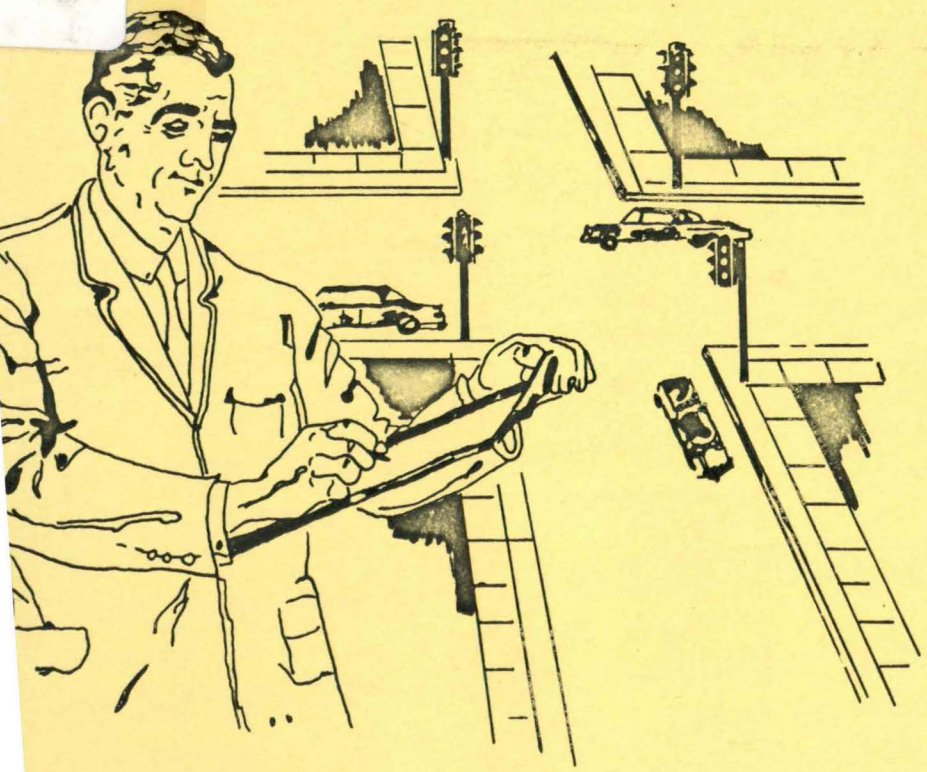
Speer

CITY OF IOWA CITY, IOWA

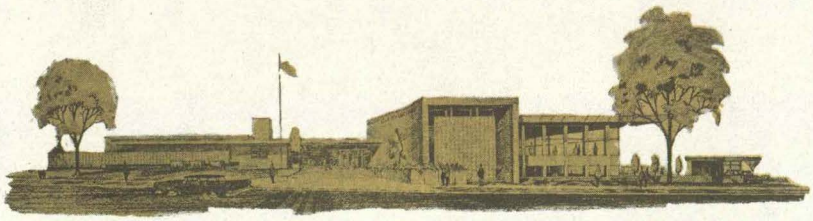
DEPARTMENT OF

PUBLIC WORKS

MAY 1970



A STUDY OF THE NEED FOR TRAFFIC SIGNALS AT SELECTED INTERSECTIONS



CITY OF IOWA CITY

Public Works Department
(319) 337-9605

May 15, 1970

Mr. Frank R. Smiley
City Manager
Civic Center
Iowa City, Iowa 52240

Dear Mr. Smiley;

I wish to submit herewith my report entitled, "A Study of the Need for Traffic Signals at Selected Intersections" which describes the results of our study at eleven locations within Iowa City. Based upon a detailed investigation and analysis of data recommendations are submitted as to whether or not traffic signals are justified at each particular intersection, as well as establishing a priority system for signalizing those intersections where traffic signals are warranted.

In this report I have also attempted to explain the criteria and procedures which should be followed when analyzing the need for a proposed traffic signal installation. I hope that the material in this report will resolve any misunderstandings that the citizen may have regarding the City's interest in protecting the lives of the citizens of Iowa City by providing our street system with adequate and efficient traffic signal installations.

I trust that the information contained in this report will be of assistance to you in discussing with the Mayor and City Council the implementation of a traffic signal improvement program for Iowa City.

Respectfully submitted,

Ralph E Speer Jr

Ralph E. Speer, Jr., P.E.
Director of Public Works

RES:mc

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A STUDY OF THE NEED FOR TRAFFIC SIGNALS AT SELECTED INTERSECTIONS

INTRODUCTION

The purpose of this study was to investigate in depth those intersections or locations within Iowa City where traffic congestion was increasing and the safety of motorists and pedestrians was becoming critical. A preliminary review of traffic volumes and accident records indicated that there were a total of eleven locations that should be studied in further detail. (See Appendix I)

The proposed recommendations as submitted in this report are based on the criteria mentioned in the following paragraphs. In discussing the matter of traffic signal installations it is well to keep in mind the rationale that is followed in deciding as to whether or not signals are justified at a particular location.

PROFESSIONAL STANDARDS

The basic document dealing with the problems of traffic signal installation is a manual entitled, "Manual on Uniform Traffic Control Devices for Streets and Highways", published by the U. S. Bureau of Public Roads. In addition, the Iowa State Highway Commission has its own manual and specifications for a uniform system of traffic control devices for use upon streets and highways within Iowa. The Iowa manual conforms for the most part to the national manual but does have some modifications that pertain only to Iowa. The Code of Iowa requires all local authorities to place and maintain traffic control devices in accordance with the standards and requirements as set forth by the Iowa manual.

These manuals contain the practical lessons learned by traffic engineers throughout the country over a good number of years. The idea behind these manuals is simple --- to set forth standards for traffic control devices that would be used throughout the United States.

NEED FOR STANDARDS

In the field of traffic engineering there has come the conviction that traffic controls should be installed based on nationally accepted standards. Why? Over a period of years it was found that some traffic signals worked very well --- they separated the streams of traffic the way they were supposed to; they caused no needless delays; they prevented, or at least helped prevent accidents.

Other signals, however, did not do as well --- there was confusion, backups, congestion, and accidents. The people working in this field began to see certain correlations, began to see why this signal worked and why that one didn't. From these pooled findings came a set of "warrants" --- a list of the circumstances under which signals could be expected to function properly.

WARRANTS

These warrants --- codified, discussed, analyzed, criticized, revised and finally set forth in great detail --- help the practicing traffic engineer to decide when a signal should be installed. Such decisions are not easy to make and are very seldom ever clear-cut. Often a request for signals stems from a point of view, for while the local motorist may want a signal at the intersection where he enters a busy street, he does not want to be delayed by additional signals once he becomes part of the main stream of traffic.

What the individual motorist may not realize is that he may be only one of many, many citizens clamoring for traffic signals at their particular intersections along the main stream. The individual is almost certainly not able to forsee the chaos that would ensue should each request be granted.

Briefly, the primary standards used to evaluate traffic conditions at an intersection for which a signal has been requested are six in number:

Warrant 1: Minimum vehicular volume
Warrant 2: Interruption of continuous traffic
Warrant 3: Minimum pedestrian volume
Warrant 4: Progressive movement
Warrant 5: Accident experience
Warrant 6: Combination of warrants

WHY TRAFFIC SIGNALS ARE INSTALLED

The philosophy of the traffic engineering profession, as expressed in the Manual, is that when properly located and operated, traffic signals offer the following advantages:

1. They provide for orderly movement of traffic.

2. They reduce the frequency of certain types of accidents.

3. They can be coordinated to provide nearby continuous movement of traffic at a definite speed along a given route.

4. They can be used to interrupt heavy traffic at intervals to permit other traffic to cross.

WHY TRAFFIC SIGNALS ARE NOT INSTALLED

If traffic signals were the panacea to all our control and accident problems, no city official in his right mind would deny a request for additional signals. However, a traffic signal can only function by stopping traffic, and it is axiomatic that any time a motor vehicle is stopped on the traveled portion of a street an accident potential is created. It does not matter whether the stop is prompted by a flat tire, a left-turn into a hot-dog stand, or by a traffic signal --- the danger exists that a following motorist will not notice the stopped vehicle until it is too late. What motorist has not experienced that sickening feeling that occurs when a traffic signal suddenly turns amber a few hundred feet in front of him? The accident files of the city bulge with the records of those unwary motorists who made the wrong decision too soon or the right decision too late.

A second reason for not installing traffic signals is the aggravating hopelessness motorists experience when waiting in a long line of cars for a traffic signal to change, moving ahead five or six car-lengths, seeing the signal go to amber and red --- and than going through the same process at the next signal a block away. Another traffic signal would only increase the aggravation --- and the accident potential.

There are, then, two major reasons why the city does not grant every request for a traffic signal: a signal in the wrong location can cause accidents, or can cause congestion, or both.

It must be remembered that the function of the City is to keep traffic moving. Our whole economy is geared to the concept of huge numbers of vehicles moving from home-to-work, from home to recreational areas, to the shopping centers --- but moving. Each and every traffic signal installed detracts from this traffic movement. Traffic engineers have evolved all sorts of systems with various actuated equipment, channelization and techniques of progression, but there is a point beyond which even the most sophisticated device will NOT MOVE TRAFFIC.

Here, again, the standards in the Manual are called into use. The experience reflected in the warrants has shown that if the traffic volumes are below a certain value (that varies with the physical characteristics of the two roadways) the chances are that the signal will impose time-loss penalties on both the major street and the side street. If, for example, a single motorist must wait 30 to 45 seconds for a signal to turn green, whereas without the signal he might have had a safe gap in traffic within 15 or 20 seconds, he obviously would be better off without the signal.

The motorist, of course, has no way of calculating whether or not he would be better off with or without the signal. As he sits at an unsignalized intersection waiting for a safe gap, the time seems to stretch out to eternity, whereas in reality even during peak periods it may be no longer than 20 to 30 seconds --- and at most of our signalized intersections the side street most probably will wait 30 to 45 seconds or more for the green to appear.

When this is pointed out to most motorists they grasp the idea very quickly. Unfortunately, this explanation cannot be given to each and every motorist who complains that "what is needed is a traffic signal". About all that can be done is to rely on the time-worn but accurate phrase, "signals are not warranted because the volumes are too low".

SIGNAL INVESTIGATION

The investigation that the City makes may be considered in three parts: a count of the traffic volume; an analysis of the accident records; and a field study.

TRAFFIC COUNT

The traffic count is made by City personnel. The counts are made manually by individuals who record the movement of each vehicle through the intersection for a 4, 8 or 16 hour period. For example, the 16 hour count would be made in 15 minute increments from 6 A.M. until 10 P.M. The 8 hour count would be conducted from 7 A.M. to 11 A.M. and again from 2 P.M. to 6 P.M. As a general rule, traffic counts are made here in Iowa City on Tuesdays, Wednesdays and Thursdays so as to reflect as much as possible a "typical" week day.

These actual or "raw" counts are then adjusted to reflect seasonal, monthly, weekly and daily variations and are then factored so as to give a 24-hour average daily traffic figure that can be used for design purposes.

ACCIDENT RECORDS

The information on accidents is obtained through the cooperation of the Police Department. The accident investigation review is for a period of three years. This time span has been found to be adequate for the projection of trends.

As has been previously mentioned, not all types of accidents can be corrected by traffic signals. However, the information that is recorded in the accident reports enables us to distinguish between the types of accidents which are correctable by signals and those which are not.

To the average citizen, an accident is an accident. He knows that two cars were involved in a terrific smash-up at such and such a location but little else. His reaction often is, "Why doesn't the City do something about conditions at that intersection?" His reaction is based on his compassion for the victims and his scorn for the supposedly indifferent City officials who permit such things to happen.

FIELD INVESTIGATION

The City is not blind to the fact that statistics may be misleading. After studying the traffic counts and the accident records an inspection in the field is made so as to observe the physical characteristics of the intersection and the behavior of traffic. Some of the items looked at in the field are the type and condition of the road; the presence or absence of curves, hills, or other impairments to sight distance; the presence of large traffic generators such as shopping centers, restaurants, hamburger stands and the like; the existence of parking prohibitions, one-way streets, bus stops and other traffic control features; and the proximity of other traffic signals. All of these may have a bearing on whether the signal is needed or should be installed.

LOCATIONS STUDIED

The following locations were included in this report. At the present time none of them are controlled by traffic signals with the exception of the intersection of U.S. #6-218 (Westlawn Curve) and North Riverside Drive.

U.S. #6 By Pass and Keokuk Street
U.S. #6 By Pass and Sycamore Street
U.S. #6 By Pass and Lower Muscatine-Fair Meadows
First Avenue and Lower Muscatine Road
Burlington Street and Capitol Street
U.S. #6-218 (Westlawn Curve) and North Riverside Drive
U.S. #6-218 and VA Hospital Entrance
Dubuque Street and Park Road
Dubuque Street and Church Street
Washington Street and Madison Street
Washington Street and Gilbert Street

CONCLUSIONS

As was mentioned earlier in this report warrants have been established for the installation of traffic signals. Although the warrants are not the sole criteria upon which to base the need for traffic signals, they do serve as an excellent tool in evaluating traffic conditions at those locations where signals have been requested. The detailed warrants as set forth in the "Iowa Manual on Uniform Traffic Control Devices for Streets and Highways" are included in this report. (See Appendix II)

A tabulation has been prepared on page 7 showing which of the six warrants, if any, each of the intersections met. In some instances the word "Close" will appear. This means that the warrant was not met but that the traffic volumes were sufficient for 6 or 7 of the required eight hour period. It should be pointed out that for the most part the three principal warrants that apply are the minimum vehicular volume, the interruption of continuous traffic, and the accident experience warrants. As each of these intersections was analyzed if the three principal warrants mentioned above were not met then the sixth warrant, which is a combination of two or more of the other warrants, was looked at to see whether or not a signal installation could be justified. In addition, for the intersection of Washington and Madison and for the intersection of Washington and Gilbert the minimum pedestrian volume warrant was also investigated.

RECOMMENDATIONS

In attempting to arrive at a priority rating of needed traffic signal improvements it should be kept in mind that no "point rating" system was used. Each intersection was studied to see if it not only met the warrants but, from an overall traffic improvement program, whether or not traffic signals were justified and how they ranked in relation to other intersections.

On the basis of this report the following improvements are recommended:

1. The traffic signal at the intersection of U.S. #6-218 (Westlawn Curve) and North Riverside Drive should be removed and North Riverside Drive from U.S. #6-218 to River Street should be made a one-way street northbound. It is felt that the following improvements to traffic flow and safety would result:

    a. It would reduce accidents by moving a traffic signal out of a blind spot on a curve.

    b. The average motorist does not see the traffic signal until he is right at the intersection which results in a number of accidents.

    c. The removal of the signal would eliminate an unnecessary stop for traffic moving on U.S. #6-218.

    d. It would reduce the congestion at the intersection of U.S. #6-218 and Iowa Avenue, especially at the peak hours when traffic backs through this intersection as a result of the signal at U.S. #6-218 and Riverside Drive.

2. Traffic signals should be installed at the following intersections and in the priority as they are listed:

   a. U.S. #6 By Pass and Keokuk Street
   b. Dubuque Street and Park Road (This installation becomes critical if signal is removed from U.S. #6-218 and North Riverside Drive.)
   c. U.S. #6 By Pass and Lower Muscatine-Fair Meadows
   d. Burlington Street and Capitol Street
   e. U.S. #6 By Pass and Sycamore Street
   f. Washington Street and Madison Street

3. At this time traffic signals are not warranted at the following locations but continuous review of these intersections should be carried out:

   a. Washington Street and Gilbert Street
   b. U.S. #6-218 and VA Hospital Entrance
   c. Dubuque Street and Church Street
   d. First Avenue and Lower Muscatine Road

FINANCING

In order to finance the proposed traffic signal installations as recommended above the following schedule should be followed:

Install in 1970

1.	U.S. #6 By Pass and Keokuk Street (Semi-actuated control)	$15,000
2.	U.S. #6-218 (Westlawn Curve) and North Riverside Drive (Removal of existing signal)	500
3.	Dubuque Street and Park Road (Full-actuated control)	13,000
	Total	$28,500

Install in 1971

1.	U.S. #6 By Pass and Lower Muscatine-Fair Meadows (Semi-actuated control)	$15,000
2.	Burlington Street and Capitol Street (Fixed time or semi-actuated control)	13,000
3.	U.S. #6 By Pass and Sycamore Street (Semi-actuated control)	15,000
	Total	$43,000

Install in 1972

1.	Washington Street and Madison Street (Fixed time or full-actuated control)	$14,000

It should be kept in mind that installing traffic signals on any portion of the state highway system, which includes U.S. #6 By Pass as well as Burlington Street (Iowa #1) would mean that the City would be entitled to some reimbursment from the Iowa Highway Commission based on their new policy of sharing with the municipalities in the cost of traffic signal installations. The amount of participation would probably vary from somewhere around 20 percent on Iowa #1 to 30-40 percent on U.S. #6 By Pass.

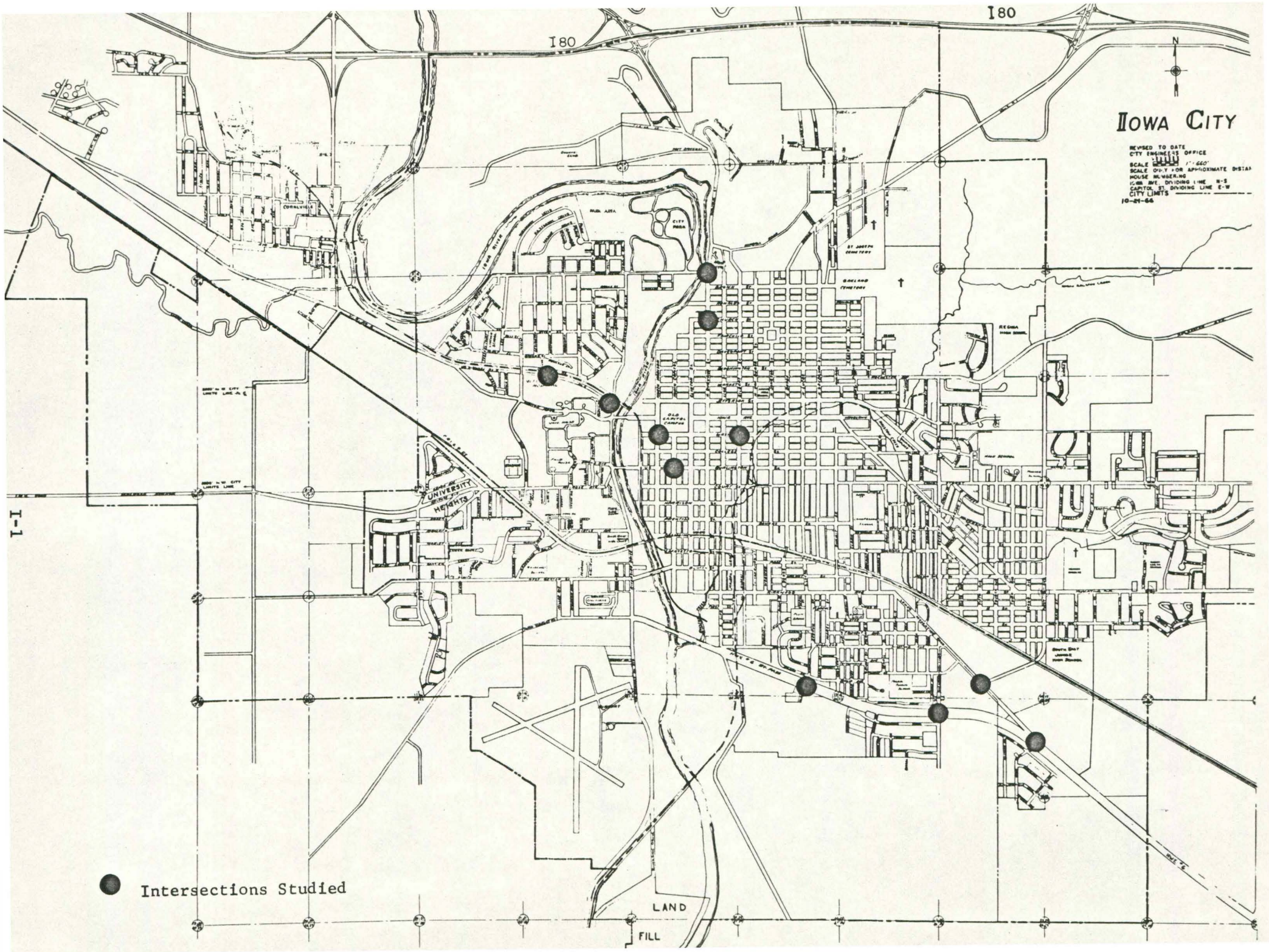
TABULATION SHOWING WARRANTS MET
BY LOCATION

INTERSECTION	WARRANTS					
	Minimum Vehicular Volume	Interruption of Cont. Traffic	Minimum Pedestrian Volume	Progressive Movement	Accident Experience	Combination of Warrants
U.S. #6 By Pass & Keokuk	Yes	Yes	N.A.	N.A.	Yes	N.A.
U.S. #6 By Pass & Sycamore	Yes	No	N.A.	N.A.	No	N.A.
U.S. #6 By Pass & Lower Muscatine	No	No	N.A.	N.A.	Close	Yes
First Avenue & Lower Muscatine	No	No	N.A.	N.A.	No	No
Burlington & Capitol	No	Yes	N.A.	N.A.	Yes	N.A.
U.S. #6-218 & North Riverside	Yes	Yes	N.A.	N.A.	Yes	N.A.
U.S. #6-218 & VA Hospital	No	No	N.A.	N.A.	No	No
Dubuque & Park Road	Close	No	N.A.	N.A.	No	Close
Dubuque & Church	No	No	N.A.	N.A.	No	No
Washington & Madison	No	No	No	N.A.	No	Yes
Washington & Gilbert	No	No	No	N.A.	No	No

N.A.--Not Applicable

APPENDIX I

LOCATION OF INTERSECTIONS STUDIED


I80
I80
IOWA CITY
REVISED TO DATE
CITY ENGINEER'S OFFICE
SCALE 1" = 660'
SCALE ONLY FOR APPROXIMATE DISTANCE
HOUSE NUMBERING
CAPITOL ST. DIVIDING LINE E-W
CITY LIMITS
10-24-66
CORALVILLE
IOWA RIVER
CITY PARK
ST. JOSEPH CEMETERY
OAKLAND CEMETERY
REGINA HIGH SCHOOL
OLD CAPITOL CAMPUS
UNIVERSITY HEIGHTS
SOUTH EAST JUNIOR HIGH SCHOOL
LAND
FILL
I-1
Intersections Studied

APPENDIX II

WARRANTS FOR INSTALLATION

OF TRAFFIC SIGNALS

WARRANTS FOR INSTALLATION OF TRAFFIC SIGNALS

Warrants for traffic signals are listed and defined in detail in Sections 3D-3 through 3D-9 of the Iowa Manual on Uniform Traffic Control Devices for Streets and Highways. One or more of these warrants must be satisfied before the signal may be installed and operated.

Warrant No. 1, Minimum Vehicular Volume

The minimum vehicular volume warrant is intended for application where the volume of intersecting traffic is the principal reason for consideration of signal installation. The warrant is satisfied when for each of any eight hours of an average day the traffic volumes below exist on the major street and on the higher-volume minor-street approach to the intersection.

Minimum Vehicular Volumes for Warrant No. 1

Number of Lanes for Moving Traffic on Each Approach		Vehicles per Hour on Major Street (Total of Both Approaches)	Vehicles per Hour on Higher-Volume Minor-Street Approach (one direction only)
Major Street	Minor Street		
1	1	500	150
2 or more	1	600	150
2 or more	2 or more	600	200
1	2 or more	500	200

The major-street and the minor-street volumes shall be for the same eight hours. During those eight hours the direction of higher volume on the minor street may be on one approach during some hours and on the opposite approach during other hours.

When the 85 percentile speed of major-street traffic exceeds 40 miles per hour, or when the intersection lies within the built-up area of an isolated community having a population less than 10,000, the minimum vehicular volume warrant shall be 70 percent of the requirements above, in recognition of differences in the nature and operational characteristics of traffic in urban and rural environments and smaller municipalities.

Warrant No. 2, Interruption of Continuous Traffic

The interruption of continuous traffic warrant is intended for application where operating conditions on a major street are such that the minor street traffic suffers undue delay or hazard in entering or crossing the major street. The warrant is satisfied when for each of any eight hours of an average day, the traffic volumes given below exist on the major street and on the higher-volume minor-street approach to the intersection, and the signal installation will not seriously disrupt progressive traffic flow.

Minimum Vehicular Volumes for Warrant No. 2

Number of Lanes for Moving Traffic on Each Approach		Vehicles per Hour on Major Street (Total of Both Approaches)	Vehicles per Hour on Higher-Volume Minor-Street Approach (one direction only)
Major Street	Minor Street		
1	1	750	75
2 or more	1	900	75
2 or more	2 or more	900	100
1	2 or more	750	100

The major-street and minor-street volumes shall be for the same eight hours. During those eight hours the direction of higher volume on the minor street may be on one approach during some hours and on the opposite approach during other hours.

When the 85 percentile speed of major street traffic exceeds 40 miles per hour, or when the intersection lies within the built-up area of an isolated community having a population less than 10,000, the interruption of continuous traffic warrant shall be 70 percent of the requirements above, in recognition of differences in the nature and operational characteristics of traffic in urban and rural environments and smaller municipalities.

Warrant No. 3, Minimum Pedestrian Volume

The minimum pedestrian volume warrant is satisfied when, for each day of any eight hours of an average day, the following traffic volumes exist:

1. On the major street 600 or more vehicles per hour enter the intersection (total of both approaches); or, 1,000 or more vehicles per hour (total of both approaches) enter the intersection on the major street where there is a raised median island four feet or more in width; and

2. During the same eight hours as in 1, there are 150 or more pedestrians per hour on the highest volume crosswalk crossing the major street.

When the 85 percentile speed of major-street traffic exceeds 40 miles per hour or when the intersection lies within the built-up area of an isolated community having a population less than 10,000, the warrant shall be 70 percent of the requirements above, in recognition of differences in the nature and operational characteristics of traffic in urban and rural environments and smaller municipalities.

A signal installed under this warrant should be of the pedestrian-actuated type.

Warrant No. 4, Progressive Movement

Progressive movement control sometimes necessitates traffic-signal installations at intersections where they would not otherwise be warranted in order to maintain proper grouping of vehicles and effectively regulate group speed. The progressive movement warrant is satisfied when:

1. On an isolated one-way street or on a street which preponderantly has unidirectional traffic significance, adjacent signals are so far apart that the desired degree of platooning and speed control of vehicles would

otherwise be lost.

2. On a two-way street, adjacent signals do not provide the desired degree of platooning and speed control; and, the proposed and adjacent signals can constitute a progressive signal system.

Warrant No. 5, Accident Experience

General public opinion that signals materially reduce the number of accidents is rarely substantiated by experience. Not infrequently there are more accidents with signals in operation than before signal installation. Hence, if none of the warrants except the accident experience warrant described below is fulfilled, the initial presumption should be against signalization. Signals should not be installed on the basis of a single spectacular accident or on the basis of unreasonable demands and dire predictions of accidents which allegedly might occur. The accident experience warrant is satisfied when:

1. Adequate trial of less restrictive remedies with satisfactory observance and enforcement has failed to reduce the accident frequency; and

2. Five or more reported accidents of types susceptible of correction by a traffic control signal have occurred within a 12 month period, each accident involving personal injury or property damage to an apparent extent of $100 or more; and

3. There exists a volume of vehicular and pedestrian traffic not less than 80 percent of the requirements specified in the minimum vehicular volume warrant, the interruption of continuous traffic warrant, or the minimum pedestrian volume warrant; and

4. The signal installation will not seriously disrupt progressive traffic flow.

Any signal installed solely on this warrant should be semi-traffic-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system, and normally should be full traffic-actuated if installed at an isolated intersection.

A traffic control signal, when obeyed by drivers and pedestrians, can be expected to eliminate or reduce materially the number and seriousness of the following types of accidents:

1. Those involving substantially right-angle collisions or conflicts, such as occur between vehicles on intersecting streets.

2. Those involving conflicts between straight-moving vehicles and crossing pedestrians.

3. Those between straight-moving and left-turning vehicles approaching from opposite directions, if an independent time interval is allowed during the signal cycle for the left-turn movement.

4. Those involving excessive speed, in cases where signal coordination will restrict speed to a reasonable rate.

On the other hand, traffic control signals cannot be expected to reduce the following types of accidents:

1. Rear-end collisions, which often increase after signalization.

2. Collisions between vehicles proceeding in the same or opposite directions, one of which makes a turn across the path of the other, particularly if no independent signal interval is provided for these turn movements.

3. Accidents involving pedestrians and turning vehicles, when both move during the same interval.

4. Other types of pedestrian accidents, if pedestrians or drivers do not obey the signals.

Warrant No. 6, Combinations of Warrants

Signals may occasionally be justified where no one warrant is satisfied but two or more are satisfied to the extent of 80 percent or more of the stated values. These exceptional cases should be decided on the basis of a thorough analysis of facts.

Adequate trial of other remedial measures which cause less delay and inconvenience to traffic should precede installation of signals under this warrant.

APPENDIX III

TRAFFIC FLOW DIAGRAMS

AND ACCIDENT SUMMARY

CHARTS BY INTERSECTION

INTERSECTION

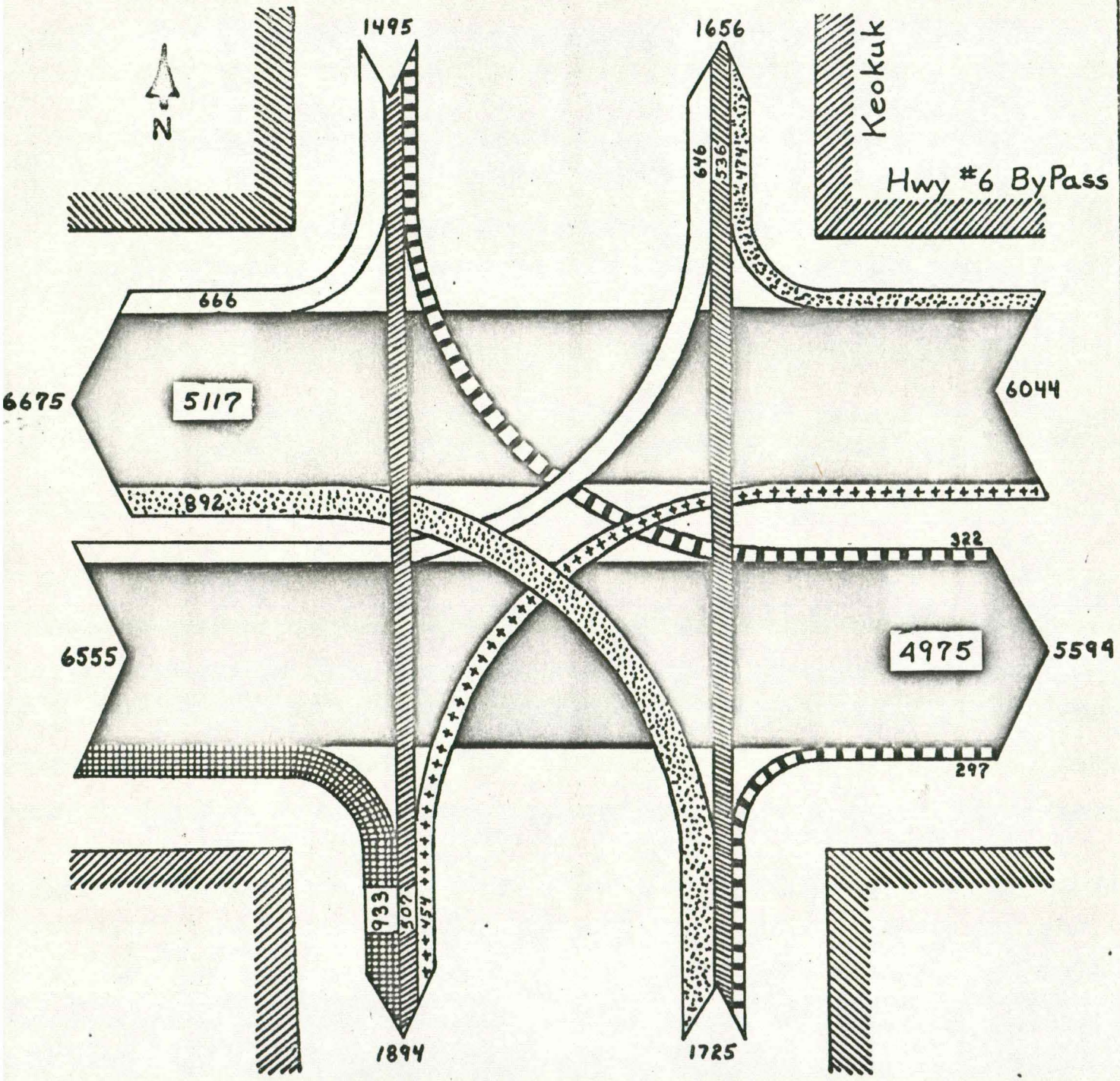
OF

U.S. #6 BY PASS AND KEOKUK STREET

VEHICLE VOLUME FLOW

24 HOUR ADT - 1969

LOCATION: Hwy #6 Bypass & Keokuk St.



Scale ½" = 2,000 vehicles

ACCIDENT SUMMARY

Intersection
of
U.S. #6 By Pass and Keokuk Street

TIME OF DAY	NO. OF ACCIDENTS 1967	1968	1969
6 A.M.-10 A.M.	2	2	2
10 A.M.- 4 P.M.	3		5
4 P.M.- 7 P.M.	3	2	6
7 P.M.-12 Mid.	1	2	
12 Mid.- 6 A.M.			
TOTAL	9	6	13

DIRECTION OF APPROACH	NO. OF VEHICLES 1967	1968	1969
North	3	1	3
South	7		7
East	4	6	11
West	4	5	5
TOTAL	18	12	26

WEATHER	NO. OF ACCIDENTS 1967	1968	1969
Clear	5	6	13
Fog			
Rain	4		
Sleet			
Snow			
TOTAL	9	6	13

ACCIDENT TYPE	NO. OF ACCIDENTS 1967	1968	1969
Sideswipe		1	
Rear End	1	3	2
Right Angle	4	1	8
Left Turn	4	1	3
Pedestrian			
Other			
TOTAL	9	6	13

PAVEMENT	NO. OF ACCIDENTS 1967	1968	1969
Dry	5	6	12
Icy			
Wet	4		1
TOTAL	9	6	13

ACCIDENT SEVERITY	NO. OF ACCIDENTS 1967	1968	1969
Fatal Injury	1		
Non-fatal Injury	2	2	4
Property Damage Only	6	4	9
TOTAL	9	6	13

TIME OF YEAR	NO. OF ACCIDENTS 1967	1968	1969
Winter (Dec.-Feb.)	1	1	4
Spring (Mar.-May)	3	1	2
Summer (June-Aug.)	2	1	3
Fall (Sep.-Nov.)	3	3	4
TOTAL	9	6	13

TYPE OF VEHICLE	NO. OF VEHICLES 1967	1968	1969
Passenger Cars	18	12	25
Commercial Vehicles			1
TOTAL	18	12	26

INTERSECTION

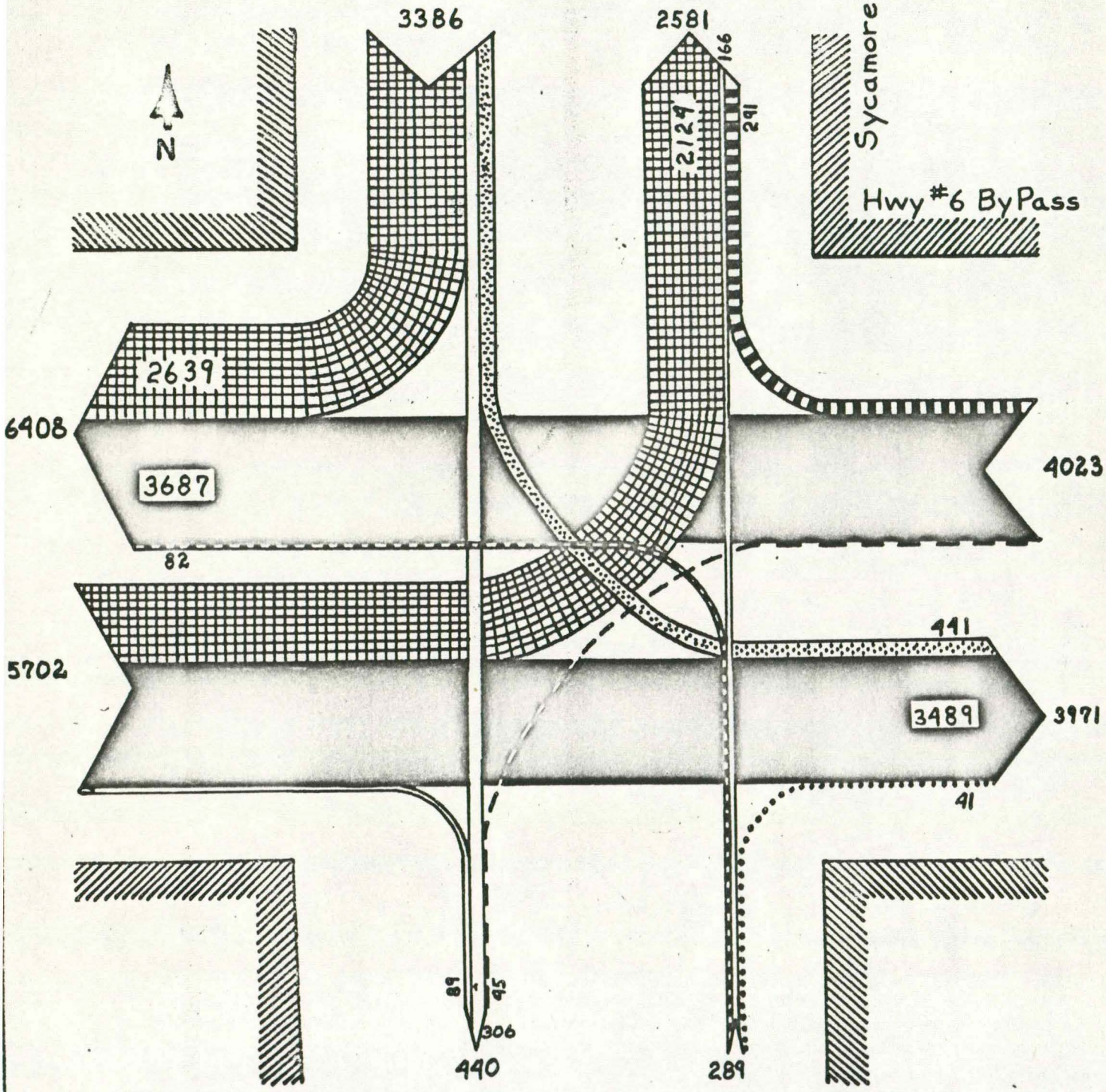
OF

U.S. #6 BY PASS AND SYCAMORE STREET

VEHICLE VOLUME FLOW

24 HOUR ADT - 1969

LOCATION: Hwy #6 Bypass & Sycamore St.



Scale ½" = 2,000 vehicles

ACCIDENT SUMMARY

Intersection
of
U.S. #6 By Pass and Sycamore Street

TIME OF DAY	NO. OF ACCIDENTS 1967	1968	1969
6 A.M.-10 A.M.		1	
0 A.M.- 4 P.M.	1	2	
4 P.M.- 7 P.M.	1	2	3
7 P.M.-12 Mid.	2	2	2
2 Mid.- 6 A.M.	1		1
TOTAL	5	7	6

DIRECTION OF APPROACH	NO. OF VEHICLES 1967	1968	1969
North	2	4	3
South	1	3	3
East	4	2	
West		7	7
TOTAL	7	16	13

WEATHER	NO. OF ACCIDENTS 1967	1968	1969
Clear	3	7	3
Fog	2		
Rain			1
Sleet			
Snow			2
TOTAL	5	7	6

ACCIDENT TYPE	NO. OF ACCIDENTS 1967	1968	1969
Sideswipe		1	3
Rear End	1	2	1
Right Angle		4	2
Left Turn	2		
Pedestrian			
Other	2	1	
TOTAL	5	8	6

PAVEMENT	NO. OF ACCIDENTS 1967	1968	1969
Dry	3	7	2
Icy			2
Wet	2		2
TOTAL	5	7	6

ACCIDENT SEVERITY	NO. OF ACCIDENTS 1967	1968	1969
Fatal Injury			
Non-fatal Injury			
Property Damage Only	5	8	6
TOTAL	5	8	6

TIME OF YEAR	NO. OF ACCIDENTS 1967	1968	1969
Winter (Dec.-Feb.)	2		
Spring (Mar.-May)			
Summer (June-Aug.)	1	1	1
Fall (Sep.-Nov.)	2	6	5
TOTAL	5	7	6

TYPE OF VEHICLE	NO. OF VEHICLES 1967	1968	1969
Passenger Cars	7	14	13
Commercial Vehicles		2	
TOTAL	7	16	13

INTERSECTION

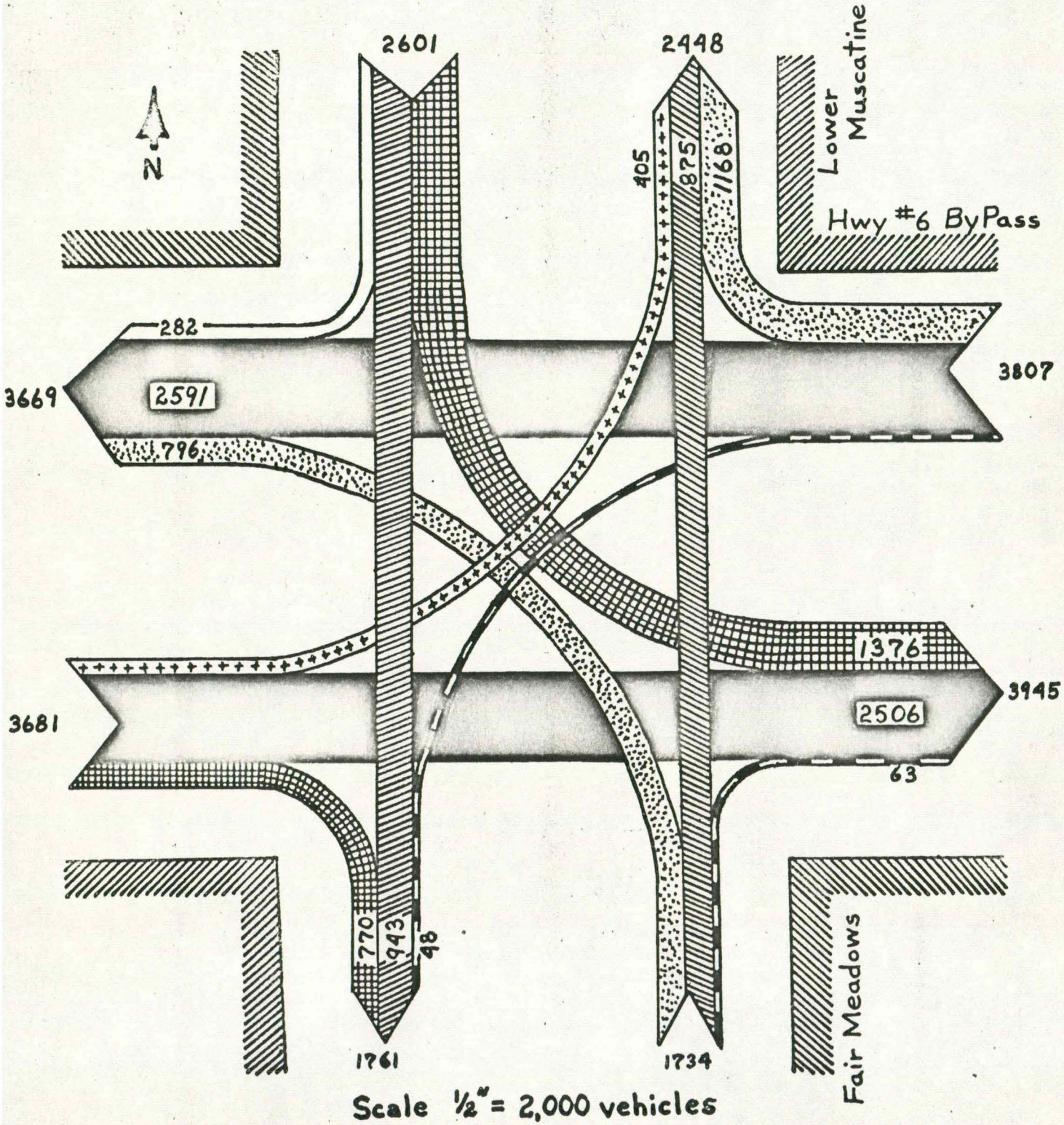
OF

U.S. #6 BY PASS AND LOWER MUSCATINE ROAD-FAIR MEADOWS

VEHICLE VOLUME FLOW

24 HOUR ADT - 1969

LOCATION: Hwy #6 Bypass & Lower Muscatine & Fair Meadows



Scale ½" = 2,000 vehicles

ACCIDENT SUMMARY

Intersection
of
U.S. #6 By Pass and Lower Muscatine Road-Fair Meadows

IME OF DAY	NO. OF ACCIDENTS 1967	1968	1969
6 A.M.-10 A.M.	1	2	3
0 A.M.- 4 P.M.	5	2	4
4 P.M.- 7 P.M.		2	2
7 P.M.-12 Mid.	1	1	2
2 Mid.- 6 A.M.	1	1	
TOTAL	8	8	11

DIRECTION OF APPROACH	NO. OF VEHICLES 1967	1968	1969
North	6	5	7
South	3	3	7
East	6	5	3
West	1	3	6
TOTAL	16	16	23

EATHER	NO. OF ACCIDENTS 1967	1968	1969
lear	5	6	11
og		1	
ain	3	1	
leet			
now			
TOTAL	8	8	11

ACCIDENT TYPE	NO. OF ACCIDENTS 1967	1968	1969
Sideswipe			
Rear End			1
Right Angle	7	8	8
Left Turn			2
Pedestrian			
Other	1		
TOTAL	8	8	11

AVEMENT	NO. OF ACCIDENTS 1967	1968	1969
ry	5	7	8
cy			2
et	3	1	1
TOTAL	8	8	11

ACCIDENT SEVERITY	NO. OF ACCIDENTS 1967	1968	1969
Fatal Injury			
Non-fatal Injury		1	2
Property Damage Only	8	7	9
TOTAL	8	8	11

IME OF YEAR	NO. OF ACCIDENTS 1967	1968	1969
inter (Dec.-Feb.)	2	1	4
pring (Mar.-May)		2	2
ummer (June-Aug.)	2	2	1
all (Sep.-Nov.)	4	3	4
TOTAL	8	8	11

TYPE OF VEHICLE	NO. OF VEHICLES 1967	1968	1969
Passenger Cars	16	15	22
Commercial Vehicles		1	1
TOTAL	16	16	23

INTERSECTION

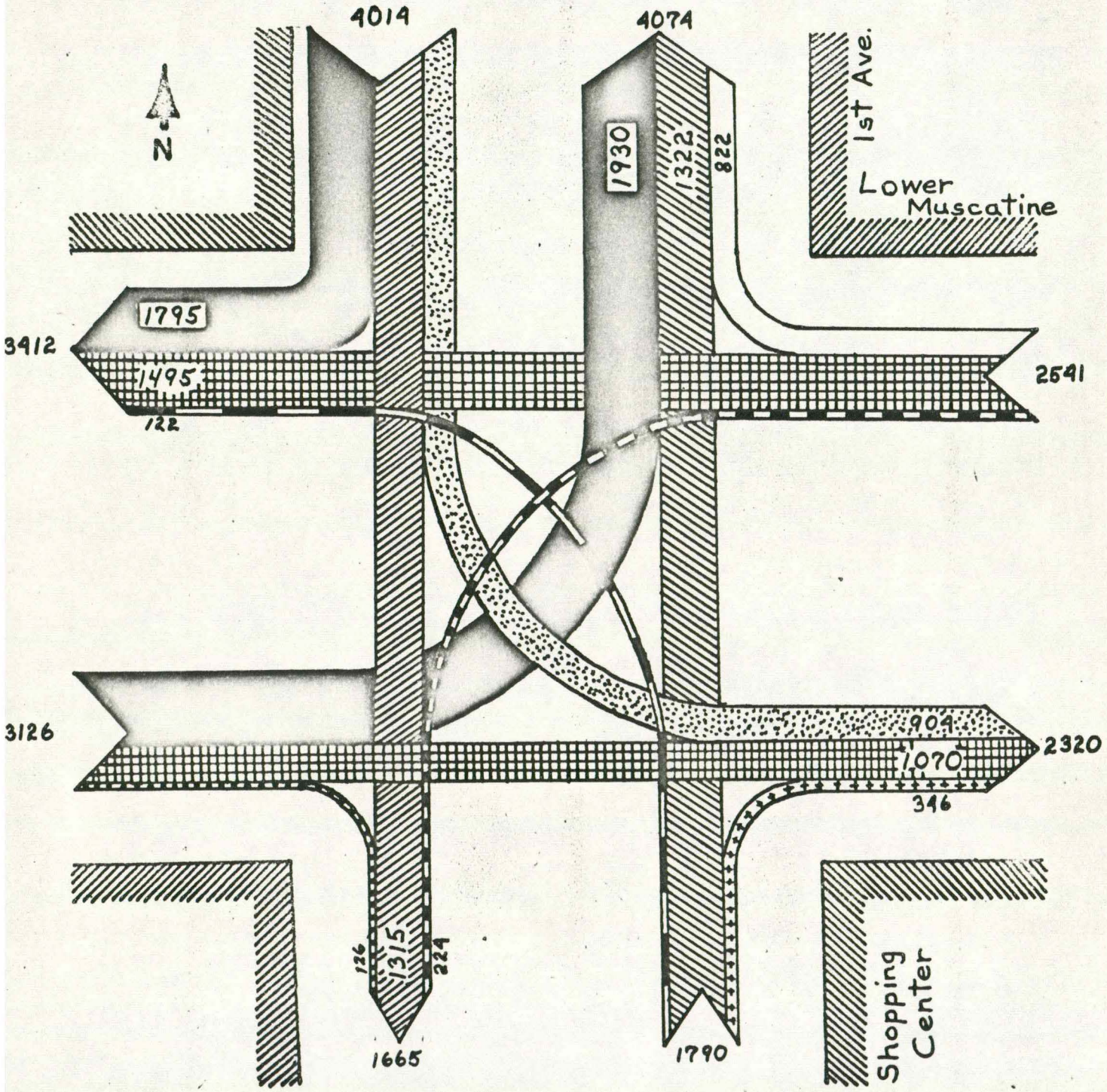
OF

FIRST AVENUE AND LOWER MUSCATINE ROAD

VEHICLE VOLUME FLOW

24 HOUR ADT - 1969

LOCATION: 1st. Avenue & Lower Muscatine Road



Scale ½" = 2,000 vehicles

ACCIDENT SUMMARY

Intersection
of
First Avenue and Lower Muscatine Road

IME OF DAY	NO. OF ACCIDENTS 1967	1968	1969
6 A.M.-10 A.M.	1	1	
0 A.M.- 4 P.M.			2
4 P.M.- 7 P.M.			1
7 P.M.-12 Mid.			
2 Mid.- 6 A.M.			
TOTAL	1	1	3

DIRECTION OF APPROACH	NO. OF VEHICLES 1967	1968	1969
North		1	
South	2		1
East			3
West		1	1
TOTAL	2	2	5

EATHER	NO. OF ACCIDENTS 1967	1968	1969
lear		1	2
og	1		
ain			
leet			
now			1
TOTAL	1	1	3

ACCIDENT TYPE	NO. OF ACCIDENTS 1967	1968	1969
Sideswipe			1
Rear End	1		
Right Angle			1
Left Turn		1	
Pedestrian			
Other			1
TOTAL	1	1	3

AVEMENT	NO. OF ACCIDENTS 1967	1968	1969
ry		1	2
cy	1		1
et			
TOTAL	1	1	3

ACCIDENT SEVERITY	NO. OF ACCIDENTS 1967	1968	1969
Fatal Injury			
Non-fatal Injury			
Property Damage Only	1	1	3
TOTAL	1	1	3

IME OF YEAR	NO. OF ACCIDENTS 1967	1968	1969
inter (Dec.-Feb.)	1		2
pring (Mar.-May)			
ummer (June-Aug.)		1	
all (Sep.-Nov.)			1
TOTAL	1	1	3

TYPE OF VEHICLE	NO. OF VEHICLES 1967	1968	1969
Passenger Cars	2	2	4
Commercial Vehicles			1
TOTAL	2	2	5

INTERSECTION

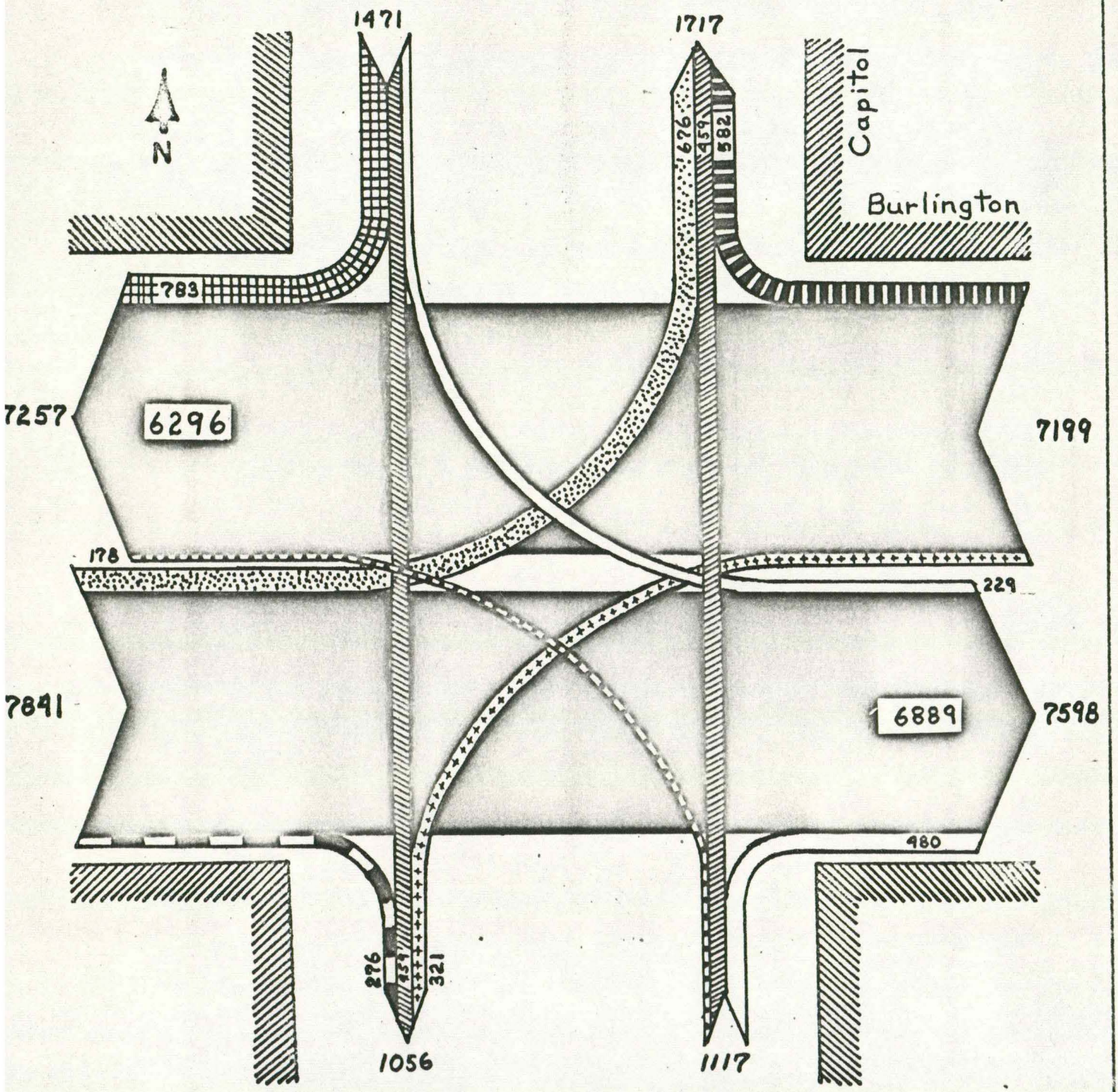
OF

BURLINGTON STREET AND CAPITOL STREET

VEHICLE VOLUME FLOW

24 HOUR ADT - 1969

LOCATION: Burlington St. & Capitol St.



Scale ½" = 2,000 vehicles

ACCIDENT SUMMARY

Intersection
of
Burlington Street and Capitol Street

TIME OF DAY	NO. OF ACCIDENTS 1967	1968	1969
6 A.M.-10 A.M.	1		
10 A.M.- 4 P.M.	6	1	3
4 P.M.- 7 P.M.		2	3
7 P.M.-12 Mid.	1	2	
12 Mid.- 6 A.M.	1	2	1
TOTAL	9	7	7

DIRECTION OF APPROACH	NO. OF VEHICLES 1967	1968	1969
North	5	3	2
South	5	4	4
East	8	3	2
West	2	5	6
TOTAL	20	15	14

WEATHER	NO. OF ACCIDENTS 1967	1968	1969
Clear	5	2	5
Fog			
Rain	3	2	2
Sleet			
Snow	1	3	
TOTAL	9	7	7

ACCIDENT TYPE	NO. OF ACCIDENTS 1967	1968	1969
Sideswipe			
Rear End		1	1
Right Angle	7	4	5
Left Turn	2	2	1
Pedestrian			
Other			
TOTAL	9	7	7

PAVEMENT	NO. OF ACCIDENTS 1967	1968	1969
Dry	5	1	4
Icy			
Wet	4	6	3
TOTAL	9	7	7

ACCIDENT SEVERITY	NO. OF ACCIDENTS 1967	1968	1969
Fatal Injury			
Non-fatal Injury	2		1
Property Damage Only	7	7	6
TOTAL	9	7	7

TIME OF YEAR	NO. OF ACCIDENTS 1967	1968	1969
Winter (Dec.-Feb.)	1	2	1
Spring (Mar.-May)	3	1	1
Summer (June-Aug.)	2		1
Fall (Sep.-Nov.)	3	4	4
TOTAL	9	7	7

TYPE OF VEHICLE	NO. OF VEHICLES 1967	1968	1969
Passenger Cars	20	14	13
Commercial Vehicles		1	
Motorcycle			1
TOTAL	20	15	14

INTERSECTION

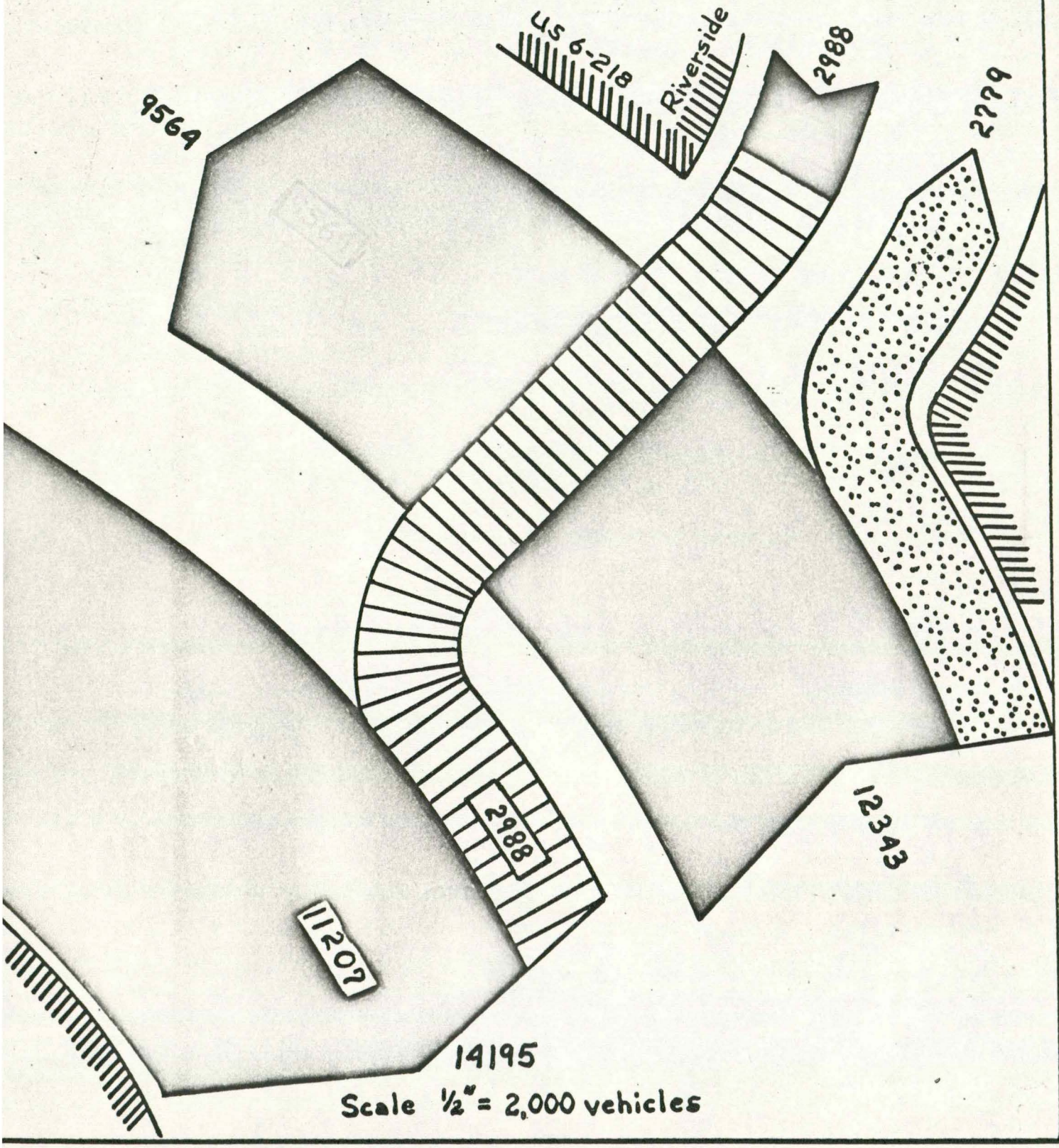
OF

U.S. #6-218 (WESTLAWN CURVE) AND NORTH RIVERSIDE DRIVE

VEHICLE VOLUME FLOW

24 HOUR ADT - 1969

LOCATION: US. # 6-218 and N. RIVERSIDE DR.



Scale ½" = 2,000 vehicles

ACCIDENT SUMMARY

Intersection
of
U.S. #6-218 (Westlawn Curve) and North Riverside Drive

TIME OF DAY	NO. OF ACCIDENTS 1967	1968	1969
6 A.M.-10 A.M.	1		6
10 A.M.- 4 P.M.	4	8	7
4 P.M.- 7 P.M.	1	8	3
7 P.M.-12 Mid.	5	7	2
12 Mid.- 6 A.M.	5	2	5
TOTAL	16	25	23

DIRECTION OF APPROACH	NO. OF VEHICLES 1967	1968	1969
North (US6-218)	8	12	14
South (US6-218)	14	26	20
East (Riverside)	9	8	5
West			
TOTAL	31	46	39

WEATHER	NO. OF ACCIDENTS 1967	1968	1969
Clear	11	20	15
Fog			1
Rain	4	2	2
Sleet			
Snow	1	3	5
TOTAL	16	25	23

ACCIDENT TYPE	NO. OF ACCIDENTS 1967	1968	1969
Sideswipe	2	3	2
Rear End	3	9	4
Right Angle	6	6	4
Left Turn			
Pedestrian			
Other	5	7	13
TOTAL	16	25	23

PAVEMENT	NO. OF ACCIDENTS 1967	1968	1969
Dry	10	17	12
Icy		1	5
Wet	6	7	6
TOTAL	16	25	23

ACCIDENT SEVERITY	NO. OF ACCIDENTS 1967	1968	1969
Fatal Injury			
Non-fatal Injury	3	3	4
Property Damage Only	13	22	19
TOTAL	16	25	23

TIME OF YEAR	NO. OF ACCIDENTS 1967	1968	1969
Winter (Dec.-Feb.)	2	10	10
Spring (Mar.-May)	5	6	1
Summer (June-Aug.)	4	1	10
Fall (Sep.-Nov.)	5	8	2
TOTAL	16	25	23

TYPE OF VEHICLE	NO. OF VEHICLES 1967	1968	1969
Passenger Cars	30	44	37
Commercial Vehicles	1	1	1
Motorcycle		1	1
TOTAL	31	46	39

INTERSECTION

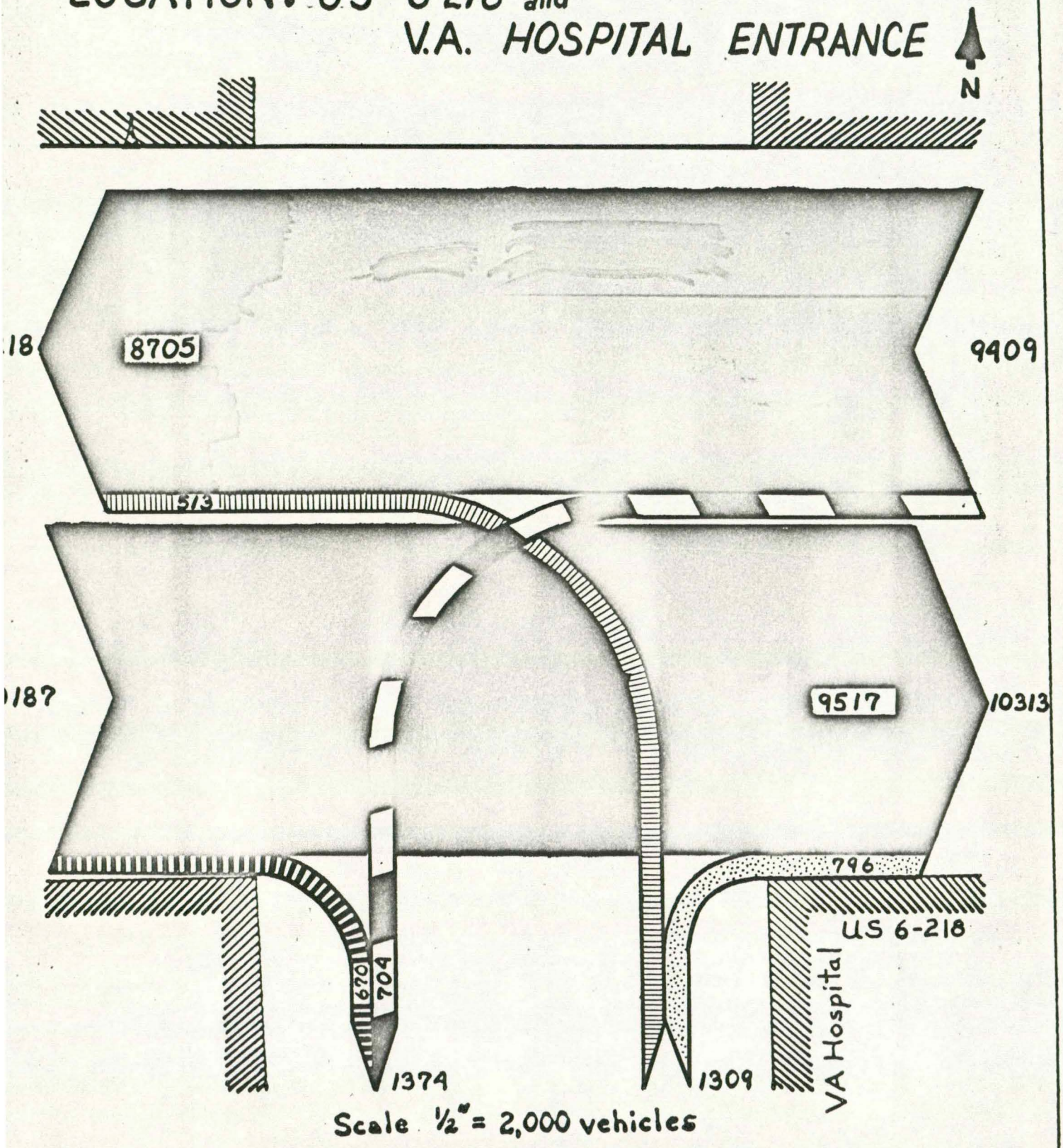
OF

U.S. #6-218 AND VA HOSPITAL ENTRANCE

VEHICLE VOLUME FLOW

24 HOUR ADT - 1969

LOCATION: US #6-218 and V.A. HOSPITAL ENTRANCE



Scale ½" = 2,000 vehicles

ACCIDENT SUMMARY

Intersection
of
U.S. #6-218 and VA Hospital Entrance

IME OF DAY	NO. OF ACCIDENTS 1967	1968	1969
6 A.M.-10 A.M.			2
0 A.M.- 4 P.M.		1	2
4 P.M.- 7 P.M.	1	1	1
7 P.M.-12 Mid.	1	1	
2 Mid.- 6 A.M.			1
TOTAL	2	3	6

DIRECTION OF APPROACH	NO. OF VEHICLES 1967	1968	1969
North			
South			2
East		3	6
West	4	3	4
TOTAL	4	6	12

EATHER	NO. OF ACCIDENTS 1967	1968	1969
lear	2	3	5
og			
ain			
leet			
now			1
TOTAL	2	3	6

ACCIDENT TYPE	NO. OF ACCIDENTS 1967	1968	1969
Sideswipe			1
Rear End	2	2	2
Right Angle			1
Left Turn		1	1
Pedestrian			1
Other			
TOTAL	2	3	6

'AVEMENT	NO. OF ACCIDENTS 1967	1968	1969
ry	2	2	5
cy			
et		1	1
TOTAL	2	3	6

ACCIDENT SEVERITY	NO. OF ACCIDENTS 1967	1968	1969
Fatal Injury			
Non-fatal Injury			1
Property Damage Only	2	3	5
TOTAL	2	3	6

'IME OF YEAR	NO. OF ACCIDENTS 1967	1968	1969
inter (Dec.-Feb.)		1	1
pring (Mar.-May)	2		1
ummer (June-Aug.)		2	1
all (Sep.-Nov.)			3
TOTAL	2	3	6

TYPE OF VEHICLE	NO. OF VEHICLES 1967	1968	1969
Passenger Cars	4	6	12
Commercial Vehicles			
TOTAL	4	6	12

INTERSECTION

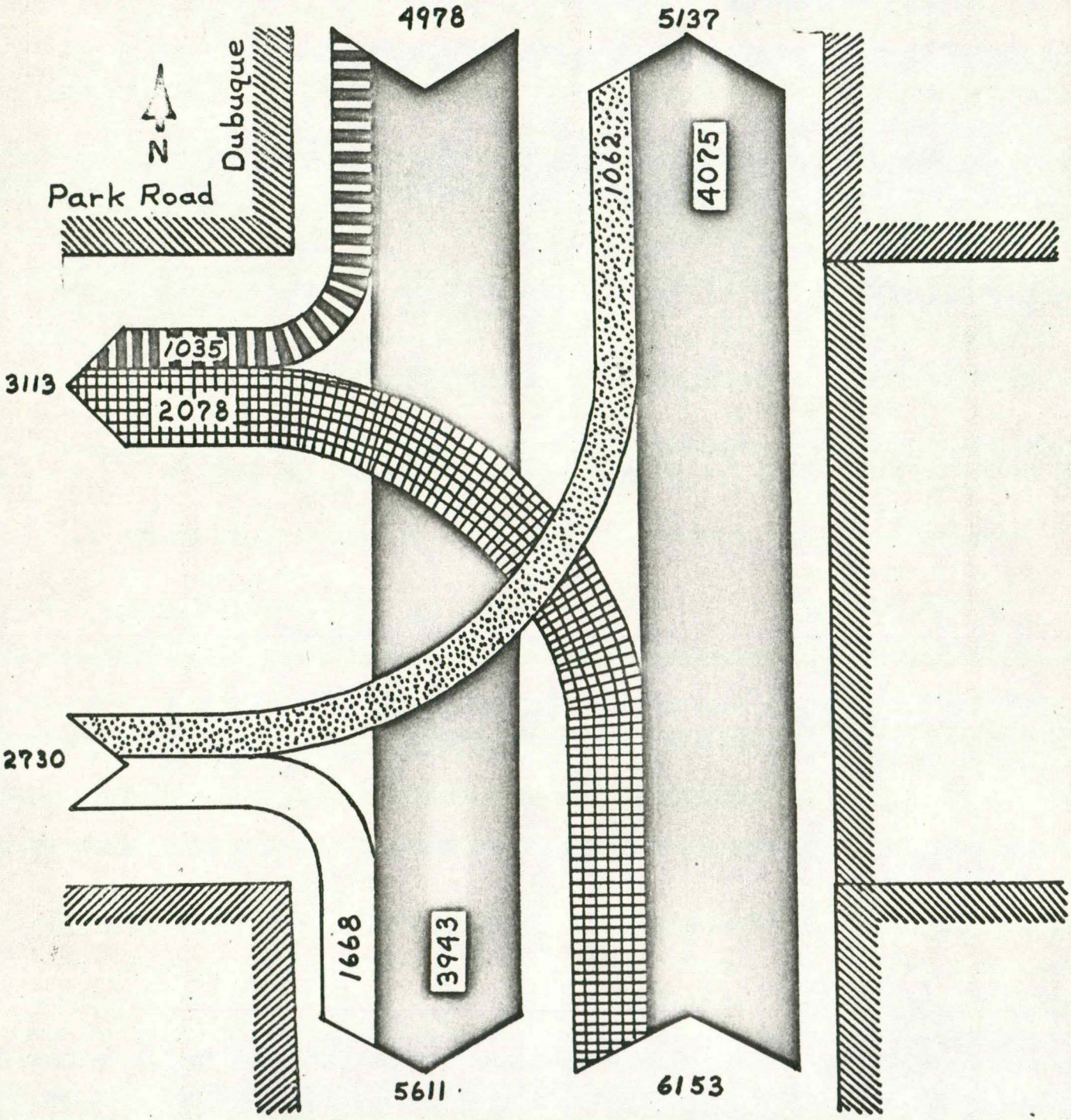
OF

DUBUQUE STREET AND PARK ROAD

VEHICLE VOLUME FLOW

24 HOUR ADT - 1969

LOCATION: N. Dubuque St. & Park Road



Scale ½" = 2,000 vehicles

ACCIDENT SUMMARY

Intersection
of
Dubuque Street and Park Road

TIME OF DAY	NO. OF ACCIDENTS 1967	1968	1969
6 A.M.-10 A.M.			3
10 A.M.- 4 P.M.	3	1	1
4 P.M.- 7 P.M.	2	1	
7 P.M.-12 Mid.	1		3
12 Mid.- 6 A.M.		1	1
TOTAL	6	3	8

DIRECTION OF APPROACH	NO. OF VEHICLES 1967	1968	1969
North		2	7
South	4	3	
East			
West	6	1	5
TOTAL	10	6	12

WEATHER	NO. OF ACCIDENTS 1967	1968	1969
Clear	6	1	6
Fog		1	
Rain		1	1
Sleet			1
Snow			
TOTAL	6	3	8

ACCIDENT TYPE	NO. OF ACCIDENTS 1967	1968	1969
Sideswipe			1
Rear End	3	1	2
Right Angle	1	1	1
Left Turn		1	
Pedestrian			
Other	2		4
TOTAL	6	3	8

PAVEMENT	NO. OF ACCIDENTS 1967	1968	1969
Dry	6	1	6
Icy			1
Wet		2	1
TOTAL	6	3	8

ACCIDENT SEVERITY	NO. OF ACCIDENTS 1967	1968	1969
Fatal Injury			
Non-fatal Injury	1		2
Property Damage Only	5	3	6
TOTAL	6	3	8

TIME OF YEAR	NO. OF ACCIDENTS 1967	1968	1969
Winter (Dec.-Feb.)		1	2
Spring (Mar.-May)		1	2
Summer (June-Aug.)	5	1	1
Fall (Sep.-Nov.)	1		3
TOTAL	6	3	8

TYPE OF VEHICLE	NO. OF VEHICLES 1967	1968	1969
Passenger Cars	9	6	11
Commercial Vehicles	1		1
TOTAL	10	6	12

INTERSECTION

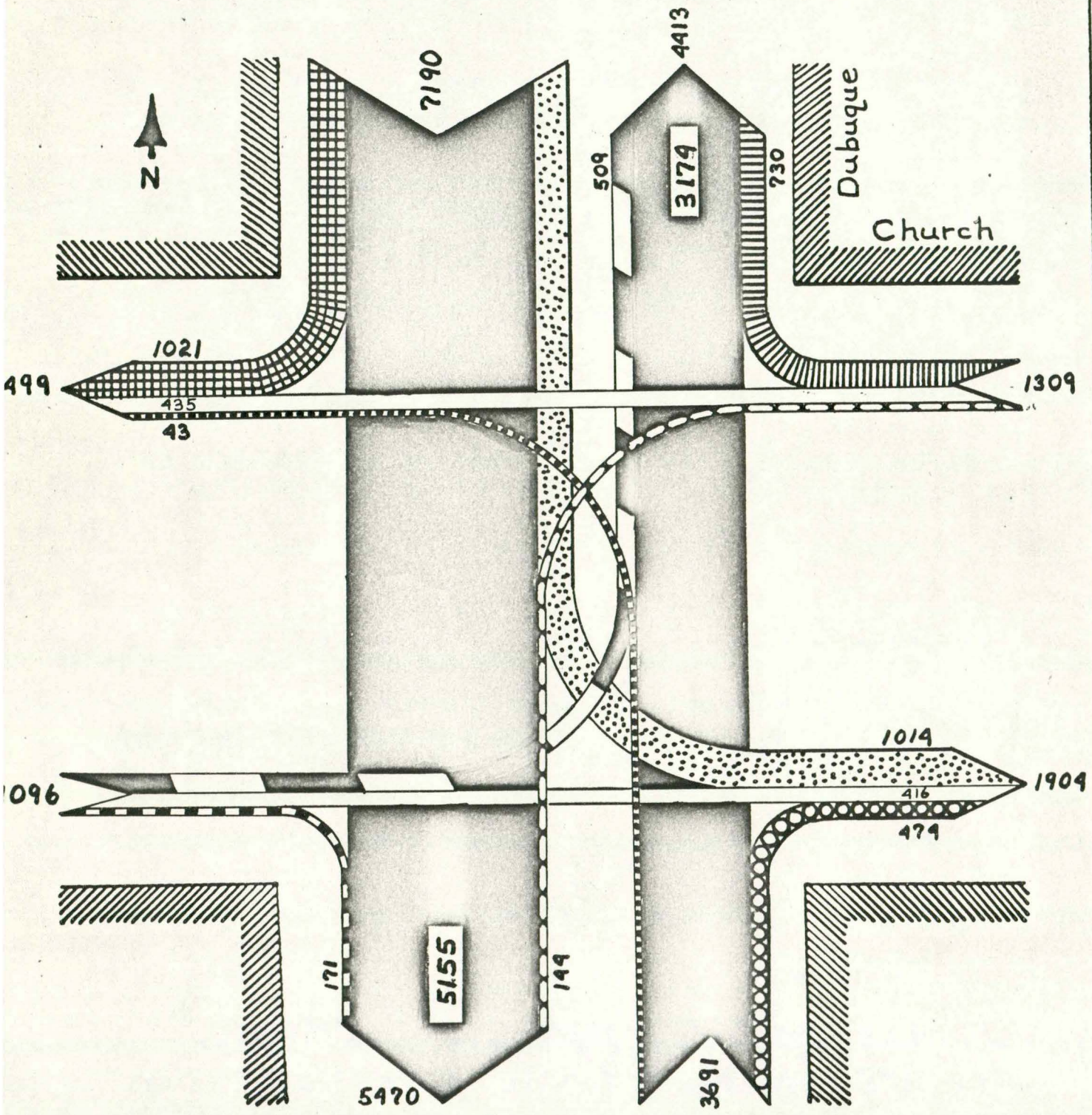
OF

DUBUQUE STREET AND CHURCH STREET

VEHICLE VOLUME FLOW

24 HOUR ADT - 1969

LOCATION: CHURCH and DUBUQUE ST.



Scale ½" = 2,000 vehicles

ACCIDENT SUMMARY

Intersection
of
Dubuque Street and Church Street

TIME OF DAY	NO. OF ACCIDENTS 1967	1968	1969
6 A.M.-10 A.M.	1	3	
10 A.M.- 4 P.M.	1	3	1
4 P.M.- 7 P.M.		2	2
7 P.M.-12 Mid.			
12 Mid.- 6 A.M.		1	1
TOTAL	2	9	4

DIRECTION OF APPROACH	NO. OF VEHICLES 1967	1968	1969
North	4	8	1
South		3	4
East		2	
West		4	3
TOTAL	4	17	8

WEATHER	NO. OF ACCIDENTS 1967	1968	1969
Clear	2	7	4
Fog			
Rain		2	
Sleet			
Snow			
TOTAL	2	9	4

ACCIDENT TYPE	NO. OF ACCIDENTS 1967	1968	1969
Sideswipe	2	1	2
Rear End		1	1
Right Angle		4	1
Left Turn		2	
Pedestrian		1	
Other			
TOTAL	2	9	4

PAVEMENT	NO. OF ACCIDENTS 1967	1968	1969
Dry	2	7	4
Icy			
Wet		2	
TOTAL	2	9	4

ACCIDENT SEVERITY	NO. OF ACCIDENTS 1967	1968	1969
Fatal Injury			
Non-fatal Injury		1	1
Property Damage Only	2	8	3
TOTAL	2	9	4

TIME OF YEAR	NO. OF ACCIDENTS 1967	1968	1969
Winter (Dec.-Feb.)	1	3	1
Spring (Mar.-May)	1	3	1
Summer (June-Aug.)		1	2
Fall (Sep.-Nov.)		2	
TOTAL	2	9	4

TYPE OF VEHICLE	NO. OF VEHICLES 1967	1968	1969
Passenger Cars	4	17	8
Commercial Vehicles			
TOTAL	4	17	8

INTERSECTION

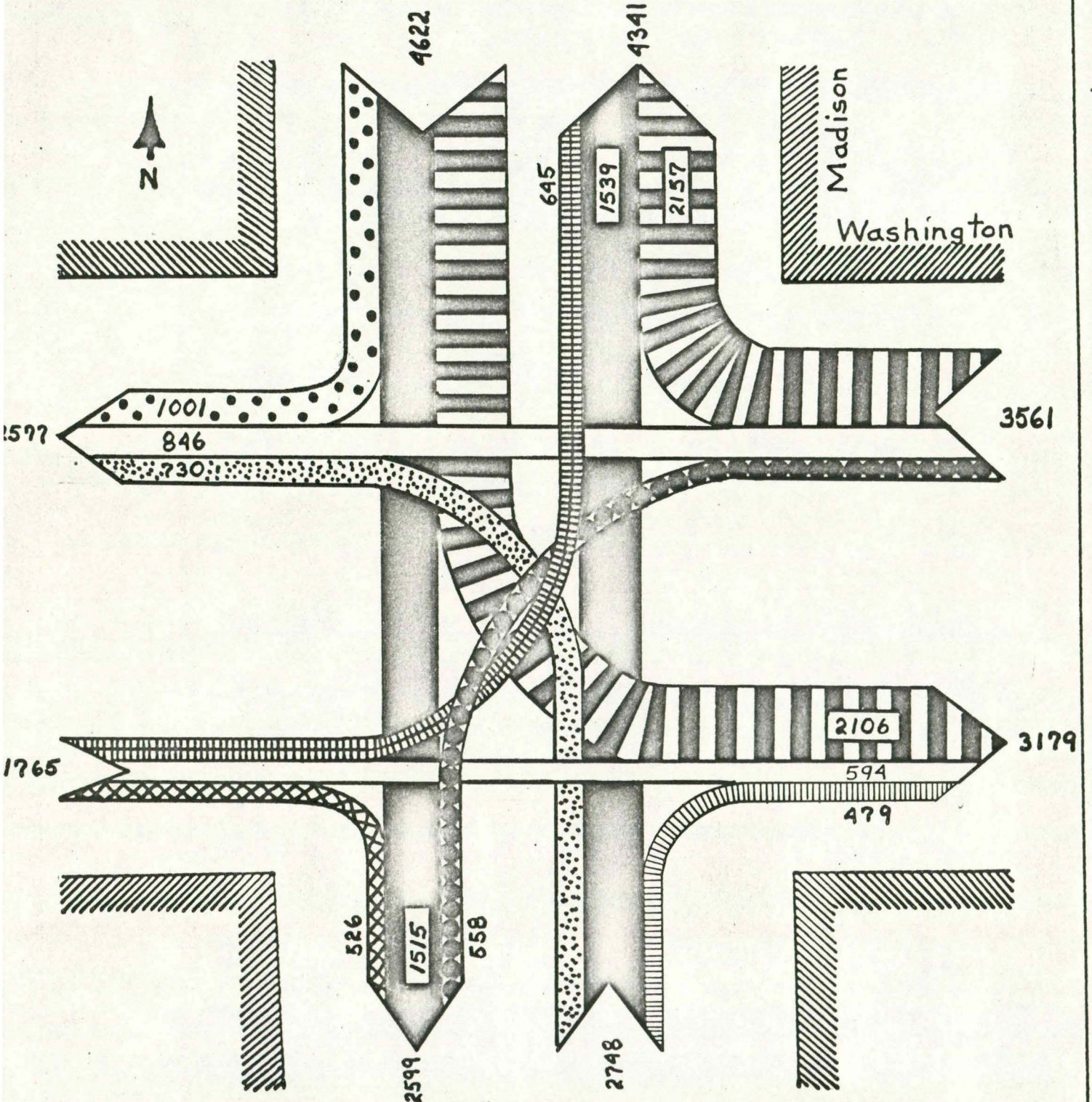
OF

WASHINGTON STREET AND MADISON STREET

VEHICLE VOLUME FLOW

24 HOUR ADT - 1969

LOCATION: WASHINGTON and MADISON ST.



Scale ½" = 2,000 vehicles

ACCIDENT SUMMARY

Intersection
of
Washington Street and Madison Street

IME OF DAY	NO. OF ACCIDENTS 1967	1968	1969
6 A.M.-10 A.M.	1	1	
0 A.M.- 4 P.M.	3	3	2
4 P.M.- 7 P.M.			2
7 P.M.-12 Mid.	1		
2 Mid.- 6 A.M.	2	2	
TOTAL	7	6	4

DIRECTION OF APPROACH	NO. OF VEHICLES 1967	1968	1969
North	5		1
South	2		
East	5		2
West	2	8	4
TOTAL	14	8	7

EATHER	NO. OF ACCIDENTS 1967	1968	1969
lear	5	4	1
og			
ain	2	1	2
leet			
now		1	1
TOTAL	7	6	4

ACCIDENT TYPE	NO. OF ACCIDENTS 1967	1968	1969
Sideswipe			
Rear End		3	2
Right Angle	4	2	1
Left Turn	3		
Pedestrian			1
Other		1	
TOTAL	7	6	4

AVEMENT	NO. OF ACCIDENTS 1967	1968	1969
ry	3	2	1
cy	1	2	1
et	3	2	2
TOTAL	7	6	4

ACCIDENT SEVERITY	NO. OF ACCIDENTS 1967	1968	1969
Fatal Injury			
Non-fatal Injury	3	2	1
Property Damage Only	4	4	3
TOTAL	7	6	4

IME OF YEAR	NO. OF ACCIDENTS 1967	1968	1969
inter (Dec.-Feb.)		2	1
pring (Mar.-May)	3	3	
ummer (June-Aug.)	1		
all (Sep.-Nov.)	3	1	3
TOTAL	7	6	4

TYPE OF VEHICLE	NO. OF VEHICLES 1967	1968	1969
Passenger Cars	14	8	7
Commercial Vehicles			
TOTAL	14	8	7

INTERSECTION

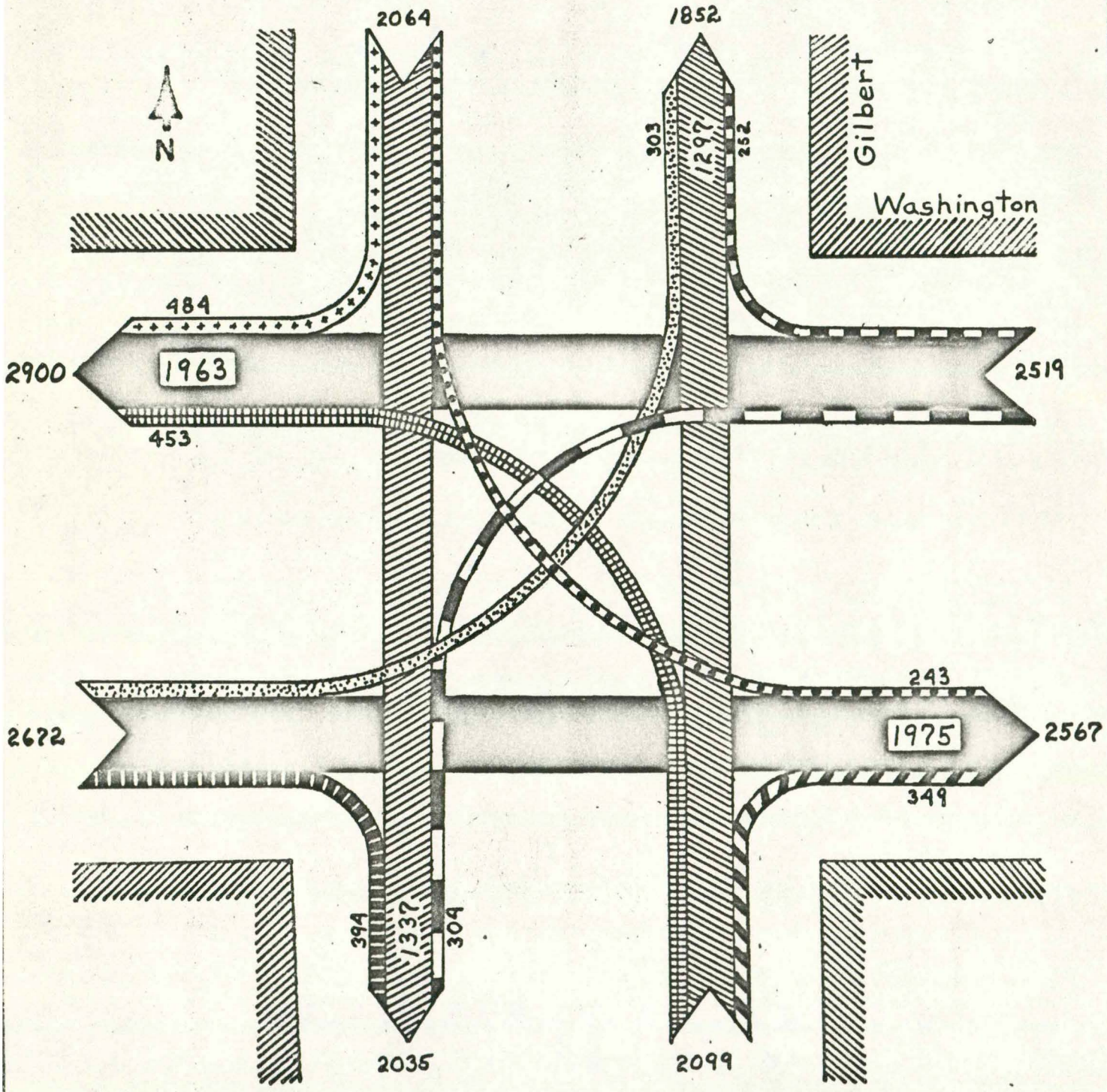
OF

WASHINGTON STREET AND GILBERT STREET

VEHICLE VOLUME FLOW

24 HOUR ADT - 1969

LOCATION: Washington St. & Gilbert St.



Scale ½" = 2,000 vehicles

ACCIDENT SUMMARY

Intersection
of
Washington Street and Gilbert Street

TIME OF DAY	NO. OF ACCIDENTS 1967	1968	1969
6 A.M.-10 A.M.	1		1
0 A.M.- 4 P.M.	3	4	3
4 P.M.- 7 P.M.	5	5	1
7 P.M.-12 Mid.	1		3
12 Mid.- 6 A.M.			
TOTAL	10	9	8

DIRECTION OF APPROACH	NO. OF VEHICLES 1967	1968	1969
North	3	6	4
South	7	3	3
East	3	3	4
West	7	6	5
TOTAL	20	18	16

WEATHER	NO. OF ACCIDENTS 1967	1968	1969
Clear	1	8	7
Fog			
Rain	9		1
Sleet			
Snow		1	
TOTAL	10	9	8

ACCIDENT TYPE	NO. OF ACCIDENTS 1967	1968	1969
Sideswipe			
Rear End			
Right Angle	9	8	6
Left Turn	1	1	1
Pedestrian			1
Other			
TOTAL	10	9	8

PAVEMENT	NO. OF ACCIDENTS 1967	1968	1969
Dry	1	6	4
Icy		1	1
Wet	9	2	3
TOTAL	10	9	8

ACCIDENT SEVERITY	NO. OF ACCIDENTS 1967	1968	1969
Fatal Injury			
Non-fatal Injury	1	1	1
Property Damage Only	9	8	7
TOTAL	10	9	8

TIME OF YEAR	NO. OF ACCIDENTS 1967	1968	1969
Winter (Dec.-Feb.)	4	2	2
Spring (Mar.-May)	3	5	2
Summer (June-Aug.)		1	1
Fall (Sep.-Nov.)	3	1	3
TOTAL	10	9	8

TYPE OF VEHICLE	NO. OF VEHICLES 1967	1968	1969
Passenger Cars	20	16	16
Commercial Vehicles		1	
Motorcycle		1	
TOTAL	20	18	16