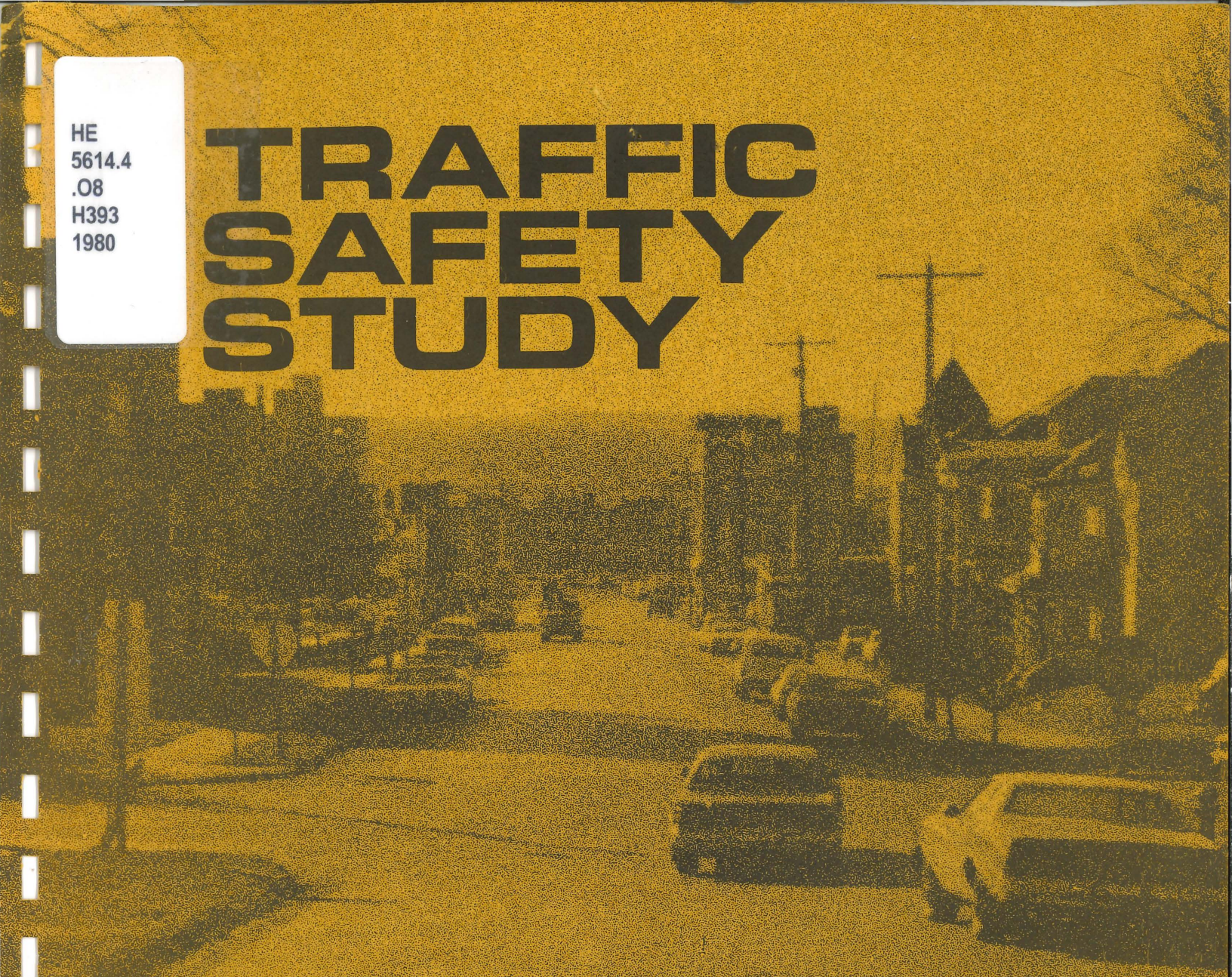
TRAFFIC SAFETY STUDY



OTTUMWA, IOWA

SEPTEMBER, 1980

HDR

Henningson, Durham & Richardson

HDR Henningson, Durham & Richardson
8404 Indian Hills Drive
Omaha, NE 68114
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October 3, 1980

Mr. Darrell Adams, City Engineer
City of Ottumwa
Municipal Building
Ottumwa, Iowa 52501

Dear Mr. Adams:

Henningson, Durham & Richardson, Inc., is pleased to submit its final report on the Ottumwa Traffic Safety Study.

This report consists of a written and graphic account of the data, analyses, findings, and recommendations related to the safety study. The recommendations reflect a careful study of the accident experience and traffic conditions at each studied location and emphasize low-cost, short term improvements. We believe that implementation of the proposed improvements will enhance traffic safety in Ottumwa.

We wish to thank you, Assistant City Engineer Mr. Mark Garrett, the City staff, the Iowa Department of Transportation, and the Federal Highway Administration for your assistance and cooperation during the course of this study. It is our hope that this report will be a useful guide for improving traffic safety in the City of Ottumwa.

Respectfully,

HENNINGSON, DURHAM & RICHARDSON, INC.

Jack S. Schnettler, P.E.
Project Manager

David A. Meier
Project Engineer

DM:mk

TRAFFIC SAFETY STUDY

FOR THE

CITY OF OTTUMWA, IOWA

September, 1980

Prepared by

HENNINGSON, DURHAM & RICHARDSON

OMAHA, NEBRASKA

This report was prepared through a grant provided by the United States Department of Transportation, Federal Highway Administration pursuant to the provision of Section 402 of Title 23 of the United Staes Code.

ACKNOWLEDGEMENTS

City of Ottumwa

Mayor	Dale F. Gottschalk
City Commission	Larry Roush Jerry Parker Rex Moore Joe Curran
City Engineer	Darrell Adams
Assistant City Engineer	Mark Garrett
Chief of Police	Wilfred Boettcher

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CHAPTER 1

INTRODUCTION

The contents of this report document the efforts of Henningson, Durham & Richardson (HDR) in conducting a traffic engineering safety study for the City of Ottumwa, Iowa. Funding for this study originated from Federal Highway Administration Section 402 Safety Funds and was administered by the Iowa Department of Transportation.

1.1 STUDY OBJECTIVES

The primary objectives of the study were to perform a traffic engineering analysis of twenty-nine high hazard and problem locations in Ottumwa and to formulate corrective measures to improve motorist and pedestrian safety at those locations. The recommendations were to be realistic and cost-effective to promote implementation.

These objectives were achieved by examining existing conditions at the intersections - accident experience, geometrics, traffic controls, and where available, traffic volumes. Existing conditions were then compared with accepted traffic engineering practice and standards in order to identify unsafe, nonconforming, or confusing situations.

1.2 STUDY SCOPE

The study approach consisted of four basic steps:

1) Survey of existing street and traffic conditions, traffic control devices and accident history at specified high hazard locations.

2) Evaluation of existing conditions, traffic controls, and accident experience to identify deficiencies and develop remedies.

3) Formulation of recommended measures to improve safety and achieve uniformity of controls, and development of an implementation program.

4) Development of a procedure for the City to use in evaluating the effectiveness of implemented recommendations.

The study approach was applied to the high hazard locations by means of the following work tasks:

1.2.1 Data Collection

Data collection was the first task undertaken, and was comprised or the following steps:

- Prior studies and reports were compiled and reviewed.
- Accident records for 1976-1978 were tabulated and collision diagrams drawn.
- Available traffic volume data was obtained.
- The high hazard locations were field inspected to identify geometric, sight distance, pavement, and street lighting conditions.
- Signing, traffic control devices, and pavement markings at each location were inspected for conformance with standards and proper placement.

1.2.2 High Hazard Analysis

The accident data was examined with respect to field conditions at each intersection to identify deficiencies in traffic control and intersection geometry that contribute to the hazard potential. Such deficiencies include:

- Excessive speed.
- Poor sight distance.
- Lack of intersection definition.
- Confusing alignment or pavement markings.
- Ineffective lane usage or assignments.
- Inappropriate intersection controls.
- Inadequate parking control.
- Insufficient night time lighting.

Recommended improvements for solving high accident problems at each intersection were developed as part of the analysis process. Emphasis was placed on immediate or short-term improvements such as:

- Changes in intersection controls.
- Improved pavement markings.
- Improved warning and guide signing.
- Changes in signal timing or phasing.
- Upgrading signal hardware.
- Driveway controls.
- Selective traffic enforcement.

Medium or long-range recommendations such as street realignment, channelization, and mast-arm signal installation were developed for those intersections which require more extensive improvement to enhance traffic safety.

1.2.3 Implementation Program

Following the development of recommendations, priorities were assigned to each proposed improvement on the basis of safety benefits to be derived, immediacy of need, and cost of the improvement. The Consultant also studied funding sources and applicable levels or funding as part of the project. With improvement priorities and funding resources in mind, a staged implementation program was formulated.

1.2.4 Evaluation Procedure

Finally, an evaluation procedure was prepared for the City to follow in monitoring the effectiveness of implemented recommendations. This procedure involves a before-and-after study approach to changes in accident patterns and statistics, and is presented with a complete set of instructions for its use.

1.3 COMMUNITY PARTICIPATION

An important consideration in conducting the study was coordination with the Ottumwa community, its elected officials, and its technical staff. During the course of the project, their thoughts and comments were welcomed and carefully evaluated.

The City of Ottumwa technical staff was able to provide a large amount of valuable information used in the completion of the study, and the City Commission and Retail Merchants Association expressed considerable interest in the study objectives and traffic safety. The interest shown in the study and willingness to provide requested information promoted good two-way communication and enabled the Consultant to better address the traffic problems of the community.

A list of those individuals and agencies contacted during the study is contained in the Appendix.

1.4 REPORT ORGANIZATION

This report is organized to reflect the study emphasis on individual high hazard locations. An analysis and list of recommendations for each location is included in Chapter 2, and accompanied by a diagram showing existing conditions at the intersection and the recommended improvements. Chapter 3 outlines an implementation program and Chapter 4 presents a safety evaluation process.

It is intended that this report be used and consulted, therefore the analysis and recommendations are as thorough as possible and should contribute to improved traffic safety in Ottumwa.

CHAPTER 2

ANALYSIS OF HIGH HAZARD LOCATIONS

2.1 INTRODUCTION

This chapter presents the traffic engineering analyses for the twenty-nine high hazard intersections listed in Table 2-1. The discussion of each intersection includes:

- A review and description of the physical features and existing traffic controls.
- Comments on significant traffic volumes and turning patterns at locations where recent traffic counts were available.
- An examination of the accident experience and patterns.
- An explanation of safety deficiencies and nonconforming traffic controls.
- A discussion of recommended improvements.

Intersection diagrams that accompany the text depict existing conditions and proposed improvements in a clear and concise manner.

Traffic control devices - signs, signals, and pavement markings - were reviewed for conformance with the guidelines specified in the 1978 Manual on Uniform Traffic Control Devices (MUTCD) and standard engineering practice. Recommended traffic control improvements were based on bringing Ottumwa into compliance with MUTCD standards.

The study recommendations have been assigned priorities ranging from 1 to 3. Emphasis is placed on Priority 1 recommendations which are low cost, easy to implement improvements that result in increased safety and efficiency at the intersection. The Consultant recommends implementation of Priority 1 improvements by January 1, 1981.

Priority 2 and Priority 3 improvements were recommended to bring the intersection up to current design standards and to correct major geometric flaws at locations where the accident experience does not warrant immediate action. Suggested implementation dates for these improvements are January 1, 1983, and January 1, 1985 respectively.

Before discussing each intersection, however, this chapter will address briefly the Ottumwa traffic accident reporting system and several area-wide traffic engineering recommendations.

TABLE 2-1

STUDY LOCATIONS

Location	Accident Data (1976-1978)	
	Total Accidents	Injury Accidents
1. U.S. 34 and U.S. 63 (West Junction at Wapello)	24	9
2. U.S. 63, Bryan road and North Court Street	24	9
3. U.S. 63, McLean Street and Woodland Avenue	14	6
4. U.S. 34 and Quincy Avenue	5	2
5. Marion Street and Second Street	22	5
6. U.S. 63 and Kitterman Avenue	3	-
7. U.S. 63 and Rochester Avenue	29	8
8. Church Street and Myrtle Street	8	1
9. McLean Street and Second Street	15	4 (incldes. 1 fatality)
10. Fourth Street and Ash Street	7	4 (incldes. 1 fatality)
11. Pennsylvania Avenue and Jefferson Street	15	3
12. Cook Avenue and Church Street	12	6
13. Kitterman Avenue and Main Street	5	-
14. U.S. 63, Mary Street and Rabbit Run Road	12	3
15. Jefferson Street and Main Street	16	3
16. Hancock Street, Madison Avenue and Garfield Street	3	1
17. Fourth Street and Jefferson Street	10	-
18. Marion Street and Main Street	5	1
19. Washington Street and Second Street	10	2
20. Kitterman Avenue and Second Street	8	1
21. Church Street and Richmond Avenue	5	-
22. Church Street and Weller Street	10	1
23. Bardell Street and Weller Street	2	-
24. Fourth Street and Marion Street	8	-
25. Fourth Street and Washington Street	5	-
26. Fourth Street and Court Street	1	1
27. Main Street and Iowa Avenue	12	2
28. Wapello Street, Albia Road and Ferry Street	12	2
29. Ferry Street and Richmond Avenue	4	1

2.2 TRAFFIC ACCIDENT REPORTING SYSTEM

Without a doubt, engineering analysis of accident data is a very rapid way of evaluating the effectiveness of an accident reporting system. The deficiencies most often encountered involve how the accident location is specified or how the accident diagram is drawn and described. Accident reports should specify the collision location to within 50 feet and identify roads with both street name and highway number, when applicable. Diagrams must show clearly the directions of travel of all involved vehicles, reference the accident location to an intersection or other landmark, and identify the north direction. Finally, the accident narrative should provide adequate support for the diagram through clarity and completeness.

The most common problems encountered by the Consultant in analyzing City of Ottumwa accident records, were unclear accident diagrams and illegible or vague narratives. While the police reports were usually clear enough, reports completed by motorists were often confusing or indecipherable. Currently, accident reports are filled out by police officials only when a personal injury accident occurs. This procedure has led to vague and incomplete accident reporting because the police have no control over the way motorists complete an accident report.

The National Safety Council recommends that police make reports on all traffic accidents coming to their attention except for minor collisions involving only scratched or dented fenders. Whenever there is doubt whether an accident is minor, the police officer should make a report.

The Consultant concurs with the National Safety Council recommendation and urges its adoption for accident reporting in Ottumwa. Although additional police personnel may be required and paperwork will increase, an officer's report is impartial, and can be much more easily checked for incompleteness, contradiction, or vagueness than a report made by an involved driver. It should also be remembered that the City Engineering Staff will require complete and accurate accident reports to evaluate the effectiveness of implemented study recommendations. Without adequate accident data, the evaluation procedure included in this report will yield inaccurate results and be of little use to the City.

The accident report filing system used by the City deserves comment in that it works well for Ottumwa. The City is divided into six numbered regions which are subdivided into letter-designated zones. Accident reports are filed according to date within each zone. Although pulling accident reports for a specific intersection requires a search of all records for the zone in which it is located, pin maps kept by the City for the current year and previous years do indicate the total number of accidents for the intersection. This system is simple, and Ottumwa's size and the annual number of reported accidents are such that it remains workable.

2.3 AREA-WIDE RECOMMENDATIONS

While studying the 29 study locations individually, several area-wide recommendations were developed to correct deficiencies and nonconforming practices noted at a majority of locations. Additionally, several suggestions are included to improve overall traffic operations.

2.3.1 Pavement Markings

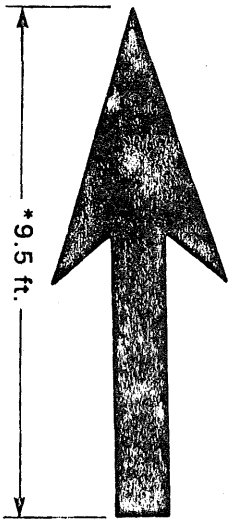
The pavement arrows currently in use throughout Ottumwa are of a temporary nature and nonconforming in design. An elongated, solid arrow as shown in Figure 2-1 is specified by the MUTCD. The existing arrows on city streets should be replaced by conforming arrows. At some of the studied locations, the existing arrows are positioned too far in advance of the intersection to which they apply. When excessive notice of lane assignments is provided, drivers tend to ignore the pavement arrows. A good policy in most cases is to locate a set of arrow markings approximately 20 ft. from the stop line. The arrows should be repeated in advance of the intersection, when necessary, to prevent entrapment in mandatory turn lanes and to help motorists select the appropriate lane before reaching a line of waiting vehicles at the intersection. Where normally legal traffic movements are prohibited, such as mandatory turn lanes, arrow markings must be accompanied by lane assignment signs and the word marking "ONLY". This MUTCD requirement is not currently met in Ottumwa.

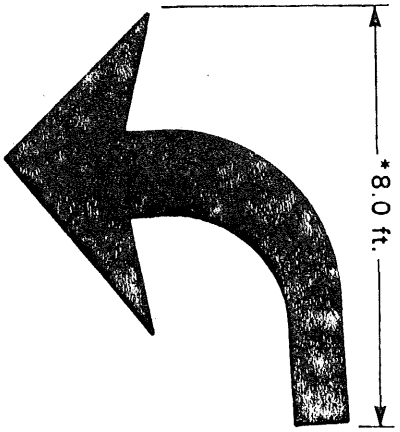
Recommended changes in existing pavement markings are included in the discussion of individual study locations, and suggested locations for markings and lane assignment signs are shown on the improvement diagrams.

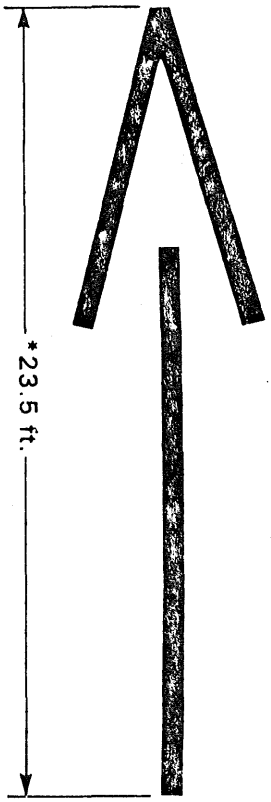
2.3.2 Signing

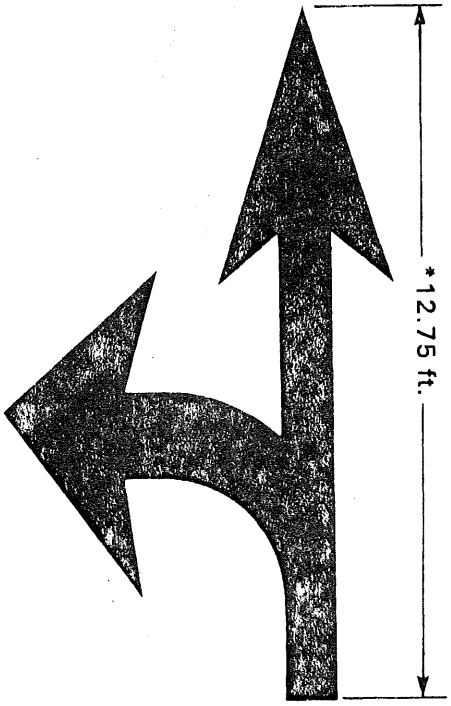
City-wide improvements in two areas of signing are recommended. First, all existing street name signs should be upgraded to reflectorized white-on-green signs, and at all intersections where street name signs are not currently located, they should be installed on diagonally opposite corners so that they are on the far right-hand side of the intersection for traffic on the major street. Advance street name signs are needed at important intersections on highways and should be located 150-250 feet from the intersection. The purpose of these guidelines is to enable motorists unfamiliar with the City to easily identify streets, and thereby avoid the confusion and last-minute decisions which cause some rear-end and turning collisions. Recommended street name signing improvements apply to all of the study intersections and, except for discussions of the highway intersections, they will not be repeated elsewhere in this report.

The second recommended improvement to signing involves the mounting height of No Parking signs and some other regulatory signs in Ottumwa. A vertical clearance of approximately 4 feet from sign to pavement is presently used by the City when installing No Parking signs. The MUTCD, however, requires a minimum vertical clearance of 7 feet for all signs in urban areas, as illustrated in Figure 2-2 of this report. The Consultant recommends that the City revise its policy on the mounting height of No Parking signs and all other regulatory signs to conform with that of the MUTCD.

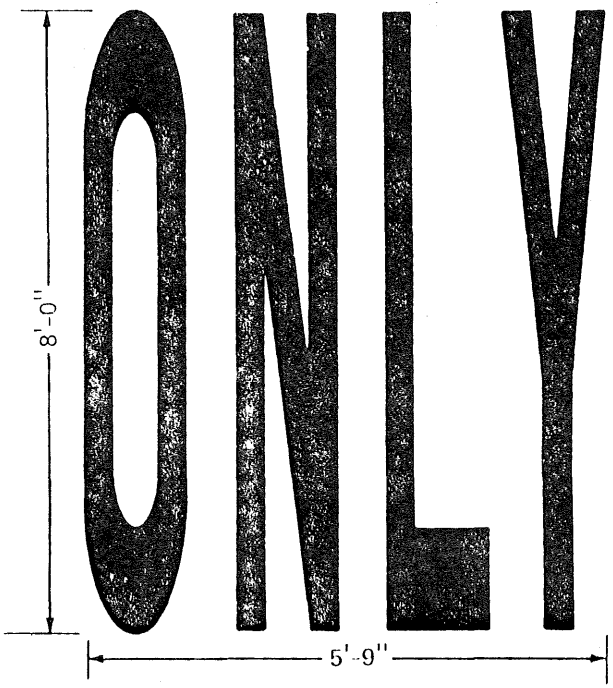






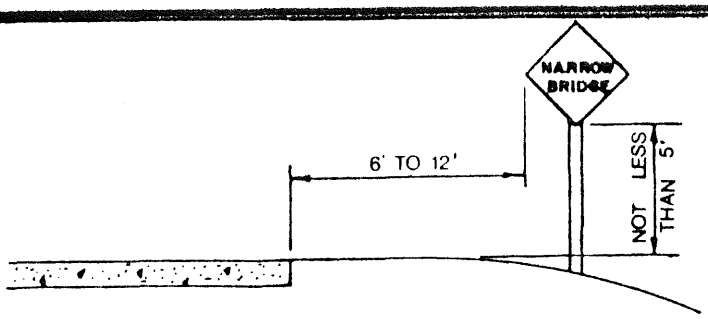


Minimum size for normal installation,larger sizes may be needed for freeways,above average speeds,and other critical conditions

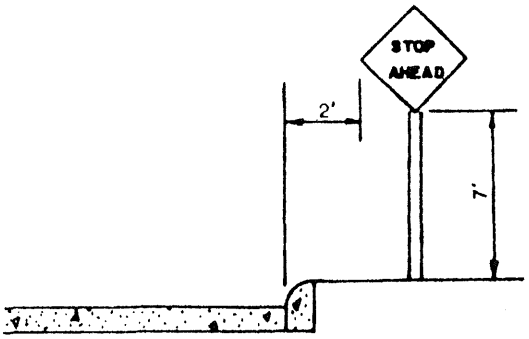


PAVEMENT MARKINGS

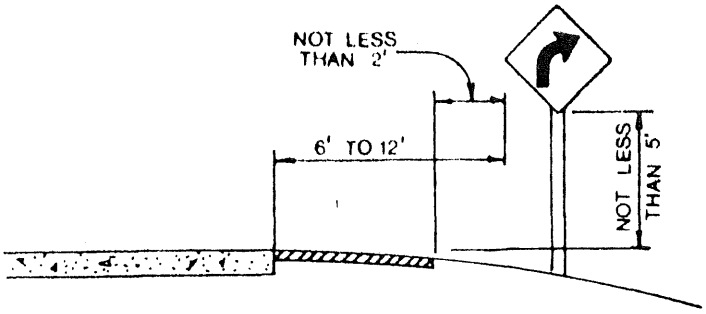
Figure 2-1



rural section



urban section



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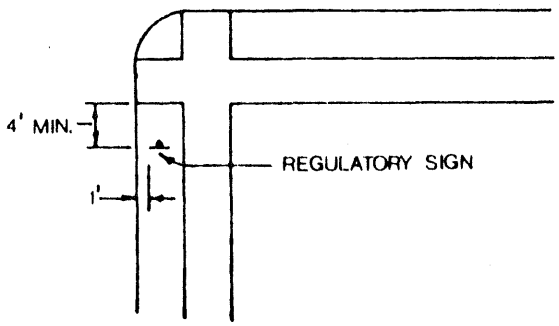
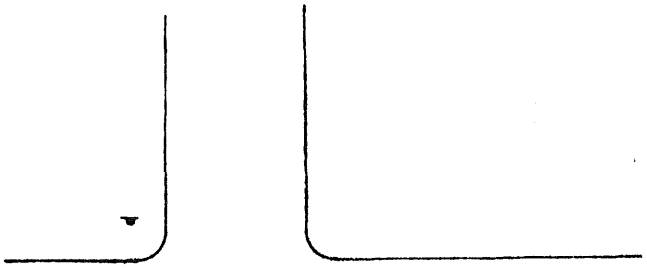
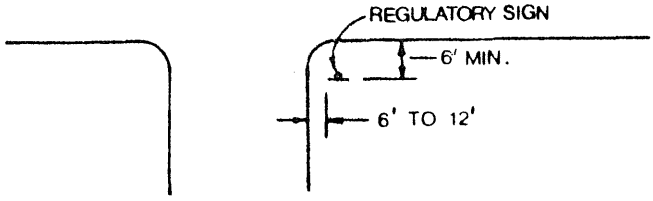


urban intersection





rural intersection

SIGN PLACEMENT

Figure 2-2

2.3.3 Traffic Signals

Analysis of the signalized study intersections has indicated that existing clearance intervals at 8 of the 12 locations are longer than necessary. The Consultant found that amber times at intersections in and near the CBD ranged from 4 to 7 seconds, while combined amber and all-red intervals of 7 to 11 seconds were in use at the highway intersections studied. Experience has shown that at urban intersections, where approach speeds are 25 to 30 mph, amber times in excess of 4 seconds are actually used by motorists as additional green time, which defeats the purpose of a clearance interval. At highway intersections and extremely wide or complex intersections, clearance intervals of more than 6 seconds are not only used as extra green time, but are likely to cause impatience among drivers awaiting the signal change who may start through the intersection without a green indication. This situation can obviously result in cross traffic collisions.

For the most efficient and safest signal operation amber times should be held to 3 or 4 seconds at most intersections. Where cross traffic or left turn collisions are a problem, a 1 or 2 second all-red interval should be used. Recommended timing revisions for the intersections studied are included in this report. At several locations where all-red intervals are not currently used, but are recommended, additional cam lobes will have to be broken out in the controller to accommodate the extra interval. Clearance intervals should also be checked for unnecessary length at other signalized intersections within the City.

Another important, signal related improvement is replacement of the old signal controllers now in use at most of the City's signalized intersections. The existing pretimed, single-dial controllers are 25 to 30 years old, allow no timing flexibility, and demand a substantial maintenance effort. The installation of new, solid state or electromechanical controllers will provide the capability for multiple cycle lengths and splits so that signals can be programmed to accommodate changing traffic patterns during the day. More importantly, new controllers will require much less maintenance. Although priorities, based on costs and expected benefits, have been assigned to the replacement of controllers at specific study intersections, a replacement policy based on operation costs should be developed by the City for aging controllers. Such a policy would insure efficient signal operation at a minimized cost.

As aids to the signal maintenance effort and a controller replacement policy, an up-to-date timing plan and a maintenance record should be placed in a plastic envelope inside the controller cabinet door. The timing plan will guarantee that signal timings are reset correctly following any required controller maintenance and the maintenance record will provide up-to-date information regarding the cost of maintaining an existing controller. As a means of forestalling unnecessary repair costs and signal down-time, signal plans showing the location of underground conduit should be placed in City maintenance vehicles. This is a common practice in some cities which can prevent conduit from being accidentally cut during excavations near a signalized intersection.

2.3.4 Traffic Operation

The energy shortages that surfaced in 1979 have mandated the development of energy conservation techniques, and the President has personnaly urged the implementation of measures that will save energy. One of the most direct methods of conserving energy is the promotion of efficient traffic operation on existing street networks. There are many facets of improved traffic operation, but the elimination of unwarranted signals or all-way stops is a measure that offers great potential for energy savings.

Estimates of operating costs for stops and delays have been developed during the last decade and, although very conservative by current prices, they can still be used to provide an idea of the annual costs involved. An approximate operating cost (gasoline, tires, maintenance, and depreciation) of 2.1 cents for every vehicle stopped from a speed of 30 mph was developed (1). If this figure is applied to a four-way stop intersection where the major street carries an average daily traffic volume of 6,000 vehicles, the annual operating cost of stopping every vehicle on the major street exceeds $45,000.

In determining the effect of vehicle stops on fuel consumption alone, studies have shown that 150 fewer stops from an average speed of 30 mph will result in saving one gallon of gasoline (2). At the four-way stop intersection in question, over 14,000 gallons of fuel are burned annually by stopping traffic on the major street. From this example, it is evident that unnecessary stops result in considerable costs and substantial fuel consumption. Traffic signals and all-way stops should therefore be avoided or eliminated wherever traffic volumes, inadequate sight distance, or accident experience does not warrant them.

(1) Thomas, Joe M. "A Traffic Engineer's Challenge," Technical Notes, A Publication of ITE, December, 1979.

(2) Michael, Harold L. "Opportunities in Transportation Engineering Funding and Intersection Management," ITE Journal, March, 1980, p. 18.

2.4 ANALYSES AND RECOMMENDATIONS

2.4.1 U.S. 34 and U.S. 63 (West Junction at Wapello St.)

Physicial Features and Traffic Control: This intersection is a junction of U.S. 34 and U.S. 63 which continue as a single route east of the intersection. Both highways are classified as rural principal arterials, while Wapello Street, the south leg of the intersection, is classified as a minor arterial. All approaches are four-lane, divided roadways with exclusive left turn bays. The U.S. 34 - 63 (east) approach and the U.S. 63 approach have channelized right turn lanes.

The existing traffic signals are fully actuated with separate phases for through and left turn movements. Each approach is provided with an overhead and a side-mounted signal to indicate through and right turn movements and a pedestal-mounted left turn signal. The left turn signals are located on the far side median for all approaches except the Wapello approach where it is located on the far left-hand side. This signal should be relocated, as it is mounted in an unexpected position and cannot be seen until a driver reaches the intersection. The Consultant recommends a longer Wapello approach mast-arm, so the left turn signal can be installed over the left turn lane. Although the left turn signals are currently signed as such, the installation of optically programmed (3-M) signal heads would prevent motorists in other lanes from misinterpreting the left turn indication. Backplates should also be installed on all overhead signals to improve their visibility.

The existing clearance intervals range from 6 to 9 seconds for combined amber and all-red times. Considering the street widths and 45 mph speed limit, the total clearance interval for any phase should not exceed 6 seconds; with amber times of 3 to 4 seconds and a 2 second all-red interval. A timing plan showing the recommended timing revisions is included in this report.

Traffic Volumes: A 1978 traffic count indicates a daily traffic volume of over 24,000 vehicles entering this intersection. In excess of 2,000 vehicles enter during the P.M. peak hour alone. The heaviest traffic movements are north and south bound through vehicles, which account for 40% of the peak hour entering volume. Left turns from U.S. 63 are the heaviest turning movement and comprise 13% of the peak hour traffic volume.

Accident Patterns: Twenty-four accidents were recorded during the 1976-1978 study period. Although this is a very high number of accidents for the Ottumwa area, it should be remembered that the intersection also experiences heavy traffic volumes. Nine of the reported accidents involved personal injuries, which is probably due to high approach speeds. Enforcement of the speed limit is advised as a possible means of reducing injury accidents.

The identifiable accident patterns are rear end and cross traffic collisions, which accounted for 11 and 6 accidents respectively. Four of the rear end collisions occurred on the Wapello approach alone. The accident patterns suggest problems with clearance timing and signal visbility. The revision of clearance intervals, as recommended, should decrease cross traffic collisions, but some motorists are evidently not seeing the signals soon enough - especially on the Wapello approach. Because sight distance is not a problem, the only real improvement to be made is the installation of an additional overhead signal for each approach.

Recommendations:

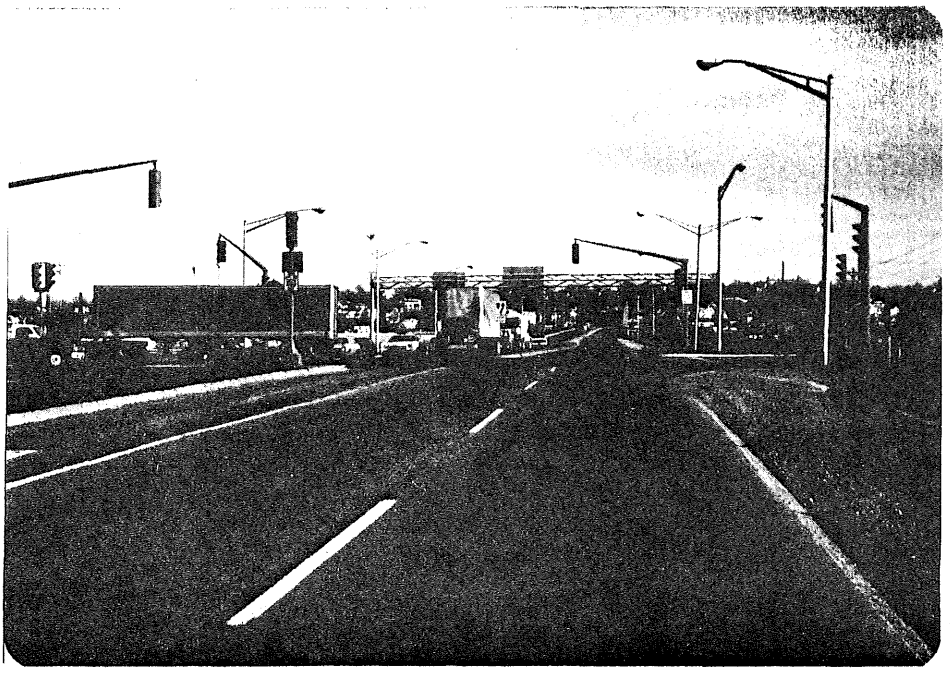
PRIORITY 1

- Speed limit enforcement
- Revise the clearance interval timings as shown on the signal timing plan.
- Install backplates on all overhead signals.*
- Repaint the existing stop lines.*

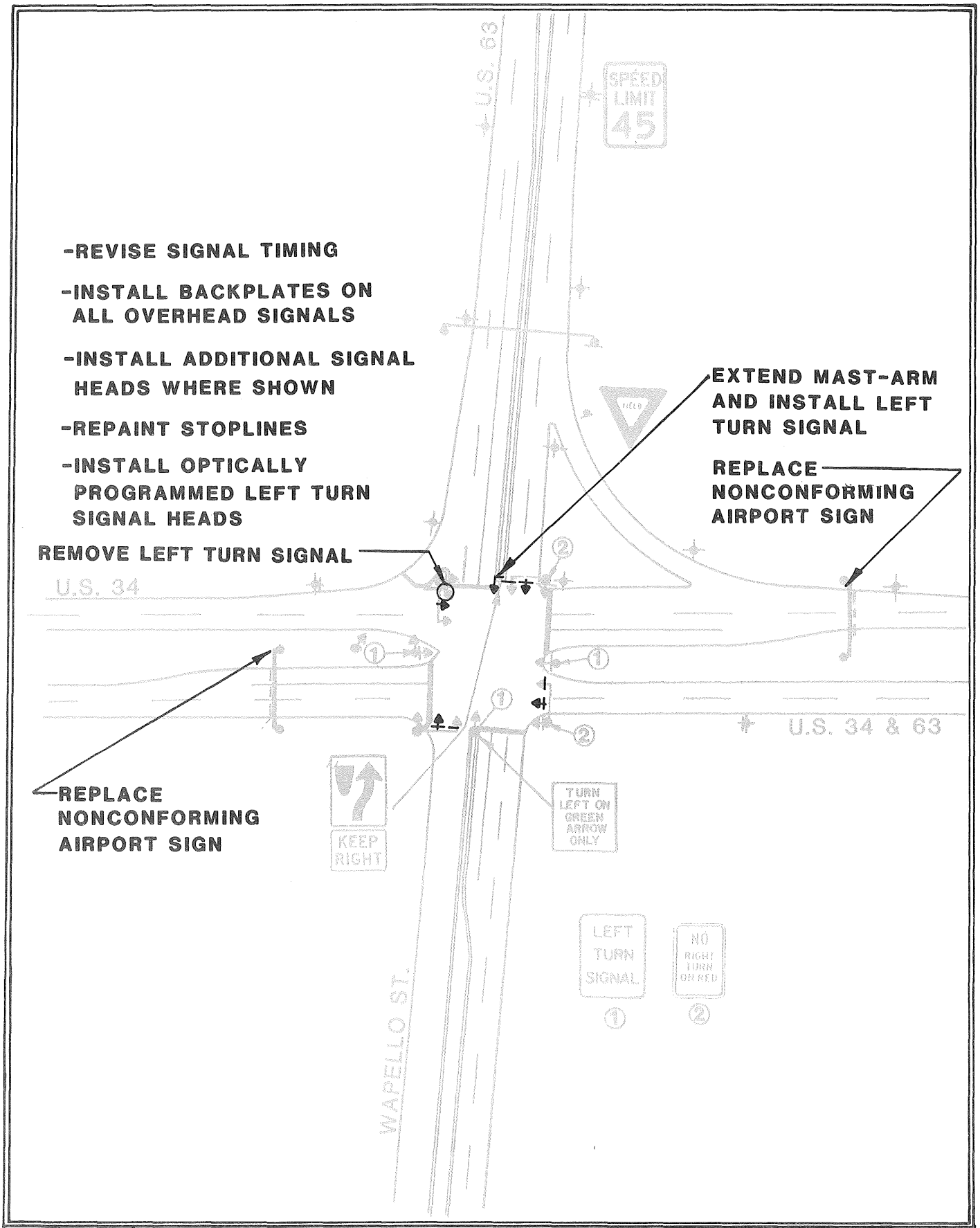
PRIORITY 2

- Install a longer mast-arm on the Wapello approach and relocate the existing pole-mounted left turn signal to the mast-arm.*
- Install an additional overhead signal head for each approach.*
- Replace the left turn signals with optically programmed signal heads.*
- Replace the existing airport signs on the east and west approaches with MUTCD recommended airport symbol signs.*

* Responsibility of Iowa D.O.T.



Looking northeast on Wapello - an additional signal head and backplates are recommended.



U.S. 34 & U.S. 63

Figure 2-3a

IMPROVEMENTS IN BLACK

TRAFFIC SIGNAL TIMING

(Actuated/Semi-Actuated)

Intersection: U.S. 34 and U.S. 63 **Date:** _____

Controller Make: Eagle Moduvac **Model:** _____

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
Minimum Initial	8.0	6.0	8.0	7.0	7.5	7.0	5.0	6.0
Variable Initial	1.7	2.5	1.9	2.1	1.6	1.8	1.8	1.8
Unit Extension	15.0	6.0	12.0	10.0	5.0	5.0	5.0	5.0
Extension Limit	27.0	35.0	35.0	25.0	35.0	40.0	40.0	25.0
Clearance	4.0	4.0	3.5	3.5	4.0	4.0	3.5	3.5
All-Red	1.0	1.0	1.5	1.5	1.0	1.0	1.5	1.5
Recall/Detector	On	Off	On	On	Off	Off	Off	Off
Walk								
Ped. Clearance								

Figure 2-3b

2.4.2 U.S. 63, Bryan Road, and North Court Street

Physical Features and Traffic Control: U.S. 63 is intersected by Bryan Road from the west and North Court from the east at this location. North Court is classified as a minor arterial and Bryan Road is not classified. U.S. 63 is a 4-lane divided roadway with 12 foot lanes and a 4 foot raised median. No left turn bays are provided. The North Court approach is approximately 70 feet wide at the intersection with a narrow, raised median. A one-way frontage road parallels U.S. 63 to the east and is accessed from the highway 70 feet north of the intersection. A connection to the frontage road from North Court is also provided. Bryan Road parallels U.S. 63 to the west and turns sharply to intersect the highway. There are no pavement markings on the Bryan Road and North Court approaches. Night time lighting is provided by a single luminaire located on the northeast corner.

This is a signalized intersection with vehicle detectors located on all approaches to provide full actuation. The signals are mounted on mast-arms without backplates. Signals for the U.S. 63 approaches are comprised of 12 inch red and amber circular indications and 12 inch green arrows as shown on the intersection diagram. Pedestrian actuated signals are currently provided on the north approach to assist pedestrians in crossing U.S. 63. During three visits to the intersection, the Consultant observed no one using the pedestrian signals, which could be due to the absence of sidewalks near the intersection or a lack of pedestrian traffic. The City should install sidewalks if pedestrian demand exists or is expected to grow, but should remove the pedestrian signals if that is not the case as they unnecessarily complicate the traffic signals.

As noted earlier, there are no left turn bays on U.S. 63, but a lagging left turn phase is utilized to clear the inside lanes of vehicles waiting to turn left during the through phase. The left turn phase is actuated by the presence of a stopped vehicle in the median lane of U.S. 63 during the through phase. Stop lines and signs informing motorists where to stop to activate the left turn phase have been installed on the north and south approaches. This arrangement is very unsafe because it requires left turning vehicles to remain stopped in a through lane while other traffic approaches from behind at highway speeds. In addition, it greatly reduces the traffic carrying capacity of U.S. 63 by limiting through traffic to a single lane in each direction.

The clearance intervals now in use consist of a 5 or 5.5 second amber indication. To discourage drivers from using the amber as additional green time, the amber times should be reduced to 3 or 3.5 seconds with a 2 second all-red interval. This would insure better clearance of the intersection before a conflicting traffic movement is given the green signal.

Traffic Volumes: U.S. 63 is heavily travelled with a two-way daily traffic volume of over 10,000 vehicles, and North Court is a major north-south through street that is accessed from south bound U.S. 63 at this intersection by a significant amount of traffic. A peak hour turning movement count taken in September, 1980, indicates a peak period entering volume of over 1600 vehicles. Of that volume, left turns from south bound U.S. 63 comprise 275 vehicles, making it the most critical turning movement. North and south bound through traffic on U.S. 63 amounts to approximately 350 and 600 vehicles respectively during the peak hour.

Accident Patterns: During the study period, 24 accidents were reported at this intersection. Over 89% of all involved vehicles were either north or south bound on U.S. 63, where the recurring accident types were rear end and left turn collisions. Rear end collisions on U.S. 63 are a result of left turning vehicles stopped on the highway during the through green phase. Nine accidents of this kind occurred during the three-year period. Left turn collisions are frequent here because through traffic often cannot see left turning vehicles and vice versa.

To mitigate the existing potential for accidents, construction of left turn bays on U.S. 63 is recommended as an ultimate improvement to this intersection. An immediate improvement in operational safety can be made, however, by revising the signal phasing to eliminate the lagging left turn arrow on U.S. 63. In addition, the north-south phase length should be extended and split to provide a leading interval for the north approach. During this interval, the north approach would be given green ball and left turn arrow indications. A clearance interval for the left turn movement (amber arrow indication) should follow, before the south approach is given a green ball indication. Combined north and south through and right turn movements with yielding left turns would be allowed for the remainder of the phase.

This phasing arrangement does not provide a protected interval for left turns from the south approach. These left turns only account for around 10 vehicles during the P.M. peak hour and should be accommodated easily by gaps in south bound traffic and by the north-south clearance interval.

The proposed signal phasing and timing shown in Figure 2-4c is based on a peak hour capacity analysis of the intersection; however, field adjustments should be made as needed to provide adequate overall operation. In addition, special signing should be posted on the U.S. 63 approaches to inform and guide drivers. This signing should consist of "Left Turns On Green Ball Must Yield To Opposing Traffic" signs on the north and south approaches and a "Special Signal - Wait For Your Green" sign on the south approach.

It should be emphasized that although the recommended signal phasing will reduce the occurrence of stopped left turning vehicles on U.S. 63, it will not eliminate the situation. Should left turn and rear end collisions continue to increase in number, consideration should be given to three-phase signal operation, whereby the north and south approaches would be given separate phases. Although it would eliminate the conflict between left turning vehicles and through traffic, three-phase operation would increase overall delay to motorists and reduce the intersection level of service.

PRIORITY 1

- Revise the signal phasing and clearance interval timing.
- Sign the frontage road exit on U.S. 63.*
- Install stop lines and lane striping on the Bryan Road and North Court approaches.
- Install pavement markings and lane assignment signs on North Court Street

- Install a "Left Turns On Green Ball Must Yield To Opposing Traffic" signs on the north and south approaches as shown on the improvement diagram.

- Install a "Special Signal - Wait For Your Green" sign on the south approach.

- Repaint the lane lines on U.S. 63.*

PRIORITY 2

- Close the median opening on the North Court Street approach.

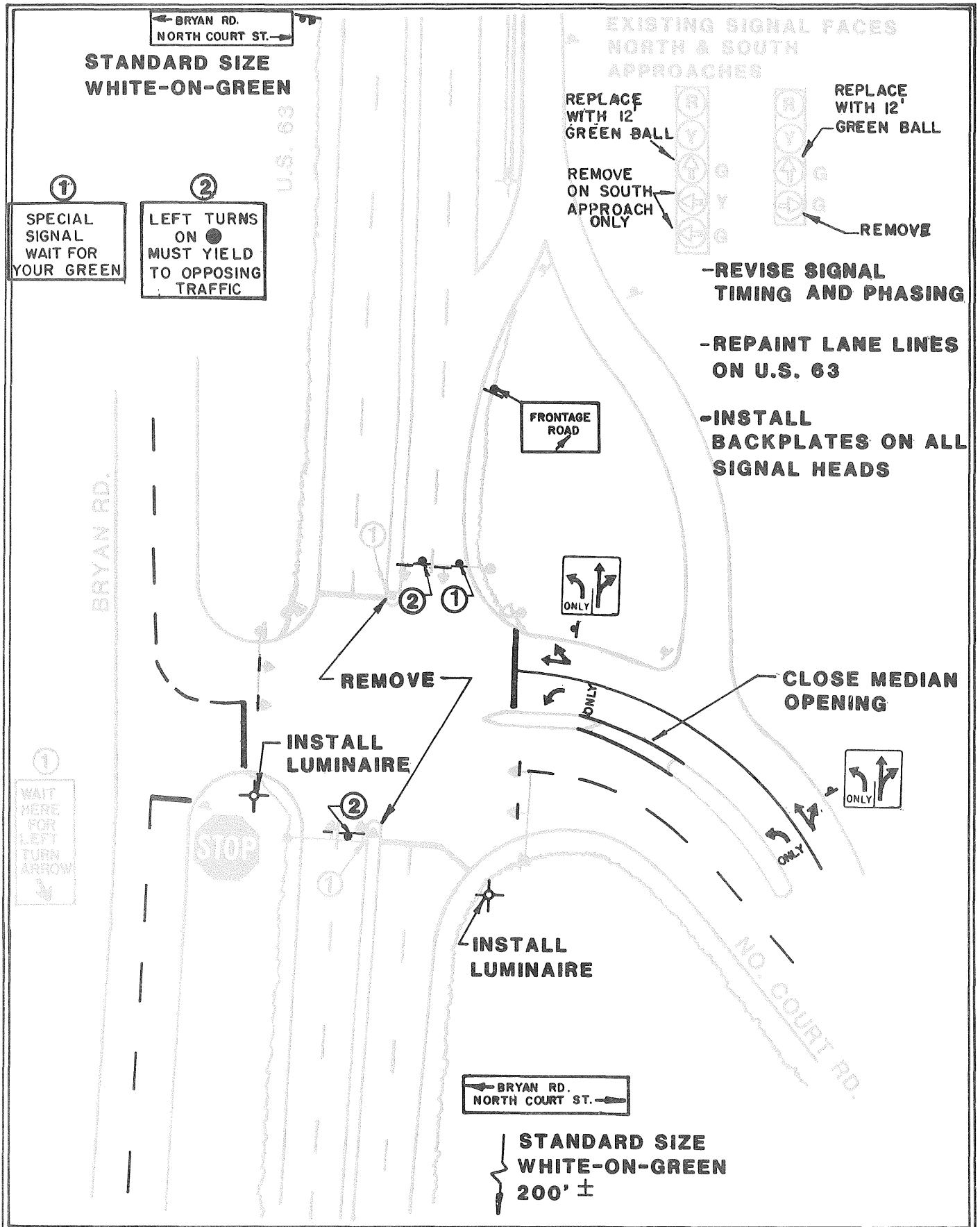
- Install backplates on all overhead signals.*

PRIORITY 3

- Construct left turn bays on U.S. 63.*

- Install an additional luminaire on the southeast and southwest corners.*

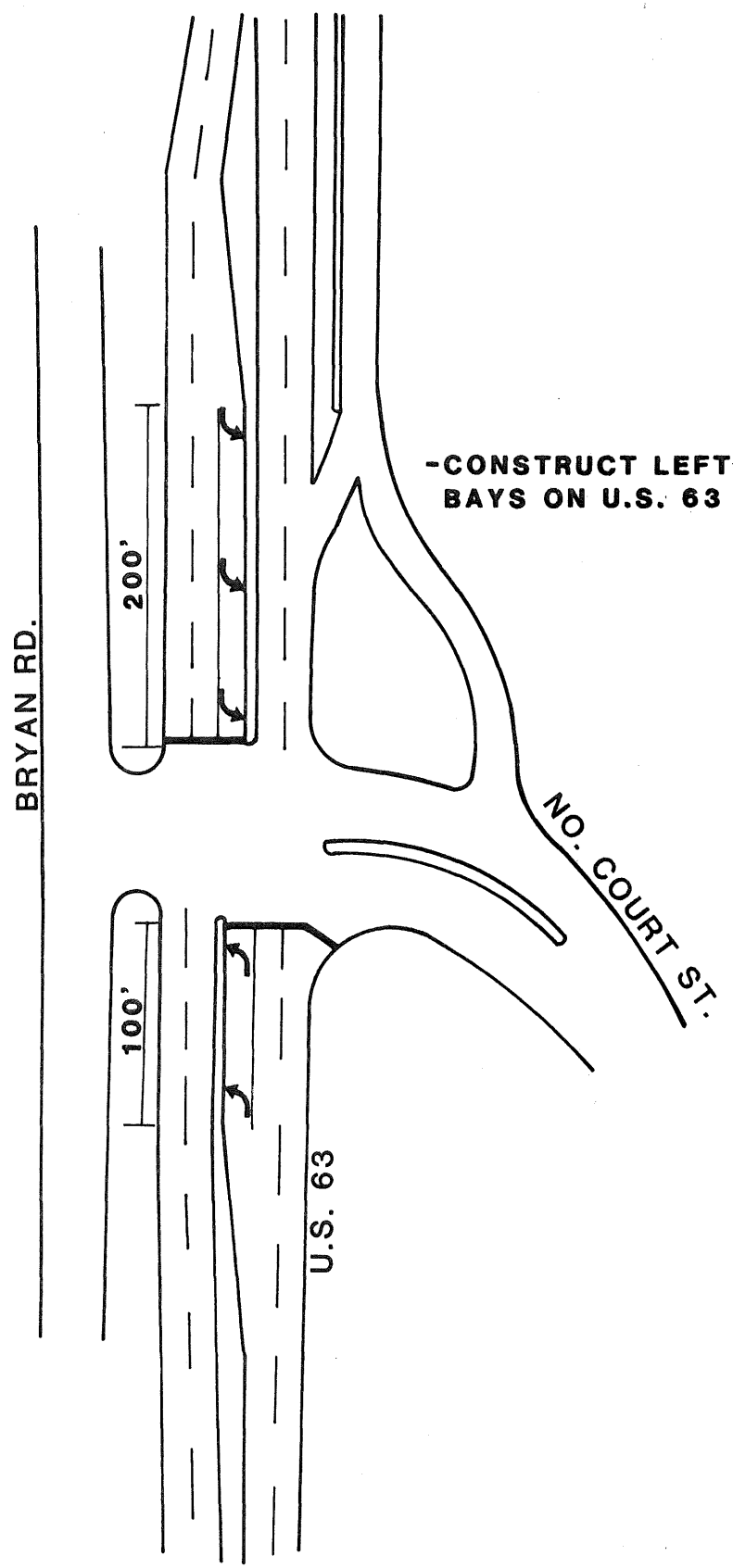
* Responsibility of Iowa D.O.T.



U.S. 63, BRYAN ROAD, & NORTH COURT STREET

IMPROVEMENTS IN BLACK

Figure 2-4a



U.S. 63,BRYAN RD., & NO. COURT STREET

IMPROVEMENTS IN BLACK

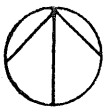
Figure 2-4b

TRAFFIC SIGNAL TIMING

(Actuated/Semi-Actuated)

Intersection: U.S. G3, Bryan Rd. and N. Court Street **Date:** _____

Controller Make: Eagle Moduvac **Model:** _____



	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
Minimum Initial	5.0		14.0					
Variable Initial	1.0	2.0	1.6					
Unit Extension	5.0	13.0	9.5					
Extension Limit	15.0	20.0	20.0					
Clearance	4.0	3.5	3.5					
All-Red	-	1.0	1.0					
Recall/Detector	Presence	On	On	Off				
Walk				7.0				
Ped. Clearance				18.0				

Figure 2-4c

2.4.3 U.S. 63, McLean Street, and Woodland Avenue

Physical Features and Traffic Control: As the intersection diagram shows, U.S. 63 is intersected at an acute angle by McLean Street and Woodland Avenue. U.S. 63 and Woodland Avenue are classified as a rural principal arterial and a minor arterial respectively, while McLean Street is unclassified. Again, at this location, U.S. 63 has no protected left turn bays. The McLean and Woodland approaches have a through lane and a left turn lane.

Traffic is controlled at this intersection by traffic signals which are mounted on mast-arms for the U.S. 63 approaches and on pedestals for McLean and Woodland. Due to the width of U.S. 63 and the intersection skew, signals for Woodland and McLean are located 100 to 130 feet from the stop line. MUTCD guidelines state that, where at all practical, at least one signal face for each approach must be located between 40 and 120 feet from the stop line. Although the existing signal placement does comply, the installation of mast-arms is recommended for Woodland and McLean.

The signals are fully actuated and two-phase operation is currently in use. Clearance times at this intersection are 8.5 seconds for the Woodland and McLean approaches and 9 seconds for U.S. 63, both of which include an all-red phase. These intervals should be shortened to 6 seconds, with a 4 second amber and a 2 second all-red. Pedestrian actuated signals are located on the south approach of U.S. 63, however, a crosswalk should be installed to inform motorists of the crossing.

Stop lines are painted on the Woodland and McLean approaches, but are placed excessively close to the intersection and should be relocated as shown on the improvement diagram. Existing pavement arrows located 150 feet in advance of the intersection on Woodland and McLean should be removed and conforming arrows installed as shown.

Traffic Volumes: A 1977 traffic count at this location indicates a daily two-way volume of over 11,000 vehicles on U.S. 63 and 3,000 and 4,000 vehicles on McLean and Woodland respectively. Left turn movements on U.S. 63 account for only 6% of the south approach traffic and 2% of the north approach traffic.

Accident Patterns: All of the 14 accidents reported for the 1976-78 period involved only north bound or south bound traffic. The most frequent accident type involved south bound, left turning vehicles on U.S. 63 which were struck by north bound vehicles. This single type of collision accounted for 28% of the total. The available accident data does not clearly indicate what the left turn collisions were caused by. Speeding north bound traffic combined with somewhat limited sight distance on the south approach may have been contributing factors. If that is the problem, the best solution would be construction of left turn bays and use of a left turn signal phase. However, those measures will not be warranted unless turning volumes increase substantially. In the meantime, speed enforcement on U.S. 63 and implementation of the recommended clearance time revisions should decrease the potential for left turn collisions. If left turn accidents do increase markedly, the north and south approaches should be given separate signal phases.

Recommendations:

PRIORITY 1

- Speed enforcement on U.S. 63
- Revise the signal clearance intervals as shown on the timing plan.
- Install a crosswalk on the south approach.
- Remove the existing pavement arrows on McLean and Woodland and install conforming arrows and lane assignment signs as shown.
- Repaint the lane lines on U.S. 63.*
- Install standard size, white-on-green street name signs 150 feet in advance of the intersection on U.S. 63.*

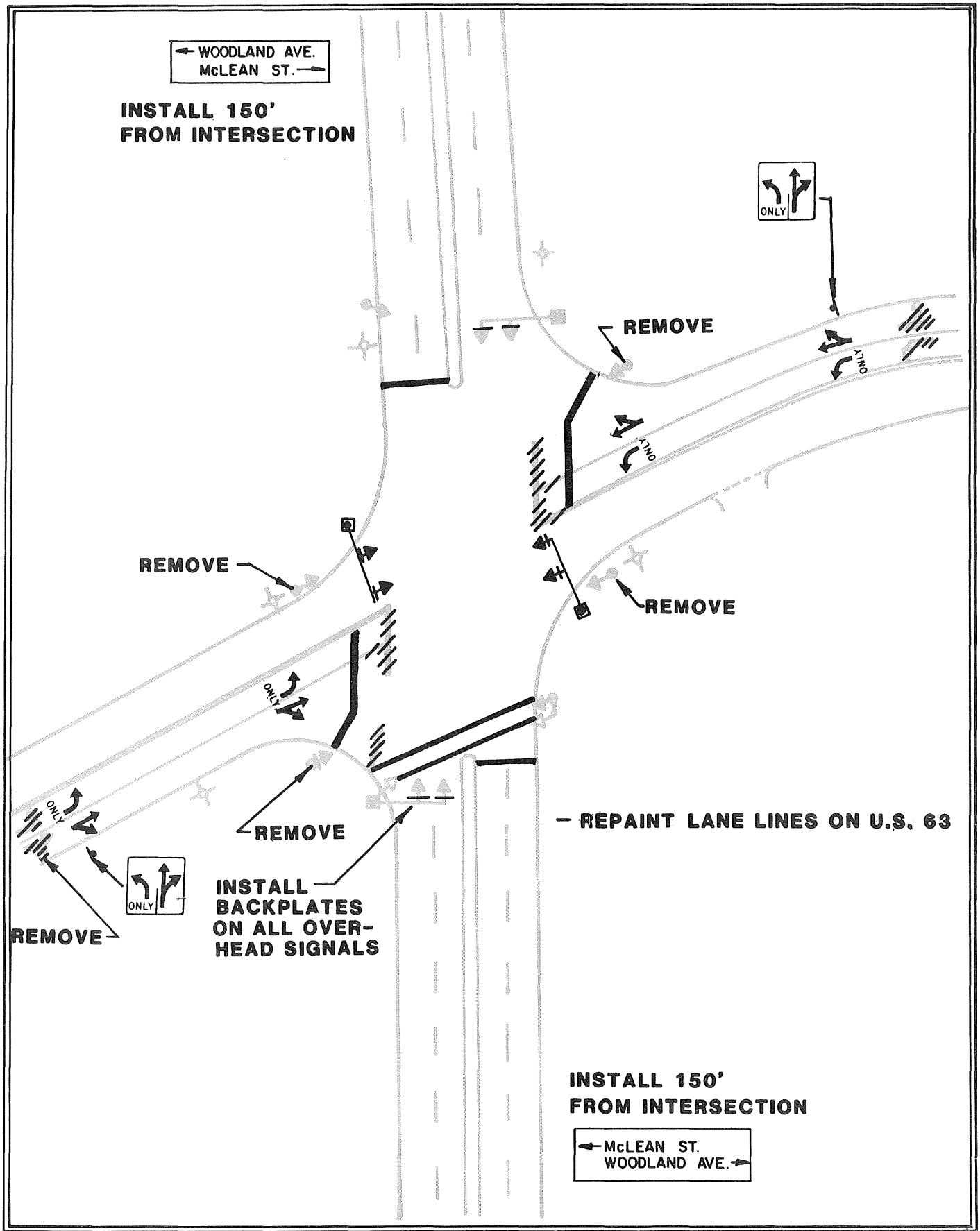
PRIORITY 2

- Install backplates on all overhead signals.*

PRIORITY 3

- Install mast-arms for the McLean and Woodland approaches.*

* Responsibility of Iowa D.O.T.



U.S. 63, McLEAN STREET & WOODLAND AVENUE

IMPROVEMENTS IN BLACK

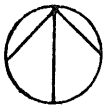
Figure 2-5a

TRAFFIC SIGNAL TIMING

(Actuated/Semi-Actuated)

Intersection: U.S. 63, McLean St. Woodland Avenue **Date:** _____

Controller Make: Eagle **Model:** _____



	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
Minimum Initial	10.0	14.0						
Variable Initial	2.0	1.5						
Unit Extension	2.2	2.5						
Extension Limit	21.0	20.0						
Clearance	4.0	3.5						
All-Red	1.5	1.5						
Recall/Detector	On	On	Off					
Walk			7.0					
Ped. Clearance			17.0					

Figure 2-5b

2.4.4 U.S. 34 and Quincy Avenue

Physical Features and Traffic Control: U.S. 34 is a four-lane divided highway with a 40 foot wide grass median. It is classified as a rural principal arterial. Quincy Avenue is a 2-lane collector that intersects U.S. 34 from the north and south. Despite the slight grade on the Quincy approaches, there is a sufficient sight distance at this intersection. Traffic volume counts indicate that U.S. 34 carries approximately 1100 vehicles per day north of U.S. 34 and 2000 vehicles per day south of U.S. 34. No volumes wer available for U.S. 34.

Traffic is controlled by Stop signs on Quincy Avenue while no control is imposed on U.S. 34. Yield signs are located on the median for vehicles turning left across the median from Quincy and One Way signs are currently placed above the Stop and Yield signs. The One Way signs should be removed and 18" x 24" Divided Highway signs should be installed beneath the Stop signs. Black-on-white Quincy Avenue signs that are located at the intersection on U.S. 34 should be replaced by white-on-green signs placed 150 feet in advance of the intersection.

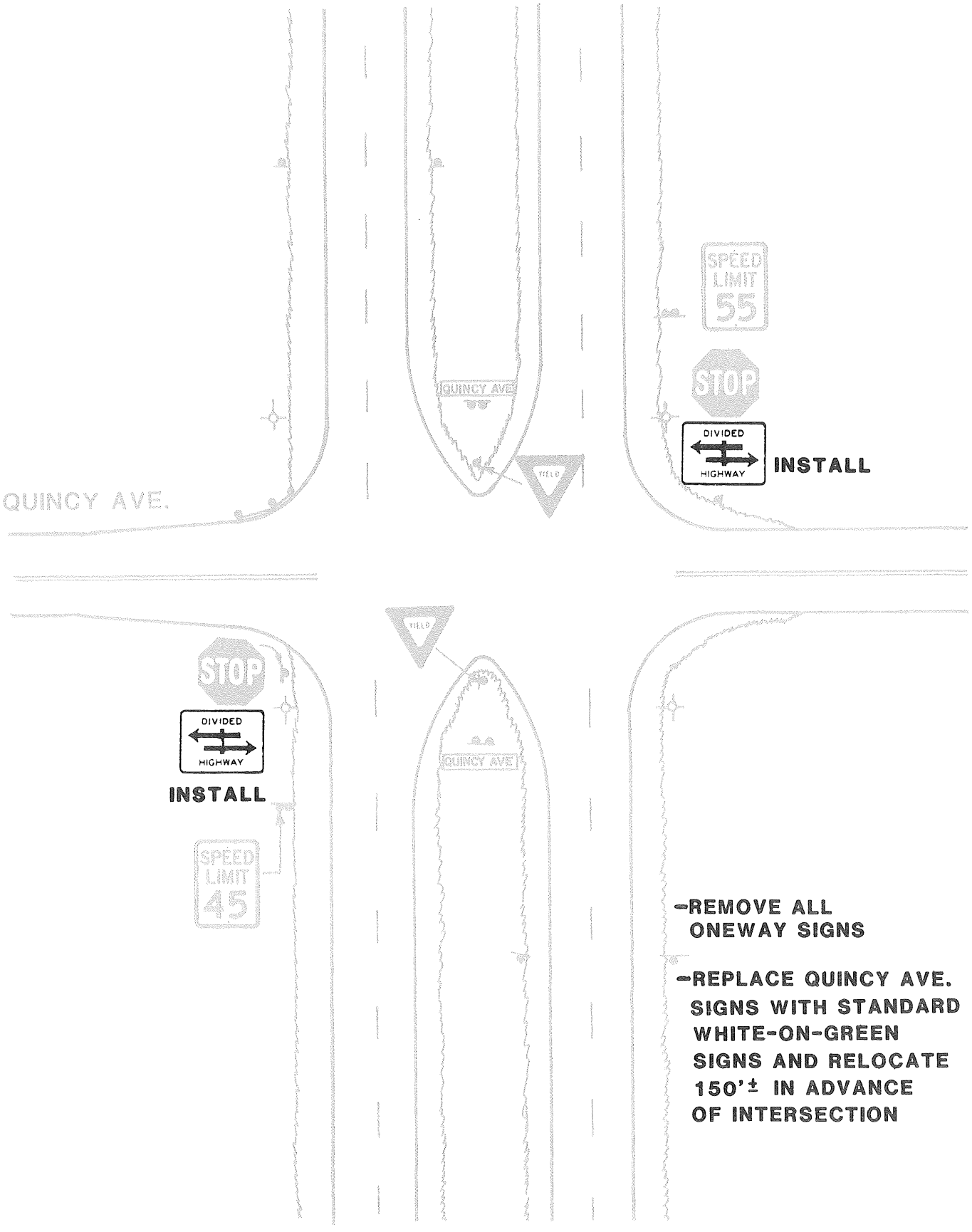
Accident Patterns: Of the five accidents reported at this location, three were cross traffic collisions, and one each were left turn and rear end collisions. Two of the cross traffic collisions involved east bound vehicles on U.S. 34 and north bound vehicles on Quincy. Both occurred in midafternoon during the month of August, which suggests a bright sun may have hindered motorists on Quincy in seeing east bound traffic. The single rear end collision on U.S. 34 may have been a result of too little advance warning of the Quincy Avenue intersection or excessive speed.

Recommendations:

PRIORITY 1

- Remove the existing One Way signs and install divided highway (R6-3) signs beneath the Stop signs on Quincy Avenue.*
- Replace the Quincy Avenue street name signs with standard size, white-on-green signs and relocate them 150 feet in advance of the intersection.*

* Responsibility of Iowa D.O.T.



U.S. 34 & QUINCY AVENUE

IMPROVEMENTS IN BLACK

Figure 2-6

2.4.5 Marion Street and Second Street

Physical Features and Traffic Control: Second Street, a two-lane, one-way facility, is also designated west bound Iowa Route 23. The intersection with Marion Street is located in Ottumwa's central business district (CBD). Second Street is classified as a minor arterial and Marion Street is classified as a rural minor arterial.

Currently, traffic is controlled by Stop signs on Marion Street. The existing Stop signs are 24 inch signs, however, 30 inch signs are recommended to increase motorist perception. Back-to-back One Way signs are located on unused traffic signal poles on the southwest and northeast corners. The placement of these signs does not conform to MUTCD standards and they should be relocated on the opposite corners above the Stop signs. Metered parking is provided on the east approach of Second Street and on the west side of the Marion Street south of the intersection. The north approach includes 10 foot wide parking lanes on both sides where 2-hour parking is permitted.

Accident Patterns: During the three year study period, 22 accidents were recorded at this location. Half of those accidents were cross traffic collisions and nine involved north bound vehicles on Marion Street in collision with west bound vehicles on Second Street. This pattern is probably due to poor sight distance on Marion Street combined with an occasional motorist running the Stop sign. Sight distance on the Marion Street approaches can be improved by eliminating one parking stall on both sides of the Second Street east approach, and by relocating the north approach Stop sign to a position four feet from the sidewalk line. Relocation of the Stop sign will require that it be cantilevered over the roadway because of a power pole located near the curb.

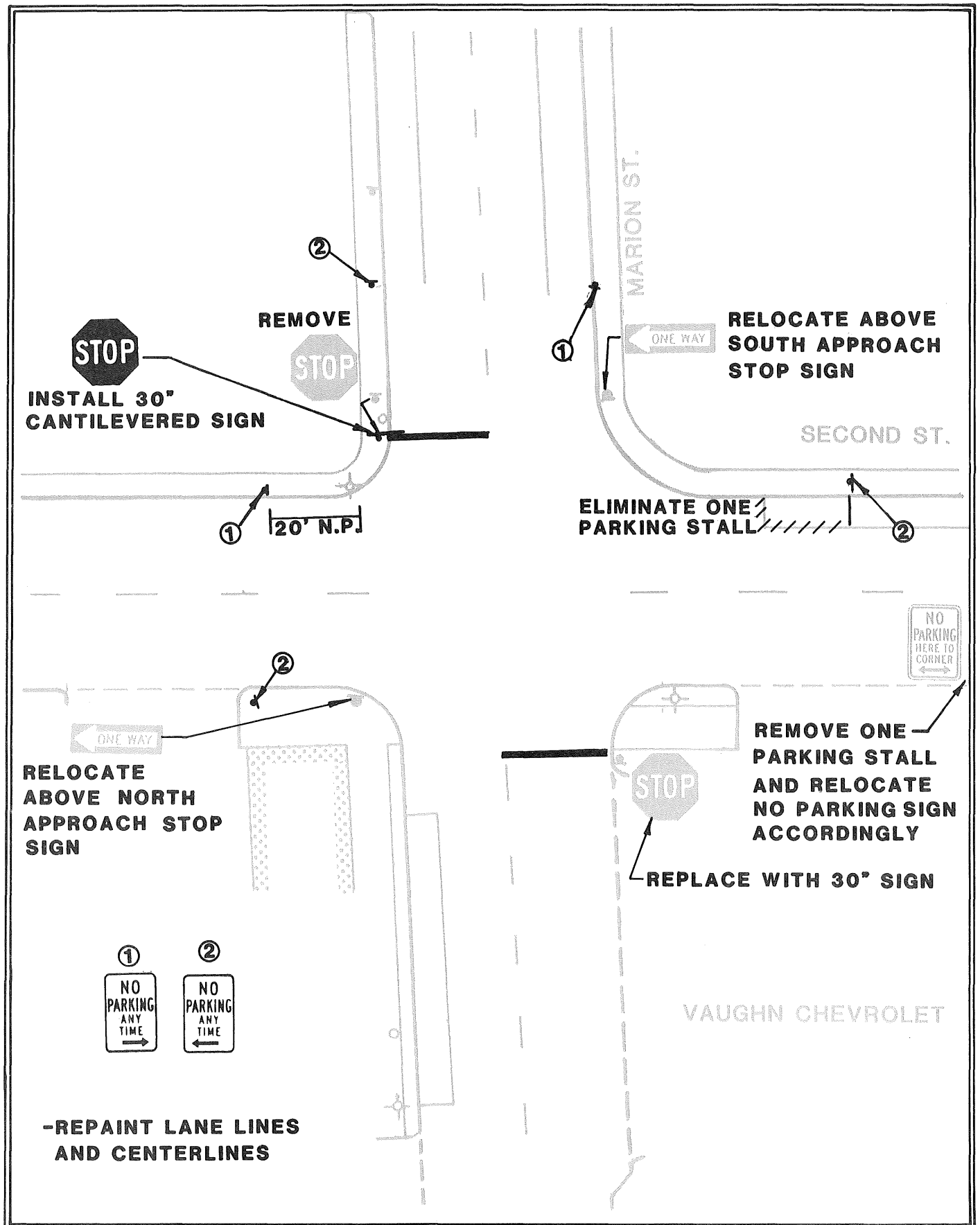
The installation of 30 inch Stop signs and stop lines on the Marion Street approaches should increase compliance with the required stop. Speed enforcement on Second Street is another recommended measure that may have a considerable effect on accidents at this intersection. If cross traffic collisions do continue, consideration should be given to reinstalling traffic signals.

Recommendations:

PRIORITY 1

- Speed enforcement on Second Street.
- Install 30 inch Stop signs on Marion Street.
- Relocate the north approach Stop sign 4 feet from the sidewalk line and cantilever it so the sign is not blocked by the power pole.
- Eliminate one parking stall on both sides of the Second Street east approach and install No Parking signs.

- Relocate the existing One Way signs to the northwest and southeast corners.
- Install stop lines on the Marion Street approaches.
- Repaint existing lane lines and center line.



MARION STREET & SECOND STREET

IMPROVEMENTS IN BLACK

Figure 2-7

2.4.6 U.S. 63 and Kitterman Avenue

Physical Features and Traffic Controls: Kitterman Avenue forms an entrance ramp to south bound U.S. 63, and provides a link with Iowa Route 23. The ramp turns 180 degrees in approaching U.S. 63 and does so on an uphill grade. Vehicles on the ramp are now required only to yield to traffic on U.S. 63, and a No Left Turn sign is posted on the north side of the ramp.

Traffic Volumes: The south bound lanes of U.S. 63 carry approximately 9,000 vehicles per day, while the daily volume on the Kitterman ramp is around 2,500 vehicles.

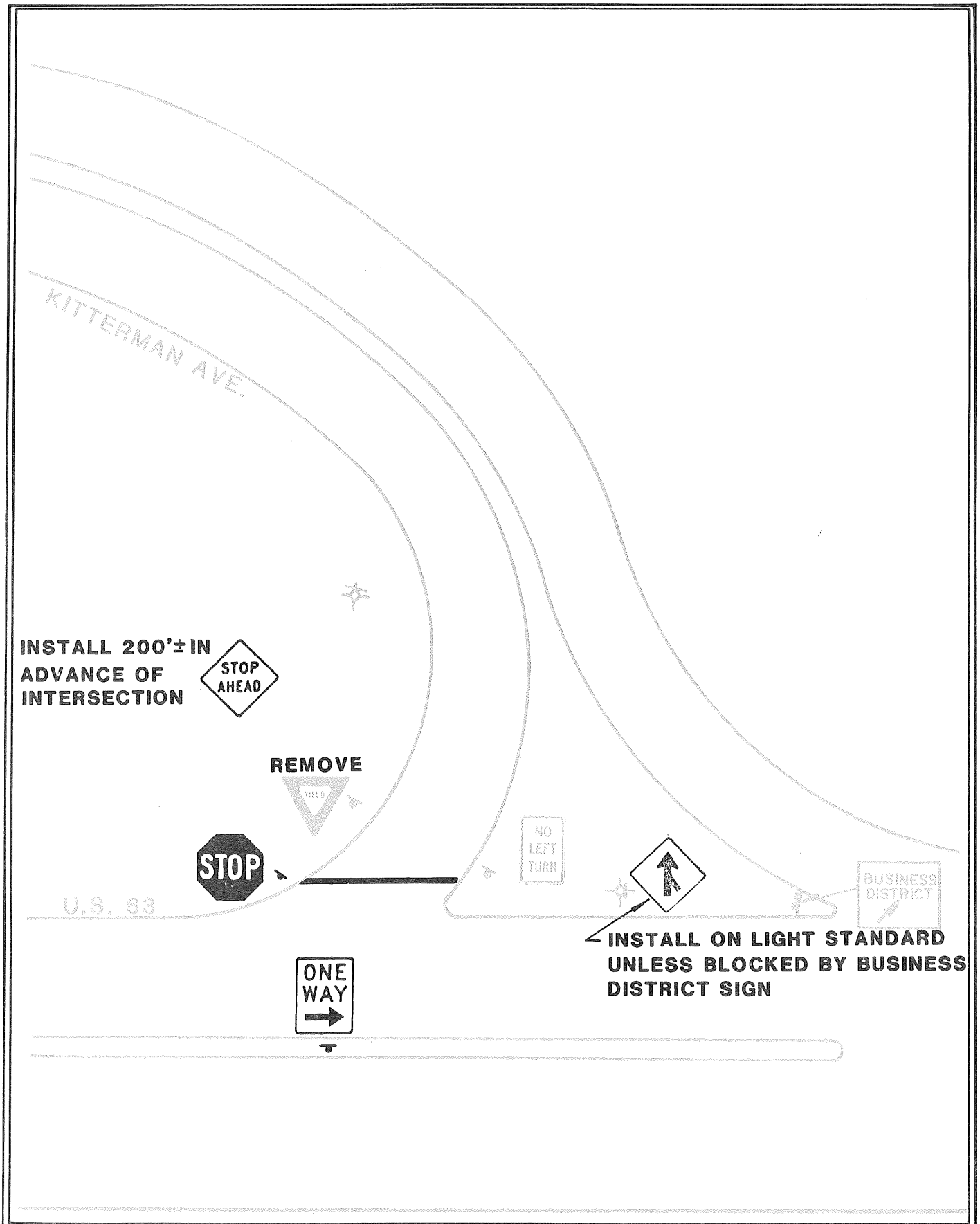
Accident Patterns: Three rear end collisions involving vehicles on the Kitterman ramp were reported during the study period. The potential for rear end accidents can be decreased by requiring all ramp traffic to stop. Because U.S. 63 traffic does not approach at high speeds, acceleration from a complete stop on the ramp will not cause unsafe merging of traffic. The Yield sign should be replaced by a Stop sign and a stop line. A Stop Ahead sign is required due to the ramp curvature and should be installed 200 feet in advance of the intersection. To warn motorists on U.S. 63 of the Kitterman ramp, a Merging Traffic sign should also be installed.

Recommendations:

PRIORITY 1

- Replace the existing Yield sign on Kitterman with a Stop sign and stop line.
- Install a Stop Ahead sign (W3-1) on Kitterman approximately 200 feet from the intersection.
- Install a Merging Traffic sign (W4-1) on U.S. 63.*
- Erect a One Way sign on the U.S. 63 median opposite the Kitterman entrance.*

* Responsibility of Iowa D.O.T.



U.S. 63 & KITTERMAN AVENUE

IMPROVEMENTS IN BLACK

Figure 2-8

2.4.7 U.S. 63 and Rochester Avenue

Physical Features and Traffic Control: U.S. 63 is intersected by Rochester Avenue, a two-lane collector, at this location. Frontage roads which parallel the highway intersect Rochester 50 feet to the east and west of U.S. 63. The Rochester approaches are 42 feet wide and U.S. 63 is a four-lane divided roadway with 12 foot lanes. All of the approaches are level with excellent sight distance. An automobile dealership and other types of strip development are located northwest of the intersection and a Target store is situated on the northeast corner.

This is the first signalized intersection encountered by south bound traffic on U.S. 63. Signal Ahead signs should therefore be posted approximately 600 feet in advance of the intersection to warn motorists. An overhead signal and a side-mounted signal, both with 12 inch indications, are provided for each approach. The signals are fully actuated with two phases. Clearance intervals of 8 seconds for U.S. 63 and 11 seconds for Rochester Avenue are much longer than necessary and should be reduced to 5 seconds and 6 seconds respectively. Although there are no stop lines painted on the Rochester approaches, signs have been posted that inform motorists where to stop to activate the vehicle detectors.

Traffic Volumes: Traffic volume counts taken at this intersection in 1977 indicate a two-way daily volume on U.S. 63 of over 10,000 vehicles. The east and west Rochester approaches carry around 3,100 and 1,700 vehicles per day respectively. The heaviest turning movements are to and from U.S. 63 and the east Rochester approach (1,400 vehicles/day) which is caused by shoppers using the stores northeast of the intersection. Left turns from U.S. 63 to the west Rochester approach are the third heaviest movement at 650 vehicles per day.

Accident Patterns: Nearly half of the 29 reported accidents at this intersection involved left turning vehicles on U.S. 63. The most frequent single type of accident occurred when a north bound left turning vehicle was struck by a south bound car. Although left turn bays should be constructed on U.S. 63, left turn accidents are most likely caused by high approach speeds on U.S. 63, where the speed limit is 45 mph, and by through traffic using the long clearance interval as extra green time. Revising the signal timing, installing backplates on overhead signals, and posting Signal Ahead signs should reduce the occurrance of left turn collisions.

The installation of an additional signal head on the U.S.63 mast-arms and two more luminaires (to supplement the existing two) are other improvements that will reduce the potential for accidents at this intersection. If, for any reason, left turn collisions increase in number, the north and south approaches should be given separate phases. Should three-phase operation be utilized, special signs such as: "Special Signal - Wait For Your Green" must be installed on U.S. 63 to avoid the motorist confusion that accompanies a leading or lagging green signal.

Recommendations:

PRIORITY 1

- Revise the clearance interval timing.
- Install Signal Ahead signs (W3-3) on U.S. 63 600 feet in advance of the intersection.*

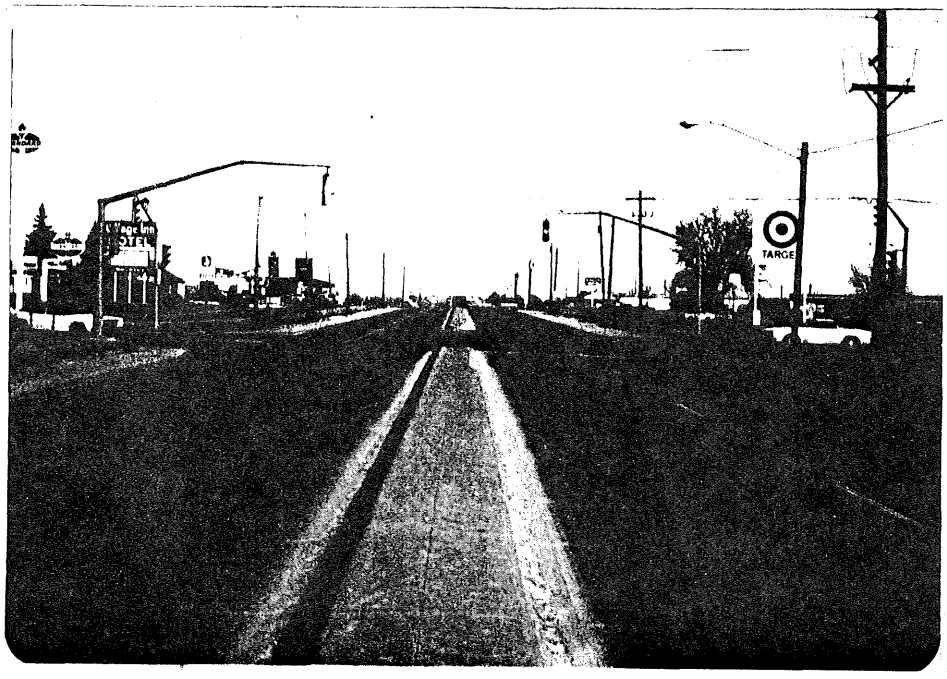
- Install backplates on the overhead signals.*
- Install stop lines on the Rochester Avenue approaches.
- Install standard size, white-on-green Rochester Avenue signs on U.S. 63 200 feet in advance of the intersection.*
- Repaint the lane lines on U.S. 63.*

PRIORITY 2

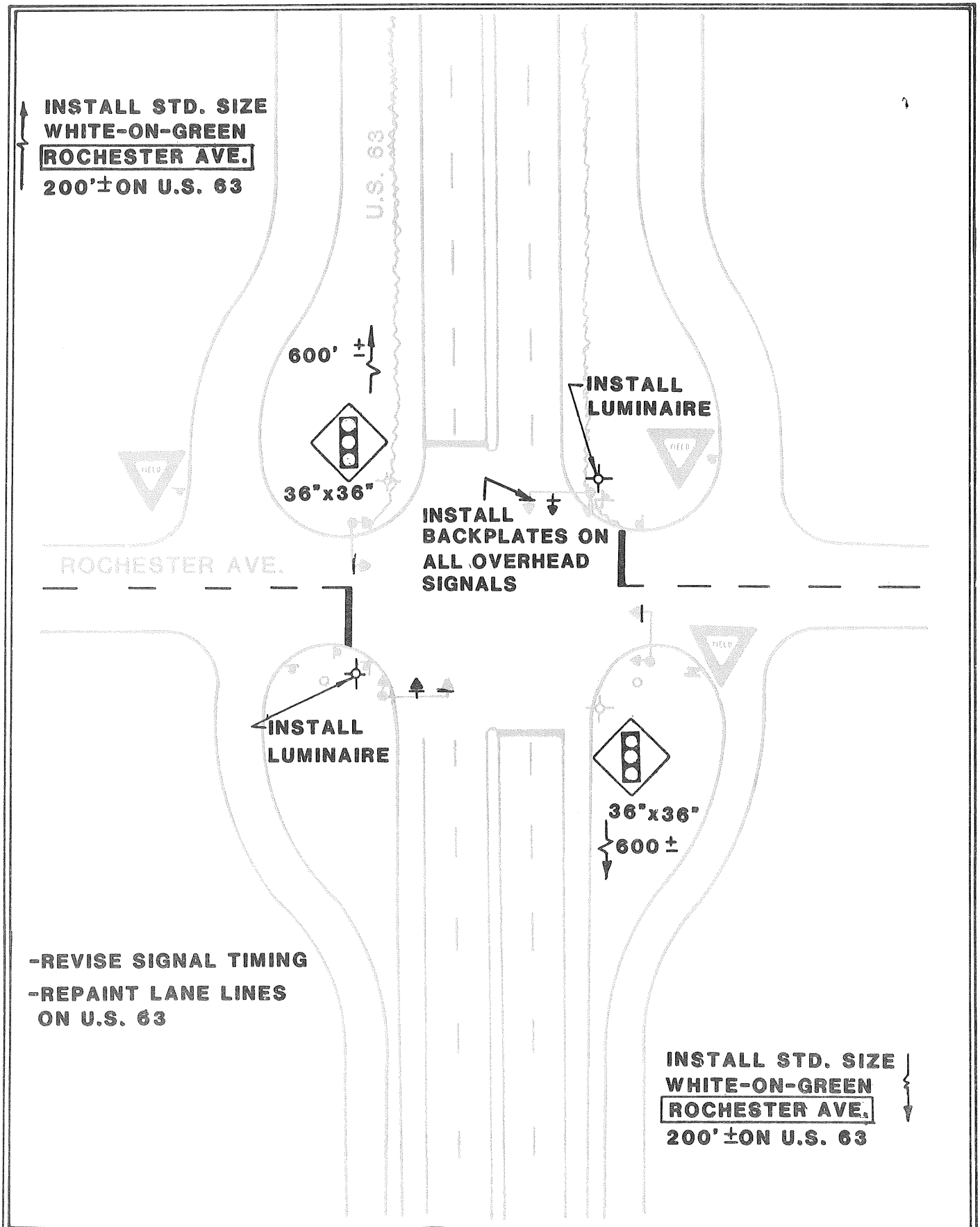
- Install an additional overhead signal on the U.S. 63 approaches.*
- Install center line striping on Rochester Avenue.

PRIORITY 3

- Construct left turn bays on U.S. 63.*
- Install an additional luminaire on the northeast and southwest corners.*



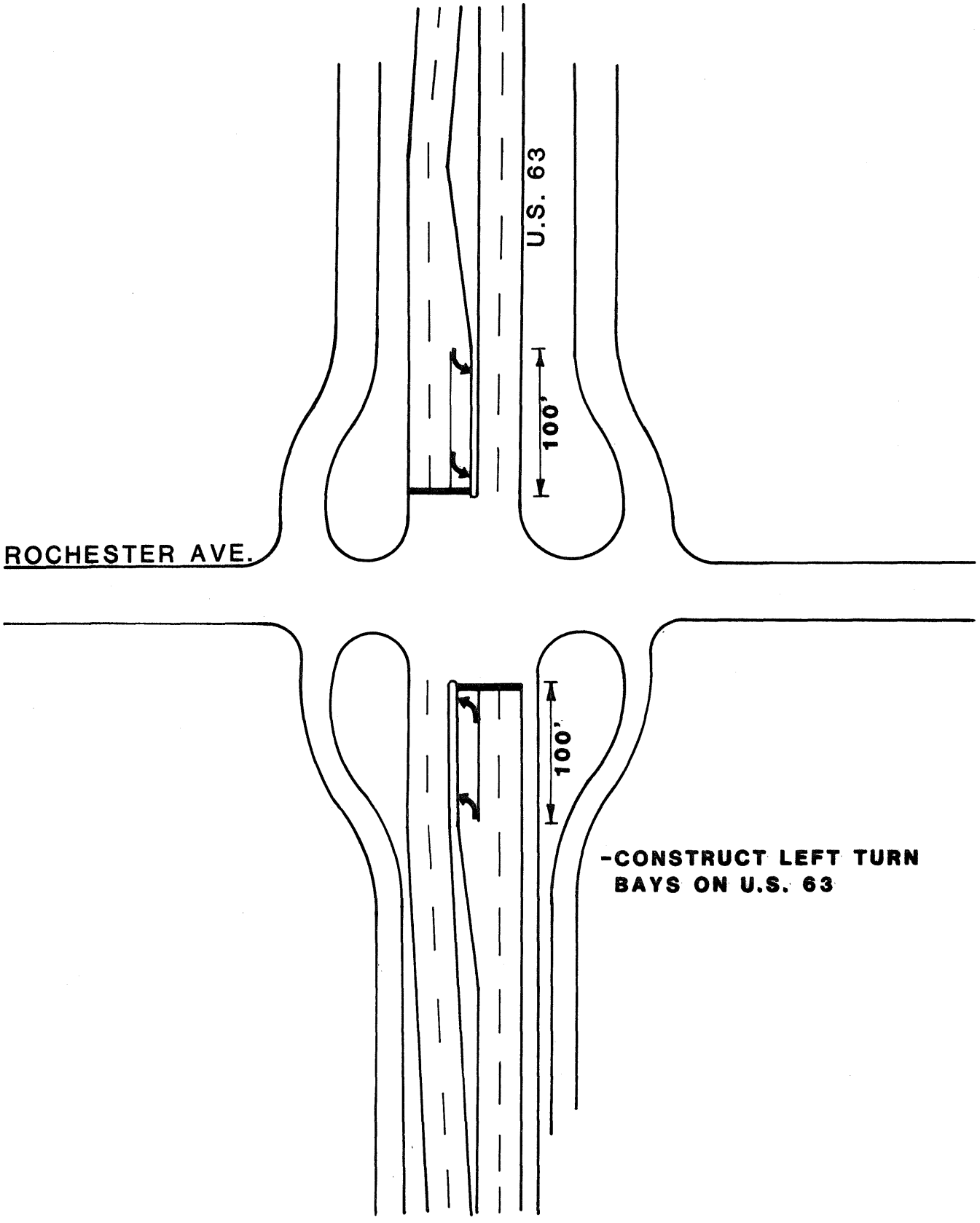
A view of the north U.S. 63 approach showing the absence of left turn bays.



U.S. 63 & ROCHESTER AVENUE

IMPROVEMENTS IN BLACK

Figure 2-9a



U.S. 63 & ROCHESTER AVENUE

Figure 2-9b

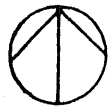
IMPROVEMENTS IN BLACK

TRAFFIC SIGNAL TIMING

(Actuated/Semi-Actuated)

Intersection: U.S. 63 and Rochester Ave. **Date:** _____

Controller Make: Eagle Moduvac **Model:** _____



	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
Minimum Initial	23.0	6.0						
Variable Initial	-	-						
Unit Extension	8.0	4.5						
Extension Limit	45.0	30.0						
Clearance	3.5	3.5						
All-Red	1.5	1.0						
Recall/Detector								
Walk								
Ped. Clearance								

Figure 2-9c

2.4.8 Church Street and Myrtle Street

Physical Features and Traffic Control: This intersection is part of the U.S. 34 & 63 and Jefferson Street interchange. Church Street, a four-lane undivided roadway is intersected by an exit ramp from U.S. 63 and Myrtle Street, a one way east bound connection to Jefferson Street. The Church Street approaches are skewed, which forces motorists to turn as they drive through the intersection. To make matters worse, the curb lanes on Church are narrow (10 feet wide or less) and should be restriped to provide 11 feet of width. Eventual reconstruction of the northwest corner is recommended to decrease the sharpness of the Church Street bend. The wooden light pole that stands less than a foot from the curb face on the west side of Church has often been sideswiped and should be relocated behind the sidewalk.

Traffic on the exit ramp is controlled by Stop signs, while no control is imposed on Church Street traffic. One Way signs on the northwest corner should be relocated above the Stop sign to reduce the sign post clutter. The route directional assembly that is also located on the northwest corner limits sight distance there and should be raised about one foot. Existing pavement arrows on the north and south approaches are adequately placed but do not meet MUTCD guidelines. They should be replaced with standard pavement markings and lane assignment signs as shown. Parking is currently permitted on the west side of Church Street south of the intersection. To improve sight distance for traffic on the exit ramp, two of those parking stalls should be eliminated.

Traffic Volumes: Church Street carries a 2-way daily volume of 8,500 to 9,000 vehicles. Daily volumes on Myrtle Street and the exit ramp are 3,200 and 1,700 vehicles respectively. Left turns from Church to Myrtle are the most frequent turning movement at over 1,500 vehicles per day. Although over 1,000 vehicles per day turn right from Church to Myrtle, north bound through traffic on Church is three times as heavy and the exclusive right turn lane on the south approach is not warranted.

Accident Patterns: Eight accidents were recorded here during the study period, and cross traffic collisions were the most frequent type of accident. Poor sight distance and the intersection geometry are contributing factors to this pattern. The recommended parking prohibition and sign adjustments should improve sight distance for drivers on the exit ramp and the lane restriping will make the intersection more comfortable to drive for motorists on Church.

Installation of Do Not Enter (R5-1), Wrong Way (R5-9) signs and pavement arrows on this exit ramp as mandated by the MUTCD (Sections 2E-23, 24) will reduce the potential for motorists mistakenly turning on to the ramp.

Recommendations:

PRIORITY 1

- Eliminate two parking stalls on the west side of Church Street south of the intersection.

- Relocate the wooden light pole on the west side of north Church Street to a position behind the sidewalk.

- Raise the route directional assembly on the northwest corner one foot to improve sight distance.

- Relocate the One Way signs on the northwest corner to the Stop sign post.

- Install Do Not Enter signs on the backs of the exit ramp Stop signs.*

- Install Do Not Enter - Wrong Way (R5-1, R5-9) signs on both sides of the exit ramp 250' from the intersection.*

- Remove all existing pavement arrows on Church Street and install conforming arrows and lane assignment signs.

- Install pavement arrows on the exit ramp as shown.

PRIORITY 2

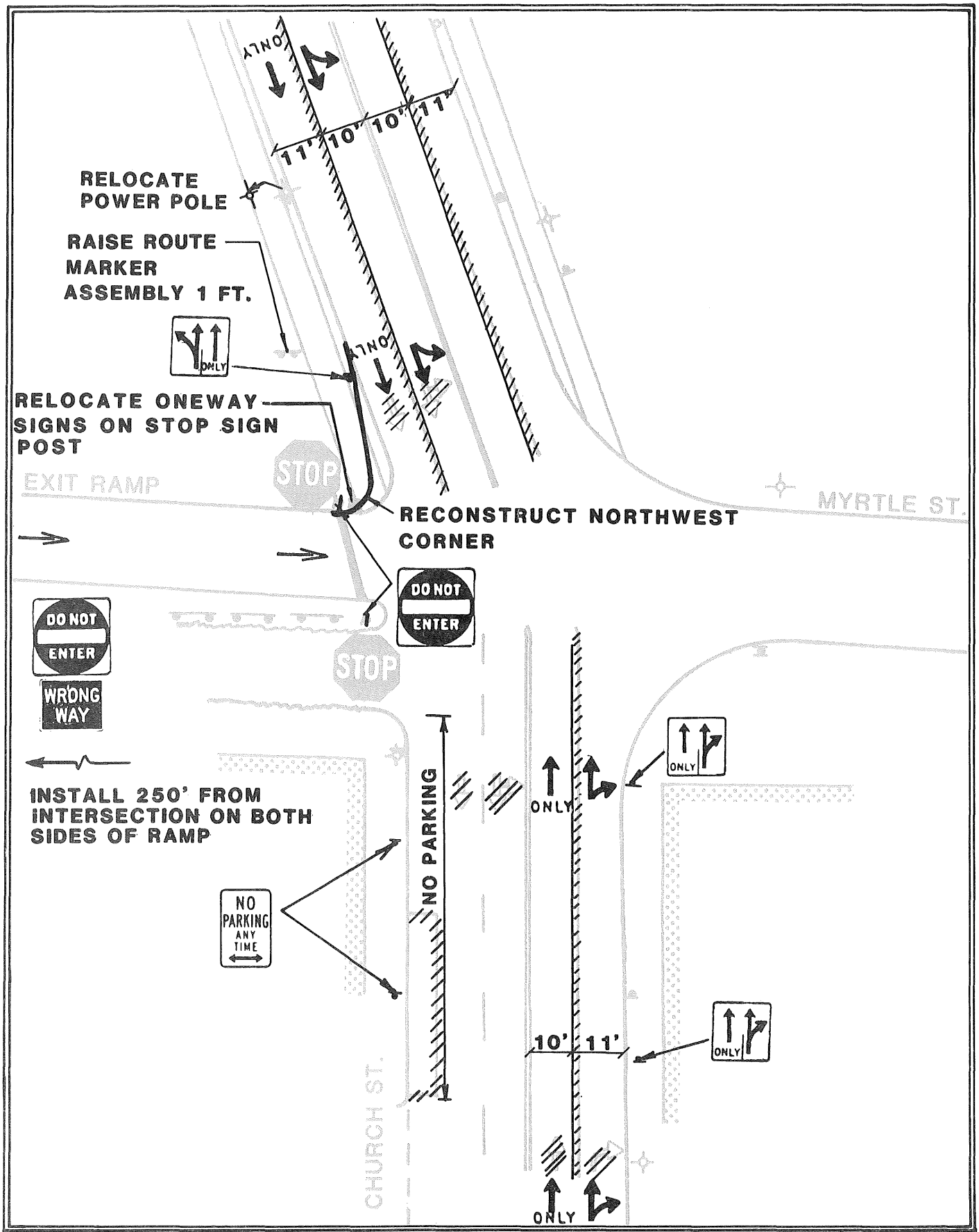
- Restripe the Church Street approaches to provide 11 foot curb lanes and 10 foot inside lanes.

PRIORITY 3

- Redesign the northwest corner radius to flatten the bend in Church Street.

* Responsibility of the Iowa D.O.T.

Looking south along Church Street.



CHURCH STREET & MYRTLE STREET

Figure 2-10

IMPROVEMENTS IN BLACK

2.4.9 McLean Street and Second Street (Iowa 23)

Physical Features and Traffic Control: This intersection is located in the western fringe area of Ottumwa's CBD, and is surrounded by small businesses. Second Street (west bound Iowa 23) is a one-way minor arterial and McLean is an unclassified two-way street. Sight distance is very limited on all approaches because of buildings on the northeast and southeast corners.

Stop signs are used to control traffic on both Second Street and McLean. The existing Stop signs are all 30" x 30", which is adequate for the McLean approaches - but 36 inch signs should be installed on Second Street, where approach speeds are higher. Sight distance on the north approach can be significantly improved if the Stop sign is relocated 4 feet south. One Way signs are currently located only on the northwest corner. To comply with MUTCD guidelines, the existing One Way signs should be relocated above the Stop sign, and additional One Way signs should be installed on the southeast corner Stop sign. Parking is prohibited on Second Street in advance of the intersection through the use of yellow painted curbs. As it is important to keep parked cars out of this area to maintain sight distance, No Parking signs should be installed to supplement the painted curbs.

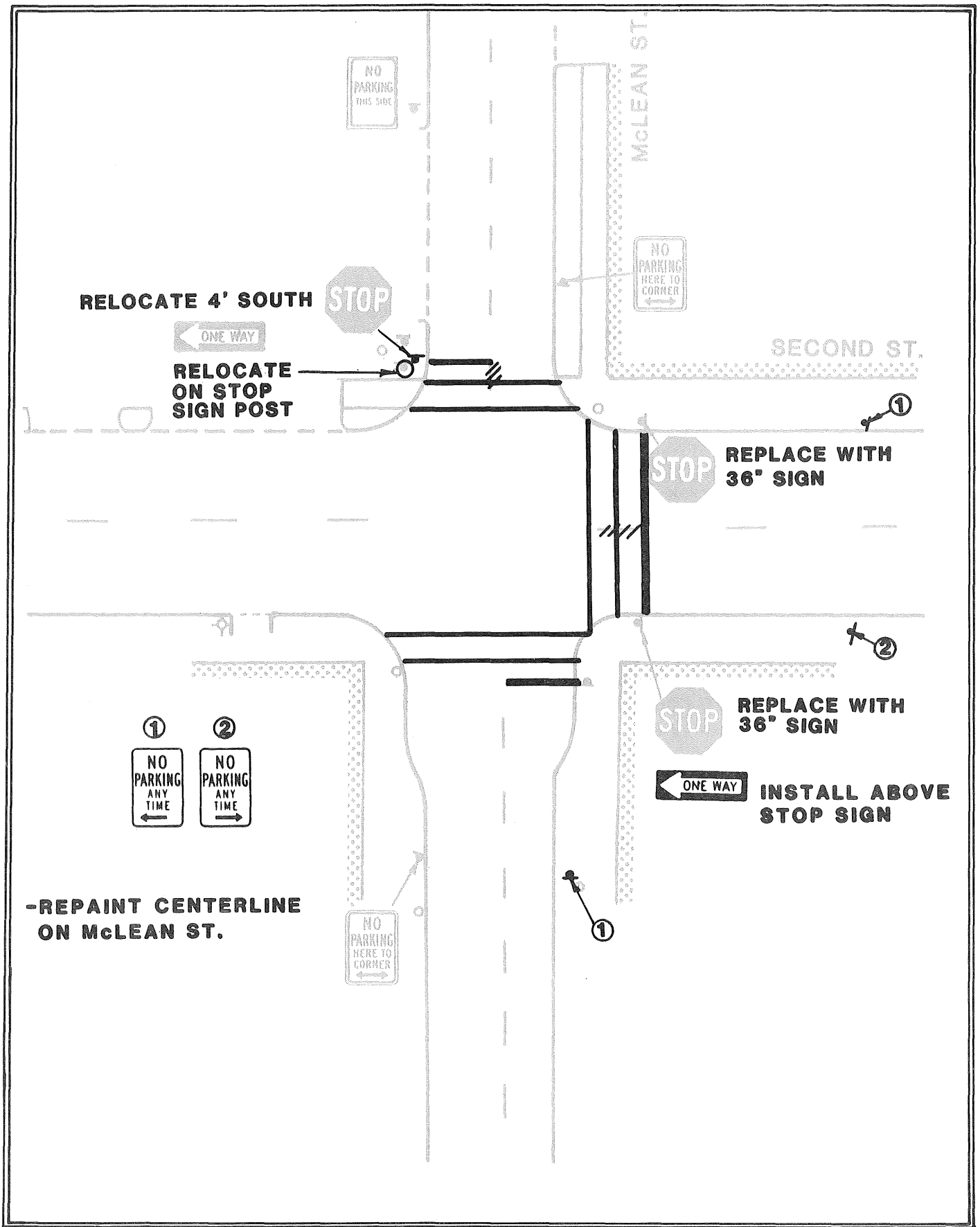
Traffic Volumes: The intersection carries over 800 entering vehicles during the peak hour, at which time through traffic on Second Street accounts for half of that volume. Right turns from Second to McLean comprise 12% of the peak hour traffic and are the heaviest turning movement. Daily traffic on Second Street ranges from 5,400 to 5,500 vehicles per day near the intersection, while McLean Street traffic varies from 2,700 to 3,300 vehicles per day.

Accident Patterns: Of 15 reported accidents at this location during the study period, 8 were cross traffic collisions. This pattern is indicative of the sight distance problem and a lack of compliance with the Stop signs on Second Street. Nearly 27% of the accidents involved personal injuries. Although one fatality did occur in 1977, the circumstances surrounding the accident do not indicate a dangerous existing condition. Should cross traffic collisions continue to occur, an all-red flashing beacon should be suspended over the intersection as is the case at several other locations in Ottumwa.

Recommendations:

PRIORITY 1

- Replace existing 30 inch Stop signs on Second Street with 36 inch signs.
- Relocate the north approach Stop sign 4 feet closer to the intersection.
- Install stop lines and crosswalks on the north, south, and east approaches.
- Relocate existing One Way signs to the north approach Stop sign and install One Way signs on the south approach Stop sign.
- Install No Parking signs to supplement the painted curbs.
- Repaint the center line on McLean Street.



McLEAN STREET & SECOND STREET

Figure 2-11

IMPROVEMENTS IN BLACK

2.4.10 Fourth Street and Ash Street

Physical Features and Traffic Control: This intersection is located adjacent to Wilson Elementary School in eastern Ottumwa. Fourth Street, a minor arterial, and Ash Street are both two-lane, two-way facilities. School crossings are currently established on the north and east approaches. Sight distance is very limited on the southeast corner due to a stone wall and the hill on which Wilson School is situated.

The traffic signals at this intersection are pedestal-mounted and controlled by a pretimed controller. Button-activated pedestrian signals are provided on all approaches. The existing signals were installed in 1974 when Fourth Street was widened, but were turned off early in 1978 after complaints that the pedestrian signals were being misused and that the signals were unwarranted. Stop signs were installed on the Ash Street approaches at that time. Following a traffic fatality that occurred at the intersection in July, 1978, the signals were turned back on. The pedestrian signals were not reactivated, however.

To accommodate school children, the signals are set to flash red during the morning, noon and afternoon periods of school crossing activity. A portable four-way Stop sign assembly is placed in the middle of the intersection at those times to supplement the flashing red signals and adult crossing guards are present to control pedestrians. On the day field data was collected at this intersection, the Consultant noted that the signals had not been switched to flashing red and that crossing guards were allowing school children to cross on a red light. Stop signs should not be used with operating traffic signals because it is confusing to motorists and therefore unsafe. To avoid this situation in the future and to eliminate the need for Stop signs when children are crossing, it is recommended that the pedestrian signals be reactivated and used with the traffic signals. This will result in the safest and most efficient operation of the intersection.

The signal timing at Fourth and Ash provides amber clearance intervals of 5.4 seconds for Fourth Street and 6.9 seconds for Ash Street. Although the Consultant did observe traffic on Fourth Street exceeding the 25 mph speed limit by 5 to 10 mph, the existing amber times are excessively long and actually encourage drivers to run the light. At this intersection, the amber times should be held to 3.6 seconds. Figure 2-12b is a recommended signal timing plan that includes revised amber times and pedestrian signal timing. As an additional improvement to signal operation at Fourth and Ash, it is highly recommended that the existing single dial controller be replaced with a new controller to allow for the use of all-red intervals.

Existing crosswalks at Fourth and Ash are located on the north and east approaches. A third crosswalk should be installed on the south approach and the pedestrian signals on the west approach should be removed. All stop lines need to be relocated 4 feet in advance of the crosswalks and an additional stop line on the south approach should be installed.

The Fourth Street approaches now have School Xing pavement markings in advance of the intersection. A School Crossing sign should be erected at each of the crosswalks as recommended by the MUTCD and School Speed Limit 20 signs should also be installed on the Fourth Street approaches as additional safety measures. The establishment of no parking zones where shown on the diagram is recommended to provide adequate clear zones near the intersection.

Accident Patterns: Two cross traffic collisions were reported during 1976 and 1977, both of which involved personal injuries. After the traffic signals were shut off, two additional cross traffic collisions occurred over a two week period in July, 1978. The second accident involved a west bound vehicle struck by a north bound vehicle that had run the Stop sign. The accident resulted in a fatality and the signals were reactivated. The only subsequent accidents reported in 1978 took place under icy conditions on the east Fourth Street approach.

Recommendations:

PRIORITY 1

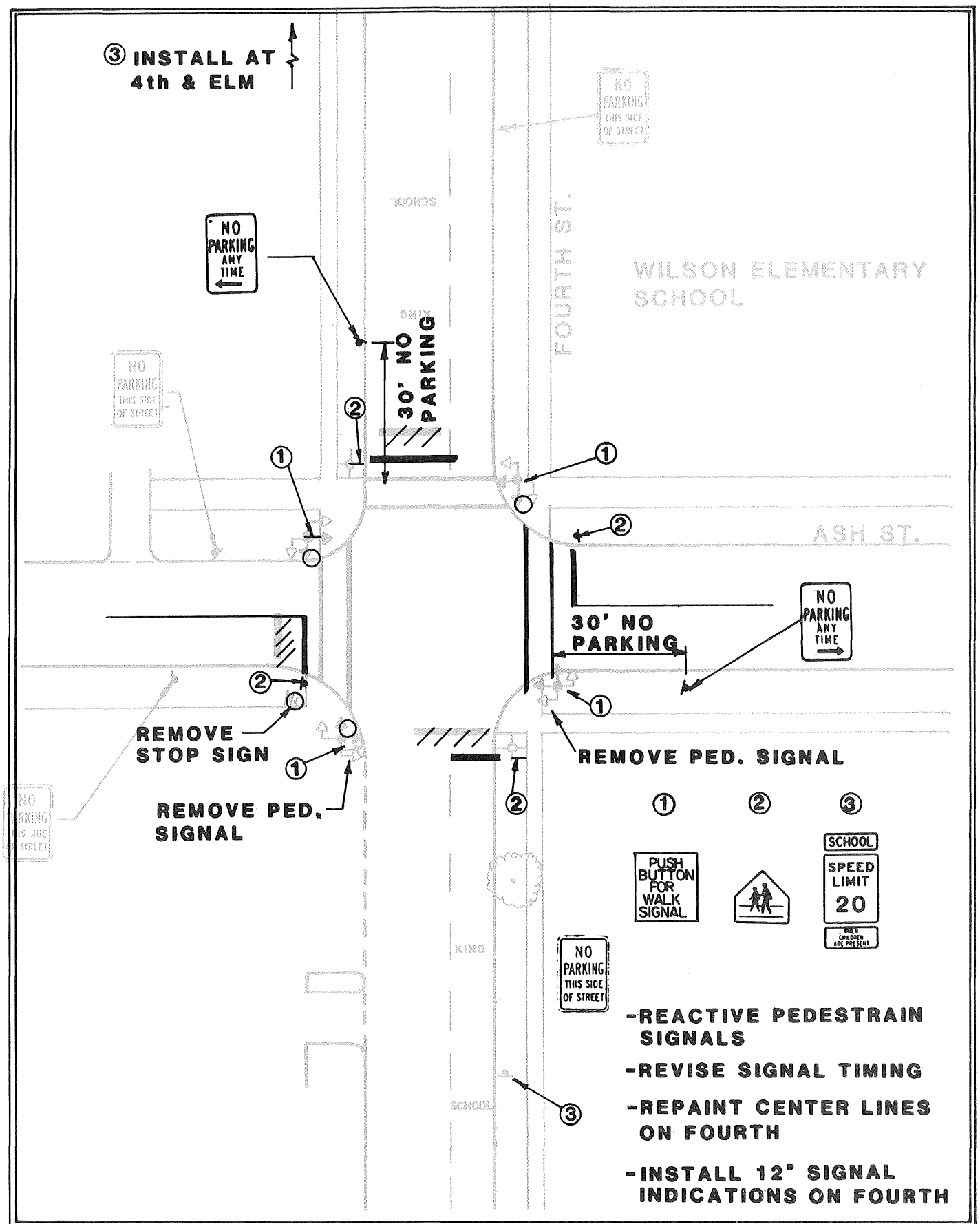
- Reactivate the pedestrian signals and remove the portable stop signs.
- Revise the clearance interval timing.
- Speed enforcement on Fourth Street.
- Remove the pedestrian signals on the west approach.
- Remove the existing stop lines and install new ones 4 feet in advance of the crosswalks.
- Install a crosswalk and stop line on the south approach.
- Install a solid center line on the Ash Street approaches.
- Erect School Crossing signs (S2-1) at all crosswalks.
- Install "Push Button For Walk Light" signs on the signal pedestals.
- Post School Speed Limit 20 signs on Fourth Street one block in advance of the school zone.
- Prohibit parking where shown on the improvement diagram.
- Repaint the existing center line on Fourth Street.

PRIORITY 2

- Install 12 inch red indications on the Fourth Street signal heads.

PRIORITY 3

- Install a new pretimed signal controller.



FOURTH STREET & ASH STREET

IMPROVEMENTS IN BLACK

Figure 2-12a

TRAFFIC SIGNAL TIMING

(Fixed Time)

Intersection: Fourth Street and Ash Street **Date:** _____

Controller Make: Eagle **Model:** _____

Phase	Dial # Cycle Length sec.			Comments
	Key Position	% of Cycle	Time of Cycle	
4th St. Grn/Walk	0	45	27.0	
4th St. Grn/FDW	45	14	8.4	
4th St. Amber/DW	59	6	3.6	
Ash St. Grn/Walk	65	14	8.4	
Ash St. Grn/FDW	79	15	9.0	
Ash St. Amber/DW	94	6	3.6	

HOURS OF OPERATION

Dial: _____ **Offset1(red):** _____ **Flashing:** _____

Offset2(yellow): _____ **Yellow:** _____

Offset3(white): _____ **Red:** _____

Figure 2-12b

2.4.11 Pennsylvania Avenue and Jefferson Street

Physical Features and Traffic Control: Pennsylvania Avenue and Jefferson Street intersect at right angles northeast of the Ottumwa CBD. Both streets are two-lane facilities and are classified as minor arterials. This intersection serves a majority of traffic enroute to the Ottumwa Hospital which is located less than a mile east on Pennsylvania Avenue.

Filling stations and a grocery store, all with wide driveway entrances, surround the intersection. The southeast corner especially suffers from a lack of definition. Extremely wide parking lot entrances and a large curb radius make the corner curbing appear to be a channelization island. City buses use this corner when turning right from Jefferson to Pennsylvania. The Consultant recommends redesign of the curb radius to 35 feet and enlarging the corner island. This would better define the intersection while still permitting buses to turn right easily.

This intersection is operated under three-way Stop sign control. A suspended beacon flashes red for the north, east, and west approaches and amber for the south approach. Traffic volumes are heavier on the south approach and vehicles are not required to stop because of the steep grade there. Center lines are painted on Jefferson Street and should be installed on Pennsylvania Avenue to separate directional traffic flow.

Traffic Volumes: Traffic volumes at Pennsylvania and Jefferson are approximately 5,900 vehicles per day (two-way) on Jefferson Street and 3,900 vehicles per day (two-way) on Pennsylvania Avenue. These volumes do not warrant consideration of four-way stop control at this intersection.

Accident Patterns: Driveway-related accidents accounted for 27% of the 15 reported accidents at this location. Seven cross traffic collisions were also recorded, most of which involved northbound vehicles on Jefferson. The frequency of cross traffic collisions is a result of three-way Stop sign control, which is inherently unsafe at four-legged intersections. The problem with a three-way stop is that drivers who are unfamiliar with the intersection do not know on which approach traffic does not stop. To eliminate that situation at Pennsylvania and Jefferson, the north approach Stop sign should be removed and the red beacon lens replaced with an amber lens. Two-way stop control should provide adequate operating efficiency and will promote safety at the intersection.

Recommendations:

PRIORITY 1

- Remove the north approach Stop sign and replace the red beacon lens with an amber lens.
- Replace the 3-Way signs below the east and west approach Stop signs with 2-Way signs.

- Relocate the east approach Stop sign 4 feet closer to the curb face for improved visibility.

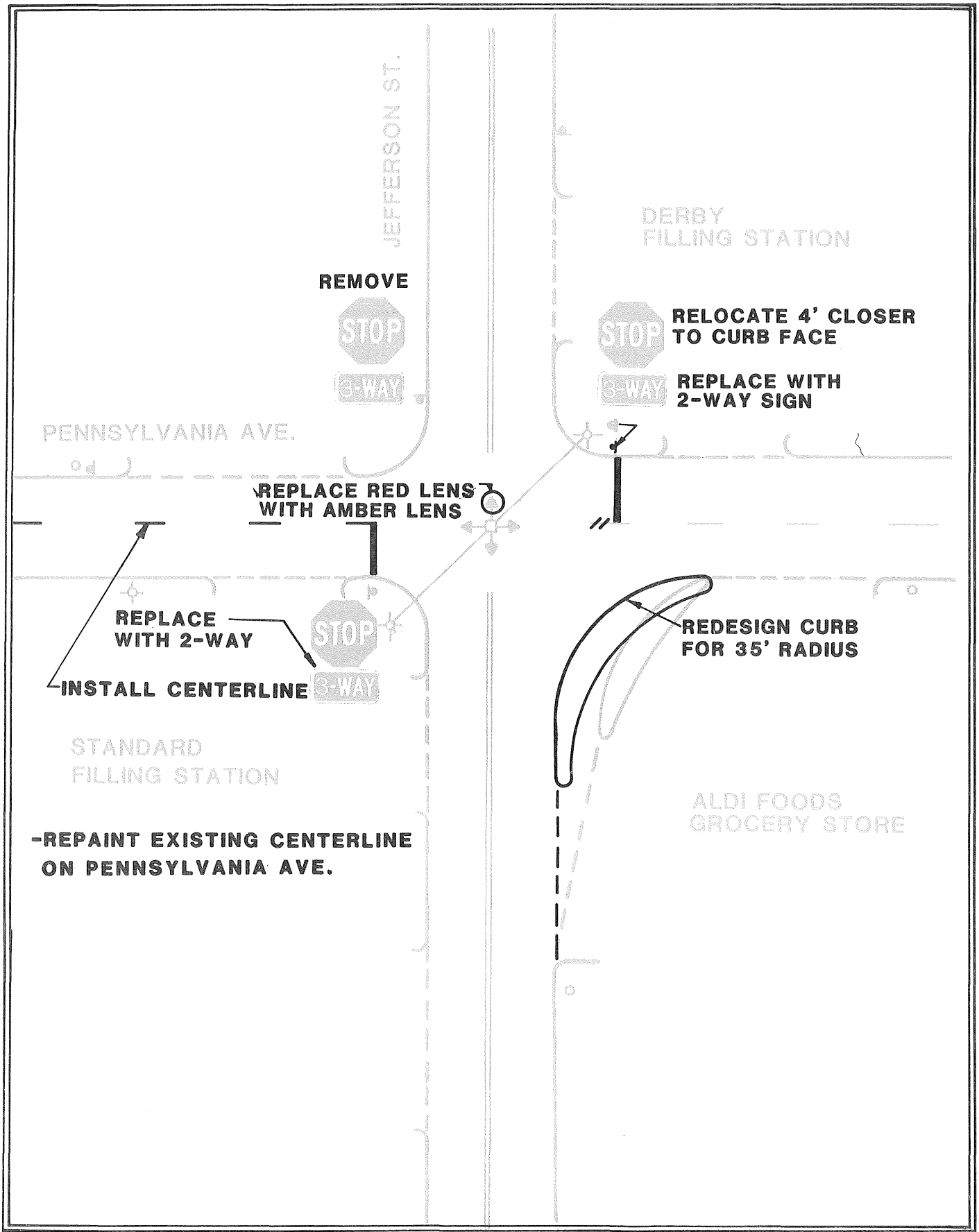
- Install stop lines and center line striping on the west Pennsylvania Avenue approach.

- Repaint the existing center lines on Jefferson and Pennsylvania.

PRIORITY 2

- Redesign the southeast corner curb radius and enlarge the corner island.

The southeast corner of Pennsylvania and Jefferson as seen from Pennsylvania Avenue.



PENNSYLVANIA AVENUE & JEFFERSON STREET

Figure 2-13

IMPROVEMENTS IN BLACK

2.4.12 Cook Avenue and Church Street

Physical Features and Traffic Control: This is a skewed intersection located 400 feet north of the Myrtle and Church intersection and is also part of the U.S. 34 & 63 and Jefferson Street interchange. Cook Avenue forms the east leg of the intersection and the west leg is an entrance ramp to U.S. 63.

Traffic on Cook Avenue is controlled by Stop signs while Church Street traffic is allowed to flow freely through the intersection. Existing lane widths on Church Street range from 9 feet to 11 feet. To provide the south bound curb lane with the 11 foot width that is necessary for smooth traffic flow, the north and south approaches should be restriped. The north approach curb lane is currently designated for right turns only and the south approach center lane is an exclusive left turn lane.

Because parallel parking is allowed north of the intersection on Church Street, it is important that north bound through traffic is restricted to the south approach curb lane. The installation of a painted median island on the north approach is recommended to insure that through traffic does not use the left turn lane. A white edge stripe can be used to guide through vehicles around parked cars on the north approach. The existing pavement arrows should be removed and replaced by standard arrows and lane assignment signs. Finally, One Way signs located on the southeast corner should be relocated above the east approach Stop sign to eliminate an unnecessary sign post.

Traffic Volumes: Traffic volume counts taken in 1977 indicate Church Street carries a daily volume of 8,500 to 9,000 vehicles. North bound and south bound through vehicles account for the heaviest traffic movements. Left turns from Cook to Church are the heaviest turning movement at over 1,100 vehicles per day. The 1977 traffic count also reveals that less than 1,000 cars per day turn right from Church to the entrance ramp, which does not warrant an exclusive right turn lane. The Consultant recommends that the south bound curb lane be redesignated for through and right turning traffic.

Accident Patterns: Of 12 reported accidents during the study period, half involved personal injuries. This suggests that the 25 mph speed limit on Church may need enforcement. Cross traffic collisions were the most frequent type of accident and indicate inadequate sight distance for drivers on Cook Avenue. To improve sight distance, the existing stop line and Stop signs should be relocated to a position four feet from the sidewalk line.

Recommendations:

PRIORITY 1

- Relocate the Stop signs and stop line on Cook Avenue to increase sight distance.
- Relocate the One Way signs on the southeast corner to the Stop sign post.

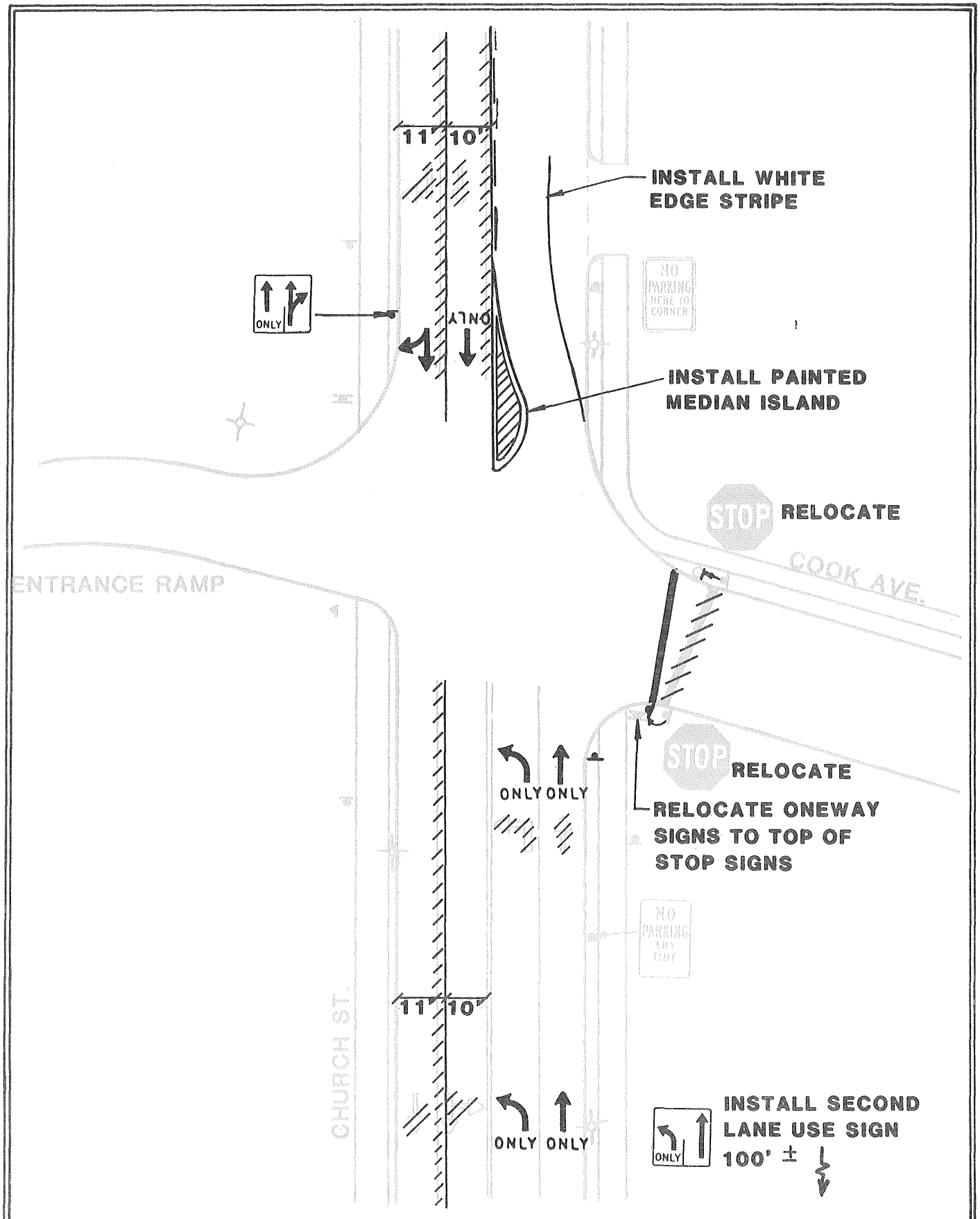
- Remove the existing pavement arrows and install conforming arrows and lane assignment signs.

- Install Do Not Enter signs on the backs of the Cook Street Stop signs.

PRIORITY 2

- Restripe the Church Street approaches to provide 11 foot curb lanes and 10 foot inside lanes.

- Install a painted median island and edge striping as shown on the improvement diagram to channel north bound through traffic.



COOK AVENUE AND CHURCH STREET

IMPROVEMENTS IN BLACK

Figure 2-14

2.4.13 Kitterman Avenue and Main Street

Physical Features and Traffic Control: Main Street intersects Kitterman Avenue in the Ottumwa CBD. Main Street is a two-lane, one way facility with parking permitted on both sides. Kitterman Avenue is a two way street that serves as a link to U.S. 63.

Traffic is controlled on all approaches by Stop signs. The existing signs are 30 inches in size and adequately located to provide sight distance at the intersection. A route directional assembly is currently located on the southwest corner next to the Stop sign, but its placement distracts attention from the Stop sign. The route assembly directs motorists to turn left at Kitterman Avenue to access U.S. 63 and should be relocated on the northeast corner. An advance route turn assembly should be erected on the north side of Main Street at midblock to supplement the existing marker on the south side of Main.

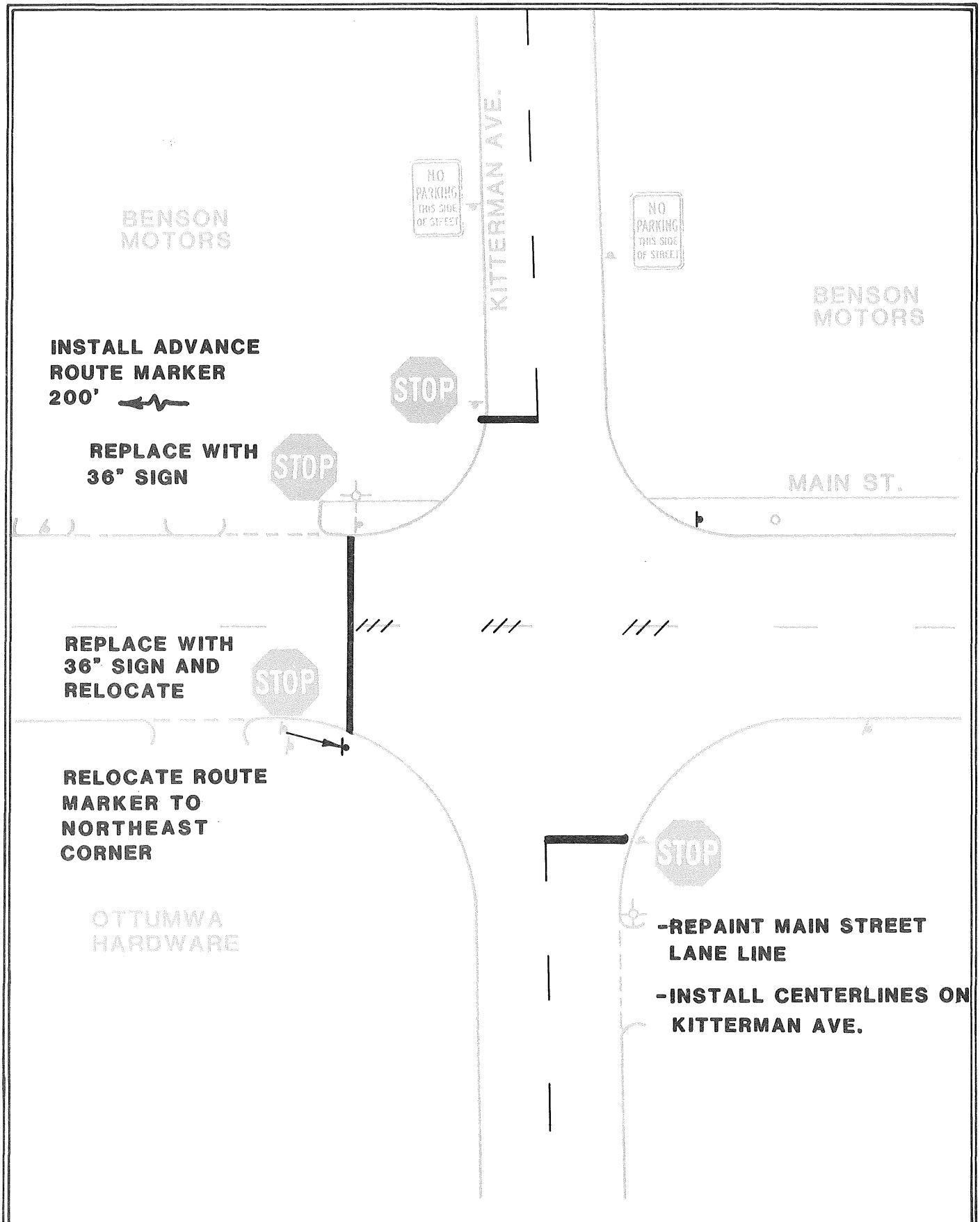
Traffic Volumes: The daily traffic volume on Main Street is currently more than 7,000 vehicles, while Kitterman Avenue carries between 3,000 and 4,000 vehicles. Left turns from Main Street to the north leg of Kitterman Avenue are the heaviest turning movement at over 2,000 vehicles per day.

Accident Patterns: Only five accidents were reported at Kitterman and Main during the study period. Of those accidents, two were cross traffic collisions. Although two accidents in three years does not constitute a pattern, the potential for cross traffic collisions can be reduced by replacing the existing Main Street Stop signs with 36 inch signs, and by installing stop lines on all of the approaches. In addition, center line striping should be added to the north and south approaches to separate directional traffic flows.

Recommendations:

PRIORITY 1

- Replace the existing 30 inch Stop signs on Main Street with 36 inch signs.
- Install stop lines on all approaches.
- Install center line striping on the Kitterman Avenue approaches.
- Relocate the southwest corner route marker assembly to the northeast corner.
- Install an advance route turn marker on the north side of Main Street.
- Repaint the Main Street lane line.



KITTERMAN AVENUE & MAIN STREET

IMPROVEMENTS IN BLACK

Figure 2-15

2.4.14 U.S. 63, Mary Street, and Rabbit Run Road

Physical Features and Traffic Control: This is a skewed intersection on the southeast edge of Ottumwa. The west leg of the intersection is Mary Street, a through east-west street that provides access to the John Deere Ottumwa Plant. Mary Street is classified as a minor arterial and carries a daily traffic volume of over 9,000 vehicles. Rabbit Run Road, the east leg, is a collector street that serves the homes and cottages along the Des Moines River. U.S. 63, Mary Street, and Rabbit Run Road are all two-lane roadways at this location, however the north approach of U.S. 63 is flared to allow right turning vehicles to decelerate safely. Traffic on Mary Street and Rabbit Run Road is controlled by Stop signs.

Traffic Volumes: Traffic volume counts taken in 1979 show that U.S. 63 carries daily traffic volumes of 7,600 vehicles north of Mary Street and 5,300 vehicles south of Mary Street, while over 9,000 vehicles per day use Mary Street. Peak hour traffic counts were taken by the City staff to supplement the daily counts in order to determine if traffic signals are warranted. These counts indicate a peak hour total entering volume of 839 vehicles which exceeds the volume requirement of Warrant 7, the Systems Warrant (800 peak hour entering vehicles). Because U.S. 63 has the following characteristics, this intersection does, in fact, meet the Systems Warrant for traffic signals.

- U.S. 63 is part of the highway system that serves as the principal network for through traffic flow.

- U.S. 63 is a rural highway outside the City of Ottumwa.

If it is assumed that traffic volumes for the eighth highest hour during an average weekday are approximately six percent of the daily volumes, it appears the U.S. 63 and Mary Street approach volumes also exceed the major street and minor street volume requirements of Warrant 1, the Minimum Vehicular Volume Warrant, for major streets with 85th percentile traffic speeds of 40 mph or greater (the speed limit on U.S. 63 is 45 mph). On the basis of Warrants 1 and 7 then, traffic signals are justified and should be installed as soon as possible.

As at other intersections along U.S. 63, traffic actuated signals are recommended for U.S. 63 and Mary Street to minimize interruption of through traffic on U.S. 63 during off-peak period.

Accident Patterns: Although state records indicate that 12 accidents were reported at this intersection during the study period, specific details were available for only four collisions. Two of the accidents were rear end collisions on the south approach, the third was a right turn collision also on the south approach, and the fourth was a cross traffic collision involving south bound and east bound vehicles. Three of the accidents resulted in personal injuries, which is probably attributable to the 45 mph approach speeds on U.S. 63. Six reported accidents occurred in the evening or at night.

Speed enforcement on U.S. 63 is recommended to protect traffic entering the intersection or turning off U.S. 63. The Mary Street signs located 100 feet in advance of the intersection on U.S. 63 should be replaced by standard size white-on-green signs to increase their visibility. Street name signs should also be erected on the northeast and southwest corners of the intersection.

Recommendations:

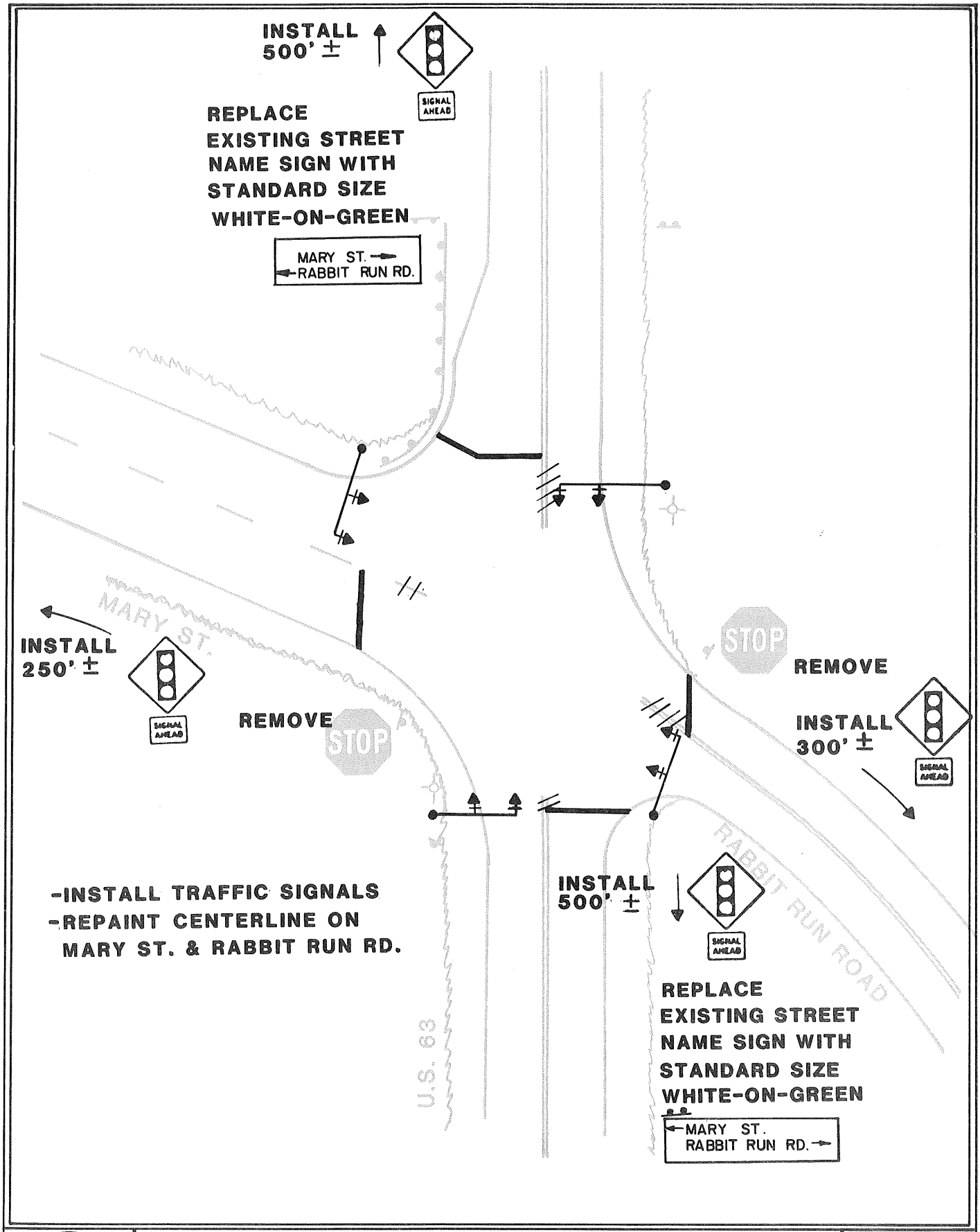
PRIORITY 1

- Install traffic signals.*
- Install Signal Ahead (W-3-3) signs in advance of the intersection on all approaches as shown on the improvement diagram.*
- Replace the existing Mary Street signs on U.S. 63 with standard size white-on-green signs denoting both Mary Street and Rabbit Run Road.*
- Speed enforcement on U.S. 63.*

PRIORITY 2

- Repaint the center lines on Mary Street and Rabbit Run Road.

* Responsibility of Iowa D.O.T.



U.S. 63, MARY STREET, & RABBIT RUN ROAD

IMPROVEMENTS IN BLACK

Figure 2-16

2.4.15 Jefferson Street and Main Street

Physical Features and Traffic Control: This right-angle intersection is located in the CBD. Main Street, which is a one-way, east bound street on the west approach, reverts to a two-way street east of the intersection. The north and south approaches are formed by Jefferson Street, a two-way minor arterial. The north approach is a four-lane, 47 foot roadway and the south approach is a three-lane, 30 foot viaduct. Two one-way streets parallel the viaduct and provide access to a parking lot south of the intersection. The one-way streets complicate the intersection by effectively adding another approach.

The traffic signals at this location are pedestal-mounted on the northeast corner and attached to a light standard on the northwest corner and on both sides of the viaduct. The nose of the viaduct is set back from the intersection, which makes the signals located there difficult for Main Street traffic to see.

Signal faces for the Main Street approaches are comprised of eight inch indications arranged as shown on Figure 2-17a. The eight inch green arrows currently used are not in compliance with MUTCD standards which require 12 inch arrows, and should be replaced by green ball indications to simplify the signal face. Pedestrian-actuated WALK signals are provided for crossing the Jefferson Street approaches. Additional pedestrian signals should be installed on the west approach for crossing Main Street and DONT WALK indications should be added to all of the pedestrian signals. Crosswalks are recommended for the north, south and west approaches to emphasize the pedestrian crossings.

The signals operate on a pretimed, 80 second cycle with separate phases for both of the Main Street approaches and for Jefferson Street. Each phase is currently provided with approximately 22 seconds of green time, and clearance intervals are 4.5 seconds for Main Street and 5 seconds for Jefferson Street.

When a walk button is activated, on either the north or south approach, pedestrians are given an 11 second flashing WALK indication during the east bound Main Street phase. While a pedestrian signal is on, the conflicting turn movement for Main Street traffic is not permitted (the green arrow remains dark). When the flashing Walk goes off, the green arrow comes on for the rest of the green interval. A flashing WALK indication should be used only when a conflicting traffic movement is allowed and, if used, should be common throughout the area to familiarize pedestrians with its meaning. The Consultant recommends that a steady WALK signal be used at this location. A pedestrian clearance interval is also needed and must be indicated by flashing DONT WALK signal.

Figure 2-17c is a timing plan that shows revisions to the existing signal timing. The recommended timing plan includes a reduced green interval for east bound Main Street and slightly longer clearance intervals. Pedestrian clearance intervals are also shown and should be utilized when DONT WALK indications are installed. When a new signal controller is installed at this intersection, the WALK signals should be changed from button-actuated to automatic because pedestrian traffic is heavy and because pedestrians expect automatic signals at CBD intersections.

Mast-arms should be installed at Jefferson and Main. The existing corner-located signals present visibility problems - especially to traffic on Main Street - because they are outside most drivers' normal cone of vision, and motorists are forced to intentionally scan the roadside to locate the signals. This intersection is complex enough without adding the problem of obscure signal indications. Overhead signals with 12 inch indications and backplates will provide greatly improved visibility.

Traffic flow at this intersection can be improved by restriping the Main Street approaches to provide wider lanes. The west approach left turn and through lanes should be increased to 10 foot widths as should the east approach curb lane. The required restriping is shown on the improvement diagram. All existing pavement arrows should be replaced by standard arrows and lane assignment signs. The stop lines located on the north, south, and west approaches need to be repainted, as it is important to designate the correct stopping point on those approaches. A stop line should also be installed on the east approach. To prevent parking encroachments near the intersection, one parking stall should be eliminated on the north side of the west approach.

Traffic on the one-way street just east of the viaduct is now controlled only by a Yield sign. To prevent possible conflicts from this approach, the Yield sign should be replaced by a Stop sign and only right turns onto Main Street should be permitted.

Accident Patterns: The 16 accidents that occurred at Jefferson and Main during the study period involved such a variety of accident types that no patterns are evident. Four of the accidents involved vehicles making lane changes or executing turning movements. The recommended pavement marking and lane control signing improvements will provide better guidance to motorists and should reduce the occurrance of such accidents.

A collision that occurred in 1977 involved a vehicle turning right from the Jefferson Street viaduct and a vehicle entering the intersection from the parking lot exit street, where traffic is now controlled by a Yield sign. This type of accident can be avoided by the recommended installation of a Stop sign and Right Turn Only sign.

Improvements are planned for this intersection which include installation of mast-arm signals and the closing of the one-way streets that parallel the Jefferson Street viaduct. A suggested arrangement for mast-arms and crosswalks, assuming the installation of 35 foot curb returns on the southeast and southwest corners, is shown in Figure 2-17b.

Recommendations:

PRIORITY 1

- Replace the existing eight inch green arrow indications on Main Street with green ball indications.

- Revise the signal timing as indicated on the timing plan (Figure 2-17c).

- Replace the Yield sign on the parking lot exit with a Stop sign and a Right Turn Only sign (R3-5).

- Install a Do Not Enter sign on the southwest corner.

- Install an Object Marker (OM-3R) on the nose of the viaduct to warn south bound traffic on Jefferson.

- Crosswalks should be painted on the Jefferson Street approaches and on the west Main Street approach.

- Repaint the existing stop lines and install a stop line on the east approach.

- Eliminate one parking stall on the west approach and erect No Parking signs as shown on the improvement diagram.

- Remove the existing pavement arrows and install conforming arrows and lane assignment signs.

PRIORITY 2

- Remove the existing WALK signals and install pedestrian signals with WALK and DONT WALK indications on the west Main Street approach and the Jefferson Street approaches. At this time pedestrian clearance intervals should be added to the signal timing and "Push Button For Walk Light" signs should be installed near all pedestrian buttons.

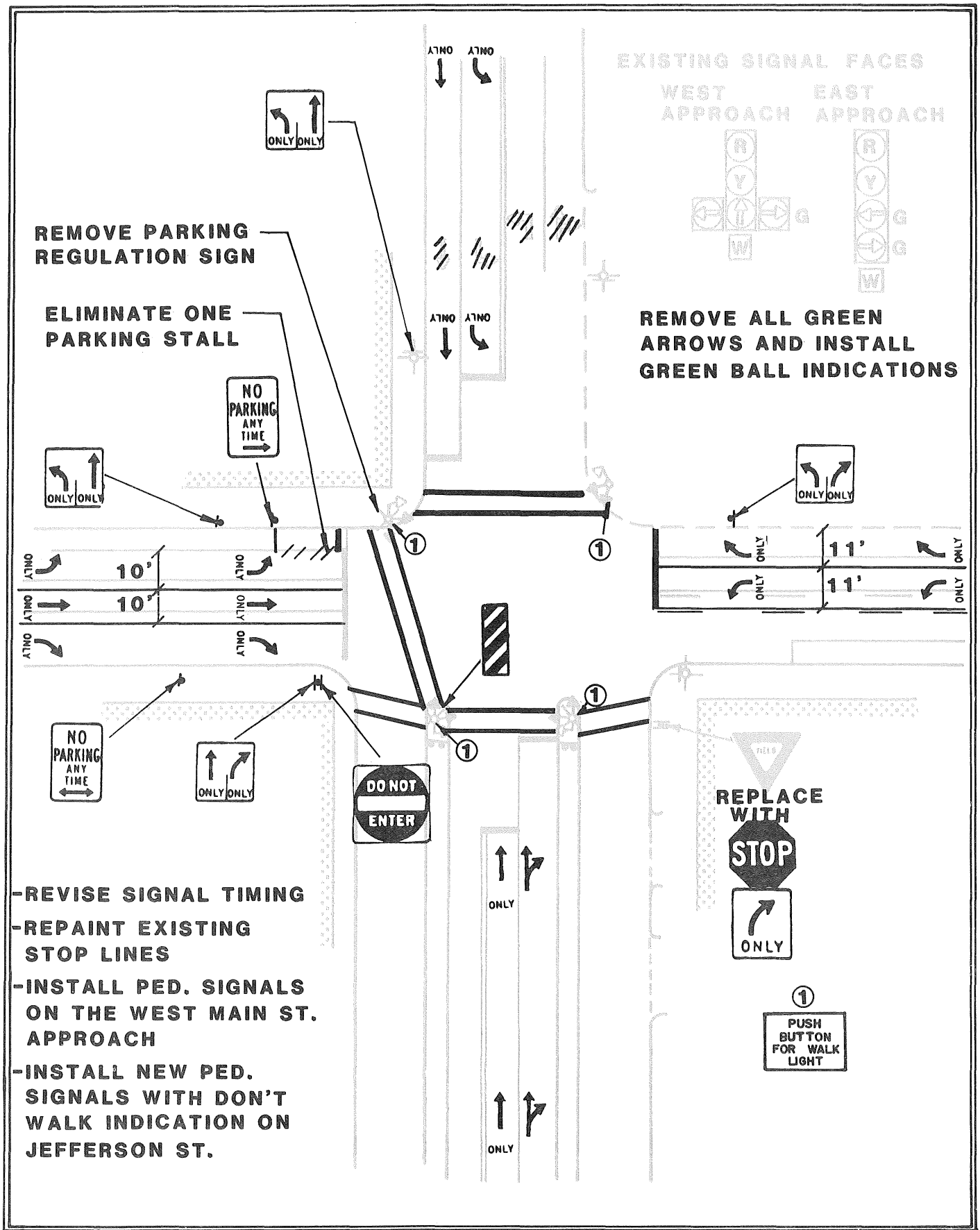
- Restripe the Main Street approaches to provide 10 foot lanes.

PRIORITY 3

- Install a new pretimed signal controller.

- Install mast-arms with 12 inch signal heads.

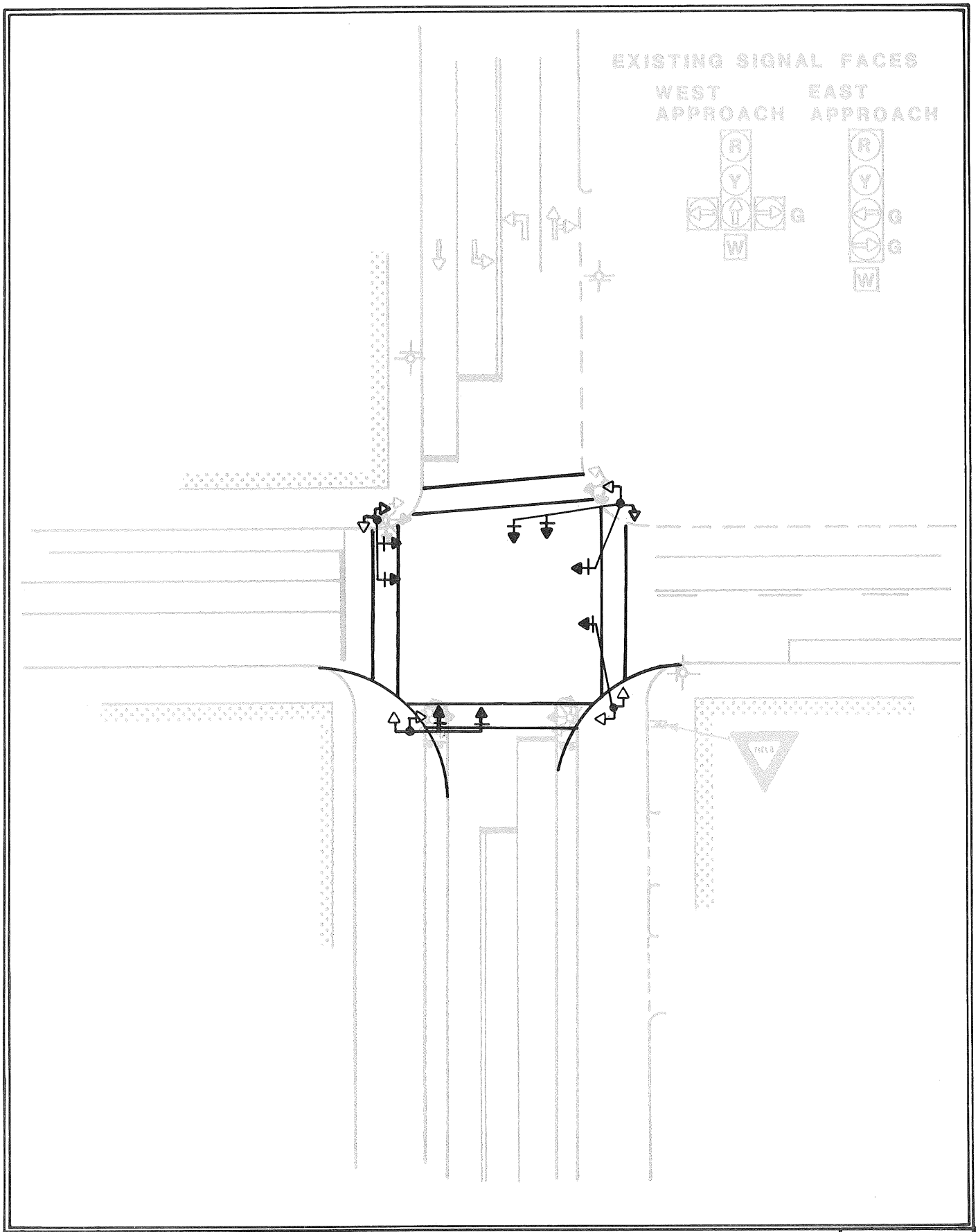
Looking east at the nonconforming Main Street signals.



JEFFERSON STREET & MAIN STREET

Figure 2-17a

IMPROVEMENTS IN BLACK



JEFFERSON STREET & MAIN STREET

Figure 2-17b

IMPROVEMENTS IN BLACK

TRAFFIC SIGNAL TIMING

(Fixed Time)

Intersection: Jefferson Street and Main Street **Date:** _____

Controller Make: Eagle **Model:** _____

Phase	Dial # Cycle Length 80 sec.			Comments
	Key Position	% of Cycle	Time of Cycle	
Jefferson Grn/Walk	0	11	8.8	-These timings are for
Jefferson Grn/FDW	11	17	13.6	use when new ped.
Jefferson Amber/DW	28	6	4.8	signals are installed.
E. Main Grn/Walk	24	13	10.4	
E. Main Grn/FDW	47	15	12.0	
E. Main Amber	62	6	4.8	
W. Main Grn	68	26	20.8	
W. Main Amber	94	6	4.8	

HOURS OF OPERATION

Dial: _____ **Offset1(red):** _____ **Flashing:** _____

Offset2(yellow): _____ **Yellow:** _____

Offset3(white): _____ **Red:** _____

Figure 2-17c

2.4.16 Hancock Street, Madison Avenue, and Garfield Street

Physical Features and Traffic Control: At this intersection, Hancock Street forms the north and south approaches, and Garfield Street is the west approach. Madison Avenue, the fourth leg, is a skewed approach from the southeast. The primary direction of traffic flow is to and from north Hancock and Madison Avenue. The Iowa Department of Transportation (IDOT) has a maintenance garage on the southwest corner and Wormhoudt's Lumber and Hardware Co. is located on the northeast corner.

The intersection lacks definition because there is no driveway control on either the southeast or northwest corner. To provide definition on the northeast corner where it is most needed and to control access to Madison Avenue, a raised island should be constructed on the east side of Madison, opposite the Garfield approach. Although such an island would constrict parking in front of the Wormhoudt's building, it would decrease the potential for accidents by limiting access to the intersection. Angle parking or parallel parking could be utilized in front of Wormhoudt's to permit the movement of traffic in the lot after construction of the island.

Traffic control at this location consists of Stop signs on Garfield Street and on the south approach of Hancock Street. While the Stop sign placement on Hancock provides adequate sight distance, the Garfield Stop sign is located more than 50 feet from the corner and behind the building line of the IDOT garage. Drivers familiar with the intersection will proceed to a point where cross traffic can be seen and then stop, but for other motorists, the poor location of the sign promotes conflicts with north bound traffic on Hancock Street. The accident experience at this intersection does not justify any extensive improvements in the near future, however, daily traffic volumes on Madison, which range from 5,000 to over 7,000 vehicles per day, require that as much sight distance as possible be provided, therefore the Garfield approach Stop sign should be relocated as far east as possible (approximately 10-15 feet) and cantilevered to improve its visibility.

Figure 2-18b depicts a long range concept to improve the intersection. This plan would separate the Hancock and Garfield approaches by realigning Hancock Street south of the existing intersection. Two "T" intersections would be created. The construction of a raised island in front of the IDOT garage is also suggested to define the corner and to provide an object on which to relocate the Garfield Stop sign. This plan is beyond the scope of the study and therefore no cost estimate has been made.

Accident Patterns: Only three accidents were reported during the study period. Two of the accidents were cross traffic collisions and each involved an east bound vehicle on Garfield and a north bound vehicle on Hancock. Both of the accidents were probably due to the Stop sign placement on Garfield. Relocation of the sign as recommended should provide much needed additional sight distance.

Recommendations:

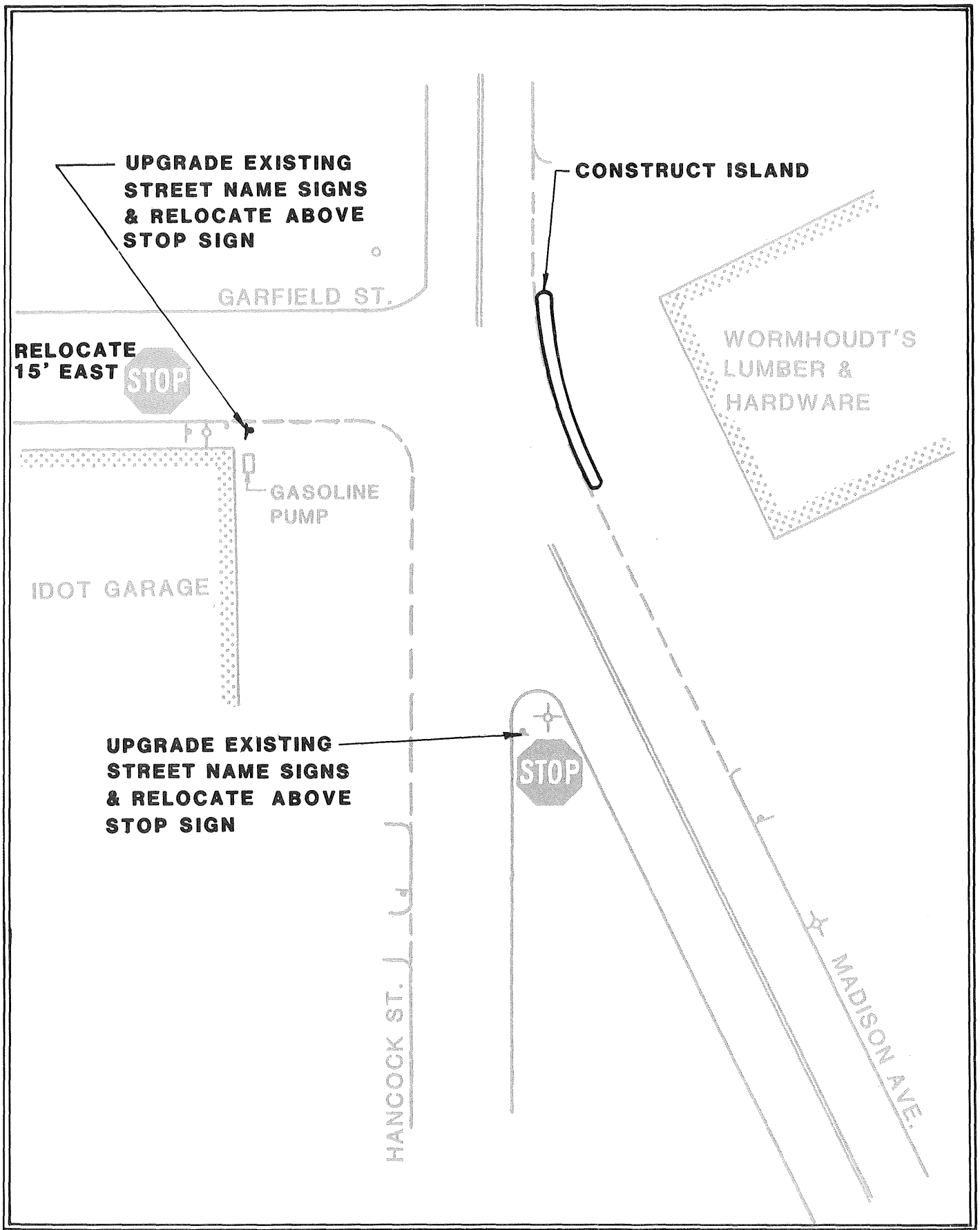
PRIORITY 1

- Relocate the Stop sign on Garfield Street approximately 15 feet east of its present location.

- Relocate the Street Name signs to the Stop sign posts on Garfield and Hancock.

PRIORITY 2

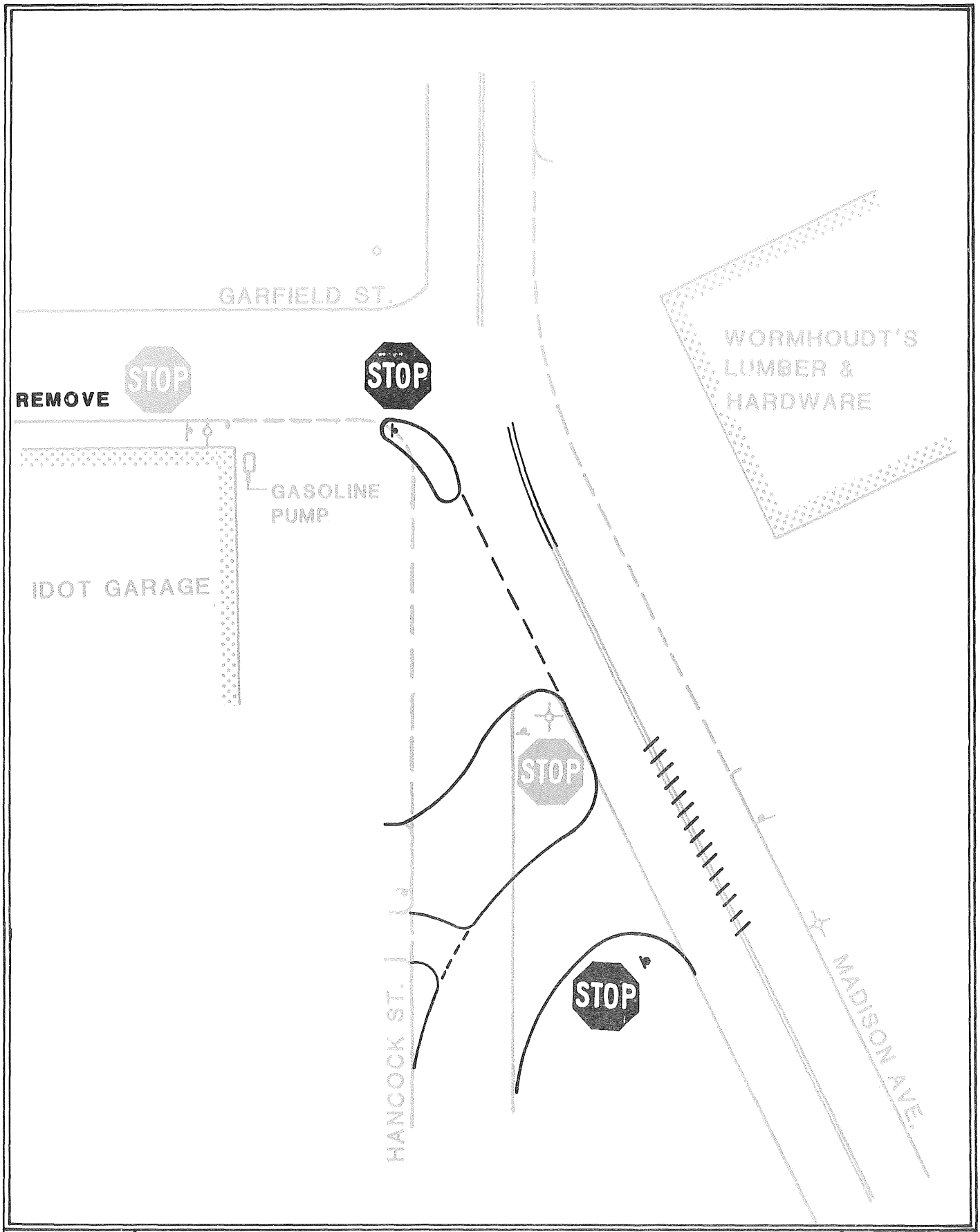
- Construct a raised island on the east side of Madison Avenue opposite the Garfield approach.



HANCOCK STREET & MADISON AVENUE

IMPROVEMENTS IN BLACK

Figure 2-18a



HANCOCK STREET & MADISON AVENUE

IMPROVEMENTS IN BLACK

Figure 2-18b

2.4.17 Fourth Street and Jefferson Street

Physical Features and Traffic Control: This is a four-legged, right angle intersection located on the northeastern edge of Ottumwa's CBD. Both Fourth Street and Jefferson Street are classified as minor arterials. This intersection is heavily used by traffic going to and from Ottumwa High School, which is located one block east on Fourth Street. The steep grade on the south approach, and the northwest and southwest corner knolls present sight distance contraints.

Three-way Stop sign control is utilized at Fourth and Jefferson, with signs located on all but the south approach, where traffic is not required to stop because of the steep hill. As stated earlier, three-way stop control should be avoided, as it causes driver confusion and uncertainty. It is therefore recommended that a Stop sign be installed on the south approach. Four-way stop control is favored over two-way stop control at this location because of limited sight distance on the Jefferson Street approaches. The restricted sight distance would create a potentially dangerous situation for yielding left turns from both Jefferson Street approaches.

Installation of a four-way stop will also insure that Fourth Street traffic, especially the buses which cross the intersection on Fourth Street, are not subjected to excessive delays. It will probably be necessary, however, for the City to heavily salt and sand Jefferson Street in winter to provide adequate traction. Sand barrels might also be placed on Jefferson for motorists to use themselves when the hill is slippery.

As other means of promoting safe operation, the north approach Stop sign and stop line should be relocated 10 feet closer to the intersection and stop lines should be installed on the south, east, and west approaches. The Consultant also recommends restriping the Jefferson Street approaches to provide ten foot lane widths and changing the south approach center line to a solid double line.

As at other study locations, the existing pavement arrows should be removed. Pavement markings that conform to MUTCD standards and lane assignment signs are recommended as replacements. Parking prohibitions currently in effect near the intersection are sufficient, but a No Parking sign should be installed on the west approach as shown to supplement the painted curb.

Traffic Volumes: Four-way stop control is warranted by traffic volumes at the intersection which vary from 4,200 vehicles per day to 6,800 vehicles per day on the west and east Fourth Street approaches and from 5,700 vehicles per day to 6,200 vehicles per day on the south and north Jefferson Street approaches (all two-way volumes). These volumes and an eight hour traffic count taken in 1975 indicate that the average entering volume during the peak eight hours of an average day does exceed 500 vehicles per hour as required by the MUTCD to warrant a four-way stop.

Accident Patterns: Cross traffic and left turn collisions accounted for 70% of the 10 study period accidents. Collisions involved south bound vehicles and east bound vehicles which is due, in part, to poor sight distance on the northwest corner. Relocating the north approach Stop sign as suggested will improve that situation. North bound motorists were involved in all of the left turn collisions - an indicator of the confusion caused by a three-way stop.

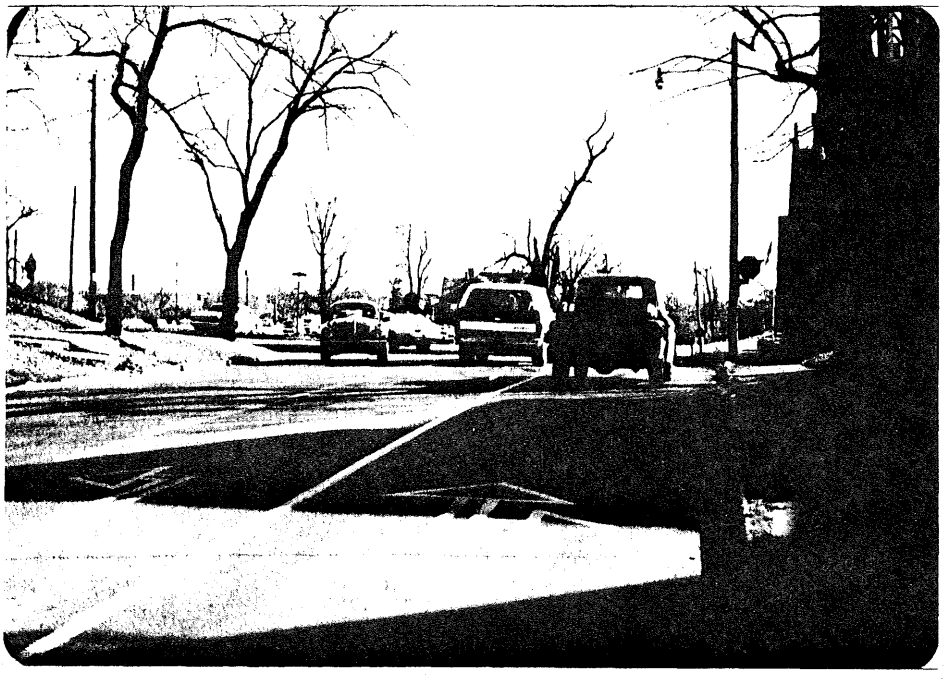
Recommendations:

PRIORITY 1

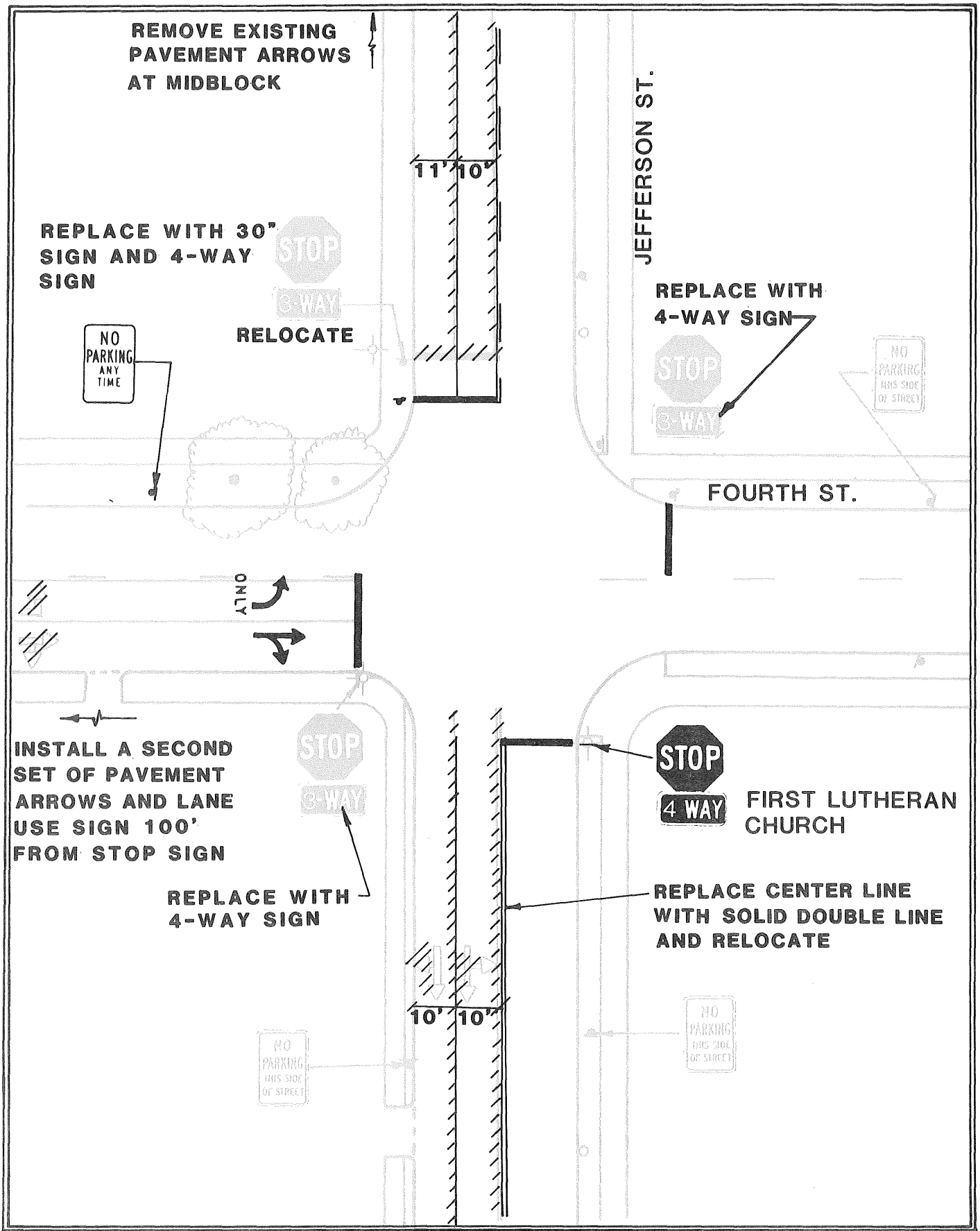
- Install a Stop sign and stop line on the south Jefferson Street approach and replace the 3-Way signs with 4-Way signs.
- Install stop lines on Fourth Street.
- Relocate the north approach Stop sign and stop line to within 4 feet of the sidewalk line.
- Remove the existing pavement arrows and install conforming pavement arrows.
- Install a No Parking sign on the west approach.

PRIORITY 2

- Restripe the Jefferson Street approaches to provide 10 foot lane widths and replace the existing south approach center line with a solid double line.



Nonconforming pavement arrows at
Fourth and Jefferson



FOURTH STREET & JEFFERSON STREET

IMPROVEMENTS IN BLACK

Figure 2-19

2.4.18 Marion Street and Main Street

Physical Features and Traffic Control: Main Street, a one-way east bound facility, intersects Marion Street, two-lane street at this location. The north Marion Street approach is a link to U.S. 63 and generates over 1,000 left turns from Main to Marion daily. Although existing curb radii at this intersection are extremely small, the street widths compensate to provide enough maneuvering space for turning vehicles.

Marion Street traffic is controlled by Stop signs. The north and south approach Stop signs are currently located 25.5 feet and 20 feet from the intersection, respectively. To improve sight distance and thereby reduce the potential for cross traffic and rear end collisions, the Stop signs on both approaches should be relocated to a position four feet from the sidewalk edge as recommended in the MUTCD guidelines. When the signs are relocated, they should be mounted to provide 7 feet of clearance between sign and pavement.

The only One Way signs now in place at the intersection are mounted on a light standard on the southeast corner. These signs should be relocated above the Stop sign and additional One Way signs should be mounted above the northwest corner Stop sign. Metered parking is furnished on both sides of Main Street east of the intersection and on the west side of the north Marion approach. Parking should be prohibited 60 feet from the intersection on both sides of the west Main Street approach, if it is not already, to provide adequate sight distance for Marion Street traffic.

The route directional assembly located on the southwest corner directs motorists to turn left at Marion Street to access U.S. 63 but will provide much better guidance if relocated on the northwest corner, where it would be closest to drivers in the left lane. Likewise, the advance route directional assembly located at midblock on the south side of Main should be supplemented by another advance route assembly on the north side at approximately the same location.

Accident Patterns: The five reported accidents at this intersection do not constitute a pattern of any type. The potential for sideswipe collisions, such as the one that occurred on west Main Street, can be decreased by installing a lane line on the west approach, and a center line on the south approach. The existing center line on the north approach should be repainted. Relocating the north and south approach Stop signs and prohibiting parking near the intersection will insure against the occurance of right angle collisions by providing more sight distance for traffic on Marion Street.

Recommendations:

PRIORITY 1

- Relocate the Marion Street Stop signs to within 4 feet of the sidewalk line.
- Relocate the existing One Way signs on the southeast corner to the Stop sign post and install additional One Way signs above the northwest corner Stop sign.

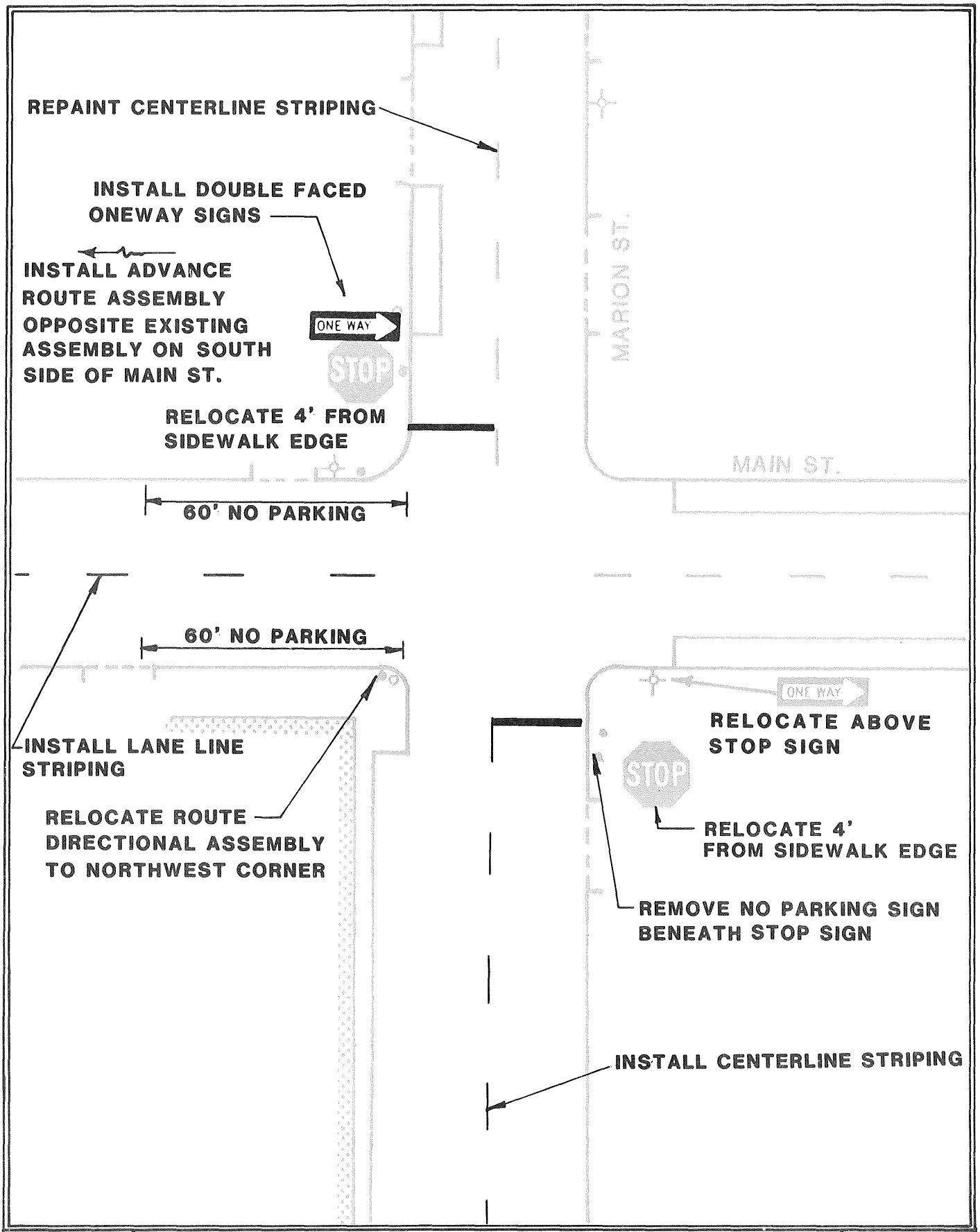
- Prohibit parking 60 feet from the intersection on both sides of the west approach.

- Remove the No Parking sign beneath the south approach Stop sign.

- Relocate the route directional assembly on the southwest corner to the northeast corner.

- Erect an additional advance route marker at midblock on the north side of Main Street.

- Install lane line striping on the west approach and center line striping on the south approach.



MARION STREET & MAIN STREET

IMPROVEMENTS IN BLACK

Figure 2-20

2.4.19 Washington Street and Second Street

Physical Features and Traffic Control: This is a CBD intersection at which Second Street is a one-way west bound minor arterial and Washington Street is a two-way collector. All of the approaches are 42 feet wide with parallel parking permitted on both sides.

Traffic at Washington and Second is controlled by pedestal-mounted signals that are located on the corners. Each approach is provided with far-left and far-right indications that are equipped with eight inch lenses. Signal visibility is extremely bad at this intersection because the streets are wide and because three of the signal poles are set too far from the corner. Mast-arms are highly recommended to provide the required visibility, however, the existing eight inch signal indications should be replaced by 12 inch indications until mast-arms can be installed. The suggested arrangement of mast-arms is shown on Figure 2-21b.

As at other locations in the City, clearance intervals here are excessive. Considering the 20 to 25 mph approach speeds, amber times should be reduced from 5.4 seconds to 3 seconds with a 1.2 second all-red interval. This will discourage drivers from abusing the clearance interval and result in safer operation of the intersection. Pedestrian signals should also be added when mast-arms are installed.

One Way signing at this intersection should be supplemented by additional One Way signs on the northeast and southwest corners. The Consultant recommends that stop lines be painted on all approaches and that existing pavement arrows be replaced by conforming arrows. Lane line striping should be added to the south bound lanes of the north approach to prevent sideswipe accidents there. The existing center line and lane line on Washington Street south approach should be changed from broken lines to solid lines to discourage lane changes near the intersection.

The MUTCD recommends a 30 foot minimum no parking zone in advance of signalized intersections. This zone, which is measured from a crosswalk, or the sidewalk edge, is intended to provide adequate clearance near the intersection. To achieve the necessary clear zone at Second and Washington, one parking stall on both sides of the east approach should be eliminated.

Traffic Volumes: Average daily traffic volumes on Second Street range from nearly 4,700 vehicles per day east of the intersection to 6,800 vehicles per day west of the intersection. Washington Street traffic varies from 3,400 vehicles per day on the south approach to 5,500 vehicles per day on the north approach. Although turning movement counts were not available, the daily traffic volumes suggest fairly heavy turning movements from the Washington Street approaches to Second Street.

Accident Patterns: Over 70% of the vehicles involved in accidents at this location were west bound on Second Street, which reflects the predominant traffic movement. Of 10 recorded accidents, 30% were cross traffic collisions. The recommended change in clearance timing should reduce the occurrance of this type of accident, however, poor signal visibility also causes cross traffic collisions, and only the installation of 12 inch lenses or mast-arms will help solve that problem.

Two collisions involving cars leaving a parking stall on the east approach were also reported at this intersection. The suggested elimination of one parking stall on each side of Second Street will decrease the potential for conflicts with parked cars.

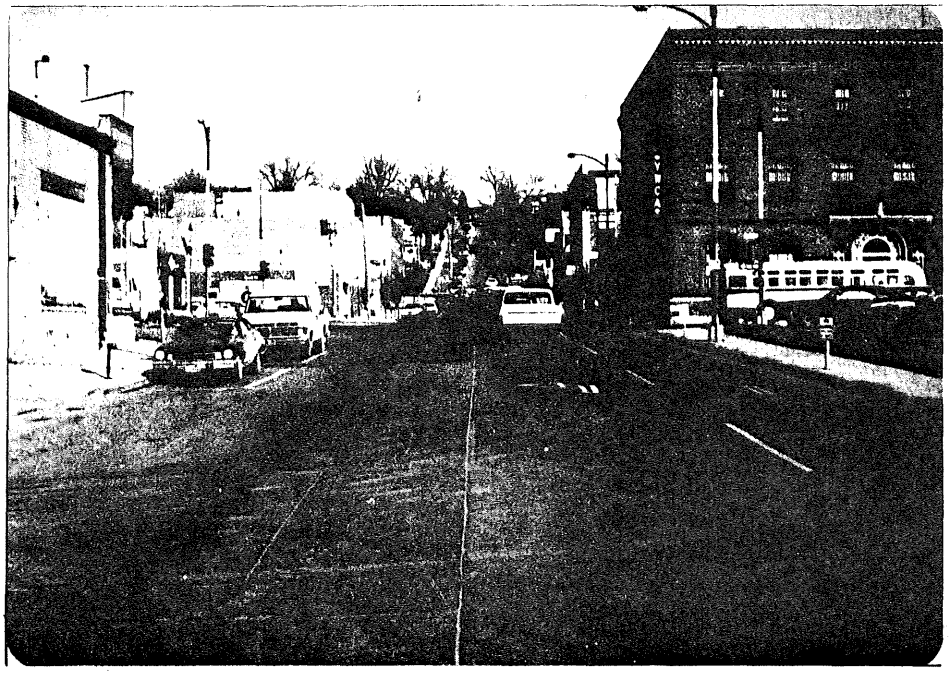
Recommendations:

PRIORITY 1

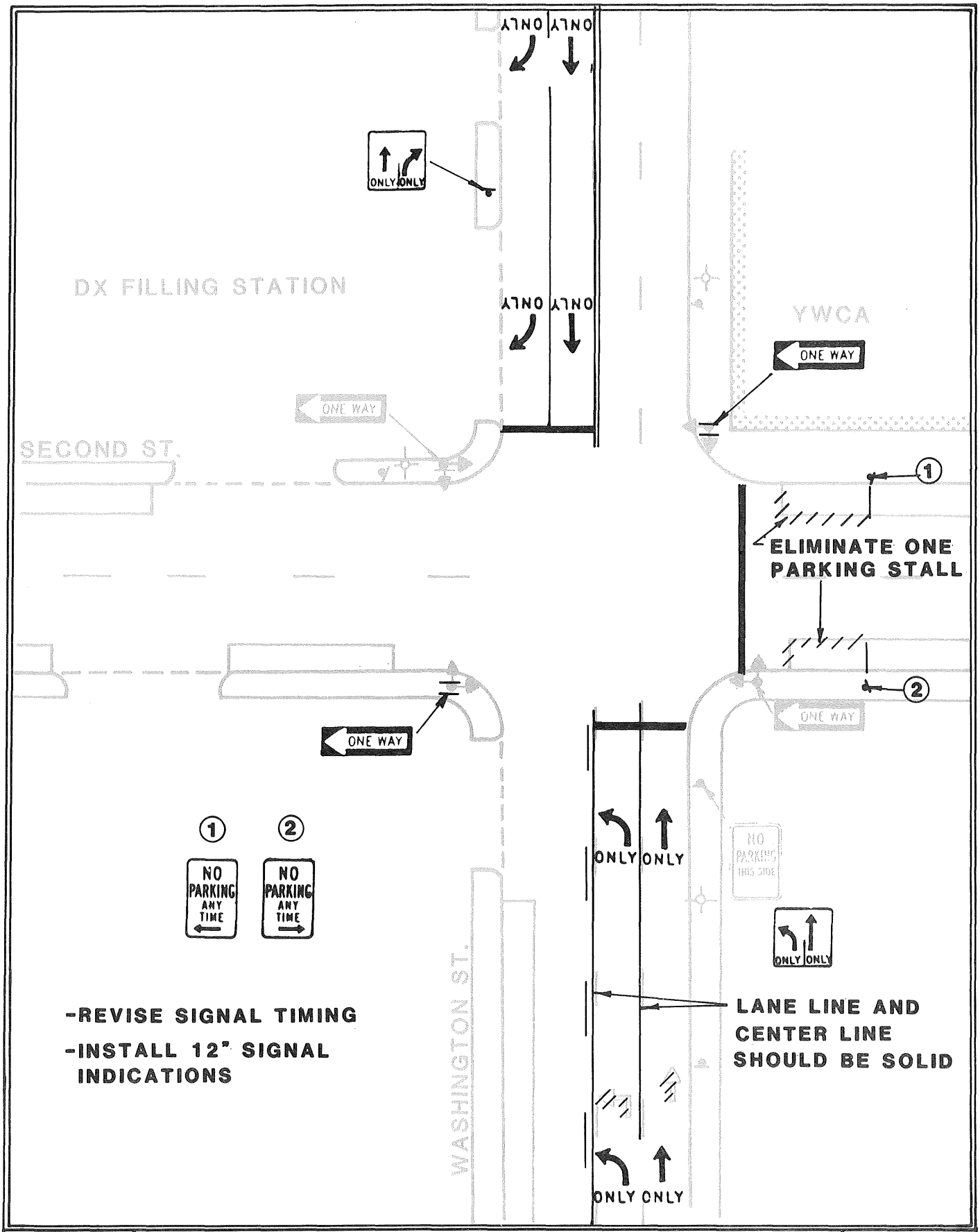
- Revise the clearance interval timing.
- Install stop lines on all approaches.
- Install One Way signs on the northeast and southwest corner signal poles.
- Remove the existing pavement arrows and install conforming pavement arrows and lane assignment signs as shown on the improvement diagram.
- Install lane line striping on the north approach and replace the dashed lane and center lines on the south approach with solid lines.
- Eliminate one parking stall on both sides of the east approach and erect No Parking signs.

PRIORITY 3

- Install a new pretimed signal controller.
- Install mast-arms with 12 inch signal heads and pedestrian signals.



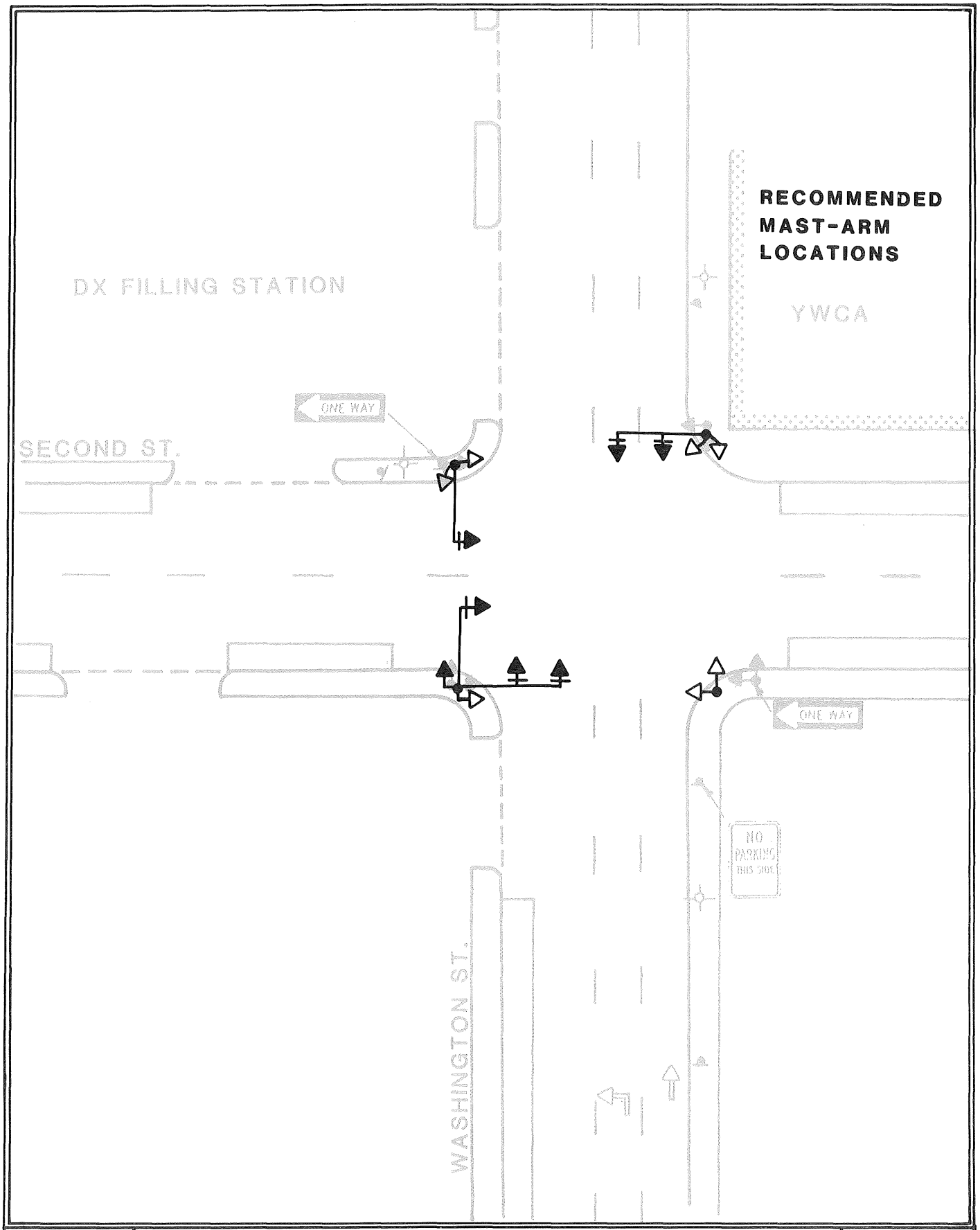
A view of Washington and Second showing poor visibility of the traffic signals.



WASHINGTON STREET & SECOND STREET

IMPROVEMENTS IN BLACK

Figure 2-21a



WASHINGTON STREET & SECOND STREET

Figure 2-21b

IMPROVEMENTS IN BLACK

TRAFFIC SIGNAL TIMING

(Fixed Time)

Intersection: Washington Street and Second Street **Date:** _____

Controller Make: Eagle **Model:** _____

Phase	Dial # Cycle Length 60 sec.			Comments
	Key Position	% of Cycle	Time of Cycle	
Second St. Grn.	0	47	28.2	
Second St. Amber	47	5	3.0	
All-Red	52	2	1.2	
Washington St. Grn.	54	39	23.4	
Washington St. Amber	93	5	3.0	
All-Red	98	2	1.2	

HOURS OF OPERATION

Dial: _____ **Offset1(red):** _____ **Flashing:** _____

Offset2(yellow): _____ **Yellow:** _____

Offset3(white): _____ **Red:** _____

Figure 2-21c

2.4.20 Kitterman Avenue and Second Street

Physical Features and Traffic Control: The north approach of Kitterman Avenue is a divided roadway that serves as an entrance and exit ramp for U.S. 63, and the south approach is an undivided, two-lane street. Second Street is a one-way, west bound minor arterial. The intersection is located just west of the CBD.

This is a signalized intersection at which signals are mounted on span wires in a box formation. Two signal faces with 12 inch indications are provided for each approach, but none of the signals have backplates. Two-phase, semi-actuated control is utilized, and loop detectors are located on the north and south approaches. The clearance intervals at this intersection are timed correctly for the vehicle speeds and approach widths.

Pavement markings are currently used on both Kitterman Avenue and Second Street. The east approach is striped for three traffic lanes and parking is permitted only on the south side. Existing pavement arrows designate a right turn lane, a through lane, and a through-left turn lane. The existing arrows, however, should be replaced by arrows that conform to MUTCD guidelines and located closer to the intersection. Lane assignment signs are especially recommended for the east approach as they can be placed on the span wire and centered over each lane. A stop line should also be installed to inform motorists of the proper stopping point.

Center line striping is recommended for the south approach to separate directional traffic flows. The exit ramp portion of the north approach is wide enough (23 feet) to provide a separate through and right turn lane. A solid lane line, pavement arrows, and lane assignment signs should be installed. A route marker assembly should also be erected on the exit ramp to identify Second Street as west Iowa 23 and to direct motorists to east Iowa 23.

The Consultant recommends removal of the old business district sign on the southwest corner, and replacement of the Do Not Enter sign on the southeast corner with a conforming sign.

Traffic Volumes: Peak hour traffic at this intersection accounts for over 1,000 entering vehicles. Left turns from Second to Kitterman Avenue constitute the heaviest turning movement at over 80 vehicles during the peak hour. Right turning traffic on the exit ramp constitutes the heaviest movement on that approach and warrants an exclusive right turn lane.

Accident Patterns: Good signal visibility and proper clearance interval timing at Kitterman and Second is reflected in the low number of accidents (8) reported during the study period. Rear end collisions are difficult to substantially reduce at a signalized intersection, and the three that were reported is not an excessive number. The three recorded sideswipe collisions, however, indicate a problem with lane assignment on the east approach. Installing pavement arrows near and in advance of the intersection and placing lane assignment signs on the signal span wire will provide better guidance to motorists and should decrease the occurrance of sideswipe accidents.

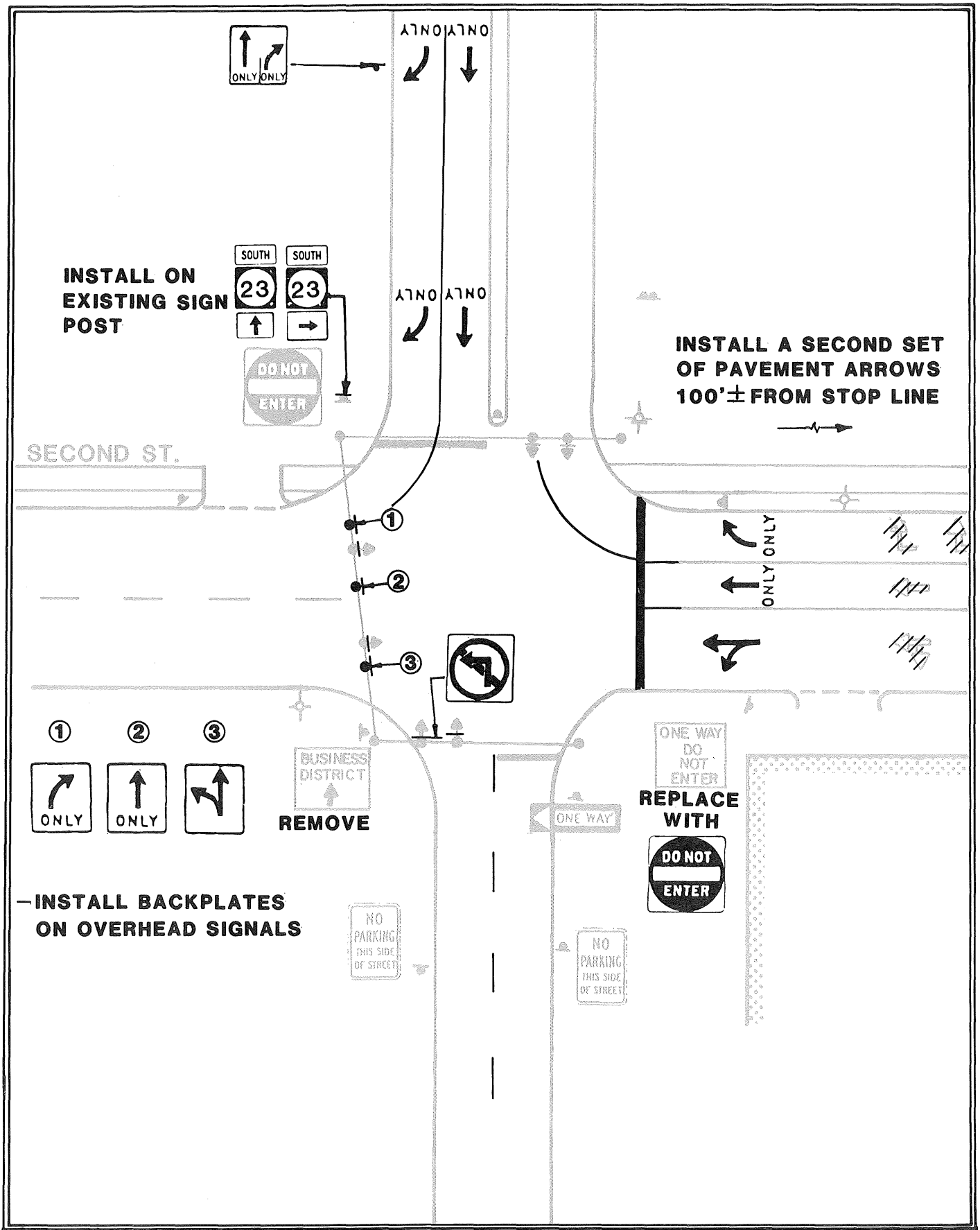
Recommendations:

PRIORITY 1

- Install a stop line on the east approach.
- Replace the existing pavement arrows with conforming arrows and overhead lane assignment signs as shown on the improvement diagram.
- Install lane striping and Lane Assignment signs on the north Kitterman approach to designate a right turn lane and a through lane.
- Erect an Iowa Route 23 directional marker on the north approach.
- Replace the nonconforming Do Not Enter sign on the southeast corner.
- Remove the old Business District sign on the southwest corner.

PRIORITY 2

- Install backplates on all signal heads.



KITTERMAN AVENUE & SECOND STREET

IMPROVEMENTS IN BLACK

Figure 2-22

2.4.21 Church Street and Richmond Avenue

Physical Features and Traffic Control: This is a complex, five-legged intersection in southern Ottumwa. Church Street, a minor arterial, is intersected by Richmond Avenue, Vine Street, and Willard Street. The resulting large area for traffic conflicts makes this a potentially very dangerous intersection. Geometric modifications would be the most desirable improvement, and several concepts were considered by the Consultant, however, for various reasons geometric improvements are not really workable. Any street closure, for instance, would not be practical because of the businesses and church located near the intersection, and likewise, turn prohibitions would be unpopular and confusing to motorists. Street rerouting is an even more costly alternative that cannot be justified by the accident experience. If a serious accident problem were to develop, the cost and inconvenience of the above mentioned geometric modifications might be warranted, but it appears at this time that signing, pavement marking and signal hardware improvements will more effectively increase safety at this intersection.

The existing traffic signals are pretimed, and the 65 second cycle length is comprised of three phases as shown on Figure 2-23a. Green intervals are provided for all approaches except Willard Street, where traffic is given a flashing amber indication during the Richmond Avenue green phase. The flashing amber allows vehicles on Willard to enter the intersection, but requires them to yield to Richmond Avenue traffic. Despite light vehicular volumes on Willard, this phasing arrangement promotes traffic conflicts and does not conform to standard traffic engineering practice.

The traffic signals are pedestal-mounted with eight inch indications and two signal heads are provided for each approach. Due to intersection geometry, the signals are, by necessity, located far from the approaches to which they apply and are difficult for the unfamiliar motorist to see. The north Church Street approach, and the Vine Street approach, for instance, each have a signal indication located over 130 feet from the stopping point, while both of the indications for Willard Street are placed considerably outside a normal driver's cone of vision. In fact, the signal locations on none of the approaches fully meet MUTCD guidelines for signal placement.

Improvements to this intersection should begin with revision of the signal phasing now in affect to add a separate phase for Willard Street. This will require a 70 second cycle length, slight reductions in the percentage of green time for Richmond and Church and a considerable green time reduction for Vine Street. The recommended timing revisions are shown on Figure 2-23b. This action will eliminate the potential for conflicts between Richmond Avenue and Willard Street traffic that now exists, but the suggested timing revisions will not provide adequate service if traffic volumes increase significantly.

Because the existing signal controller cannot be expanded to allow for a fourth phase, it is necessary that another fixed time controller be installed until more extensive signal improvements can be made. A new controller might be purchased or the existing controller could be replaced with a spare controller now in the City's possession. If neither of these options is feasible, the priority of the signal improvements recommended in the following paragraphs should be increased.

To efficiently handle future traffic, both the Willard Street and Vine Street phases should be actuated. Semi-actuated signal control will insure that unnecessary delays to the much heavier traffic volumes on Richmond Avenue and Church Street will be avoided by providing green time to the Willard and Vine approaches only when traffic calls for it. The present location of the signal controller (on the south side of Vine Street) will allow for low cost installation of vehicle detectors on Willard and Vine. A new, semi-actuated controller will be required to provide the recommended actuation.

The problem of inadequate signal visibility should be addressed by installing mast-arms, so that signal indications can be positioned over the roadway. At a complex and potentially confusing intersection such as this, mast-arms are really the only means of locating signals so that drivers cannot miss seeing them. A recommended mast-arm arrangement that should provide adequate signal visibility is shown on the improvement diagram.

The cost of actuating the Willard and Vine approaches and of installing mast-arms will be considerable. The City would be best advised to apply now for a safety grant to specifically improve this intersection. In that way, the signal-related recommendations can be implemented as a package and City funds can be more effectively spent by distributing them among other intersections that require fewer and less costly improvements.

It may be several years before a grant can be obtained and in the meantime, the existing signal timing should be revised as recommended. In addition, lane assignment signs and pavement markings should be installed on all of the approaches as shown on the improvement diagram to provide much needed guidance to motorists approaching the intersection. These improvements should help to decrease accidents caused by turns from the wrong lane and swerving maneuvers.

Traffic Volumes: The partial 1979 traffic counts taken at this intersection show daily volumes of 7,300 vehicles (two-way) on the Richmond Avenue approach and 8,500 vehicles (two-way) on Church Street north of the intersection. These would appear to be the highest volume approaches, with the likelihood of heavy turning movements to and from Richmond Avenue and the Church Street north approach.

Accident Patterns: Only five accidents were reported during the study period, which indicates that motorists drive this intersection with extreme caution. All of the accidents involved at least one south bound vehicle on Church Street and three of the collisions were rear end accidents on the north Church Street approach. The rear end collisions are due more likely to the poor location of signals, than to an inadequate clearance interval, however, a short all-red interval is included in the signal timing revisions to help clear the intersection.

Two left turn collisions were also reported, one of which involved a vehicle turning left from Richmond Avenue that was struck by a south bound car on Church. The existing 7 second amber interval for Richmond Avenue may have contributed to that accident. It is obvious that the accident experience at Richmond and Church does not, in itself, warrant extensive improvements, but the nature of the intersection and the poor traffic control afforded by the existing signals require that some action be taken to promote increased safety.

Recommendations:

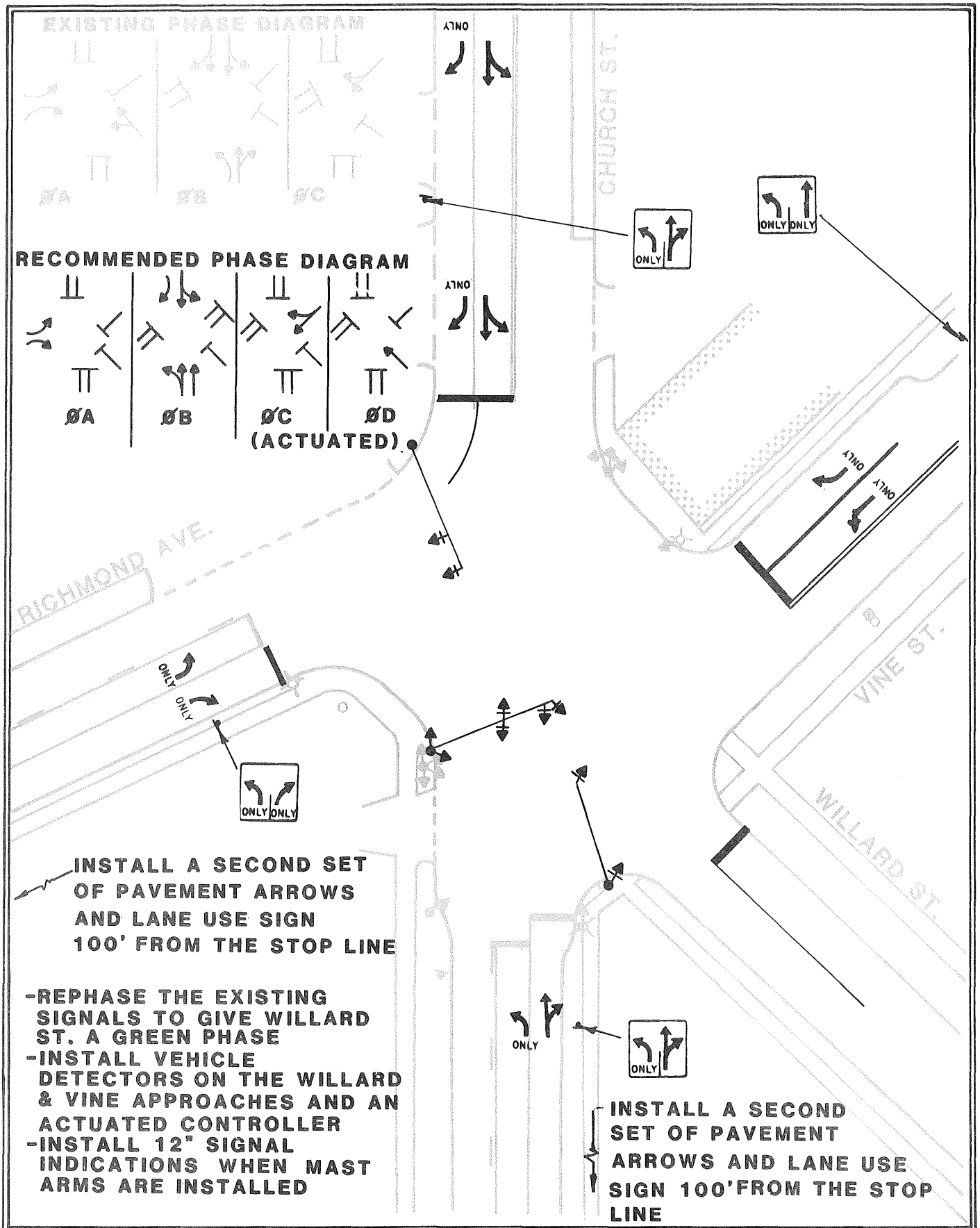
PRIORITY 1

- Modify the signal phasing and revise the timing.
- Install pavement arrows and lane assignment signs as shown on the improvement diagram.

PRIORITY 3

- Install vehicle detectors on the Vine Street and Willard Street approaches.
- Install a new 4-phase controller with two actuated modules.
- Install mast-arms with 12 inch signal heads.
- Install overhead lane use signs on signal mast-arms (Richmond Avenue and Church Street Approaches).

Church and Richmond looking
south on Church Street.



CHURCH STREET & RICHMOND AVENUE

Figure 2-23a

IMPROVEMENTS IN BLACK

TRAFFIC SIGNAL TIMING

(Fixed Time)

Intersection: Richmond Ave. and Church Street **Date:** _____

Controller Make: Eagle **Model:** _____

Phase	Dial # Cycle Length 70 sec.			Comments
	Key Position	% of Cycle	Time of Cycle	
Richmond Grn.	0	25	17.5	
Richmond Amber	25	6	4.2	
Church Grn.	31	23	16.1	
Church Amber	54	5	3.5	
All-Red	59	2	1.4	
Vine Grn.	61	13	9.1	
Vine Amber	74	6	4.2	
Willard Grn.	80	13	9.1	
Willard Amber	93	5	3.5	
All-Red	98	2	1.4	

HOURS OF OPERATION

Dial: _____ **Offset1(red):** _____ **Flashing:** _____

Offset2(yellow): _____ **Yellow:** _____

Offset3(white): _____ **Red:** _____

Figure 2-23b

2.4.22 Church Street and Weller Street

Physical Features and Traffic Control: Church and Weller form a "T" intersection located half a mile north of the Richmond and Church intersection. Church Street is a 47 foot wide, three-lane roadway with parking on both sides, and Weller Street is a 42 foot, three-lane brick road. The intersection is located in a fringe area of the CBD and is surrounded by small businesses which include a hardware store, a bank and an auto parts store.

Traffic signals at Church and Weller are semi-actuated. Church Street retains a green light until a vehicle in the left lane of Weller Street trips the detector there. Right turning traffic on Weller does not activate the signal and is allowed to turn right on red. Motorists should, however, be informed of the permitted right turn on red by installing a sign confirming the movement.

Pedestal-mounted traffic signals are located on the far right and far left sides for the north Church Street approach, and on the far right and near left sides for the south Church Street approach. The signal heads for Weller Street are both mounted on a far side light standard and are separated by less than the required minimum eight feet. Eight inch circular indications are used for the Church Street approaches and for the red and amber lights on Weller Street where right and left green arrows are provided. Right and Left arrows are included on both Weller Street signal faces so that one arrow still operates if the other burns out. This arrangement is somewhat unorthodox and the eight inch green arrows do not conform to MUTCD guidelines.

Crosswalks are painted on the Weller Street and south Church Street approaches, but pedestrian signals are only provided for crossing Church Street. The WALK signals are pedestrian-actuated and preempt the left turn arrow for Weller Street during the pedestrian interval.

Sight distance is quite limited at Church and Weller because of a building located near the street on the southeast corner and because parking is allowed within 30 feet of the intersection on the Church Street approaches. The presence of parked vehicles near the intersection prevents motorists from seeing pedestrians and other vehicles, provides additional distraction from the traffic signals, and presents a possible conflict to vehicles moving through the interesection.

Several improvements should be made as soon as possible at this intersection. Among the most critical is that adequate no parking zones be provided. This will require elimination of one parking stall on both sides of the south approach and on the west side of the north approach. The resulting 30 feet clear zone on the Church Street approaches will meet the MUTCD recommendations for no parking zones near intersections and will create a much safer intersection. No Parking signs should be erected to delineate the clear zone and police enforcement should be used if necessary to maintain it.

To prevent encroachment on the crosswalks by emphasizing the proper stopping point, stop lines should be painted on all approaches and the crosswalks should be repainted. The Consultant also recommends that the center line on the south Church Street approach be changed to a solid double line, like the north approach, to prohibit

passing. Center line striping and pavement arrows should be installed on Weller Street to separate the directional traffic flows and to help guide motorists into the correct lane when approaching the intersection.

The existing traffic signals should be improved at this time by replacing the green arrows on the Weller Street approach with circular green indications so that motorists can see and understand the signals at a glance and by rephasing the signals to allow left turns from Weller during the pedestrian phase. This would result in a two-phase signal as shown on Figure 2-24a. The pedestrian phase should consist of an 11 second WALK indication and 14 second clearance (flashing DONT WALK) interval. Should a problem with pedestrians and left turning vehicles develop, a sign should be posted under the signal face bearing the message; "Turning Vehicles Must Yield To Pedestrians".

Eventual improvements at this intersection should consist of mast-arm installation and replacement of the existing signal controller. Mast-arms are recommended because the pedestal-mounted signals blend with the surroundings and are simply not as visible as required. A mast-arm arrangement such as that shown on Figure 2-24b with 12 inch indications would separate the signals from distracting surroundings and focus a driver's attention on them.

An overhanging metal canopy on the west side of Church Street will, however, present a problem when the mast-arm for Weller Street is installed. The existing signal heads clear the canopy by only a few inches, and it will have to be shortened or removed entirely to accomodate a mast-arm signal assembly. The City should be able to resolve the removal or alteration of the canopy because it is located within the Church Street right-of-way, and a City ordinance may already exist regarding overhanging structures in street right-of-ways, or should be instituted.

Additional pedestrian signals for the Weller Street approach are recommended to control the use of the existing crosswalk. Finally, the Consultant recommends replacement of the existing controller with a new pretimed model. Actuation is not really a necessity at this location and if the timing is correctly designed, delays to Church Street traffic would not noticeably increase under pretimed control. A pretimed controller has the advantage of being less costly, and the pedestrian signals could be made automatic as they should be at this intersection.

Accident Patterns: Six of ten reported accidents at Church and Weller during the study period involved parked cars, and all of the parking-related accidents occurred in the south bound lanes of Church Street. Two of the accidents involved parked cars which were sideswiped by south bound vehicles and two other collisions occurred when parked vehicles pulled out into the path of an oncoming car. As stated earlier, parking near this intersection is an obvious problem. The recommended parking prohibitions should alleviate a large number of future accidents by providing the required clear space near the intersection.

Three of the non-parking accidents involved left turning vehicles from Weller Street that were struck by cars on Church Street. This pattern is probably due to drivers on Church failing to notice a red signal indication. The recommended installation of mast-arm signals should reduce these accidents by improving signal visibility on all approaches.

Recommendations:

PRIORITY 1

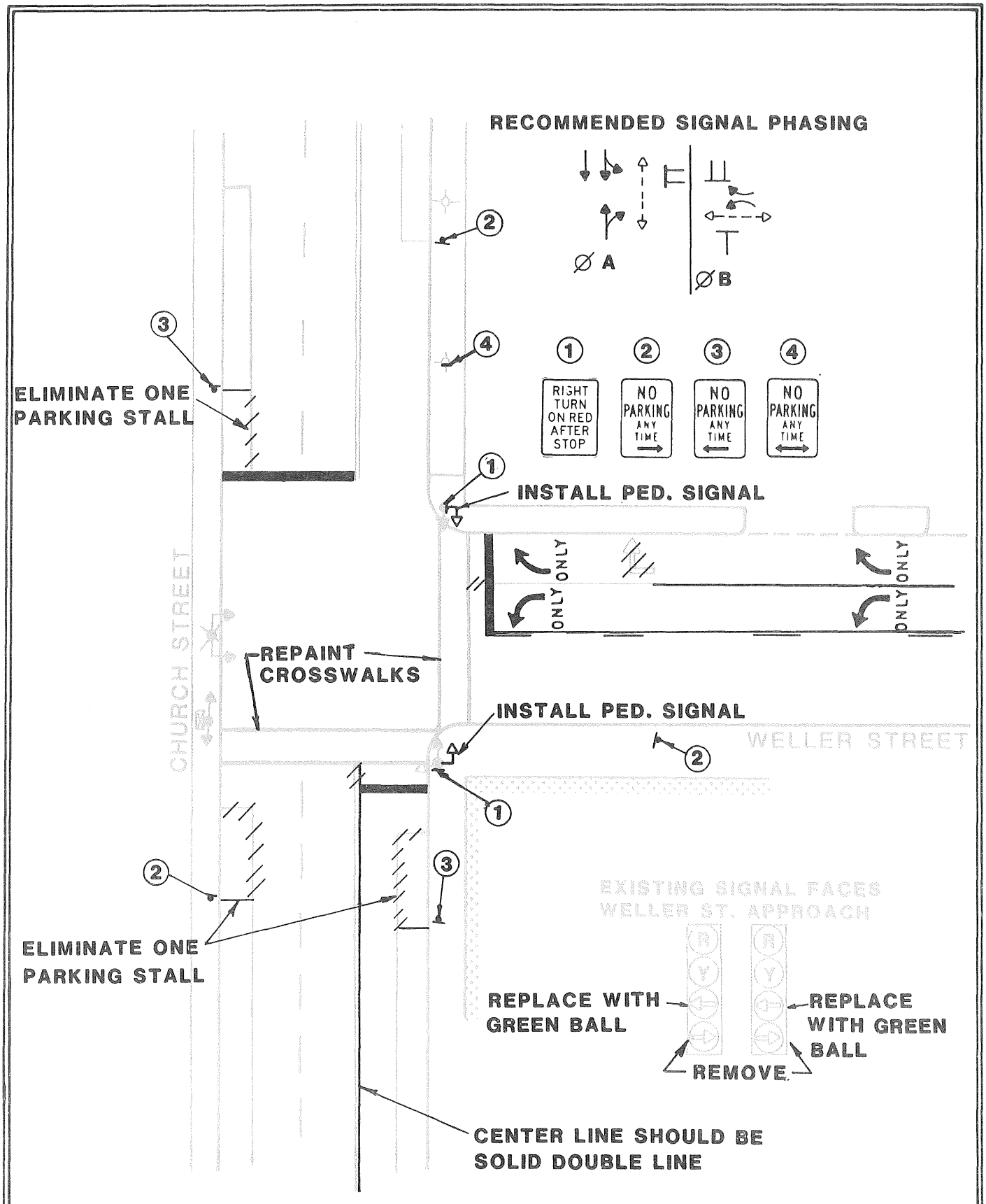
- Revise the signal phasing to allow left turns from Weller Street during the pedestrian walk interval.
- Replace the eight inch green arrows with green ball indications.
- Install "Right Turn on Red After Stop" signs on the northeast corner and the southeast corner.
- Eliminate parking stalls on the Church Street approaches as shown on the improvement diagram and install No Parking signs.
- Repaint the existing crosswalks on the south Church Street approach and on Weller Street.
- Install stop lines on all approaches and a center line on Weller Street.
- Remove the existing pavement arrow on Weller Street and install conforming arrows.

PRIORITY 2

- Install pedestrian signals on Weller Street.

PRIORITY 3

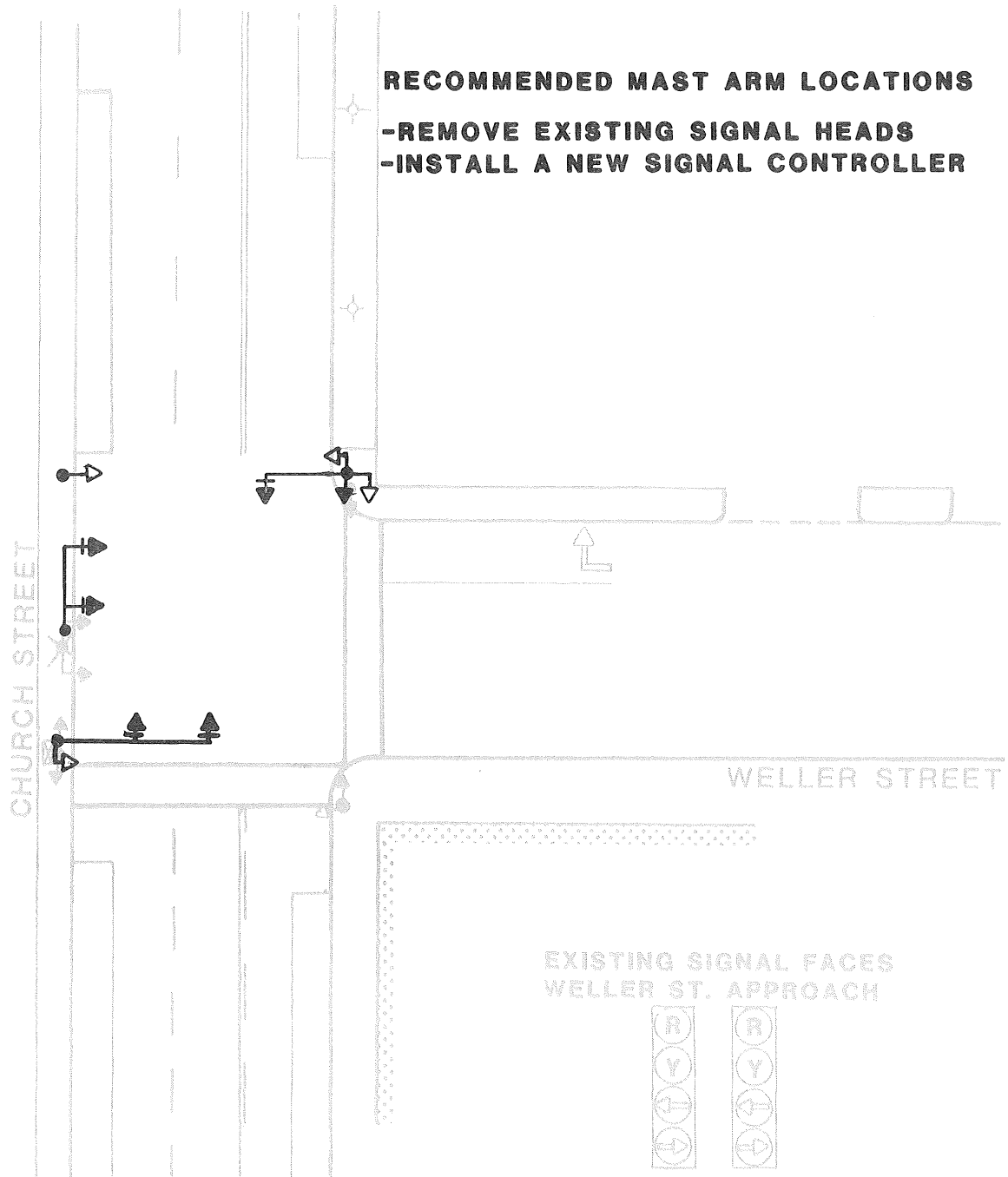
- Install mast-arms with 12 inch signal heads.
- Install a new pretimed signal controller.



CHURCH STREET & WELLER STREET

IMPROVEMENTS IN BLACK

Figure 2-24a



CHURCH STREET & WELLER STREET

Figure 2-24b

IMPROVEMENTS IN BLACK

TRAFFIC SIGNAL TIMING

(Actuated/Semi-Actuated)

Intersection: Church Street and Weller Street **Date:** _____

Controller Make: Eagle **Model:** _____

N	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
Minimum Initial	24.0	4.8						
Variable Initial								
Unit Extension		4.0						
Extension Limit		25.0						
Clearance	4.0	4.2						
All-Red								
Recall/Detector								
Walk		11.0						
Ped. Clearance	12.0	14.0						

Figure 2-24c

2.4.23 Bardell Street, Weller Street, and Madison Avenue

Physical Features and Traffic Control: This is a complex, four-legged intersection formed by Bardell Street, Weller Street, and Madison Avenue. The approaches are both skewed and offset which creates a large expanse of pavement. To prevent uncontrolled traffic flow, a triangular island has been painted in the middle of the intersection. While it does provide a degree of guidance to motorists, the island effectively creates three separate conflict areas for potential accidents.

The east corner of the intersection is almost totally undefined because of the wide, filling station driveways and a minor street opening on Madison Avenue. A driveway from the Ace Hardware parking lot opens directly into the intersection from the north corner and provides an extra source of vehicle conflict.

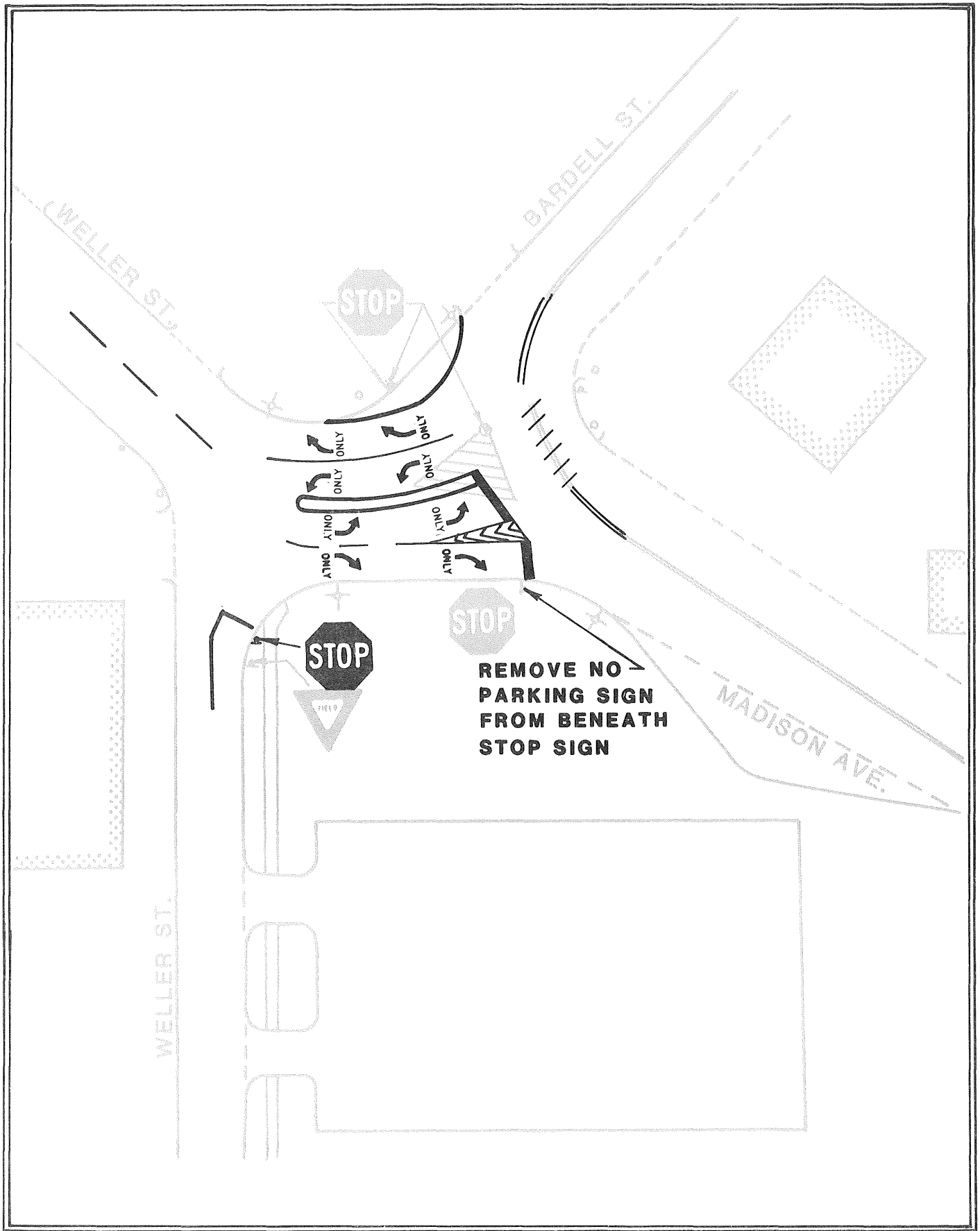
The predominant traffic patterns at this intersection are to and from Bardell Street and Madison Avenue and from Madison Avenue to Weller Street. Existing Stop sign locations are consistant with these patterns; traffic is allowed to flow freely to and from Bardell and Madison and from Madison to Weller, while all other traffic is required to stop. South Weller Street is an exception because traffic on that approach is controlled by a Yield sign. The existing arrangement of this intersection is working because motorists drive it with caution and because traffic performing the controlled movements is light. If traffic flow from Bardell to Weller or from Weller to Madison increases significantly, the lack of storage for vehicles stopped in the intersection will cause a considerable amount of congestion.

The two accidents that occurred during the study period do not constitute a pattern of any kind and extensive intersection improvements are obviously not warranted at this time. There are really no immediate recommendations that will signifiicantly improve the intersection either. The nature of the intersection, however, will require eventual geometric changes to avoid traffic congestion and a developing accident problem. Any geometric improvements undertaken should reduce the number of conflict areas and provide adequate storage for vehicles stopped in the intersection.

Two improvement concepts are included in this report (Figures 2-25a and 2-25b) for the City to consider. Both of the plans would eliminate the painted island and effectively separate the Weller Street approaches from Bardell Street and Madison Avenue. This would reduce the number of conflict areas from three to two by channeling all traffic that crosses from Bardell or Madison to Weller along a single path. Also, storage for vehicles waiting to turn left would be provided to eliminate congestion. The plans both maintain existing free traffic movements but require the installation of a Stop sign on the south Weller Street approach.

Figure 2-25a depicts the construction of a narrow, raised median to separate two traffic lanes in each direction and some curbing changes. This plan has the advantages of being less costly and requiring no additional right-of-way. The concept shown on Figure 2-25b involves realignment of the Bardell and Madison approaches to flatten the curve on Bardell and to completely separate the existing intersection into two "Y" intersections. This plan would provide for an even higher degree of safety and a much simplified design, however, construction and right-of-way acquisition costs would be much greater.

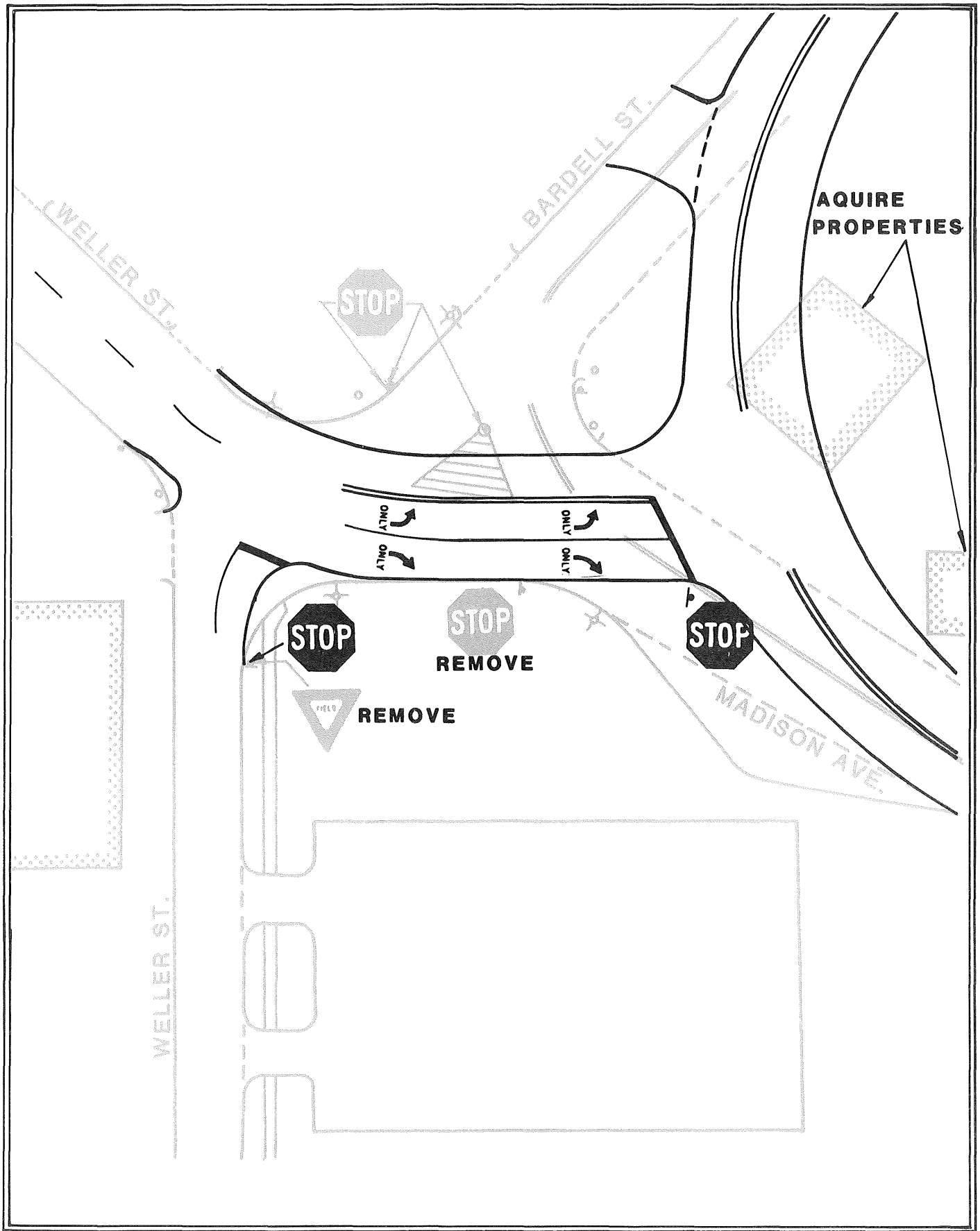
Neither of the improvement concepts is warranted at this time, and cost estimates have not been developed for them, but the City should consider these types of plans for eventual improvements to the intersection.



BARDELL STREET, WELLER STREET, & MADISON AVENUE

IMPROVEMENTS IN BLACK

Figure 2-25a



BARDELL STREET, WELLER STREET, & MADISON AVENUE

IMPROVEMENTS IN BLACK

Figure 2-25b

2.4.24 Fourth Street and Marion Street

Physical Features and Traffic Control: This right-angle intersection is located on the northwest edge of the CBD, but is surrounded by a church and private residences. The approaches are all two-lane streets that vary in width from 40 feet on Fourth Street to 27 feet on the north Marion approach.

Marion and Fourth is the first of three consecutive intersections along Fourth Street that are studied in this report. Four-way Stop sign control is utilized at this location, at Fourth and Washington, and at Fourth and Court. Fourth and Market Street was not included in this study, but is also a four-way stop. Despite its role as a major east-west route that intersects U.S. 63, traffic on Fourth Street is required to stop at four intersections in a row.

Existing traffic volumes on Marion Street at the intersection are less than 1500 vehicles per day and do not warrant a four-way stop. In addition, field observations at the intersection indicate that sight distance on the Marion Street approaches will be adequate if no parking zones near the intersection are increased as specified on the improvement diagram. The daily traffic volume on Fourth Street is such that the cost of stopping all vehicles is excessive and wastes fuel. The Consultant recommends removal of the Fourth Street Stop signs.

While collecting field data at this intersection, the Consultant noted a traffic backup on Fourth Street shortly before noon caused by parents picking up their children at the First United Methodist Church. The church is located on the southeast corner of the intersection and vehicles entering the parking lot lined up along Fourth. The Consultant recommends that the City Engineering Staff speak to representatives of the church about an improved pickup system. Perhaps a driveway off Marion Street could be used for this operation.

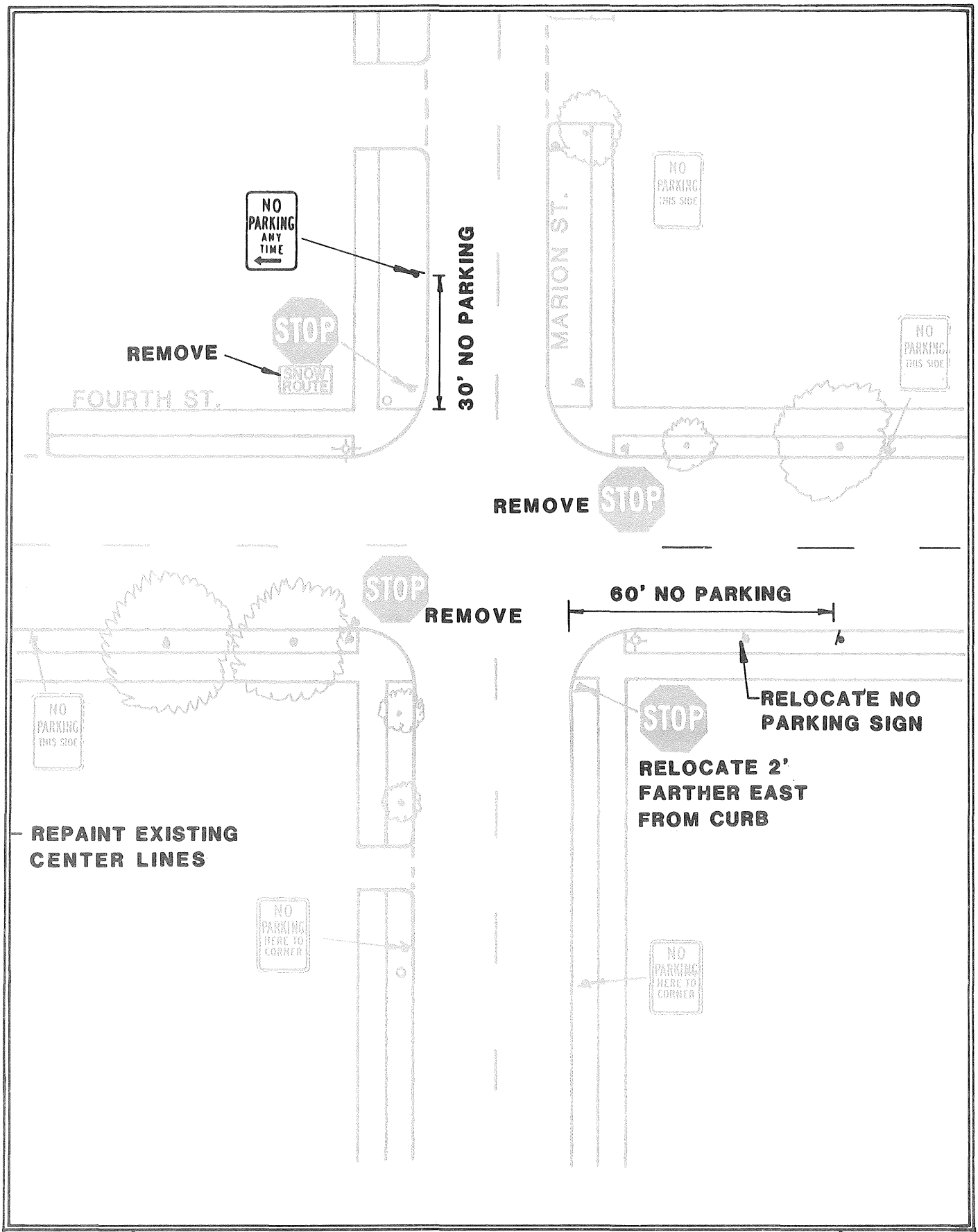
Accident Patterns: Only eight accidents were reported at Fourth and Marion from 1976 through 1978. Three of the accidents were cross traffic collisions which may have been caused by motorists on Fourth failing to observe the Stop signs. That reason is suggested because trees along the Fourth Street approaches block the fixed-mount Stop signs and the City has been forced to install temporary Stop signs in the street.

Recommendations:

PRIORITY 1

- Remove the Stop signs on Fourth Street.
- Relocate the south approach Stop sign 2 feet farther from the curb face.
- Install a No Parking sign 30 feet from the sidewalk line on the north approach.
- Relocate the No Parking sign on the east approach as shown on the improvement diagram to increase sight distance on the southeast corner.
- Install center line striping on the east approach and repaint the existing center lines on the other approaches.

Note: In January of this year, the City removed the Stop signs on Fourth Street and installed signs on the Marion Street approaches warning motorists that Fourth Street traffic does not stop. The Consultant suggests that such signs carry the more general message: "CAUTION - CROSS STREET TRAFFIC DOES NOT STOP", so they can be reused at other locations.



MARION STREET & FOURTH STREET

Figure 2-26

IMPROVEMENTS IN BLACK

2.4.25 Fourth Street and Washington Street

Physical Features and Traffic Control: This intersection is located one block east of Fourth and Marion. All of the approaches except north Washington Street are three-lane roadways with parking on one side. The north Washington Street approach is a two-lane 26 feet roadway on a steep hill.

Four-way Stop signs are used to control traffic at Fourth and Washington. Pedestrian crosswalks are painted on the south and west approaches and stop lines are located on all but the north approach.

Mandatory right turn lanes are designated by pavement arrows on the west and south approaches and the east approach is provided with a left turn lane. These lane designations are consistant with turning patterns at this intersection and should not be changed, however the existing pavement arrows should be replaced by two sets of standard type arrows and a lane assignment sign on each approach. The center line location on the north approach allows only a 7 foot lane for north bound traffic and should be relocated to provide a 10 foot lane.

The north approach Stop sign should also be relocated, approximately 6 feet south of its present position, and supplemented with a stop line. For the present time, an object marker should be installed on the wood power pole at midblock of the east approach to warn motorists of its presence near the curb. However, this pole and the others along the north side of Fourth Street between Court Street and Marion Street should be relocated behind the sidewalk, if possible, to prevent sideswipe or head-on collisions. The existing 66 foot right-of-way along Fourth Street is adequate to allow the City to move the poles.

As of January, 1980, the City was considering plans to widen Washington Street north of Fourth Street in an attempt to divert north-south traffic from the intersection of Fourth and Court. Many south bound motorists currently turn left from Court Street to Fourth, and then turn right at Market Street to access the CBD. Widening the north segment of Washington Street will promote it as an alternate, more direct route to the CBD that can accomodate increased traffic. This plan should be implemented as it offers the potential for improved traffic flow to the CBD and a traffic reduction at the intersection of Fourth and Court and the Market Street intersections.

Traffic Volumes: Two-way volumes on Washington Street vary from 1,300 vehicles per day north of the intersection to 5,500 vehicles per day south of the intersection. Daily traffic on the east Fourth Street approach amounts to 3,800 vehicles per day. Although a recent volume for the west Fourth Street approach was not available, it is evident that the average hourly entering volume from all approaches do warrant the existing four-way Stop signs.

Accident Patterns: The 5 reported accidents at Fourth and Washington do not present a serious accident problem and preclude a meaningful accident analysis. The recommended improvements at this intersection are based on general safety considerations and standard traffic engineering practice.

Recommendations:

PRIORITY 1

- Relocate the north approach Stop sign to within 4 feet of the sidewalk line and install a stop line.

- Relocate the north approach center line to provide a 10 foot north bound lane.

- Install a No Parking sign on the west side of the north approach as shown on the improvement diagram.

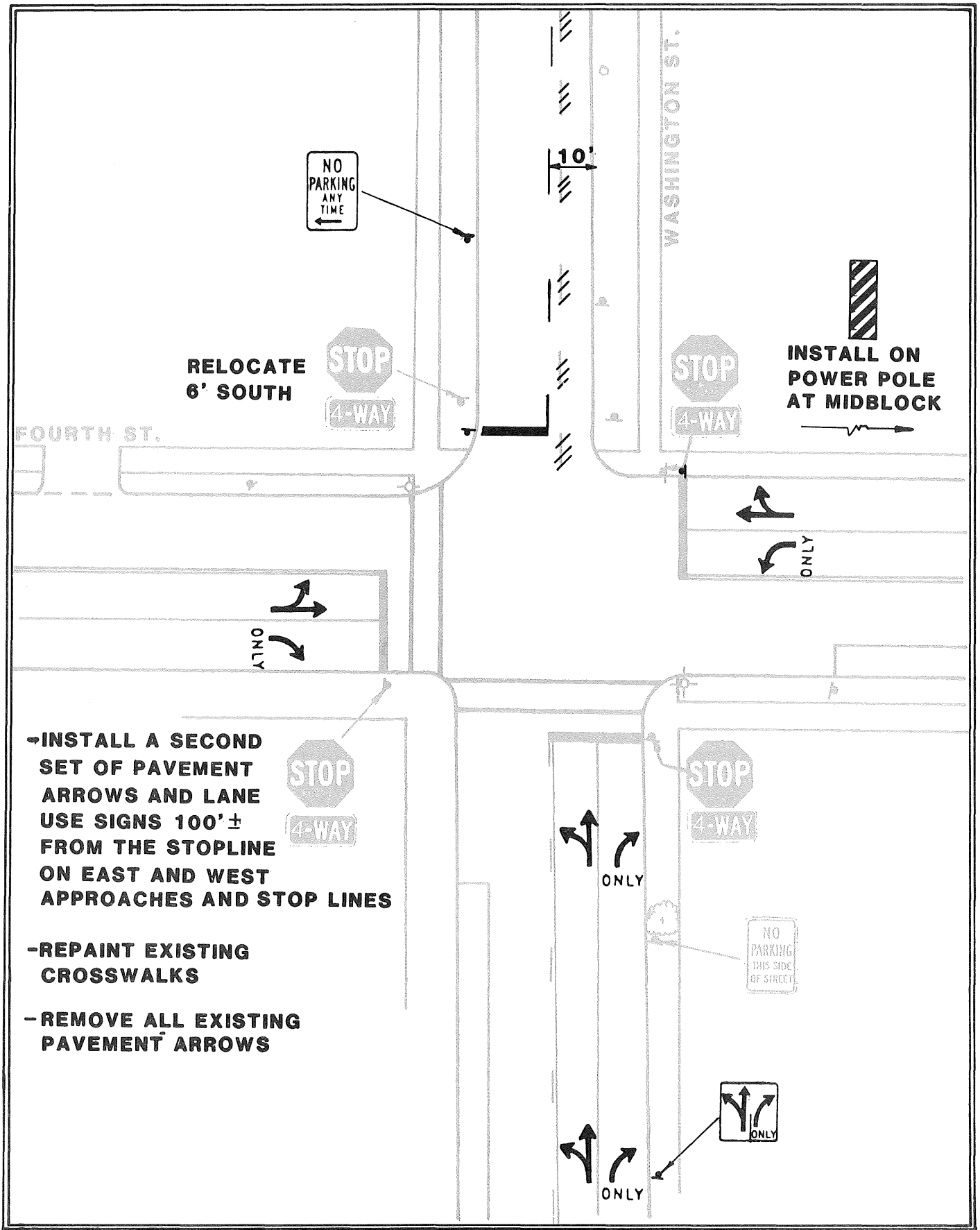
- Repaint existing crosswalks and stop lines.

- Remove all existing pavement arrows and install conforming arrows and lane use assignment signs.

- Install an Object Marker (OM-3R) on the power pole at midblock on Fourth Street.

PRIORITY 3

- Relocate the power poles along the north side of Fourth Street to positions behind the sidewalk.



WASHINGTON STREET & FOURTH STREET

IMPROVEMENTS IN BLACK

Figure 2-27

2.4.26 Fourth Street and Court Street

Physical Features and Traffic Control: Fourth and Court is essentially a "T" intersection, however entrance and exit roads from the park area south of the intersection form an additional approach. The park roads are each offset 65 feet from the Court Street center line, which greatly increases the intersection conflict area. Court Street is a 60 foot, two-lane roadway and the Fourth Street approaches are flared to a 53 foot width near the intersection. Public buildings surround this intersection and pedestrian traffic is heavy.

Traffic is controlled by four-way Stop signs at Fourth and Court. The Stop signs are located at the intersection on all but the west approach where traffic is forced to stop 60 feet in advance of Court Street so that vehicles can access the park entrance road. On the east approach, the Stop signs and stop line are separated by 30 feet and an angled pedestrian crosswalk is located between them. To make matters worse, a second crosswalk is located over 100 feet from what would be its normal location on the west approach. The entire arrangement is very confusing to drivers unfamiliar with the intersection and forces all motorists to drive the intersection with extreme caution. Surprisingly, only one accident - a rear end collision on Court Street - occurred between 1976 and 1979.

Improvements to this intersection should begin with the closure of the park roads. Less than 1,000 vehicles per day use the park roads which does not justify the confusing and potentially dangerous situation they cause at Fourth and Court. Closing the park roads will permit the Fourth Street crosswalks to be relocated to normal positions and will eliminate the dispersed conflict points at the intersection. Motorists who currently use the park roads to reach the library will still be able to access them from Third Street by driving around the block.

The City should close the park roads at this time by any means it prefers, however, curbing and sidewalks should be installed eventually to provide permanent closure and an asthetic appearance. The flared section of Fourth Street will provide a safe unloading zone near the library and the book drop box should be relocated to this location.

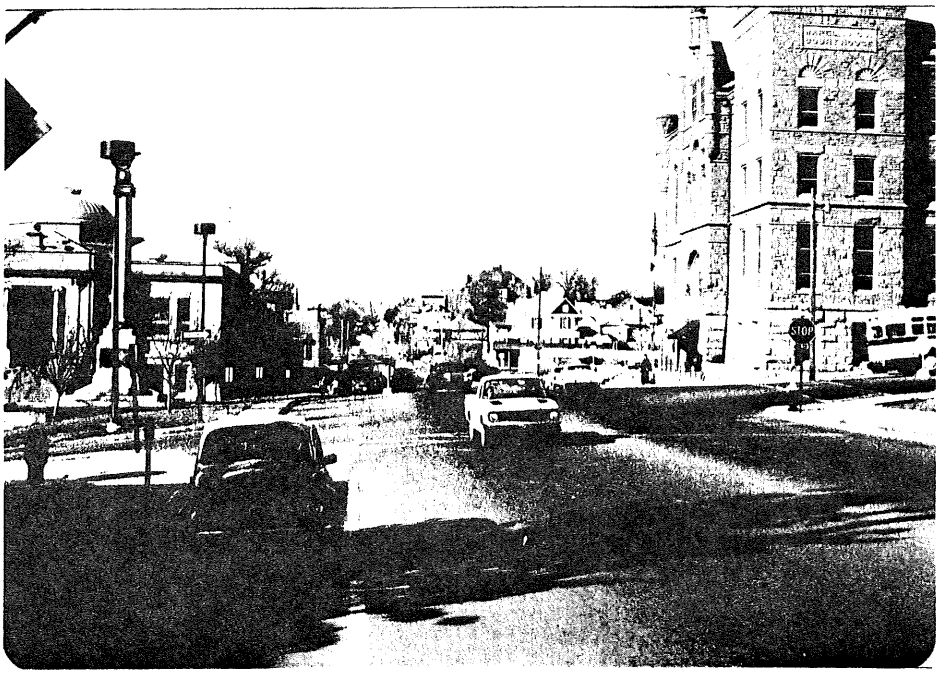
The Consultant also recommends removal of the Stop signs on Fourth Street. The existing two-way traffic volume on Court Street is less than 2,000 vehicles per day, while Fourth Street carries 4,000 to 4,500 vehicles per day. These volumes do not warrant a four-way stop and removal of the Stop signs on Fourth Street will eliminate another unnecessary stop on Fourth and will further promote Washington Street as an alterate north-south route. Removal of the Stop signs will require the installation of Advance Pedestrian Crossing signs on the Fourth Street approaches.

Improvements at Fourth and Court should also include the addition of a center line on Fourth Street to separate east and west bound traffic, and installation of a lane line and lane use pavement arrows on Court Street.

Recommendations:

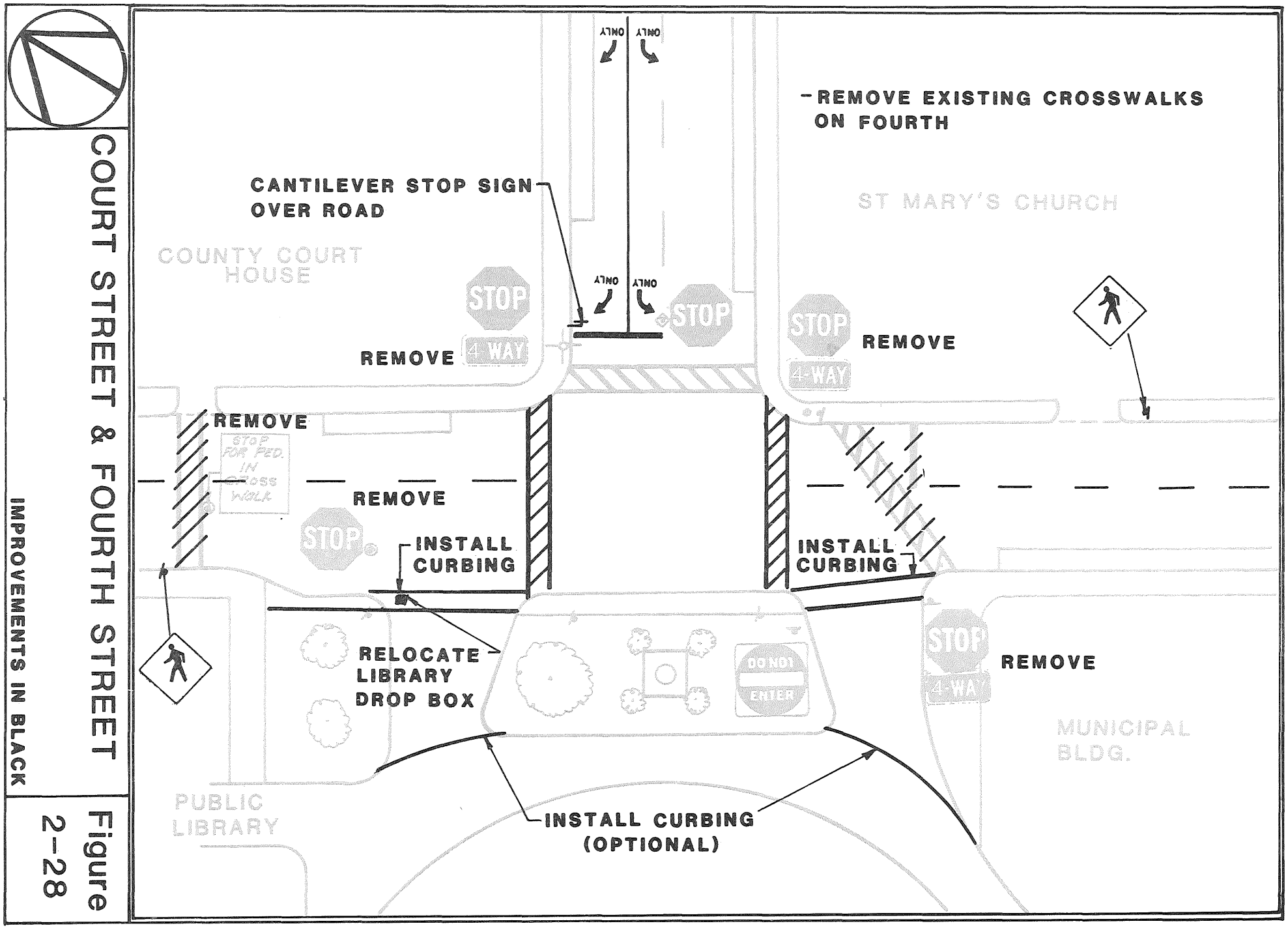
PRIORITY 1

- Close the park entrance and exit roads.
- Relocate the crosswalks on Fourth Street as shown on the improvement diagram.
- Remove the Stop signs on Fourth Street.
- Install center line striping on the Fourth Street approaches.
- Install Pedestrian Crossing signs (W11a-2) on Fourth Street in advance of the crosswalks.
- Install pavement arrows on the Court Street approach.
- Relocate the library drop box as shown on the improvement diagram.



Fourth and Court - Looking northwest

Note: During the months of February and March, the City closed the park entrance and exit roads and removed the Fourth Street Stop signs on a 90 day trial basis. A flashing beacon was suspended over the intersection to warn motorists of the change.


COURT STREET & FOURTH STREET
IMPROVEMENTS IN BLACK
Figure 2-28
REMOVE EXISTING CROSSWALKS ON FOURTH
CANTILEVER STOP SIGN OVER ROAD
ST MARY'S CHURCH
COUNTY COURT HOUSE
STOP
4 WAY
ONLY
REMOVE
REMOVE
STOP FOR PED. IN CROSS WALK
REMOVE
INSTALL CURBING
INSTALL CURBING
RELOCATE LIBRARY DROP BOX
DO NOT ENTER
REMOVE
MUNICIPAL BLDG.
PUBLIC LIBRARY
INSTALL CURBING (OPTIONAL)

2.4.27 Main Street and Iowa Avenue

Physical Features and Traffic Control: This intersection is located in eastern Ottumwa in the midst of small business developments. Main Street is a 42 foot, three-lane facility and Iowa Avenue is a 30 foot, two-lane street. Both streets are classified as minor arterials. The Main Street approaches are level, but Iowa Avenue slopes downhill to the south. A 9 foot curb radius exists on the northeast corner which makes right turns from Main Street difficult for any driver to execute without encroaching on the south bound lane of Iowa Avenue. Except for some curbing around the traffic signal pedestal, the northwest corner is totally undefined.

Main and Iowa is a signalized intersection at which the signal heads are mounted on wooden power poles. Far left and far right indications are provided for each approach. The existing signals have eight inch lenses except for the far right red indications for Main Street, which have 12 inch lenses. Signal control is provided by a rather ancient Eagle pretimed controller that is kept in a controller cabinet with a broken lock. A two-phase, 60 second cycle is used with 5.4 second clearance intervals.

Faint sets of pavement arrows are located on the Main Street approaches. The arrows designate a mandatory right turn lane on the west approach and a left turn lane on the east approach. Existing lane widths on Main Street range from slightly over 9 feet to 23 feet for a combined traffic and parking lane.

The existing signals at Main and Iowa blend almost totally with the intersection surroundings and are extremely hard to see on all approaches. The Consultant recommends that new signals be mounted overhead on a box formation span wire - similar to the installation at Second and Kitterman. Two signal heads, each with 12 inch red, amber, and green indications and backplates should be provided for each approach. The existing power poles on the northwest, northeast, and southwest corners should be checked to determine whether they can accomodate the span wire loads and an additional pole will definitely be required on the southeast corner. The overhead power connection used for the existing signals will provide for an easy conversion to a span wire assembly.

Once the span wire signals are installed, the corner-mount signal heads should be removed. The recommended span wire installation will provide an inexpensive way of providing much more visible signals and should have a positive effect on the accident experience at this intersection.

The existing controller cabinet, which is wired shut because of a broken lock, should be replaced by a new cabinet as soon as possible. The signal controller is quite old and should also be replaced. Of more immediate concern, however, is the clearance interval timing, which is currently too long and should be revised to provide 3.6 second amber intervals for each approach.

Curbing should be installed on the northwest corner, not only to define the corner, but to prevent the signal pole from being easily struck by an errant vehicle. The northeast corner also deserves attention and should be reconstructed to provide at least a 15 foot radius.

A recent traffic volume count taken by the City indicates that traffic on Iowa Avenue is heavier north of the intersection. On that basis, the Consultant questions the need for a mandatory right turn lane on the west approach, and suggests instead that a left turn lane be provided. Because the Main Street approaches already have offset center lines and should be restriped to provide wider lanes, it is recommended that shadowed left turn bays be painted on the east and west approaches as shown on Figure 2-29b. This improvement should be accompanied by the removal of existing pavement arrows and the installation of left turn arrows and the word message "ONLY" on the left turn lanes.

The no parking zones on Main Street should be increased as shown on Figure 2-29a to promote safer traffic flow through the intersection. It is also recommended that parking on the sidewalk be prohibited on the east side of the north approach, because this practice blocks the sidewalk and breaks down the curb over a period of time. The sidewalk is within City right-of-way so the parking prohibition can be enforced.

Traffic Volumes: Two-way traffic volumes on Iowa Avenue are 3,000 vehicles per day south of the intersection and 6,100 vehicles per day north of the intersection. Main Street carries 3,700 vehicles per day east of the intersection.

Accident Patterns: Rear end collisions comprised one third of the 12 accidents reported during the analysis period. Two cross traffic collisions and two left turn collisions also occurred. These types of accidents are probably being caused by the poor visibility of traffic signals and the excessive clearance intervals. The recommended installation of span wire-mounted signals and the revisions of existing amber times should decrease rear end, cross traffic, and left turn accidents.

Two collisions that involved stopped, south bound cars on Iowa that were hit by right turning vehicles from Main Street indicate the need for a larger curb radius on the northeast corner. Finally, one rather unusual accident that occurred when an out-of-control truck rolled into three cars parked on the north approach sidewalk can be prevented from happening again if sidewalk parking is prohibited.

Recommendations:

PRIORITY 1

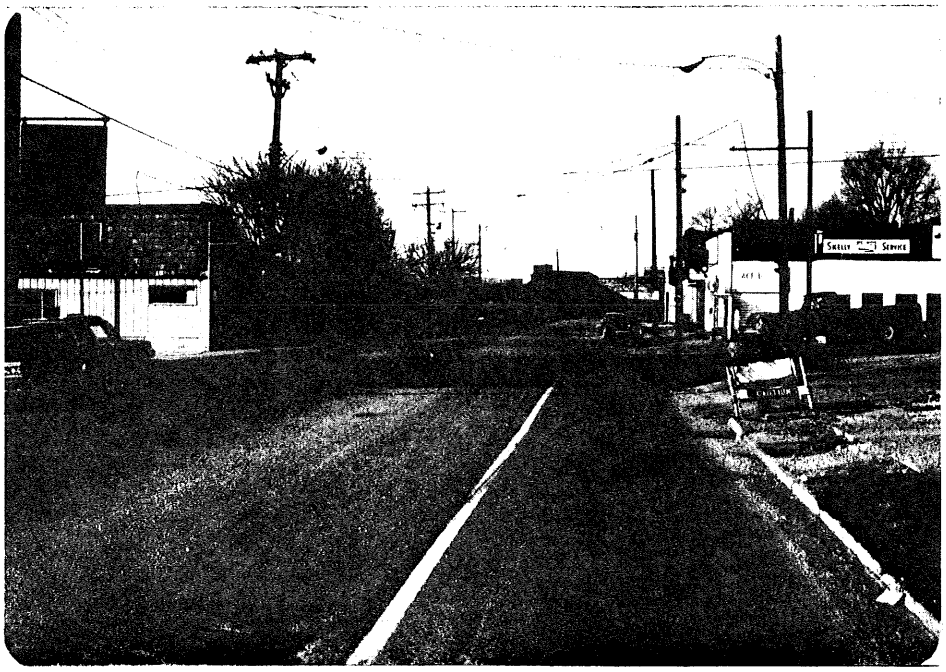
- Revise the clearance interval timings.
- Install a new controller cabinet.
- Restripe the Main Street approaches as shown on the improvement diagram to provide protected left turn lanes.
- Increase the no parking zones on Main Street as required by the striping changes.

PRIORITY 2

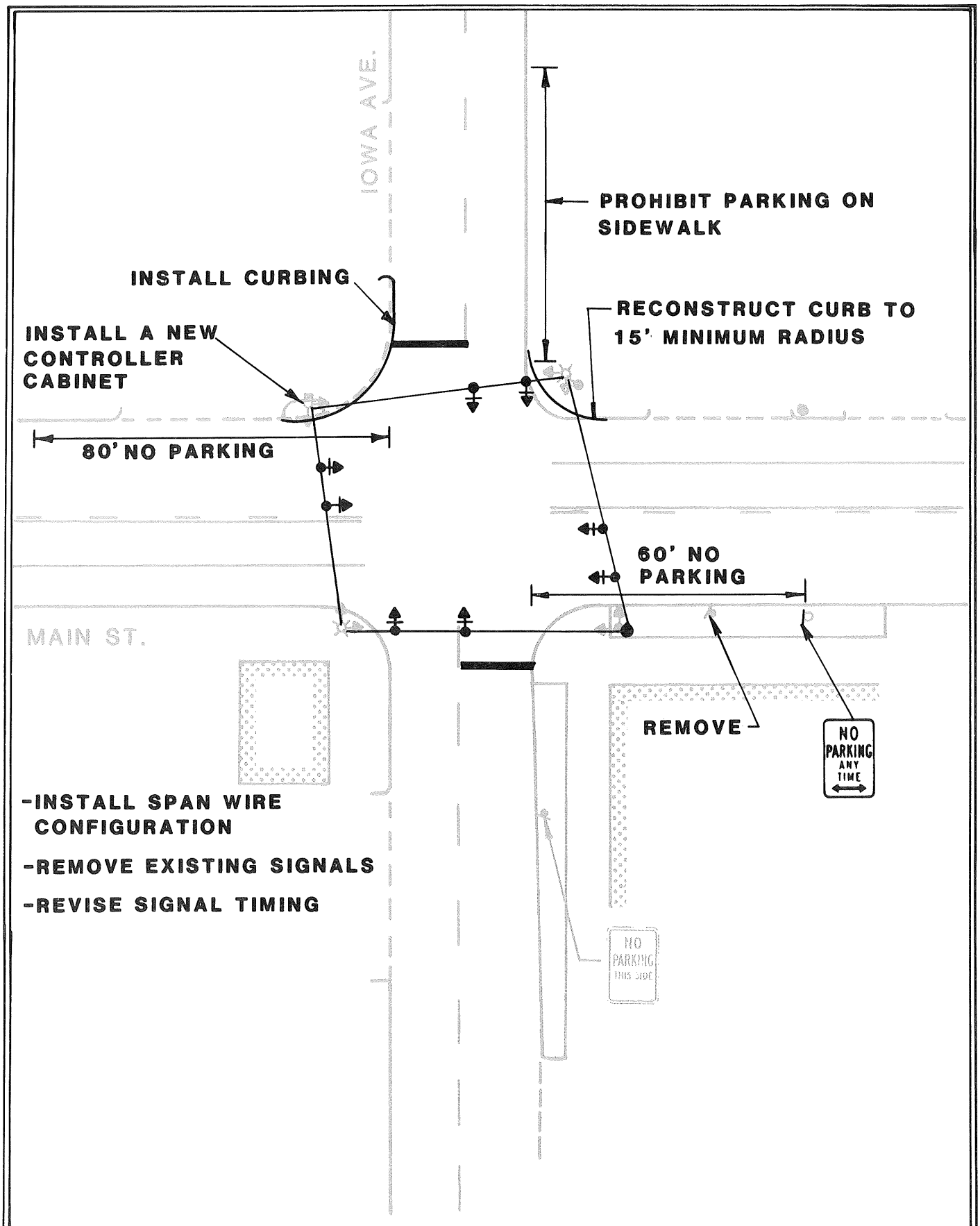
- Install span wire-mounted signals.
- Reconstruct the northeast corner to provide a minimum 15 foot curb radius.
- Install curbing on the northwest corner.

PRIORITY 3

- Install a new pretimed signal controller.



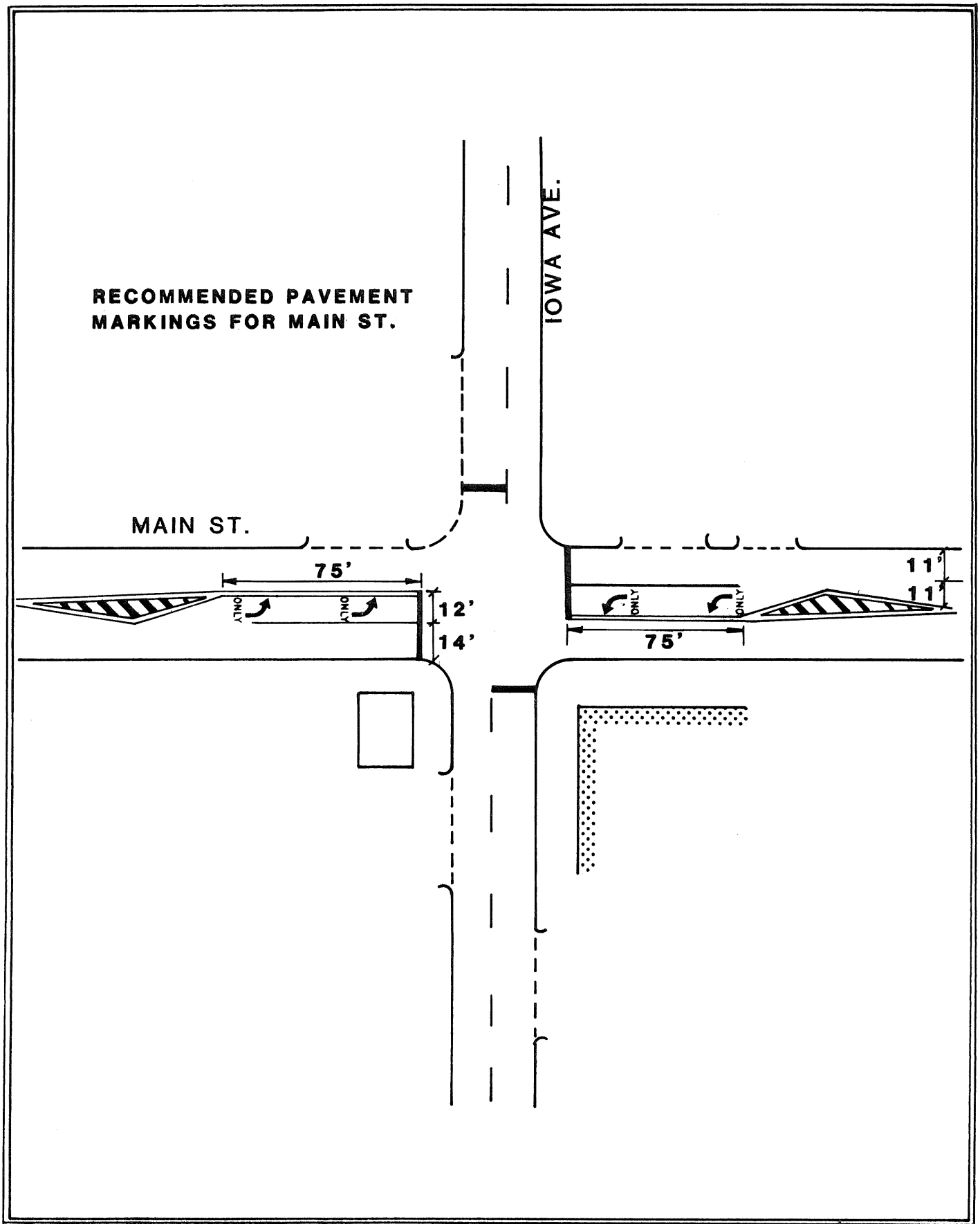
A view of Main and Iowa showing
the poor visibility of traffic signals.



MAIN STREET & IOWA AVENUE

IMPROVEMENTS IN BLACK

Figure 2-29a



MAIN STREET & IOWA AVENUE

IMPROVEMENTS IN BLACK

Figure 2-29b

TRAFFIC SIGNAL TIMING

(Fixed Time)

Intersection: Main Street and Iowa Avenue **Date:** _____

Controller Make: Eagle **Model:** _____

Phase	Dial # Cycle Length sec.			Comments
	Key Position	% of Cycle	Time of Cycle	
Main Street Grn.	0	48.0	28.8	
Main Street Amber	48	6.0	3.6	
Iowa Grn.	54	40.0	24.0	
Iowa Amber	94	6.0	3.6	

HOURS OF OPERATION

Dial: _____ **Offset1(red):** _____ **Flashing:** _____

Offset2(yellow): _____ **Yellow:** _____

Offset3(white): _____ **Red:** _____

Figure 2-29c

2.4.28 Wapello Street, Albia Road, and Ferry Street

Physical Features and Traffic Control: This "T" intersection is located in southwestern Ottumwa. The Wapello and Ferry approaches are four-lane divided roadways with a raised median, and Albia Road is a three-lane facility. A channelized right turn lane allows free movement from Wapello to east bound Albia Road and the Ferry Street approach has a protected left turn bay. The Consultant observed that trucks cannot turn left from Ferry Street to Albia without running partially off the road. This situation is due to the nose of the Ferry Street median which projects too far into the intersection.

Traffic control is provided by fully actuated signals. The signal heads are mounted on mast-arms for the Wapello and Ferry approaches and are pole-mounted for Albia Road. The Albia signals are signed as right and left turn signals and double green arrows are provided to indicate permitted movements (shown on Figure 2-30a). Separate signal phases are furnished for north and south through traffic, for east bound traffic, and for left turns from Ferry and right turns from Albia. Clearance intervals currently range from 5 to 7.5 seconds with an all-red phase. Pavement arrows are located only on the Ferry Street approach and stop lines are provided on Ferry and Albia.

Clearance intervals at this intersection need to be decreased as shown on the included signal timing plan to insure that the amber interval is not used as additional green time. The Albia Road signals should be altered by removing all but one of the green arrows and installing a green ball indication on each signal head. This will eliminate the need for right and left turn signal signs and will make the signals easier to understand at a glance.

A stop line should be installed on the Wapello approach and the Albia Road stop line should be relocated four feet behind the sidewalk line. The existing pavement arrows are not of a conforming style and need to be replaced by standard arrows where indicated on the improvement diagram. Pavement arrows for the Ferry Street approach are only necessary on the left turn bay to inform motorists of its use. A Double Arrow sign should be installed on Wapello Street to indicate a division in the roadway. It is recommended that the Ferry Street median be shortened eventually to allow trucks to make a left turn without running off the roadway.

Traffic Patterns: Daily traffic counts taken at Wapello, Albia, and Ferry show that Albia Road carries a two-way volume of nearly 8,400 vehicles while Wapello Street carries over 9,900 vehicles.

Accident Patterns: 12 accidents were reported at this intersection during the analysis period. The percentage of personal injury accidents was high, at over 58% of the total accidents, but higher approach speeds are probably a contributing factor. At first glance, the 6 rear end collisions appear to constitute a significant pattern, however two of the collisions occurred on the same date under icy conditions and the rest were evenly distributed among all the approaches. The two reported left turn collisions may have been due to the lengthy clearance intervals and if so, the recommended timing revisions should eliminate the problem.

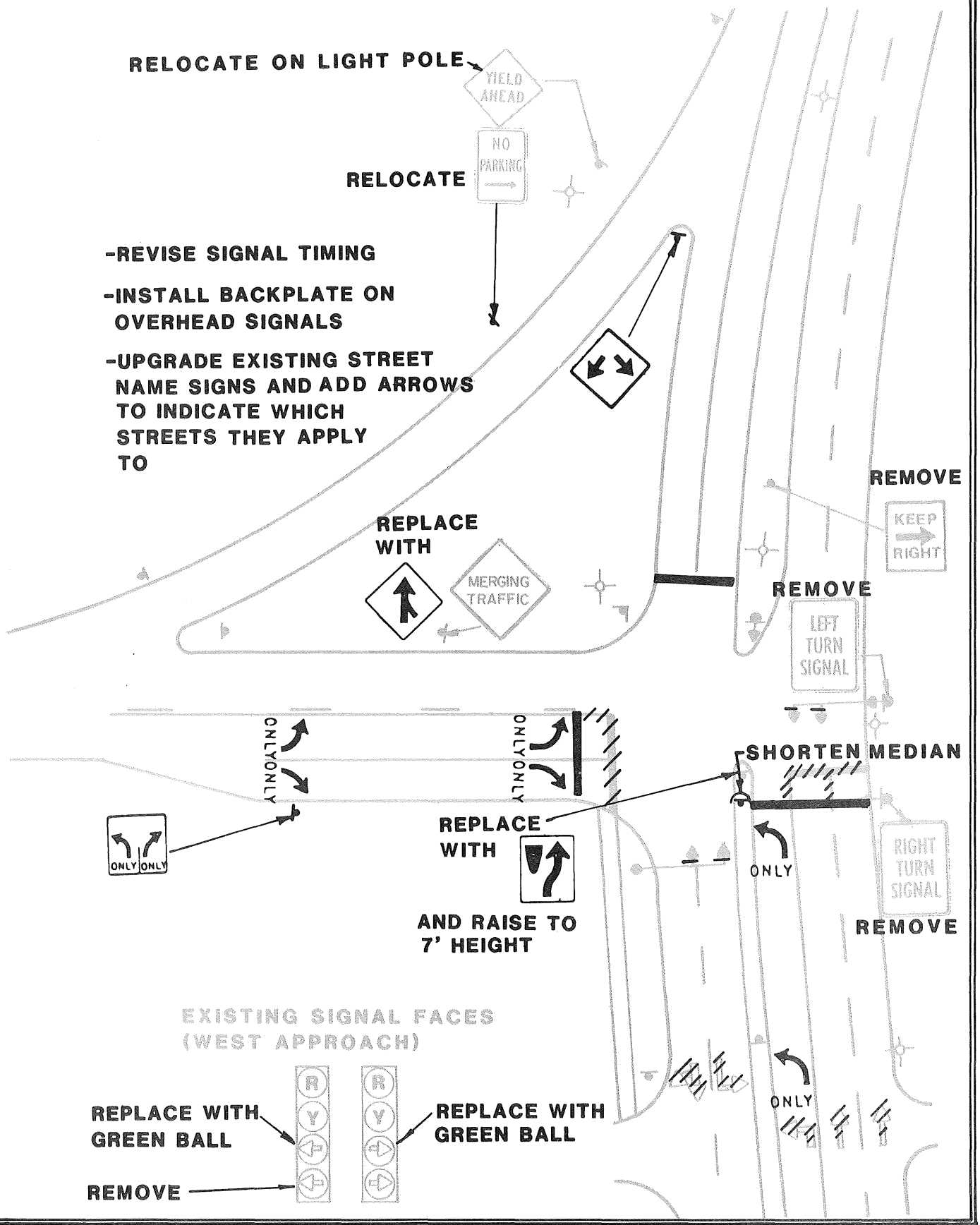
Recommendations:

PRIORITY 1

- Revise the clearance interval timings.
- Replace the green arrows on the Albia Road signals with green ball indications and remove the right and left turn signal signs.
- Relocate the stop line on Albia Road and install a stop line on Wapello Street.
- Remove existing pavement arrows and install conforming arrows as indicated on the improvement diagram.
- Install a Double Arrow sign (W12-1) on the Wapello approach.
- Relocate the Yield Ahead and No Parking signs as shown on the improvement diagram.
- Replace the Merging Traffic sign on Albia Road and the Divided Highway sign on Ferry Street with new symbol signs (W4-1 and R4-7).

PRIORITY 2

- Reconstruct the median nose on Ferry Street.
- Install backplates on the overhead signals.



WAPELLO STREET, ALBIA ROAD, & FERRY STREET

IMPROVEMENTS IN BLACK

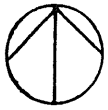
Figure 2-30a

TRAFFIC SIGNAL TIMING

(Actuated/Semi-Actuated)

Intersection: Wapello Street, Albia Rd. & Ferry St. **Date:** _____

Controller Make: Eagle **Model:** _____



	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
Minimum Initial	6.0	8.0	8.0					
Variable Initial	1.8	1.4	1.8					
Unit Extension	12.0	3.0	5.0					
Extension Limit	30.0	35.0	28.0					
Clearance	3.5	3.5	3.5					
All-Red	1.0	1.0						
Recall/Detector	On	Presence	Presence					
Walk								
Ped. Clearance								

Figure 2-30b

2.4.29 Richmond Avenue and Ferry Street

Physical Features and Traffic Control: Richmond Avenue intersects Ferry Street 300 feet south of Wapello, Albia and Ferry. Ferry Street is a four-lane divided roadway that reverts to a two-lane roadway south of this intersection. The east Richmond approach is a three-lane roadway and the west approach is a two-lane roadway.

A recent traffic volume count provided by the City indicates that the north Ferry Street approach and the east Richmond approach carry over 5,000 and 6,000 vehicles per day respectively. Traffic movements at this intersection consist primarily of turns to and from north Ferry Street and east Richmond Avenue. The turning demand is serviced by a mandatory left turn lane on the north approach and a mandatory right turn lane on the east approach. Pavement arrows are located on both of these approaches to inform drivers of the lane assignments, but are placed too far in advance of the intersection to be effective. Traffic on the east, west, and south approaches is controlled by Stop signs, while north approach traffic is allowed to flow freely through the intersection.

A three-way stop intersection is always confusing to unfamiliar drivers and usually leads to a dangerous condition that is reflected in accidents at the intersection. It is therefore recommended that the south approach Stop sign be removed to result in two-way stop traffic control. This modification will require that the 3-Way signs mounted beneath the east and west approach Stop signs be replaced with 2-way signs.

Because Ferry Street narrows from four lanes to two lanes south of the intersection, ample lane use guidance on the north approach is a necessity. To provide the required lane use guidance, existing pavement arrows on the north approach should be removed and two sets of standard pavement arrows should be installed as shown on the improvement diagram. The existing "Left Lane MUST Turn Left" sign should be relocated approximately 50 feet north of its present location and a Left Turn Only symbol sign should be erected at the intersection.

A Pavement Width Transition sign now located on the north approach prematurely warns drivers of the decreased pavement width south of the intersection and may actually be encouraging some motorists to merge left prior to the intersection. This sign should be removed and the Speed Limit 25 sign beneath it should be raised to a 7 foot mounting height. A No Parking sign is also needed on the north approach to supplement the painted curbing.

The installation of an Object Marker on the southwest corner is suggested to aid south bound through traffic in making the transition to a narrower roadway. Proper lane use should also be promoted on the east approach through the installation of pavement arrows and a lane assignment sign. Finally, to supplement the existing Stop signs, stop lines should be painted on the east and west approaches.

Traffic Volumes: A peak hour traffic count taken for this study indicates a total entering volume of just over 1,100 vehicles at Richmond and Ferry. Left turns from the north approach and right turns from the east approach are the two heaviest traffic movements and account for 250 to 300 vehicles each during the peak hour. Through movements from the north and south approaches amount to approximately 260 and 180 vehicles respectively, while all other traffic movements account for less than 50 vehicles each during the peak hour.

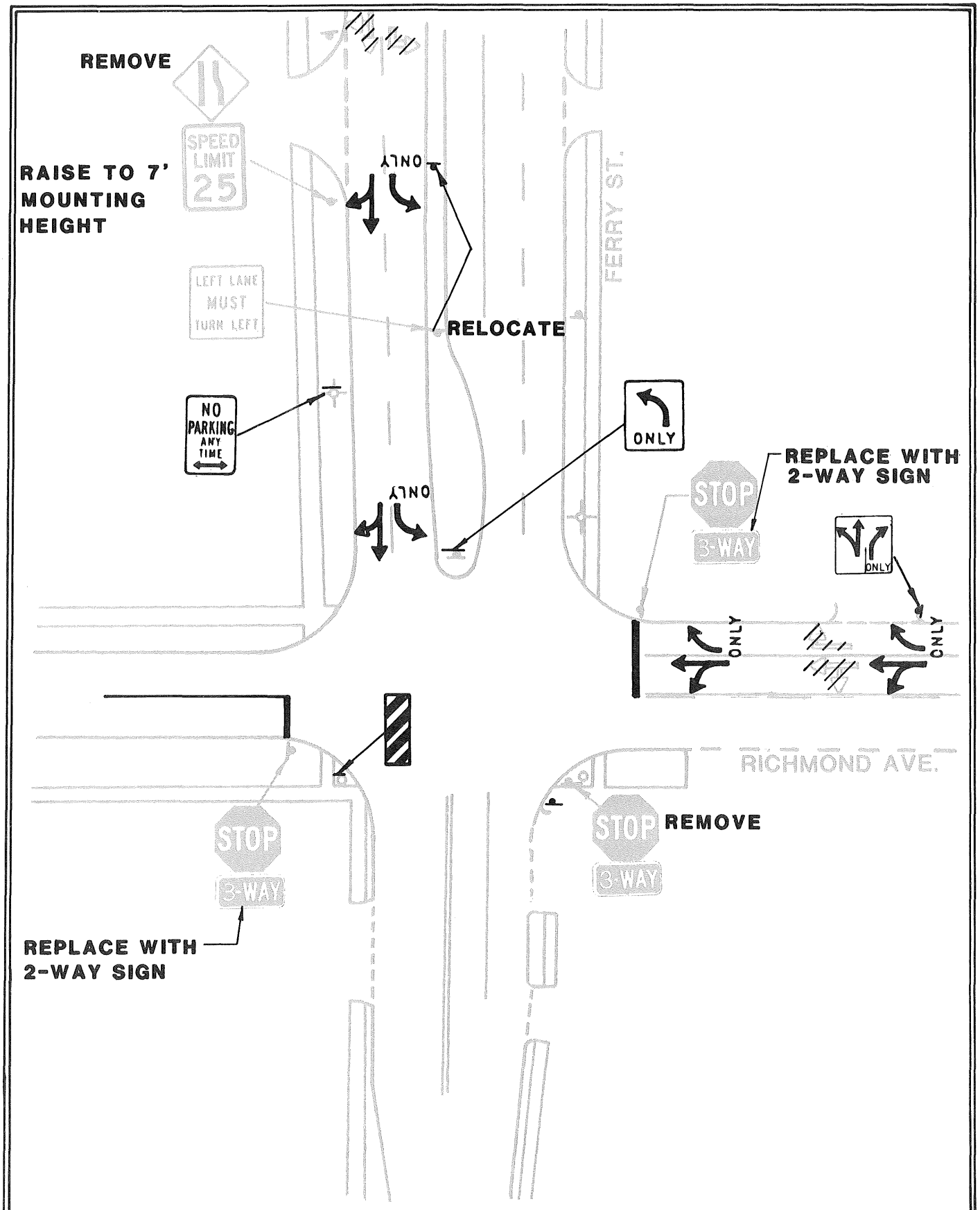
Because of the short distance between this intersection and the intersection of Ferry Street with Wapello Street and Albia Road to the north, it is necessary to prevent traffic from backing up in the left turn lane of the north approach, especially during peak periods. The existing three-way stop arrangement accomplishes this by assigning right-of-way solely to the north approach. Implementation of two-way stop control by removing the south approach Stop sign will create a potential for delay to left turning vehicles on the north approach. No significant delay is anticipated, however, because of light opposing traffic from the south approach. Potential delay to right turning vehicles from the east approach is alleviated by the mandatory turn lane, which separates right turns from through and left turn movements. Although through and left turning traffic on Richmond Avenue will experience unavoidable delays, these traffic movements are light and will not affect the heavy turning movements from the north and east approaches.

Accident Patterns: Relatively light traffic volumes on the south approach and very low volumes on the west approach have allowed this intersection to operate under three-way stop control without a serious accident problem. During the 1976 to 1979 analysis period four accidents were reported, three of which can probably be attributed to the three-way stop. Two of the accidents were left turn collisions and the third was a cross traffic collision. Three accidents in three years does not consitiute a hazardous condition, however, for the reasons cited previously, three-way stop control should be discontinued.

Recommendations:

PRIORITY 1

- Install stop lines on the east and west approaches.
- Remove the existing pavement arrows and install conforming arrows and lane assignment signs.
- Remove the Stop sign on the south approach.
- Install an Object Marker (OM-3R) on the southwest corner power pole.
- Install a No Parking sign on the north approach to supplement the painted curb.
- Remove the Pavement Transition sign on the north approach and raise the Speed Limit 25 sign to a 7 foot mounting height.



FERRY STREET & RICHMOND AVENUE

IMPROVEMENTS IN BLACK

Figure 2-31

CHAPTER 3

IMPLEMENTATION

3.1 INTRODUCTION

The preceding chapter of this report has concerned the analysis of existing traffic conditions, accident experience, and the development of recommended improvements to correct unsafe, deficient, and nonconforming conditions. This chapter discusses potential sources of funding for the recommended improvements and presents a prioritized implementation program. The information included in the chapter should be used by City of Ottumwa officials to develop their plans for the future. It is intended to be a long-term source of ideas for safety programs and funding assistance.

3.2 SAFETY PROGRAMS AND FUNDING SOURCES

Congressional passage of the Highway Safety Act of 1966 stimulated the development and operation of national and state highway safety programs. The Federal program is jointly administered by two divisions of the U.S. Department of Transportation - The Federal Highway Administration (FHWA) and the National Highway Traffic Safety Administration (NHTSA). Highway aspects of the program are the responsibility of the FHWA while the NHTSA is concerned with vehicle and human aspects.

State highway safety programs are required by federal law and must be designed to reduce traffic accidents and the resulting deaths, injuries, and property damage. The Iowa Department of Transportation, Office of Safety Programs is the state agency responsible for providing coordination, guidance, and communication between governmental and private safety interests in the planning, development, implementation, and evaluation of safety-related improvements. IDOT also allocates federal highway and safety funds to local jurisdictions and operates its own traffic engineering funding program for Primary Road extensions.

A catalogue of programs available to assist local governments in implementing highway safety programs is included in the Appendix. Most of the programs listed offer financial assistance, however some provide information or education programs. In some cases, the information and education programs are available through state or local agencies while others required contacts with private organizations. Each program listing states the administrative agency and program authorization, briefly describes the program purpose and guidelines, and indicates an individual or department to be contacted for additional information.

Community officials can consult the catalogue to determine whether assistance is available for a planned improvement and how to request it. If assistance is available under a specific program, the requirements of the program should be carefully reviewed and understood by City officials. The responsible state or federal agency should be contacted to get detailed information and guidance on application procedures and any guidelines and restrictions pertaining to use of the funds.

Finally, local funding for the recommended improvements is usually made available from road use taxes, general revenues, special assessments and cooperative agreements. Local resources would be best spent if used to match Federal or State funds and to implement various low-cost improvements.

3.3 IMPLEMENTATION OF IMPROVEMENTS

The purpose of this section is to summarize the recommended improvements and their assigned priorities and associated costs in order to assist Ottumwa in budgeting and seeking financial aid for the projects. As stated earlier in this report, all of the recommendations have been assigned one or the following priorities:

- Priority 1 - Improvements of an immediate nature to be implemented by January 1, 1981.
- Priority 2 - Short-term improvements to be implemented by January 1, 1983.
- Priority 3 - Medium-term improvements to be implemented by January 1, 1985.

The priorities were assigned using expected safety benefits (i.e. accident reduction) and costs as criteria, with the objective of cost-effectiveness. Improvements offering greater accident reduction potential for each dollar spent were therefore usually given higher priority. The need to correct deficient and nonconforming traffic controls identified during the analysis was also an important criterion, regardless of estimated accident reduction. Yet another criterion used in the priority assignment process was improved traffic operations. This criterion does not lend itself to simple cost analysis and priorities assigned on this basis are qualitative.

Priority 1 recommendations generally involve signal timing and phasing revisions and most signing and pavement marking improvements. These projects are relatively inexpensive and can be easily implemented. Priority 2 recommendations are some badly needed signal hardware improvements and minor geometric changes. The upgrading of street name signs and raising the mounting height of regulatory signs are included in this priority class. Medium-term, Priority 3 projects involve extensive signal hardware upgrading and major geometric additions or modifications. These recommendations are costly and will require Federal and State financial assistance.

The recommendations have not been ranked within the assigned priorities to permit flexibility in implementation. The City might wish to combine all or most of the improvements at one location into a single project or may prefer to complete all improvements of the same type, such as signal controller replacement, at one time. A systematic approach of some kind to the implementation program is urged, however.

Estimated improvement costs include present costs of all required materials and installation, assuming a staff increase to implement the recommendations. If the projects can be completed using existing staff only, savings can be expected. By the same token, if all installation is done by contractors, the actual costs may be higher than the estimates. It should also be noted that all estimated costs for pavement marking improvements were based on the use of reflective paint. If the City prefers to use cold plastic or thermoplastic markings because of the added lifespan they offer, the costs will be higher.

Tables 3-1, 3-2, and 3-3 summarize the proposed traffic safety implementation program for Ottumwa. Cost estimates for improvements of each priority at each location are included with a listing of the most applicable funding sources. This information and the summary of improvements to be completed during the next five years should make the tables a useful reference.

The proposed program contained in this section offers adequate flexibility for the City of Ottumwa to complete successfully the necessary traffic safety improvements. Implementation of the study recommendations should reduce the occurrence and severity of traffic accidents, and improve traffic operations in Ottumwa.

TABLE 3-1

PRIORITY 1 RECOMMENDATIONS

Location	Improvement	Page	Cost	Funding Source
U.S. 34 and U.S. 63	Signal timing, backplates, repainting	2-10	$ 550	Local/Federal State
U.S. 63, Bryan Rd. and N. Court	Signal timing, signing, pavement marking	2-14	940	Local/Federal State
U.S. 63, McLean, and	Signal timing, signing	2-20	1,000	Local/Federal
U.S. 34 and Quincy	Signing	2-23	350	Local
Marion and Second	Signing, restriping, stop	2-25	830	Local/Federal
U.S. 63 and Kitterman	Signing	2-28	240	Local
U.S. 63 and Rochester	Signal timing, signing pavement markings	2-31	700	Local/Federal State
Church and Myrtle	Pavement markings, signing, power pole relocation	2-35	2,110	Local/Federal
McLean and Second	Signing, restriping, stop lines	2-38	750	Local/Federal
Fourth and Ash	Signal timing, signing, restriping, reactivate ped. signals	2-41	1,140	Local/Federal
Pennsylvania and Jefferson	Signing, pavement striping	2-44	540	Local
Cook and Church	Pavement markings, signing	2-47	1,100	Local/Federal
Kitterman and Main	Signing, stoplines	2-50	400	Local
U.S. 63, Mary and Rabbit Run Road	Traffic signals, signing	2-53	33,680	Local/Federal State
Jefferson and Main	Signal timing, pavement markings, signing, signal indication changes	2-56	1,730	Local/Federal
Hancock, Madison, and Garfield	Sign relocation	2-63	120	Local

TABLE 3-1

PRIORITY 1 RECOMMENDATIONS
CONTINUED

Location	Improvement	Page	Cost	Funding Source
Fourth and Jefferson	Signing, pavement markings	2-67	$ 700	Local/Federal
Marion and Main	Signing, sign relocation	2-69	450	Local
Washington and Second	Signal timing, pavement markings, signing	2-73	1,100	Local/Federal
Kitterman and Second	Pavement markings, additional Stop sign, signing	2-78	900	Local/Federal
Church and Richmond	Signal phasing	2-81	100	Local
Church and Weller	Signal phasing, signal indication changes, signing, pavement markings	2-87	670	Local/Federal
Fourth and Marion	Remove Stop signs, striping	2-94	250	Local
Fourth and Washington	Pavement markings, striping, Stop sign relocation	2-98	1,130	Local/Federal
Fourth and Court	Stop sign removal, pavement markings, crosswalk relocation	2-101	1,230	Local/Federal
Main and Iowa	Signal timing, controller cabinet, left turn bay striping	2-104	1,100	Local/Federal
Wapello, Albia, and Ferry	Signal timing, pavement markings, signing	2-110	850	Local/Federal
Ferry and Richmond	Stop lines, pavement markings, signing	2-114	680	Local
			$55,340	

TABLE 3-2
PRIORITY 2 RECOMMENDATIONS

Location	Improvement	Page	Cost	Funding Source
U.S. 34 and U.S. 63	Additional signal heads, signal relocation, 3-M heads, signing	2-10	$ 5,400	Local/Federal State
U.S. 63, Bryan Rd., and N. Court	Backplates	2-15	600	Local
U.S. 63, McLean, and Woodland	Backplates	2-20	300	Local
U.S. 63 and Rochester	Additional signal heads, striping	2-31	700	Local/Federal State
Church and Myrtle	Restriping	2-36	560	Local
Fourth and Ash	12 inch signal indications	2-41	500	Local
Pennsylvania and Jefferson	Curb redesign	2-45	1,700	Local/Federal
Cook and Church	Restriping	2-48	490	Local
U.S. 63, Mary and Rabbit Run Rd.	Restriping	2-53		
Jefferson and Main	Restriping, ped. signals	2-57	2,300	Local/Federal
Hancock, Madison, and Garfield	Raised island	2-63	770	Local
Fourth and Jefferson	Restriping	2-67	390	Local
Kitterman and Second	Backplates	2-78	450	Local
Church and Weller	Ped. signals	2-87	400	Local
Fourth and Court	Perm. closure of park roads	2-101	2,900	Local/Federal
Main and Iowa	Span wire signals, curbing improvements	2-105	5,900	Local/Federal
Wapello, Albia, and Ferry	Backplates, median redesign	2-110	550	Local
Area-wide	Street name sign upgrading	2-4		Local/Federal
Area-wide	Raising regulatory sign height	2-4		Local
			$23,910	

TABLE 3-3

PRIORITY 3 RECOMMENDATIONS

Location	Improvement	Page	Cost	Funding Source
U.S. 63, Bryan Rd. and N. Court	Left turn bays, additional luminaries median closure	2-15	$55,000	Local/Federal State
U.S. 63, McLean, and Woodland	Mast-arms	2-20	9,400	Local/Federal State
U.S. 63 and Rochester	Left turn bays, additional luminaires	2-31	52,000	Local/Federal State
Church and Myrtle	Geometric improvements	2-36	900	Local
Fourth and Ash	Signal controller	2-41	4,000	Local/Federal
Jefferson and Main	Mast-arms, signal controller	2-57	20,000	Local/Federal
Washington and Second	Mast-arms, signal controller	2-73	19,000	Local/Federal
Church and Richmond	Mast-arms, signal controller, detector loops, pavement markings, signing	2-82	28,000	Local/Federal
Church and Weller	Mast-arms, signal controller	2-87	13,000	Local/Federal
Main and Iowa	Signal controller	2-105	4,000	Local/Federal
Fourth Street	Power pole relocation	2-98		Local/Federal
			$205,300	

CHAPTER 4

EVALUATION PROCEDURE

4.1 INTRODUCTION

As stated earlier, the primary purpose of this report is to provide the City of Ottumwa with recommendations to improve traffic safety at the twenty-nine intersections studied. Once implemented, however, the resulting safety benefits should be assessed. This final chapter presents an evaluation procedure for the City to use in determining the effectiveness of implemented improvements.

The evaluation procedure uses a before-and-after study approach to compare pre-improvement traffic and accident data to the same statistics following implementation. This procedure represents an effort to develop a simple analysis technique that will not require extensive time and effort to complete, but will accurately indicate the significance of resulting safety benefits. It is applicable in evaluating changes in traffic control type and operation, geometric improvements, and enforcement efforts.

4.2 EVALUATION REQUIREMENTS

To evaluate the effectiveness of improvements using the included procedure, the following requirements must be fulfilled:

- Adequate documentation of accident analyses and the purpose of specific improvements. This requirement is met by the analyses and discussions in this report.

- An allowance of several weeks between the before and after periods to permit public adjustment to the improvement. This is especially important where signal relocation or timing revision and geometric improvements are involved.

- Complete accident data for a period of time after implementation comparible to that of the before analysis. A period of three years would be necessary to match that used in conducting this study.

- Average Daily Traffic (ADT) volumes for both periods, to allow adjustment of accident numbers for exposure.

- A compatible traffic flow composition (percent of trucks and buses) for both periods.

- Correction of accident data for any far-reaching trends.

4.3 EVALUATION PROCEDURE STEPS

At the completion of the after implementation period, the before-and-after evaluation should be conducted as follows:

Step 1 - Using the accident records compiled after the improvement was implemented, complete an accident diagram for each location using the form shown in Figure 4-1. (Accident diagrams for the analysis period used in this report can be found in the Supplemental Report.)

Step 2 - Summarize the accident data for each location by number and percentage of collisions on the form shown in Figure 4-2 (Accident summaries for the analysis period used in this report can be found in the Supplemental Report).

Step 3 - Compute the before-and-after accident rates by the following formula:

$$\text{Accidents/MEV} = \frac{\text{Number of accidents during the analysis period} \times 1 \text{ million}}{\text{24-hour intersectional entering volume} \times 365 \times \text{the number of years in the analysis period}}$$

MEV = Million Entering Vehicles

For example, at an intersection where the total entering volume from all approaches is 8,000 vehicles per day, and which had experienced 20 accidents over two years, the accident rate per MEV would be:

$$\text{Accidents/MEV} = \frac{20 \times 1 \text{ million}}{8000 \times 365 \times 2} = 3.4$$

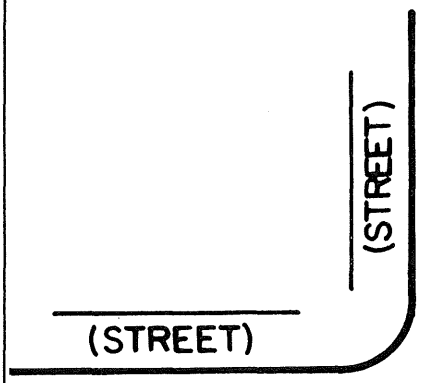
Computing the accident rates per million entering vehicles serves to adjust the accident numbers for changing traffic volumes (exposure) which is necessary to avoid drawing incorrect conclusions about the effectiveness of a given improvement.

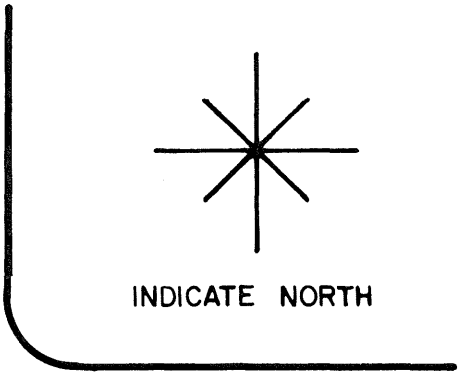
Step 4 - Compute the percent accident reduction for total accidents, injury accidents or specific types of collisions using the following formula:

$$\text{Percent reduction} = \frac{(\text{Accidents/MEV before} - \text{Accidents/MEV after}) \times 100}{\text{Accidents/MEV before}}$$

Step 5 - Once a percent of accident reduction is calculated, it must be determined whether or not the reduction is statistically significant. This is easily done by referring to the Chi-square and Poisson distributions. The Chi-square relationship is used to minimize the chance of an insignificant accident reduction being called significant, while the Poisson distribution insures against a significant reduction being mistakenly labeled insignificant.

LOCATION_____ PERIOD_____





LEGEND

- M.V. BACKING
- M.V. MOVING AHEAD
- PEDESTRIAN
- PARKED VEHICLE
- FIXED OBJECT
- REAR END COLLISION
- SIDE SWIPE
- OUT OF CONTROL VEHICLE
- TURNING VEHICLE
- FATAL ACCIDENT
- PERSONAL INJURY
- PROPERTY DAMAGE ONLY

DATE: MO.-DAY-YR-DAY OF WEEK
TIME: A=A.M. P=P.M.
PAVEMENT: D=DRY I=ICY W=WET
WEATHER: C=CLEAR F=FOG R=RAIN
S=SNOW SL=SLEET
CL=CLOUDY

ACCIDENT COLLISION DIAGRAM

Figure 4.1

INTERSECTION:

TIME OF DAY	ACCIDENTS No.	ACCIDENTS %
7 A.M. - 9 A.M.		
9 A.M. - 4 P.M.		
4 P.M. - 6 P.M.		
6 P.M. -12 Mid.		
12 Mid. - 7 A.M.		
Total		

DIRECTION OF APPROACH	VEHICLES No.	VEHICLES %
North		
South		
East		
West		
Total		

WEATHER	ACCIDENTS No.	ACCIDENTS %
Clear		
Fog/Mist		
Rain		
Cloudy		
Snow		
Total		

ACCIDENT TYPE	ACCIDENTS No.	ACCIDENTS %
Sideswipe		
Rear End		
Cross Traffic		
Left Turn		
Right Turn		
Other		
Total		

PAVEMENT	ACCIDENTS No.	ACCIDENTS %
Dry		
Wet		
Icy/Snowy		
Total		

ACCIDENT SEVERITY	ACCIDENTS No.	ACCIDENTS %
Fatality		
Personal Injury		
Property Damage Only		
Total		

TIME OF YEAR	ACCIDENTS No.	ACCIDENTS %
Winter (Dec.-Feb.)		
Spring (Mr.-May)		
Summer (June-Aug.)		
Fall (Sept.-Nov.)		
Total		

COMMENTS:

ACCIDENT SUMMARY

Figure 4-2

The Chi-square and Poisson curves are shown on Figure 4-3. These curves will indicate at the 95% confidence level whether a significant accident reduction has, in fact, occurred. The Poisson curve is meaningful when accidents over several year before and after periods are analyzed, while the Chi-square curve applies most when accidents over a short period are studied.

The computed accident reduction percentage is compared to the reduction percentage necessary for significance that is read from the appropriate curve. If the computed reduction is greater than the curve value, the reduction is considered significant, and the improvement or improvements can be deemed effective.

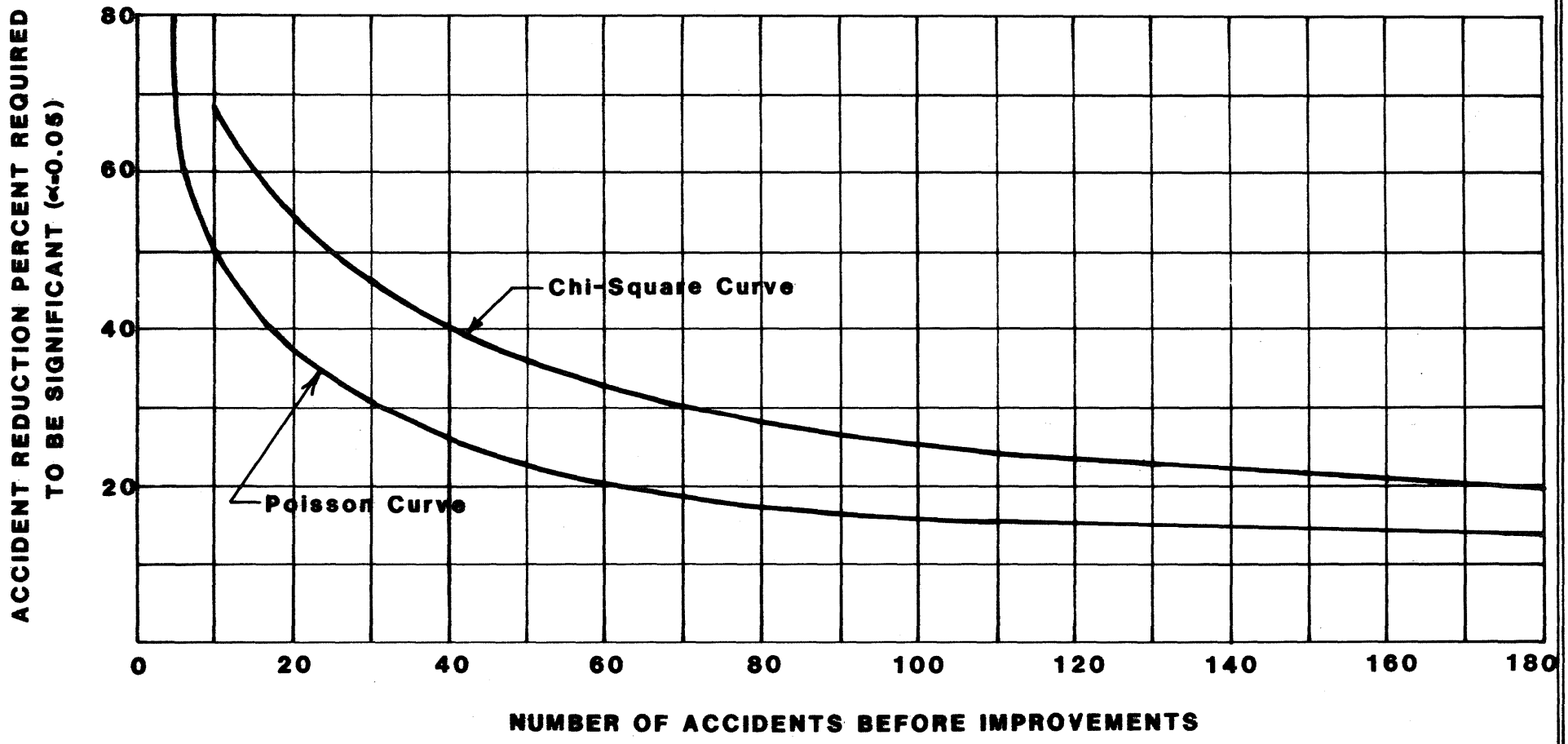
If should be noted, however, that if accidents are few in number, as is the case at many of the intersections studied in Ottumwa, only a very substantial accident reduction will be considered significant because of the purely random fluctuation of annual accidents. In those situations the evaluation procedure will be of little use. As stated earlier though, recommendations for low-accident locations in the study were made on a basis of traffic engineering guidelines and judgement.

The above procedure offers a simple and direct process of evaluating the effectiveness of implemented safety improvements, and requires minimal time and effort. Such a procedure should best satisfy Ottumwa's needs in eventually assessing the value or recommendations made in this report.

REFERENCES

Box, Paul C. and Oppenlander, Joseph C., Manual of Traffic Engineering Studies Fourth Edition, Arlington, Virginia, Institute of Transportation Engineers (1976).

Graham, Jerry L. and Glennon, John C., Manual on Identification, Analysis and Correction of High Accident Locations, U.S. Department of Transportation and The Missouri State Highway Commission (1975).



CURVES OF SIGNIFICANCE FOR ACCIDENT REDUCTION

Figure 4-3

APPENDIX

LIST OF CONTACTS

The Ottumwa City Commission

Mr. Mark Garrett, Assistant City Engineer

Mr. Darrell Adams, City Engineer

Mr. Larry Roush, City Streets Commissioner

Mr. Wilfred Boettcher, Police Chief

Mr. Rich Gross, Retail Merchant's Association

Mr. George Moran, Retail Merchant's Association

Mr. Lavern Weaver, Retail Merchant's Association

Mr. David Waggoner, Retail Merchant's Association

Mr. Mike Runnells, Retail Merchant's Association

Mr. Harold Schiel, IDOT

Mr. Lowell Vander Hamm, Local Systems Engineer, IDOT

Mr. Bob Andresen, IDOT

Mr. Bob Sayler, IDOT

Mr. Fred Walker, IDOT

SAFETY PROGRAMS AND FUNDING SOURCES

The description of each program will include the following information, if available, that is applicable to the program:

Agency: Name of the federal agency, state agency or private enterprise responsible for the program. If both a federal and state agency are named, the contact should initially be through the State agency.

Authorization: Denotes the citation in the United States Code (U.S.C.) or Public Law (P.L.).

Objective: Purpose of the program.

Uses and Use Restrictions: Describes possible uses for the assistance and restrictions of such use.

Eligibility: Describes eligibility requirements of applicants and beneficiaries where applicable.

Assistance Considerations: Details the percent of federal or state funds available.

Information Contacts: Lists sources of information on fund availability, likelihood of receiving assistance, pre-application and application forms, as well as details on the program.

HAZARD ELIMINATION PROGRAM

Federal Agency: Federal Highway Administration, Department of Transportation.

State Agency: Iowa Department of Transportation

Authorization: 23 U.S.C. 152.

Objectives: Correct hazardous locations, road sections and elements.

Uses and Use Restrictions: An engineering survey shall be made of all hazardous locations. Priorities will be assigned upon the basis of a cost-benefit analysis.

Eligibility: Projects on Federal-Aid System (excluding Interstate) including the upgrading of warning and regulatory signs to MUTCD standards, placement or upgrading signs at high hazard locations. Pavement markings are not currently eligible.

Assistance Considerations: 90% federal funding.

Information Contact: Mr. Frederic Walker - Office of Design, Iowa Department of Transportation, 826 Lincoln Way, Ames, Iowa 50010.

RAIL-HIGHWAY CROSSING PROGRAM

Federal Agency: Federal Highway Administration, Department of Transportation.

State Agency: Iowa Department of Transportation

Authorization: Highway Safety Act of 1978, Section 203 (Amended 1976 and 1978).

Objectives: Elimination of hazards at rail-highway crossings.

Uses and Use Restrictions: Railroad crossing improvements.

Eligibility: For installations at rail-highway grade crossings both on and off the Federal-Aid System including no passing zone markings, advance warning, delineators, pavement markings and crossbuck markings.

Assistance Considerations: 90% federal funding.

Information Contact: Mr. Neil Volmer - Railroad Division, Iowa Department of Transportation, 800 Lincoln Way, Ames, Iowa 50010.

PAVEMENT MARKING DEMONSTRATION PROGRAM

Federal Agency: Federal Highway Administration, Department of Transportation.

State Agency: Iowa Department of Transportation.

Authorization: 23 U.S.C. 151.

Objective: To demonstrate the value of pavement markings in providing greater vehicle and pedestrian safety.

Uses and Use Restrictions: Eligible activities include materials, labor, equipment rental or depreciating charges necessary to apply pavement markings; renewal of markings applied under the program to ensure effectiveness for a two-year evaluation; and installation of higher type markings on previously marked section to increase safety and installation of delineators. Ineligible costs are those for renewing markings not applied under the program (and which conform to the Manual on Uniform Traffic Control Devices) and purchase of marking machinery.

Eligibility: Projects on or off the Federal-Aid System at urban or rural locations.

Application and Award Process: Interested cities and towns should contact the State to discuss their proposed project. Upon recommendation, the project will be added to a statewide priority listing of projects.

Assistance Considerations: 100% Federal funding.

Post Assistance Requirements: Markings must be maintained for two years to provide data for evaluation. Remarking for this purpose may be done with Pavement Marking Demonstration Program funds.

Information Contact: Mr. Lowell Vander Hamm, Iowa Department of Transportation, Box 587 Fairfield, Iowa 52556.

HIGHWAY BRIDGE REPLACEMENT AND REHABILITATION PROGRAM

Federal Agency: Federal Highway Administration, Department of Transportation.

State Agency: Iowa Department of Transportation.

Authorization: 23 U.S.C. 144.

Objective: Major rehabilitation or replacement of unsafe bridges.

Uses and Use Restrictions: Construction projects to rehabilitate or replace unsafe bridges.

Eligibility: Projects on or off the Federal-Aid System.

Assistance Considerations: 80% Federal funding.

Information Contact: Mr. Lowell Vander Hamm, Iowa Department of Transportation, Box 587 Fairfield, Iowa 52556.

HIGHWAY SAFETY GRANTS

Federal Agency: Federal Highway Administration, Department of Transportation.

State Agency: Iowa Department of Transportation.

Authorization: 23 U.S.C. 402.

Objective: To implement highway safety standards.

Uses and Use Restrictions: Regulatory and warning sign upgrading on Off-System roads; projects requiring consultant traffic engineering services, such as sign inventories, accident or traffic studies, and intersection analysis; safety training programs and safety equipment acquisition.

Eligibility: Projects on or off the Federal-Aid System.

Assistance Considerations: 100% Federal funding.

Information Contact: Mr. Bob Andresen - Office of Safety Programs, Iowa Department of Transportation, 5268 2nd Ave. N.W., Des Moines, Iowa 50313.

URBAN SYSTEMS PROGRAM (FAUS)

Federal Agency: Federal Highway Administration, Department of Transportation.

State Agency: Iowa Department of Transportation.

Authorization: 23 U.S.C. 103(d)(2) and 104 (b)(6).

Uses and Use Restrictions: Projects of the following types; improvement of accident locations; removal of roadside obstacles; railroad crossing improvements; pavement markings; sign upgrading; bridge rehabilitation or replacement.

Eligibility: Projects on the Urban System (Cities over 5,000 population).

Assistance Considerations: 75% Federal funding.

Information Contact: Mr. Lowell Vander Hamm, Iowa Department of Transportation, Box 587 Fairfield, Iowa 52556.

SECONDARY ROADS PROGRAM (FAS)

Federal Agency: Federal Highway Administration, Department of Transportation.

State Agency: Iowa Department of Transportation.

Authorization: 23 U.S.C. 103(c)(2) and 104 (b)(2).

Uses and Use Restrictions: Projects of the following types; improvement of accident locations; removal of roadside obstacles; railroad crossing improvements; pavement markings; sign upgrading; bridge rehabilitation or replacement.

Eligibility: Projects on the Federal-Aid Secondary System.

Assistance Considerations: 75% Federal funding.

Information Contact: Mr. Lowell Vander Hamm, Iowa Department of Transportation, Box 587 Fairfield, Iowa 52556.

URBAN-STATE TRAFFIC ENGINEERING PROGRAM (U-STEP)

State Agency: Iowa Department of Transportation.

Objective: To provide assistance for traffic engineering improvements on the primary road extensions.

Uses and Use Restrictions: U-STEP funds are restricted to safety and capacity improvements on primary road extensions. The City is required to engineer the improvement.

Eligibility: Improvements along U.S. 34, U.S. 63, and Iowa Route 23 may be eligible for U-STEP funds.

Assistance Considerations: Projects receive 50% funding assistance up to a maximum of $150,000, and are allocated on a first come-first serve basis. Funds are subject to a 2 year time limit between project approval and contract letting.

Information Contact: Mr. Lowell Vander Hamm, Iowa Department of Transportation, Box 587 Fairfield, Iowa 52556.