city of mason city

traffic safety study

BY BARTON-ASCHMAN ASSOCIATES, INC.

TRAFFIC SAFETY STUDY

MASON CITY, IOWA

Prepared for
The City of Mason City

By
Barton-Aschman Associates, Inc.
Chicago, Illinois

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1. INTRODUCTION

Mason City is located in the far north-central portion of Iowa, approximately 25 miles south of the Iowa-Minnesota state line. Because it serves as an urban center for many rural satellite communities, Mason City performs many roles. It functions both as a local and as a regional focal point for all business, social, and civic affairs, and as a result, is beset with many of the inherent problems associated with each role.

One of these problems is providing for safe, efficient, and economical traffic movement throughout Greater Mason City, and it was to meet this objective that the study was conducted. Recognizing that traffic safety hazards exist at various locations throughout the community, the city sought recommendations predicated upon the following analyses:

-- *Analysis of High-Accident Intersections.* Seven high-accident, congested intersections designated by the city were analyzed for the purpose of recommending modifications that would reduce traffic safety hazards.

-- *School Area Safety Study.* In an attempt to improve traffic safety city-wide, traffic movements, and the pedestrian-vehicular conflicts at five school sites selected by the city, were investigated.

-- *Central Business District Traffic Safety Study.* High-accident and highly congested intersections within the core of the central business district and its area of influence were analyzed and recommendations were made which would promote safer, more efficient vehicular and pedestrian movements.

The improvements recommended as a result of this safety study are summarized, both in narrative and illustrative form, in the succeeding chapters.

2.
HIGH-ACCIDENT INTERSECTIONS

The Mason City Safety Study included detailed analyses at seven intersections selected by the city on the basis of recent accident experience. The purposes of the detailed analysis were to (1) identify the intersection characteristics which increase or influence the accident potential at these locations, (2) recommend physical or operational improvements that would reduce accident potential, and (3) estimate the expected benefits (e.g., accident reduction and capacity increase) and expected costs of these improvements.

The intersections selected for detailed analysis are listed below and shown graphically on Figure 1.

-- 4th Street (U.S. 18) and College Drive

-- 4th Street (U.S. 18) and Illinois Avenue

-- 4th Street (U.S. 18) and South Kentucky Avenue

-- 4th Street (U.S. 18) and South Virginia Avenue

-- 4th Street (U.S. 18) and South Pierce Avenue

-- 5th Street (U.S. 18) and South Monroe Avenue

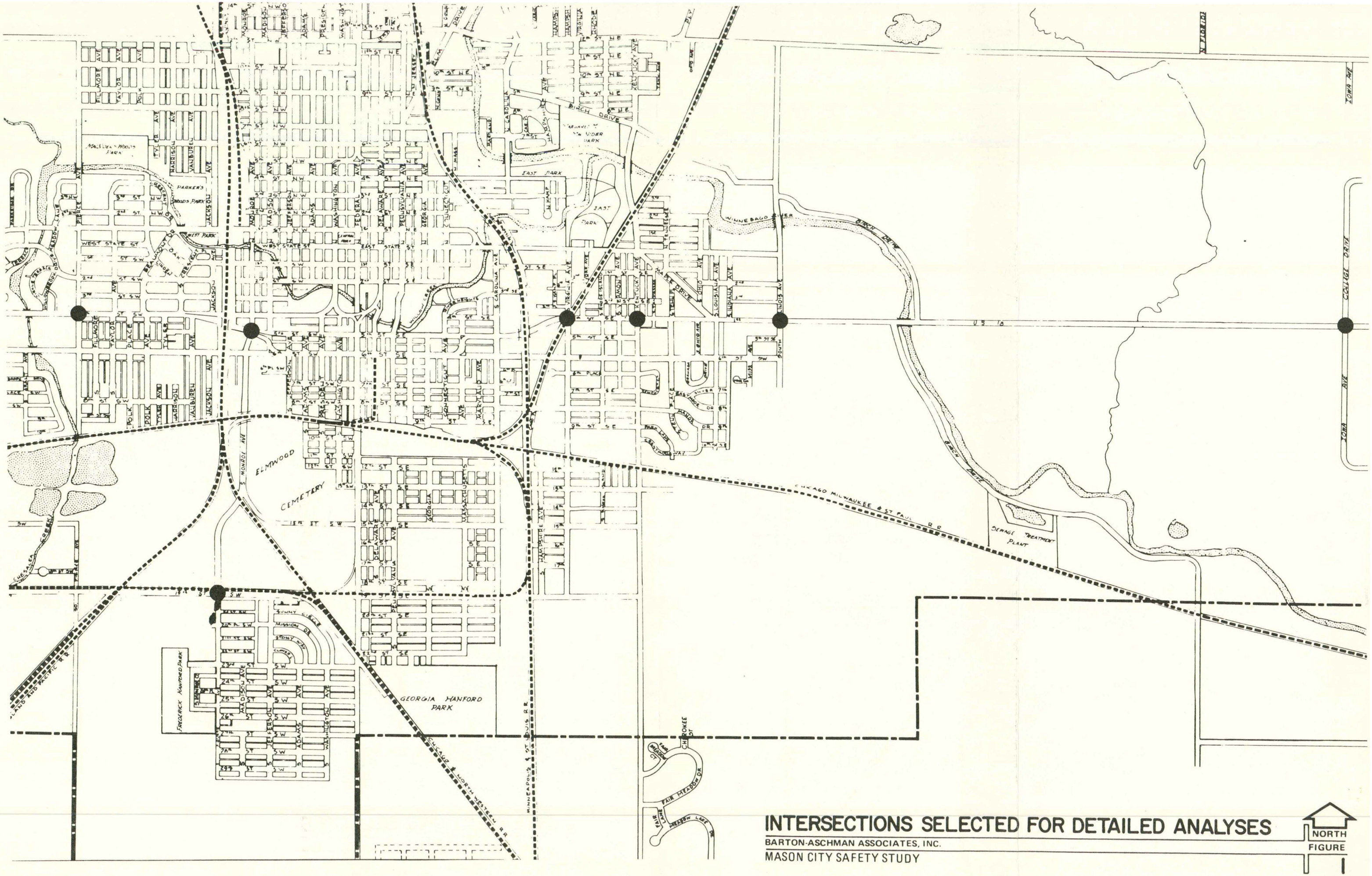
-- 19th Street and South Monroe Avenue

Following completion of the analyses, each of the seven intersections was ranked according to the relative cost-effectiveness of the recommended improvements. In establishing the cost-effectiveness evaluation procedure, three major elements were considered:

1. Time savings due to decreased delay (as related to increased intersection capacity).

2. Savings due to accident reduction.

3. Improvement costs.



INTERSECTIONS SELECTED FOR DETAILED ANALYSES

BARTON-ASCHMAN ASSOCIATES, INC.

MASON CITY SAFETY STUDY

NORTH

FIGURE 1

All three of these items were computed in terms of annual dollar savings or cost. The cost effectiveness of an improvement was based upon the ratio of total annual savings (annual time savings plus annual accident savings) to total annual improvement cost (annual construction cost). The higher the ratio, the higher the cost-effectiveness ranking. However, it should be remembered that this cost-effectiveness ranking is merely a tool to be used in scheduling projects. The final decision on scheduling improvements should also be based on judgment, taking into consideration: (1) the availability of funds for the work; (2) the relative urgency of the various improvements; (3) the willingness of other public agencies to assist financially with the improvement; (4) the amount of lead-time needed to prepare plans; (5) the necessity for coordinating this work with other work in the area; and (6) the advisability of improving considerable segments of the route at one time.

Table 1 contains the intersection cost-effectiveness ranking along with other pertinent information related to existing characteristics and expected improvement costs and benefits of each intersection.

During the course of our investigations in Mason City, the issue of permitting right turns on the red signal indication in either the outlying areas or the central business district was avoided because of the national controversy which now exists on this issue. By allowing drivers to proceed to turn right after stopping at a red signal and waiting for cross-traffic to clear, it was anticipated that delays to some traffic would be significantly reduced and capacity of intersections increased. However, there continues to be much discussion on the merits of this concept.

Table 1
INTERSECTION COST-EFFECTIVENESS RANKINGS

Intersection	Priority Ranking	Peak-Hour Volume	Number of Accidents (1/72-3/73)	Estimated Improvement Cost	Expected Accident Reduction	Expected Capacity Increase
4th Street - South Kentucky Avenue	1	1,200	26	$ 1,000	10%	0%
4th Street - South Pierce Avenue	2	2,050	27	22,000	25%	10%
5th Street - South Monroe Avenue	3	2,250	24	4,500	15%	5%
19th Street - South Monroe Avenue	4	1,100	28	350	5%	0
4th Street - Illinois Avenue	5	1,050	12	25,000	20%	0
4th Street - College Drive	6	650	10	68,000	30%	40%
4th Street - Virginia Avenue	7	1,000	14	50	0	0

Proponents of the concept claim that it does reduce delays to right-turning traffic by nearly 50 percent without any appreciable increase in the number of accidents being caused by right-turning traffic. Opponents have stated a number of reasons why a right-turn-on-red policy should be prohibited. Among these are increased vehicular pedestrian conflicts, increased accident occurrence, and violation of uniformity as specified in the *Manual on Uniform Traffic Control Devices*.

Although there have been many papers and articles written concerning right-turn-on-red advantages and disadvantages, few have had sufficient factual data to reinforce the arguments that were presented. One of the first technical evaluations of the right-turn-on-red concept was done in California by James Ray in 1956. For years, this study was the standard. In the 1960s, as more states and cities considered the use of right-turn-on-red, several papers were written on the subject. One such paper, prepared by Paul Graves in 1963, was based on opinions expressed by various traffic engineers throughout the country. Although sparse factual data was presented, this paper became a basis for many of the subsequent papers.

Then, in the middle 1960s, the Institute of traffic Engineers formed a committee to study right-turn-on-red. This study surveyed all available previous studies and included detailed questionnaires sent to city and state traffic engineers in the United States and Canada. Even with all existing information at hand, the Institute did not publish a report, presumably because insufficient information was available at the time.

Some 25 states now permit right-turn-on-red in some form--yet, *it has never been conclusively shown that right-turn-on-red is truly beneficial or detrimental to traffic operations and safety*. The Illinois legislature has just enacted a revision to the state traffic code to permit right-turn-on-red, except where otherwise signed. This change, however, was enacted before an evaluation was concluded.

Four general policies on right-turn-on-red (RTOR) are now in effect in the United States:

1. RTOR prohibited.
2. RTOR prohibited, except at certain selected intersections.
3. RTOR permitted, except at certain selected intersections.
4. RTOR permitted.

These policies have been enacted almost strictly on the basis of speculation and opinion rather than factual information. Obviously, this basis has not been adequate, for it has yielded policies covering all possibilities.

Simply stated, a *uniform policy* for this concept with national applicability is desired. This policy must be based on sound supporting evidence. In addition to the policy itself, procedures in the form of a *user's manual* are needed *to aid local officials in implementing the policy*. The Federal Highway Administration is now sponsoring a study which will address these problems. However, until that study is completed and a national standard adopted, it does not behoove communities such as Mason City to proceed with a right-turn-on-red program.

The following pages of this section of the report contain the findings and recommendations of the detailed analyses conducted at each intersection. The format utilized to present this information is explained in Table 2.

Table 2
INTERSECTION PRESENTATION FORMAT

Section	Explanation
Location	Names of intersecting streets.
Existing Conditions	This section summarizes the existing conditions on each leg of the intersection and includes rights-of-way, street and approach widths, parking restrictions, traffic volumes and accidents, and other information intended to provide a complete picture of the intersection as it exists and operates today. (See Appendix for a more detailed discussion of this section.)
Existing Problems	Those problems which contribute to safety or capacity deficiencies have been identified during the analyses and are listed in this section.
Recommended Improvements	Modifications in the geometrics, control devices, or operation of the intersection are suggested.
Comments	This section contains general comments with regard to existing problems, the proposed improvements, and/or future improvements that might be required.
Improvement Benefits	To facilitate the evaluation of recommended improvements, expected benefits are listed. Where possible, the estimated increase in capacity and decrease in traffic accidents on a percentage basis are given.
Estimated Improvement Costs	The total costs are estimated for the recommended improvements. Construction costs are based upon unit prices from typical recent contracts for similar state and county work.
Figure	If geometric changes are recommended, an illustration of the changes is provided. The illustrations are intended to be of sufficient detail so that the city can utilize them for preparing engineering drawings.

INTERSECTION ANALYSIS AND RECOMMENDATIONS
MASON CITY SAFETY STUDY
JUNE 1973

I. LOCATION 4TH STREET (US 18) AND COLLEGE DRIVE, MASON CITY, IOWA

II. EXISTING CONDITIONS

	COLLEGE DRIVE (NORTH LEG)	COLLEGE DRIVE (SOUTH LEG)	4TH (US 18) (EAST LEG)	4TH (US 18) (WEST LEG)
STREET CROSS SECTION				
RIGHT OF WAY WIDTH (FT)	82	82	120	120
BASIC ROADWAY WIDTH (FT)	24	18*	24	24
NUMBER OF APPROACH LANES	LT TH RT PK 1	LT TH RT PK 1	LT TH RT PK 1	LT TH RT PK 1
WIDTH OF APPROACH (FT)	12	12	12	12
ROAD SURFACE	BITUMINOUS	BITUMINOUS	CONCRETE	CONCRETE
MEDIAN	NONE	NONE	NONE	NONE
SHOULDER TREATMENT	8'GRAVEL	UNIMPROVED	10'GRAVEL	10'GRAVEL
POSTED SPEED LIMIT (MPH)	45	45	70	70
VOLUME (PEAK HOUR)	AM	AM	AM	AM
	LT 0	LT 3	LT 0	LT 247
	THRU 0	THRU 0	THRU 207	THRU 107
	RT 17	RT 0	RT 68	RT 7
	TOT 17	TOT 3	TOT 275	TOT 361
AM COUNT FRI MAY 1973				
PEDESTRIAN ACTIVITY	NONE OBSERVED	NONE OBSERVED	NONE OBSERVED	NONE OBSERVED
TRUCKS AND THRU BUSES	MODERATE	MODERATE	MODERATE	MODERATE
SERVICE VOLUME (LEVEL C) AND VOLUME/CAPACITY RATIO(V/C)	200 .08	200 .02	700 .39	560 .65
TRAFFIC CONTROL	STOP	STOP	THRU	THRU
LAND USE	COMMERCIAL	SE-COMMERCIAL	SW-COMMERCIAL	NW-COMMERCIAL

ACCIDENTS (1/72 - 3/73)

SEVERITY	
PROPERTY DAMAGE	8
PERSONAL INJURY	2
FATAL	0
TOTAL	10

*THE SOUTH LEG TAPERS FROM 18 FEET TO 24 FEET AT THE INTERSECTION

INTERSECTION ANALYSIS AND RECOMMENDATIONS: 4TH STREET (U.S. 18) AND COLLEGE DRIVE

III. EXISTING PROBLEMS

1. BECAUSE OF THE HIGH SPEED OF TRAFFIC ON U.S. 18 AND THE RURAL CHARACTER OF THE AREA, IT IS DIFFICULT TO DISCERN THE LOCATION OF THIS INTERSECTION WHEN APPROACHING IT ON U.S. 18.
2. THE HIGH PERCENTAGE OF TURNING MOVEMENTS FROM U.S. 18 INTO THE NORTH LEG OF COLLEGE DRIVE COMBINED WITH THE HIGH SPEED OF TRAFFIC ON U.S. 18, INCREASE THE POTENTIAL FOR REAR-END AND TURNING ACCIDENTS.
3. POSTED SPEED LIMITS ON THE ENTRANCE ROADWAY (NORTH LEG) ARE CONFUSING TO DRIVERS BECAUSE THE NORTHBOUND SPEED IS POSTED AT 25 MPH AND THE SOUTHBOUND AT 45 MPH.
4. ABSENCE OF PAVEMENT MARKINGS AT THE INTERSECTION INCREASES THE POTENTIAL FOR VEHICLE CONFLICTS.

IV. RECOMMENDED IMPROVEMENTS (SEE FIGURE 2)

1. INSTALL A FLASHING TRAFFIC SIGNAL AT THE INTERSECTION TO NOTIFY MOTORISTS OF ITS LOCATION. THE TRAFFIC SIGNAL SHOULD FLASH RED FOR COLLEGE DRIVE AND YELLOW FOR U.S. 18.
2. WIDEN BOTH LEGS OF COLLEGE DRIVE TO 36 FEET TO ACCOMMODATE 12-FOOT LEFT TURN LANES.[1]
3. WIDEN BOTH LEGS OF U.S. 18 TO ACCOMMODATE 12-FOOT LEFT-TURN STORAGE LANES. ALSO CONSTRUCT A 12-FOOT RIGHT-TURN DECELERATION LANE ON THE NORTH SIDE OF THE EAST LEG.[1]
4. INSTALL LARGER STOP SIGNS (36-INCH) TO CONTROL COLLEGE DRIVE.
5. INSTALL A "STOP AHEAD" SIGN ON THE NORTH LEG FOR SOUTHBOUND TRAFFIC. THE EXISTING SIGN LOCATED THERE IS NONSTANDARD.
6. ALTER THE POSTED SPEED LIMITS ON THE NORTH LEG SO THAT THEY ARE CONSISTENT FOR BOTH NORTHBOUND AND SOUTHBOUND VEHICLES.
7. UPGRADE PAINTING PROGRAM SO THAT PAVEMENT MARKINGS ARE RE-STRIPED MORE FREQUENTLY.

V. COMMENTS

THE PROBLEMS AT THIS INTERSECTION ARE ACCENTUATED BECAUSE OF THE HIGH SPEED OF TRAFFIC (70 MPH) ON U.S. 18. AT THIS TIME TRAFFIC VOLUMES DO NOT APPEAR TO WARRANT A TRAFFIC SIGNAL AT THIS LOCATION. HOWEVER, STEPS SHOULD BE TAKEN TO IMPROVE THE VISIBILITY OF THE INTERSECTION AND TO PROTECT TURNING VEHICLES FROM EXPOSURE TO REAR-END COLLISIONS. THE WIDENING OF U.S. 18 AT THIS INTERSECTION SHOULD BE ACCOMPLISHED IN SUCH A MANNER THAT IT LENDS ITSELF TO THE PROPOSED WIDENING OF U.S. 18 TO FOUR LANES IN THE FUTURE.

VI. IMPROVEMENT BENEFITS

1. EXPECTED ACCIDENT REDUCTION--30 PERCENT.
2. EXPECTED CAPACITY INCREASE--40 PERCENT.

VII. ESTIMATED IMPROVEMENT COST

$ 68,000

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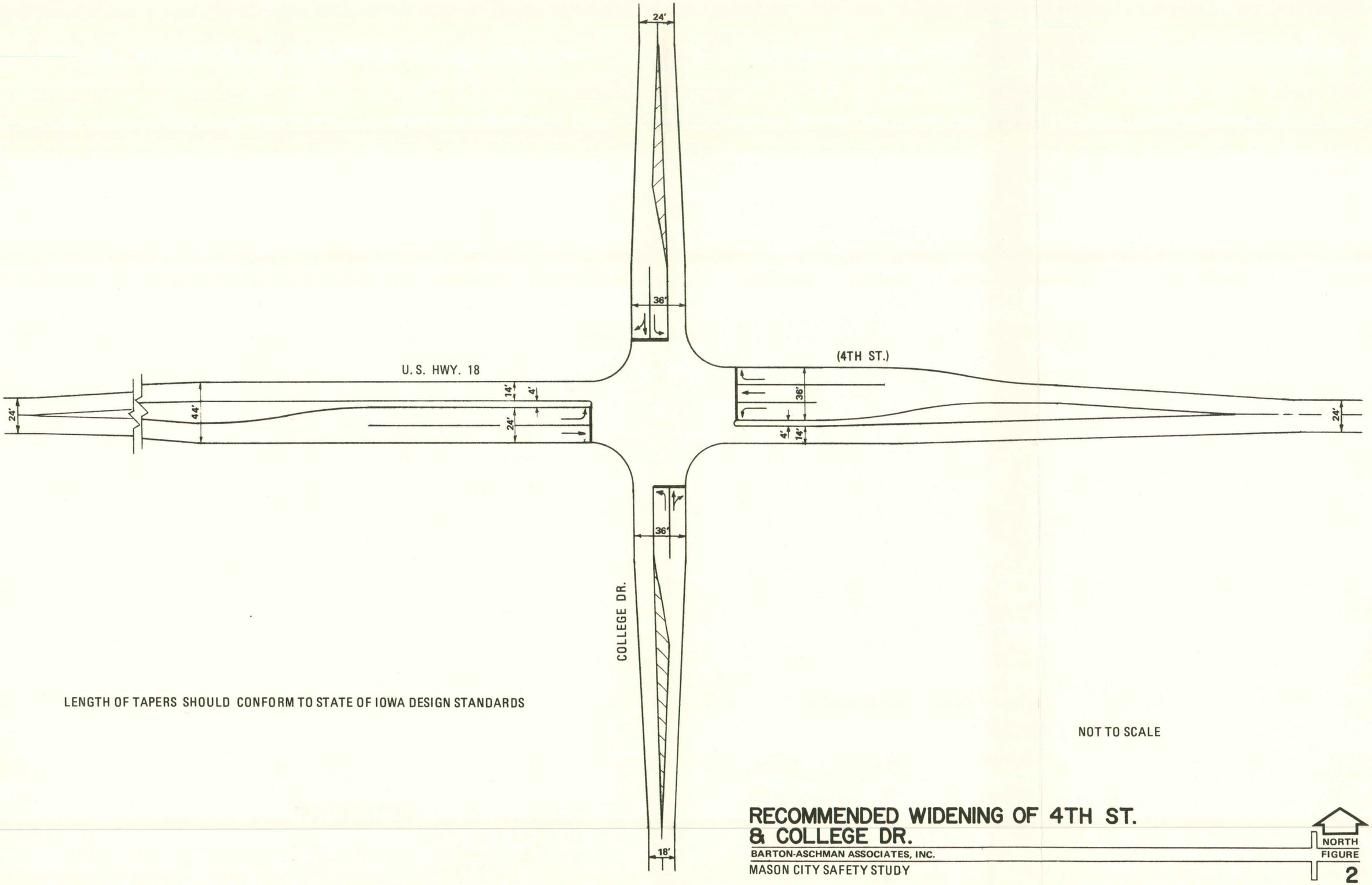
[1]THE WIDENING AND CHANNELIZATION OF THE SOTH LEG AS WELL AS THE CONSTRUCTION OF A LEFT-TURN LANE ON THE EAST LEG ARE NOT WARRANTED ON THE BASIS OF VOLUME.HOWEVER, WIDENING SHOULD OCCUR ON BOTH OF THESE LEGS IN ORDER TO ALIGN THE THROUGH LANES WITH THOSE ON THE OPPOSITE LEGS. IT SEEMS APPROPRIATE (IN TERMS OF COSTS) TO DO THE COMPLETE WIDENING AT ONE TIME,RATHER THAN A PARTIAL WIDENING FOLLOWED BY RECONSTRUCTION AT A LATER DATE.



LENGTH OF TAPERS SHOULD CONFORM TO STATE OF IOWA DESIGN STANDARDS

NOT TO SCALE

RECOMMENDED WIDENING OF 4TH ST. & COLLEGE DR.

BARTON-ASCHMAN ASSOCIATES, INC.

MASON CITY SAFETY STUDY

NORTH

FIGURE 2

INTERSECTION ANALYSIS AND RECOMMENDATIONS
MASON CITY SAFETY STUDY
JUNE 1973

I. LOCATION 4TH STREET (US 18) AND ILLINOIS AVENUE, MASON CITY, IOWA

II. EXISTING CONDITIONS

	ILLINOIS (NORTH LEG)	ILLINOIS (SOUTH LEG)	4TH (US 18) (EAST LEG)	4TH (US 18) (WEST LEG)
STREET CROSS SECTION				
RIGHT OF WAY WIDTH (FT)	80	80	66	120
BASIC ROADWAY WIDTH (FT)	40	44	24	48
NUMBER OF APPROACH LANES	LT TH RT PK 1 1	LT TH RT PK 1	LT TH RT PK 2	LT TH RT PK 2
WIDTH OF APPROACH (FT)	20	22	22*	24
ROAD SURFACE	CONCRETE	CONCRETE	CONCRETE	CONCRETE
MEDIAN	NONE	NONE	NONE	NONE
SHOULDER TREATMENT	CURB-GUTTER	CURB-GUTTER	CURB-GUTTER	10'GRAVEL
POSTED SPEED LIMIT (MPH)	20	20	35	35
PARKING PROHIBITIONS				
NEAR SIDE-APPROACH AREA	NPAT 100'	PKG ALLOWED	NPAT	NPAT
-BLOCK BEFORE	NPAT	PKG ALLOWED	NPAT	NPAT
FAR SIDE-EXIT AREA	PKG ALLOWED	NPAT	NPAT	NPAT
-BLOCK BEYOND	PKG ALLOWED	NPAT	NPAT	NPAT
VOLUME (PEAK HOUR)	AM	AM	AM	AM
	LT 15	LT 4	LT 6	LT 311
	THRU 7	THRU 9	THRU 220	THRU 343
	RT 119	RT 20	RT 16	RT 1
	TOT 141	TOT 33	TOT 242	TOT 655
AM COUNT FRI MAY 1973				
PEDESTRIAN ACTIVITY	HEAVY		HEAVY	HEAVY
TRUCKS AND THRU BUSES	NONE	NONE	MODERATE	MODERATE
SERVICE VOLUME (LEVEL C) AND VOLUME/CAPACITY RATIO(V/C)	200 .28	240 .32	1250 .32	1250 .36
TRAFFIC CONTROL	STOP	STOP	THRU	THRU
LAND USE	NW-RESIDENTIAL	NE SCHOOL	SE - FARM	SW -COMMERCIAL

ACCIDENTS (1/72 - 3/73)

SEVERITY	
PROPERTY DAMAGE	9
PERSONAL INJURY	3
FATAL	0
TOTAL	12

*NOTE: THE BASIC ROADWAY WIDTH OF 24 FEET TAPERS TO 44 FEET AT THE INTERSECTION TO APPROXIMATELY MATCH THE ROADWAY WIDTH OF THE WEST LEG. THUS, THE APPROACH WIDTH FOR THE EAST LEG IS 22 FEET.

INTERSECTION ANALYSIS AND RECOMMENDATIONS: 4TH STREET (U.S. 18) AND ILLINOIS AVENUE

III. EXISTING PROBLEMS

1. TRAFFIC CONTROL AT THE INTERSECTION (STOP SIGNS FOR ILLINOIS AVENUE) IS NOT SUFFICIENT TO EFFICIENTLY ACCOMMODATE PEAK-HOUR TRAFFIC VOLUMES ON ILLINOIS AVENUE.
2. THE EASTBOUND TO NORTHBOUND LEFT-TURN MOVEMENT IS QUITE HEAVY DURING THE MORNING PEAK HOURS WHEN SCHOOL IS IN SESSION.
3. THE TAPER FROM TWO LANES DOWN TO ONE LANE ON THE EAST LEG (EASTBOUND) IS ACCOMPLISHED IN A DISTANCE WHICH IS NOT SUFFICIENT TO PERMIT SAFE MERGING MANEUVERS.
4. ABSENCE OF PAVEMENT MARKINGS AT THE INTERSECTION INCREASES POTENTIAL FOR PEDESTRIAN AND VEHICULAR CONFLICTS.

IV. RECOMMENDED IMPROVEMENTS (SEE FIGURE 3)

1. INSTALL TRAFFIC SIGNAL CONTROL AT THE INTERSECTION (SUBJECT TO THE RESULTS OF AN 8-HOUR COUNT TO SATISFY WARRANTS)
2. STRIPE THE WEST LEG OF THE INTERSECTION SO THAT THE TWO THROUGH EASTBOUND LANES ARE MERGED INTO ONE LANE WEST OF ILLINOIS AVENUE. THIS WILL PERMIT THE CENTER EASTBOUND LANE TO BE USED EXCLUSIVELY FOR THE WEST-TO-NORTH LEFT-TURN MOVEMENT.
3. REMOVE THE YIELD SIGN ON THE WEST LEG WHICH IS INTENDED TO WARN MOTORISTS OF THE CHANGE FROM FOUR LANES TO TWO LANES.
4. INSTALL "SIGNAL AHEAD" SIGN ON THE EAST LEG FOR WESTBOUND TRAFFIC.
5. UPGRADE PAINTING PROGRAM SO THAT PAVEMENT MARKINGS REMAIN VISIBLE THROUGHOUT THE YEAR.

V. COMMENTS

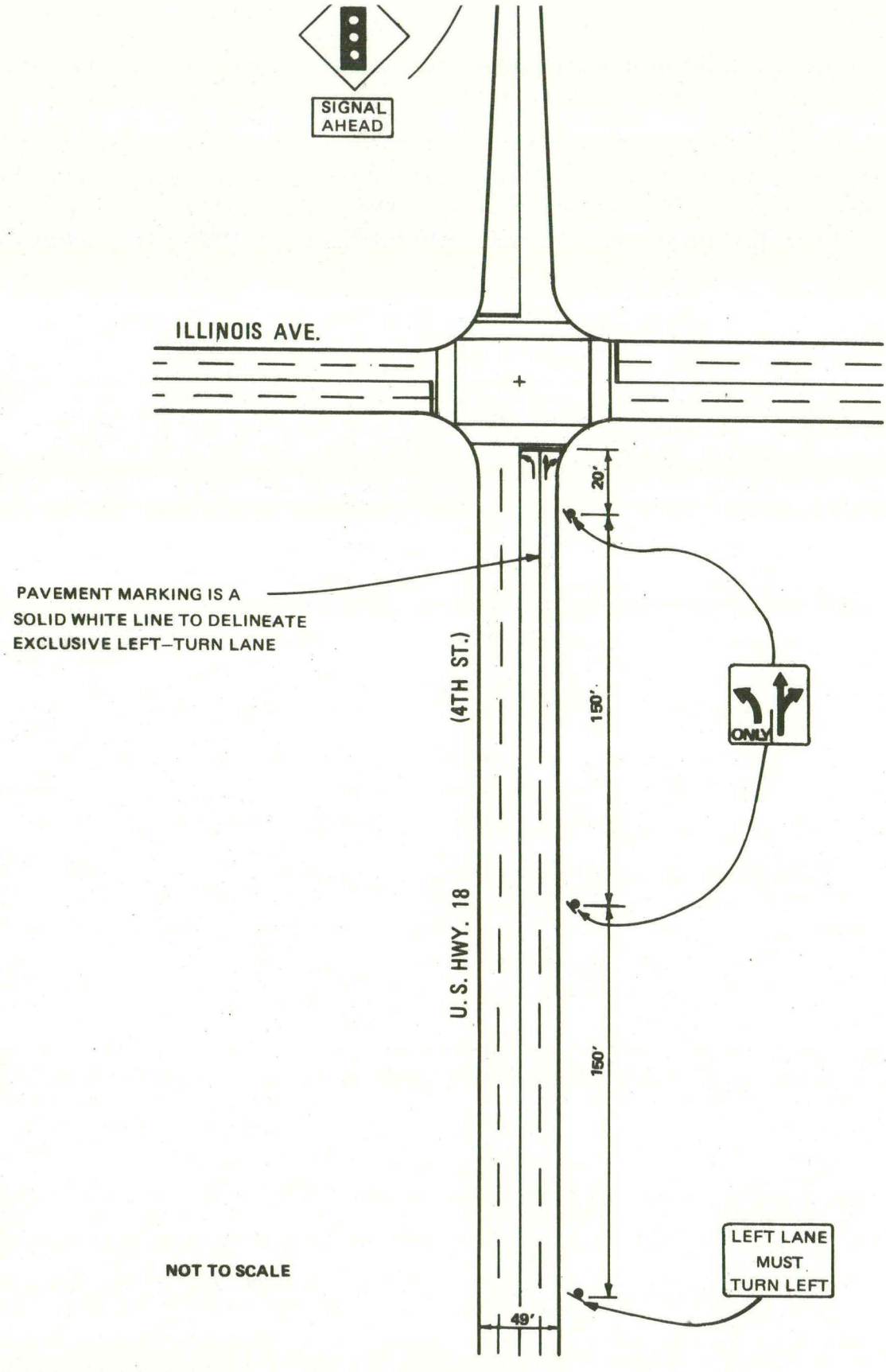
A TRAFFIC SIGNAL AT THIS INTERSECTION WOULD SERVE THE DUAL PURPOSE OF PROVIDING POSITIVE CONTROL AND OF INDICATING TO WESTBOUND MOTORISTS ON U.S. HIGHWAY 18 THAT THEY ARE ENTERING THE URBAN AREA OF MASON CITY. THE RECOMMENDED LANE DISIGNATIONS ON THE WEST LEG ARE INTENDED TO FACILITATE THE MAJOR MOVEMENT (EASTBOUND TO NORTHBOUND LEFT TURN) AT THE INTERSECTION. THESE DESIGNATIONS ARE COMPATIBLE WITH THE EXISTING LANE USAGE AND MERELY RELOCATE THE THROUGH-LANE REDUCTION TO ONE LANE FROM EAST OF ILLINOIS AVENUE TO WEST OF ILLINOIS AVENUE. WHEN 4TH STREET IS WIDENED TO FOUR LANES EAST OF ILLINOIS AVENUE, THIS IMPROVEMENT SHOULD INCLUDE THE PROVISION FOR SEPARATE LEFT-TURN LANES AT ILLINOIS AVENUE.

VI. IMPROVEMENT BENEFITS

1. EXPECTED ACCIDENT REDUCTION--20 PERCENT
2. EXPECTED CAPACITY INCREASE--ZERO PERCENT

VII. ESTIMATED IMPROVEMENT COST

$25,000



RECOMMENDED LANE STRIPING ON 4TH ST. AT ILLINOIS AVE.

NORTH

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MASON CITY SAFETY STUDY

FIGURE 3

INTERSECTION ANALYSIS AND RECOMMENDATIONS
MASON CITY SAFETY STUDY
JUNE 1973

I. LOCATION 4TH STREET (US 18) AND KENTUCKY AVENUE, MASON CITY, IOWA

II. EXISTING CONDITIONS

	KENTUCKY (NORTH LEG)	KENTUCKY (SOUTH LEG)	4TH (US 18) (EAST LEG)	4TH (US 18) (WEST LEG)
STREET CROSS SECTION				
RIGHT OF WAY WIDTH (FT)	66	66	66	66
BASIC ROADWAY WIDTH (FT)	34	40	48	48
WIDTH OF APPROACH (FT)	17	20	24	24
ROAD SURFACE	CONCRETE	BITUMINOUS	BITUMINOUS	BITUMINOUS
MEDIAN	NONE	NONE	NONE	NONE
SHOULDER TREATMENT	CURB-GUTTER	CURB-GUTTER	CURB-GUTTER	CURB-GUTTER
POSTED SPEED LIMIT (MPH)	30	30	35	35
PARKING PROHIBITIONS				
NEAR SIDE-APPROACH AREA	NPAT 130'	NPAT 120'	NPAT	NPAT
-BLOCK BEFORE	PKG ALLOWED	PKG ALLOWED		
FAR SIDE-EXIT AREA	PKG ALLOWED	NPAT 30'	NPAT	NPAT
-BLOCK BEYOND	PKG ALLOWED	PKG ALLOWED		

VOLUME (PEAK HOUR)		PM		PM		PM		PM
	LT	18	LT	44	LT	65	LT	47
	THRU	143	THRU	145	THRU	235	THRU	297
	RT	39	RT	94	RT	7	RT	69
	TOT	200	TOT	283	TOT	307	TOT	413

PM COUNT THU MAY 1973

PEDESTRIAN ACTIVITY	NONE OBSERVED	NONE OBSERVED	NONE OBSERVED	NONE OBSERVED
TRUCKS AND THRU BUSES	MODERATE	MODERATE	MODERATE	MODERATE
SERVICE VOLUME (LEVEL C) AND VOLUME/CAPACITY RATIO(V/C)	480 .41	500 .56	850 .36	900 .45
TRAFFIC CONTROL	TWO PHASE ACTUATED SIGNAL			
LAND USE	NE-RESIDENTIAL	SE-RESIDENTIAL	SW-RESIDENTIAL	NW-RESIDENTIAL

ACCIDENTS (1/72 - 3/73)

SEVERITY (CITY RECORDS)

PROPERTY DAMAGE	21
PERSONAL INJURY	5
FATAL	0
TOTAL	26

TYPE (CITY RECORDS)

RIGHT ANGLE	4	SIDESWIPE	4	RAN OFF ROAD	0
REAR END	4	HEAD ON	0	FIXED OBJECT	1
LEFT TURN	11	PEDESTRIAN	0	OTHER	3
				TOTAL	26

INTERSECTION ANALYSIS AND RECOMMENDATIONS: 4TH STREET (U.S. 18) AND KENTUCKY AVENUE

III. EXISTING PROBLEMS

1. THE TRAFFIC SIGNAL ON THE NORTHWEST CORNER FACING SOUTH IS LOCATED TOO FAR WEST TO BE EASILY SEEN BY VEHICLES ON THE SOUTH LEG.
2. THE TIMING FOR THE PEDESTRIAN SIGNALS DOES NOT PROVIDE SUFFICIENT CLEARANCE INTERVALS TO ALLOW PEDESTRIANS TO CLEAR THE STREET BEFORE THE SIGNAL CHANGE.
3. ABSENCE OF BACKPLATES ON THE OVERHEAD SIGNALS REDUCES SIGNAL VISIBILITY.
4. ABSENCE OF PAVEMENT MARKINGS AT THE INTERSECTION INCREASES THE POTENTIAL FOR PEDESTRIAN AND VEHICULAR CONFLICTS.
5. HIGH NUMBER OF LEFT-TURN ACCIDENTS HAVE OCCURRED AT THE INTERSECTION.

IV. RECOMMENDED IMPROVEMENTS

1. INSTALL A NEW SIGNAL POST ON THE NORTHWEST CORNER AND RELOCATE THE SIGNAL HEAD FACING SOUTH TO THIS POLE SO THAT IT IS MORE VISIBLE TO VEHICLES ON THE SOUTH LEG.
2. THE PEDESTRIAN CLEARANCE INTERVALS (I.E., THE INTERVALS BETWEEN THE WALK SIGNALS AND THE PHASE CHANGES OF THE TRAFFIC SIGNAL) SHOULD BE EXTENDED TO PROVIDE 12 SECONDS OF CLEARANCE ACROSS KENTUCKY AVENUE AND 15 SECONDS OF CLEARANCE ACROSS 4TH STREET.
3. INSTALL BACKPLATES ON THE OVERHEAD TRAFFIC SIGNALS.
4. UPGRADE PAINTING PROGRAM SO THAT PAVEMENT MARKINGS REMAIN VISIBLE THROUGHOUT THE YEAR.

V. COMMENTS

THE TRAFFIC VOLUMES ON 4TH STREET AT THIS INTERSECTION DO NOT INDICATE HEAVY LEFT-TURN MOVEMENTS NOR A CAPACITY PROBLEM FOR THROUGH MOVEMENTS. HOWEVER, ACCIDENTS INVOLVING LEFT TURNERS ON 4TH STREET REPRESENT THE PRIMARY SAFETY PROBLEM AT THE INTERSECTION. IF THIS LEFT-TURN ACCIDENT PATTERN CONTINUES, CONSIDERATION SHOULD BE GIVEN TO WIDENING 4TH STREET FOR LEFT-TURN LANES AND PROVIDING SEPARATE TURNING PHASES FOR THESE MOVEMENTS.

VI. IMPROVEMENT BENEFITS

1. EXPECTED ACCIDENT REDUCTION--10 PERCENT.
2. EXPECTED CAPACITY INCREASE--ZERO PERCENT.

VII. ESTIMATED IMPROVEMENT COST

$1,000

INTERSECTION ANALYSIS AND RECOMMENDATIONS
MASON CITY SAFETY STUDY
JUNE 1973

I. LOCATION 4TH STREET (US 18) AND VIRGINIA AVENUE, MASON CITY, IOWA

II. EXISTING CONDITIONS

STREET CROSS SECTION	VIRGINIA (NORTH LEG)	VIRGINIA (SOUTH LEG)	4TH (US 18) (EAST LEG)	4TH (US 18) (WEST LEG)
RIGHT OF WAY WIDTH (FT)	50	66	66	80
BASIC ROADWAY WIDTH (FT)	34	30	48	52
NUMBER OF APPROACH LANES	LT TH RT PK 1	LT TH RT PK 1	LT TH RT PK 2	LT TH RT PK 2
WIDTH OF APPROACH (FT)	17	15	29	38
ROAD SURFACE	BITUMINOUS	CONCRETE	CONCRETE	CONCRETE
MEDIAN	NONE	NONE	NONE	4' BARRIER
SHOULDER TREATMENT	CURB-GUTTER	4'GRAVEL	CURB-GUTTER	CURB-GUTTER
POSTED SPEED LIMIT (MPH)	25	25	35	35
PARKING PROHIBITIONS				
NEAR SIDE-APPROACH AREA	NPAT 40'	NPAT 100'	PKG ALLOWED	PKG ALLOWED
-BLOCK BEFORE	PKG ALLOWED	PKG ALLOWED	NPAT	NPAT
FAR SIDE-EXIT AREA	NPAT 100'	NPAT 40'	NPAT	PKG ALLOWED
-BLOCK BEYOND	PKG ALLOWED	PKG ALLOWED	NPAT	NPAT

VOLUME (PEAK HOUR)

	PM		PM		PM		PM
LT	11	LT	33	LT	11	LT	44
THRU	32	THRU	34	THRU	376	THRU	357
RT	14	RT	11	RT	13	RT	57
TOT	57	TOT	78	TOT	400	TOT	458

PM COUNT THU MAY 1973

PEDESTRIAN ACTIVITY	NONE OBSERVED	NONE OBSERVED	NONE OBSERVED	NONE OBSERVED
TRUCKS AND THRU BUSES	MODERATE	MODERATE	MODERATE	MODERATE
SERVICE VOLUME (LEVEL C) AND VOLUME/CAPACITY RATIO(V/C)	210 .27	170 .45	1250 .32	1250 .36
TRAFFIC CONTROL	STOP	STOP	THRU	THRU
LAND USE	NE-RESIDENTIAL	SE-RESIDENTIAL	SW-HWY DPT	NW-RESIDENTIAL

ACCIDENTS (1/72 - 3/73)

SEVERITY	
PROPERTY DAMAGE	11
PERSONAL INJURY	3
FATAL	
TOTAL	14

INTERSECTION ANALYSIS AND RECOMMENDATIONS: 4TH STREET (U.S. 18) AND VIRGINIA AVENUE

II. EXISTING PROBLEMS

1. DUE TO THE GRADE AND CURVATURE OF THE WEST LEG OF 4TH STREET, MOTORISTS ON THE SOUTH LEG OF VIRGINIA AVENUE HAVE DIFFICULTY SEEING VEHICLES APPROACHING FROM THE WEST.
2. THE AT-GRADE RAILROAD LINE WHICH DIAGONALLY CROSSES THE INTERSECTION PRODUCES OPERATIONAL DIFFICULTIES AT THIS INTERSECTION.

IV. RECOMMENDED IMPROVEMENTS

1. PLACE A "DIVIDED ROADWAY AHEAD" SIGN ON THE EAST LEG TO WARN WESTBOUND MOTORISTS OF THE MEDIAN.

V. COMMENTS

IN ORDER TO ELIMINATE THE SIGHT-DISTANCE PROBLEM IN THE SOUTHWEST QUADRANT, MAJOR IMPROVEMENTS WOULD HAVE TO BE IMPLEMENTED AT THIS INTERSECTION. THESE IMPROVEMENTS WOULD INVOLVE ONE OF THE FOLLOWING:

- INSTALLATION OF A TRAFFIC SIGNAL WITH EXPENSIVE RAILROAD PREEMPTION EQUIPMENT.
- REMOVING OR GRADING DOWN THE EMBANKMENT IN THE SOUTHWEST QUADRANT.
- RESTRICTING THE SOUTH LEG TO RIGHT-TURN MOVEMENTS.

BASED UPON EXISTING ACCIDENT EXPERIENCE NONE OF THESE MEASURES APPEAR TO BE WARRANTED AT THIS TIME. HOWEVER, IF THE SIGHT-DISTANCE PROBLEM BECOMES A SAFETY HAZARD, ONE OF THE MEASURES LISTED ABOVE SHOULD BE CONSIDERED FOR THIS INTERSECTION.

VI. IMPROVEMENT BENEFITS

1. EXPECTED ACCIDENT REDUCTION--ZERO PERCENT.
2. EXPECTED CAPACITY INCREASE--ZERO PERCENT.

VII. ESTIMATED IMPROVEMENT COST

$50

INTERSECTION ANALYSIS AND RECOMMENDATIONS
MASON CITY SAFETY STUDY
JUNE 1973

I. LOCATION 4TH STREET (US 18) AND PIERCE AVENUE, MASON CITY, IOWA

II. EXISTING CONDITIONS

	PIERCE (NORTH LEG)	PIERCE (SOUTH LEG)	4TH (US 18) (EAST LEG)	4TH (US 18) (WEST LEG)
STREET CROSS SECTION				
RIGHT OF WAY WIDTH (FT)	66	64	66	66
BASIC ROADWAY WIDTH (FT)	40	30	48	48
NUMBER OF APPROACH LANES	LT TH RT PK 2	LT TH RT PK 2	LT TH RT PK 2	LT TH RT PK 2
WIDTH OF APPROACH (FT)	20	15*	24	24
ROAD SURFACE	BITUMINOUS	ROAD OIL	BITUMINOUS	BITUMINOUS
MEDIAN	NONE	NONE	NONE	NONE
SHOULDER TREATMENT	CURB-GUTTER	UNIMPROVED	CURB-GUTTER	CURB-GUTTER
POSTED SPEED LIMIT (MPH)	25	25	35	35
PARKING PROHIBITIONS				
NEAR SIDE-APPROACH AREA -BLOCK BEFORE	DRIVEWAY 100' PKG ALLOWED	NPAT 90' PKG ALLOWED	NPAT	NPAT
FAR SIDE-EXIT AREA -BLOCK BEYOND	NPAT 30' PKG ALLOWED	NPAT 30' PKG ALLOWED	NPAT	NPAT
VOLUME (PEAK HOUR)	PM	PM	PM	PM
	LT 67	LT 34	LT 21	LT 57
	THRU 50	THRU 54	THRU 795	THRU 727
	RT 117	RT 18	RT 114	RT 19
	TOT 234	TOT 106	TOT 930	TOT 803
PM COUNT FRI MAY 1973				
PEDESTRIAN ACTIVITY	LIGHT	LIGHT	LIGHT	LIGHT
TRUCKS AND THRU BUSES	MODERATE	MODERATE	MODERATE	MODERATE
SERVICE VOLUME (LEVEL C) AND VOLUME/CAPACITY RATIO(V/C)	350 .66	240 .44	1150 .80	1150 .69

TRAFFIC CONTROL: TWO PHASE ACTUATED SIGNAL

LAND USE: NE-RESIDENTIAL SE-SERVICE STA SW-SERVICE STA NW-SHOP.CENTER

ACCIDENTS (1/72 - 3/73)

SEVERITY (CITY RECORDS)

PROPERTY DAMAGE	23
PERSONAL INJURY	4
FATAL	0
TOTAL	27

TYPE (CITY RECORDS)

RIGHT ANGLE	5	SIDESWIPE	5	RAN OFF ROAD	0
REAR END	7	HEAD ON	0	FIXED OBJECT	0
LEFT TURN	5	PEDESTRIAN	0	OTHER	5
				TOTAL	27

*NOTE: THERE IS NO CENTERLINE ON THIS LEG, SO THE APPROACH WIDTH WAS ASSUMED TO BE ONE HALF OF THE BASIC ROADWAY WIDTH. HOWEVER, MOTORISTS DO DRIVE THIS APPROACH AS TWO LANES, PARTICULARLY WHEN ONE LANE IS OCCUPIED BY A VEHICLE TURNING LEFT.

INTERSECTION ANALYSIS AND RECOMMENDATIONS: 4TH STREET AND PIERCE AVENUE

III. EXISTING PROBLEMS

1. LACK OF LEFT-TURN LANES ON 4TH STREET REDUCES THE CAPACITY OF THE INTERSECTION AND INCREASES THE POTENTIAL FOR RIGHT ANGLE, REAR END, AND SIDESWIPE ACCIDENTS.
2. TWO-WAY DRIVE ON THE NORTH APPROACH ADJACENT TO THE INTERSECTION INTRODUCES ADDITIONAL CONFLICTING MOVEMENTS (E.G., LEFT-TURNS INTO DRIVEWAY) NEAR THE INTERSECTION, THUS INCREASING ACCIDENT POTENTIAL.
3. PARKING ON THE NORTH LEG NEAR THE INTERSECTION REDUCES THE STORAGE CAPACITY AND MANEUVERING AREA FOR VEHICLES ON THIS LEG.
4. THE TIMING FOR THE PEDESTRIAN SIGNALS DOES NOT PROVIDE SUFFICIENT CLEARANCE INTERVALS TO ALLOW PEDESTRIANS TO CLEAR THE STREET BEFORE THE SIGNAL CHANGES.
5. THE PEDESTRIAN SIGNAL ON THE NORTHEAST CORNER IS NOT ALIGNED PROPERLY WITH THE CROSSWALK.
6. THE LONG YELLOW TIMES (FIVE SECONDS) ENCOURAGE MOTORISTS TO UTILIZE THESE INTERVALS TO "BEAT" THE RED LIGHT AND "JUMP" THE GREEN LIGHT.
7. THE TRAFFIC SIGNAL ON THE SOUTHEAST CORNER FACING NORTH IS NOT ALIGNED PROPERLY WITH THE NORTH APPROACH.
8. ABSENCE OF PAVEMENT MARKINGS AT THE INTERSECTION INCREASES THE POTENTIAL FOR PEDESTRIAN AND VEHICULAR CONFLICTS.

IV. RECOMMENDED IMPROVEMENTS (SEE FIGURE 4)

1. WIDEN 4TH STREET TO A 54-FOOT CROSS SECTION NEAR THE INTERSECTION TO PROVIDE SEPARATE LEFT-TURN LANES.(1)
2. INTRODUCE ONE-WAY OPERATION IN THE PARKING LOT IN THE NORTHWEST QUADRANT. THE NORTHERN ACCESS DRIVE SHOULD BE FOR INBOUND VEHICLES AND THE SOUTHERN DRIVE FOR OUTBOUND.
3. PARKING SHOULD BE PROHIBITED ON THE NORTH LEG WITHIN 100 FEET OF THE INTERSECTION.
4. THE PEDESTRIAN CLEARANCE INTERVALS (I.E., THE INTERVALS BETWEEN THE WALK SIGNALS AND THE PHASE CHANGES OF THE TRAFFIC SIGNAL) SHOULD BE EXTENDED TO PROVIDE 12 SECONDS OF CLEARANCE ACROSS PIERCE AVENUE AND 15 SECONDS OF CLEARANCE ACROSS 4TH STREET.
5. THE YELLOW TIMES SHOULD BE REDUCED TO BETWEEN 3.5 SECONDS AND A MAXIMUM OF FOUR SECONDS.
6. ALIGN THE PEDESTRIAN SIGNAL ON THE NORTHEAST CORNER WITH THE CROSSWALK ON THE EAST LEG OF THE INTERSECTION.
7. ALIGN THE TRAFFIC SIGNAL ON THE SOUTHEAST CORNER WITH THE NORTH APPROACH.
8. INSTALL BACKPLATES ON THE OVERHEAD TRAFFIC SIGNALS FACING 4TH STREET.
9. UPGRADE PAINTING PROGRAM SO THAT PAVEMENT MARKINGS REMAIN VISIBLE THROUGHOUT THE YEAR.

V. COMMENTS

THE NEED FOR LEFT-TURN LANES ON 4TH STREET AT THIS INTERSECTION IS BASED UPON THE HEAVY THROUGH-TRAFFIC VOLUMES AND THE DELAY AND INTERFERENCE WHICH IS CAUSED BY THE FEW LEFT-TURN MOVEMENTS.

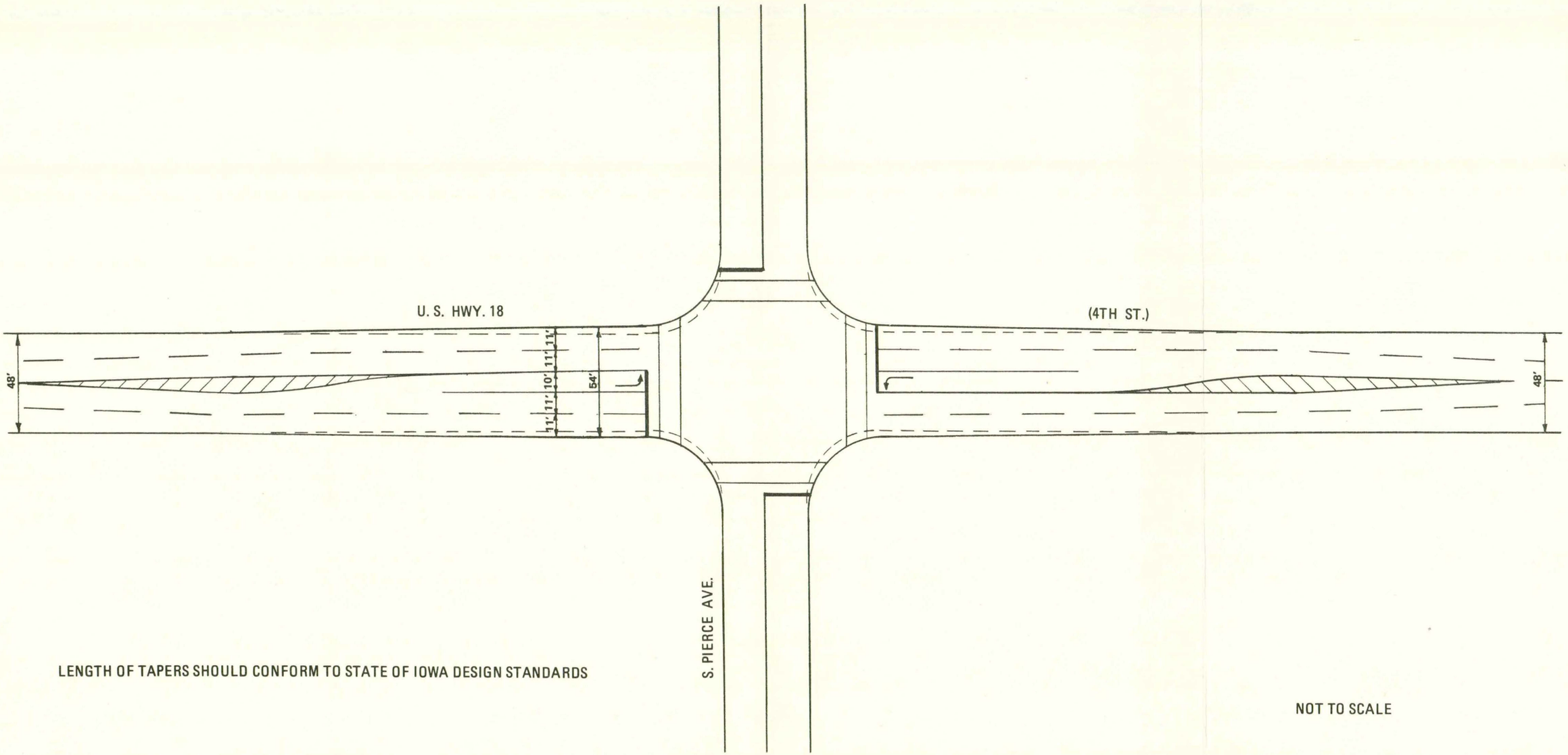
VI. IMPROVEMENT BENEFITS

1. EXPECTED ACCIDENT REDUCTION--25 PERCENT.
2. EXPECTED CAPACITY INCREASE--10 PERCENT.

VII. ESTIMATED IMPROVEMENT COST

22,000

(1) LANE WIDTHS OF LESS THAN 12 FEET HAVE BEEN RECOMMENDED IN ORDER TO REMAIN WITHIN THE EXISTING RIGHT-OF-WAY. IF ADDITIONAL RIGHT-OF-WAY CAN EASILY BE ACQUIRED, THEN 12-FOOT LANES (60-FOOT CROSS SECTION) SHOULD BE CONSIDERED.



LENGTH OF TAPERS SHOULD CONFORM TO STATE OF IOWA DESIGN STANDARDS

NOT TO SCALE

RECOMMENDED WIDENING OF 4TH ST. AT PIERCE AVE.

BARTON-ASCHMAN ASSOCIATES, INC.

MASON CITY SAFETY STUDY

NORTH

FIGURE 4

INTERSECTION ANALYSIS AND RECOMMENDATIONS
MASON CITY SAFETY STUDY
JUNE 1973

I. LOCATION 5TH STREET (US 18) AND MONROE STREET, MASON CITY, IOWA

II. EXISTING CONDITIONS

STREET CROSS SECTION	MONROE (NORTH LEG)	MONROE (SOUTH LEG)	5TH (US 18) (EAST LEG)	5TH (US 18) (WEST LEG)
RIGHT OF WAY WIDTH (FT)	66	66	94	94
BASIC ROADWAY WIDTH (FT)	48	44	58	58
NUMBER OF APPROACH LANES	LT TH RT PK 2	LT TH RT PK 2	LT TH RT PK 1 2	LT TH RT PK 1 2
WIDTH OF APPROACH (FT)	24	22	36	36
ROAD SURFACE	CONCRETE	CONCRETE	BITUMINOUS	BITUMINOUS
MEDIAN	NONE	NONE	BARRIER	BARRIER
SHOULDER TREATMENT	CURB-GUTTER	CURB-GUTTER	CURB-GUTTER	CURB-GUTTER
POSTED SPEED LIMIT (MPH)	25	20	35	35
PARKING PROHIBITIONS				
NEAR SIDE-APPROACH AREA	PKG ALLOWED	PKG ALLOWED	PKG ALLOWED	PKG ALLOWED
-BLOCK BEFORE	NPAT	NPAT	NPAT	NPAT
FAR SIDE-EXIT AREA	PKG ALLOWED	NPAT	PKG ALLOWED	PKG ALLOWED
-BLOCK BEYOND	NPAT	NPAT	NPAT	NPAT
VOLUME (PEAK HOUR)	PM	PM	PM	PM
LT	85	117	147	174
THRU	207	239	588	434
RT	53	4	78	126
TOT	345	360	813	734
PM COUNT THU MAY, 1973				
PEDESTRIAN ACTIVITY	NONE OBSERVED	NONE OBSERVED	NONE OBSERVED	NONE OBSERVED
TRUCKS AND THRU BUSES	MODERATE	MODERATE	MODERATE	MODERATE
SERVICE VOLUME (LEVEL C) AND VOLUME/CAPACITY RATIO(V/C)	470 .73	470 .76	960 .84	940 .78
TRAFFIC CONTROL	MULTIPHASE ACTUATED SIGNAL			
LAND USE	NE-COMMERCIAL	SE-OPEN	SW-OPEN	NW-COMMERCIAL

ACCIDENTS (1/72 - 3/73)

SEVERITY (CITY RECORDS)

PROPERTY DAMAGE	21
PERSONAL INJURY	3
FATAL	0
TOTAL	24

TYPE (CITY RECORDS)

RIGHT ANGLE	3	SIDESWIPE	4	RAN OFF ROAD	0
REAR END	9	HEAD ON	0	FIXED OBJECT	3
LEFT TURN	4	PEDESTRIAN	0	OTHER	1
				TOTAL	24

III. EXISTING PROBLEMS

1. THE SIMULTANEOUS OPERATION OF THE EXCLUSIVE LEFT-TURN PHASES FOR 5TH STREET WHEN THE LEFT-TURN TRAFFIC DEMANDS ARE UNEVEN ON THE EAST AND WEST LEGS, WASTES GREEN TIME THAT COULD BE USED FOR THE THROUGH MOVEMENTS TO INCREASE THE CAPACITY OF THE INTERSECTION.
2. THE TRAFFIC SIGNAL ON THE NORTHWEST CORNER FACING SOUTH IS LOCATED TOO FAR WEST MAKING IT DIFFICULT FOR DRIVERS ON THE SOUTH LEG TO SEE.
3. THE CONNECTIONS BETWEEN THE OVERHEAD TRAFFIC SIGNALS AND THE MAST ARM SIGNAL POLES ALLOW THE SIGNALS TO SWING FREELY, THUS REDUCING THE TARGET VALUE OF THE SIGNALS.
4. THE TIMING FOR THE PEDESTRIAN SIGNALS DOES NOT PROVIDE SUFFICIENT CLEARANCE INTERVALS TO ALLOW PEDESTRIANS TO CLEAR THE STREET BEFORE THE SIGNAL CHANGES.
5. THE LONG YELLOW TIMES ENCOURAGE MOTORISTS TO UTILIZE THESE INTERVALS TO "BEAT" THE RED SIGNAL AND "JUMP" THE GREEN SIGNAL.

IV. RECOMMENDED IMPROVEMENTS (SEE FIGURE 5)

1. ADJUST THE PRESENT SIGNAL PHASING TO PERMIT THE LEFT-TURN PHASES FOR 5TH STREET TO OPERATE INDEPENDENTLY OF EACH OTHER. THIS TYPE OF OPERATION WILL PERMIT THE CONTROLLER TO CHOOSE THE APPROPRIATE PHASE (EITHER AN ADVANCE GREEN FOR THE EAST LEG, AN ADVANCE GREEN FOR THE WEST LEG, OR SIMULTANEOUS OPERATION OF THE LEFT-TURN PHASES) DEPENDENT UPON THE ACTUATIONS RECORDED BY THE DETECTORS IN THE LEFT-TURN LANES.
2. INSTALL A NEW SIGNAL POST ON THE NORTHWEST CORNER AND RELOCATE THE SIGNAL HEAD FACING SOUTH ON THIS POLE SO THAT IT IS MORE VISIBLE TO VEHICLES ON THE SOUTH LEG.
3. INSTALL A BACKPLATE ON THE OVERHEAD SIGNAL LOCATED ON THE SOUTHEAST CORNER FACING WEST.
4. INSTALL MORE RIGID CONNECTIONS ON THE OVERHEAD SIGNALS TO PREVENT THEIR SWINGING.
5. INSTALL A TRAFFIC SIGNAL ADVANCE SIGN ON THE WEST LEG WEST OF THE UNDERPASS SO THAT EASTBOUND MOTORISTS WILL HAVE ADVANCE WARNING OF THE SIGNALIZED INTERSECTION.
6. THE PEDESTRIAN CLEARANCE INTERVALS (I.E., THE INTERVALS BETWEEN THE WALK SIGNALS AND THE PHASE CHANGES OF THE TRAFFIC SIGNAL) SHOULD BE EXTENDED TO PROVIDE 15 SECONDS OF CLEARANCE ACROSS MONROE AVENUE AND 18 SECONDS OF CLEARANCE ACROSS 5TH STREET.
7. REDUCE THE YELLOW TIMES TO BETWEEN 3.5 SECONDS AND A MAXIMUM OF 4.0 SECONDS.
8. UPGRADE PAINTING PROGRAM SO THAT PAVEMENT MARKINGS REMAIN VISIBLE THROUGHOUT THE YEAR.

V. COMMENTS

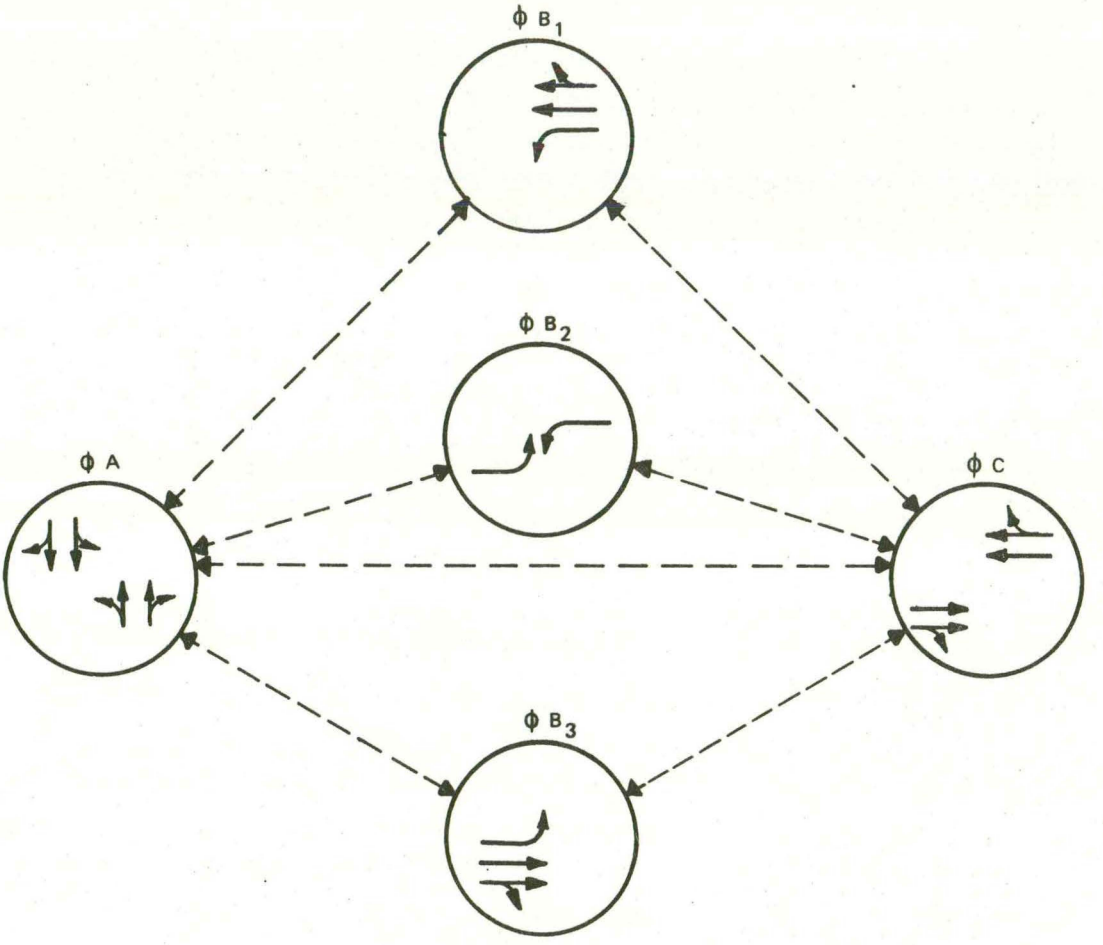
ALTHOUGH A CAPACITY PROBLEM DOES NOT PRESENTLY EXIST AT THIS INTERSECTION, IT IS APPARENT THAT A SIGNIFICANT AMOUNT OF GREEN TIME IS WASTED DUE TO THE SIMULTANEOUS OPERATION OF THE LEFT-TURN PHASES FOR 5TH STREET. THE SIGNAL CONTROLLER SKIPS THE LEFT-TURN PHASES IF NO VEHICLES ARE DETECTED IN THE LEFT-TURN LANES. HOWEVER, IT ACTUATES BOTH LEFT-TURN PHASES EVEN WHEN VEHICLES ARE DETECTED IN ONLY ONE OF THE LEFT-TURN LANES. BY SEPARATING THESE LEFT-TURN PHASES IT IS POSSIBLE TO GIVE ADVANCE GREEN PHASES TO EITHER THE EAST OR WEST LEG WHEN NO VEHICLES ARE DETECTED IN THE OPPOSITE LEFT-TURN LANES, THUS GIVING ADDITIONAL GREEN TIME FOR THROUGH MOVEMENTS ON 5TH STREET.

VI. IMPROVEMENT BENEFITS

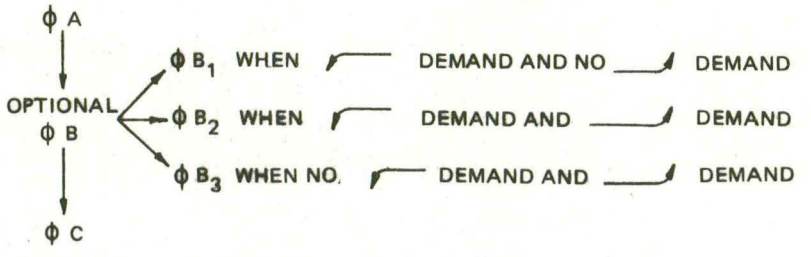
1. EXPECTED ACCIDENT REDUCTION--15 PERCENT.
2. EXPECTED CAPACITY INCREASE--FIVE PERCENT.

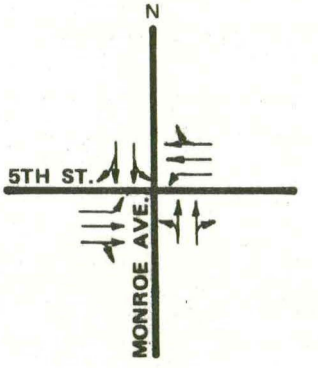
VII. ESTIMATED IMPROVEMENT COST

$4,500



TIMING SEQUENCE





RECOMMENDED SIGNAL PHASING AT 5TH ST. & MONROE AVE.

BARTON-ASCHMAN ASSOCIATES, INC.

MASON CITY SAFETY STUDY

NORTH

FIGURE 5

INTERSECTION ANALYSIS AND RECOMMENDATIONS
MASON CITY SAFETY STUDY
JUNE 1973

I. LOCATION 19TH STREET AND MONROE AVENUE, MASON CITY, IOWA

II. EXISTING CONDITIONS

STREET CROSS SECTION	MONROE (NORTH LEG)	MONROE (SOUTH LEG)	19TH (EAST LEG)	19TH (WEST LEG)
RIGHT OF WAY WIDTH (FT)	78	66	66	66
BASIC ROADWAY WIDTH (FT)	24	40	48	48
NUMBER OF APPROACH LANES	LT TH RT PK 1 1	LT TH RT PK 2	LT TH RT PK 2	LT TH RT PK 2
WIDTH OF APPROACH (FT)	26	20	24	24
ROAD SURFACE	BITUMINOUS	CONCRETE	CONCRETE	CONCRETE
MEDIAN	NONE	NONE	NONE	NONE
SHOULDER TREATMENT	8'GRAVEL	CURB-GUTTER	CURB-GUTTER	CURB-GUTTER
POSTED SPEED LIMIT (MPH)	35	25	35	45
PARKING PROHIBITIONS				
NEAR SIDE-APPROACH AREA	PKG ALLOWED	PKG ALLOWED	PKG ALLOWED	PKG ALLOWED
-BLOCK BEFORE	NPAT	PKG ALLOWED	NPAT	NPAT
FAR SIDE-EXIT AREA	PKG ALLOWED	NPAT	PKG ALLOWED	PKG ALLOWED
-BLOCK BEYOND	PKG ALLOWED	NPAT	NPAT	NPAT

VOLUME (PEAK HOUR)	PM	PM	PM	PM
LT	87	24	15	111
THRU	87	59	204	282
RT	103	25	77	28
TOT	277	108	296	421

PM COUNT FRI MAY 1973

PEDESTRIAN ACTIVITY	NONE OBSERVED	NONE OBSERVED	NONE OBSERVED	NONE OBSERVED
TRUCKS AND THRU BUSES	LIGHT	LIGHT	LIGHT	LIGHT
SERVICE VOLUME (LEVEL C) AND VOLUME/CAPACITY RATIO(V/C)	680 .40	440 .24	930 .31	880 .47

TRAFFIC CONTROL TWO PHASE ACTUATED SIGNAL

LAND USE NE-OPEN SE-RESIDENTIAL SW-RESIDENTIAL NW- FARM

ACCIDENTS (1/72 - 3/73)

SEVERITY (CITY RECORDS)

PROPERTY DAMAGE	24
PERSONAL INJURY	4
FATAL	0
TOTAL	28

TYPE (CITY RECORDS)

RIGHT ANGLE	7	SIDESWIPE	4	RAN OFF ROAD	0
REAR END	7	HEAD ON	0	FIXED OBJECT	1
LEFT TURN	5	PEDESTRIAN	0	OTHER	4
				TOTAL	28

INTERSECTION ANALYSIS AND RECOMMENDATIONS: MONROE AVENUE AND 19TH STREET

III. EXISTING PROBLEMS

1. LOCATION OF AT-GRADE RAILROAD CROSSING ON THE NORTH LEG ADJACENT TO THE INTERSECTION COMPLICATES THE OPERATIONAL CHARACTERISTICS OF THE INTERSECTION.
2. THE FRONTAGE ROAD WHICH PARALLELS 19TH STREET AND INTERSECTS THE SOUTH LEG OF MONROE AVENUE IS NOT PROPERLY CONTROLLED AT ITS INTERSECTION WITH MONROE AVENUE.
3. LONG YELLOW TIMES ENCOURAGE MOTORISTS TO UTILIZE THESE INTERVALS TO "BEAT" THE RED SIGNAL AND TO "JUMP" THE GREEN SIGNAL.
4. ABSENCE OF PAVEMENT MARKINGS AT THE INTERSECTION INCREASES THE POTENTIAL FOR VEHICULAR CONFLICTS.

IV. RECOMMENDED IMPROVEMENTS

1. PLACE A "STOP HERE ON RED" SIGN ON THE NORTH LEG, NORTH OF THE RAILROAD CROSSING TO PREVENT MOTORISTS FROM STOPPING ON THE TRACKS.
2. PLACE STOP SIGN CONTROL ON THE FRONTAGE ROAD AT ITS INTERSECTION WITH MONROE AVENUE.
3. REDUCE YELLOW TIMES TO BETWEEN 3.5 SECONDS AND A MAXIMUM OF 4.0 SECONDS.
4. UPGRADE PAINTING PROGRAM SO THAT PAVEMENT MARKINGS REMAIN VISIBLE THROUGHOUT THE YEAR.

V. COMMENTS

THERE APPEARS TO BE A SIGNIFICANT WEST-NORTH TRAFFIC DEMAND AT THIS INTERSECTION. BECAUSE THROUGH-TRAFFIC VOLUMES ARE RELATIVELY LIGHT AT THIS TIME, THE EASTBOUND-TO-NORTHBOUND LEFT-TURN MOVEMENT DOES NOT WARRANT AN EXCLUSIVE LANE OR SIGNAL PHASE. HOWEVER, IF THROUGH-TRAFFIC VOLUMES INCREASE AND DELAY AND INTERFERENCE RESULT FROM THE HEAVY EASTBOUND-TO-NORTHBOUND LEFT-TURN MOVEMENT, CONSIDERATION SHOULD BE GIVEN TO BOTH CONSTRUCTING AN EXCLUSIVE LEFT-TURN LANE ON THE WEST LEG AND PROVIDING AN ADVANCE GREEN PHASE FOR THIS MOVEMENT. THE RECENT INSTALLATION OF A TRAFFIC SIGNAL AT THIS INTERSECTION HAS DECREASED ACCIDENT POTENTIAL.

VI. IMPROVEMENT BENEFITS

1. EXPECTED ACCIDENT REDUCTION-- 5 PERCENT.
2. EXPECTED CAPACITY INCREASE--ZERO PERCENT.

VII. IMPROVEMENT COST

$350

3.
SCHOOL AREA SAFETY

The second phase of this study was concerned with the safety of pedestrians and motorists in school areas. This subject is very important and very sensitive because there is no traffic accident that arouses greater public concern than one involving a school-age child or one occurring adjacent to a school. Responding to this concern, traffic engineers have established certain standards and procedures for controlling pedestrians and vehicles in these areas in order to promote maximum safety.

In the 1971 *Manual On Uniform Traffic Control Devices*, a separate chapter was devoted to school area control. The following paragraphs which identify specific problems related to school areas and the need for standard design treatments are taken from the introduction to that chapter.

> "Traffic control in school areas is a highly sensitive subject. If all the demands of parents and others were met, there would have to be many more police and adult guards for school duty; and many more traffic signals, signs, and markings. Such demands, however, are not always in line with actual needs.
>
> "Analyses often show that at many locations, school crossing controls requested by parents, teachers, and other citizens are unnecessary and costly and tend to lessen the respect for controls that are warranted. It is therefore important to stress the point that regardless of the school location, safe and effective traffic control can best be obtained through the uniform application of realistic policies, practices, and standards developed through engineering studies.
>
> "Pedestrian safety depends in large measure upon public understanding of accepted methods for efficient traffic control. This principle is never more important than in the control of pedestrians and vehicles in the vicinity of schools. Neither school children nor motorists can be expected to move safely in school zones, unless they understand both the need for traffic controls and the ways in which these controls function for their benefit.

"Nonuniform procedures and devices cause confusion among pedestrians and motorists, prompt wrong decisions, and can contribute to accidents. In order to achieve uniformity of traffic control in school areas, comparable traffic situations must be treated in the same manner. Each traffic control device and control method described in this part fulfills a specific function related to specific traffic conditions.

"The type of school area traffic control used, either warning or regulatory, must be related to the volume and speed of traffic, street width and the number of children crossing. For this reason, the traffic controls necessary in a school area located on a major highway would not be needed on a residential street away from heavy traffic. Yet, the important point to be made is that a uniform approach to school area traffic controls must be developed to assure the use of similar controls for similar situations (which promotes uniform behavior on the part of motorists and pedestrians)."

PEDESTRIAN CROSSING CONTROL

When it becomes necessary for school children to cross a street in order to reach their school, a pedestrian crossing point should be designated to provide for the safe and orderly flow of these children. At this crossing point, children must wait for a gap in traffic that is of sufficient duration to permit the crossing maneuver to be completed safely. When the time interval gaps produce delays for pedestrians to the point that they attempt to utilize inadequate gaps, then some type of control is needed at the crossing. The type of control should be consistent with the pedestrian and vehicular volumes, the speed of traffic, and the character of the particular street and area. The types of controls include pavement markings, signs, student patrols, adult guards, and grade-separated crossings.

Pavement Markings

Street crossings along major school routes should have as a minimum control painted crosswalks and stop lines. At a crossing where particular emphasis on visibility is desired (either because of a safety problem or a potential safety problem due to the lack of respect by either pedestrians or motorists), the area of the crosswalk may be marked with white diagonal lines at a 45-degree angle to the line of the crosswalk.

Signs

The signs that are used in connection with school area control consist of speed limit signs and advance warning signs. The school speed

limit sign is used to indicate the speed limit where a reduced speed zone for a school area has been established or when a speed limit is specified for such areas by statute. In connection with this sign, flashing beacons may also be used to identify the periods the speed limit is in force.

There are two types of advance warning signs: one to be used in connection with a school area and one to be used for school crosswalks. The school advance sign is intended for use in advance of locations where school areas are located adjacent to the highway. The school crossing sign is intended for use at established crossings, including signalized intersections where school children cross.

Adult Guards or Student Patrols

Adult guards may be used to provide gaps in traffic at school crossings where studies have shown that adequate gaps must be *created*. In the case of those school areas which were analyzed in Mason City, the safety problems were not related to insufficient gaps but rather to lack of utilization of crosswalks and pedestrian signals by the pupils. For these types of problems, student patrols could be helpful in guiding and supervising pupils.

School Area Traffic Signals

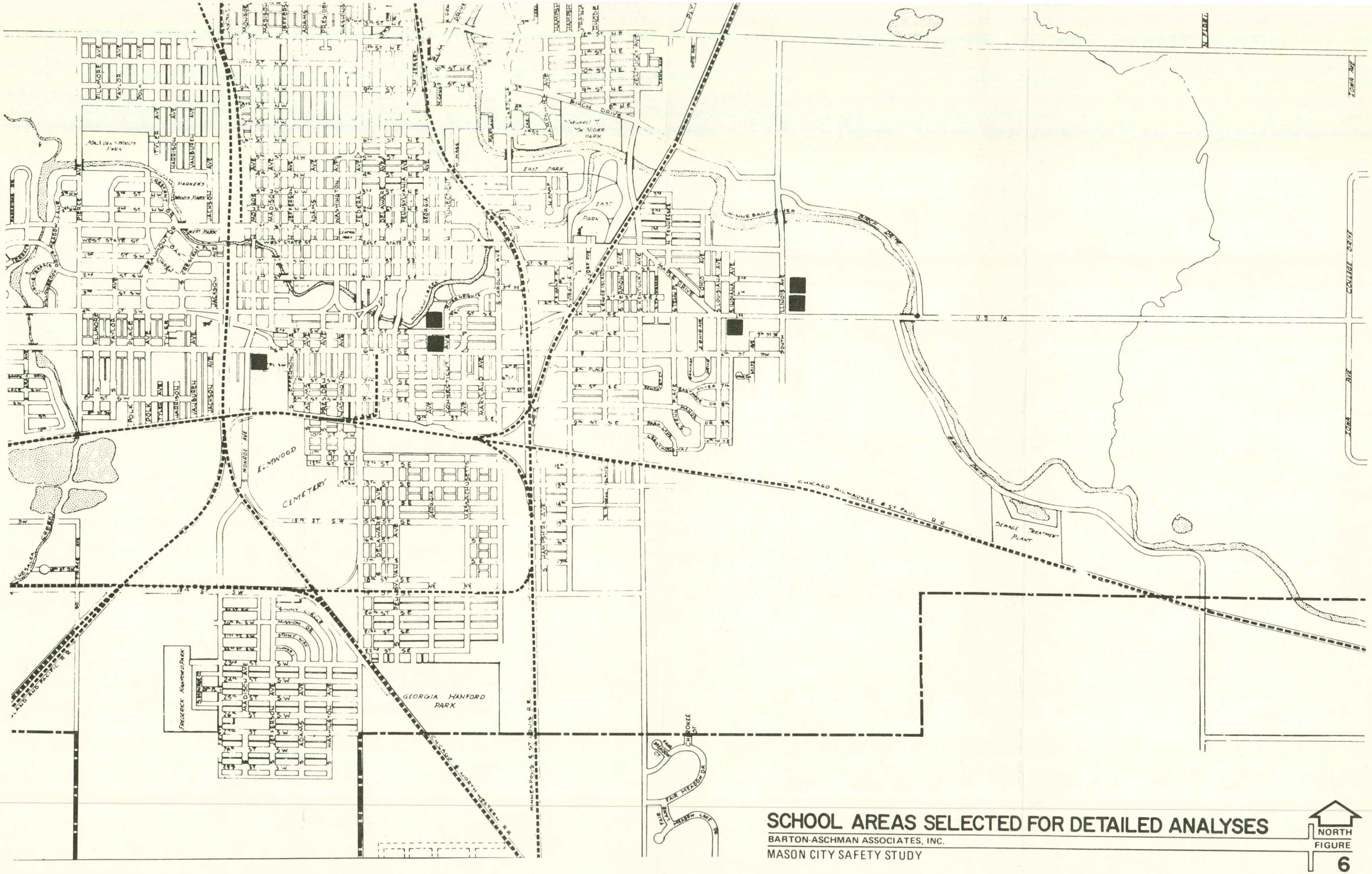
School signals can be erected at established school crossings (either at an intersection or mid-block) on the basis of a need to create adequate gaps in the vehicular traffic stream for pedestrian crossings. These school signals should conform to the standards (both design and operation) established for traffic signals. At two of the school areas analyzed as part of this study, the school signals did not operate in the same manner as traffic signals. The cross streets were controlled by stop signs supplemented by flashing red lights during non-crossing periods and solid red lights during the crossing phase. This deviation from normal operation, even though it is understood by most local motorists, could result in confusion and disobedience by strangers.

Grade-Separated Crossings

School crossings are grade-separated when pedestrian and vehicular volumes indicate that a grade crossing is undesirable because of either safety or capacity conditions. This method of control is usually reserved for crossings where all other control techniques would be ineffective and which are suited for this type of treatment (i.e., could be drained properly if below grade, would fit into the scale of the area if above grade, and would be readily used by pedestrians). None of the school areas which were analyzed warranted this type of control.

The particular school areas that were analyzed as part of this study are listed below and shown on Figure 6.

Grant School--6th Street and Monroe Avenue



SCHOOL AREAS SELECTED FOR DETAILED ANALYSES

BARTON-ASCHMAN ASSOCIATES, INC.

MASON CITY SAFETY STUDY

NORTH

FIGURE 6

John Adams Junior School and Mason City High School--Illinois Avenue

Jefferson School--4th Street and Indiana Avenue

Garfield and St. Joseph Schools--5th and 6th Streets

However, since the problems identified at these locations are probably common to other school areas in the city, the recommended improvements should be applicable to all school areas.

With regard to priorities for implementing the recommended improvements at the school areas, it appears that Grant School should receive first attention because the safety problems identified for this area are deemed more serious than those found at the other school areas. However, in terms of overall priorities, all four of the school areas should receive prompt attention because of the potential serious accidents which could result if any safety problems were allowed to exist in these areas.

ANALYSIS AND RECOMMENDATIONS: GRANT SCHOOL

I. Existing Conditions

Grant School is located in the southeast quadrant of the intersection of Monroe Avenue and 6th Street. The primary pedestrian movements in this area occur along the south side of 6th Street and in the crosswalk across the south leg of Monroe Avenue. The intersection of 6th Street and Monroe Avenue is controlled by stop signs for 6th Street which are supplemented by a pedestrian crossing signal and pedestrian walk lights across Monroe Avenue. The operation of the crossing signal is fixed time (80-second cycle length) with the crossing phase actuated by pedestrian push buttons. During non-crossing periods, the signal flashes red for 6th Street and remains green for Monroe Avenue.

The pedestrian and vehicle volumes recorded at this intersection during the morning crossing period (7:00-9:00) are shown on Figure 7.

II. Existing Problems

1. The pedestrian crossing signal at the intersection of 6th Street and Monroe Avenue does not effectively control traffic at this location because either (a) its operation is not completely understood by motorists, or (b) it does not command the respect that a traffic signal does and, therefore, is ignored.

2. The pedestrian clearance interval on the crossing signal is not sufficient to ensure that children will clear Monroe Avenue before the signal changes.

3. The 80-second cycle length on the crossing signal requires pedestrian to wait at least 60 seconds between crossing phases. This long wait encourages pedestrians to cross Monroe Avenue without the aid of the signal.

4. The absence of advance warning signs for the school area and pedestrian crosswalks dulls the awareness of motorists that children are present in the area.

5. The five-minute parking restriction on 6th Street is frequently violated by long-term parkers. The presence of parked cars in this area constitutes a safety hazard because of the possibility of children darting across 6th Street from between parked cars.

III. Recommended Improvements (See Figure 8.)

1. Upgrade the existing pedestrian crossing signal to the standards recommended in the UMTCD.[1] (This intersection satisfies the warrants for a pedestrian traffic signal because the number of adequate gaps in the traffic stream during the period when children are using the crossing, is less than the number of minutes in that same time period.)

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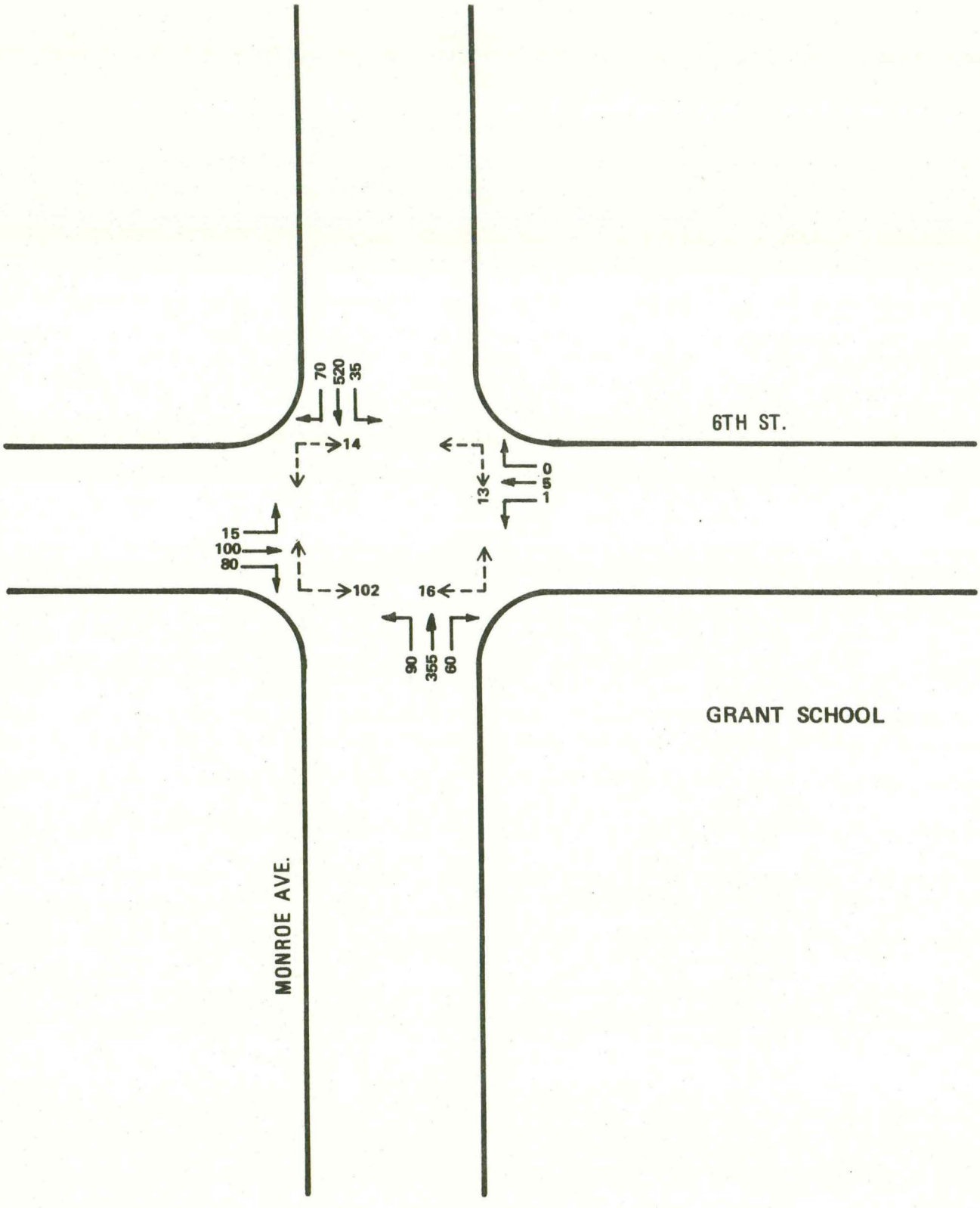
[1]Uniform Manual on Traffic Control devices.



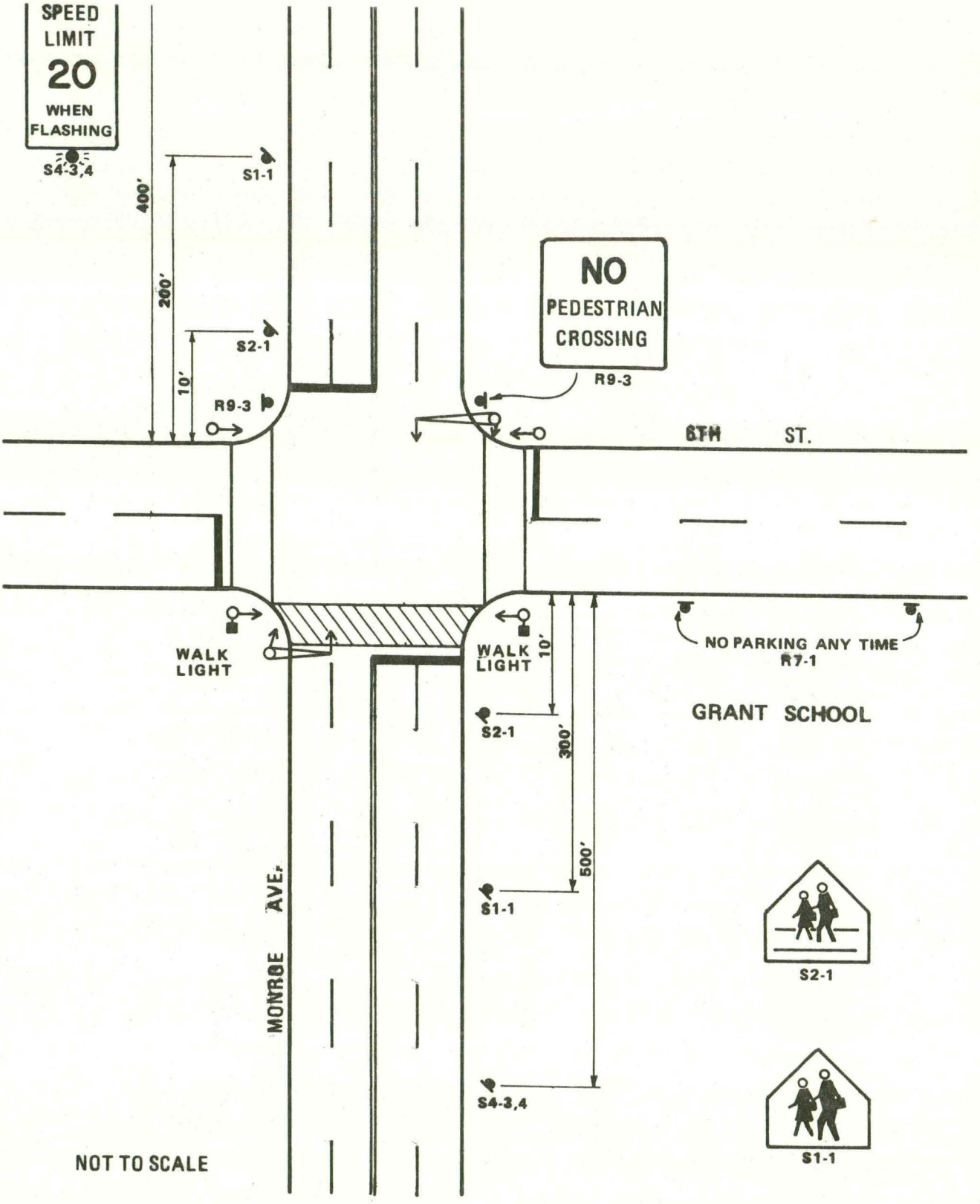
PEDESTRIAN & VEHICULAR VOLUMES (7:00-9:00 A.M.) - GRANT SCHOOL

BARTON - ASCHMAN ASSOCIATES, INC.

MASON CITY SAFETY STUDY

NORTH

FIGURE 7



RECOMMENDED TREATMENT FOR GRANT SCHOOL

BARTON-ASCHMAN ASSOCIATES, INC.

MASON CITY SAFETY STUDY

NORTH

FIGURE 8

This traffic signal should operate in the following manner:

-- The cycle length should be reduced to 60 seconds.

-- Monroe Avenue should receive a continuous green until an actuation is recorded by either traffic on 6th Street or by pedestrians desiring to cross Monroe Avenue.

-- The green time for the 6th Street phase should be 21.6 seconds of which 7.2 seconds will be for walk time and 14.4 seconds as the clearance interval.

2. The far-side signals facing Monroe Avenue should be installed on overhead mast arm poles.

3. The crosswalk across the south leg of Monroe Avenue at 6th Street should be designated as the school crosswalk. This would entail the following:

   -- Posting signs which warn pedestrians not to cross the north leg of Monroe Avenue. This restriction could be supplemented by plantings which would discourage pedestrians from utilizing this crosswalk.

   -- Remove pedestrian walk lights from the north crosswalk.

   -- Paint the crosswalk on the south leg with cross-hatched lines.

4. Install school speed limit signs on Monroe Avenue both north and south of 6th Street. These signs should be equipped with yellow flashing lights which are actuated by means of a time clock during crossing periods.

5. Install advance warning signs for the school area and school crosswalks.

6. Paint stop lines and crosswalks at the intersection of Monroe Avenue and 6th Street.

7. Post "No Parking Anytime" restrictions on 6th Street adjacent to the school and relocate the five-minute parking zone farther east of the school building.

8. Consider utilizing crossing guards (either older pupils or adults) during peak-crossing periods to supervise the crosswalks at the intersection of Monroe Avenue and 6th Street.

IV. Comments

Of those schools which were studied as part of this analysis, Grant School appeared to have the most hazardous pedestrian crossings. During observations at the school, the following problems were noted:

1. On several occasions motorists on 6th Street violated the red signal and proceeded across Monroe Avenue during the pedestrian crossing phase.

2. On one occasion, a motorist on Monroe Avenue ran the red light and proceeded through the crosswalk when pedestrians (both children and adults) were in the crosswalk.

3. Small children of kindergarten age started from the curb just as the "Do Not Walk" phase came on and they did not get across Monroe Avenue before the signal changed to allow Monroe Avenue traffic to proceed.

Because Monroe Avenue is a major street carrying high traffic volumes, motorists on this street seem unaware of the school area at 6th Street. In order to make these motorists more conscious of the children, traffic control techniques should be used which produce a stronger visual impact. These would include a cross-hatched crosswalk, flashing speed limit signs, and traffic signal control with overhead mast arm signal heads.

One alternative improvement which was considered for this area is the relocation of the signalized pedestrian crossing to a mid-block location south of 6th Street. While this relocation would improve the spacing of traffic signals on Monroe Avenue and remove the movements on 6th Street away from the crosswalk, it also has several negative aspects. These aspects primarily relate to the possibility that pupils will be reluctant to use a mid-block crossing because it does not represent the most convenient route between school and home. At the present time, virtually all of the pedestrians crossing Monroe Avenue use the crosswalk on the south leg at 6th Street.

During non-school periods, the traffic signal could be allowed to flash (e.g., yellow for Monroe Avenue and red for 6th Street) so that it would result in only minimum interference to traffic progression on Monroe Avenue.

V. Estimated Improvement Costs

$20,000

ANALYSIS AND RECOMMENDATIONS: JOHN ADAMS JUNIOR HIGH SCHOOL AND MASON CITY HIGH SCHOOL

I. Existing Conditions

John Adams Junior High School and Mason City High School are located adjacent to one another east of Illinois Avenue between 3rd Street and State Street. The primary pedestrian movements in this area occur along the east side of Illinois Avenue, at the intersections with 3rd Street and State Street, and in the parking and pickup/drop-off areas within the site. Vehicle access to building areas and parking lots is via State Street and 3rd Street both of which extend into the site to form a ring circulation road around the schools. The intersections of Illinois Avenue with both State Street and 3rd Street are controlled by stop signs. The pedestrian and vehicle counts taken at these intersections during the peak inbound (7:00-9:00 A.M.) and outbound (2:00-4:00 P.M.) periods for the schools are shown on Figures 9 and 10. The vehicle counts were adjusted slightly to reflect the impact of 300 vehicles which are usually driven to and from Mason City High School by members of the senior class, who did not have classes the day of the survey.

II. Existing Problems

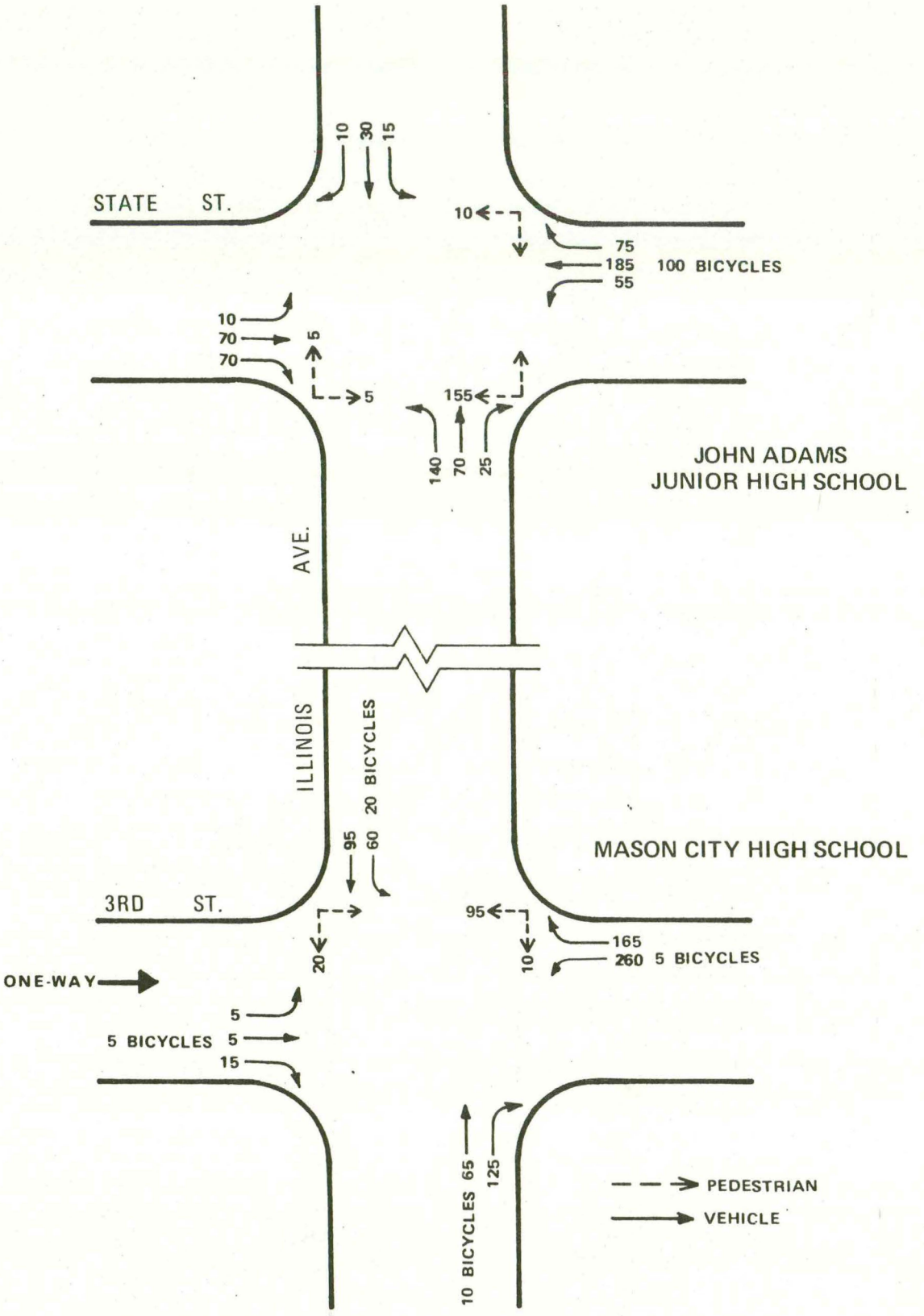
1. During peak inbound and outbound periods for the schools, the intersection of Illinois Avenue and State Street becomes congested due to the number of pedestrians, bicycles, and vehicles which are present.

2. Illinois Avenue is not signed properly to warn motorists of the presence of the school area and crosswalks.

3. Because the major traffic movements at the intersection of Illinois Avenue and 3rd Street occur between the south and east legs, pedestrians utilizing the crosswalk across the south leg of Illinois Avenue interfere with and are exposed to a high number of vehicle movements.

4. The absence of adequate pavement markings (e.g., crosswalks and stop lines) increases the potential for pedestrian and vehicle conflicts.

5. To those unfamiliar with the circulation pattern, driving within the school site is confusing because of the lack of informational signs.



PEDESTRIAN & VEHICULAR VOLUMES (2:00–4:00 P.M.) – ILLINOIS AVE.

NORTH

BARTON-ASCHMAN ASSOCIATES, INC.

MASON CITY SAFETY STUDY

FIGURE 10

III. Recommended Improvements (See Figure 11)

1. The intersection of Illinois Avenue and State Street would operate safer and more efficiently, if it were controlled by a school crossing signal. This would operate just as a normal intersection signal, except it would operate on a fixed time basis during school hours and then be set (by means of a time clock) to flash during non-school hours. The crossing phase for Illinois Avenue should consist of an eight-second walk interval and a 12-second clearance interval.

2. Install school speed limit signs on Illinois Avenue north of State Street for southbound traffic and south of 3rd Street for northbound traffic.

3. Install advance warning signs for the school area and school crosswalks.

4. The crosswalk across the north leg of Illinois Avenue at 3rd Street should be designated as the school crosswalk. This would entail the following:

   -- Posting signs which warn pedestrians not to cross the south leg of Illinois Avenue. This restriction could be supplemented by plantings which would discourage pedestrians from utilizing this crosswalk.

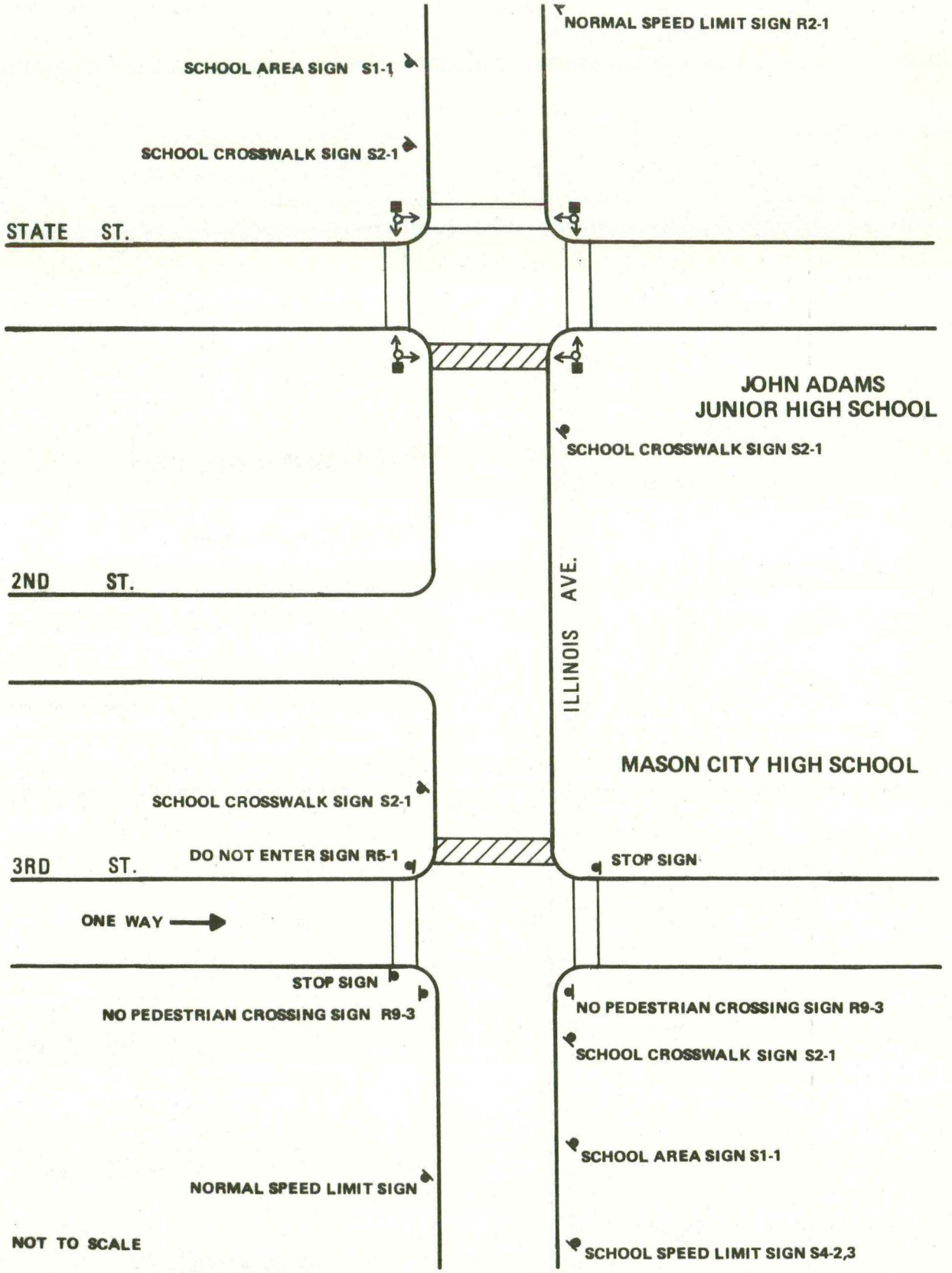
   -- Paint the crosswalk on the north leg with cross-hatched lines.

5. Paint crosswalks and stop lines at the intersection of Illinois Avenue and State Street. The crosswalk across the south leg of Illinois Avenue should be painted with cross-hatched lines.

6. Post new "Stop" and "Do Not Enter" signs on the west leg of 3rd Street.

IV. Comments

The most serious safety problem noted at this location was the operation of the intersection of Illinois Avenue and State Street during peak school periods. The traffic volumes alone do not warrant traffic signal control at this intersection. However, in combination with the pedestrian and bicycle volumes, it appears this intersection does require more positive control than that which would be provided by stop signs. The National Manual on Uniform Traffic Control Devices states that a traffic signal is warranted at a school crossing only when the number of adequate gaps in the traffic stream during the period when the children are using the crossing is less than the *number of minutes* in that same time period. Observations at the Illinois Avenue-State Street intersection indicate that



TRAFFIC CONTROL FOR ILLINOIS AVENUE

BARTON- ASCHMAN ASSOCIATES, INC.

MASON CITY SAFETY STUDY

NORTH

FIGURE 11

adequate gaps are created only when pedestrians and bicyclists cross the street and stop traffic due to their presence in the crosswalk. It does not appear that there would be sufficient gaps for 150 pedestrians and 100 bicyclists, if the pedestrians and bicyclists were not, in effect, stopping traffic and creating gaps.

V. Estimated Improvement Costs

$25,000

ANALYSIS AND RECOMMENDATIONS: JEFFERSON SCHOOL

I. Existing Conditions

Jefferson School is located on the south side of 4th Street (U.S. Highway 18) between Indiana and Illinois Avenues. The primary pedestrian movements at this location occur along both sides of 4th Street and in the crosswalks across 4th Street at Indiana Avenue. The intersection of 4th Street and Indiana Avenue has only three legs (Indiana Avenue having only a north leg). It is controlled by a stop sign for Indiana Avenue, and a pedestrian crossing signal and walk lights. The operation of the crossing signal is fixed time (60-second cycle lengths), with the crossing phase actuated by pedestrian push buttons. During non-crossing periods the signal flashes red for Indiana Avenue and remains green for 4th Street.

II. Existing Problems

1. The pedestrian clearance interval on the crossing signal is not sufficient to ensure that children will clear 4th Street before the signal changes.

2. The absence of backplates and rigid connections on the mast arm traffic signals reduces the target value of the signal heads.

3. Advance pedestrian crossing signs are posted on 4th Street. However, these signs should be supplemented by school speed limit signs (with flashers), in order to slow down motorists effectively during crossing periods.

4. The pickup/drop-off function appears to be occurring across 4th Street from the school (in the northwest quadrant of the 4th Street-Indiana Avenue intersection), thus requiring these children to cross 4th Street.

5. The parking which occurs near 4th Street on the east side of Indiana Avenue reduces the maneuvering space on this leg of the intersection.

III. Recommended Improvements

1. Adjust the timing of the pedestrian signal to allow eight seconds of walk time and a 15-second clearance interval.

2. Install backplates and rigid connections on the mast arm signal heads.

3. Install school speed limit signs on 4th Street in advance of the

school area. These signs should be equipped with yellow flashing lights which are controlled by a time clock so that they operate only during crossing periods.

4. If possible, the pickup/drop-off function should be provided for on the south side of 4th Street so that these children will not have to cross 4th Street. This function should occur at a location within the site (off-street) which is easily accessible from both directions of travel on 4th Street.

5. Parking should be prohibited on the east side of Indiana Avenue within 60 feet of 4th Street.

6. Consider utilizing crossing guards (either older pupils or adults) during peak crossing periods to supervise the crosswalks across 4th Street.

7. Paint the crosswalks across 4th Street with cross-hatched lines.

IV. Comments

In general, the utilization and obedience of the pedestrian crossing signal at this location was very good. Undoubtedly, this is at least partially *a result of the difficulty encountered when attempting* to cross 4th Street at this location, without the aid of the signal. However, some children were observed crossing during the green phase for 4th Street in violation of the "Do Not Walk" signal. It would seem that the only reliable means of preventing these violations would be to use crossing guards to supervise the crosswalks during peak periods. Even though the violations are few in number, the consequences of an accident which might occur as a result of these violations are too severe to depend upon the common sense of children.

V. Estimated Improvement Costs

$3,000

ANALYSIS AND RECOMMENDATIONS: GARFIELD AND ST. JOSEPH SCHOOLS

I. Existing Conditions

St. Joseph School is located in the northwest quadrant of the intersection of Connecticut Avenue and 5th Street. Garfield School is located opposite St. Joseph School between 5th and 6th Streets. To assist pedestrians crossing 5th and 6th Streets (the one-way pair which carries the U.S. Highway 18 route designation through central Mason City), pedestrian crossing signals and walk lights have been installed on both streets midway between Connecticut and Georgia Avenues. The operation of the crossing signals is fixed time (60-second cycle length) with the crossing phase actuated by pedestrian push buttons.

II. Existing Problems

1. There is a tendency on the part of many of the students to cross 5th and 6th Streets without the aid of the pedestrian crossing signals.

2. Advance pedestrian crossing signs are posted on both 5th and 6th Streets. However, these signs should be supplemented by school speed limit signs in order to slow down motorists effectively during crossing periods.

3. Overhanging tree limbs along 5th Street reduce the visibility of the pedestrian crossing signal.

4. The entrance to St. Joseph School does not align with the pedestrian crossing, thus requiring children living southeast of the school to walk out of their way in order to travel to and from school.

5. Pavement markings at both crosswalks are faded.

6. The pedestrian clearance interval on both crossing signals is not sufficient to ensure that pedestrians will clear the street.

III. Recommendations

1. Install school speed limit signs in advance of the two pedestrian crosswalks on 5th and 6th Streets. These signs should be equipped with yellow lights which flash during school crossing times.

2. Install school area warning signs in advance of the existing school crossing signs on 5th and 6th Streets.

3. Trim the tree limbs blocking the school crossing signal on 5th Street.

4. Repaint the crosswalks (cross-hatched) and stop lines on 5th and 6th Streets.

5. Adjust the timing of the pedestrian signals to allow 10 seconds of walk time and a 10-second clearance interval.

6. Close the existing fence opening in front of St. Joseph School and relocate this opening near the church so that it more closely aligns with the pedestrian crossing signal location.

7. Repair the fence at the corner of 6th Street and Georgia Avenue to prevent the children from entering Garfield School at this location.

8. Consider utilizing crossing guards (either older pupils or adults) during peak crossing periods to supervise the crosswalks across 5th and 6th Streets.

IV. Comments

The major traffic safety problem noted at these school areas was the lack of utilization of the pedestrian crossing signal. From observations at the crossing locations, it appears this disregard for the signal is a result of the following conditions:

-- For some children, the controlled crosswalk does not represent the most convenient route between the school and home because of the location of the gates to the school.

-- Because both 5th and 6th Streets are one-way streets requiring pedestrians to observe only one direction of traffic, some feel the controlled crosswalk is unnecessary.

-- Because there is no supervision of the crossings, it appears to the children that there is no penalty for disregarding the controlled crosswalk.

The recommendations listed above are intended to increase utilization of the controlled crosswalks and make drivers more aware of the presence of school children in the area.

V. Estimated Improvement Costs

$3,000

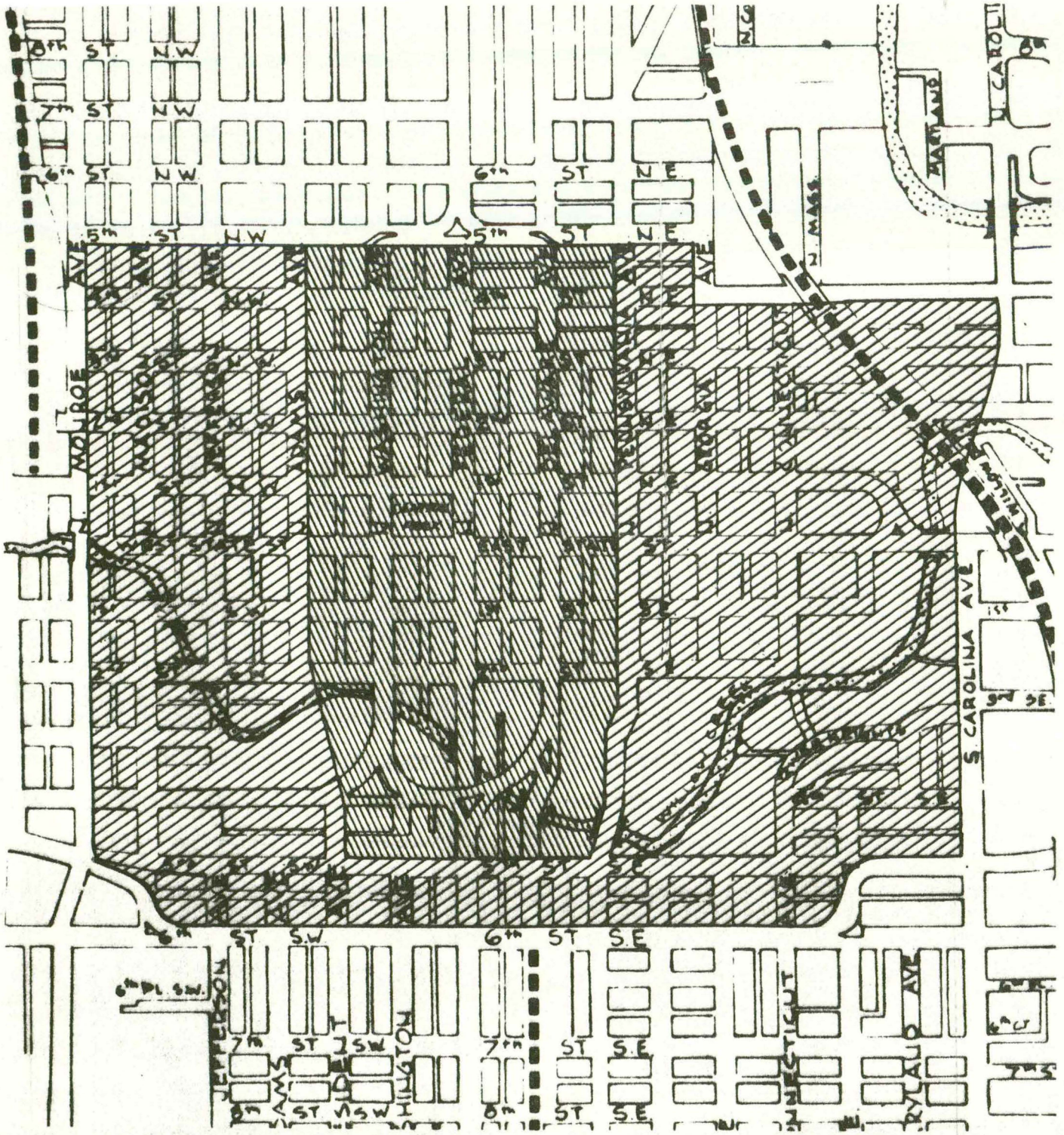
4.
CENTRAL BUSINESS DISTRICT TRAFFIC SAFETY STUDY

The concluding phase of the *Traffic Safety Study* was concerned with Mason City's central business district (CBD). As illustrated in Figure 12, the study area necessarily extended beyond the "downtown core," as defined and illustrated in *A General Downtown Plan for Mason City*, updated in March, 1970. The latter's boundaries consist of 5th Street North to the north, 5th Street South to the south, Pennsylvania Avenue to the east, and Adams Avenue to the west. Because the vehicular flow within and around the CBD is greatly affected by the operation of certain components of the transportation network encompassing this frame area, a more liberal interpretation of the CBD was adopted--5th Street North to the north, 6th Street South to the south, Carolina Avenue to the east, and Monroe Avenue to the west. It should be understood that the motive for extending the study boundaries was *not* to imply or recommend an expanded CBD core, per se, but instead to include certain arterials contained in the abutting fringe area which exert a significant and direct influence upon the CBD circulation plan.

STUDY PROCEDURE

The extent of the need for streets in Mason City is and has been predicated upon the character and growth of the community. Concurrently, however, the street system establishes the framework for community development. Therefore, in utilizing the 1965 Central Business District Circulation Plan as the data base for this safety study, the land-use and transportation network changes which have occurred since 1965 (as well as those proposed) in the Mason City central area were evaluated as to their impact on both the traffic patterns and the circulation plan itself.

As a basis for proceeding in the investigation, peak-hour traffic movements (see Table 3), summaries of accident data at key locations (see Table 4), traffic signal information, and land-use data were obtained for purposes of identifying hazardous, inefficient, and capacity deficient routes and intersections. After reviewing this information, recommendations (priorities included) which would provide a much more acceptable level of service on the transportation network within the study area were established.



CENTRAL BUSINESS DISTRICT STUDY AREA

BARTON-ASCHMAN ASSOCIATES, INC.

MASON CITY SAFETY STUDY

NORTH

FIGURE 12

Table 3
EXISTING AVERAGE WEEKDAY EVENING CBD PEAK-HOUR TRAFFIC FLOW

Intersection	Intersection Approach			
	North	South	East	West
Washington-4th North	411	-	116	102
Washington-3rd North	563	-	145	77
Washington-2nd North	687	-	119	185
Washington-1st North	805	-	261	-
Washington-State	862	-	199	128
Washington-1st South	954	-	-	300
Washington-2nd South	899	-	143	61
Delaware-4th North	-	705	134	101
Delaware-3rd North	-	769	111	85
Delaware-2nd North	-	914	115	198
Delaware-1st North	-	901	240	-
Delaware-State	-	940	185	209
Delaware-1st South	-	785	-	350
Delaware-2nd South	-	718	111	71
Federal-5th South	560	612	597	-
Federal-6th South	620	598	-	774
Pennsylvania-State	262	182	213	139
Adams-1st North	67	97	251	150

EXISTING CONDITIONS

While downtown streets are generally the most extensively traveled streets in the city, certain areas of the CBD are far less convenient as destinations for vehicles than are many of the areas near the city's periphery. This is partially attributable to the limited parking facilities in the most frequented locations, but primarily because downtown streets must unavoidably serve the dual function of accommodating intercity/crosstown traffic as well as vehicles actually destined to the CBD.

The core of the downtown area should be as free as possible from interference, confusion, and congestion of vehicular flow. Although some of the traffic action improvement projects contained in *A Comprehensive Plan for Mason City*[1] have been implemented essentially as recommended, others have not (as indicated by the sometimes inefficient movement of traffic within the CBD). For example, in the downtown's north-south corridor, the ring system of one-way streets involving Washington and Delaware Avenues has alleviated the severe congestion previously occurring along

[1] *A Comprehensive Plan for Mason City*, Barton-Aschman Associates, Inc., 1965.

Table 4
CENTRAL BUSINESS DISTRICT INTERSECTION
ACCIDENTS--1972

Intersection	Adams			President			Washington			Federal			Delaware			Pennsylvania		
	F	PI	PD	F	PI	PD	F	PI	PD	F	PI	PD	F	PI	PD	F	PI	PD
5th North	0	0	0	-	-	-	0	1	1	0	0	8	0	0	0	0	0	2
4th North	0	0	3	-	-	-	0	1	6	0	3	3	0	4	12	0	0	1
3rd North	0	1	3	-	-	-	0	2	4	0	0	5	0	5	3	0	0	3
2nd North	0	1	6	-	-	-	0	0	8	0	1	4	0	3	6	0	0	1
1st North	0	2	4	-	-	-	0	3	6	0	3	8	0	1	6	0	0	1
State	0	0	0	-	-	-	0	0	5	0	1	6	0	1	3	0	0	3
1st South	0	0	2	-	-	-	0	1	12	0	1	9	0	0	8	0	0	3
2nd South	0	0	0	-	-	-	0	2	8	0	1	8	0	4	12	0	0	7
4th South	0	0	0	0	1	1	0	0	4	0	0	7	0	1	4	0	0	0
5th South	0	1	1	0	4	3	0	0	0	0	8	28	0	4	0	0	0	11
6th South	0	0	3	0	0	1	0	0	1	0	1	11	0	0	1	0	0	2

F = Fatality PI = Personal Injury PD = Property Damage

Federal Avenue. However, the north-south "system" has yet to become optimally effective, in that Adams and Pennsylvania Avenues remain two-way streets. To enhance the general circulatory capabilities in the area, it was originally proposed that one-way couples immediately east (Delaware-Pennsylvania) and west (Adams-Washington) of Federal Avenue be effected. This decision to delay implementation greatly discourages the use of these streets for circulation purposes, thus adversely increasing, to a certain extent, the vehicular-pedestrian conflicts on the CBD's most important business and retail street, Federal Avenue.

In the east-west direction, the *primary* vehicular movements were to be accommodated via the following one-way couples: 1st Street North-State Street and 3rd Street North-4th Street North. To date, neither has been implemented as recommended. As a result, State Street continues to function as a heavy carrier of east-west *through and CBD-oriented* traffic, a situation with ramifications not totally unlike those related to Federal Avenue prior to the adoption of the Washington-Delaware one-way couple.

These problems, together with others which, when combined, inhibit the achievement of a less hazardous, more efficient circulation system, are summarized along with recommended solutions in the next section of the report.

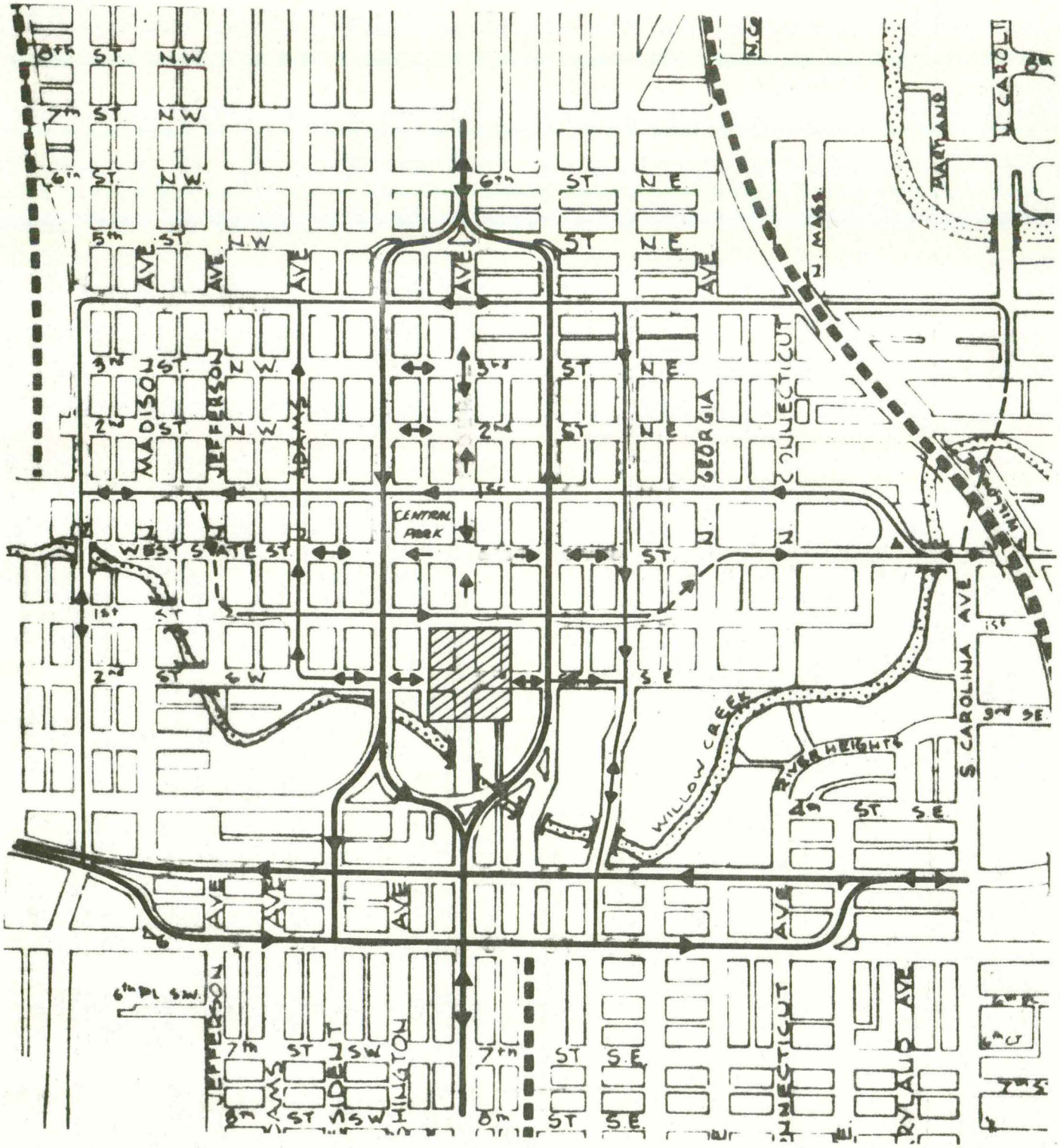
SUMMARY OF RECOMMENDED IMPROVEMENTS

Recommendations have been developed for improvements which will enable the transportation network to accommodate the forecast vehicular and pedestrian volumes in the CBD safely, efficiently, and economically. These are based upon roadway capacity analyses utilizing 1973 peak-hour traffic counts supplied by the City of Mason City Engineering Department; 1985 traffic flow projections as forecast in *A Comprehensive Plan for Mason City*; 1972 vehicular accident data supplied by the City of Mason City Engineering Department; and CBD land-use information obtained via conversations with Mason City officials and from *A General Downtown Plan for Mason City*, updated in March, 1970.

The improvements developed during the conduct of this study consist of a number of projects ranging from parking removal to interconnected signalization to the implementation of one-way street couples.

The form of the major street plan suggested for the study area is dictated primarily by existing community needs, and by needs arising from residential, industrial, and commercial growth anticipated during the next 10-15 years. The circulation system shown in Figure 13 consists of routes required to provide circulation to, and access for, all parts of the study area.

To a great extent, the recommended pattern of routes illustrated on Figure 2 closely parallels that recommended pattern in the 1965 Central



CENTRAL BUSINESS DISTRICT CIRCULATION SYSTEM

BARTON-ASCHMAN ASSOCIATES, INC.

MASON CITY SAFETY STUDY

NORTH

FIGURE 13

Business District Circulation Plan. Certain modifications to the 1965 Plan now enacted have precluded the exact implementation of all elements as originally proposed, but the flow concepts of each remain identical, i.e., provide for several basic types of traffic movements--to and from the CBD, around the CBD, and crosstown.

The principal elements of the recommended improvements are discussed below and illustrated in Figure 14 (see pocket at end of report):

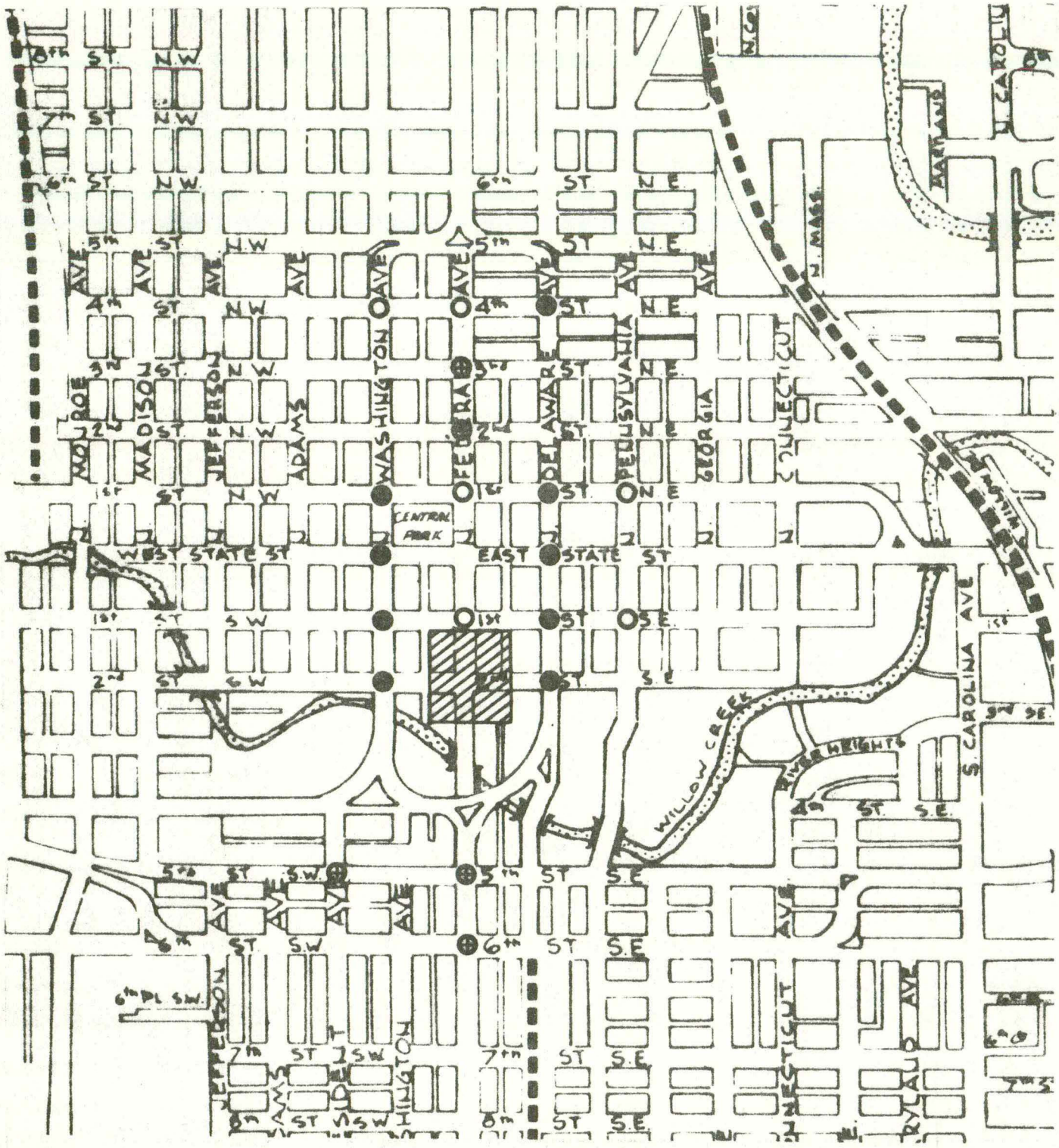
CBD North-South Corridor Improvements

To complement the existing Delaware-Washington one-way couple, Adams Avenue and Pennsylvania Avenue should also be made one-way to facilitate general circulation in the area. Southbound traffic would be accommodated on Pennsylvania Avenue between 4th Street North and 2nd Street South, and northbound traffic on Adams Avenue also between 4th Street North and 2nd Street South. To date, the majority of CBD activity is generally confined along and between Washington and Delaware Avenues, but as the core of the CBD expands farther east and west, the provision of more efficient circulation and access via Adams and Pennsylvania Avenues will be required.

Federal Avenue, the city's principal retail and business street, primarily serves local access needs , not only because of its design, but also because of the relief afforded by the Delaware-Washington one-way ring. Current indications are that the integrity of this street is to be maintained and, moreover, further enhanced by the development of a "super block" at 1st Street South (see Figure 15). Such a development would place a strong retail/business anchor at the core's southern boundary, thereby giving rise to a more active pedestrian movement along Federal Avenue. From a land-use planning point of view, this intention is well founded, and the circulation plan recommended here would satisfy its requirements for both the vehicular and pedestrian movements involved. It should be emphasized that the three-block section of one-way operation proposed on Federal Avenue between 1st Street South and 2nd Street North is designed to facilitate the local access needs of the downtown area. Although a pedestrian environment can be achieved, vehicular circulation along Federal Avenue (and, as discussed later, along State Street) would be *improved* by discouraging through or non-CBD traffic from using Federal Avenue.

CBD East-West Corridor Improvements

Essential to the achievement of safe and efficient movement within and through the CBD is the implementation of the 1st Street North-1st Street South one-way couple. Although each operates as a one-way street today, the respective designs are incomplete and/or inefficient to the point that State Street still functions as a heavy carrier of high-traffic volumes within the downtown. This situation, although not as severe, is similar to that pertaining to Federal Avenue prior to the



TRAFFIC SIGNAL SYSTEM FOR CENTRAL BUSINESS DISTRICT

BARTON-ASCHMAN ASSOCIATES, INC.

MASON CITY SAFETY STUDY

NORTH

FIGURE 15

adoption of the Delaware-Washington one-way couple. To remedy this and allow State Street between Washington Avenue and Delaware Avenue to function in a deemphasized manner analogous to the proposed operation of Federal Avenue, this east-west loop should be implemented (as shown in Figure 13) between Willow Creek to the east and Jefferson Avenue to the west. This system, together with the one-way pairs of Adams-Washington and Delaware-Pennsylvania, will provide excellent access and circulation patterns both for CBD-oriented and intercity, crosstown movements. The corner roundings to the east at Georgia Avenue (between 1st Street South and State Street), and to the west at Jefferson Avenue (between 1st Street North and 1st Street South) are essential, and to compromise either alignment would adversely affect the loop's effectiveness.

To improve the accommodation of east-west through traffic volumes now utilizing CBD streets, it is recommended that 4th Street North operate as a higher-capacity arterial between Monroe Avenue to the west and Carolina Avenue to the east. On-street parking should be prohibited between Washington Avenue and Delaware Avenue to provide four moving lanes; between Monroe and Washington Avenues and between Delaware and Carolina Avenues, two moving lanes are recommended, except at intersections where separate left-turn lanes (painted) are recommended to increase capacity and ensure a safer operation.

State Street, 2nd Street North, and 3rd Street North should be deemphasized as major traffic carriers, thereby creating a more desirable format for future land-use planning and development. This will be made possible via the capacity provided by 1st Street South, 1st Street North, and 4th Street North.

CBD Traffic Signal System Progression

Evaluation of the interconnected signal system within the CBD core required analyses of green time apportionment, phasing, cycle length, and progression. This evaluation was designed to maximize progression band width along a linear route and select the optimum signal cycle length, which along with the offset intervals, would provide for the most efficient movement of vehicles. This technique was applied to the high-priority routes in the CBD, and the results of this evaluation then were analyzed as a grid network of signals.

The apportionment of green time and the use of signal phasing are critical factors in obtaining efficient signal operation. Analysis of these factors requires examination of the physical conditions, operational characteristics, and peak-hour turning movement volumes at each intersection.

The optimum cycle length for a fixed-time signal system should provide the best combination of capacity, reduced delay, and signal progression. Observation of the downtown area and the results of capacity analyses indicate that a 70-second cycle length generally satisfies the

criteria of adequate capacity and minimum delay. In addition, an evaluation of signal progression on the high-priority streets reveals this period to be most acceptable.

In selecting an offset system, examination of the distribution of vehicular flow across the street network was performed. Because traffic is not evenly distributed and a set of primary traffic carriers is evident, an offset system which establishes street progressions on a priority basis according to traffic volumes will improve the overall efficiency of the signal system.

The priority offset system involved the following considerations:

1. All streets within the central area where signal progression is desirable (see Figure 15) were given a priority ranking according to their traffic volumes (see Table 5). These volumes were determined from existing peak-hour counts and a reassignment of traffic based on proposed changes to the existing street and signal systems.

2. Offsets which provide the best obtainable progression were determined for each street in the order of the street's priority ranking. These offsets were obtained through graphic techniques.

3. Final adjustments to each offset were made. These adjustments were based on the relative benefits to be obtained by both major and cross street progressions. The recommended offsets for each signalized intersection are listed in Table 6.

Table 5
PRIORITY RANKING OF CBD STREETS

Priority Number	Streets
1	(Delaware Avenue (Washington Avenue
2	(1st Street North (1st Street South
3	4th Street North
4	Pennsylvania Avenue
5	Federal Avenue

Note: Printouts are based on projected traffic volumes for the central area following implementation of proposed street modifications and addition of new traffic signals.

Table 6
RECOMMENDED SIGNAL OFFSETS AND SPLITS

Major Street/ Minor Street	Major Street Split Percent	Major Street Offset Percent	Minor Street Split Percent	Minor Street Offset Percent
Delaware Avenue				
2nd Street South	60%	0%	40%	60%
1st Street South	60	12	40	72
State Street	60	23	40	83
1st Street North	60	34	40	94
4th Street North	60	69	40	29
Washington Avenue				
2nd Street South	60	96	40	56
1st Street South	60	84	40	44
State Street	60	73	40	33
1st Street North	60	62	40	22
4th Street North	60	24	40	84
1st Street North				
Pennsylvania Avenue	60	93	40	53
Federal Avenue	60	7	40	67
1st Street South				
Pennsylvania Avenue	60	84	40	44
Federal Avenue	60	57	40	17

Note: The base point from which offsets should be measured is the offset at the intersection of Delaware Avenue and 2nd Street South.

The signal progressions produced by the method appear to be quite efficient. Major streets such as Delaware and Washington Avenues and 1st Streets North and South would afford virtually optimum progressions; i.e., these are the best progressions obtainable in light of signal spacing, cycle splits, design speeds, and flexibility of available control. Progression is also provided on the remaining streets, but it is far less than optimum due to the priority ranking of these routes in the grid network.

It should be emphasized that the aforementioned conclusions were established after analysis of existing data and proposed revisions to the system. However, traffic patterns and volume characteristics in a CBD area are subject to change and variation. The addition or relocation of a major traffic generator could alter traffic patterns considerably. Therefore, an ongoing program of signal system reevaluation should be initiated. This program should include:

-- Periodic signal system "runs" to check progression offsets and signal operation.

-- A traffic counting program to conduct peak-hour turning movement counts at the major intersections.

-- Periodic evaluation of signal phasing, splits, and offsets based on current traffic volumes.

In addition, a file containing information such as existing signal timing, signal equipment, time-space diagrams, etc., should be maintained. All changes to the signal system should be recorded in this file.

The proposed interconnected single dial, fixed-time signal system is not responsive to actual traffic demands. The present system can satisfy only one set of traffic conditions because splits and offsets are fixed until manually changed. In order to obtain the maximum benefit of this system, traffic flow should be monitored on a continuing basis (at least annually) and adjustments made to the signal timing at the local controllers, as required.

Customarily, a central area experiences three distinct traffic flow periods:

-- Morning peak--heavy inbound movement to the CBD.

-- Evening peak--heavy outbound movement from the CBD.

-- Off-peak--equivalent movements to and from the CBD.

Mason City appears to have these characteristics. Therefore, a signal system capable of utilizing more than one control scheme would improve the efficiency of traffic flow during these periods. Consideration should be given to providing a more flexible signal system to serve the central area. A more in-depth signal system analysis would be required to determine the specific requirements of such a system and the type of signal equipment best suited to satisfy these requirements.

Specific Intersection Improvements

The most critical section of the study area transportation network from a safety and capacity standpoint involves the intersections of Federal Avenue with 5th Street South and with 6th Street South. Although 5th and 6th Streets are both one-way streets, the heavy northbound-to-westbound and southbound-to-eastbound left-turn movements at 5th and 6th Streets, respectively, create undesirable safety and capacity problems.

To alleviate this condition, it is recommended that the southbound-to-eastbound left-turn movements at Federal Avenue and 6th Street South be prohibited, thus allowing the two southbound lanes on Federal Avenue

to operate only as through lanes. Because the great majority of vehicles now making this left turn originate from the north via a Washington Avenue-to-Federal Avenue-to-6th Street South routing, it is proposed that South President Avenue become one-way southbound between 4th Street South and 6th Street South, so as to provide a Washington Avenue-to-South President Avenue-to-6th Street South routing. This improvement will allow the intersection to operate much more safely and efficiently, and by rerouting traffic from the north onto South President Avenue will reduce the vehicular demand at the intersection of Federal Avenue and 5th Street South. The South President Avenue-5th Street South intersection will require signalization initially, and signalization at South President Avenue-6th Street South *may* be required at a later time.

In order to accommodate the aforementioned left-turn movements at 5th Street South, it is recommended that the south leg of the intersection (the two northbound lanes on Federal Avenue) be given a lead green signal phase. This will satisfy the left-turn movement by briefly eliminating opposing flow, and, also, will allocate more green time to the heavier northbound through movement. However, as traffic volumes increase, throat-widening of this intersection to provide a separate left-turning lane will eventually be required.

RECOMMENDED IMPROVEMENT PRIORITIES

As discussed earlier, a number of projects of varying magnitude and complexity comprise the CBD improvement program. Although collectively these projects are recommended for immediate implementation on the basis of existing deficiencies in the traffic system, it is recognized that for various reasons a staging of implementation will be inevitable. Therefore, a priority system is recommended which relates each major CBD project to the overall operation of the system as well as to other directly related projects.

Group I

In order to discourage through or non-CBD traffic from using State Street within the study area, especially between Washington and Delaware Avenues, the improvements recommended along State Street, 1st Street North, and 1st Street South should be implemented simultaneously. Completion of the 1st Street North-1st Street South one-way couple (corner roundings at Jefferson Avenue to the west and Georgia Avenue to the east included) and the implementation of one-way sections on State Street east and west of Federal Avenue cannot operate *effectively* independently. This subsystem of improvements is unquestionably the most important insofar as providing the greatest--and most needed--relief to the safety/congestion problems now existing in the area.

Group II

In terms of sheer roadway capacity deficiencies and traffic operational

problems, Federal Avenue's intersections with 5th and 6th Streets South warrant the greatest attention. Therefore, of next importance is the implementation of the one-way southbound movement on President Avenue between 4th and 6th Streets South, concurrently with the traffic operation improvements at the Federal Avenue-5th Street South and Federal Avenue-6th Street South intersections. These three modifications are relatively simple, yet the result will be significant enhancement in the efficiency of vehicular flow throughout the area.

Group III

As an aid in reducing congestion and delay within the CBD, it is recommended that the control system of interconnected traffic signals illustrated and discussed earlier be implemented as soon as possible. Because such a system is not really dependent upon the completion of the other improvement projects, its implementation may be pursued independently.

Group IV

To generally enhance the circulation system of the CBD via providing additional intersection capacity and fewer vehicular conflict locations, the following improvement projects should be pursued to eliminate the CBD's traffic deficiencies: (1) as recommended in *A Comprehensive Plan for Mason City*, Adams Avenue should be converted to one-way operation northbound, and Pennsylvania Avenue converted to one-way operation southbound; (2) on-street parking should be prohibited in advance of certain intersections as shown in Figure 14; (3) on-street parking between Washington and Delaware Avenues should be prohibited to provide four moving lanes; and (4) miscellaneous improvements such as intersection point channelization (more extensive and more frequent) and the adoption of uniform signing.

Appendix

Appendix
EXPLANATION OF "EXISTING CONDITIONS" FORMAT

The first two sections of each intersection report, "location" and "existing conditions," are printed by a computer using a set of programs titled "Barton-Aschman Intersection Analysis System" (BAIAS). While most items on the BAIAS output are clear, some do deserve special explanation:

STREET CROSS SECTION

Right-of-Way Width. Width of the right-of-way at the intersection was obtained from intersection drawings.

Basic Roadway Width. Width of the roadway curb-to-curb (including medians) prior to any intersection throat-widening

Number of Approach Lanes. Lanes are identified as left- or right-turn lanes only if they are marked and signed as exclusive lanes.

Road surface. Self-explanatory.

Median. Self-explanatory.

Shoulder Treatment. Self-explanatory.

POSTED SPEED LIMIT (MPH)

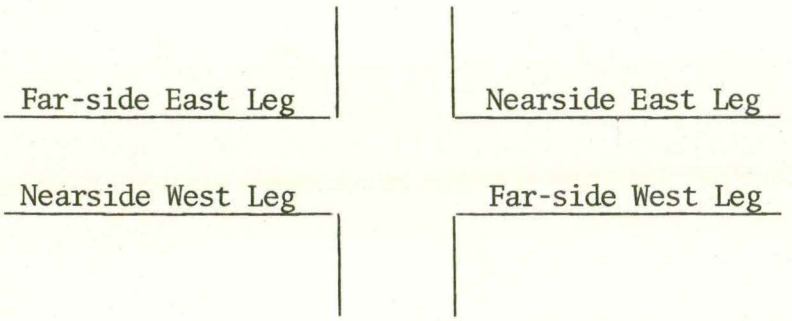
Speed limit posted on the approach to the intersection.

PARKING PROHIBITIONS

Nearside Approach Area and Far-side Exit Area. These are the curb parking restrictions enforced just prior to and just after the intersection itself. If parking is allowed mid-block but prohibited near the corner, then the distance of the corner restriction also is given.

Nearside Block Before and Far-side Block Beyond. These are the predominant curb parking restrictions on the block before and after the intersection.

As an example, the parking restrictions listed for the nearside of the east leg will be those posted along the north side of east leg and the restrictions listed for the far-side of the east leg will be those posted along the north side of the west leg (see below).



VOLUME (PEAK HOUR)

Morning or afternoon peak-hour traffic counts are listed along with the dates on which the traffic counts were conducted.

SERVICE VOLUME (LEVEL C) AND VOLUME/ CAPACITY RATIO (V/C)

Where capacity may be a problem at a particular intersection, the service volume for each leg of the intersection has been calculated. Cycle splits for actuated signals are based upon observation of operating conditions during the peak hours and upon the maximum green setting on the controllers. The V/C ratio is then obtained by dividing the peak-hour total volume by the calculated service volume.

PEDESTRIAN ACTIVITY

Pedestrian activity listed is based upon the engineer's observations while studying operations at the intersection Four categories were used for identifying the activity observed: None Observed (0/Hr), Light (1-9/ Hr), Medium (10-19/Hr), and Heavy (20 </Hr).

TRUCKS AND THROUGH BUSES

Based on classification counts if available; otherwise on observations as above.

TRAFFIC CONTROL

The type of traffic signal is listed. If an intersection is controlled by stop or yield signs, the words "Stop" or "Yield" will appear for the intersection legs which must stop or yield.

LAND-USE

Self-explanatory.

ACCIDENTS

The time period of accident totals was selected to be January 1972 through March 1973 because of the ready availability of detailed accident information for this period.

Accident Severity. Self-explanatory.

Accident Type. Self-explanatory.

CAPACITY INCREASE

$$\text{Percent Capacity Increase} = \frac{(\text{V/C Existing} - \text{V/C Expected after Improvements})}{\text{V/C Existing}}$$

$$\text{with V/C Existing} = \frac{\text{Volume on critical N-S leg plus Volume on critical E-W leg}}{\text{Capacity on critical N-S leg plus Capacity on critical E-W leg}}$$

The V/C expected after improvements was calculated in a similar manner as V/C existing, except the capacity calculations were adjusted to reflect the recommended signal timing or geometric improvements.

PERCENT ACCIDENT REDUCTION

$$\text{Percent Accident Reduction} = \frac{\text{Accidents Correctable by Improvements}}{\text{Existing Accidents}}$$

The calculations for percent accident reduction are necessarily more subjective because there are no definite formulae for relating correctable accidents to the types of improvements recommended. These relationships were derived from published before-after accident studies (similar to the study published in the October issue of Better Roads) and adjusted to reflect the individual characteristics at each location.