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Seventh Avenue Study

City Of
Marion, Iowa

Wilbur Smith and Associates

SEVENTH AVENUE STUDY
INTERIM REPORT

Prepared for

Marion, Iowa

by

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March, 1975

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March 17, 1975

Mr. Herman W. Thompson
Director of Community Development
City of Marion
Box 99
Marion, Iowa 52302

Dear Mr. Thompson:

We are pleased to submit this interim report of the Seventh Avenue Study. The purpose of this report is to provide preliminary findings and recommendations developed to date in the study.

Findings and recommendations will be finalized in the subsequent project final report to be submitted following the completion of the Seventh Avenue Study.

We trust these preliminary findings and recommendations will provide you with timely study output and also provide a forum for discussion and refinement of these preliminary recommendations.

Respectfully submitted,

WILBUR SMITH AND ASSOCIATES

E.L. Walker, Jr.
Vice President

ELWJr:dc

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Chapter 1

INTRODUCTION

Marion, as part of the Cedar Rapids-Marion Metropolitan Area, is one of the fastest growing cities in Iowa. Population in Marion grew 65 per cent between 1960 and 1970 to a population of 18,028. Dramatic growth is expected to continue in future years, and its population is expected to double by 1990.

Seventh Avenue is the major traffic facility in Marion and has experienced a growth in traffic which parallels the city's growth. Seventh Avenue as a regional transportation facility (U.S. Highway 151), being an extension of First Avenue in Cedar Rapids and continuing to the east as a major highway route.

Study Objectives

Objectives of the Seventh Avenue Study are to make evaluations of operations and safety and to develop a recommended implementation program for roadway and traffic operations improvements. The recommended program is to include immediate-action improvements, short-range (2-5 years) improvements, and long-range (5+ years) improvements.

The study section is approximately 3.9 miles long and extends from the intersection of First Avenue and Collins Road

along Marion Boulevard and Seventh Avenue (U.S. Highway 151) to its intersection with Iowa Highway 13. In this report, general reference to Seventh Avenue also includes Marion Boulevard.

Interim Report

This interim report presents preliminary findings and recommendations of the Seventh Avenue Study. Findings and recommendations will be finalized in a project report following additional evaluation and analysis, and review by city officials of this interim report.

Chapter 2

EXISTING CONDITIONS

Information on existing conditions on Seventh Avenue were assembled from the City of Marion, previous studies, and collection of data in the field. This section of the report summarizes pertinent information relating to existing physical and operational features of Seventh Avenue.

Right-of-Way and Street Width

Right-of-way in the study section varies from 64 to 120 feet. Marion Boulevard right-of-way is 120 feet from Collins Road to the Indian Creek Bridge, with variable right-of-way from the bridge to the railroad grade separation with Chicago, Milwaukee, St. Paul, and Peoria Railroad. From the railroad grade separation east to 15th Street, the right-of-way is 80 feet. Between 15th Street and the curve on Seventh Avenue beginning west of 31st Street, right-of-way is 64 feet. Right-of-way in the curve from a point west of 31st Street to 35th Street is 100 feet. Right-of-way of U.S. 151 east of 35th Street is of variable width, but is sufficiently wide to contain the existing divided four-lane roadway with shoulders and wide median.

Roadway cross-sections vary in the study section from the rural divided highway section east of 35th Street to 43 feet at

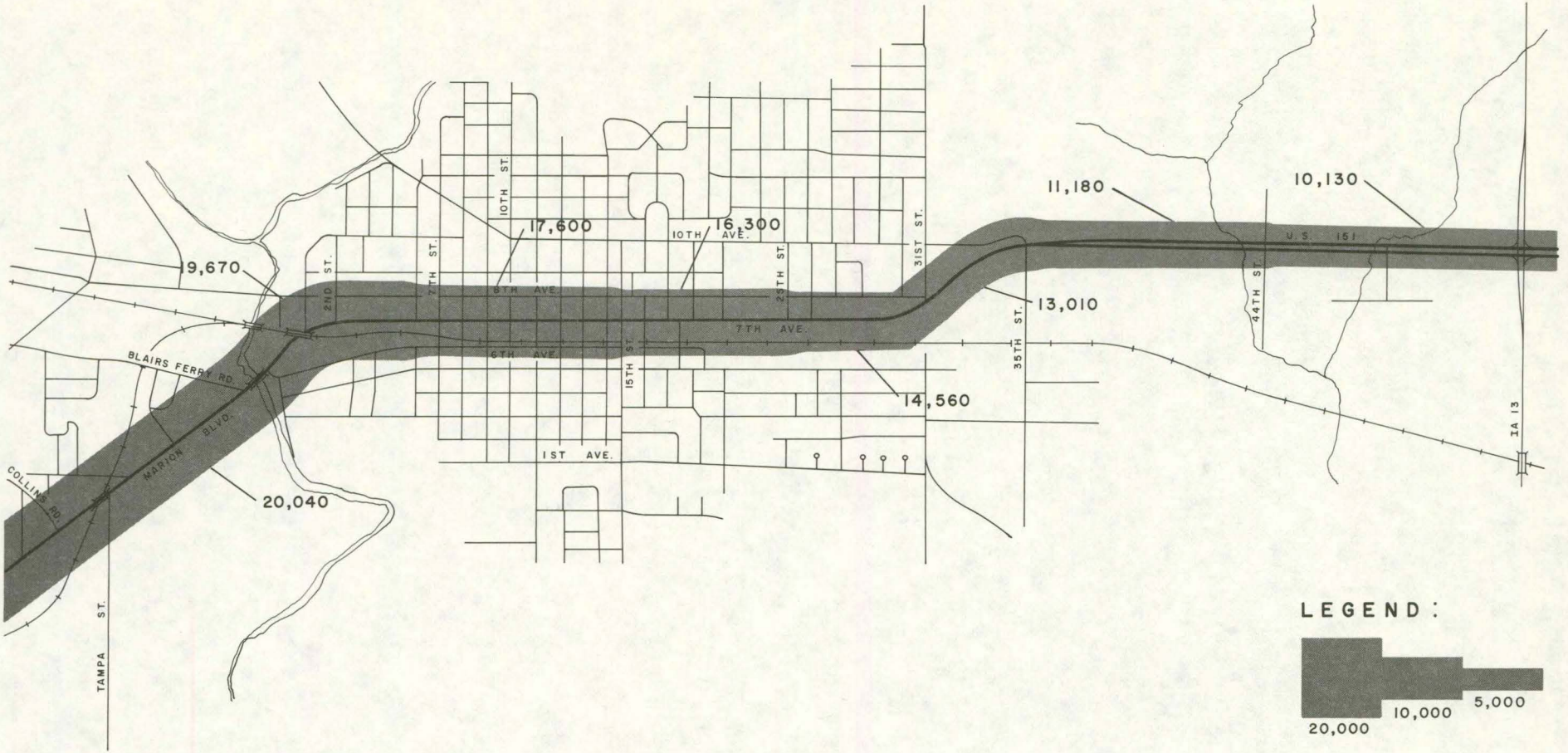
Blairs Ferry and 6th Avenue. Street width from the southeast city limit to Thomas Park is 52 feet, narrowing to 43 feet to a point just south of the railroad overpass. The facility divides for a short distance into two 24 feet wide roadways to pass under the railroad overpass. From the railroad overpass to 35th street the roadway is 48 feet wide, with the exception of the section between 10th Street and 13th Street, which is widened to 56 feet to accommodate curb parking.

Traffic Demand

Weekday traffic demand on Seventh Avenue is from 22,260 vehicles per day south of Blairs Ferry Road to 11,180 vehicles per day east of 35th Street. Traffic volumes generally decrease from west to east, due to the orientation of Marion traffic toward the City of Cedar Rapids as indicated in the traffic flow map shown in Figure 1. Traffic volumes through the Marion Central Business District are approximately 16,000 vehicles per day.

Speed Limits

Speed limits in the study section are between 20 miles per hour and 55 miles per hour. From the southwest city limits to 9th Street, the speed limit is 35 miles per hour. From 9th Street to 15th Street, through the Marion Central Business District, the speed limit is 20 miles per hour. Between 15th Street



TRAFFIC VOLUME FLOW MAP

SEVENTH AVENUE STUDY

MARION, IOWA

N

SCALE

0.0 0.2 0.4

MILES

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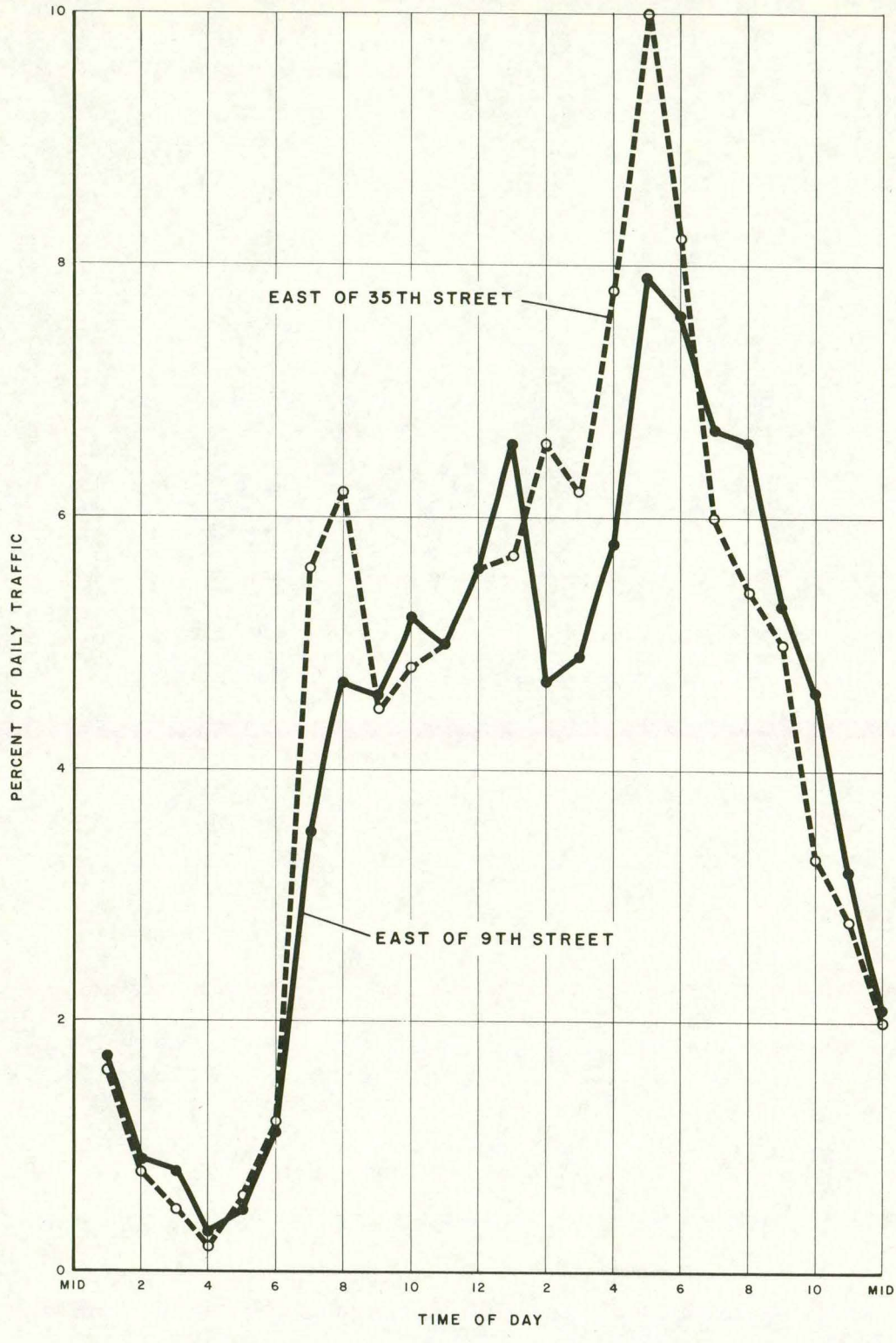
FIGURE 1

and 35th Street, the speed limit is 35 miles per hour. A short transition speed limit of 45 miles per hour is in effect for a distance east of 35th Street, increasing to 55 miles per hour for the remainder of the study section.

Traffic Characteristics

Hourly distribution of traffic on Seventh Avenue is shown graphically in Figure 2 for two locations--east of 9th Street and east of 35th Street. It can be seen that the morning peak period is moderate compared with the evening peak period of traffic flow, although a sharper morning peak occurs at the location east of 35th Street. The evening peak hour is also more pronounced east of 35th Street, with 10 per cent of daily traffic traveling between 4:00 P.M. and 5:00 P.M. This compares to 7.9 per cent for the evening peak hour at the location east of 9th Street.

Directional distribution of traffic for the morning peak period indicates a highly directional movement, with 70 per cent of traffic westbound. During the middle portion of the day, directional distribution is evenly split between eastbound and westbound traffic. During the evening peak, traffic movement is predominantly east bound with 59 per cent of traffic traveling eastbound.



HOURLY DISTRIBUTION OF TRAFFIC

SEVENTH AVENUE STUDY

MARION, IOWA

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FIGURE 2

Curb Usage

Usage of curb space for parking and loading is prohibited over most of the study section. Parking is permitted on Seventh Avenue only between 9th Street and 13th Street, where parking is generally limited to one hour. Parallel parking is permitted on both sides of the street in that section of Seventh Avenue between 10th Street and 13th Street, where the street width is 56 feet. It is also permitted on the north curb between 8th Street and 9th Street, where street width is 52 feet.

Accident Experience

Accidents occuring during the last five years at intersections along Seventh Avenue are summarized in Table 1. Over the five year period, accident experience has been relatively stable with accident ranging from 78 accidents in 1971 to 95 accidents in 1970. Eighty seven intersection accidents occurred in 1974.

Accident experience is more meaningful when expressed as a function of traffic. This parameter is called "accident rate" and for intersection accidents is expressed in units of accidents per million vehicles entering the intersection during the period of analysis. Intersection accident rates for major intersections on Seventh Avenue in 1974 are indicated in Table 2.

Non-intersection accidents occurring in 1973 and 1974 are summarized in Table 3. There were 71 non-intersection accidents

Table 1

INTERSECTION ACCIDENT FREQUENCY
SEVENTH AVENUE

INTERSECTING STREET	ACCIDENTS BY YEAR				
	1970	1971	1972	1973	1974
Twixt Town Rd.	2	0	3	2	1
Keyes Court	4	3	2	2	4
Thomas Park	3	7	1	4	2
Blairs Ferry Rd.	9	8	12	12	10
6th Avenue	6	5	10	6	7
2nd Street	1	2	0	1	3
3rd Street	2	0	2	0	3
6th Street	6	2	0	3	2
7th Street	14	9	8	2	10
8th Street	2	4	2	2	1
9th Street	2	7	2	2	1
10th Street	7	5	11	8	8
11th Street	6	9	3	6	2
12th Street	3	2	4	3	3
13th Street	11	5	6	7	9
14th Street	1	1	1	0	2
15th Street	1	1	3	1	3
16th Street	0	0	1	0	0
18th Street	3	0	1	2	1
19th Street	1	1	0	3	2
20th Street	1	0	1	1	1
22nd Street	3	0	1	1	0
25th Street	0	0	0	0	2
26th Street	2	0	0	1	0
31st Street	3	3	6	3	3
35th Street	2	4	8	6	7
Total	95	78	88	78	87

Table 2

ACCIDENT RATES FOR SEVENTH AVENUE
MAJOR INTERSECTIONS--1974

CROSS STREET	NUMBER OF ACCIDENTS	EXPOSURE (MEV) (1)	ACCIDENT RATE (Acc/MEV)
Blairs Ferry Road	10	9.18	1.09
6th Avenue	7	8.97	0.80
7th Street	10	7.07	1.41
9th Street	1	6.59	0.15
10th Street	8	7.77	1.03
11th Street	2	7.74	0.26
12th Street	3	6.55	0.46
13th Street	9	6.49	1.39
22nd Street	0	5.55	0
31st Street	3	4.57	0.66
35th Street	7	6.33	1.11

(1) MEV = million entering vehicles.

Table 3

SUMMARY OF 1973-1974 NON-INTERSECTION ACCIDENTS
SEVENTH AVENUE

ACCIDENT TYPE	NUMBER OF ACCIDENTS
Parked Vehicle	17
Parking Vehicle	3
Driveway Locations	
Left Turns	22
Right Turns	11
Exiting Driveway	28
Lane Changes	29
Rear End	11
Rear End While Turning	11
Total	132

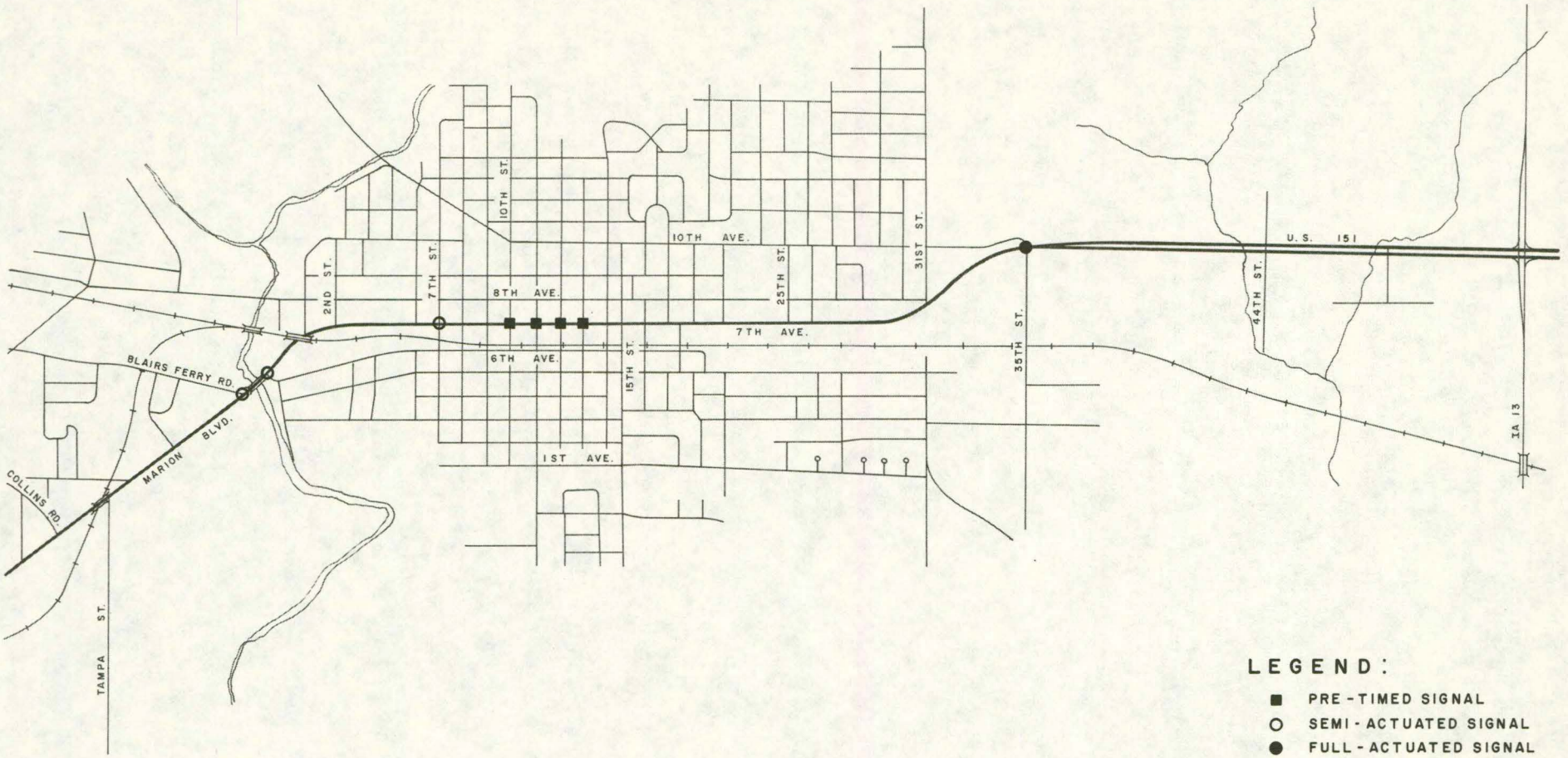
in 1973 and 61 in 1974. A total of 61 non-intersection accidents were related to movements into and out of driveways along Seventh Avenue. It is significant that 17 accidents involved a parked vehicle. This probably is a result of the provision of parking in the four blocks of the Central Business District where limited street width requires the use of narrow moving traffic lanes.

Traffic Signals

There are eight signalized intersections on Seventh Avenue between Blairs Ferry Road and 35th Street, as indicated in Figure 3. Of these eight intersections, signals at Blairs Ferry Road and 6th Avenue are semi-actuated and mutually coordinated, while the signal at 7th Street is also semi-actuated. The signal at 35th Street is a full-actuated signal. The Central Business District signals between 10th Street and 13th Street operate as a pre-timed single-dial interconnected system.

Provision for Pedestrians

There are four locations along Seventh Avenue which experience significant pedestrian crossing. These locations are at signalized intersections, where pedestrian signals are also provided. These locations are at the four Central Business District signals between 10th Street and 13th Street and at 7th Street.



LOCATION OF TRAFFIC SIGNALS

SEVENTH AVENUE STUDY

MARION, IOWA

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SCALE

0.0 0.2 0.4

MILES

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FIGURE 3

Pedestrian counts were made at these locations and are shown in Table 4. These counts were made during the periods between 7:00 A.M. and 10:00 A.M. and between 3:00 P.M. and 6:00 P.M. The highest pedestrian crossing location was at 12th Street with 230 pedestrians during the afternoon period. Other Central Business District locations also had significant pedestrian activity. The lowest pedestrian volumes were found to be at 7th Street where nine pedestrians crossed during the morning period and 31 during the afternoon period.

Table 4

PEDESTRIAN VOLUMES CROSSING SEVENTH AVENUE

	OBSERVATION PERIOD	
CROSS STREET	7:00A.M.-10:00A.M.	3:00 P.M.-6:00P.M.
7 th Street	9	31
10th Street	33	72
11th Street	67	110
12th Street	128	230
13th Street	39	147

Chapter 3

ANALYSIS AND FINDINGS

Analysis and evaluation of existing physical and traffic operational conditions on Seventh Avenue were conducted using accepted traffic engineering methodology. These included analysis of available data from the City, data obtained by the consultant, and field observations. Discussions of particular analyses and findings are presented in this chapter.

Existing Roadway Geometrics

Seventh Avenue is a four-lane facility, over its entire length, with a width of 48 feet in most locations as previously noted. One significant feature of the geometric configuration is that separate left-turn lanes are not provided at intersections. The provision of separate left-turn lanes on a high-volume arterial street is a very desirable design feature for both safety and traffic operations. This is particularly important at major intersections.

A short section of Marion Boulevard between Thomas Park Road and the Chicago, Milwaukee, St. Paul, and Peoria Railroad overpass (including the Blairs Ferry Road and 6th Avenue intersections and the Indian Creek Bridge) is 43 feet wide. This is

less than the desired width for a four-lane roadway, which should be 48 feet wide.

Volume/Capacity Relationships

Capacity is the capability of a roadway to accommodate traffic. When compared to the traffic demand (volume/capacity ratio) a measure of traffic service can be determined. A volume/capacity analysis was made of all signalized intersections on Seventh Avenue. Level-of-Service C was used as the basis for computing intersection capacity, and traffic volumes for the highest hour were used for comparison. The peak hour, in general, occurs between 4:00 P.M. and 5:00 P.M.

Three eastbound intersection approaches on Seventh Avenue were found to be operating with a volume/capacity ratio in excess of 1.00 during the peak hour--6th Avenue, 10th Street, and 13th Street. In all cases, traffic movements on side street approaches are operating with relatively low volume/capacity ratios. This indicates the division of green signal time between Seventh Avenue and the side street movements is over-biased in favor of the side streets.

To achieve equitable levels of service among all users of the intersection, traffic signal timing should be apportioned to provide essentially the same volume/capacity ratio to all movements.

Travel Time and Delay

Travel time and delay studies were conducted on Seventh Avenue between Blairs Ferry Road and 35th Street. These runs were made during the morning peak, evening peak, and off-peak periods. Travel time data for the morning and evening peak periods are shown in Table 5.

Through the entire section, the average speed for the morning peak period was 26 miles per hour compared to 24 miles per hour during the evening peak period. Delays occurred at signalized intersections, while travel speed between these intersections was free flow and sppeds at or near the speed limit were possible. Total delay (stop time) during the morning peak period was 52 seconds, while delay for the evening peak was 43 seconds.

The pattern of stops indicates that the potential exists for decreasing delays by modifying the coordination of signals in the Central Business District. During the conduct of travel time runs, and through field observation, it was often not possible to pass through the section between 10th Street and 13th Street without stopping. Modifications in signal timing could lessen delays experienced in the Central Business District, particularly in the predominate traffic flow direction during peak periods.

Table 5

TRAVEL TIME AND DELAY SUMMARY

REFERENCE POINT	TRAVEL TIME (Seconds) A.M.	TRAVEL TIME (Seconds) P.M.	AVERAGE SPEED (MPH) A.M.	AVERAGE SPEED (MPH) P.M.	DELAY (Seconds) A.M.	DELAY (Seconds) P.M.
Blairs Ferry Road						
	17	14	19	23	11	
6th Avenue						
	67	60	29	32	13	
7th Street						
	23	26	32	26		
10th Street						
	27	29	10	9	18	17
11th Street						
	9	13	29	20		
12th Street						
	11	27	24	10		16
13th Street						
	138	146	29	27	10	10
35th Street						
AVERAGE SPEED			26	24		
TOTAL DELAY					52	43

NOTE: A.M. Peak period runs made westbound, P.M. runs made eastbound.

Accident Analysis

Collision diagrams were developed for intersections on Seventh Avenue for the years 1973 and 1974. These diagrams give pertinent information relating to each accident, such as: type of collision, date, time of day, weather, and pavement conditions. Review of collision diagrams can indicate accident patterns and provide the basis for determining contributing factors and possible remedial measures.

Of the 165 accidents occurring at intersections on Seventh Avenue in 1973 and 1974, it was found that 103 were rear-end accidents, most of which occurred on Seventh Avenue. Many of these collisions, particularly at unsignalized intersections, occurred as a result of a vehicle stopping to make a left turn and being struck from the rear. Since separate left-turn lanes are not provided at intersections, a vehicle making a left turn must often stop in a moving traffic lane until the turn can be made.

Rear-end accidents are characteristic at signalized intersections because of the stop-and-go nature of traffic signal control. However, where a significant number of rear-end accidents occur at a signalized intersection, conditions may exist which contribute to the accident frequency. Often the contributing factors can be eliminated or mitigated.

Of the remaining intersection accidents occurring in 1973 and 1974, 25 were right angle collisions, 22 involved left-turning vehicles struck by thru vehicles, and 11 were side-swipe accidents.

There are five intersections on Seventh Avenue which experienced accident rates in 1974 of more than one accident per million entering vehicles, as previously indicated in Table 2. These locations experienced from seven to ten accidents in 1974. These locations are the intersections of Seventh Avenue with Blairs Ferry Road, 7th Street, 10th Street, 13th Street, and 35th Street. It is interesting, though not surprising, to note that each of these intersections is signalized.

These five locations will subsequently be examined in more detail and field observations made to determine if corrective action is indicated. Where corrective action is indicated, recommendations will be developed and reported in the project report to be submitted at a later date.

Curb Parking

Parking is permitted between 9th Street and 13th Street in the Central Business District. Between 10th Street and 13th Street, the street width is 56 feet. With a parking lane requiring 8 feet of width, this leaves 40 feet of the street for moving traffic lanes (lane widths average 10 feet). These lane widths

are not considered adequate for the movement of traffic on an arterial street, where the desirable width is 12 feet per lane, with a minimum acceptable width of 11 feet.

The loss of usable street width to parking creates safety as well as traffic operational problems. It was found that 17 accidents in the 1973-1974 period involved parked vehicles, which were assumed to have occurred in this section of Seventh Avenue where parking is permitted.

Future Role of Seventh Avenue

The role of Seventh Avenue in the future, and the traffic demand it will experience, are subject to long-range transportation planning and implementation decisions.

The 1990 Transportation Plan contained a freeway facility generally parallel to First Avenue in Cedar Rapids and Seventh Avenue in Marion, passing to the south of the intensely developed part of Marion.(1) This would provide a by-pass route for through trips. Forecasted traffic on Seventh Avenue, with this plan, was in the range of 11,000 vehicles per day to 20,000 vehicles per day.

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(1) 1990 Transportation Plan, Cedar Rapids-Marion Metropolitan Area, Linn County Regional Planning Commission and Howard, Needles, Tammen, and Bergendoff, 1970.

The proposed freeway corridor was studied in more detail in the SW-NE Corridor Location Study.[2]

The proposed routing of this freeway met with considerable opposition from the community and has apparently been deleted from the area's transportation plan. However, that portion which by-passes Marion was reconfigured and remains on the latest plan as a high-type facility between Collins Road on the west and U.S. 151 on the east.[3] The 1995 forecasted traffic on Seventh Avenue ranges between 5,000 and 30,000 vehicles per day.

In the Preliminary 1995 Plan Report, it was indicated that upgrading of Seventh Avenue-Marion Boulevard should be accomplished between 1975 and 1980. Marion Boulevard was recommended to be a six-lane facility from the southwest city limits to 2nd Street. Seventh Avenue was recommended to be upgraded to an improved four-lane facility from 2nd Street to 35th Street.

(2) SW-NE Corridor Location Study, Howard, Needles, Tammen, and Bergendoff, 1972.

(3) Preliminary Report, 1995 Major Street Plan of the 1995 Transportation Plan, Linn County Regional Planning Commission, 1975.

Chapter 4

PRELIMINARY RECOMMENDATIONS

Preliminary recommendations presented in this chapter are based upon analyses, field observations, and findings discussed in the previous chapter. Previous studies and available information have also been considered as has future development plans likely to affect Seventh Avenue. The recommendations are categorized into three priorities: immediate (1 to 2 years), short range (2 to 5 years), and long range (over 5 years).

Immediate Action Recommendations

Preliminary recommendations for immediate action improvements on Seventh Avenue are discussed by project in the following sections.

Signal Retiming - It was noted in the discussion of volume/capacity analysis that existing capacity deficiencies could be corrected by a reallocation of green time at the signalized intersections. Therefore, it is recommended that the traffic signals be retimed with the intent of achieving comparable levels of service on both Seventh Avenue and intersecting approaches. This retiming should produce immediate benefits to Seventh Avenue traffic in reducing stops and delays.

Curb Parking - Operational and safety concerns related to curb parking in the Central Business District were discussed in the previous chapter. With the street width presently available on Seventh Avenue in the Central Business District, and with parking permitted, less than desirable lane widths are left for moving traffic lanes resulting in specific safety and operation problems.

Elimination of curb parking on one side of Seventh Avenue in the Central Business District to improve traffic operations and safety is recommended at this time, with parking removal on the other side at such time as the physical widening of 7th Avenue occurs.

Short-Range Improvement

The short-range improvement recommended is the modernization of the signal system in the Central Business District between]0th Street and]3th Street. This recommendation includes both the modernization of signal control equipment and signal displays.

Existing signal displays on Seventh Avenue include both overhead and side-mounted signals. Side-mounted signals do not generally provide the visibility and clarity-of-intent inherent with overhead signals. Further, it is desirable to provide consistent signal displays along a major street so that drivers view a similar treatment of signals from location to location as they proceed along the street. Overhead signal displays can be

expected to reduce accidents, particularly rear-end type accidents, because of their better visiblity.

It is recommended that the four single-dial signal controllers on Seventh Avenue at 10th Street, 11th Street, 12th Street, and 13th Street be replaced with modern three-dial controllers. The existing controllers are over 25 years old and are nearing the end of their useful life. More importantly, the variations in traffic demand, sharp peaking, and significant shifts in directional distribution of traffic at these intersections could better be served with the multi-timing program capability of the proposed system. Timing-program options offered by three-dial controllers, with program selection being made by a time-of-day programmer, will adequately serve the signal control needs for the foreseeable future.

Long-Range Improvements

The future role of Seventh Avenue and the expected future traffic volumes were discussed in the previous chapter. The proposed Marion by-pass will have a significant affect on the function and traffic demand on Seventh Avenue. Until the by-pass is completed, Seventh Avenue will continue to experience a growth in traffic demand as the urban area grows.

In the concurrent study of First Avenue in Cedar Rapids, a preliminary recommendation has been made to widen First Avenue to a high-type six-lane thoroughfare to Collins Road. This six-lane facility is recommended to extend into Marion to accommodate expected future traffic demand. The transition of the facility from six lanes to four lanes should be made between 6th Street and the Central Business District. The railroad overpass of the Chicago, Milwaukee, St. Paul, and Peoria Railroad may be a consideration in determining the transition point, since a six-lane cross section with adequate clearances cannot be accommodated under the existing structure.

The remainder of Seventh Avenue east of 6th Street to 35th Street is recommended for upgrading to provide four full lanes of traffic with separate left-turn lanes at major intersections to provide the capacity, improved traffic operations, and safety necessary to accommodate the traffic demands.

If construction of the Marion by-pass is delayed significantly, traffic demand on Seventh Avenue could exceed the capacity of the proposed improved four-lane section. If this delay should occur, continuation of the six-lane construction requiring extensive right-of-way acquisition is evident. An alternative to the six lane upgrading on Seventh Avenue east of 6th Street which would create additional capacity, is the development of a one-way street pair of Seventh Avenue and Eighth Avenue between 2nd Street and 3]st Street. This improvement would require the widening of Eighth Avenue and construction of the termination treatments at both ends of the one-way operation.

Development of Seventh Avenue into a high-type six-lane facility would provide a capacity in the order of 33,000 to 36,000 vehicles per day at Level-of-Service C. Improvement into a high-type four lane facility would provide a capacity in the order of 25,000 to 27,000 vehicles per day at Level-of-Service C.

Summary of Recommendations

The following is a concise summary of preliminary recommendations discussed in the previous section:

Immediate Action

Retiming of Signals
Parking Prohibitions

Short Range

Upgrade Signal Installations
Replacement of Signal Controllers

Long Range

Widen Seventh Avenue to six lanes from 6th Street westerly
Widen Seventh Avenue from 6th Street easterly to 35th Street to four lanes with channelization.