FINAL REPORT

TRAFFIC ENGINEERING STUDY OSKALOOSA, IOWA

PREPARED FOR THE

City Of Oskaloosa, Iowa

AND THE

Iowa Department Of Transportation

alan m. voorhees & associates, inc.

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TRAFFIC ENGINEERING STUDY
OSKALOOSA, IOWA

November, 1977

This report was prepared through a grant provided by the United States Department of Transportation, Federal Highway Administration (FHWA), pursuant to the provisions of Section 402 of Title 23, U.S. Code. The opinions, findings, and conclusions in this publication are those of the author and not necessarily those of the Iowa Department of Transportation, Division of Highways, Office of Planning and Programming or the FHWA.

Alan M. Voorhees & Associates, Inc.
12161 Lackland Road
St. Louis, Missouri 63141

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ACKNOWLEDGEMENTS

This report was prepared with the cooperation of the Oskaloosa Police Department; the City Clerk's office; and the assistance of the Oskaloosa Chamber of Commerce, Gardner & Associates, Consulting Engineers; and the Student Employment Office of William Penn College.

I. INTRODUCTION

The City of Oskaloosa, Iowa, population 11,224, is the County Seat of Oskaloosa County. It is the site of William Penn College and Venard College in nearby University Park. The city is approximately 65 miles southeast of the State Capitol in DesMoines. As such, the city is located on the major roads leading to DesMoines from the southeast portion of the state.

The city has experienced traffic volumes and accident rates that are heavier than what would normally be expected for a city its size. This heavy traffic volume and high accident experience has causes concern among city officials. With this in mind, the city applied to the Iowa Department of Transportation (IDOT) for a grant to study the city's overall traffic situation and to make recommendations to improve the overall efficiency and safety of the city's street system. This study is the result of that grant.

Briefly, this report deals with the city street system, the traffic flow and accidents experienced on that system, traffic control devices, the parking situation in the Central Business District (CBD) and the appropriateness of existing school crossing controls. The identification of problems and suggested recommendations to alleviate these problems are included. Overall, the report presents a program whereby the city can increase the overall efficiency and safety of its street system.

STUDY METHODOLOGY

In order to properly conduct this traffic engineering study, several specific tasks had to be completed. These tasks constitute the study methodology. They are:

- Data Collection and Reduction
- Field Investigation
- Analysis and Problem Identification
- Preparation of Recommendations

Data Collection and Reduction

All available existing data was collected and reviewed. Included in this data were such items as traffic accident records for the three years 1974-1976, traffic volume counts for major streets and intersections, and any previous master plan or transportation plan completed for the city.

The review of these data indicated a need for additional data collection. Included in this additional data were such items as:

- Twelve-hour manual traffic counts at key intersections
- Automatic traffic counter twenty-four hour counts of collector streets
- An occupancy and turnover survey of the CBD on-street parking
- An occupancy survey of CBD off-street parking facilities
- Speed and delay surveys of the CBD street system
- Pedestrian group size and traffic gap studies at school crossings on major streets

Field Investigation

Several field investigations were conducted in order to obtain detailed information about traffic operation on major streets and intersections, pedestrian movements at school crossings, and on and off-street parking characteristics. These field investigations were generally conducted during time periods of peak traffic and pedestrian flow, and during peak parking demand.

Analysis and Problem Identification

The collected data and field investigation results were then analyzed to determine specific problems at specific locations. These problems took the form of traffic congestion, traffic signal indications with poor visibility, improperly timed traffic signals, parking facilities operating at capacity, and unsafe school crossings. Once these problems were identified, alternative solutions were developed and evaluated to determine the best and most cost effective solution.

Preparation of Recommendations

Once the best solutions were determined, they were detailed and prepared in the form of specific recommendations for specific locations and some general recommendations for the overall improvement of the street system in Oskaloosa. Included, also, is an Implementation Program detailing the cost and scheduling of the improvements. A Continuing Traffic Maintenance Program is also included to insure that the city has the ongoing capability to properly handle its present and future traffic matters.

II. STREET AND HIGHWAY SYSTEM

The street and highway system of any city is designed for two basic functions: service of traffic and service of land uses for the people of the community. Service of traffic relates to accommodating vehicles during the portion of their trips between terminals. Service to land use relates to providing ingress and egress to land use activities abutting the system. In Oskaloosa these functions are performed by several state routes and many local streets.

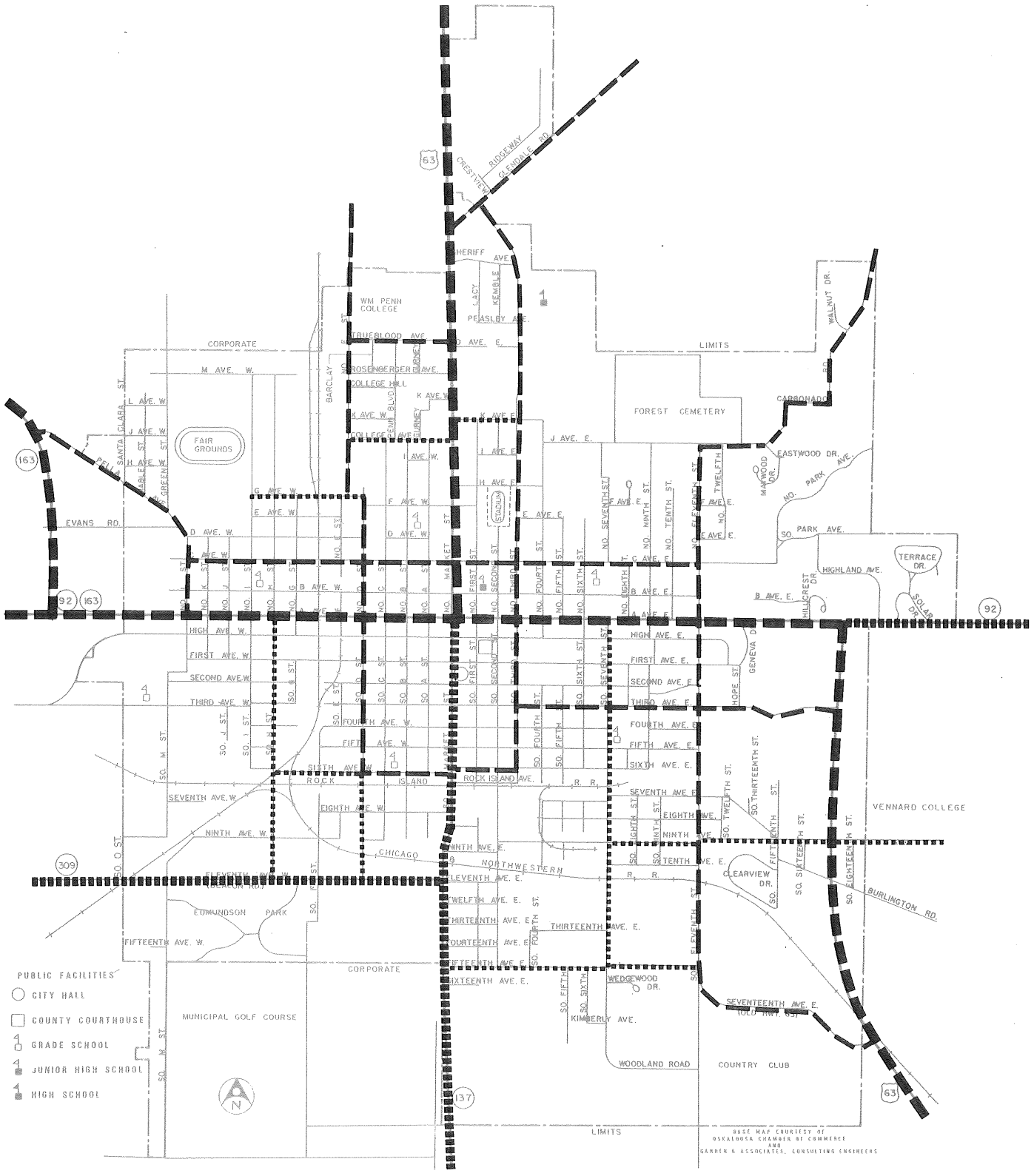
The state routes serving the city include U.S. Route 63 and State Routes 92, 137, 163, and 309. These routes are the major streets within the city and provide access to all parts of the state.

FUNCTIONAL CLASSIFICATION

In order to determine the extent to which a given street facility performs either of the two basic functions, service of traffic and service of land use, a classification system was prepared by IDOT using national standards from the U.S. Department of Transportation (DOT). This national functional classification is shown in Figure 1.

At the present time a new Master Plan is being prepared for the city by the Regional Planning Agency. In that plan there may be some additions, deletions, or corrections to this functional classification of the Oskaloosa street system. However, as of this writing that plan is not completed.

Another national road and street network that is relevant to the classification of the city's street system is the Federal-Aid System. This system was initiated by the U.S. DOT for the purposes of providing federal financial aid to states and cities for improvements to their major road system. In particular, the streets in Oskaloosa are included as part of two Federal-Aid Systems: Federal-Aid Primary and Federal-Aid Urban. These systems are shown in Figure 2.



LEGEND

- CONNECTING LINK OF A RURAL PRINCIPAL ARTERIAL
- CONNECTING LINK OF A RURAL MINOR ARTERIAL
- MINOR ARTERIAL
- COLLECTOR

National Functional Classification

Figure 1

TRAFFIC ENGINEERING STUDY: Oskaloosa, Iowa

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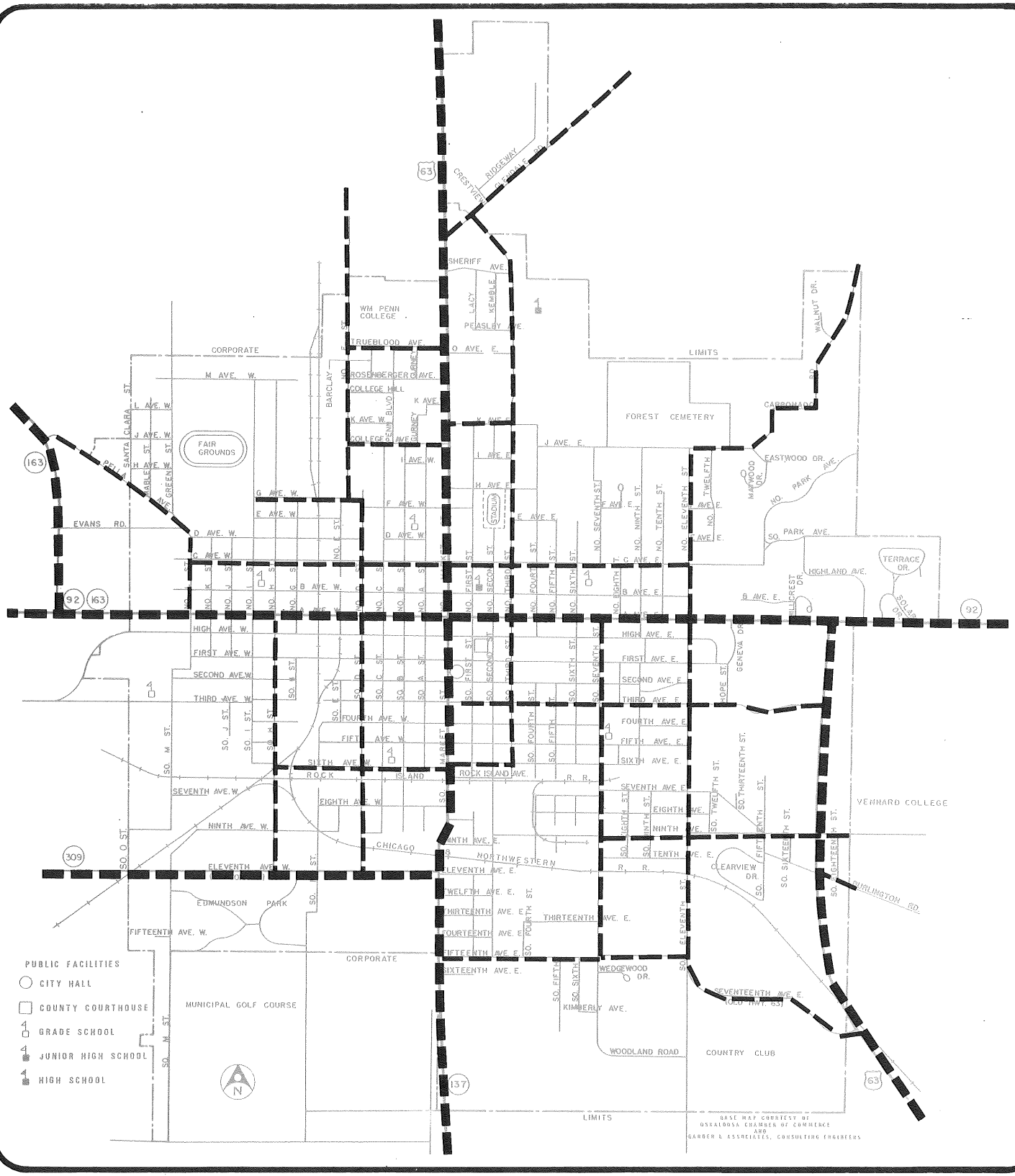

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FEDERAL-AID PRIMMARY (F A P)

FEDERAL-AID URBAN (F A U)

Federal-Aid System	Figure 2
TRAFFIC ENGINEERING STUDY: Oskaloosa, Iowa	AMV

TRAFFIC FLOW PATTERN

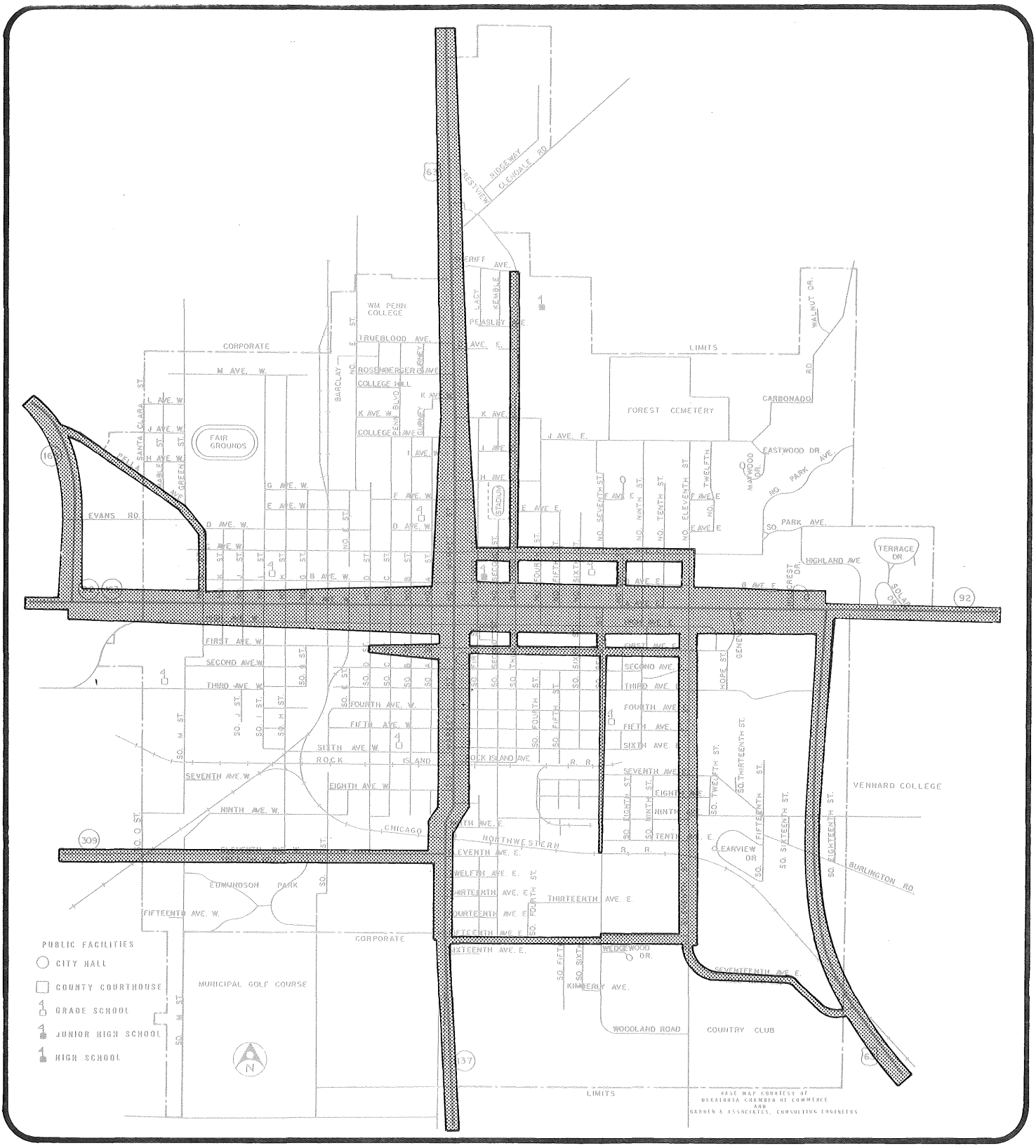
To determine the extent to which the street network is used by vehicles, daily traffic volumes were obtained for 1976 from the Planning and Research Division, Office of Transportation Inventory of IDOT. These volumes were for the state routes going through Oskaloosa. Supplemental counts were made during the course of the study to determine the traffic volumes on local city streets. These volumes are shown graphically in the traffic flow map in Figure 3.

The most heavily traveled route is A Avenue and Market Street. Volumes on A Avenue reach almost 13,000 vehicles per day (Average Daily Traffic, ADT) near the Market Street intersection. Market Street volumes are slightly over 8,000 ADT just north of A Avenue. Volumes on other state routes are between 3,900 and 4,300 ADT on U.S. 63 south of A Avenue, between 3,000 and 6,200 ADT on State Route 137 south of A Avenue, between 5,900 and 12,800 ADT on State Routes 92 and 163 east of Market Street, 4,500 ADT on State Route 163 north of A Avenue, and approximately 2,500 ADT on State Route 309 east of Market Street.

The most heavily traveled local street is Eleventh Street south of A Avenue with almost 4,500 ADT. Other volumes include both High Avenue West and First Avenue East with 3,700 ADT, C Avenue East with between 2,600 and 1,800 ADT, Third Street North with between 1,700 and 1,400 ADT, Fifteenth Avenue East with 1,660 ADT, Seventh Street South of A Avenue with 1,650 ADT, and North Ninth Street with 1,390 ADT.

TRAFFIC CONTROL DEVICES

An inventory was made of the traffic control devices within Oskaloosa. This inventory included all traffic signals, both intersection and school crossings; Stop signs; and Yield signs. The location of these control devices is shown in Figure 4.



LEGEND

NOTE: VOLUMES LESS THAN 1,000 ARE NOT SHOWN.

20,000

10,000

5,000

1976 Daily Traffic Volumes

Figure 3

TRAFFIC ENGINEERING STUDY: Oskaloosa, Iowa

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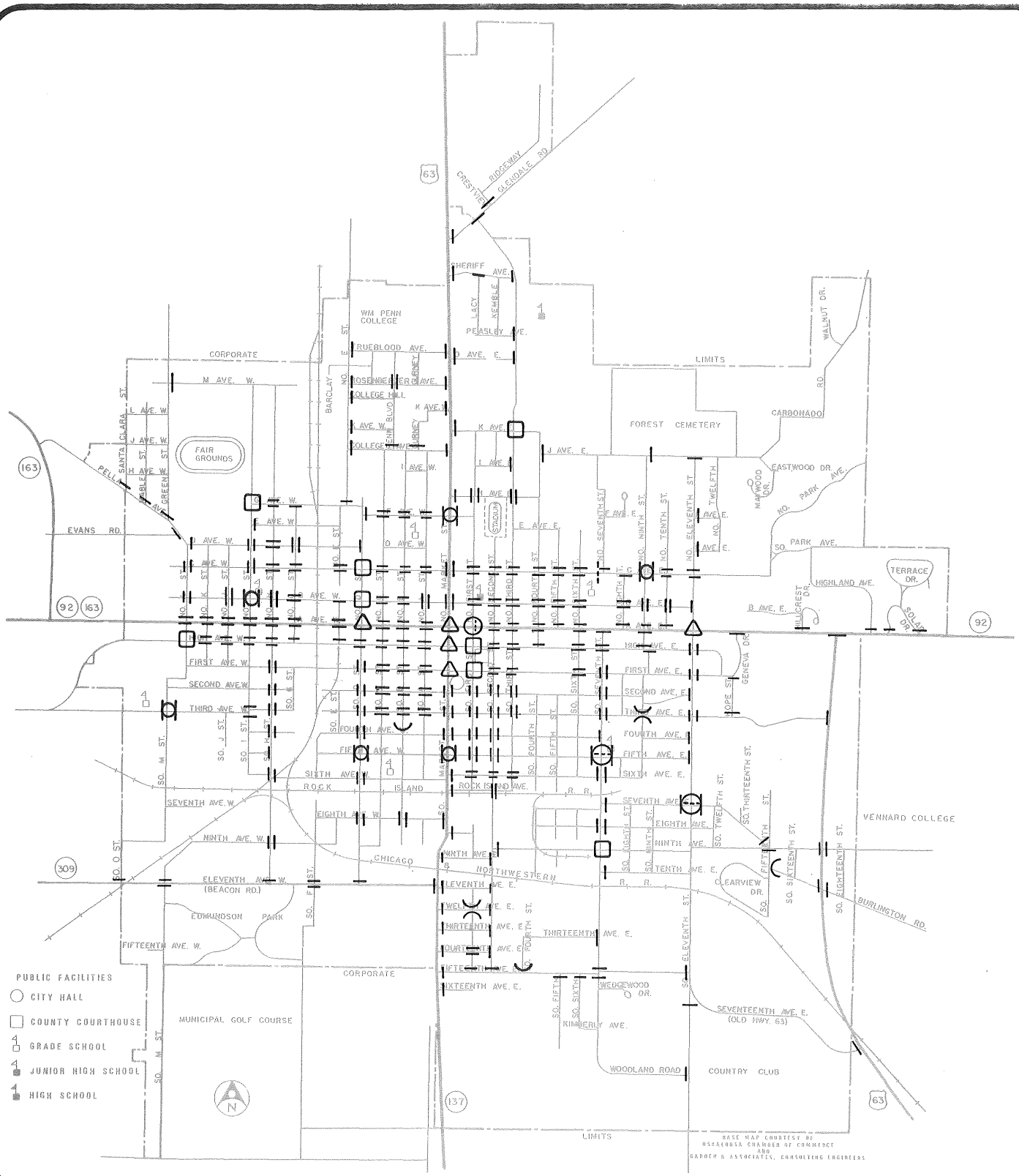


LEGEND

- △ INTERSECTION TRAFFIC SIGNAL
- ○ SCHOOL CROSSING SIGNAL
- — STOP SIGNS
- □ 4-WAY STOP
- ⌒ YIELD
- ---- ROLL-OUT STOP

Traffic Control Devices | **Figure 4**

TRAFFIC ENGINEERING STUDY: Oskaloosa, Iowa | **AMV**

Intersection Traffic Signals

At the present time, Oskaloosa has five signalized intersections. Three are located on A Avenue and were installed by IDOT. They comply with the standards as indicated in the U.S. DOT's Manual on Uniform Traffic Control Devices (MUTCD). The other two signals are located on Market Street at its intersection with High Avenue and First Avenue. The High Avenue intersection signals are not in conformance with MUTCD standards. The principle violation is the lack of two far-side signal indications for approaching traffic on each leg of the intersection. The First Avenue intersection signals are in conformance with the standards in the MUTCD.

Additional comments about the traffic signals will be made in the chapter on individual intersections.

School Crossing Controls

Presently there are nine school crossing traffic signals in Oskaloosa. All of them are located within three blocks of either an elementary or the junior high school. In general, the signals consist of one red signal indication that flashes during those time periods when students are walking to and from school. During the remainder of the day, the signal indications are off.

Exceptions are the two signals on Market Street. One is located at the intersection of North Market Street and F Avenue and the other is located at the intersection of South Market Street and Fifth Avenue. Both of these signals have two indications, red and yellow. During their hours of operation, the yellow indication flashes until such time that a student, pedestrian, or crossing guard at the Fifth Avenue location push the crosswalk button. The yellow indication then becomes steady for three to four seconds, the red indication then comes on steady for 20 seconds, both indications then come on for three seconds, and then back to flashing yellow.

A roll-out Stop sign is used at three locations to supplement the single, flashing red indication. These locations are: A Avenue East and North First Street, Fifth Avenue East and South Seventh Street, and Seventh Avenue East and South Eleventh Street. A roll-out Stop sign is used by itself on C Avenue East at North Seventh Street at the Grant Elementary School.

Signs

The inventory indicated that in general the intersection and other traffic control signs are in compliance with the MUTCD standards. Those signs not in compliance are being replaced by the city as funds become available. Eventually all signs will be in compliance with the MUTCD.

There are very few 4-way Stop controls in the city. In fact, only eight intersections are controlled by a four-way Stop and two of these intersections are in the CBD at the corners of the Square. Most communities of Oskaloosa's size have many more four-way Stop controlled intersections. The Chief of Police is responsible for this situation and his attitude of keeping four-way Stops to a minimum should be commended.

There are also very few Yield sign controlled intersections. Only five intersections have Yield signs on at least one leg. Again, this situation is good and should be commended.

Other Traffic Control Devices

The other principle traffic control device is pavement markings. In Oskaloosa, IDOT provides the pavement marking on the U.S. and state route marked streets. The city is responsible for the remaining streets. In general, the pavement markings in the CBD are adequate. Although they did need repainting. This was expected since the weather was too cold and wet for any pavement marking application. Most of the other streets that are classified as collectors, however, were not marked. This situation should be corrected so that the city will have pavement markings meeting the MUTCD standards.

III. SELECTION OF STUDY LOCATIONS

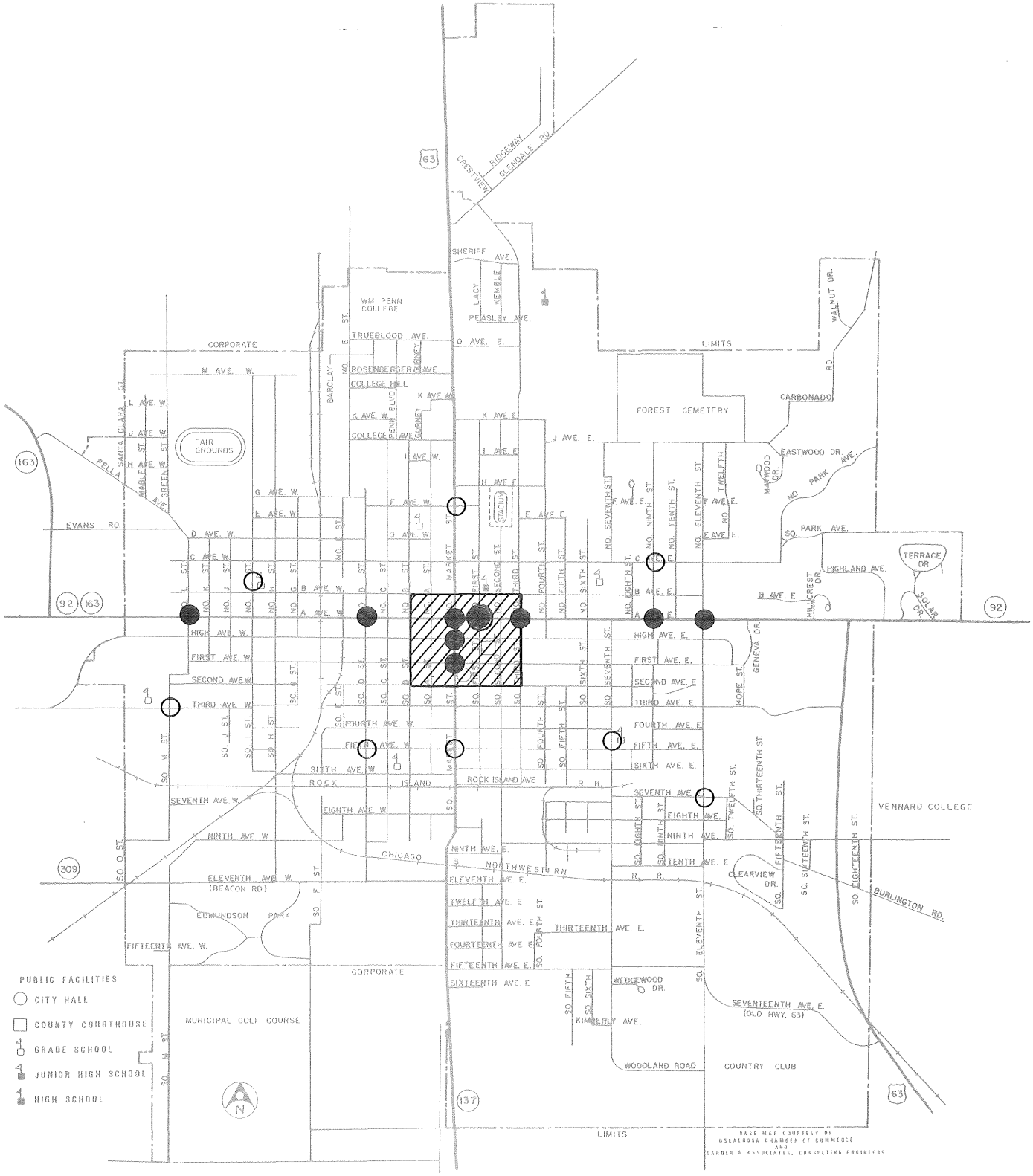
One of the principle tasks of this study was to examine in detail those intersection locations which had the highest traffic volumes and most accidents. In order to determine these detailed study locations, the accident records for each intersection over the three-year period, 1974-1976, were ranked by total number of accidents. Traffic volumes along the major city streets and in the CBD and information resulting from the field investigation were reviewed and analyzed in conjunction with the accident records.

Those intersections with the highest number of accidents and/or those locations within the heart of the CBD which have sight distance restrictions or which would be included in any type of coordinated traffic control system for the CBD were selected for detailed study. This analysis resulted in the selection of nine intersections for detailed study.

In addition to these intersections, the entire CBD was studied relative to overall traffic flow and parking needs, and school crossings were examined at each public school. These study locations are shown in Figure 5 and listed in Table 1.

ANALYSIS METHODOLOGY

All data for each study location was analyzed in detail to provide recommendations for improvements which could be implemented in a relatively short time period at relatively low costs. These improvements would provide relief for traffic safety and congestion problems. The following procedure was followed for each location.



LEGEND

- INTERSECTIONS
- CENTRAL BUSINESS DISTRICT
- SCHOOL CROSSINGS

Detailed Study Locations | **Figure 5**

TRAFFIC ENGINEERING STUDY: Oskaloosa, Iowa | AMV

TABLE 1

DETAILED STUDY LOCATIONS

TRAFFIC ENGINEERING STUDY

OSKALOOSA, IOWA

Intersections	Number of Accidents 1974-1976
A Avenue and North Market Street	62
A Avenue East and North Eleventh Street	25
A Avenue East and North Third Street	23
A Avenue West and North D Street	22
High Avenue and Market Street	19
A Avenue East and North First Street	18
A Avenue West and North L Street	16
A Avenue East and North Ninth Street	15
First Avenue and South Market Street*	--
Second Avenue and South Market Street*	--

* These intersections were added due to their location within the heart of the CBD and their impact on any improvements recommended for adjacent locations.

Accident Analysis

The accident reports provided information for the construction of collision diagrams. These diagrams showed graphically the total number and the type of accidents which occurred at each location. In addition, other pertinent data such as the severity, time of day, weather conditions and other contributing circumstances were noted.

An examination of each study location was made to review operating characteristics bearing in mind the type of accidents which occurred. Physical features which could contribute to the types of accidents were noted.

Such features included vertical and horizontal alignment, location of signals and signs,view obstructions, and any other physical features.

Capacity Analysis

The volume of traffic at each location was reviewed. In some cases capacity analyses were conducted. A capacity analysis is a mathematical computation which determines the number of vehicles which can pass through an intersection with various conditions at a specific level of service. The resultant level of service is the degree of congestion which is experienced. Capacity analyses were conducted for only those locations experiencing capacity problems.

Volume counts at other locations were viewed in relation to the existing controls and use of present operations. Present traffic control devices, such as signals, stop signs and other regulatory signs were reviewed in relation to traffic volumes. Deficiencies in these controls were noted. The visibility of existing traffic control devices and other items which influence the safe and efficient flow of traffic such as parking was reviewed.

Field Observations

Field observations of study locations were made starting with a cursory appraisal of all possible study locations. As the study progressed and traffic volumes, accident frequency, and other data were examined, more detailed observations were made during the peak periods of traffic at the study locations. Notations were made of operating conditions, physical features and other deficiencies such as lack of signal visibility, sight distance problems, substandard traffic controls and poor geometrics. The data collected from the field observations were used in conjunction with other traffic data in the analysis of study locations and formulation of recommended improvements.

IV. DETAILED STUDY LOCATIONS

This chapter contains a review of the existing conditions and an analysis of each of the nine intersections selected for detailed study in Chapter III. Recommendations have been prepared resulting from the analysis of each intersection. A detailed study of the entire CBD and the school crossings are presented in Chapters V and VI, respectively.

A AVENUE AND NORTH MARKET STREET

Existing Conditions

This is the main intersection in Oskaloosa. It is the junction of all U.S. and State Routes that enter the city except for State Route 309. As such, this intersection handles the greatest traffic volume of any intersection in the city. During the afternoon peak hour, 4:30-5:30 p. m., over 1,600 vehicles entered this intersection.

The intersection is one block north of the heart of the CBD. Commercial land use exists on both the southeast and southwest corners. A church is on the northwest corner and the Oskaloosa Board of Education Building is on the northeast corner. The buildings on the two south corners are 12 feet from the curb of both streets. The church is approximately 40 feet from A Avenue and 15 feet from Market Street. The Board of Education Building is 38 feet from A Avenue and 30 feet from Market Street.

Traffic at the intersection is controlled by a two-phase pretimed signal with mast arm indications for all four legs of approaching traffic. Parking is prohibited along the entire length of A Avenue and along both curbs of the north leg of North Market Street. On the south leg of North Market Street parking is prohibited along the east curb back to the mid-block alley or about 130 feet. Along the west curb, parking is prohibited

for 32 feet. Each leg has pavement markings providing for four lanes. The east, north, and west legs have a thru/right-turn lane and a left-turn lane. The south leg has a thru/left-turn lane and a right-turn lane.

Analysis

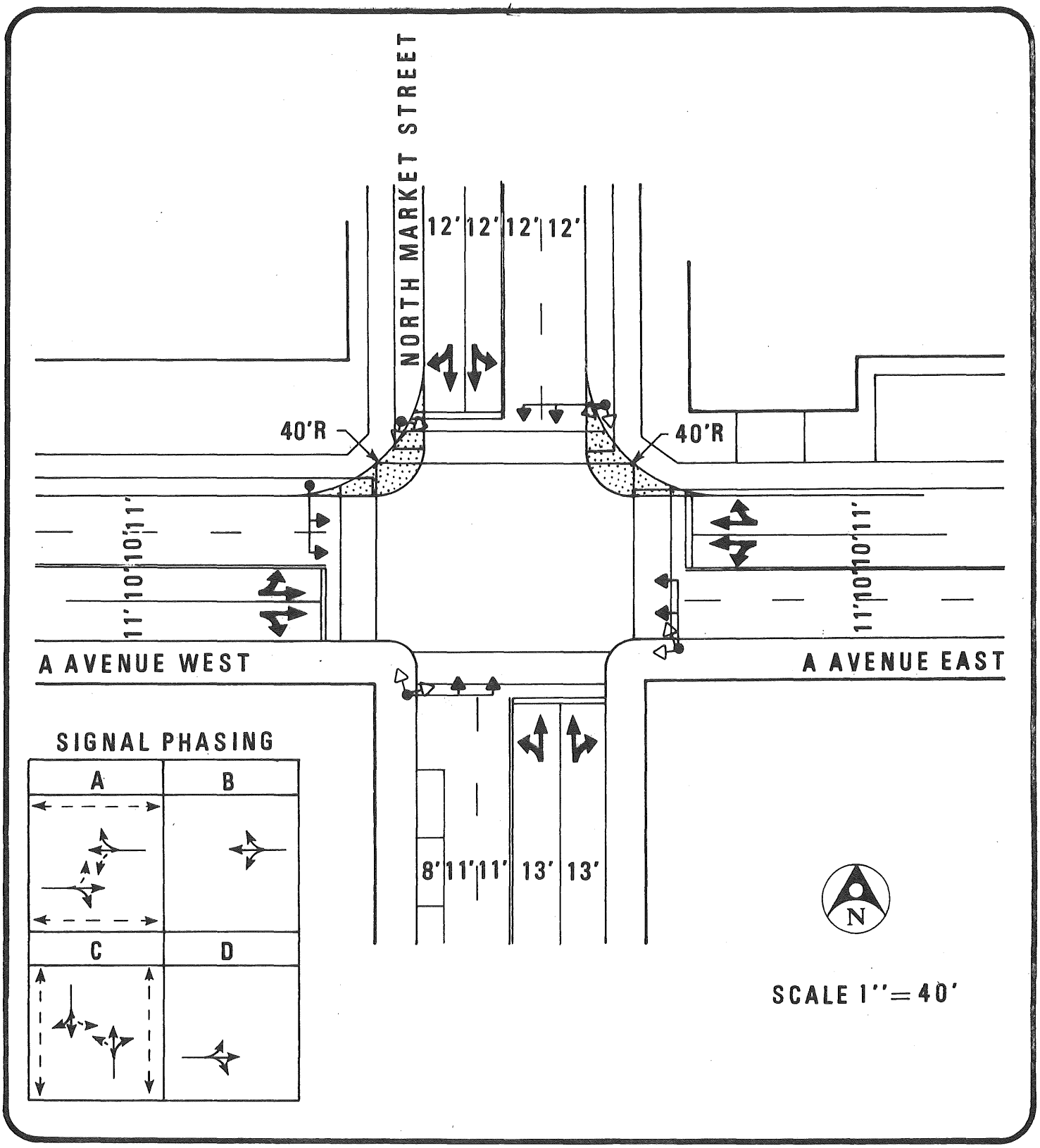
During the years 1974-1976, this intersection experienced a total of 62 accidents. Of this total, 22 involved left-turning vehicles. This fact indicates that the signal controls are not properly phased and/or the lane configurations are not correct to handle the type of traffic movements going through the intersection. In this particular case the two-phase signal does not provide for a protected left-turn thereby contributing to the left-turn type of accidents.

The field inspection of this intersection indicated that the visibility and target value (the ability of the signal indication to command the approaching motorist's attention) of the traffic signals is poor for approaching traffic on all four legs. The signal indications blend into the commercial sign background or are partially blocked by utility and light poles. Large tractor trailer trucks sometimes also block the signal indication. Congestion at this intersection was noted during various periods of the day. Much of the congestion was caused by left-turning vehicles waiting for a gap in the oncoming traffic flow.

In order to correct these problems, several improvements are recommended. These improvements are shown in Figure 6.

- New traffic signal hardware similar to that at the intersection of A Avenue West and North D Street should be installed. Twelve inch head sections for red, yellow, and green indications should be used. Backplates should be installed behind each signal indication to increase target value.

- The signal should be retimed and split phased to provide for a protected left-turn for both eastbound and westbound traffic on A Avenue. This phasing is shown in Figure 6.



LEGEND

MAST ARM MOUNTED TRAFFIC SIGNAL

PEDESTRIAN SIGNAL

TO BE REMOVED

RECOMMENDED IMPROVEMENTS: A AVENUE AND N. MARKET STREET | Figure 6

TRAFFIC ENGINEERING STUDY: Oskaloosa, Iowa | AMV

- New pavement markings should be applied to the pavement to better delineate lanes and crosswalks.
- Pedestrian crosswalk signals should be included with the signal installation.
- The corner radii should be improved on the northeast and northwest corners to better facilitate turning movements.
- This signal should be interconnected with others along A Avenue and along Market Street to provide for progressive movement of traffic along these two streets.

A AVENUE EAST AND NORTH ELEVENTH STREET

Existing Conditions

This intersection is located on the eastern part of the city approximately 10 blocks from the eastern city limits. Immediately east of the intersection is a strip commercial area of service stations and motels. To the west is the major residential portion of the city. Approximately two blocks to the north is the Mahaska County Hospital and to the south, Eleventh Street leads to a major industrial area.

Traffic at the intersection is presently controlled by a semi-actuated, two-phase traffic signal which dwells on the green indication for A Avenue East. Traffic on North Eleventh Street activates the signal to provide a green indication for the side street. Parking is prohibited on all four legs of the intersection. During the p.m. peak hour, 4:30-5:30 p.m., a total of 1,146 vehicles entered the intersection. Of these, 870, or 76%, were on A Avenue East with 59% westbound and 41% eastbound. North Eleventh Street traffic is split 60% southbound, 40% northbound.

Analysis

During the years 1974-1976, a total of 25 accidents occurred at this intersection. Of this total, seven or 28%, of them were right-angle types

involving eastbound and northbound vehicles. This type of accident pattern indicates that eastbound motorists do not see the signal indications in sufficient time to stop. The field inspection of this intersection confirms this fact. The west leg of the intersection is hilly enough, so that eastbound motorists periodically loose sight of the traffic signal indication. This is compounded by the distraction to the motorist caused by the commercial signs east of the intersection. A third item adding to this problem is the natural tendency of motorists to increase their speed as they come closer to the outskirts of a city.

Recommendations

In order to correct this problem it is recommended that three improvements be made. First, back plates should be installed at least on those signal heads controlling eastbound traffic and, preferably, on all signal indications. This will improve the target value of the signal and make it more visible for the motorist. Second, a standard Signal Ahead Sign (W3-3) with an eight inch yellow flasher should be installed for eastbound traffic 600 feet west of the intersection beyond the hillcrest. This will warn eastbound motorists of the signal controls which are over the crest of the hill even though the terrain is such that the signal may not be visible. Third, the loop detector for northbound traffic on North Eleventh Street should be extended south for 20 feet so that northbound motorists will not have to creep into the intersection in order to activate the signal detector.

A AVENUE EAST AND NORTH THIRD STREET

Existing Conditions

This intersection is located at the north eastern edge of the CBD. The land use at the intersection is mixed with residential to the east and north, and commercial to the west and south. A service station is located

in the northwest corner of the intersection. The northwest curb of the intersection is actually a driveway to the service station. North Third Street serves as a collector type facility and serves the north central part of the city and the Senior High School.

Traffic at the intersection is controlled by a two-way Stop for vehicles on North Third Street. A Avenue East has the right-of-way through the intersection. During the afternoon peak hour period, 4:15-5:15 p.m., a total of 1,356 vehicles entered the intersection. Of these, 1,185 vehicles, or 87% were on A Avenue East.

Analysis

During the years 1974-1976, a total of 23 accidents occurred at this intersection. Of those, 8 accidents, or 35%, were right-angle types and 5 accidents, or 22%, involved eastbound vehicles colliding with westbound left-turning vehicles. These types of accidents indicate that the traffic on A Avenue East is of sufficient volume and steady flow that vehicles on the side street or vehicles turning onto the side street do not have sufficient time or gaps to complete their movement safely.

The field inspection indicates that northbound vehicles must pull up into the crosswalk area in order for the motorist to see to the east. To motorists traveling in both directions on A Avenue East, the intersection is poorly defined and appears to blend into the existing land uses.

A review of the 11-hour traffic volume counts indicate that the intersection meets the minimum vehicle volumes for Warrant 2, Interruption of Continuous Traffic, as stated in the MUTCD. Due to the city's population of approximately 11,000, 70% of the traffic volumes are required to meet the volume warrants. A summary of the traffic counts for signal justification is included in the Appendix.

Recommendations

In order to correct the deficiencies at this intersection, the recommendations shown in Figure 7 should be implemented.

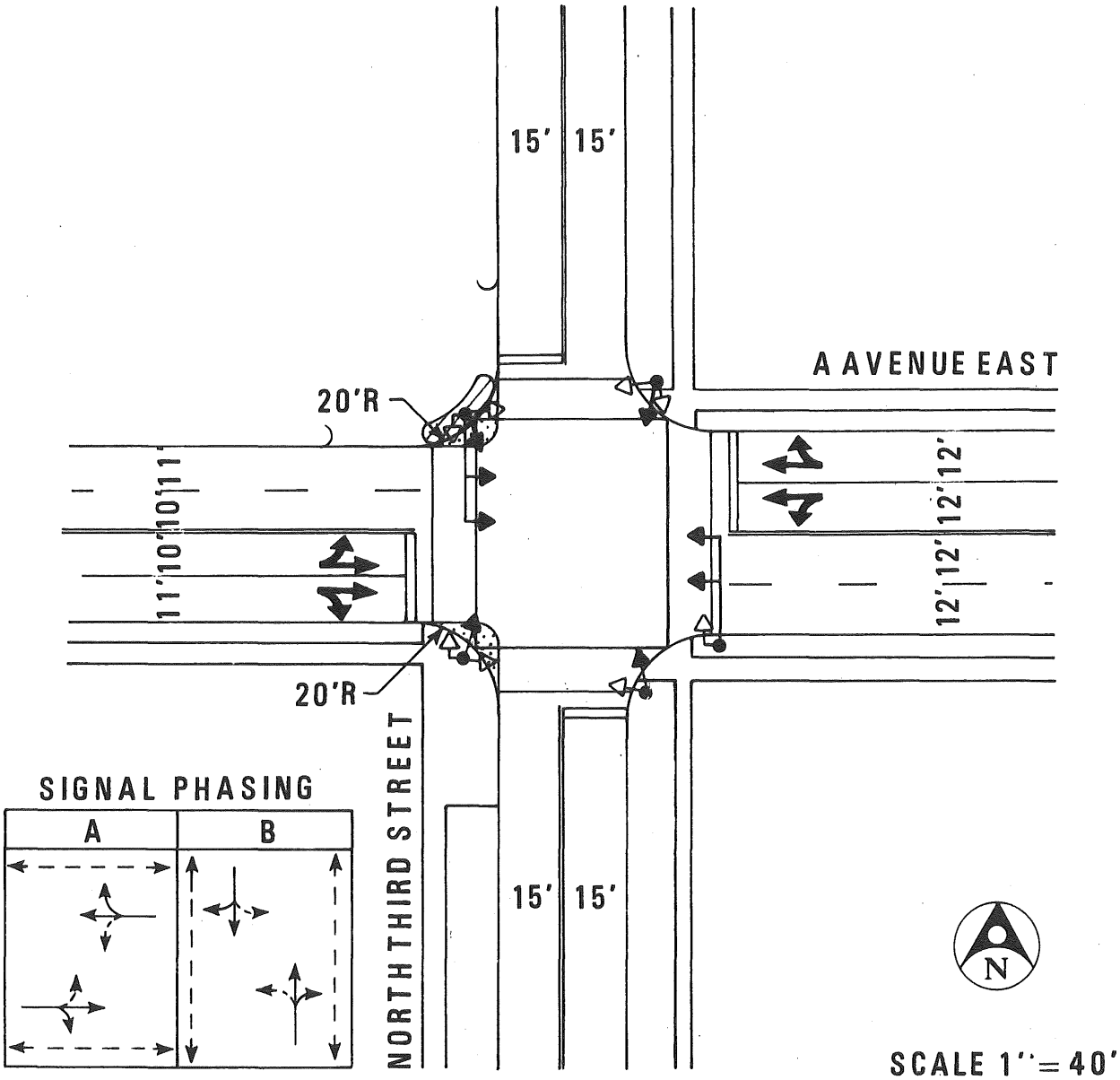
- A traffic signal should be installed at this location with twelve inch head sections used for all the indications controlling A Avenue East and North Third Street traffic. Backplates should be used for the A Avenue East head section to increase target value.
- Pedestrian indications should be included with the signal installation.
- Corner radii should be improved as shown in the figure including the closing of the driveway in the northwest corner.
- Standard pavement markings should be applied to the pavement as shown in the figure.
- This signal should be interconnected with other traffic signals along A Avenue to provide for progressive movement of traffic.

A AVENUE WEST AND NORTH D STREET

Existing Conditions

This intersection is located on the northwest fringe of the CBD. The land use on the two streets is a mixture of commercial and industrial-warehousing. During the afternoon peak hour period, 4:15-5:15 p.m., a total of 1,233 vehicles passed through the intersection. Of this total, 960 vehicles, or 78%, were on A Avenue West.

The intersection is controlled by a semi-actuated, two-phase traffic signal with A Avenue East receiving a dwelling green indication. Vehicles on North D Street are detected by the signal hardware and the signal goes through its pre-timed cycle to allow the side street traffic to enter or cross the major street.



LEGEND

- MAST ARM MOUNTED TRAFFIC SIGNAL
- POST MOUNTED TRAFFIC SIGNAL
- PEDESTRIAN SIGNAL
- TO BE REMOVED
- TO BE ADDED

RECOMMENDED IMPROVEMENTS: A AVENUE E. & N. THIRD STREET | Figure 7

TRAFFIC ENGINEERING STUDY: Oskaloosa, Iowa | AMV

Analysis

During the years 1974-1976, a total of 22 accidents occurred at the intersection. Of these, 10 accidents, or 45%, were right-angle type. This type of accident pattern indicates that the signal indications are not as visible as they could be to approaching motorists on A Avenue West. A total of 13 of these accidents occurred after the traffic signal was installed in January, 1976.

The police department indicated that most of these accidents in 1976 involved local Oskaloosa residents who were usually the faulty party. This can be expected with the installation of a new traffic signal until the public becomes accustomed to it. The field inspection, however, did indicate that the signal had poor target value which could be a mitigating cause of the accidents.

Recommendations

In order to correct this deficiency, back plates should be installed on the signal indications for at least A Avenue West traffic in order to increase the target value of the signal indications. Another item that could improve the situation would be to retime the signal to allow for more amber indication time and, possibly, an all-red clearance of three seconds to insure that all traffic stops before the green indication is given to one of the streets. This intersection should be interconnected with the other signals along A Avenue to the east.

HIGH AVENUE AND MARKET STREET

Existing Conditions

This intersection is in the heart of the CBD. The main shopping facilities are within two blocks of this intersection. The southeast corner contains the city park square and bandstand. During the afternoon peak

period, 4:00-6:00 p.m., a total of 2,315 vehicles entered the intersection. Approximately one half of this total occurred in each one hour period indicating a two-hour peak period rather than the usual one hour. The traffic volumes are divided 55% on Market Street and 45% on High Avenue.

The intersection is controlled by a 60-second cycle, two-phase, pretimed traffic signal. The signal phasing provides 26 seconds of green indication and 4 seconds of yellow indication to both streets. The signals include only one set of indications for each leg of the intersection. The signal is located on the far left corner, strapped to a street light pole. This configuration of signal indication is non-standard according to the MUTCD since two far-side signal indications are required by the MUTCD standards. Left turns are prohibited at the intersection.

Analysis

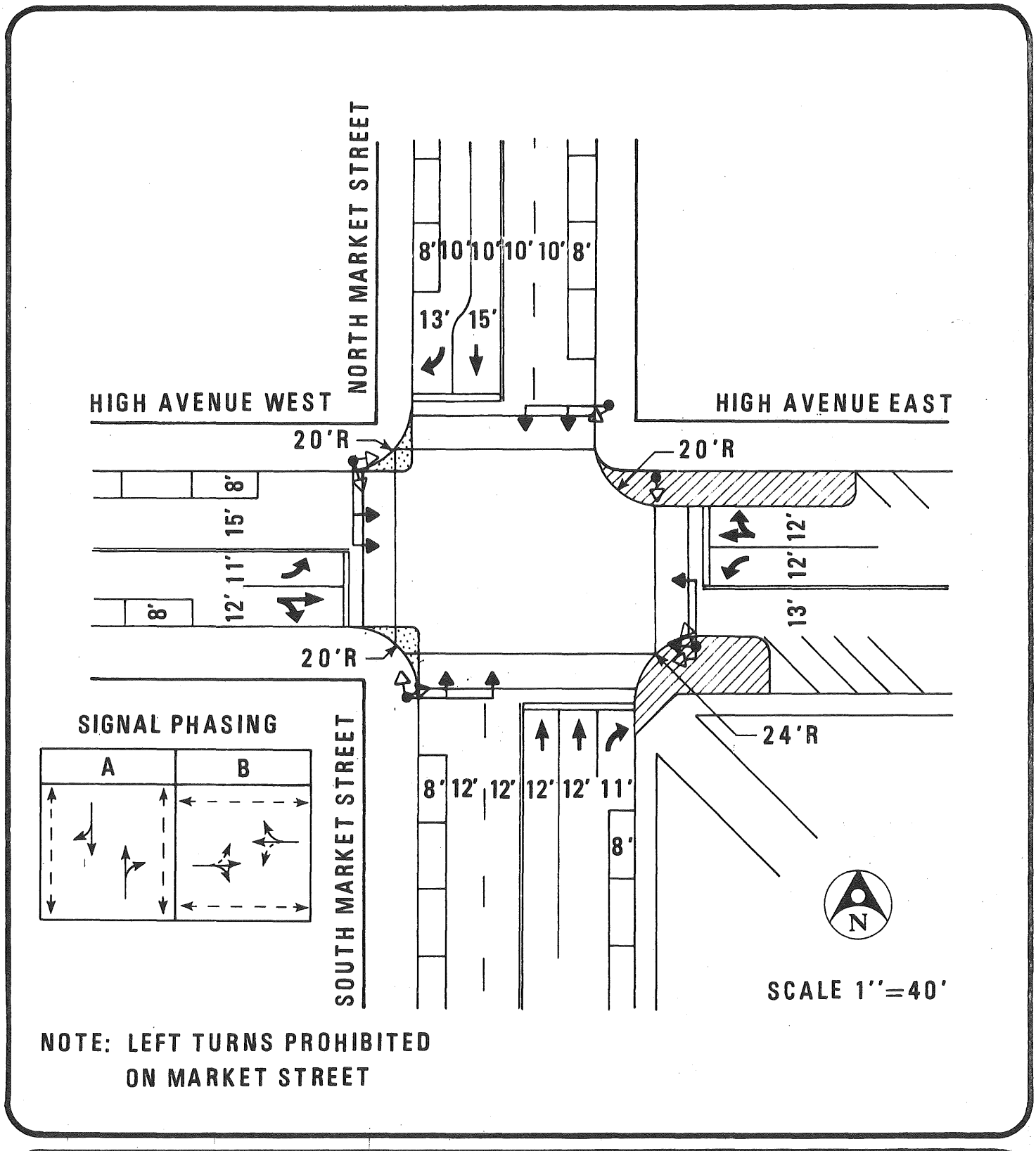
During the years 1974-1976, a total of 19 accidents occurred at this intersection. The accident pattern is mixed. This can be expected and is typical of CBD intersections.

The field investigation indicated that the signal indication cannot be seen adequately by approaching motorists. Because of the commercial signs in the CBD, the signal indications blend into them and this results in a target value of almost zero.

Reviewing the traffic counts indicates that there is sufficient vehicles to meet the Minimum Vehicular Volume Warrant to the extent of 80% as prescribed by the MUTCD and required due to the accident experience. A summary of these traffic volumes is shown in the Appendix.

Recommendations

Based on the above analysis, the following recommendations should be implemented at this intersection. These recommendations are shown in Figure 8.



LEGEND

- MAST ARM MOUNTED TRAFFIC SIGNAL
- POST MOUNTED TRAFFIC SIGNAL
- PEDESTRIAN SIGNAL
- TO BE REMOVED
- TO BE ADDED

RECOMMENDED IMPROVEMENTS: HIGH AVENUE & MARKET STREET | Figure 8

TRAFFIC ENGINEERING STUDY: Oskaloosa, Iowa | AMV

- New traffic signal hardware should be installed at this intersection. Twelve inch head sections for all indications should be used and back plates should be installed behind all indications to improve target value. All signal indications should be mast arm mounted.

- Pedestrian indications must be included in the installation due to the surrounding land uses and the large number of pedestrians crossing both streets.

- New pavement markings should be applied to the pavement to better delineate the traffic lanes and the crosswalks.

- Corner radii should be improved as shown in the figure to not only facilitate traffic flow, but also narrow the east leg of the intersection and reduce the length of time pedestrians need to cross the street.

- Left turns should be permitted from High Avenue to better facilitate circulation in the downtown area.

- This signal should be interconnected with other signals along Market Street to facilitate traffic flow.

A AVENUE EAST AND NORTH FIRST STREET

Existing Conditions

This intersection is located at the northeast corner of the CBD. Commercial land use is present on three of the four corners and a church is located on the northwest corner. The Oskaloosa Junior High School is located one block north of this intersection. During the afternoon peak hour period, 4:30-5:30 p.m., a total of 1,276 vehicles passed through the intersection. Of this total, 1,156 vehicles, or 91%, were on A Avenue East. Parking is prohibited along both legs of A Avenue East, but is permitted up to the corner radii on North First Avenue.

The intersection is controlled by a two-way Stop with A Avenue East having the right-of-way. During morning and late afternoon periods, a portable Stop sign is rolled to the middle of the intersection for A Avenue

East traffic and a single, flashing red signal indication is turned on. The Stop sign and flashing signals are used as a crosswalk control for the near-by junior high school.

Analysis

During the years 1974-1976, a total of 18 accidents occurred at this intersection. The accident pattern is mixed but most of the accidents involved a turning vehicle.

The field investigation indicated that motorists approaching the intersection from both the north and south on North First Street are required to pull their vehicles into the crosswalk area in order to see oncoming traffic on A Avenue East. This is due to buildings being close to the street and the number of utility, street light, and sign poles on A Avenue East.

The field investigation also indicated that the intersection is very poorly defined for motorists on A Avenue East. This is due to commercial driveways and signs along A Avenue East. An approaching motorist is unaware of the intersection and therefore can have his attention diverted and not concentrate on vehicles at this intersection.

A third item noted in the field investigation relates to the use of the intersection by the junior high students. On the day of the investigation the school dismissed at least 20 minutes before the flashing red signal indication started at the intersection. As a consequence, students were forced to cross A Avenue East with no protection. Many of them were rather bold in walking out in front of oncoming traffic and expecting the vehicles to stop for them. Clearly, the school crossing controls are not adequate for this intersection.

A review of the 11-hour traffic counts at this intersection indicate that there is sufficient vehicles to meet 70% of the volume warrants required for the Interruption of Continuous Traffic Warrant. The 70% values are used because of the city's population being approximately 11,000 and, therefore, considered a rural city. Thess volumes are shown in the Appendix.

Recommendations

Based on the above analysis, the following recommendations are made to improve this intersection. These improvements are shown in Figure 9.

- New traffic signals should be installed at this intersection. Twelve inch head sections should be used for all indications controlling A Avenue East and North First Street traffic. Back plates should be installed on all indications. Indications for A Avenue East traffic should be mast arm mounted and indications for North First Street should be post mounted.

- Pedestrian indications must be included with the signal installation.

- New pavement markings should be applied to the pavement to better delineate the traffic lanes and crosswalks.

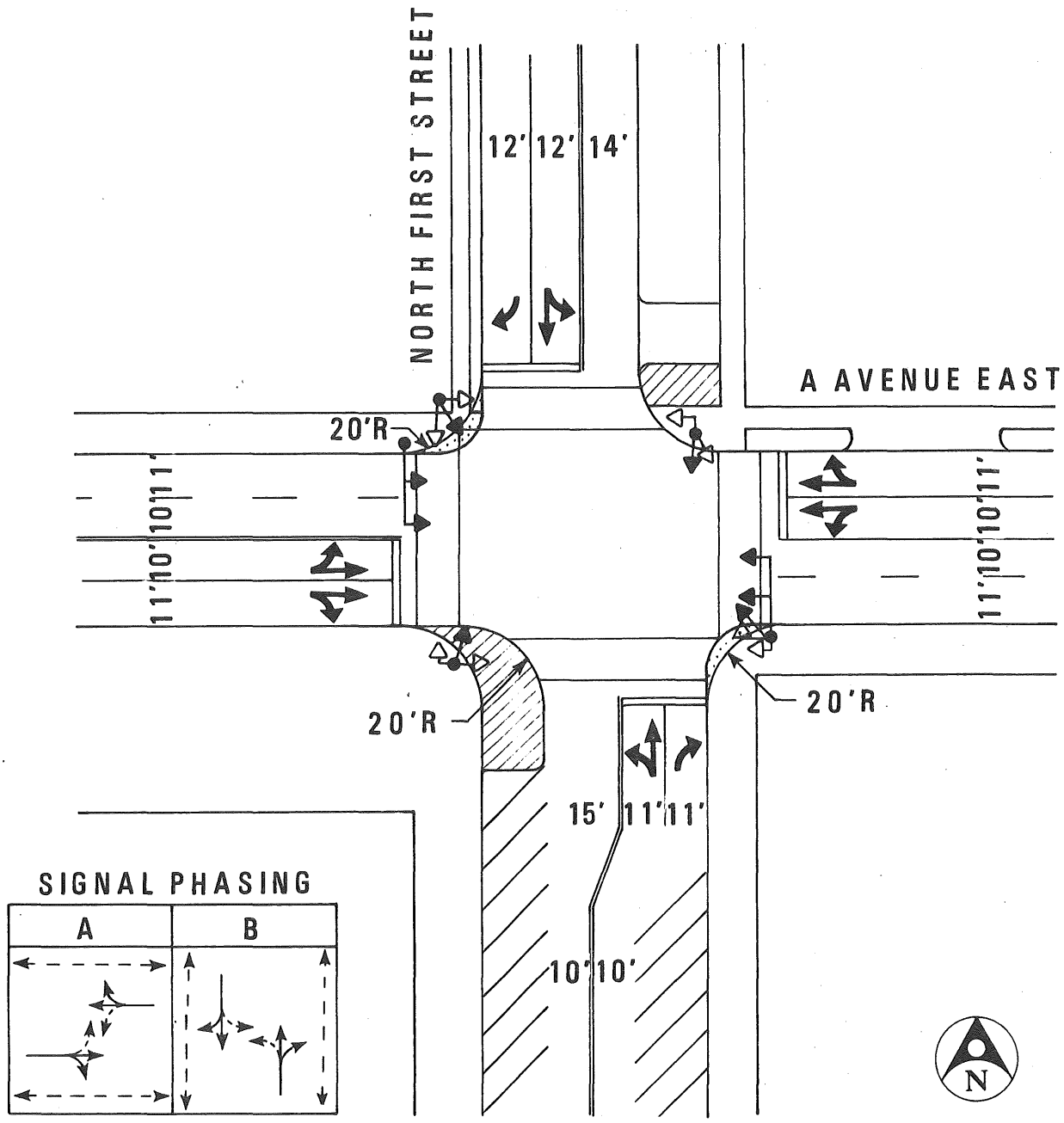
- Corner radii should be improved as shown in the figure.

- This signal should be interconnected with other signals along A Avenue to better facilitate traffic flow.

A AVENUE WEST AND NORTH L STREET

Existing Conditions

This intersection is located at the western edge of the built-up area of the city approximately 850 feet east of the western city limits and approximately 0.4 miles from the junction of State Routes 92 and 163. Land use in the area is a mixture of commercial and residential with the commercial uses along both legs of A Avenue West and the residential uses along both legs of North L Street. Commercial uses are present at the intersection.



LEGEND

- MAST ARM MOUNTED TRAFFIC SIGNALS
- POST MOUNTED TRAFFIC SIGNAL
- PEDESTRIAN SIGNAL
- TO BE REMOVED
- TO BE ADDED

RECOMMENDED IMPROVEMENTS: A AVE. EAST & N. FIRST STREET | Figure 9

TRAFFIC ENGINEERING STUDY: Oskaloosa, Iowa | AMV

The intersection is controlled by a two-way Stop for North L Street traffic. A Avenue West traffic has the right-of-way through the intersection. Traffic volumes at the intersection are approximately 7,500 ADT on A Avenue West and 1,100 ADT on North L Street.

Analysis

During the years 1974-1976, a total of 16 accidents occurred at this intersection, 8 accidents, or 50%, involving right-angle or turning movement types. This type of accident pattern is indicative of poor sight distance and lack of intersection definition. The field investigation verified this problem. Motorists on A Avenue do not see an intersection due to the commercial signs and driveways. The intersection simply blends into the surrounding land uses. An added problem is that eastbound motorists are entering the city and are usually traveling at higher than normal speeds as they pass this intersection. This problem is compounded by the incline up which they must travel before getting to this intersection. Review of traffic volumes at the intersection indicated that presently insufficient volumes are present on the side street for the required eight hours to meet traffic signal warrants as stated in the MUTCD.

Recommendations

In order to correct the deficiencies at this intersection, a Cross Road Sign (W2-1) should be installed in advance of the intersection on both legs of A Avenue West and Intersection Control Beacon should be installed at the intersection. The Beacon should flash yellow on A Avenue West and red on North L Street. The sign and Beacon will define the intersection for the motorists on A Avenue West. Intersection volume counts should be made at least yearly to determine if the volumes have increased enough to warrant traffic signals.

A AVENUE EAST AND NORTH NINTH STREET

This intersection is located in the east central part of Oskaloosa. The land use surrounding the intersection is entirely residential. The Grant Elementary School is two blocks to the northwest and a signalized school crossing for the school is located two blocks north at C Avenue East.

The intersection is controlled by a two-way Stop with A Avenue East having the right-of-way. Traffic volumes at the intersection are approximately 11,000 ADT on A Avenue West and 1,400 ADT on North Ninth Street.

Analysis

During the years 1974-1976, a total of 15 accidents occurred at this intersection. Of those, a total of 8 accidents, or 53%, involved either right-angle or turning movement type collisions. Three westbound rear-end collisions were experienced. This accident pattern indicates that the intersection is not well defined for motorists on A Avenue East. The field investigation verified this situation especially for westbound motorists. Immediately east of the intersection there is a slight hill crest which effectively blocks the westbound motorist's view of the intersection.

Recommendations

In order to correct the above noted problem, the Cross Road Sign (W2-1) should be installed 50 feet west of the A Avenue East and North Tenth Street intersection for westbound traffic and a flashing eight inch yellow beacon installed on top of the Cross Road Sign. This will warn the motorist of the approaching intersection and should help reduce the rear-end type accidents.

FIRST AVENUE AND SOUTH MARKET STREET

Existing Conditions

This intersection is located in the heart of the CBD at the southwest corner of the city park square. All the land use on each leg of this intersection is commercial. Parking is permitted on all curbs of all four legs to within 10 feet of the corner radii.

The intersection is presently controlled by a pre-timed, two-phase traffic signal. The signal is standard in that two far-side indications are present for approaching traffic on each leg. However, the signal head indications are not within the required 20^{o} lateral sight distance on all approaches. Left turns are prohibited at this intersection. During the peak hour of traffic flow, 1:00-2:00 p.m., a total of 796 vehicles entered the intersection. Of these, 469 vehicles, or 59%, were on South Market Street. During most of the mid-day period, after 12:00 Noon, traffic volumes were fairly constant fluctuating between 675 and 800 vehicles per hour entering the intersection.

Analysis

The accident history indicated a total of only 13 accidents occurred at the intersection during the years 1974-1976. However, most of these accidents involved backing vehicles and, therefore, could not be considered in the intersection.

The field inspection indicated that the location of the traffic signal indications caused them to blend into the background of commercial signs for all four approaches. The intersection has a high number of pedestrian crossing both streets due to its location in the heart of the CBD. These facts, plus the non-standard location of the signals causes the approaching motorists to be unsure about what controls are present at this location.

Recommendations

In order to correct the above noted problem, the following recommendations are made. These improvements are shown in Figure 10.

- New traffic signal hardware should be installed at this intersection. Twelve inch head sections should be used for all indications. Back plates should be installed on all indications. Indications controlling South Market Street traffic and one indication controlling each direction of First Street traffic should be mast arm mounted. The other indications controlling First Street traffic should be post mounted.

- Pedestrian indications must be included with the signal indications due to the location of the intersection in the heart of the CBD.

- New pavement markings should be applied to the pavement to better delineate the traffic lanes and crosswalks.

- Corner radii improvements should be improved as shown in the figure. The corners have been extended into the street to better define the intersection, provide shorter crosswalk length, and afford some protection to the parked vehicles along both streets.

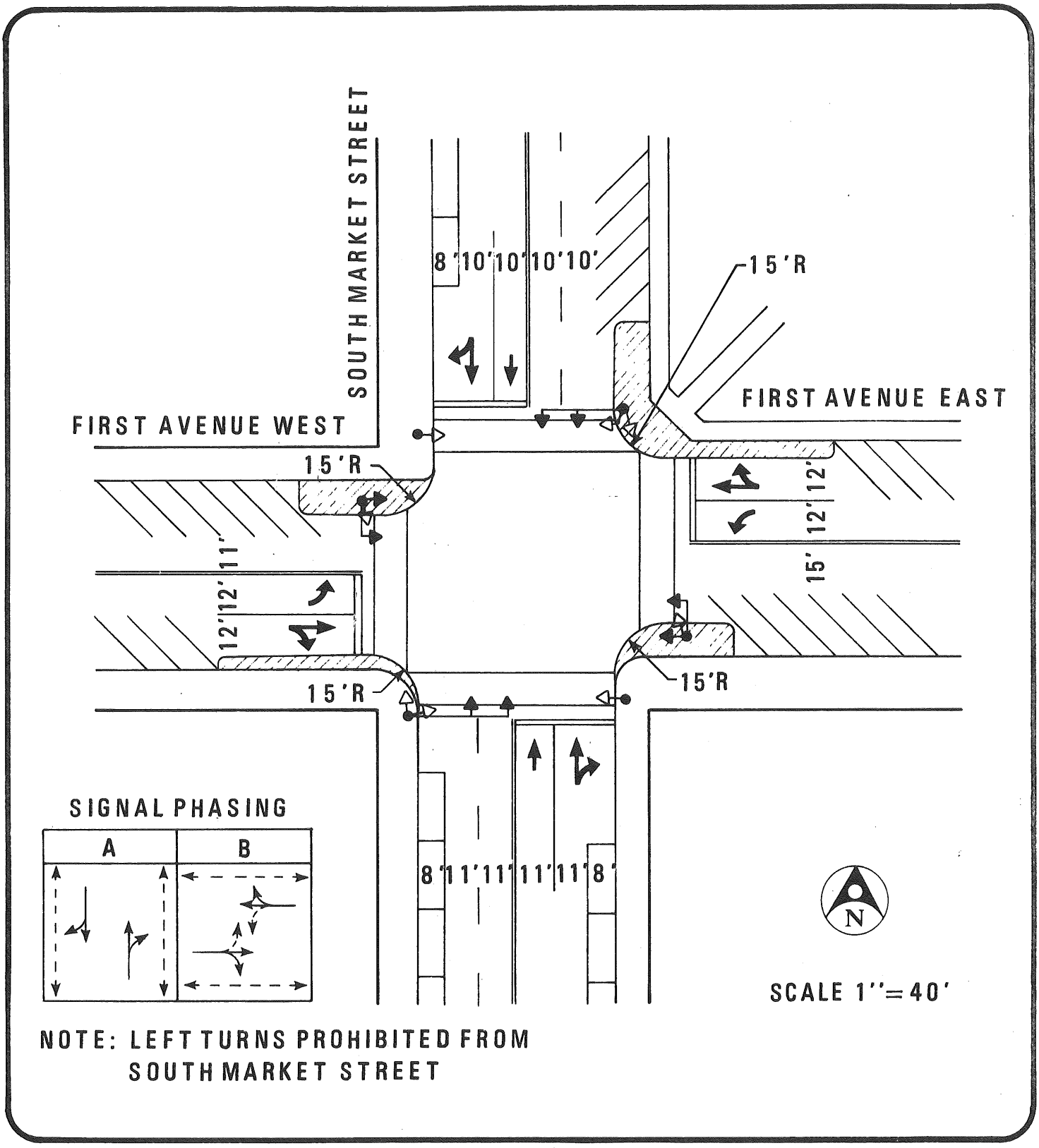
- Left turns should be permitted from First Avenue to better facilitate circulation in the CBD.

- This signal should be interconnected with other signals along Market Street to better facilitate traffic flow along this major artery.

SECOND AVENUE AND SOUTH MARKET STREET

Existing Conditions

This intersection is at the south edge of the CBD and is the boundary between the more residential area to the south and the commercial activity in the CBD. Commercial land uses are located in the northwest and southeast



LEGEND

- MAST ARM MOUNTED TRAFFIC SIGNAL
- POST MOUNTED TRAFFIC SIGNAL
- PEDESTRIAN SIGNAL
- TO BE ADDED

RECOMMENDED IMPROVEMENTS: FIRST AVENUE & S. MARKET STREET | Figure 10

TRAFFIC ENGINEERING STUDY: Oskaloosa, Iowa | AMV

corner of the intersection. Public land uses exist in the other two corners, the city hall and the city library. Parking is prohibited on the south and east legs, but is permitted on the curbs of the north and west legs. However, the parking permitted along the east curb of the north leg is only for police vehicles.

The intersection is presently controlled by a two-way Stop sign with South Market Street having the right-of-way through the intersection. Traffic volumes entering this intersection during the peak hour of traffic flow, 3:45 to 4:45 p.m., are 1,028. Of these, 760 vehicles, or 74%, were on South Market Street.

Analysis

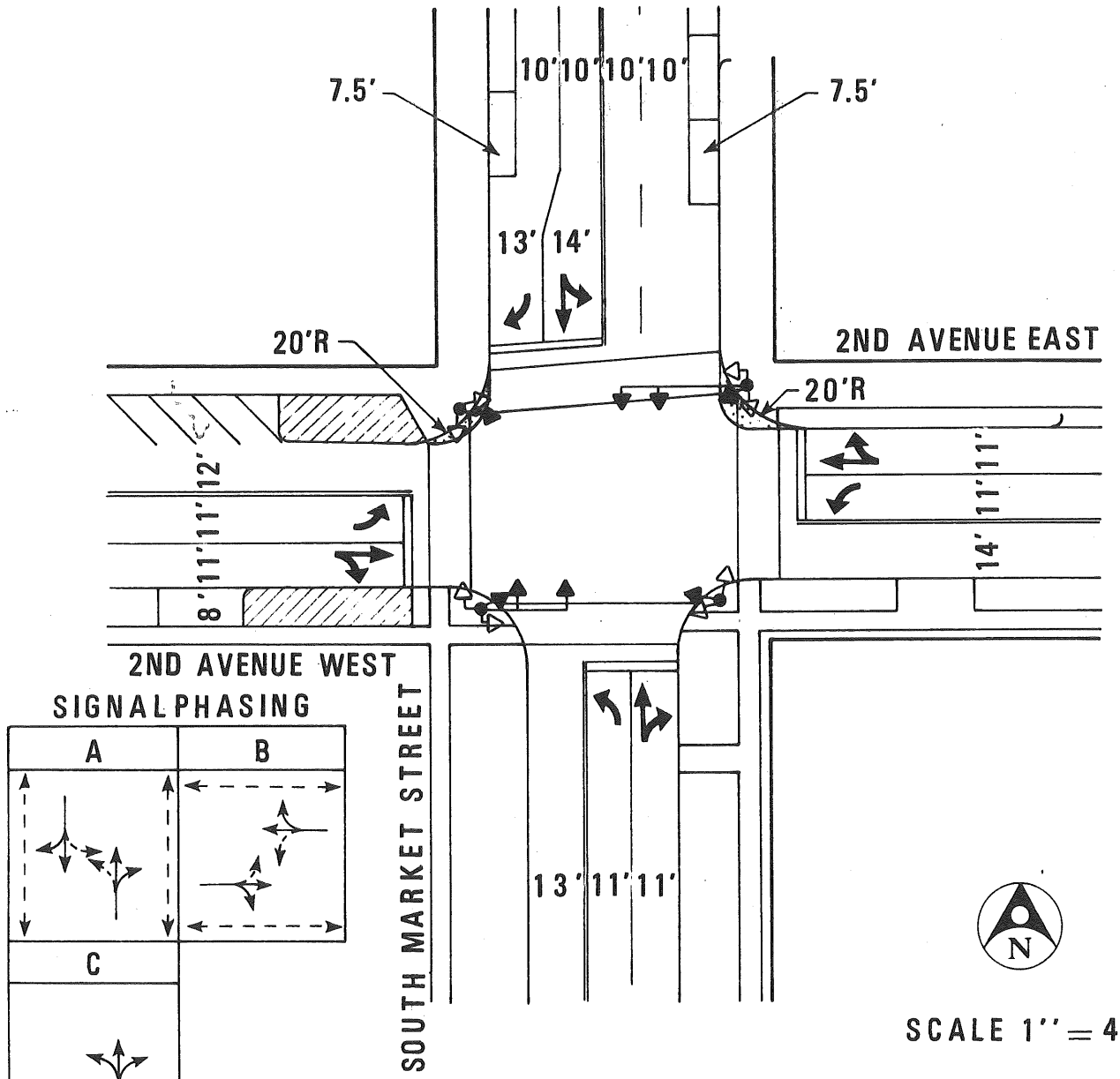
During the years 1974-1976, a total of only seven accidents occurred at this intersection. However, the number of accidents have increased each year with only one in 1974, two in 1975, and four in 1976. The accident pattern involves right-angle collisions and turning vehicles. One pedestrian/vehicle accident occurred in 1976 resulting in a pedestrian injury. This accident pattern is indicative of poor sight distance, especially from the side street. The field investigation verified this problem. Motorists on both legs of Second Street must pull their vehicles into the intersection in order to see vehicles approaching from the north. This is caused by the parked vehicles, including police cars, along both curbs of the north leg. Another operational problem is the close proximity to the intersection (within 10 feet) of the angle parking along the north curb of the west leg of Second Avenue. Vehicles backing from the first two or three parking spaces effectively block westbound traffic leaving the intersection causing periodic congestion, especially when both the bank facility in the southeast corner and the supermarket in the northwest corner are both operating. During peak traffic periods some difficulty is experienced by the fire department

in exiting onto East Second Street. This is caused by the vehicle stopped at South Market Street being backed-up past the fire station. Review of the 11-hour traffic volume counts at this intersection indicated that sufficient volumes are present to meet 70% of the Minimum Vehicular Volume Warrant. The 70% figure was used due to the population of the city being approximately 11,000 and, therefore, considered a rural city.

Recommendations

Based on the above analysis, the following recommendations are made to improve this intersection. These improvements are shown in Figure 11.

- Traffic signals should be installed at this intersection. Twelve inch head sections and back plates should be installed for all indications.
- Pedestrian indications should be included with the signal indication due to the location of the intersection in the CBD.
- New pavement markings should be applied to better delineate the traffic lanes and crosswalks.
- A preemption for the fire station should be designed into the signal hardware so that only westbound Second Avenue will have a green indication at the intersection. This will enable the fire vehicles to more easily exit onto East Second Street.
- Corner radii and curb extensions should be improved as shown in the figure.
- This signal should be interconnected with other signals along Market Street to better facilitate traffic flow along this major artery.



LEGEND

- MAST ARM MOUNTED TRAFFIC SIGNAL
- POST MOUNTED TRAFFIC SIGNAL
- PEDESTRIAN SIGNAL
- TO BE REMOVED
- TO BE ADDED

RECOMMENDED IMPROVEMENTS: 2ND AVENUE & S. MARKET STREET | Figure 11

TRAFFIC ENGINEERING STUDY: Oskaloosa, Iowa | AMV

V. CENTRAL BUSINESS DISTRICT STUDY

In most cities the Central Business District (CBD) or downtown area is the most important and active section of the community in terms of employment, services, and shopping. This is the case in Oskaloosa. In fact, the commercial activity in Oskaloosa is much greater and vital than is normally expected in a city with 12,000 population.

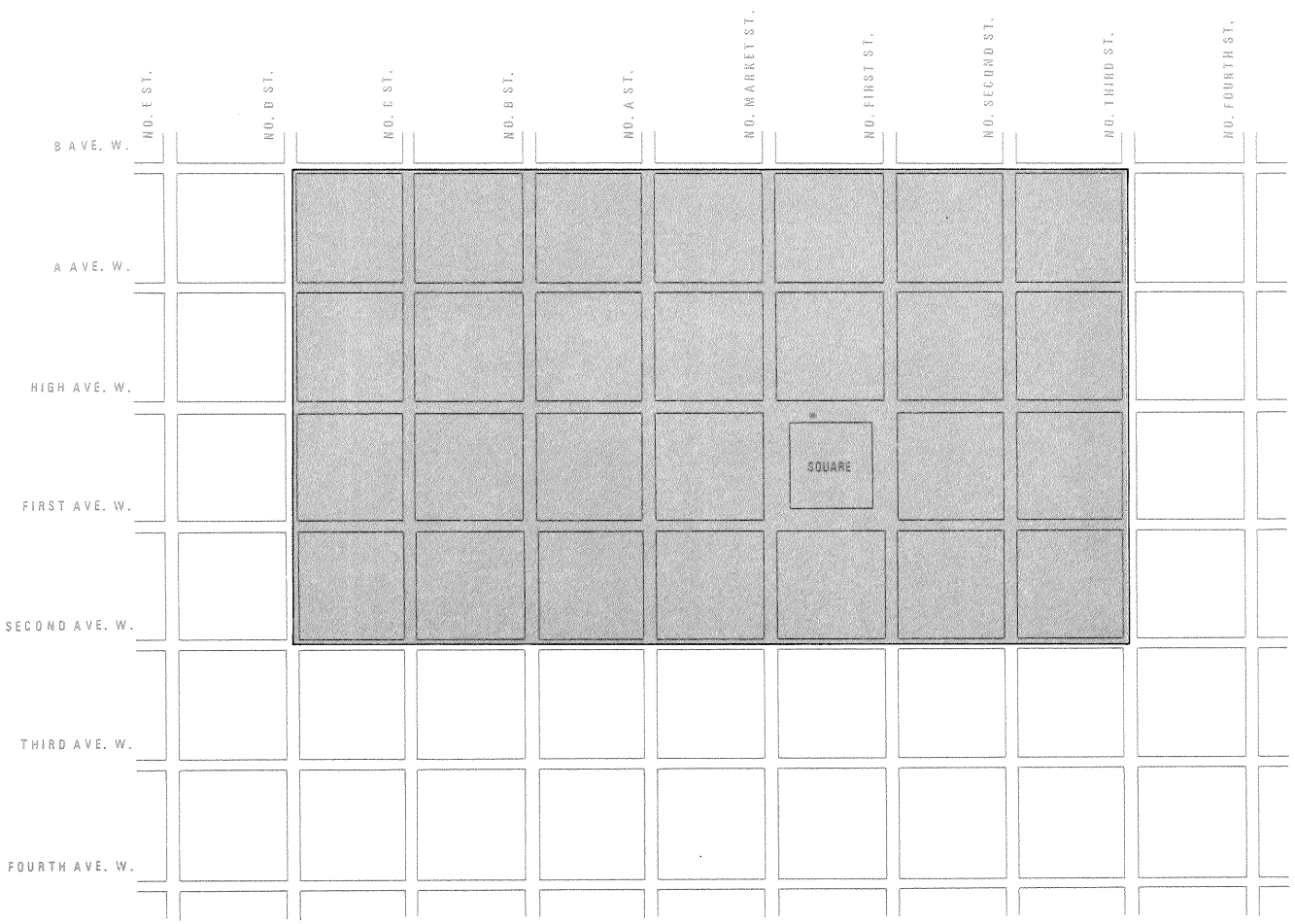
Due to this activity, traffic circulation and parking have become problems in the CBD. As part of this traffic engineering study, a detailed examination has been made of the parking and traffic circulation within the Oskaloosa CBD. This study area is shown in Figure 12.

PARKING

In order to determine the parking situation in Oskaloosa, three surveys were conducted; two surveys of on-street parking and one survey of off-street parking. The on-street surveys were of parking occupancy and parking duration or turnover. The off-street survey was of parking occupancy. The surveys were conducted on a typical weekday between the hours of 10:00 a.m. and 4:00 p.m. These times were chosen because usage of parking facilities during these time periods is usually at its maximum.

On-Street Parking

On-street parking on 16 block faces was surveyed in the Oskaloosa CBD. The surveyed block faces are shown in Figure 13. The survey method consisted of two people walking along a specified route and noting on a survey form the last three digits of the license plates of parked vehicles. This survey technique was repeated every hour beginning at 11:00 a.m. and ending at 4:00 p.m.



TRAFFIC ENGINEERING STUDY
Oskaloosa, Iowa

CENTRAL BUSINESS DISTRICT STUDY AREA

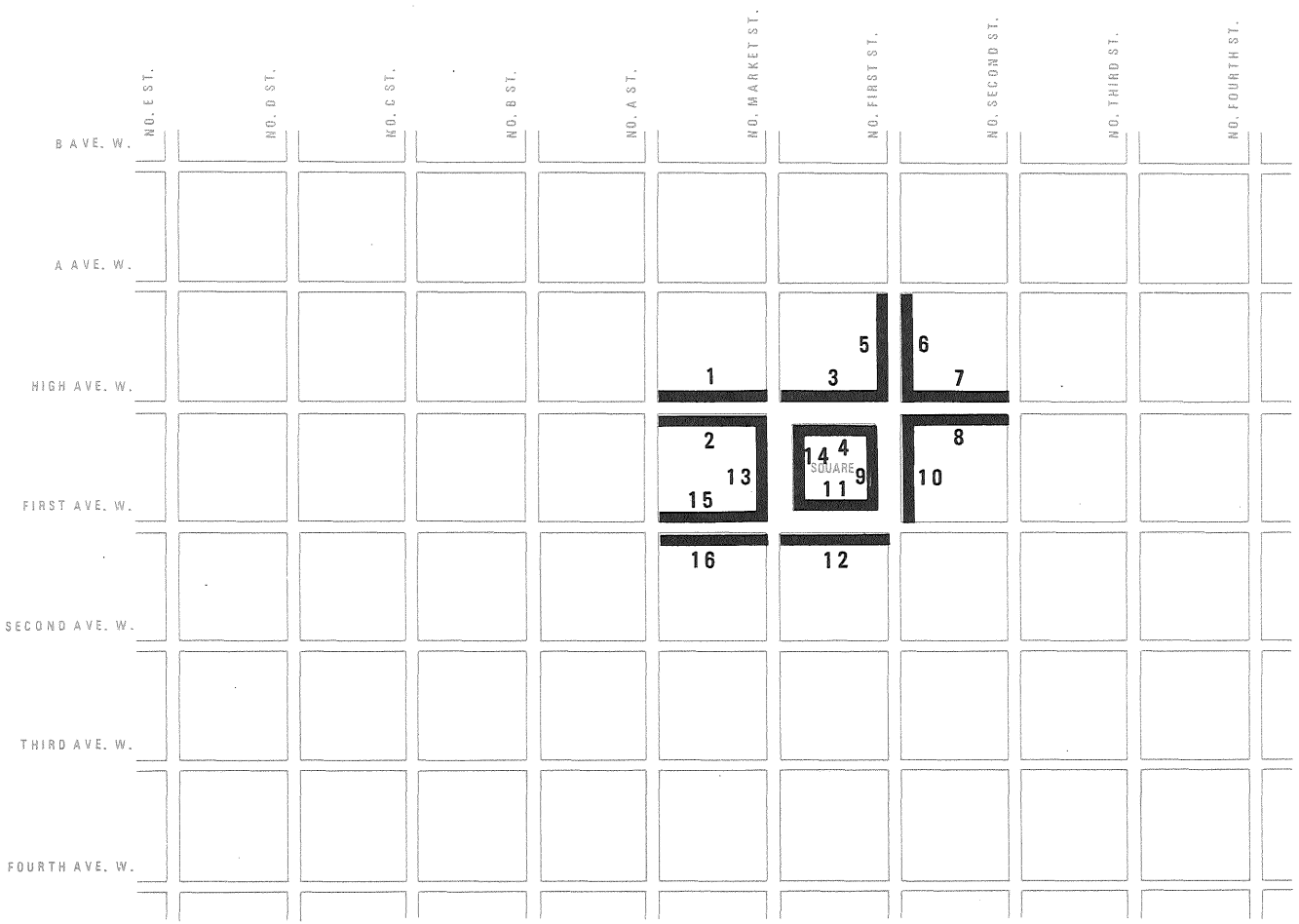
LEGEND

STUDY AREA

N

Figure 12

AMV ALAN M. VOORHEES & ASSOCIATES, INC.



TRAFFIC ENGINEERING STUDY
Oskaloosa, Iowa

ON-STREET PARKING SURVEY

SURVEYED BLOCK FACES

LEGEND

BLOCK FACE

1 BLOCK FACE NUMBER

Figure 13

AMV ALAN M. VOORHEES & ASSOCIATES, INC.

The data obtained by the license plate survey was then summarized to provide information about two parking characteristics; occupancy and duration or turnover.

Parking Occupancy:

Parking occupancy constitutes the time when a vehicle is actually parked in an on-street parking space. The vehicle occupies the parking space. Parking occupancy is usually reported in terms of the percent of time the parking space is occupied by a vehicle. This percentage is usually reported for a geographic area such as a block face. For the parking occupancy in the Oskaloosa CBD, this percentage is reported for two time periods; first, the average occupancy by block face over the entire survey period, and second, the occupancy during the hour of peak occupancy for the total number of surveyed spaces.

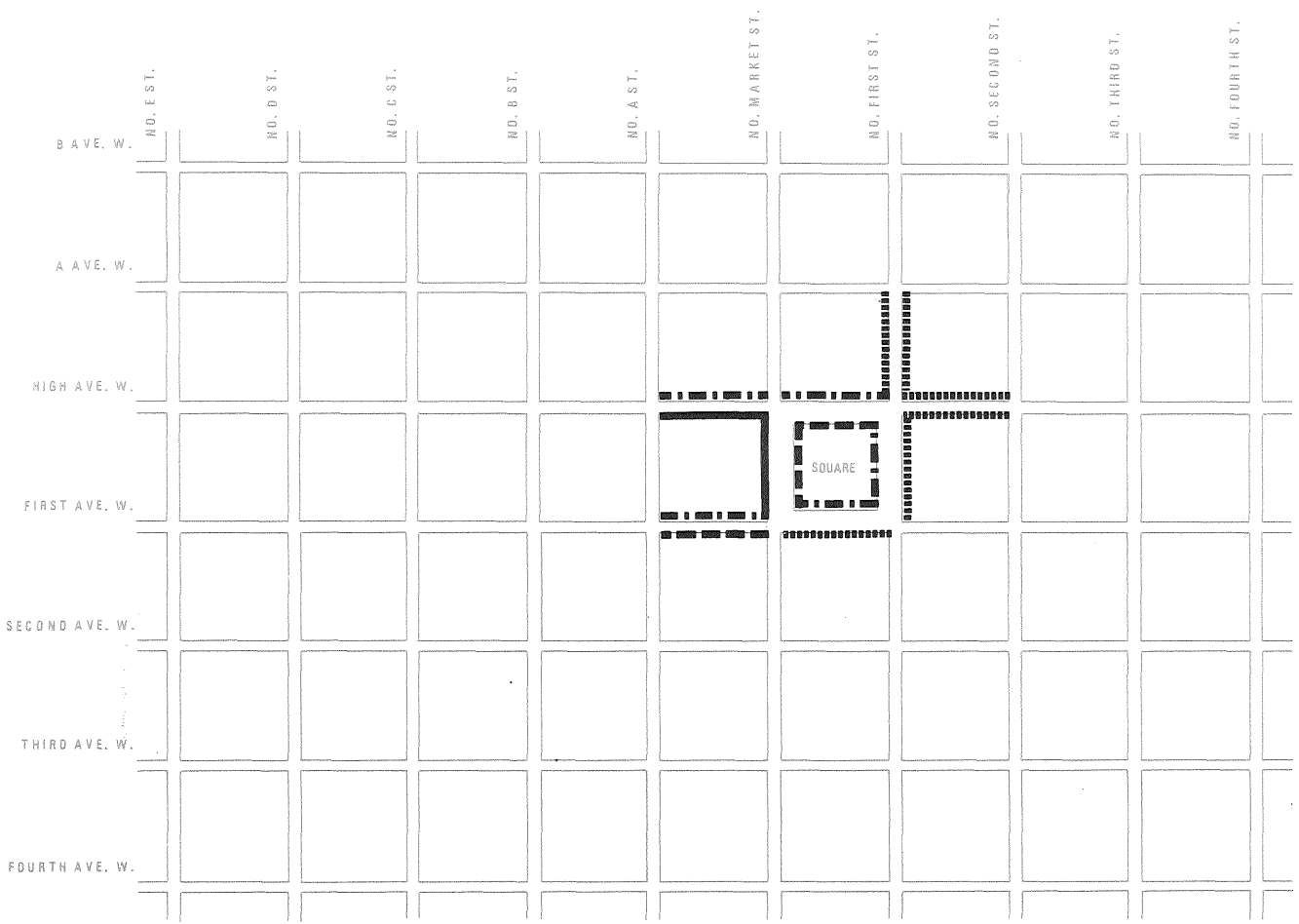
The average occupancy percentage of the surveyed block faces is presented in Table 2 and graphically shown in Figure 14. The block faces with the highest percentage of average occupancy (100%) are the south side of High Avenue West between Market and A Streets and the west side of South Market Street between High and Second Avenues. Other block faces with an average occupancy of over 80% are the south side of High Avenue East between Market and First Avenues, the south side of First Avenue West between South Market and South A Streets, and the east side of South Market Street between High and First Avenues. Overall, the surveyed block faces were occupied for an average of 69% of the time during the survey.

Another measure of parking occupancy is the occupancy of each block face during that time period when the overall peak occupancy occurs. In this instance the peak overall occupancy occurred during the hour ending at 11:00 a.m. During that hour, overall occupancy reached 80%. The peak occupancy percentage for each block face is shown graphically in Figure 15.

TABLE 2
AVERAGE ON-STREET PARKING OCCUPANCY PERCENTAGE
BY BLOCK FACE
CENTRAL BUSINESS DISTRICT STUDY
OSKALOOSA, IOWA

Block Face No.	Total Available Spaces	Percentage Occupied by Time Period Ending 11	12	1	2	3	4	Average Occupancy Percentage
1	10	100%	90%	70%	40%	50%	60%	70%
2	9	100%	100%	100%	100%	100%	100%	100%
3	18	89%	61%	67%	67%	67%	56%	67%
4	18	89%	78%	94%	78%	100%	83%	89%
5	15	87%	33%	67%	33%	33%	27%	47%
6	16	81%	25%	50%	62%	6%	19%	44%
7	16	100%	50%	62%	38%	50%	44%	56%
8*	15	87%	40%	87%	53%	60%	33%	60%
9	18	78%	67%	83%	94%	61%	67%	78%
10	18	56%	50%	61%	50%	33%	17%	44%
11	18	56%	67%	50%	67%	72%	78%	67%
12	15	73%	40%	47%	60%	40%	40%	53%
13	10	100%	100%	100%	100%	100%	100%	100%
14	16	88%	81%	100%	75%	94%	88%	88%
15	19	53%	84%	95%	79%	68%	68%	74%
16	18	78%	67%	89%	94%	83%	100%	83%
Total	249	80%	63%	76%	68%	63%	59%	69%

* Occupancy calculated not using spaces reserved for Police vehicles.



TRAFFIC ENGINEERING STUDY
Oskaloosa, Iowa

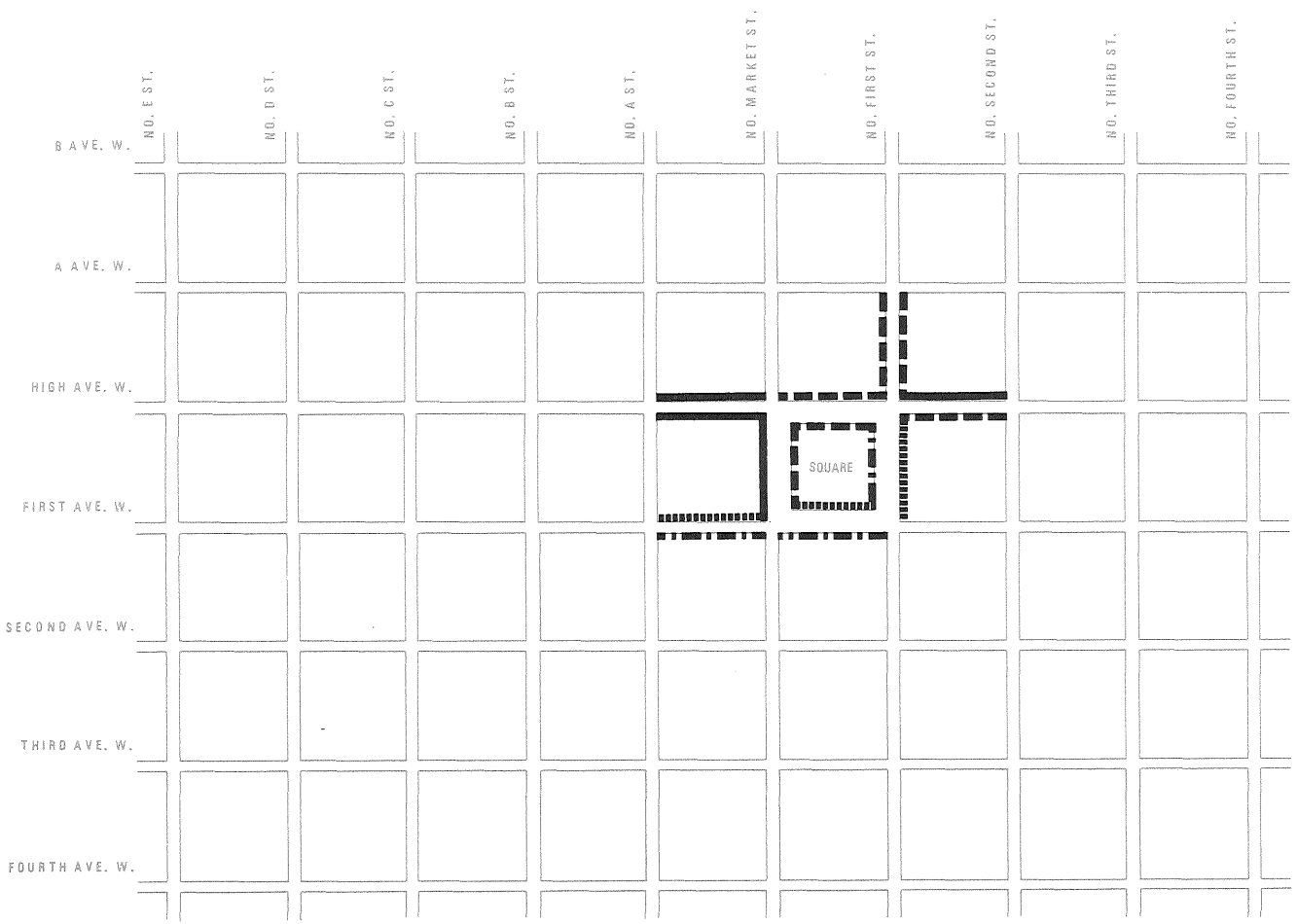
ON-STREET PARKING SURVEY
AVERAGE OCCUPANCY

LEGEND

- 100%
- 81-99%
- 61-80%
- 41-60%

Figure 14

AMV ALAN M. VOORHEES & ASSOCIATES, INC.



TRAFFIC ENGINEERING STUDY

Oskaloosa, Iowa

ON-STREET PARKING SURVEY
OCCUPANCY DURING HOUR OF PEAK OCCUPANCY
11:00 A.M.

LEGEND

- 96-100%
- 81-95%
- 61-80%
- 41-60%

N

Figure 15

AMV ALAN M. VOORHEES & ASSOCIATES, INC.

During the hour of peak occupancy the parking spaces along four block faces were 100% occupied. These block faces are the north and south sides of High Avenue West between Market and A Streets, the north side of High Avenue East between First and Second Streets, and the west side of South Market Street between High and First Avenues.

These two figures and the data in Table 2 indicates that overall on-street parking is generally full in downtown Oskaloosa and that on-street parking spaces near the department stores and principle shops are at a premium. This low availability of parking spaces results in motorists circulating through the CBD hunting for vacant parking spaces. This circulating, in turn, creates additional traffic volumes and turning movements at the CBD intersections, thus placing unnecessary strain on the traffic control system in terms of safely and efficiently handling these increased volumes.

Parking Duration:

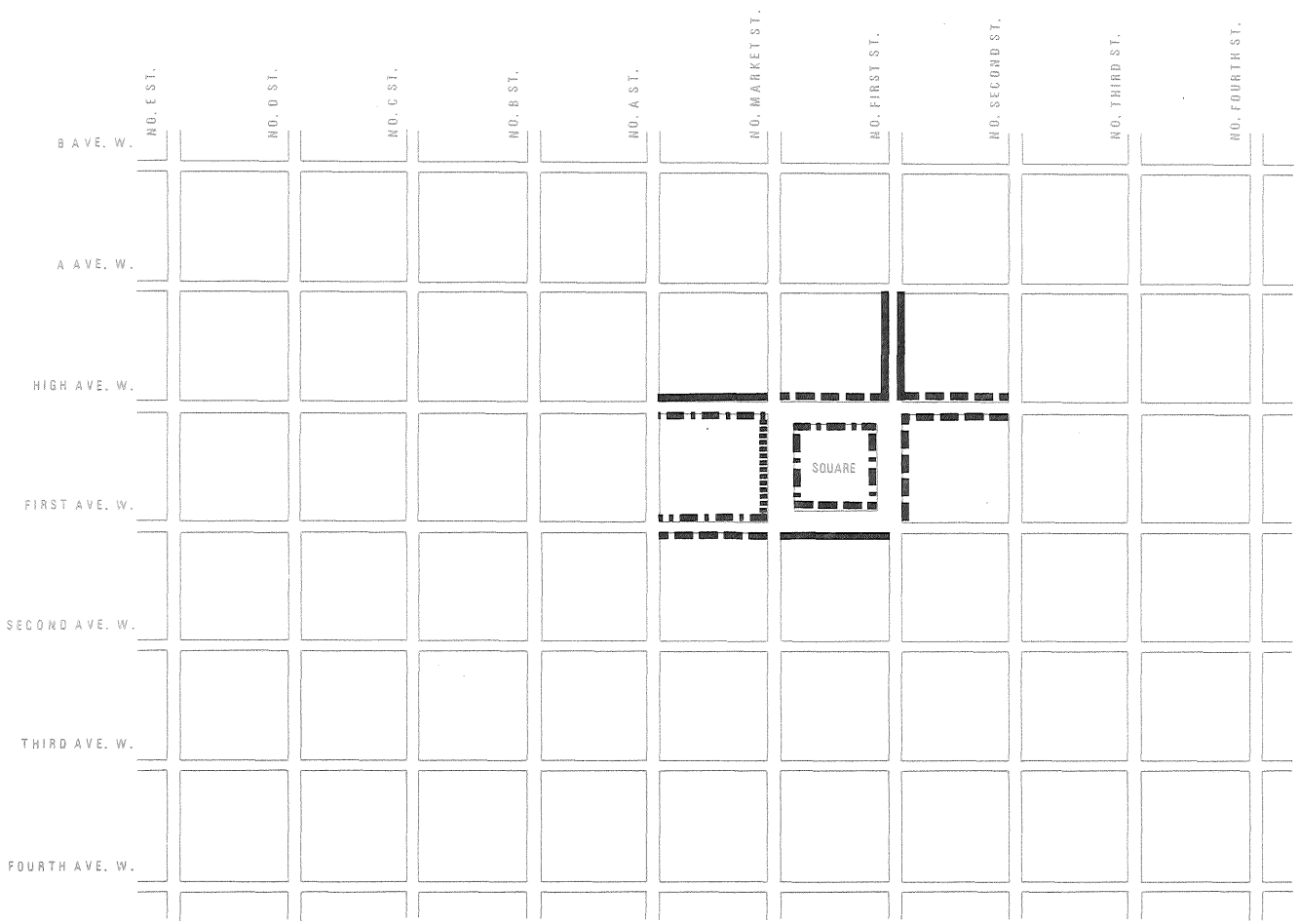
Parking duration is another measure of the use of parking space. Duration indicates the length of time that a particular parking space is occupied by a vehicle. Duration, in effect, indicates how efficient the parking space is; whether it is used by only one vehicle over a given time period or by a number of vehicles. If a large number of vehicles use the space, the duration will be low, but the "turnover" of that space will be high indicating the greater usage of the space.

The parking duration in the Oskaloosa CBD was determined from the license plate survey for the same 16 block faces for which parking space occupancy was determined. Parking duration is summarized in Table 3. One-hour parking duration percentages by block face is shown in Figure 16.

TABLE 3
AVERAGE ON-STREET PARKING DURATION PERCENTAGE
BY BLOCK FACE
CENTRAL BUSINESS DISTRICT STUDY
OSKALOOSA, IOWA

Block Face No.	Duration Percentage by Length of Time (in hours)					
	1	2	3	4	5	6
1	100%	--	--	--	--	--
2	74%	4%	7%	4%	4%	7%
3	99%	1%	--	--	--	--
4	68%	12%	9%	5%	2%	4%
5	100%	--	--	--	--	--
6	100%	--	--	--	--	--
7	98%	2%	--	--	--	--
8*	95%	5%	--	--	--	--
9	68%	14%	10%	4%	2%	2%
10	96%	4%	--	--	--	--
11	89%	7%	2%	2%	--	--
12	100%	--	--	--	--	--
13	48%	26%	16%	--	5%	5%
14	75%	17%	3%	5%	--	--
15	75%	14%	4%	2%	--	5%
16	89%	4%	1%	3%	--	3%

* Duration calculated not using spaces reserved for Police vehicles.



TRAFFIC ENGINEERING STUDY

Oskaloosa, Iowa

ON-STREET PARKING SURVEY
ONE HOUR
PARKING DURATION PERCENTAGE

LEGEND

- 100%
- 81-99%
- 61-8. %
- 41-60%

Figure 16

AMV ALAN M. VOORHEES & ASSOCIATES, INC.

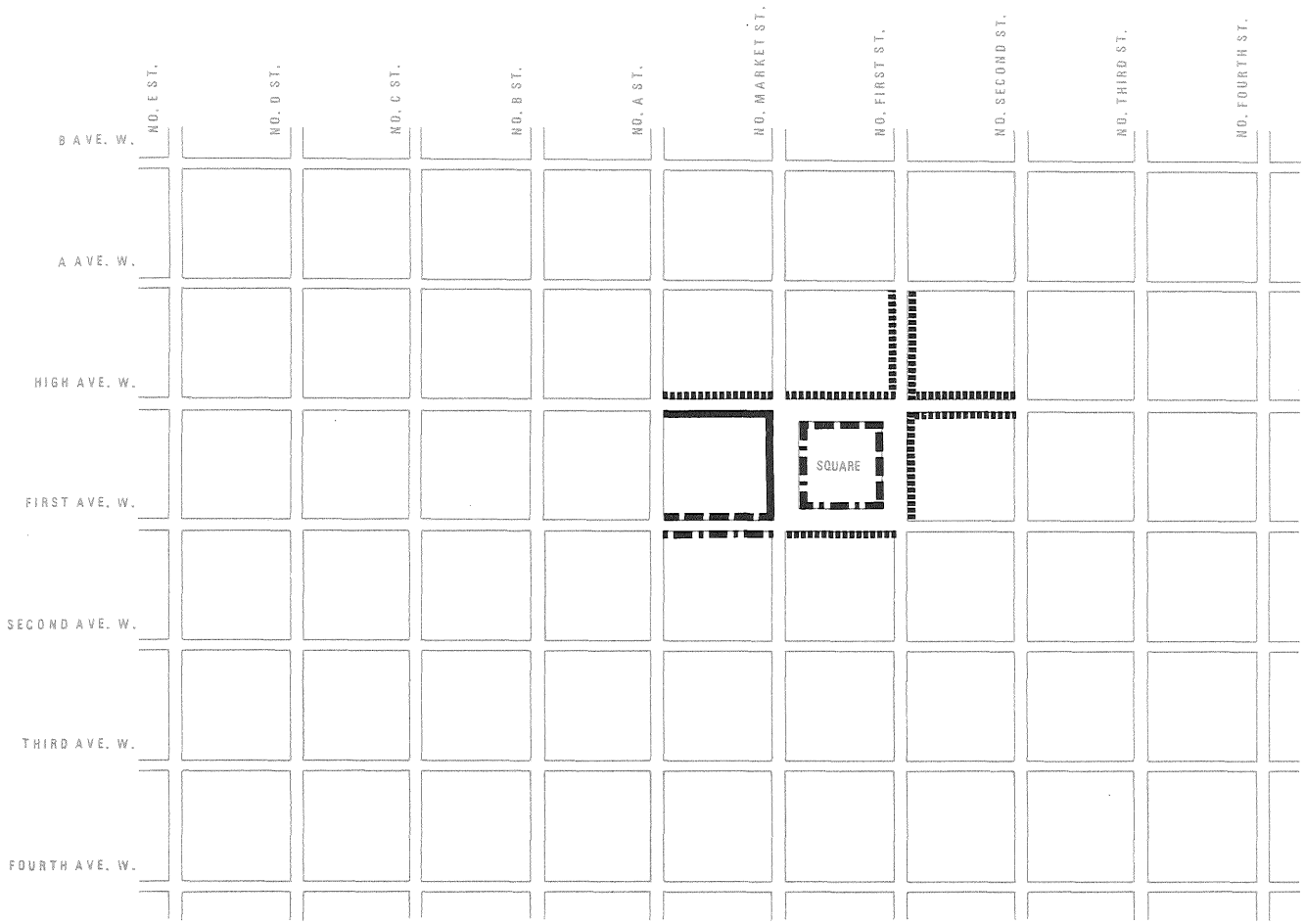
As indicated in the table, almost all of the surveyed block faces had a parking duration of one hour or less. Only one block face, the west side of South Market Street between High and First Avenues, had a one hour parking duration of less than 50%. This same block face, surprisingly, had the highest percentage of illegally parked vehicles (those which stayed longer than two hours). A total of 26% of the vehicles parked on that block face stayed for three or more hours. The block face on the south side of High Avenue West between Market and A Streets also had a high percentage (22%) of vehicles parked for three hours or more. Three-hour parking duration percentages by block face are shown in Figure 17.

The parking duration data indicates that the vast majority of people coming to the CBD park their vehicles for one hour or less and that only a few park for a period of time longer than that allowed on the parking meters. Overall, the parking spaces in the CBD are being used fairly efficiently. It does not appear that many motorists are using the on-street spaces for all day parking needs. The on-street spaces are generally being used as intended; for short term visits to the various commercial, business, and government activities in the Oskaloosa CBD.

Off-Street Parking

No parking system in the CBD of a city can be totally dependent on on-street parking alone. Some off-street parking must be provided due to the different types of parking requirements; long-term for employees and short-term for shoppers and visitors. The Oskaloosa CBD is no different. A total of 10 off-street parking facilities in the CBD were examined. These lots and the analysis sectors are shown in Figure 18.

An occupancy survey was conducted of all 10 off-street facilities. The survey was conducted between 10:00 a.m. and 4:00 p.m. on the same day as the on-street survey was conducted. This was done in order to obtain



TRAFFIC ENGINEERING STUDY

Oskaloosa, Iowa

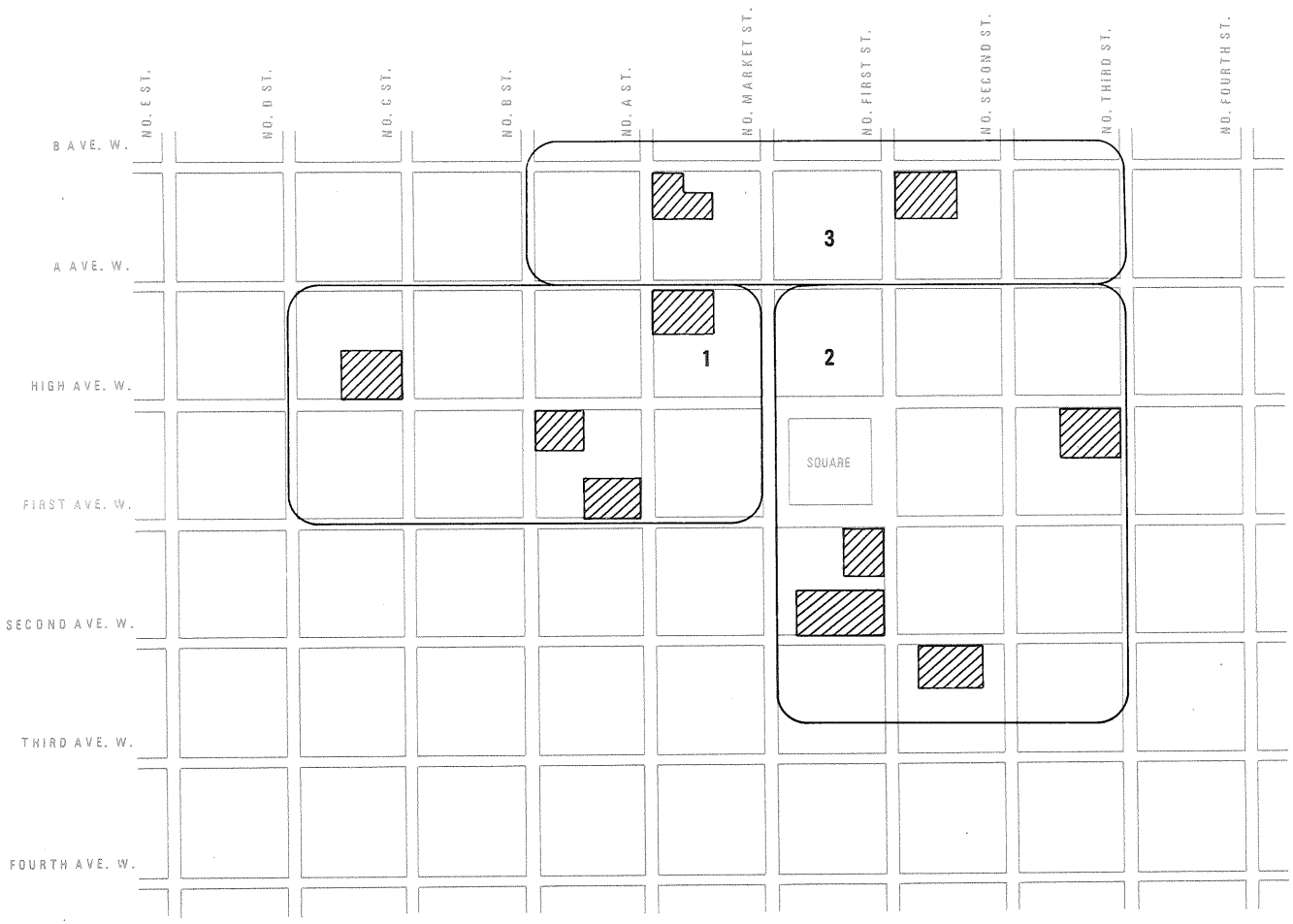
ON-STREET PARKING SURVEY
THREE HOUR AND GREATER PARKING DURATION PERCENTAGE

LEGEND

- 0%
- 1-10%
- 11-20%
- 21-30%

Figure 17

AMV ALAN M. VOORHEES & ASSOCIATES, INC.



TRAFFIC ENGINEERING STUDY
Oskaloosa, Iowa

OFF-STREET PARKING SURVEY
SURVEYED LOTS

LEGEND

- LOT
- [1] ANALYSIS SECTOR

Figure 18

AMV ALAN M. VOORHEES & ASSOCIATES, INC.

a total picture of the parking situation in the CBD. As in the case of the on-street facilities, parking occupancy has been summarized in two ways: average occupancy and peak occupancy. These occupancy percentages are shown in Figures 19 and 20, respectively and are summarized in Table 4.

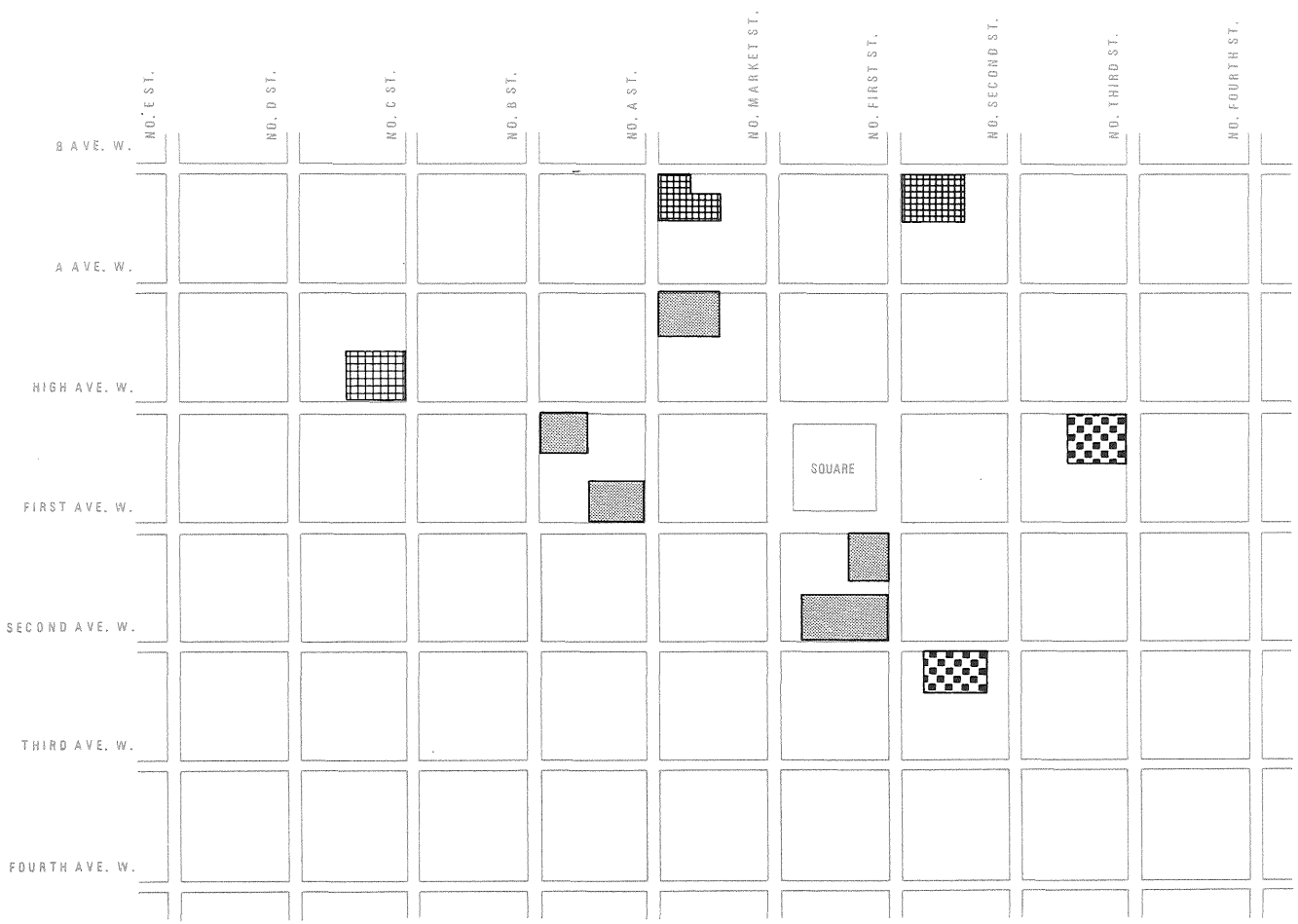
An average parking occupancy during the survey day ranged from a low of 27% for the lot at High Avenue West and C Street to a high of 95% for the two lots in the city block bounded by High and First Avenue West and South A and B Streets. Overall, average parking occupancy was 72%. In terms of geographic distribution of the parking, those lots closest to the square and the major stores had the highest percentage of average parking occupancy. This should be expected since the most demand for off-street parking is in those areas of employment and shopping activity concentration. As the intensity of these activities decreases so does the average parking occupancy.

There is actually no single time period of day during which off-street parking occupancy is highest. In fact, total off-street parking occupancy for all 10 surveyed lots was 75% or higher between 10:00 a.m. and 2:00 p.m. The time of 10:00 a.m. was chosen for Figure 19 because at the time the most actual spaces were occupied. Again, this pattern is expected since most of the employment and commercial activity takes place during that time.

Summary of Parking Situation

The three parking surveys have indicated these facts about the parking situation in Oskaloosa's CBD.

- Most of the motorists using the on-street parking spaces do so for a one-hour time period or less.
- The highest turnover of on-street parking spaces took place around the square and in front of major stores along the west side of South Market Street between High and First Avenues.



TRAFFIC ENGINEERING STUDY
Oskaloosa, Iowa

OFF-STREET PARKING SURVEY
AVERAGE OCCUPANCY

LEGEND

- 100%
- 81-99%
- 61-80%
- 41-60%
- 21-40%
- 20%

Figure 19

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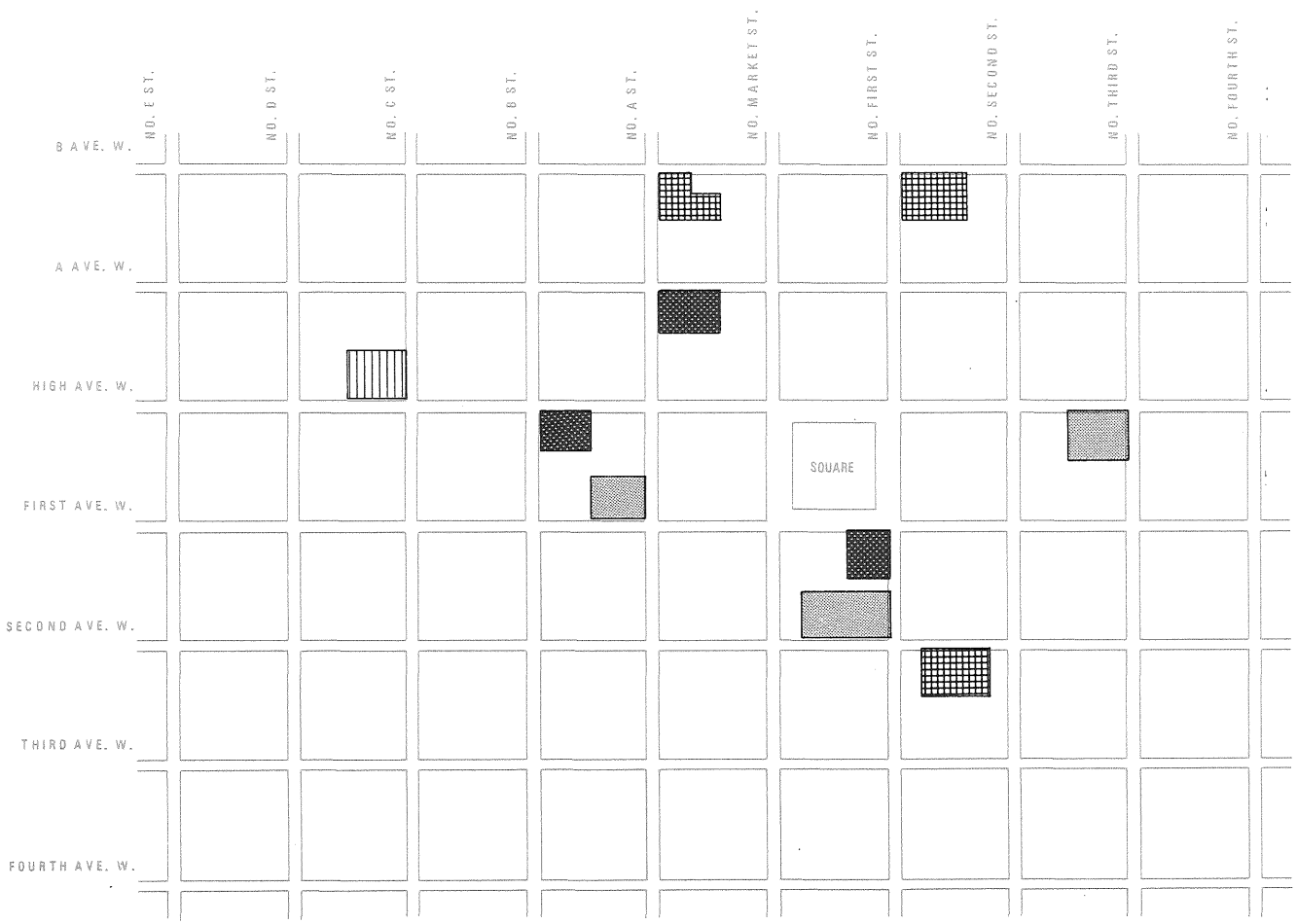


TRAFFIC ENGINEERING STUDY

Oskaloosa, Iowa

OFF-STREET PARKING SURVEY
PEAK OCCUPANCY
10:00 A.M.

LEGEND

- 100%
- 81-99%
- 61-80%
- 41-60%
- 21-40%
- 20%

Figure 20

AMV ALAN M. VOORHEES & ASSOCIATES, INC.

TABLE 4
AVERAGE OFF-STREET PARKING OCCUPANCY PERCENTAGE
BY PARKING LOT
CENTRAL BUSINESS DISTRICT STUDY
OSKALOOSA, IOWA

Lot	Total Available Spaces	Time Period Ending: 10 AM No. Occ.	10 AM % Occ.	12 Noon No. Occ.	12 Noon % Occ.	2 PM No. Occ.	2 PM % Occ.	4 PM No. Occ.	4 PM % Occ.	Average No. Occ.	Average % Occ.
1A	22	20	91	20	91	21	95	14	64	19	86
1B	21	10	48	12	57	16	76	17	81	14	67
1C	10	10	100	10	100	8	80	7	70	9	90
1D	53	49	92	46	87	39	74	23	43	39	74
2A	22	21	95	22	100	21	95	19	86	21	95
2B	22	22	100	20	91	22	100	21	95	21	95
2C	56	56	100	56	100	50	89	47	84	52	93
2D	22	3	14	6	27	7	32	9	41	6	27
3A	50	29	58	27	54	27	54	16	32	25	50
3B	31	16	52	16	52	20	20	16	52	17	55
Total	309	236	76	235	76	231	75	189	61	223	72

- Surprisingly, these same block faces had the highest percentage of motorists parking their vehicles for three or more hours. This would indicate a need for more long-term off-street parking to accommodate this need.

- Average parking occupancy of on-street spaces is very high, over 80%, on those block faces in front of the major stores. Overall, on-street occupancy is 69%.

- Off-street parking occupancy is also quite high near the major shopping and government facilities.

- Parking facilities are usually considered full when they are 90-95% occupied due to improperly parked vehicles using more than one space. Four off-street lots and three on-street block faces have an average occupancy of 90% or greater.

- There is need for more off-street parking facilities in the CBD in order to provide for the long-term parking demand and to make available for short-term parking those on-street spaces being used for time periods of three hours or more.

TRAFFIC CIRCULATION

Traffic circulation can be considered the most important function of the CBD street system. The ability of that street system to adequately handle traffic volumes is directly related to the economic vitality of the CBD. This ability can be identified in terms of traffic congestion, safety, and the speed with which vehicles can move along the street system.

In order to determine the adequacy of the CBD street system to provide traffic circulation, several types of field investigation, surveys, and analysis were conducted. Field investigations were conducted during various times of the day to determine characteristics of the traffic flow and the degree of congestion on the streets. A speed survey was conducted along four of the principle CBD streets; Market Street; A, High and First Avenues to determine the speed at which vehicles are able to travel along

these streets. Traffic volumes and accident information was analyzed to determine the potential need for one-way street operation and possible need to improve sight distance at intersections.

Field Investigation

The field investigation consisted of driving the CBD street system during various times of the day and noting traffic operational characteristics and points of congestion. The investigations were conducted during morning, noontime, and afternoon periods. These characteristics for the major CBD streets are noted below by street.

Market Street:

Market Street is the major north/south arterial street in Oskaloosa. It provides access to the northern and southern areas of the city and to outlying communities in those directions. Within the CBD, Market Street bisects the main shopping area. Some of the major stores in the CBD are located along Market Street.

From the alley south of A Avenue, parking is permitted along both sides of Market Street. Traffic signals control the three CBD intersections at A Avenue, High Avenue, and First Avenue. Left turns are permitted on a yielding basis at North Market Street and A Avenue, but they are not permitted at the other two intersections. Several U.S. and state routes are marked on Market Street. Because of this, a high percentage of the traffic can be considered through trips. Traffic volumes are approximately 6,000 vehicles per day.

The field investigation indicated that traffic can move fairly easily along Market Street. The pavement is of sufficient width to allow moving vehicles to maneuver around stopped or parking vehicles. However, the traffic signals controlling the three intersections are not coordinated to facilitate traffic movement. A motorist leaving one signalized intersection

will most likely be stopped at the next intersection. No progression is provided along Market Street. This causes much delay to through and local traffic alike. The yielding left-turn at North Market Street and A Avenue cause some delay especially when volumes are heavy enough so that the number and length of gaps in the oncoming traffic flow is such that the left-turning vehicles must wait through more than one cycle of the traffic signal.

A Avenue:

A Avenue is the major street in Oskaloosa in terms of traffic volume. Through the center of the city, A Avenue carries approximately 13,000 vehicles per day. It serves the eastern and western portion of the city, and, through connections to the state road system, provides access to outlying communities to east and west of the city. Several U.S. and state routes are marked on A Avenue. The street is actually one block north of the major shopping area of the CBD, but it does contain many service facilities such as restaurants, gasoline service stations, and food and drug stores.

Parking is prohibited along the entire length of A Avenue indicating its importance in moving traffic through the city. Because of the route marking on A Avenue, a high percentage of the traffic could be considered through trips. Left turns are permitted at all intersections. Only the intersection of A Avenue and Market Street is controlled by a signal in the CBD area. All other intersections are controlled by a two-way stop with A Avenue having the right-of-way. The intersection of A Avenue West and North D Street is controlled by a signal, but this intersection could be considered on the fringe of the CBD. The intersection of A Avenue East and North First Street is normally controlled by a two-way Stop, but during school hours, a flashing red signal is actuated and a portable Stop sign is placed in the middle of the intersection. The control then becomes a four-way stop.

The field investigation indicated that traffic can move fairly well along A Avenue. The parking prohibition is rigidly enforced and rarely do vehicles stop in the curb lane even for brief time periods. The major impediments to traffic flow are the left turning vehicles at North Market Street and the portable Stop sign placed on A Avenue East at North First Street during school hours. Since the pavement is of uniform width for the entire street length west of North Third Street, there are no separate left-turn lanes at North Market Street. Due to the traffic volumes on A Avenue, vehicles must wait to turn left thereby effectively blocking the left lane to through traffic. This rarely occurs at the other intersections since the signals on A Avenue do provide sufficient gaps at the other intersections for vehicles to make a left turn.

The temporary Stop controls used during school hours cause undo delay to traffic on A Avenue. This delay would be acceptable if the students were using the intersection at the time the Stop controls were on. However, this is not the case. The students arrive at the intersection and are gone before the Stop controls are actuated.

High Avenue:

High Avenue is the principle shopping street in Oskaloosa. Most of the major stores and shops in the CBD, and the city in general, are along High Avenue between D Street and Third Street. The street can also be considered a collector type street since it is continuous from L Street on the west to Eleventh Street on the east.

Parking is permitted along both sides of the street in the CBD. As indicated previously by the parking surveys, some of the highest on-street parking occupancy is experienced along these blocks of High Avenue. Within the CBD, High Avenue has the right-of-way at each intersection except for its intersection with Market Street and First Street. A signal controls the

Market Street intersection and a four-way Stop controls the First Street intersection. Traffic volumes on the street are approximately 3,700 vehicles. Left turns are prohibited at the Market Street intersection.

The field investigation indicated that some congestion was noted especially in the blocks to the east and west of Market Street. This occurred during peak shopping times in the middle of the day and on Thursday night when the stores were open. The cause of this congestion is the angle parking and the vehicles maneuvering into and out of the parking spaces. In those blocks west of Market Street with parallel parking, the congestion was not as noticeable because the vehicles attempting to park were more visible than those on those blocks with angle parking. Because of the increased sight distance, abrupt stops of moving vehicles were not as prevalent as on those blocks with angle parking. The parallel parking also provided more room for a moving vehicle to go around one stopped and waiting for a shopper or parking space.

First Avenue:

First Avenue is only slightly less important as a shopping street in the CBD. Some major shops and stores are located on this street, however, there are fewer of these types of establishments on this street than on High Avenue. Although the street is continuous for the same distance as High Avenue, it could not be considered a true collector street.

Parking is permitted along both sides of the street in the CBD. Parking space occupancy is not quite as high on First Avenue as it is on High Avenue indicating the lower intensity of stores and shopping activity. Within the CBD, First Avenue has the right-of-way at every intersection except the ones with South Market Street and South First Street. The South Market Street intersection is controlled by a signal and the South First

Street intersection is a four-way Stop. Left turns are prohibited at the South Market Street intersection. Traffic volumes are approximately 3,500 vehicles per day.

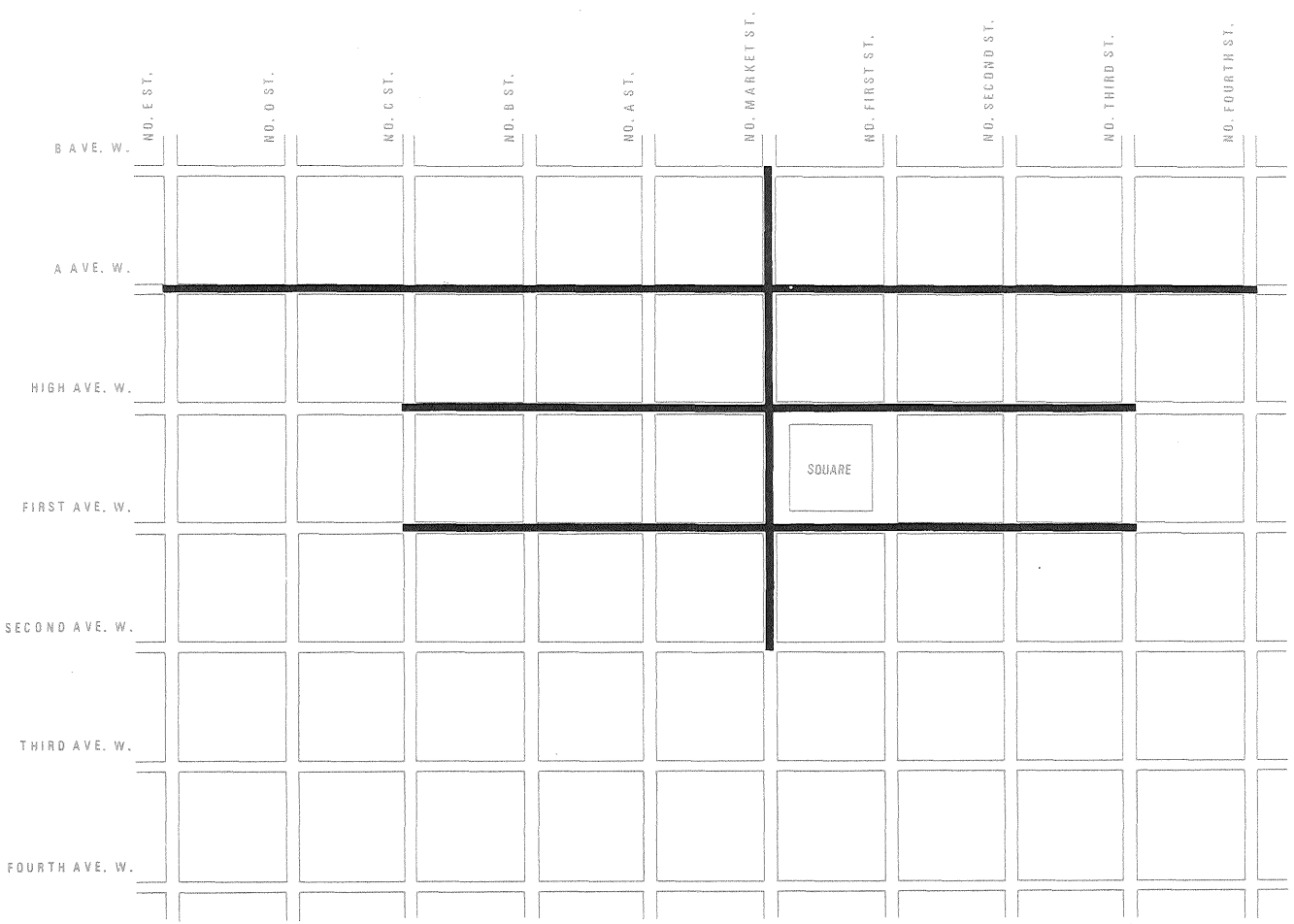
The field investigation indicates some minor amounts of congestion in the first block west of South Market Street where angle parking is present and the driving lanes are relatively narrow. This situation provides no space for a moving vehicle to maneuver around a stopped vehicle. No congestion of major proportion was noted on any other block of the street.

Other CBD Streets:

Because of the lower traffic volumes and the less intense commercial activity, congestion comparable to that experienced on the aforementioned four streets was noted only rarely and for very short time durations. The one block of North First Street and the one block of North A Street between High and A Avenues, experienced the most congestion. This congestion was minor and intermitent in nature and was usually caused by a parking vehicle or a pedestrian crossing mid-block.

Speed Survey

Another method of measuring the traffic circulation of a CBD is to conduct a speed survey of the major street. This survey consists of driving each street several times in each direction during various time periods of the day. For this particular speed survey, three runs in each direction were made on each street during three time periods of the day: 11:00 a.m. to 12:00 Noon, 2:00-3:00 p.m. and 5:00-6:00 p.m. The surveyed streets are shown in Figure 21 and the survey results are summarized in Table 5.



TRAFFIC ENGINEERING STUDY
Oskaloosa, Iowa

SPEED SURVEY

LEGEND

SURVEYED STREETS

Figure 21

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TABLE 5
AVERAGE DRIVING SPEEDS (M.P.H.)
TRAFFIC ENGINEERING STUDY
OSKALOOSA, IOWA

Street	Time		
	11 AM-12 N.	2-3 PM	5-6 PM
Market Street			
Northbound	9.96 mph	9.61 mph	10.31 mph
Southbound	14.31 mph	16.20 mph	8.44 mph
A Avenue			
Eastbound	20.64 mph	17.61 mph	23.55 mph
Westbound	19.40 mph	21.61 mph	17.99 mph
High Avenue			
Eastbound	13.59 mph	10.22 mph	14.73 mph
Westbound	13.98 mph	13.18 mph	12.36 mph
First Avenue			
Eastbound	17.12 mph	13.07 mph	18.84 mph
Westbound	13.34 mph	15.25 mph	15.88 mph

An average speed of between 12 and 15 miles per hour can be used as a barometer of whether or not the street can be considered to have too many delays to efficiently move traffic. While this speed may seem low, it should not be considered so in a CBD given the higher degree of overall congestion and parking activity normally experienced.

The most important item shown in Table 5 is the low average speed experienced on northbound Market Street between the three unsynchronized traffic signals at the intersections with A, High, and First Avenues. As previously noted, most vehicles leaving one of these signalized intersections would be required to stop at the next one. This is due to the signals not being interconnected to provide continuous flow of traffic.

Another item of interest is the rather high average speed experienced in both directions on A Avenue even though it is the busiest street in the city in terms of traffic volumes. The reason for this is the prohbition of parking on the street. With no parked vehicles, the motorists are able to maintain a consistant speed. This indicates the street is efficiently handling vehicle movements.

The only other problem areas are southbound Market Street traffic between 5:00 and 6:00 p.m. and eastbound High Avenue in mid-afternoon. The low speed on Market Street can be attributed to the unsynchronized signals and to the exiting of workers from the CBD during that time period. The low speed on High Avenue can be attributed to the parking activity and the resulting congestion caused by vehicles maneuvering to and from parking spaces and to vehicles stopped to drop-off and pick-up passengers by the commercial shops.

RECOMMENDATIONS

The following recommendations are made in order to alleviate the parking and traffic circulation problems noted above.

Parking

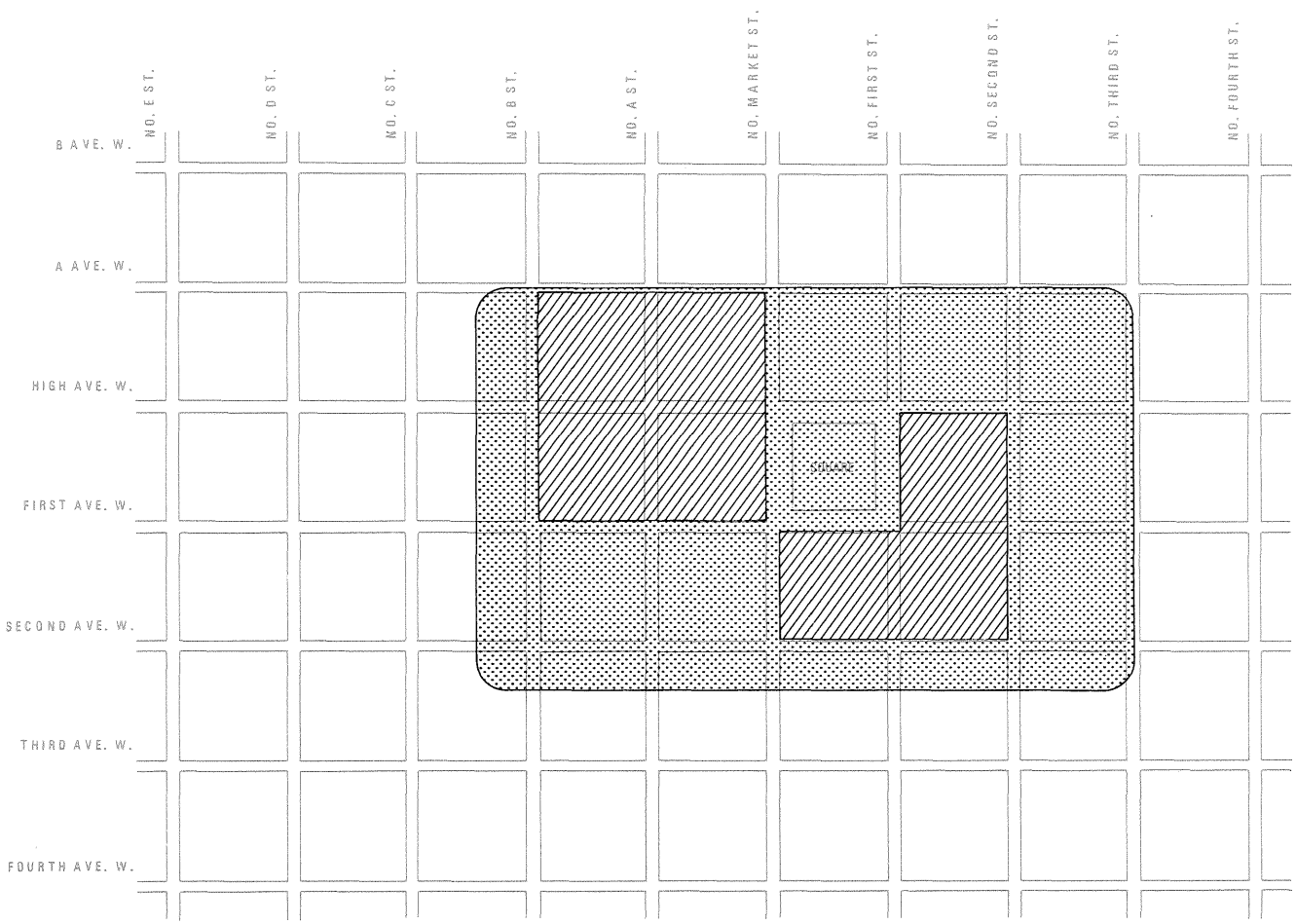
As noted previously, the most critical parking problem is the lack of sufficient off-street parking spaces. This problem is concentrated near

the major stores and government facilities. In order to alleviate this situation, it is recommended that additional off-street parking lots be constructed within the area as shown in Figure 22. Specifically, new off-street facilities should be built, if land is available, in the two primary areas noted in Figure 22. In order to determine the exact location and the costs of the facilities, a detailed parking study would be required. This study would delve into costs and availability of land, sources of financing the facility, the possibility of building a parking ramp or garage, and a detailed parking space needs analysis.

There is a definite need for this additional off-street parking space as shown from the two on-street and one off-street parking survey. The general geographic area of this need has been determined. More detailed study must be carried out before the city can make a final determination as to the exact size and location of new off-street parking facilities. At this point in time, the city should be alert for any land that might become available in the two areas of primary need, purchase these parcels, and convert them to surface, off-street parking. This would be an interim measure until such time as the more detailed parking study is completed.

Traffic Circulation

As previously noted, traffic circulation within the CBD has some problem areas, but overall is relatively good for a CBD. These problem areas are South Market Street through the unsynchronized traffic signals, A Avenue East at North First Street during the operation of the school crossing signal, periodically, parts of High Avenue during times of heavy parking activity, and the site restrictions to motorists at many CBD intersections caused by vehicles parked close to the intersection.



TRAFFIC ENGINEERING STUDY
Oskaloosa, Iowa

OFF-STREET PARKING
AREA OF PARKING NEED

LEGEND

- AREA OF OFF-STREET PARKING NEED
- PRIMARY LOCATION FOR NEW OFF-STREET FACILITIES

Figure 22

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The improvements required to alleviate the problems on South Market Street and A Avenue East are incorporated in the recommendations for the individual intersections in Chapter IV. In addition to these specific improvements, the signal improvements, and the newly recommended signals should be interconnected to facilitate traffic flow along these two major streets.

The periodic congestion experienced on High Avenue is not of sufficient magnitude to warrant any changes to the traffic operation of the street. One-way street operation for High and First Avenue were examined, but traffic volumes on these two streets were not great enough and directional distribution was too even to warrant making the streets one way. A third negative factor is the additional distance and number of turns that many motorists would have to make to get to their destination. The extra distance and additional turns add to motorist travel time and, therefore, the motorist exposure rate for potential accidents. The wide streets in parts of the CBD facilitate two-way traffic movement. At this point in time, one-way streets in downtown Oskaloosa are not needed. However, traffic volumes and directional distribution should be monitored and one-way operation should again be evaluated when traffic volumes increase and the congestion increases. Should traffic volumes approach 8,000 per day on High Avenue, consideration should be given to making the street one-way coupled with First Avenue. The most logical limits of this operation would be from South D Street east to South Third Street.

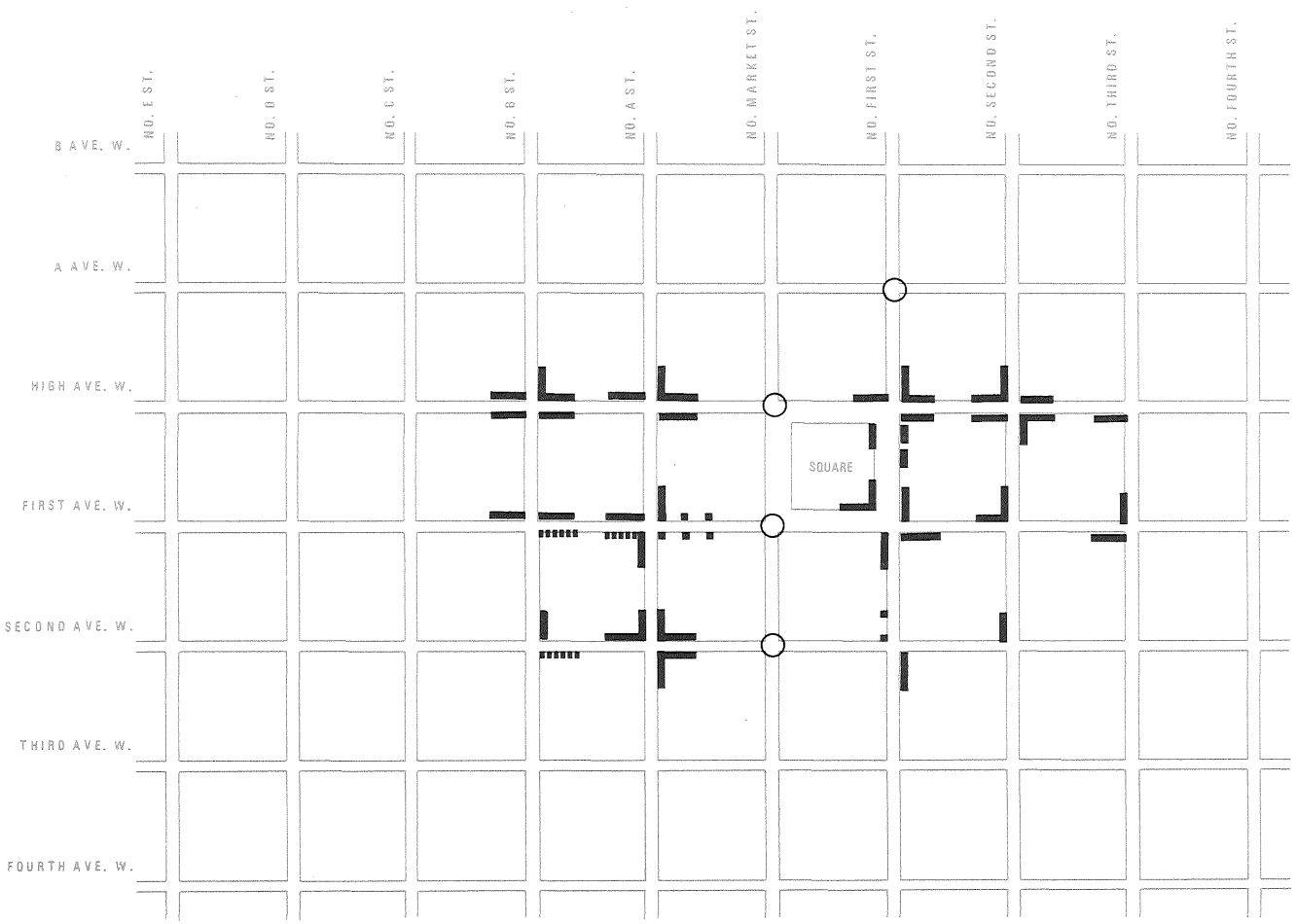
Another traffic operation technique which has proven helpful is the permission of right-turns on a red (RTOR) signal indication. This is presently permitted in Oskaloosa and should be continued. National research on the subject has shown that the general experience of cities of all sizes with RTOR is good in that no increase occurs in pedestrian/vehicular accidents and traffic flow is helpful.

The sight distance restriction at the CBD intersections can be corrected by eliminating the parking at the corners of those intersections with these restrictions. These restrictions and the resultant change in parking is shown in Figure 23. Overall, a total of 72 on-street parking spaces have been eliminated. This elimination can be accommodated by new off-street parking spaces. Until that time, however, the existing on-street spaces should be eliminated in order to improve the safety of both the pedestrian and motorist.

Some comments were made by city officials concerning the institution of an Opti-Con system for emergency and public safety vehicles. While this system could be included in any new traffic signal system installed in the city, the additional costs would not warrant such a system. This is due, mainly, to the relatively low traffic volumes in the city when compared to much larger urban areas where such systems are in use.

Signal Interconnection

The recommendations mentioned in the previous chapter for improvements at the intersections on Market Street and on A Avenue indicated a need for coordination between the signals on these two streets. An analysis was conducted to determine if interconnection could be achieved between the signals on each street. Time Space Diagrams were prepared using data base information such as spacing between signals, present vehicle travel time and delays, traffic volumes, number of traffic lanes, on-street parking, if any, and the existing and proposed signal cycle lengths and phasing. From the Time Space Diagrams it was found that interconnection could be provided such that a more uniform flow of traffic between signalized intersections, both of A Avenue and Market Street, could be achieved. This interconnection would be from North D to North Third Streets on A Avenue and from A to Second Avenues on Market Street. The Time Space Diagrams are shown in the Appendix of this report.



TRAFFIC ENGINEERING STUDY

Oskaloosa, Iowa

INTERSECTION PARKING SPACE REVISIONS

LEGEND

- ELIMINATE ONE SPACE
- ELIMINATE TWO SPACES
- CONVERT TWO ANGLES SPACE TO ONE PARALLEL SPACE
- CONVERT THREE ANGLES TO ONE PARALLEL SPACE
- SEE SPECIFIC INTERSECTION RECOMMENDATION

Figure 23

AMV ALAN M. VOORHEES & ASSOCIATES, INC.

Providing interconnected signal timing through all signalized intersections such that traffic can flow without stopping in both directions is based on the many factors noted above. As a result, almost ideal conditions have to prevail in order for motorists traveling in opposite directions on the same street to have a green light as they approach each intersection. The analysis using the Time Space Diagrams came close to achieving complete progression of traffic flow, however, as often is the case, the ideal situation wherein all traffic could flow without stopping could not be achieved.

Progression and a smooth flow of traffic could be provided for eastbound traffic on A Avenue from North D Street through North 3rd Street. Westbound traffic, however, would be required to stop at either North 3rd or North 1st Streets before being able to travel west through the remaining signals. Travel speed was computed at 25 miles per hour which appeared to offer the most effective and yet safe speed.

On Market Street a similar situation resulted. Ideal traffic flow in both directions of travel could not be achieved whereby motorists could receive a green light traveling through the four intersections of A, High, 1st, and 2nd Avenues. Northbound traffic would be required to stop once at either 1st Avenue or High Avenue while southbound traffic would be required to stop at High Avenue before passing through 1st and 2nd Avenues. Other factors on Market Street, especially parking maneuvers, would interfere with ideal progression of traffic flow.

The interconnect system proposed will reduce the number of stops required for the major flow of traffic. It will therefore decrease travel time, thus enhancing traffic flow. By reducing the starting and stopping of traffic it will add to the safety of the facility. Other benefits will be derived in less fuel consumption, operating costs of vehicles, and exhaust emissions. In all, the interconnect system will be a very beneficial addition to the motorists and the public in general for the City of Oskaloosa.

VI. SCHOOL CROSSINGS

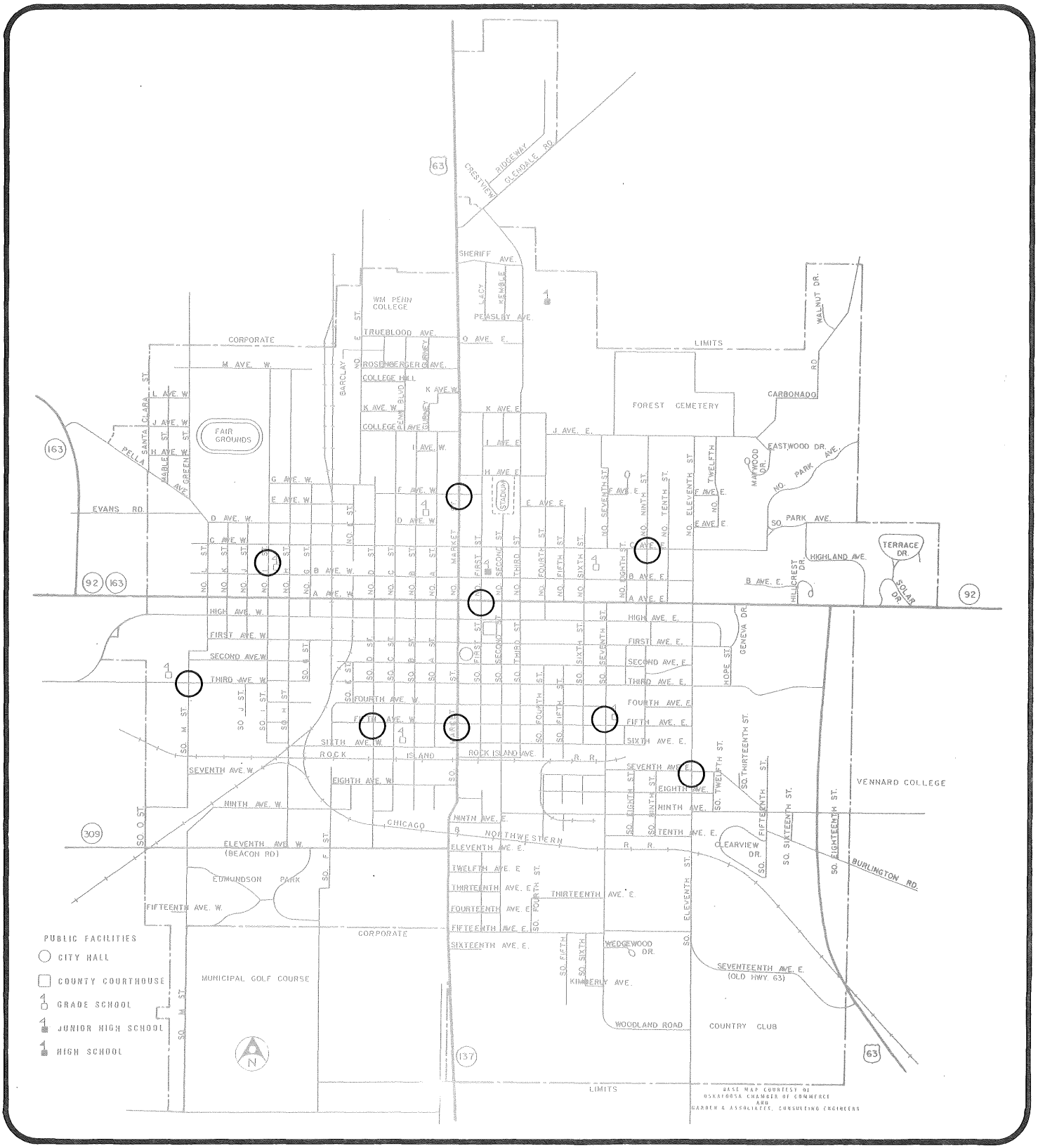
This chapter deals specifically with the signalized school crossings in the city, their operation, the characteristics of the traffic and the students at the crossing, and recommendations for upgrading or altering the traffic control at the crossings. The school crossings studied are shown in Figure 24. For purposes of analysis and discussion, these school crossings will be listed separately.

The analysis technique used at those crossings of the major and collector streets included a Pedestrian Group Size Study and a Pedestrian Delay Time Study. These studies are used to determine whether or not there are sufficient gaps in the traffic flow to permit the pedestrians or students to safely cross the street. Should insufficient gaps exist, then some type of control is needed to permit safe crossing of the street. The exact type of crossing protection is then determined by field observations and engineering evaluation and judgement. The types of crossing protection range from a pedestrian activated traffic signal to a school crossing guard to school crossing sign.

The analysis procedure and survey forms are presented in A Program for School Crossing Protection, published by the Institute of Traffic Engineers. The survey forms used in these studies are contained in the Appendix.

A AVENUE EAST AT NORTH FIRST STREET

A discussion of this intersection is included in Chapter II and in Chapter IV. Recommendations include the signalization of the intersection and the inclusion of a pedestrian actuation cycle in the signal operation to provide a protected crossing for the students.



LEGEND

○ SCHOOL CROSSING

Signalized School Crossing Studied | **Figure 24**

TRAFFIC ENGINEERING STUDY: Oskaloosa, Iowa | **AMV**

Additional material indicating the need for protection at this crossing are two surveys conducted at this location. A group size of one was used to determine the minimum gap length in traffic flow on A Avenue East required for a student to safely cross. This group size resulted in a minimum gap time of 15 seconds required to cross a street 42 feet wide. The delay time study indicated that no gaps of 15 seconds or greater existed on A Avenue East during the time period when students were crossing the street. Therefore, traffic control was needed at this crossing. The field investigation along with the traffic volumes and accidents at this location dictated the need for the traffic signal.

SOUTH MARKET STREET AT FIFTH AVENUE

Existing Conditions

This crossing is located three blocks west of the Jefferson Grade School and is similar in operation to the one on North Market Street. The major difference is that an adult crossing guard is present at this location. The guard actuates the signal and walks into the crosswalk with the students holding a Stop paddle. Traffic volumes at this location on South Market Street are approximately 6,000 vehicles per day. The street is 36 feet wide and parking is prohibited on both sides of South Market Street.

Analysis

The field investigation indicated a relatively low number of students use this crossing, approximately 10, during the afternoon period after school had been dismissed. The two surveys indicated that the group size was one and that 13 seconds is required to cross a street 36 feet wide. The delay time study indicated that 13 gaps of 13 seconds or greater occurred during the survey period. This resulted in a total gap time of

256 and a delay to 76.3% of the students and pedestrians desiring to use this crossing. The chart in the ITE publication indicates this to be a borderline situation as to whether or not a control is needed. However, considering the traffic volume on South Market Street, the type of traffic, high amount of non-local traffic, and the functional classification of the street, this crossing should be controlled.

Recommendations

Based on the above analysis, it is recommended that a new traffic signal be installed at this crossing to adequately protect the students using it. The signal should be installed according to the standards in the MUTCD. Its operation and hardware should be the same as that signal at the North Market Street crossing. The WALK indication should remain on for a minimum of 13 seconds to insure adequate time for the pedestrians to cross the street. The adult crossing guard should remain.

OTHER CROSSINGS

The previous two school crossings can be considered major ones in terms of the streets involved. The crossing on North Market Street at Fifth Avenue can also be considered a major crossing. However, the elementary school attendance areas use North Market Street as a dividing line between two schools. Therefore, no elementary age children use this crossing. The existing signal can, therefore, be removed. The remaining six crossings can be considered less critical due to the lower volumes of traffic on the streets at the crosswalk.

With the lower volumes of traffic there is a resultant increase in gaps in the traffic flow. Utilizing the studies that were conducted at the three major crossings and comparing the results of the gap studies and the

traffic volumes on the streets indicates the following. When traffic volumes are over 12,000 vehicles per day and the roadway is between 40 and 48 feet wide, no gaps exist in the traffic flow of sufficient length to provide for a safe crossing of the street. When traffic volumes are in the 6,000 vehicles per day range, the need for a crossing control is borderline and other factors must be used to determine whether or not a control is needed.

When this correlation is used to evaluate the other six crossings, it becomes evident that insufficient traffic volumes exist on all of the other streets to require a crossing control. The greatest traffic volumes at these six crossings is on South Eleventh Street at Seventh Avenue East. At that location, there are approximately 4,000 vehicles per day on South Eleventh Street. This is far below the minimum volume of 6,000 vehicles per day needed to even consider crossing controls.

It must be stated, however, that even though the other six crossings do not have enough traffic volumes to require crossing controls, a recommendation of no controls would not be realistic or consistant with providing safety to the students. Therefore, the recommendations for the remaining six crossings is to remove the non-standard traffic signal installations and replace them with the standard School Advance and School Crosswalk Signs (S1-1 and S2-1, respectively) and improved pavement markings to further delineate the crosswalk location. In those instances when an adult or student guard is used, that guard should be kept. This crossing control will provide the safety required for the students to cross the respective streets yet will not be considered too much control by the motorists.

As an added aid to the students and to increase the safety of their journey to and from their schools, a School Route Plan should be prepared for each of the schools. The procedure for preparing such a plan is outlined in Part VII of the MUTCD. These plans will direct the students to the newly upgraded school crossings and provide them with the safest route to their school.

VII. IMPLEMENTATION PROGRAM

The preceding chapters have dealt with the individual study locations that were deficient in traffic operation safety. The detailed study of these locations resulted in certain recommended improvements at each location. These improvements consisted of revised intersection geometrics, new and updated traffic signals, interconnection of traffic signals, revision of on-street parking, and the need for additional off-street parking. If implemented, these recommendations will improve overall traffic flow and safety and increase the efficiency of the street system to carry present and future traffic volumes.

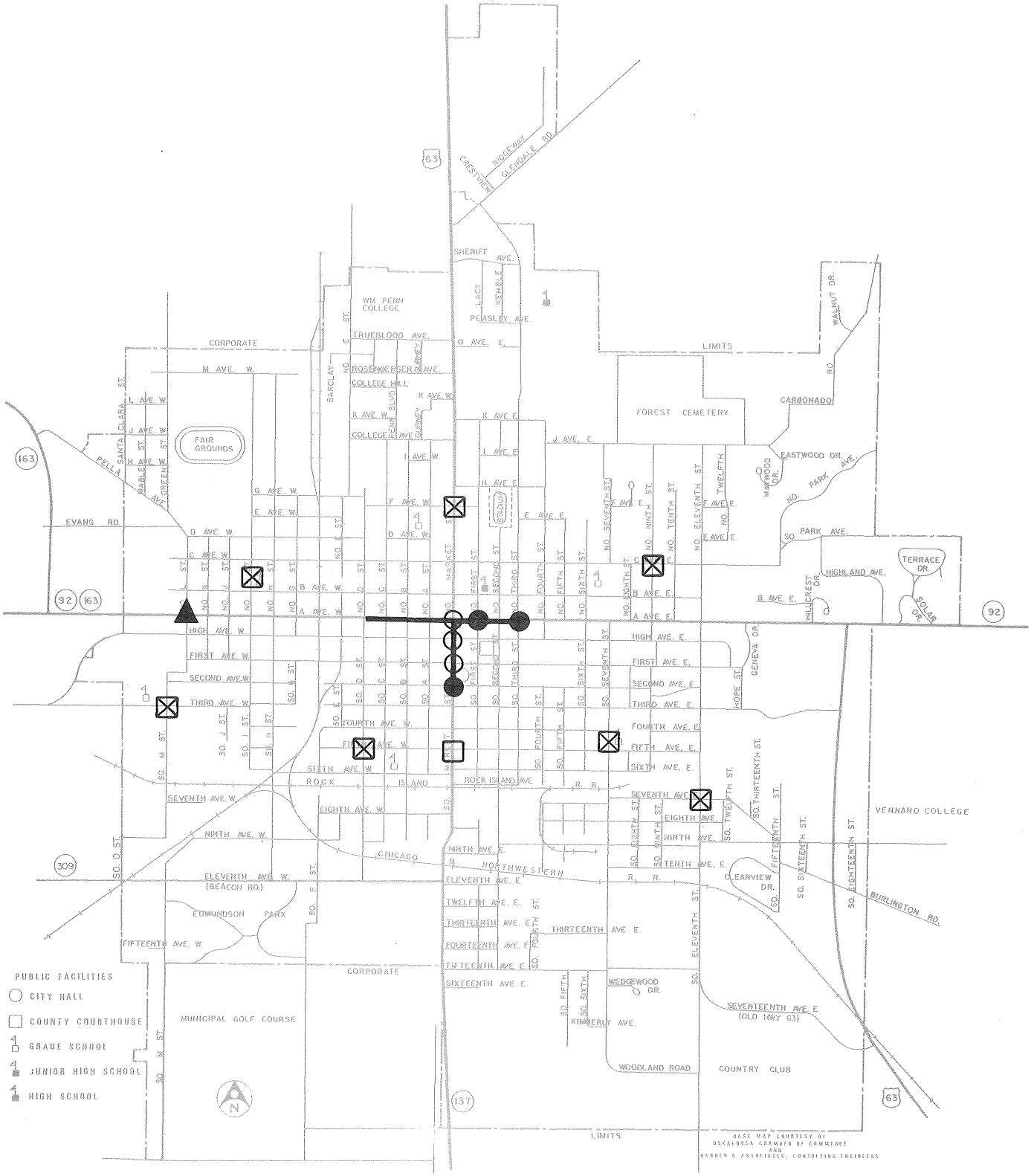
The total cost for the recommended capitol improvements is $142,000. The cost of additional off-street parking spaces is not included in this amount. A breakdown of this total cost by study location and type of improvement is contained in Table 6 and shown in Figure 25.

No priority by project is shown in the table since all of the intersection traffic signal projects should be included in a single program package. The reason for this is the funding programs available from the federal and state government. If all of these projects are implemented at one time, the city will benefit the most in terms of obtaining the maximum amount of matching funds from federal and state agencies. With this thought in mind, the new and updated intersection traffic signal improvements should be given first priority. The other improvements are of lower priority with the school crossing signals considered second and the additional off-street parking facilities and on-street parking revision next.

It must be noted, however, that implementation of the new off-street parking facilities can be started before the traffic signal improvements. The parking facility implementation can be ongoing concurrently with the other improvements.

TABLE 6
IMPLEMENTATION PROGRAM COSTS
TRAFFIC ENGINEERING STUDY
OSKALOOSA, IOWA

Improvement		Estimated Cost	Participation % Federal	State	City
New & Updated Intersection Traffic Signals					
• A Avenue & North Market Street		$20,000	0%	50%	50%
• A Avenue East & North First Street		30,000	70%	0%	30%
• A Avenue East & North Third Street		25,000	70%	15%	15%
• High Avenue & Market Street		25,000	70%	0%	30%
• First Avenue & South Market Street		25,000	70%	0%	30%
• Second Avenue & South Market Street		25,000	70%	0%	30%
• Interconnection of above signals plus existing signal at A Avenue West & North D Street		8,000	70%	15%	15%
• Flashing Beacon at A Avenue West & North L Street		5,000	70%	15%	15%
Sub-total, Signal Cost		$163,000			
FAUS & SOS	Federal	100,100			
U-STEP, FAUS, SOS	State	15,700			
	City	47,200			
Updated School Crossing Signal					
• South Market Street at Fifth Avenue		$15,000	70%	0%	30%
Removal of Seven Non-Standard School Crossing Signals		4,000	70%	0%	30%
Sub-total, School Signals		$19,000			
SOS	Federal	13,300			
	City	5,700			
Construct Additional Off-Street Parking Facilities (to be done after detailed Parking Study)					
• Cost per Garage Space		$4,000-$6,000 including land			
• Cost per Surface Space		$1,500-$2,500 excluding land			
Revise On-Street Parking		No Capital Costs			
TOTAL IMPROVEMENT COSTS (excluding additional off-street parking)		$182,000			
	Federal	$113,400			
	State	$ 15,700			
	City	$ 52,900			



LEGEND

- ▲ NEW FLASHING BEACON
- ● NEW TRAFFIC SIGNAL
- ⊠ SCHOOL SIGNAL REMOVAL
- ○ UPDATED TRAFFIC SIGNAL
- □ UPDATED SCHOOL SIGNAL
- — INTERCONNECTED SIGNALS

Summary Of Recommended Improvements | **Figure 25**

TRAFFIC ENGINEERING STUDY: Oskaloosa, Iowa | **AMV**

In terms of timing, these improvements should be scheduled for completion for the next two to five years depending on local financing and the availability of federal and state grant money.

FUNDING SOURCES

Discussions with IDOT personnel indicated three sources of funding that would likely be the most feasible for Oskaloosa. These three programs are the Federal-Aid Urban System (FAUS), Federal-Aid Safer Roads Off-System (SOS), and the Urban-State Traffic Engineering Program (U-STEP).

The FAUS program is available for those streets on the FAUS for the city. The specific streets included were shown in Figure 2, Chapter II. Under both FAUS and SOS, the federal government will pay 70% of the improvement costs with the additional 30% coming from either the state, the local community, or a combination of the state and local community. The state will provide the 30% at those intersections of an FAUS street with a Federal-Aid Primary (FAP) street which is maintained by the state. At intersections of an FAUS street and a street not on any federal-aid system (an off-system street) the city must pay the matching 30%. SOS funds may be used where at least one leg of the intersection is not on any federal-aid system. Again, the city would pay the matching 30%. In Oskaloosa, the improvements recommended at the intersection of A Avenue East and North Third Street and the intersection of A Avenue West with North D and North L Streets are eligible for FAUS assistance. SOS funds could also be used for the improvement at A Avenue West and North L Street since the south leg of the intersection is off-system. The state would pay the 30% matching funds for the improvements at the other two intersections.

SOS funds can be used for implementing the other intersection and school crossing improvements with the exception of the intersection of

A Avenue and North Market Street. This intersection could be improved by the U-STEP. This is a new program which can be used at any intersection in the community regardless of the federal-aid system in which the street is incorporated. Under this program, both the state and the city pay 50% of the total project costs.

Consideration was given to using Federal-Aid Primary (FAP) funds for the improvements at the intersection of A Avenue and North Market Street. However, under FAP, this improvement would be in competition with other proposed projects statewide. Because of this statewide competition, the chance of this improvement being funded under FAP is very low. For this reason, FAP funding was not considered feasible for this improvement.

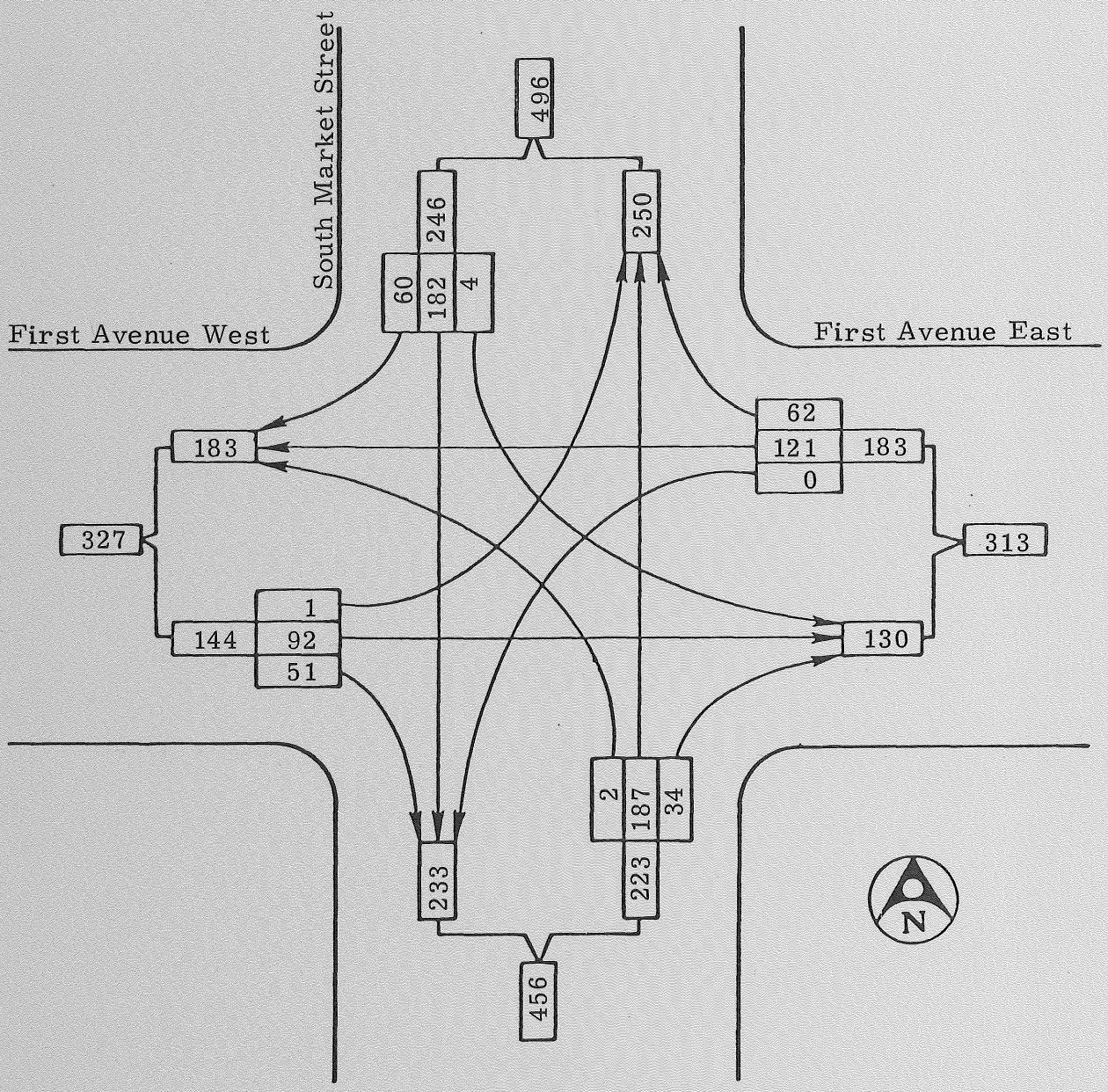
No source of matching funds for the construction of off-street parking facilities is available. In most cases, the local community would issue either revenue or general obligation bonds to finance the new facilities. Revenue bonds are paid for from funds generated by the revenue produced from the parking facility; in this instance, from parking fees. General obligation bonds are paid from funds generated by an increase in the city's property tax. Exact funding requirements and sources would have to be determined in the detailed parking study.

APPENDIX

PEAK HOUR TRAFFIC FLOW DIAGRAM

Project Traffic Engineering Study, Oskaloosa, Iowa **Date** 2-23-77

Location First Avenue & South Market Street **Time** 1:00 to 2:00 p.m.

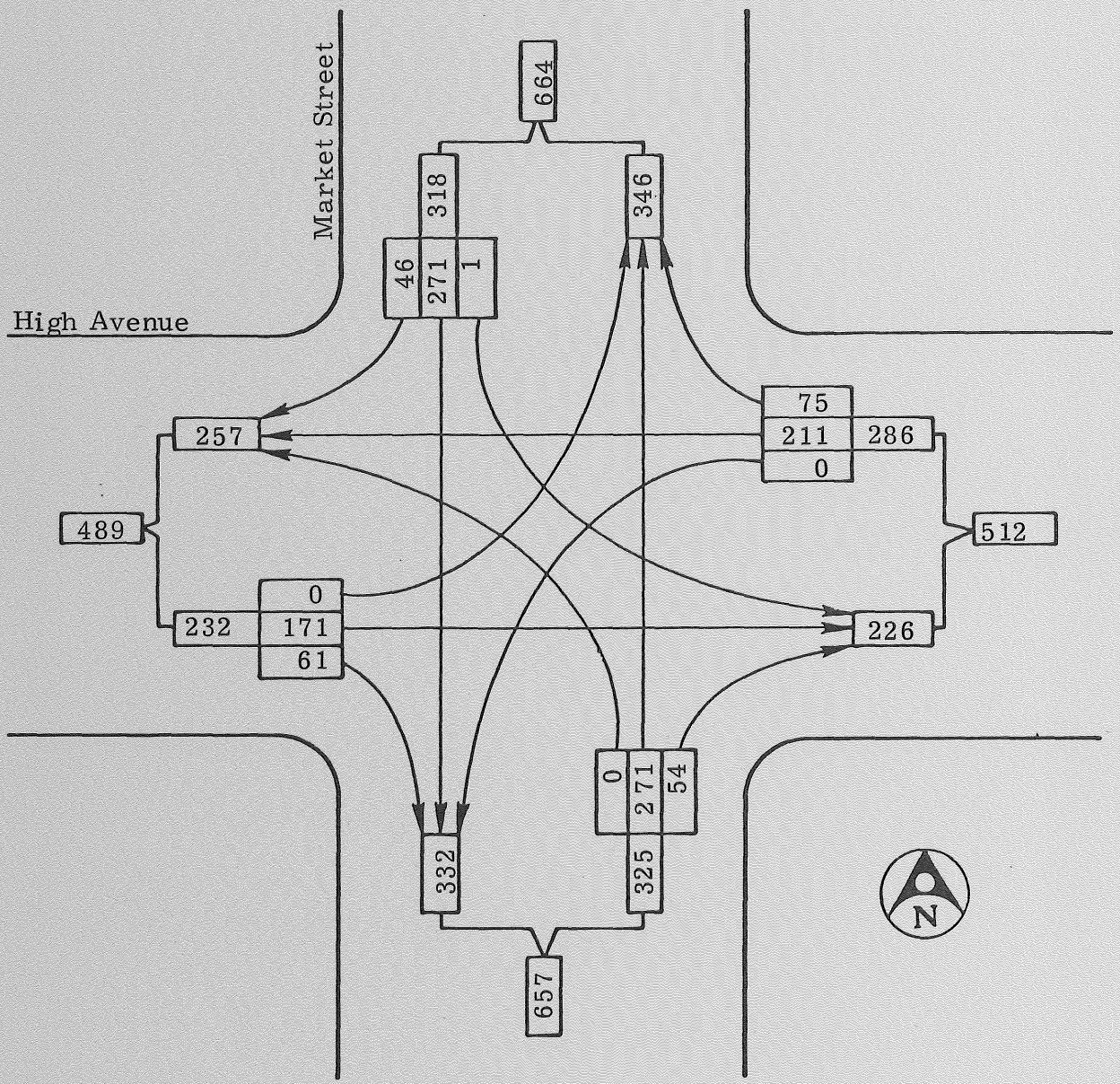


REMARKS: _____

PEAK HOUR TRAFFIC FLOW DIAGRAM

Project Traffic Engineering Study, Oskaloosa, Iowa **Date** 2-25-77

Location High Avenue & Market Street **Time** 3:00 to 4:00 p.m.

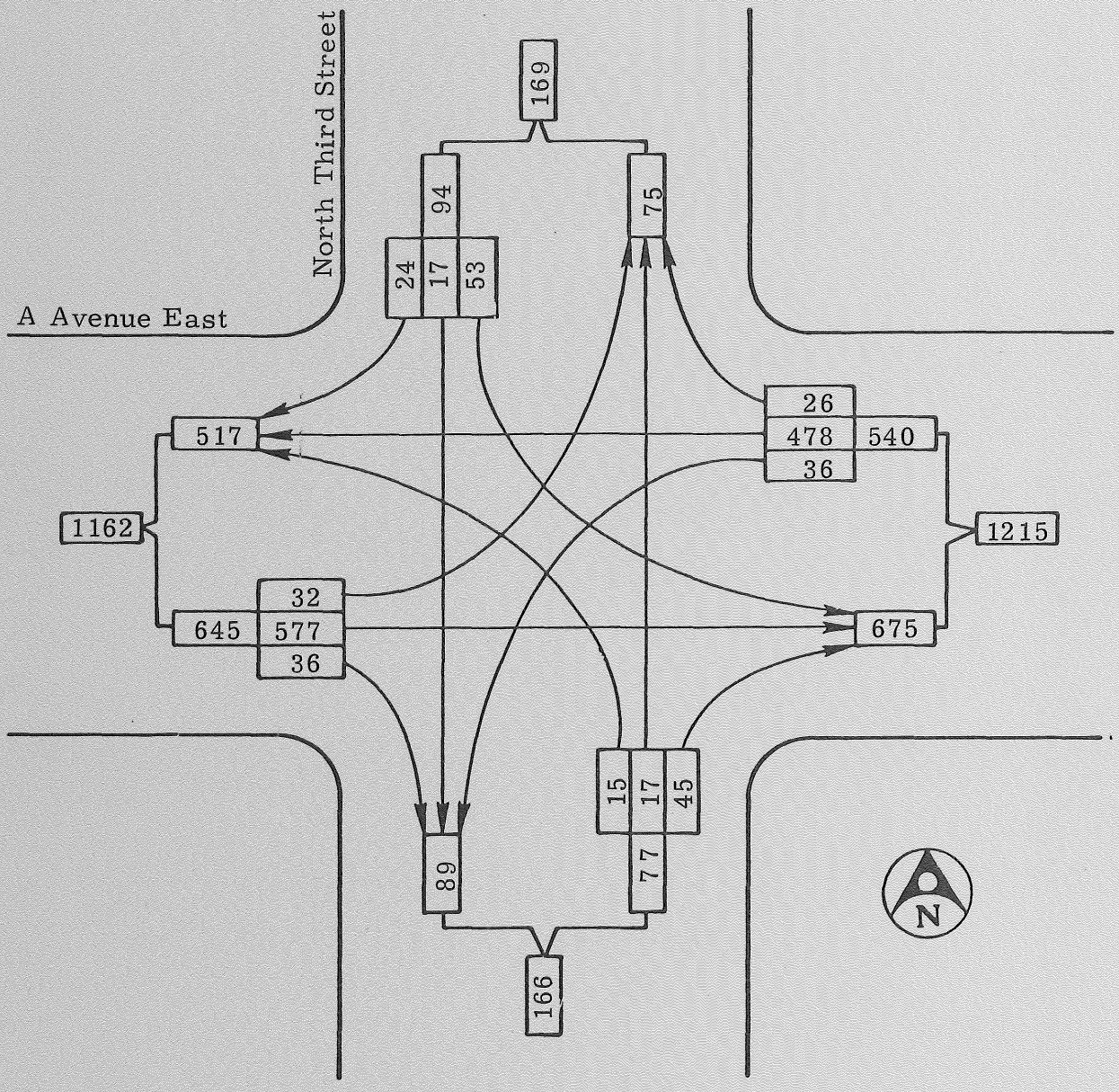


REMARKS: _____

PEAK HOUR TRAFFIC FLOW DIAGRAM

Project Traffic Engineering Study, Oskaloosa, Iowa **Date** 2-24-77

Location A Avenue East & North 3rd Street **Time** 4:15 to 5:15 p.m.

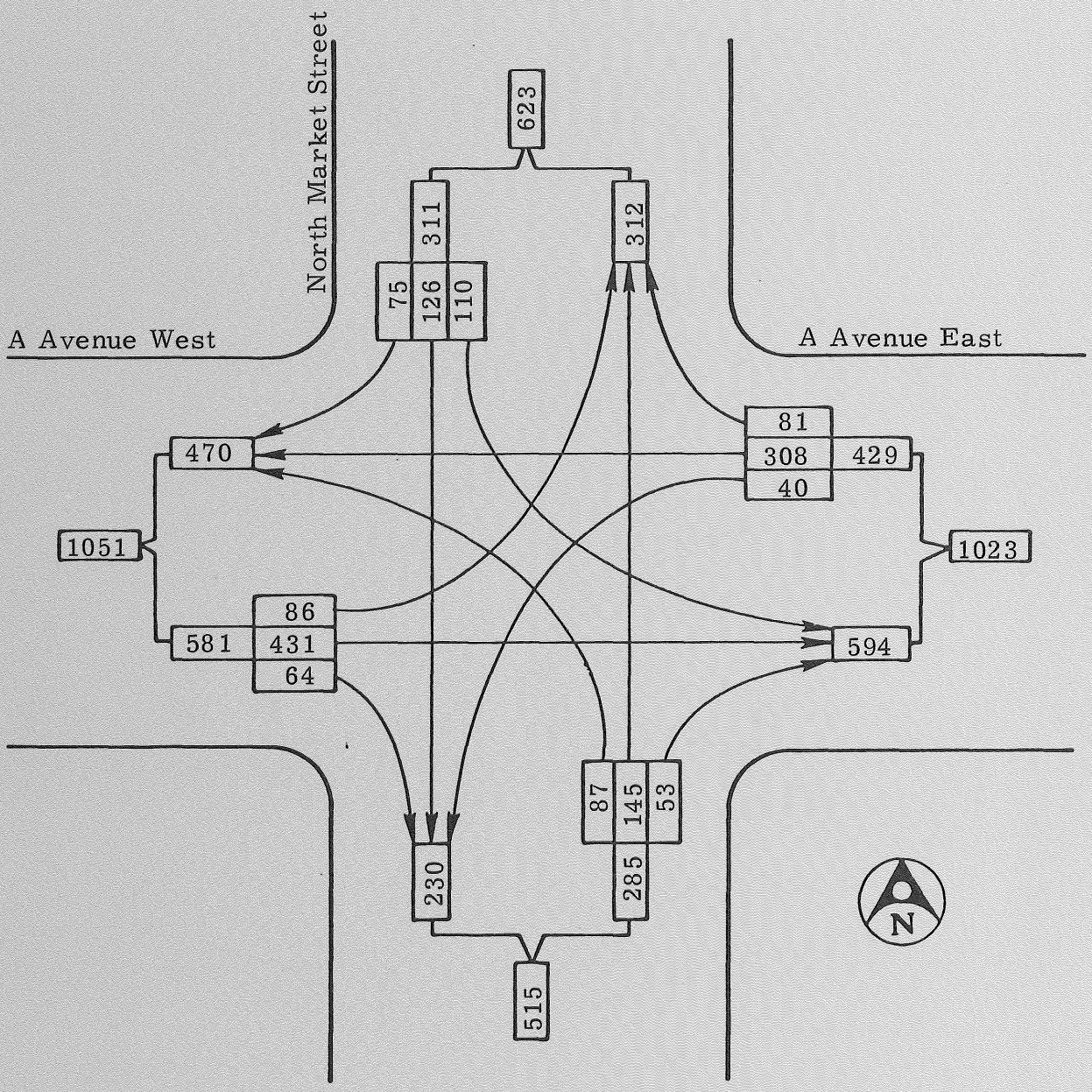


REMARKS: _____

PEAK HOUR TRAFFIC FLOW DIAGRAM

Project Traffic Engineering Study, Oskaloosa, Iowa **Date** 2-23-77

Location A Avenue & North Market Street **Time** 4:30 to 5:30 p.m.



REMARKS: _____

SUMMARY OF TRAFFIC COUNTS FOR SIGNAL JUSTIFICATION
OSKALOOSA, IOWA

Project Traffic Engineering Study Location South Market Street & 2nd Avenue

Date 10/21/77 Warrant #1, Minimum Vehicular Volume

Major St. Speed 30 (posted); _____ (85th percentile)

Remarks: 70% of volume warrant #1 used due to city population of approximately 11,000

S. Market Street 2nd Avenue

Time	Major Street vph (Total of Both Approaches)	Minor Street vph (Higher Volume Approach)	Qualifying Hour
7:00-8:00 a.m.	348	40	
8:00-9:00 a.m.	465	92	
9:00-10:00 a.m.	427	86	
10:00-11:00 a.m.	468	98	1
11:00-12:00 N.	438	93	2
12:00-1:00 p.m.	576	99	3
1:00-2:00 p.m.	471	101	4
2:00-3:00 p.m.	463	106	5
3:00-4:00 p.m.	631	113	6
4:00-5:00 p.m.	715	162	7
5:00-6:00 p.m.	516	102	8

vph = vehicles per hour

SUMMARY OF TRAFFIC COUNTS FOR SIGNAL JUSTIFICATION
OSKALOOSA, IOWA

Project Traffic Engineering Study Location A Avenue E. & N. 1st Street

Date 2/24/77 Warrant #2, Interruption of Continuous Traffic

Major St. Speed _____ (posted); _____ (85th percentile)

Remarks: 70% of volume warrant #2 used because of city population of approximately 11,000

A Avenue E. North 1st Street

Time	Major Street vph (Total of Both Approaches)	Minor Street vph (Higher Volume Approach)	Qualifying Hour
7:00-8:00 a.m.	520	26	
8:00-9:00 a.m.	633	54	
9:00-10:00 a.m.	643	70	
10:00-11:00 a.m.	774	68	1
11:00-12:00 N.	930	84	2
12:00-1:00 p.m.	926	63	3
1:00-2:00 p.m.	933	82	4
2:00-3:00 p.m.	885	69	5
3:00-4:00 p.m.	1043	76	6
4:00-5:00 p.m.	1111	98	7
5:00-6:00 p.m.	1021	99	8

vph = vehicles per hour

SUMMARY OF TRAFFIC COUNTS FOR SIGNAL JUSTIFICATION

OSKALOOSA, IOWA

Project Traffic Engineering Study Location High Avenue & Market Street

Date 2/25/77 Warrant #1 Minimum Vehicular Volume

Major St. Speed _____ (posted); _____ (85th percentile)

Remarks: 70% of volume warrant #1 used because of city population of approximately 11,000

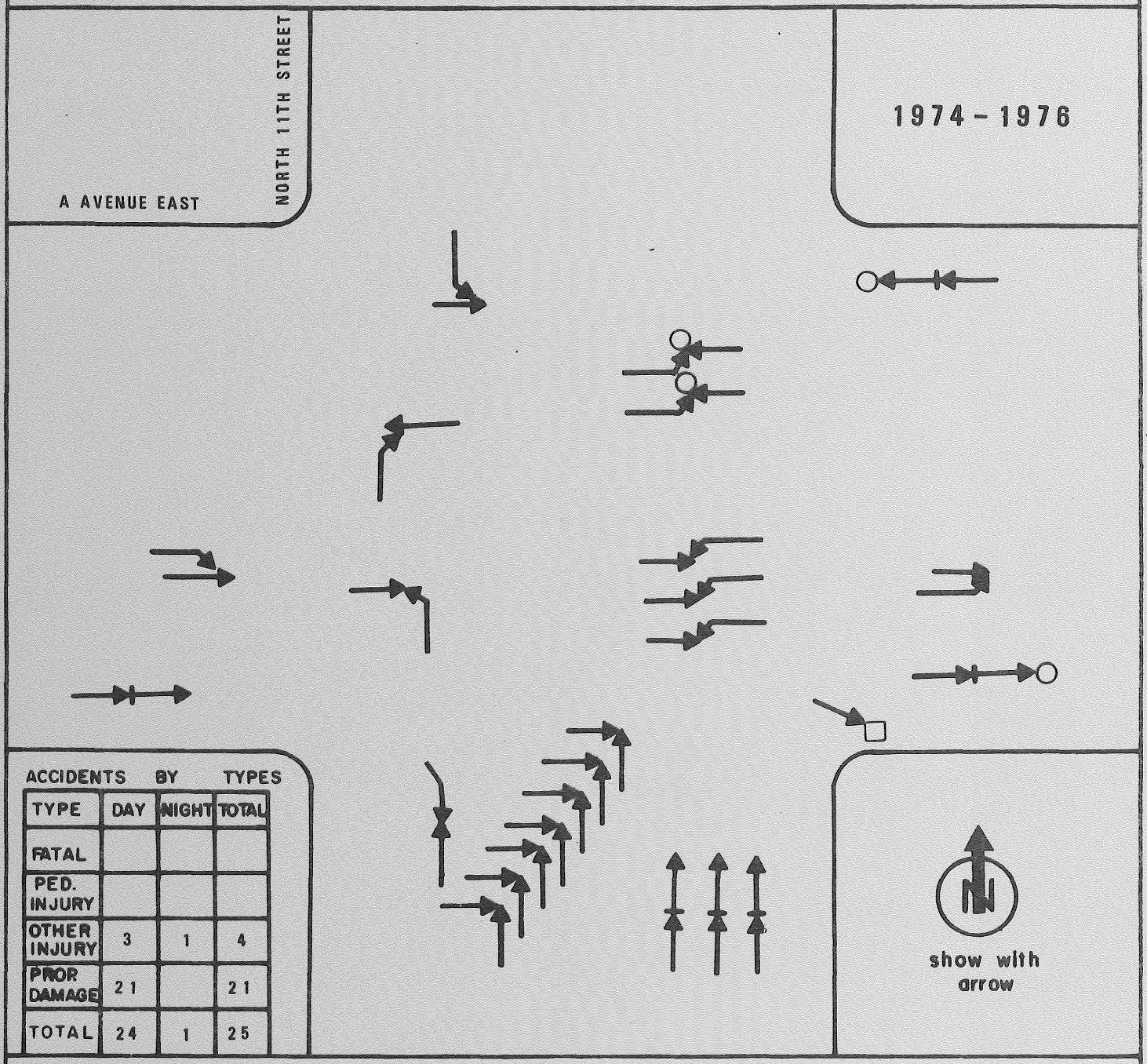
Market High

Time	Major Street vph (Total of Both Approaches)	Minor Street vph (Higher Volume Approach)	Qualifying Hour
7:00-8:00 a.m.	302	85	
8:00-9:00 a.m.	359	115	
9:00-10:00 a.m.	344	142	
10:00-11:00 a.m.	421	182	1
11:00-12:00 N.	443	253	2
12:00-1:00 p.m.	483	297	3
1:00-2:00 p.m.	518	272	4
2:00-3:00 p.m.	463	272	5
3:00-4:00 p.m.	643	286	6
4:00-5:00 p.m.	572	324	7
5:00-6:00 p.m.	428	207	8

vph = vehicles per hour

COLLISION DIAGRAM

A Avenue East & North 11th Street



ACCIDENTS BY TYPES

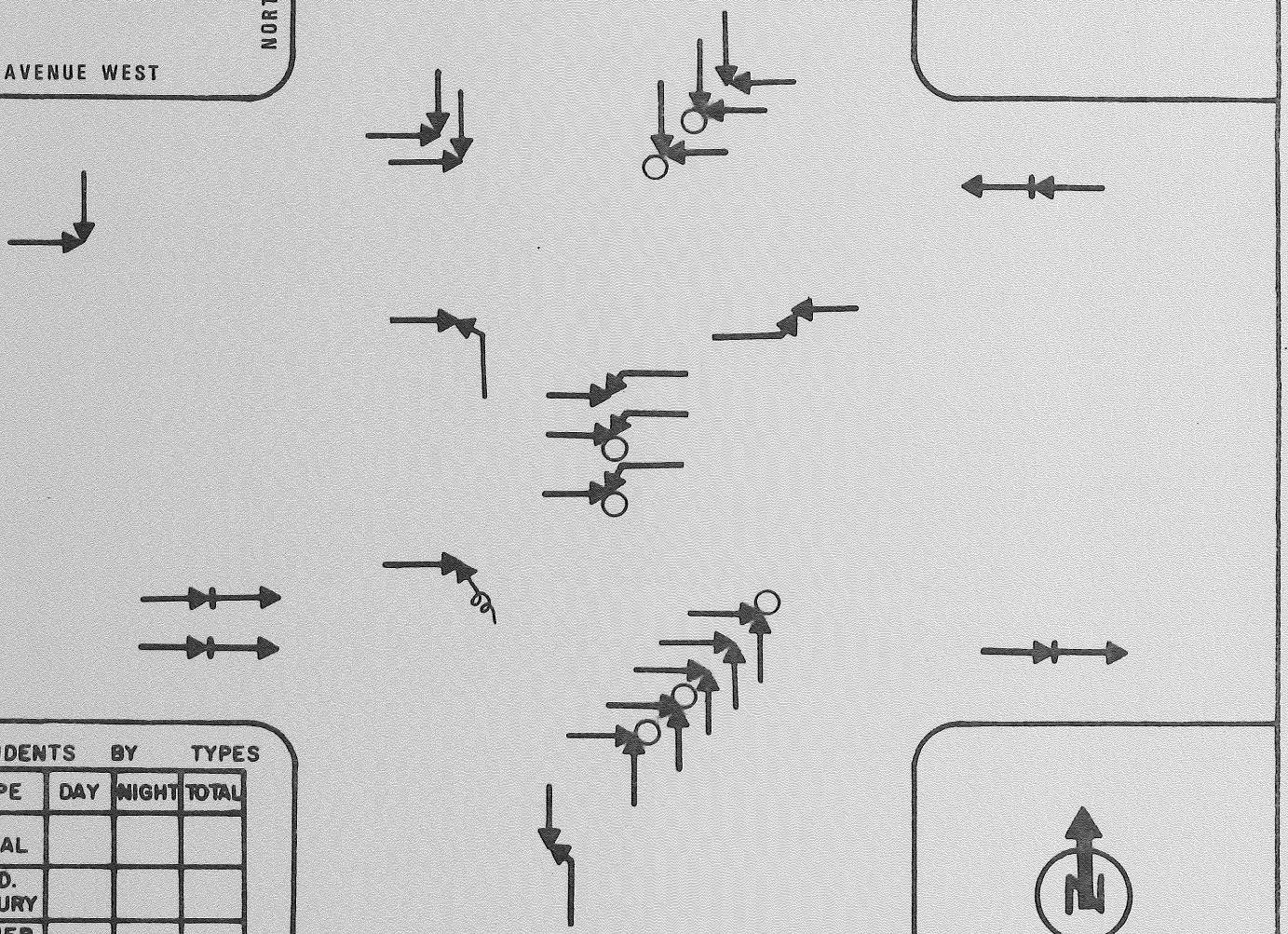
TYPE	DAY	NIGHT	TOTAL
FATAL			
PED. INJURY			
OTHER INJURY	3	1	4
PROP DAMAGE	21		21
TOTAL	24	1	25

LEGEND

- MOVING VEHICLE
- PEDESTRIAN
- PARKED VEHICLE
- PARKING OR UNPARKING VEH.
- FIXED OBJECT
- REAR END COLLISION
- HEAD ON COLLISION
- RIGHT ANGLE COLLISION
- LEFT TURN COLLISION
- SIDE SWIPE
- OUT OF CONTROL
- REAR END COLLISION WITH BACKING VEHICLE
- FATAL ACCIDENT
- PERSONAL INJURY

COLLISION DIAGRAM

A Avenue West & North D Street



ACCIDENTS BY TYPES

TYPE	DAY	NIGHT	TOTAL
FATAL			
PED. INJURY			
OTHER INJURY	5	2	7
PROP DAMAGE	15		15
TOTAL	20	2	22

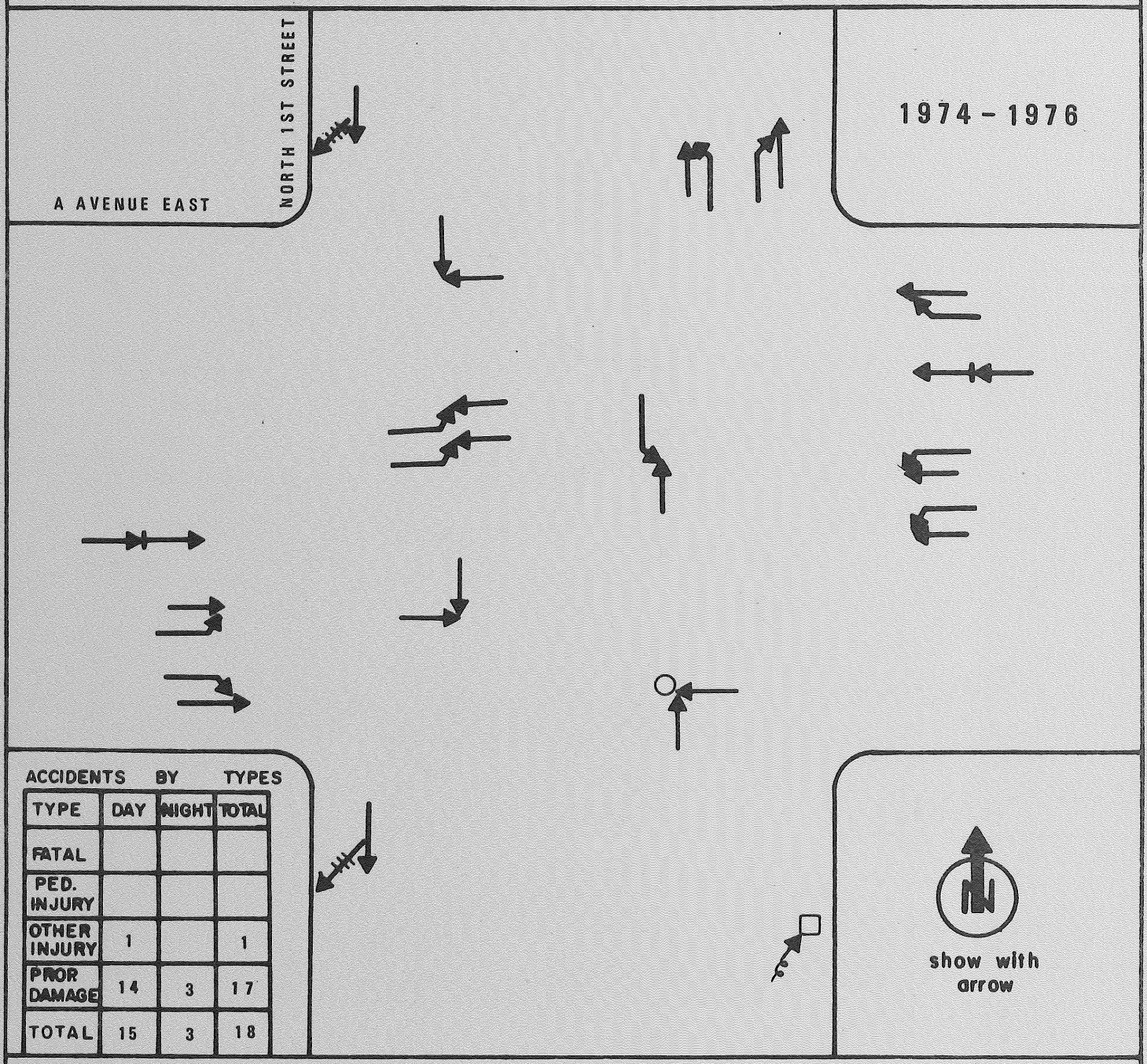
show with arrow

LEGEND

- MOVING VEHICLE
- PEDESTRIAN
- PARKED VEHICLE
- PARKING OR UNPARKING VEH.
- FIXED OBJECT
- REAR END COLLISION
- HEAD ON COLLISION
- RIGHT ANGLE COLLISION
- LEFT TURN COLLISION
- SIDE SWIPE
- OUT OF CONTROL
- REAR END COLLISION WITH BACKING VEHICLE
- FATAL ACCIDENT
- PERSONAL INJURY

COLLISION DIAGRAM

A Avenue East & North 1st Street



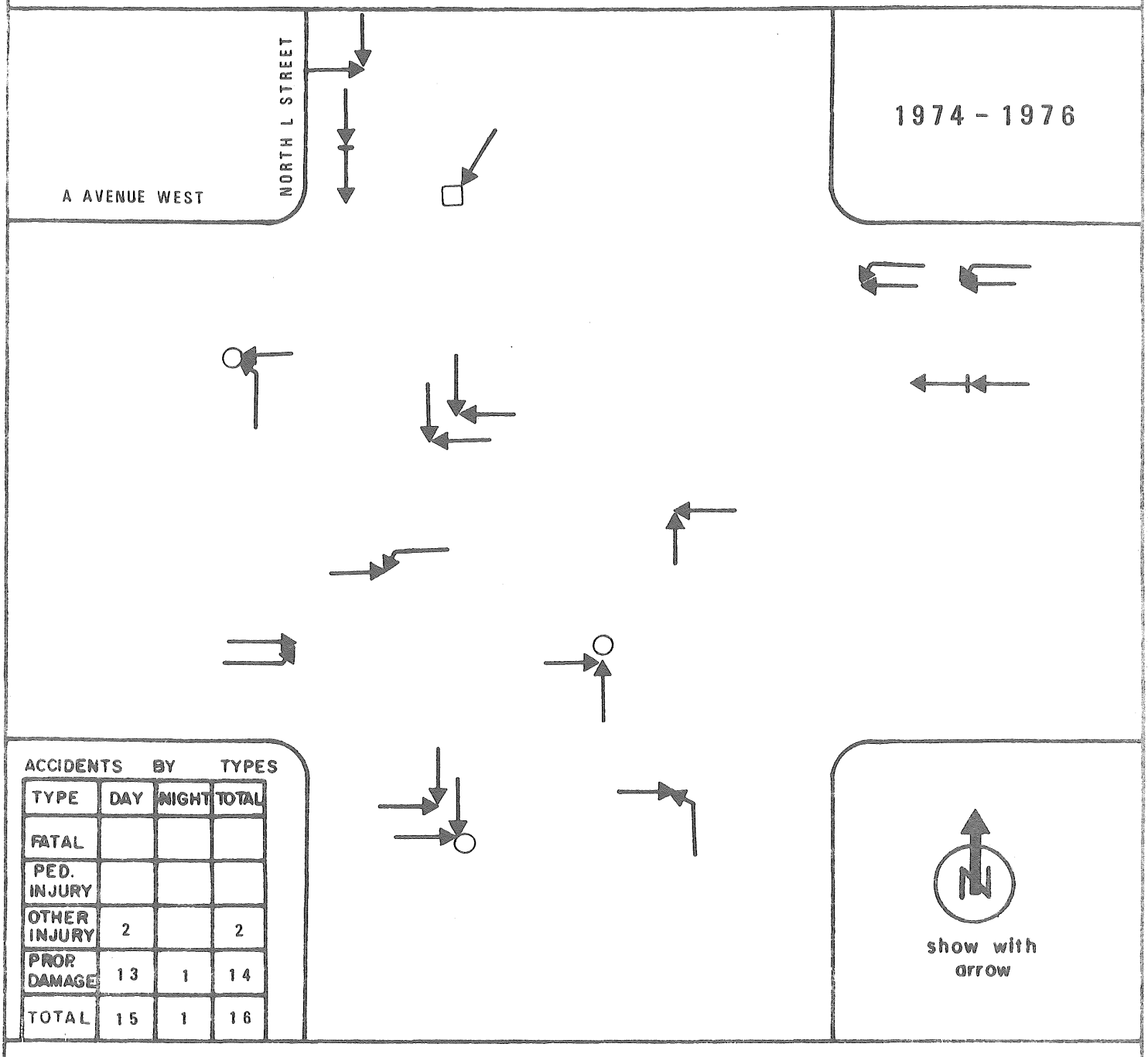
TYPE	DAY	NIGHT	TOTAL
FATAL			
PED. INJURY			
OTHER INJURY	1		1
PROP DAMAGE	14	3	17
TOTAL	15	3	18

LEGEND

- MOVING VEHICLE
- PEDESTRIAN
- PARKED VEHICLE
- PARKING OR UNPARKING VEH.
- FIXED OBJECT
- REAR END COLLISION
- HEAD ON COLLISION
- RIGHT ANGLE COLLISION
- LEFT TURN COLLISION
- SIDE SWIPE
- OUT OF CONTROL
- REAR END COLLISION WITH BACKING VEHICLE
- FATAL ACCIDENT
- PERSONAL INJURY

COLLISION DIAGRAM

A Avenue West & North L Street



ACCIDENTS BY TYPES

TYPE	DAY	NIGHT	TOTAL
FATAL			
PED. INJURY			
OTHER INJURY	2		2
PROP DAMAGE	13	1	14
TOTAL	15	1	16

show with arrow

LEGEND

- MOVING VEHICLE
- PEDESTRIAN
- PARKED VEHICLE
- PARKING OR UNPARKING VEH.
- FIXED OBJECT
- REAR END COLLISION
- HEAD ON COLLISION
- RIGHT ANGLE COLLISION
- LEFT TURN COLLISION
- SIDE SWIPE
- OUT OF CONTROL
- REAR END COLLISION WITH BACKING VEHICLE
- FATAL ACCIDENT
- PERSONAL INJURY