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TRAFFIC SAFETY STUDY

for the City of Denison, Iowa

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8404 Indian Hills Drive
Omaha, Nebraska 68114
October 21, 1977

Mr. Richard C. Dueland, P. E.
City Engineer
Post Office Box 43
Denison, Iowa 51442

Dear Mr. Dueland:

In accordance with our contractual agreement for engineering services, Henningson, Durham & Richardson is pleased to submit our report on the Denison Traffic Safety Study.

This report contains a written and graphical accounting of the data, analyses, conclusions and recommendations associated with this safety study. The recommendations are based upon a careful study of the accident history and the traffic control devices currently utilized by the City on its street system. We believe that the implementation of the recommendations in this report will benefit traffic safety in Denison.

We wish to thank you, the City staff, involved local organizations, the Iowa Department of Transportation, and the Federal Highway Administration for their assistance and cooperation during the course of this study. We sincerely hope that this report will be a useful guide toward the betterment of traffic safety in the City of Denison.

Respectfully,

HENNINGSON, DURHAM & RICHARDSON

Robert A. Rohling, P. E.
Vice President

Larry V. Hoffman
Transportation Engineer

RAR/LVH/hw

TRAFFIC SAFETY STUDY

FOR

DENISON, IOWA

JULY 1977

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 U.S. Code.

The opinions, findings and conclusions expressed in this publication are those of the author and not necessarily those of the Iowa Department of Transportation, Office for Planning and Programming, Division of Highways, or the Federal Highway Administration.

ACKNOWLEDGEMENTS

Mayor

Keith Duncan

Council

Jane Flood
Carl Johnson
Wayne Johnson
Loren Schultz
Clair Servoss

City Engineer

Richard C. Dueland

Police Chief

Robert Schraeder

and the many Organizations, Agencies, Businesses and other groups and individuals who contributed their time and thoughts in supplying information, ideas, suggestions and criticisms to the consummation of this report.

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Chapter 1

INTRODUCTION

The contents of this report document the study efforts undertaken by Henningson, Durham & Richardson for a traffic engineering safety study of the City of Denison, Iowa. The study places particular emphasis upon high accident locations, signs and signals, the downtown business district, school pedestrian areas, and railroad crossings and underpasses.

The content of the report is structured in such a manner as to provide the City with clear guidelines and directions on the improvements which should be made to improve traffic safety and traffic flow within the City. With this in mind, the reader will find that the first chapters in the report primarily address the city street system at large, wherein the discussion covers the functional classification of streets, city-wide traffic flow, city traffic generators, city-wide high accident locations, city-wide intersection controls and other items relating to the general street system. The later chapters in the report begin to address specific areas such as the downtown, school areas, railroad crossings, and special spot location improvements.

The closing chapter addresses an implementation program for the City with emphasis placed upon funding and financing of improvements as well as their scheduling and priorities. At the end of the report is an appendix which contains appropriate supporting information relevant to the study.

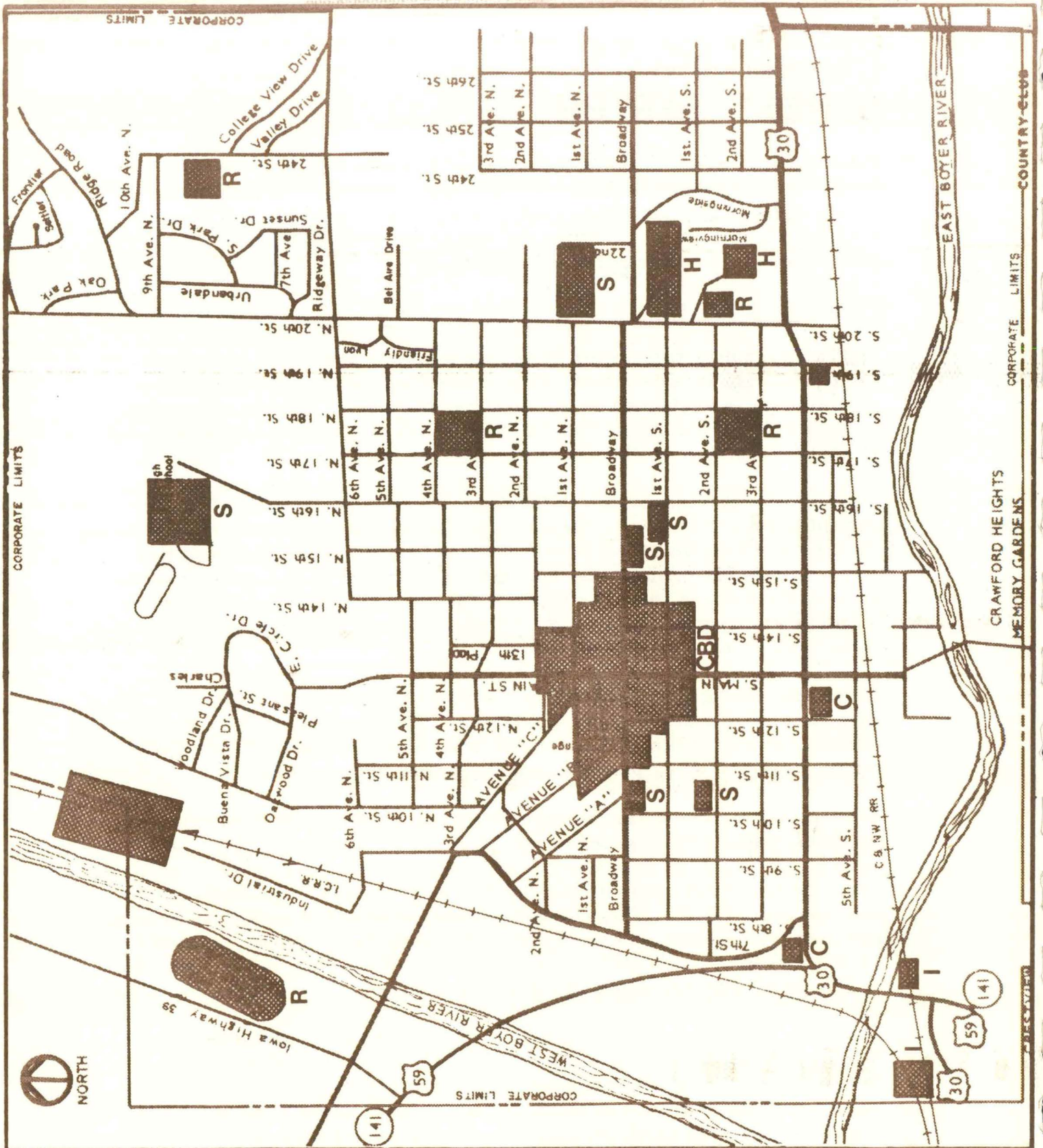
STUDY OBJECTIVES

In recognition of the high incidence of traffic accidents and the growing traffic demands on its streets, the City of Denison applied for and received a grant for a Traffic Safety Study. This Study was funded by the Iowa Department of Transportation (IDOT), Division of Highways and the Federal Highway Administration under the Highway Safety Program Standard 13, issued in accordance with the Highway Safety Act of 1966, as revised.

The primary objective of this study was to develop measures for the improvement of traffic safety on the city streets. This was accomplished by the application of accepted traffic engineering practices, principles, and standards to the physical elements of the existing street system and the operational elements of the traffic control devices which regulate traffic on that street system.

STUDY AREA

The study area consisted of the streets and highways within the corporate limits of the City of Denison, Iowa. The corporate limits of the City of Denison have been expanded to the point that all existing or potential traffic-related problem areas have been circumscribed. Therefore, the Consultant felt that the City's corporate limits were a valid boundary for delineating the study area.



legend

- | | | | |
|------------|---|--------------|---|
| Hospital | H | Industrial | I |
| School | S | Recreational | R |
| Commercial | C | | |

**Traffic
Generators**

figure 2-1

CITY STREET SYSTEM

The functional street classification for the City of Denison is depicted in Figure 2-2. The two principal arterial connecting links through the City are U. S. 30 which traverses the southern portion of the City in an east-west direction and the concurrent highways U. S. 59 and State Highway 141 which extend in the north-south direction on the western outskirts of the City.

The minor arterials of 7th Street, North 10th Street, Avenue C, South Main Street, South 16th Street, 20th Street, and Ridge Road in the northeast part of the City are all predominantly oriented in the north-south direction. Broadway is the only minor arterial traversing the City from west to east.

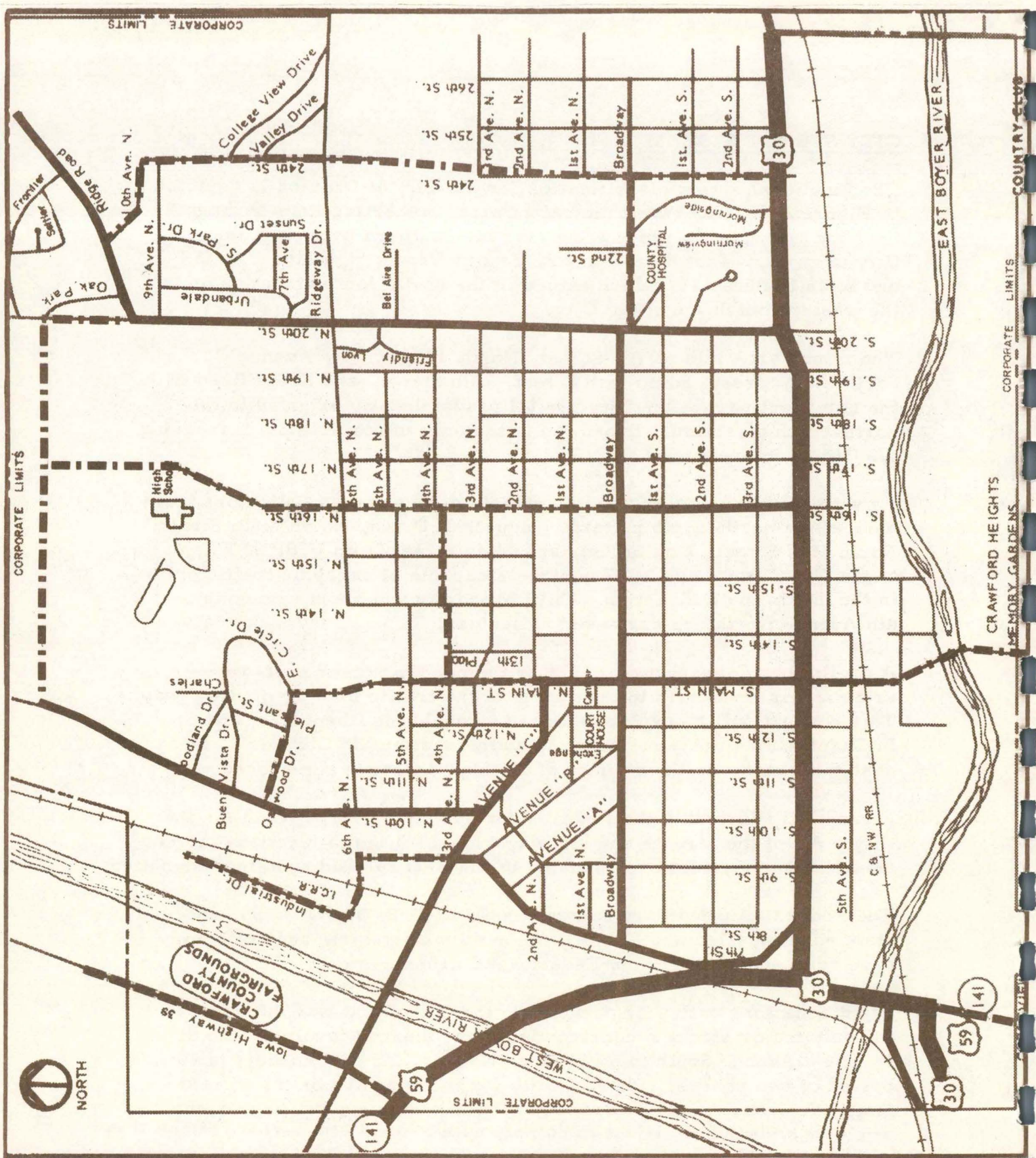
As with the minor arterials, the streets designated as collectors form basically a north-south pattern. Industrial Drive, North Main Street, North 16th Street, 24th Street, and Main Street from U. S. 30 south to the City Limits are all City streets capable of carrying traffic only in the north-south direction. Only Broadway and short segments of 4th Avenue North are east-west collectors.

A preliminary observation might be the need for other east-west arterials or collectors to take some of the traffic load off of Broadway. This concept will be explored more thoroughly in Chapters 3 and 5. In Chapter 3, 4th Avenue North is addressed; and in Chapter 5, an east-west street in the vicinity of the high school is considered.

Figure 2-3 illustrates the Federal-Aid System as established for the City. All of the streets and highways included in the functional street classification system are repeated in the Federal-Aid system designation.

The Federal-Aid primary routes consist of U. S. 30, U. S. 59, and State Highways 141 and 39. All other minor arterials and collectors have been placed under the Federal-Aid urban system.

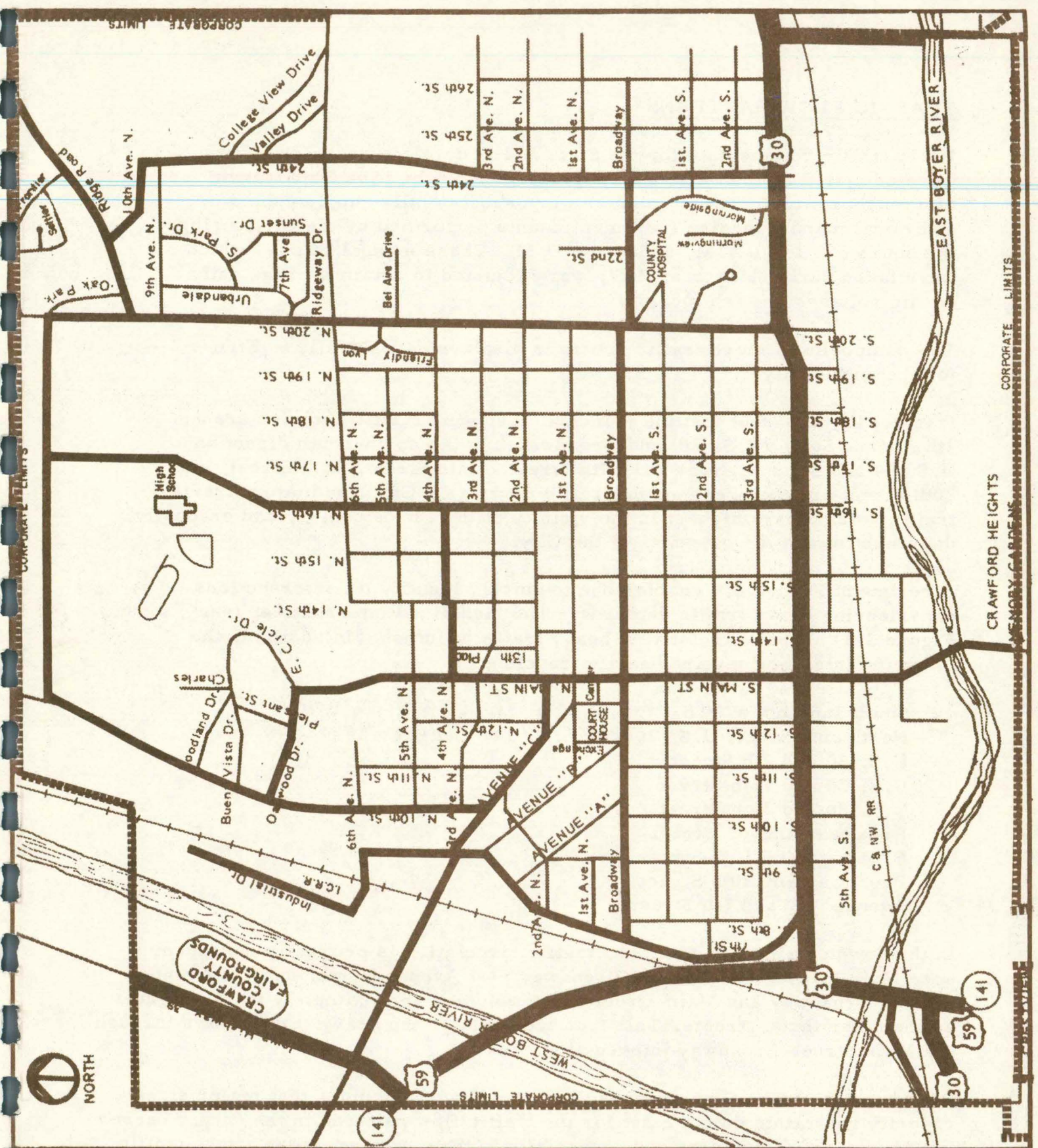
Via discussions with City personnel, the Consultant was informed that the only major street reconstruction being planned involves 16th Street from 4th Avenue South to 6th Avenue North. The new concept is comprised of two phases. Phase I calls for the widening of 16th Street from 4th Avenue South to Broadway. The existing width of 25 feet would be widened to 31 feet to comply with federal standards. Phase II provides for the construction of this same cross section from Broadway to 6th Avenue North.



- legend**
- Principal Arterial
 - Minor Arterial
 - Other Minor Arterial
 - Collector

Functional Classification Map

figure 2-2



Legend

- Federal-Aid Primary
- Federal-Aid Secondary
- Federal-Aid Urban
- Urban Area Boundary

Federal-Aid System Map

figure 2-3

TRAFFIC FLOW PATTERNS

Basic traffic volume data for the State and Federal routes in Denison were compiled from traffic counts performed by the Iowa Department of Transportation. These volumes were substantially supplemented by additional manual turning movement counts performed by the City during the hours of 7 to 11 A.M. and 2 to 6 P.M. These manual counts, which were taken during March of 1977, were adjusted to obtain average daily traffic volumes at each location.

The composite of these traffic counts is displayed graphically in Figure 2-4 for the entire City.

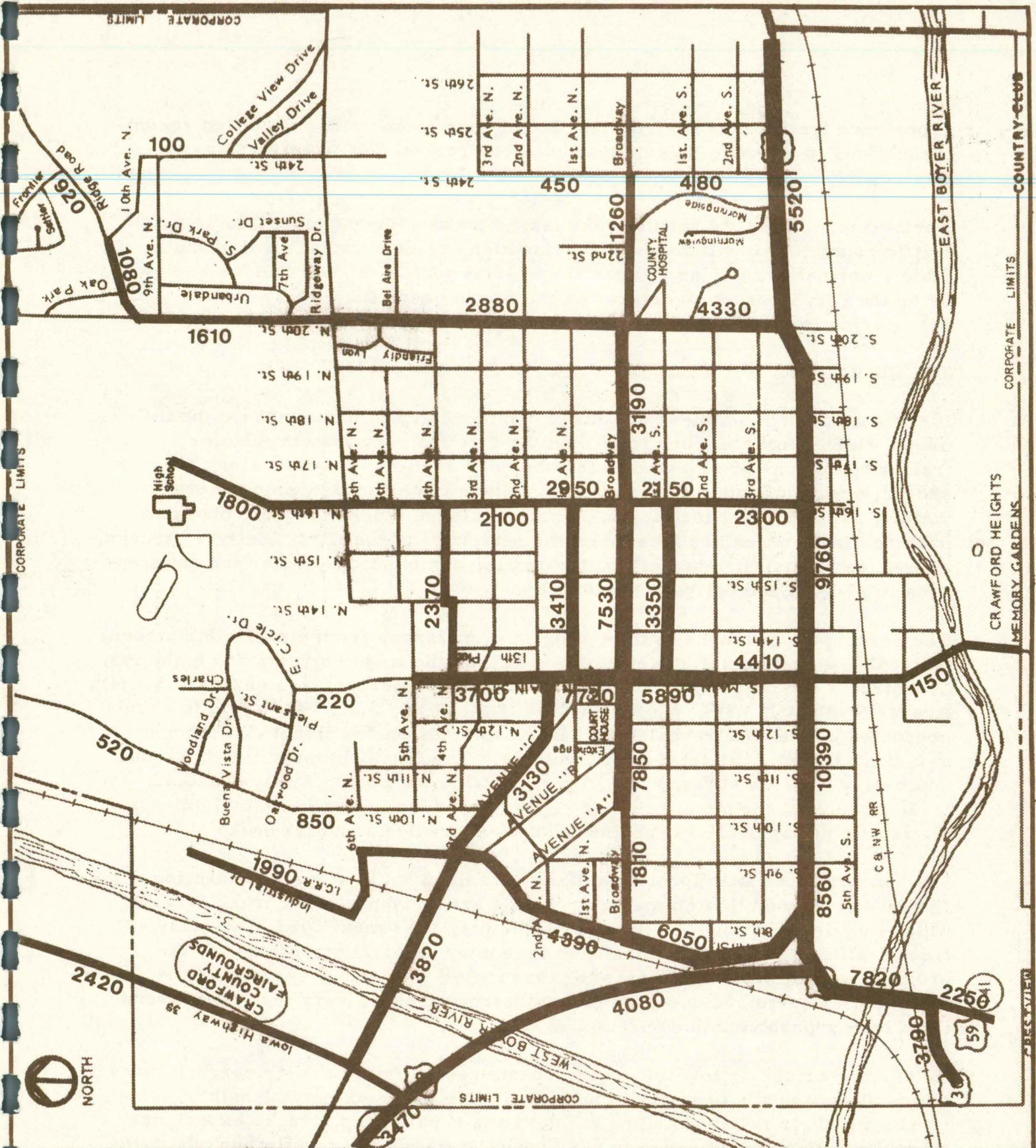
It is readily apparent that the principal east-west traffic arteries are 4th Avenue South (U.S. 30) and Broadway. In the north-south direction, U.S. 59 and State Highway 141, 7th Street, Main Street, 16th Street, and 20th Street are the predominant traffic carriers. On these major streets, traffic volumes are highest in the vicinity of the City's center, and gradually decrease toward the outskirts of the City.

A review of Figure 2-4 enables one to quickly identify the intersections experiencing heavy traffic demands. The signalized intersections (see Figure 3-1) all serve relatively heavy traffic volumes. In addition, the following intersections are heavily traveled:

- South Junction of U.S. 30 with S.H. 141 and U.S. 59
- North Junction of U.S. 30 with S.H. 141 and U.S. 59
- U.S. 30 and 7th Street
- U.S. 30 and 16th Street
- U.S. 30 and 20th Street
- Broadway and 7th Street
- Broadway and 16th Street
- Broadway and 20th Street
- Avenue "C" and 7th Street

In the downtown area of Denison, traffic circulation is primarily dependent upon Main Street, 15th Street, Broadway, 1st Avenue North, and 1st Avenue South. Broadway and Main Street carry volumes approximately twice as great as the other three streets. This fact accounts for the heavy traffic flows through the Main Street-Broadway intersection.

Based on the traffic flow patterns, the Consultant concludes that major street capacity restraints do not exist for the traffic flow patterns in the City. There are, however, a few locations, especially in the downtown area, where traffic flow is impeded by on-street parking and poor signalization. Other locations



- legend**
- Average Daily Traffic
 - 0-1000
 - 1000-2500
 - 2500-5000
 - 5000 & Over



Traffic Volumes

figure 2-4

experience traffic flow restrictions due to poor geometrics. Detailed recommendations to improve these situations are presented in later sections of this report.

Furthermore, the City should make traffic counts, or request IDOT to make traffic counts, at locations experiencing high accident rates. All of the State's normal counts, as well as any special counts, should then be reviewed by the City in order to determine the future needs for further traffic engineering improvements.

TRUCK ROUTES

In the City of Denison there are many commercial and industrial establishments which generate truck traffic on the City's street system. Motor freight operations are located in the southern sector of Denison along 4th and 5th Avenues South. Grain elevators are situated in the same general vicinity as the freight terminals. Small and large trucks frequent the meat packing plants which are located on the periphery of the City. Delivery trucks, as well as a small number of tractor-trailer combinations, enter the downtown area to pick-up and deliver commodities.

The percentage of trucks in the traffic stream ranges from a negligible amount on local and residential streets to over 20% on the major streets and highways. The streets and highways experiencing the largest percentages of trucks are 4th Avenue South (U.S. 30), 7th Street, and U.S. 59 and S.H. 141. Traffic counts conducted by the City revealed that truck volumes on 7th Street can account for as much as 22% of the total traffic volume. The truck volumes on 4th Avenue South vary between 10% and 16%. Truck traffic maintains a fairly constant level throughout the year; however, operations involved with the collection and distribution of agricultural grains tend to experience seasonal peaks.

Via conversations with local establishments involved in trucking operations, the Consultant learned that no major problems are encountered by truck drivers while entering, leaving, or traversing the City. As mentioned previously, truck traffic is confined primarily to the major arterial streets due to the proximity of the truck terminals to those major streets. Inasmuch as the major city streets are designed to handle truck traffic, very few truck-associated traffic problems occur.

No narrow-bridge or low-underpass constrictions exist to restrict truck flows or to present unsafe operating conditions. Due to the extreme length of some trucks and their relatively slow acceleration capabilities, trucks experience difficulty with gaining access to 4th Avenue South during certain periods of the day. Since many truck-related operations are located in the vicinity of 4th Avenue South, this particular access problem is another reason for the City to monitor traffic volumes to determine the need for a second traffic signal

installation on 4th Avenue South (see discussions on analyses of high-accident locations of 11th Street and 4th Avenue South and 12th Street and 4th Avenue South).

Considering the foregoing discussion, it is concluded that a truck route signing project is not required in the City. Due to the location of truck terminals within the City, the most efficient routes for trucks are offered by those streets which are also most capable of accommodating truck traffic. Truck traffic on streets other than the major arterials is not a common occurrence.

Rather than sign truck routes on a city-wide basis, the Consultant suggests that the City post NO TRUCKS signs (R5-2) on streets that exhibit a truck traffic problem. Any local street experiencing a truck problem could then be restricted to prohibit usage by commercial vehicles, thereby concentrating signing and enforcement efforts at the source of the problem.

Chapter 3

TRAFFIC CONTROLS

The safe control and regulation of traffic on an urban street system requires the use of many different signs, signals, and pavement markings. The lighting of streets and intersections is an additional tool for improving night-time driver visibility as well as for the discouragement of crime.

In Denison, a variety of traffic control devices are utilized on city streets in an attempt to smoothly govern traffic flow, define right-of-way in conflict situations, and otherwise insure the safety of the motoring and pedestrian public.

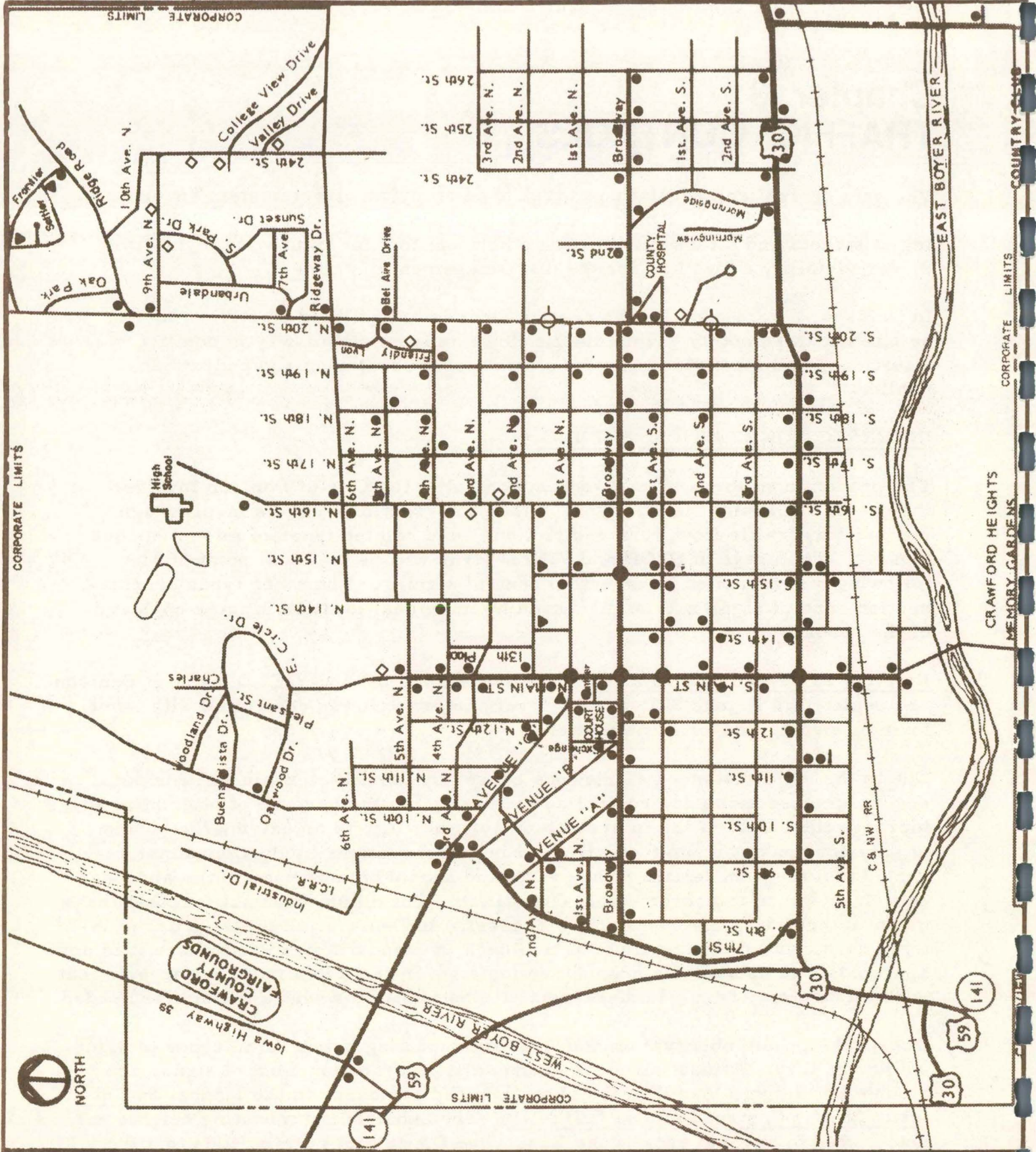
INTERSECTION CONTROL SIGNING

The predominant form of intersection control in the City of Denison involves the use of STOP and YIELD signs. Other intersection controls involve signs for one-way traffic flow, turn restrictions, and related types of miscellaneous signing. The usage of STOP and YIELD signs will be the focal point of the following discussion on intersection control signing. The other types of intersection control signs will be discussed by individual location in later chapters of the report.

Existing STOP and YIELD Signs. The existing STOP and YIELD signs in Denison are depicted in Figure 3-1. Nearly every intersection is controlled with some form of signing and/or signalization.

Due to the sight distance restrictions caused by the hilly terrain in Denison, several intersections are controlled by signing for the purpose of attempting to increase the safety of the intersections by removing, to an extent, the burden of decision-making from the driver. Field observations by the Consultant revealed that these installations are valid and should be continued in the absence of sight distance improvements. Overall, the Consultant does not feel that the use of intersection control signs is excessive in Denison. Excessive use of intersection control signing must be avoided. A standard sign used where it is not appropriate is as bad as a nonconforming sign; in fact, this may be worse, in that such misuse may result in disrespect at those locations where the sign is needed.

One striking field observation concerns the mounting height of all types of signs within the City. Almost all signs, especially intersection control signs, are mounted at heights less than the recommended standards in the Manual on Uniform Traffic Control Devices (MUTCD). The substandard mounting heights are not limited to any one area of the City. The Consultant recommends that the Street Commissioner take positive measures as a part of his annual maintenance program to restore all signs at substandard mounting heights to the acceptable mounting heights. Guidelines on sign placement may be found in the APPENDIX to this report and also in the MUTCD.



legend

- Stop ●
- Yield ▼
- Slow ◇
- Signal ●
- Flashing Beacon ○

Intersection Controls

figure 3-1

Field inspections by the Consultant revealed that the City adopts the very commendable practice of not mixing the usage of STOP and YIELD signs at the same intersection. That is, the opposite approaches to an intersection display the same control sign rather than a YIELD sign on one approach and a STOP sign on the opposite approach. The Consultant highly recommends the continued application of this practice by the City.

At several locations within the City, the Consultant noticed that a SLOW (diamond shaped, black on yellow) warning sign was being used as an intersection control sign at street intersections or driveway entrances onto a street. This is a non-conforming use of a warning sign, since they do not legally establish right-of-way for vehicles entering an intersection. The Consultant recommends the removal of these nonconforming SLOW signs, and their replacement with STOP or YIELD signs as dictated by sight distance and approach speed conditions.

In the vicinity of Central Elementary School, the City currently has three intersections where all of the legs are controlled with STOP signs. Hinged STOP signs are employed on the major street approaches at these intersections to enable the major streets to function as "through streets" during hours when school is not in session. The MUTCD does not allow the use of part-time STOP signs except for emergency purposes. However, Iowa's State Law does permit this type of STOP sign installation. In hopes of resolving this difference, a research project is currently being conducted to ascertain the merits and disadvantages of part-time STOP signs. At this point in time, the Consultant must recommend that the City replace the hinged STOP signs with STOP signs which conform to the requirements of the MUTCD.

All three of the above locations did not contain the supplemental 4-WAY plates. The Consultant recommends that these supplemental plates be installed at all three locations. In addition, 3-WAY, 4-WAY and ALL WAY supplemental plates should be installed at all existing as well as future multi-stop intersections. The utilization of these plates clearly advises the motorist that drivers on the other legs must stop at the intersection.

In many cities, trees and shrubs cause a problem by obstructing the driver's view of intersection control signs. The Consultant's field review revealed that the City of Denison has held this problem to a minimum. Only isolated cases were discovered where poor sign visibility could be attributed to the interference of vegetation. If it is not already an adopted practice, it would be advisable for the Street Commissioner to establish a program for inspecting and trimming trees and shrubs throughout the City each spring when the foliage is most dense.

The Consultant also observed many locations where vehicles parked at the curb blocked the visibility of STOP and YIELD signs at the intersection. This problem is a combination of the low sign mounting heights and the proximity of the parked vehicles to the intersection signs. As a general rule, the accepted standard is to prohibit parking for 20 feet in advance of an intersection control sign.

Primarily, the problem of parked vehicles obstructing the view of intersection control signs is confined to locations in and around the downtown area. The City has signed for the prohibition of parking on most of the residential streets thereby precluding this problem in those areas. It is therefore suggested that the Street Commissioner take corrective measures through the installation of NO PARKING signs in advance of intersections in the downtown area in order to prevent visual obstruction of intersection controls by parked vehicles.

Chapter 4 contains sketches showing specific locations for most of the downtown intersections where no parking provisions should be added. Chapter 8 provides general guideline information on parking restrictions at intersections.

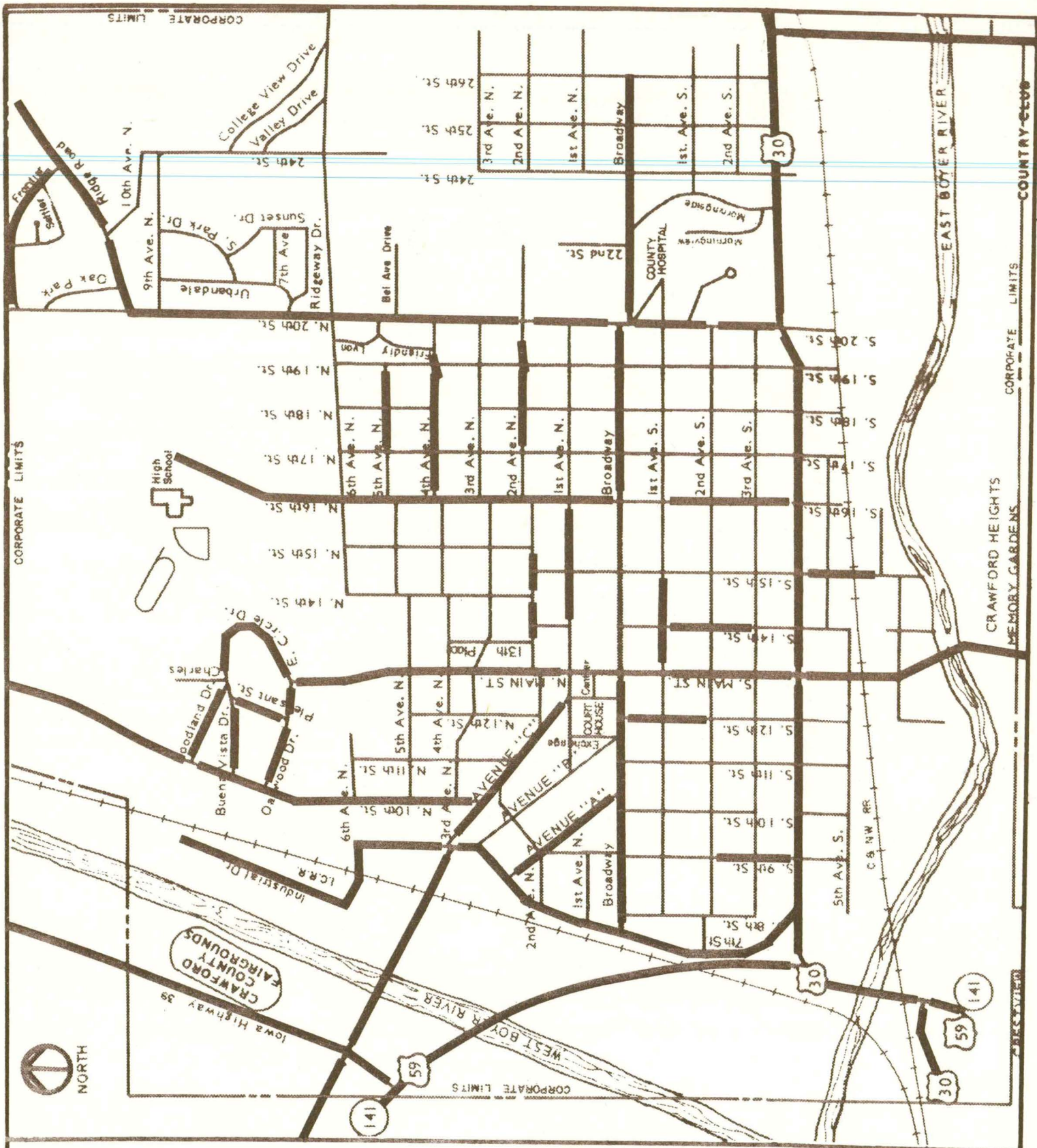
Recommended STOP and YIELD Sign Changes. Based upon a review of the intersection controls shown in Figure 3-1, the Consultant delineated those street segments having continuous right-of-way for vehicular traffic. The results of this evaluation are shown in Figure 3-2 which illustrates the existing traffic flow continuity on the present street system.

A comparison was then made between the traffic flow continuity in Figure 3-2 and the functional street classification shown previously in Figure 2-2. This comparison provides an indication of how the street system plan (Functional Street Classification in Figure 2-2) compares directly with what has been implemented on the streets themselves with the intersection traffic control devices (Existing Traffic Flow Continuity shown in Figure 3-2).

In comparing these two figures, the functional classification and the existing traffic flow continuity are consistent for the connecting links of the rural principal and minor arterials. In other words, flow continuity is maintained for U.S. 30, U.S. 59, and State Highways 39 and 141. The continuity must be broken, of course, on one or both of these major routes when they intersect at-grade.

Overall, the city streets functionally classified as minor arterials exhibited a very good compatibility between the existing traffic flow continuity and their classification. The violations in flow continuity for the minor arterials are primarily caused by the traffic signals in the downtown area and the 4-Way stops and flashing red beacon located near the elementary school. Due to the nature of the interruptions, there is little that can be done to improve the traffic flow continuity on the minor arterials. The Consultant feels that the City has done a commendable job in installing intersection control signing to provide traffic flow continuity on these routes.

In comparison to the minor arterial streets, the existing traffic flow continuity on the collector streets does not parallel the functional classification so closely. One obvious inconsistency between the signing and the designated street classification involves 4th Avenue North between Main Street and 16th Street. 4th Avenue North is stopped at both ends of this segment, that is, at Main Street and 16th Street. These controls are expected; however, 4th Avenue North and the intermediate intersecting streets are uncontrolled except for a STOP sign on the



Legend

Street Segments Having Continuous Right-Of-Way



Existing Traffic Flow Continuity

figure 3-2

north approach of 14th Street. To bring 4th Avenue North into conformance with its designation as a collector street, 4th Avenue should be assigned the right-of-way by placing STOP signs on all approaches of the intersecting streets. Of course, this recommendation applies only to those intersections between 16th Street and Main Street.

In addition to bringing 4th Avenue North into conformance with its designation as a collector street, the recommended intersection control modifications will enable 4th Avenue North to function as a much-needed carrier of traffic in the east-west direction. By providing continuous right-of-way to traffic on 4th Avenue North, the potential will be created for the attraction of traffic to 4th Avenue North from the heavily-traveled Broadway arterial.

Another apparent inconsistency between traffic flow and classification involves the collector 24th Street. The intersections along the entire length of 24th Street are uncontrolled except for the STOP signs on 24th Street at U.S. 30 and Broadway. If 24th Street is to carry the collector classification, it should be assigned the right-of-way by installing STOP or YIELD signs on all intersecting streets (except Broadway and U.S. 30). The decision to install a STOP or YIELD sign should be based on sight distance and approach speed studies at each intersection.

Other discrepancies between Figure 2-2 and Figure 3-2 are mainly confined to single intersections along other minor arterials and collectors.

Figure 3-3 indicates the suggested intersection control modifications for STOP, YIELD and related signs. Most of the recommended STOP and YIELD placements are intended to bring conformity to the existing installations, bring conformity with the functional street classification, replace vandalized signs, and strengthen intersection controls.

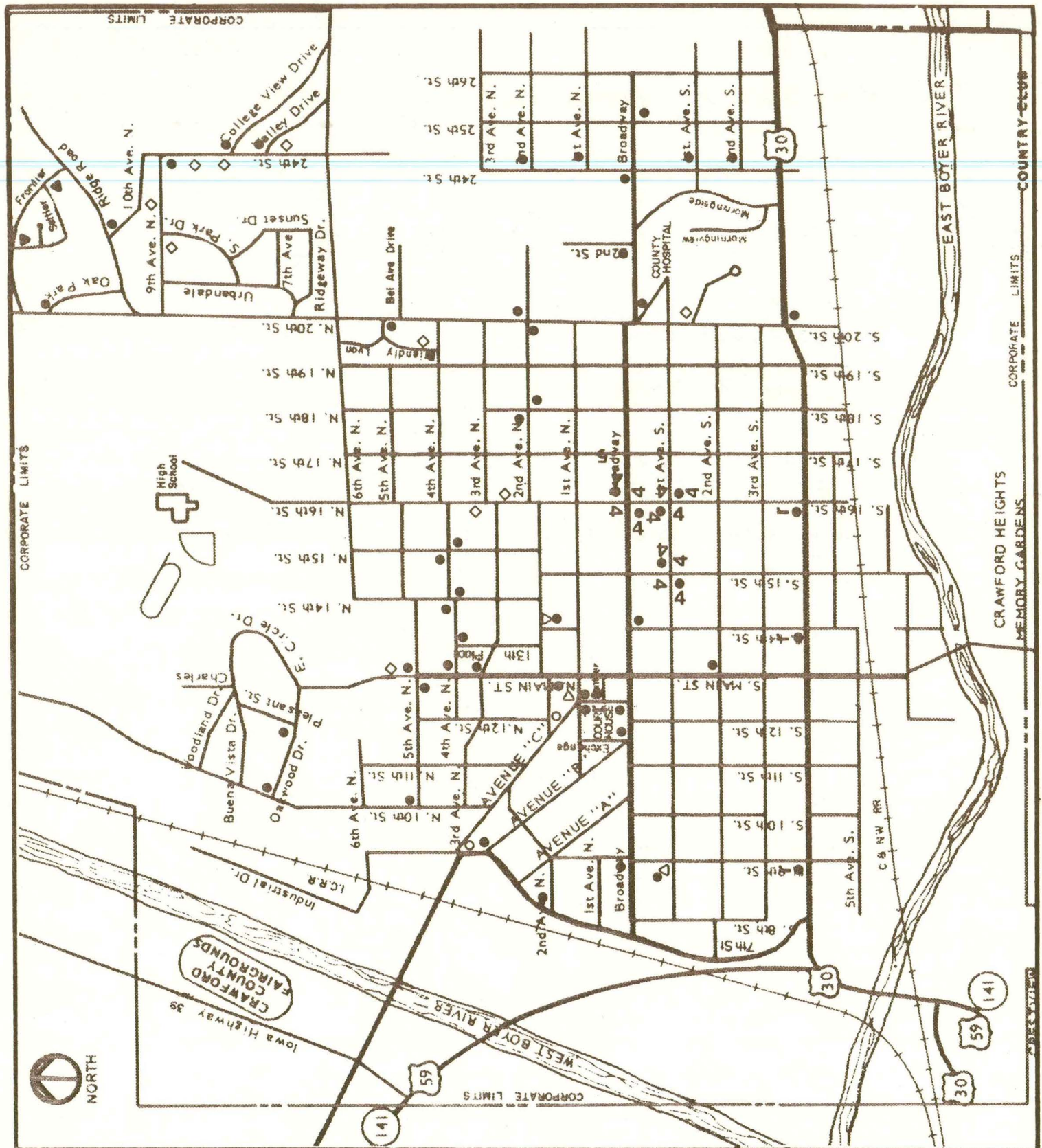
Figure 3-3 also shows the removal of all nonconforming SLOW warning signs and the installation of 4-WAY plates to supplement STOP sign installations at multi-stop intersections.

Table 3-1 provides a listing of the intersection control modifications shown in Figure 3-3. The signs in Table 3-1 are summarized in Table 3-2. This summary table lists the net number of signs required as well as an estimate of the cost associated for completing the sign modifications to the entire City street system.

The intersection control modifications for signs do not include all of the signs for the downtown area which is discussed separately in Chapter 7.

When making any changes in the intersection control signing, the Consultant strongly urges that ---

- a. The changes be made on a systematic basis rather than a random or spot basis.



Legend

- | | | | |
|------------------|---|-------------------|---|
| New Stop Sign | ● | Remove Stop Sign | ○ |
| Add 4-Way Plate | 4 | New Yield Sign | ▼ |
| Remove Slow Sign | ◇ | Remove Yield Sign | ▽ |
| Relocate | r | | |

Intersection Control Modifications

figure 3-3

TABLE 3-1
 INTERSECTION CONTROL MODIFICATIONS
 (Tabulation of Changes Shown in Figure 3-3)

<u>Intersection</u>	<u>Approach(es)</u>	<u>Sign Change</u>
7th Street at 2nd Avenue North	E	Add STOP
9th Street at Avenue "C"	E	Remove STOP on Left Side
at Avenue "B"	E	Replace STOP
at Broadway	N	Replace STOP
at 1st Avenue South	N	Remove YIELD, Add STOP
at U.S. 30	N	Relocate STOP
10th Street at Oakwood Drive	E	Replace STOP
at 5th Avenue North	E	Replace STOP
Pleasant Street at Oakwood Drive	N	Add STOP
2nd Avenue North at Avenue "C"	E	Remove STOP on Left Side
1st Avenue North at Avenue "C"	E	Remove YIELD
	W	Replace STOP
	S	Add STOP
Center Street at Avenue "C"	E	Replace STOP
Broadway at Exchange Street	N	Replace STOP on Left Side
at Avenue "C"	N	Replace STOP
at Hospital Driveway	S	Replace STOP
Main Street at 5th Avenue North	N	Remove SLOW
	E&W	Replace STOP
at 4th Avenue North	E	Replace STOP
at 3rd Avenue North	E	Replace STOP
at 2nd Avenue North	W	Replace STOP
at 2nd Avenue South	E	Replace STOP
13th Place at 4th Avenue North	S	Add STOP
14th Street at 4th Avenue North	N	Replace STOP
	S	Add STOP
at 2nd Avenue North	S	Remove YIELD, add STOP
at Broadway	S	Add STOP
at U.S. 30	N	Relocate STOP

<u>Intersection</u>	<u>Approach(es)</u>	<u>Sign Change</u>
15th Street at 4th Avenue North	N&S	Add STOP
at 1st Avenue South	E&W	Replace STOP
	ALL	Add 4-WAY plates
16th Street at 3rd Ave. North	N&S	Remove SLOW
at Broadway	E&W	Replace STOP
	ALL	Add 4-WAY plates
at 1st Avenue South	N&S	Replace STOP
	ALL	Add 4-WAY plates
at U.S. 30	N	Relocate STOP
18th Street at 2nd Avenue North	N&S	Replace STOP
4th Avenue North at Friendly Lane	N	Add STOP; Remove SLOW
20th Street at Oak Park Blvd.	E	Add STOP
at Friendly Lane	W	Replace STOP
at 2nd Avenue North	W	Replace STOP
	E	Add STOP
at School Driveway	E	Add STOP
at 1st Avenue South	S	Remove SLOW
at U.S. 30	S	Add STOP
22nd Street at Broadway	N	Replace STOP
24th Street at 9th Avenue	W	Add STOP
at College View Drive	N&W	Remove SLOW
	E	Add STOP
at Valley Drive	E	Add STOP
	S	Remove SLOW
at 2nd Avenue North	E	Add STOP
at 1st Avenue North	E	Add STOP
at Broadway	N	Replace STOP
at 1st Avenue South	E	Add STOP
at 2nd Avenue South	E	Add STOP
25th Street at Broadway	S	Replace STOP
9th Avenue North at South Park Drive	E&W	Remove SLOW
10th Avenue North at County Road	S	Add STOP
Frontier Road at Settlers Lane (East)	S	Replace YIELD
at Settlers Lane (West)	S	Replace YIELD

TABLE 3-2

ESTIMATED COST FOR INTERSECTION CONTROL MODIFICATIONS

<u>Sign Change</u>	<u>Number</u>	<u>Estimated Cost</u>
Removed STOP	--(1)	
New STOP	<u>49</u>	
Net STOP Needed	49	\$2,500 ⁽²⁾
Removed YIELD	3	
New YIELD	<u>2</u>	
Net YIELD Excess	1	\$ 100 ⁽³⁾
Relocated STOP	3	\$ 90
Removed SLOW	7	\$ 70
New 4-WAY plates Needed	12	<u>\$ 250</u>
	Total	<u>\$3,010</u>

-
- (1) Cost computed for the specific location improvements shown elsewhere in the report.
 - (2) Average cost including removal of old signs and posts and installation of new signs and posts.
 - (3) Average cost incurred in removing signs and posts and installing signs at new locations.

- b. The improvements be done in small groups; i. e. along an entire street or by a neighborhood or specific section of the City.
- c. The assistance of the local newspaper and radio station should be sought to provide public notice of the sign control changes.
- d. Bright red flags (plastic or cloth) should be affixed to the top of all newly installed traffic control signs for a period of 30 days following their installation.

Additional information is contained in Chapter 8 on the standard procedures to follow in the stallation of new traffic control devices.

Summary Guidelines on STOP and YIELD. In general, the Consultant wishes to call special attention to the following concluding guidelines regarding the placement of STOP and YIELD signs.

1. The City should avoid any over-usage of STOP and YIELD signs, as over-usage or improper usage will promote a disregard for these important control signs by the motoring public.
2. The City should follow the proper placement criteria contained in the MUTCD, as supplemented by the Sign Placement Chart contained in the Appendix of this report. Such placement of the signs should conform to the need for the traffic control sign based upon sound engineering judgment and principles rather than political opinions or pressures.
3. The City should not mix STOP and YIELD signs at the same intersection for opposing legs of traffic.
4. The City should install 3-WAY or 4-WAY plates with STOP signs at all multi-stop intersections.
5. The black on yellow diamond shaped SLOW warning sign should not be used at intersections to establish vehicular right-of-way.
6. The City should adopt, as part of their normal street maintenance procedures, a means of inspecting and keeping tree limbs trimmed on approaches to major intersections or intersections with problem sight distance.
7. No parking zones should be established and enforced for 20 feet in advance of STOP and YIELD signs at intersections in and around the downtown and around the schools.
8. The placement of STOP and YIELD signs at intersections should conform with the Functional Street Classification (Figure 2-2).

9. The Consultant advises the City to use YIELD signs cautiously at intersections as the usage of these signs in lieu of STOP signs can promote accident potential. This is especially true when one considers the intersection sight restrictions caused by the rolling terrain upon which the street system is superimposed.
10. The City should install bright red warning flags to the top of any new sign placements for a period of 30 days following the installation.
11. The mounting height of all signs, especially STOP and YIELD signs, should conform with the MUTCD as reflected in the Sign Placement Chart contained in the Appendix of this report.

MISCELLANEOUS SIGNS

NO PARKING Signs. During the field reconnaissance, the Consultant observed that the City has quite a variety of types of NO PARKING signs. These signs have been employed comprehensively along most streets throughout the City due to the narrowness (25 feet, back-of-curb to back-of-curb) of those streets. The one apparent weakness noted in the lack of parking restriction signing was in the downtown area where this type of signing is very lightly utilized. The parking situation in the downtown area will be discussed in CHAPTER 7 of this report.

The NO PARKING signs currently installed on the City streets have various messages with the predominant messages being NO PARKING THIS SIDE OF STREET and NO PARKING THIS SIDE. The colors of these signs are the accepted red legend on a white background (red on white).

Generally, the mounting heights of the NO PARKING signs are not in conformance with the MUTCD. Many signs were noted as being only three or four feet above the curb in height. An illegally parked vehicle or a stalled vehicle would easily obscure these signs mounted near to the ground thereby causing other motorists to park in the same area because they were unable to see the parking restriction sign.

Many of the existing NO PARKING signs were bent and/or damaged to the point of being in need of replacement. Therefore, most of the NO PARKING sign installations throughout the City will require sign replacements and/or mounting height adjustments.

Although many wordings on NO PARKING signs are sometimes necessary to fit local conditions, the Consultant believes that the majority of the NO PARKING signs should be standardized rather than employing a mixture of messages. The Consultant recommends a sign with an arrow (as depicted in the MUTCD) of red on white coloring with a size of 12" x 18". The arrow (left, doubleheaded, or right) indicates the extent of the restricted zones.

The Consultant believes that the City should undertake, through its normal budget, a program to replace, standardize, and mount properly the NO PARKING signs throughout the City. Major emphasis should be given first to the downtown area and secondly to the arterial and collector streets.

Since the exact number of sign changes is unknown, only a rough estimate of the cost of the NO PARKING sign upgrading can be given. Other cities the size of Denison have expended anywhere from \$10,000 to \$20,000 over several years within the street budget.

The need for new NO PARKING signs is two-fold: First, to clearly identify no parking zones to the motoring public; and, second to provide a concrete basis for enforcement of no parking zones by the Police Department.

PEDESTRIAN CROSSWALK Signs. Several locations not near to schools were observed throughout the City where SLOW CHILDREN and WATCH CHILDREN signs were installed to warn of pedestrians crossing the street. These signs are non-conforming signs with respect to the MUTCD.

These signs were observed on 9th Avenue North, 6th Avenue North, Bel Aire Drive, South Park Drive, and near Washington Park. It is highly recommended by the Consultant that these nonconforming signs be removed. In addition, these types of signs should be removed at any other locations within the City which were not identified by the Consultant during the field inspections.

If conditions warrant the identification of a non-school location as a pedestrian crosswalk, the Consultant recommends the installation of PEDESTRIAN CROSSING (W11 and W11A Series) signs. The ADVANCE CROSSING (W11-2) signs should be placed a minimum of 150 feet in advance of the crosswalk while the CROSSING (W11A-2) signs should be located immediately adjacent to the crossing location. The signs should be mounted at the proper height, and parking should be prohibited within 100 feet of either side of the crosswalk. In addition, the crossing should be identified by pavement markings. Crosswalk signing and marking in school areas will be discussed in Chapter 5 of this report.

A pedestrian crossing of the type described above can be provided for about \$100 per location.

STREET NAME Signs. During the field inspections made by the Consultant, it was observed that a small number of STREET NAME signs were either missing, damaged, or deteriorated from age. Most of the problems seem to center around the missing signs. A few occasions were noted where the existing posts were either bent or the sign was turned 90 degrees thereby reversing the street names from the indications that should properly be given

Considering the conditions of the STREET NAME signs on a city-wide basis, the Consultant believes that the City need not undertake a sign replacement program in the immediate future. However, within the next five years, the City should implement a systematic approach to upgrade the STREET NAME signs.

The Consultant recommends that the procedure discussed below be implemented at a future date when the City feels the need to initiate a STREET NAME sign replacement program. Such a program can be done on a phase basis or on a city-wide basis.

If the replacement program is to be done on a phase basis, the Consultant suggests that the phasing be done on the basis of the functional street classification as previously shown in Figure 2-2. Therefore, the primary arterials would be done first, minor arterials second, and collectors third. The STREET NAME sign replacement for the local streets could then likewise be phased by dividing the City into three or four sectors.

The need for the STREET NAME sign replacement is to provide proper identification to the public in using the street system. In addition, the STREET NAME signs are very important for the proper identification of vehicular accidents.

The Consultant believes that most of the existing poles for STREET NAME signs would not require replacement.

The Consultant would suggest that the new STREET NAME signs be reflective and be white on green. The cost for the sign replacement program could range from as low as \$10,000 to as high as \$25,000, depending upon the number of signs to be replaced and the time period over which those signs would be replaced.

In lieu of the amount of money required for the STREET NAME sign replacement, it may be in the best interest of the City's budget to program the sign replacement as part of their annual improvements, thereby phasing the new signs over a number of years.

Other Signs. Northbound traffic on Main Street experiences a lane drop on the approach to 2nd Avenue South. The curb lane is discontinued at this intersection while the left lane is carried through the intersection. A RIGHT LANE MUST TURN RIGHT sign (R3-7) should be installed at this location to warn motorists in the right lane that they must either turn right onto 2nd Avenue South or merge with traffic in the left lane to continue northbound on Main Street.

Currently, there is a STOP AHEAD sign installed just south of 1st Avenue South on 20th Street. The sign faces southbound traffic and is intended to warn motorists of a required stop at the flashing red beacon located in the vicinity of the swimming pool. Since the removal of the flashing red beacon is recommended in the next section of this report, the Consultant highly recommends the removal of this STOP AHEAD SIGN.

TRAFFIC SIGNALS

During one of the Consultant's field reconnaissance trips, a detailed inspection was made of the existing traffic signals in Denison. Currently, there are five

traffic signal installations in the City. The locations of these signals can be ascertained from Figure 3-1. Four of the five traffic signals control traffic on Main Street and the fifth signal is located at Broadway and 15th Street. Table 3-3 provides a summary of information pertinent to the five signal installations.

The traffic signal installation at the intersection of Main Street and 1st Avenue North has pedestal-mounted, 8" signal heads operated by a pretimed controller set for a 40-second cycle length and a 50-50 split. Pedestrian signals(WALK/DONT WALK) are not provided. The signals are capable of flashing operation. The controller is old and in poor condition having exposed wires and a loose terminal panel.

The traffic signals at the intersection of Main Street and Broadway are identical to those at Main Street and 1st Avenue North with a few minor exceptions. The signal heads are banded to street light poles instead of being pedestal-mounted. The controller is in much better condition than the controller at 1st Avenue North.

The intersection of Main Street and 1st Avenue South has traffic signals identical to Main Street and 1st Avenue North except 1st Avenue South is equipped with a pretimed Eagle controller which is in excellent condition.

The traffic signals at the intersection of 4th Avenue South (U.S. 30) and Main Street are a combination of mast-arm-mounted and pedestal-mounted signal heads (12"). Pedestrian signals are provided for the two north-south crosswalks, however, the pedestrian signal heads on the northwest quadrant of the intersection are missing. Pedestrian and minor-street actuation are provided but are not in operation. The pedestrian signals do not function at all. A sophisticated solid-state controller is provided, however, the minor street is on automatic recall thereby providing a 50-second cycle length and a 70-30 split favoring traffic on U.S. 30. This installation is capable of a more efficient operation than that which is currently being utilized.

The fifth signal installation at Broadway and 15th Street, has fairly new 12" signal heads that were salvaged from the closing of 14th Street at Broadway. The heads are mounted on utility poles, and the head on the northwest quadrant is not within the 20 - degree angle (as specified by the MUTCD) for motorists on the east approach. This installation has a controller that is nearly new. The cycle length is 40 seconds and the split is 50-50.

A detailed discussion on the specific improvements needed at these five signalized intersections may be found in Chapters 4 and 7. In general, the intersections of Main Street with 1st Avenue North, Broadway, and 1st Avenue South require upgraded hardware. The signals at Main Street and U.S. 30 need repairs and a more efficient operation. The signals at Broadway and 15th Street need pedestrian signals.

TABLE 3-3

EXISTING TRAFFIC SIGNAL LOCATIONS

<u>Major Street</u>	<u>Minor Street</u>	<u>Type</u>	<u>Mounting</u>	<u>Indications</u> ¹	<u>Age (yrs.)</u>
Main Street	1st Avenue North	Pretimed	Pedestal	8" RAG	20 (Est.)
Main Street	Broadway	Pretimed	Utility Poles	8" RAG	20 (Est.)
Main Street	1st Avenue South	Pretimed	Pedestal	8" RAG	20 (Est.)
4th Avenue South (U.S. 30)	Main Street	Actuated	Mast Arms, Pedestal	12" RAG; W/DW	9
Broadway	15th Street	Pretimed	Utility Poles	12" RAG	10 (Est.)

1 R- Red
A- Amber
G- Green
W/DW - Walk/Dont Walk

In reviewing the traffic volumes for the City, the Consultant made the following observations and conclusions regarding signalization:

a. The traffic volumes at the existing signalized intersections meet the minimum vehicular volume warrants of the Manual on Uniform Traffic Control Devices. The traffic signals in the downtown area serve the additional purpose of controlling pedestrian flows.

b. Traffic counts reveal that four intersections are approaching the volume warrants of the MUTCD. These locations are as follows:

4th Avenue South at 11th Street
4th Avenue South at 12th Street
4th Avenue South at 16th Street
4th Avenue South at 20th Street

The first two locations are considered in more detail in the Accident Chapter of this report. The last two locations (16th and 20th Streets) experience afternoon volumes which are high enough to warrant signals (using 70% criteria); however, these volumes are not sustained for any 8 hours of an average day.

All four of these locations should have annual traffic counts taken to monitor the growth in traffic and the ultimate need for any signalization. Due to the uniformity of the traffic volumes on 4th Avenue South throughout the City, all four of these intersections appear to be equally likely of reaching the signalization warrants. With regard to the 11th and 12th Street intersections, signalization may not become a major problem due to the proximity of these intersections to the signals at 4th Avenue South and Main Street.

The Consultant does recommend that the City request IDOT to add these four intersections to their standard traffic count program. The IDOT count program currently takes traffic volume measurements at certain intersections on the sections of U.S. 30, S.H. 141, and U.S. 59 passing through Denison.

In addition, the City should make or should request IDOT to make traffic counts at other strategic locations with high accident rates or high traffic volumes. All of the state's normal counts, as well as the special counts, should then be reviewed by the City to determine the future needs for signalization.

c. Currently, there are no school crossing signals erected in the City of Denison. However, there are two flashing red beacon installations on the streets. One location is at 20th Street Elementary School, and the other beacon is located on 20th Street by the swimming pool. The flashing beacon in front of the 20th Street Elementary School will be discussed in Chapter 5.

The Consultant recommends the removal of the flashing red beacon located near the swimming pool. The hazards associated with the intermittent operation of flashing red beacons and the motorists' disrespect for the beacon, caused by its seasonal use, combine to warrant the removal of the beacon. The Consultant recommends the installation of a pedestrian crosswalk as described earlier in this Chapter. Since the unexpected hazard is seasonal, the signs should be removed when the hazard ceases to exist (when the pool is closed for the year).

The estimated cost of the beacon removal and the pedestrian crossing installation is \$300.00.

OTHER TRAFFIC CONTROL DEVICES

Other elements relating to traffic control are speed limits, pavement marking, and lighting. While speed limit signing is an expected and familiar form of traffic control, pavement markings and street lighting are less obvious features which blend into the general roadway environment.

According to most traffic engineering publications, the major criteria for establishing speed limits is the utilization of the 85th percentile speed based on a spot speed study. However, in setting speed limits in urban areas, other factors such as land use, pedestrian traffic, and roadway conditions must be considered in addition to the 85th percentile speed.

Although speed limits on city streets were found to be reasonable, the limits are not always well-posted. Speed zones on the two principal arterials present sensible reductions in 10-mph steps approaching the center of the City, and the reverse is true moving from the center to the outskirts. On 4th Avenue South, speed limits range from 55 mph at the corporate limits to 35 mph between 7th Street and 20th Street. State Highways 141 and 39 and U.S. 59 are signed for a 55-mph speed limit.

Minor arterial and collector streets are either posted for a 35-mph limit, posted for a 25-mph limit, or unposted. At the time of the study, SPEED LIMIT signs were not posted on Broadway and 16th Street, except for a 20-mph limit on 16th Street in the vicinity of the High School.

Although the City Ordinances define speed limits enforceable in school zones, the speed limits are not physically signed on the streets. Recommendations regarding school zone speed limits are addressed in Chapter 5 of the report.

Locations of SPEED LIMIT signs should conform to the MUTCD (Section 2B-13). That is, SPEED LIMIT signs should be located at the points of change from one speed limit to another, on the departing legs of major intersections, at points where it is necessary to remind motorists of the applicable speed limit, and at school zones.

The Consultant highly recommends that the City undertake a program to sign speed limits in conformance with the speed zones established in the City Ordinances. The guidelines stated above should be employed in locating the SPEED LIMIT signs. Care should be taken to prevent over-signing which would most probably lead to disregard of the signs by the motorists.

The recommended size of the SPEED LIMIT sign for Denison is 24" x 30" which is in accordance with the requirements of the MUTCD. The color of the SPEED LIMIT sign should, of course, be black on white.

Since a detailed SPEED LIMIT sign inventory was not conducted, the actual number of SPEED LIMIT signs required to provide adequate coverage on the City streets is unknown. However, it is estimated that for \$1,000, the City could provide reasonable coverage of the City's arterials and collectors.

Pavement markings are used alone or in conjunction with other traffic controls to convey certain regulations or warnings to motorists. They have the advantage of providing information which could not be easily presented by some other means. They do not divert the driver's attention from the roadway.

Presently, the City assumes responsibility for all pavement markings except those on the State and Federal routes, which are maintained by the Iowa Department of Transportation.

At the time of the study, which was conducted in late winter and early spring, the pavement markings on all streets and highways within the City were in poor condition. It is understood that pavement markings cannot readily be applied during winter months thereby accounting for the faded condition of many center-lines and lane lines. The markings that were visible seemed to be properly located. Recommended pavement marking applications are made in Chapter 4 for the High-Accident locations.

The City maintains all crosswalks in the downtown area and in the vicinity of the schools. All crosswalks are currently painted a nonconforming yellow color. The Consultant recommends that the City mark all existing future crosswalks to meet MUTCD standards, which are presented in other sections of the report.

The parking space markings in the downtown area are maintained by the City. In addition, the City has adopted the practice of yellow curb marking to delineate no parking zones on intersection corners and approach curbing.

In summary, the pavement markings currently used by the City are consistent and properly placed, although they appear to be neither comprehensive nor adequately maintained.

Lighting on city streets is another element which can contribute to safer operations. Nighttime driving is considered more hazardous than day driving, due

primarily to the greatly reduced visibility of roadway design and control elements and adjacent physical features along the roadway. Numerous studies have indicated conclusively that adequate street lighting results in reduced nighttime accident rates. This is attributable to improved visibility of roadway features and of other motorists or pedestrians also using the roadway.

In addition to proven accident reduction, the illumination of streets during darkness increases driver comfort and convenience, acts as a deterrent to crime, and generally enhances property values and public welfare.

Illumination of principal streets in Denison is well-executed. Broadway, from Main Street to 15th Street is equipped with decorative street lighting, which is both functional and aesthetically pleasing. Roadway lighting on the other streets of the City is provided by mercury-vapor luminaires.

The review of accident records did not indicate that poor or inadequate lighting was a major contributing factor at high-accident locations. In fact, several of the high-accident locations are well-lighted.

Chapter 4

ACCIDENTS

ACCIDENT HISTORY AND TRENDS

An important measure of the safety of traffic operations in Denison is the accident experience, both city-wide and at individual locations. A detailed analysis of accident report forms makes possible the identification of high-accident locations, accident patterns, and accident trends. This information can lead to the formulation of traffic engineering and physical treatments to lessen the accident potential at those locations with significant accident experience.

Geographical summaries of accident locations for 1975 and 1976 are presented in Figure 4-1 and Figure 4-2, respectively. Each dot represents an accident occurrence, and the placement of the dots provides a general location of each accident. The high-accident locations are indicated by a large dot and the annual accident rate. These diagrams provide an indication of the main accident concentrations, which allows the analyst to direct his efforts toward specific locations when researching the individual accident reports.

In reviewing Figure 4-1 and 4-2, it becomes readily apparent that the City of Denison has a disproportionate number of accidents in relation to the population. The Consultant's experiences with other traffic safety studies in Nebraska and Iowa have revealed that the annual number of accidents per 1,000 population usually falls in the 50 to 60 range. The computation of this statistic for Denison showed that the average annual rate was about 75 accidents per 1,000 population.

As evidenced by Table 4-1, the overall accident trend in Denison has been one of a gradual increase in accident numbers over the past six years. From 1972 to 1973 the City experienced a very large increase (33%) in accidents from which it has never been able to recover. This observation is further portrayed in Figure 4-3. Although the numbers of accidents in Denison have experienced their peaks and valleys over the years, the general accident trend has been on the increase.

Table 4-1 further points out the relationships of the numbers of personal injury, fatal, and pedestrian accidents to the total number of accidents each year. Generally speaking, personal injury accidents account for approximately 10 to 14 percent of the total number of accidents within the City. Fortunately, pedestrian accidents, which tend to be severe, and fatal accidents have been rare occurrences within the City.

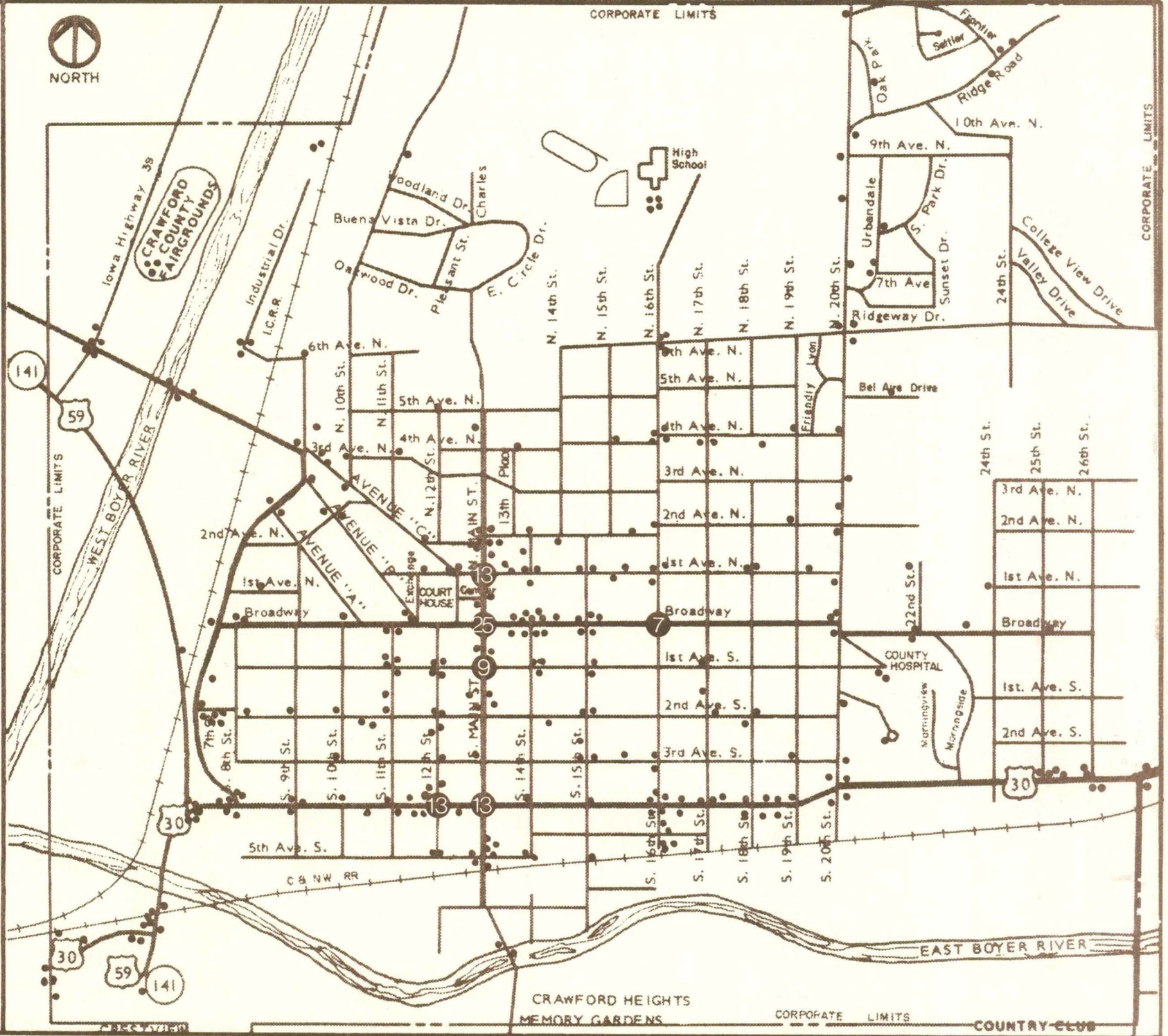
In driving the steeply-sloped streets of the City, the Consultant could not help but wonder at the potential for accidents created by snow and ice conditions prevalent during the winter months. As a result of this impression, Table 4-2 was prepared in an attempt to relate the number of winter-time accidents to the total number of accidents occurring over the past six years. A quick reference to Table 4-2 reveals that accident frequencies for the spring, summer and



NORTH

Legend

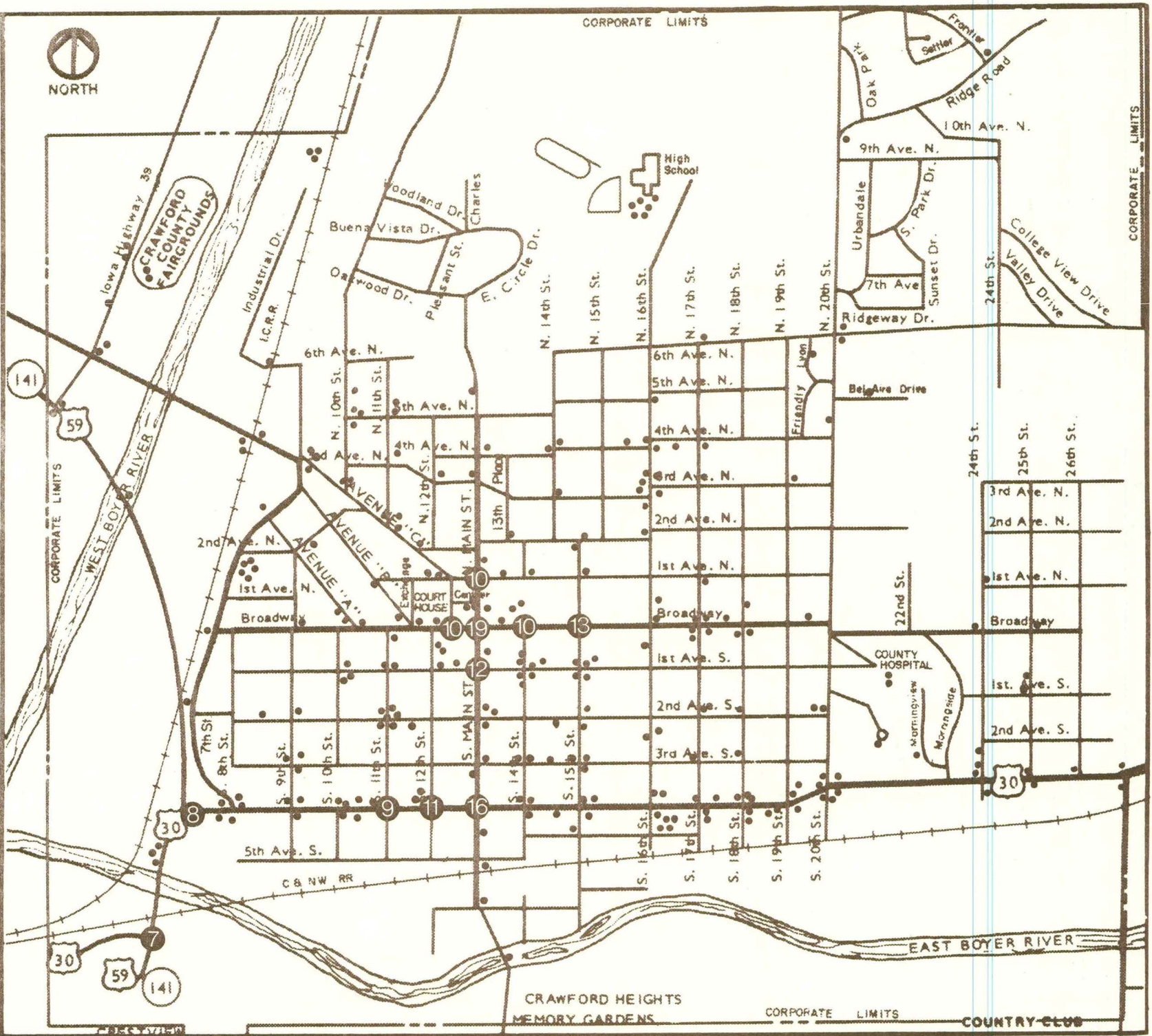
Accident •



1975 High Accident Locations

figure 4-1

Legend
 Accident

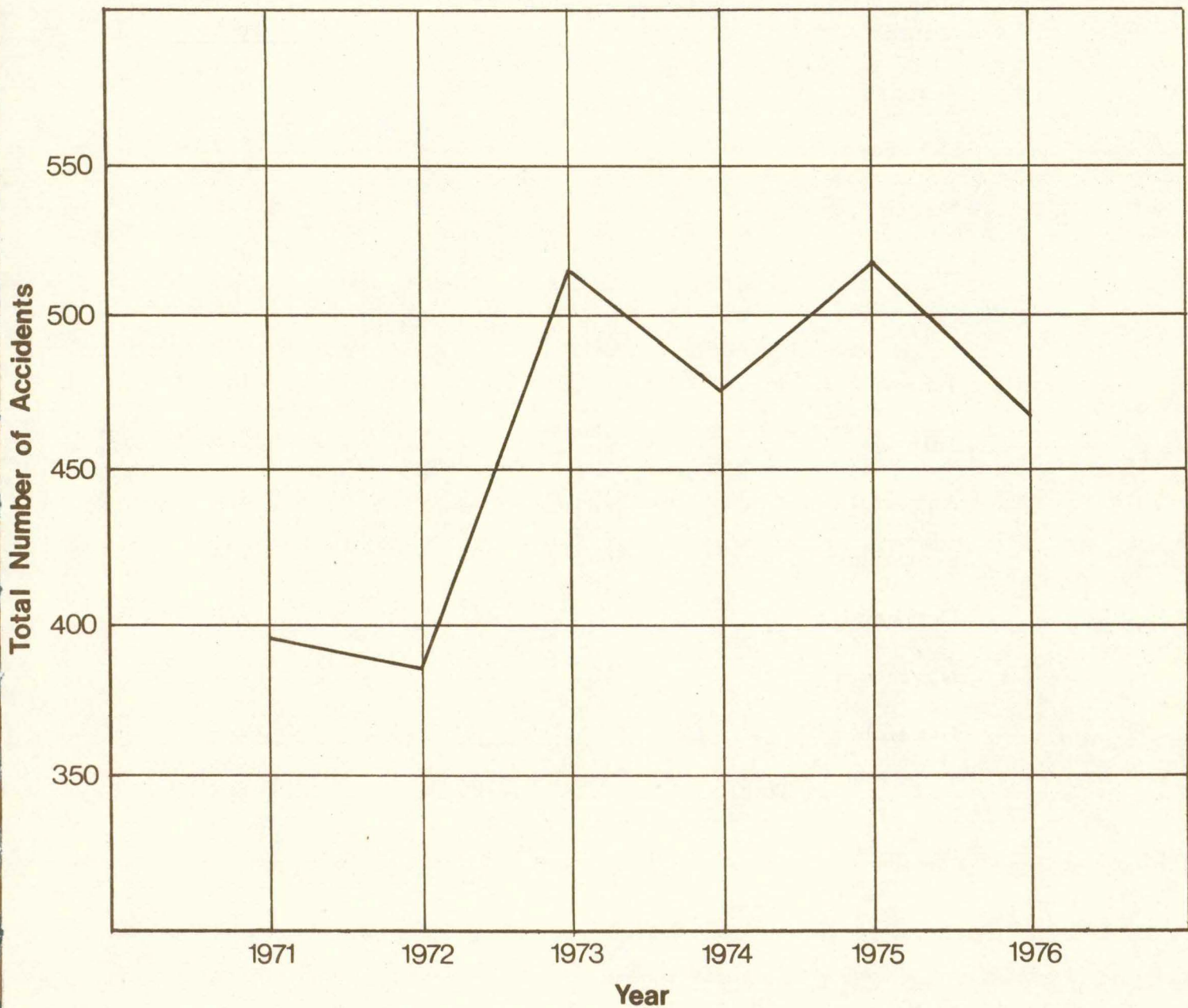


1976 High Accident Locations
 figure 4-2

TABLE 4-1

Annual Accident Trends (1971-1976)

	<u>1976</u>	<u>1975</u>	<u>1974</u>	<u>1973</u>	<u>1972</u>	<u>1971</u>
Property Damage Only	406	464	423	450	327	349
Personal Injury	60	53	50	64	55	43
Fatal Accidents	1	0	1	0	0	0
Pedestrian Accidents	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>	<u>4</u>	<u>3</u>
Total	467	517	475	515	386	395
% Annual Change	-10%	+9%	-8%	+33%	-2%	-



legend

Annual Accident Trends (1971-1976)

figure 4-3

TABLE 4-2

Accident Frequency by Month of Occurrence (1971-1976)

<u>Month</u>	<u>Number of Accidents</u>	<u>Percent of Total</u>
January	289	10.4
February	242	8.7
March	232	8.3
April	205	7.4
May	214	7.7
June	192	6.9
July	221	7.9
August	239	8.5
September	206	7.4
October	218	7.8
November	251	9.0
December	<u>280</u>	<u>10.0</u>
Total	2,789	100.0

autumn months range from 7 to 8 percent of the total; however, the accident frequencies for the winter months are anywhere from 2 percent to 3 percent higher than those rates during other months of the year.

To combat the increased wintertime accident potential created by the natural terrain upon which the City is built, the Consultant recommends that timely sanding and salting operations be employed by the City's street maintenance crews. Furthermore, public information programs should be established to provide local citizens and visitors with information regarding locations rendered unduly hazardous by snow and ice conditions.

In the process of reviewing and analyzing the individual accident records themselves, the Consultant observed that the vast majority of accidents occurring in the downtown area involved vehicles either parked or in the process of parking. Locations outside of the downtown area experienced primarily rear-end accidents and accidents involving turning vehicles.

HIGH-ACCIDENT LOCATIONS

A high-accident location is defined for this study as a location within the City that has experienced seven or more accidents per year. Based upon the concentrations of the accidents shown in Figures 4-1 and 4-2, the Consultant obtained from the Denison Police Department the accident records for the locations that appeared to meet the criterion for classification as a high-accident location. Several locations met the accident-experience criterion for both 1975 and 1976; however, a few locations met the criterion for one year, but not the other. All locations meeting the criterion for at least one year were, of course, considered as high-accident locations for this study.

From these efforts, the following locations were identified as being primary in the frequency of accidents over the 1975 and 1976 time periods:

- Main Street at U.S. 30
- Main Street at 1st Avenue South
- Main Street at 1st Avenue North
- Main Street at Broadway
- U.S. 30 at 11th Street
- U.S. 30 at 12th Street
- Broadway at Avenue "C"
- Broadway at 14th Street
- Broadway at 15th Street
- Broadway at 16th Street
- North Junction of U.S. 30 with U.S. 59 and S.H. 141
- South Junction of U.S. 30 with U.S. 59 and S.H. 141

The estimated costs for the proposed improvements are tabulated below:

Curb extension	\$100
Signal backplates	\$600
Pavement markings	\$100
Signs	\$300
Pedestrian signals	<u>\$300</u>
	\$1,400

W11-2
US 30

Note: Improvements are shown in **bold**

150'

SPEED LIMIT
35

Extend
Curb & Gutter

No Curb & Gutter

Main

W11A-2

30'

Relocate

100'

ONLY

ONLY

R3-7R

Relocate

W11A-2

SPEED LIMIT
35

Add Backplates
Typ.

150'

W11-2



legend

- Mast Arm Pole
- 12in RYG Signal
- Walk / Dont Walk
- No Parking



**Main at
US 30**

figure 4-4

Main Street at 1st Avenue South. In reviewing the accident collision diagrams in the Appendix, the accident-producing conflict at this location becomes readily apparent. Of the twenty-one (21) accidents recorded at this intersection during the past two years, a total of 17 accidents were directly tied to vehicles legally parked on the street or vehicles attempting to enter or vacate legal parking spaces. Furthermore, a rear-end accident was indirectly caused by a vehicle backing from a parking space when a car was struck from behind while braking abruptly to avoid the vehicle vacating a legal parking stall.

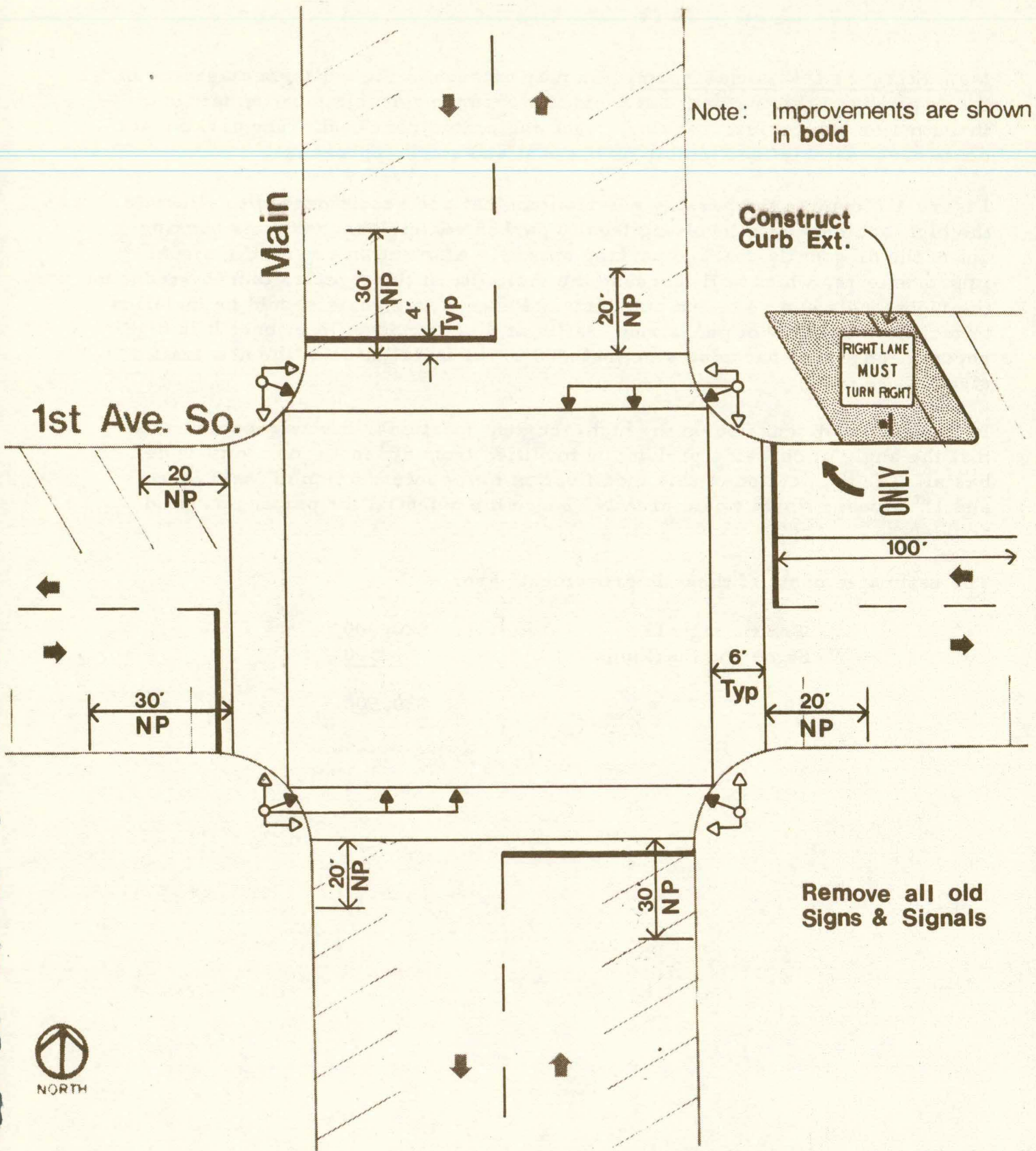
Figure 4-5 shows the recommended improvements for this intersection. Primarily, the improvements relate to the restriction of parking near the intersection.

Although few accidents appear to be related to the traffic signal installation at this intersection, the City should definitely consider the possibility of upgrading the poles, signal heads, and wiring in the near future. The certainty of increased traffic demands on Main Street, coupled with the old age of the present installation, warrant new signal equipment. The new signal heads should preferably be mounted on mast arms to provide better visibility. The signal controller appears to be in excellent condition, therefore, its replacement is not recommended by the Consultant. Due to the significant volume of pedestrians at this location, the installation of pedestrian signals is recommended.





The costs of the improvements are estimated as follows:

Signalization	\$20,000
Signs and Markings	600
Curb extension	<u>700</u>
	\$21,300

Note: Improvements are shown in **bold**



legend

- Mast Arm Pole 
- 12in RYG Signal 
- Walk / Dont Walk 
- No Parking **NP** 

**Main St. at
1st Ave. So.**

figure 4-5

Main Street at 1st Avenue North. As may be seen in the collision diagrams in the Appendix of this report, the accidents occurring at this location fall into three major categories: parking, right angle, and rear-end. The parking accidents have materialized mainly on the east and south approaches.

Figure 4-6 depicts the parking restrictions that are recommended to alleviate the high-accident rate involving legally parked vehicles and vehicles backing out of the diagonally-marked parking spaces. Also shown are traffic signal improvements, which will increase the visibility of the signals, thereby reducing the right-angle and rear-end accidents. Pedestrian signals should be installed to facilitate the flow of pedestrian traffic at this downtown location. It is highly recommended that backplates be included in the installation of the new traffic signals.

In the general discussion on the high-accident locations, it was recommended that the angle of curbside parking be modified from 60° to 45° on a city-wide basis. The application of this modification to the intersection of Main Street and 1st Avenue North would greatly reduce the potential for parking-related accidents.

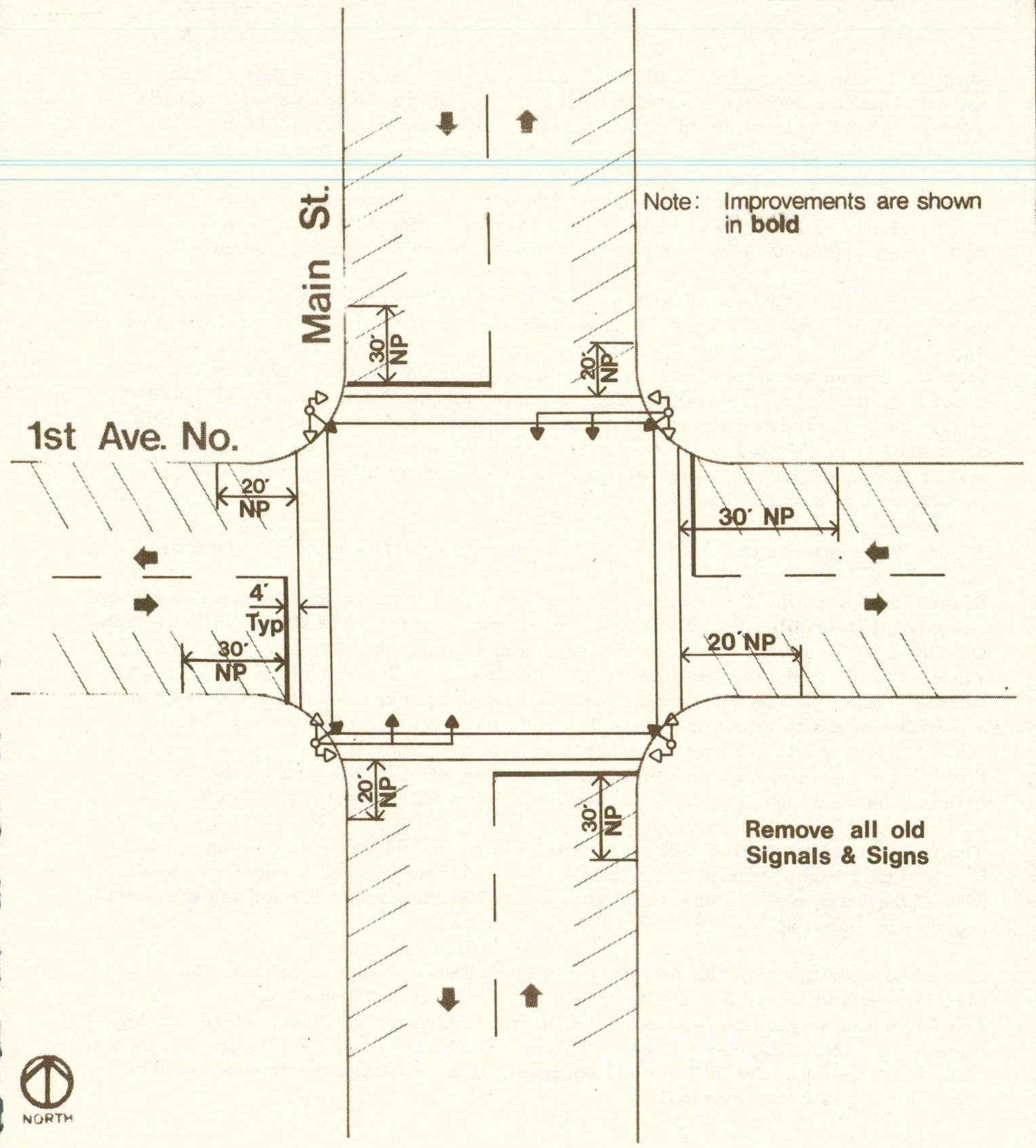
The estimated costs of these improvements are:

Traffic signals	\$20,000
Signs and markings	<u>500</u>
	\$20,500

Main St.

1st Ave. No.

Note: Improvements are shown in **bold**



Remove all old Signals & Signs



Legend

- Mast Arm Pole
- 12in RYG Signal
- Walk/Dont Walk
- No Parking

Main St. at 1st Ave. No.

figure 4-6

Main Street at Broadway. A detailed analysis of the accident collision diagrams for this location is not required in order to determine the major factors influencing the high rate of accident occurrence. By scanning the accident collision diagrams, the analyst is able to immediately ascertain the two predominant accident patterns in and around this intersection. Accidents involving parked vehicles and vehicles backing from parking spaces account for the vast majority of collisions. Secondary in terms of number of accidents are the rear-end collisions, some of which are indirectly tied to vehicle backing maneuvers.

Over 70 percent of the accidents occurring at this location in the last two years were related to parked vehicles or vehicles backing from parking stalls. Nearly 23 percent of the accidents over the same time period were of the rear-end variety. When combined, these two types of accident patterns account for 93 percent of the accidents recorded at this intersection for the years 1975 and 1976. The conclusions drawn from this supporting data are that vehicles are permitted to park too near to the intersection, thereby conflicting with smooth traffic flow and that the motorists experience poor visibility of the existing traffic control devices (traffic signals).

Figure 4-7 presents the recommended improvements for this intersection.

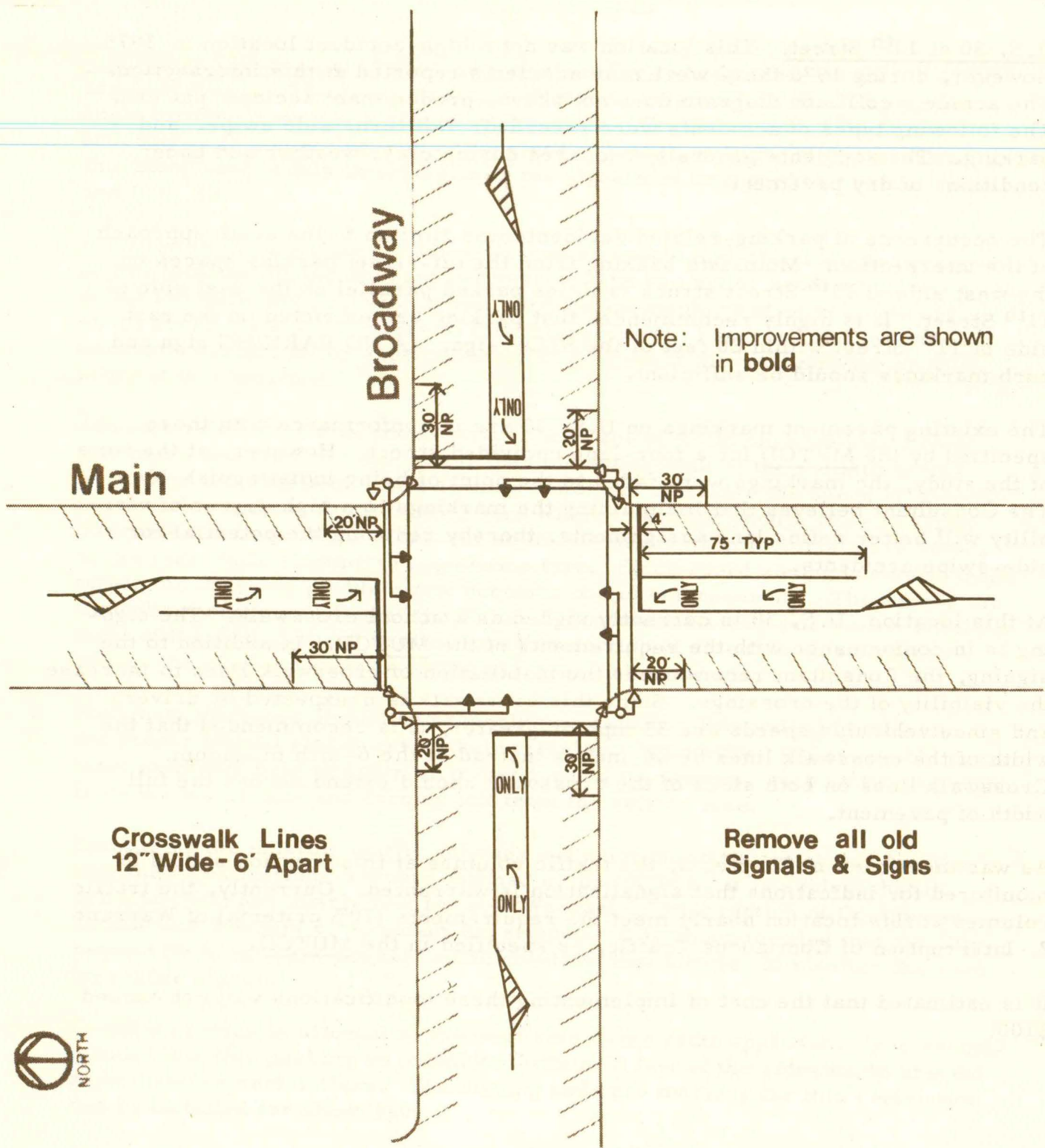
Discussions with the City administration and field observations by the Consultant revealed that problems with turning movements are frequent at this intersection. On Thursday evenings when the stores are open late, the problem with turning vehicles is so acute that the City rolls out a NO TURNS sign which prohibits all turning maneuvers on all approaches. All four approaches to this intersection are wide enough to accommodate a left turn bay, which would segregate the left-turning vehicles from the traffic stream, thereby allowing a smoother flow than currently exists. The continued use of the NO TURNS sign is not recommended inasmuch as the sign is nonconforming with respect to the MUTCD.

The Consultant conducted a capacity analysis of this intersection to determine if a left-turn signal phase is required. The analysis yielded a negative result. Therefore, a two-phase operation appears to be sufficient for handling the existing traffic demand.

It is recommended that the old existing signal hardware be upgraded. Since Main Street and Broadway are both very wide streets, the installation of mast-arm-mounted signals is recommended to improve their visibility. Pedestrian signals are recommended to reduce the potential for pedestrian-vehicle conflicts. The existing controller is in good condition, and the Consultant considers its replacement as being optional.

The estimated costs of these modifications are tabulated below:

Traffic signals	\$24,000
Signs	300
Pavement markings	<u>500</u>
	\$24,800



Broadway at 14th Street. A review of the accident collision diagrams indicates that this location did not appear to be a high-accident location in 1975, however, ten accidents were reported in 1976. Generally, the accidents can be classified as either parking-related collisions or rear-end accidents.

When 14th Street was closed-off to form the semi-mall concept, the intersection of Broadway and 14th Street was redesigned to function as it does today. The design of the intersection appears to be both functionally and geometrically sound. The curb extensions, besides being aesthetically pleasing, effectively prohibit parking near the intersection and provide short walking distances for pedestrians crossing either street.

The Consultant does not recommend any design modifications for this intersection. A detailed research of the investigating officers' reports of the accidents at this location revealed that the primary causes for the accidents were driver-related and not roadway-related. Of the 15 accidents occurring at this location in 1975 and 1976, twelve (12) were the result of driver inattention or driver error. Typical contributing factors were: following too closely, improper backing, failure to yield right-of-way, and drinking drivers.

The Consultant does recommend that the angle of parking be reduced from 60° to 45°. It is also recommended that a STOP sign be installed on the 14th Street approach (See Figure 3-3). Also, a STOP LINE should be marked on 14th Street. The cost of the STOP sign is covered in Chapter 3. The cost of the STOP LINE is minimal.

Broadway at 15th Street. The accident collision diagrams for this location reveal that parking, backing, and rear-end accidents are the predominant types of collisions. The rear-end accidents have occurred mainly on the west approach while the parking and backing collisions have occurred on the other three approaches.

Figure 4-9 shows the existing conditions as well as the recommended improvements for this intersection. Parking restrictions are of foremost importance in improving the accident record of this location.

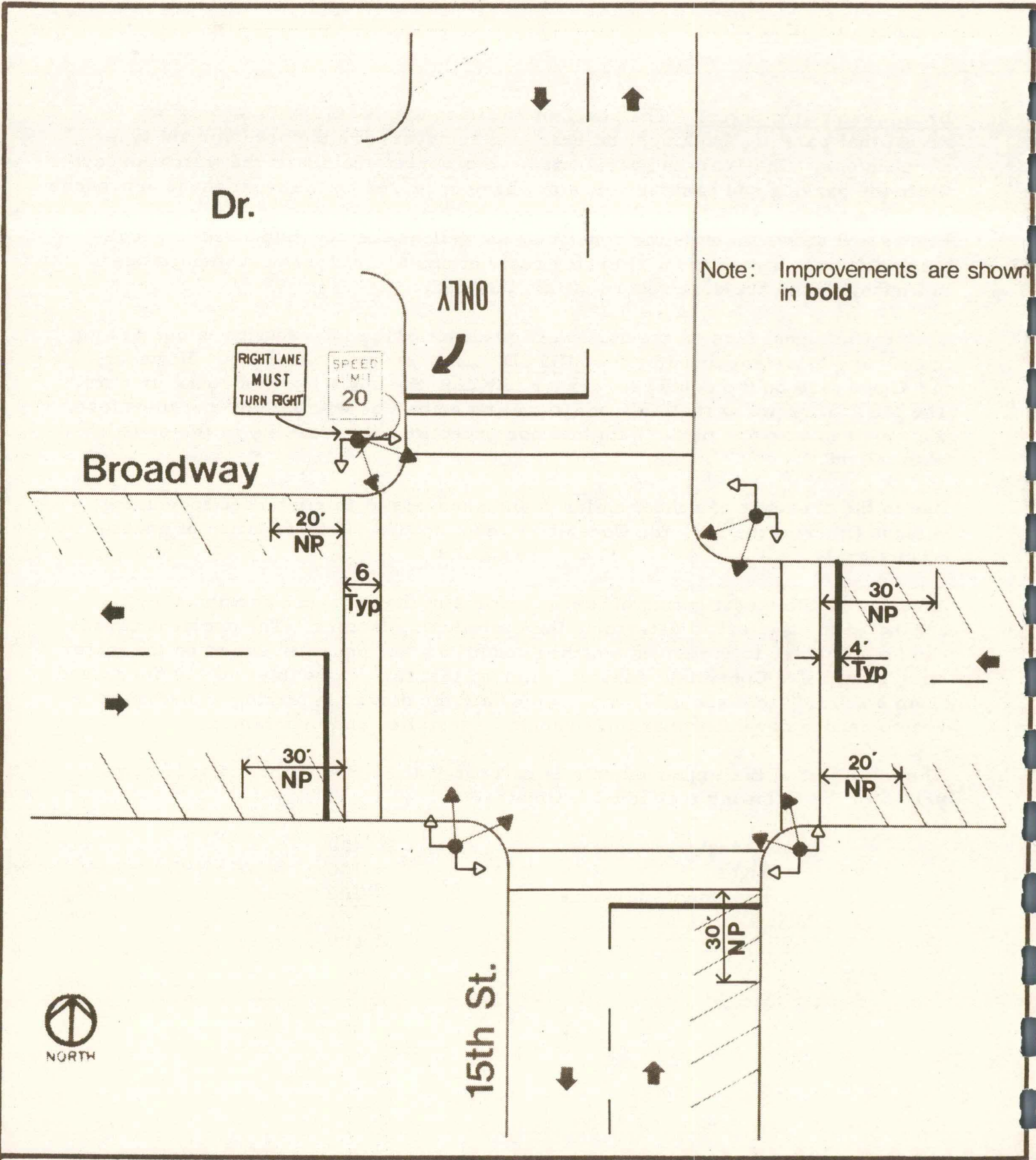
The traffic signal face on the northwest quadrant of the intersection is not within the 20° angle, as specified by the MUTCD, for westbound motorists. However, the signal face on the southwest corner is within the angle for westbound drivers. The MUTCD requires that only one signal face shall be within the cone; therefore, the requirements are met. With this one exception, the visibility of the signals is excellent.

Due to the presence of school children and shoppers at this intersection during various times of the day, the Consultant recommends the installation of pedestrian signals.





A review of the investigating officers' reports of the rear-end accidents was conducted in an effort to determine the contributing factors. The accident causes can be attributed to inclement weather conditions and poor judgement on the motorists' part. The Consultant does recommend that the yellow intervals be increased from 3 seconds to 4 seconds. To further aid the driver in making decisions, the recommended pavement markings should be installed and maintained.

The total cost of the improvements is estimated at \$1,800. This total is comprised of the following individual estimates:

Pedestrian signals	\$2,400
Signs	100
Pavement markings	<u>100</u>
	\$2,600



legend

- Mast Arm Pole 
- 12in RYG Signal 
- Walk/Dont Walk 
- No Parking 

Broadway at 15th St.

figure 4-9

Broadway at 16th Street. The 1975 accident collision diagram for this location is presented in the Appendix of this report. The diagram shows a mixture of parking, backing, right-angle, and rear-end accidents occurring throughout the intersection. These accidents were experienced while the intersection was controlled with STOP signs only on the 16th Street approaches. After the installation of STOP signs on the Broadway approaches, the intersection experienced the occurrence of only one accident. Therefore, this intersection did not appear as a high-accident location in 1976.

In Chapter 3 specific STOP sign modifications were recommended. Chapter 5 contains recommended school crossing improvements for this location. The Consultant believes that the combination of these two improvements will suffice to retain the accident rate for this location at its present low number.

North Junction of U.S. 30 with U.S. 59 and S.H. 141. As may be seen in the collision diagrams for this location, a variety of types of accidents has occurred over the past two years. Three major patterns may be distinguished. These patterns are fixed-object accidents, right-angle collisions, and side-swipe maneuvers.

Although this intersection is of a high-type, acceptable design, the geometrics are somewhat confusing to the driver accustomed to traveling the uncomplicated two-lane highways of the surrounding area. Stop sign beacons, excellent roadway lighting and signing, and pavement markings have been provided to assist the motorist in negotiating the intersection. Roadside obstacles have been marked with reflectors, and guardrail has been installed to direct errant vehicles away from these obstacles. In spite of all these safety precautions, accidents still persist at this location.

The existing guide signs at this intersection have a white background with a black legend. Although very legible during daylight hours, the signs become difficult to read at night. Much of the visibility problem at night is caused by the glare created by the existing roadway lighting. The Consultant believes that the high nighttime accident rate (5 out of a total of 13 accidents) is predicated on the fact that the visibility of the guide signs is less than desirable at night.

The Consultant recommends that the City request IDOT to investigate the possibility of replacing the existing signs with guide signs exhibiting a white legend on a green background.

The Consultant recommends the installation of 3-WAY supplemental plates on the STOP signs to inform the drivers on each approach that the drivers on the other two approaches must also stop.

The pavement markings should be maintained to a high degree of visibility, especially at the conflict point between vehicles southbound from the north and from the east. Reflectorized plastic pavement marking material should be installed at this point of conflict to provide a semi-permanent marking to reduce the potential for side-swipe accidents.

During conditions of inclement weather and slippery pavement, out-of-control vehicles tend to impact the guardrail which protects the massive supports of the cantilevered guide signs. By relocating these guide signs from the gore areas to the roadway shoulders, the vulnerable island areas could be freed of fixed objects. This suggestion is in keeping with the national effort to eliminate dangerous roadside obstacles.

Generally, residents of the Denison area regard this intersection as being both confusing and dangerous to motorists. Many would like to see the intersection rebuilt to a simpler configuration. However, the Consultant believes that the number and type of accidents occurring at this location do not warrant any drastic and costly modifications. At the expiration of the intersection's design life, the Iowa Department of Transportation may want to consider the redesign of the subject intersection.

It is estimated that the cost of the pavement marking and signing recommendations (excluding the relocation of the sign supports) would be about \$2,600.

South Junction of U. S. 30 with U. S. 59 and S. H. 141. The design of this intersection is almost identical to the layout of the north junction of U. S. 30 with U. S. 59 and S. H. 141. Furthermore, the accident patterns at this location very nearly resemble the patterns evident at the north junction. The correctable accidents at this intersection are primarily caused by two factors. The first factor is the problem of drinking drivers. The second factor involves failure-to-yield maneuvers resultant from westbound and southbound drivers being unsure as to whether or not eastbound motorists are required to stop. The intoxicated-driver accidents are law enforcement problems. However, the failure-to-yield collisions can be addressed by means of signing additions.

At this location, the volume of traffic turning from the west to the north is more than double the north to south traffic and almost thirty (30) times heavier than the movement from the south to the west. Considering the disproportionately higher volume on the west approach, the Consultant recommends that the movement from the west to the north remain uncontrolled. However, signing should be installed on the north and south approaches warning motorists that the cross-traffic does not stop.

Two out of three accidents at this location occur under conditions of darkness. As was the case with the north intersection of U. S. 30 with U. S. 59 and S. H. 141, the poor visibility of the black-on-white guide signs is a contributing factor to the night-time accidents at this intersection. The installation of white-on-green guide signs is recommended.

The intersection signing and the guide signs could be modified for approximately \$2,600.

SPECIAL IMPROVEMENTS

In the City of Denison, there are a few locations that do not experience a high accident rate, but the potential for accidents exists. Furthermore, the existing conditions at these locations cause restrictions to the smooth flow of traffic. Therefore, the Consultant analyzed three special intersections and formulated recommendations that would improve both the safety and flow of vehicular traffic. The three intersections are:

Broadway at 20th Street
2nd Avenue North at Avenue "C"
16th Street at 4th Avenue North

Each location is treated separately in the following text. In addition, sketches are provided to show the existing conditions and the recommended modifications. Generally speaking, the recommendations involve the reconstruction of all or parts of each intersection. Therefore, the costs of the modifications are high. Since accidents are not prevalent at these locations, expensive reconstruction projects are not warranted in the very near future. As traffic volumes increase in the future and safety problems are complicated, these recommendations may be used as guides for improving the operation of each intersection.

Broadway at 20th Street. This multi-legged intersection is located in the eastern part of Denison near County Hospital. In the vicinity of this location both Broadway and 20th Street are classified as minor arterials. Traffic volumes at this location are relatively low. The heaviest volumes occur on the south approach, which experiences an average daily traffic of 4,330 vehicles.

A review of the accident records reveals that this intersection did not meet the high-accident criterion for either 1975 or 1976. In fact, only three accidents were recorded at this location during the two-year period. Although the accident experience does not appear to be a problem, the undesirable geometrics and sight distance restrictions at this intersection adversely affect traffic flow.

The two main factors impeding the smooth, efficient flow of traffic at this intersection are the jog in Broadway and the proximity of the hospital entrance to the intersection. The combination of these two factors results in hazardous turning maneuvers and an increased number of vehicle conflicts. Furthermore, the present layout of the location tends to elongate the intersection in the north-south direction, thereby rendering motorists susceptible to conflicting vehicles for quite a distance.

The Consultant analyzed this intersection in an attempt to develop traffic engineering improvements which would improve the overall operation of the intersection. However, due to the peculiarity of the intersection, the layout does not readily lend itself to the implementation of any low-cost modifications. The angles and locations at which the approaches intersect, the steep grades existing on three of the approaches, and the high ground and retaining wall on the southwest quadrant all combine to preclude the implementation of any beneficial short-term improvements.

The Consultant firmly believes that in order to improve traffic operations at this location, the intersection must be reconstructed to improve the alignment, geometrics, grades, and sight distances associated with each approach.

However, the accident experience does not warrant the immediate expenditure of large sums of money to rebuild this confusing intersection. Therefore, the Consultant recommends a medium-range improvement plan which would be compatible with a long-range, more-comprehensive plan for the improvement of this intersection. The Consultant recommends that the City monitor this location relative to accident frequency to determine when the implementation of the suggested improvements would become cost-effective.

Figure 4-10 shows the medium-range concept that would improve the existing situation. This plan attempts to segregate the hospital driveway from the street intersection. Not only would this plan reduce the intersection from five legs to four, but this concept would also allow northbound 20th Street traffic to stop

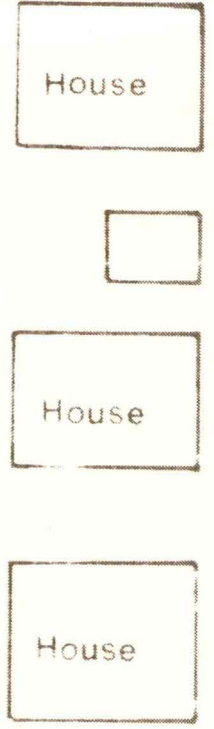
closer to Broadway, thereby improving sight distance conditions. The service driveway to the hospital would require minor realignment to be compatible with the modified hospital entrance. In addition, a 4-WAY stop condition should be instituted.

Figure 4-11 depicts the long-range plan for improving the traffic operations at this location. This plan calls for the realignment of Broadway to eliminate the existing jog. Channelization is utilized to facilitate right-turn maneuvers from 20th Street to Broadway. It is recommended that only the traffic on Broadway be required to stop, thereby making 20th Street a through street. The medium-range plan could also be incorporated into the design of this realignment. On the southwest quadrant of the intersection, the high ground would be cut down and the retaining wall removed.

Crawford County Memorial Hospital is currently contemplating an addition to the north end of the existing hospital building. Concurrent with the construction of the addition, the service driveway is to be realigned to connect with Broadway, as shown by the dashed lines in Figure 4-11. This modification of the service driveway would be compatible with both the medium-range and long-range recommendations.

The medium-range plan, while being beneficial, is relatively inexpensive (estimated cost of \$7,000). It is apparent, however, that the long-range improvement would require both the acquisition of right-of-way and the displacement of residences. When combined with the construction and engineering costs, the total cost is prohibitive at this time. The long-range plan will warrant implementation as traffic volumes increase.

Broadway



R1-1
R1-3

Service Dr.

Co. Hosp. Dr.



relocate
& Add
R1-3

Rotate

Relocate

20th St

Add
R1-3 STOP



Retaining
Wall

STOP Add
R1-3

STOP
AHEAD

legend

Broadway at
20th St.
Medium Range
figure 4-10

Note: Improvements are shown in **bold**

Broadway

House

House

House

R1-1

Service Dr.

Co. Hosp. Dr.

R1-2

STOP

Remove

Rotate

STOP

PR

20th St

Relocate

Relocate

STOP

R1-2

Relocate

Retaining Wall

STOP

STOP AHEAD



legend

**Broadway at
20th St.
Long Range
figure 4-11**

2nd Avenue North at Avenue "C". This intersection is located just north and west of the downtown area in Denison. At this location both 2nd Avenue North and Avenue "C" carry the designation of minor arterials. Avenue "C" is a major link between the northwest region of the City and the central business district. 2nd Avenue North is an east-west street which runs parallel to heavily-travelled Broadway.

Figure 4-12 shows the existing conditions and the recommended improvements for the subject intersection. In the vicinity of 2nd Avenue North, Avenue "C" is a straight segment of street with constant cross section. 2nd Avenue North intersects Avenue "C" from the East, creating a skewed intersection. Less than 100 feet East of the Avenue "C" - 2nd Avenue North junction, North 12th Street intersects 2nd Avenue North.

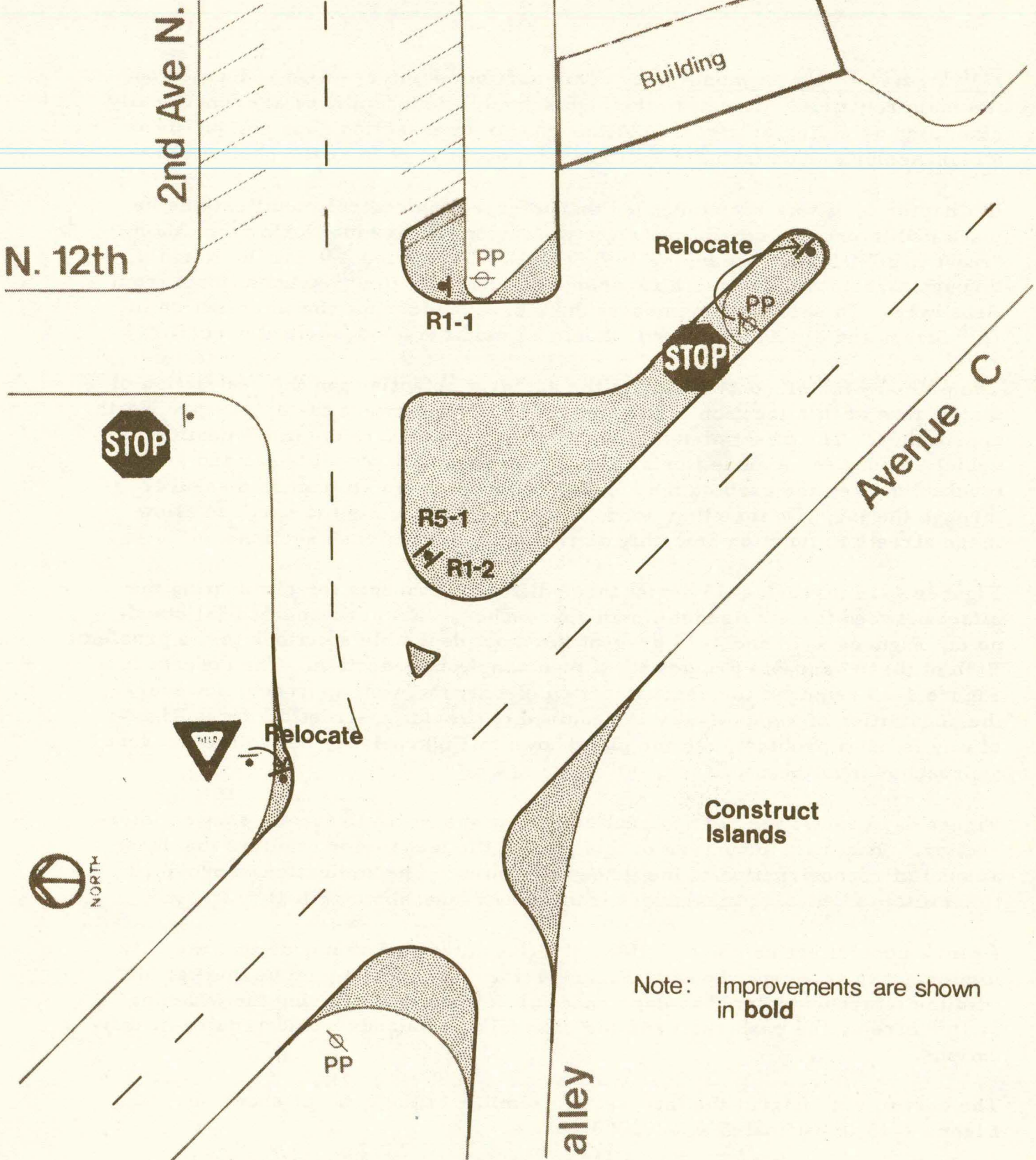
As evidenced by Figure 4-12, the primary problem associated with this intersection is the vast area of pavement available to make turning maneuvers. No channelization exists to define travel paths for the motorists.

Field observations revealed one frequent problem associated with the lack of channelization. Quite often a motorist traveling west on 2nd Avenue North or South on 12th Street desires to drive southeastward on Avenue "C". To do so, the driver cuts the corner and stops at the STOP sign located on the small island adjacent to Avenue "C". While waiting at the STOP sign, another motorist, traveling on Avenue "C" from the southeast, desires to turn right to reach 2nd Avenue North. A conflict of interests arises resulting in poor traffic flow. This is only one of the myriad conflicts which occur at this location due to the "wide open spaces" available for negotiating the intersection.

Through conversations with the local populace, the Consultant learned that most drivers in the Denison area are somewhat apprehensive when it comes to using the subject intersection. Field observations reinforce this idea in that most drivers, due to their familiarity with the many maneuvers possible at this location, reduce their speed and proceed cautiously through the intersection. In the opinion of the Consultant, it is this induced caution on the drivers' behalf that prevents this location from experiencing a high accident rate.

Although the accident numbers at this location are not high, the potential for a high rate is present. The Consultant believes that the recommended signing and channelization improvements will reduce the accident potential by regulating conflicting traffic movements into definite paths of travel. The proposed channelization will improve traffic flow, improve safety, and instill driver confidence.

It is estimated that the proposed channelization and signs could be installed for approximately \$8,000.



Note: Improvements are shown in **bold**

legend

2nd Ave. No. at Ave. C

figure 4-12

16th Street at 4th Avenue North. This particular intersection is located on the main route (16th Street) to the high school. Both facilities are functionally classified as collector streets. Although this intersection does not qualify as a high-accident location, six accidents did occur here over the past two years.

In Chapter 3, it was recommended that intersection control modifications be instituted to provide continuous right-of-way on 4th Avenue North from Main Street to 20th Street (excluding 16th Street). By making 4th Avenue North a through street, east-west traffic should be attracted to 4th Avenue North from Broadway. To safely accommodate the increased traffic, the intersection of 16th Street and 4th Avenue North should be modified as described herein.

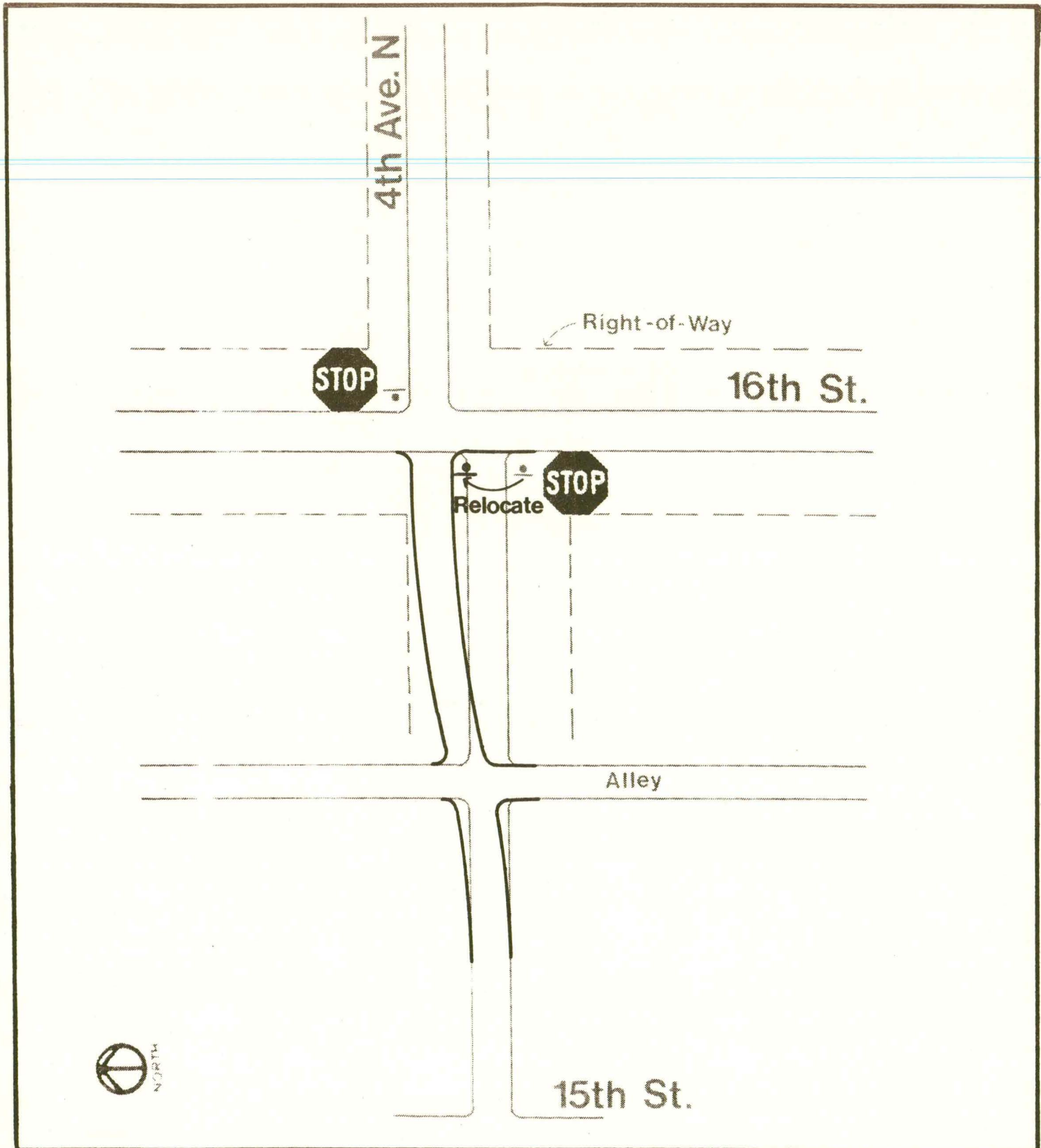
The primary factor contributing to the accident potential and the restriction of traffic flow at this location is the amount of offset between the 4th Avenue North approaches. The offset distance is too large to facilitate the movement of vehicles along 4th Avenue North. In fact, west bound school buses and small trucks run over the curb on the northwest corner in an attempt to maneuver through the jog. On the other hand, the offset distance is too small to allow these streets to function smoothly as two separate "T" intersections.

Figures 4-13 through 4-15 depict three different concepts for eliminating the offset between the 4th Avenue North approaches. From an operational standpoint, Figures 4-13 and 4-14 present the most desirable solutions to the problem. Both of these concepts provide for a right-angle intersection. The concept in Figure 4-13 requires the reconstruction of only the west approach; however, the acquisition of right-of-way is required to provide a street border. Right-of-way is not a problem with the plan shown in Figure 4-14, but both east-west approaches must be realigned.

Figure 4-15 shows the realignment of 4th Avenue North to form a skewed intersection. The main advantage of this plan is the fact that it requires the least amount of reconstruction of the three alternates. Channelization is provided to facilitate right-turn maneuvers from 4th Avenue North onto 16th Street.

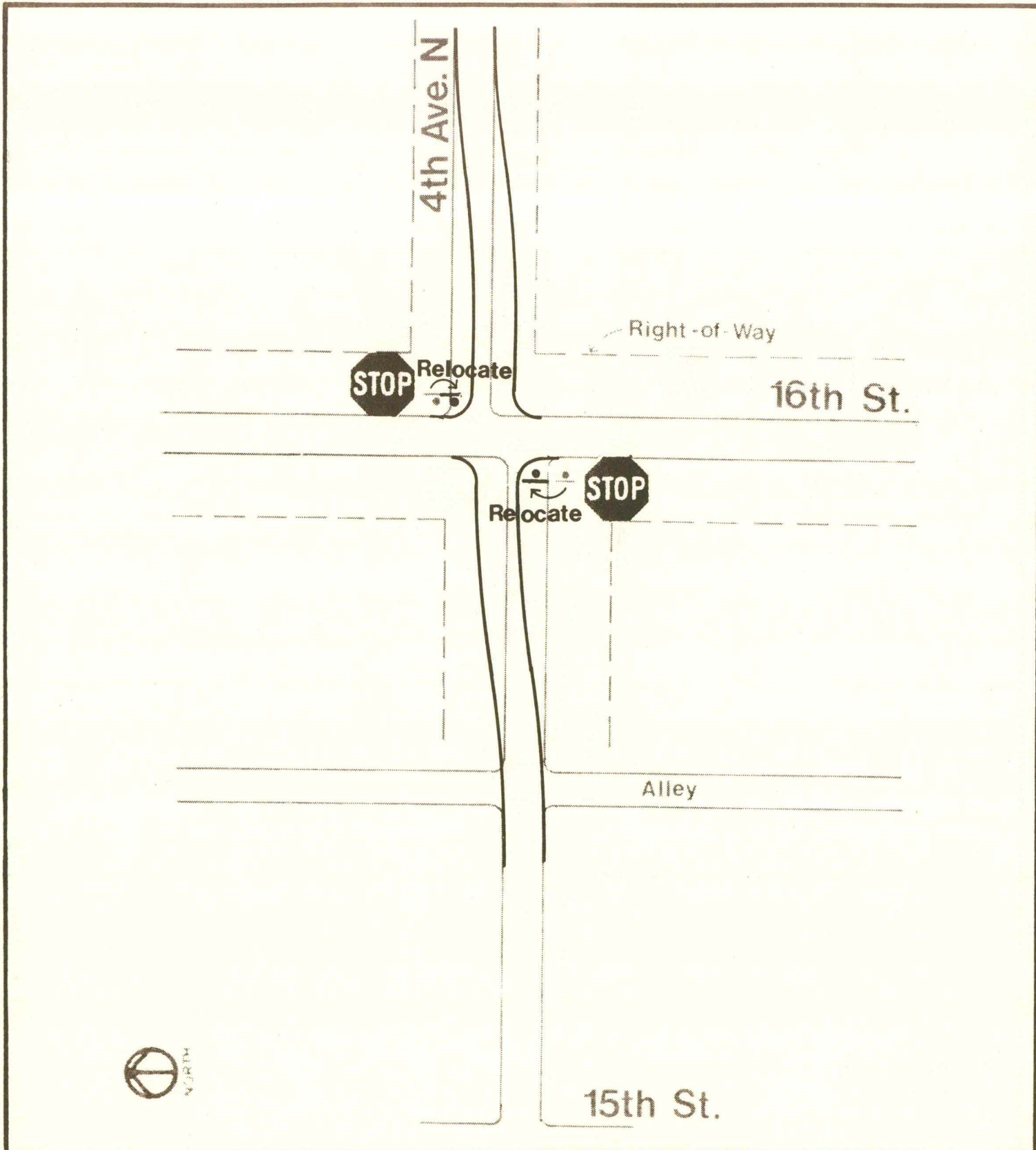
From a cost-effective point of view, the Consultant recommends that the City implement the concept shown in Figure 4-15. This plan would be compatible with the future widening that is planned for 16th Street. During the widening of 16th Street, the curb radii and the channelizing islands would require modifications.

The cost to reconstruct the intersection similar to the concept shown in Figure 4-15 is estimated at \$20,000.



legend

16th St. at
 4th Ave. No.
 Alt. 1
 figure 4-13



legend

**16th St. at
4th Ave. No.
Alt. 2
figure 4-14**

4th Ave N.

Right-of-Way

16th



Rotate



R1-1

R1-1



Rotate



NORTH

legend

16th St at
4th Ave. No.
Alt. 3
figure 4-15

ACCIDENT RECORDS

The accident records utilized in this study are currently on file with the Denison Police Department. The following steps are taken to establish the present record keeping system used by the Police Department:

1. The investigating officer completes a motor vehicle accident report which consists of the standardized Iowa State Form currently being used for this purpose.
2. The completed form is reviewed by office personnel at the Denison Police Department. Those accident reports involving no personal injury or involving property damages less than \$250 for both vehicles are copied and distributed to the involved parties with a copy being retained in the Police Department's files. For those accidents over \$250 in property damages or involving personal injuries, an additional accident report form is typed and sent to the State.
3. For the current month, accident reports are kept in daily files. At the end of each month, the daily files are combined to form a monthly file, which is the permanent method of filing the accident reports. In each monthly file, office personnel insert a summary sheet containing the date of the accident, the parties involved in the accident, and the investigating officer.
4. Each month a chronological listing of the accidents for the preceding month is prepared by Police Department personnel. The list includes the date, the persons involved, the location of the accident, any injuries involved, and the total estimated property damage. These monthly listings are very useful as a quick source of information for compiling accident statistics.

The accident records are mainly used by insurance companies and by Police officials when making court appearances regarding traffic violations or professional testimony on the causes of the accident. To use the present system, the researcher must know the month and year in which the accident occurred. With this knowledge he can then consult the monthly accident file and obtain the desired accident report.

If a researcher desires to review all of the accidents occurring at one particular intersection, he must read through each and every monthly chronological listing of the accidents and obtain the dates on which the accidents occurred at the subject intersection. Armed with these dates he may then proceed to the monthly files and retrieve the desired accident reports. In lieu of this two-step procedure, one may page through every accident record on file while sorting out the required reports.

During the review of accident records to determine the location of high-accident locations, the Consultant observed two common shortcomings in the investigating officers' completion of the accident report form. Several reports were noted as containing only the street name on which the accident occurred with no information to indicate at what point along that street the accident took place. Secondly, many reports utilized the names of local establishments to reference the location of an accident. Both of these practices make it very difficult for a person unfamiliar with the City to accurately locate accidents by utilizing the accident records. The Consultant highly recommends that the investigating officers be briefed on the avoidance of these two practices.

Overall, the accident filing system is set up entirely for use by the insurance investigator who, in turn, is interested in one accident. The filing system is not set up for use by the City Engineer or by the Police Department to analyze a series of accidents occurring at one location. Thus, a policy decision needs to be made at the City level to determine for which purpose (insurance investigators or Engineer/Police Officer) the accident record keeping system should be designed.

The Consultant recommends that the City adopt the practice of filing accident records by location rather than by month of occurrence. An appropriate system for Denison is a manual location file in which accident records are filed by street-name intersections. Since Denison has both named and numbered streets, an alpha-numeric system should be used for filing the accident reports. An example alpha-numeric listing follows:

Avenue "A"
Avenue "B"
Avenue "C"
Broadway
Buena Vista Drive
Charles Street

1st Avenue North
1st Avenue South

7th Avenue North
7th Avenue South
7th Street

10th Street
11th Street
12th Street
Etc.

The manual location file, then, should be an alpha-numeric file of street names with intersection accidents filed behind a primary tab bearing the name of the street that comes first alpha-numerically and a secondary tab bearing the name of the intersecting street. Mid-block accidents should be filed by block number immediately behind the primary tab for the street on which the accident occurred.¹ Off-street accidents, such as in parking lots, would require separate handling.

The location filing system outlined above would be slightly more complex than the existing filing system. However, the new system would enable a researcher to easily locate high-accident locations, and their respective accident records, while still being of use to an insurance investigator.

¹Transportation and Traffic Engineering Handbook, Institute of Traffic Engineers, 1976

Chapter 5

SCHOOL SAFETY

SCHOOL LOCATIONS

Within the City of Denison, the school facilities fall into two general categories - public and parochial. The school locations, along with the school attendance boundary for the public elementary schools, are shown in Figure 5-1.

The high school is located in the north-central part of the city on the west side of the 16th Street extension. The football and baseball fields are located in the vicinity of the high school; thereby causing parking and traffic problems during athletic contests. Adequate parking is available for the normal school-time hours.

The Middle School and Central Elementary School are located on the block bounded by Broadway, 16th Street, 1st Avenue South, and 15th Street. These schools lie just east of the downtown area and are situated in a primarily residential setting. Grades 6 through 8, totaling about 575 children, attend the Middle School. Central Elementary School houses about 325 students including Kindergarten through fourth grade and two sections of fifth grade.

On the east side of 20th Street between 1st Avenue North and 2nd Avenue North lies the 20th Street Elementary School. Grades one through four and 3 sections of fifth graders attend this school. The total enrollment approximates 380 students.

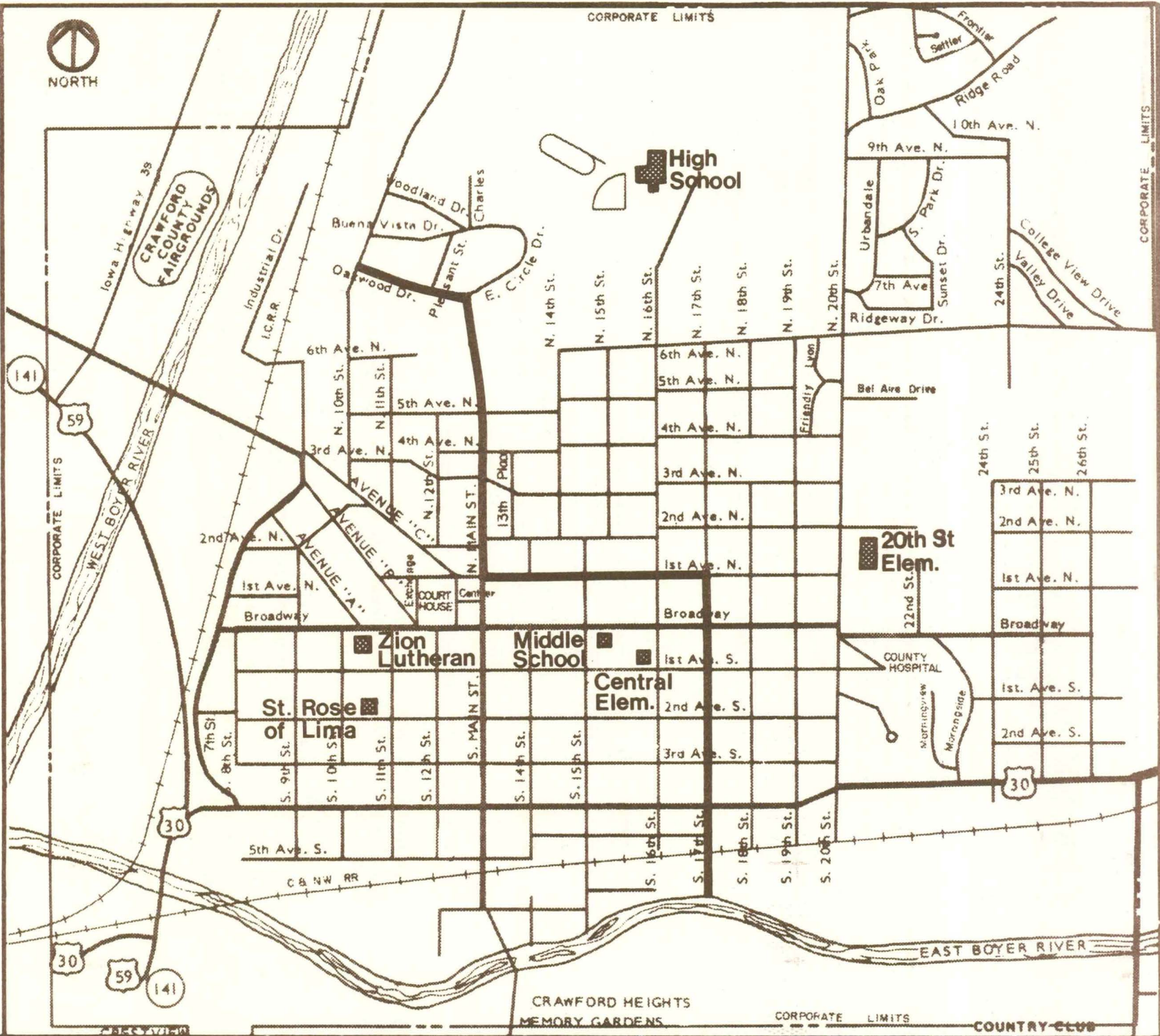
Zion Lutheran School instructs grades kindergarten through 8. This school facility is located on the south side of Broadway just east of 10th Street and serves the Lutheran community for the Denison regional area. The total enrollment in this school is about 75 children.

St. Rose of Lima Catholic School is situated just two blocks south of Zion Lutheran School, therefore, these two schools are considered together in the recommendation of school safety improvements. This Catholic School currently educates 101 youngsters in grades kindergarten through six.

ELEMENTS OF A SCHOOL SAFETY PROGRAM

The philosophy of a school safety program is fairly straightforward and simple: to provide a safe path to and from school for children. Necessary elements of such a program include:

- school route planning.
- appropriate signing, markings, signal controls, and crossing guards.
- adequate site layout (to reduce vehicle-pedestrian conflicts).
- education of children, parents and motorists.
- review of operational and safety experience.
- updating plan at regular intervals.



NORTH

Legend

Public Elementary Boundary
 School



School Locations

Public Elementary Boundary

figure 5-1

Long-range considerations which apply, especially in the implementation of more costly control devices, are the stability of school attendance boundaries, and the potential for school relocation, expansion, or closing.

Each of these elements is amplified in the following discussion.

School Route Plan. This simply involves the designation of suggested routes between a school and the residential areas within its attendance boundary.

Guiding factors in the placement of each route are:

- Aggregate children on their way to school to consolidate principal crossings and to enhance the visibility by grouping the children.
- Minimize the number of crossings on major streets.
- Provide routes that are direct as possible given other more important constraints.
- Maximize use of existing traffic and crossing controls, if they are suitable.
- Maximize use of existing available sidewalks.
- Provide adequate sight distances.
- Avoid midblock crossings other than those adjacent to schools.

Traffic Controls. These include pavement markings, crosswalks and related signing, speed limits, intersection controls, beacons, traffic signals, and crossing guards. The proper use and general warrants for each are described below:

A. Pavement Markings. The MUTCD specifies that crosswalks shall be marked by two white lines at least 6 inches in width and at least 6 feet apart (alternate markings are available). Stop bars are not specifically required by the MUTCD, but may be used in conjunction with most marked crosswalks. One stated warrant for marked crosswalks requires 25 or more children crossing a minimum volume of 60 vehicles an hour.

B. Signing serves to alert motorists to the proximity of a school or crossing and to regulations on speed limit and right-of-way.

- a. **SCHOOL ADVANCE** sign (S1-1) is intended for use in advance of school grounds and school crossings. A general guide for placement is a distance not less than 150 feet nor more than 700 feet in advance of the school crossing.

- b. SCHOOL CROSSING sign (S2-1) is intended for use at established crosswalks except at crossings controlled by a STOP sign. It shall be preceded by a SCHOOL ADVANCE sign. Placement is at, or as near as possible to, the crosswalk.
- c. A SCHOOL SPEED LIMIT sign assembly (R2-1 with S4-3 and S4-2) is used to define a reduced speed zone near school grounds. This sign can be used with flashing beacons, or as a changeable message sign with beacons, to emphasize the school speed zone on streets with higher traffic volumes or a higher base speed limit. At the end of the zone, the standard speed limit should be posted. This pertains more to major streets.
- d. STOP signs should be installed primarily on the basis of traffic volumes and assignment of right-of-way. Accident experience, sight distance, and inadequate gaps in traffic for children are potential influencing factors.
- e. NO PARKING signs (R7-series) are usually necessary to provide proper sight distance at crossings, and similar signs can be used to identify school area loading zones.

C. Beacons may be used in conjunction with various school area signing to draw special attention. Standard permissible uses are YELLOW beacons used with SCHOOL CROSSING signs or SCHOOL SPEED LIMIT signs, which flash to coincide with the hours of pedestrian activity. According to the MUTCD, FLASHING RED beacons are not to be used on an intermittent basis at intersections or mid-block school crosswalks. This implies that their present use at crosswalks with various warning signs is not conforming. The intent is that at all locations where a motorist is required to fully stop at some times and not at other times, this control be provided only by signal-type controls.

In summary, YELLOW beacons can be used with warning or regulatory signs on an intermittent basis, if necessary. RED beacons must be used as permanent installations and should be supplemented by a STOP sign.

D. Pedestrian-Actuated Traffic Signals are warranted in the MUTCD when there is less than one adequate gap per minute in traffic for children to cross during the period of crossing activity. Considering walking speed and street width, Table 5-1 depicts the approximate threshold volumes for meeting the signal warrant.

TABLE 5-1

VOLUME WARRANTS FOR SIGNALIZED CROSSWALKS

<u>Street Width</u>	<u>Crossing Time</u>	<u>Maximum Volume Allowing 1 Safe Gap per Minute¹⁾</u>
18	8	910
22	9	740
24	10	675
28	11	570
30	12	520
36	13	465
40	14	435
44	16	405
48	17	375
55	19	335
65	22	285

1) Use 70% of these values since Denison is under 10,000 in population.

Table 5-1 provides a general guide and should be supplemented by additional field data including pedestrian volumes, vehicle speeds, sight distances and other engineering factors.

Signalized intersection control can help complete the safe route concept by providing a specified gap in heavy traffic. Such crossings at signals should be marked with crosswalks, warning signing and pedestrian indications. Care should be taken in signal phasing to assure that adequate time is available during a phase for children to completely cross the street.

E. Adult Crossing Guards are usually assigned to assist children using a marked crosswalk where special hazards exist that can be best gauged by an adult. Such hazards could include long crossings and heavy vehicular or truck traffic. Considerable judgment in the use of crossing guards is necessary because of the expense incurred. One general set of warrants in use specifies the use of adult guards:

- at major crosswalks on State and Federal routes.
- at crosswalks where the volume of vehicles and children is 1600 or greater at the time children use the crossing.
- as an interim control at crosswalks where a signal is warranted or as a permanent control if special conditions indicate that the guard could provide better protection.

In the control of traffic, adult guards should pick opportune times to create a safe gap. When traffic has stopped, then he permits children to cross. Guard training and supervision should be coordinated through the Police Department.

F. School Crossing Patrols are an alternative supplement to traffic control measures.

G. Pedestrian Overpasses are the ultimate solution to eliminating vehicle-pedestrian conflicts at critical locations. However, it is felt the high cost of these structures (about \$100,000 for a four-lane overpass) precludes their use at the present and in the near future in Denison.

Attendance Areas. Optimally, elementary schools should be located away from major streets. Attendance boundaries likewise should follow along principal streets, railroads, or natural features. Following these general guidelines on the location of schools and attendance areas certainly will promote school safety.

Junior and senior high schools on the other hand require accessibility and therefore are best located on or near major or minor arterials.

Overall, the delineation of attendance areas should keep in mind school safety as a criteria for identifying school attendance boundaries. Most assuredly, school boundaries should be located in such a manner as to prevent or discourage students from having to cross hazardous areas or obstacles on their routes to and from school.

School Site Layout. The physical layout of the school site itself can contribute a great deal to the traffic operations and controls as related to pedestrian safety. Adequate sidewalks, specified areas for student loading and unloading from vehicles, bus loading zones, and entry-exits to the school buildings, all have an important bearing on school safety.

SAFE ROUTE TO SCHOOL PLAN

Presently public school students are given informal instructions within their classrooms as to the proper means of crossing streets. Emphasis is also given by the teachers and the school administration for students to use the school crosswalks at the various locations in the City when attending school. Additional instruction is provided a student by incorporating safety and the learning about safety into the course work actually being taught in the classroom. It is the intention that the direct and indirect coverage of safety will be applied by the students as they attend school.

The Consultant did not find that efforts had been made by the schools, particularly the elementary schools, in identifying a safe route to school plan. Generally, it is left up to the parents to sit down with their children and map out the safest route for each child to take to and from school

Zion Lutheran School provides children in kindergarten through grade 2 with formal instruction on the meaning of traffic signals and signs and on the safest locations to cross streets. The 1st and 2nd grade children go for walks during which they are instructed in safe street-crossing procedures. In addition, the school uses safety manuals published by the National Child Safety Council to educate the students about traffic-pedestrian safety.

St. Rose of Lima School invites the Iowa Highway Patrol to their school to lecture the children on bicycle and pedestrian safety. Furthermore, traffic safety booklets provided by the Iowa Department of Transportation are furnished to the children and discussed.

In an effort to provide the local schools with guidelines on a safe route to school program, the Consultant has compiled the following discussions. This discussion centers around the elementary schools and the middle school in Denison.

It is suggested that the principal and the parent organizations at each school develop safe routes to school based on the guidelines for a School Route Plan presented earlier in this Chapter. Such a development would include the production of a map handout showing the major safe routes to school. Such a handout would then be used as part of the regular continuing education program to train the students to follow the safest routes to school.

An additional use of the safe route to school plan would be for identifying areas which require new sidewalks or replacement of existing sidewalks. The school route plan will also serve to identify those areas where additional traffic control planning or devices are required to further promote school pedestrian safety. Additional discussions are contained elsewhere in this Chapter regarding sidewalks and the traffic control devices required to enhance the major safe routes to schools.

A major point which the Consultant wishes to make is that the Consultant can only identify the major criteria or guidelines centering around a safe route to school plan. For such a plan to be successful, however, it is the Consultant's opinion that the school officials, parents, and students must take an active part in developing the best safe route to school plan for their school. Such participation will promote the development of a sound school plan and provide better assurances that it will be followed by the students.

In closing, the special comment on the next page is quite interesting in regards to school safety. It points out that engineering alone will not totally handle school safety. The best safety protection is a safe route to school and a thorough education of our children so they, as individuals, can make the proper decisions on their own safety.

SCHOOL CROSSINGS: A COMMENT

(The following article by Jan Bierman was submitted as a Letter to the Editor and appeared in the Des Moines Register and Tribune, October 1974)

There is no such thing as a "safe route", where the combination of motor vehicles and children occurs. Some day, by some fantastic stroke of luck, people are going to realize this and work toward educating children and drivers in this direction. A child must learn to cross the street independently -- with a healthy respect for vehicles -- without dependency upon Adult Crossing Guards or "Safety Bugs", which are available only at school times. A driver must learn to SEE what is around him and to watch especially for children whose traffic judgment is still developing.

Parents need to spend time teaching traffic values in the home, and demonstrating these values in a positive way on the streets as they come into contact with traffic. Licensing requirements and education of drivers need to be more thorough, with emphasis on children at ALL times, not just near schools or on school routes.

Individual priorities need to be reassigned, so if any mother feels her child is in danger at a crossing, she will be with that child showing him what he needs to watch for -- for the other times and other crossings he may need to make when she is not there. A Crossing Guard has no more control over traffic than a parent has and provides the type of assistance that fosters acceptance of protection in place of independent learning.

It is unrealistic to interpret "safe route" in a literal sense. It was not intended to be understood in that way, and was a poor choice of words by trusting-type officials who felt most people were of reasonable intelligence.

Separation of children and traffic is the only sure way to avoid tragedies. The next best way is to equip our kids on a round-the-clock basis through education of both children and drivers, along with acceptance of responsibility by those who really have the most to gain.

We can educate and accomplish some long term benefits. Or we can assign more Crossing Guards during school times and leave kids to their own resources after 3:45 each school day; and ALL DAY each day throughout week-ends and summer vacations -- which is what we're doing now to "protect our children".

It is not enough. And we need to decide if safety at school times is all we really care about.

SIDEWALK NEEDS

A review by the Consultant of the sidewalks in the vicinity of the schools indicates that overall adequate sidewalk facilities do exist for students and other pedestrians. However, certain locations, which should have sidewalks, are without them, and other locations have sidewalks that are sufficiently deteriorated to require replacement.

Overall, the Consultant suggests that the public and parochial schools work with the City, either through the City Engineer or the Street Commissioner, to begin a program of sidewalk construction and reconstruction. The first phase of such a program should be to construct sidewalks along those blocks not currently having sidewalks. This phase should be directed at those locations which are identified as being on major school routes.

Phase Two of this overall program should be the reconditioning of existing sidewalks along the major school routes. Such reconditioning would include the reconstruction of those sidewalk sections which are broken or badly deteriorated.

Phase three of the sidewalk program should concentrate on the providing of sidewalks or the reconditioning of sidewalks along all major streets (arterials and collectors).

At intersections, sidewalk ramps for the handicapped should be provided on new sidewalk installations. Several locations in downtown Denison currently have ramps provided. Illustrations showing typical sidewalk ramps may be found in the Appendix to this report.

It is the Consultant's feeling that much of the sidewalk construction should be financed by assessing the costs directly to the property owners involved.

In the vicinity of the schools, specific locations for sidewalk reconstruction are recommended by the Consultant. These recommendations are included later in the report under the suggested improvements for individual school locations.

SCHOOL BUS OPERATION

Currently, thirteen buses are used to carry students to and from the public and parochial schools in the City of Denison. In the opinion of the Consultant, the school administrations have done a very commendable job in establishing the morning and afternoon bus routes, the bus scheduling, and the scheduling of student dismissals.

In the morning, buses unload students at the St. Rose of Lima School and the Zion Lutheran School before proceeding to the Middle-Central School complex. Middle School children are unloaded on Broadway just east of 15th Street. Central Elementary School students disembark on Broadway just west of 16th Street and on 16th Street adjacent to the school building. The buses then drive to the 20th Street Elementary School where students are unloaded in front of the school. Finally, the buses are driven to the High School, which is the last stop.

In the afternoon, buses pickup the parochial school children, the 20th Street School children, and the High School students. All buses meet at the Central Elementary School location where bus transfers take place, and the Central School and Middle School students board the buses. The buses then depart simultaneously to cover their respective routes.

After much study and deliberation, the Consultant concludes that the current bus routes and scheduling cannot be greatly improved. Furthermore, the schedules for student dismissal provide for smooth pedestrian and vehicular flow in the vicinity of the schools.

During the afternoon busing operations, 16th Street between Broadway and 1st Avenue South becomes quite congested due to the presence of the buses. The diagonally-parked buses effectively reduce 16th Street to a one-lane street. The school administrators are planning a modification to the afternoon bus operations which will serve to reduce this congestion problem. The plan is to align the buses bumper-to-bumper facing west on 1st Avenue south and facing south in the parking bay on 16th Street. The Consultant concurs in this plan which will improve traffic operations and student safety on 16th Street (a minor arterial) and will not adversely affect traffic flow on 1st Avenue South (no functional classification).

With the one exception noted above, the school bus operations within the City of Denison were observed to be quite satisfactory. Much time, thought, and effort on the part of the school administration are the prime ingredients resulting in an efficient and safe product.

EXISTING TRAFFIC CONTROLS

At the present time, the City of Denison primarily employs STOP signs and painted crosswalks to control vehicular and pedestrian traffic at school locations. A traffic signal provides control at the northwest corner (Broadway and 15th Street) of the Central School - Middle School complex. The 20th Street school location utilizes a roll-out STOP sign, an adult guard, and a flashing red beacon, which is used intermittently to handle pedestrian - vehicle conflicts.

All crosswalks in the vicinity of all schools are painted with yellow paint. As mentioned in Chapter 3, hinged STOP signs are used near the Central School - Middle School location to provide 4-way stop conditions during hours when school is in session. SCHOOL ADVANCE and SCHOOL CROSSING signs are almost non-existent.

Although speed limits are not well signed in the vicinity of the schools, City Ordinances are in force requiring motorists not to exceed 15 miles per hour when driving through school zones, which are also established by Ordinance.

Currently, no pedestrian signals are in operation at school crossing locations within the City. A pedestrian-actuated traffic signal exists at the U.S. 30 and

Main Street intersection, however, the actuation buttons and the pedestrian signals are not in operation. Based on field observations, the Consultant does not recommend the installation of any new school signals. The Consultant does suggest that the City closely monitor all school crossings, especially the 20th Street School mid-block crossing, for indications that a school signal may be warranted.

RECOMMENDED TRAFFIC CONTROLS

Particularly for grade school age children, a coordinated plan of crosswalk controls can guide students to avoid hazardous crossings or intersections, provide effective and efficient use of protective measures, and further promote safety by treating similar situations in a similar fashion.

The recommended modifications to the present system of school crossing controls and protection are discussed for each school location in the following text. The Central Elementary School and Middle School were treated as one location since they are located on the same block. The parochial schools were also considered together due to their nearness. Where required, related sketches are provided to graphically depict the recommended scheme of crossing controls.

It is important to note that the system of school crossing controls should be periodically reviewed. This is necessary to reflect the changes which can occur in the form of attendance boundaries, new schools, new residential areas, traffic volumes, and intersection signing. Periodic reviews will also reveal required maintenance of the crossing controls.

Denison High School. The High School in Denison is strategically located in the north-central part of the City away from the heavy downtown traffic. Even with its remote location, the High School suffers from large traffic volumes during certain hours on school days and during the ingress and egress of vehicles and pedestrians for school events (especially athletic contests).

Many high schools in small midwestern cities are faced with the problem of drivers exceeding the speed limits posted in the vicinity of the school. The Consultant was gratified to learn that this unsafe practice is nearly nonexistent on the high school grounds. Very strict enforcement procedures have held the speeding problem to a minimum.

From discussions with school officials, it was learned that two major problems exist in the vicinity of the high school. These problems are:

- . Intersection of 16th Street and 6th Avenue North
- . The need for another access route to the High School

The problems at the 16th Street and 6th Avenue North intersection are primarily associated with the vertical alignment of the approaches. On 16th Street, northbound motorists are confronted with a very sharp transverse crown about 50 feet south of the intersection followed by a deep dip at the intersection. The Crown and the dip combine to form a hazardous "roller-coaster" effect.

The east approach to this intersection slopes rather steeply away from the intersection. This slope in conjunction with the high ground on the southeast corner of the intersection causes severe sight distance restrictions to the south.

Motorists utilizing the west intersection approach likewise experience sight restrictions to the south due to the high ground on the southwest quadrant of the intersection. Drivers approaching the intersection from the north encounter no apparent problems.

Short-range and long-range solutions are recommended for the inherent problems of this intersection. The suggested short-range solution involves signing for the bump and the dip. On the east side of 16th Street, facing northbound traffic, a BUMP sign (W8-1) should be installed 150 south of the bump. On the west side of 16th Street, facing southbound traffic, a DIP sign (W8-2) should be installed 150 north of the dip. A 15 M.P.H. ADVISORY SPEED PLATE (W13-1) should be installed to supplement each sign. The ADVISORY SPEED PLATE shall be mounted below the warning sign and on the same assembly. These signs could be installed for about \$100.

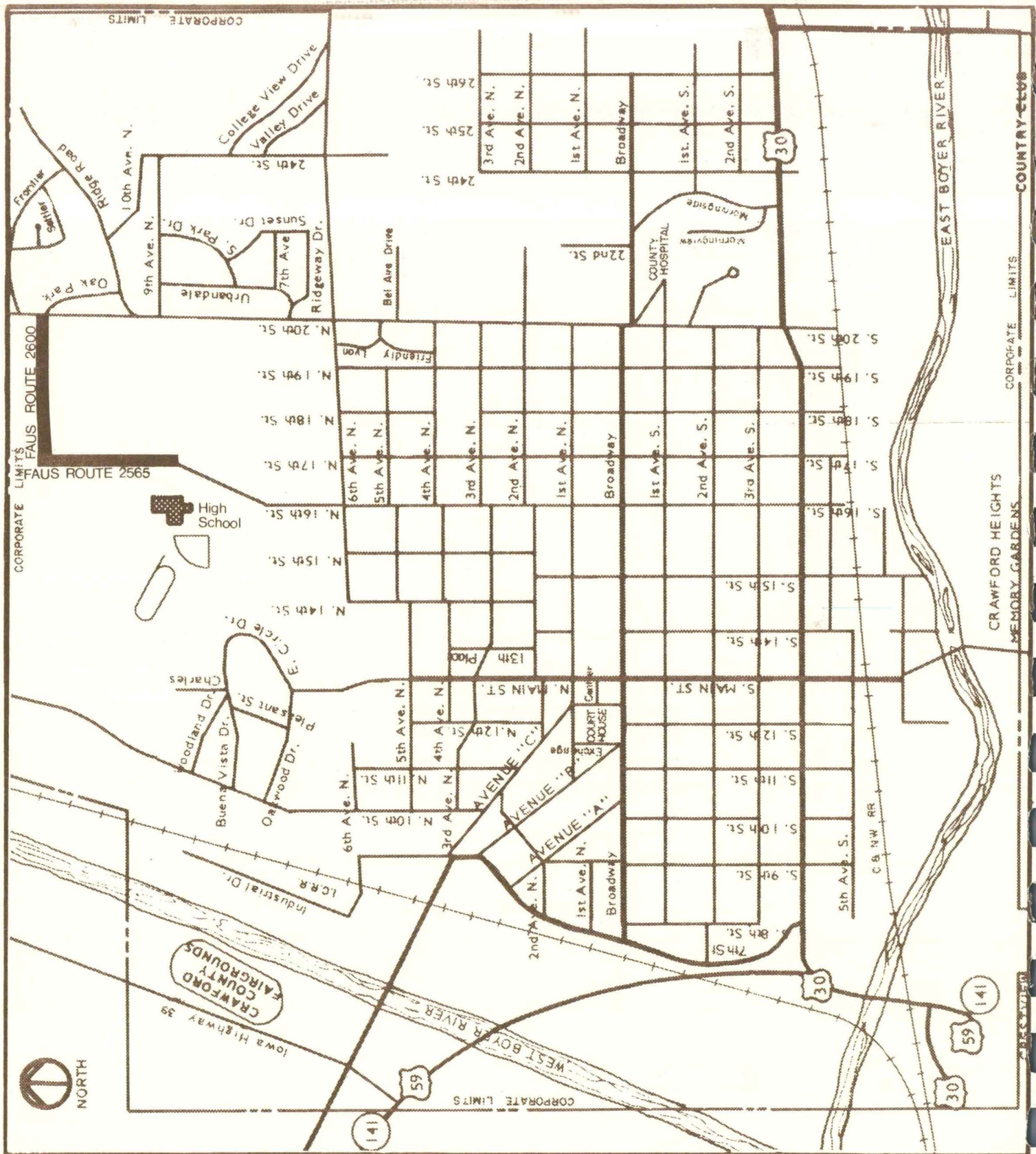
The recommended long-range solution involves a street reconstruction project. The south approach to the intersection should be reconstructed to flatten the grade and remove the dangerous bump-and-dip situation. In addition, the high ground in the yards on the southeast and southwest corners should be cut down to improve

the sight distance conditions. If the City decides to reconstruct 16th Street from a two-lane street to a three-lane facility, these safety improvements should be incorporated into the design of that project.

The second problem, namely an east-west access route to the High School has been discussed briefly in preceding sections of the report. As a result of field observations, the Consultant has concluded that an access route, in addition to 16th Street, would greatly benefit traffic flow in the vicinity of the High School. Furthermore, an east-west street serving the High School would attract traffic off of 16th Street, thereby improving the situation at the 16th Street and Broadway intersection. Also, peak traffic flows, caused by school events, could be accommodated without the current practice of converting 16th Street into a one-way street. Converting 16th Street into a one-way street, causes problems, since there exists no parallel street to act as the other half of a one-way pair. Making 16th Street one-way southbound, for example, totally prohibits access to the school.

Presently, the City of Denison has on its Federal-Aid Urban System unconstructed portions of Federal-Aid Urban Routes 2565 and 2600. These two routes, which are located north and east of the High School (See Figure 5-2) are also functionally classified as collector streets. Federal-Aid Urban System monies could be used to construct this additional link between the community and the school.

Regarding the need for new or additional signing, the Consultant does not believe that any major revisions in the signing around the high school are required. Most signs appeared to be relatively new and properly located and installed. The STOP sign at the south parking lot entrance was noted to be twisted in such a manner as to be visible to southbound vehicles on 16th Street. The sign should be oriented so that it is visible only to drivers leaving the parking lot.



legend
New Road ———

Proposed High School Access Route

figure 5-2

Middle School and Central Elementary School. Figure 5-3 shows the recommended improvements to increase the safety of pedestrians and vehicles at this location. The recommendations stress the signing and pavement marking improvements required to bring the school crossings into conformance with the standards specified in the MUTCD. Please refer to the Sign Legend (Figure 5-6) included at the end of this Chapter.

All crosswalks should be marked as described earlier in the discussion on pavement markings under ELEMENTS OF A SCHOOL SAFETY PROGRAM. The Consultant recommends that STOP LINES be marked in advance of the crosswalks where stop conditions exist. STOP LINES should be placed 4 feet in advance of and parallel to the nearest crosswalk line. The STOP LINES should be 12 to 24 inches wide and should be solid white.

Additional recommended improvements for the intersection of 15th Street and Broadway are presented in Figure 4-9, and discussed in the Chapter on Accidents.

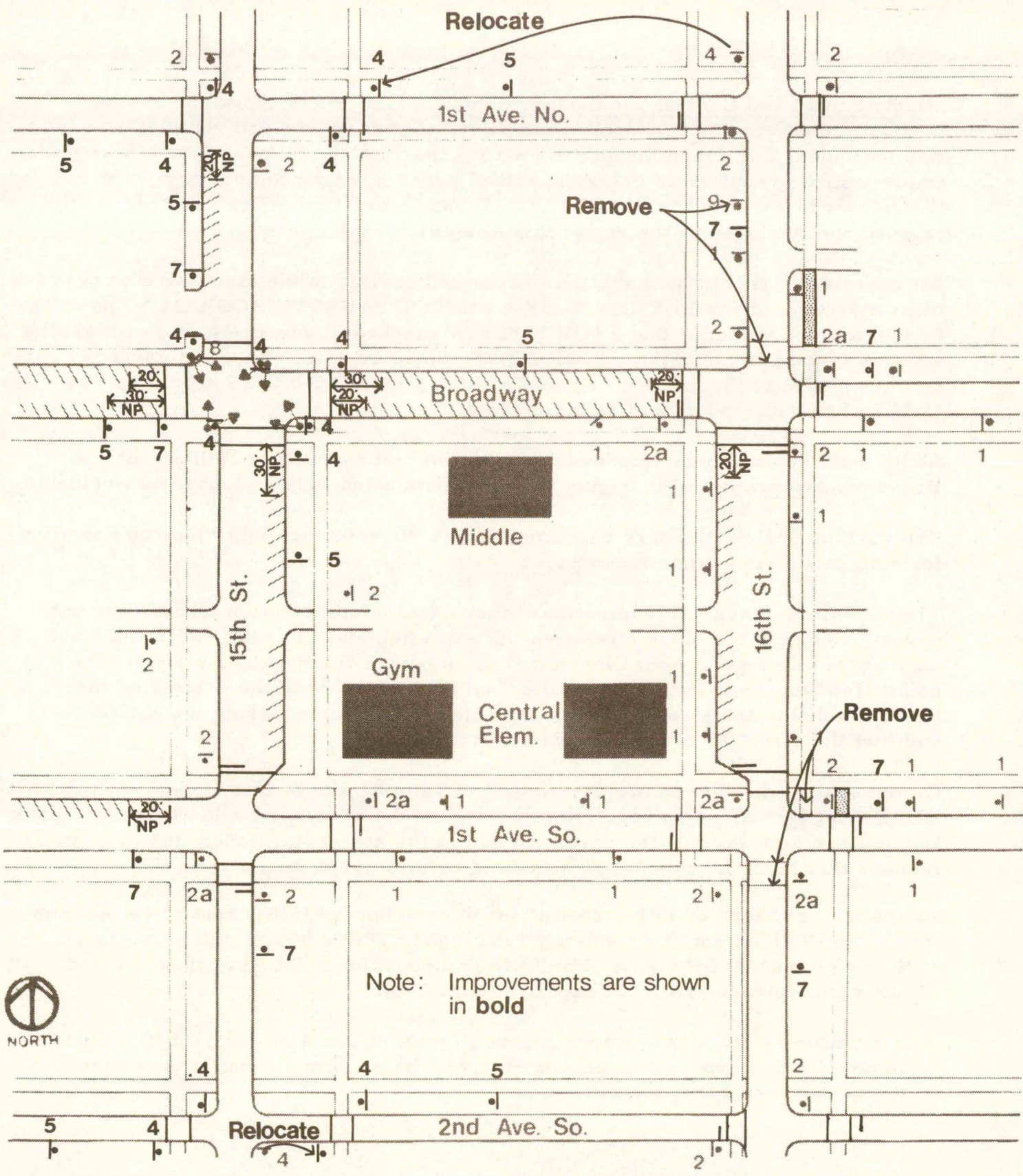
The parking prohibitions are recommended to improve the sight distance conditions for both pedestrians and motorists.

Via the parent-teacher organizations, the school administration should instruct parents to circle the block clockwise while loading and unloading children. Not only would this type of operation result in smoother traffic flow, but students could also be picked-up and dropped-off on the right side of the vehicle on the "school side" of the street. Thus, students could avoid crossing the entire width of the street to reach their destination.

On the south side of Broadway, just west of 16th Street, is installed a NO PARKING HERE TO CORNER sign regulating parking on the west approach. However, parking stalls are marked on the pavement within the no parking zone. It is recommended that these markings be rubbed out or allowed to weather.

At the intersections of 15th Street at 1st Avenue South, 16th Street at 1st Avenue South, and 16th Street at Broadway, the hinged STOP signs should be replaced with conforming STOP signs. For further discussion relative to these hinged STOP signs, please refer to Chapter 3 (page 3-3).

The estimated cost of the improvements shown in Figure 5-3 is \$1,540. This assumes that the sidewalk improvements will be paid for through assessments to the adjacent property owners.



Note: Improvements are shown in bold

legend

- No Parking NP
- New Sidewalk

Middle & Central Elem.

figure 5-3

20th Street Elementary School. Figure 5-4 shows the existing conditions as well as the recommended improvements for this school location. Please refer to the Sign Legend (Figure 5-6) included at the end of this Chapter.

Currently, the mid-block crossing in front of the school is controlled by various combinations of an adult guard, a roll-out STOP sign, and a red beacon. The Consultant recommends the continued use of the adult guard, however, the intermittent use of the red beacon and the roll-out STOP sign should be discontinued. The reasoning behind these recommendations may be found by reading the discussion on beacons presented earlier in this Chapter under the section entitled ELEMENTS OF A SCHOOL SAFETY PROGRAM.

To replace the red beacon and the roll-out STOP sign, the Consultant recommends the installation of standard SCHOOL CROSSING and SCHOOL ADVANCE signs as shown in Figure 5-4. It is suggested that HAZARD IDENTIFICATION BEACONS be used to supplement the SCHOOL CROSSING signs. The beacons should be equipped with a timing device to operate the beacons only during those hours when activity is present in the crosswalk. A typical installation of a school crossing sign with beacon is illustrated in the Appendix of this report.

It is recommended that a STOP sign be installed on the east approach of 2nd Avenue North. This recommendation is not shown in Figure 5-4 since the same installation was covered in the Section of this report dealing with INTERSECTION CONTROL MODIFICATIONS.

Field observations by the Consultant revealed that, in the afternoon, parents park on the west side of 20th Street to pick up their children. This location currently has one sign prohibiting parking on that side of the street. The Consultant recommends the installation of additional signs to prohibit parking because cars parked at this location block the southbound lane of traffic and cause sight distance restrictions by their presence. After the installation of the signs, the no-parking condition should be enforced by the Police Department. Instead of parking on the west side of 20th Street, parents should be instructed to circle the block and park in the bay on the east side of the street.

Presently, children living north of the school and east of 20th Street are required to cross 20th Street twice in the morning and twice in the afternoon. This problem exists due to the lack of sidewalks on the east side of 20th Street north of the school. To eliminate the necessity of these four daily crossings of busy 20th Street, the Consultant recommends the construction of a new sidewalk east of 20th Street from the school northward to Bel Air Drive.

The Consultant highly recommends the installation of the school speed limit signs as shown in Figure 5-4. Since the City Ordinances do not currently provide for these school speed zones, it is recommended that the City take the necessary steps to add this school zone to Chapter III of Title X of the City Ordinances of Denison.

Zion Lutheran School and St. Rose of Lima School. Due to the proximity of these two schools, they must be considered as a single area in order to analyze the signing, pavement marking, and other improvements required to increase pedestrian and vehicular safety.

Primarily, the improvements center around the addition, deletion and relocation of signs. Figure 5-5 gives a visual representation of the recommended improvements for this two-school location. During the review of Figure 5-5, please refer to the SIGN LEGEND (Figure 5-6) included at the end of this Chapter.

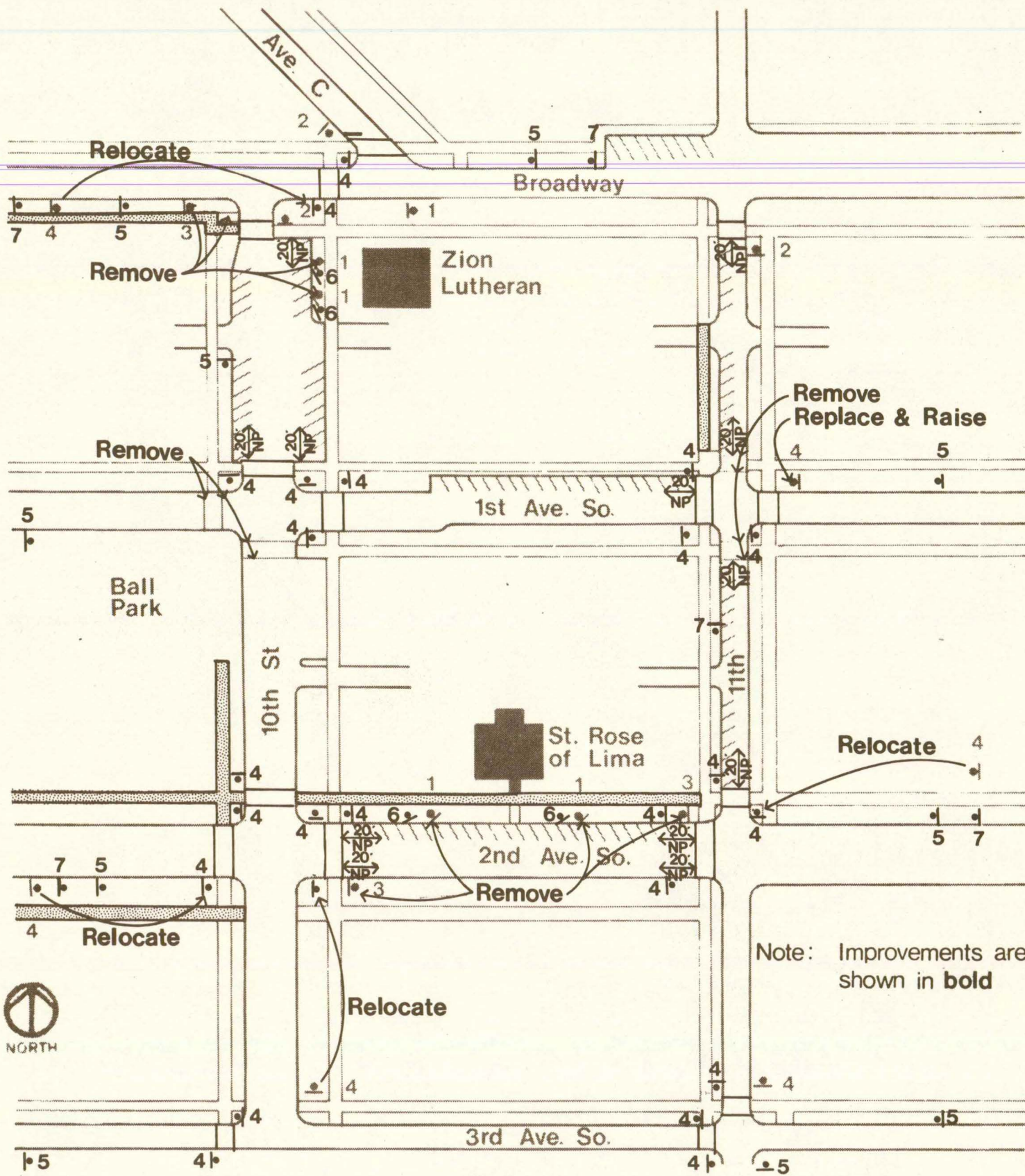
Every crosswalk in this vicinity is currently marked on the pavement with yellow paint. The use of yellow paint is not in conformance with the MUTCD. Those crosswalks recommended for removal should either be rubbed out or allowed to weather. All new or repainted crosswalk lines shall be solid white and shall be a minimum of 6 inches in width and not less than 6 feet apart.

The SCHOOL CROSSING signs should be erected at the crosswalk. The SCHOOL ADVANCE sign must be used in advance of the SCHOOL CROSSING sign, and the SCHOOL ADVANCE sign must be installed not less than 150 feet in advance of the crosswalk.

The removal of parking near corners is suggested to improve the motorists' visibility of other vehicles and of students in the crosswalks.

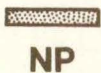
Speed limit signing and locations for sidewalk rehabilitation are also recommended. At the end of an authorized and posted school speed zone, the speed limit for the following section of street should be posted with a standard SPEED LIMIT sign.

The estimated cost of the improvements shown in Figure 5-5 is \$1,950. It is assumed that the sidewalk improvements will be paid for through assessments to the adjacent property owners.



Legend

New Sidewalk
No Parking



Zion Lutheran & St. Rose of Lima

figure 5-5

1 (NO PARKING
Restriction)

6



2



2a



(Hinged)

7



3



8



4



9



4a



10



5



11



legend

Sign Legend

figure 5-6

Chapter 6

RAILROAD CROSSINGS

The City of Denison presently has two railroad lines traversing the Corporate Limits. The Chicago and Northwestern Railroad (C. & N.W.) crosses the southern portion of the City from east to west. In addition to the mainline tracks, the C. & N.W. line has several spur and switching tracks located primarily between 14th Street and 18th Street. The mainline of the Illinois Central Railroad runs parallel to the West Boyer River on the western outskirts of the City.

The alignment of these two railroads has resulted in the creation of six rail-highway crossings within the City. Figure 6-1 indicates the locations of the six crossings as well as the types of railroad crossing protection devices installed at each crossing. It is apparent from Figure 6-1 that three of the six crossings are grade separations while the remaining three crossings are at-grade. Three crossings exist on the C. & N.W. line while three crossings are located on the Illinois Central tracks.

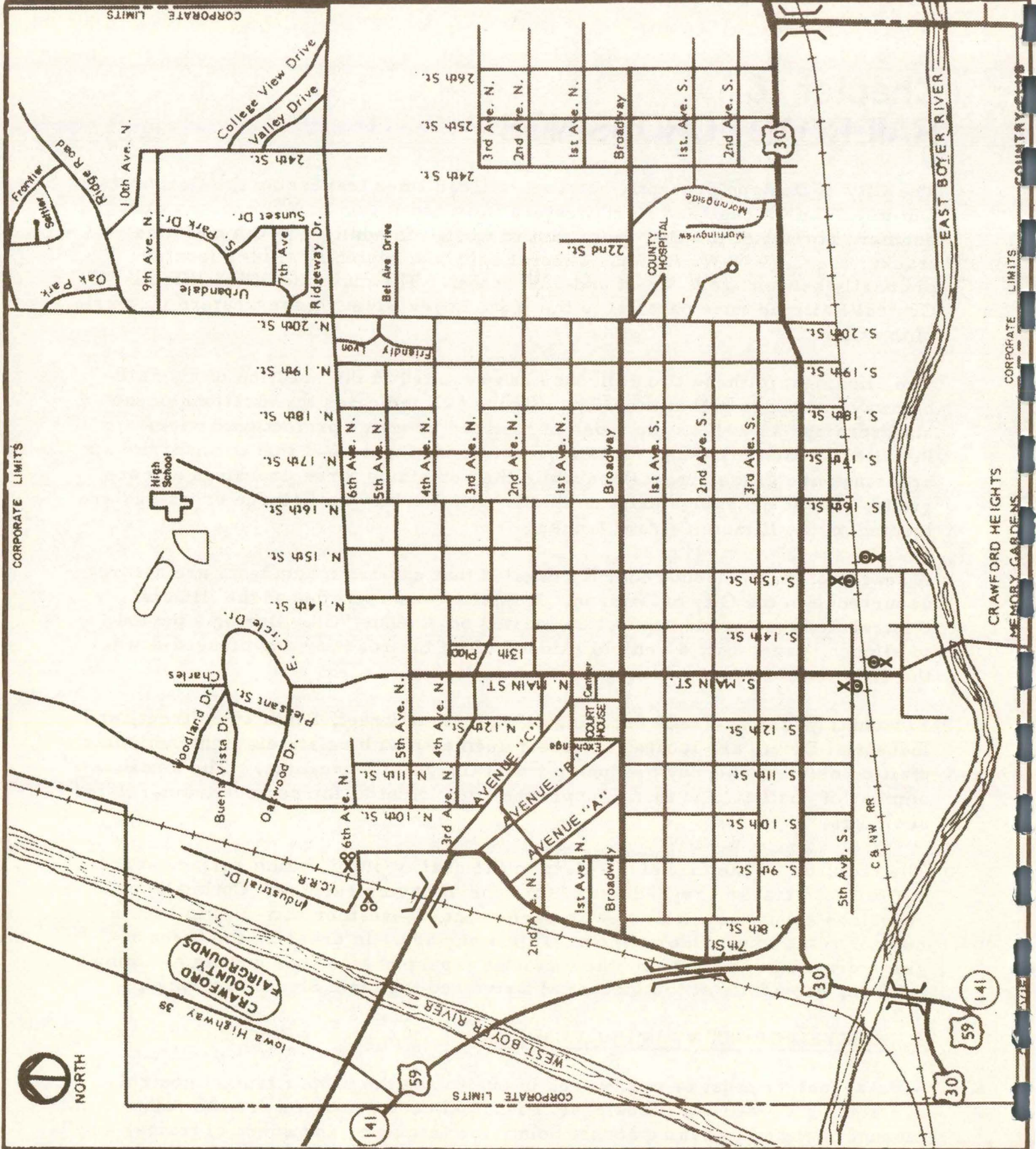
A search of the accident records revealed that car-train accidents are a rare occurrence in the City of Denison. A fatality was recorded at the Illinois Central Railroad grade separation located on Avenue "C". During a period of slippery pavement, a vehicle skidded off of the roadway and plunged down the steep embankment, killing the motorist.

Fortunately, the at-grade crossings (South Main Street, South 15th Street, and Industrial Drive) are located on street segments with relatively light vehicular traffic volumes, thereby producing few train-vehicle conflicts. The small number of conflicts, in turn, suppresses the potential for serious train-related accidents.

The condition of the crossing refers to the quality of the riding surface across the railroad tracks, regardless of the type of paving surface. Optimally, crossings should be surfaced with permanent all-weather material in such a manner so as to provide a smooth-riding surface. In crossing the three at-grade crossings in Denison, the motorist experiences a poor quality of riding surface, especially at the Industrial Drive and the Main Street crossings.

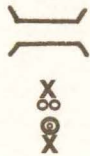
SUGGESTED CROSSING IMPROVEMENTS

Several factors must be considered in evaluating the proper type of controls and signing at railroad crossings. Principal considerations are the relative amount of traffic crossing at that point, the frequency and speed of trains, and the geometrics and sight distance conditions of the crossing.



legend

- Grade Separation
- Crossbuck With Flashing Lights
- Crossbuck With Wig-Wag



Railroad Crossings

figure 6-1

The concurrent highways of U.S. 59 and State Highway 141 intersect the C. & N.W. Railroad and the Illinois Central Railroad at one location on each line. Both crossings are provided with grade-separations carrying the highway over the railroad tracks. Since these two grade separations provide the ultimate means of eliminating vehicle-train conflicts, the Consultant does not recommend that any modifications be made to the existing conditions.

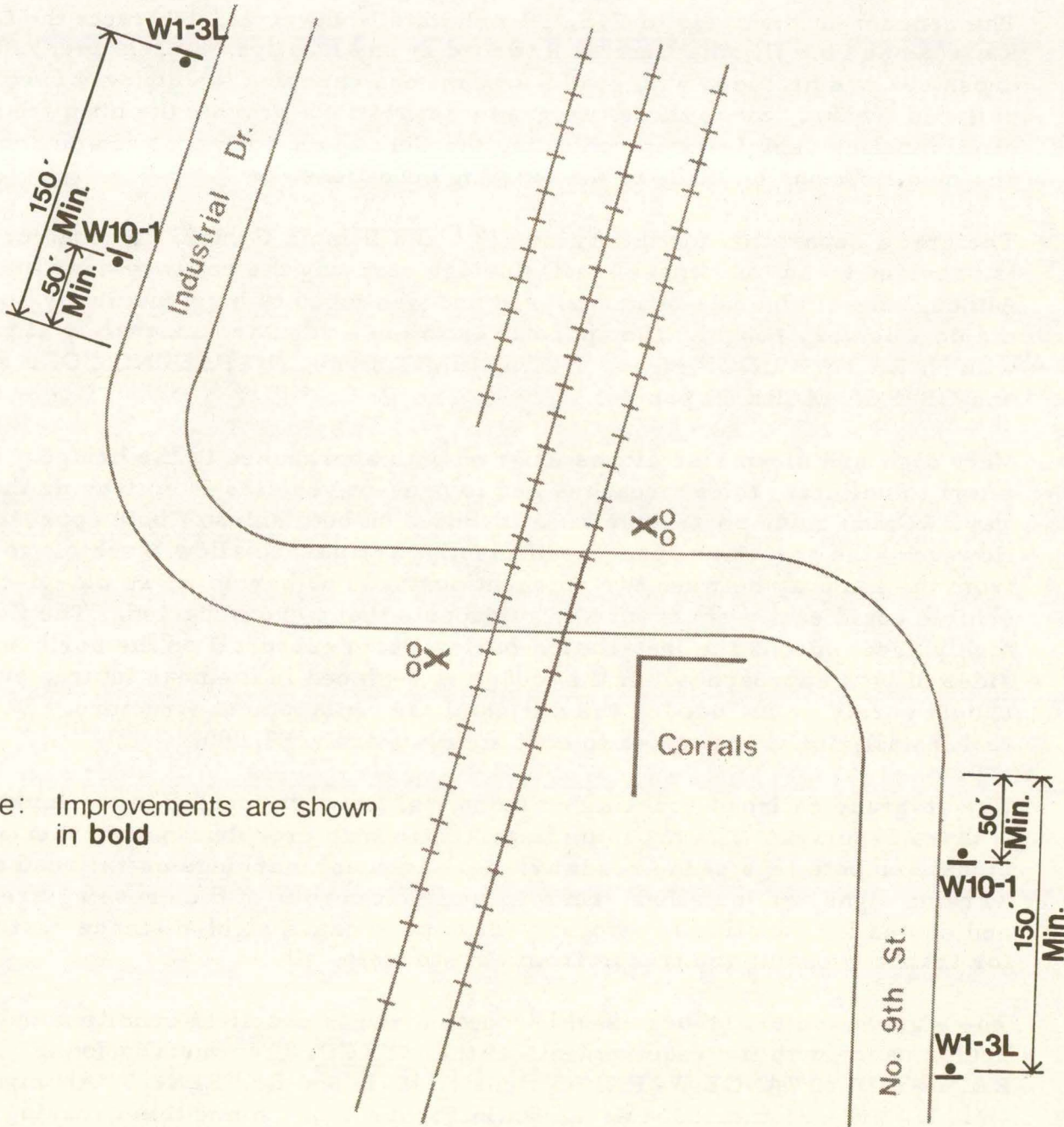
The grade separation for the Avenue "C" and Illinois Central Railroad crossing is provided by an old timber trestle bridge carrying the roadway over the tracks. Although the bridge has been analyzed and was found to be structurally sound, the deck is very rough. The approaches to the bridge are adequately signed, with NARROW BRIDGE signs, SPEED LIMIT signs, NO PASSING ZONE signs, and OBJECT MARKER panels.

Very high and steep side slopes exist on both approaches to the bridge. In an effort to delineate the approaches and to prevent vehicles from leaving the roadway, wooden guide posts have been installed on both sides of both approaches. However, the posts are spaced sufficiently far apart to allow a vehicle to exit from the roadway between two adjacent posts. Furthermore, an out-of-control vehicle could easily shear off any guideposts that were impacted. The Consultant highly recommends the installation of flex-beam guardrail on the north and south sides of both approaches. If the bridge is replaced in the near future, guardrail should surely be included in the design of the replacement structure. The guard-rail installation is estimated to cost approximately \$9,000.

The at-grade railroad crossing on Industrial Drive is located in the middle of a sharp S-curve. The crossing is protected with crossbucks and train-approach signals on both legs of the roadway. No pavement markings or railroad advance warning signs are installed. On the southeast corner of the crossing are corrals and chutes for handling livestock. These pens cause sight-distance restrictions for traffic crossing the tracks from east to west.

The signals and crossbucks at this location are in excellent condition and are in conformance with the requirements of the MUTCD. The installation of RAILROAD ADVANCE WARNING signs (W10-1) and REVERSE TURN signs (W1-3L) are recommended as shown in Figure 6-2. Since this crossing does not exhibit a high accident rate and approach speeds are necessarily low due to the sharp curve on either approach, pavement markings are not recommended in advance of the crossing. The suggested signs can be provided for approximately \$200.

Between 5th Avenue South and 6th Avenue South, Main Street crosses the C. & N.W. tracks at grade. The crossing is composed of three tracks, one of which is a lightly used spur line located about 75 feet north of the two mainline tracks. The spur line has one crossbuck installed on the north approach. The mainline tracks are equipped with crossbucks and wigwag signals. A truck crossing, which is identified by DANGER TRUCK CROSSING signs, exists between the spur line and the mainline tracks.



Note: Improvements are shown in bold



legend

Industrial Dr. Crossing

figure 6-2

Sight distance at the crossing is excellent. The speed limit in the vicinity of the crossing is posted at 20 miles per hour.

Only one immediate improvement is recommended for this railroad crossing. On each approach to this crossing, a RAILROAD ADVANCE WARNING sign (W10-1) should be installed a minimum of 100 feet from the crossing. The estimated cost of these signs is \$100.

The wigwag signals located at the Main Street crossing are not recommended by traffic engineers. However, since the signals are still operable and there is no accident problem at this location, the immediate removal of the wigwags is not recommended. The Consultant does believe that as a long-range improvement the existing signals should be upgraded to a standard flashing-light signal to reduce any potentials for accidents in the future.

The 15th Street railroad crossing is somewhat similar to the Main Street crossing just discussed. The primary difference between the two crossings is the fact that the 15th Street crossing is composed of seven tracks, thereby making it very wide and potentially dangerous for crossing vehicles. Fortunately, this section of 15th Street experiences low traffic volumes, which may account for the crossing's low accident rate.

The building of the Farmers Elevator Mill, located on the northwest corner of the crossing, presents some sight distance problems for southbound motorists. This condition necessitates the utilization of effective devices to indicate the approach or presence of trains.

The Consultant recommends the installation of RAILROAD ADVANCE WARNING signs on both approaches to the crossing. Since there are more than two tracks, the Consultant recommends the installation of two auxiliary signs (R15-2) indicating the presence of seven tracks. One sign should be mounted below each crossbuck. The number-of-tracks signs are the responsibility of the railroads. The RAILROAD ADVANCE WARNING signs are the responsibility of the City, and could be installed for about \$100.

As was recommended for the Main Street crossing, the immediate removal of the wigwag signals at the 15th Street crossing is not suggested. As a part of the national effort to provide uniformity for railroad crossing signals thereby increasing the safety of all railroad crossings, the wigwag signals at this location should be upgraded in the future.

As was mentioned earlier in this Chapter, the condition of the riding surfaces at the at-grade railroad crossings are of a less than satisfactory quality. All three crossings must be negotiated at a very slow speed for both the reasons of vehicle control and passenger comfort.

Although crossing maintenance is the responsibility of the respective railroads and not of the City, the railroads should be encouraged to regularly inspect their grade crossings and upgrade those which are in some state of disrepair.

Chapter 7

DOWNTOWN

The Central Business District (CBD) of Denison is the primary retail shopping area for Crawford County. Figure 7-1 depicts the general location of the boundary of Denison's downtown area. As evidenced by the Figure, the CBD is quite compact and is located approximately in the center of the city.

The intersection controls in the downtown area are predominantly STOP signs. However, four of the city's five traffic signals are located in the downtown area. The fifth signal is located on Main Street about three blocks south of the CBD.

A one-way street system does not currently exist in the downtown area. The Comprehensive Plan for the City of Denison recommends a one-way system which has not been implemented. A one-way alley and parking lot exist south of 1st Avenue North between Main Street and 14th Street. The lot is in the process of being reconstructed. A few comments relative to the operation of this lot are presented later in this chapter.

Most of the designated on-street parking spaces are marked for 60° angle parking. A few locations allow parallel parking, while three areas have been designated as off-street parking facilities. The off-street lot located on the southwest corner of the 1st Avenue South and 14th Street intersection doubles as a free parking lot on weekdays and as a church parking lot on Sundays.

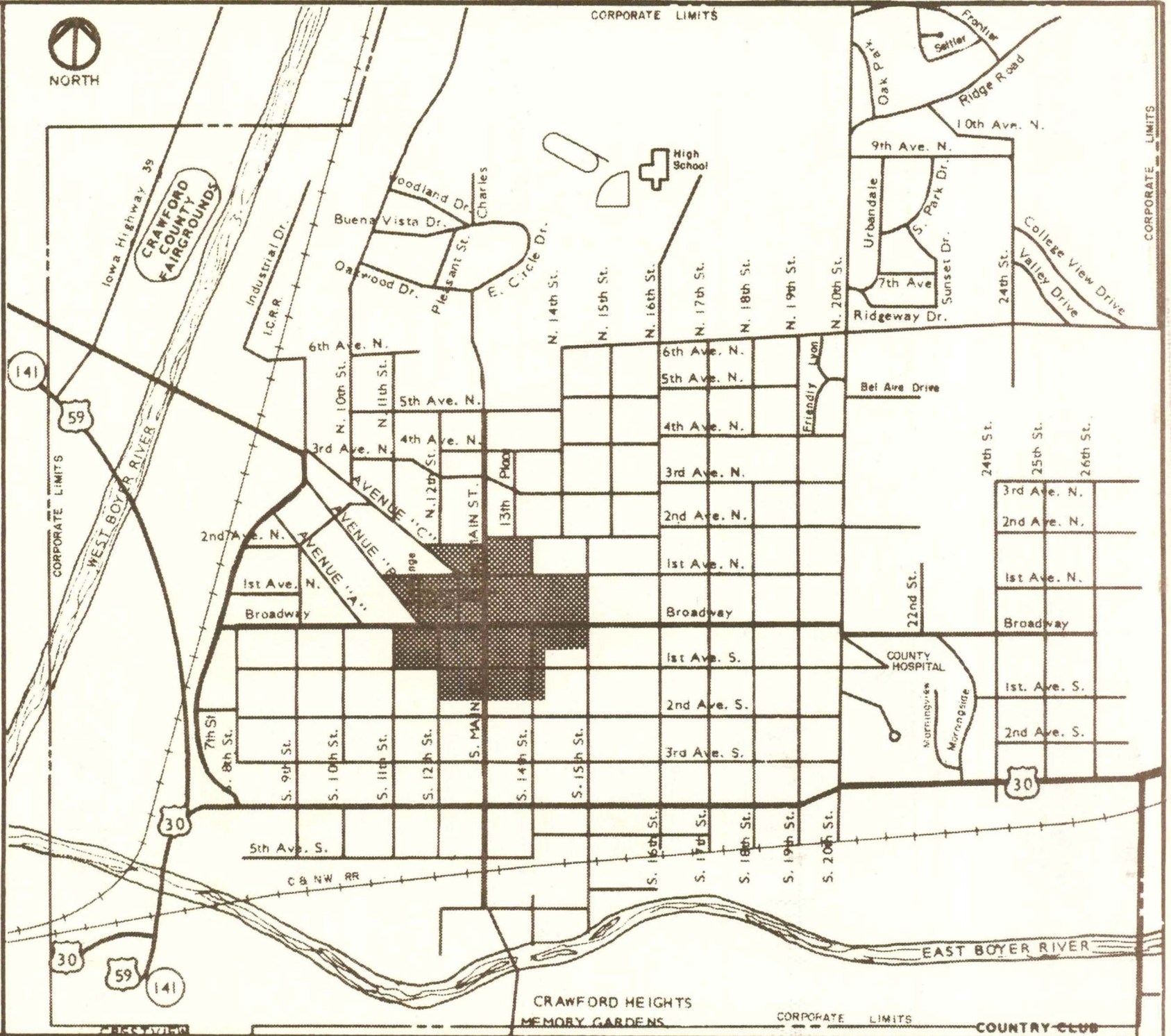
Broadway and Main Street are the two major traffic carriers in the downtown area. Both streets are very wide allowing for two lanes of traffic with angle parking on both sides of the street. The remaining streets in the CBD are adequately wide to provide for two moving traffic lanes and one or two lanes of angle parking. One exception is 14th Street which scarcely accommodates two parallel parking lanes and two moving traffic lanes. Another exception is 2nd Avenue North between Main Street and 14th Street. This segment of 2nd Avenue North accommodates two lanes of traffic with no parking.

The accident statistics for some of the downtown intersections were discussed in Chapter 4. Fully one-half of the identified high-accident locations are situated in the City's Central Business District. A review of the accident collision diagrams reveals that the downtown accidents relate primarily to angle parking. Secondary and tertiary causes are

CBD
legend



Central Business District figure 7-1



1-1-68-571-10

CORPORATE LIMITS COUNTRY CLUB

those of poor visibility of traffic controls and driver inattentiveness and/or error. The intersection of Broadway and Main Street is by far the City's highest-ranking intersection in terms of accident frequency.

TRAFFIC SIGNALS

The signalized intersections in the downtown area are: Main Street at 1st Avenue North, Main Street at Broadway, Main Street at 1st Avenue South, and Broadway at 15th Street.

Detailed descriptions of the existing signal installations were given in Chapter 3, and recommended improvements for the downtown signals were made in Chapter 4. Therefore, only a brief summary is attempted here. Basically, the downtown traffic signals are old 8" heads operated by pre-timed controllers on a 40-second cycle length with 50-50 splits. The signals at Broadway and 15th Street are operated like those on Main Street, but they have fairly new 12" heads. All signals are not equipped with pedestrian indications.

The recommended improvements related mainly to the installation of new signal heads on mast arms and the installation of pedestrian signals. New controllers were recommended for the 1st Avenue North at Main Street and the Broadway at Main Street intersections.

The Consultant believes that the four intersections now signalized in the downtown area should remain signalized in the future to provide pedestrian safety and traffic flow regulation. The Consultant strongly recommends, however, that the City adopt a positive program for upgrading the signal equipment at these four locations.

City officials in Denison are concerned about the circulation of traffic in the downtown area. At the present time, each signal installation is operating independently of the other traffic signals in the CBD. One common tool used by traffic engineers to increase traffic flow is the coordination of adjacent traffic signals. That is, a progressive signal system is created by timing the signals to permit a platoon of vehicles to move along the street, at a given speed, without stopping.

The key intersection for establishing a progressive signal system is the installation at Main Street and Broadway. Offsets can be computed to synchronize the 1st Avenue North, 1st Avenue South, and 15th Street signals with the signals at Broadway and Main Street. The offset between any two signals is simply the distance between them divided by the desired speed of the progressed vehicles. The Consultant recommends that the speed of progression be no greater than 20 mph in the downtown area.

A progressive system can be established both now for existing installations and in the future for new installations. Furthermore, if the signal at U. S. 30 and Main Street continues to operate in the pre-timed mode, that signal could be included in the progressive system. Since the cycle lengths of all signals in the progressive system must be equal, either the U. S. 30 installation would have to be adjusted to a 40-second cycle length or all four downtown signals would have to be converted to 50-second cycle lengths. In adjusting cycle lengths, it should be remembered that overall intersection delay is normally minimized by the utilization of shorter cycle lengths. However, the signal timing must accommodate pedestrian traffic. Therefore, the Consultant recommends the utilization of a 50-second cycle length.

Considering the size of Denison and the type of signal control, it is not necessary that funds be expended on sophisticated hardware to interconnect the downtown intersections. In order to be cost effective and functional, it is recommended by the Consultant that the new signal controllers at Main Street and Broadway and at Main Street and 1st Avenue North be single-dial fixed-time equipment. The progression should be established by means of timing the desired offsets between adjacent signals. Once the timing is established, the City should instruct its maintenance personnel to monitor the operation and readjust the timing on a periodic basis. The offsets should be checked after power outages or any other time when the signals have been out of operation for some reason.

Finally, it should be noted that the speeds used to determine offsets are theoretical in nature. This speed reflects the average speed at which a vehicle should progress in order to encounter a green signal indication at each successive intersection. In actual practice, the established progression may be interrupted by vehicles entering or leaving parking spaces and by vehicles traveling above or below the average speed for which the progression is set.





PARKING

Figure 7-2 gives an overall view of the parking provisions in downtown Denison. With the availability of wide streets, angle parking is permitted extensively to increase the supply of parking. Parallel parking is allowed on those streets with narrower widths. Off-street parking is scarce, thereby requiring the City to utilize angle parking in an effort to maximize the supply of parking.

As previously indicated, a major contributor to accidents in the downtown area is the angle parking which exists on nearly all of the streets in the CBD. A discussion of the problems associated with angle parking was presented in Chapter 4. The same chapter also included recommendations for parking



legend

- Parallel Parking 
- Angle Parking 
- Off Street Parking 
- Metered Parking 

**Downtown
Parking**

figure 7-2

prohibitions and parking modifications in the downtown area.

It was recommended that the existing 60° angle parking be converted to angle parking of 45°. The Consultant believes that a minimum of three benefits can be produced by this action. First, physically maneuvering vehicles into and out of the parking stalls would be facilitated. Second, sight distance restrictions for backing vehicles would be decreased. Finally, the width of the street available for moving traffic would be slightly increased. In addition, the present number of parking spaces would not be substantially reduced.

In the downtown area, Main Street and Broadway are 68 feet wide from back-of-curb to back-of-curb. If the City would eventually decide to convert the existing angle parking to parallel parking, both streets could accommodate four lanes of moving traffic, two lanes in each direction. This modification would certainly increase the traffic-carrying capacity of these important streets in addition to improving vehicular safety. However, this conversion would also significantly reduce the number of parking spaces on both streets. Since off-street parking is not presently available to handle the loss of existing spaces that would be created by the adoption of parallel parking, the Consultant does not recommend the immediate implementation of this alternative. In the event that the off-street parking supply in Denison is increased, the Consultant believes that parallel parking on Main Street and Broadway is a workable solution to the existing safety and congestion problems.

On the wider streets in the City's Central Business District, delivery vans and mail trucks are allowed to park in the middle of the street while conducting business in nearby establishments. This practice requires motorists to exercise extreme caution while "squeezing by" on either side of the parked vehicle. Pedestrian safety is jeopardized in that pedestrians emerge from between the parked vehicles when not expected. Sight distance restrictions increase the potential for accidents between moving vehicles.

The Consultant recommends that the City take the necessary steps to discontinue this practice of parking in the middle of the streets. Deliveries should be made by utilizing alleys where available. If alleys do not exist where required, curbside loading zones should be established to prevent double-parking. Generally, one loading per day may be used as a warrant for establishing a truck loading zone. The City should post on the loading zone signs, the hours and days when the zone is effective.

During field inspections, the Consultant observed several instances of "meter feeding". That is, proprietors and employees of establishments parked their vehicles in metered stalls near to their work places, and then periodically deposited coins in the meter to prevent the expiration of the meter. This practice ties up parking spaces for the entire working day, thereby reducing parking turnover, and parking turnover is one of the main purposes for which meters are installed.

Since parking spaces in Denison are important commodities, the Consultant highly recommends that the City utilize the news media to inform the citizenry that "meter feeding" will not be allowed. The Consultant further recommends that meter maids use the chalk-mark method to enforce the 2-hour time limit on the long-term parkers. It is also suggested that long-term parkers be issued multiple tickets.

In Chapter 4, of this report, it was recommended that angle parking be removed in the vicinity of several downtown intersections. The parking removal served the purpose of increased safety among vehicles and between vehicles and pedestrians. The removal of these parking stalls will improve safety, but the overall parking supply in the downtown area will be reduced.

To offset this reduction in parking supply, the Consultant recommends that the City take steps to increase the number of off-street parking spaces. The reconstruction of the parking lot at 1st Avenue North and 14th Street is a step in the right direction. The proposed expansion of the Safeway parking lot will also increase the availability of off-street parking. In terms of future parking lot provisions, it is suggested that the City investigate the possibilities of instituting portions of the off-street parking plan as outlined in the Comprehensive Plan for the City of Denison.

The Consultant reviewed the construction plans for the North 14th Street Parking Lot Project. As a result of that review, the following comments are offered:

1. The lot is designed to allow 60-degree parking. From a traffic safety standpoint, 45-degree parking is more desirable.
2. The one-way operation of the streets, alleys, and aisles in the vicinity of the parking lot will facilitate the ingress and egress of vehicles. However, the one-way operation will require motorists to utilize 1st Avenue North in the

process of searching for a parking space. That is, if a stall is not found in the aisle initially chosen by a driver, the driver must return to 1st Avenue North prior to trying another aisle. The Consultant believes that this circulation pattern is inconvenient for shoppers and will unduly increase traffic volumes on 1st Avenue North.

3. If the parking lot is operated as currently designed, the City must install conforming ONE WAY and DO NOT ENTER signs to regulate the flow of traffic.

PEDESTRIAN CIRCULATION

Pedestrians have good access to the downtown area in Denison. Adequate sidewalks are provided along the major routes leading from the residential areas to the Central Business District.

Pedestrian traffic is a significant element of the downtown environment. Pedestrian movements are heaviest along Main Street and Broadway. Thus, it is not surprising that the most-travelled intersection is that of Broadway and Main Street. Significant numbers of pedestrians also cross at the Broadway and 14th Street intersection and at the Broadway and 15th Street location. The pedestrians crossing the latter intersection are predominantly students attending the Middle and Central Elementary Schools.

Pedestrian street-crossing is expected to occur only at the intersections, and no mid-block crossings are provided in the CBD. Yellow crosswalk markings are provided at the major intersections. At none of the signalized intersections are pedestrian indications (WALK/DONT WALK) utilized. Those persons on foot must watch the vehicular traffic indications to determine the proper time to cross. Several of the street corners in the downtown area have sidewalk ramps for the handicapped.

Overall, pedestrian circulation and safety in the CBD appears to be satisfactory. During periods of heavy vehicular and pedestrian traffic, congestion occurs due to conflicts between pedestrians in crosswalks and vehicles attempting to make turning movements.

Chapter 4, contains recommendations for improving the flow of vehicular and pedestrian traffic at the six downtown intersections which experience the heaviest traffic volumes. Recommendations are made concerning the installation of standard crosswalks and STOP lines. These markings will not only better define the crossing locations for the pedestrians, but will

also indicate to drivers the point behind which they are required to stop for the signal. Hopefully, the STOP lines will prevent vehicles from rolling into the crosswalk while stopping.

To facilitate pedestrian traffic movements and to provide for pedestrian safety, the installation of pedestrian signals is recommended at all signalized locations. It is understood that pedestrian signals will not eliminate all conflicts between pedestrians and turning vehicles. However, the use of pedestrian signals enables the pedestrians to be platooned and specifies the periods during which the groups may cross the street. Thus, stragglers attempting to cross near the end of the green interval are, for all practical purposes, eliminated, allowing turning vehicles to utilize that green time to make their maneuvers.

During conversations with residents of the City, the Consultant was informed that some people, especially the elderly, encounter difficulty in crossing the entire widths of Main Street and Broadway prior to the expiration of the green interval. Both streets are 68 feet wide, and both streets are allotted 17 seconds of green time. This easily computes to an average walking speed of 4 feet per second (fps), which is the figure normally used by traffic engineers. If a person is at the curb ready to cross when the green indication is given, he will theoretically be able to cross the street before the green interval expires. But what about the person that arrives after the start of the green interval, or the elderly persons that cannot walk at a rate of 4 fps? They will, of course, be left standing in the middle of the street when the signal changes!

Pedestrian signals, as recommended earlier, will deter most pedestrians from starting to cross during the middle of the green interval. To enable the elderly pedestrians to cross the streets safely, the cycle lengths must be lengthened to allow them sufficient green time. Prior to the installation of new traffic and pedestrian signals, the Consultant recommends that the City increase the cycle lengths of all signals to 50 seconds, which will permit the crossing of persons with lower walking speeds. When the new signals are installed, care should be taken to see that the cycle lengths and splits are adequate to accommodate pedestrians, even though longer cycle lengths generally increase overall delay at the intersection.

Through conversations, the Consultant also learned that pedestrians encounter difficulty in crossing 14th Street just south of Broadway. The problem seems to stem from the fact that 14th Street traffic is uncontrolled. The installation of a STOP sign and a STOP LINE on 14th Street, as recommended in Chapter 4, should improve this situation.

The Consultant believes that the implementation of the above recommendations will improve not only pedestrian circulation and safety, but also the safety and circulation of vehicles in the downtown area.

VEHICULAR CIRCULATION

Regional and local access to the downtown area of Denison is excellent in that it lies adjacent to U. S. 30, which is an important highway link to outlying communities as well as to major local arterial streets. This primary access route is supplemented by the grid system of collector and local streets which offer a variety of access routes to and from the downtown.

Primary feeders into the Central Business District itself are North and South Main Street and Broadway, which runs east and west. Access to the downtown area from the northwest part of the City can be gained by use of the radial streets of Avenue "B" and Avenue "C". All of these routes currently function as two-way streets.

Through conversations with local citizens and through field observations, the Consultant has determined that the primary impedance to traffic flow in the downtown area is the intersection of Main Street and Broadway. Heavy vehicular and pedestrian traffic volumes on all approaches to this intersection cause congestion problems during certain periods of the day.

A review of the accident records shows that the intersection of Main Street and Broadway is also the primary location jeopardizing vehicular safety in the downtown area. As was pointed out earlier in the report, parking-related accidents are very frequent at the subject location as well as at all downtown intersections.

One-Way Street System. In the course of reviewing existing downtown traffic operations, consideration was given to the practicality and feasibility of the implementation of a one-way traffic circulation system. Options considered were a one-way pair system and a "loop" system similar to the plan contained in the City's Comprehensive Plan. The one-way "loop" is basically a one-way pair connected on each end by a one-way street.

General advantages of one-way streets include increased intersection capacity, the elimination of friction between opposing flows, and the implementation of signal progression on a grid system. From a traffic engineering standpoint, the general disadvantages are reduced accessibility and increased circulation, confusion to unfamiliar motorists, and the accident potential of illegal turns and wrong-way travel. In addition, opposition from the business sector is often encountered.

One-way street systems are most often implemented in response to a substantial level of traffic activity, intense land use activities, restrictive street widths, through traffic demands, provision of adequate intersection capacity, and efficient connections to the arterial street system. It must be noted that a one-way operation should be installed only when it is more desirable than alternate solutions.

Applying these criteria to downtown Denison, none of them actually describes the existing situation very well. While traffic volumes on Main Street and Broadway are heavy during certain hours of the day, volumes on other streets are much lower. The land use activities in the downtown are basically related to retail sales and office space, and these establishments are mainly located on the perpendicular streets of Main Street and Broadway. If land uses were equally intense on two parallel streets, a one-way pair might be justified. The City of Denison has fortunately provided wide streets in the downtown area; therefore, restrictive street widths cannot be considered as just cause for implementing a one-way street system. Even though Main Street and Broadway serve as through streets, these through movements could not readily be replaced by a one-way pair. Finally, a one-way pair (north-south or east-west) in downtown Denison would not efficiently connect to the arterial street system.

The intersection of Main Street and Broadway at certain times suffers from inadequate capacity. This one criterion might justify the implementation of a one-way system which both precludes turning movements at this location and reduces the traffic demand at this intersection by routing traffic through surrounding intersections. The one-way loop system accomplishes both of these objectives. However, there appear to be other measures for increasing the capacity of this location without converting the existing two-way street system to a one-way system. Furthermore, the one-way loop system requires the routing of traffic through the Avenue "B", Exchange Street, and First Avenue North triangle, which is not capable of handling high vehicular volumes.

Conclusions and Recommendations. Any alteration from current two-way flows would require substantial need to justify change-over costs and potential merchant opposition to a "selective" reduction in accessibility. Change-over costs would be significant and would include the installation of one-way signs, turn prohibition signs, DO NOT ENTER signs, and lane control signs; the remarking of parking stalls on one side of the streets converted from two-way to one-way operation; and the removal or re-location of some existing regulatory signs. Development of a circulation scheme utilizing one-way streets does not appear necessary or practical from a traffic operations standpoint nor desirable from the merchants' or customers' viewpoint.

The present circulation scheme has several advantages over other potential schemes. Primary among these advantages is flexibility in circulation. A specific destination can be approached from two directions. Continuity of flow with adjacent streets is also more easily achieved. Retention of the existing street system, with some improvements, would provide a compromise system maximizing simplicity and accessibility while holding excess circulation to a minimum.

Rather than undertaking the task of converting the street system to a one-way operation at this time, the Consultant recommends that the City implement the signal changes, pavement marking modifications, and parking restrictions suggested elsewhere in this report. The existing downtown street system, with these improvements, is capable of handling the traffic demand placed on the system.

Vehicular safety will be enhanced in the downtown by restricting parking near the intersections, flattening the angle of the curbside parking stalls, and the installation of new signals with better visibility. Pedestrian-vehicle conflicts will be minimized by the installation of pedestrian signals and properly marked crosswalks and STOP lines.

As previously mentioned, the streets in the downtown area are sufficiently wide to serve their designated purposes. Only 14th Street and Second Avenue North are of a narrow cross section. It is recommended that no streets in the downtown area be widened for the sole purpose of providing parking (especially angle parking). The primary purpose of streets and their borders is to provide for the efficient and safe circulation of vehicles and pedestrians. Rather than widening existing streets to accommodate parking, the City should utilize available funds to foster the development and construction of off-street parking lots.

Parking-related accidents account for 70-80% of the vehicular accidents at several locations within the downtown area. Parking maneuvers impede the smooth flow of traffic through and around the downtown area. The widening of existing streets for parking, as opposed to supplying off-street parking, would only serve to perpetuate these accident and congestion problems.

SIDEWALK RAMPS FOR THE HANDICAPPED

Field observations within the downtown area revealed that curb cut ramps have been installed at certain locations. At the present time, many of the Federal Programs require that sidewalk ramps be installed with any new

construction or reconstruction of sidewalks. Thus, at any locations where sidewalks will be reconstructed due to the specific improvements contained in this report or at any locations where new sidewalks may be constructed due to any reason, the City is encouraged to incorporate special ramps for the handicapped into the construction.

The Appendix to this report contains sketch drawings showing the typical design for Residential Sidewalk Ramps and for Business District Sidewalk Ramps.

SIGN MOUNTINGS

Field observations within the downtown area found nearly all of the existing traffic signs to be improperly mounted as to their height. A diagram showing Sign Placements may be found in the Appendix of this report, as well as in the MUTCD. The City is strongly encouraged to correct the mountings of any and all signs in the downtown area which do not conform to the minimum mounting heights shown in the diagram in the Appendix.

INDIVIDUAL INTERSECTION IMPROVEMENTS

In Chapter 4, individual intersection improvements were recommended for those downtown locations identified as high-accident locations. At the same time, blanket recommendations were made for all intersections within the downtown area. Of primary importance was the recommendation for the removal of parking within 20 feet of the crosswalks (30 feet on approaches to signalized intersections).

In Chapter 4, are also presented suggested modifications to be implemented at other locations within and around the downtown area. These locations did not satisfy the high-accident criterion, but they are considered by the local citizenry to exhibit a high-accident potential.

The recommendations made in Chapter 4 are considered to comprehensively cover the required improvements at individual downtown intersections.

Chapter 8

SPECIAL GUIDELINES & STANDARDS

The purposes of this chapter are mainly to provide a general discussion of those procedures, guidelines, and standards which the City should be cognizant of when dealing with traffic engineering controls and general public safety.

SIGN PLACEMENT STANDARDS

In previous sections of this report, discussion was given to the proper placement of traffic control signs with respect to their setbacks from the edge of the roadway and to their proper mounting height above the roadway surface. The MUTCD contains specific directions on the proper placement of signs to insure their visibility by the motoring public. The Street Commissioner should refer to the MUTCD for the proper instructions on the installation of signing. As a supplement to the MUTCD, this report contains a Sign Placement Chart in the Appendix which can also be followed by the Street Commissioner and his staff in placing signs.

As previously indicated, the City currently has many signs that are mounted at heights which are too low to be in conformance with the requirements of the MUTCD. Generally, the existing signs are properly placed with respect to their setbacks from the edge of the street. The implementation of the specific signing improvements recommended in this report should go a long way toward bringing the City's regulatory signs into conformance with the placement standards set forth in the MUTCD. Over a period of years, all signs within the City can be made to conform to the accepted placement criteria, if special attention is paid to the proper placement of future installations.

INTERSECTION NO PARKING REGULATIONS

It is a good practice to follow the general standards for restricting curb parking within a minimum of 20 feet of the crosswalk or STOP sign on the approach to an intersection. If the approach is to a signalized intersection, the 20-foot restriction should be increased to a 30-foot minimum. Similarly, curb parking should be restricted for a minimum length of 20 feet along the traffic lanes leaving the intersection.

Currently, these standards are not being followed in the City of Denison. By not implementing these standards, safety problems have been created

throughout the entire downtown area. Around the schools, parking restrictions exist to a certain extent, but improvements can be made as suggested in Chapter 5 of this report.

Many of the recommendations presented by the Consultant for the downtown area and for schools will, if followed, introduce proper NO PARKING restrictions at intersections and crosswalks. The City is advised to follow these recommendations to restrict curb parking at the intersections and thereby improve safety to the motoring public and to pedestrians.

The primary reason for implementing these types of intersection parking regulations is to improve the motorist's visibility of intersection traffic controls and pedestrians. In addition, the NO PARKING regulations assist in preventing vehicles from encroaching on an intersection when attempting to enter or leave a parking stall.

INTERSECTION SIGHT DISTANCE STANDARDS

The Appendix contains a drawing from the City of Omaha regarding their Intersection Visibility Ordinance for maintaining proper sight distances at intersections. The Consultant suggests that the City of Denison follow the general guidelines contained in this drawing for insuring that proper safety provisions through adequate sight distance are available at city intersections.

The Street Commissioner can follow the standards shown in the Appendix at locations where sight distance restrictions are contributing to the accident frequency or accident potential.

TREE TRIMMING

As previously noted, the Consultant witnessed very few instances in the City of Denison where hedges, tree branches, or fences obscure the visibility of cross street traffic or of traffic controls. Furthermore, it was not apparent from the accident records that poor visibility, due to vegetation or fences, was a major contributing factor.

Due to the absence of these types of sight distance hindrances in Denison, the Consultant does not offer any specific recommendations for improving the situation. However, in order to maintain good sight distances at city-wide intersections, the Consultant suggests that the City adopt a program of annually inspecting the visibility at intersections along major streets. The vegetation should be trimmed at those locations where it is obstructing the motorists' view of traffic control devices, pedestrians, or other vehicles.

PLACEMENT OF NEW SIGNS

The City should install bright red warning flags at the top of any new sign placements for a period of 30 days following the installation. The flags will call special attention to the traffic engineering changes. In the majority of cases the red flags will gain the attention of the motorist and direct it toward the new or changed traffic control signing. The main intention is to avoid a surprise situation for the motorist which could possibly contribute to an accident because the motorist did not perceive the new or changed traffic sign.

ORDINANCES

A number of additional recommendations, which do not fall into the realm of operational or physical improvements, are made regarding modifications that should be made to the City Ordinances. Certain sections of the City Ordinances require updating at the present time. The Ordinances should be updated on a continual basis, as necessary, for conformity with study recommendations.

A review of the City Ordinances pertaining to Traffic and Parking reveals that nearly all Chapters were written long ago and are outdated. A general recommendation is that the City make a concerted effort to update the Ordinances to reflect current traffic engineering standards and to conform with the physical traffic control installations actually in place on the streets.

The Consultant does not see any major problems with implementing traffic engineering safety improvements through the existing Denison City Ordinances. By means of the Nuisance Ordinance (Title XIV, Chapter I), it appears that the City is able to handle sight distance problems caused by obstructions on private property.

In reviewing the City Ordinances, the Consultant compiled the following list of specific modifications which should be given special attention during the overall effort to update the Ordinances and to bring existing traffic controls into conformance with the Ordinances.

1. Chapter VI of Title X designates certain intersections in Denison as Traffic Control Device Intersections. The intersections of Main Street and Broadway, Main Street and 1st Avenue South, and Main Street and 1st Avenue North are so designated. The Consultant suggests that the Ordinance be updated to include the intersections of Broadway at 15th Street and Main Street at 4th Avenue South.

2. Chapter VI of Title X also designates the intersections of 11th Street at 4th Avenue South and 15th Street at 4th Avenue South as School Traffic Control Device intersections, which require the installation of school signals. This designation is inconsistent with the existing control devices at these two intersections. Either the Ordinance should be modified or, after a traffic engineering study verifies that the signals are warranted, the signals should be installed to conform with the Ordinance. The City should request the Iowa Department of Transportation to conduct gap studies at these two locations to determine the need for school signals.
3. Chapter VI of Title X designates STOP intersections. Several designations differ from the traffic controls actually installed on the streets. These discrepancies should be resolved. Furthermore, STOP sign changes implemented as a result of this study should also be noted in the Ordinances.
4. Chapter VIII of Title X classifies all city streets as being one of three types. City streets are said to be within the Business District, within the Residence Districts, or within the Suburban Districts. Furthermore, the Ordinance establishes speed limits on these streets as 20 mph, 25 mph, or 45 mph, respectively. The Ordinance then goes on to state that speed limit enforcement shall not commence until suitable signs have been erected advising drivers of the required speed limit. Following the sign location criteria presented in Chapter 3 of this report, the City should properly post the streets with speed limits as specified in the City Ordinance.
5. Chapter VIII of Title X establishes speed zones on Primary Road Extension 141 in the City of Denison. Inasmuch as State Highway 141 is currently routed over the U.S. 59 by-pass and does not follow 7th Street, the Ordinance should be modified to reflect this route change.
6. Chapter III of Title X establishes School Zones and the speed limits for those zones. Furthermore, the Ordinance requires the placement of suitable SPEED LIMIT signs at the limits of the School Zones. Therefore, it is recommended that School Zone Speed Limits be posted as shown in Chapter 5.

7. Chapter III of Title X defines the required behavior of motorists when approaching a movable STOP sign, which has been placed in a School Zone. Since it has been determined that movable STOP signs are not in conformance with the requirements of the MUTCD and should not be used, it is suggested that this section be struck from the City Ordinance.

In conclusion, it can be said that efforts to improve the safe operation of streets and highways should not be confined to field modifications and traffic engineering measures. Much can be accomplished by the City Officials and City Staff in establishing policies, regulations, and operating procedures directed at improving public safety. This includes the updating of City Ordinances to include current, accepted traffic engineering standards and to bring the Ordinances and the existing traffic controls into conformance with one another. The City, through its City Attorney, may wish to further review its Ordinances as it begins to initiate the improvements outlined in this report. The City Attorney is the proper authority to advise the City if any conflicts do in fact exist between what is permissible under the various Ordinances as related to the improvements contained in this report. Finally, the City Attorney should be consulted to determine the City's liability associated with traffic accidents caused by uncorrected, but identified, traffic hazards.

Chapter 9

IMPLEMENTATION

The preceding chapters of this report have dealt with the analysis of existing traffic conditions, accident experience, and operations and with the formulation of modifications and improvements to correct deficient, inadequate, or nonconforming conditions. In this final chapter of the report, the discussion is directed toward potential sources of funding for the recommended improvements and a priority schedule for implementation.

SOURCES OF FUNDING

Monies for traffic control improvements such as those contained in this report can be obtained from several sources. Funds are available on a reimbursement basis, 70% Federal funds and 30% local matching funds, for street construction projects, traffic control devices and other improvements on city streets which are on the Federal-Aid Urban System (FAUS). As described in Chapter 2, much of the arterial and collector street mileage in the City is on this system (see Figure 2-3). Consequently, many improvements on these streets could qualify for FAUS funds.

The Iowa Department of Transportation has allocated \$142,000 (through fiscal year 1978) to the City of Denison for use on streets classified as Federal-Aid Urban routes. These monies constitute the 70% Federal share which the City must match on a 30% basis. For example, if the City wishes to use all of the \$142,000, then the City must match the Federal share with \$60,857. The resultant total dollar amount (Federal plus local monies) available for projects on the Federal-Aid Urban System equals \$202,857.

Furthermore, the City, if it so desires, may borrow money against future allocations of Urban System monies. That is, if the City decides that more than \$142,000 of Federal funds are needed immediately, then up to \$62,000 of future Federal allocations can be obtained now. Therefore, by supplying the City's 30% match to this advancement on Urban Systems monies, the City could have an additional \$88,571 available to institute traffic safety improvements.

A new Safer Off-System Roads Program has been established by combining the previously authorized Off-System Roads and Safer Roads Demonstration Programs. Funding is authorized to improve the safety and capacity of existing toll-free roads not on the Federal-aid highway system. Where feasible, the projects funded under this new program are to be low-cost improvements which provide significant safety benefits.

This new Safer Off-System Roads Program has just recently been funded on a national basis and provides for a 70% Federal and 30% local match. At the time of this writing, the Iowa Department of Transportation had not allocated the funds to local jurisdictions. Preliminary indications suggest that Denison's allotment will be small, since only \$3 million were made available on a state-wide basis.

A third source of safety funds is available to the City of Denison through the Iowa Department of Transportation's Urban-State Traffic Engineering Program (U-STEP). The objective of U-STEP is to make available a formalized procedure and a continuing funding source through which to assist the cooperating cities with traffic engineering improvements on the Primary Road extensions. The State and the City would each contribute 50% of the cost of any construction under this program.

The U-STEP Program will be administered by the Highway Division with principal involvement of the Traffic Engineering Office. As improvements are identified, the District Office shall be advised and, in cooperation with the District Engineer and the City, will determine if a project is possible. Safety projects on U. S. 30, (4th Avenue South) in Denison could possibly qualify for funding under this program.

Local monies come from various sources including the road use tax, property taxes, special assessments, and other related sources. Summaries of the receipts and expenditures for both the street and the parking programs are shown respectively in Tables 9-1 and 9-2. From these Tables, it is evident that at the close of fiscal year 1976, the City had balances of \$210,896 in the street account and \$25,026 in the parking account. Although these balances are somewhat committed in the street and parking budgets for the next fiscal year, Denison has the flexibility to rebudget its street and parking receipts in order to produce the local matching monies for applying for the available State and Federal funds.

IMPLEMENTATION OF IMPROVEMENTS

All of the recommended improvements in this report have been summarized in Tables 9-3 through 9-5. In addition, each improvement project has been classified as an immediate action project, a short-term project, or a long-term project.

The immediate action projects, listed in Table 9-3, are relatively small, inexpensive projects primarily dealing with isolated modifications. Also included as immediate action projects are the city-wide STOP and YIELD sign changes and the city-wide SPEED LIMIT signs, both of which require

TABLE 9 - 1
STREET FINANCE REPORT

Municipality <u>Denison, Iowa</u> County <u>Crawford</u> Official Census Figure <u>6218</u>	Road Use Tax Fund	Street Account	From Other Accounts*	Totals
A. Actual Balance, July 1, 1975	\$ 81,449	\$ 41,222	\$ 57,896	\$180,567
ACTUAL RECEIPTS				
B. 1. Road Use Tax	115,412			115,412
2. Property Taxes		89,096	52,259	141,355
3. Special Assessments			21,553	21,553
4. Miscellaneous			97,800	97,800
C. Total Receipts (Lines B1 - B4)	115,412	89,096	171,612	376,120
D. TOTAL FUNDS AVAILABLE (Line A + Line C)	\$196,861	\$130,318	\$229,508	\$556,687
ACTUAL EXPENDITURES				
E. Maintenance				
1. Roadway Maintenance		54,879		54,879
2. Snow and Ice Removal		16,086		16,086
3. Storm Sewers		740		740
4. Traffic Services		1,578		1,578
5. Street Cleaning		4,650		4,650
F. Construction or Reconstruction				
1. Engineering	15,516	11,234		26,750
2. Roadway Construction	15,128	5,151		20,279
3. Storm Sewers	8,945	5,960		14,905
4. Traffic Services		1,730		1,730
5. Sidewalks		4,327		4,327
G. Administration		6,341		6,341
H. Street Lighting			97,800	97,800
I. Trees			7,925	7,925
J. Equipment Purchased		17,642		17,642
K. Miscellaneous		--	--	
L. Bonds and Interest Paid				
1. Paid on Bonds Retired			55,000	55,000
2. Interest Paid on Bonds			15,159	15,159
M. Non-Street Purposes		--		
N. Total Expenditures (Lines E thru M)	\$39,589	\$130,318	\$175,884	\$345,791
O. BALANCE, June 30, 1976	\$157,272	0	\$ 53,624	\$210,896
P. TOTAL FUNDS ACCOUNT FORWARD (Line N + Line O)	\$196,861	\$130,318	\$229,508	\$556,687

* Debt Service, General, Sanitation, Public Safety, Utility, etc. Includes the balances for accounts which are used entirely for streets.

TABLE 9 - 2

PARKING FINANCE REPORT

Municipality Denison

A.	ACTUAL BALANCE, July 1, 1975	\$ 17,762
ACTUAL RECEIPTS		
B.	Parking and Meter Receipts	
1.	Street Meter Revenue	22,917
2.	Lot or Garage Meter Revenue	
3.	Other Lot or Garage Revenue (Rentals)	32
4.	Property Taxes	
5.	Miscellaneous (Fines)	8,980
C.	Proceeds of Parking Bonds Sold	
D.	Total Receipts (Lines B1-B5 and Line C)	31,929
E.	TOTAL PARKING FUNDS AVAILABLE (Lines A and D)	\$ 49,691
ACTUAL EXPENDITURES		
F.	For On and Off Street Parking	
1.	Acquisition and Installation of Meters	10,460
2.	Maintenance and Repair of Meters	1,626
3.	Acquisition and Improvement of Parking	1,834
4.	Maintenance and Operation for Parking	
5.	Policing and Enforcement	
	Total (Lines F1-F5)	\$ 10,745
G.	Parking Bonds and Interest Paid	
1.	Paid on Bonds Retired	
2.	Interest Paid	
H.	Street Work Paid from Parking	
I.	Total Expenditures (Lines F1-F5, G1-G2, and Line H)	\$ 24,665
J.	ACTUAL BALANCE, June 30, 1976	\$ 25,026
K.	TOTAL PARKING FUNDS ACCOUNTED FOR (Lines I and J)	\$ 49,691

TABLE 9 - 3

IMMEDIATE ACTION PROJECTS

Priority	Recommendation	Page	Estimated Cost	Funding		
				Type	Federal	City
1	Remove red beacon and install pedestrian crossing near swimming pool	3-18	\$ 300	Local		\$ 300
2	Safe route to school plan	5-6		Schools		
3	Time downtown signal progression	7-3	100	Local		100
4	RIGHT LANE MUST TURN RIGHT sign at Main Street and 2nd Avenue South	3-14	50	Local		50
5	Warning signs at 16th Street and 6th Avenue North	5-12	100	Local		100
6	STOP and YIELD sign changes	3-4	3,010	Local		3,010
7	City-wide SPEED LIMIT signs	3-19	1,000	Local		1,000
8	Industrial Drive railroad crossing	6-3	200	Local		200
9	Main Street railroad crossing	6-5	100	Local		100
10	15th Street railroad crossing	6-5	100	Local		100
TOTAL			\$4,960			\$4,960

TABLE 9 - 4

SHORT - TERM PROJECTS

Priority	Recommendation	Page	Estimated Cost	Funding		
				Type	Fed.	State
1	Crossing controls at Central and Middle Schools	5-15	\$1,540	\$550 FAUS \$990 OFF-SYSTEM	\$385 695	\$165 295
2	Crossing controls at 20th Street Elementary School	5-17	1,310	FAUS	920	390
3	Crossing controls at Zion Lutheran and St. Rose of Lima Schools	5-20	1,950	\$350 FAUS \$1,600 OFF-SYSTEM	245 1,120	105 480
4	Sidewalk replacements	5-9		Special Assessment		
5	Improvements at U.S. 30 Intersections: U.S. 30 and 11th Street U.S. 30 and 12th Street U.S. 30 and Main Street	4-21 4-22 4-11	1,550	U-STEP	\$775	775
6	Improvements at Broadway and Avenue "C"	4-23	1,550	FAUS	1,085	465
7	Improvements at Broadway and 15th Street	4-26	2,600	FAUS	1,820	780
8	NO PARKING sign replace- ment	3-12	2,000/year Local for 5 years			2,000/yr. for 5 yrs.
9	STREET NAME sign replacement	3-13	2,000/year Local for 5 years			2,000/yr. for 5 yrs.
10	Guardrail on Avenue "C" railroad overpass	6-3	9,000	FAUS	6,300	2,700
TOTAL			\$39,500		\$12,570 \$775	\$26,155

TABLE 9 - 5

LONG - TERM PROJECTS

Priority	Recommendation	Page	Estimated Cost	Funding		
				Type	Federal	City
1	Improvements at Main Street and Broadway	4-18	\$ 24,800	FAUS	\$ 17,360	\$ 7,440
2	Improvements at Main Street and 1st Avenue South	4-14	21,200	FAUS	14,840	6,360
3	Improvements at Main Street and 1st Avenue North	4-16	20,500	FAUS	14,350	6,150
4	Sign changes at North junction of U. S. 30 with U. S. 59 and S. H. 141	4-29	2,600 ¹			
5	Sign changes at South junction of U. S. 30 with U. S. 59 and S. H. 141	4-31	2,600 ¹			
6	Update City Ordinances	8-3				
7	Modify Accident Records Procedure	4-44				
8	Geometrics at Broadway and 20th Street	4-33	7,000	FAUS	4,900	2,100
9	Geometrics at 16th Street and 4th Avenue North	4-39	20,000	FAUS	14,000	6,000
10	Geometrics at Avenue "C" and 2nd Avenue North	4-37	8,000	FAUS	5,600	2,400
TOTAL			\$ 106,700		\$ 71,050	\$ 30,450

¹ Intersection is responsibility of Iowa Department of Transportation.

the City's early attention. Due to the relatively low costs associated with these improvements, all of the immediate action projects can be handled locally as part of the regular street budget. It would be of little or no benefit to the City to expend time and effort to apply for Federal funds to defray the costs of these low-cost projects.

With regard to a timetable for implementation, the immediate action projects should be completed as soon as possible, and certainly within six months, after the acceptance of this report. Although the Consultant has assigned a priority to each of these projects, the City may deem it appropriate to adjust the priorities based on local desires and the availability of funds. Furthermore, the City may find it advantageous to combine several individual projects into one large project.

As shown in Table 9-4, the short-term projects involve school crossing improvements, modifications at high-accident locations, and sign replacement projects. Approximately one-third of the total cost of the improvements can be covered by funds available through Federal and State programs. The costs of the NO PARKING and STREET NAME sign replacements can be amortized over a number of years thereby minimizing the impact of these projects on the street budget. A five-year period is suggested, however, any time frame can be used that is acceptable to the City.

The Consultant has combined all improvements on U. S. 30 (4th Avenue South) into one project which may be eligible for funding under the U-STEP program. The City may also wish to combine the school improvements into one project. FAUS funds may be utilized for the school improvements on the streets classified as Federal-Aid Urban routes. The school improvements made on the streets that are not on any Federal-aid system are eligible for funding under the Safer Off-System Roads Program.

Table 9-5 is a listing of the proposed long-term projects which were identified throughout the course of the study. Basically, these are the high-cost projects (signalization and geometric modifications) which will require considerable planning and design prior to their implementation.

The signing modifications at the two intersections of U. S. 30 with U. S. 59 and S. H. 141 are the responsibility of the Iowa Department of Transportation and are not a financial liability for the City. The City can apply for FAUS funds to help finance the other construction projects. City forces can be used to update the City Ordinances and modify the procedure for filing accident records.

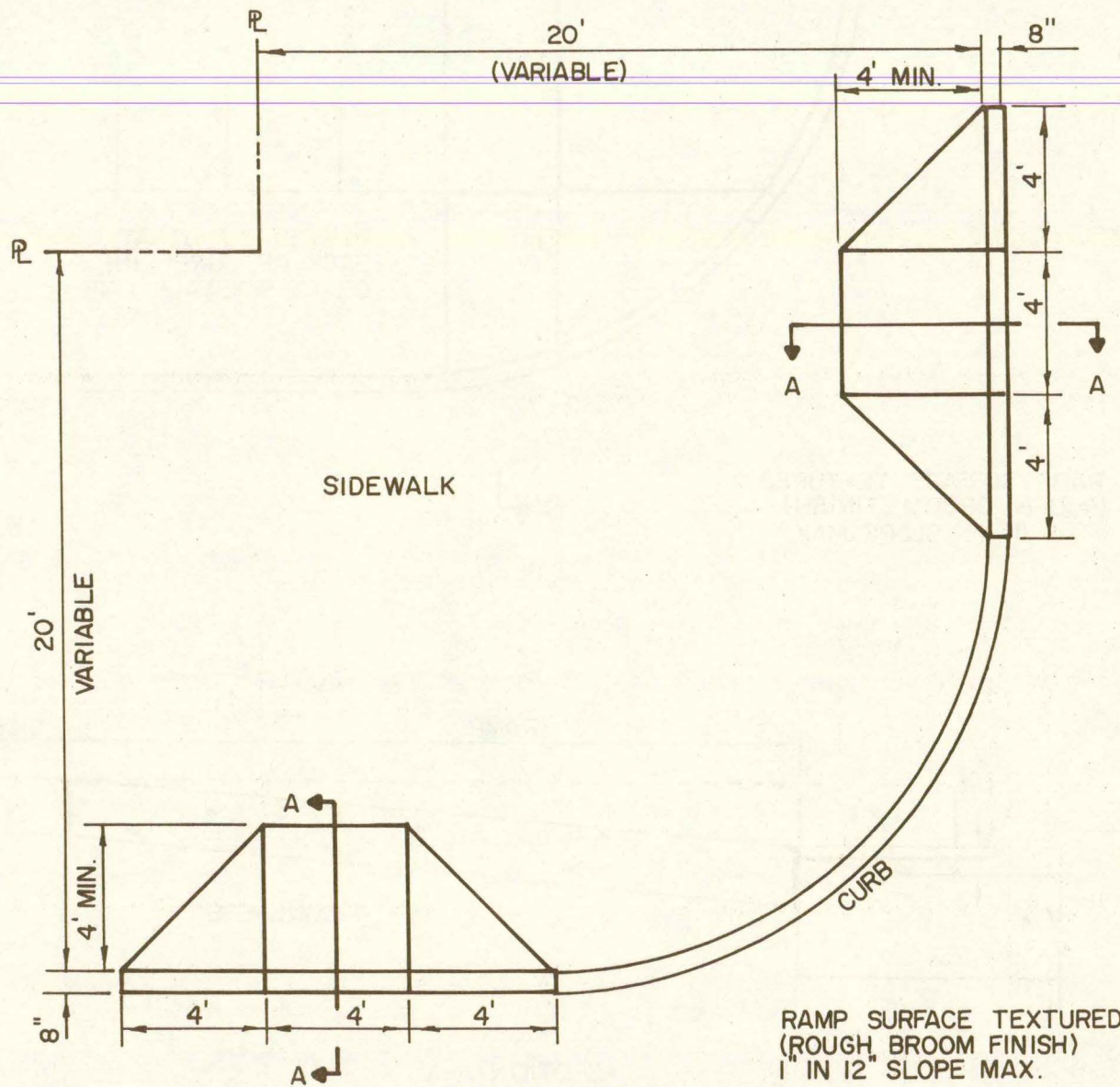
Although the downtown signalization projects are designated as long-term projects, the Consultant suggests that these improvements be implemented as soon as possible. The traffic signals are considered long-term only because of the magnitude of their costs. The Consultant believes that traffic flow, vehicular safety, and pedestrian safety in the downtown area can be improved via the installation of modern traffic signals.

Overall, the guidelines contained in this section provide the City with sufficient flexibility to approach the proposed traffic engineering improvements on an individual or collective basis. The successful completion of the improvements in this report will enable the City to reduce the occurrence of accidents and improve the overall safety and traffic flow within the City of Denison.

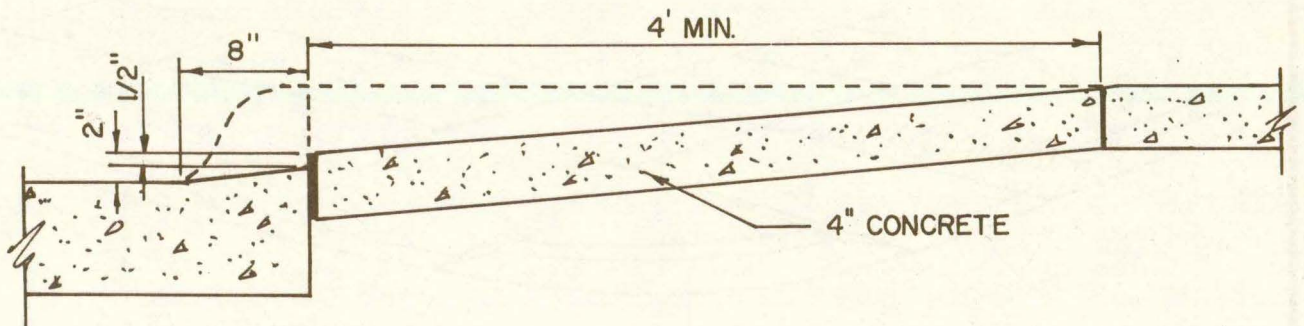
APPENDIX

LIST OF CONTACTS

Mr. Keith Duncan, Mayor of Denison
Mr. Richard Dueland, City Engineer
Mr. Robert Schraeder, Police Chief
Mr. O. H. "Bud" Webb, City Clerk
Mrs. Ila Wyant, Deputy City Clerk
Mrs. Barb Schwitters, Chief Dispatcher, Police Department
Mr. Dan Fitzgerald, Chamber of Commerce
Mr. LaVern Peters, City Maintenance Department
Mr. Chuck Joachim, Assistant Superintendent of Schools
Mr. Robert Meyer, Elementary School Principal
Mr. Louis Luvaas, H. Gene McKeown and Associates
Mr. James Laubscher, City Street Commissioner
Mr. Leonard Reis, City Street Department
Mrs. LaVern Venzke, Assistant Principal - Zion Lutheran School
Sister Mary Jane, Principal - St. Rose of Lima School
Mr. Ken Gilbert, Crouse Cartage
Mr. Bob DeMey, Farmers Elevator Mill
Mr. Bill Cullen, Farm Service Co-op
Mr. Tom Gorman, Assistant High School Principal
Mr. LaVern Keuck, Chief Engineer - Crawford County Hospital
Mr. George Rowe, Iowa Department of Transportation
Mr. Lowell Richardson, Iowa Department of Transportation
Mr. Harold Schiel, Iowa Department of Transportation
Mr. Robert Studer, Iowa Department of Transportation



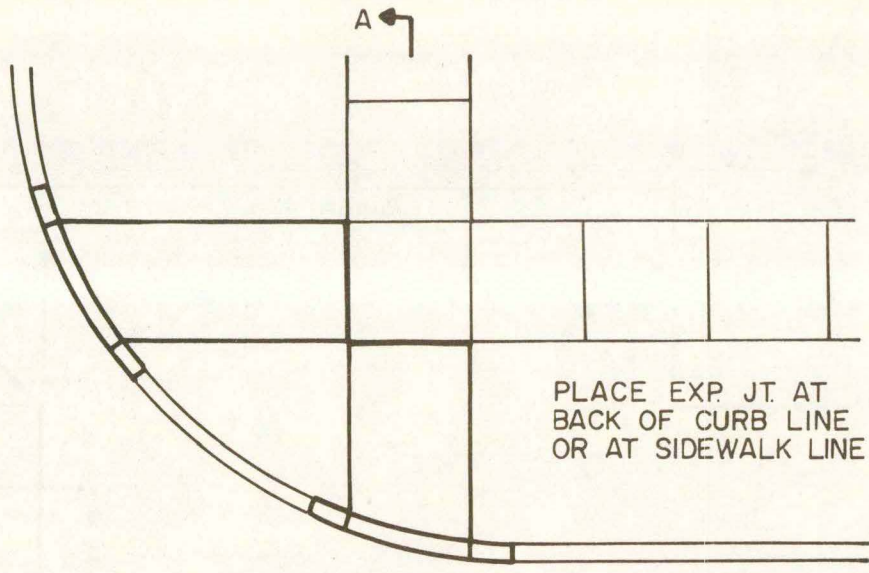
PLAN



SECTION A-A

Business District Sidewalk Ramp

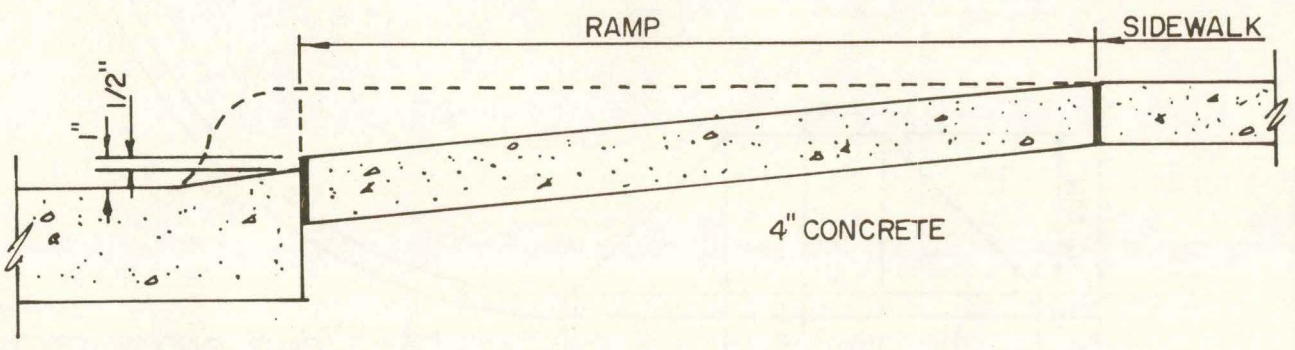
NOT TO SCALE



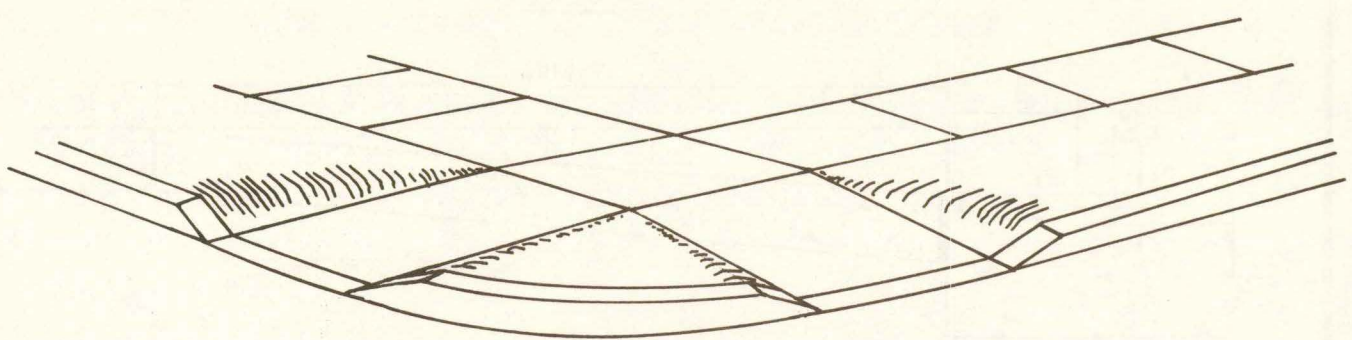
PLACE EXP. JT. AT
BACK OF CURB LINE
OR AT SIDEWALK LINE

RAMP SURFACE TEXTURED
(ROUGH BROOM FINISH)
1" IN 12" SLOPE MAX.

A ←
PLAN

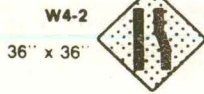


SECTION A-A



Residential Sidewalk Ramp

NOT TO SCALE



PAVEMENT WIDTH TRANSITION SIGN



CROSSROAD SIGN



SIGNAL AHEAD SIGN



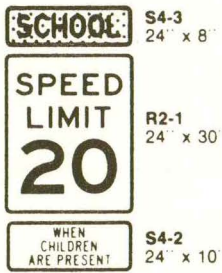
SCHOOL ADVANCE SIGN



SCHOOL CROSSING SIGN



RIGHT LANE ENDS SIGN



SCHOOL SPEED LIMIT SIGN ASSEMBLY



RAILROAD ADVANCE SIGN



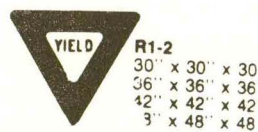
OBJECT MARKER SIGN



DO NOT ENTER SIGN



STOP SIGN

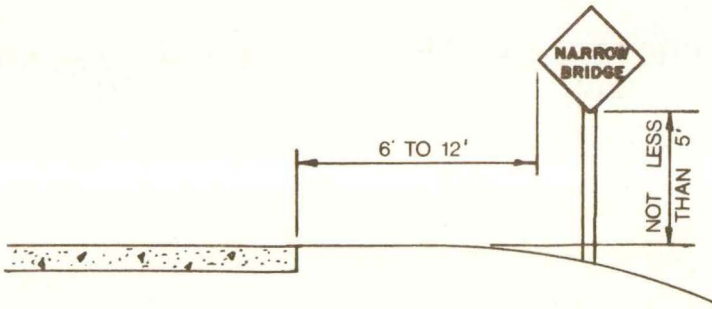


YIELD SIGN

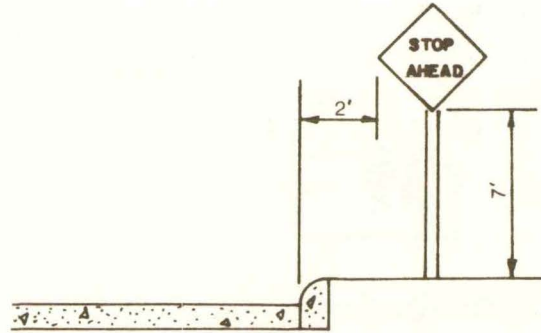


NO RIGHT TURN SIGN

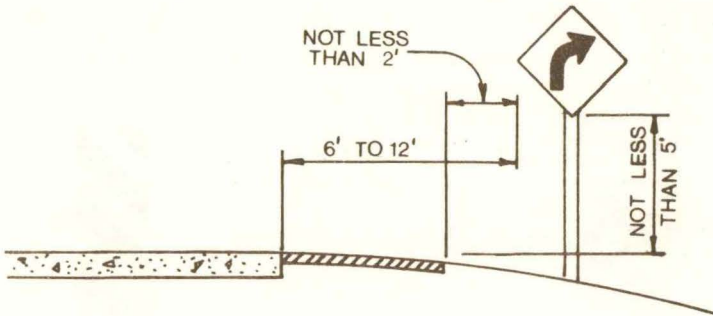
Typical Signs



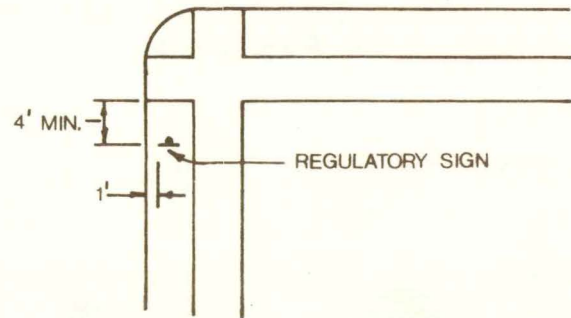
rural section



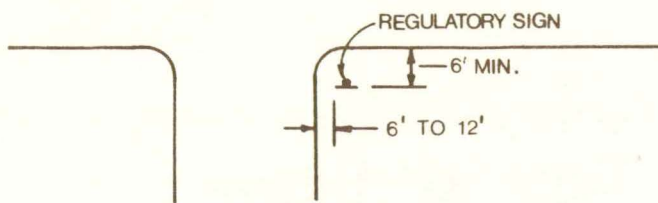
urban section



rural section



urban intersection



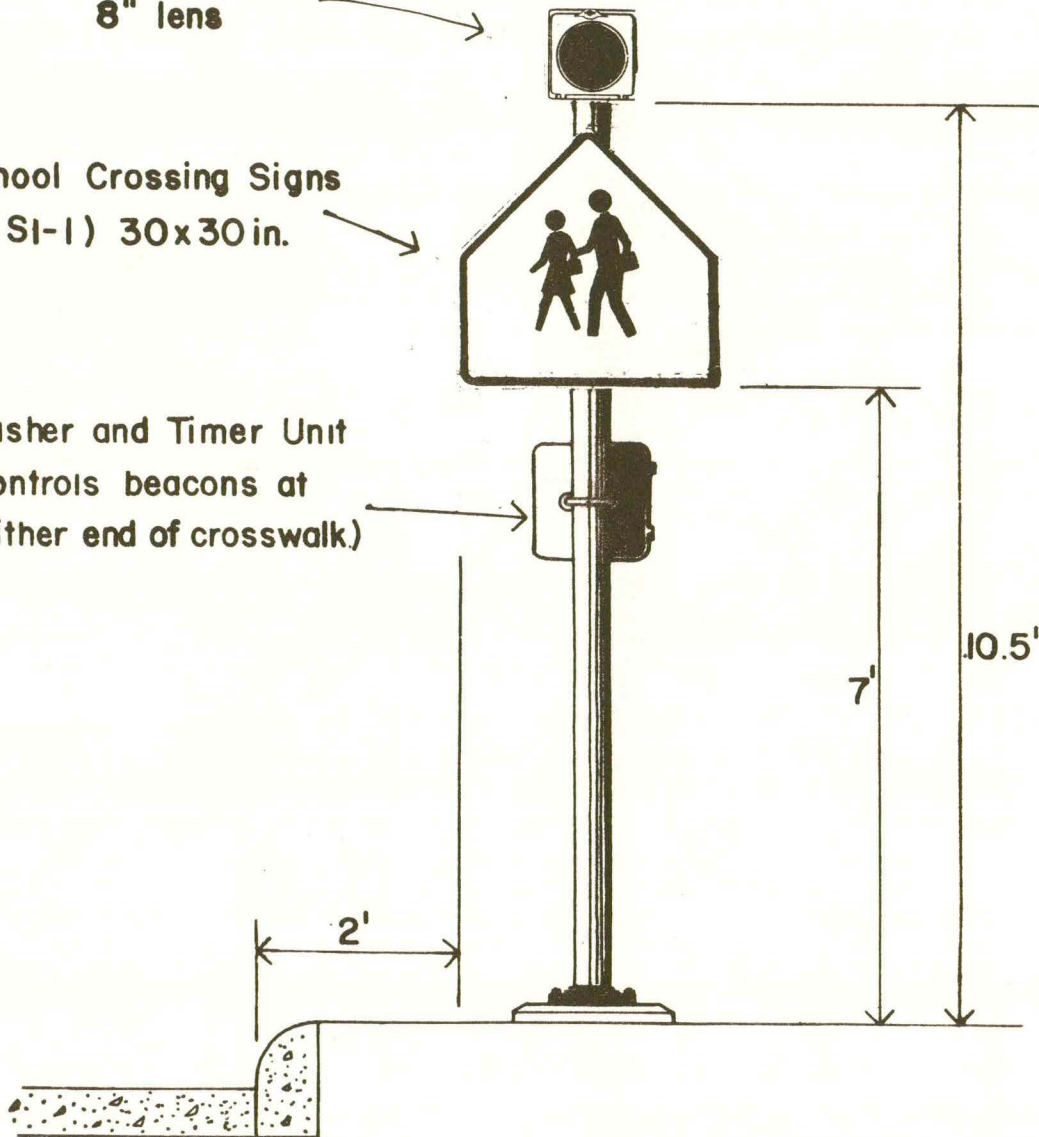
rural intersection

Sign Placement

Flashing Yellow Beacon
8" lens

School Crossing Signs
(SI-1) 30x30 in.

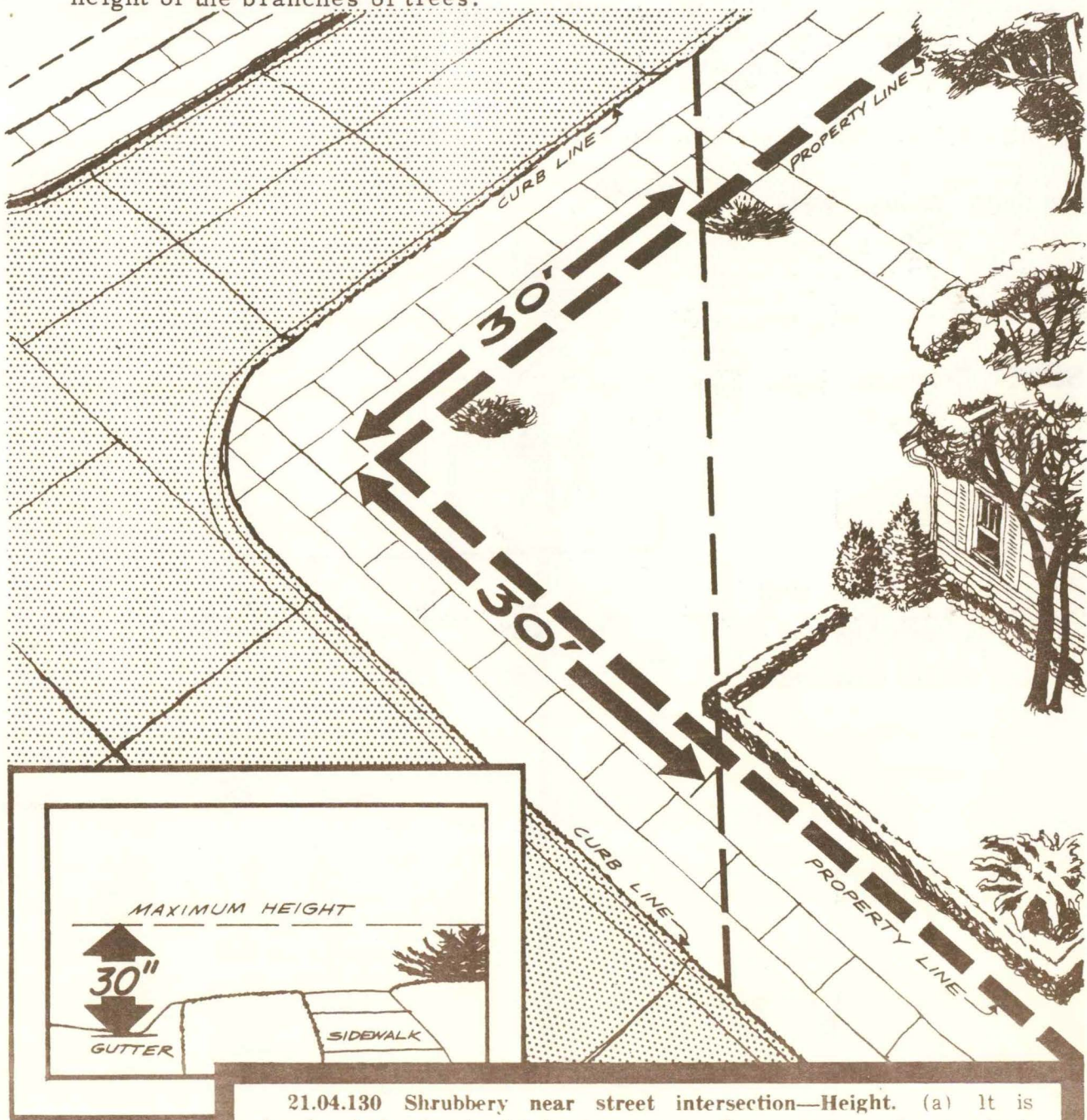
Flasher and Timer Unit
(controls beacons at
either end of crosswalk)



**School Crossing
Sign with Beacon**

INTERSECTION VISIBILITY ORDINANCE

The City of Omaha ordinance relating to sight distances at intersections appears below. Such ordinances often include restrictions on the minimum height of the branches of trees.

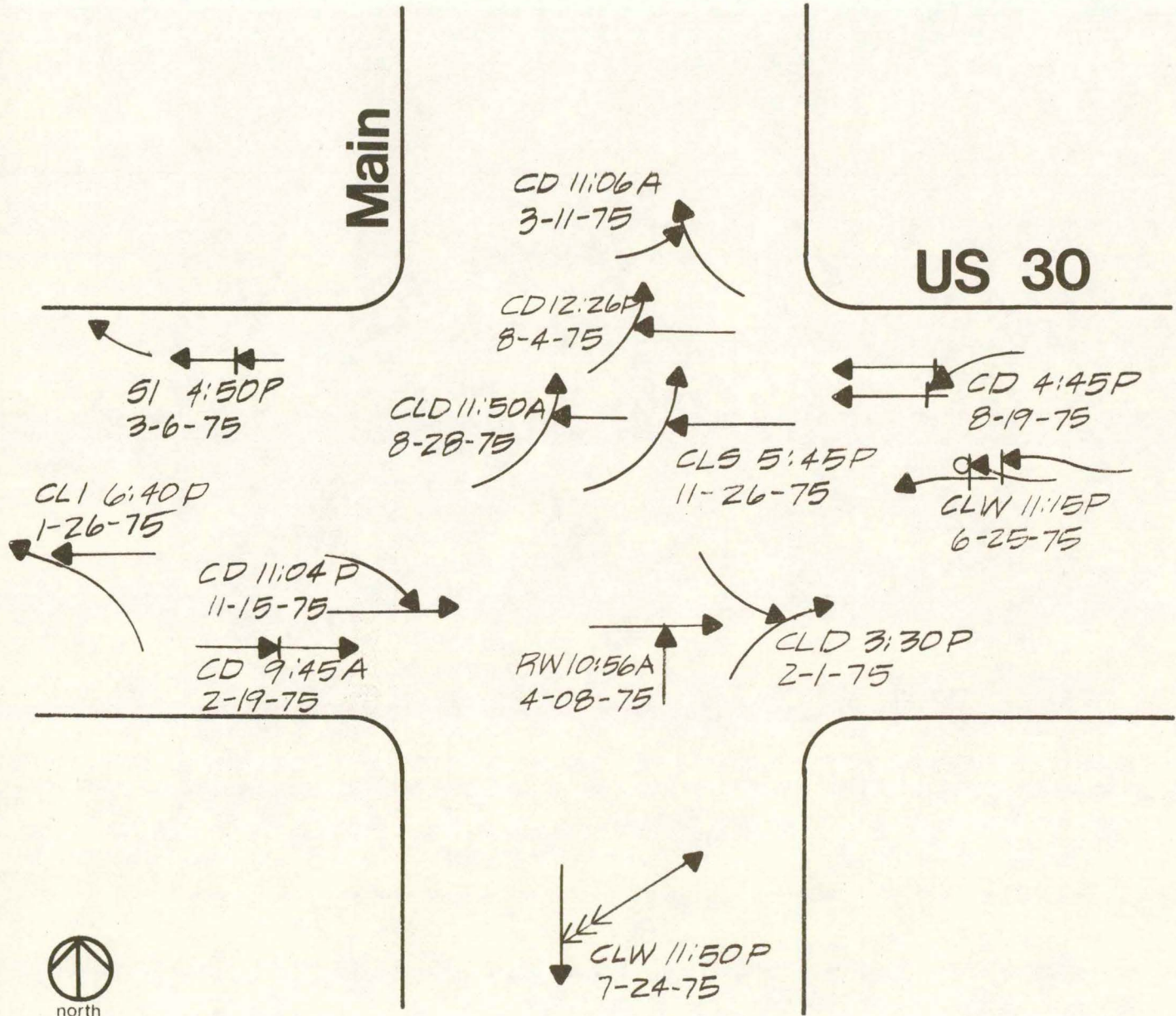


21.04.130 Shrubbery near street intersection—Height. (a) It is hereby declared unlawful for any person, firm or corporation to plant, grow, keep, or maintain, or cause to be planted, grown, kept or maintained any hedge, bush or shrubbery of any kind or nature more than two and one-half feet in height above the roadway within the triangle formed by the adjacent side lines of two intersecting streets and the line joining points distant thirty feet on each side line from their point of intersection.

(b) For the purpose of this section "side line" of street, shall mean the property line. (Ord. 14924 § 56-1.13, as amended by Ord. 21423; September 6, 1960).

Main

US 30



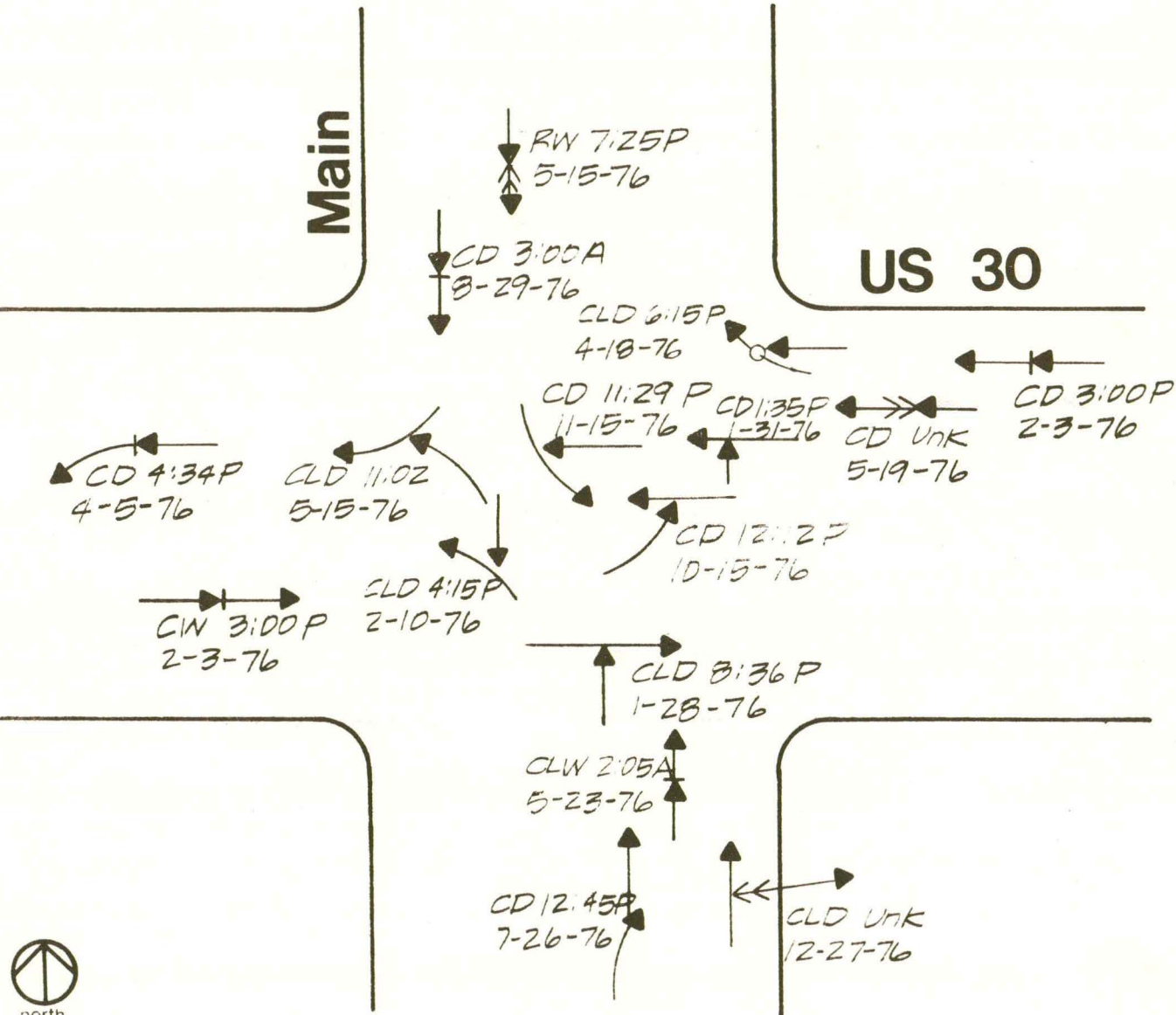
legend

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

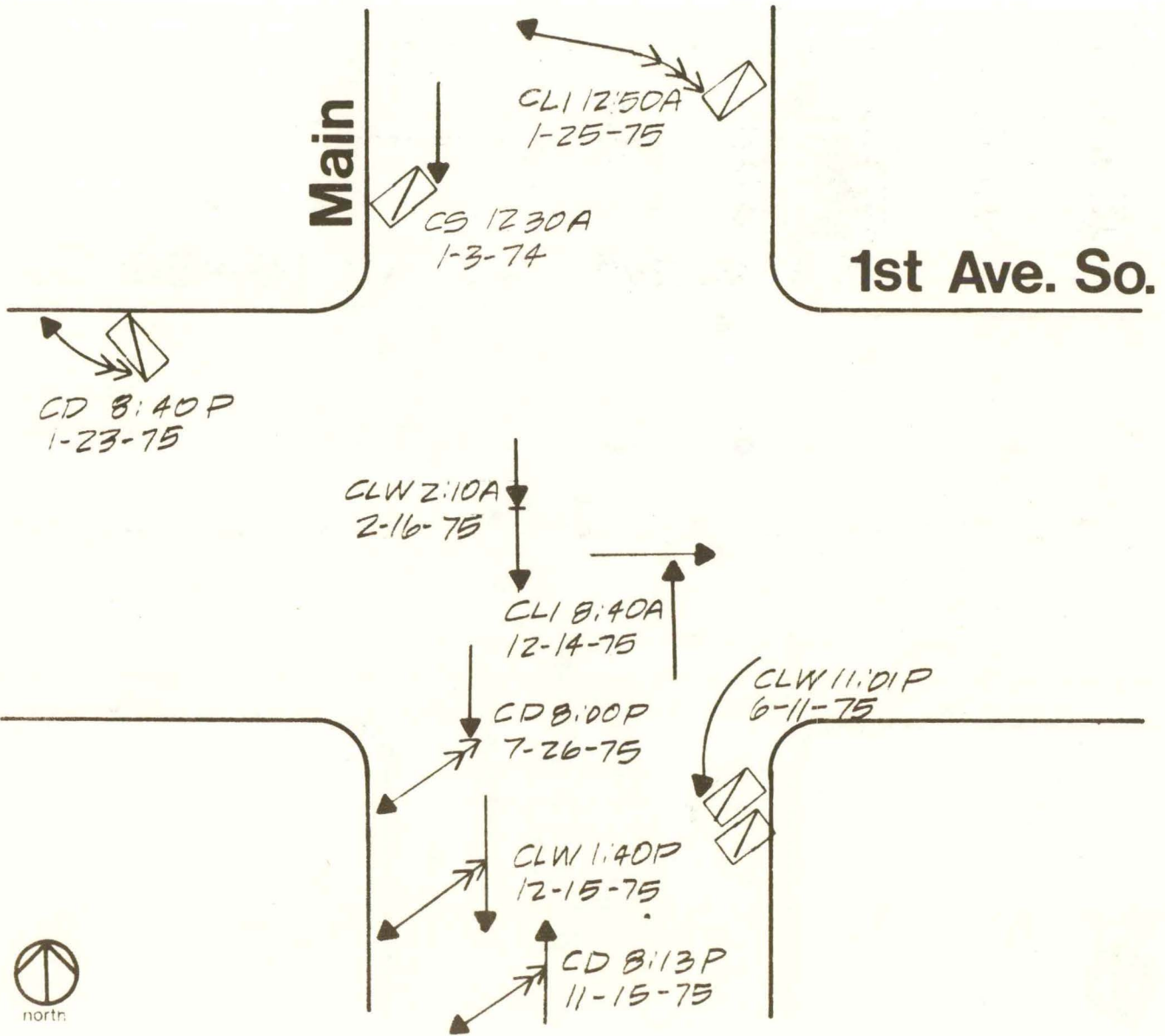
ACCIDENT COLLISION DIAGRAM 1975

Main

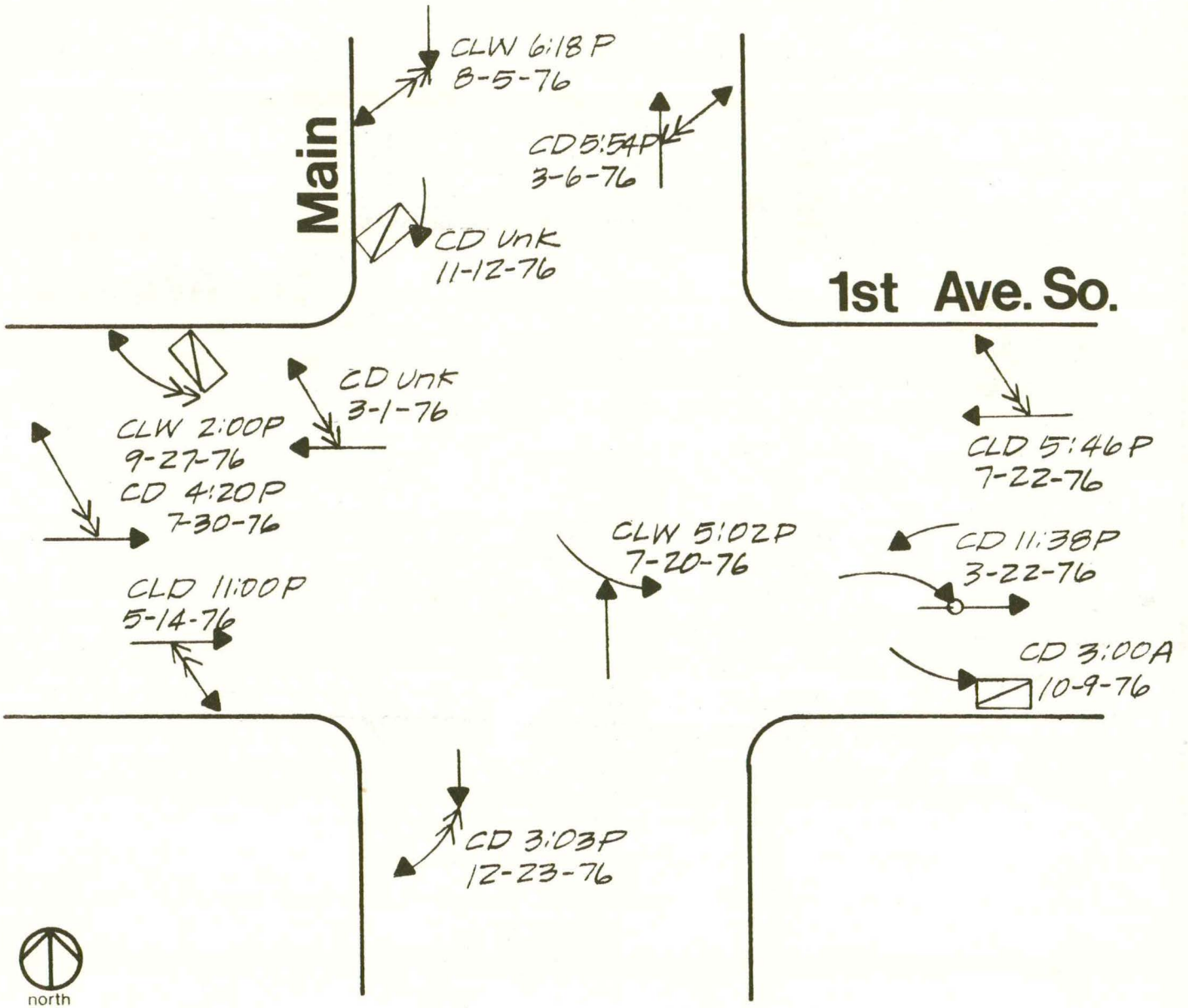
US 30



ACCIDENT COLLISION DIAGRAM 1976



ACCIDENT COLLISION DIAGRAM 1975



ACCIDENT COLLISION DIAGRAM 1976

Main

CLW 11:45A
4-18-75

1st Ave No.

CLD 12:02P
11-9-75

CLD 9:45P
12-26-75

CI 8:30A
4-3-75

SI 10:45A
4-2-75

CD 4:15P
3-19-75

CI 9:00P
3-24-75

CD 11:05A
6-13-75

CD 11:50A
5-27-75

CD 5:00A
12-9-75

SI 5:20P
3-13-75

CLW 3:40P
2-20-75

CI 11:32A
1-19-75



ACCIDENT COLLISION DIAGRAM 1975

Main

CS 2:30P
1-8-76

CD 8:30A
5-6-76

CD 1:55P
12-12-76 1st Ave No.

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1-17-76

CD 8:06
12-21-76

CD 9:06A
8-3-76 CD 4:00P
5-4-76

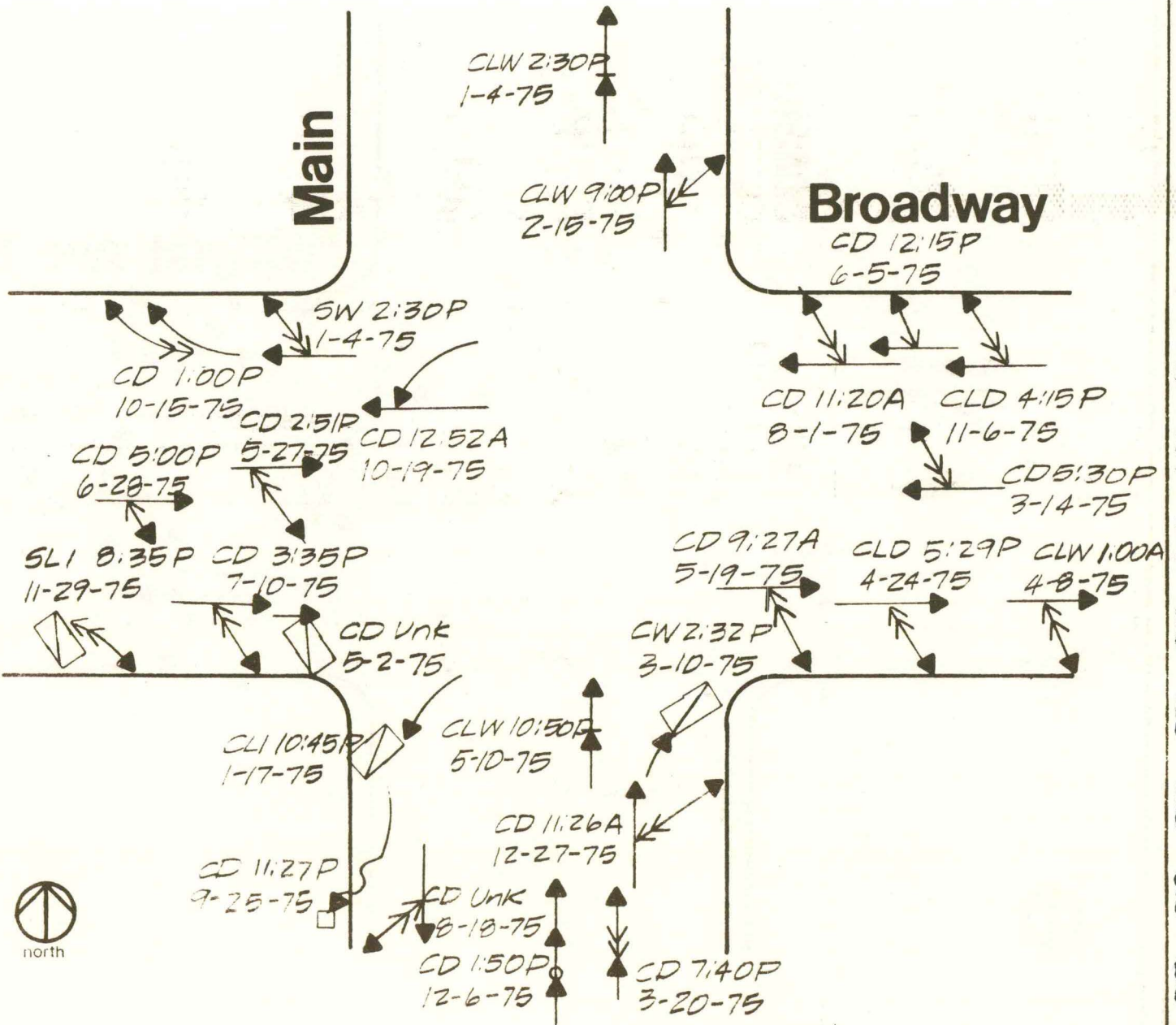
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CD 4:34P
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7-10-76



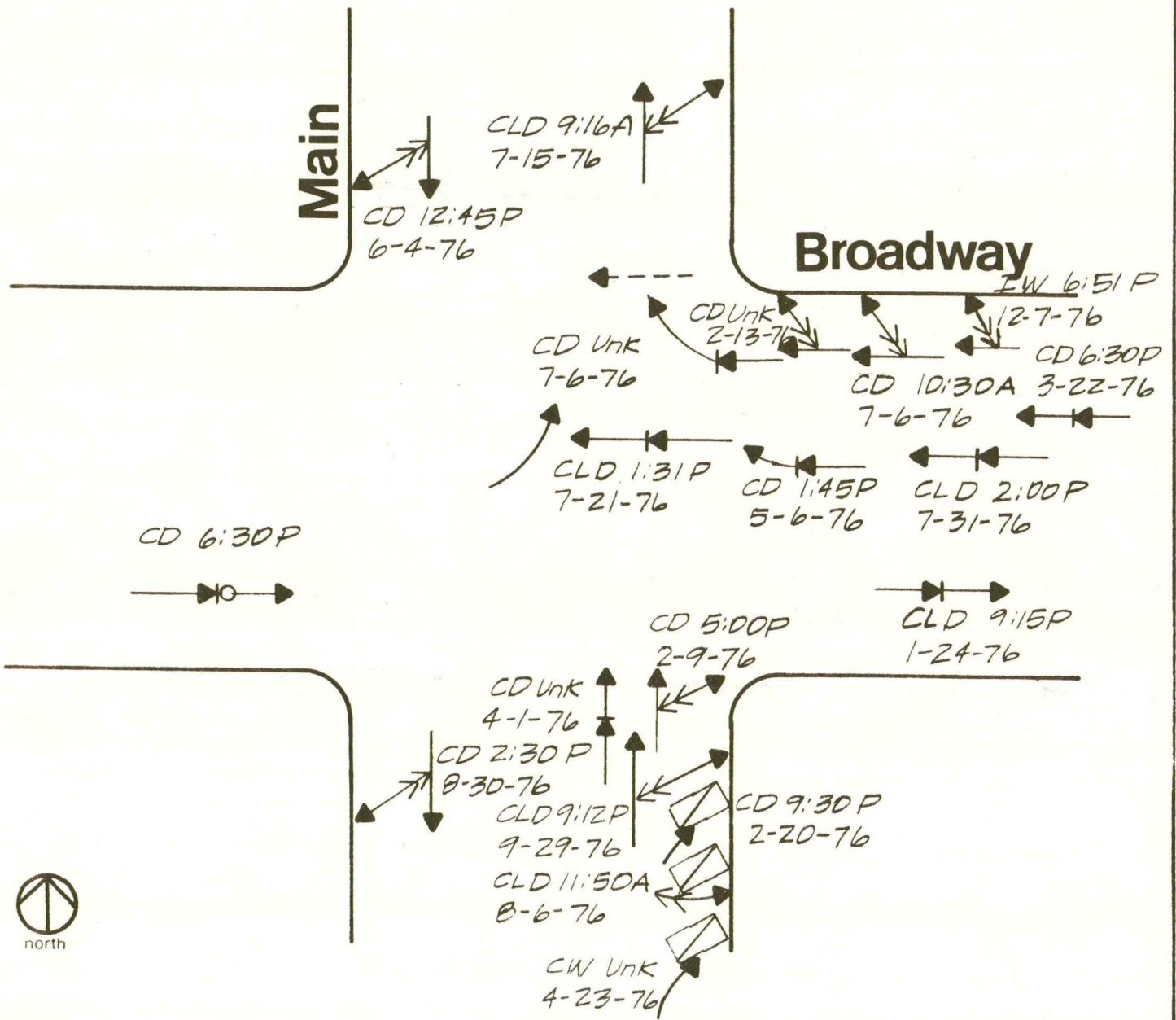
ACCIDENT COLLISION DIAGRAM 1976



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Main

Broadway



ACCIDENT COLLISION DIAGRAM 1976

So. 11th

US 30

CL 7:15A
1-10-76

CD 4:51 P
9-14-76

CD 3:25P
1-9-76

CLD 5:00P
4-20-76

CD 5:25P
11-29-76

CD 4:00P
6-18-76

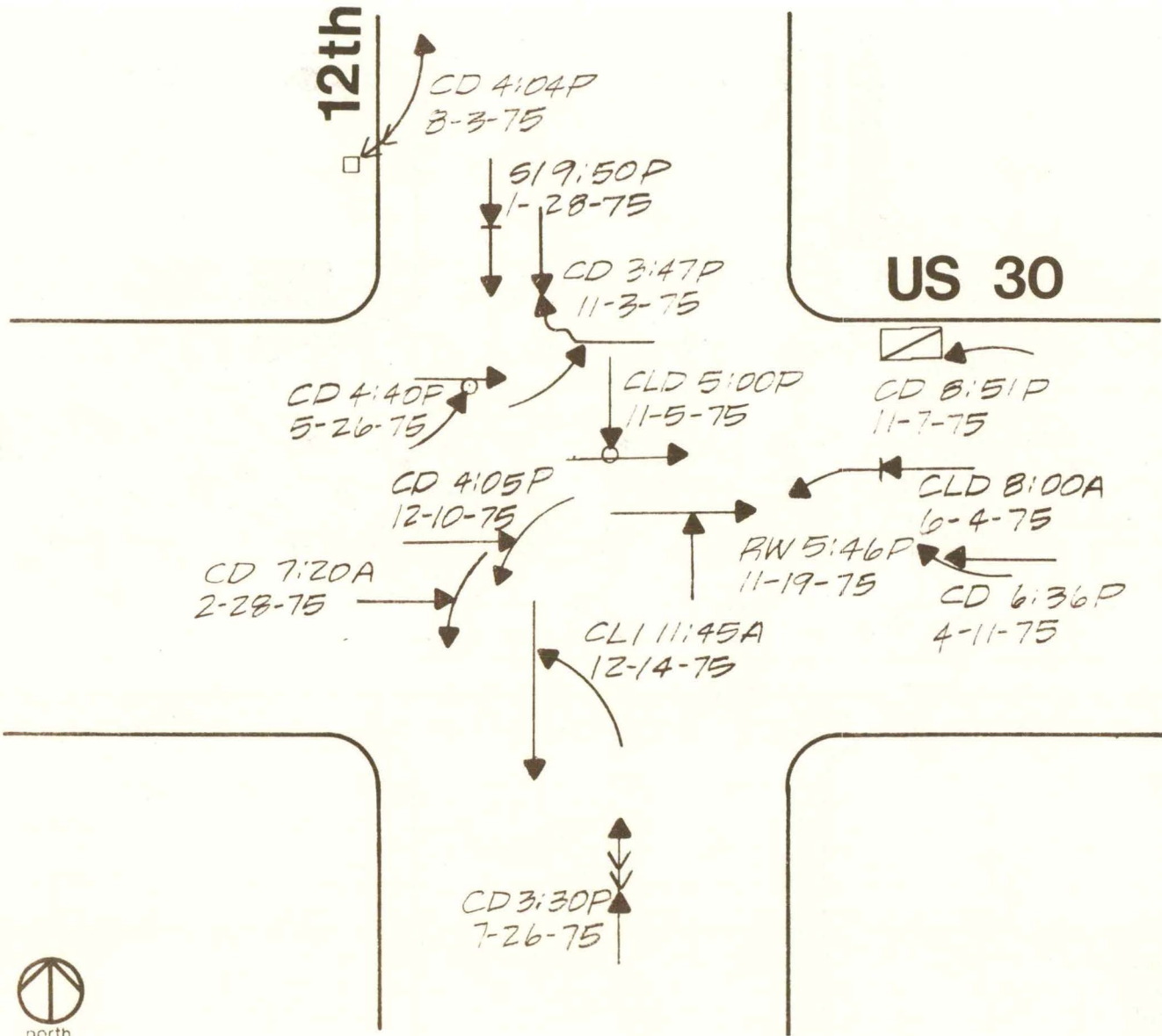
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CD 10:30A
4-19-76

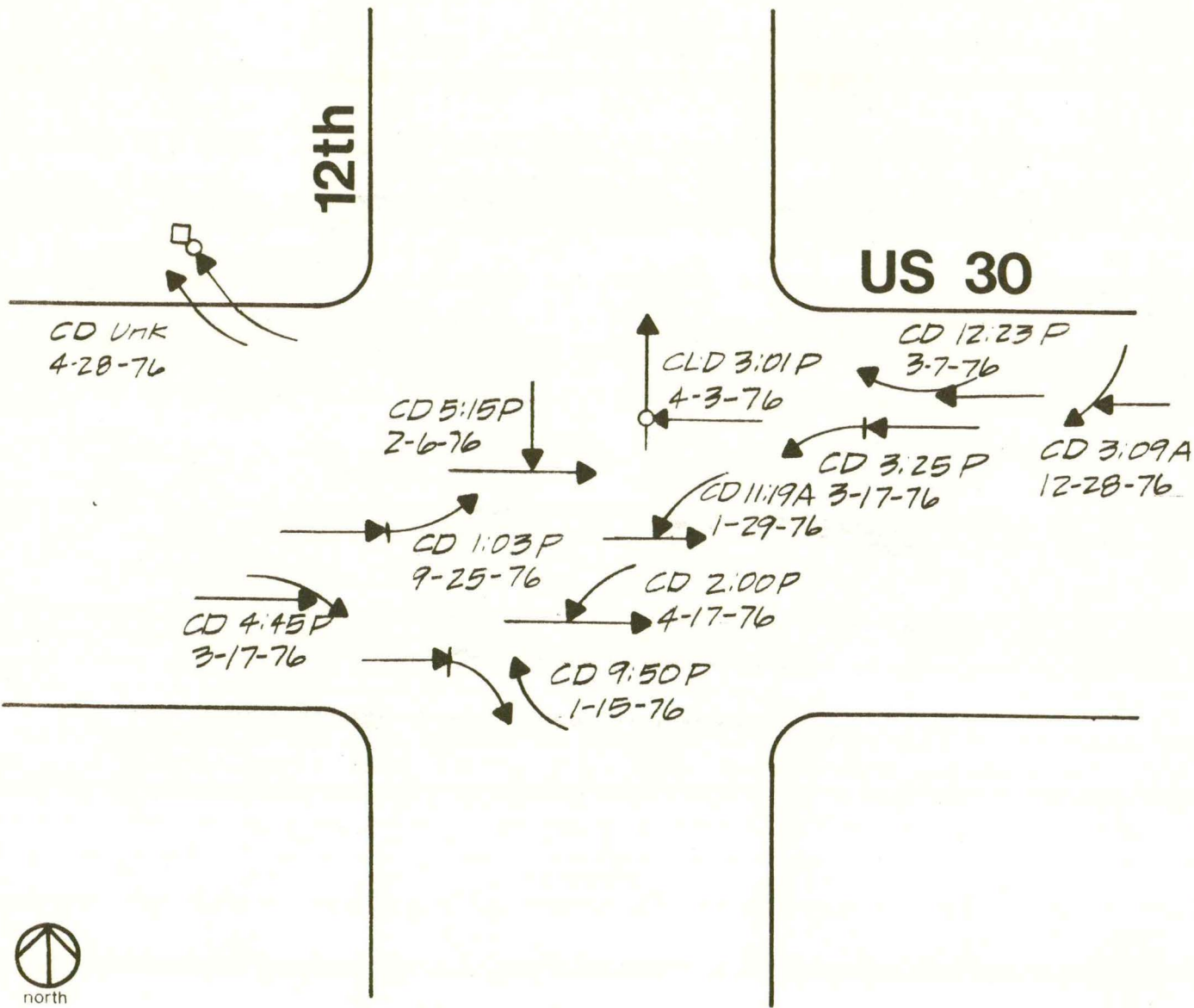
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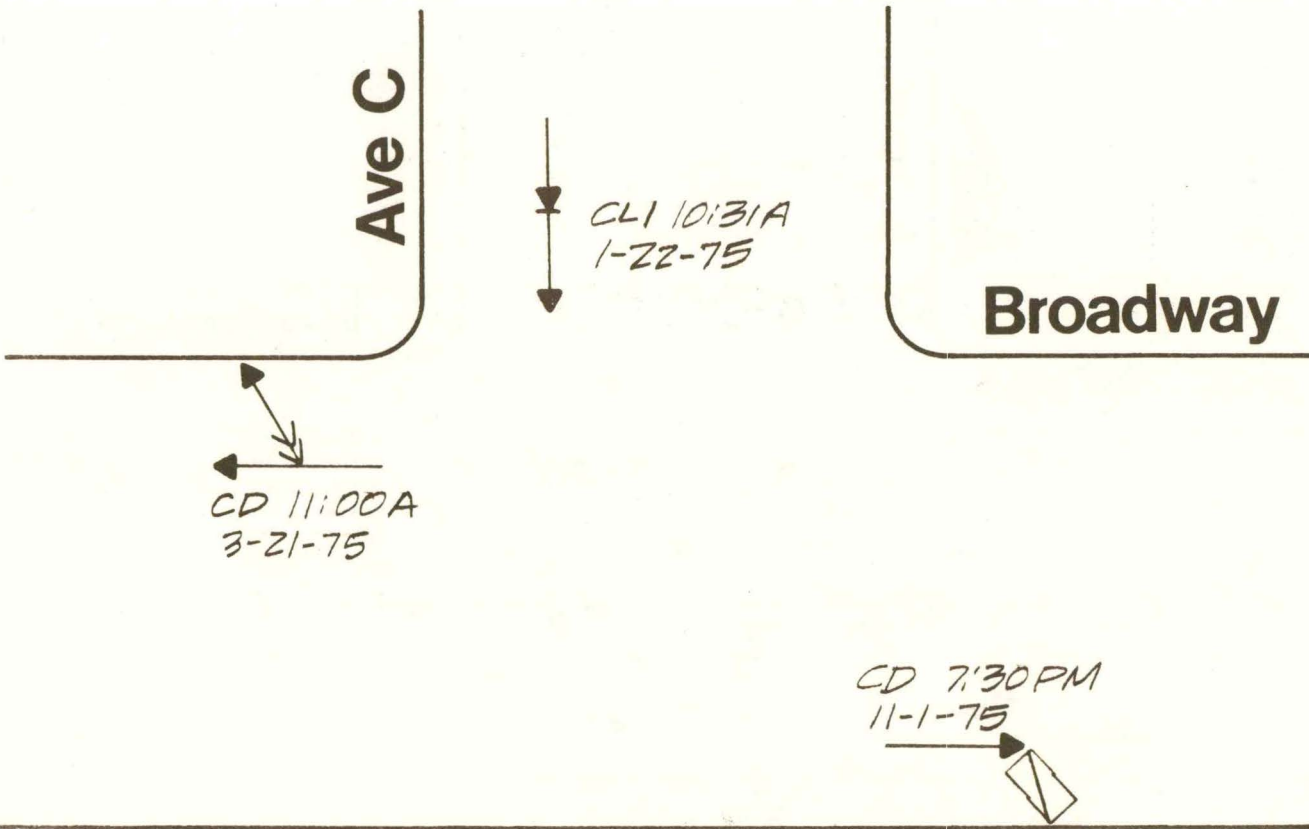
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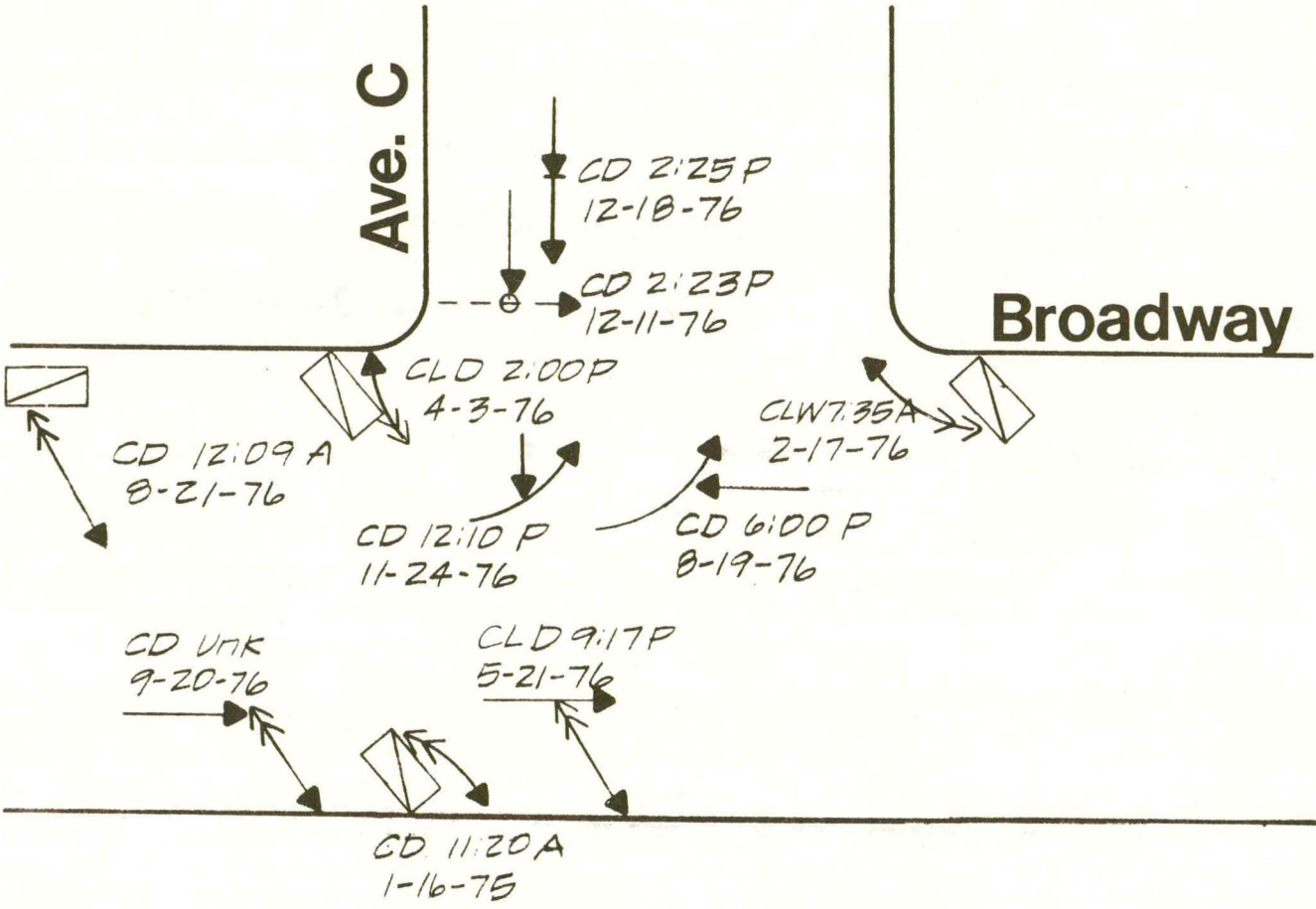
ACCIDENT COLLISION DIAGRAM 1975



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ACCIDENT COLLISION DIAGRAM 1976

Broadway

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7-17-75

→ | →
CD 8:38P
8-7-75

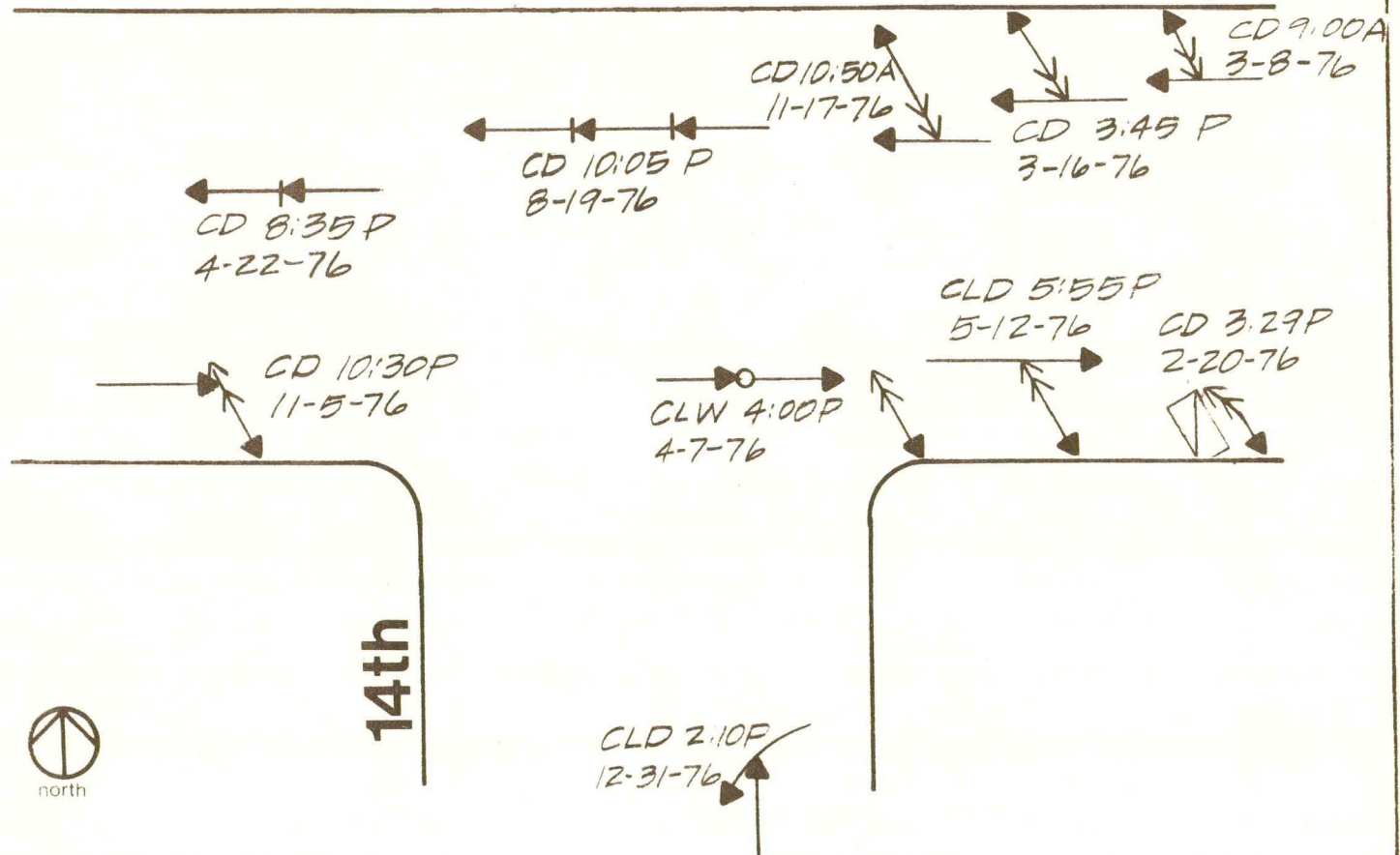
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CD 8:09P
10-9-75
↘ ↖
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↘ ↖
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10-13-75

14th



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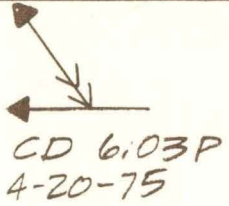
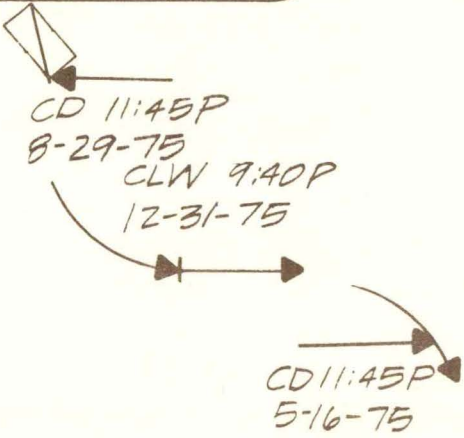
Broadway



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15th

Broadway



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15th

Broadway

CD 1:30P
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CLD 8:48A
1-19-76

CD 3:30P
8-23-76

CLD 11:09A
2-20-76

CD 6:23P
8-02-76

CD 8:30A
6-5-76

CLW 9:15P
6-17-76

CD 9:40P
6-24-76

CD 4:30P
3-27-76

CLD 9:35P
4-17-76

CD Unk
3-24-76

CLD 11:10P
2-28-76

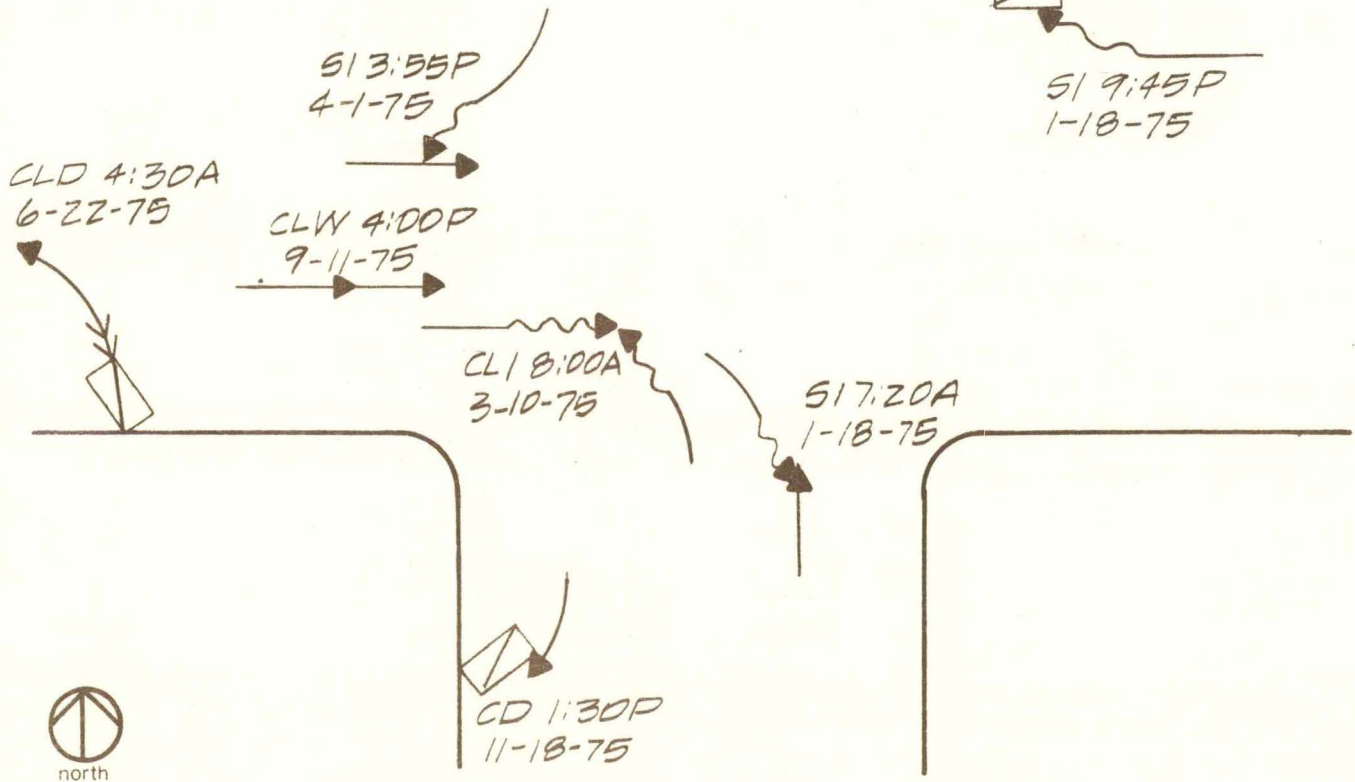
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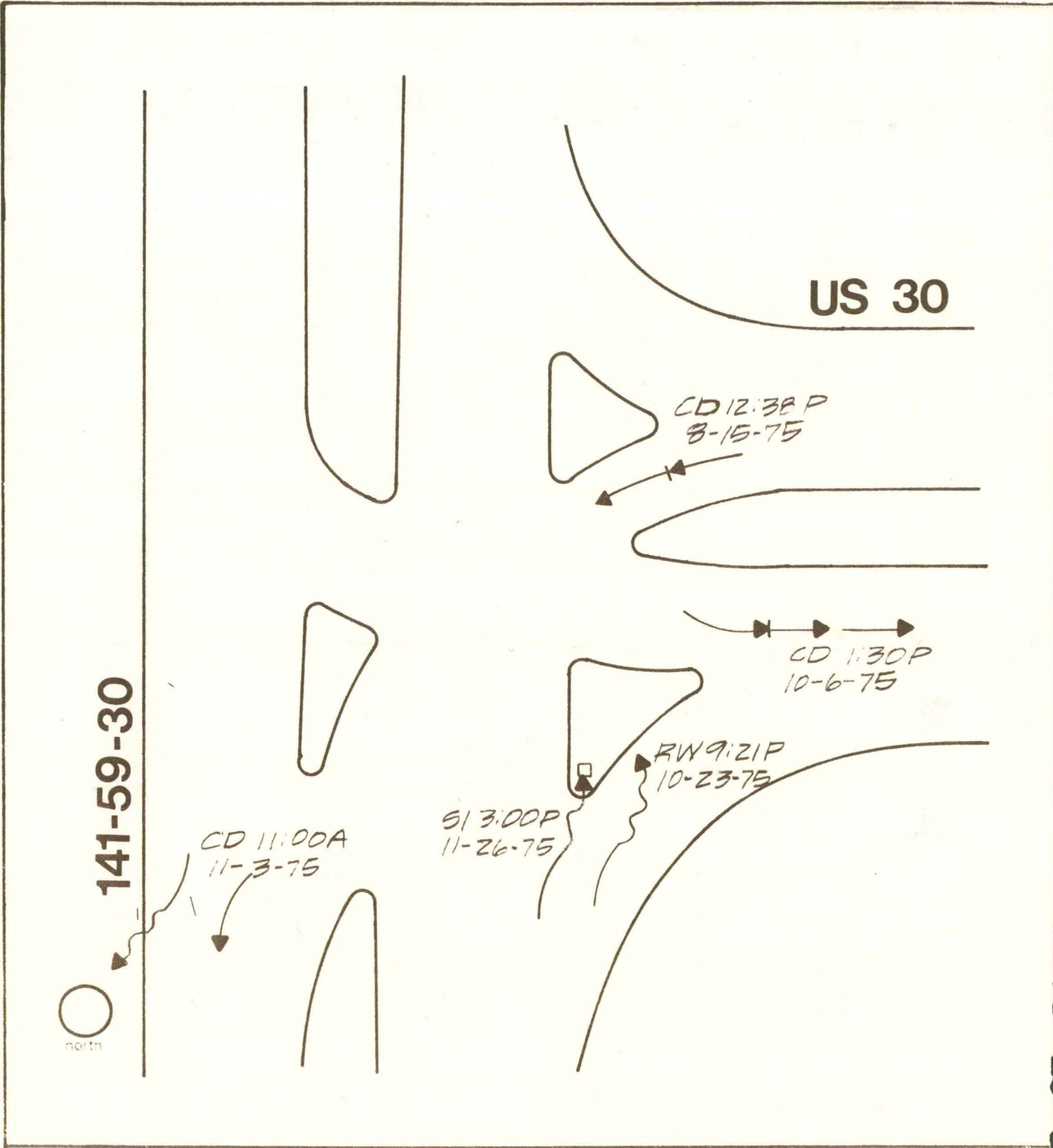
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16th

Broadway



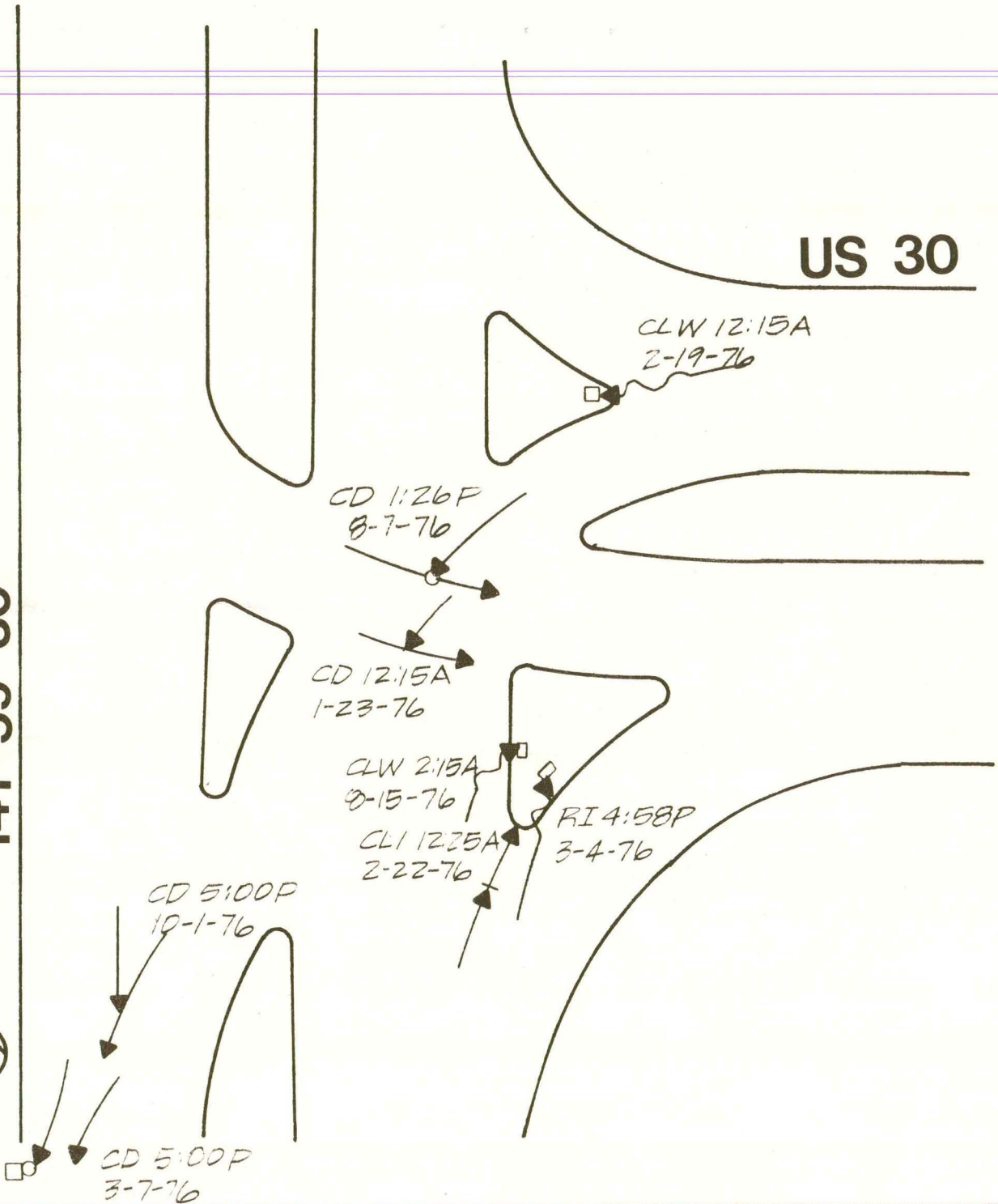
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COLLISION
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141-59-30

US 30



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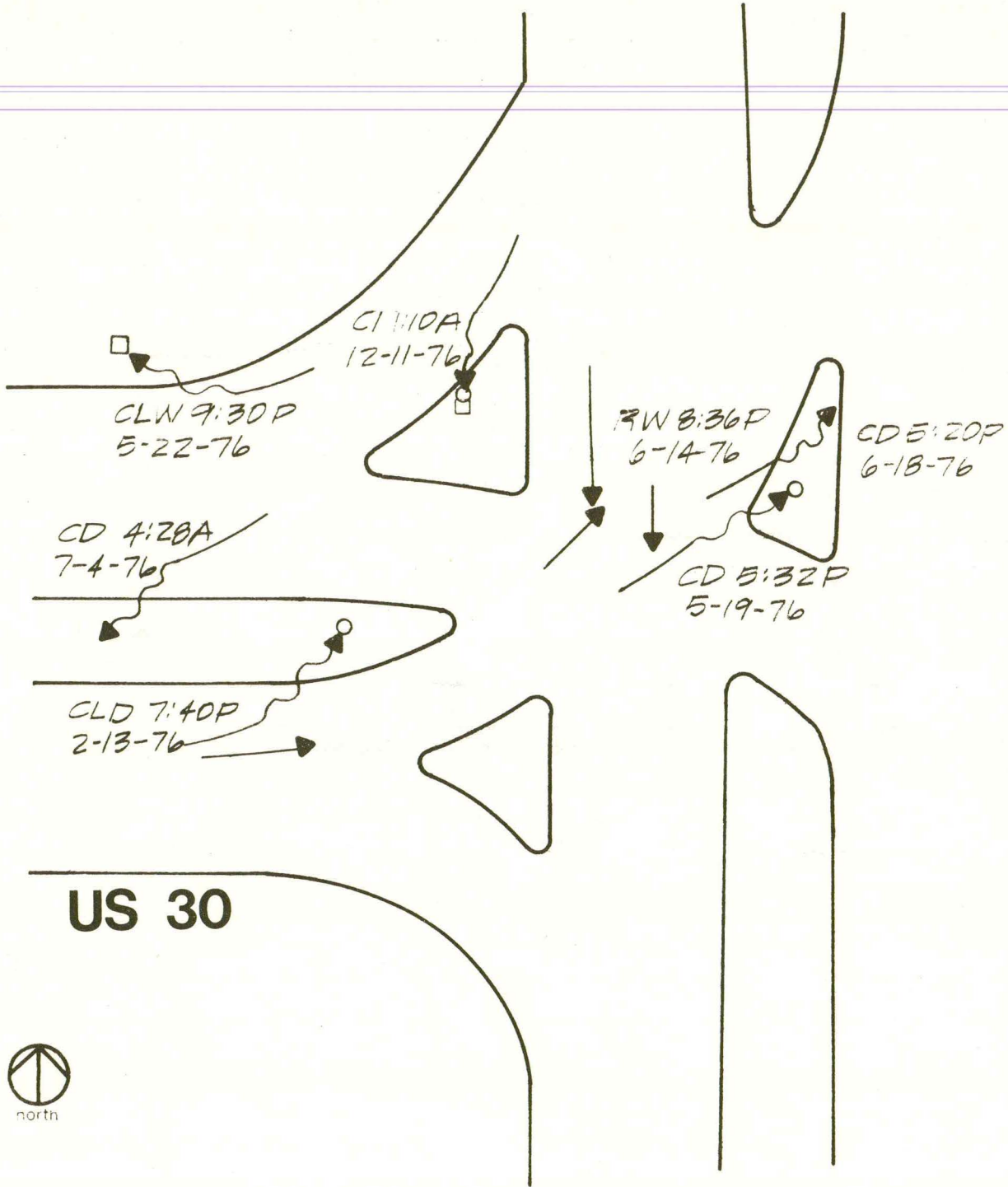
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CD 11.00A
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US 30



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141-59-30

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DIAGRAM 1976**

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