designated on the joint property line between Sharpest Cut and Century 21 and Stop-N-Go.

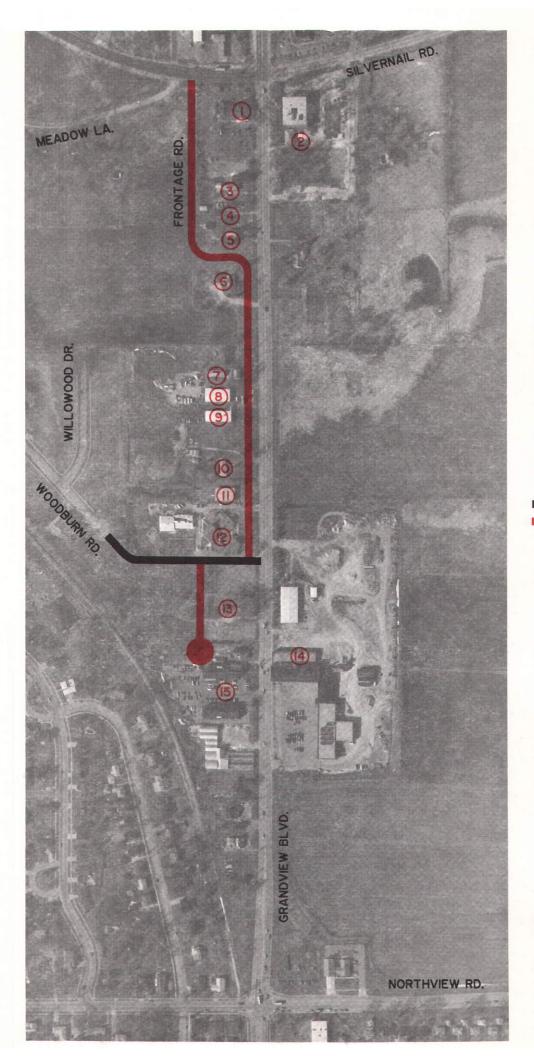
An alternative traffic management action considered to alleviate the accident problem was increased law enforcement activity. The advantage of this alternative traffic management action is increased motorist compliance with the posted speed limit. Thus, the speed differential between vehicles slowing or stopped to make turns and through vehicles will be reduced and motorists will have additional time to react to, and maneuver around, turning vehicles. A potential disadvantage is the diversion of personnel from other locations in order to implement this action. It is recommended that this alternative

control measure be implemented on a random basis for a total of 100 hours annually, at an estimated cost of \$2,250 per year.

A number of other alternative control measures were considered but rejected, including the prohibition of left turns either permanently or on a timerestricted basis; conversion of the northbound left lane to an exclusive leftturn lane; re-striping the existing roadway to provide five lanes with the center lane a continuous left-turn lane; pavement markings to delineate leftturn bays at selected driveways; and construction to provide left-turn bays at selected driveways. The prohibition of left turns may be considered a significant impairment of existing access and, therefore, was rejected. Converting the northbound left lane to an exclusive left-turn lane would significantly degrade the roadway capacity and was, therefore, rejected. Provision of a fifth lane though the re-striping of the existing pavement results in substandard lane widths and was, therefore, rejected. Provision of left-turn bays at selected driveways was rejected because, given the existing driveway spacings, left-turn bays cannot be provided without interfering with operation at adjacent driveways.

Potential New Frontage Roads: At the request of the Northwest Council of the Waukesha Chamber of Commerce, the Commission staff considered two other alternative traffic management actions to alleviate the congestion and delay problems identified on Grandview Boulevard between Northview Road and Silvernail Road. The first alternative considered is the construction of a frontage road on the west side of Grandview Boulevard between the present curb line and the existing buildings. The second alternative considered is the construction of a new access roadway at the rear of the properties abutting Grandview Boulevard on the west. These actions, intended to relieve existing problems, would, unlike the other actions considered in the short-range plan, entail relatively substantial construction costs and a longer period of time to complete implementation.

The frontage road alternative would entail construction of a new roadway on the west side of, and parallel to, Grandview Boulevard. Accepted design standards would require that the frontage road would be 38 feet wide from curb to curb, with two traffic lanes and a 10-foot-wide parking lane. The frontage road should be separated from the existing curb line of Grandview Boulevard by at least 20 feet, except at those locations where the frontage road would intersect with Grandview Boulevard or with local streets which would intersect with Grandview Boulevard. At these locations, accepted design standards would recommend that the frontage road be separated from Grandview Boulevard by at least 150 feet, as shown in Figure 12. It may be noted that the frontage road alternative incorporates the extension of Woodburn Road from its current terminus located west of Merchants' Grove to Grandview Boulevard. This roadway extension is proposed by the City of Waukesha for construction in the summer of 1989. It should be noted that the frontage road would entail closure of all Grandview Boulevard driveways to businesses where the frontage road is located within 20 feet of Grandview Boulevard, that is, between Bielinski Realty and Merchants' Grove. Access to these businesses would be restricted to the frontage road which would connect with Grandview Boulevard at Woodburn Road and Silvernail Road.

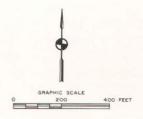


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Figure 12 POTENTIAL FRONTAGE ROAD ALTERNATIVE

LEGEND

- GASTHAUS RESTAURANT
- SILVERNAIL WOODS OFFICE PARK
- 3 PRIVATE RESIDENCE
- PRIVATE RESIDENCE
- B PRIVATE RESIDENCE
- 6 BIELINSKI REALTY
- 7 PRIVATE RESIDENCE
- (8) BUDGET RENTAL CENTER
- 9 MIDWEST ACCOUNTING
- PRIVATE RESIDENCE
- III BLUE AND KOEPSELL
- @ MERCHANT'S GROVE
- (3) PRIVATE RESIDENCE
- WAUKESHA COUNTY HIGHWAY SHOP
- (5) GRANDVIEW SQUARE OFFICE CENTER
- PLANNED LOCAL STREET
- FRONTAGE ROAD



This frontage road alternative may be expected to improve traffic conditions on Grandview Boulevard by removing the local traffic from through traffic. In addition, turn movements to and from the frontage road will be easier than those associated with Grandview Boulevard. However, the access to these businesses will be indirect. In addition, the frontage road would eliminate existing off-street parking located in front of the buildings abutting the west side of Grandview Boulevard. In addition, a desirable setback of the frontage road from Grandview Boulevard at Woodburn Road could be provided only with acquisition and removal of Merchants' Grove buildings. Also, the frontage road would make any future widening of Grandview Boulevard more difficult. The estimated construction cost of the frontage road, not including right-of-way, This alternative is not recommended for implementation. It should be noted, as well, that, if the western Waukesha bypass is constructed and Grandview Boulevard is reconstructed to a four-lane divided cross-section, as recommended in a later section of this report, there would be no need for a frontage road.

Another similar alternative action considered was the construction of a local service road located behind the businesses abutting the west side of Grandview Boulevard, as shown in Figure 13. It may be noted that Grandview Boulevard driveways to the businesses on the west side of Grandview Boulevard could remain open under this alternative.

The local service road may be expected to improve traffic conditions on Grandview Boulevard by removing some local traffic from through traffic. In addition, turns to and from the businesses on the local service road will be easier than on Grandview Boulevard. However, the local service road will present problems for local businesses. To encourage use of the service road, business owners may need to add parking at the rear of their buildings, along with additional entrances and business signs. The roadway would likely require 60 feet of right-of-way, which would eliminate some existing parking, and present some circulation problems at Merchants' Grove. In addition, the roadway would entail providing double frontage for residential properties on Willowood Drive and, as well, for businesses on Grandview Boulevard. Lastly, as access to Grandview Boulevard via driveways would be retained by existing businesses, it may be expected that most motorists would use the most direct route to the businesses via Grandview Boulevard, rather than the local service road. The estimated construction cost of the frontage road, not including right-of-way, is \$510,000. It is recommended that the construction of a local service road be rejected. It should be noted, as well, that, if the western Waukesha bypass is constructed and Grandview Boulevard is reconstructed to a four-lane divided cross-section, as recommended in a later section of this report, there would be no need for a local service road.

It may be noted that the City of Waukesha has scheduled for construction in the summer of 1989 the extension of Woodburn Road. Woodburn Road is a local street, under the sole jurisdiction of the City of Waukesha, and presently terminates in a cul-de-sac behind Merchants' Grove west of Grandview Boulevard. Woodburn Road has a pavement width of 38 feet, including a seven-footwide parking lane adjacent to each through lane. The City of Waukesha plans to extend Woodburn Road from its present terminus to intersect with Grandview Boulevard at a point approximately 1,800 feet north of the intersection of Northview Road and Grandview Boulevard. In addition, to create a four-leg

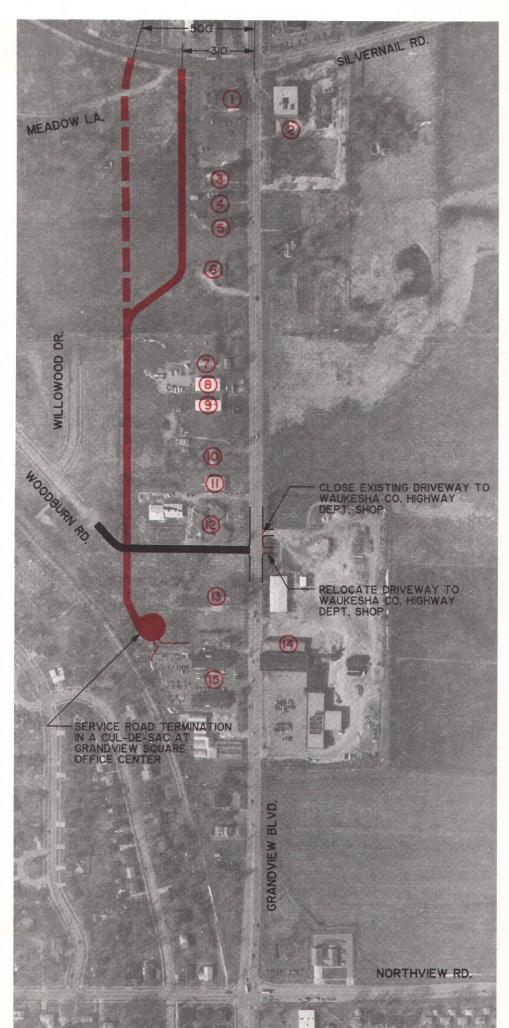
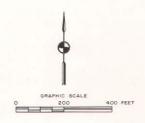


Figure 13

POTENTIAL LOCAL SERVICE ROAD ALTERNATIVE

LEGEND

- GASTHAUS RESTAURANT
- 2 SILVERNAIL WOODS OFFICE PARK
- 3 PRIVATE RESIDENCE
- 4 PRIVATE RESIDENCE
- PRIVATE RESIDENCE
- 6 BIELINSKI REALTY
- 7 PRIVATE RESIDENCE
- BUDGET RENTAL CENTER
- MIDWEST ACCOUNTING
- PRIVATE RESIDENCE
- BLUE AND KOEPSELL
- (2) MERCHANT'S GROVE
- (3) PRIVATE RESIDENCE
- WAUKESHA COUNTY HIGHWAY SHOP
- (5) GRANDVIEW SQUARE OFFICE CENTER
- PLANNED LOCAL STREET
 - SERVICE ROAD
- ALTERNATIVE ALIGNMENT OF SERVICE ROAD



Source: SEWRPC.

intersection at this point, Waukesha County plans to relocate its northern driveway to the County Highway Shop to be directly opposite Woodburn Road. This new intersection would be controlled by a traffic signal. During the evening hour of peak traffic flow, 110 vehicles are estimated to turn right from southbound Grandview Boulevard onto westbound Woodburn Road; 90 vehicles are estimated to turn left off northbound Grandview Boulevard onto westbound Woodburn Road; 55 vehicles are estimated to turn left off eastbound Woodburn Road to northbound Grandview Boulevard; and 45 vehicles are estimated to turn right off eastbound Woodburn Road to southbound Grandview Boulevard. It should be noted that the estimated northbound Grandview Boulevard left-turn volume is slightly less than the 100 vehicle per hour threshold at which installation of an exclusive left-turn lane suggested by the 1985 Highway Capacity Manual is considered. However, the Wisconsin Department of Transportation and the City of Waukesha consider the installation of an exclusive left-turn lane when the left-turning volume on an approach exceeds 10 percent of the design hourly volume for the approach. The estimated left- turn volume of 90 vehicles represents more than 10 percent of the northbound approach volume during the evening peak hour. Provision of a separate left-turn lane on the northbound approach is expected to result in a significant reduction in delay during the evening peak period. The average vehicular delay if no exclusive left-turn In comparison. lane is provided is estimated to be 11.5 seconds per vehicle. the average vehicular delay with an exclusive left-turn lane is estimated to be 5.4 seconds per vehicle, or less than half the average delay estimated if no left-turn lane is provided. Therefore, it is recommended that a left-turn lane be provided on both the northbound and southbound approaches to the intersection, at an estimated cost of \$53,600, not including right-of-way.

The configuration of the west leg of Woodburn Road at the intersection of Grandview Boulevard is planned to be 44 feet from face-of-curb to face-of-curb. This would accommodate two eastbound traffic lanes, one 12-foot-wide lane for left-turning vehicles to northbound Grandview Boulevard and one 10-foot-wide lane for right-turning vehicles to southbound Grandview Boulevard. The remaining lanes would consist of one traffic lane 12 feet wide and a 10-foot-wide parking lane which tapers to seven feet.

The City of Waukesha plans to control this intersection with a traffic-actuated traffic signal. This traffic signal may be expected to produce additional gaps in the traffic stream and reduce the average operating speed on Grandview Boulevard.

Careful consideration should be given to the access permitted to properties abutting Woodburn Road. The southern driveway to Merchants' Grove would, because of its proximity to the intersection of Woodburn Road and Grandview Boulevard, be closed. It is recommended that any new entrance on Woodburn Road not be located within 230 feet of the intersection of Grandview Boulevard and Woodburn Road, and that the existing northern driveway to Merchants' Grove provide its only direct access to Grandview Boulevard. Further, it is recommended that access on Grandview Boulevard to the property located immediately west of Grandview Boulevard and south of Woodburn Road should not be allowed within a distance of 120 feet from the intersection of Woodburn Road and Grandview Boulevard. Access may also be provided on Woodburn Road for this property, but it is recommended that no access be permitted within 230 feet of Grandview Boulevard.

Grandview Boulevard and Northview Road: The problem identified at this intersection was traffic accidents. A pattern exists of rear end accidents in the right-turn lane on the westbound approach to the intersection.

An alternative traffic management action considered to alleviate this problem is to change the existing traffic control for this lane by replacing the existing "Yield" sign with a stop sign. The advantage of this alternative traffic management action is to eliminate doubt as to whether the lead vehicle will yield right-of-way and stop or proceed without stopping, as all vehicles would now be required to stop. This action may be expected to be of some benefit to upstream driveway turn movement operations, to the extent that vehicles will be discharged singly from the intersection rather than in platoons. The disadvantage of this alternative traffic management action is that all right-turning vehicles on the westbound approach must stop, resulting in increased delay at the intersection. It is recommended that this alternative traffic management action be implemented, at an estimated cost of \$75.

It may be noted that the westbound Northview Road approach has a shared left turn and through traffic lane with the through lane carried through the intersection; an exclusive through lane in which parking is permitted on the west side of the intersection; and an exclusive right-turn lane. The current peak hour westbound through and left-turning volume is 290 vehicles, which is well within the design capacity of the approach. Moreover, currently there is no accident problem involving the left-turning and through vehicles on this approach. Therefore, no change in the lane designations or initiation of parking restrictions is recommended at this time. However, it may become necessary in the long range to consider prohibiting parking on the north side of Northview Road from Grandview Boulevard to Pebble Valley Road. Conversion of the existing shared left-turn and through lane to an exclusive left-turn lane along with the application of pavement marking through the intersection to guide motorists between offset lanes from the east side to the west side of the intersection could also be considered.

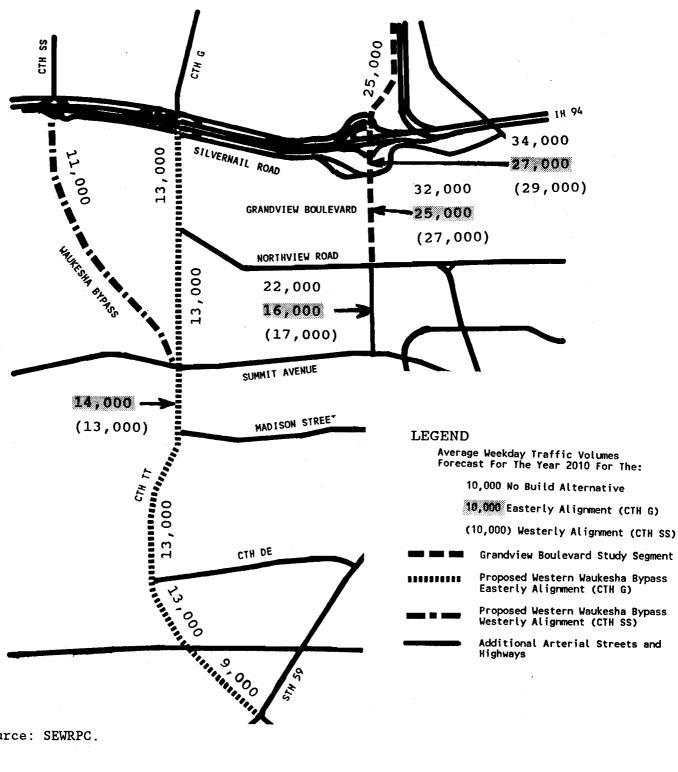
LONG-RANGE HIGHWAY IMPROVEMENT PLAN

Based upon the adopted regional land use and transportation plans, and on population and employment forecasts to the year 2010, average weekday traffic forecasts for the year 2010 were prepared. One traffic forecast was prepared under an assumption that the western Waukesha bypass would not be implemented. Two other forecasts were prepared assuming that the western Waukesha bypass would be implemented. Both these forecasts assumed that all other planned transportation improvements in Waukesha County and southeastern Wisconsin would be implemented, for example, including the extension of CTH SS along the southern boundary of the Waukesha County Technical College between CTH G and CTH T. One of these two forecasts assumed a long-planned bypass alignment which connected to IH 94 at CTH G, and the other assumed the connection to be at CTH SS.

As shown on Figure 14, average weekday traffic volumes on the study segment of Grandview Boulevard between Northview Road and Silvernail Road are expected to increase from the current 22,900 vehicles per average weekday to approximately 25,000 to 27,000 vehicles per average weekday in the year 2010 with the

Figure 14

FORECAST AVERAGE WEEKDAY TRAFFIC VOLUMES FOR THE DESIGN YEAR 2010 ON THE STUDY SEGMENT OF GRANDVIEW BOULEVARD AND ON THE PROPOSED WESTERN WAUKESHA BYPASS



Source: SEWRPC.

construction of the western Waukesha bypass--the higher volume under a CTH SS connection. Average weekday traffic volumes on this segment of Grandview Boulevard, if the bypass is not completed, are expected to increase to 32,000 vehicles per average weekday in the year 2010.

On the study segment between Silvernail Road and IH 94, average weekday traffic volumes may be expected to increase from the current 24,800 to approximately 27,000 to 29,000 vehicles per average weekday with the construction of the western Waukesha bypass. Average weekday traffic volumes on this segment are expected to increase to 34,000 vehicles per average weekday if the bypass is not completed.

The average weekday traffic volumes on the study segment between the eastbound IH 94 and the westbound IH 94 ramps may be expected to increase from its current 20,500 average weekday traffic volume to approximately 23,000 to 25,000 vehicles per average weekday if the western Waukesha bypass is completed. Average weekday traffic volumes on this segment may be expected to increase to 30,000 vehicles per average weekday by the year 2010 if the western bypass is not completed.

The average weekday traffic volumes on the study segment north of IH 94 may be expected to increase from the current 16,000 vehicles per average weekday to 25,000 vehicles per average weekday under both alternative transportation system scenarios.

On the segment of Grandview Boulevard between Northview Road and Summit Avenue, the existing traffic volume is 17,200 vehicles per average weekday and is anticipated to increase to 22,000 vehicles per average weekday in the year 2010 without a western bypass, and to be reduced to 16,000 to 17,000 vehicles per average weekday in the year 2010 with a bypass.

Existing average weekday traffic volumes along the study segment of Grandview Boulevard from Northview Road to Golf Road currently exceed the design capacity of the roadway; and from Golf Road to Fatima Drive, existing traffic volumes approach design capacity. The traffic engineering actions recommended in the previous section of this report will not be sufficient to significantly abate these existing traffic problems, and it will be necessary to implement a major highway improvement in the short range to address these problems. The Wisconsin Department of Transportation has a programmed major highway improvement project for the reconstruction of Grandview Boulevard over IH 94 to provide a four-traffic-lane divided roadway. This project--anticipated to be completed by 1993--includes the addition of a structure over IH 94. As part of this project, the existing freeway interchange ramp configurations and their termini will be improved as needed. Waukesha County has a programmed highway improvement project to reconstruct CTH T from IH 94 to Fatima Drive to a four-traffic-lane divided roadway.

Based upon the forecast traffic volumes, it should be noted that the programmed improvement of Grandview Boulevard between IH 94 and Silvernail Road to a four-lane divided roadway will have insufficient design capacity for forecast traffic volumes, even with the proposed west Waukesha bypass, and a six-lane divided roadway will be needed. With respect to the programmed improvement of the Grandview Boulevard structure over IH 94 between the

freeway on- and off-ramps, the programmed improvement to a four-lane divided roadway will be sufficient if the western portion of the Waukesha bypass is constructed. However, if the bypass is not constructed, a six-lane divided roadway will be necessary. With respect to the programmed improvement of Grandview Boulevard between IH 94 and Fatima Drive, the programmed improvement to a four-traffic-lane divided roadway should be sufficient to meet future needs with or without the bypass proposed. However, even with the construction of the bypass, the forecast traffic volumes on Grandview Boulevard between the IH 94 on- and off-ramps and between IH 94 and Fatima Drive will approach the need for a six-lane divided roadway by the year 2010, and it would be desirable if the programmed improvements would be constructed in a way to permit further expansion beyond the year 2010.

There is no programmed improvement for the stretch of Grandview Boulevard between Silvernail Road and Northview Road. As noted earlier, the current traffic volume of approximately 22,900 vehicles per average weekday exceeds the typical design capacity of its four-traffic-lane undivided cross-section. Traffic engineering actions alone will not be sufficient to improve the operation of this roadway section in the short range, and the need exists in the short range for a major highway improvement. If the western Waukesha bypass is not constructed, average weekday traffic volumes on this stretch of Grandview Boulevard are anticipated to increase to 32,000 vehicles per average weekday; and, with the bypass, average weekday traffic volumes are anticipated to increase to only 25,000 to 27,000 vehicles per average weekday in the year 2010. Thus, with the construction of the Waukesha bypass, some major improvement of Grandview Boulevard between Northview Road and Silvernail Road will still need to be considered, as it would be expected to carry higher traffic volumes in the future. However, without the construction of the Waukesha bypass, a more substantial improvement of Grandview Boulevard may be necessary. Specifically, a six-traffic-lane divided roadway would clearly be warranted.

A bypass on the west side of the City of Waukesha consisting of a north-south route between IH 94 and the intersection of STH 59 and CTH X has long been proposed. The alignment of the bypass identified in past regional and county plans would connect the bypass with IH 94 at CTH G. Waukesha County is currently engaged in the conduct of a preliminary engineering study which may be expected to identify and evaluate alternative bypass routes. An alternative route which will be considered in the study would connect the bypass to IH 94 at CTH SS. Based on Commission travel forecasts, it is anticipated that the completion of the bypass may be expected to reduce the average weekday traffic volumes on Grandview Boulevard between Northview Road and IH 94 by 5,000 to 7,000 vehicles per average weekday. The estimated cost of constructing the western bypass with a four-lane divided roadway cross-section on the alignment identified in past regional and county plans connecting with IH 94 at CTH G is \$6.7 million not including right-of-way or potential reconstruction of the interchange with IH 94. The estimated cost of constructing the bypass on the alignment connecting with IH 94 at CTH SS is \$7.2 million not including rightof-way or potential reconstruction of the interchange with IH 94.

The proposed west Waukesha bypass will improve the existing operating conditions on Grandview Boulevard between Northview Road and Silvernail Road and will reduce the degree of widening that may be necessary in the future on this

stretch of Grandview Boulevard. The proposed bypass also will reduce such long-range improvement need on the Grandview Boulevard structure over IH 94. The potential cost savings of widening to four, rather than six, lanes Grandview Boulevard between Northview Road and Silvernail Road and the Grandview Boulevard structure over IH 94, is about \$500,000. In addition and, perhaps, more importantly, the proposed bypass has the potential to reduce traffic and improve operating conditions on Grandview Boulevard between Northview Road and Summit Avenue, limiting future year 2010 traffic volumes to potentially less than current traffic volumes. This stretch of Grandview Boulevard is abutted principally by residences and a city park, and widening may be difficult from its current 38- to 44-foot-wide curb-to-curb pavement width which provides two traffic and two parking lanes. Without the bypass, anticipated traffic would increase by about 30 percent and warrant a widening to four traffic lanes with a median, at an estimated cost of \$1.0 million, not including right-of-way. Other benefits of the bypass include removing through traffic from congested City of Waukesha central business district streets and other congested city streets, including East Avenue and Barstow Street, thus further reducing the need for other roadway improvements and, as well, parking restrictions. The proposed bypass would also provide a more understandable route between IH 94 and the south side of the Waukesha area, with attendant implications for economic development. Therefore, as part of the long-range plan for the study stretch of Grandview Boulevard, it is recommended that the long planned west Waukesha bypass be implemented.

Both the adopted regional transportation system plan and the Waukesha County jurisdictional highway system plan recommend that the Waukesha bypass be developed as a state trunk highway. A first step toward development of this bypass, then, would be for the City, County, and Town of Waukesha, and the Town of Pewaukee to formally request that the Wisconsin Department of Transportation place the bypass on the state trunk highway system and that the necessary action be initiated to include the bypass as a candidate in the State's major projects development process.

Roadway Improvement Alternatives--Grandview Boulevard Between Silvernail Road and Northview Road

Three capital-intensive roadway improvement alternatives were considered to provide the necessary capacity to meet the anticipated future travel demand on Grandview Boulevard between Northview Road and IH 94. The first alternative roadway improvement considered was the construction of a four-lane divided highway with a 24-foot-wide median and twin curb-to-curb 28-foot-wide roadways. The second alternative roadway improvement considered was a five-lane roadway with a 14-foot-wide fifth lane in the center of a curb-to-curb 66-foot-wide roadway. The final alternative roadway improvement considered was a six-lane divided highway with a 24-foot-wide median and twin curb-to-curb 40-foot-wide roadways. The first two alternative roadway improvements would provide two lanes of travel in each direction, while the third alternative roadway improvement would provide for three lanes of travel in each direction. Parking would be prohibited on Grandview Boulevard over the study segment under each of these alternatives.

Four-Lane Divided Roadway Improvement Alternative: The design capacity of a four-lane divided urban roadway is 25,000 vehicles per average weekday. Therefore, it may be expected that implementation of this alternative would

generally provide sufficient capacity to the year 2010 for existing and fore-cast travel demand between Northview Road and Silvernail Road, assuming that the western Waukesha bypass is constructed. The advantage of this alternative roadway improvement is that left-turn bays could be provided in the median to accommodate left-turning vehicles. These left-turn bays provide refuge for left-turning vehicles awaiting a gap in the opposing traffic stream and are then removed from the through traffic stream, thus reducing delay and congestion. Vehicles turning left from driveways would also be provided refuge in the median and thus can take advantage of gaps in the individual traffic streams rather than having to wait for a suitable gap in both directions. An additional advantage of this alternative roadway improvement would be that the median could readily be tapered to a narrower cross-section to take advantage of the existing intersection geometry at both Northview Road and Silvernail Road. Finally, the median provides the opportunity to attractively landscape one of the major entrances to the City of Waukesha.

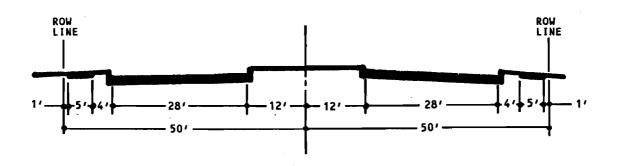
The disadvantage of this alternative roadway improvement is the reduction in access which necessarily results from construction of a median and the spacing of the median openings. The minimum spacing between midblock median openings would be 350 feet, while the desirable spacing would be approximately 550 In addition, the design capacity of this alternative would be approached, and potentially exceeded, by forecast year 2010 traffic volumes, even with the completion of the bypass. Also, this alternative would entail right-of-way acquisition. Grandview Boulevard is roughly centered within a 66-foot-wide right-of-way from Northview Road northerly for a distance of approximately 2,670 feet. From that point to Silvernail Road, the right-of-way is 74 feet in width, with the additional eight feet on the west side of the roadway. This alternative roadway improvement requires 100 feet of right-ofway--90 feet if sidewalks are not to be provided--and would require the acquisition of additional right-of-way. The width of the roadway would increase from its present 48-foot curb-to-curb width to 80 feet, as shown in Figure 15. It should also be noted that one of the buildings in the complex of the Waukesha County Highway Shop located on the east side of Grandview Boulevard is located about 4.5 feet east of the face of curb of the existing roadway. However, Waukesha County is planning to move the County Highway Shop from its current location to a location on Silvernail Road. It is therefore recommended that a four-lane divided urban roadway with 100 feet of right-of-way be implemented, as shown in Figure 16, at an estimated cost of \$1 million not including the cost of relocating the County Highway Shop or procuring other necessary right-of-way.

An option to the recommended four-lane divided highway would be to construct auxiliary lanes for right turns into and out of driveways to remove right-turning traffic from the through traffic lanes. These auxiliary lanes would terminate with appropriate lane-drop tapers prior to the intersections of Grandview Boulevard at Northview Road and Silvernail Road. This option would necessitate the acquisition of an additional 30 feet of right-of-way for a total width of about 130 feet. Given the amount of undeveloped land abutting Grandview Boulevard to the east, acquisition of the necessary right-of-way to preserve the potential for the ultimate construction of auxiliary lanes would cause no more disruption to residences or businesses than the acquisition of 100 feet of right-of-way if the additional 30 feet are generally purchased on

Figure 15

RECOMMENDED FOUR-LANE DIVIDED CROSS-SECTION OF

RECOMMENDED FOUR-LANE DIVIDED CROSS-SECTION OF GRANDVIEW BOULEVARD FROM NORTHVIEW ROAD TO SILVERNAIL ROAD



Source: SEWRPC.

the east side of the existing roadway. It should be noted that, if construction is to be staged with the four traffic lanes built first and the auxiliary lanes added at a later date, the proposed roadway should be built on the center line of the potential 130-foot-wide right-of-way.

Given the existing commercial development on the west side of Grandview Boulevard, a sub-option would be to construct an auxiliary lane on the west side of the recommended four-lane divided roadway. Another sub-option would be to construct an auxiliary lane on both sides of the roadway

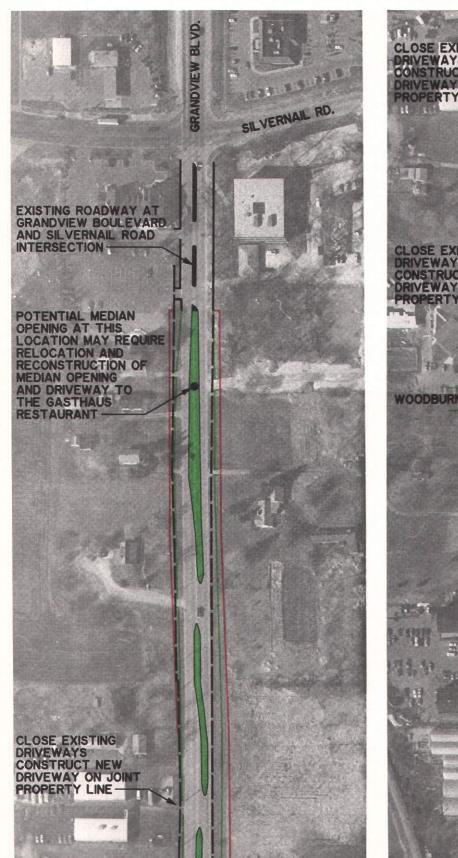
It is also recommended that requests for future access and for the extension of the local street system, particularly on the east side of Grandview Boulevard, be carefully reviewed at the time such requests are made. Direct access to Grandview Boulevard should be minimized to preserve capacity and to minimize accident potential. Based on the existing 35 miles per hour speed limit, the minimum centerline-to-centerline driveway spacing should be 150 feet. In addition, driveways should be located either at the median opening or should be offset by 150 feet. The number of driveways to existing abutting properties may be designated now, and subsequent additional requests for driveways may be denied regardless of future subdivision of abutting property. Finally, if an abutting parcel also abuts an intersecting street, direct access to Grandview Boulevard should be limited to a single driveway, with any additional access provided on the intersecting street.

Six-Lane Divided Roadway Improvement Alternative: The design capacity of a six-lane divided urban roadway is 35,000 vehicles per average weekday. This alternative would be necessary to provide sufficient capacity if the western Waukesha bypass is not constructed. The advantage of this alternative roadway improvement would be to remove left-turning vehicles from the through traffic stream, thereby reducing delay and congestion and providing a refuge for leftturning vehicles awaiting a gap in the opposing traffic stream. Vehicles turning left from driveways would also be provided refuge in the median and thus can take advantage of gaps in the individual traffic streams rather than having to wait for a suitable gap in both traffic streams. The disadvantage of this alternative roadway improvement is the necessity to acquire significant amounts of right-of-way to implement the construction. This alternative roadway improvement requires 130 feet of right-of-way--120 feet if sidewalks are not built--and would require the acquisition of additional right-of-way. width of the roadway would increase from its present 48-foot curb-to-curb width to 104 feet, as shown in Figure 17. This may result in loss of parking for some abutting property owners and may be expected to impair internal parking lot circulation for additional property owners. Finally, blending this ultimate cross-section with the existing cross-sections at the intersections of Northview Road and Silvernail Road would be difficult. It is therefore recommended that this alternative roadway improvement not be implemented.

Five-Lane Roadway Improvement Alternative: The final alternative roadway improvement considered was a five-lane undivided roadway with the center lane a continuous left-turn lane. The design capacity of a five-lane roadway is approximately 19,000 vehicles per average weekday. An advantage of this alternative roadway improvement is that left-turning vehicles are removed from the

Figure 16

GRANDVIEW BOULEVARD RECOMMENDED LONG-RANGE IMPROVEMENT FOUR-LANE DIVIDED ROADWAY



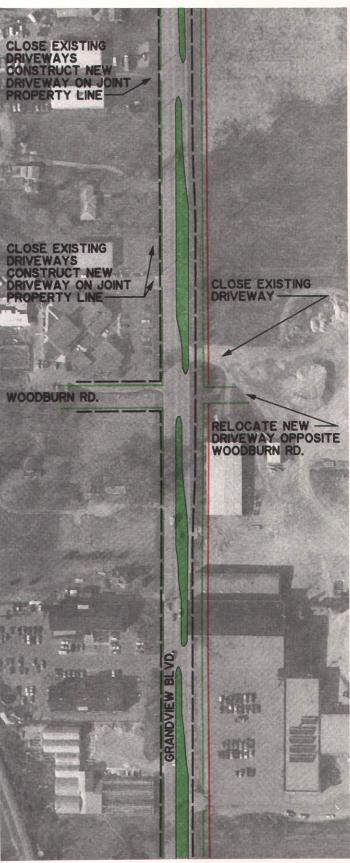
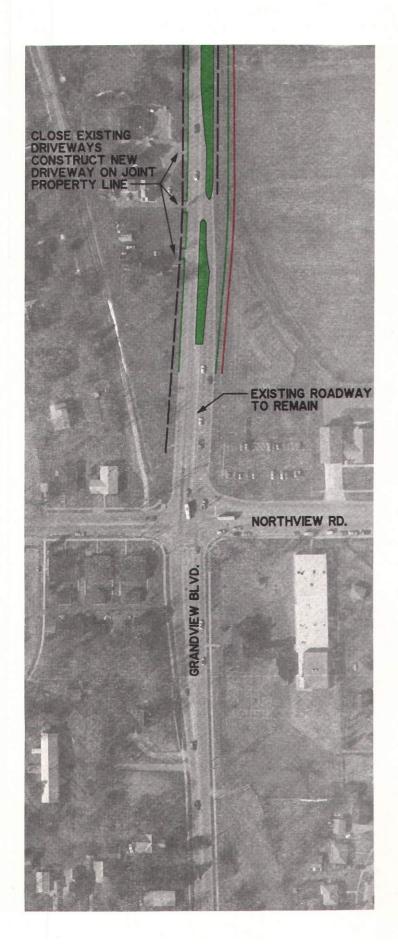
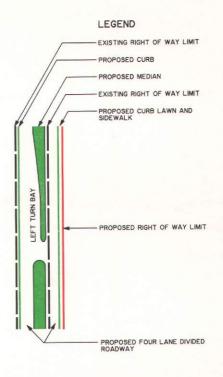


Figure 16 (continued)



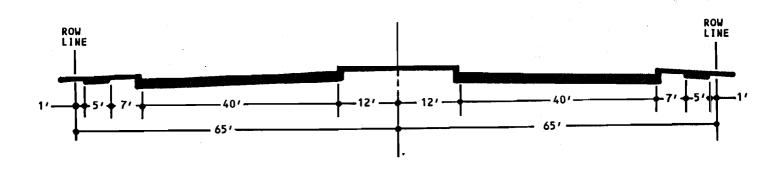




Source: SEWRPC.

Figure 17

SIX-LANE DIVIDED CROSS-SECTION ALTERNATIVE OF GRANDVIEW BOULEVARD FROM NORTHVIEW ROAD TO SILVERNAIL ROAD



Source: SEWRPC.

through traffic stream, thus reducing delay and congestion, and provided refuge while awaiting a gap in the opposing traffic stream. The center lane can also provide an area for vehicles turning left out of driveways to accelerate before entering the through traffic stream. Another advantage to implementing this alternative roadway improvement is that disruption to abutting properties is minimized. However, this roadway cross-section does not provide sufficient capacity to meet either the existing or the forecast travel demand. This alternative roadway improvement requires 90 feet of right-of-way--80 feet if sidewalks are not built--and would require the acquisition of additional right-of-way. The width of the roadway would increase from its present 48-foot curb-to-curb pavement width to 66 feet, as shown in Figure 18. It is recommended that this alternative roadway improvement not be implemented.

Summary of Long-Range Recommended Improvements

The long-range roadway improvements recommended for implementation include the construction of the western Waukesha bypass between the intersection of STH 59 and CTH X and IH 94 and the widening of Grandview Boulevard to a four-lane divided roadway between Northview Road and Silvernail Road. These long-range improvements take on added importance because no short-range improvement can alleviate the current problem of insufficient roadway capacity to meet existing travel demand. The recommended long-range improvements are expected to provide the necessary capacity to meet both existing and future travel demand.

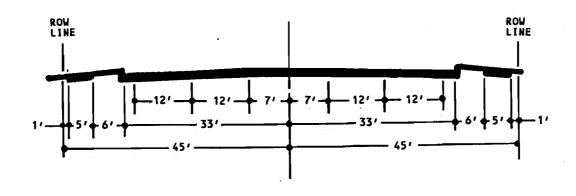
It is recommended that the long planned west Waukesha bypass be developed as a state trunk highway in the shortest time frame possible. Implementation of the bypass may be expected to improve existing operating conditions on the study segment Grandview Boulevard by providing an alternative route and, thus, postpone the need for, and reduce the extent of, widening that will be necessary to meet the future travel demand on Grandview Boulevard. In addition, the bypass has the potential to reduce the need for other roadway improvements, specifically including Grandview Boulevard between Summit Avenue and Northview Road, as well as reducing the need for parking prohibitions and roadway improvements on other facilities in the City of Waukesha as well. Finally, the bypass would provide greatly improved access to the south side of Waukesha from IH 94, with attendant favorable implications for future development.

The four-lane divided roadway is recommended for implementation by Waukesha County on Grandview Boulevard between Northview Road and Silvernail Road because it provides the capacity necessary to meet both the existing travel demand and the design year 2010 forecast travel demand if the west Waukesha bypass is built. While the recommended four-lane divided roadway requires only 100 feet of right-of-way, consideration should be given to purchasing 130 feet of right-of-way to provide the potential for the addition of auxiliary lanes for right turns into and out of driveways along Grandview Boulevard. The auxiliary lanes would not continue through the intersections of Grandview Boulevard with Northview Road and Silvernail Road, to facilitate matching existing roadways at these intersections.

As previously noted, the recommended short-range traffic engineering actions will not alleviate the problem of insufficient roadway capacity to meet existing travel demand on Grandview Boulevard and it may be expected that future development will exacerbate these problems. The long-range improvements will resolve existing and probable future problems and, importantly, support

Figure 18

FIVE-LANE CROSS-SECTION ALTERNATIVE OF GRANDVIEW BOULEVARD FROM NORTHVIEW ROAD TO SILVERNAIL ROAD



Source: SEWRPC.

continued land use development adjacent to Grandview Boulevard and in other areas of Waukesha and Pewaukee, as well. While the western Waukesha bypass and widened Grandview Boulevard improvements are referred to as long-range because of the potential time required for design, right-of-way acquisition, funding, and construction activities, it is essential that Waukesha County and the Wisconsin Department of Transportation initiate work on these improvements now. No low-cost, short-range action is available to abate existing traffic problems. The City of Waukesha has already given consideration to restricting additional development along Grandview Boulevard, particularly with respect to those land uses generating large volumes of traffic, to prevent a further degradation of operating conditions on Grandview Boulevard. Such actions may become increasingly necessary in the future if the bypass and the widening of Grandview Boulevard between Northview Road and Silvernail Road are not implemented in the short term.

Finally, it should be noted that Waukesha County has a roadway improvement project programmed for 1993 to reconstruct CTH T from IH 94 to Fatima Drive to a four-lane divided roadway. The Wisconsin Department of Transportation also has a roadway improvement project programmed for 1993 to reconstruct Grandview Boulevard--CTH T--over IH 94 to provide a four-lane roadway. This schedule for reconstruction of the interchange needs to be maintained. These improvements are also needed now to meet existing traffic demand, and may be expected to be sufficient to meet future travel demand on the southern segments of Grandview Boulevard if the western Waukesha bypass is built.

SUMMARY

On July 1, 1988, the Highway and Transportation Committee of Waukesha County requested that the Southeastern Wisconsin Regional Planning Commission conduct a traffic engineering study of Grandview Boulevard--CTH T--between Northview Road and Fatima Drive. This traffic study was to identify existing traffic problems and to evaluate and recommend those short-range traffic engineering actions which may be expected to alleviate the existing traffic problems. The study also evaluated two intermediate traffic management actions which had been suggested by members of the Northwest Businessmen's Council of the Waukesha Chamber of Commerce. Finally, the year 2010 travel demand was forecast and a long-range improvement plan was recommended to meet the expected travel.

Grandview Boulevard between Northview Road and the eastbound IH 94 on- and off-ramps has two traffic lanes in each direction; the remainder of the study segment has one traffic lane in each direction. Grandview Boulevard provides the west side of the City of Waukesha with access to IH 94. The major intersections along the study segment--at Northview Road and Silvernail Road--are controlled by traffic-actuated traffic signals, while other cross streets are stop sign-controlled on the cross street approaches. A mix of residential, commercial, service, office, and governmental land uses has resulted in a number of driveways providing access to Grandview Boulevard, particularly between Northview Road and Silvernail Road.

In 1988, traffic volumes on the study segment of Grandview Boulevard were 24,700 vehicles per average weekday between Silvernail Road and IH 94; 20,500 vehicles per average weekday between IH 94 and Golf Road; and 10,700 vehicles per average weekday between Golf Road and Fatima Drive. Without exception,

the existing average weekday travel volumes exceed the design capacity of the roadway. The average weekday traffic has experienced significant annual growth since 1968, ranging between 6 and 9 percent since 1968; however, it should be noted that the traffic on Grandview Boulevard between Northview Road and Silvernail Road has only increased about 3 percent annually over the past three years. The pattern of hourly distribution of traffic exhibited on this study segment shows traffic increasing through the early morning to a peak of about 8 percent during the morning peak hour; remaining fairly constant through the midday, before peaking at more than 8 percent during the evening peak hour, and then dropping later in the day. This pattern is typical of street segments with commercial development abutting them.

The analyses of the signalized intersections indicate that, during the evening peak hour, the southbound approach at the intersection of Northview Road and Grandview Boulevard operates at design capacity. The other approaches at this intersection are operating under design capacity. At the intersection of Grandview Boulevard and Silvernail Road, the eastbound approach is operating under design capacity, while the other three approaches operate at design capacity. A capacity analysis of the intersection of Grandview Boulevard with the westbound-to-southbound IH 94 off-ramp indicates that the traffic volume exceeds the design capacity and is equal to the actual capacity of the offramp approach to the intersection. Because this approach operates at its actual capacity, significant delay and vehicle queueing results. Based on Commission observation, the maximum number of vehicles in the queue ranged between 28 and 40 vehicles, with a maximum delay of 110 seconds and an average delay of more than 90 seconds. Finally, capacity analysis of the intersection of Grandview Boulevard and the northern leg of the eastbound IH 94 on-ramp indicates that the southbound Grandview Boulevard approach operates under design capacity during the evening peak hour.

The Commission staff found that vehicles entering and exiting the businesses located on the west side of Grandview Boulevard between Northview Road and Silvernail Road experience significant delay. This delay is a function of a lack of gaps in the traffic stream of sufficient length to execute, particularly left-turning, maneuvers. The lack of gaps of sufficient length to complete these maneuvers is directly related to the average weekday traffic Because the demand remains volume on this portion of the study segment. nearly constant from 7:00 a.m. in the morning until 6:00 p.m. in the evening, the delay encountered by motorists entering and exiting the driveways of these businesses is a problem throughout the day. Compounding the delay experienced by motorists entering and exiting the driveways as a result of the high traffic volumes is the speed along this portion of the study segment. The 85th percentile speed was measured to be approximately 43 miles per hour, compared to the posted speed limit of 35 miles per hour. The higher the travel speed, the longer the gap required for motorists to complete a left-turning movement.

A three-year motor vehicle accident history for the study segment of Grandview Boulevard indicates that the number of accidents declined from a total of 55 accidents in 1986 to 52 accidents in 1987 and to 41 accidents in 1988. Based on the incidence of accidents and accident rates, the IH 94-Grandview Boulevard interchange, the intersection of Northview Road and Grandview Boulevard, and the midblock segment of Grandview Boulevard between Grandview Square and Silvernail Road were identified as accident problem locations.

A number of low cost traffic engineering improvements to abate the existing traffic congestion, delay, and accident problems were identified, evaluated, and recommended for implementation. It is important to note that, while these actions are designed to address a specific problem, it may be expected that they will have a beneficial impact on the other problems as well. Those low cost traffic engineering improvements which were recommended for implementation are found in Table 3.

The traffic engineering study also reviewed a number of intermediate range improvement measures. These measures are designed to address the existing problems identified on the study segment, yet, because of their nature, may be expected to require significant amounts of time and capital to implement. One of these alternative actions is the extension of Woodburn Road from its current terminus easterly to Grandview Boulevard and abutting Merchants' Grove on The City of Waukesha is awaiting the conveyance of the remaining right-of-way necessary to implement this project and expects to do so during the summer of 1989. This project would include the signalization of the intersection of Woodburn Road and Grandview Boulevard, and may be expected to produce additional gaps in the traffic stream between Woodburn Road and Northview Road; and may be expected to reduce the overall travel speed on Grandview Boulevard. The Commission staff recommends that left-turn lanes be provided on Grandview Boulevard at its proposed intersection with Woodburn Road. At the request of the Northwest Businessmen's Council of the Waukesha Chamber of Commerce, the staff reviewed two other alternative intermediate improvement measures, namely the construction of a frontage road on the west side of Grandview Boulevard between Grandview Boulevard and the existing buildings, and a local service road west of Grandview Boulevard on the west side of the existing buildings. Neither of these alternative actions was recommended for implementation because of significant disruption to existing parking and internal circulation; the significant amount of right-of-way required; and cost. In addition, construction of a frontage road may be expected to render implementation of improvements on Grandview Boulevard more difficult.

The study also contains a long-range highway improvement plan which is based on the forecast design year 2010 average weekday traffic volumes. The longrange highway improvement plan stresses the importance of the implementation of the western Waukesha bypass to the study segment of Grandview Boulevard. Implementation of the bypass may be expected to remove between 5,000 and 7,000 vehicles per average weekday from the study segment of Grandview Boulevard. Therefore, completion of the bypass would postpone the need to improve Grandview Boulevard between Northview Road and Silvernail Road, and ultimately permits the construction of a less intrusive roadway cross-section to meet the anticipated travel demand. It should be noted that Waukesha County is currently engaged in a preliminary engineering study for the western bypass. It is recommended that the western bypass be implemented. The bypass has long been proposed to be developed as a state trunk highway. The City, County, and Town of Waukesha, and the Town of Pewaukee should formally request that the bypass be added to the state trunk highway system and that action be initiated for its inclusion in the State's major projects development process.

The Wisconsin Department of Transportation has an improvement project programmed for completion in 1993 to add a structure over IH 94 to provide two traffic lanes in each direction on Grandview Boulevard--CTH T. This project

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Table 3

LOW COST TRAFFIC ENGINEERING SOLUTIONS

Recommendations	Estimated Cost
Recommendations	Escimated 00st
Delineate traffic lanes with eight-inch white lines at intersection of eastbound IH 94 off-ramp with southbound Grandview Boulevard	\$ 600
Install advisory "Added Lane (From Right)" sign at the eastbound to southbound leg of the eastbound IH 94 off-ramp	\$ 200
Increase random law enforcement activity on Grandview Boulevard north from Northview Road to Fatima Drive	\$4,500 per year
Prohibit right turns on red at the intersection of Grandview Boulevard and Silvernail Road	\$ 200
Construct consolidated driveways on the joint property line between Merchants' Grove and Blue and Koepsell property and on the joint property line between Midwest Accounting and Budget Rental Center	\$7,500
Cut property and the Century 21 and Stop-N-Go property by closing the Sharpest Cut driveway and the northernmost Century 21 driveway. Access would be via the remaining driveway if an easement is granted to Sharpest Cut or via a new driveway on the joint property line	\$1,000
Replace existing "Yield" sign with a "Stop" sign at the right-turn lane on the westbound approach of Northview Road at the intersection of Grandview Boulevard with Northview Road	\$ 75

Source: SEWRPC.

will provide the capacity necessary to meet the future travel demand. Selected on- and off-ramps in the the IH 94 and Grandview Boulevard--CTH T--interchange will be reconstructed as well, not only to accommodate the additional structure, but to alleviate the existing accident and delay problems. Waukesha County intends to reconstruct Grandview Boulevard--CTH T--north of IH 94 to provide for two travel lanes in each direction. The programmed improvement project between Silvernail Road and Fatima Drive will provide the capacity necessary to meet the future travel demand except for the stretch between Silvernail Road and IH 94, where a six-lane divided roadway improvement will be needed.

Three capital intensive roadway improvement alternatives were considered to provide the capacity necessary to meet the anticipated future travel demand on Grandview Boulevard between Northview Road and Silvernail Road. alternative roadway improvement considered was the construction of a four-lane divided highway with a 24-foot-wide median and twin 28-foot-wide curb-to-curb roadways. The second alternative considered was a five-lane roadway with a 14-foot-wide fifth lane in the center of a 66-foot-wide curb-to-curb roadway that would provide for a continuous left turns. The final alternative roadway improvement considered was a six-lane divided highway with a 24-foot-wide median and twin 40-foot-wide curb-to-curb roadways. The four-lane divided roadway improvement alternative was recommended for implementation because it provides the capacity necessary to meet the year 2010 forecast travel demand with the bypass. In addition, left-turn bays could be provided in the median to accommodate left-turning vehicles and, thus, remove those left-turning vehicles from the through traffic stream. This roadway alternative would require the acquisition of additional right-of-and increase the width of the roadway from its present 48-foot curb-to-curb width to 80 feet. An option of the recommended four-lane divided roadway improvement would be to construct auxiliary lanes which would terminate prior to entering the intersections of Grandview Boulevard at Northview Road and Silvernail Road, and which would accommodate right turns into and out of driveways at some point in the future. Sub-options would include the construction of an auxiliary lane on the west side of the roadway at the same time that Grandview Boulevard is reconstructed to the four-lane divided roadway, given the level of existing development there, or to construct the auxiliary lanes on both sides of the roadway when Grandview Boulevard is reconstructed. Grandview Boulevard is currently operating over design capacity, and traffic engineering actions may not be expected to resolve these traffic congestion problems. A need exists to implement in the short range both the Waukesha bypass and the recommended improvement of Grandview Boulevard to a four-traffic-lane divided roadway.

It should be noted that, if the western Waukesha bypass is not constructed, a six-lane divided roadway would be required on Grandview Boulevard between Northview Road and Silvernail Road to meet the expected year 2010 travel demand. If this alternative were implemented, the curb-to-curb roadway width would increase from its current 48 feet to 104 feet. This would necessarily result in the loss of parking for some abutting property owners and may be expected to impair the internal parking lot circulation for other property owners. Finally, tapering this cross-section to match the two-lane roadway on Grandview Boulevard south of Northview Road would be extremely difficult.

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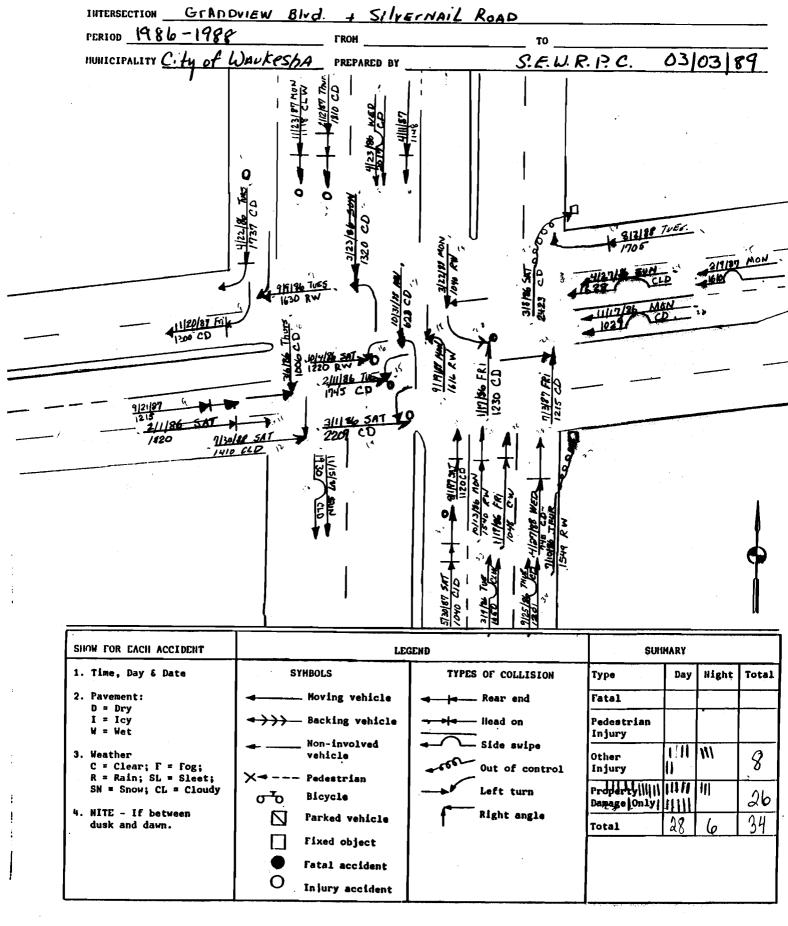
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