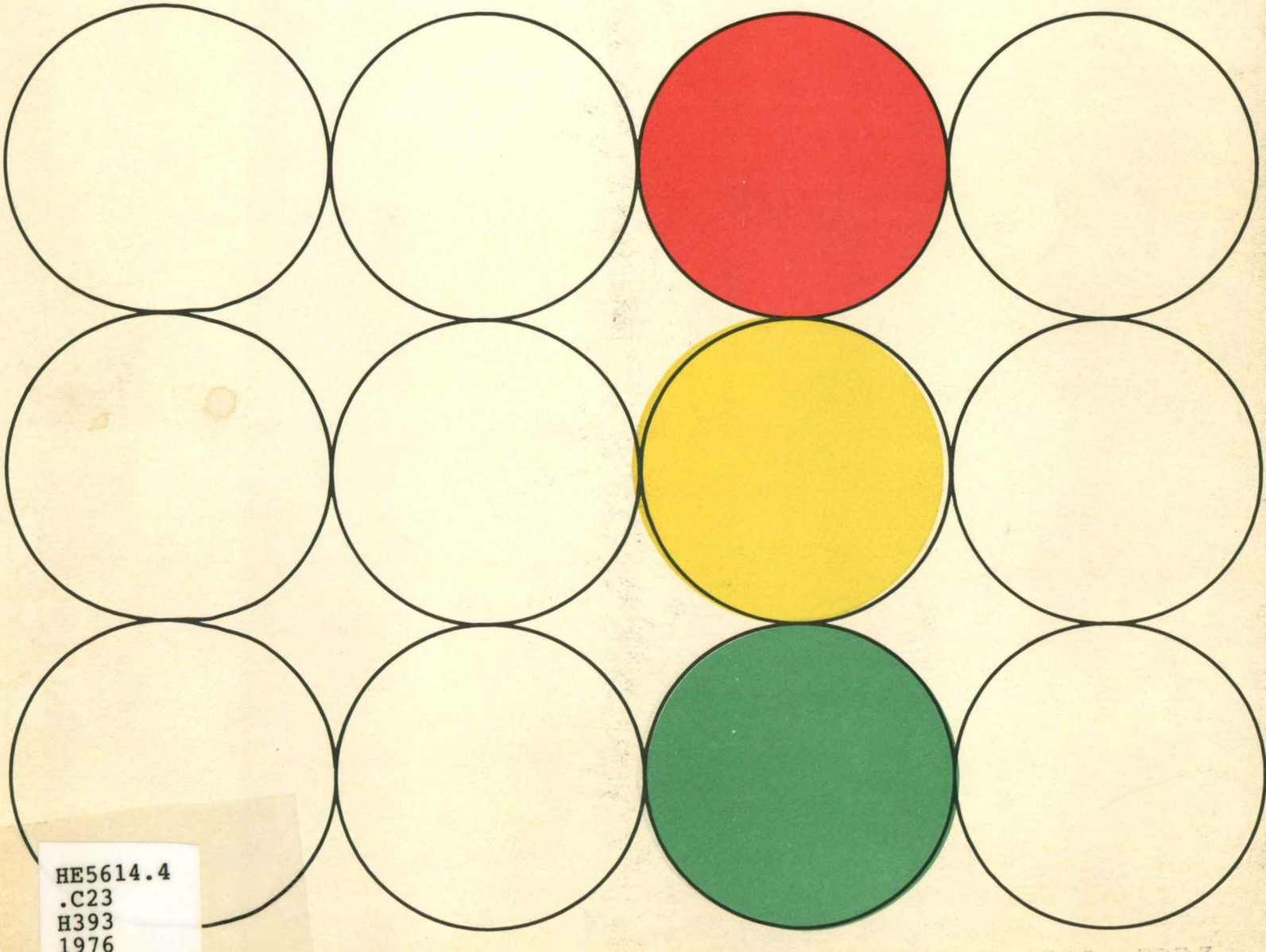
Carroll, Iowa
TRAFFIC SAFETY STUDY



HENNINGSON, DURHAM & RICHARDSON

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES
(Continued)

LIST OF TABLES

1 INTRODUCTION

As a general statement -- many of the changes recommended throughout require review and/or approval by the I.D.O.T. -- this fact is not brought out. (i.e Speed Zone changes)

Some of the changes may not be in line with I.D.O.T. policy (some striping changes).

Also

Many of the recommendations require elimination of parking -- what is the impact of this parking elimination?

would like to see funding section expanded

Progression?

Part I
INTRODUCTION

This report documents the study efforts undertaken to improve traffic safety and reduce accidents in the City of Carroll.

PART II contains a review and informal inventory of existing traffic conditions and traffic control devices currently in use on the City's street system as well as an overview of the available accident history.

In PART III, the various elements of the existing traffic controls are analyzed for suitability, conformance and completeness. Where deficiencies or other conditions were noted, appropriate improvements and modifications were developed and are presented in sketches for clarity.

PART IV of the report provides a summary of the various recommendations developed in PART III, including a priority listing, an estimate of improvement costs, and a discussion of various sources of funding for the implementation of the recommended improvements.

The APPENDIX contains material supplemental to the report, including accident collision diagrams and traffic flow diagrams.

Scope of Study

In recognition of the high incidence of traffic accidents and growing traffic demands on its streets, the City of Carroll 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 (DOH), and the Federal Highway Administration under Highway Safety Program Standard 13, issued in accordance with the Highway safety Act of 1966.

The prime objective of this study was to develop measures for the improvement of traffic safety on city streets. This was to be accomplished by the application of accepted traffic engineering practices, principals, 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 Approach

The basic study approach was a three-phase process involving the following steps:

1. Survey of existing traffic conditions, traffic control devices, and accident history.

2. Evaluation of existing system and controls to identify deficiencies and develop solutions.

3. Formulation of suggested improvements and guidelines for implementation.

This study procedure was applied to a set of study work tasks which were formulated in response to the traffic safety and circulation needs of the City. These work tasks comprise the following items:

1. Review and analyze traffic flow patterns as related to access, circulation, safety and efficiency in the movement of vehicles and pedestrians in the City, with particular emphasis upon the Downtown, school locations and adjacent areas, hospital areas, and special traffic generators. Recommended improvements where deficiencies are identified.

2. Review and analyze locations with vehicle-pedestrian conflicts and develop recommended improvements for increased pedestrian safety.

3. Study the street system to determine where traffic control changes can contribute to improved safety and operation.

4. Review railroad crossings for sight distance, crossing controls and crossing conditions.

5. Analyze all high accident locations and formulate measures to reduce accident potential at intersections with 5 or more accidents per year.

6. Review of existing traffic control devices, including the proper usage, adequacy, conformance, and placement of regulatory and warning signs, traffic signals and beacons and pavement markings. For deficient or non-conforming traffic control usages, develop changes or additions to upgrade traffic controls to standards.

7. Toward the implementing of recommended changes and improvements, prepare a general implementation plan, including cost estimates, time schedule, priorities, and funding sources.

This report documents existing traffic control device usages and on-street conditions. It then evaluates and analyzes identifiable operational and physical deficiencies and needs, and develops recommendations to correct these deficiencies to meet the traffic safety needs.

Study Area

The study area is confined to streets and roads within the corporate limits of the City of Carroll (FIGURE 1).

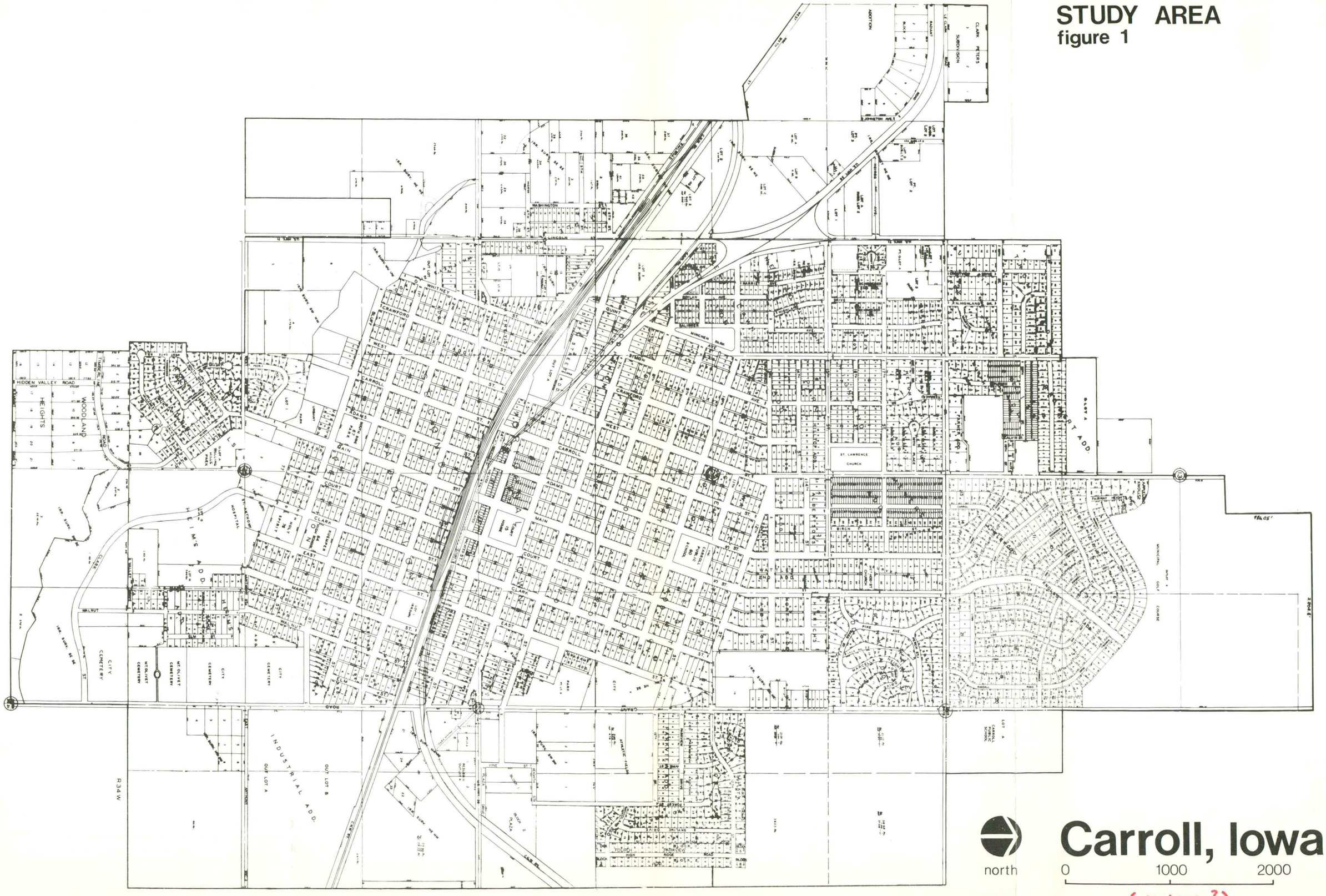
The segment of US 30 west of US 71 was not included in the analysis and evaluation of this study because this facility has recently been reconstructed and conclusions based on past records would be invalid.

Community Involvement

During the period of study the opinions and thoughts of city officials, businessmen, school officials, police, and other interested parties were actively solicited. These thoughts and opinions were evaluated and incorporated in this report.

The working relationship established with local groups and officials served as a valuable source of information for the study. It was also instrumental in establishing a two-way avenue of communication that enabled individuals on the local level to be better informed of the progress of the study.

STUDY AREA
figure 1



II EXISTING TRAFFIC CONDITIONS

Part II
EXISTING TRAFFIC CONDITION

Carroll, a city of approximately 9,800 people, is located at the junction of two federal highways - US 30 and US 71. This, together with the fact that Carroll has recently completed an ambitious urban renewal project, makes Carroll an important commercial hub in west central Iowa.

Street System

The existing street network consists of a basic grid system with a slight divergence from the cardinal directions in the City's Core Area. This minor deflection is situated in such a way that the usual multi-legged intersections common to this configuration are avoided.

The Functional Classification of streets as designated by the Carroll Public Works Department is presented in FIGURE 2. The major streets in the system are US 30 and US 71 and are designated as Primary arterials.

Other major streets are Main, Clark, West, Quint and Grant Road in the north-south direction. Streets designated as major in the east-west direction are portions of 1st, 3rd, 10th, 15th and 18th. Many of these streets particularly the east-west sections are not assigned vehicular right-of-way and therefore do not function as they are classified.

US 30 and sections of Main Street are the only four-lane routes within Carroll. The remaining streets are two-lane, two-way sections with the exception of sections of 5th Street and Adams in the CBD which are two-lane, one-way. Street widths range from 25 to 68 feet with surfaces generally in good condition.

In addition to the functional classifications the Federal Aid Urban Street System is presented in FIGURE 3. Classifications of some routes on the Federal Aid System vary from the more extensive Functional Classifications in FIGURE 2. However, the Federal Aid Classifications are included here as they will be helpful in determining possible sources of funding for future street improvement projects. It should be noted that an effort to unify the Federal Aid Classifications with local functional classifications is scheduled for early 1976.

Traffic Flow and Circulation

Traffic volume data was compiled from traffic counts performed by the State Division of Highways. Supplementary counts were performed by the Public Works Department of the City of Carroll. The composite of these counts from 1972, 1974 and 1975 are presented in FIGURE 4.

Volumes on US 30 are nearly ~~two times higher than~~ twice as high as those found on any other section of roadway in Carroll. The highest volume is 11,240 vehicles between Adams and Main. However, volumes are between 10,000 and 11,000 along the majority of US 30. At Main the street cross-section consists of four 10-foot lanes and two 8-foot parking lanes. In areas outside the CBD lane widths generally are 12-foot with no parking.

The sections of US 30 from US 71 to Carroll Street and from Clark Street to the east corporate limit contain a high concentration of commercial development. Driveway openings in these areas are quite numerous and in some areas they are poorly defined. The section between Grant Road and Vine contains 90° angle parking on both sides of the highway.

Main Street contains the second most traveled street segment in Carroll. Between 5th Street and US 30, Main carries approximately 6,130 vehicles. Here the street width is 68 feet containing four driving lanes with diagonal parking on both sides.

The two street segments described above meet to create Carroll's busiest intersection, US 30 and Main Street, which handles approximately 16,500 vehicles per day. This intersection is currently functioning at a high level of service with only minor congestion in some periods.

The intersection at US 30 and Carroll is the second busiest intersection with 14,500 movements per day. However, in this case the cross street, Carroll, is only a two-lane section. The level of operation at this intersection is not as high as US 30 and Main. Minor congestion occurs on a regular basis at the closing of business hours typically at 5:00 p.m. on weekdays. Congestion is confined to a 15-minute period and is not considered serious. General operation is very good.

Other areas with similar roadway sections have substantially lower traffic volumes. Inspection indicates levels of service at these intersections equal to or better than those mentioned above. Turning movements for intersections studied are contained in the APPENDIX of this report.

FUNCTIONAL CLASSIFICATION OF STREETS
figure 2

Primary Arterial
Minor Arterial
Collector

why not use state terms

north

Carroll, Iowa

0 1000 2000

FEDERAL AID SYSTEM
figure 3

federal-aid primary route (type I) & state primary

federal-aid secondary route

federal-aid primary route (type II)

~~Show~~ FAUS
use latest FAUS Map

north

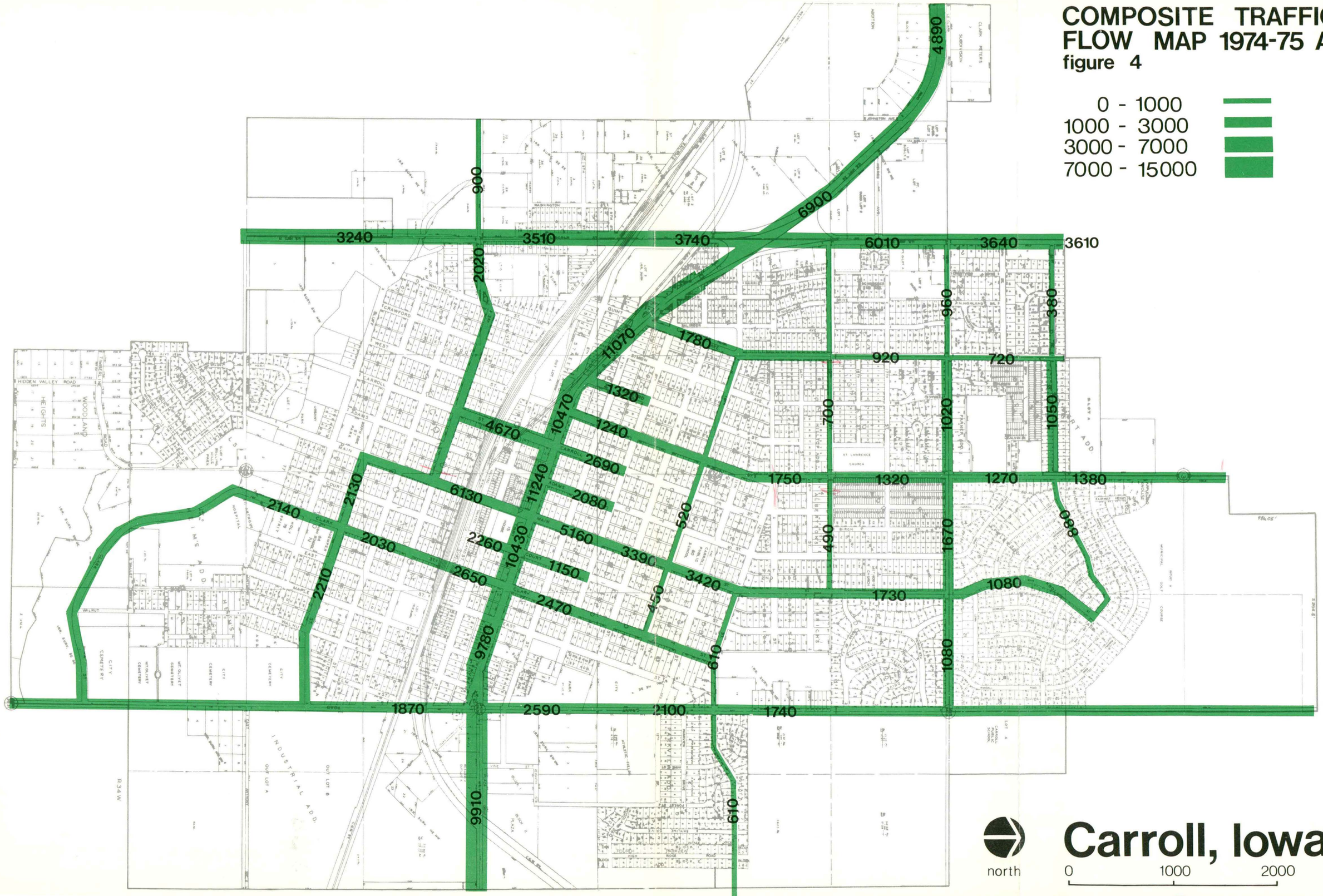
Carroll, Iowa

0 1000 2000

COMPOSITE TRAFFIC FLOW MAP 1974-75 ADT

figure 4

0 - 1000
1000 - 3000
3000 - 7000
7000 - 15000



Regional access to Carroll is provided by the two primary highways US 71 and US 30 and to a lesser extent by the rural extensions of Grant Road, 18th Street and West Street. Within Carroll the previously described street network is very efficient. Many of the local streets run continuously across town and nearly all streets are paved. FIGURE 5, Traffic Flow Continuity, shows routes unimpeded by either physical barriers or regulatory signing.

The major street system functions quite well for both local and regional traffic. East-west movements are carried almost entirely on US 30 with north-south movements channeled to US 30 on several small but functionly adequate routes. The street system can be characterized as non-congested and free-flowing. Travel times from or to all locations in town are short. In the north-south direction congested areas are easily avoided because of the abundance of suitable alternate routes. East-west movements present a slightly more difficult situation in that no suitable alternate routes exist. However, the operational characteristics of US 30 are such that delays are not overly restrictive and are infrequent.

Traffic flow in the C B D is designed to funnel traffic into the business district by using one-way streets on Adams and 5th Street. This layout is functioning smoothly with traffic entering the core area at 6th and Adams, 5th and Main and at 4th and Adams. Traffic is permitted to exit at 4th and Adams and at 5th and Carroll. This layout creates a right hand circulation pattern on US 30 and on the portion of Main north of 5th and is instrumental in reducing traffic conflicts on these busier streets.

Left turns are restricted on US 30 at Adams. This restriction together with the fact that 5th Street is closed between Court and Main requires eastern based trips to the C B D to make a left turn off US 30 at Main or Carroll. The turning movements for these locations indicate that this is not a factor contributing to operational problems because left turns are more prevalent on the eastbound leg of US 30.

Traffic Control Devices

To safely control and regulate traffic on a city street system, many different signs, signals, and pavement markings are used. An additional tool is the lighting of the streets and intersections, for improved night-time driver visibility as well as for the discouragement of crime.

one word?

In Carroll, a variety of traffic control devices are displayed 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.

These control devices and aids fall into several categories as follows:

1. Signs.
   (a) Guide - such as street signs, or mileage signs
   (b) Regulatory - such as speed limits, parking regulations, and non-signalized intersection controls
   (c) Warning - such as pedestrian crossings, curving or winding roads

2. Beacons - Flashing amber and/or red warning signals usually used in complement with traffic regulatory signs.

3. Signals.

4. Pavement Markings - Crosswalks, lane striping, delineation of parking stalls, and curb parking prohibition (usually in conjunction with regulatory signing).

5. Street Lighting - Overhead illumination of streets during darkness, usually of the incandescent or mercury-vapor type. ? far from most efficient

The usage of these devices are described in the Manual on Uniform Traffic Control Devices [1] (MUTCD) and is incorporated in the Carroll "Traffic Code". This publication guides the placement, usage, and conformance of traffic control devices on a nationwide basis to develop uniformity of traffic control across the country.

Intersection Controls

Most of the intersections in Carroll are controlled by the use of yield or stop signs. Seven intersections have traffic signals, four in the CBD and three on the outskirts at Grant Road and US 30, at US 71 and 3rd, and at 1st and Clark.

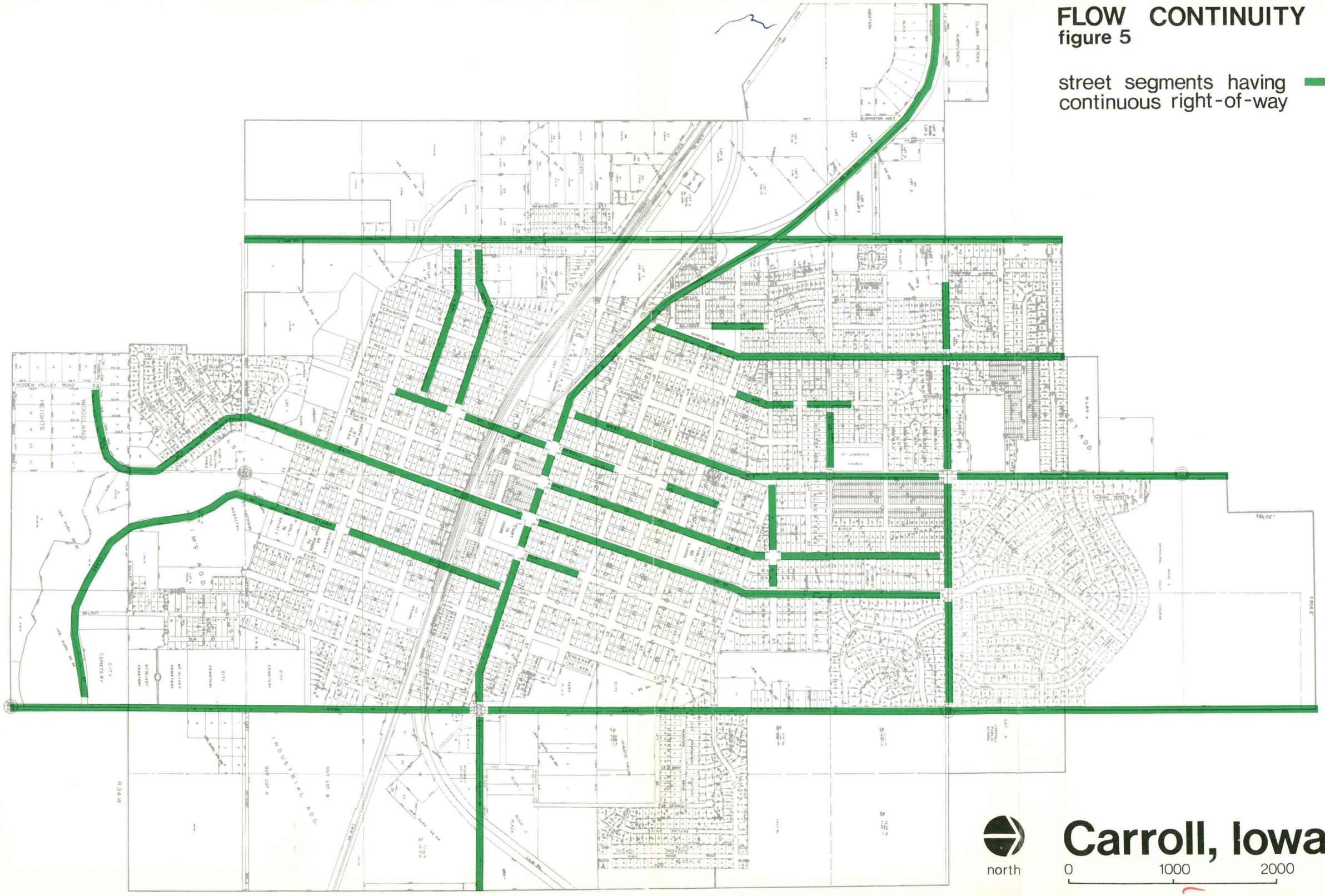
The existing intersection controls are summarized graphically in FIGURE 6. Of the more than 272 intersections in the city about 58 are controlled by stop signs and 62 are controlled by yield signs.

1. Manual on Uniform Traffic Control Devices For Streets and Highways. U.S. Department of Transportation, Federal Highway Administration, U.S. Government Printing Office, Washington, D. C., November 1970.

Be sure the City has a copy of this

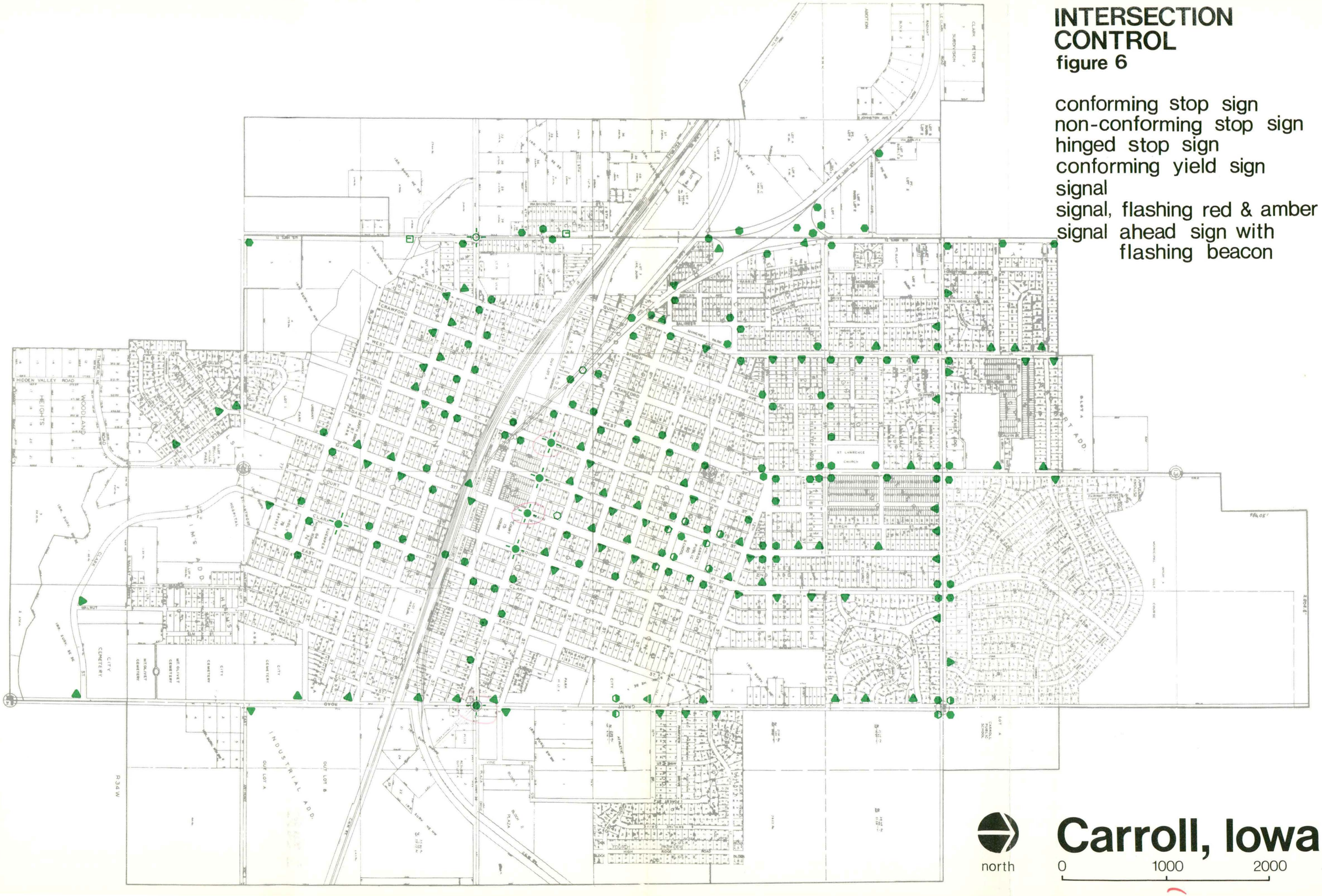
FLOW CONTINUITY
figure 5

street segments having continuous right-of-way



INTERSECTION CONTROL
figure 6

conforming stop sign
non-conforming stop sign
hinged stop sign
conforming yield sign
signal
signal, flashing red & amber
signal ahead sign with flashing beacon



north

Carroll, Iowa

0 1000 2000

I would like to see
a time/space diagram
of the signal installations
along U.S. 30 to see if the
system does indeed operate
"very efficiently" or, if
perhaps it could be modified
to allow a more reasonable
progression than ~~seems~~ apparent
in Carroll.

where is time space diagram

If you know that the system
is timed progressively -- you
must have access to a time/space
diagram.

Double Attended
~~186~~ 20 mph
410' interval
~~interconnected~~

Signal near RR
overpass is fully
actuated - non interconnected

Generally speaking, intersection controls conform to the MUTCD. However, non-conforming installations were found in several areas. Folding stop signs have been installed at six intersections, four around Carroll Public High, a fifth at Fairview and a sixth at the municipal swimming pool on Grant Road. Two locations combine stop and yield signs in the same intersection - Quint and 8th and 17th and Quint. Two intersections are controlled with stop signs on one leg only. They are 8th and ~~Clark~~ Court and 9th and ~~Clark~~ Court. A non-conforming stop sign was found at the southwest corner of 7th Street at Main.

The signalized intersections on US 30 are located at Grant Road, Court Street, Main Street, Adams Street and Carroll Street. These installations ~~are~~ timed progressively and function very efficiently.

The signal at Grant Road and US 30 is a fully actuated system with three 12" faces, two on mast arms and one on a far side pedestal, for each US 30 approach. Grant Road approaches have two 12", far side, pedestal mounted faces. Pedestrian indications are provided for the US 30 crossings.

Signalized intersections in the CBD are located at Court, Main, Adams and Carroll on US 30. These signals were installed in 1964 as nearly as can be determined and are all of the same configuration. Three indications are presented to each approach of US 30, two on pedestals and one on a mast arm. Minor streets have two indications mounted on pedestals. No pedestrian faces are provided.

Apparently some components were salvaged from previous installations. These are still located in their original positions and in some cases are poorly located from the visibility standpoint of motorists.

Right turns on red are prohibited on the minor streets at all the CBD signals. In addition left turns are prohibited off US 30 at Adams.

None of the above installations have back plates on any of the signal faces.

The corner of 1st Street and Clark has a signal installation consisting of four pedestals displaying two signal faces to each approach. All lenses are 8-inch diameter lenses and there are no pedestrian indicators. Due to intersection geometry the signal heads on the southeast corner of the intersection are located considerably back from the travelled way. The west approach signal faces at this location are also obscured by trees along the south side of the west approach.

The corner of US 71 and 3rd is signalized; however, the existing installation is burnt out and the unit is operating in a flashing mode with flashing amber indications on US 71 and flashing red on 3rd Street. Existing equipment is in poor condition and one of the pedestals has had its base damaged.

School Crossings

School crossings are found at 12 locations as shown in FIGURE 7. These crossings are marked with the new five sided school advance signs with school crossing signs and are controlled by a variety of means.

The majority of school crossings are controlled by some form of stop sign either fixed or folding. The folding signs are located at the four locations around Carroll High and one location at Fairview. A traffic signal is located at 1st and Clark for Kuemper High and a permanent four-way stop at 15th and West for St. Lawrence. Other crossings are controlled by minor street stops only except for 17th and Crawford which has no control.

Folding stop signs are activated by school custodial personnel before school each day and are taken down in the evening after the children leave. School officials indicated that the responsibility to deploy the signs was shared by several individuals to minimize the possibility of not displaying the signs.

Advanced warning signs are located on routes approaching school crossings and are located according to the MUTCD. School crossing signs are placed at all crosswalks including those with stop sign control. Such placement is contrary to the MUTCD in that proper placement of both signs with respect to the crosswalk is not possible. In some cases the improperly placed crossing sign obscures the correctly located stop sign.

The crossings themselves are in many cases obscured by on-street parking in the vicinity of the schools. Intersections where sight distance problems at school crossings were observed are Clark and Bluff, Clark and 1st, Main and 11th, Adams and 11th and to a lesser extent at Adams and 10th.

In the cases of Clark and Bluff, Clark and 1st and Main and 11th, visability of the crosswalk or the traffic control devices at the crosswalks were obscured by vegetation.

School crossings at parochial schools are supervised by junior high students and a faculty representative. Public schools provide no crossing supervision.

On-Street Parking

Outside of the downtown area, curb parking is prohibited as necessary to maintain at least one through traffic lane on residential streets, and on arterials to insure two travel lanes. Generally, two-sided parking is permitted on most city streets. In some locations, parking is prohibited near schools for student terminals and to provide space for day-time bus parking. Angle parking occurs in outlying areas at spot locations, such as near churches.

SCHOOL CROSSINGS
figure 7

crosswalk =
school advance sign S1-1 ⌂
school crossing sign S2-1 ⬟

north

Carroll, Iowa

0 1000 2000

Traffic operational problems were observed in two locations as a result of on-street parking. The hospital entrance is conveniently accessable only from Clark Street which for three blocks ~~south~~ North of the hospital has angle parking on the east and parallel parking on the west. This section is heavily congested when the schools (Holy Spirit and Kuemper) and the hospital dismiss at 3:15 p.m.

The second parking related problem is found adjacent to St. Lawrence School and results when church functions coinside with school hours. Here the congestion is primarily due to the restriction in street width with angle parking on the west and parallel parking on the east.

Within the CBD and the immediate vicinity, both angle and parallel parking are utilized in an effort to meet parking demands. Most parking spaces are metered in the areas of high demand. On-street parking is supplemented by several City-supported off-street parking lots. On-street downtown parking is summarized in FIGURE 8.

Clearances between curb parking and drives and intersections are generally minimal, with nearly every available foot of curbs being devoted to parking. Lateral clearances are satisfactory in most locations with angle parking skewed at 60 degrees and having stall widths varying from 8.5 feet to 11.5 feet.

Speed Limits

The speed limits in Carroll were found to be appropriate for the street dimensions, curb parking, abutting land uses, geometrics, and traffic controls. Speed limits of 15 MPH are required in city parks, 20 MPH in the CBD and 25 MPH in all residential and school areas. A maximum speed of 45 MPH is established for all suburban areas.

Pavement Markings

Presently, the Iowa Department of Transportation maintains or reimburses the Cities for this work. pavement markings on those highways and streets that are "US-numbered" or State highways. On US 30 and 71 these consist mainly of lane and centerline striping.

The City presently stripes angle and parallel parking stalls in the ~~downtown~~ CBD. It also maintains pedestrian crossings in downtown at the major intersections and at all school crossings.

Striping condition at the time of this study ranged from quite good in the CBD to poor at some of the outlying school crossings.

Lighting

Night driving is considered more hazardous than day driving, due primarily to the greatly reduced visibility of roadway design and control elements and physical features along the roadway. Numerous studies have indicated conclusively that adequate street lighting results in reduced night 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.

Field observations indicated that there were two levels of street lighting in Carroll. The majority of the City has lighting at intersections only. These lights consist of 175 watt mercury vapor installations and provide an adequate level of lighting, except in some of the older well developed sections. Here large trees have grown in the right-of-way resulting in midblock areas being poorly lighted.

Were these levels measured

In one section of Carroll, approximately east of Main and north of US 30, midblock lighting in addition to corner lighting is provided. In this area street lighting is very good.

The CBD is excellently lighted. Plans are presently being prepared to up-grade lighting on US 30 outside the CBD.

Railroad Crossings

Principal railroad grade crossings are found at five locations. Four of these crossings (Carroll, Main, Clark and Maple) are controlled by train approach signals and gates and provide the highest possible form of mechanical protection. No advanced warning signs are utilized at these locations.

Grant Road has railroad crossings at two locations approximately 300 feet apart. The northerly crossing is a spur line with low train volumes and is protected with a crossbuck and flashing lights only. The southerly crossing, the main line, is protected by train approach signals and gates similar to the other four crossings.

Hospital Access

St. Anthony Hospital, located one block southeast of the intersection at Bluff and Clark is accessable primarily from Clark Street. This route provides direct access to US 30 along a well signed and protected arterial.

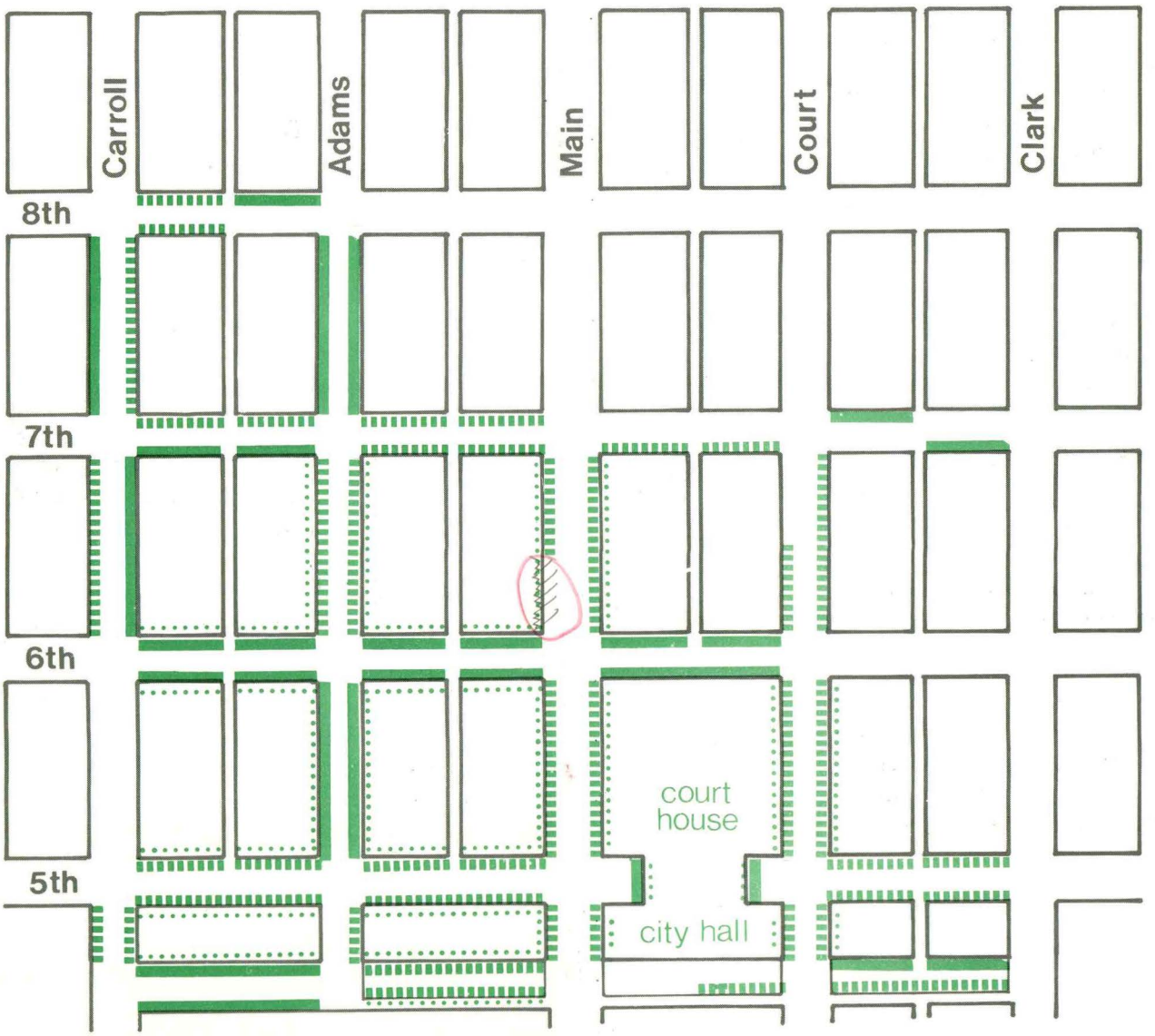
north

no scale

DOWNTOWN ON STREET PARKING

figure 8

angle parking
parallel parking
parking meters



However, Kuemper High and Holy Spirit Grade School located on Clark are provided with angle parking on the east and parallel parking on the west side of the street. This parking causes a great deal of congestion during school dismissal or major school activities.

A secondary access is available via Maple and Anthony Streets, but this route has many unprotected intersections and would be unsafe for emergency vehicles. Other routes are available using Grant Road but necessitate a fair amount of adverse travel.

The location of the railroad creates a problem in some instances when large trains block the crossings in the CBD. On these occasions hospital access for more than half of Carroll is provided only via the US 71 overpass and 3rd Street. This route requires a fairly high amount of adverse travel; however, low congestion and free flowing traffic allow for low travel times.

Accident History

Traffic accident records covering the period from January 1970 to December 1975 were made available by the City Police Department. The accident data for reported accidents were recorded on the two-page version of the "Investigating Officers Report of Motor Vehicle Accident". A newer, longer form organizing the accident information to facilitate eventual computer coding was put into use in January 1975.

Accident reports are filed by accident location according to street. A cross reference file is also provided giving driver name and accident location. This system proved very efficient for the purposes of this study.

The Police Department also maintains an accident pin map which shows the location and type of the traffic accidents to date for the current year. Maps for the past three years are displayed in the police station.

The available accident records were reviewed and studied to determine intersections or locations with a high incidence of accident occurrence, and recurring accident patterns.

From the data collected, a total of 2,476 accidents were reported between January 1970 and January 1975 to the Carroll Police Department. The highest yearly total reported was 584 accidents in 1974. The breakdown of the accidents reported to the State on a monthly basis is as follows.

TABLE I - SUMMARY OF REPORTABLE ACCIDENTS BY MONTH

	1970	1971	1972	1973	1974	Total	Avg.
January	37	51	41	54	60	243	49
February	23	30	26	33	26	138	28
March	33	29	20	47	28	157	31
April	16	27	23	36	30	132	26
May	23	22	23	41	45	154	31
June	30	31	23	45	39	168	34
July	35	24	17	30	39	145	29
August	29	21	21	31	41	143	29
September	32	31	29	34	41	167	33
October	27	19	34	35	45	160	32
November	34	32	27	37	42	172	34
December	36	38	61	56	50	241	48
Total	355	355	345	479	486	2020	404

527

NOTE: This table excludes accidents under $100 damage.

Assuming an equal level of police effort, TABLE I indicates a trend to more accidents per year. No five-year seasonal trend is apparent except that the highest monthly total generally occurs in December or January. Periods with unusually high accidents in the five-year period occurred from February through June in 1973 and from May through November in 1974.

TABLE II shows the class of accidents which occurred during the study period. This table shows that the trend toward more accidents consists almost entirely of accidents over $100 Damage. Reported accidents under $100, pedestrian accidents and bicycle accidents all have remained relatively stable.

TABLE II - CLASS OF ACCIDENTS

	1970	1971	1972	1973	1974
Accidents Over $100 Damage	355	355	330	458	476
Reported Accidents Under $100	77	96	84	90	98
Pedestrian Injury Accidents	4	3	3	7	2
Car, Bicycle, and Motor Bike Accidents	5	2	9	14	8
Total	441	456	426	569	584

No cost summaries are available for property damages to vehicles involved in accidents, for damages to personal property, or for costs of injuries incurred in the accidents, as the accident reports were often incomplete in this regard.

The types of accidents reported are shown in TABLE III. Here again increases are found in the 1973-74 period. Types of accidents with increases are two-car, car-truck, hit and run and car-fixed object accidents. The remaining types are relatively constant for the period.

TABLE III - TYPE OF ACCIDENTS

	1970	1971	1972	1973	1974	Average
Two-Car	250	254	225	295	331	271
Three-Car	11	9	12	19	11	12
Four-Car	1	1	2	1	0	1
Car-Truck	48	55	57	73	80	63
Car-Pedestrian	4	3	2	7	2	4
Hit and Run	15	4	3	22	28	14
Car-Fixed-Object	26	18	29	35	40	30
Car-Bicycle	4	2	2	5	4	3
Car-Motocycle	0	8	3	8	5	5
Truck-Truck	1	1	5	5	6	4
Driverless Car	0	5	2	2	1	2
Car-Train	3	0	0	1	0	1
Under $100 Other	1	0	0	6	11	4
Total Accidents	355	355	345	479	486	404

Personal injuries, from TABLE IV, show a trend toward improvement except for 1973. The year 1973 was particularly bad with injuries being nearly twice as frequent as either the preceeding or following year.

TABLE IV - INJURIES

	1970	1971	1972	1973	1974	Average
Personal Injuries	82	75	55	112	59	76
Fatalities	0	0	2	1	0	1

The three fatalities which occurred during the study period were of different natures. In 1972 one fatality occurred west of US 71 on US 30 in a semi-trailer-pickup accident. The roadway configuration at this location has since been changed to a four-lane configuration. The other 1972 fatality was a motorcycle-fixed obstacle accident in the 600 block of West 2nd Street.

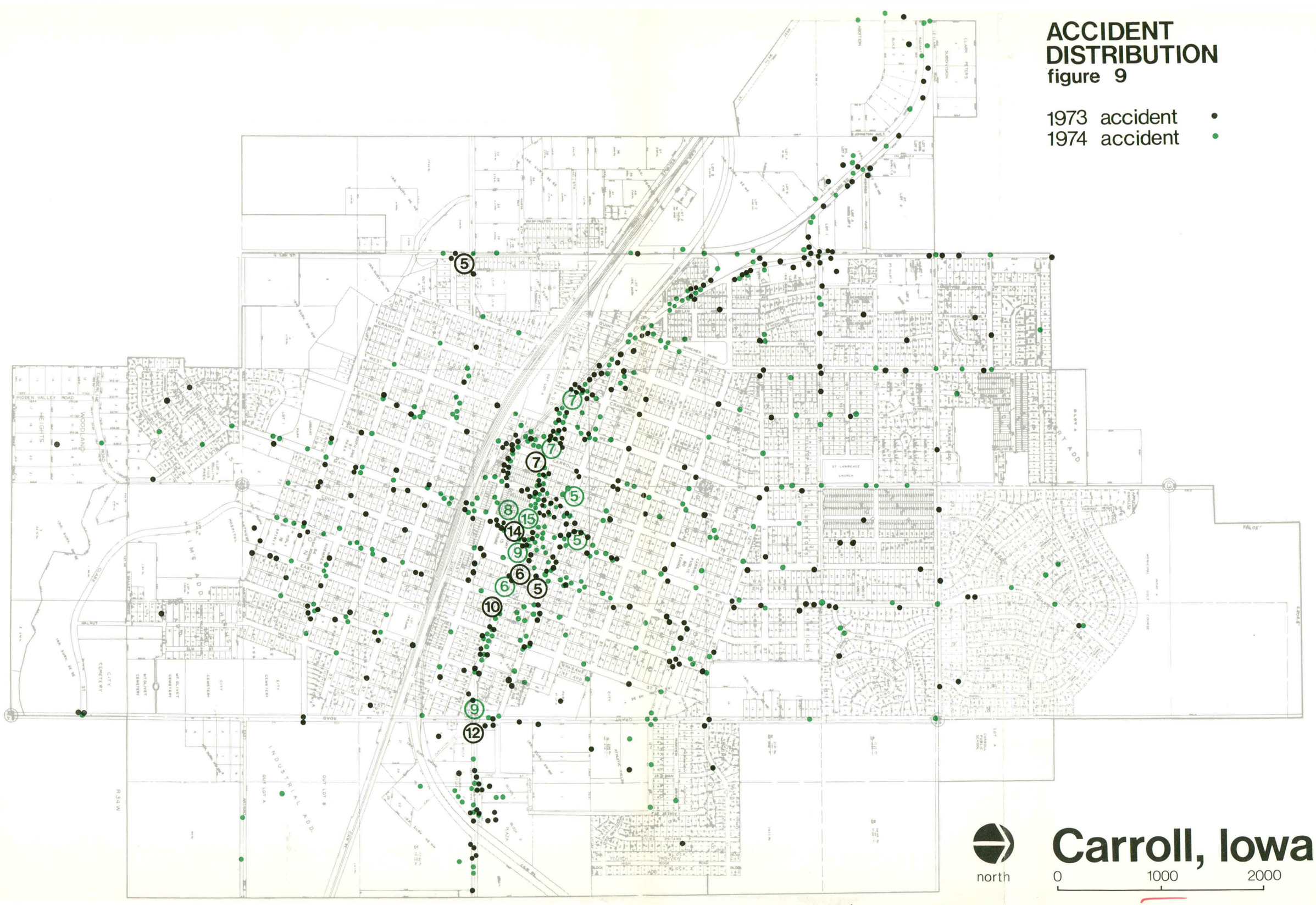
The 1973 fatality was a car-train accident on Maple Street. New signals and gate have since been added at this crossing.

A geographical summary of accident locations is presented in FIGURE 9. The map shows at a glance the areas of high accident involvement. Predominant clusters are the section of US 30 in the CBD, several other locations along US 30, and a few other scattered locations.

A high-accident location is defined for this study as an intersection with five or more accidents per year. Consequently, locations with five or more recorded accidents in one year, or locations where a readily identifiable pattern of accidents could be discerned, were considered as locations with significant accident experience. Collision diagrams for these are located in the rear of this report. Discussion of accident experience and remedial measures are presented later in this report for each problem area.

ACCIDENT DISTRIBUTION
figure 9

1973 accident •
1974 accident •



north

Carroll, Iowa

0 1000 2000

III ANALYSES & CONCLUSIONS

Part III
ANALYSES & CONCLUSIONS

In this section existing traffic control devices and their usage, accident experience, geometrics, and other elements of the existing on-street driving environment are evaluated. Where deficiencies, inconsistencies, and other operational or traffic control problems are identified, modifications and up-dates are formulated towards the lessening of these problem areas and the betterment of public safety.

In this evaluation, reference will be made to standards for signs, signals, and their proper usage contained in the Manual on Uniform Traffic Control Devices (MUTCD). These standards provide guidelines for the design, placement, operation, maintenance, and uniformity of application for all traffic control devices. For convenience, references will be made to various sections of the manual, such as Section 2A-11, which refers to standard sign colors, or to certain standard signs contained in the manual, for example, S1-1, a School Advance sign. Signs to which reference is made frequently are illustrated in the APPENDIX.

High Accident Locations

A review of the available accident records revealed several intersections and midblock locations where accident involvement was high. This was defined to be a location where five or more accidents occurred in the period of a year, or additionally a location where a readily identifiable pattern of accidents could be discerned.

The downtown is defined to include the intersections and streets in the area bounded by 7th Street on the north, West Street on the west, 4th Street on the south, and Clark Street on the east. Within this area which includes 22 intersections, eight intersections or their approaches were found to have significant accident experience.

Ten intersections outside the downtown area were found to have an accident experience over the last five years significant enough to warrant review and discussion. These high-accident locations are considered in the following discussion. Supplemental accident collision diagrams and traffic volume diagrams are located in the APPENDIX.

US 30 and US 71 Interchange. The US 30-71 interchange was considered as a single high-accident location because problems within the interchange were felt to be interrelated. Several "hot spots" show high concentrations of

similar accidents. These are the southeast quadrant (US 71 to eastbound US 30), the westbound US 30 to North US 71 exit lane, the merge to northbound US 71 from westbound US 30 and the vicinity of US 71 and 15th Street.

Accidents ranged from 7 to 18 per year during the study period. One fatality occurred in 1973 in the area. Analysis shows that the percentage of out-of-town drivers involved in accidents is higher here than on other sections of either US 71 or US 30. Also a high percentage of the accidents occur when an out-of-town driver is making an improper or illegal movement.

Study of the interchange layout reveals that the existing configuration is unable to function properly for the following reasons.

1. The present interchange is unconventional and is difficult for the motorist to understand. People unfamiliar with the area are often confused and make improper turns. In an attempt to solve the problem a large number of roadway identification signs have been utilized. However, the numerous, closely spaced, multi-message signs tend to add to the problem by distracting the motorist.

2. The general layout of the interchange is small by modern standards. Ramps are short and contain many conflict points. Spacing between decision points is also short requiring rapid decisions and providing little or no weaving distance to enter correct lanes.

3. With the upgrading of West US 30 to a four-lane section a constriction has been created at the US 71 overpass which remains two lanes. With low traffic volumes this should not cause problems. However, volumes will increase in this area and problems will eventually arise.

4. The merge lane from US 71 to eastbound US 30 has a sight distance problem that is currently contributing to accidents. The combination of horizontal and vertical alignment at this location together with the presence of a concrete retaining wall having a strip of usually un-cut grass along its top edge, obscures the view of the outside eastbound lane of US 30. The merge lane from US 30 to northbound US 71 also has a sight distance problem related to horizontal and vertical alignment.

5. Several high traffic generators are located on the westbound US 30 cutoff to North US 71. These businesses are allowed to maintain two-way access from the ramp and its approach. This encourages improper use of the cutoff and increases accident potential from left turning vehicles onto US 30.

6. With the construction of a shopping center on the southwest corner of this intersection, a substantial increase in turning volumes is expected. Some of these increases will be in areas of current high accident involvement. More frequent accidents are anticipated in these areas.

Considering the above problems in relation to the traffic volumes presented in FIGURE 4, it is apparent that the US 71-30 interchange causes many more problems than it is worth. It is therefore concluded that the existing grade separation should be removed and replaced with a modern signalized intersection as depicted in FIGURE 10.

It is recommended that the City of Carroll and the Iowa Department of Transportation begin action to thoroughly study this location with respect to area growth, future traffic demands, public safety, and possible sources of funding.

An interim solution was developed to reduce some of the existing problems with a minimum capital expenditure. FIGURE 11 shows proposed modifications as outlined below.

1. Signing should be simplified and made to conform with interchange standards. Existing composite displays should be replaced with single white on green signs of much larger size. The number of messages per display should be reduced to a minimum. Unnecessary and redundant signs should be removed.

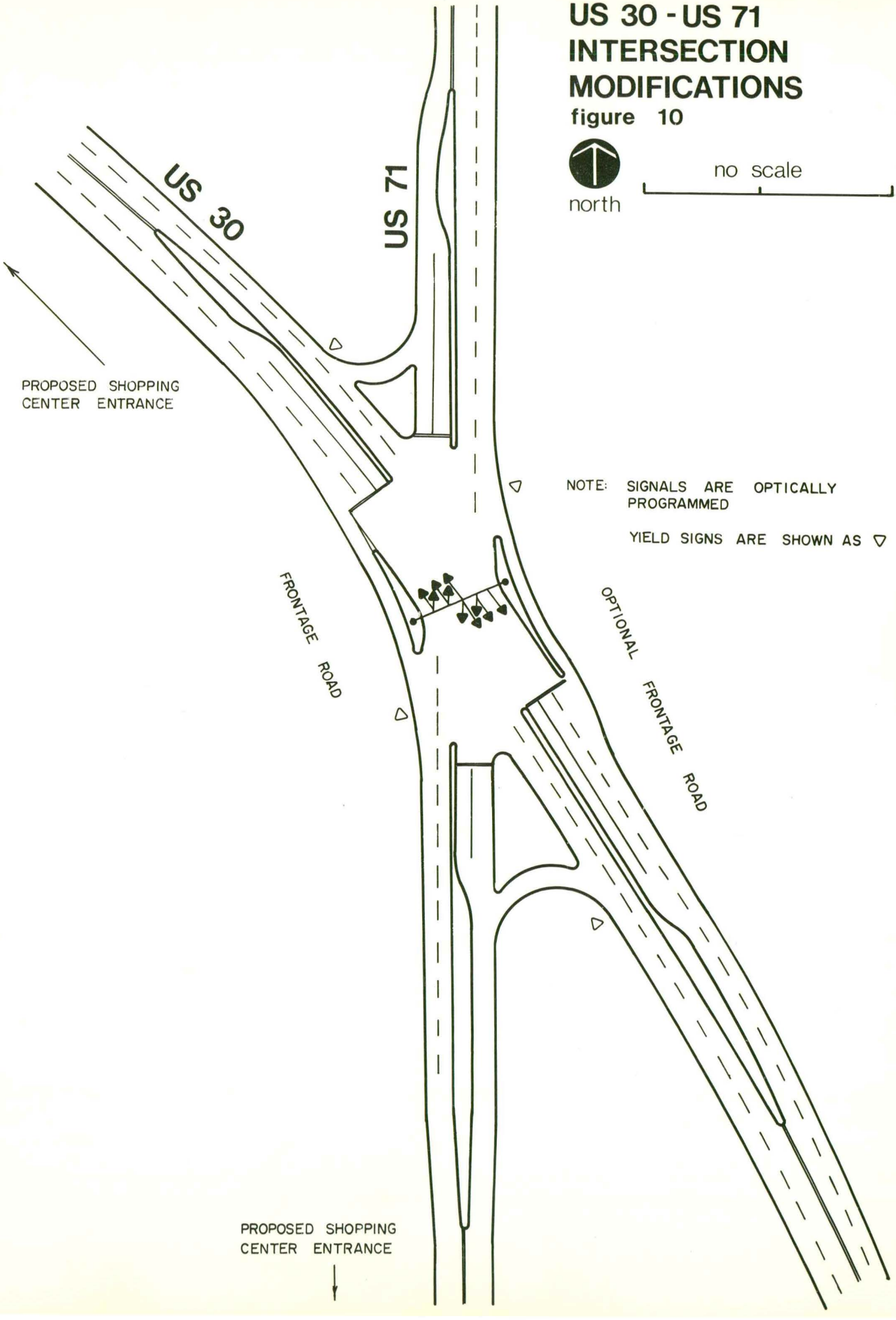
2. Curbing and islands should be constructed where indicated to prevent improper turns.

3. Left turns should be prohibited on eastbound US 30 from US 71 to 10th Street.

4. Parking should be prohibited between the back of the curb and street right-of-way line along US 30. This area is presently being used for parking by businesses and is contributing to the problem by reducing sight distances and obscuring visibility of signing.

US 30 - US 71 INTERSECTION MODIFICATIONS

figure 10



INTERIM SOLUTION US 30 - US 71 INTERCHANGE

figure 11

north

no scale

Advance Route Markers

does this belong here.

MAST ARM MOUNTED SIGNS CENTERED OVER APPROPRIATE LANES

REMOVE

SOLID WHITE STRIPE

SOLID YELLOW LINE

REMOVE

REMOVE

REMOVE

REMOVE

REMOVE

ADD TAPER ESCAPE LANE WITH CURBING

SOLID WHITE LINE

REMOVE

EXTEND ISLAND

MAST ARM MOUNTED SIGNS CENTERED OVER APPROPRIATE LANES

REMOVE

CONSTRUCT ISLAND

SOLID WHITE LINE

NO RIGHT TURN SKEWED 30° TO FAVOR US 71

US 71

US 30

JCT

What is the cost of this

US 30 and Boylan. Accident history indicates a high frequency of rearend accidents on the east approach of US 30 at this location. Inspection of the site indicates that several factors contribute to a sight distance problem.

The combination of a crest vertical curve with a horizontal curve to the right (going west on US 30) reduces sight distance particularly in the outside lane. Cars parked behind the curb line on the northeast corner of the intersection further accentuate the problem.

Very little can be done about the sight distance along US 30. However, the visibility of the intersection at Boylan can be improved by removing the parking. It is therefore recommended that parking be prohibited within the US 30 right-of-way on the northeast corner of Boylan. Also parking should be prohibited on either side of Boylan for a distance of 35 feet from the curbline of US 30 as shown in FIGURE 12.

It was observed that pavement striping on US 30 is carried through the intersection at this and other intersections. This practice should be stopped.

US 30 and Quint. US 30 and Quint is a high accident location with 6 accidents in 1974. Study of these accidents reveals no characteristic pattern. Inspection of the site indicated that the intersection is not readily apparent when approaching from either direction of US 30. This is also true at many other locations along West US 30 between Carroll Street and US 71. The presence of many driveways, some quite wide, together with the occurance of parking and maneuvering areas adjacent to the traveled way makes the recognition of intersections very difficult.

To increase intersection visibility along West US 30, the following measures are recommended. Vegetation that covers the curb should be periodically removed. Curbing along the intersection radii should be painted yellow. Where possible driveway accesses should be eliminated and a maximum curb cut should be established. Parking in areas behind the curbline that detracts from visibility of either intersections or signing should be prohibited.

US 30 and Crawford. Accidents at US 30 and Crawford contain a high frequency of side swipes in the westbound lane. The major contributor to these accidents is the fact that drivers leaving the CBD begin to accelerate and attempt to pass slower vehicles.

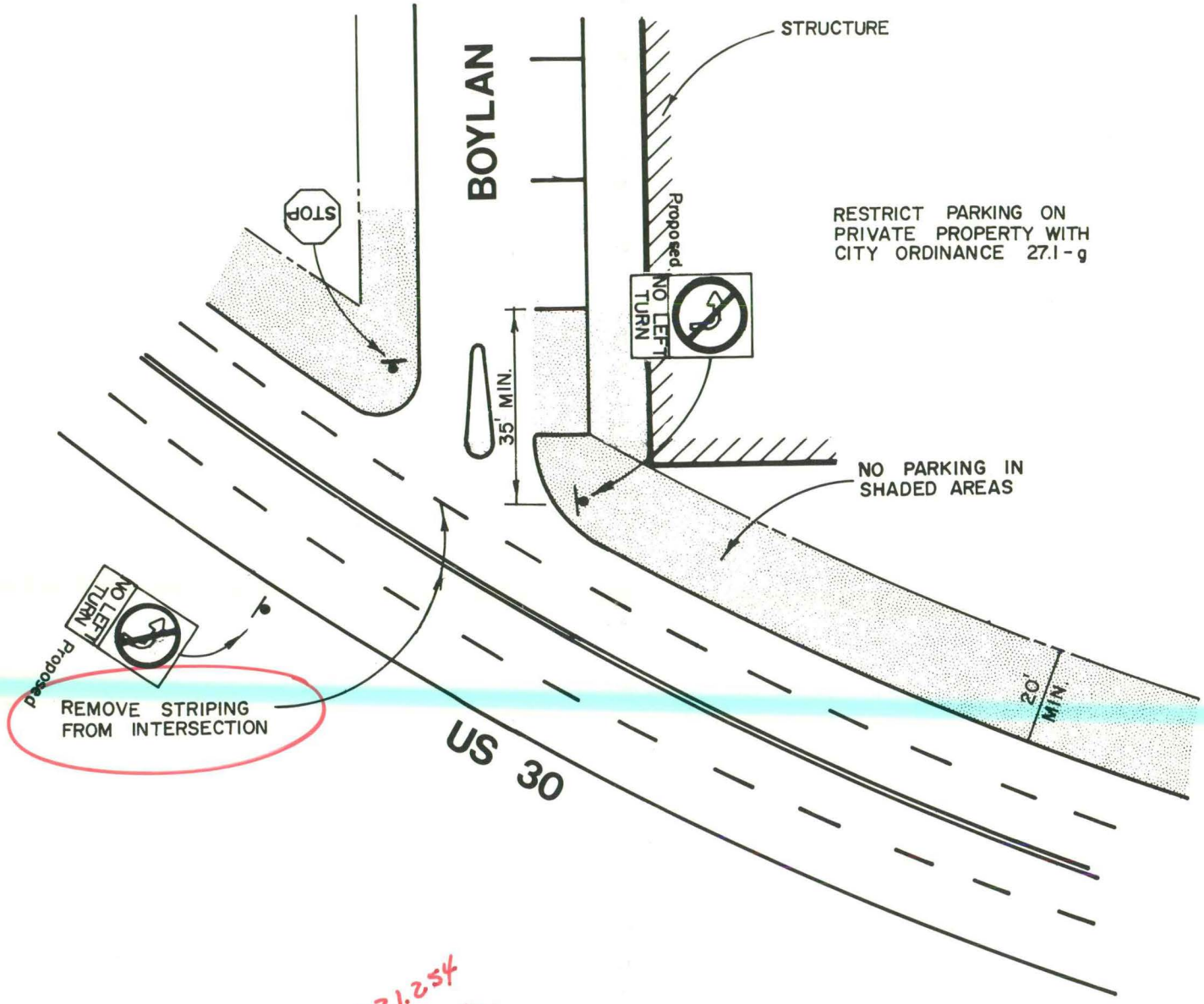
The present speed limit is 35 MPH beginning at the west side of West Street. Approximately 100 feet west of this point a 26 degree deflection in alignment occurs which restricts visibility of the preceeding roadway. This together with the above mentioned acceleration are contributing factors to the high frequency of side swipe accidents at Crawford.

IMPROVEMENTS FOR US 30 & BOYLAN

figure 12

north

no scale



§ 321.254 Iowa Code

(§ 321.290 Iowa Code)

It is recommended that the 35 MPH speed zone beginning at West Street be relocated to begin at a point approximately 50 feet east of Crawford. This will delay acceleration and lane change maneuvers until vehicles have negotiated the turn and have clear visibility of the road ahead.

Will it?

Will require review by I.D.O.T.

US 30 and West. Of the nine accidents which occurred at this location in 1974, no pattern was observed. It was observed, however, that no accidents occurred within the intersection and that all accidents originated from US 30, predominantly from the west approach.

It should be noted that the west approach of US 30 is the location of a change in horizontal alignment as well as the location of a speed reduction from 35 MPH to 25 MPH. However, there is no evidence to support a reduction in speed or to justify a physical modification. Therefore, no recommendation for modifications is made.

US 30 and Carroll. Accidents at US 30 and Carroll occurred at an average rate of seven a year for the study period and were varied in type. In 1974 there were eleven accidents. Of these, five were right angle involving vehicles from both US 30 and Carroll and six were other types between vehicles traveling on US 30 only. Few accidents were located on the west approach.

A geometric deficiency exists on the north approach of Carroll. Street width on the north is substantially wider than the south approach and is offset to the west. This requires signals for Carroll to be placed outside the driver's field of vision on the west side of the street. Construction of a larger island on the northwest corner is recommended to facilitate the relocation of traffic signals as shown in FIGURE 13.

The installation of mast arm signals on the Carroll Street approaches is also suggested.

Drive widths on the north side of US 30 should be restricted particularly on the east approach.

Parking on the south side of the west approach of US 30 was observed to have a low utilization. This fact contributes to a low accident rate on this approach. Therefore, it is recommended that parking be removed from this location.

?

It is recommended that backplates be installed on all signal faces at this intersection.

US 30 and Adams. In 1974 six accidents took place in the vicinity of US 30 and Adams. However, no two of these accidents are of a similar type. This is attributed to the fact that this location has no left turns off Adams and that Adams south of US 30 is one-way south.

Half of the accidents here are due to parking but are in different areas and are of different types.

Either way
Geometrical deficiencies found at this location consist of the signal on the northeast corner, which is outside the visibility of the west approach of US 30. The indication facing south at this corner serves only as a pedestrian indication. Therefore, this signal should be relocated to optimize visibility from US 30 as shown in FIGURE 14.

Parking on Adams north of US 30 should be restricted for a distance of 20 feet behind the crosswalk on both sides of the street as shown in FIGURE 14.

Backplates should be added to all signal faces displayed to vehicular traffic.

US 30 and Main. Review of accidents for 1974 indicates the occurrence of a high percentage of rearend and parking accidents at this location. Of the 33 accidents, 16 were parking-related and 9 were rearend. Only two right-angle accidents took place and both of these were motorists attempting left turns.

The highest number of accidents were found on the west leg of US 30 and were predominantly rearend collisions. The second most hazardous approach was on the north leg of Main where a variety of accidents occurred. ~~The other two legs contained accidents which were not related to the intersection.~~
Accidents occurred at the other two legs
Examination of the site reveals that signal placement corresponds to accident frequency with the poorest signal location for the west leg of US 30. Signal visibility for Main is deficient on both approaches.

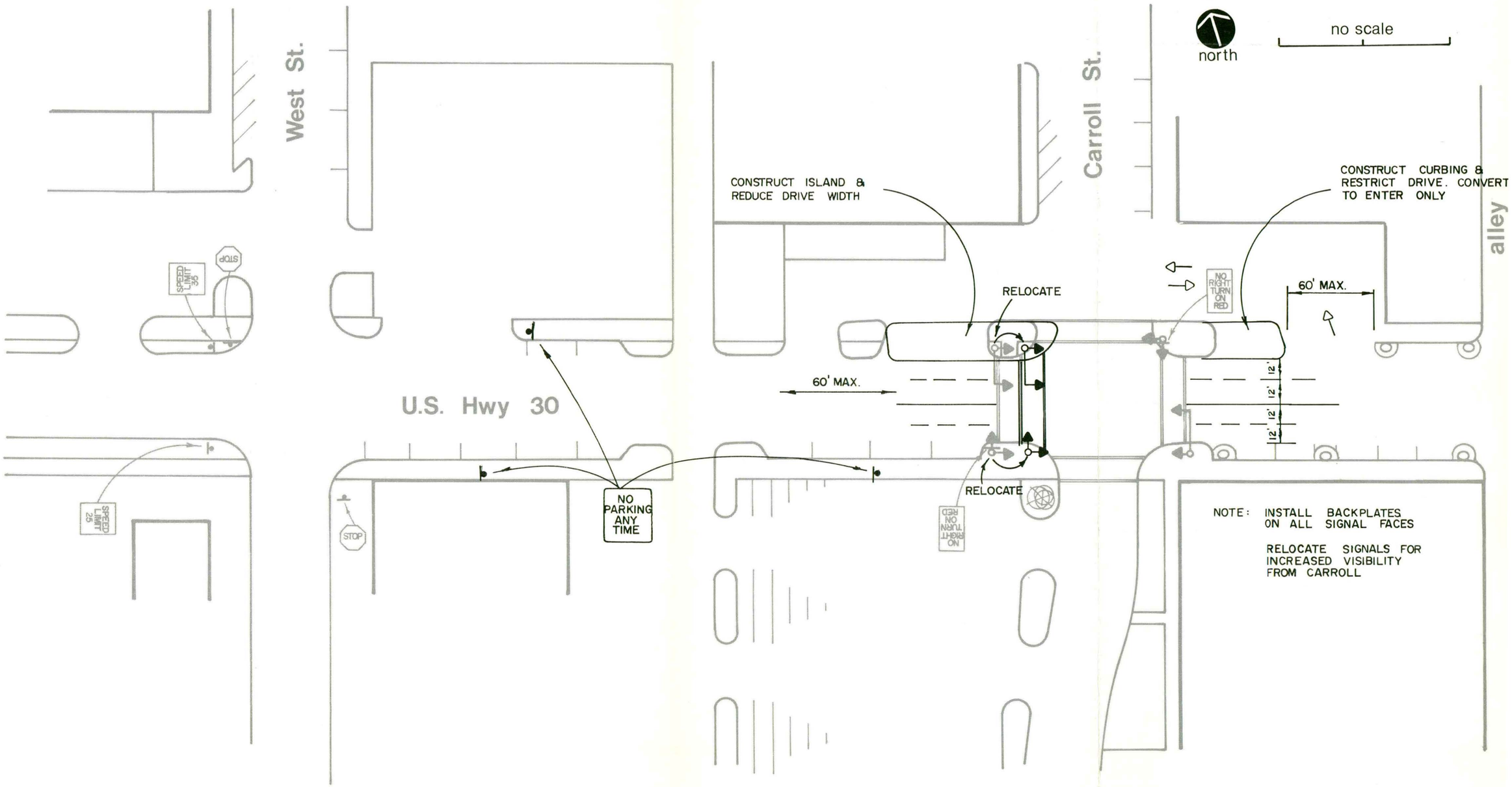
Parking is a problem from two standpoints. First, the parking operations themselves cause accidents particularly on the south leg of Main. Secondly, the presence of parked cars contributes to driver distraction and together with the narrow lanes and poor signal visibility further contributes to rear-end collisions particularly on the west approach of Main.

None of the signal faces are equipped with backplates at this installation.

Two proposals were formulated in an attempt to reduce accidents -- one, a recommended desirable solution presented in FIGURE 14 and the other a minimum solution. Any part of the recommended solution that can be implemented over and above the minimum solution will help to reduce accidents.

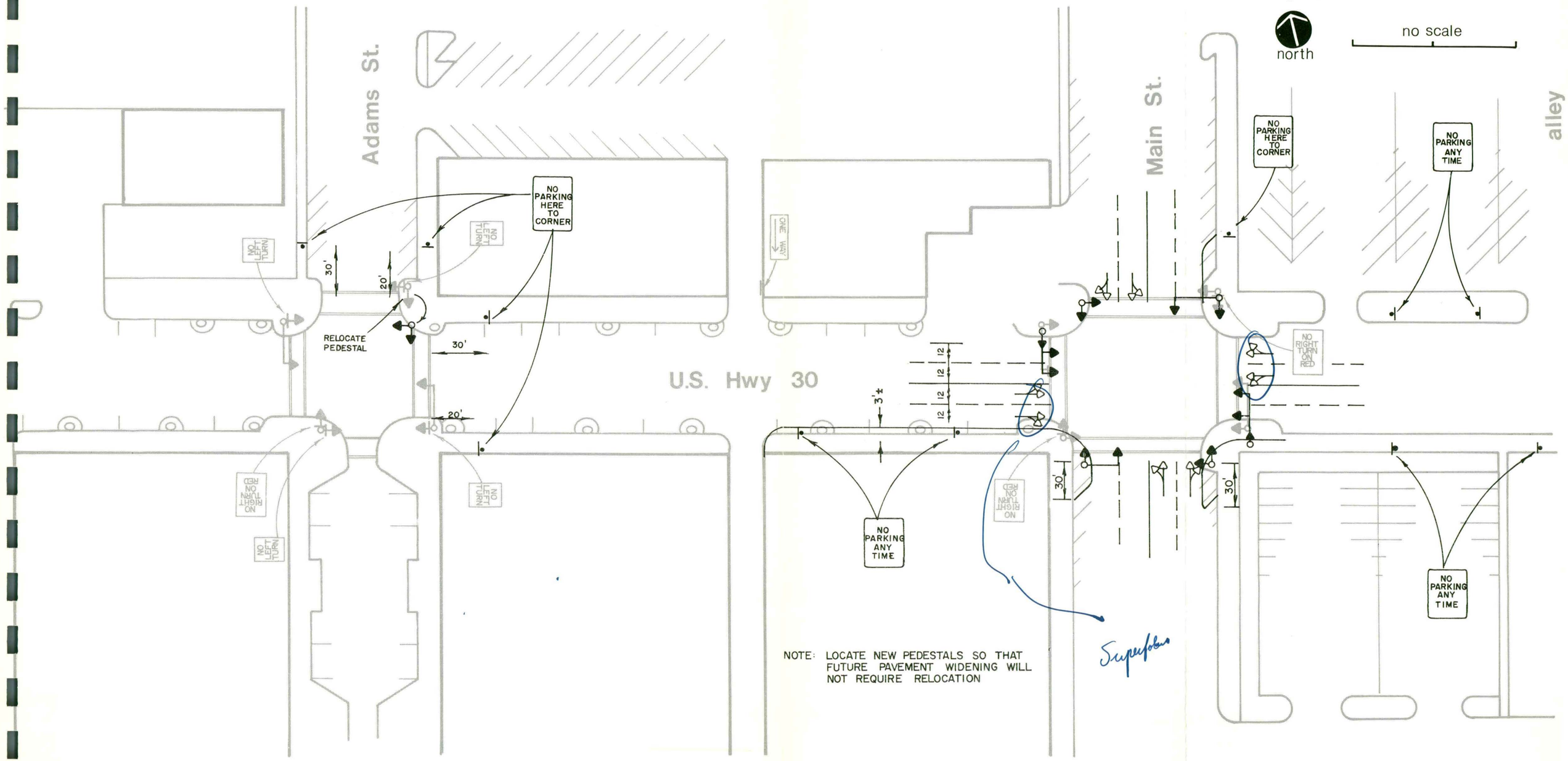
IMPROVEMENTS FOR U.S. HWY 30 Carroll to West

figure 13



IMPROVEMENTS FOR U.S. HWY 30 Main to Adams

figure 14



1. Parking should be removed a distance of 30 feet from the crosswalk on all approaches and a distance of 20 feet on the far side as shown in FIGURE 14. The north side of US 30 from Main to Court should be stripped of parking as the parking lane at this location is only 6 feet wide and is hazardous. Consideration should be given to removing parking along the south side of US 30 in this same block. The parking utilization here is very low and the one or two cars parked along this block create an undesirable parked car hazard. The removal of parking on the south of US 30 from Main for one-half block west to reduce driver distraction and to provide for lane widening to a full 12 feet is also recommended.

2. Replacement of signals to provide mast arm signals over lane centers on US 30 and at least over approach centers on Main is recommended. The installation of pedestrian indicators is also recommended. Backplates should be installed on all signal faces.

3. Curbing on the south side of US 30 should be modified as shown in FIGURE 14. Lanes should then be re-striped to provide 12-foot wide lanes. The City should begin to plan for the widening of US 30 (by removing all parking and rebuilding the north and south curb lines) to incorporate a left turn lane. The future possibility of this modification should be considered in the placement of pedestals for the new signalization.

4. Pavement markings including turn arrows as shown in FIGURE 14 should be utilized and more regularly maintained.

In the event that the above modifications cannot be implemented in the near future the following temporary measures are recommended.

1. Pavement striping should be maintained to a higher level and pavement turning arrows should be utilized as mentioned above.

2. Signals on the northeast and southeast corner should be relocated to enhance visibility from the west approach of US 30. The pedestal on the northeast corner should be moved to the southeast and the mast arm on the southeast corner should be extended so that the signal is centered over the approach.

3. Backplates should be installed on all signal faces.

US 30 and Court. Twelve accidents took place at this intersection in 1974. Ten of these involved vehicles on US 30 only and the remaining two accidents were parking accidents on Court and were not related to the intersection.

This intersection is located at the crest of a vertical curve and visibility through the intersection is not good. However, the intersection itself is clearly visible.

It is recommended that backplates be installed on all US 30 signal faces. Backplates on the Court Street faces are also suggested at the option of the City.

Removal of parking between Main and Court on US 30 was recommended previously. Parking on Court should be removed within 30 feet of the crosswalks on the approaches and 20 feet from the crosswalks on the far sides as indicated in FIGURE 15.

The signal pedestal on the southwest corner should be relocated to improve visibility on both US 30 and Court.

US 30 and Clark. Accident records for 1975 show a high frequency of the type of accidents that could be reduced with the installation of a signal. Of the 12 accidents occurring in the first six months of 1975, five were right angle involving vehicles from US 30 and Court and four were left turn accidents involving US 30 traffic only.

An eight-hour manual traffic count was made and the results indicate that the traffic volumes are sufficient to warrant the installation of signals according to the MUTCD.

It is recommended that mast arm signals be installed at US 30 and Clark as shown in FIGURE 15.

Items obstructing visibility should be removed or relocated as shown.

Pavement markings should be maintained at a more frequent interval.

US 30 and East. Nine accidents took place at this location in 1974. No trend was observed with respect to type; however, all accidents occurred either within the intersection or on the east leg of US 30.

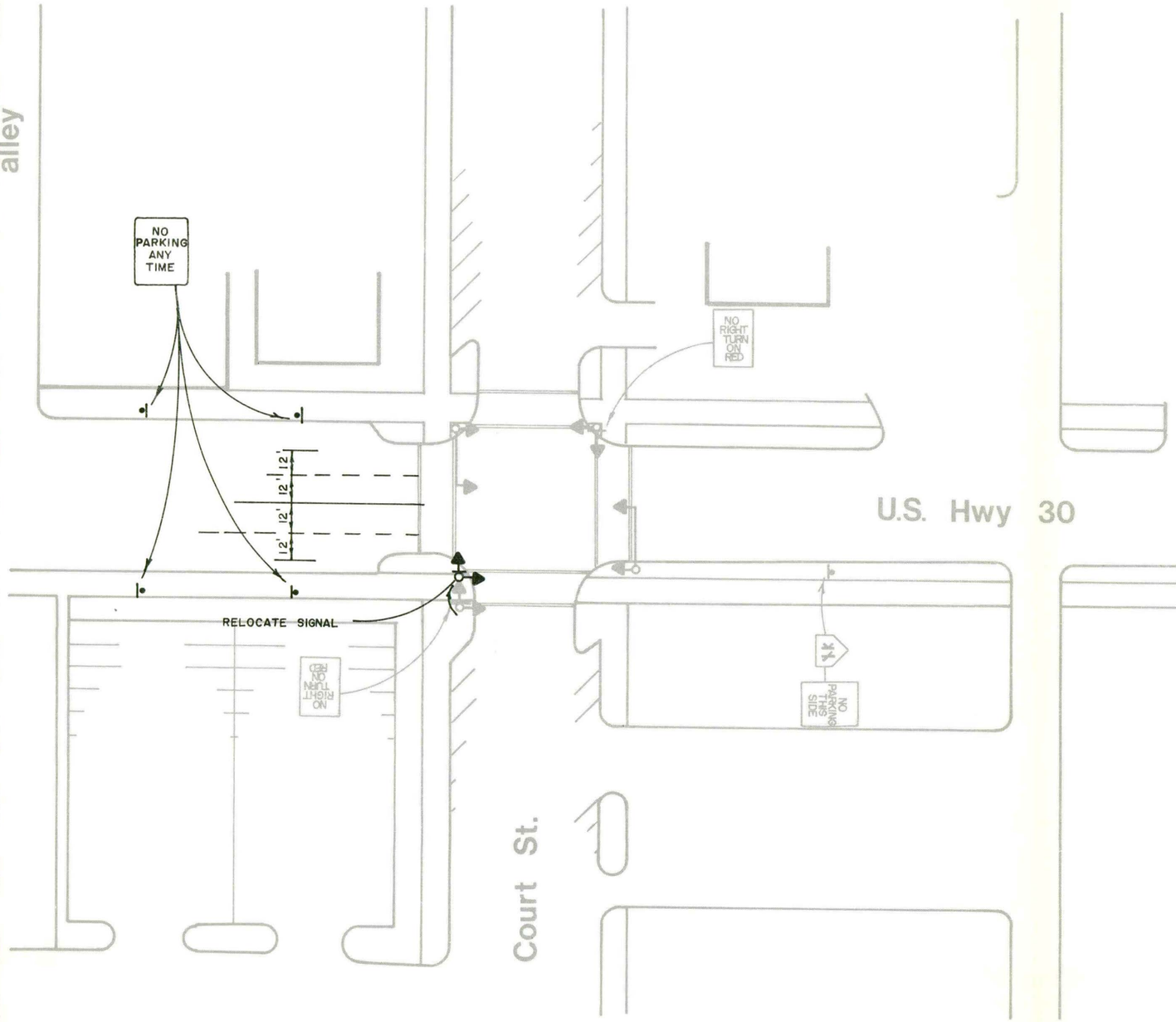
Field inspection reveals that the presence of an intersection is not readily apparent from either US 30 approach. However, visibility from all legs

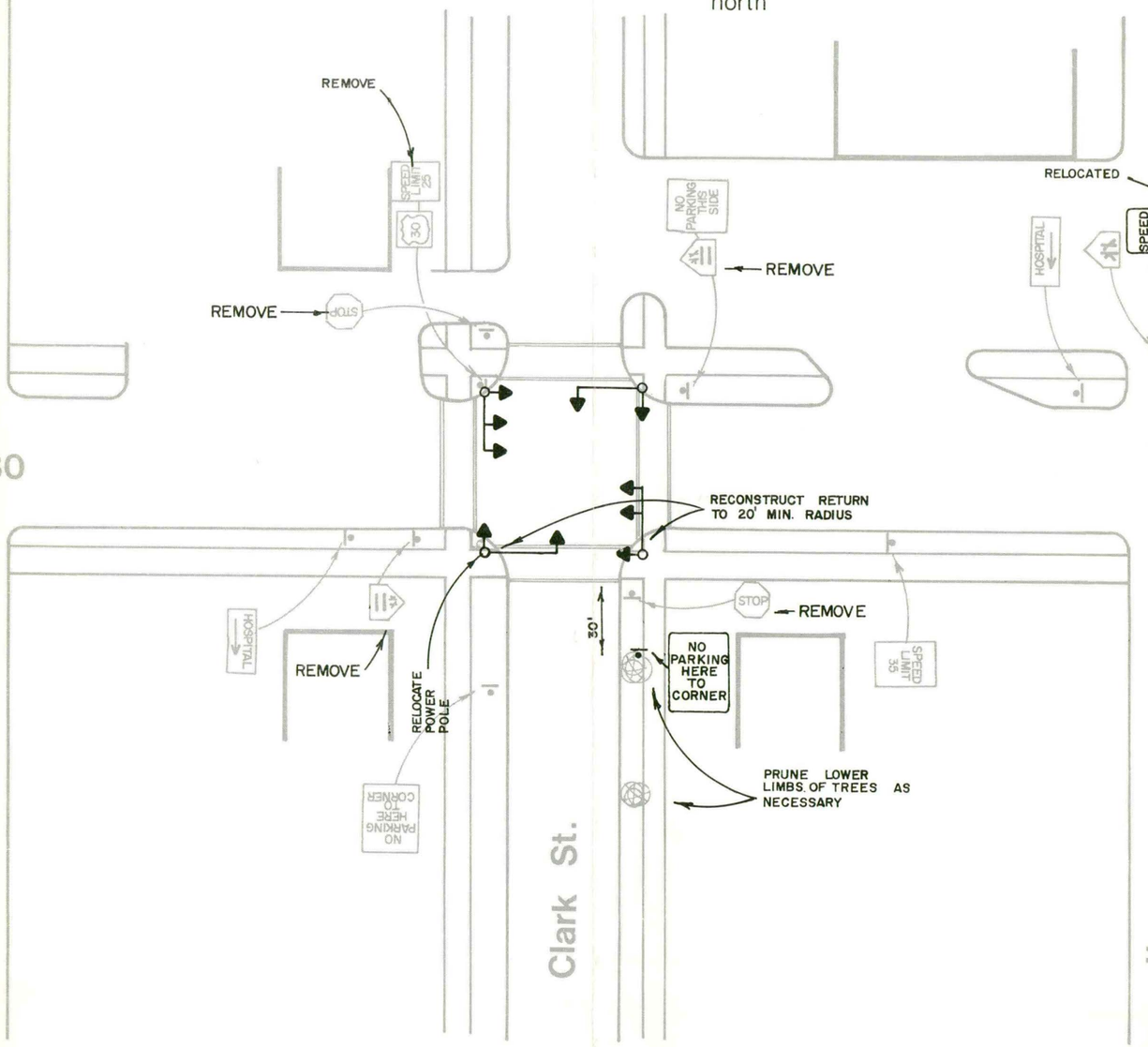
IMPROVEMENTS FOR U.S. HWY 30 Clark to Court

figure 15

north

no scale





is quite good. This is attributable to the fact that service stations are located on three corners of the intersection.

In an effort to enhance the location of the intersection it is recommended that the radii curbing be painted yellow.

Service stations should not be permitted to place signs within the right-of-way.

Possibly a problem with enforcement via the ordinance

Police surveillance of the intersection should be increased to determine if motorists are observing the stops on East.

US 30 and Grant Road. Accidents at US 30 and Grant Road for 1974 contained many turning types, particularly from US 30 to southbound Grant Road. Six of the eleven accidents at this location were of this type.

New signalization has been installed at this location. This installation should reduce these accidents.

It is recommended that foliage around the southwest corner be removed and that pavement markings be maintained on a more regular basis.

7th and Adams. Accidents at this intersection are of two types - right angle and parking.

Field inspection indicates that the intersection has been modified on many different occasions and the configuration on every corner is different. Parking is prominent on all legs and the intersection is controlled with yield signs on 7th Street.

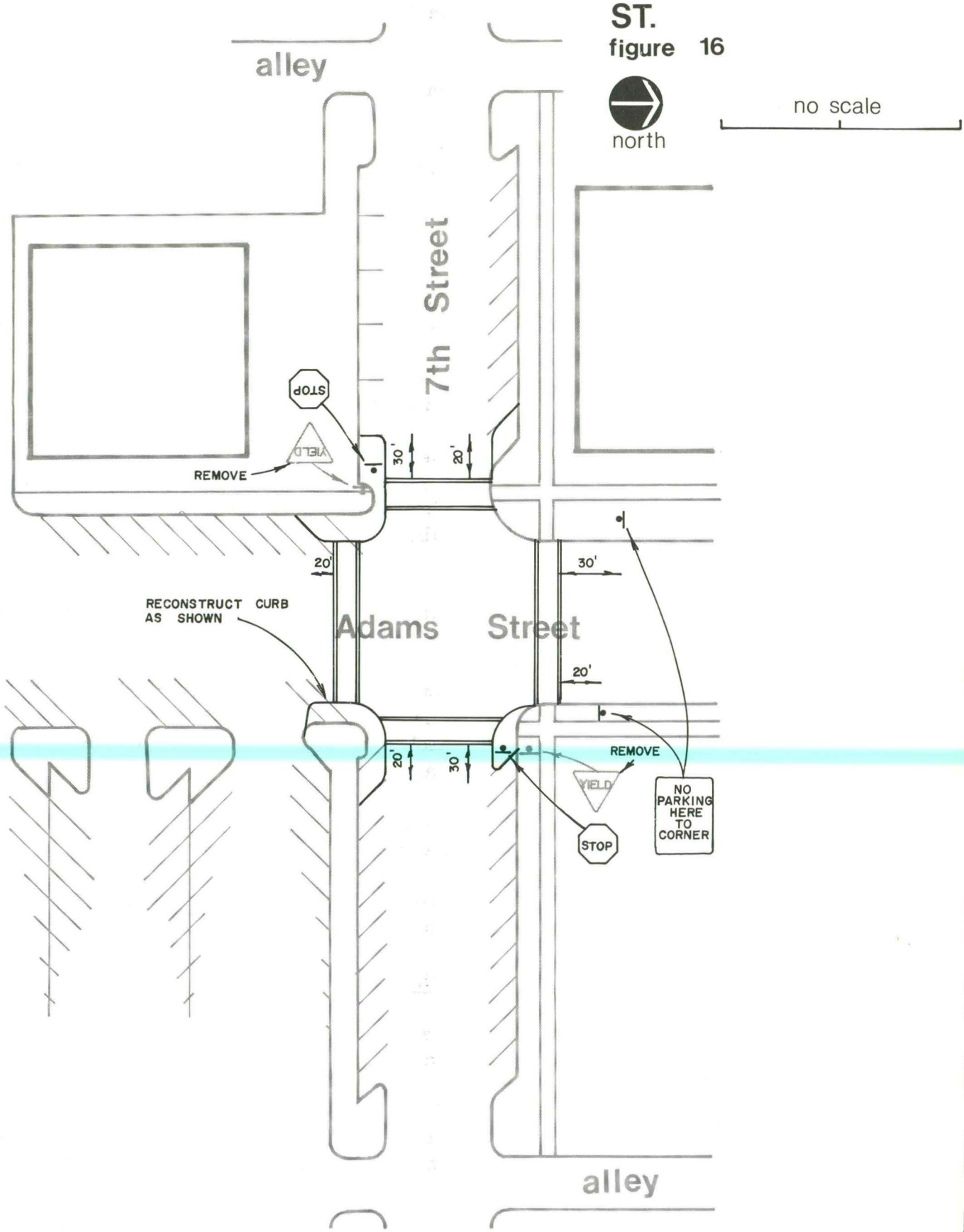
Recommended improvements are presented in FIGURE 16. Curb radii on all corners are reconstructed to create equal approach widths and to align traffic lanes on opposite legs. Parking should be prohibited as indicated and the present yield sign control should be changed to stop signs. Stops should be strictly enforced to eliminate rolling stops which are a problem at many locations.

Court and 7th. Review of 1973 and 1974 accidents at 7th and Court indicates two frequent accident types - right angle and parking.

Field inspection reveals that sight distance is poor on the south, east and west legs at this location. High ground on the southwest corner and several large trees on the northeast contribute to the problem. Parking on all legs tends to compound the problem.

IMPROVEMENTS AT ADAMS ST. & 7TH ST.

figure 16



It is recommended that stop signs be installed on the 7th Street approaches to replace the existing yield signs.

Parking should be removed as shown in Figure 17.

Consideration should be given to the removal of trees on the northeast corner if accidents caused by vehicles from the east approach continue to occur.

US 71 and 3rd. Review of accidents from 1971 through 1975 indicate a steady trend toward lower accidents at this location. Observation of accident type indicates that the majority of accidents occurring at this location are related to the presence of the traffic signal. Traffic counts were made and it was found that traffic volumes were too low to warrant signalization.

The signal is in a state of disrepair and can only present a flashing display. One pedestal has been damaged and is leaning to the west.

The intersection in general is not clearly defined. Corner radii are small and the presence of several power poles as well as the signal pedestals themselves clutter the approaches and obstruct visibility. Delineators mounted on 4-inch posts have been added at the corners in an effort to protect the signal installation.

It is recommended that the modifications shown in FIGURE 18 be made as outlined below.

1. The existing signals should be removed and replaced with stop signs on 3rd Street. A flashing beacon over the center of the intersection should be installed indicating flashing red to 3rd and flashing amber to US 71.

2. Intersection returns should be rebuilt to provide turning radii large enough to accommodate truck traffic.

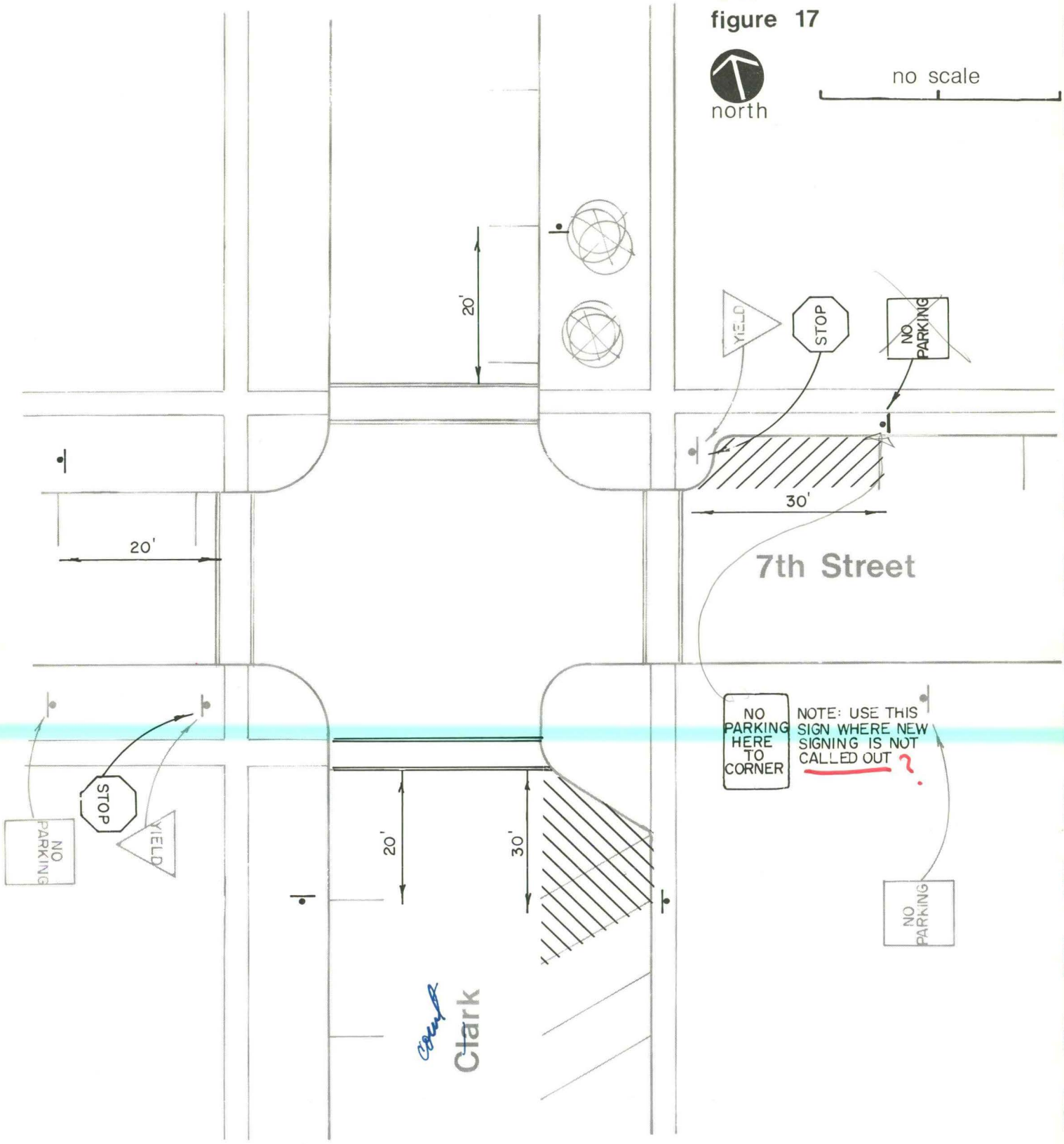
3. Fixed obstacles and power poles should be relocated to provide proper side clearance along the roadway.

Main Street Between 5th and 6th, 5th Street Between Adams and Carroll, Adams Street Between 6th and 7th. These three blocks have high accidents as defined in this study. The accidents along these blocks are caused almost entirely by angle parking and are not so much a public hazard as a public nuisance.

The City should be aware of the fact that these accidents are the price paid for a street with angle parking when evaluating the need for that parking. The

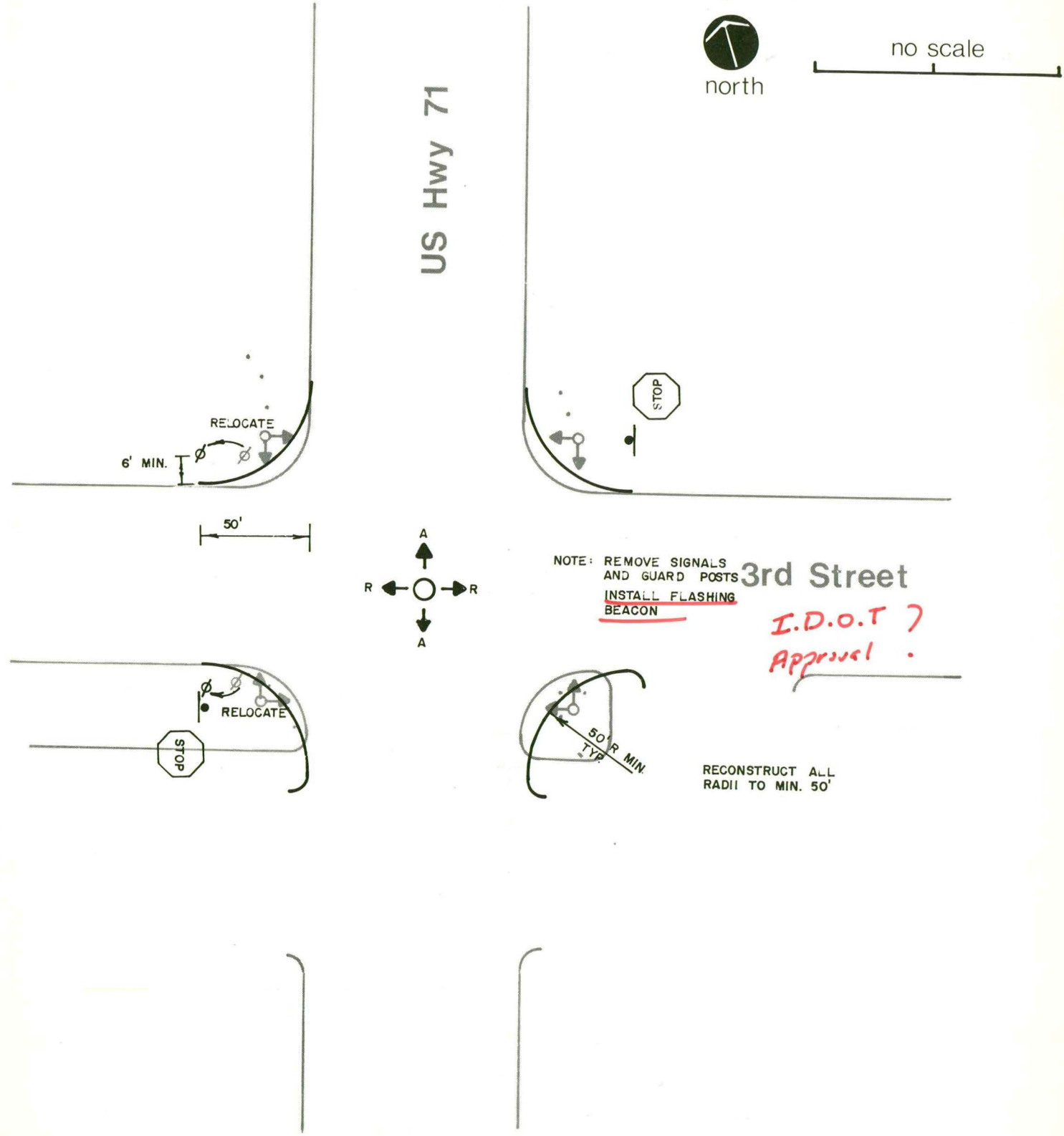
IMPROVEMENTS AT ~~CLARK~~ Court ST. & 7TH ST.

figure 17



IMPROVEMENTS AT US 71 & 3RD ST.

figure 18



Suggest that extend do not use angle parking

Fedo will not approve diagonal parking on extend

City should also be aware that the frequency of these accidents will increase as traffic volumes increase.

Field inspection of the above sites indicated that all locations utilized 60 degree parking and that stall widths varied from 9 to 10.5 feet. Drive widths were adequate for this configuration.

To reduce accident frequency, it is recommended that stall angles be reduced to 45 degrees to improve visibility to the rear for cars leaving parking stalls. Parking should be removed within 30 feet of all crosswalk approaches and 20 feet from crosswalks on the far side of intersections.

It is recommended that the north side of 5th Street be converted to parallel parking from Main to Carroll.

School Crossings

A review of school crossings in Carroll revealed deficiencies in most locations. Discussions with citizens and both city and school officials indicate that concerned individuals have made efforts to improve the crossings and have had some success. However, some problems still exist and some locations are not in conformance with the MUTCD.

Carroll Public School. The crossings adjacent to Carroll Public School have generated the most public interest in past years. FIGURE 19 shows these crossings and the proposed modifications.

The procedure followed in developing these modifications are as follows.

1. The probability of vehicular-pedestrian conflict is limited by reducing the major street crossing to one on Main and one on Adams.

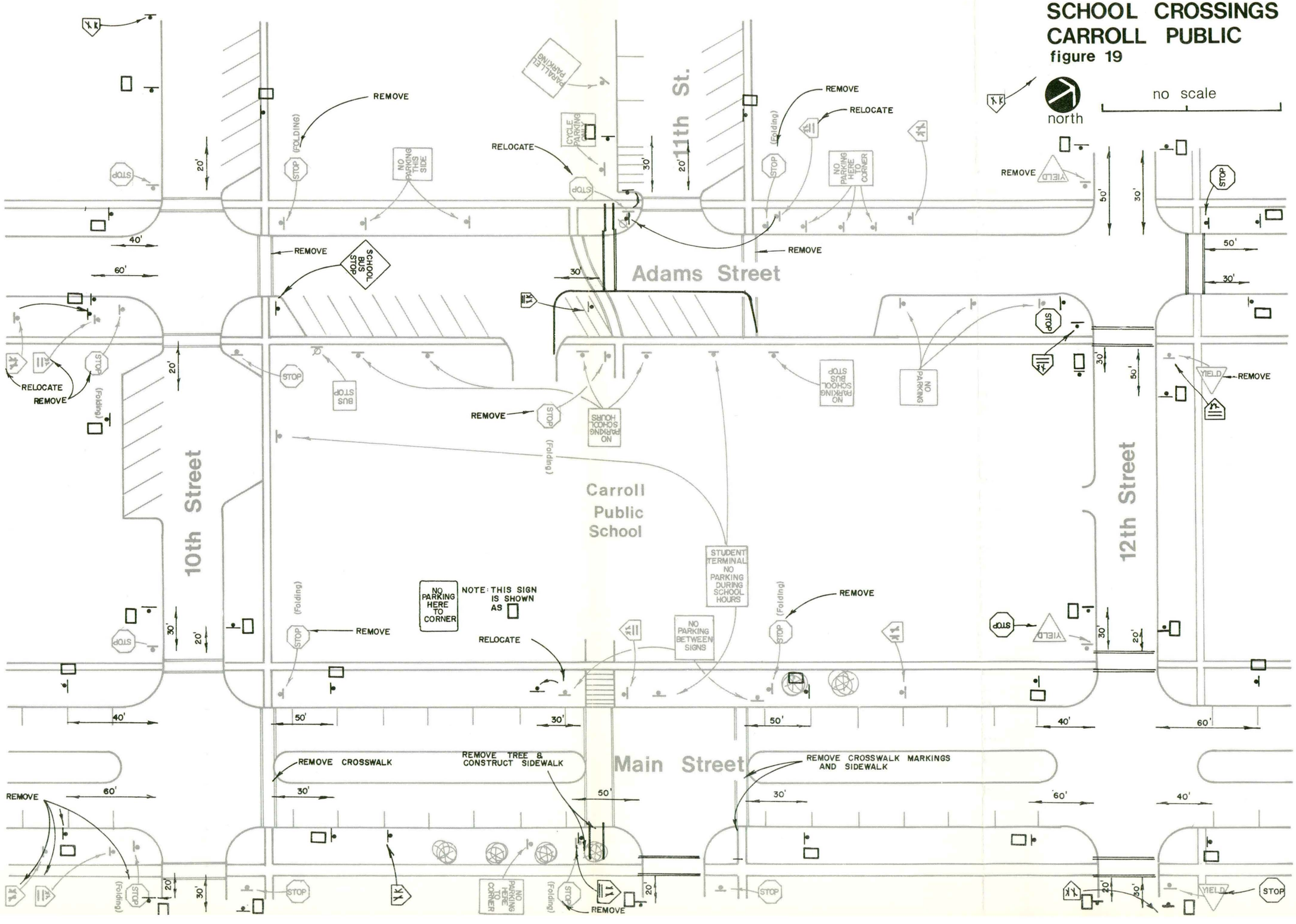
2. Minor street crossing control is changed to stop signs at crossings not so signed.

3. The visibility of all intersections is improved by the elimination of parking near crosswalks on the approach and on the far side (distances vary as indicated on FIGURES).

4. Visibility is also improved by the removal of vegetation that presently reduces sight distances.

5. Non-conforming folding stop signs are removed.

SCHOOL CROSSINGS
CARROLL PUBLIC
figure 19



6. Sidewalks are constructed where necessary.

7. A pedestrian island is located at 11th and Adams to segregate crosswalk and parking areas and to increase the visibility of the crossing and intersection as well as the school crossing sign.

In addition to the above modifications a program of education and supervision should be established. The education part should consist of a program whereby the children and parents are informed of the correct paths to and from school. These paths being as direct as possible and with major street crossings at designated locations only.

Supervision of students should be provided by faculty supervised student crossing patrols at all six intersections shown on FIGURE 19. These guards should be responsible for seeing that children use the correct crossings and stay within the crosswalk. They should not enter the street or attempt to control traffic in any way.

PART VII - E MUTCD should be consulted with respect to establishing school crossing guards.

It should be noted by the City of Carroll and Carroll Public Schools that the use of folding stop signs is contrary to Iowa law. The continued use of this form of crossing control is hazardous and in the event of accident there is a possibility that the school system and the City could be found liable.

Fairview School. Fairview is one of the best school crossings with respect to visibility. Because of this, approach speeds from Grant Road or the east leg of 18th are not considered hazardous. However, the addition of school speed limit signs is advisable.

FIGURE 20 indicates signing changes recommended at this location. They consist of the removal of folding stop signs and the relocation of school crossing signs.

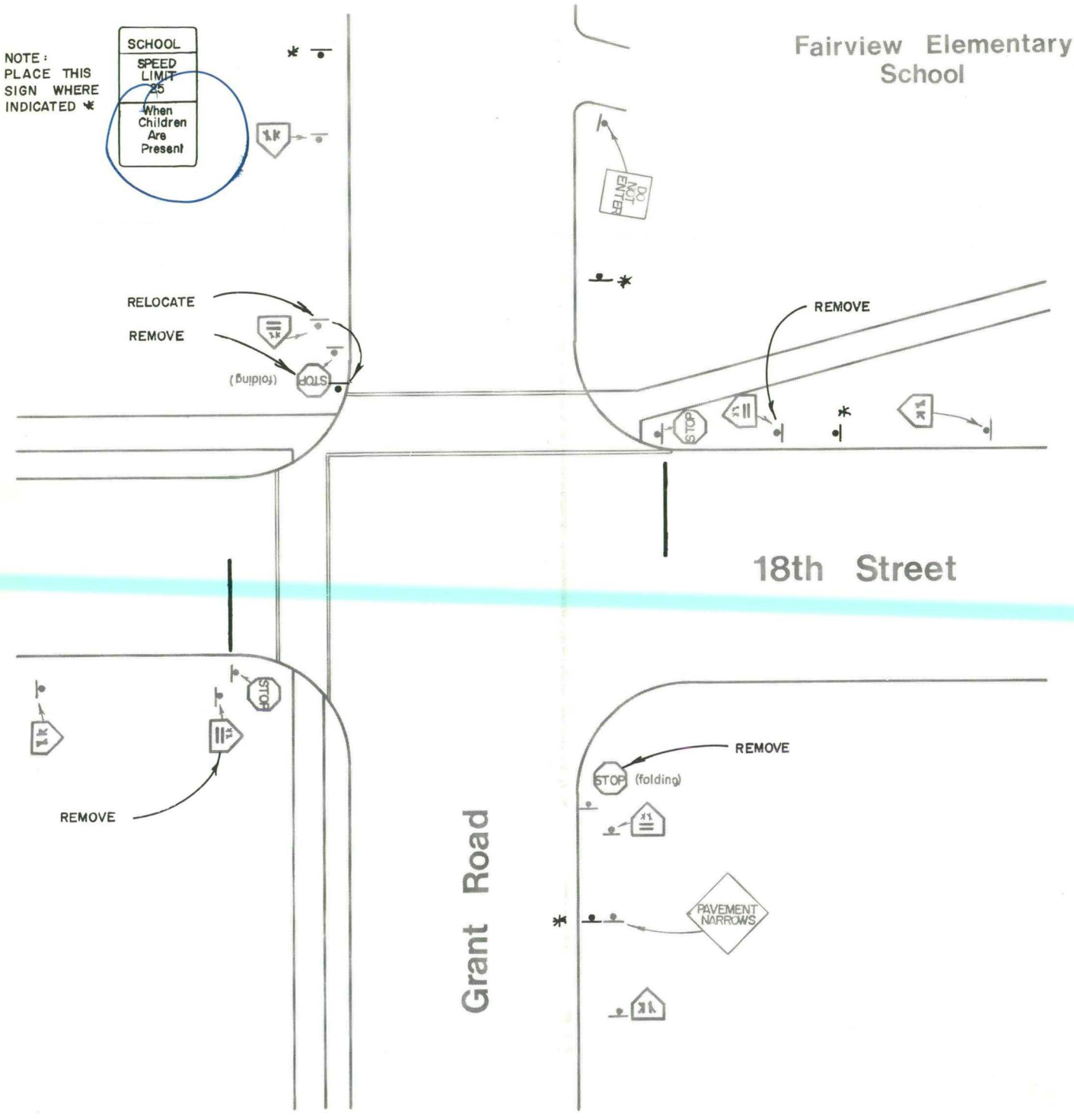
Before removing signs all children together with their parents should be informed of the change and children should be advised as to correct crossing procedures. A faculty crossing guard should be provided for a period after the change is made and a student safety patrol should be provided as outlined in PART VII - E MUTCD.

St. Lawrence Elementary School. The proximity of St. Lawrence School and Church creates a potential hazard when school and church activities coincide. On-street parking has been maximized at all locations around the

SCHOOL CROSSINGS
FAIRVIEW ELEMENTARY
figure 20

north

no scale



SCHOOL CROSSINGS
ST. LAWRENCE ELEM.
figure 21

north

no scale

16th St.

Crawford Street

15th St.

17th St.

St. Lawrence Elementary

West Street

NOTE: ALL PROPOSED SIGNING SHOWN IS:-

NO PARKING HERE TO CORNER

STRIPE FOUR NO PARKING AS SHOWN

BUS STOP NO PARKING 7:30-8:30 2:30-3:30

NOTE: 4-12" STRIPE STOP LINES THIS INTERSECTION

CONSTRUCT WALK

CONSTRUCT WALK

REMOVE

REMOVE TREE

STOP

30'

20'

50'

40'

65'

school. The full utilization of this parking prohibits the free flow of traffic and in many cases obscures the view of crosswalks.

Visibility is a prime factor in providing a safe crosswalk. Therefore, it is recommended that parking be removed from all areas near crosswalks as indicated in FIGURE 21 and that these areas be strictly patrolled by the City Police when school hours coincide with church functions.

School crossing signs should not be used at locations having stop sign control. In the case of the southeast corner of West and 15th Streets, the school crossing sign obscures the stop sign. It is recommended that the crossing sign be removed at this location. (7B-10 MUTCD).

A small tree obscures the stop sign on the east approach of the intersection at West and 15th and should be removed.

Holy Spirit Grade School and Kuemper High. Holy Spirit has problems similar to St. Lawrence in that the church and school are located in the same area and on occasion church services coincide with church functions. However, here the presence of Kuemper High and the St. Anthony Hospital greatly complicate the problem. On a typical day 1,100 high school students, 600 grade school students and the day shift from the hospital depart this area between 3:00 and 3:15 p.m.

The major safety considerations in this area are the grade school children, the majority of whom depart Holy Spirit to the northwest. The intersection of Clark and Bluff is therefore of primary importance. Recommended modifications at this intersection are shown in FIGURE 22 and are directed toward improving crosswalk visibility.

Parking should be restricted on all legs as indicated. Trees and vegetation which limit visibility should be removed. Signing changes should be made as indicated and care should be taken to eliminate the possibility of obscuring existing signs when new signing is installed.

Intersections at East and Bluff and at East and 1st have fairly good sight distances because of low utilization of on-street parking in these areas. However, when adjacent spaces are used visibility is poor. FIGURE 22 shows recommended parking restrictions in these areas.

The intersection at 1st and Clark will be discussed in detail in a following section of this report. Modifications to improve intersection visibility at this location are shown in FIGURE 22.

General Guidelines. There are a number of other general guidelines and recommendations pertaining to school crossings which are discussed as follows.

A general recommendation for all crossings was the discontinuation of the use of portable stop sign devices. Section 2B-5 of the MUTCD states that "portable or part-time STOP signs shall not be used for other than emergency purposes." A number of reasons support this directive. They are susceptible to theft, or improper use by unauthorized persons, and they do not present a permanent, standard type of control because of their intermittent use, and out-of-the-ordinary placement and usage.

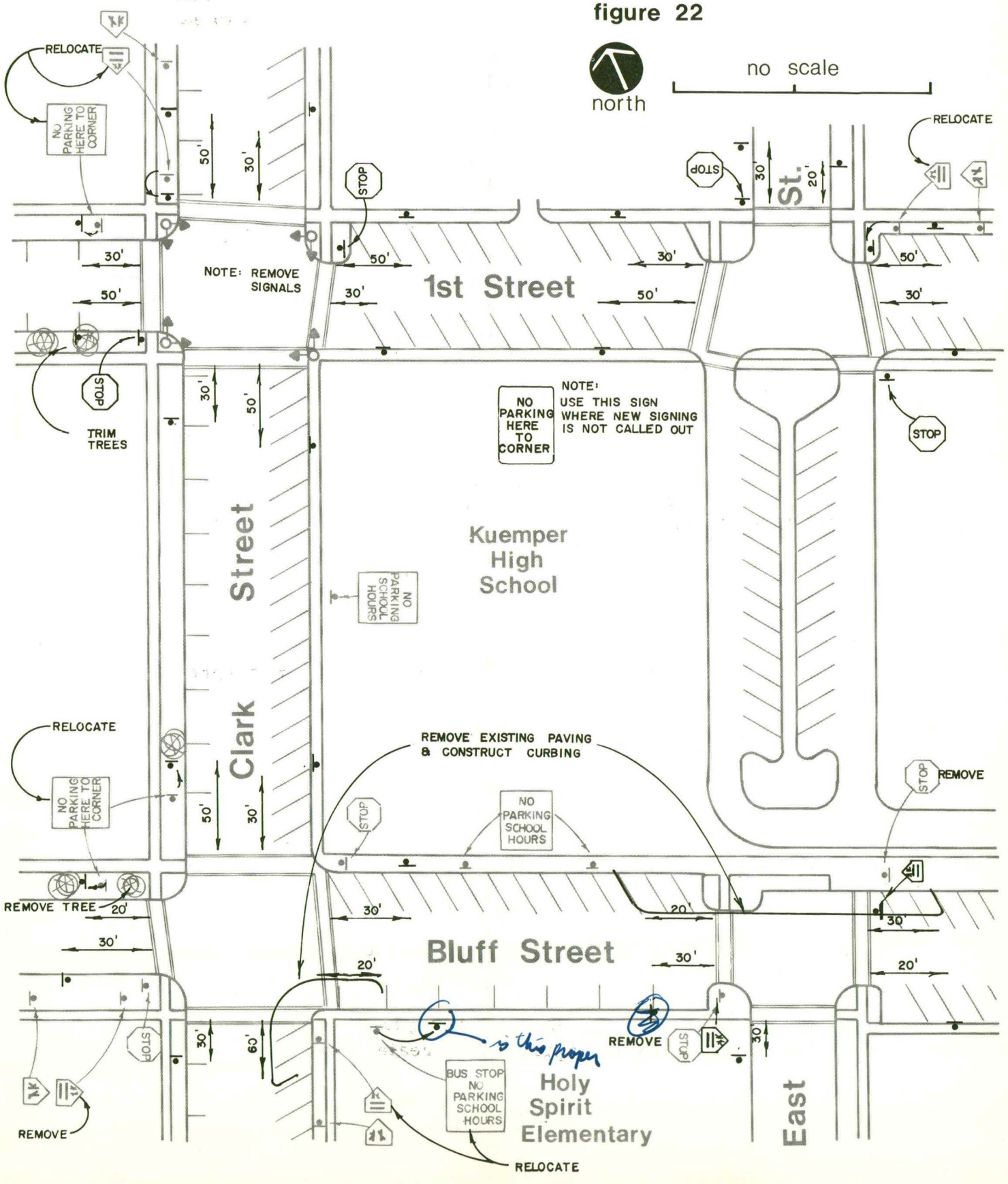
As far as their use as a speed control for traffic to permit safe passage of children is concerned, this is not valid on two counts. The first is based on the directive in Section 2B-5 that "STOP signs should not be used for speed control." This is a responsibility of the local law enforcement officials. All crossings discussed are located in 25 MPH speed zones, with the sole exception of the crossing at Fairview. This speed is satisfactory for crossings. It is recommended that standard 25 MPH speed limit signs be installed on approaches to all crossings, if not already present, to remind motorists of the proper operating speed.

The second reason for removal of the portable stop signs is based on the practical experience at the crossings. It was noted that children do not cross upon a car or cars stopping at the crosswalk. Instead they cross after the cars have cleared the crossing. Consequently, the portable signs cause unnecessary delay to motorists, which is particularly annoying when no children are near the crosswalk.

The purpose of crossing patrols is "to control children, not traffic" (Section 7E-11). Thus, the removal of the portable stop sign units should not pose any operational problems at the crossings. A psychological objection may arise in that the cars would not be required to stop. However, observance of the speed limit (either voluntary or enforced), the education of children as to proper crossing techniques, and proper signing and marking will work together to provide a safely operating school crossing. (See the APPENDIX for an additional statement on this subject).

In regard to visibility of the new signing discussed above, it is recommended that the signing be installed as outlined in the MUTCD and that the installation be inspected by the City Engineer. It is further recommended that crosswalk striping be maintained for proper visibility and the the stripes be a least 6 inches in width, spaced not less than 6 feet apart (Section 3B-15). Stop lines 12 inches in width should be used at approaches where crosswalks are not located.

SCHOOL CROSSINGS
HOLY SPIRIT ELEM.
KUEMPER HIGH
figure 22



It is strongly recommended that parking be prohibited as indicated in FIGURES 19 thru 22. In some cases, this will conform to an already existing situation, or existing field conditions which will readily allow such implementation. In other cases, some objection will likely be raised. The intent is to maximize the visibility of the child and motorists to each other.

Strict enforcement of all school related parking prohibitions is essential and is strongly recommended.

Geometric Deficiencies and Potential Hazards

During the course of this study several items constituting public hazards were either observed in the field or were pointed out by concerned citizens.

Grant Road. Grant Road from 7th to 11th is bounded by public grounds on both sides. A city park along the west and the city swimming pool, atheletic fields and a proposed recreation center on the east have the potential to generate a great amount of pedestrian traffic. However, there are no sidewalks on either side of Grant Road in this area.

It is, therefore, recommended that sidewalks be constructed on both sides of Grant Road from 6th Street to 12th Street.

A folding stop sign is located in front of the city swimming pool. This sign should be removed for the reasons outlined in the previous section. School advance signs and school crossing signs should be installed. Appropriate speed limit signs should be located on each approach. Diagonal lines could be added to the crosswalk markings to increase visibility (Figure 3-13, B MUTCD).

Pavement Markings. It was noted that pavement markings were poorly maintained in many locations but especially on US 30 and at school crossings. Pavement arrows that do not conform with the MUTCD were noted at some locations.

It is recommended that pavement marking be maintained on a more frequent interval and that markings be applied according to the MUTCD.

US 30 from Grant Road to Vine. The section of US 30 east of Grant Road is a four-lane, two-way section with no center median. Lane widths are 12-foot and sight distance is good. Accident history in this area shows no major concentrations of accidents. Speeds on US 30 are typically 30 to 35 MPH.

The fact that angle parking is permitted along both sides of the highway together with frequent driveway approaches creates a potential safety hazard.

Vehicles leaving the parking area are forced to back onto the highway creating the potential for very serious accidents. The high number of access points also contributes to the hazard by causing confusion as to where and when a vehicle may enter or leave the highway.

Modifications shown in FIGURE 23 were developed to reduce this hazard.

It is recommended that angle parking on the north side of US 30 be converted to parallel parking and that a 5-foot wide island be constructed to separate parking vehicles from the traveled way. This parking lane would be 20 feet wide and would be signed one-way westbound. Access could be provided at the mid-block to simplify circulation.

Curbing should be constructed along the south side of US 30. All unnecessary drives should be eliminated and those which are necessary should be limited to 60-foot maximum openings.

This proposal eliminates parking in front of the farm implement dealer on the south of US 30. An option would be to provide for parallel parking in this location similar to that proposed for the north side. However, the restricted area together with the few stalls provided and the availability of alternate parking space make this option unfeasible.

14th Street and Main. The intersection of 14th and Main is a blind intersection when approached from the south by virtue of an extremely steep grade on Main. Sight distance from 14th is very short and the traverse grade on 14th tends to disorientate the driver. A warning sign is currently located on Main south of 14th but is in poor condition.

It is recommended that the existing warning sign be replaced with a new sign reading "HAZARDOUS INTERSECTION". It is also recommended that the yield sign on 14th Street be replaced with a stop sign.

Main Street Islands. Islands along Main should be delineated by placing "KEEP RIGHT" signs (MUTCD R4-7) at the head of the first island in the series. More specifically, these sign locations are north of Main and Bluff, south of 3rd and Main, north of 7th and Main, and south of 12th and Main.

South Main and the Raccoon River. A potential hazard is located where Main Street meets Timberlane Road. The east side of Main is situated atop an approximate 50-foot embankment. This embankment is located on the outside of a horizontal curve. The pavement at this point is an urban section with curb and gutter and a center crown. This crown tends to create reverse superelevation making maneuvering difficult for northbound vehicles.

A guard rail has been installed; however, it is of insufficient length to prevent vehicles from leaving the road. Shoulders are narrow and no sidewalks are provided.

A fire hydrant on the east side of Timberlane contributes to the hazard in two ways. First, the hydrant is a fixed object with which vehicles can colide. Secondly, the presents of a water main creates the possibility of a water leak that could saturate the subsoil and cause the collapse of the embankment.

The ideal solution for these problems is rather complicated. It would require re-routing a reach of the Raccoon River and the re-construction of the embankment to provide a stable slope and adequate shoulder width. Guard rails and sidewalks could then be constructed. Paving could be rebuilt to reduce adverse crown or provide superelevation. Careful consideration would have to be given to pavement drainage to avoid cross-slab drainage.

As a temporary solution the following modifications are strongly recommended. The existing guard rail should be extended to the south to fully protect the slope. Warning signs should be placed on both approaches (MUTCD W1-2L & W1-2R). Speed limit signs should also be installed particularly on the south approach. The addition of sidewalks is suggested.

South Main from Anthony to Hillcrest. Discussions with citizens indicated a variety of problems along Main between Anthony and Hillcrest. Field observations indicated that these problems are not confined to this area but were fairly widespread throughout Carroll. Many of the following items are discussed in more detail elsewhere in this report.

Complaints from residents of South Main were related to a disrespect of both intersection control and speed limits. Concern was also expressed about the large number of children in relation to increasing traffic volumes. Residents contend that the paving of roads south of this area has created a link with US 71 and is attracting through trips to the Main Street Corridor.

Traffic volumes on South Main are not heavy at this time and amount to only one-fourth the roadway capacity. However, volumes are higher than an average residential street and much higher than average for Carroll. It is apparent that South Main is becoming more than a residential street and should in fact be considered a municipal collector.

Disregard for yield signs at South Gate Road and Hillcrest should normally be improved by stricter enforcement. However, in the light of the increasing usage of Main as a through street replacement of yield signs with stop signs is recommended.

IMPROVEMENTS FOR U.S. HWY 30 VINE TO GRANT

figure 23

north

no scale

No Curb construction parallel only with stripe delineate gutter line.

Grant Road

NO RIGHT TURN ON RED

SPEED LIMIT 35

DO NOT ENTER

REMOVE

NO RIGHT TURN ON RED

NO LEFT TURN

NOTE: PROVIDE MIN. DRIVE WIDTH OF 20' & RESTRIPE FOR PARALLEL PARKING

ONE WAY

EMPLOYEES TO PARK IN REMOTE AREAS

DRAINAGE PROVIDED BY OPENING IN BACK OF CATCH BASINS

PROVIDE CURBING TO SEPERATE PARKING AREAS FROM TRAVELED WAY

CUSTOMER PARKING ONLY

STOP

Vine Street

U.S. Hwy 30

60' MAX.

60' MAX.

NO RIGHT TURN ON RED

REMOVE

SPEED LIMIT 35

CONSTRUCT CURBING & LIMIT OPENINGS TO FEWEST POSSIBLE. MAX. OPENING TO BE NO GREATER THAN 60' AT CURBLINE

CONSTRUCT ISLANDS TO DEFINE ACCESS POINT

14'-2" LOW CLEARANCE

Speed control should be provided by stricter enforcement. Placement of speed limit signs (25 MPH) south of Hillcrest for northbound traffic and north of Anthony for southbound traffic is recommended.

Limiting parking to one side only is recommended from Bluff to Timberlane Road to improve traffic flow.

With respect to conflicts between children and traffic it was noted that no sidewalks were provided in this and many other areas. It is recommended that sidewalks be added to both sides of Main.

US 30 and the Railroad Overpass. The railroad overpass on East US 30 rests on a large concrete center pier located in the median of US 30. This pier represents a rather large fixed object in the roadway and as such is hazardous. It is suggested that impact attenuators be installed in front of the piers to reduce the severity of any collisions that might occur (cost $4,800). Object markers placed ahead of the pier are recommended to increase night visibility (MUTCD 3C-1).

F.tch? is not appropriate

Sidewalks. Adequate sidewalks are essential in providing pedestrian safety and are particularly important in establishing safe school routes. Field observations indicated many areas near schools with sidewalks on one side only and many areas including entire subdivisions have no sidewalks.

Carroll's existing sidewalk ordinance specifies physical requirements for the construction of sidewalks but does not require installation.

It is recommended that the City establish an ordinance requiring sidewalks with all new construction and giving the City the authority to order the installation, reconstruction or repair of sidewalks in areas of importance.

It is recommended that the City begin a program of sidewalk construction with a final goal of having sidewalks on all residential streets. Such a program could be expedited by using three phases. Phase I should provide sidewalks on both sides of streets within a four-block radius of all schools and on both sides of all major streets (arterials and collectors as defined in FIGURE 2). Phase II should strive to provide sidewalks on one side of all minor streets. Phase III would complete the program with sidewalks on both sides of all minor streets.

Sidewalk ramps at intersections for the handicapped should be provided on all new installations. Ramps should be constructed at all downtown intersections not so equipped and in all areas with high concentrations of senior citizens. The APPENDIX illustrates a typical sidewalk ramp design for the handicapped.

Intersection Control

Analysis of FIGURES 2, 5 and 6 indicates that intersection control signing is deficient with respect to the assignment of right-of-way on the major street system. Other deficiencies related to sign usage were found at scattered locations. Therefore, the discussion of the observations and conclusions regarding traffic controls is presented in two categories.

The first is the recommended intersection control signing changes, improvements, and updates on a city-wide basis. This section discusses overall guidelines and principles which were considered in the evaluation of this signing. The second part addresses specific intersections where additional discussion of signalization is necessary.

City-Wide Intersection Signing. Three basic objectives of intersection controls are:

1. Provision of adequate intersection capacity.
2. Reduction and prevention of accidents.
3. Designation and protection of major streets.

In reviewing the intersection signing currently in use, a number of accepted guidelines and principles were considered towards the development of a logical scheme of intersection signing consistent with the above objectives. The considerations are as follows:

1. Sight distance.
2. Street classification (arterial, collector, local).
3. Speed limits.
4. Intersection geometry (right-angle, skewed).
5. Relative traffic volumes.
6. Turning demands.
7. Use of yield to control only minor street.
8. Use of yield to control only one street.
9. No mixing of yield and stop signs at an intersection.

10. Conformance to MUTCD.

11. Accident experience.

The existing intersection controls were reviewed to determine the effect they had on city-wide accessibility. The results are shown in FIGURE 5 which depicts those street segments which are assigned continuous right-of-way according to the existing intersection controls.

Assignment of right-of-way is for the most part logical and sensible. Direct access to and from the CBD, the major traffic generator, is possible from all parts of the city with only a few interruptions of flow. It should be noted that most of the east-west municipal collectors have no vehicular right-of-way assigned and that the actual arterial system as shown in FIGURE 5 is heavily weighted to north-south movements.

Keeping in mind the general considerations in the preceding discussion, intersection controls were examined to determine if they were in conformance with the MUTCD with respect to usage and location. It was found that these controls were generally providing adequate and proper flow of traffic.

This examination resulted in a number of recommended intersection signing changes, which are graphically displayed in FIGURE 24. Modifications typically included simple updating of signs, changing from yield to stop signs, changes in sign placement, and the installation of additional signs.

The following is a description of recommended signing modifications in order of priority.

1. Intersection signing modifications based on accident history occur at US 30 and US 71 interchange (see FIGURES 10 and 11). 7th and Adams (FIGURE 16), 7th and Court (FIGURE 17), and 3rd and US 71 (FIGURE 18).

2. Modifications based on improper usage or non-conforming signs are found at 7th and 8th and Court, at 8th and 17th and Quint, and at 7th and Main.

3. Changes with respect to potential hazards are found at 14th and Main, and at South Gate and Main and Hillcrest and Main.

4. Changes at pedestrian crossings are located at Grant Road and the municipal swimming pool, at Grant Road and 18th Street, at 10th, 11th, and 12th with Main and at 10th, 11th, and 12th with Adams.

5. Signs changed to assign vehicular right-of-way from a minor street to a major street as indicated by functional classification are on 10th at Carroll and on 15th and at Simon.

6. Right-of-way on several east-west streets, designated as primary streets, is not assigned by intersection control. These locations are 1st from Main to Grant, 3rd at Adams, 10th from US 30 to West 12th from West to Grant, 15th from US 71 to West, and 18th at Crestview.

7. Right-of-way along a major street should be strongly assigned so that the importance of the street is apparent to the motorist. The type of control should be consistent as possible along a particular class of roadway. Therefore, it is recommended that intersection control along Main Street be changed to stop sign control on all intersections.

8. Multi-way stops are located in five locations. It is recommended that supplementary 4-way plates (MUTCD R1-3) be installed to indicate the presence of a multi-way stop. It is also recommended that a stop sign be added to the southbound leg of Carroll and 3rd to make that intersection a 4-way stop.

Correct sign placement is shown in FIGURE 25, and should be consulted for the proper placement of new signs.

Signalization. The majority of the changes discussed below have previously been covered under high accident locations but are included again to assist in the organization of a signal improvement program.

All signal locations were inspected to determine their suitability to handle existing traffic demands. Installations were examined for physical condition, for conformance to the MUTCD, for placement and usage, and for general suitability of the installation for the need.

Of the seven signals in Carroll, five are located on US 30, one at 1st and Clark and one at US 71 and 3rd. Of these the signal at US 30 and Grant Road is planned for replacement while the signal at US 71 and 3rd is in a permanent flashing cycle because of equipment failure.

INTERSECTION CONTROL MODIFICATIONS

figure 24

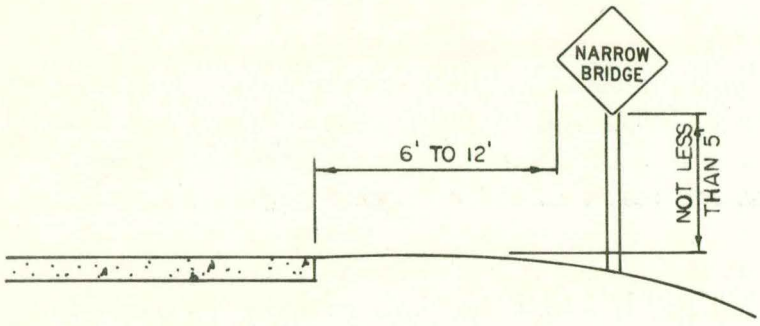
new stop sign
new yield sign
4-way plate
install flashing beacon
install signals
remove existing sign

north

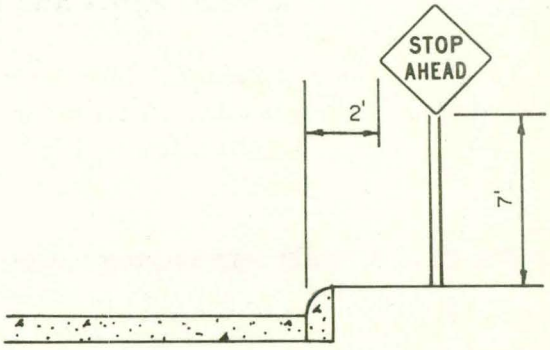
Carroll, Iowa

0 1000 2000

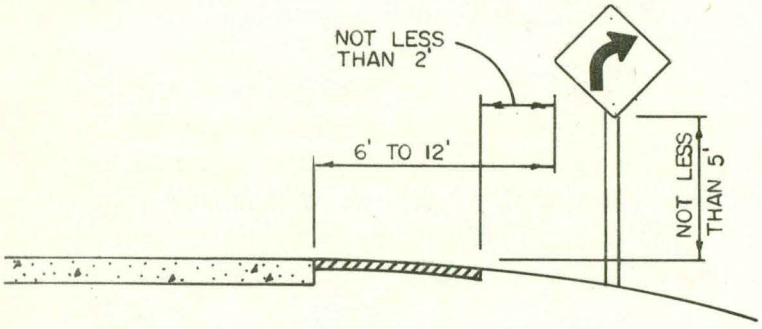
Sign Placement
figure 25



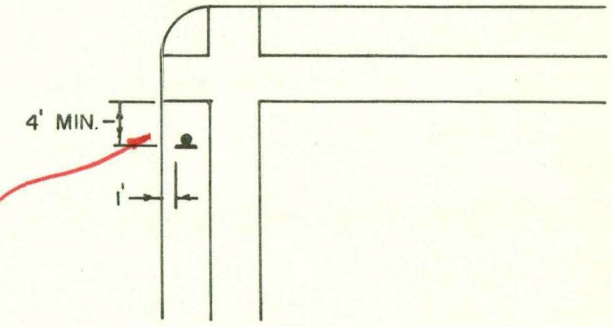
rural section



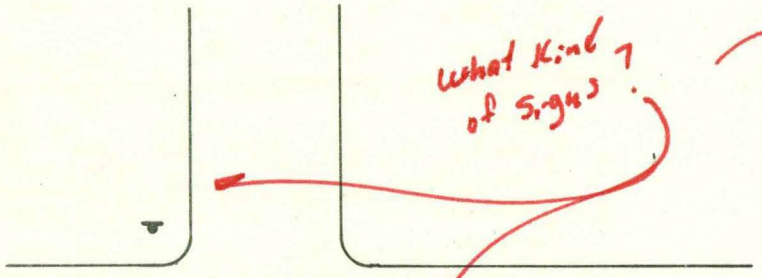
urban section

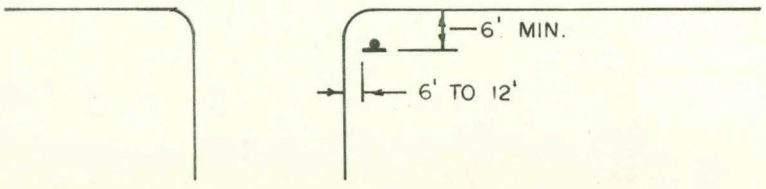


rural section



urban intersection





rural intersection

Recommended changes to signal installations are as follows.

1. US 30 and Main. This intersection is the busiest in Carroll from both the traffic volume and accident standpoints. Records show that this signal was installed in 1964. However, field inspection indicates that the 1964 work consisted of the addition of mast arms and that the many of the components are much older.

   In Coop program

   Inspection and study of the accident records indicate that signal placement is poor at some locations and could be contributing to accidents. This condition is complicated by the wide approach widths on Main Street.

   It is recommended that this installation be replaced with new signals of the mast arm type over the respective lanes. Pedestrian signal indications should also be installed. Modifications to the approach for both reconstruction and the parking restrictions shown in FIGURE 14 are recommended.

2. US 30 and Clark. Accidents of the type that can be reduced by signalization initiated an investigation for the installation of signals at this intersection. Accident diagrams and results of an 8-hour manual count that establish signal warrants are found in the APPENDIX. These examples show that signalization would be beneficial and that it is warranted according to the MUTCD.

   It is recommended that a mast arm signal be constructed at this location. Trees on the south leg of Clark should be removed and the power pole on the southwest corner of the intersection should be relocated as shown in FIGURE 15.

3. US 71 and 3rd. Here the existing signal has deteriorated to the point that only flashing yellow and red can be presented and the pedestal on the northwest corner has been damaged.

   Done

   Investigation of traffic volumes revealed that volumes do not warrant signals according to the MUTCD. Accident history showed that the majority of accidents occurring in the study period were related to the presence of the signal. Therefore, it is recommended that the signal be removed and stop sign control and a flashing beacon be installed as shown in FIGURE 18.

4. Carroll, Adams, and Court. Signalization at these locations was found to be adequate with the exception of some minor adjustments outlined in FIGURES 13, 14, and 15.

   At Carroll, recommended modifications consist of the relocation of pedestals to enhance signal visibility from the north and particularly the south legs. The installation of mast arm signals salvaged from Main Street is recommended for these approaches.

   In response to citizen complaints of a congestion problem at US 30 and Carroll in the 15-minute period after 5:00 p.m. on week days, it was determined that modifications could be made to the signal system that would eliminate the congestion. However, the cost of such changes was considered too large to be warranted. The problem will be eliminated with the future installation of signals at West.

   On Adams recommended modifications consist of parking restrictions and the suggested relocation of a pedestal on the north corner to improve visibility from the west approach.

   Recommendations for Court are similar to Adams and include the removal of some parking and the relocation of the signal on the southeast corner.

5. 1st and Clark. The signal at 1st and Clark was the object of complaints from several citizens. The signal is located on two lightly traveled streets and is very frequently a frustration to the motorist by requiring a stop and 30-second wait with no other traffic in sight. Field observations confirm this fact. Many motorists were observed stopping and then proceeding on the red. This condition is a hazard in itself but also contributes to other problems by encouraging disrespect for traffic controls in general.

   Traffic counts were made and volumes do not warrant a signal installation. The MUTCD requires a volume of at least 350 vehicles on the major street and 105 vehicles on the minor street for each of eight hours of an average day to warrant a signal at this location. Approach volumes on Clark and 1st were between 2,000 and 2,200 ADT. To warrant a signal at this location volumes would have had to exceed 5,600 ADT on the major street and 1,600 ADT on the minor street.

It is recommended that signals at 1st and Clark be removed and that the equipment be utilized at another location. Intersection control should be provided by stop signs on 1st Street. If traffic congestion occurs in conjunction with church or school activities a traffic officer should be provided by those sponsoring the activity.

As a temporary solution it is suggested that this signal be put on a flashing cycle (presenting red to 1st and amber to Clark).

West Street and US 30 was investigated for signalization in reply to citizen comments concerning difficult access to US 30. It was noted that left turns from West to US 30 were difficult during most hours. However, delays were not excessive and adequate openings do occur with some frequency.

Accident history showed no trends to accident types that would be reduced by signalization. Traffic counts indicated that volumes were not high enough to warrant signals at this time. However, volumes were fairly close and may be sufficient in future years.

It is suggested that yearly traffic counts be made at this location and that traffic accidents be monitored for an increase in right-angle or turning accidents. An increase in either factor ~~will~~ may warrant signalization.

Downtown Area

Conversations with citizens raised several questions with respect to the Downtown Area.

Carroll and US 30. Downtown merchants indicated that a traffic congestion problem exists on the south approach to US 30 and Carroll at 5:00 p.m. on weekdays. This condition is attributed primarily to the parking lots located southwest of US 30 and Carroll and southeast of Carroll and 5th. When businesses close at 5:00 p.m. the influx of shoppers and employees creates a problem for 10 to 15 minutes.

This congestion could be reduced by several means. The installation of a signal at West would be beneficial but is unwarranted by traffic volumes at this time. Widening of the south approach of Carroll to incorporate a left turn lane was considered but its cost is unproportional to the possible benefits. The use of an additional signal cycle along US 30 would permit extending the length of green time on side streets. This would require modification to all the US 30 signals to retain traffic progression and also is considered too expensive to be practical.

?

is there really good progression ?

The congestion at this location is of short duration, occurs at predictable times and can be easily avoided. Observations indicated that no delays were in excess of three signal cycles (three minutes). Therefore, no modifications are recommended.

The eventual installation of signals at West should eliminate the problem.

5th Street and Carroll. This intersection was also the subject of citizen complaints. Here a wide approach in conjunction with angle parking causes a problem on the east approach. Motorists tend to follow the center of the street to avoid conflict with vehicles leaving parking spaces. As they approach the intersection these motorists remain in the center of the street whether they are turning right or left and do not separate to form appropriate lanes.

Signing and pavement marking are recommended as shown in FIGURE 26. If these changes prove successful it is recommended that a permanent island and sign be constructed.

Planters on US 30. Planters on US 30 are constructed of 6-foot lengths of eliptical concrete pipe buried 4 feet beneath the pavement. These planters are placed in the 8-foot maneuvering space area between parking stalls. Physical appearances indicates that many motorists have problems seeing these rather formitable barriers during parking maneuvers.

It was found that if adjacent vehicles are parked correctly, within pavement markings, the planters do not interfere with parking maneuvers. However, the fact remains that motorists are having difficulties. It should be noted that the planters are not considered a threat to public safety.

Several alternatives were suggested but no suitable solution was found. The alternatives are simply to retain the planters and learn to live with them or remove them.

It is the consultant's opinion that the aesthetic value of the planters exceeds the problems they create. Their presence is apparent and it is believed that the public can learn to avoid them.

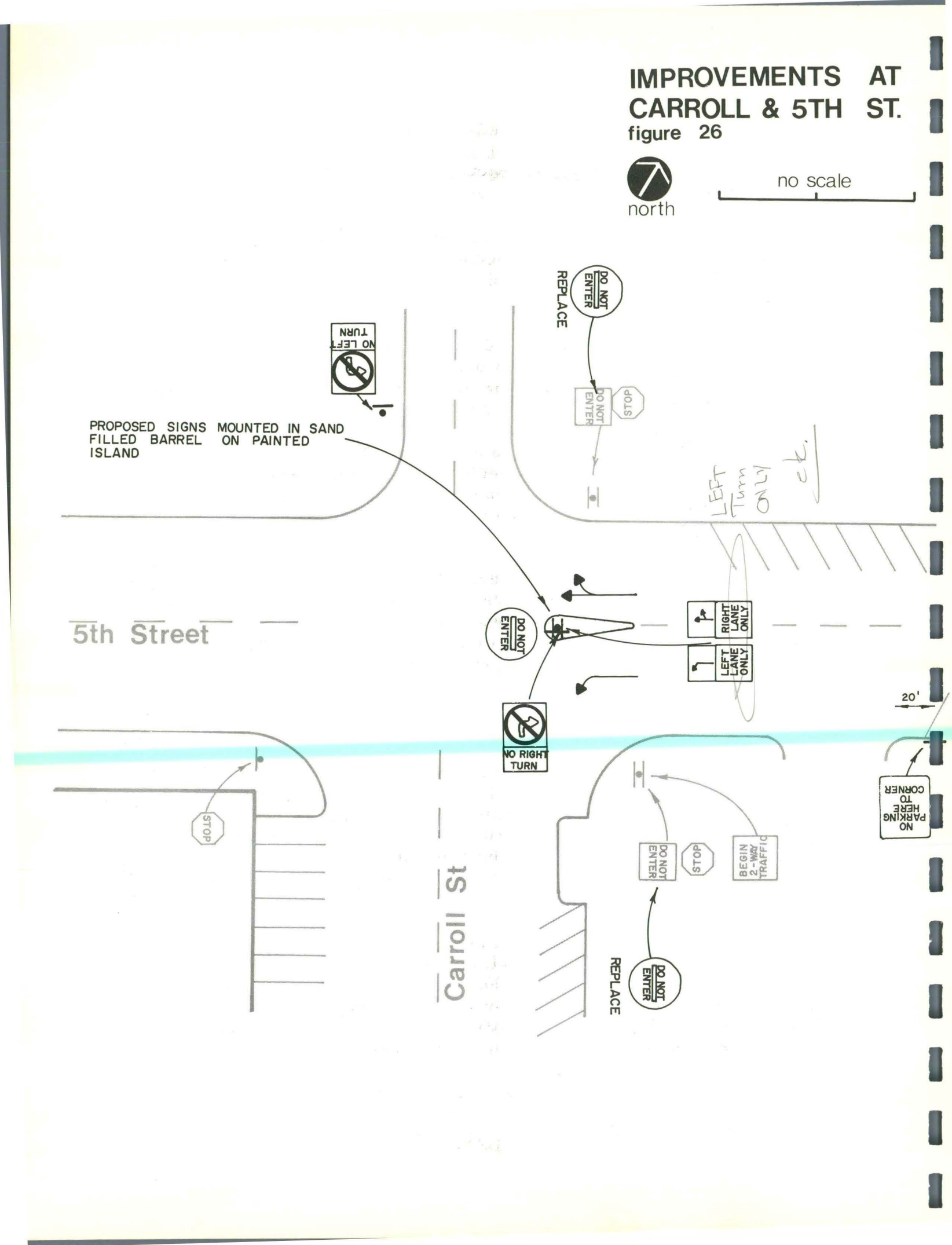
Hospital Access

Access to St. Anthony Hospital was looked at from regional and local viewpoints and several problems were observed.

With respect to regional access to the hospital, two deficiencies were observed. Hospital location signs are located at several locations but are not frequent enough to guide a non-resident with any degree of certainty to the

IMPROVEMENTS AT CARROLL & 5TH ST.

figure 26



hospital. It is recommended that supplementary signs be added on US 30, US 71 at 3rd and along 3rd, on Clark at 3rd and 1st, on Main at Bluff and at Grant Road and 1st. Signs should be the large "H" with blue background. (MUTCD D9-2).

Emergency access routes should be established for the use of emergency vehicles. These routes should coincide with snow removal practices as outlined in a following section. Routes should also provide adequate width for fire equipment.

In the vicinity of the hospital, sight distance problems were observed at two locations. The main entrance has a problem to the north with respect to parking on Clark and to the south due to roadway geometrics. Recommended modifications are shown in FIGURE 27.

The reconstruction of curbing on the north of the intersection and the relocation of intersection controls move vehicles exiting the hospital into an area of greater visibility. The change from yield to stop sign control is intended to reduce the possibility of collision with vehicles on the partially blind south approach of Clark Street.

The combination of horizontal and vertical roadway alignment together with adjacent topography creates blind areas to the south of both emergency entrance and exit drives. Recommended modifications consist of the relocation of several small trees which reduce sight distance. The erection of a stop sign at the exit and a warning sign south of the entrance is also recommended.

Parking

Vehicular travel and parking are the two major usages of city streets. The extent of either usage can be varied to create a wide range of facilities from exclusive thoroughfares with no parking to parking lots providing no through vehicle movements. However, parking and vehicular travel are indirectly related. No facility can serve both functions to a high degree and still retain a safe facility. Compromises can be made but only at the expense of traveling efficiency and safety.

In determining the amount of parking that can be provided, the nature of the street with respect to the transportation system must be taken into consideration. Parking layouts suitable for side streets should not be considered for major streets despite political pressures from adjacent property owners. The price for over-developed on-street parking is paid for by the motoring public who will be subjected to higher accident frequencies.

HOSPITAL ACCESS

figure 27

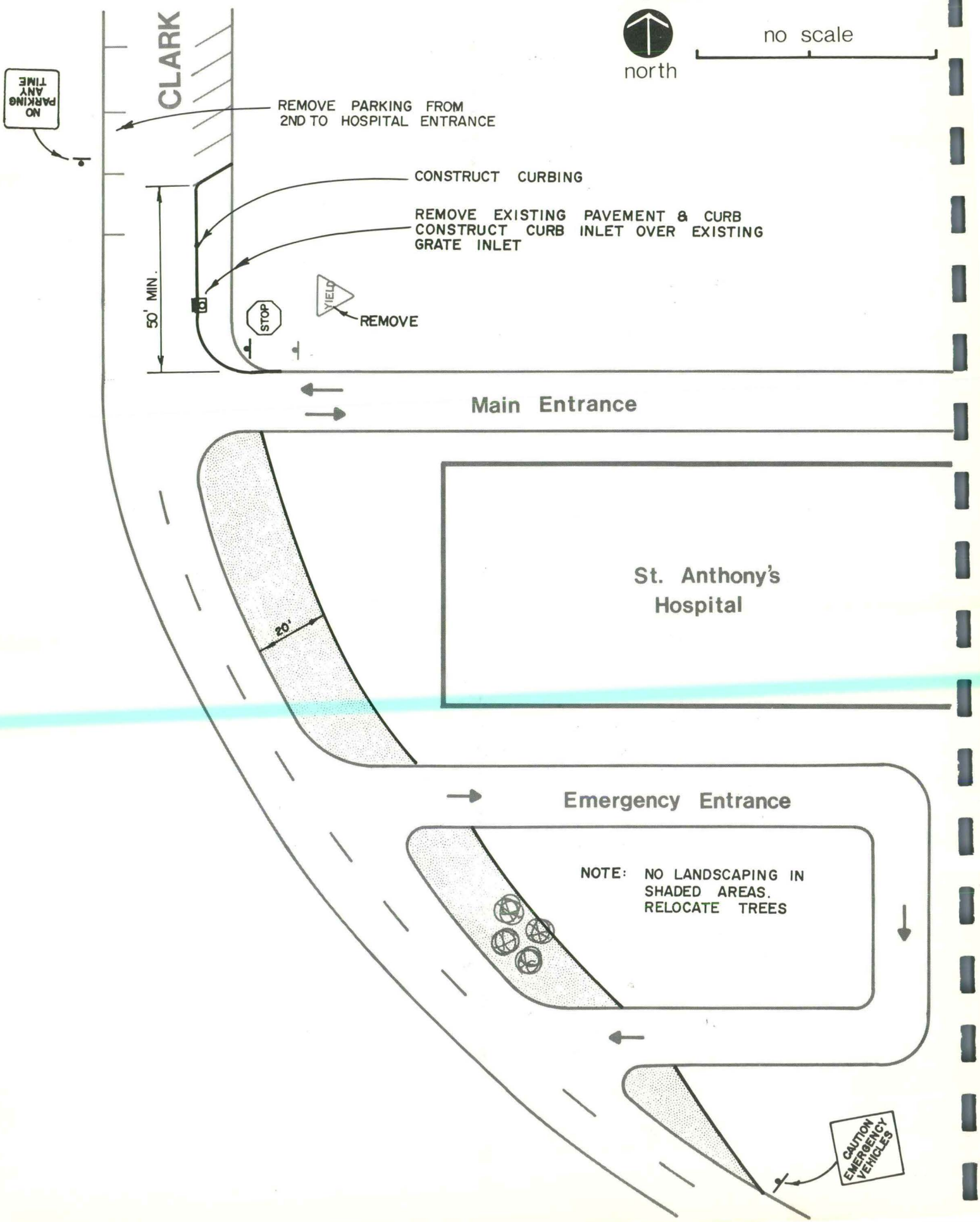


TABLE V shows the order of efficiency for various parking layouts with respect to parking supply and traffic flow. Percentages of parking apply for all street widths and a 60-degree parking angle. The traffic lane width is based on minimum pavement width. The relative order of efficiency will remain consistent for all pavement widths. This table can be used to measure effects of parking modification and to establish an order of priority in parking configuration changes.

TABLE V - PARKING LAYOUT EFFICIENCY

Type of Parking	Parking Efficiency	Percent Pavement Width for Traffic Flow	Min. Pavement Width (2 Lanes)
No parking	0 %	100 %	24 Ft.
Parallel one side only	21 %	75 %	32 Ft.
Parallel both sides	42 %	60 %	40 Ft.
Angle one side only	50 %	55 %	44 Ft.
Parallel-angle mix	71 %	46 %	52 Ft.
Angle parking both sides	100 %	38 %	64 Ft.

Clark from 2nd to the Hospital Entrance. This section of Clark comprises the major hospital access. Existing pavement width on Clark is 46 feet. This width presently accommodates 60-degree angle parking on the east, 2 lanes of traffic, and a parallel parking lane on the west. Conservatively assuming an 18-foot angle parking lane (recommended 20 feet for 60 degrees) and a 7-foot parallel parking lane (recommended 8 feet) only 21 feet remain for travel lanes (recommended lane width is 12 feet).

In order to provide adequate travel lane width for the hospital approach and in consideration of Clark Street's classification as a municipal arterial, it is recommended that parking be prohibited on the west side of Clark from 2nd to the hospital entrance.

West from 15th to 17th. Street width along this section of West Street is 42 feet. Parking provided here consists of angle parking on the west (60 degrees) and parallel on the east. This configuration requires one lane traffic and is inconsistent with the street classification (municipal arterial).

Parking use - diagram by hour or Map showing parking areas that he recommends

It is recommended that parking be removed from the east side of West Street from 15th to 17th.

US 30. All parking along US 30 has not been recommended for removal in this report. However, the city and the merchants along US 30 should be aware that further parking restrictions will be required as traffic volumes increase. The removal of all parking is suggested as a measure to increase traffic flow and safety on US 30 but is not formally recommended.

Parking between the outside curb and the right-of-way line is common in many locations along US 30. Between Grant Road and Vine a particular hazard exists where cars back onto the highway (FIGURE 23). Between West and US 71, parking in the right-of-way is limiting sight distances and obscuring roadway signing.

where are you going to put all of these cars?

Parking restrictions or modifications (as shown above) are recommended in these areas.

Main Street. Main Street from 3rd to 7th is highly utilized for angle parking. The section of this area from 5th to US 30 is also classified as a high-accident location solely to the frequency of parking accidents. As traffic volumes grow so will the extent of this high accident area. Conversion of angle parking to parallel parking would cause a 58 percent decrease in on-street parking supply on Main.

At present levels angle parking may be tolerable but accident rates and the extent of the high accident area will increase as traffic volumes increase.

10th Street from West to Main. The re-signing on 10th to conform with its assigned function in the arterial system could cause problems with respect to on-street parking. In order to improve the operation of 10th as a municipal collector, it is recommended that parking be restricted to one side. Parking restrictions will need to be varied from the north to the south side in order to retain existing angle parking.

Parking Near Intersections. In many instances parking prohibitions near intersections were recommended. It is further recommended that the city establish a policy whereby parking is restricted at all controlled intersections. Minimum restrictions should be within 30 feet of the approach to a stop sign or crosswalk on the far side of the intersection. Greater distances are recommended for special conditions such as signals or major street approaches to school crossings.

Angle Parking. City policy allows the addition of on-street angle parking wherever additional parking is required. Angle parking has been installed in all areas of town and for many different installations. In many locations

parking has been added to major streets. This maximization of parking is incompatible with a safe, efficient arterial system. Therefore, it is recommended that the city restrict the construction of angle parking areas to streets not included in the arterial and collector system.

Ordinances, Enforcement and Operations

A number of additional recommendations which do not fall in the realm of physical improvements can be made regarding administration and enforcement.

Sight Distance. The city currently has the ability to remove sight distance obstructions at intersections by means of Chapter 27 "Nuisances" of the city code. However, this law does not clearly define what constitutes an obstruction and requires council action to be utilized. Consequently, action is seldom taken and many areas have marginal or poor sight distances. In many locations vegetation even obscures traffic control signing.

An ordinance should be developed that specifically regulates the height of vegetation and fencing within a certain area on each corner of an intersection. Generally this area is triangular, with the two equal legs extending 30 feet back from the property corner along the rights-of-way line.

Such an ordinance is not intended to be used indiscriminantly, but rather as a device to develop minimal sight distance at locations where a hedge, tree branches, or fences obscure visibility of cross street traffic or of traffic signs. A copy of the City of Omaha ordinance relating to this matter may be found in the APPENDIX.

Enforcement of this regulation should be simplified so that council action is not required for simple vegetation removals. The public works department should be given authority in these cases and should be encouraged to utilize it.

Sidewalks. The existing sidewalk ordinance was found to be deficient in that it outlines all physical properties for construction but does not require installation. This ordinance should be revised to require sidewalks for all new construction.

This ordinance should be expanded to require sidewalk ramps for handicapped persons at all intersections and at all public facilities (see APPENDIX for a type design).

Enforcement. Comments from citizens indicated that at many locations intersection controls were being disregarded by motorists. Field observations at several locations confirmed this fact. A general disrespect for intersection control exists on many minor streets. In some cases (specifically at 7th and Adams and at 7th and Court) this is contributing to accidents.

Observations at 7th and West revealed that cars coming to a full stop were the exception rather than the rule.

It is recommended that enforcement of intersection controls be given special attention. Locations having high frequencies of violations should be recorded and patrolled at periodic intervals.

With respect to accident record keeping it should be noted that the system used in Carroll is one of the most efficient systems encountered by the consultant and was responsible for a substantial time savings in accident research.

The Police School Safety Program was investigated and found to be very satisfactory.

Sections 50.4 TRAFFIC ACCIDENT STUDY and 50.8 ANNUAL SAFETY REPORTS of the City Code should be modified to define high accident locations. (For the purposes of this report high accident locations were defined as locations having five or more accidents per year). Formulation of solutions to reduce accidents should be accomplished by the joint efforts of the Police Chief, and City Engineer. Only solutions conforming to the MUTCD should be considered.

Operations. Observation of many locations where vegetation reduced sight distances at intersections and obscured traffic control signs indicates the need for a periodic maintenance program. It is recommended that a program be instituted that would provide for the inspection of all intersections at least once each year, preferably in late spring. Irregularities such as missing or damaged signs and any overgrowth of vegetation should be noted and corrected. City crews should be instructed to note and report any changes in sign conditions while on other city work assignments. Thus locations requiring maintenance more frequently could be identified and corrective measures could be taken.

Emergency snow removal routes were prepared in connection with fire and ambulance access. These routes are shown in FIGURE 28. It is recommended that these routes be given priority for snow removal and that parking on these streets be prohibited during snow storms to facilitate snow removal and to maintain emergency access. Implementation would require the signing of routes together with a publicity effort to inform the public when parking was prohibited. The type of parking restriction is optional and should be determined by the public works department in conjunction with their operating characteristics.

EMERGENCY SNOW REMOVAL SYSTEM
figure 28

first priority
second priority

north

Carroll, Iowa

0 1000 2000

It is recommended that a record be kept of traffic control devices and their location. This can easily be accomplished using a large scale map of the city on which the location, size, and type of signs is recorded. In this way, replacement of a missing sign is expedited as its exact location and type are readily available. Supplementary records regarding repairs, replacements, vandalisms, and dates would be desirable.

IV RECOMMENDATIONS & IMPLEMENTATION

Here it may be appropriate to show what type of expenditures the City has been making the last few years, the actual receipts of various types taken in. -- Bond indebtedness, etc. taxes, special assessments, G.O. bonds. -- outstanding debt

This would make it more obvious to the City people what kind of money they have available to fund this project

Part IV
RECOMMENDATIONS & IMPLEMENTATION

The preceding parts of this report have dealt with existing traffic operations on city streets, and with the formulation of improvements and modifications for the betterment of public safety and the reduction of accidents.

These recommendations require implementation, though, to effect their improvements in safety. Implementation in turn requires a schedule of priorities as well as suitable sources of funding.

Monies for traffic control improvements such as those contained in this report can come 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 PART II, much of the arterial and collector street mileage in the city is on this system. Consequently, many improvements on these streets could qualify for FAUS funds.

The city also receives a portion of the state gas tax funds which are applicable to various street, roadway, and control improvements in the city.

Another category of funding is the categorical grants established by Title II of the Federal - Aid Highway Act of 1973. The grants fall into five different groups.

The first four cover pavement markings, hazardous locations, roadside obstacles, and railroad crossings on Federal-Aid routes.

The fifth group is the ~~Local~~ Safer Roads 230 Program, which can be utilized for a wide range of improvements including signing, signals, correction of high hazard locations, removal of obstacles, and elimination of railroad hazards. These funds are applicable to any local streets other than those that are part of the Federal-Aid system, but have been interpreted to include intersections at which at least one street is not on the Federal-Aid system. All five of these grant types are 90% federal funding with 10% local matching funds.

An additional source for financing improvements is local city funding. These monies would best be utilized as matching local funds to any categorical grants or Federal-Aid monies for which the city might apply.

The ~~Local~~ Safer Roads 230 Program funds would appear to be the most expeditious and efficient source of funding. It is recommended the city pursue this avenue

for funding and implementation of study recommendations. The Local Roads 230 Program is administered by the Iowa Department of Transportation, Division of Highways.

The principal recommendations contained in this report are summarized in the following priority listing. Cost estimates given are for improvements and modifications as described in the text or specified in the supplemental figures.

TABLE VI - PRIORITY LISTING AND COST ESTIMATES

Priority	Recommendation	Page	Cost
1.	Modifications to high accident locations.		
a.	US 30 and Main	III-12	$31,000
b.	US 30 and Clark	III-18	$24,000
c.	US 30 and US 71 (interim)	III-3	$13,500
d.	7th and Adams	III-21	$ 3,750
e.	US 71 and 3rd	III-23	$ 6,250
f.	7th and Court	III-21	$ 175
g.	US 30 and Carroll	III-11	$ 5,500 to $ 7,500 (1)
h.	US 30 and Adams	III-12	$ 1,100
i.	US 30 and Court	III-18	$ 1,100
j.	Intersections at US 30 and Boylan, Quint, Crawford, East and Grant	III-9, 18, & 21	$ 500
2.	Modifications to school crossings.	III-26	$ 6,400
3.	Intersection control signing and signalization. (2)	III-42	$ 4,500
4.	Sidewalk construction and ordinance.	III-41 & 57	-- (3)
5.	Parking restrictions on Clark, West, US 30 and 10th.	III-55	$ 750
6.	Construction modifications.		
a.	Hospital entrance	III-51	$ 1,400
b.	South Main and Raccoon River Embankment	III-37	$ 700
c.	US 30 from Grant to Vine	III-36	$17,700
d.	5th and Carroll	III-51	$ 500

TABLE VI - Continued

Priority	Recommendation	Page	Cost
7.	Sight distance ordinance and maintenance.	III-57	--
8.	Intersection control enforcement.	III-57	--
9.	Pavement marking maintenance.	III-9 & 36	--

(1) Range based on optional installation of salvaged mast arms at Carroll Street.
(2) Includes installation of backplates.
(3) Assessed to property owner.

The total sum of all costable recommendations is $120,825.

Certain recommendations are given high priority because their implementation can be begun without great cost. A number of recommendations can be combined when applications for funding are made.

There are other lesser recommendations which do not appear in TABLE VI or are referred to only generally. The text of PART III should be consulted with regard to these recommendations.

Write up which ones could use categorical
give typical cost of pavement
show which ones could use Federal
which one could use Local

V APPENDIX

Part V
APPENDIX

Citizens, officials and organizations contacted with respect to this report are as follows.

Mr. Robert Blincow, Hospital Administrator.

Mr. Darwin Bunger, Carroll City Council.

Mr. Leslie Butler, School Liaison Officer, Carroll Police Department.

Mr. Leo R. Clark, Public Works Director.

Mr. Thomas Dewit, District Planner, IDOT.

Mr. Maurice Dion, Chief of Police.

Father Donehue, Superintendent, Carroll Kuemper High School.

Mr. David Ellis, Resident Construction Engineer, IDOT.

Mr. George H. Fair, Principal, Carroll High.

Mr. William S. Farner, Mayor.

Mr. Thomas M. Gaffney, Citizen.

Mr. Art Gute, City Manager.

Mr. William L. Hammen, President, Chamber of Commerce.

Mr. L. E. Johnson, Signal Consultant.

Mr. Robert L. Kraus, Carroll City Council.

Mr. Thomas Louis, Assistant Public Works Director

Mr. Walter Maurice, District Engineer, IDOT.

Mr. Alvin Molitor, Asst. Principal, Carroll High.

Sister Mary Myron, Principal, St. Lawrence School.

Mr. Leon Oswald, City Clerk.

Mr. Darwin Petersen, Iowa Public Service.

Mr. James Reed, Dist. Traffic Engineer, IDOT.

Mr. Allen N. Stroh, Superintendent Public Schools.

Mr. Gary L. Tessmer, Bus Safety Director, Carroll Public Schools.

Sister Susan Till, Principal, Holy Spirit Grade School.

Mr. Leroy Toole, Safety Patrol Supervisor, Holy Spirit Grade School.

Mrs. Richard D. Watson, President, Parent Council.

How many more of these names are spelled wrong?

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.

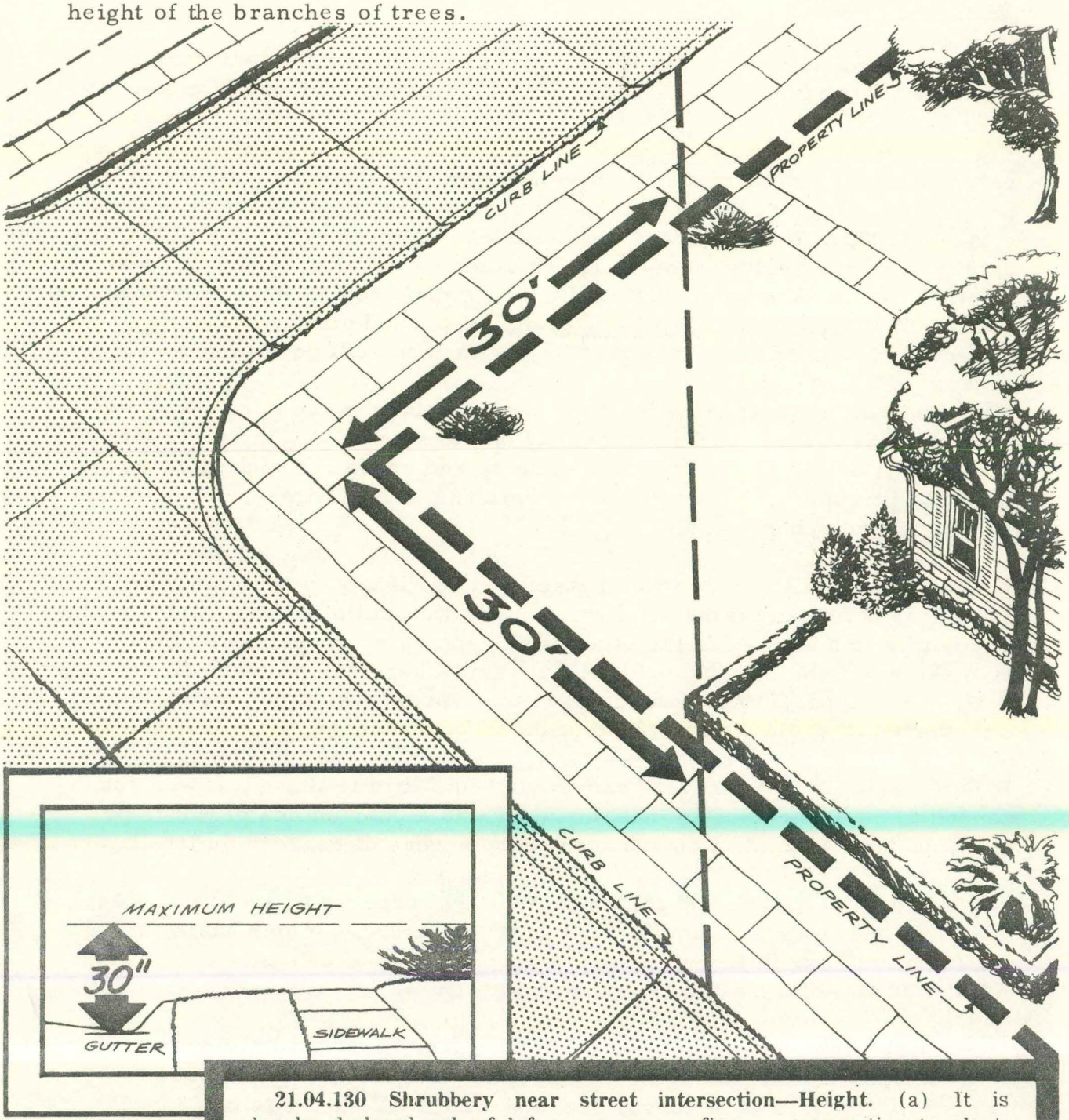
Separation of children and traffic is the only sure way to avoid tragedies. The next best way is to equip our kids on a round-the-clock basis through education of both children and drivers, along with acceptance of responsibility by those who really have the most to gain.

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.

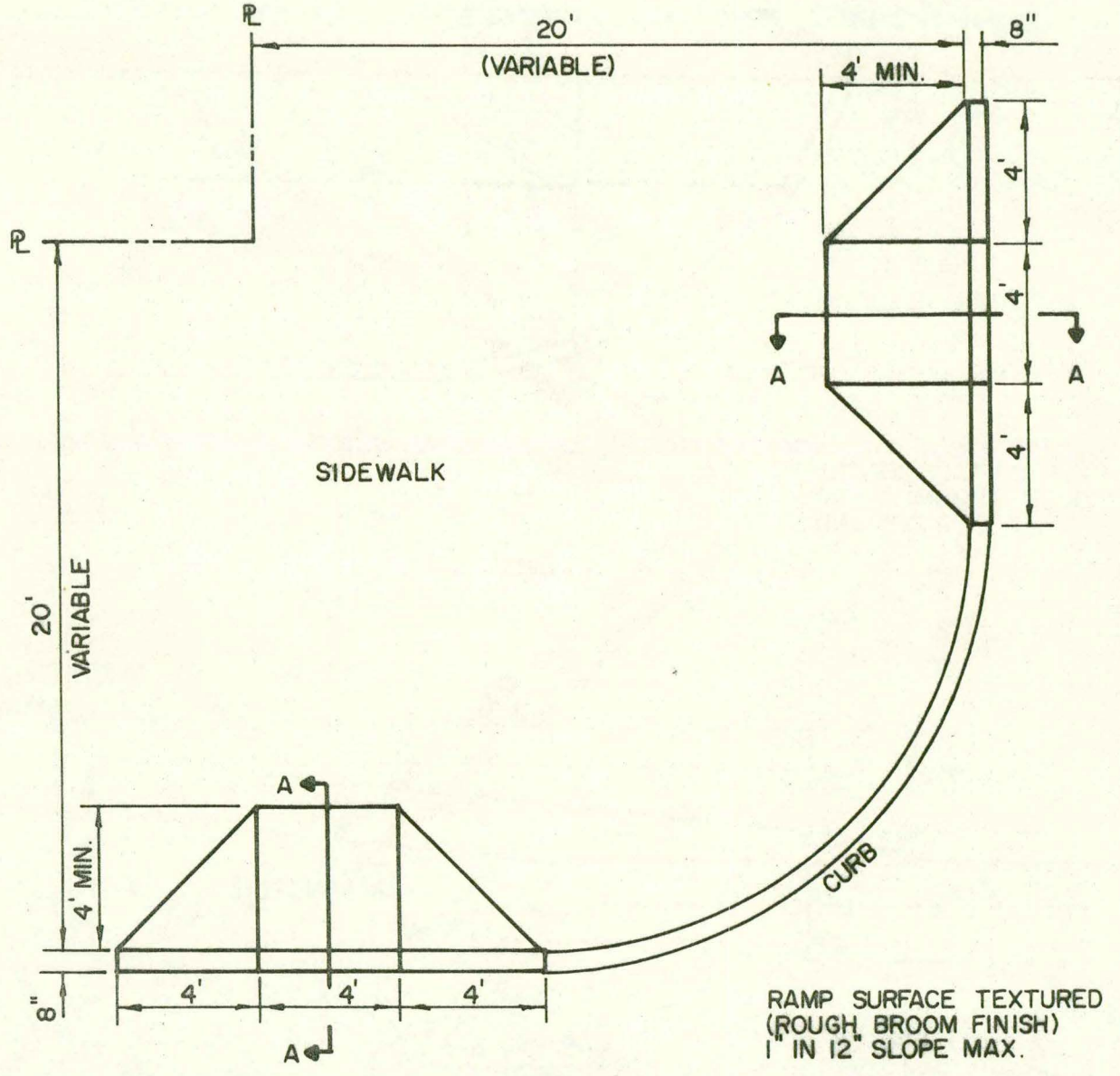
INTERSECTION VISIBILITY ORDINANCE

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.

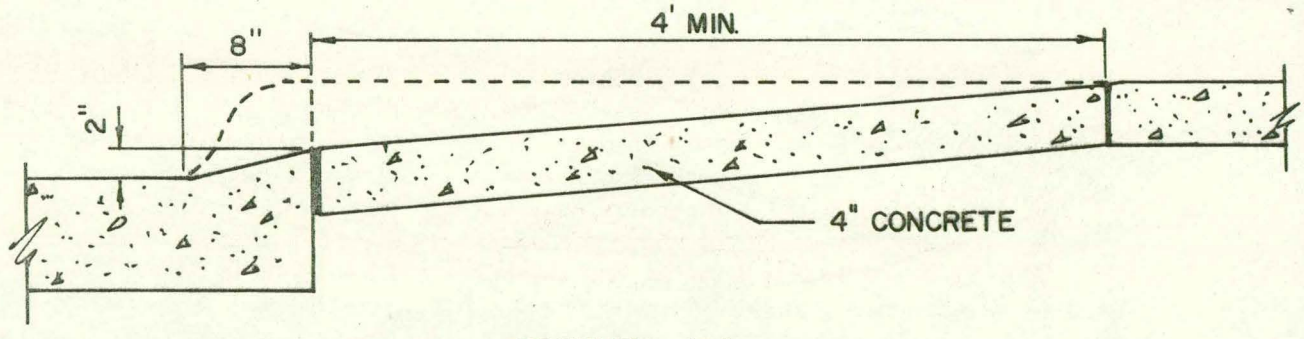


21.04.130 Shrubbery near street intersection—Height. (a) It is hereby declared unlawful for any person, firm or corporation to plant, grow, keep, or maintain, or cause to be planted, grown, kept or maintained any hedge, bush or shrubbery of any kind or nature more than two and one-half feet in height 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).



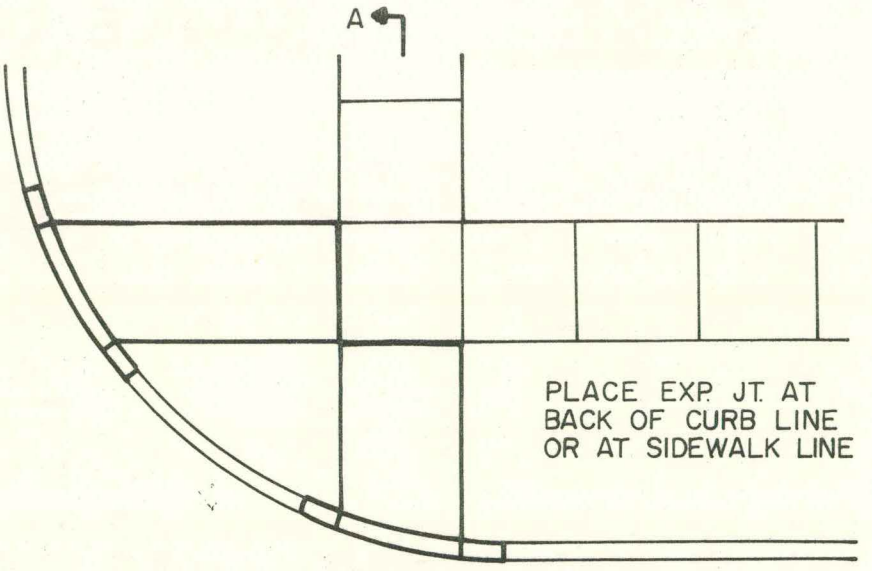
PLAN



SECTION A-A

BUSINESS DISTRICT SIDEWALK RAMP

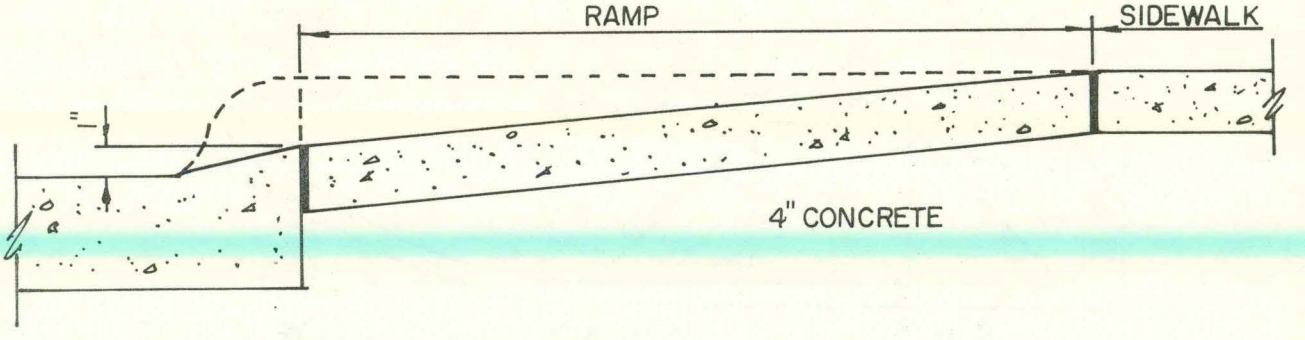
NOT TO SCALE



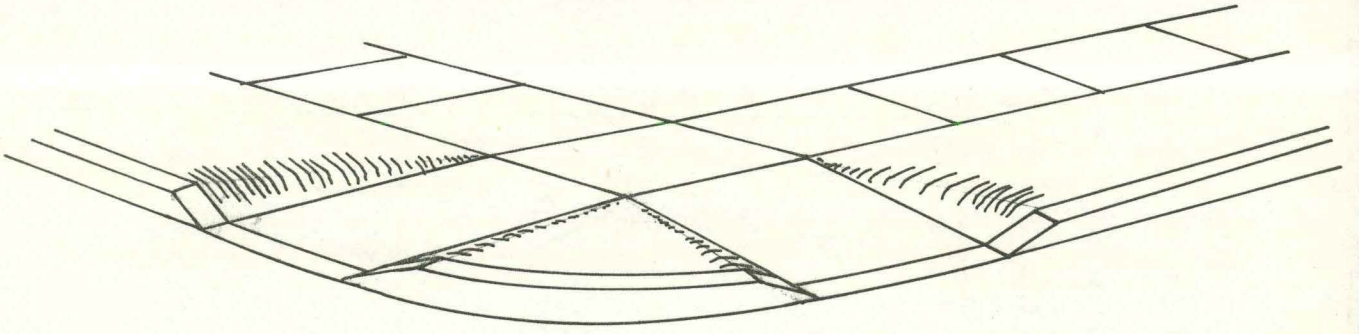
RAMP SURFACE TEXTURED
(ROUGH BROOM FINISH)
1 1/2" IN 12" SLOPE MAX.

A

PLAN



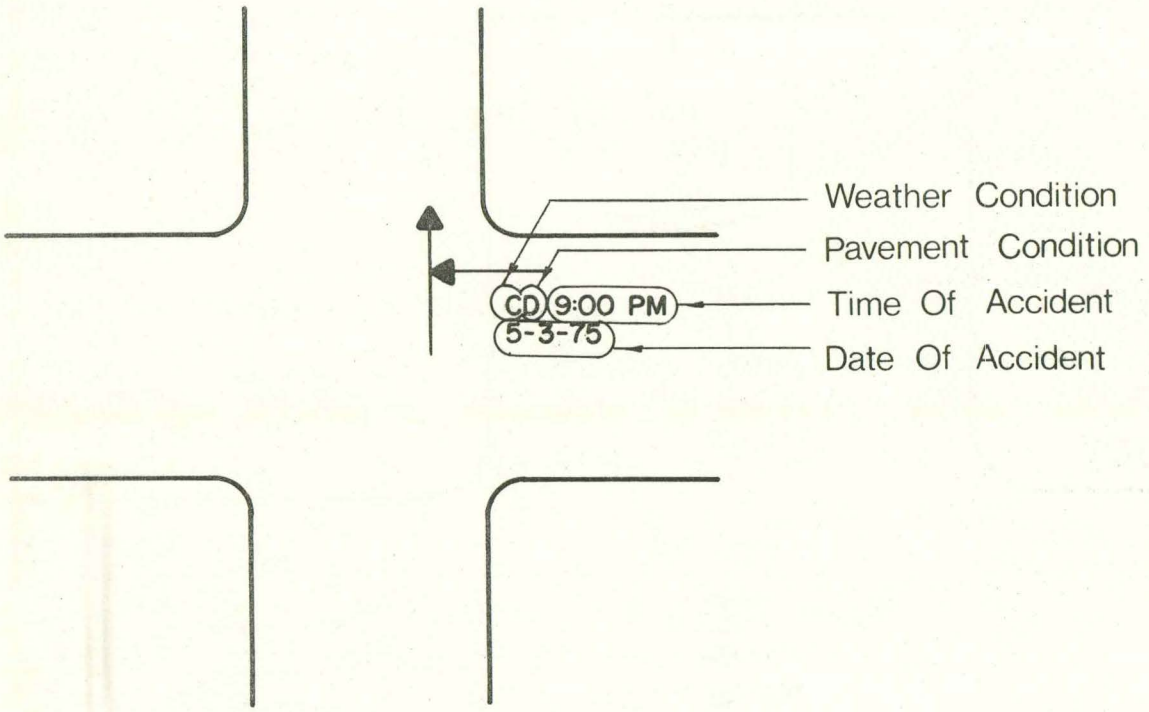
SECTION A-A



RESIDENTIAL SIDEWALK RAMP

NOT TO SCALE

ACCIDENT COLLISION SAMPLE DIAGRAM



Legend

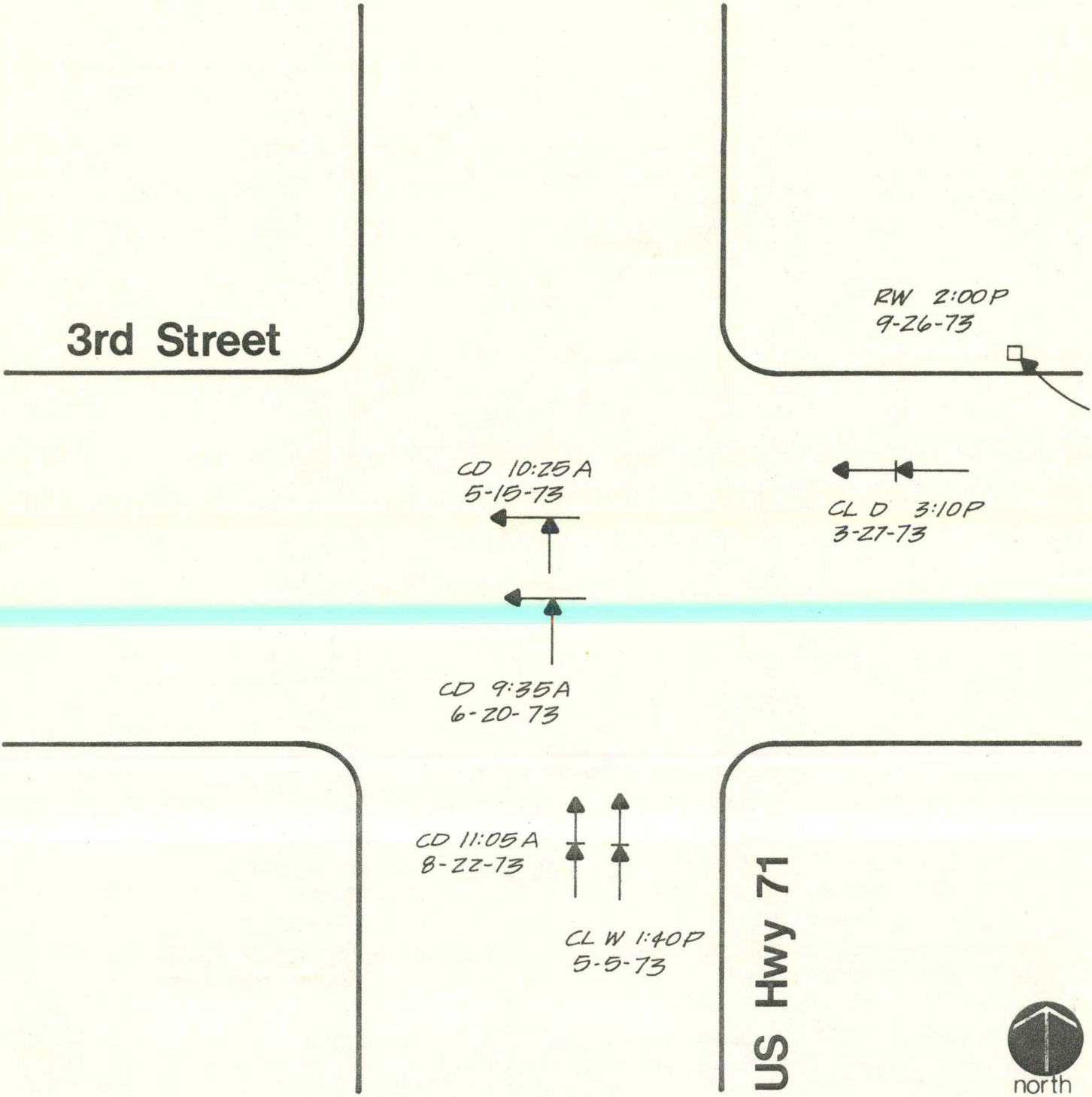
- PARKED(ING) VEHICLE
- FIXED OBJECT
- REAR END COLLISION
- SIDE SWIPE
- OUT OF CONTROL VEHICLE
- FATAL ACCIDENT
- PERSONAL INJURY
- PROPERTY DAMAGE ONLY
- M.V. BACKING
- M.V. MOVING AHEAD
- PEDESTRIAN

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 1973



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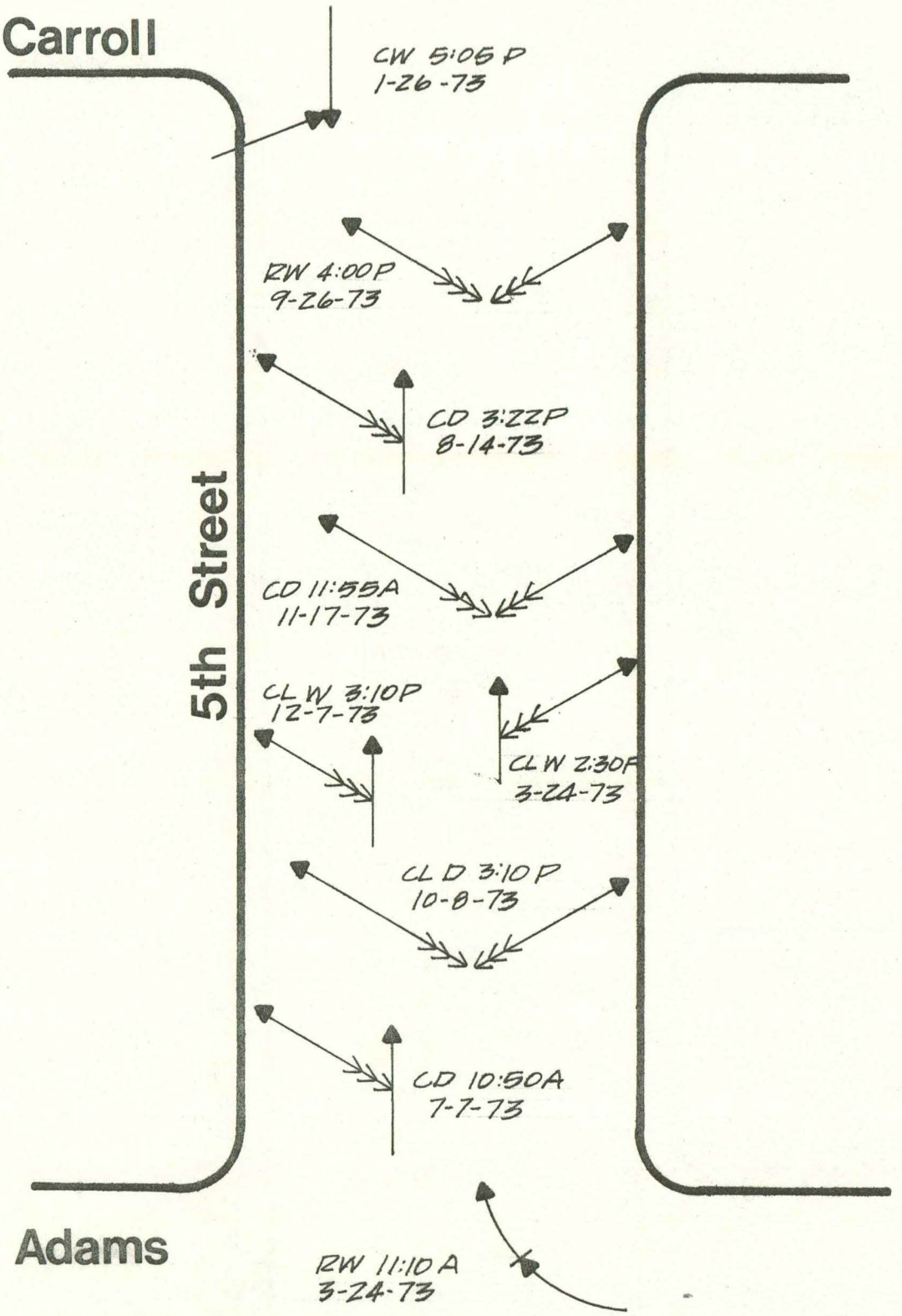

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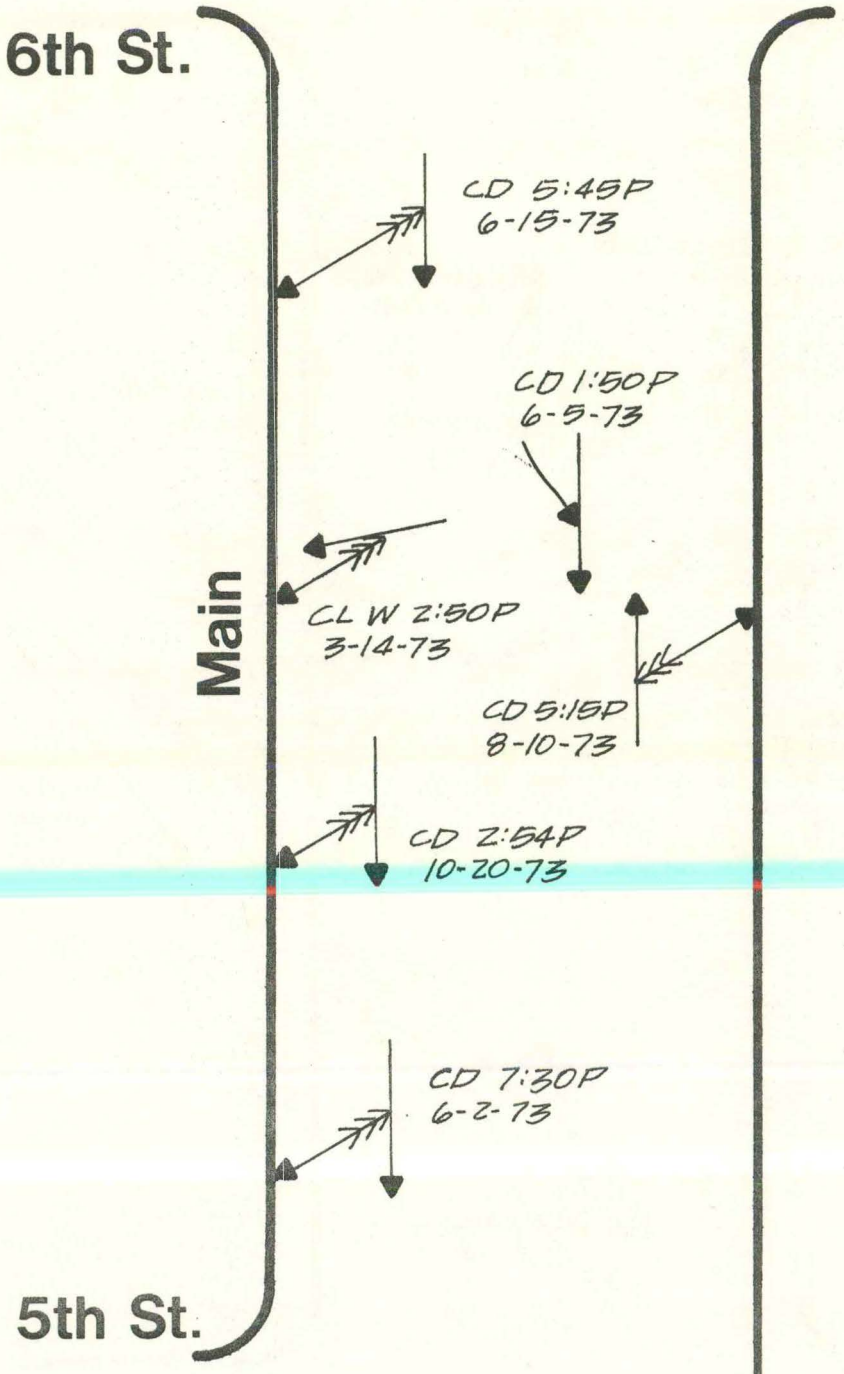

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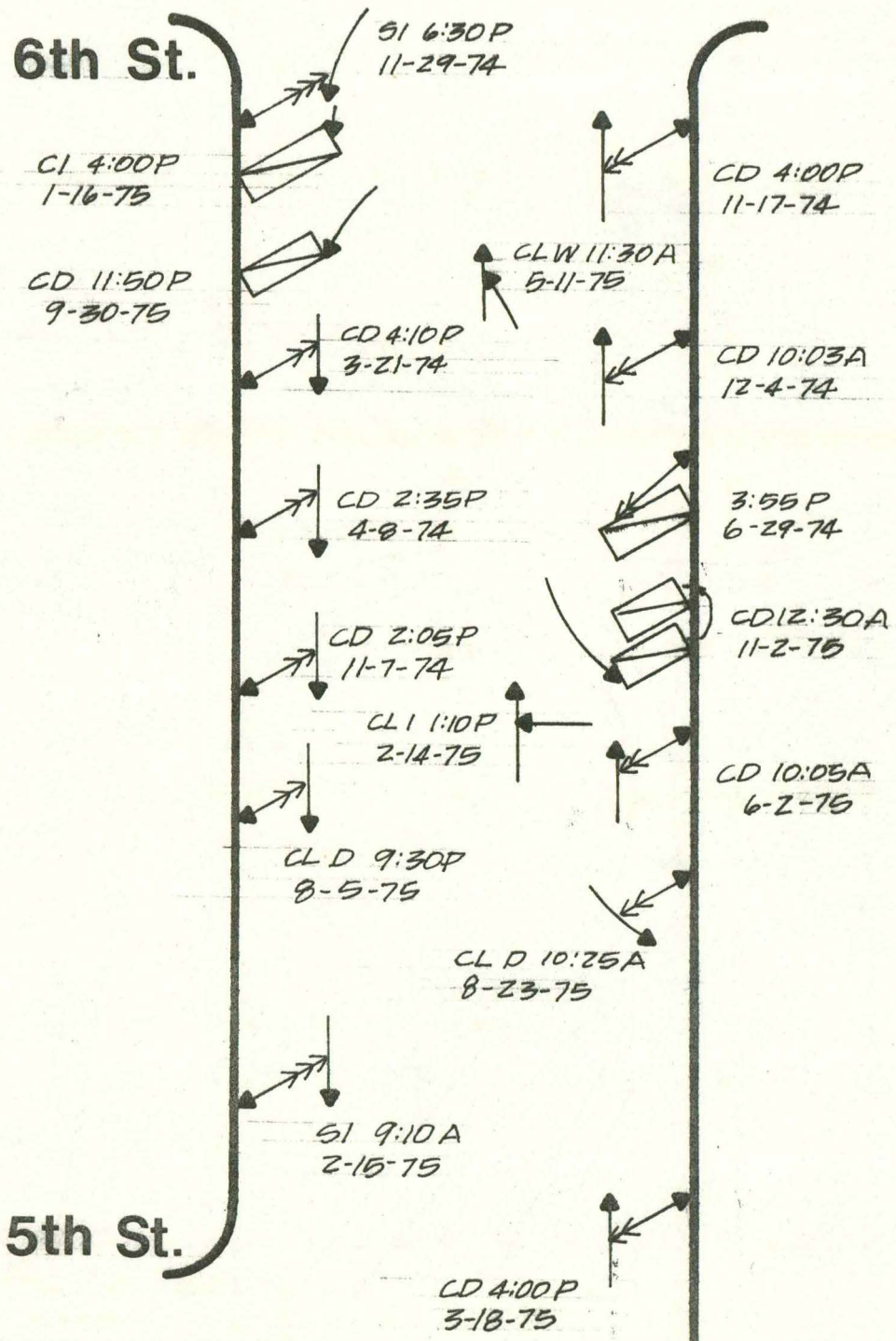

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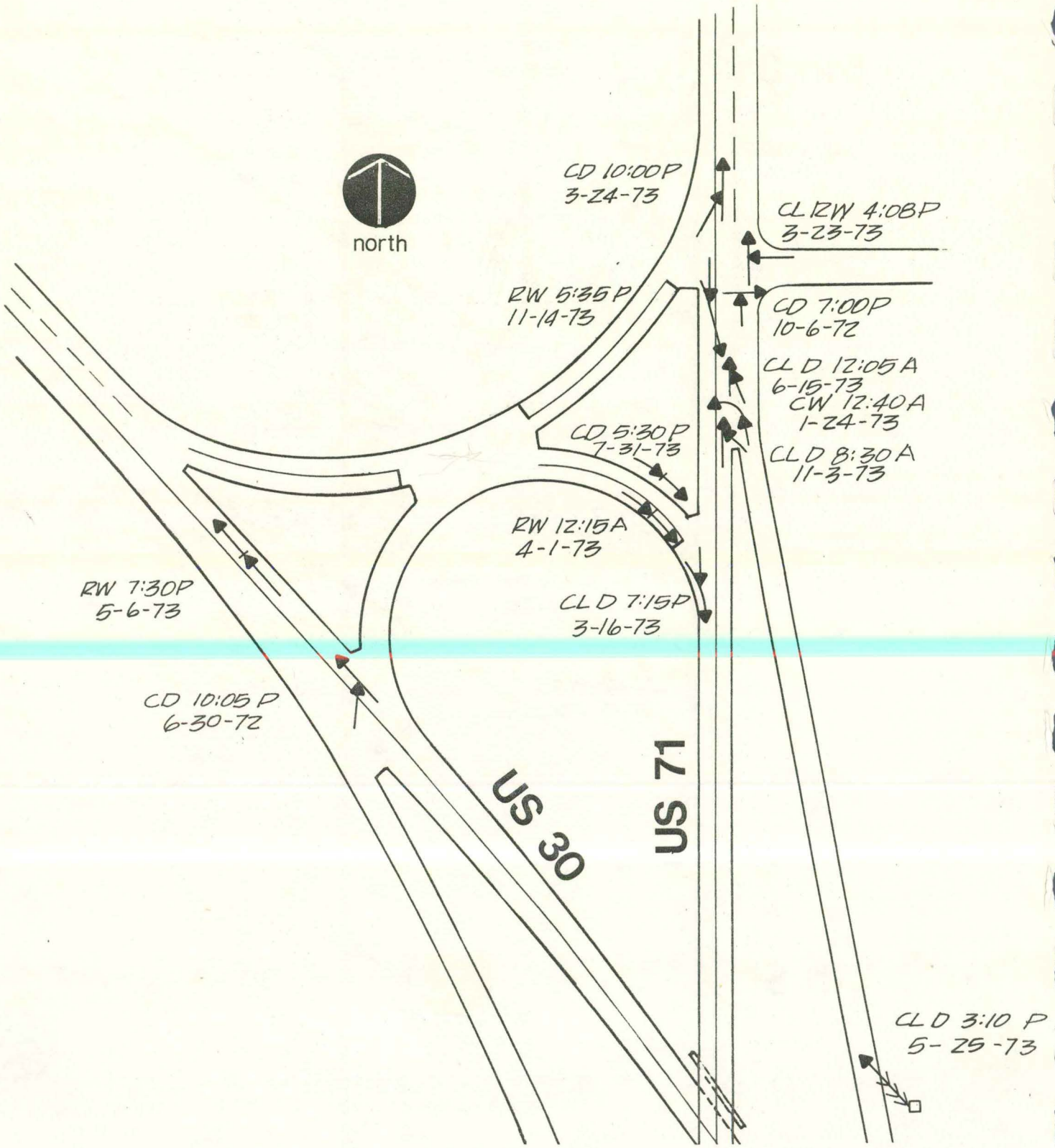

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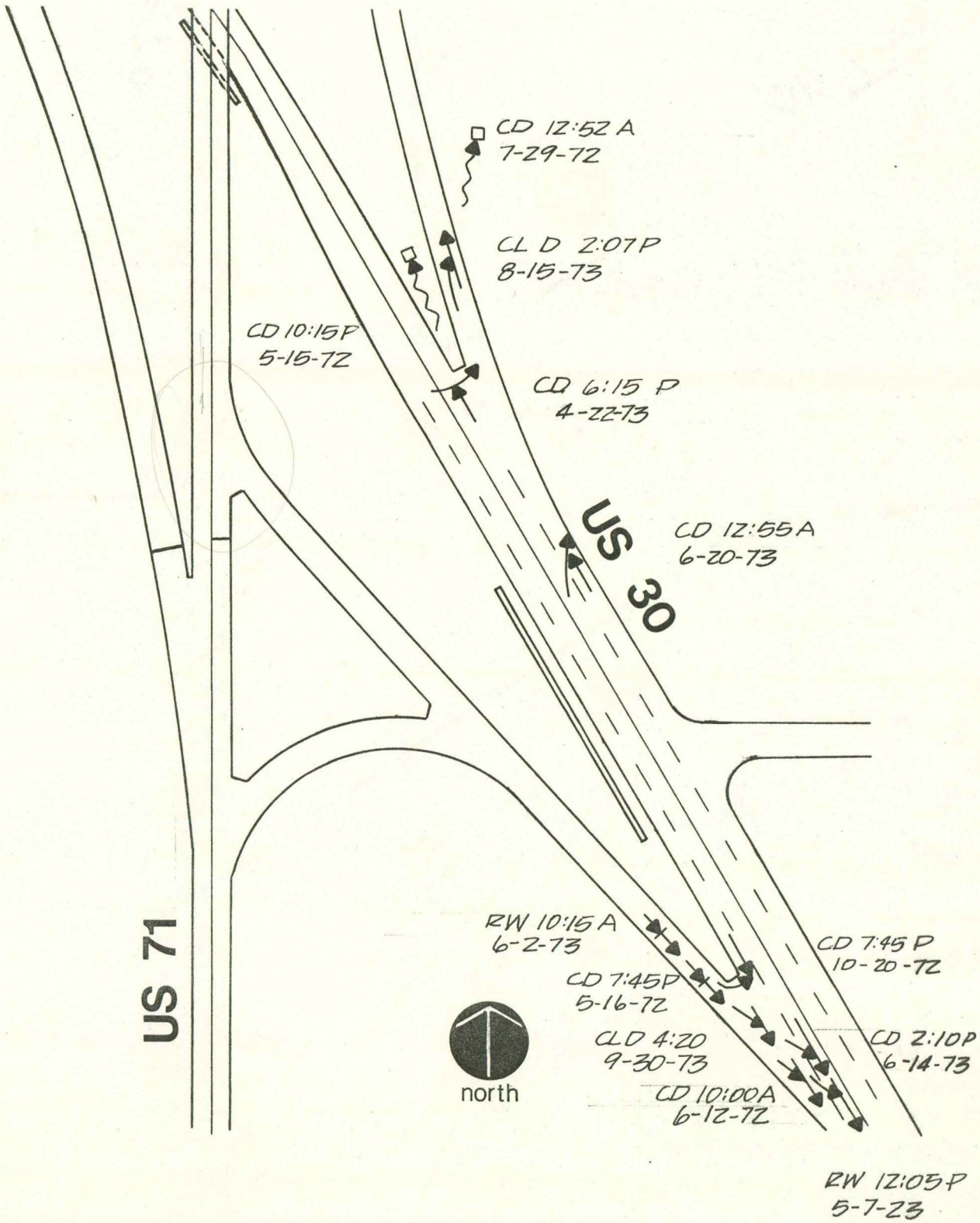

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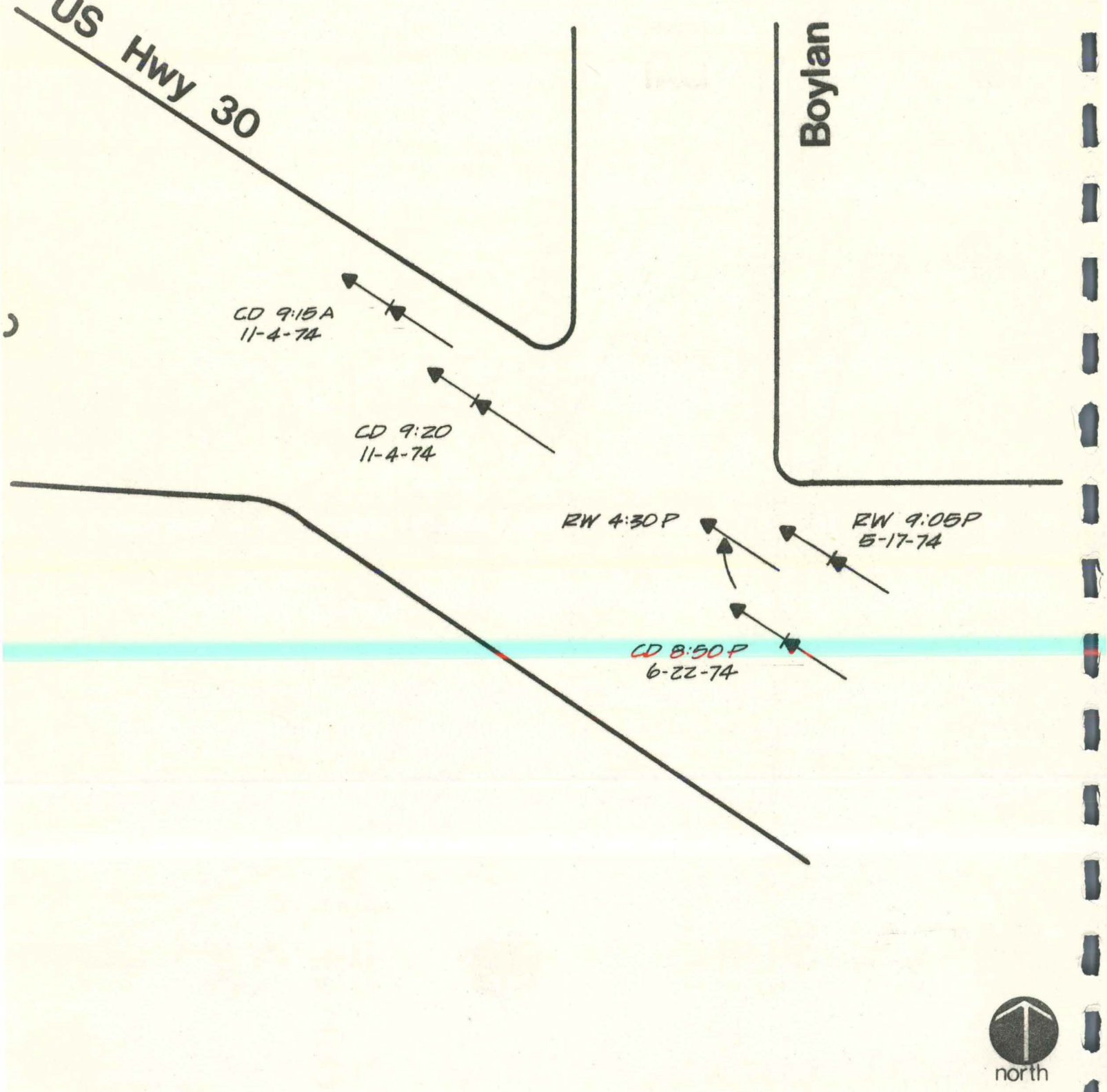

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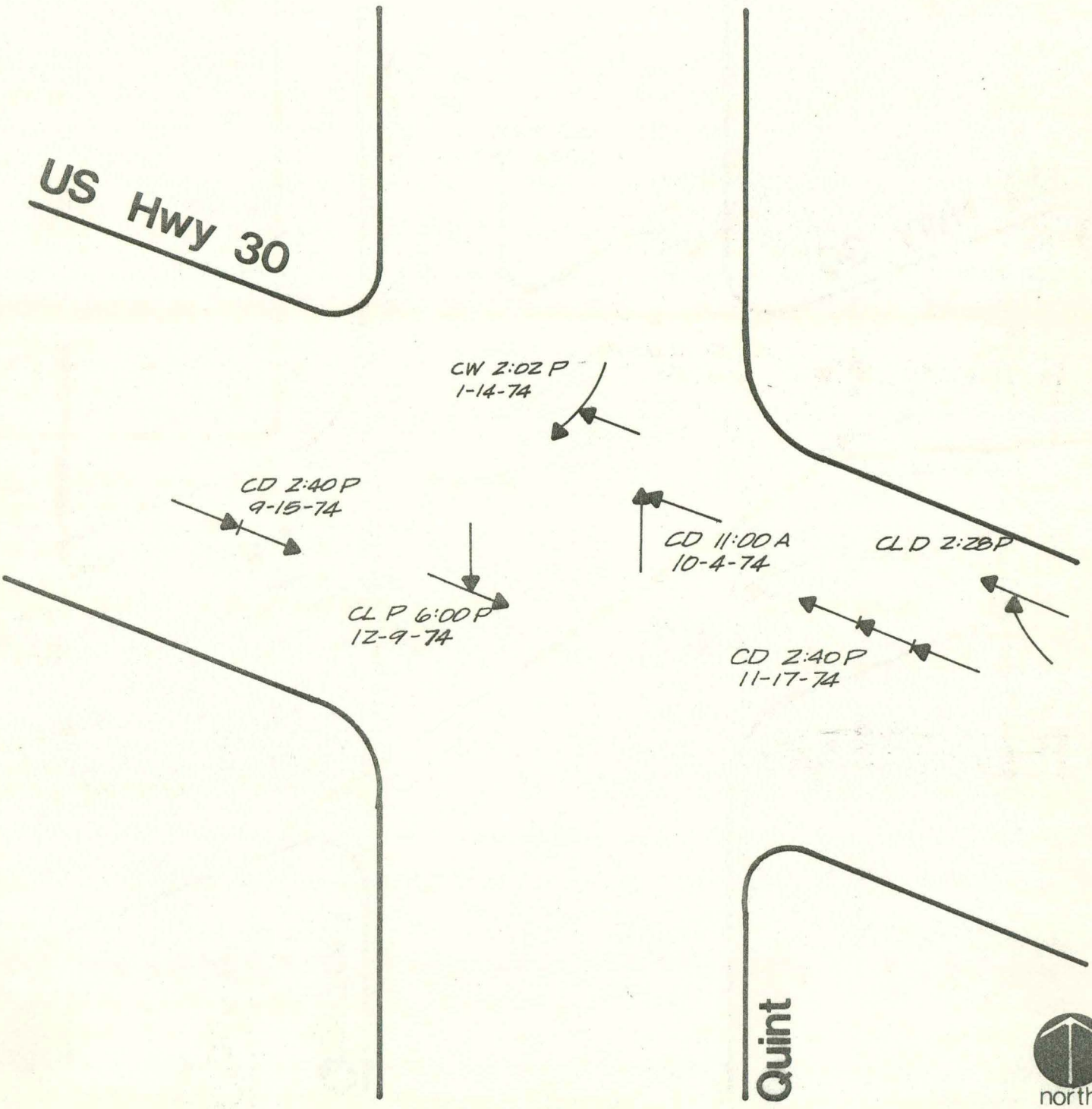

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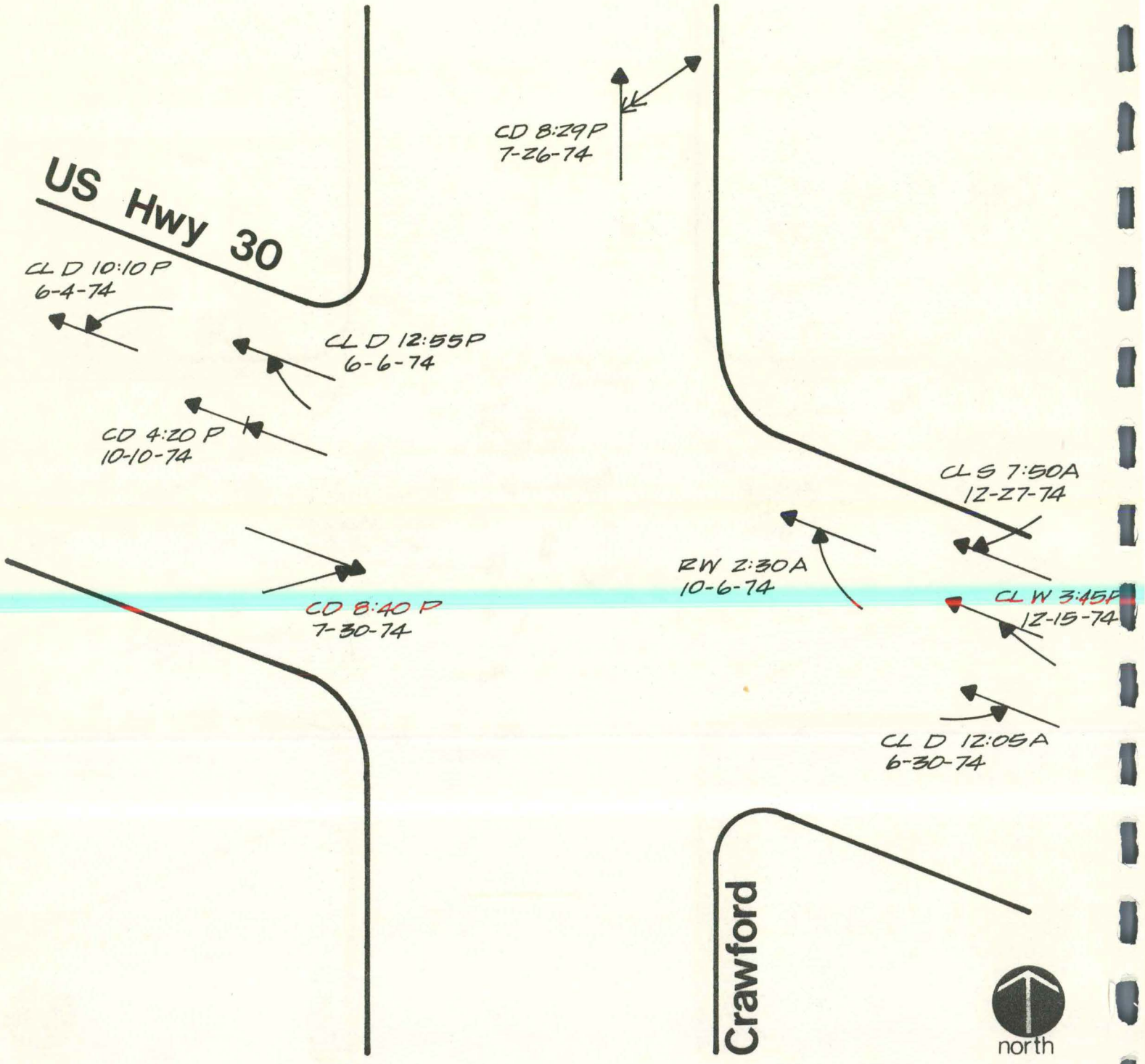

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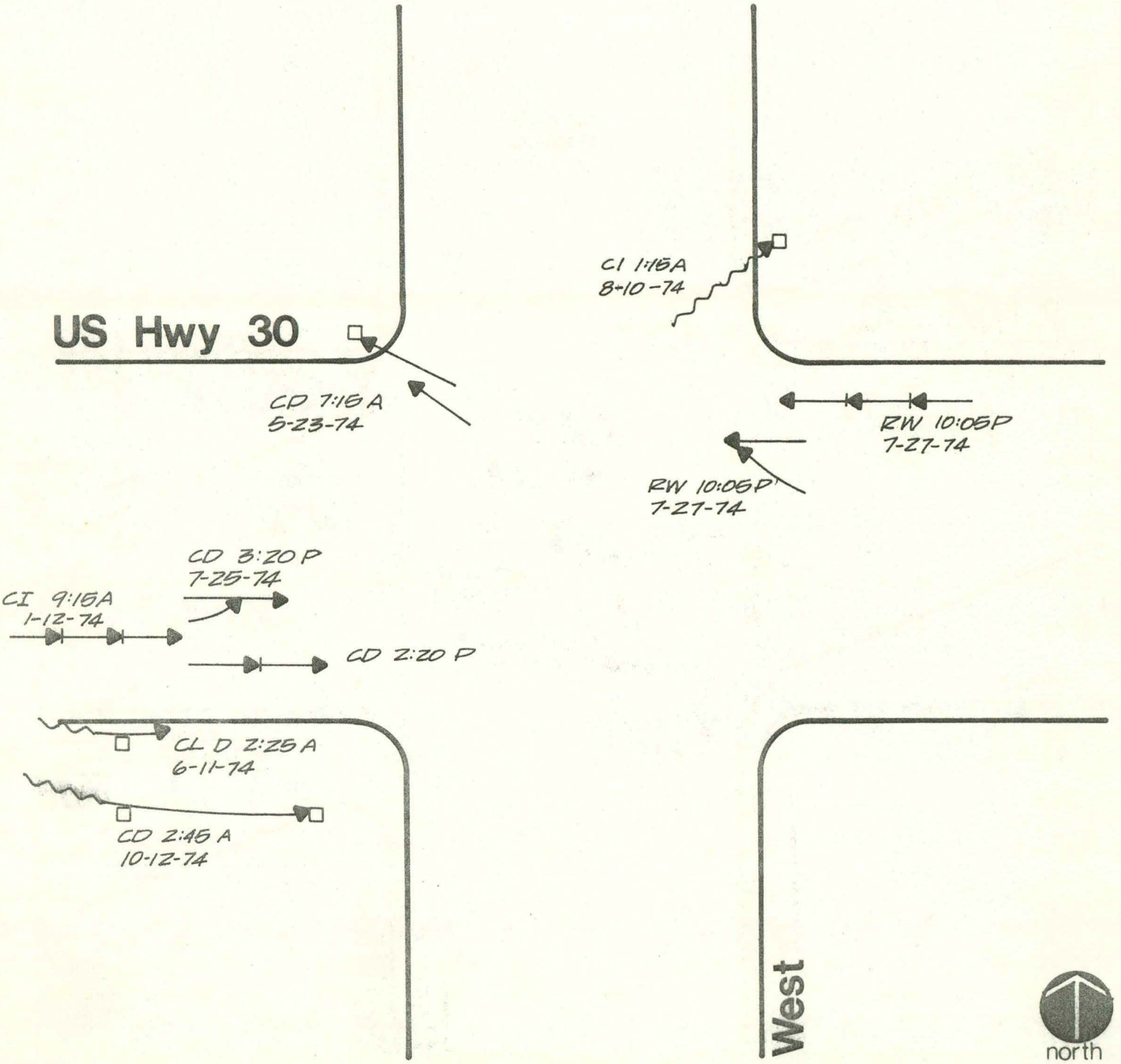

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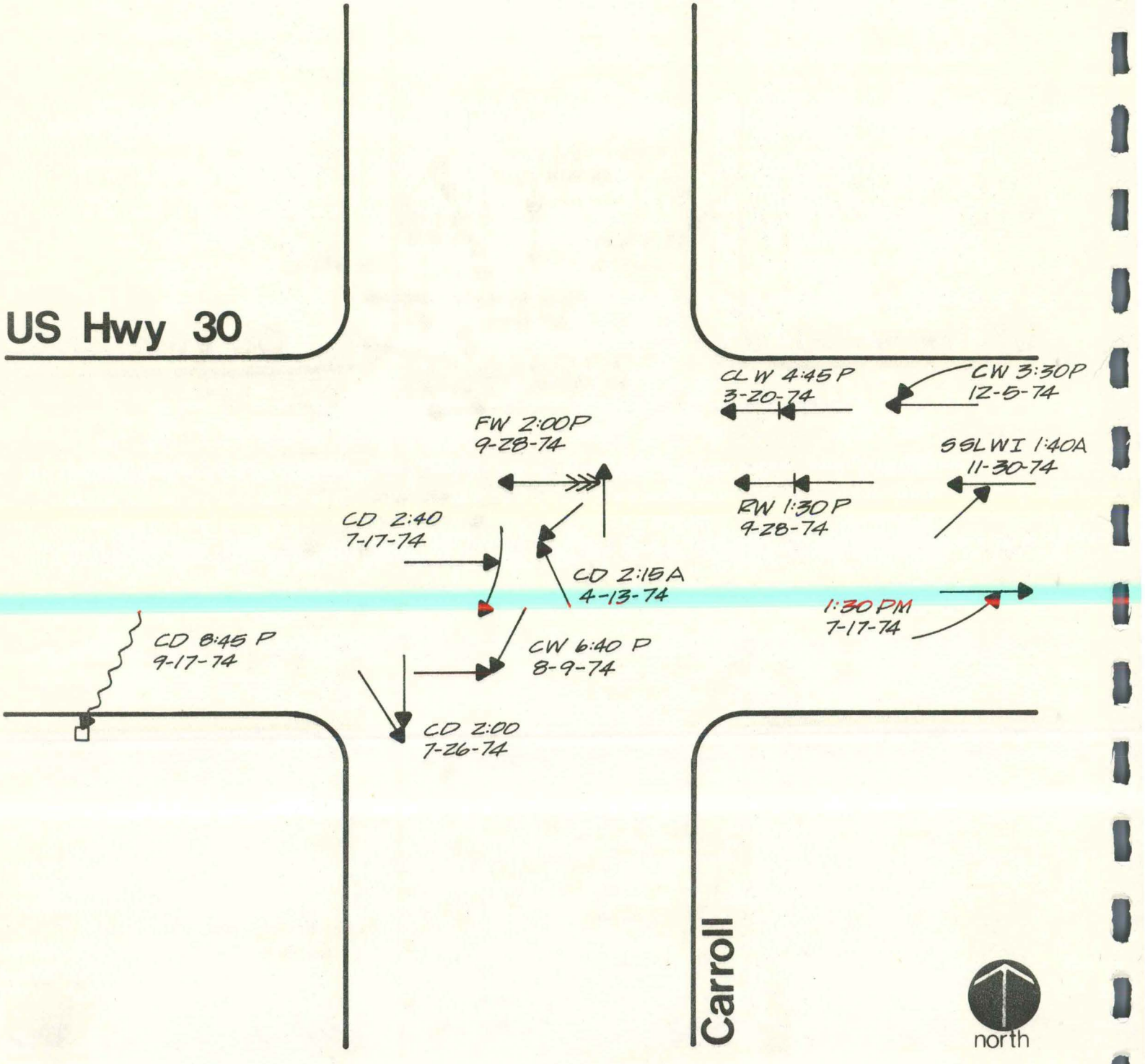

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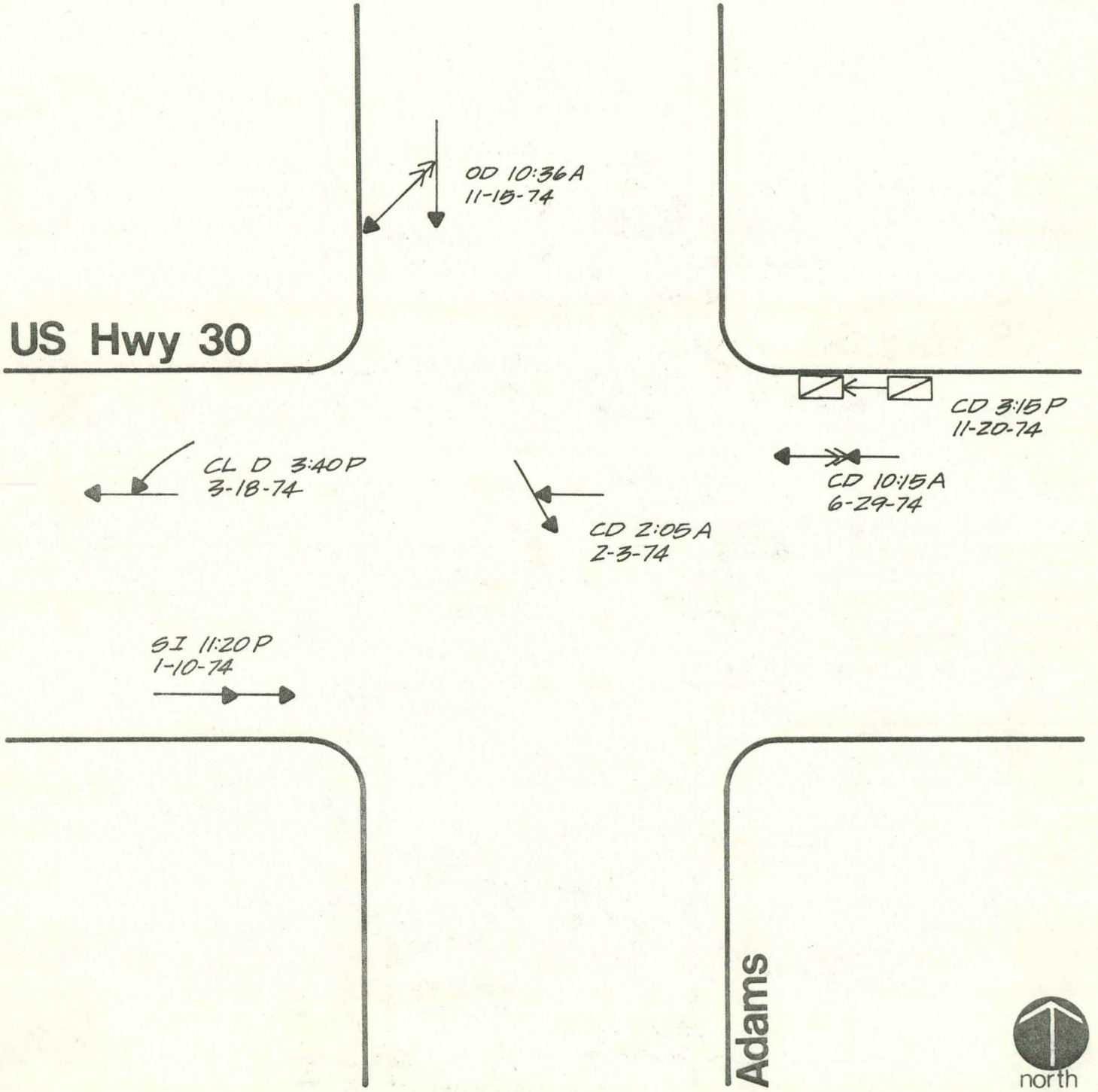

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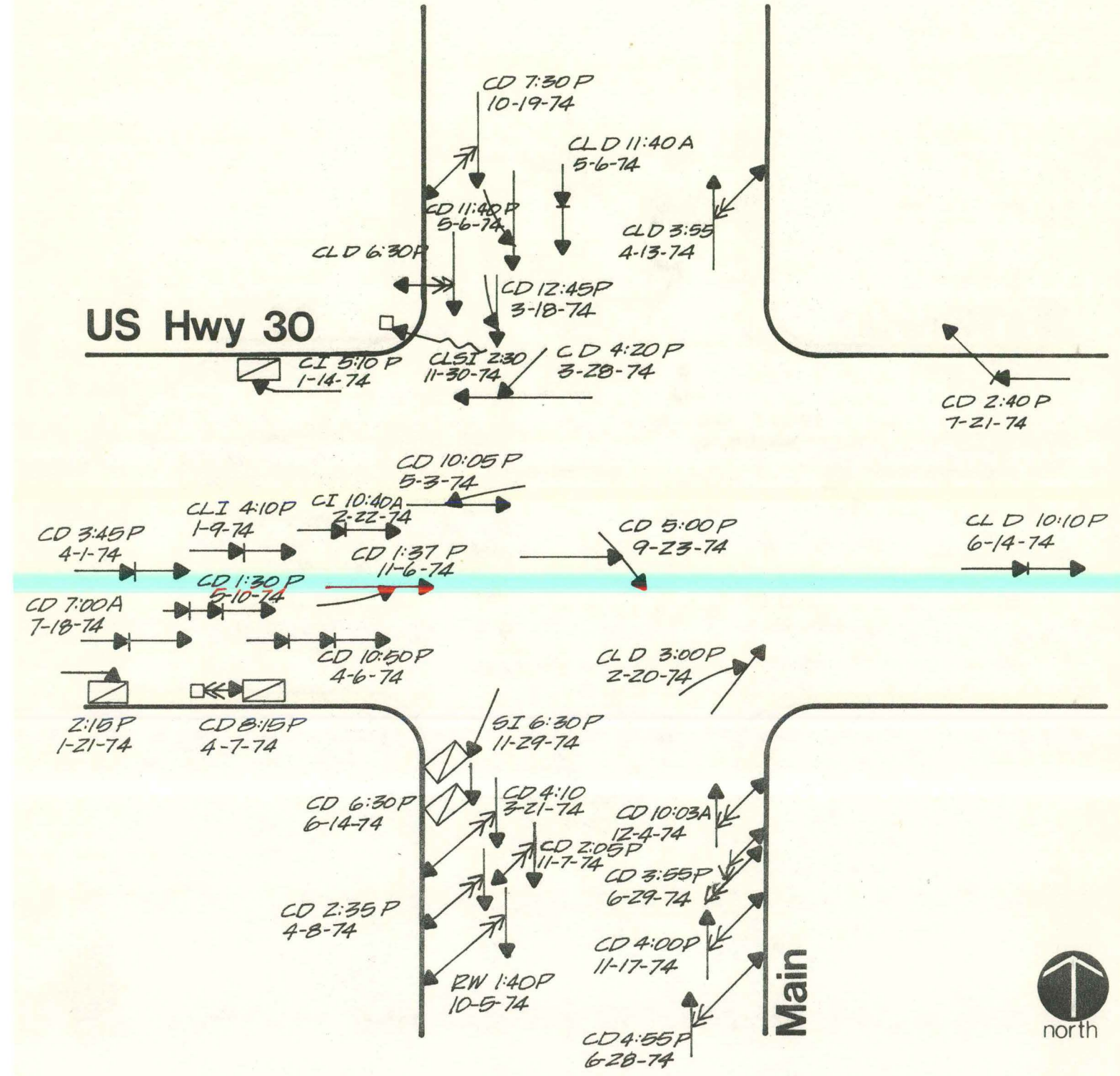

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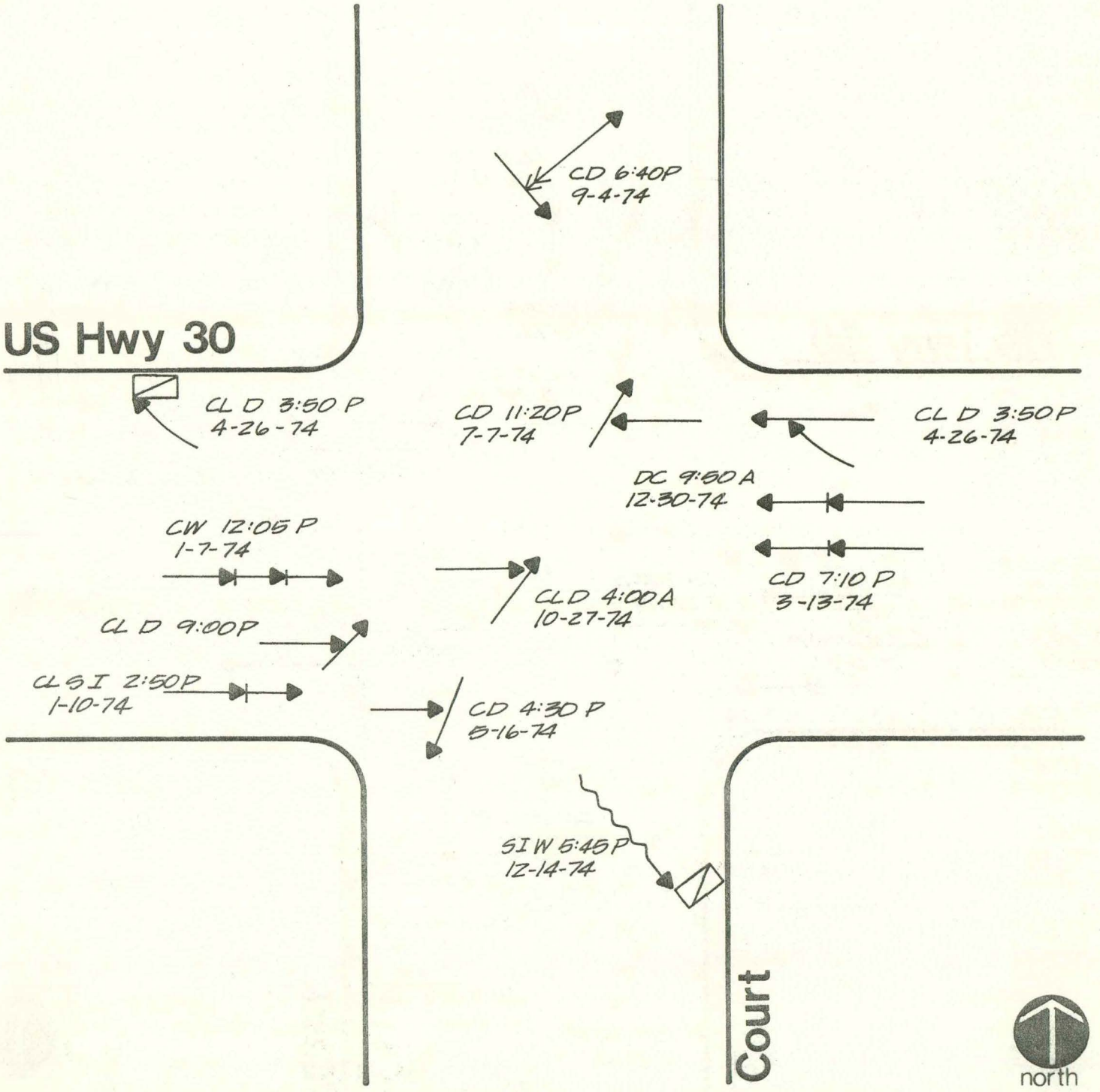

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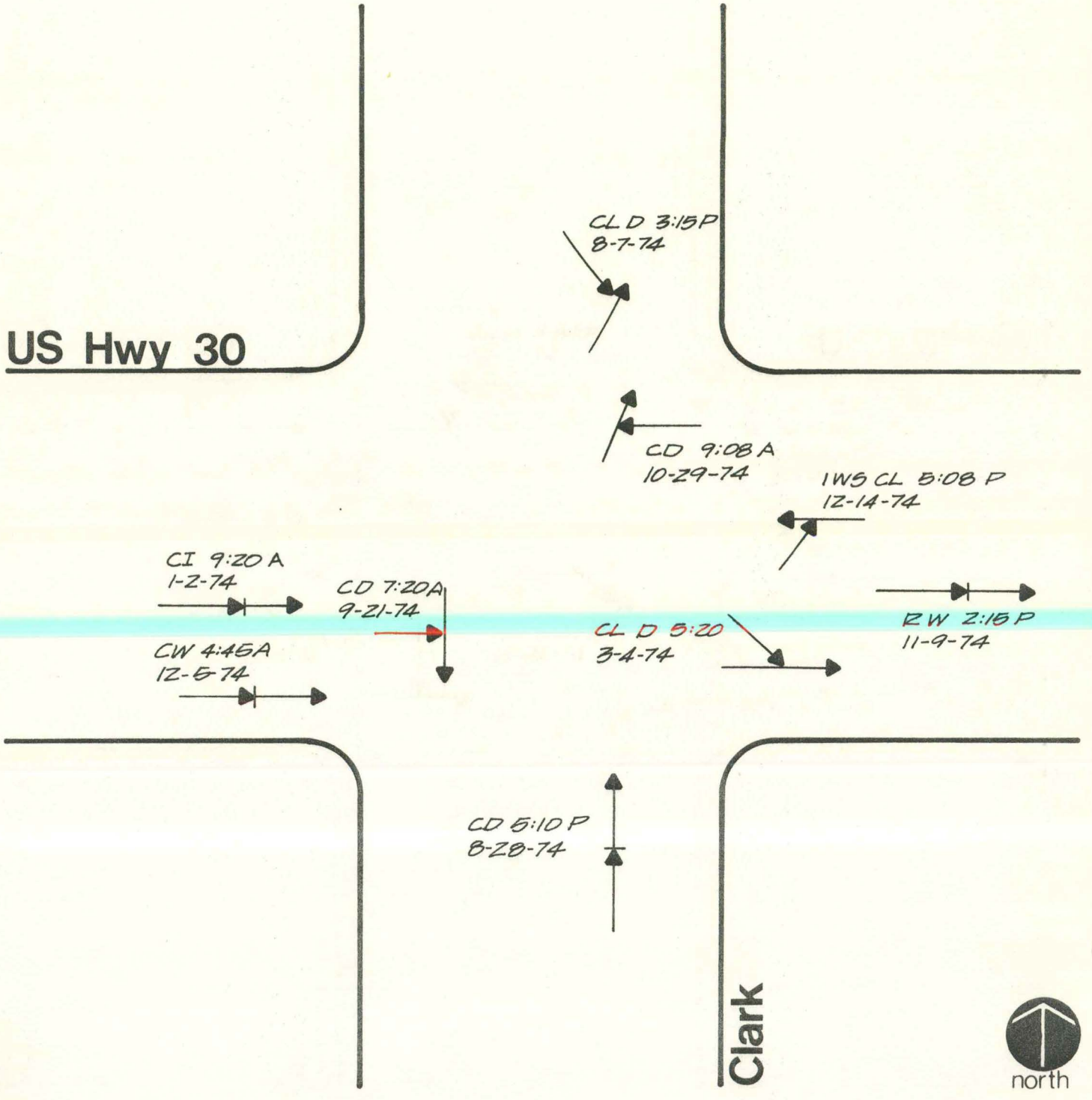

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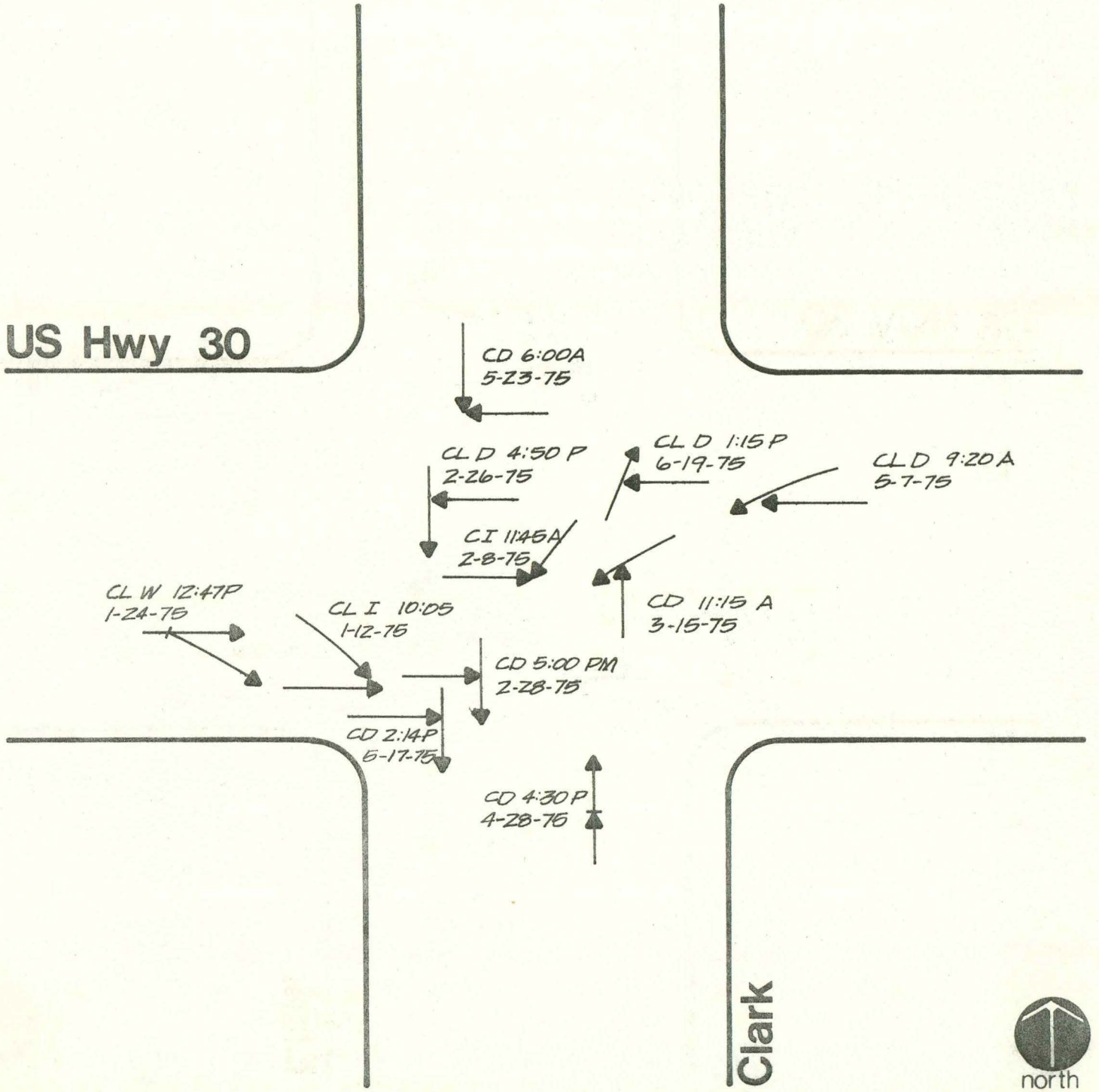

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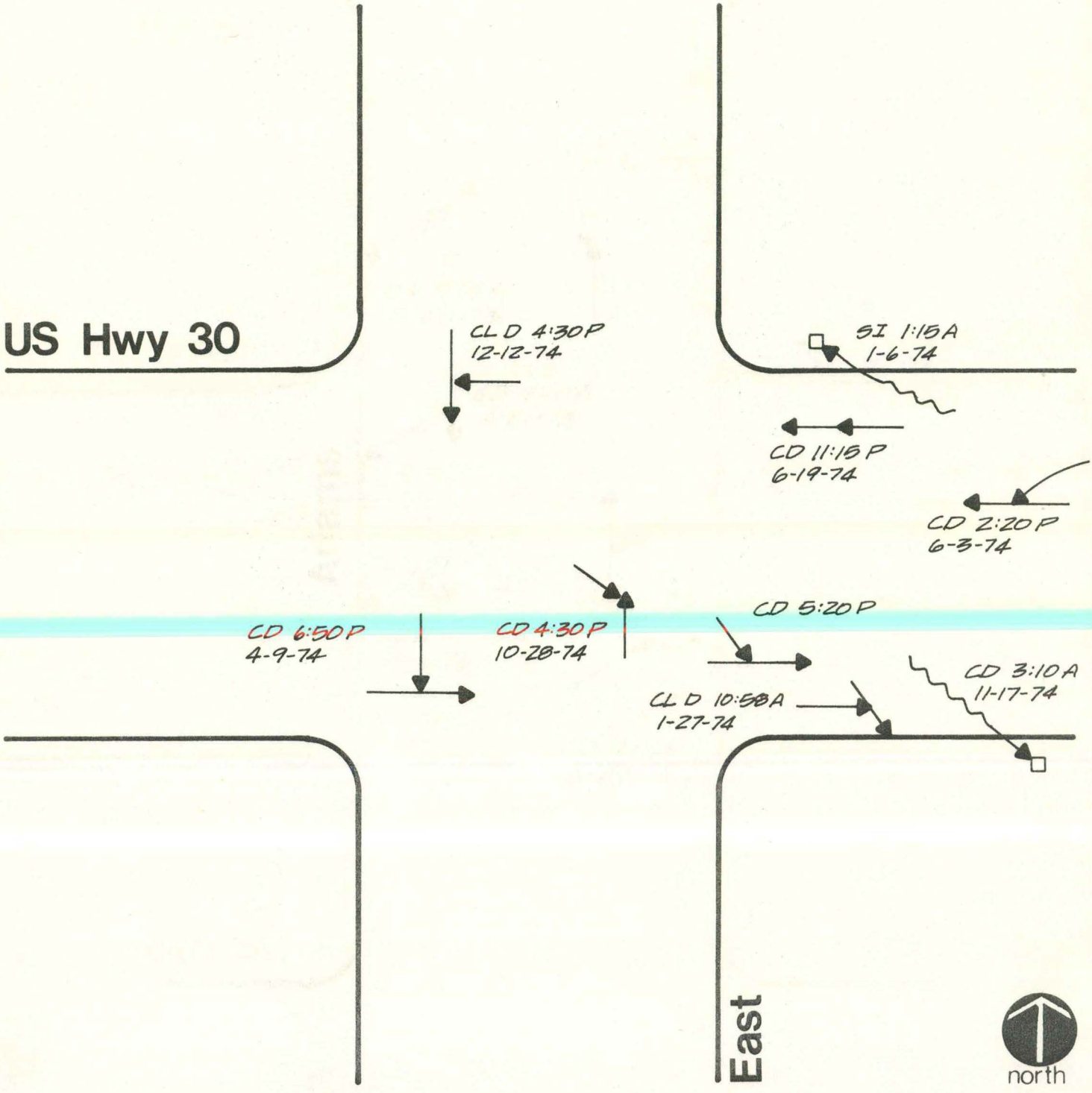

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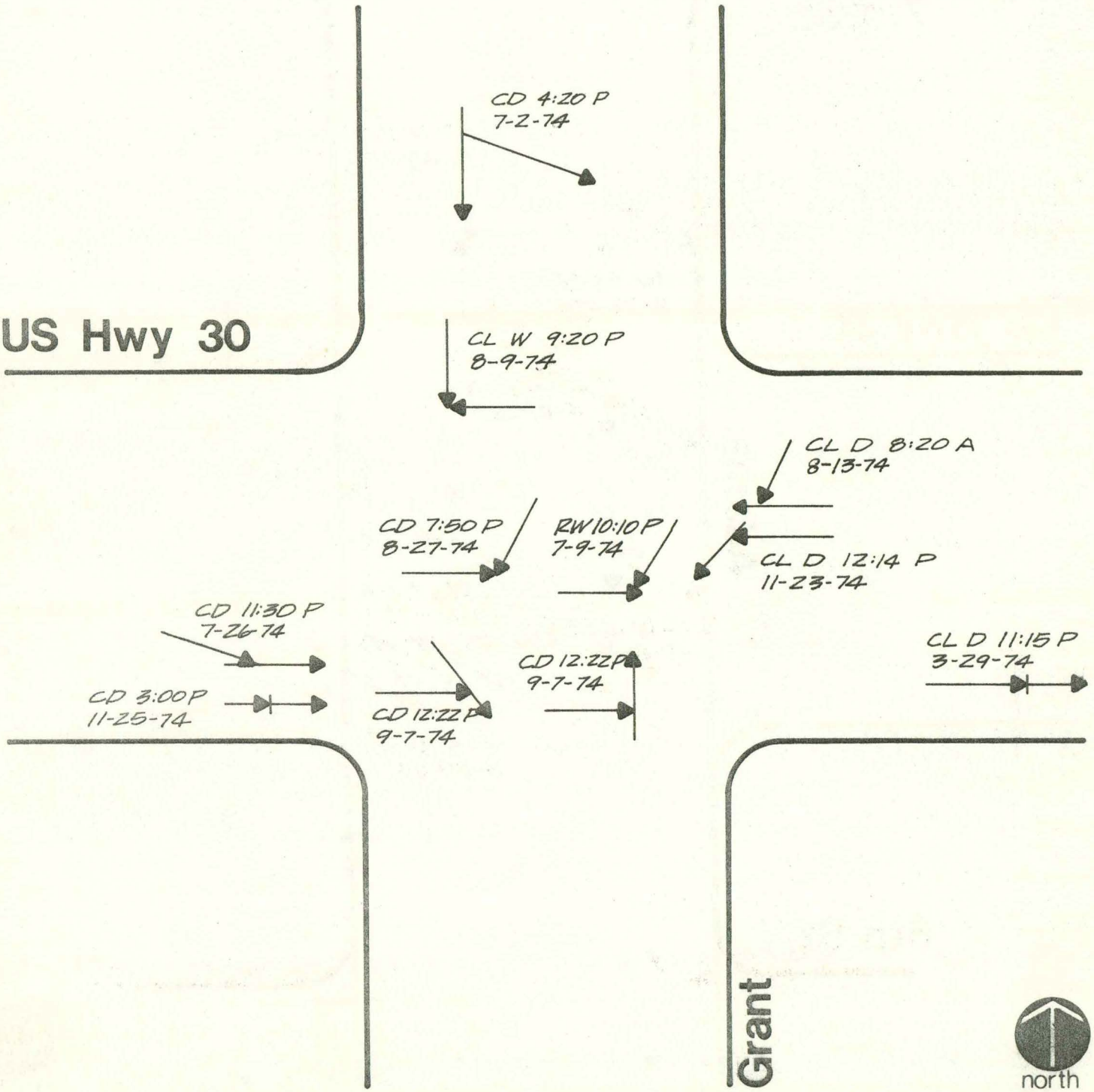

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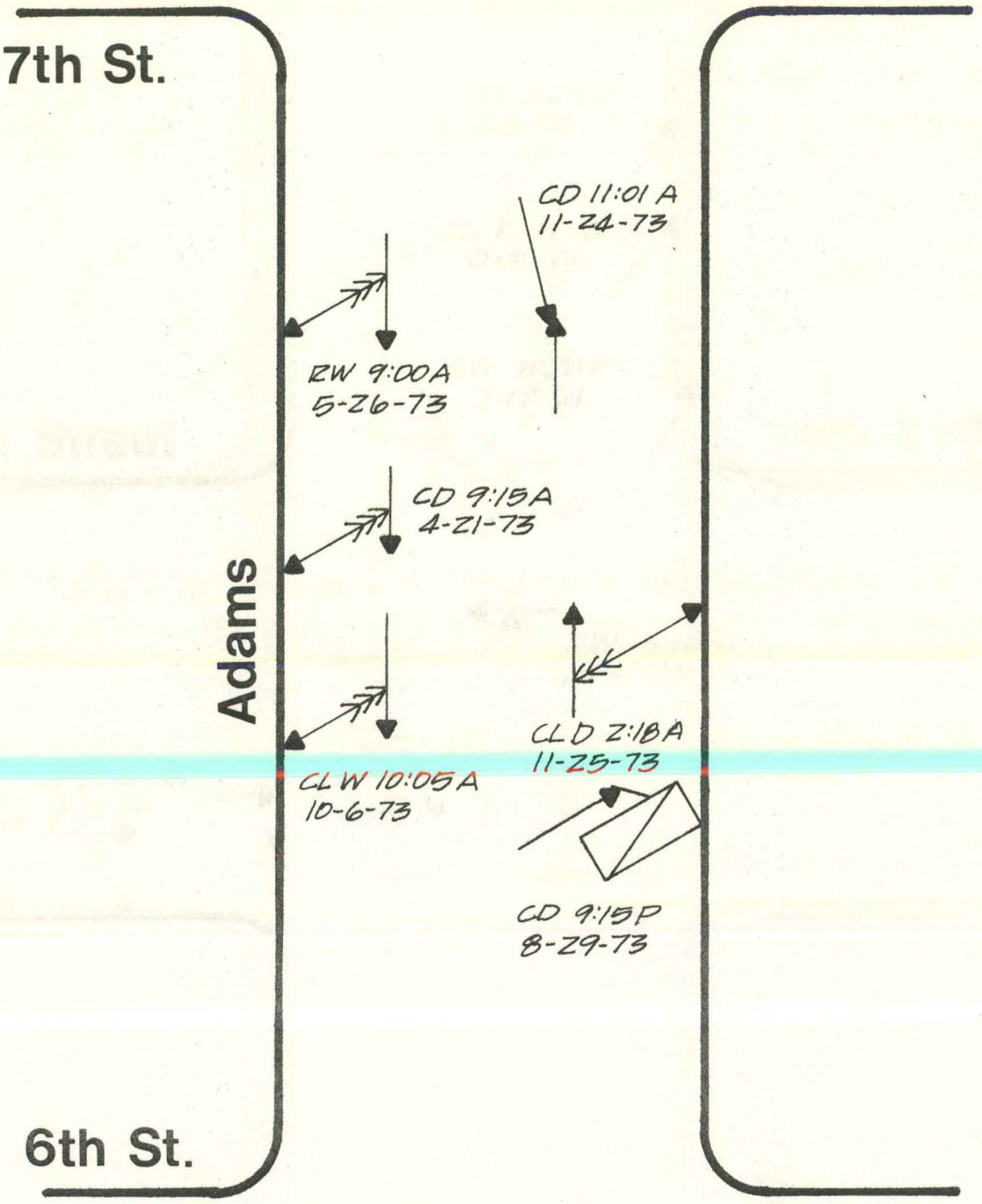

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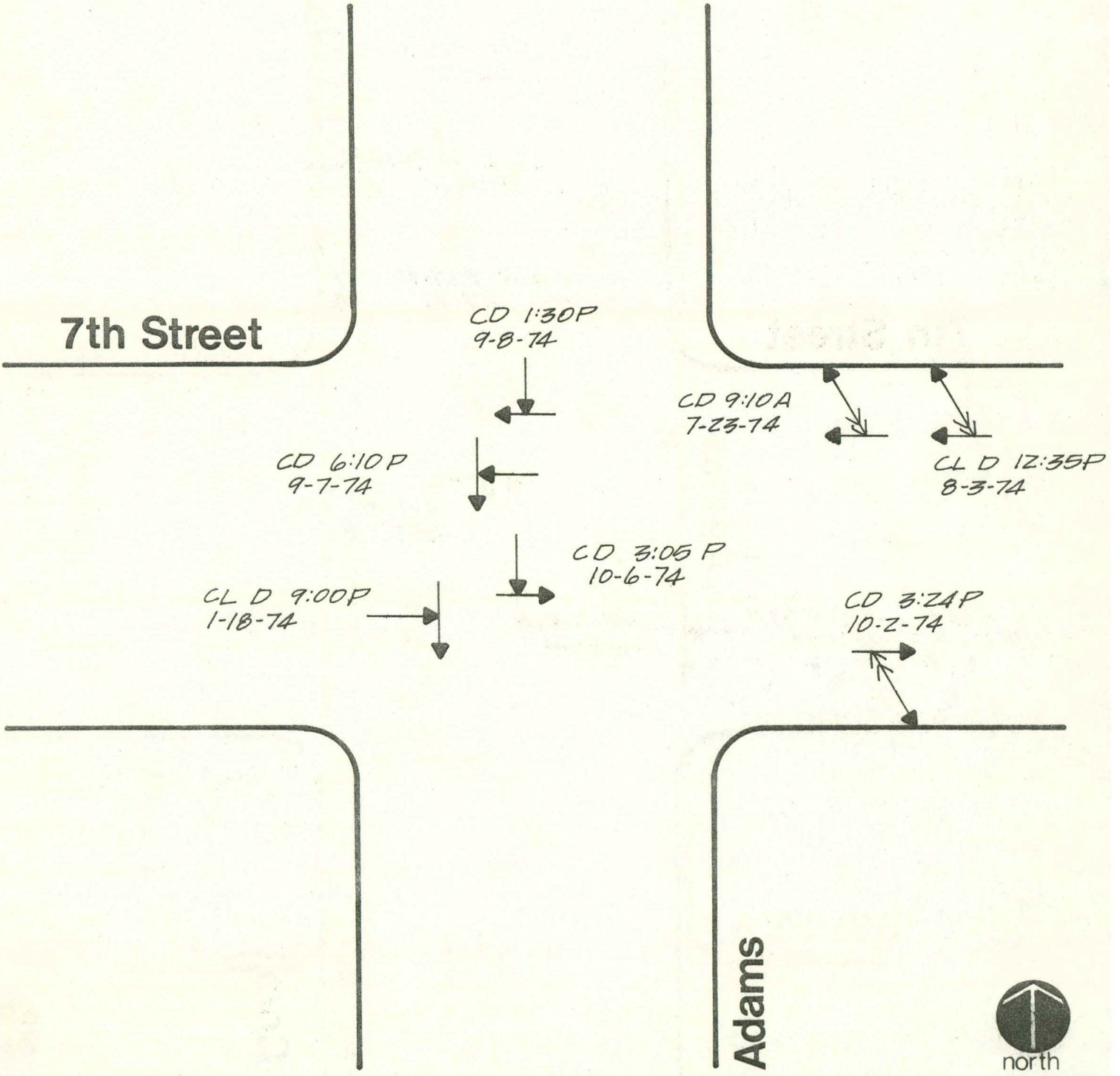

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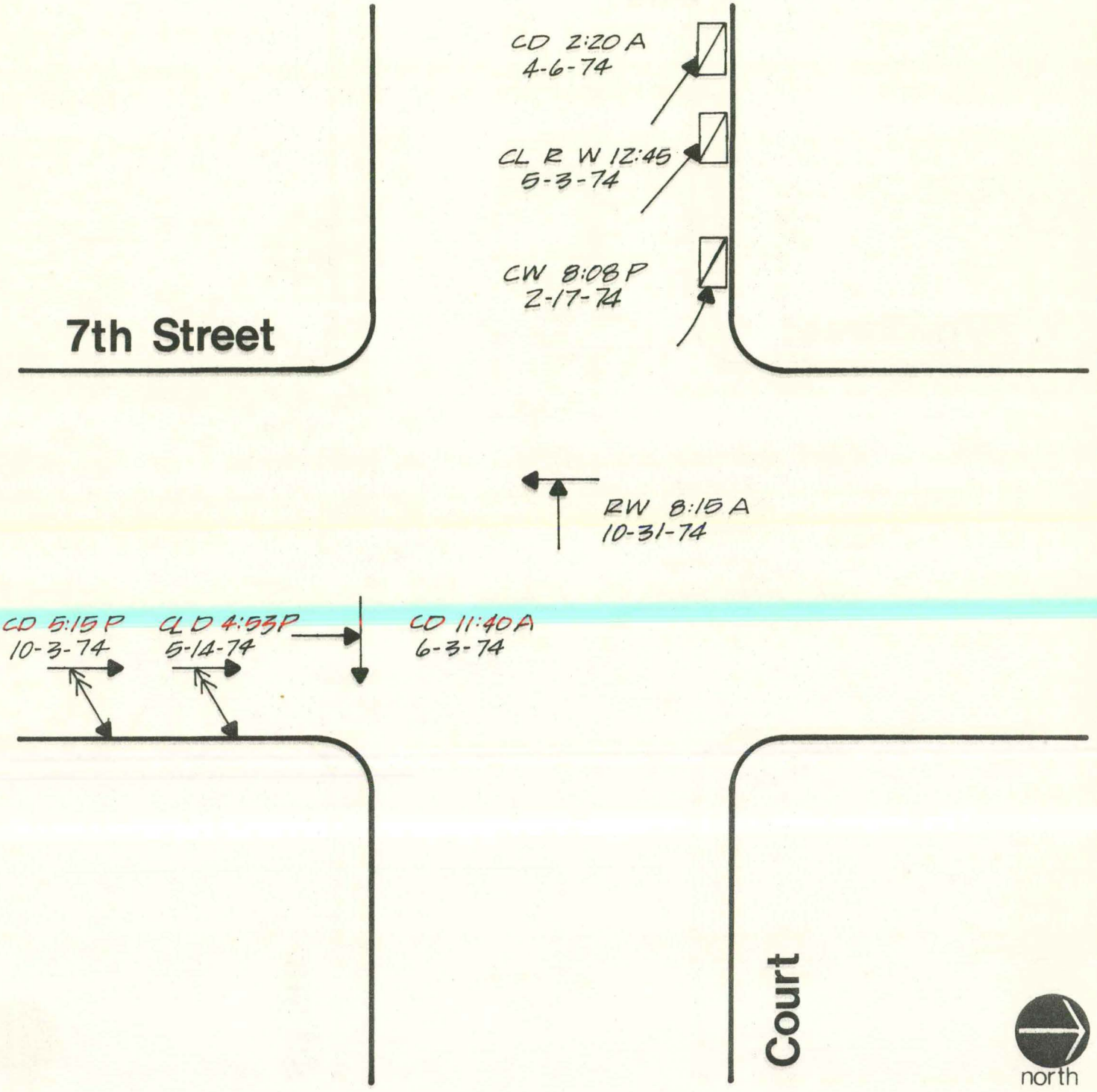

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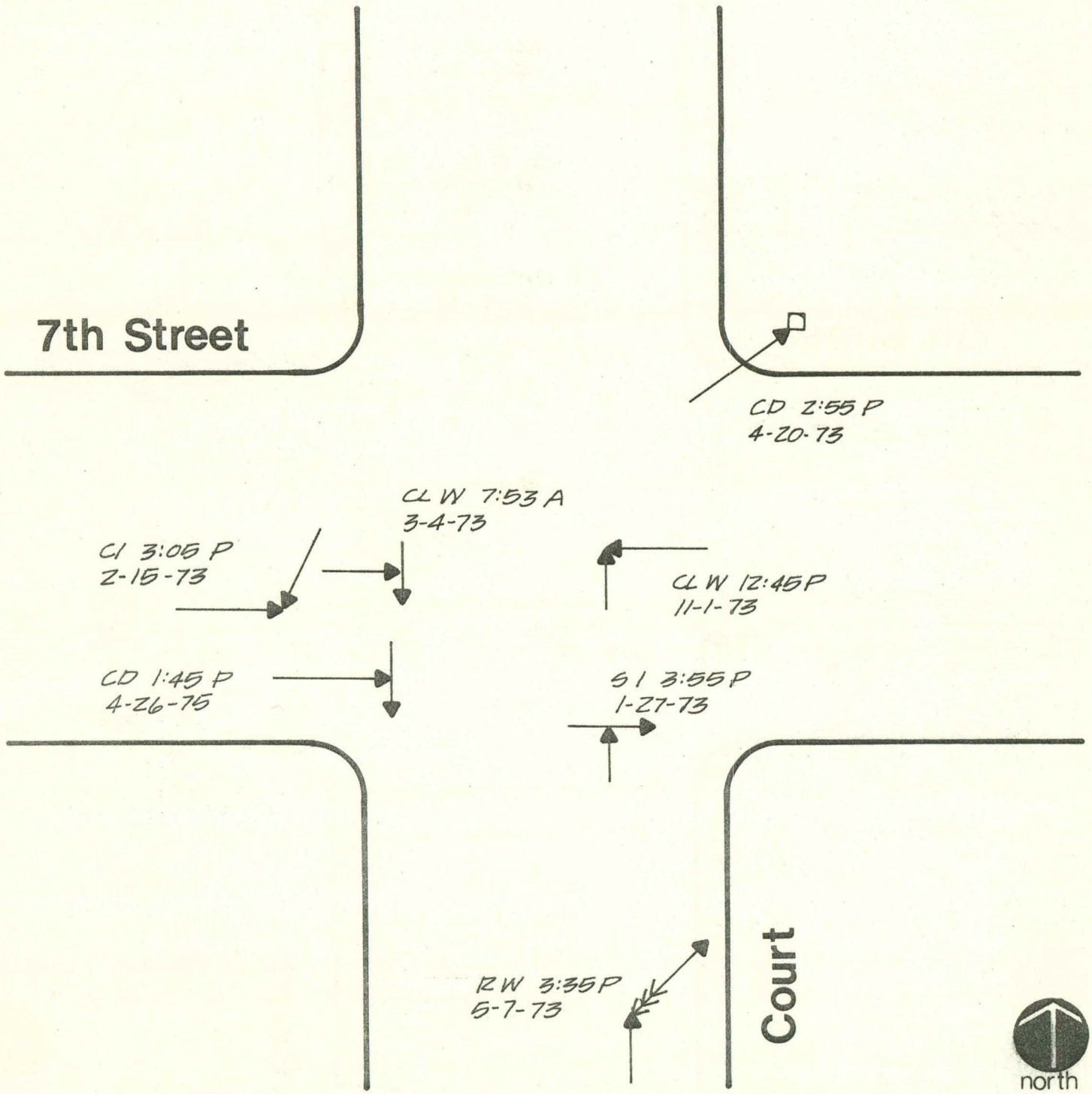
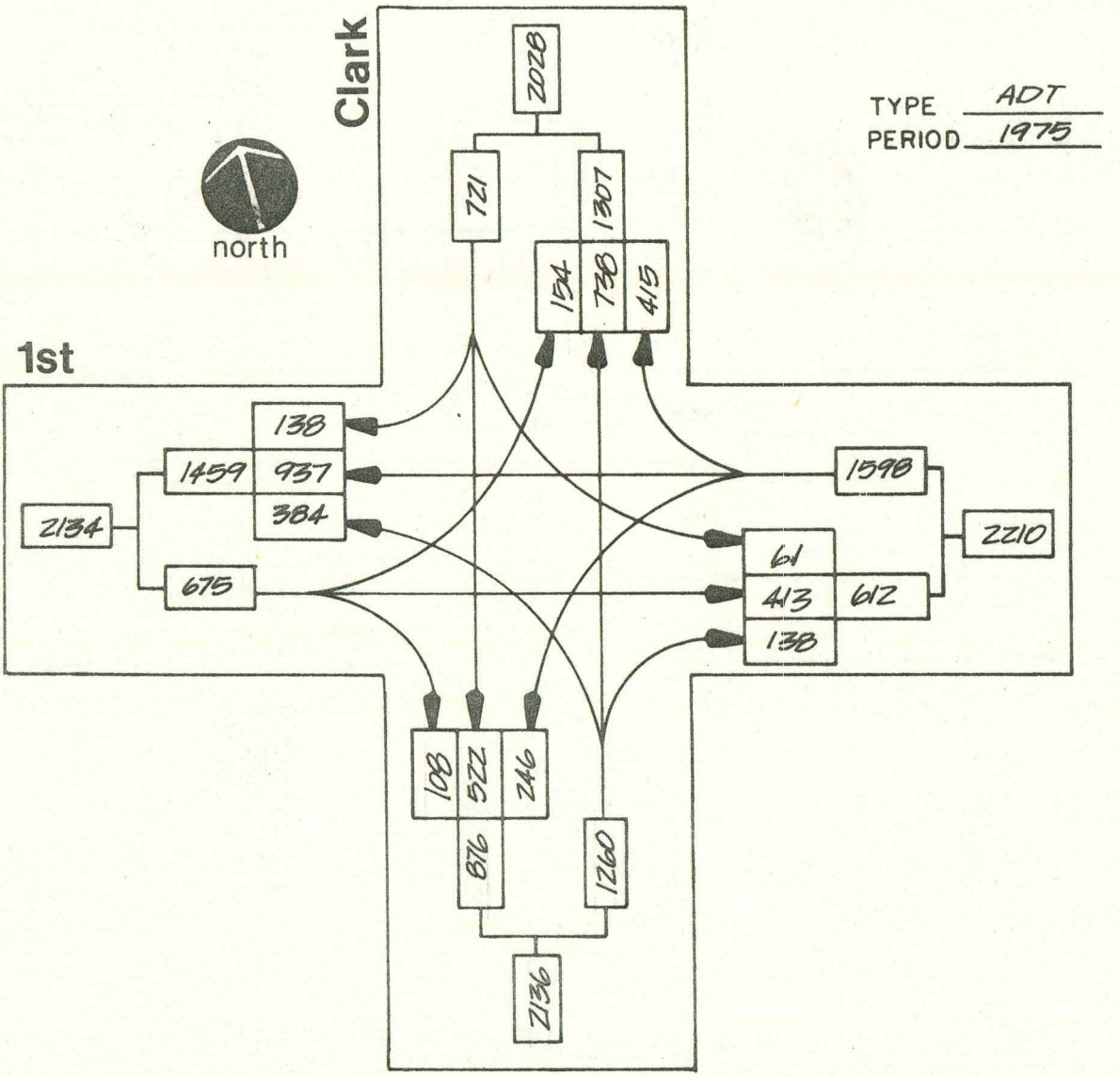
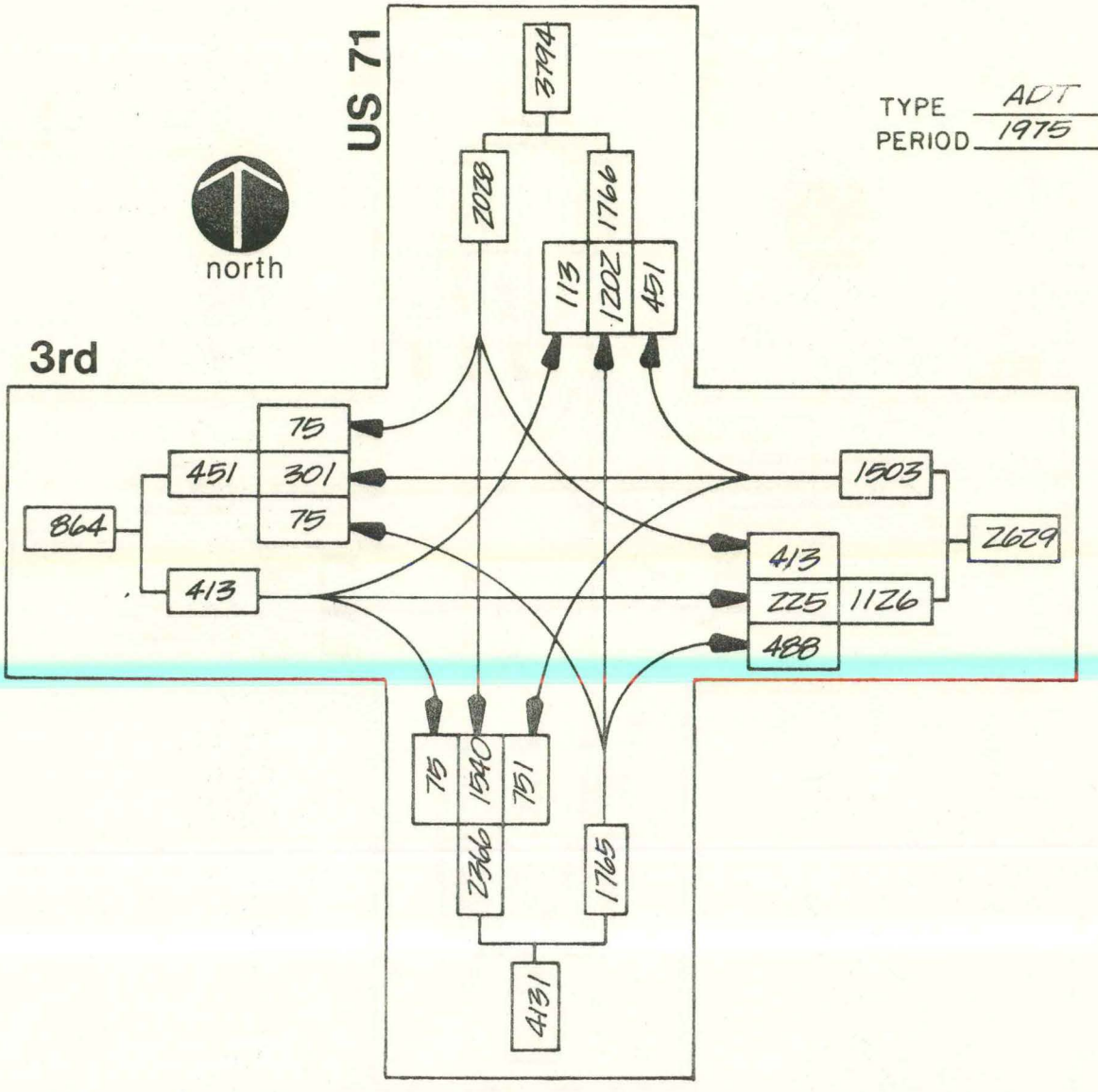


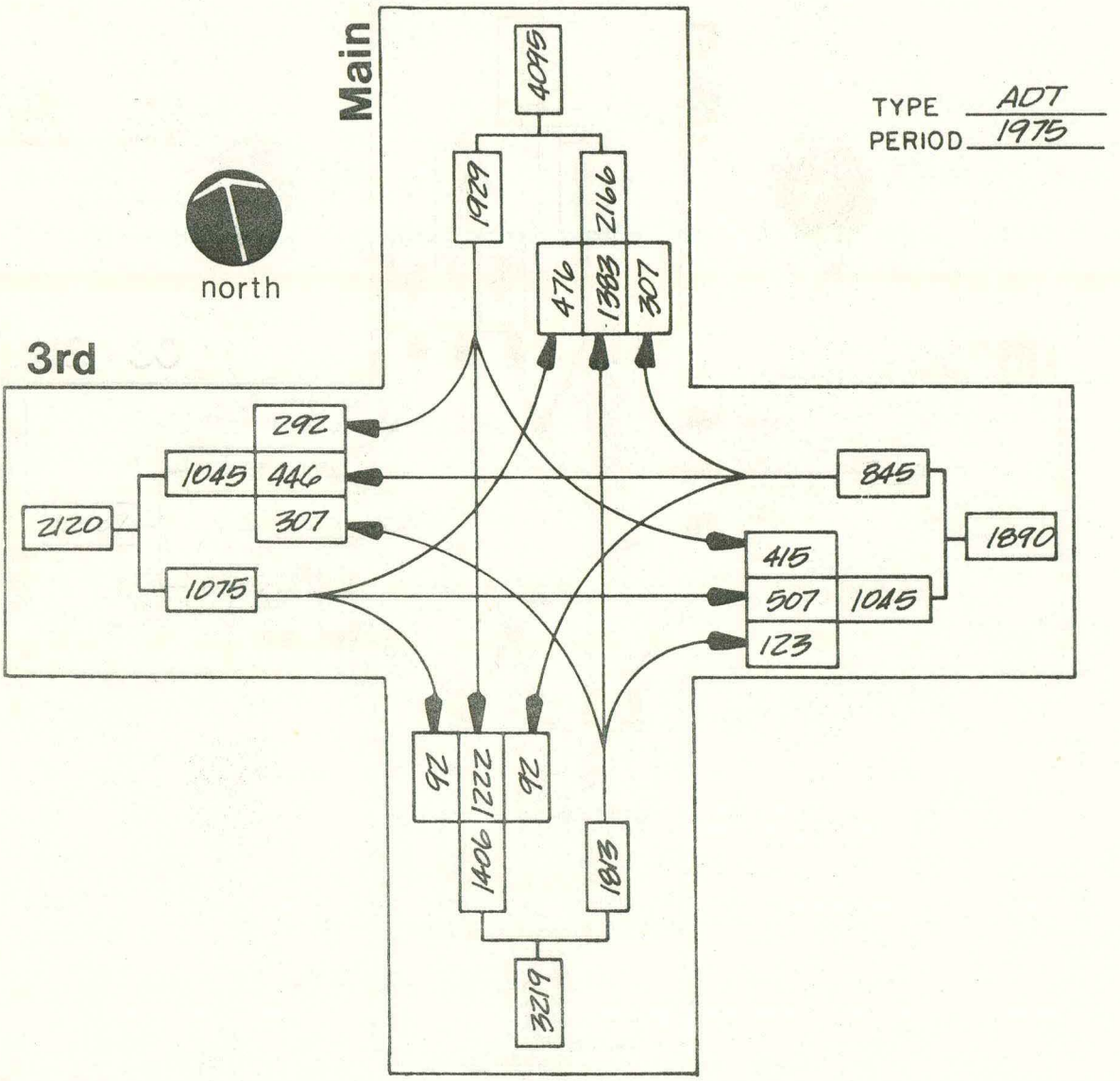
Traffic Flow Diagram



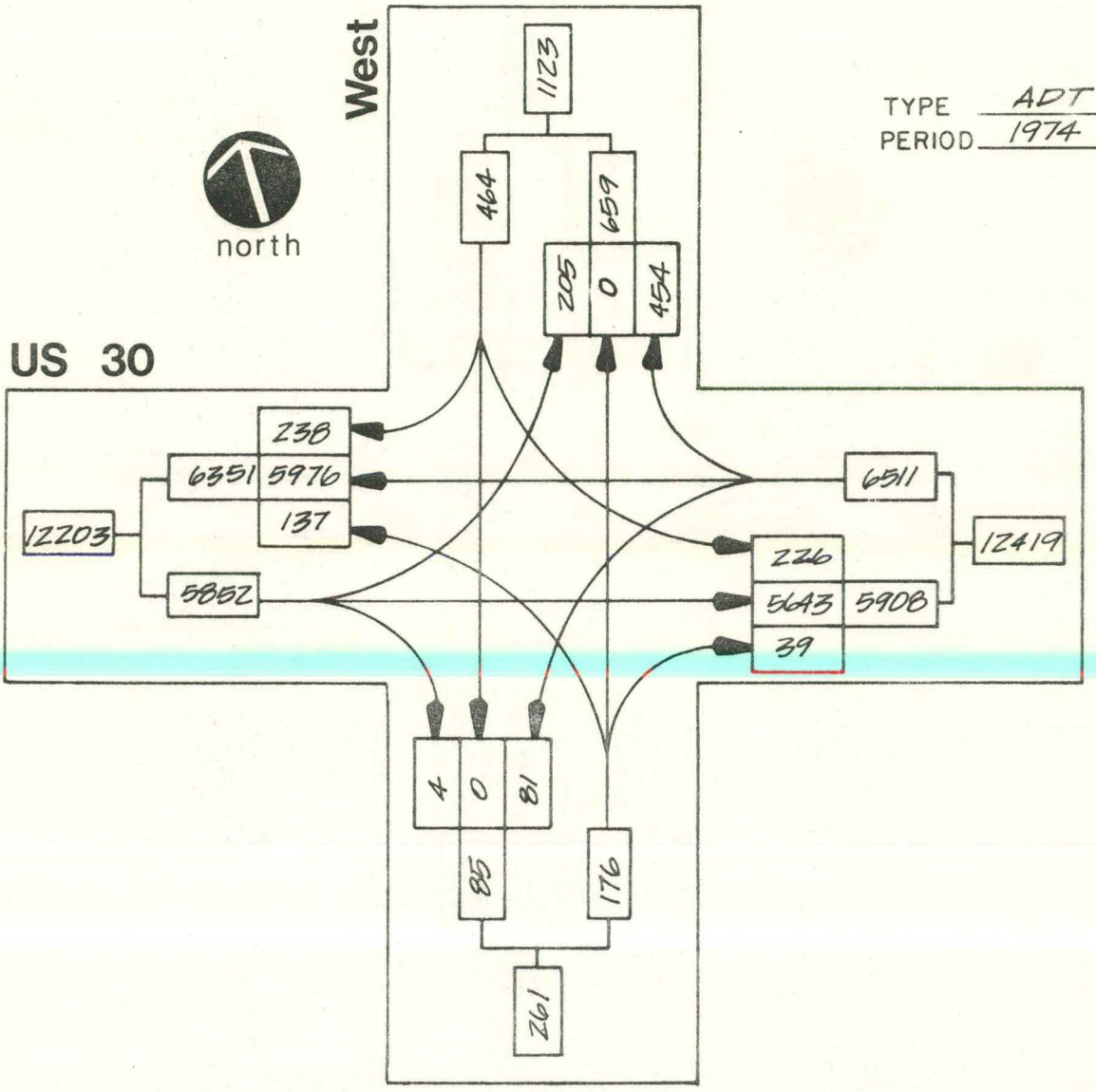
Traffic Flow Diagram



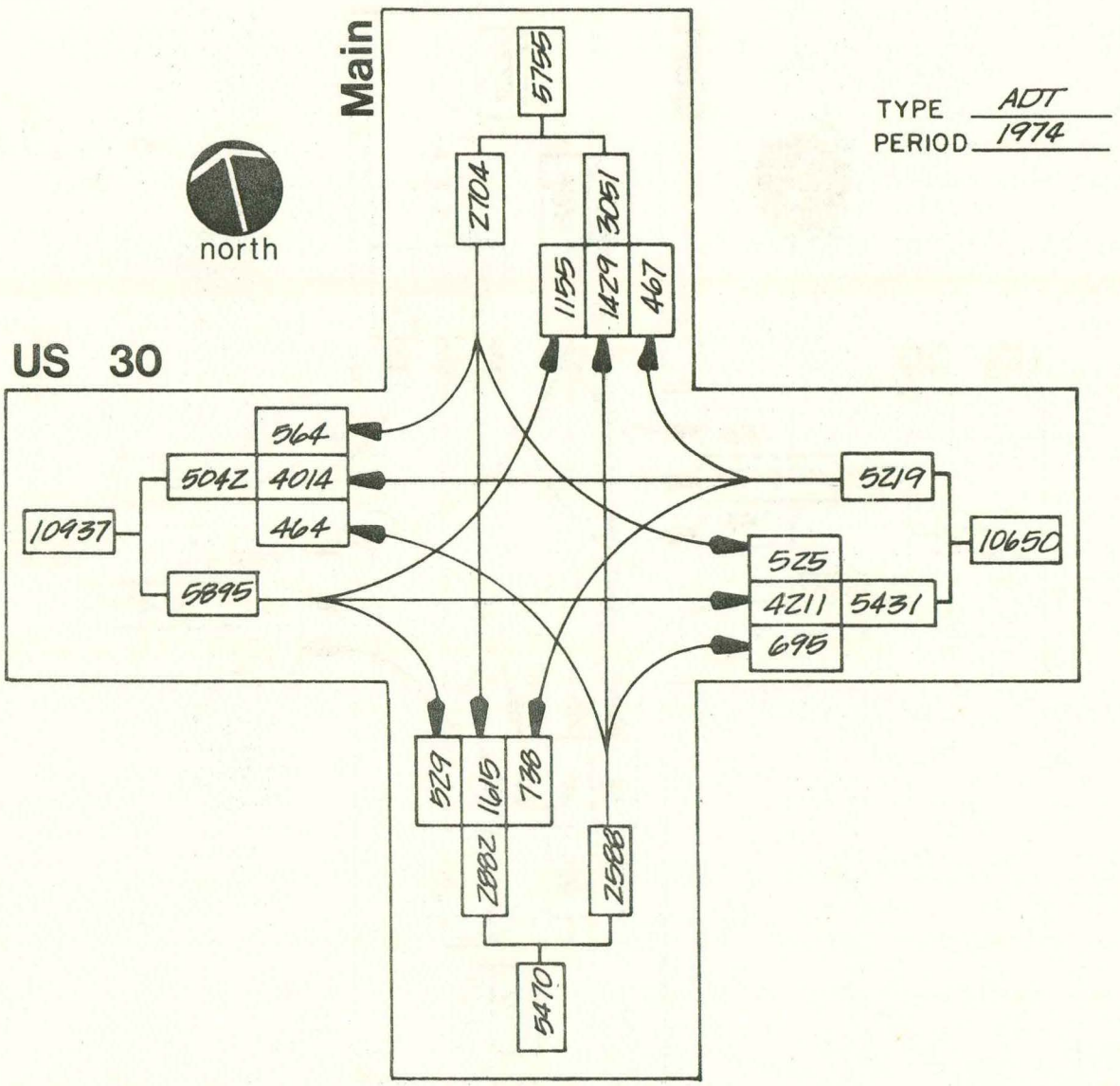
Traffic Flow Diagram



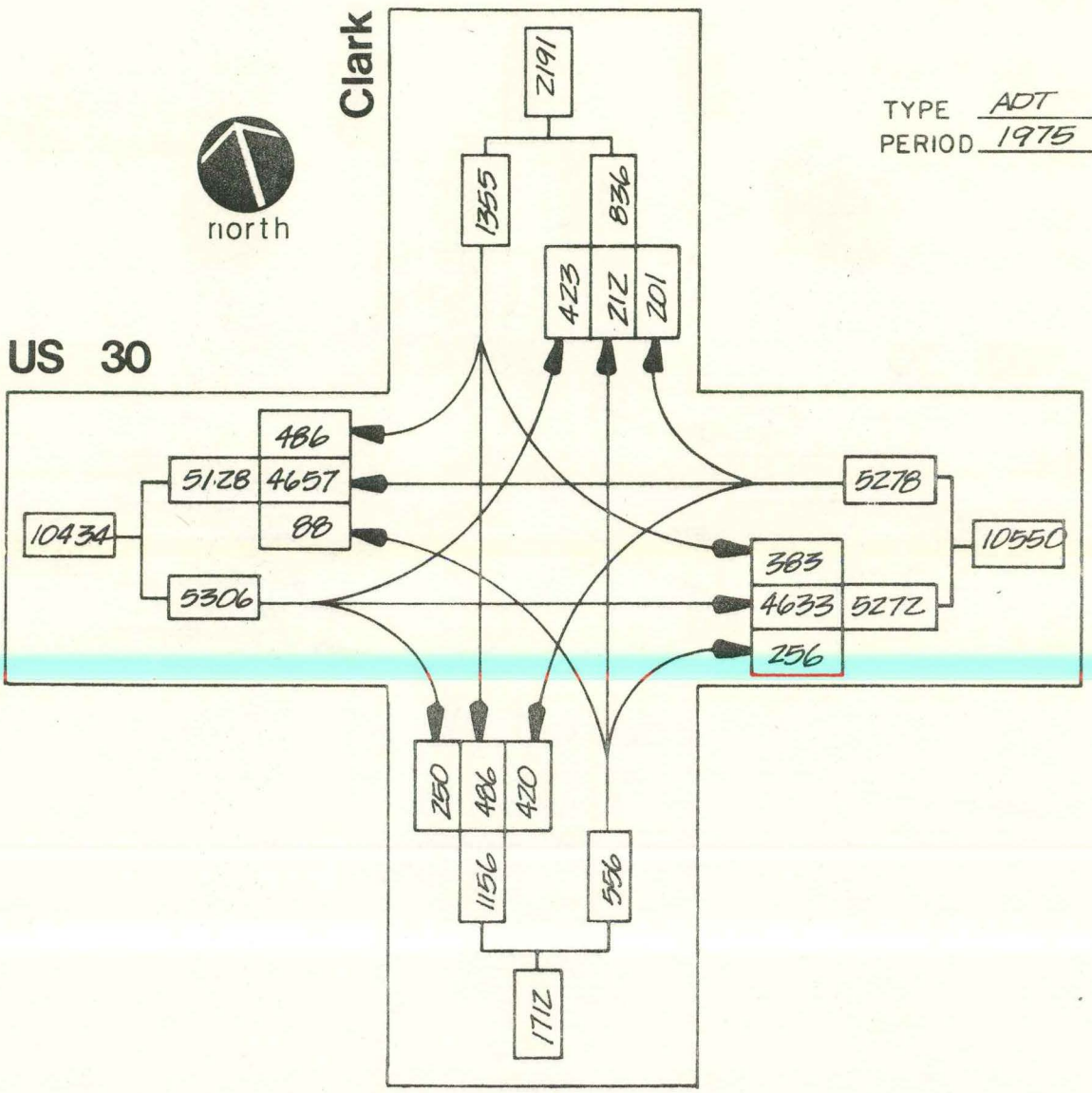
Traffic Flow Diagram



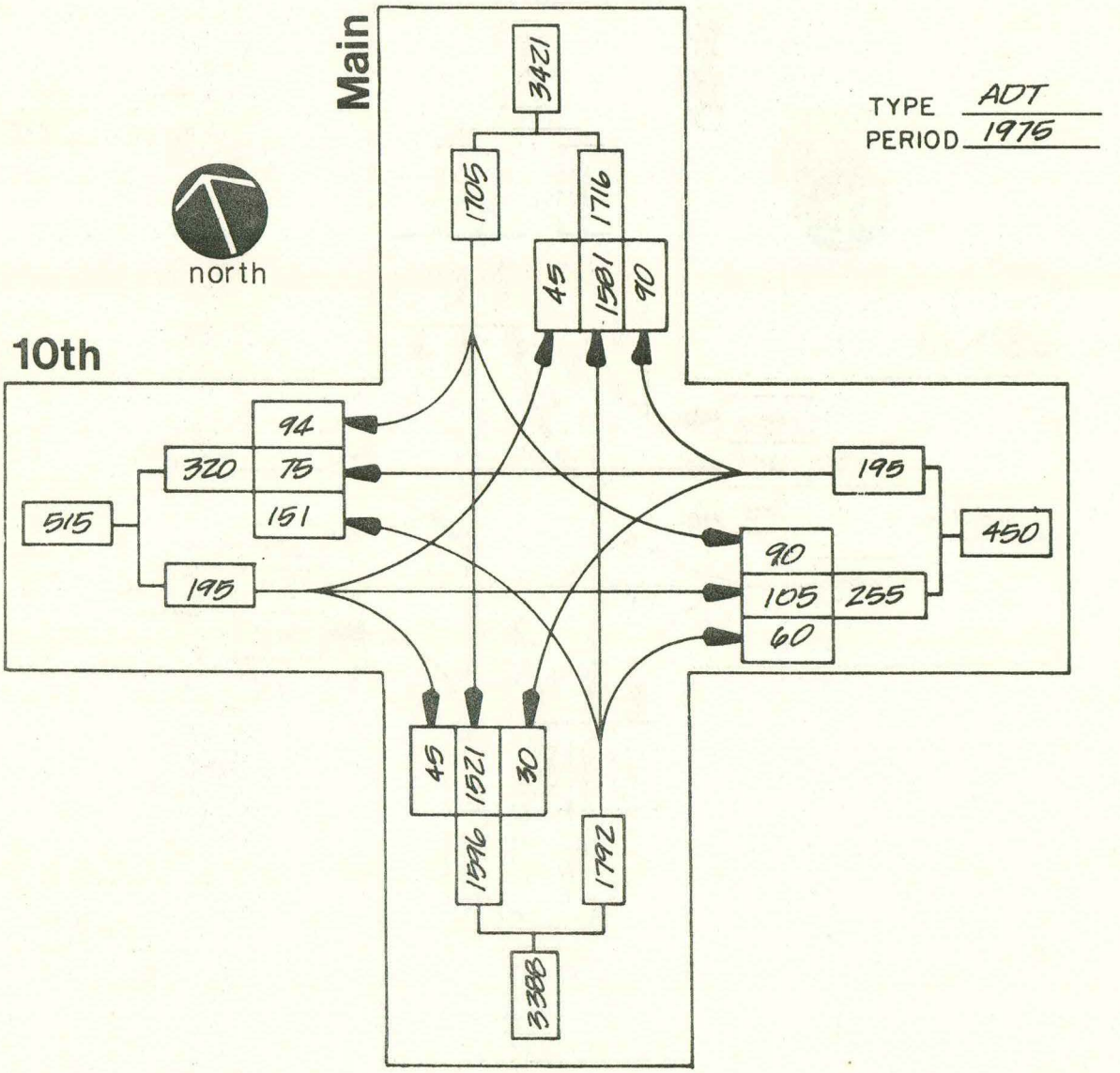
Traffic Flow Diagram



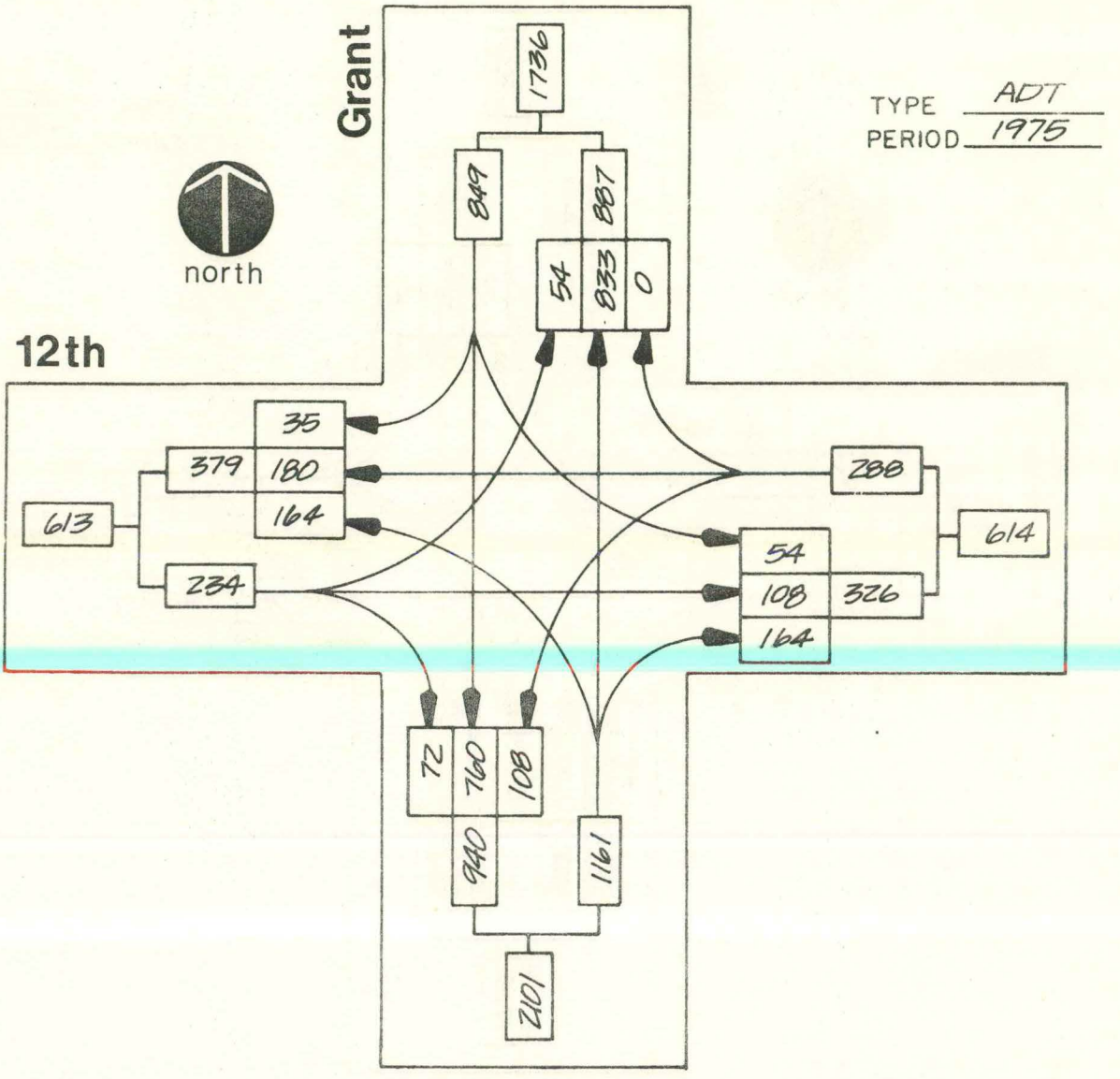
Traffic Flow Diagram



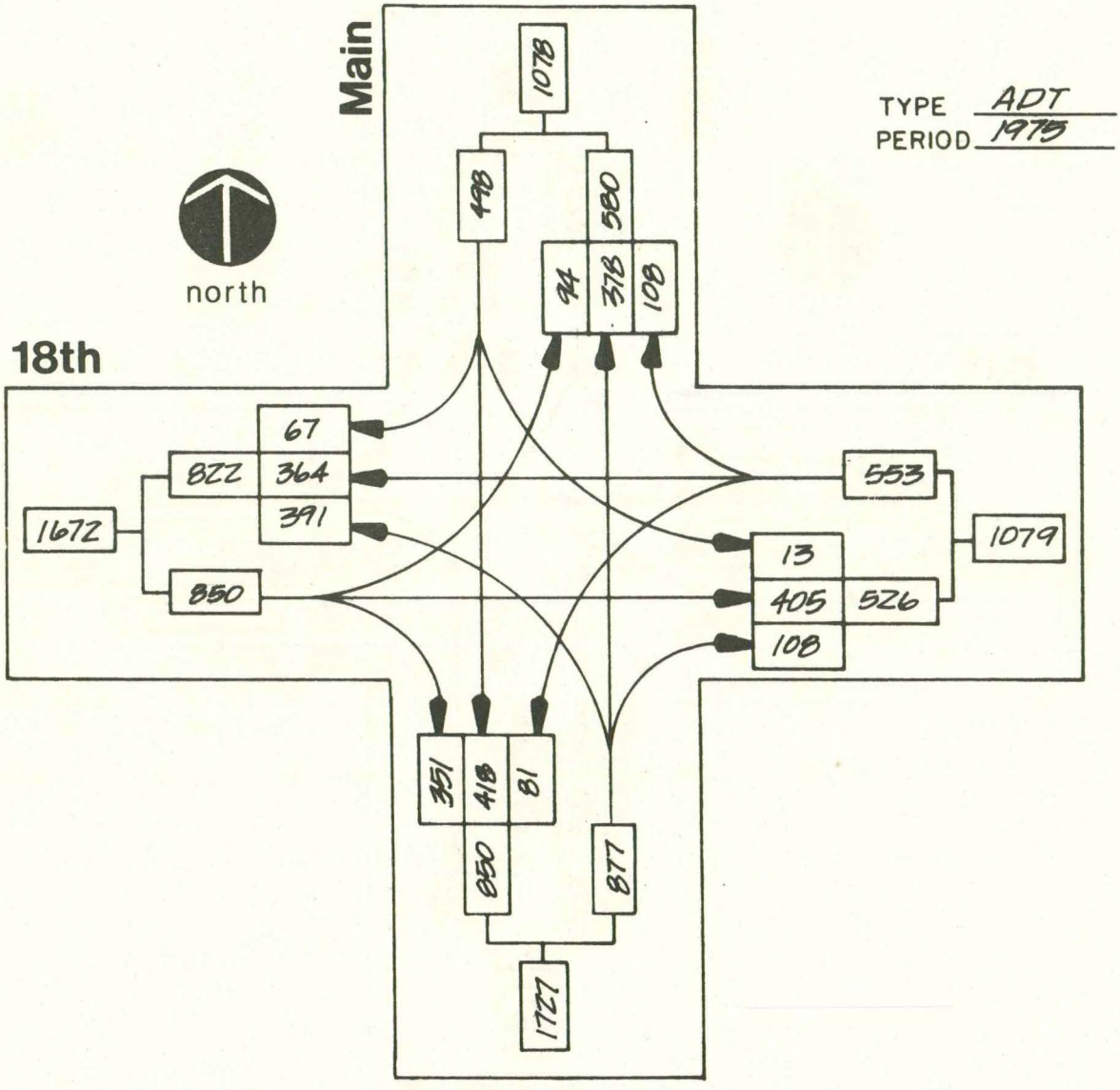
Traffic Flow Diagram



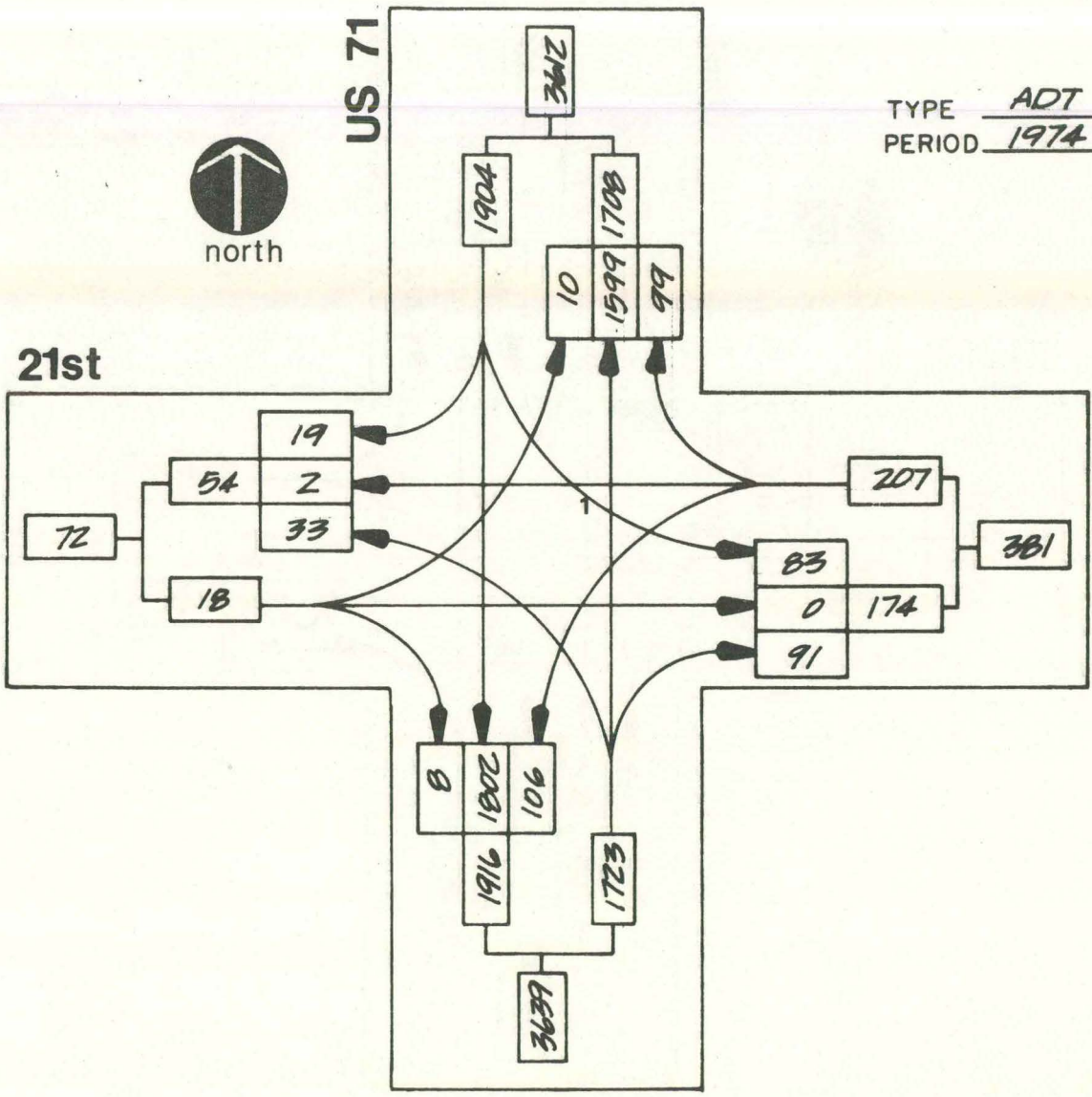
Traffic Flow Diagram



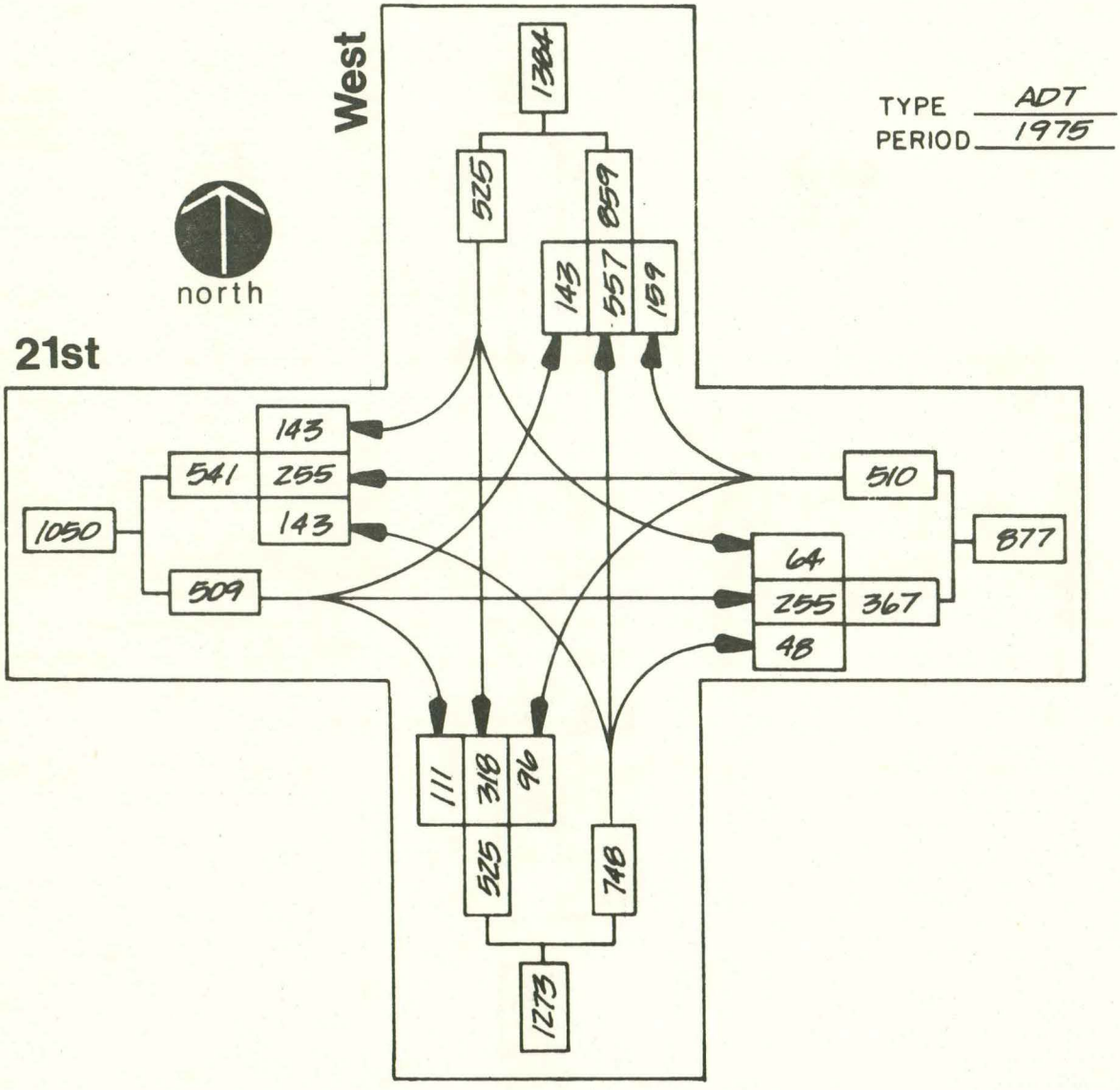
Traffic Flow Diagram



Traffic Flow Diagram

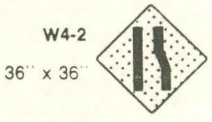


Traffic Flow Diagram



TITLE: Traffic Count Summary SOURCE: Carroll Public Works Department DATE: 10/29/75
US 30 Clark

COUNT PERIOD	NORTH				EAST				WEST				SOUTH			
	W	S	E	Total	N	W	S	Total	S	E	N	Total	E	N	W	Total
7:00 to 8:00	10	22	14	46	4	90	8	102	12	168	38	218	18	16	6	40
8:00 to 9:00	20	22	16	58	14	230	16	260	17	263	23	303	24	11	7	42
9:00 to 10:00	20	22	16	58	14	230	16	260	17	263	23	303	24	11	7	42
10:00 to 11:00	26	26	9	61	10	253	6	269	6	234	17	257	9	21	2	32
2:00 to 3:00	35	38	32	105	8	290	7	305	2	291	4	297	3	7	1	11
3:00 to 4:00	35	38	32	105	8	290	7	305	2	291	4	297	3	7	1	11
4:00 to 5:00	38	27	28	93	17	372	66	455	29	303	42	374	18	12	8	38
5:00 to 6:00	38	27	28	93	17	372	66	455	29	303	42	374	18	12	8	38
8 Hour Total	222	222	175	619	92	2127	192	2411	114	2116	193	2423	117	97	40	254
x 2.1996 = From	486	486	383	1355	201	4657	420	5278	250	4633	423	5306	256	212	88	556
x 2.1996 = To	423	212	201	836	383	4633	256	5272	88	4657	383	5128	420	486	250	1156
TOTAL	909	698	584	2191	584	9290	676	10550	338	9290	806	10434	676	698	338	1712



PAVEMENT WIDTH TRANSITION SIGN

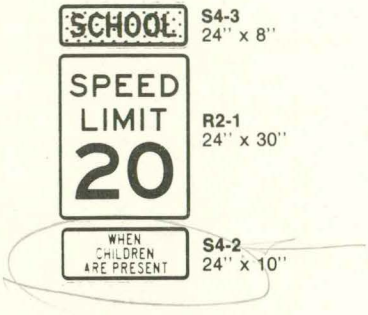
CROSSROAD SIGN

SIGNAL AHEAD SIGN

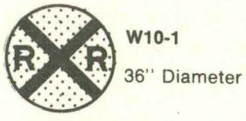
SCHOOL ADVANCE SIGN

SCHOOL CROSSING SIGN

RIGHT LANE ENDS SIGN

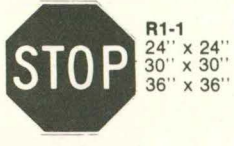


SCHOOL SPEED LIMIT SIGN ASSEMBLY

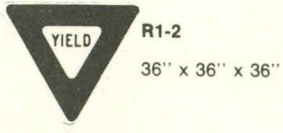


RAILROAD ADVANCE SIGN

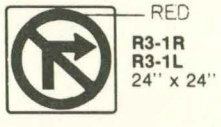
DO NOT ENTER SIGN



STOP SIGN



YIELD SIGN



NO RIGHT TURN SIGN

R6-1L
R6-1R
36" x 12"

ONE WAY
SIGN

R6-2R
R6-2L
18" x 24"

ONE WAY
SIGN

R3-7L
R3-7R
30" x 30"

LANE CONTROL
SIGN

LARGE ARROW
SIGN

12" x 36"

OBJECT MARKER
SIGN