A DESCRIPTIVE STUDY OF SENIOR DRIVER ACCIDENT RECORDS IN THE STATE OF MICHIGAN BY AGE GROUP, SEX, URBAN AND RURAL RESIDENCY

By

Gary James Bloomfield

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ABSTRACT

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Statement of the Problem

In the past, the proportion of senior drivers to the total driving population has been relatively small and very little concern was expressed in regard to the driving problems of this age group. However, this situation has changed substantially. Today the senior driver is an important part of our driving population. The senior driver is a significant factor in the total traffic accident picture, for his numbers have been expanding each year and it is predicted that this growth among senior drivers can be expected to continue.

Driving is often the only means by which the senior citizen can obtain meaningful and interesting activities. Due to lack of convenient transportation, the senior citizen population needs to drive not only for diversified interests but for basic necessities in living. The senior

citizen population needs to drive if they are to reach shopping centers, attend church, receive medical attention, and participate in community activities. Thus, there was a need to acknowledge this age group as an important part of our driving population and to become acquainted with the driving accident problems brought about by advancing years.

Because of the importance of understanding more about this segment of the driving population, it was the purpose of this study to determine whether senior drivers' accident records differed when categorized by age group, sex, urban and rural residency.

Description of the Methods, Technique, and Data Used

The population from which the sample for this study was selected consisted of those senior drivers whose names and driving records were recorded in the Michigan Department of State, Driver and Vehicle Services. All driving records were in alphabetical order on 100 computer reels accounting for 5,000,000 drivers. One reel, from which to secure a sample of senior drivers, was randomly selected. There was no reason to believe that the driving performances or the proportion of senior drivers was any different as each reel was a cluster of heterogeneous drivers in the state of Michigan.

A computer readout sheet was obtained containing 3,340 driving records on each senior driver's residency,

sex, age and accident record. Only those senior driver records indicating an accident involvement were used in final analysis. Each senior driver's age at the time of the accident was determined and those who had an accident at age 65 years or above were recorded in the age group the accident occurred. Urban and rural residency was determined according to zip code of the senior driver's address and the United States Bureau of Census.

The study programmed questions in order to derive data pertaining to the following: senior drivers involved in accidents, cited and non-cited accidents among senior drivers, violation factors among senior drivers, under the influence of alcohol in senior driver accidents, number of vehicles in senior driver accidents, fatalities in senior driver accidents and season in which senior driver accidents occurred.

The Major Findings

1. Michigan senior drivers had a higher accident rate than the national senior driver rate.

2. Senior drivers between the ages of 65-69, who were males and living in an urban area were more likely to be involved in an accident.

3. Senior drivers were more likely to have only one accident during a five year age period.

4. The majority of senior drivers when involved in an accident were cited as being at fault.

5. The majority of senior driver accidents involved a fatality. This fatality involvement increased when senior drivers were cited as being at fault.

6. The majority of senior drivers were cited as being at fault for "failed to yield the right of way" and "failed to stop in the assured clear distance ahead."

7. Cited for being under the influence of alcohol was not a major contributing factor in accidents among senior drivers.

8. Senior drivers used their automobiles throughout the year, as accidents were apparent for all seasons.

ACKNOWLEDGMENTS

To Dr. Robert O. Nolan, my sincere appreciation who as my major advisor and chairman of my guidance committee, provided counsel throughout my graduate program and all phases of this study.

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CHAPTER I

THE PROBLEM

In the past, the proportion of senior drivers to the total driving population has been relatively small and very little concern was expressed in regard to the driving problems of this age group. However, this situation has changed substantially. Today the senior driver is an important part of our driving population. The senior driver is a significant factor in the total traffic accident picture and in the future he will increasingly become a more important factor. His numbers have been expanding each year and it is predicted that this growth among senior drivers can be expected to continue.

United States Senior Citizen Population Growth

The number of persons 65 years of age and older has increased rapidly in the past several decades. The United States census figures show that in 1940 there were 9,000,000 (million) persons 65 years of age and older.[1] In 1960 this age group had increased to 16,207,000 (million)

[1]United States Department of Commerce, Population Estimates (Washington, December, 1967), p. 6.

persons or 9.1 per cent of the American population.[2] The census figures based on 1966 Population Estimates, indicated that the age group, 65 years of age and older, represented 9.4 per cent of the American population or approximately 18,500,000 (million) persons.[3] These figures reflect an average annual increase of 365,384 (thousand) persons 65 years of age and older. Thus this age group has doubled in 26 years (1940-1966).

Continued substantial increases in the population 65 years of age and older have been indicated by the United States Population Estimates. For 1970, it is estimated that those who are 65 years of age and older will number approximately 19,600,000 (million) persons or 9.6 per cent of the American population. Projections further estimate that in 1980 those who are 65 years of age and older will mount to 23,000,000 (million) persons or 10.2 per cent of the American population. Not until 1990 when the senior citizen population has reached 27,000,000 (million) persons or 10.6 per cent of the American population will the decline in births that occurred during the 1920's and 1930's begin to affect

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[2]United States Department of Commerce, 1960 Census of Population (Washington, 1960), pp. 1-153.

[3]United States Department of Commerce (December, 1967), p. 6.

the size of this age group.[4] Estimated figures reflect an average annual increase of 340,000 (thousand) persons 65 years of age and older for the next ten years (1970-1980). Further projection of these figures indicates that an average annual increase of 400,000 (thousand) persons 65 years of age and older will occur during the years 1980-1990.

Figure 1 shows graphically the population growth rate of the United States as well as the growth rate of the senior citizen population since the year 1940. From 1940 to 1960 the rate of growth was based upon United States Census figures. Increases in growth rates from 1970 to 1990 were based on projected estimates of population census. Between 1940 and 1970 the total United States population had increased 119 per cent while the United States senior citizen population had increased 58 per cent.

Michigan Senior Citizen Population Growth

The state of Michigan has experienced a substantial growth in senior citizen population. In 1950, the senior citizen population represented 7.2 per cent of the state's population or approximately 456,115 (thousand) persons. The senior citizen population grew to 638,184 (thousand)

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[4] Ibid.

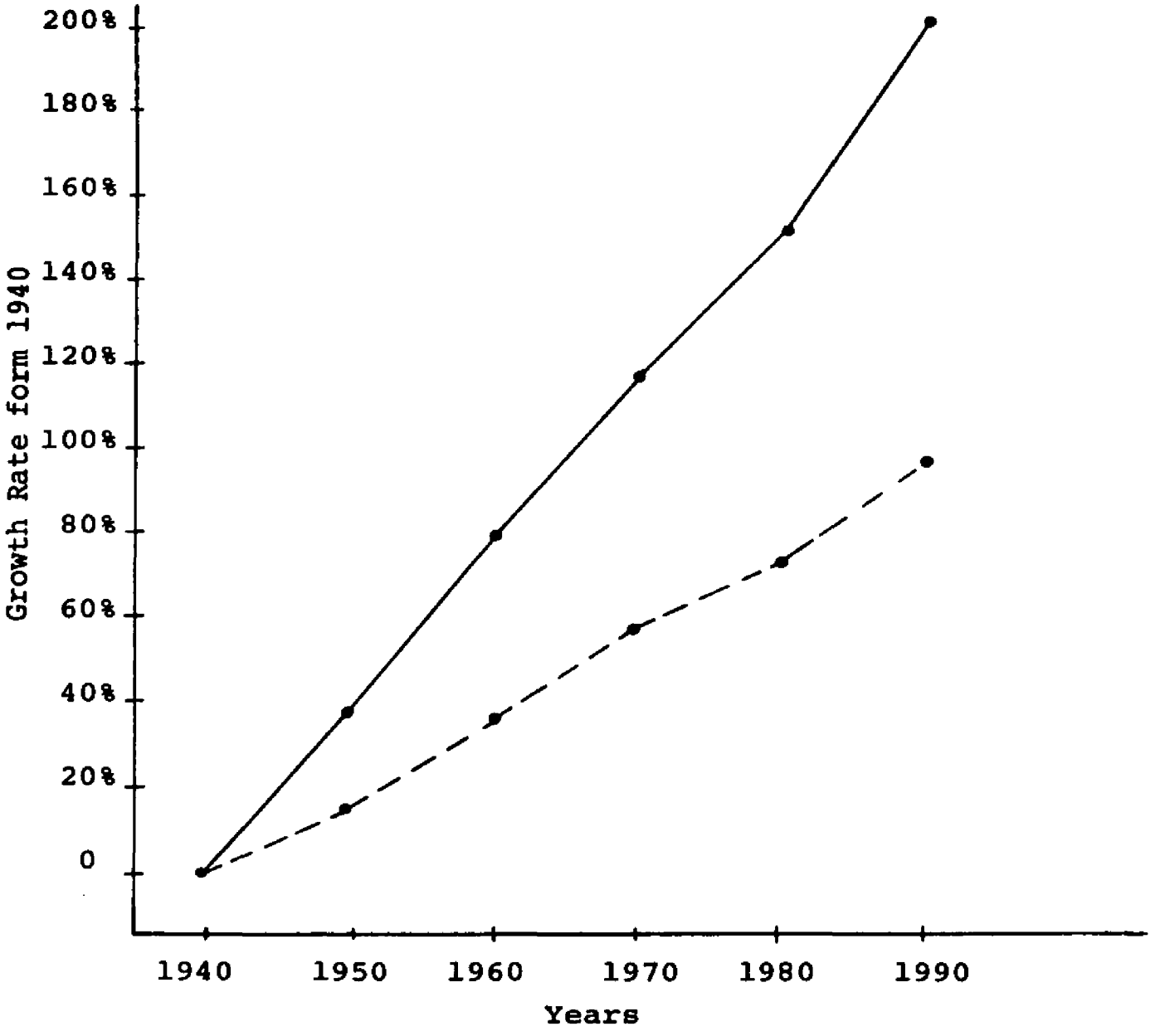

Figure 1.--United States population growth from 1940.

Key: Total U. S. population = ———
65 years and older population = ----

persons in 1960, which represented 8.2 per cent of the Michigan population.[5] This represents an increase of 169,733 (thousand) persons 65 years of age and older from 1950 to 1960.

Continued increases in the Michigan population 65 years of age and older were indicated by the Population Estimates.[6] For 1970, the senior citizen population was projected to be approximately 759,000 (thousand) persons, or 8.9 per cent of the Michigan population. Projecting further, it is estimated that by 1980 those who are 65 years of age and older will include approximately 899,000 (thousand) persons or 9.5 per cent of the Michigan population. For 1985, the state's senior citizen population will be approximately 989,000 (thousand) persons or 9.9 per cent of the Michigan population. These figures clearly denote the significant growth of Michigan's senior citizen population.

Figure 2 shows graphically the population growth rate for the total Michigan population as well as the Michigan senior citizen population growth since the year 1940. From 1940 to 1960, the rate at which Michigan's population increased, was based upon United States Census figures. Increases in population growth rates from 1970

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[5]United States Department of Commerce, 1960 Census of Population Michigan (Washington, 1960), p. 24.

[6]United States Department of Commerce, Population Estimates (Washington, October, 1967), p. 6.

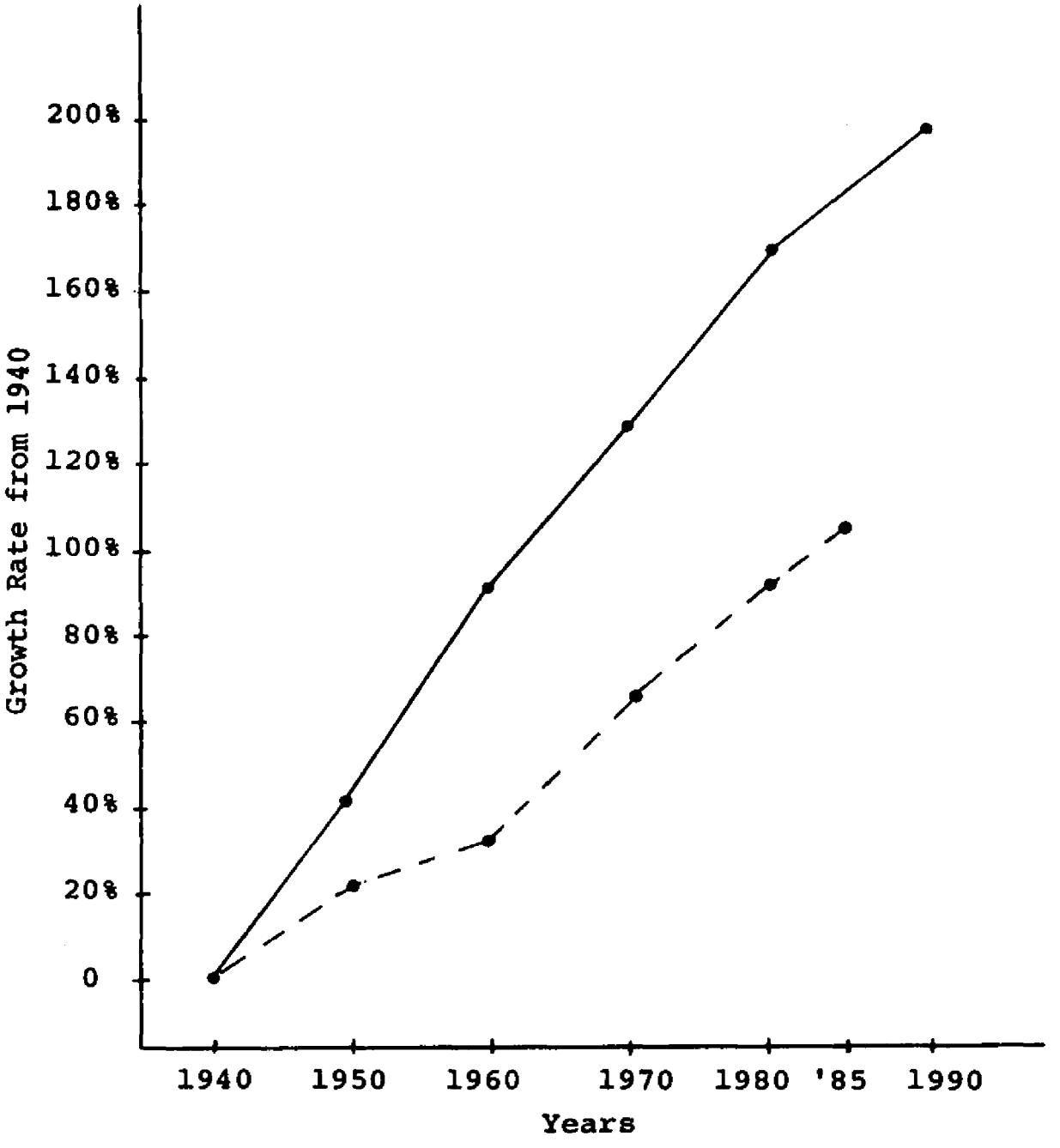

Figure 2.--Michigan population growth form 1940.

Key: Total Michigan population = ———
65 years and older population = ----

to 1990 were based upon projected estimates of population growth. Between 1940 and 1970 the total state of Michigan population had increased 129 per cent while the Michigan senior citizen population had increased 60 per cent.

A major factor in the increase of the senior citizen population can be attributed to the outstanding reductions in death from infectious diseases. As a result, life expectancy has increased. The average life expectancy at birth has increased from 47.3 years in 1900 to 70.2 years in 1965.[7]

Senior Driver Population Growth

As the senior citizen population increased so did the senior driving population. Figure 3 shows graphically the increase in percentage rate of senior drivers to all drivers in the United States beginning in the year 1940. Between 1940 and 1959 the percentage of drivers in the United States age 65 years and older was estimated to have increased from 3 per cent to about 6.8 per cent of the driving population.[8] From 1959 to 1968 the percentage of drivers in the United States age 65 years and older was estimated to have increased from 6.8 per cent to 8.5 per

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[7]Luman H. Long, ed., World Almanac and Book of Facts 1969 (Cleveland, 1969), p. 763.

[8]Burton W. Marsh, "Aging and Driving," Traffic Engineering, XXXI (November, 1960), 12.

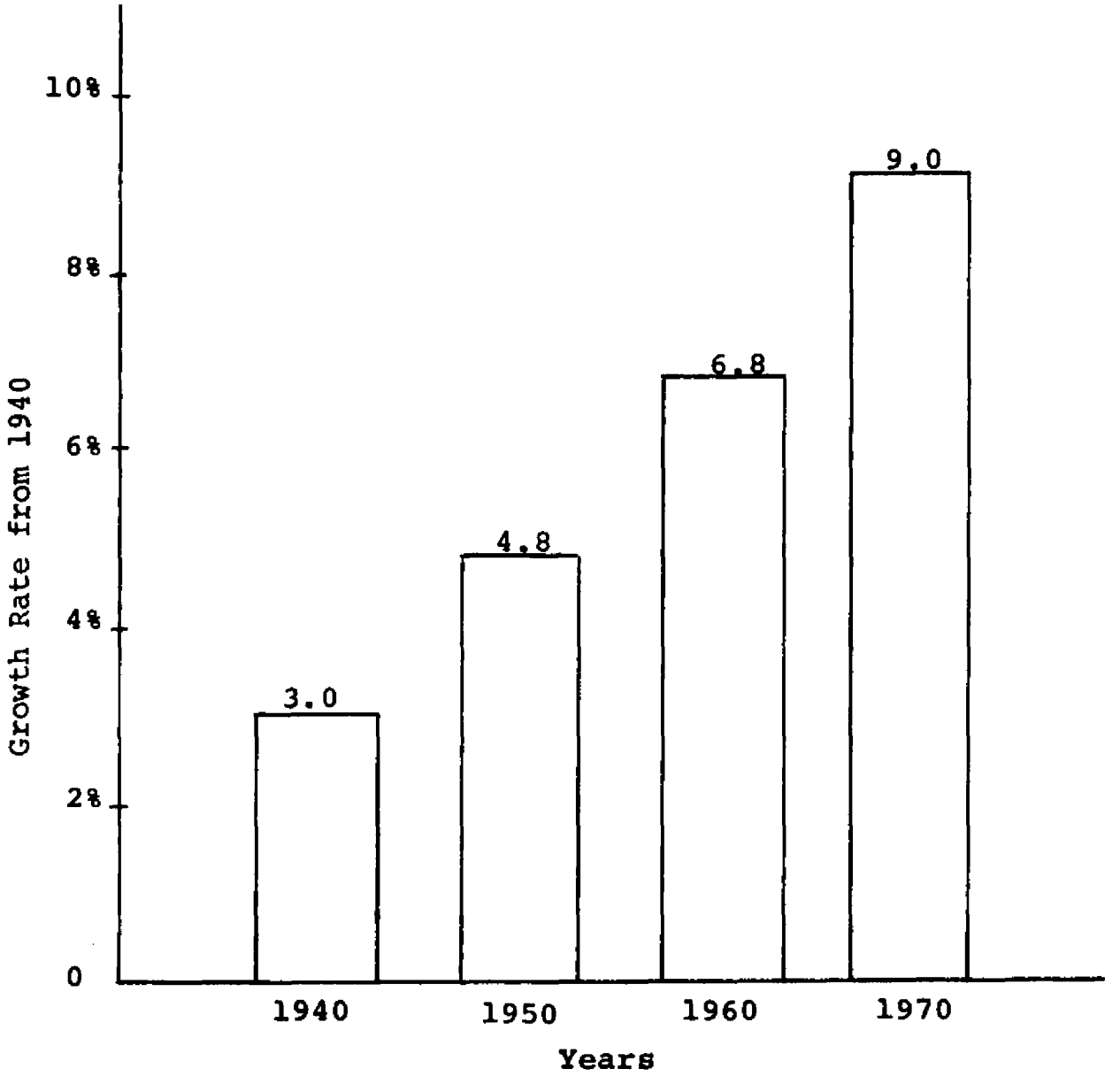

Figure 3.--Per cent of drivers 65 years of age and older per all drivers in the United States.

cent of the driving population.[9] The number of senior drivers was estimated at 1.36 million in 1940. In 1959 the number of senior drivers had increased to an estimated 5.71 million.[10] The number of senior drivers has increased steadily and by 1968, the senior driving population included an estimated 8.9 million persons.[11]

The percentage of senior drivers in proportion to the total driving population in the state of Michigan was not recorded until 1966. In that year the percentage of drivers in the state 65 years of age and older was estimated to be 7.0 per cent of the Michigan driving population.[12] Data indicates that the senior driving population has increased each year with the latest estimate being 1968 which revealed 522,500 (thousand) senior drivers who comprised 9.5 per cent of the total Michigan driving population.[13]

Factors Related to the Senior Driver Population

A factor relating to the anticipated growth in numbers of senior drivers has been the relationship of the

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[9]National Safety Council, Accident Facts 1969 (Chicago, 1969), p. 54.

[10]Marsh, p. 12.

[11]National Safety Council, p. 54.

[12]Department of State Police, Michigan Traffic Accident Facts 1966 (Lansing, 1966), p. 8.

[13]Department of State Police, Michigan Traffic Accident Facts 1968 (Lansing, 1968), p. 16.

automobile age to the population. During the 1920's the number of motor vehicles and drivers began to increase greatly. Many of the drivers who were then in their late teens and early twenties are now 65 years of age and older. Increased desire on behalf of the senior driving population to continue to drive past age 65 accounts for increased numbers of registrations among this age group. To many senior citizens, driving has been the link to interesting and purposeful activities of life. With the great and growing dispersion to places of residence in suburban areas, the senior driver has needed to drive.

Additional factors include a greater number of persons who enjoy improved health during their senior years, and an increasing number of women drivers who have reached 65 years of age.

With the advent of a shorter work week and the adoption of better retirement plans and attendant benefits, more retirements at age 65 have resulted. Driving has become a popular use of leisure time. In the past it was economically impossible for many senior citizens to continue to drive. Improved economic status among many who reach 65 years of age now permits vehicle ownership whereas once it was a luxury.

Our American automobiles are now more dependable and with the advent of power steering and power brakes, are mechanically easier to operate. In addition, the

convenience and availability of better roads and service facilities have made driving more attractive to the senior driver.

In the years to come there will continue to be a large number of senior citizens who will continue to drive through their later years. No longer is the senior driver an insignificant part of our total driving population.

Driver Licensing Factors Related to Senior Drivers

The anticipated increase of senior drivers in the United States population has presented a problem to licensing authorities and other persons in the field. These people are faced with the responsibility of recommending an age at which a person should or should not be permitted to retain his driving license.

In some states it is mandatory that drivers who reach a certain age level be retested in order to renew their operator's license even though they may never have been identified as problem drivers. Maryland[14] is currently a state which may deny an applicant a license solely upon the basis of age. In that state, any driver who has reached 70 years of age and wishes to have his license renewed must provide proof of prior satisfactory operation of a vehicle or present a certificate from a

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[14]John A. Dimling, Driver Licensing and Performance Vol. II, Survey of State Practices (Washington, 1968), pp. 3-4.

physician indicating that the applicant is in satisfactory physical and mental condition in addition to his being retested.

Ten other states presently have formal provisions for retesting drivers selected on the basis of age. Indiana, Maine, and New Hampshire require drivers attaining age 75 to submit to retesting. Nevada, Delaware, Arizona, and the District of Columbia retest drivers attaining age 65.[15] Illinois retests those drivers over 69 years of age. Alaska and Rhode Island require drivers reaching 70 years of age to undergo retesting.[16]

Most states have instructed their driver license examiners to request drivers, who appear to be losing skill because of age to take specific tests before their license can be renewed. In these states the selection for such retesting is at the discretion of the examining staff.

Michigan currently operates under such a plan. There have been bills presented to the Michigan legislature requiring proof of a physical examination by a physician at a specific age (65-70) but none have been passed. Currently, the Secretary of State's office,

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[15]"The Senior Driver" (editorial), Traffic Digest and Review, XIII (March, 1965), 3.

[16]Dimling, pp. 3-4.

Driver License Department, has received federal money to establish a Medical Advisory Board consisting of five doctors from five different disciplines (medical doctor, opthamologist, optometrist, psychologist, gerontologist). An applicant applying for a renewal driver's license may be referred by the examiner to his family physician. The Board will decide whether an applicant is unfit to drive an automobile based upon the prognosis from the family physician. However, the Medical Advisory Board is still at the planning stage and has yet to be approved by the Michigan Legislature.

A test for visual acuity and peripheral vision is currently given to all renewal applicants regardless of age. The increased number of senior drivers and special problems relating thereto, as well as inconsistencies in the driver licensing process have caused confusion and concern among driver licensing authorities.

Other Factors Related to Senior Drivers

For numerous senior drivers the difficulty in obtaining adequate automobile insurance coverage at prices which they can afford is a problem. Automobile insurance rates among senior drivers can be a real financial burden. Insurance companies have been noted to raise the insurance rate because a driver has reached a certain age regardless of his driving record or have dropped a senior driver from the company for no reason other than age. Many insurance

companies have refused to accept new automobile insurance business from persons 65 years of age. Obtaining automobile insurance for the senior driver becomes even more complex due to the inconsistency of automobile insurance coverage and rates in each state.

Satisfactory adjustment to growing old is for many, very difficult. A basic need for humans is to have a sense of personal worth and to feel needed. Yet, many senior citizens no longer have a regular job nor the responsibility for the caring of loved ones in the home.

The report of The White House Conference on Aging brought out that, as with people of all ages, the senior citizen wants the right to be useful and to live with dignity through satisfying, worthwhile physical and mental activities, employment, voluntary service and creative activities which develop and keep mental resources. The senior citizen including the retiree group, want to remain a part of the community and not become isolated from contacts with people of other ages.[17]

The Problem

Statement of the Problem

Driving is often the only means by which the senior citizen can obtain meaningful and interesting activities.

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[17]United States Department of Health, Education, and Welfare, The Nation and Its Older People (Washington, 1961).

Furthermore, the senior citizen needs to drive not only for diversified interests but for basic necessities in living. Due to lack of convenient transportation, the senior citizen population needs to drive if they are to reach shopping centers, attend church, receive medical attention, and participate in community activities. Thus, there is a need to acknowledge this age group as an important part of our driving population and to become acquainted with the driving accident problems brought about by advancing years.

Purpose and Objectives of the Problem

Because of the importance of understanding more about this segment of the driving population, it was the purpose of this study to determine whether senior drivers' accident records differed when categorized by age group, sex, urban and rural residency.

It was proposed that meaningful data could be obtained by using the following specific questions as a guide to investigate this problem:

1. Does the per cent of senior drivers involved in one accident and two or more accidents differ when categorized by age group, sex, urban and rural residency?

2. Does the per cent of accidents, cited and non-cited, among senior drivers differ when categorized by age group, sex, urban and rural residency?

3. Do the violation factors in cited accidents among senior drivers differ when categorized by age group, sex, urban and rural residency?

4. Does under the influence of alcohol become a factor in accidents among senior drivers when categorized by age group, sex, urban and rural residency?

5. Does the per cent of accidents, cited and non-cited, among senior drivers involving one vehicle and two or more vehicles differ when categorized by age group, sex, urban and rural residency?

6. Do the violation factors in senior driver accidents involving one vehicle and two or more vehicles differ when categorized by age group, sex, urban and rural residency?

7. Does the per cent of fatalities in accidents, cited and non-cited, among senior drivers differ when categorized by age group, sex, urban and rural residency?

8. Do the violation factors in senior driver accidents involving fatalities differ when categorized by age group, sex, urban and rural residency?

9. Does the per cent of senior driver accidents, cited and non-cited, by season differ when categorized by age group, sex, urban and rural residency?

Importance of the Problem

Attention needs to be given to the senior driver, for mobility and safe driving are important to this age group. To date no state-wide study has been done which concerns itself solely with the senior age group of drivers. Therefore, this investigation using accident records among senior drivers could make a significant contribution to the field of traffic safety in the following manner:

1. The Federal Highway Safety Program Standard 4.4.4[18] calls for a program of adult driver training and retraining. This study could assist in the identification of those age groups within the Michigan senior driving population that are having accident problems. It will further assist in identifying those violation factors which are predominant among each group in urban and rural areas. Certainly this type of information could be beneficial in structuring a re-education curriculum.

2. Driver licensing officials will have a better understanding of the senior citizen driver with respect to the implications for driver licensing procedures. It could assist those persons with the responsibility for recommending an age requirement for re-examination. The study may further assist the driver improvement program in identifying those violation factors which are predominant among the senior driver age group in urban and rural areas.

3. The findings of this study could serve as a source of information to insurance companies in alleviating the confusion and inconsistency of senior driver insurance rates.

4. The senior driver, himself could better evaluate his driving performance by being informed of the

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[18]United States Department of Transportation, Highway Safety Program Standards (Washington, 1967).

difficulties present within his age group, sex, and urban and rural residency.

Definition of Terms

Senior Citizen

A person whose age is 65 years or older and resides in the state of Michigan.

Senior Driver

A person whose age is 65 years or older and holds a valid Michigan driver's license as of 1969.

Senior Citizen Population

Those persons whose ages are 65 years or older and reside in the state of Michigan.

Senior Driver Age Group

Those senior drivers whose ages fall within one of the following groups: 65-69, 70-74, 75-79, 80-84, 85-89, 90-94, 95-99.

Urban Residency

An area which contains at least one city of 50,000 persons or more in 1970, as well as the surrounding closely settled incorporated places and unincorporated areas.[19] This area does not include an entire county in Michigan.

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[19]United States Department of Commerce, 1960 Census of Population, p. xxvi.

Rural Residency

An area which has a city of less than 50,000 persons in 1970. This area may include an entire county in Michigan.

Violation Factors

Those factors listed on the accident record indicating a charged driving offense as recorded by the investigating law enforcement officer. A charged driving offense is not a court conviction. This information was not available due to judicial delays.

Cited Accident

The accident record indicated the driver had been charged and ticketed for a violation in connection with an accident.

Non-cited Accident

The accident record indicated the driver was involved in the accident but not charged with a violation.

Limitations of the Study

The study was limited in the following manner:

The driving records in the state of Michigan were kept on file for a period of only six years. Therefore, it was not possible to obtain the entire accident record back to age 65 years of those senior drivers in the older age groups. For this reason each group and the computed

percentages were treated as separate entities in so far as age, sex and urban and rural residencies were concerned.

Organization of the Remaining Chapters

Chapter II contains a detailed review of the literature on the senior driver. Chapter III describes the sampling methods, procedures carried out and analysis techniques used. Chapter IV gives a descriptive analysis of the senior drivers' accident records by age group, sex, and urban and rural residency derived from a computer readout sheet of driving records. Chapter V presents the summary, conclusions and recommendations.

CHAPTER II

REVIEW OF THE LITERATURE ON THE SENIOR DRIVER

Introduction

It was indicated in Chapter I that the senior driver now represents a significant part of our driving population and will continue to do so for years to come. This chapter will present a review of the literature concerned with the senior driver as related to this study.

Michigan Senior Citizen Residency

It was interesting to note the population density of senior citizens throughout the state of Michigan and projected figures for the future. The most significant increases occurred in the metropolitan counties. In 1965 almost one-half of the total population 65 years of age and older (344,406) was contained in only four of Michigan's counties. They included Genessee, Macomb, Oakland, and Wayne.[20]

For 1970, it was projected that over one-half of the senior citizen population (377,307) will live in these

[20]University of Michigan and Wayne State University, Institute of Gerontology, Michigan Facts on Aging, Report No. 2 (Ann Arbor, 1967).

same counties. Thirteen of the smaller counties housed one-quarter of the total senior citizen population, while the remaining quarter were scattered throughout the other 66 counties (see Figure 4 and Table 1).[21]

TABLE 1.--Distribution of Michigan's senior citizen population by area.

Item	1965	Per Cent of Sr. Pop.	1970	Per Cent of Sr. Pop.
Upper Peninsula	34,556	5.00	34,478	4.63
Lower Peninsula Northern Part (30 counties)	48,436	7.01	48,798	6.56
Lower Peninsula Southern Part (34 counties)	272,702	39.51	283,285	38.08
Detroit Area (4 counties)	334,406	48.45	377,307	50.72
Total Population Senior Citizens	690,100	99.97	743,868	99.99

Age in Relation to Miles Driven

The increased percentage of senior drivers among the driving population not only paralleled the growth of the senior citizen population but remained consistent with the fact that more people are reaching age 65 and have grown

[21]University of Michigan and Wayne State University.

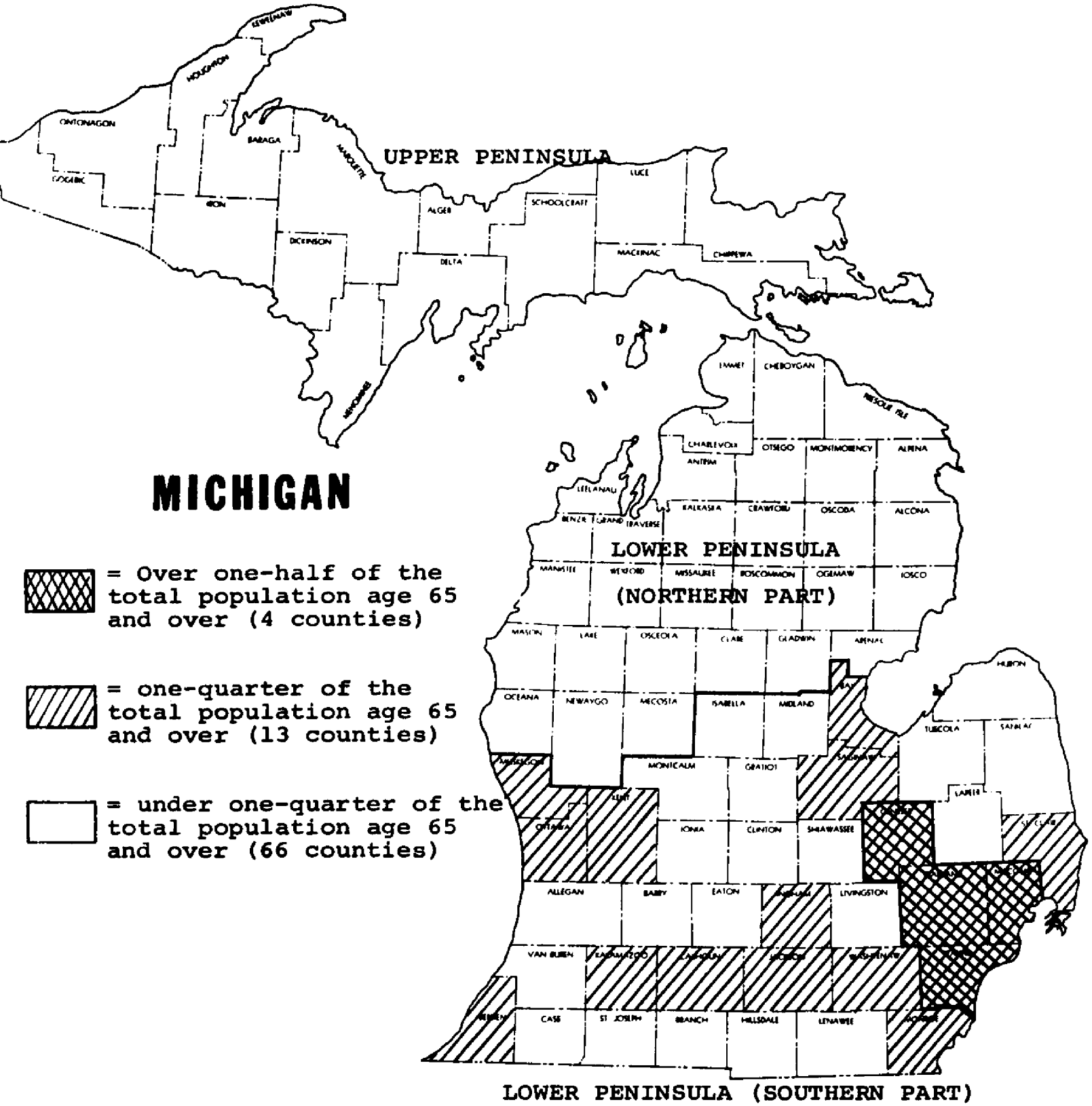

Figure 4.--Distribution of Michigan's Senior Citizen population projected for 1970.

up in a society in which the automobile has become an integral part.

A study by Beadenkopf, et al. brought out that the impact of the increase in the absolute number of drivers in older groups seemed dampened somewhat by the decline in exposure shown by these groups. Male drivers started to exhibit a decline in the number of miles driven at the age of 55. This decline, while sharp from the ages 55 to 65, was even more so from the ages 65 to 75.[22] The median mileage per year in the 50 to 59 age group was approximately 12,000 miles, in the 60 to 69 age group the median was 10,000 miles and in the 70 to 89 age group it was 3,500 miles. Other reports[23] indicated the same drop in mileage and change in exposure characterized by a decrease in per cent of travel on main rural roads and in nighttime travel.

National figures[24] showed the ratio of male to female senior drivers increased substantially within the 65 and over age group. The difference became even more marked as age increased, indicating a more rapid tapering

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[22]W. G. Beadenkopf, et al., "An Epidemiological Approach to Traffic Accidents," Public Health Reports, Vol. 71, No. 1 (1956), 15-24.

[23]American Automobile Association, Age, Exposure and Accidents (Washington, 1964).

[24]United States Department of Commerce, Driver's Licenses 1965 (Washington, 1965).

off of driving behavior among females in spite of their longer life expectancy.[25] Males represented 70 per cent of the driving population 70 years of age and older.

Aging and Disease

Studies recognized that chronological age was not a sound criteria for appraising driving competence. Age in respect to driving is a multidimensional variable, and functional age is a far better evaluation. Unfortunately, no suitable criteria seems to exist for determining functional age. Birren[26] held that human chronological age represented different points on a young-old continuum where biological, psychological, and sociological viewpoints must be considered somewhat independently. In each of these areas the individual "ages" at a different rate and according to a characteristic pattern.

The Committee on Aging of the American Medical Association[27] concluded that no disease entity or physical or mental condition resulted from or was related to the passage of time. Arteriosclerotic heart disease, high blood pressure, arthritis and cancer are found in the

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[25]United States Department of Transportation, Drivers' Licenses 1966 (Washington, 1966).

[26]J. E. Birren, "Research on the Psychological Aspects of Aging," Geriatrics, XVIII (1963), 393-403.

[27]Fredrick C. Swartz, "Aging 1968," Michigan Medicine, Vol. 67, No. 9 (1968), 591-596.

youngster; measles, mumps, chicken pox and poliomyelitis are found in the oldster.

More often it was indicated that the degenerative diseases of man resulted from the impact of environment. In laboratory studies, diseases were found to occur in animals exposed to hunger, extremes of temperature, lack of oxygen, infections, loss of blood or fear with little relationship to the age of the animal. In other laboratory studies the environment was regulated in the direction of protection for the individual from the effects of environment and the members lived for an unbelievably long time.

Chronic illnesses and long term care cases resulted from the recurring and irritating effects of environment and not the passage of time. Continuing with this concept but not really coming under effects of environment were the pot belly and flabby muscles which resulted from the lack of exercise, the loss of habits of study and forgetfulness that comes when the mind was not used, and the painful knees and flat feet that come from long-time pounding by too much weight.[28]

While the age of 65 years was strictly an arbitrary point in terms of chronological age and the human organism's environment, it seemed an adequate choice. At the age of 65 years, retirement began, income usually

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[28]Swartz, p. 594.

decreased, social security benefits became available and affiliations began to change. These external factors caused, in turn, internal changes in the human organism. It is believed that some of the external changes forced upon an individual reaching 65 years are instrumental in producing characteristic differences attributed to those over 65 years of age. It is also believed that these external changes contribute to some of the accidental producing situations in which people over 65 years find themselves.[29] In much of the literature reviewed, chronological age was used as a matter of convenience for the research criteria; in accordance with many of the age-oriented papers relating to aging studied, the group 65 years of age and older was used in this study. Working within this framework, the statistics and information gathered in the study will be discussed in terms of the population 65 years of age and over.

Accident Involvement

Nationwide in 1968, motor vehicle accidents killed 7,477 persons 65 years of age and older for a death rate of 41.8 per 100,000 population. This rate was higher than for all other age groups, except the 15-24 year old age group. Motor vehicle accidents ranked first among

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[29]National Safety Council, An Investigation of the Problems and Opinions of Aged Drivers (Chicago, 1968), pp. 2-3.

all accidental deaths for the 65-74 year old age group and second for the 75 year old and older age group.[30]

Most traffic accident figures were not corrected for miles driven. If this was accomplished, the senior driver age group might have a poorer traffic accident record than that which seemed apparent.

A study by the National Safety Council (1969),[31] in which they reported on data received from 23 states found drivers over the age of 65 were involved in only 5.7 per cent of all traffic accidents. The study further stated that when averages for each age group of senior drivers were compiled, 17 senior drivers per 100 drivers were involved in a traffic accident, while all age groups, 15-75 years and above were found to have an average rate of 25 drivers involved in a traffic accident.

One might conclude that senior drivers are safer drivers when compared to other age groups. This could lead to a false assumption. National Safety Council study data was based on the number of drivers. Perhaps a better measure would be to know such things as the number of miles driven by senior drivers under varying conditions or the accessibility of automobiles to the senior driver in relation to the number of accidents.

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[30]National Safety Council, Accident Facts 1969 (Chicago, 1969), p. 8.

[31]Ibid., p. 54.

Judge Sherman G. Finesilver[32] in a study of 30 states and the District of Columbia collected information relative to the accident involvement of senior drivers and based on the percentage of the senior driving population over 65 years of age. The study indicated that in those states sampled senior drivers had less than their share of automobile accidents in proportion to their total number in the driving population. The study revealed that wherein senior drivers were involved in fatal accidents, certain problems associated with the driving task seemed to be reoccurring. It was interesting to note that of his findings on accident involvement for senior drivers in 31 jurisdictions, the state of Michigan placed twenty-third and that the senior driver in this state had the highest fatal accident involvement index of any age group.

Alfred Crancer's[33] study in the State of Washington also found the senior driver's involvement ratio in all accidents was lower than other age groups with a comparable sex distribution. However, the senior driver in Washington was involved in a higher percentage of fatal accidents than would be expected on the basis of his representation in the driving population.

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[32]Sherman G. Finesilver, The Older Driver, A Statistical Evaluation of Licensing and Accident Involvement in 30 States (Denver, 1969).

[33]Alfred Crancer, Involvement of the Problem Driver in Fatal Motor Vehicle Accidents, Research Report No. 002 (Olympia, 1967).

Evidence concerning the decrease or increase in rate of involvement in accidents varies according to what rates are used. Senior driver studies have also compared the senior driver age group with other age groups in relation to automobile accidents. Studies seemed to show a U-shaped relation between age and accident involvement. That is, there was a high accident frequency for the young driver and the senior driver. Solomon[34] in a large sample studied a series of accidents which occurred during a given period on 600 miles of different sections of main rural highways in eleven different states, and calculated accident involvement rates for different classes of individuals. He described accidents through detailed observation and documentation of a sample of drivers operating on the same roads. His study showed great variation in accident involvement rate as a function of age. Involvement rates of the under 25 year old age groups were approximately two times as high as the middle age groups. The older age group (over 65) also showed a higher involvement rate.

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[34]D. Solomon, Accidents on Main Rural Highways Relate to Speed, Driver and Vehicle (Washington, 1964).

With respect to age differences and accident rates, Solomon's findings were consistent with other studies by McFarland, Tune, Welford[35] and Baker.[36]

McFarland[37] refers to a study conducted in Germany (Munsch, 1966) where the comparison of age versus experience was possible due to a sufficiently large portion of the population not beginning to drive until older age. Munsch's study found accidents were more frequent during the first three years of driving experience regardless of the age at which driving was begun.

In a study conducted in France[38] correlation between age of the driver and the age of the license indicated the female group accounted for more new licenses at older ages and that the aged female new driver group had a poorer accident record than was expected.

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[35]R. A. McFarland, G. S. Tune and A. T. Welford, "On the Driving of Automobiles by Older People," Journal of Gerontology, Vol. 19 (April, 1964), 190-197.

[36]J. S. Baker, "Evaluating the Older Driver," Traffic Digest and Review (March, 1965), 23-25, 30.

[37]R. A. McFarland, "Psychological and Behavioral Aspects of Automobile Accidents," Traffic Safety Research Review, Vol. 12, No. 3 (September, 1968), 71-80.

[38]F. Leygue, P. Duflot and F. Hoffmann, "Investigation into the Influence on Accidents of the Driver, His Driving Experience and the Age and Power of the Vehicle," International Road Traffic Safety Review, Vol. 14, No. 1 (1966), 13-22.

When considering the involvement of the 65 year old and older age group in automobile accidents, an additional point should be made regarding their involvement in fatal accidents. In a study by Markush[39] data indicated that since 1900, the motor vehicle mortality rates for individuals 65 years and over were higher than for any other age group, when based on 100,000 population. Markush presented data for the period 1906 to 1964, and in every case the mortality rate for this group was much greater than for other groups despite a generally decreasing trend which began in 1945.

As numerous writers have already suggested, the fact that drivers of certain ages exhibited higher accident probabilities does not mean that age in itself was the direct causal factor, but rather that age was associated with other parameters which were more directly causal. The transition of traffic record keeping from manual to electronic data processing procedures has rendered detailed and specific comparisons of the type of accidents and violations associated with various age groups.

Recent tabulations suggest that the types of accidents in which senior drivers become involved, differ from the types of accidents associated with lower age

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[39]R. E. Markush, J. Clark, R. Leibel, C. Adams and B. Ryterband, "Motor Vehicle Accidents in the United States (1906-1964)," The Journal of the American Medical Association, Vol. 203, No. 2 (1968), 3-21.

groups. McFarland, et al. (1964) restated by McFarland[40] in regard to the type of accident by age, suggested that older drivers show an increasing degree of failure to perceive adequately or react quickly enough; they exhibited a gradual loss of ability to cope with the normal hazards presented by an increasingly demanding traffic environment.

In a National Safety Council study, Planele[41] reported the senior driver did not always perceive his driving problems at the appropriate level of importance in relation to accident occurrence. The senior driver's accident problems involved interaction with the traffic flow around him rather than his ability to maintain himself within the flow of his own lane. His chief problems seemed to emerge in the driving operations of changing lanes, turning, passing and backing. The senior driver was also prone to problems of inattention and was guilty of running stop signs and red traffic signals.

An early study on California drivers by Earl Allgaier,[42] found three driving faults to be more prevalent among senior drivers. These were failure to yield right of way, improper turning and disregard of

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[40]McFarland, et al., 190-197.

[41]National Safety Council, An Investigation, p. 3.

[42]Earl Allgaier, "Accident Involvement of Senior Drivers," Traffic Digest and Review (March, 1965).

signals. Other studies seemed to indicate the same areas (McFarland, Tune, Welford,[43] and Baker).[44]

In a University of California study,[45] on driving behavior it was reported that generally the senior driver age group showed behavior which was associated with cautiousness, slower speed, fewer speed changes and more and longer brake use.

Data from the Virginia Traffic Crash Facts[46] showed that for the age groups 65 years and over, the problem of not yielding the right of way exceeded the next most common fault, following too closely, by 100 per cent.

The senior driver tended to be involved in multiple vehicle accidents.[47] When they were involved in single vehicle accidents, the causes most often cited were drowsiness, faulty driving, adverse driving conditions, and medical problems.

The consequences of involvements also showed differences between ages. Senior drivers seemed to have less

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[43]McFarland, et al., 190-197.

[44]Baker, p. 30.

[45]University of California, Driving Ability as Affected by Age, Institute of Transportation and Traffic Engineering (September 30, 1968).

[46]Virginia State Police Department, Virginia Traffic Crash Facts, 1966 (Richmond, 1966, pp. 46-49.

[47]H. S. Penn, Causes and Characteristics of Single Car Accidents: Part I, Highway Research Record No. 79 (Washington, 1965), pp. 1-8.

serious accidents than younger drivers, although the picture was confused by the fact that older people took longer to recover from injuries and such injuries as they sustained were more likely to be fatal.[48] The overall indicator is the paradoxical one that senior drivers are cautious but nevertheless have a fairly high accident rate.

Summary

In this chapter a review of literature has been presented and considered to be relevant to this investigation concerning the senior driver. The senior citizen population has increased and trends indicate that this age group will continue to grow for years to come.

In the state of Michigan one-half of the senior citizen population resided in four of Michigan's 66 counties. They included Genessee, Macomb, Oakland, and Wayne. As the senior citizen population increased so did the driving population for this age group. More and more people who reached age 65 each year find themselves in a society in which the automobile has become an integral way of life. As a result there are more and more senior drivers. The increase in senior drivers was lessened somewhat by the indication that as one became older he began to drive less.

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[48] McFarland, et al., pp. 190-197.

Presently, male senior drivers out number female senior drivers and the difference becomes greater as age increases even though women generally outlive men.

For the most part, past studies dealing with the senior driver have used chronological age as a criteria, however, the literature reveals that environmental conditions affect age and in as much as age is a multidimensional variable, there is a need to look at more than one aspect of the problem.

Motor vehicle accidents ranked first among accidental deaths for the 65-74 year old age group and second for the 75 year old and older age group. Studies relative to the senior driver differed depending on what criteria were used. Some investigations showed that senior drivers had less than their share of automobile accidents in proportion to their percentage of the driving population. Other studies which compared the senior driver with other age groups, showed the senior driver to have a high accident involvement rate, second only to that of the younger driver. With respect to fatal accident involvement, the studies agreed that the senior driver had a higher rate of involvement. According to the literature it can be further concluded that the senior driver is a very cautious person and drives at a slower speed. Their driving faults seem to be in the area of yielding and turning.

CHAPTER III

PROCEDURE

Population and Sample

The population from which the sample for this study was selected, consisted of those senior drivers whose names and driving records were recorded in the Michigan Department of State, Driver and Vehicle Services (driver licensing file). All driving records were in alphabetical order on 100 computer reels, accounting for 5,000,000 (million) drivers. When the sample was determined, the Driver and Vehicle Services division was completing the final phase of placing all Michigan drivers on computer reels. In selecting one reel from which to secure a sample of senior drivers, there was no reason to believe that the driving performances or the proportion of senior drivers was any different for the sample computer reel selected or any other reel which might have been randomly selected from the total 100 reels.

The senior driver population was estimated to be 9.5 per cent of the total Michigan driving population.[49]

[49]Michigan Department of State, Michigan Driver Statistics Report No. 1, Driver and Vehicle Services, July 21, 1968.

It was determined that the senior driving population for Michigan would amount to 475,000 drivers or 9.5 per cent of 5,000,000 drivers. Each computer reel would contain approximately 4,750 senior drivers with expired and non-expired driver licenses.

To facilitate the study, each reel was considered a cluster of heterogeneous drivers in the state of Michigan. One reel, No. 43, was randomly selected to represent the driving population for the study.

Because of a busy time schedule followed by the Michigan Department of State and the constant use of Michigan driver records for official purposes, the programming and computer time was done at Michigan State University Computer Services. The selected reel, No. 43, from a Burroughs Computer, type 550,7 track, 800 density, was converted by the Department of State in order for it to be read at the Michigan State University Computer Center's IBM Computer, type 3600, 7 track, 556 density.

Distribution of the Sample

Michigan senior drivers numbering 4,280 on the selected heterogeneous reel were removed and put onto a separate reel. Licenses were considered expired if not renewed during 1968 and before. There were 924 senior driver records removed from the reel due to license expiration. Sixteen additional driving records were removed due to incomplete record data.

The total number of records used was 3,340. Three thousand and fifty-nine non-expired senior driving records were categorized by the computer as to zip code residency, sex, and age group to determine the representation of the sample for the state of Michigan. Two hundred and eighty-one additional non-expired records had no zip code and were recorded manually.

Table 2 presents the distribution of the 3,340 Michigan senior drivers used in this study. Each of the 3,340 senior drivers had a valid driver's license. The year 1969 was established as a reference base from which to determine the senior driver's age. Urban and rural residency was determined according to the zip code of the senior driver's address. The total number of male senior drivers outnumbered by almost two to one the female senior drivers. This closely conforms to the Michigan Department of State study on the distribution of Michigan drivers.[50]

Methods of Processing the Data

The 3,340 senior driver records were originally in alphabetical order by last name from the Department of State. The 3,340 records were then put in numerical order by zip code area with those records without zip

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[50]Michigan Department of State, Driver Statistics.

TABLE 2.--Distribution of 3,340 senior driver records.

Item	N Drivers	Per Cent of Drivers
Age Group		
65-69	1462	43.77
70-74	1011	30.27
75-79	609	18.23
80-84	207	6.19
85-89	48	1.44
90-94	2	.06
95-99	1	.03
TOTAL	3340	99.99
Sex		
Male	2207	66.07
Female	1133	33.92
TOTAL	3340	99.99
Residency		
Urban	1612	48.26
Rural	1728	51.73
TOTAL	3340	99.99

N = Number

codes recorded first, followed by the records with zip codes 48001 through 49999.

A computer readout sheet was obtained containing all 3,340 records on each senior driver's residency, sex, age, and accident record. Due to the fact that Michigan State University programmers had difficulty in interpreting a Burroughs tape on an IBM computer, further programming of the senior driver reel was unsuccessful.

All remaining data was derived manually from the computer readout sheet containing the 3,340 senior driver records.

Determining the Sample for Analysis

Only those senior driver records indicating an accident involvement were used. A total of 611 Michigan senior drivers with an accident record was read and recorded.

Table 3 presents the distribution of the 611 Michigan senior drivers who had an accident record at age 65 years or older. As previously stated, the year 1969 was used as a basis to determine the senior driver's age. Their previous driving record before age 65 was not considered. The total number of male senior drivers with an accident record outnumbered female senior drivers with an accident record. The table further shows an even distribution of urban senior drivers versus rural senior drivers.

TABLE 3.--Distribution of 611 senior drivers with an accident age 65 or older.

Item	N Drivers	Per Cent of Drivers
Age Group		
65-69	156	25.53
70-74	239	39.11
75-79	160	26.18
80-84	38	6.22
85-89	17	2.78
90-94	1	.16
95-99	0	0
TOTAL	611	99.98
Sex		
Male	470	76.92
Female	141	23.07
TOTAL	611	99.99
Residency		
Urban	314	51.39
Rural	297	48.60
TOTAL	611	99.99

N = Number

Age groups.--Ages were grouped at five year intervals beginning with age 65 years and ending with 99 years of age. Each senior driver's age at the time of the accident was determined and those who had an accident at age 65 years or older were recorded. The last two age groups were dropped from final analysis due to null data.

Sex.--Each driving record was recorded by male or female.

Urban and rural residency.--Residency was determined according to the zip code of the senior driver's address. Zip code areas were considered urban in the state of Michigan according to the 1960 United States Census[51] maps of urbanized areas and the United States Numerical List of Post Offices by Zip Codes.[52]

In order to determine zip code districts for the state of Michigan, it was necessary to chart the zip codes on a Michigan Highway Map. All zip code numbers have five digits and each digit signifies a location. For example, the zip code number 48823 with the digit 4 at the beginning of the zip code refers to a nation-wide area including Michigan, Ohio, Indiana and Kentucky. These states have zip codes which begin with a 4.

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[51]United States Department of Commerce, 1960 Census, pp. 24, 29, 34.

[52]United States Post Office, United States Numberical List of Post Offices by Zip Code, obtained from local Post Office.

The second digit, 8, refers to a particular state, in this case Michigan. Michigan also uses the number 9. Any zip code which begins with 48 or 49 pertains to only Michigan.

The third digit, 8, in combination with the first two digits (e.g., 488) refers to a postal district. By charting on a map, the cities with a 488 zip code it was possible to find the district's perimeter. This was done for all districts 480 through 499 as shown in Figure 5.

The last two digits, 23, as in our example, refer to a particular city. In this case 23 was East Lansing. This information was tabulated manually as a zip code district map was not available.

To further define urban areas, detailed maps were obtained from the Bureau of the Census. The maps showed cities and surrounding urbanized areas. These cities and areas were determined from the United States Post Office Numerical List by Zip Code and their zip code numbers were recorded. The darkened regions on Figure 5 show the approximate size and location of urban areas for the state of Michigan. The detailed maps from the Bureau of the Census are included in the Appendices.

Table 4 shows the distribution of senior drivers with an accident record by zip code area. The table shows a further breakdown of urban and rural senior drivers by zip code area. This reveals a good balance of urban

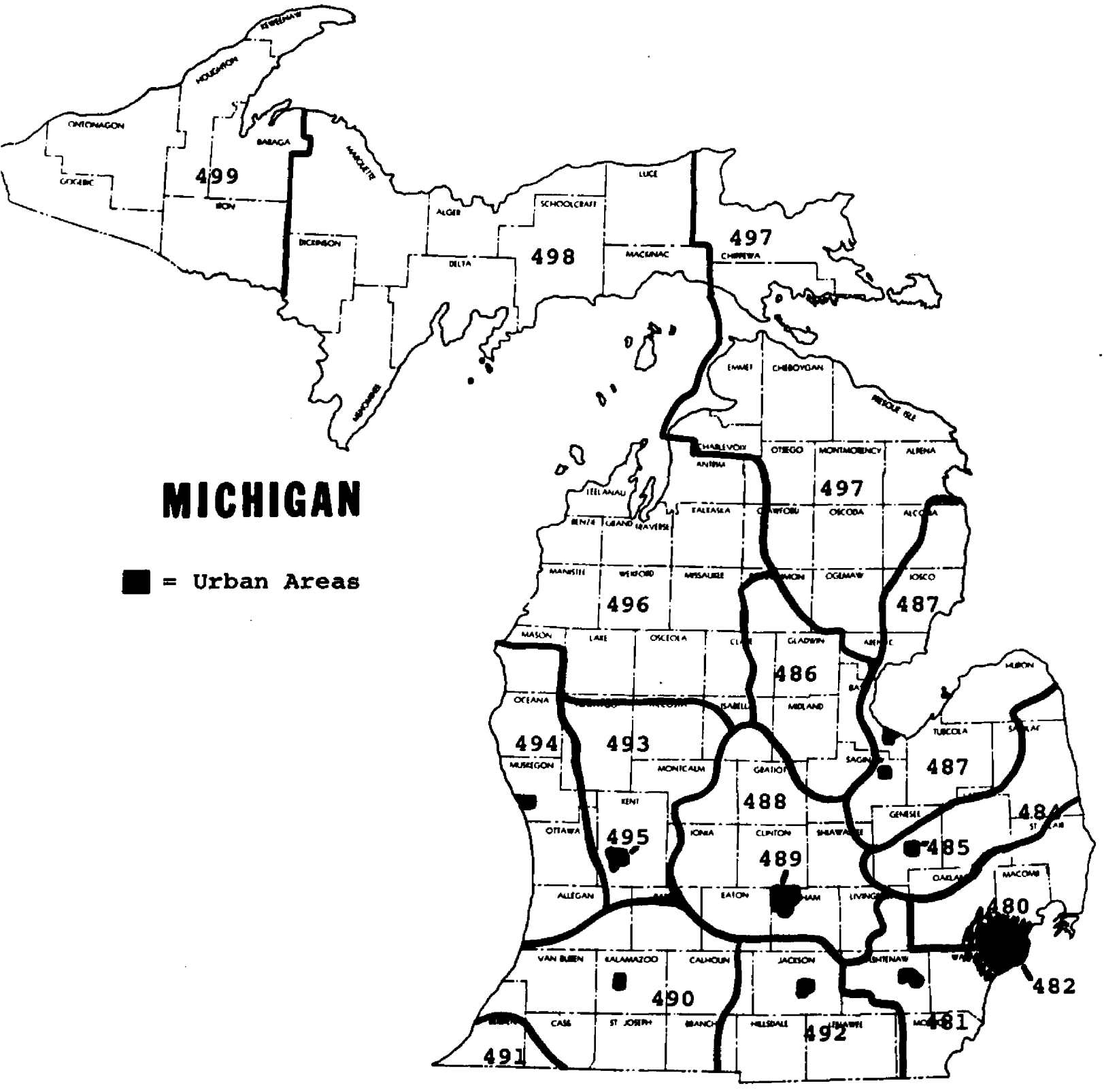

Figure 5.--Zip code districts in the State of Michigan.

TABLE 4.--Distribution of senior drivers with accident records by zip code.

Zip Code District	Total Drivers	Urban Drivers	Rural Drivers
480--	58	43	15
481--	65	51	14
482--	102	102	0
*483--	0	0	0
484--	11	1	10
485--	14	14	0
486--	8	3	5
487--	14	5	9
488--	37	3	34
489--	15	15	0
490--	67	12	55
491--	7	7	0
492--	22	9	13
493--	17	0	17
494--	54	28	26
495--	21	21	0
496--	21	0	21
497--	22	0	22
498--	45	0	45
499--	11	0	11
TOTAL	611	314	297

*Expansion number for Detroit

and rural drivers as well as a comparative number of drivers in relation to the population distribution. All zip code districts in the state of Michigan for both urban and rural areas were accounted for in the study.

Violation factors.--Those causal factors listed on the accident record indicating a cited or non-cited accident involvement as recorded by the investigating officer were used. The codes used in this study were derived from the Michigan Department of State and Michigan Department of State Police Traffic Records.

Cited accident code.--Cited accident code was the following:

V1 = Speed too fast
V2 = Failed to yield right of way
V3 = Drove left of center
V4 = Improper overtaking
V5 = Passed stop sign
V6 = Disregarded traffic signal
V7 = Followed too closely
V8 = Made improper turn
V9 = Improper or No signal
V10 = Improper parking location
V11 = Other improper driving
V12 = No violation indicated
VXI = Under the influence of alcohol

Since accident code V11 (Other improper driving) was rather nebulous, it was necessary to do further investigation of these accidents. Only accident records from 1968 and 1969 were available from the Michigan Department of State Police Accident File, the original source of the Michigan Department of State driver licensing files.

Accident record data for those drivers with a V11 cited accident for the years 1968 and 1969, including the driver's name, accident report number, city or county police department and date of the accident were manually recorded from the computer readout sheet and obtained from the microfilm file. The descriptive written report from the investigating officer was recorded and categorized.

Code V12 (No violation indicated) was deleted from the final analysis due to an absence of data.

Non-cited accident code.--Non-cited accident code was the following:

X1 = Under the influence of alcohol
X2 = Not under the influence
X3 = Influence not known
X4 = Had not been drinking
X5 = Not known if drinking
X6 = Chemical Test given

These items X2 through X6, were grouped together under X4 for the purposes of this study due to null data of these codes.

Cited for under the influence of alcohol.--VX1 data results for cited accidents were recorded. There was no data recorded for X1 non-cited accidents.

Season.--The seasons were recorded according to the month during which the accident occurred. The twelve months were divided as follows:

Winter = December (12), January (1), February (2)

Spring = March (3), April (4), May (5)

Summer = June (6), July (7), August (8)

Fall = September (9), October (10), November (11).

Vehicles involved in accidents.--Vehicles involved were recorded as one vehicle involved and two or more vehicles involved.

Fatalities in accidents.--Fatalities were recorded by number and totalled for each accident.

Processing the Data

Michigan driving records were kept on file for a period of only six years. Therefore, it was not possible to obtain the prior accident record of those senior drivers in the older age groups when they were 65 years of age. For this reason the per cents were based upon each age group, sex, and urban and rural residency rather than the total sample.

All data was recorded on columnar sheets by age group, sex, urban and rural residency. Each senior driver's age at the time of the accident was determined and those drivers who had had an accident at age 65 or above were recorded in the age group in which the accident occurred. As indicated in Table 4, there were 611 drivers who had accidents. Since there were drivers who had more than one accident during the six year period mentioned above, their inclusion is in more than one age group. Thus the total number of drivers was 664 as shown in Chapter IV, Table 5. In so far as this chapter considers procedures employed in

the study, mention is made of this process here and will again be noted in Chapter IV.

Each type of information, i.e., per cent of senior drivers, per cent of accidents, under the influence of alcohol, per cent of accidents involving one and two or more vehicles, per cent of fatalities, and season in which accidents occurred were further grouped on these sheets.

Methods for Descriptively Analyzing the Data

A descriptive analysis was made of the following data categorized by age group, sex, and residency:

1. The per cent of senior drivers involved in one and two or more accidents.

2. The per cent of cited and non-cited accidents among senior drivers.

3. The violation factors in accidents among senior drivers.

4. The number of cited and non-cited accidents among senior drivers where under the influence of alcohol was a factor.

5. The per cent of cited and non-cited accidents among senior drivers involving one and two or more vehicles.

6. The violation factors in accidents among senior drivers involving one and two or more vehicles.

7. The per cent of fatalities in cited and non-cited accidents among senior drivers.

8. The number of fatalities in cited accidents among senior drivers by violation factors.

9. The per cent of accidents by season among senior drivers.

Summary

In this chapter the methods of procedure for this investigation were presented. Included were (1) methods of obtaining the sample, (2) distribution of the senior driver sample, (3) methods of processing the data, and (4) methods for descriptively analyzing the data.

CHAPTER IV

THE FINDINGS

The previous chapter contained the procedures and methodology used in this study. This chapter presents the findings of the investigation.

It was the purpose of this study to determine whether senior drivers' accident record data would differ when categorized by age group, sex, urban and rural residency.

Information concerning the age, sex, residency and accident record on 3,340 senior drivers was obtained from the Michigan State University IBM computer. Each senior driver's age at the time of the accident was then determined manually and those who had an accident at age 65 years or older were tallied. A total of 611 Michigan senior drivers were found to have had an accident at age 65 years or older.

Accident data on 611 Michigan senior drivers was tabulated and placed onto columnar sheets. Where possible, percentages were computed or obtained to illustrate the findings.

Single and Multiple Accident Involvement Among Senior Drivers

To determine the accident involvement among Michigan senior drivers the following question was raised and programmed:

1. Does the per cent of senior drivers involved in one accident and two or more accidents differ when categorized by age group, sex, urban and rural residency?

Table 5 shows the breakdown of senior drivers in relation to the age group in which they had their accidents. Among the 611 drivers studied, there were drivers who had accidents in more than one age group during a six year period, thus the total number of drivers is 664.

Those senior drivers in the 65-69 year age group were involved in the highest per cent of accidents. The senior drivers involved in an accident decreased from 49.55 per cent for the 65-69 year age group to 1.21 per cent for the 85-89 year age group.

Male senior drivers had a 77.41 per cent involvement in accidents and female senior drivers had a 22.59 per cent involvement. There was a more even distribution of senior drivers involved in an accident when classified according to urban and rural residency. Urban senior drivers had a 50.75 per cent involvement and rural senior drivers had a 49.24 per cent.

Table 5 further shows that all categories had a higher per cent of senior drivers with a single accident

TABLE 5.--Senior drivers involved in accidents by age group, sex, and residency.

Item	Total Drivers	Per cent Drivers	Drivers in 1 Accident	Per cent 1 Acc.	Drivers in 2+ Acc	Per cent 2+ Acc
Age Group						
65-69	329	49.55	277	84.19	52	15.81
70-74	202	30.42	167	82.67	35	17.33
75-79	96	14.45	78	81.25	18	18.75
80-84	29	4.36	24	82.75	5	17.24
85-89	8	1.21	6	75.00	2	25.00
TOTAL	664	99.99	552	83.13*	112	16.86*
Sex						
Male	514	77.41	418	81.32	96	18.67
Female	150	22.59	134	89.33	16	10.66
TOTAL	664	100.00	552	83.13*	112	16.86
Residency						
Urban	337	50.75	284	84.27	53	15.72
Rural	327	49.24	268	81.95	59	18.04
TOTAL	664	99.99	552	83.13*	112	16.86*

KEY: * = Average
Acc = Accidents

involvement than senior drivers with multiple accidents. The 65-69 year age group had the highest per cent of drivers, 84.19, with one accident during that age span.

When categorized by sex, females had a higher per cent, 89.33, of senior drivers with one accident than male senior drivers with 81.32 per cent.

When categorized by residency, 84.27 per cent of the urban senior drivers and 81.95 per cent of the rural senior drivers were involved in a single accident.

Cited and Non-cited Accidents Among Senior Drivers

The following question was raised and programmed in order to ascertain the extent of cited and non-cited accident involvement among Michigan senior drivers:

2. Does the per cent of accidents, cited and non-cited, among senior drivers differ when categorized by age group, sex, urban and rural residency?

The total number of accidents for 611 Michigan senior drivers was 812 or 1.33 accidents per driver with an accident record. Table 6 shows that the majority of these accidents, 50.12 per cent, occurred when drivers were within the 65-69 year old age group. The 407 accidents in which the 65-69 year old drivers were involved were more than all other age groups combined.

Table 6 further shows that when categorized by sex, the Michigan male senior drivers had a higher per cent, 78.20, of total accidents than the female senior

TABLE 6.--Accidents, cited and non-cited, by age group, sex, and residency.

Item	Total N Acc	Per cent Acc	N Cited	Per cent Cited	N Non-cited	Per cent Non-cited
Age Group						
65-69	407	50.12	221	54.29	186	45.70
70-74	237	29.19	138	58.22	99	41.77
75-79	119	14.65	71	59.66	48	40.33
80-84	37	4.56	23	62.16	14	37.84
85-89	12	1.47	7	58.33	5	41.66
TOTAL	812	99.99	460	56.65*	352	43.34*
Sex						
Male	635	78.20	352	55.43	283	44.56
Female	177	21.79	108	61.02	69	38.98
TOTAL	812	99.99	460	56.65*	352	43.34*
Residency						
Urban	423	52.09	244	57.68	179	42.32
Rural	389	47.90	216	55.52	173	44.47
TOTAL	812	99.99	460	56.65*	352	43.34*

KEY: N = Number
Acc = Accident
* = Average

drivers, 21.79 per cent. When categorized by residency the urban senior drivers had a higher per cent, 52.09, of total accidents than the rural senior drivers, 47.90 per cent.

In Table 6 the per cent of cited accidents among Michigan senior drivers as reported by investigating officers is shown. Michigan senior drivers were cited with being at fault according to the investigating officer in 460 or 56.65 per cent of the 812 senior driver accidents. All age categories were more often cited as being at fault. The 80-84 year old drivers were cited in 62.16 per cent of the accidents. This was a high for all age groups.

When categorized by sex, the female senior drivers were cited in 61.02 per cent of their accidents, while their male counterparts were cited in 55.43 per cent of the accidents. Urban and rural residency showed an even distribution of senior driver cited accidents as there was a difference of less than 3 percentage points between each.

Violation Factors in Cited Accidents Among Senior Drivers

The following question was programmed in order to determine the violation factors in cited accidents among Michigan senior drivers:

3. Do the violation factors in cited accidents among senior drivers differ when categorized by age group, sex, urban and rural residency?

Tables 7 and 8 show that when senior drivers are grouped according to age, sex, and residency, the two violation factors reported most often by the investigating officers were "failed to yield the right of way" and "other improper driving."

After study of the accident report forms in the Michigan State Police Accident Microfilm File of the citation for "other improper driving," it was found that the two most common driving errors leading to this citation were: (1) "improper backing," and (2) "failed to stop in the assured clear distance ahead." All "other improper driving" factors were too few in number to be relevant.

When categorized by residency, "failed to yield the right of way" and "improper turn" were the two violation factors in which the rural senior driver exceeded the urban senior driver.

Cited for Under the Influence of Alcohol in Accidents Among Senior Drivers

To determine if the influence of alcohol was a factor in accidents among Michigan senior drivers, the following question was raised and programmed:

4. Does under the influence of alcohol become a factor in accidents among senior drivers when categorized by age group, sex, urban and rural residency?

Tables 7 and 8 show that when categorized by age group, sex, and residency that in only eight of the 812

TABLE 7.--Violation factors in cited accidents by age group.

Item	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	Total	VX1
Age Group													
65-69	22	77	14	11	4	5	13	19	1	1	54	221	5
70-74	7	43	6	8	1	3	10	12	1	2	45	138	2
75-79	4	22	1	1	3	2	5	7	0	1	25	71	1
80-84	3	5	0	1	0	0	1	1	0	0	12	23	0
85-89	0	4	0	0	1	0	0	1	0	0	1	7	0
TOTAL	36	151	21	21	9	10	29	40	2	4	137	460	8

Key:
V1 = Speed too fast
V2 = Failed to yield right of way
V3 = Drove left of center
V4 = Improper overtaking
V5 = Passed stop sign
V6 = Disregarded traffic signal
V7 = Followed too closely
V8 = Made improper turn
V9 = Improper or no signal
V10 = Improper parking location
V11 = Other improper driving
VX1 = Under the influence of alcohol, cited accident.

TABLE 8.--Violation factors in cited accidents by sex and residency.

Item	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	Total	XV1
Sex													
Male	29	120	16	15	6	5	25	30	2	2	102	352	8
Female	7	31	5	6	3	5	4	10	0	2	35	108	0
TOTAL	36	151	21	21	9	10	29	40	2	4	137	460	8
Residency													
Urban	17	69	14	14	5	6	22	16	1	2	78	244	3
Rural	19	82	7	7	4	4	7	24	1	2	59	216	5
TOTAL	36	151	21	21	9	10	29	40	2	4	137	460	8

Key: V1 = Speed too fast
V2 = Failed to yield right of way
V3 = Drove left of center
V4 = Improper overtaking
V5 = Passed stop sign
V6 = Disregarded traffic signal
V7 = Followed too closely
V8 = Made improper turn
V9 = Improper or No signal
V10 = Improper parking location
V11 = Other improper driving
XV1 = Under the influence of alcohol, cited accident.

accidents studied were the senior drivers cited as being "under the influence of alcohol." Drivers in the 65-69 year age group were cited as being "under the influence of alcohol" in five of the eight accidents.

When categorized by sex, male senior drivers were cited as being "under the influence of alcohol" in the eight accidents. When categorized by residency, rural senior drivers were cited as being "under the influence of alcohol" in five accidents and the urban senior driver in three accidents.

Cited and Non-cited Accidents Involving One and Two or More Vehicles Among Senior Drivers

The following question was programmed in order to ascertain the extent of cited and non-cited accidents among Michigan senior drivers involving one vehicle and two or more vehicles:

> 5. Does the per cent of accidents, cited and non-cited, among senior drivers involving one vehicle and two or more vehicles differ when categorized by age group, sex, urban and rural residency?

Table 9 shows when categorized by age group, sex, urban and rural residency all categories had a higher per cent of accidents involving two or more vehicles. For all age groups, more than 91 per cent of the accidents involved two or more vehicles.

TABLE 9.--Vehicle involvement by age group, sex, and residency.

Item	Total N Acc	Per cent Acc	N Acc 1 Veh	Per cent Acc 1 Veh	N Acc 2 Veh	Per cent Acc 2 Veh
Age Group						
65-69	407	50.12	33	8.12	374	91.88
70-74	237	29.19	19	8.01	218	91.98
75-79	119	14.65	8	6.72	111	93.27
80-84	37	4.56	3	8.11	34	91.89
85-89	12	1.47	1	8.33	11	91.66
TOTAL	812	99.99	64	7.88*	748	92.11*
Sex						
Male	635	78.20	48	7.56	587	92.44
Female	177	21.79	16	9.04	161	90.96
TOTAL	812	99.99	64	7.88*	748	92.11*
Residency						
Urban	423	42.09	25	5.91	398	94.08
Rural	389	47.90	39	10.02	350	89.97
TOTAL	812	99.99	64	7.88*	748	92.11*

KEY: N = Number
Acc = Accidents
Veh = Vehicles
* = Average

When categorized by sex and residency both had more than 89 per cent of their accidents involving two or more vehicles.

Violation Factors in Cited Accidents Involving One and Two or More Vehicles Among Senior Drivers

The following question was programmed in order to determine the violation factors among Michigan senior drivers in cited accidents involving one vehicle and two or more vehicles:

6. Do the violation factors among senior drivers in cited accidents involving one vehicle and two or more vehicles differ when categorized by age group, sex, urban and rural residency?

Table 10 shows that when categorized by age group, sex, and residency the two violation factors reported most often by investigating officers for drivers cited in accidents involving one vehicle were "speed too fast" and "other improper driving" (failed to stop in the assured clear distance ahead).

Rural senior drivers were cited more often for "speed too fast" in one vehicle accidents than were urban senior drivers.

Table 11 shows that when categorized by age group, sex, and residency the violation factors reported most often by investigating officers for drivers cited in accidents involving two or more vehicles were "failed to yield right of way" and "other improper driving" (failed to stop in the assured clear distance ahead).

TABLE 10.--Violation factors in cited accidents involving one vehicle by age group, sex, and residency.

Item	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	Total
Age Group												
65-69	7			1				1			3	12
70-74	3		1								4	8
75-79	1					1					1	3
80-84	1										1	2
85-89												0
TOTAL	12	0	1	1	0	1	0	1	0	0	9	25
Sex												
Male	9		1			1		1			5	17
Female	3			1							4	8
TOTAL	12	0	1	1	0	1	0	1	0	0	9	25
Residency												
Urban	2							1			3	6
Rural	10		1	1		1					6	19
TOTAL	12	0	1	1	0	1	0	1	0	0	9	25

KEY: V1 = Speed too fast
V2 = Failed to yield right of way
V3 = Drove left of center
V4 = Improper overtaking
V5 = Passed stop sign
V6 = Disregarded traffic signal
V7 = Followed too closely
V8 = Made improper turn
V9 = Improper or No signal
V10 = Improper parking location
V11 = Other improper driving

TABLE 11.--Violation factors in cited accidents involving two or more vehicles by age group, sex, and residency.

Item	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	Total
Age Group												
65-69	15	77	14	10	4	5	13	18	1	1	51	209
70-74	4	43	5	8	1	3	11	12	1	2	41	131
75-79	3	22	1	1	3	1	4	7		1		67
80-84	2	5		1			1	1			11	21
85-89		4			1			1			1	7
TOTAL	24	151	20	20	9	9	29	39	2	4	128	435
Sex												
Male	20	120	15	15	6	4	25	29	2	2	97	335
Female	4	31	5	5	3	5	4	10		2	31	100
TOTAL	24	151	20	20	9	9	29	39	2	4	128	435
Residency												
Urban	15	69	14	14	5	6	22	15	1	2	76	239
Rural	9	82	6	6	4	3	7	24	1	2	52	197
TOTAL	24	151	20	20	9	9	29	39	2	4	128	435

KEY: V1 = Speed too fast
V2 = Failed to yield right of way
V3 = Drove left of center
V4 = Improper overtaking
V5 = Passed stop sign
V6 = Disregarded traffic signal
V7 = Followed too closely
V8 = Made improper turn
V9 = Improper or No signal
V10 = Improper parking location
V11 = Other improper driving

When categorized by residency, "failed to yield right of way" and "improper turn" were the two violation factors in which rural senior drivers exceeded urban senior drivers in cited accidents involving two or more vehicles.

Fatalities in Cited and Non-cited Accidents Among Senior Drivers

To determine the extent of fatalities in cited and non-cited accidents among Michigan senior drivers, the following question was raised and programmed:

7. Does the per cent of fatalities in accidents, cited and non-cited, among senior drivers differ when categorized by age group, sex, urban and rural residency?

Table 12 shows Michigan senior drivers had a high per cent of fatalities in accidents. There were 446 fatalities or 54.92 per cent occurring in 812 accidents. When categorized by age group, there were 262 fatalities or 65.17 per cent when drivers were within the 65-69 year old age group. This figure was higher than any other senior driver age group.

The table further shows a breakdown of the fatalities into cited and non-cited accidents. The table reveals that 60.76 per cent of the fatalities occurred when the senior drivers were cited with being at fault by the investigating officer and 39.23 per cent of the fatalities occurred when the senior driver was not at fault.

TABLE 12.--Fatalities in cited and non-cited accidents by age group.

Item	Total N Acc	Per cent Acc	Total Fatal	Per cent Fatal. per T Acc	N Fatal. in Cited Acc	Per cent Fatal. Cited Acc per T Fatal.	N Fatal in Non-cited Acc	Per cent Fatal. Non-cited Acc per T Fatal.
Age Group								
65-69	407	50.12	262	65.17	158	60.31	104	39.69
70-74	237	29.19	120	50.63	71	59.16	49	40.83
75-79	119	14.65	42	35.29	26	61.90	16	38.09
80-84	37	4.56	16	43.24	11	68.75	5	31.25
85-89	12	1.47	6	50.00	5	83.33	1	16.66
TOTAL	812	99.99	446	54.92*	271	60.76*	175	39.23*

KEY: N = Number
Fatal. = Fatalities
T = Total
Acc = Accidents
* = Average

Table 13 shows when categorized by sex, male senior drivers had a higher per cent of fatalities in accidents than did female senior drivers. A fatality occurred in 56.37 per cent of accidents in which male senior drivers were involved and 49.71 per cent of the accidents in which female senior drivers were involved. Urban and rural residency showed an even distribution of fatalities in senior driver accidents.

The table further shows a breakdown of the fatalities into cited and non-cited accidents. The table reveals that 70.45 per cent of the fatalities occurred when the female senior drivers were cited with being at fault by the investigating officer and 58.37 per cent for the male senior drivers.

A 65.89 per cent of the fatalities occurred when rural senior drivers were cited with being at fault by investigating officers and 55.89 per cent for the urban senior drivers.

Violation Factors in Cited Accidents Involving Fatalities Among Senior Drivers

The following question was programmed in order to determine the violation factors among Michigan senior drivers in cited accidents involving fatalities:

TABLE 13.--Fatalities in cited and non-cited accidents by sex and residency.

Item	Total N Acc	Per cent Acc	Total Fatal	Per cent Fatal. per T Acc	N Fatal. in Cited Acc	Per cent Fatal. Cited Acc per T Fatal.	N Fatal in Non-cited Acc	Per cent Fatal. Non-cited Acc per T Fatal.
Sex								
Male	635	78.20	358	56.37	209	58.37	149	41.62
Female	177	21.79	88	49.71	62	70.45	26	29.54
TOTAL	812	99.99	446	54.92*	271	60.76*	175	39.23*
Residency								
Urban	423	52.09	229	54.13	128	55.89	101	44.10
Rural	389	47.90	217	55.78	143	65.89	74	34.10
TOTAL	812	99.99	446	54.92*	271	60.76*	175	39.23*

Key: N = Number
Fatal. = Fatalities
T = Total
Acc = Accidents
* = Average

8. Do the violation factors in senior driver cited accidents involving fatalities differ when categorized by age group, sex, urban and rural residency?

Table 14 shows that when categorized by age group, sex, and residency the violation factor reported most often by investigating officers in cited accidents in which fatalities were involved was "failed to yield the right of way."

Cited and Non-cited Accidents by Season Among Senior Drivers

The following question was raised and programmed in order to ascertain the extent of cited and non-cited accidents among Michigan senior drivers:

9. Does the per cent of senior driver accidents, cited and non-cited, by season differ when categorized by age group, sex, urban and rural residency?

Table 15 shows Michigan senior drivers were involved more frequently in accidents during the winter season. The table further reveals that 28.20 per cent of the accidents occurred during the winter season. However, when categorized by age group, the 80-84 and 85-89 year old drivers were an exception. Data indicated that these age groups had 40 per cent of their accidents during the spring season.

Table 16 shows that when categorized by sex, Michigan male senior drivers had the highest per cent, 28.34, of their accidents in the winter season, and the

TABLE 14.--Fatalities per violation factor by age group, sex, and residency.

Item	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	Total
Age Group												
65-69	22	64	5	8	5	2	4	18		2	28	158
70-74	7	24	3	1	3		9	8	1		15	71
75-79	3	13			1	3	1				5	26
80-84	1	5									5	11
85-89		2			1			1			1	5
TOTAL	33	108	8	9	10	5	14	27	1	2	54	271
Sex												
Male	21	84	8	5	8	3	14	21	1	2	42	209
Female	12	24		4	2	2		6			12	62
TOTAL	33	108	8	9	10	5	14	27	1	2	54	271
Residency												
Urban	16	44	2	4	5	2	8	11			36	128
Rural	17	64	6	5	5	3	6	16	1	2	18	143
TOTAL	33	108	8	9	10	5	14	27	1	2	54	271

KEY: V1 = Speed too fast
V2 = Failed to yield right of way
V3 = Drove left of center
V4 = Improper overtaking
V5 = Passed stop sign
V6 = Disregarded traffic signal
V7 = Followed too closely
V8 = Made improper turn
V9 = Improper or No signal
V10 = Improper parking location
V11 = Other improper driving

TABLE 15.--Accidents per season by age group.

Item	Total Acc	Per cent Acc	Winter		Spring		Summer		Fall	
			N Acc	Per cent Acc per T Acc	N Acc	Per cent Acc per T Acc	N Acc	Per cent Acc per T Acc	N Acc	Per cent Acc per T Acc
Age Group										
65-69	407	50.12	117	28.74	88	21.62	92	22.60	110	27.03
70-74	237	29.19	67	28.27	49	20.67	57	24.05	65	27.00
75-79	119	14.65	34	28.57	22	18.49	31	26.05	32	26.89
80-84	37	4.56	8	21.62	15	40.54	6	16.22	8	21.62
85-89	12	1.47	3	25.00	5	41.66	3	25.00	1	8.33
TOTAL	812	99.99	229	28.20*	179	22.04*	189	23.27*	215	26.47*

KEY: Acc = Accidents

N = Number

T = Total

* = Average

TABLE 16.--Accidents per season by sex and residency.

Item	Total Acc	Per cent Acc	Winter		Spring		Summer		Fall	
			N Acc	Per cent Acc per T Acc	N Acc	Per cent Acc per T Acc	N Acc	Per cent Acc per T Acc	N Acc	Per cent Acc per T Acc
Sex										
Male	635	78.20	180	28.34	138	21.74	154	24.25	163	25.66
Female	177	21.79	49	27.68	41	23.16	35	19.77	52	29.37
TOTAL	812	99.99	229	28.20*	179	22.04*	189	23.27*	215	26.47*
Residency										
Urban	423	52.09	118	27.89	91	21.51	100	23.64	114	26.95
Rural	389	47.90	111	28.53	88	22.62	89	22.87	101	25.96
TOTAL	812	99.99	229	28.20*	179	22.04*	189	23.27*	215	26.47*

KEY: Acc = Accidents

N = Number

T = Total

* = Average

lowest per cent, 21.74, in the spring. The Michigan female senior drivers had the highest per cent, 29.37, of their accidents in the fall season and the lowest per cent, 19.77, in the summer.

When categorized by residency, urban senior drivers had 27.89 per cent of their accidents in the winter season, while rural senior drivers had a 28.53 per cent rate.

Summary

This chapter presented the major findings of the study. These findings included a descriptive comparison of Michigan senior drivers' accident records when categorized by age group, sex, urban and rural residency. The following chapter contains the summary, conclusions, and recommendations of the study.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter contains a brief statement of: (1) the problem, method of procedure and major findings, (2) conclusions based on the findings, (3) recommendations and, (4) recommendations for further research.

Summary

Statement of the Problem

It was the purpose of this study to determine whether the accident records of Michigan senior drivers differed when categorized by age group, sex, urban and rural residency. The study proposed to derive data in order to answer the following programmed questions:

1. Does the per cent of senior drivers involved in one accident and two or more accidents differ when categorized by age group, sex, urban and rural residency?

2. Does the per cent of accidents, cited and non-cited, among senior drivers differ when categorized by age group, sex, urban and rural residency?

3. Do the violation factors in cited accidents among senior drivers differ when categorized by age group, sex, urban and rural residency?

4. Does under the influence of alcohol become a factor in accidents among senior drivers when categorized by age group, sex, urban and rural residency?

5. Does the per cent of accidents, cited and non-cited, among senior drivers involving one vehicle and two or more vehicles differ when categorized by age group, sex, urban and rural residency?

6. Do the violation factors among senior drivers in cited accidents involving one vehicle and two or more vehicles differ when categorized by age group, sex, urban and rural residency?

7. Does the per cent of fatalities in accidents, cited and non-cited, among senior drivers differ when categorized by age group, sex, urban and rural residency?

8. Do the violation factors in senior driver cited accidents involving fatalities differ when categorized by age group, sex, urban and rural residency?

9. Does the per cent of senior driver accidents, cited and non-cited, by season differ when categorized by age group, sex, urban and rural residency?

The Methods of Procedure

The population from which the sample for this study was selected consisted of those senior drivers whose names and driving records were recorded in the Michigan Department of State, Driver and Vehicle Services. All driving records were in alphabetical order on 100 computer reels, accounting for 5,000,000 (million) drivers. Each computer reel was considered a cluster of heterogeneous drivers in the state of Michigan. There was no reason to believe that the driving performances or the proportion

of senior drivers was any different for the sample computer reel selected or any other reel which might have been selected from the total 100 reels.

One reel, Number 43, was randomly selected for the study. The information on the selected reel came from a Burroughs Computer, type 550, 7 track, 800 density and was converted by the State Department in order for the information to be read by the Michigan State University Computer Center's IBM Computer, type 3600, 7 track, 556 density.

A computer readout sheet was obtained containing 3,340 driving records on each senior driver's residency, sex, age and accident record. Only those senior driver records indicating an accident involvement were used. A total of 611 Michigan senior drivers with an accident was read and recorded.

Michigan driving records were kept on file for a period of only six years. Therefore, it was not possible to obtain the prior accident record of those senior drivers in the older age groups when they were 65 years of age. For this reason the per cents were based upon each age group, sex, and urban and rural residency rather than the total sample.

All data was recorded on columnar sheets by age group, sex, urban and rural residency. Each senior driver's age at the time of the accident was determined

and those drivers who had had an accident at age 65 or above were recorded in the age group in which the accident occurred. As indicated in Table 4, there were 611 drivers who had accidents. Since there were drivers who had more than one accident during the six year period mentioned above, their inclusion is in more than one age group. Thus the total number of drivers was 664 as shown in Chapter IV, Table 5.

Each type of information, i.e., per cent of senior drivers, per cent of accidents, under the influence of alcohol, per cent of accidents involving one and two or more vehicles, per cent of fatalities, and season in which accidents occurred were further grouped on these sheets.

The Major Findings

The following is a summary of the major findings of this study:

Single and Multiple Accident Involvement

When categorized by age group, sex and residency, all categories had a lower average, 16.86 per cent, of senior drivers with two or more accidents compared to an average of 83.13 per cent of senior drivers with one accident.

Those senior drivers in the 65-69 year age group were involved in the highest per cent of accidents. The senior drivers involved in an accident decreased from

49.55 per cent for the 65-69 year age group to 1.21 per cent for the 85-89 year age group.

Male senior drivers had a 77.41 per cent involvement in accidents and female senior drivers had a 22.59 per cent involvement. There was a more even distribution of senior drivers involved in an accident when grouped according to urban and rural residency.

All categories had a higher per cent of senior drivers with a single accident involvement than senior drivers with multiple accidents.

Cited and Non-cited Accidents

The majority of total accidents occurred when drivers were in the 65-69 year age group. The 407 accidents, 50.12 per cent, in which the 65-69 year old drivers were involved were more than all other age groups combined.

Male senior drivers had 78.20 per cent of total accidents and female senior drivers had 21.79 per cent. Urban senior drivers had a 52.09 per cent of total accidents and the rural senior drivers had 47.90 per cent.

When categorized by age group, sex and residency, all categories showed Michigan senior drivers were cited with being at fault according to investigating officers in 56.65 per cent of the 812 senior driver accidents.

The 65-69 year age group had the highest per cent of accidents, 50.12, but the lowest per cent, 54.29, with being cited for the accident by investigating officers. The 80-84 year age group had only a 4.56 per cent of accidents but the highest per cent, 62.16, with being cited for the accident by investigating officers.

The female senior drivers had a lower per cent, 21.79, of accidents than the male drivers but a higher per cent, 61.02, with being cited for the accident by investigating officers.

Violation Factors in Cited Accidents

When categorized by age group, sex and residency, all categories had "Failed to yield the right of way" and "other improper driving" for the two violation factors most often reported by investigating officers in cited accidents. Upon further investigation of the original accident report for "other improper driving," two predominent driving errors were found, (1) "improper backing" and (2) "failed to stop in the assured clear distance ahead."

Cited for Under the Influence of Alcohol in Accidents

There were eight senior drivers cited with being "under the influence of alcohol" for a total of 812 senior driver accidents. The 65-69 year old drivers were cited as being "under the influence of alcohol" in five of the

eight cases. All cases were male senior drivers of which five were from a rural residency.

Cited and Non-cited Accidents Involving One and Two or More Vehicles

When categorized by age group, sex and residency, all categories had a higher per cent of accidents involving two or more vehicles among senior driver accidents. For all age groups, more than 91 per cent of the accidents involved two or more vehicles. When categorized by sex and residency, both had more than 89 per cent of their accidents involving two or more vehicles.

Violation Factors in Cited Accidents Involving One and Two or More Vehicles

The violation factor among senior drivers in cited accidents involving one vehicle was "speed too fast" for all categories.

The violation factors most often reported in cited accidents in which two or more vehicles were involved were "failed to yield right of way" and "failed to stop in the assured clear distance ahead."

Fatalities in Cited and Non-cited Accidents

When categorized by age group, sex and residency, all categories showed a high per cent, 54.92, for fatalities in senior driver accidents.

For total accidents, the 65-69 year old drivers had the highest involvement, 65.17 per cent, for fatalities, while the 75-79 year old drivers had the lowest involvement, 35.29 per cent.

In cited accidents, where the senior drivers were at fault according to investigating officers, the 85-89 year old drivers had the highest involvement, 83.33 per cent, for fatalities, while the 70-74 year old drivers had the lowest involvement, 59.16 per cent.

The female senior drivers had a 70.45 per cent for fatalities in cited accidents where they were at fault according to investigating officers as compared to the male senior drivers 58.37 per cent.

The rural senior drivers had a 65.89 per cent for fatalities in cited accidents where they were at fault according to investigating officers as compared to the urban senior drivers' 55.89 per cent.

Violation Factors in Cited Accidents Involving Fatalities

The violation factor most often reported in cited accidents where senior drivers were cited with being at fault according to investigating officers was "failed to yield right of way."

Cited and Non-cited Accidents by Season

When categorized by age group, sex and residency, senior drivers revealed a higher involvement in accidents, 28.20 per cent, in the winter season (December, January, February).

However, when categorized by age group, the 80-84 and 85-89 year old drivers were an exception. Data indicated that these age groups had 40 per cent of their accidents during the spring season.

Conclusions

The following are the conclusions based upon the findings of the study:

1. Michigan senior drivers have a slightly higher accident rate than the national senior driver rate. The findings of this study showed that 18.29 per cent of Michigan senior drivers had an accident record, while the national rate for 1969 was 17.58 per cent.

2. Data indicated senior drivers between the ages of 65-69, who were males and living in an urban area are more likely to be involved in an accident.

3. Michigan senior drivers are more likely to have only one accident during a five year age period.

4. Data showed that the majority of senior drivers when involved in an accident are cited as being at fault.

5. Data revealed that the majority of senior driver accidents involved a fatality. This fatality involvement increased when senior drivers were cited as being at fault.

6. Data showed the majority of senior drivers are cited as being at fault, for "failed to yield the right of way" and "failed to stop in the assured clear distance ahead."

7. Data indicated that cited for being "under the influence of alcohol" is not a major contributing factor in accidents among senior drivers.

8. Data revealed senior drivers use their automobiles throughout the year as accidents were apparent for all seasons.

Recommendations

On the basis of this study, the following recommendations are presented:

1. Establish a state medical advisory board made up of a medical doctor, opthamologist, optomotrist, psychologist, and a gerontologist, to advise licensing authorities and senior drivers as to their physical and mental ability to drive an automobile safely.

2. Establish senior driver re-education courses to alert senior drivers as to the medical and physical problems for this age group. This course would further assist drivers with new laws, driving problems for this

age group and driving techniques to help alleviate the problems.

3. A self-help driving guide be made available to senior drivers as to their driving problems, and to inform them of new laws, accident probability and fatality rate. This guide would also contain helpful hints with which to assist the senior driver to be a better driver and a more competent person.

4. The state of Michigan needs to adopt a more comprehensive reporting and records system for relevant accident research and information purposes. The present design by the Department of State is set up for a policing and penal system. The information available is limited, and a more detailed account of traffic accidents concerning the driver, the automobile, and environment needs to be available for important studies and research projects.

Our present driver licensing system needs additional data to be collected and recorded that would be conducive to licensing procedures, education and improvement. Information regarding licensing test results in reference to the driving record should be adopted for upgrading licensing test procedures, the driving problems relevant to age groups, and any information vital to the driving public. This would enable a more positive approach rather than a penalizing system.

5. If this driving record system is to contribute to our knowledge about traffic accidents, then data must be in a form that is readily available for analysis and research. This data should be in a form available to research institutions thus enabling various computer hardware systems to program and analyze it.

6. Establish renewal driver licensing examinations for the purpose of alerting senior drivers to new laws and informing them as to any bad habits or problems they may have obtained. This may best be accomplished through audio-visual testing machines.

7. The state should provide senior drivers, who after consideration, voluntarily give up their driver's license or who can no longer driver for various reasons, a means to obtain other forms of transportation for the nominal cost of a driver's license and license plates.

Discussion

Accident Site in Relation to Residency

There was an interest to determine where the accidents were taking place in relation to the driver's residency. A 20 per cent random sample survey of the 611 senior drivers with accident records was selected. The drivers' residencies were recorded and then categorized as urban or rural according to zip code location and the United States Bureau of Census.

The number of miles from the driver's residency to the accident site could not be determined as the driver licensing records indicated only the law enforcement agency involved in the reporting of the accident and not the actual site of the accident. It was also difficult to determine the exact jurisdiction of the reporting enforcement agency in regard to urban and rural areas.

The Michigan senior driver's residency was listed with the law enforcement agency or State Police post and categorized as urban or rural according to zip code location. From this it was determined whether the accident occurred in an urban or rural area which was or was not near the location of the residency.

Upon completion of this section, urban senior drivers had their accidents in urban areas and rural senior drivers had their accidents in rural areas. Only 13.9 per cent of the rural senior drivers had their accidents in urban areas and only 10.8 per cent of the urban senior drivers had their accidents in rural areas.

Recommendations for Further Research

The following are recommendations for further research:

1. A study should be conducted that would concentrate on the driving patterns of the Michigan senior driver, e.g., proportion of daylight driving time versus

driving at night, proportion of driving in urban and rural areas, proportion of driving in bad weather.

2. A study should be conducted that would compare senior driving records to all facets of exposure.

3. A similar study should be conducted that would compare other age groups with senior drivers to determine similarities and differences in the accident involvement.

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APPENDICES

APPENDIX A

APPENDIX A
DEPARTMENT OF STATE DATA PROCESSING DIVISION
BURROUGHS
Magnetic Tape Layout

Record Description: Header Record

Field Rec. Count	Ident	License Number	License Infor						Birth-date	Name (First, Middle,
			Type	Iss	Prob	Expi	Orying	Issue date		
Char. Count 3	1	13	1	1	1	2	2	6	6	

Name (con't) Last)	Street	City	State	Zip Code	Sex	Exam Stat.
34	36	19	1	5	1	6

Record Description: Accident

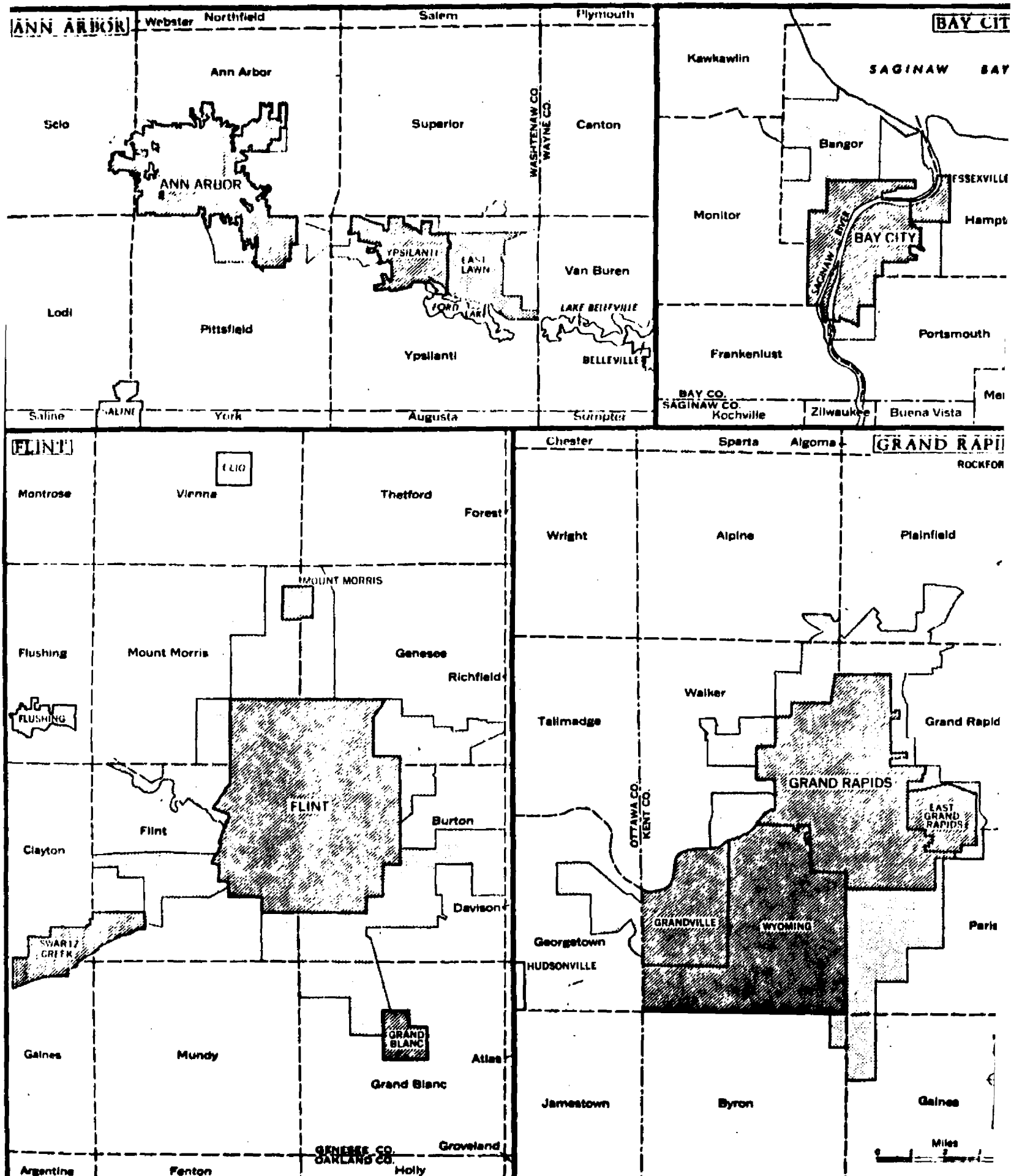
Rec. Count	Ident	Date of Accident	vehl	inj	kill	Accident Report Number	Police Department	Coded Items	Posting Date
3	1	6	2	2	2	6	24	3 3 2 2 2 2	

Sample Accident Record Printed on Computer Readout Sheet

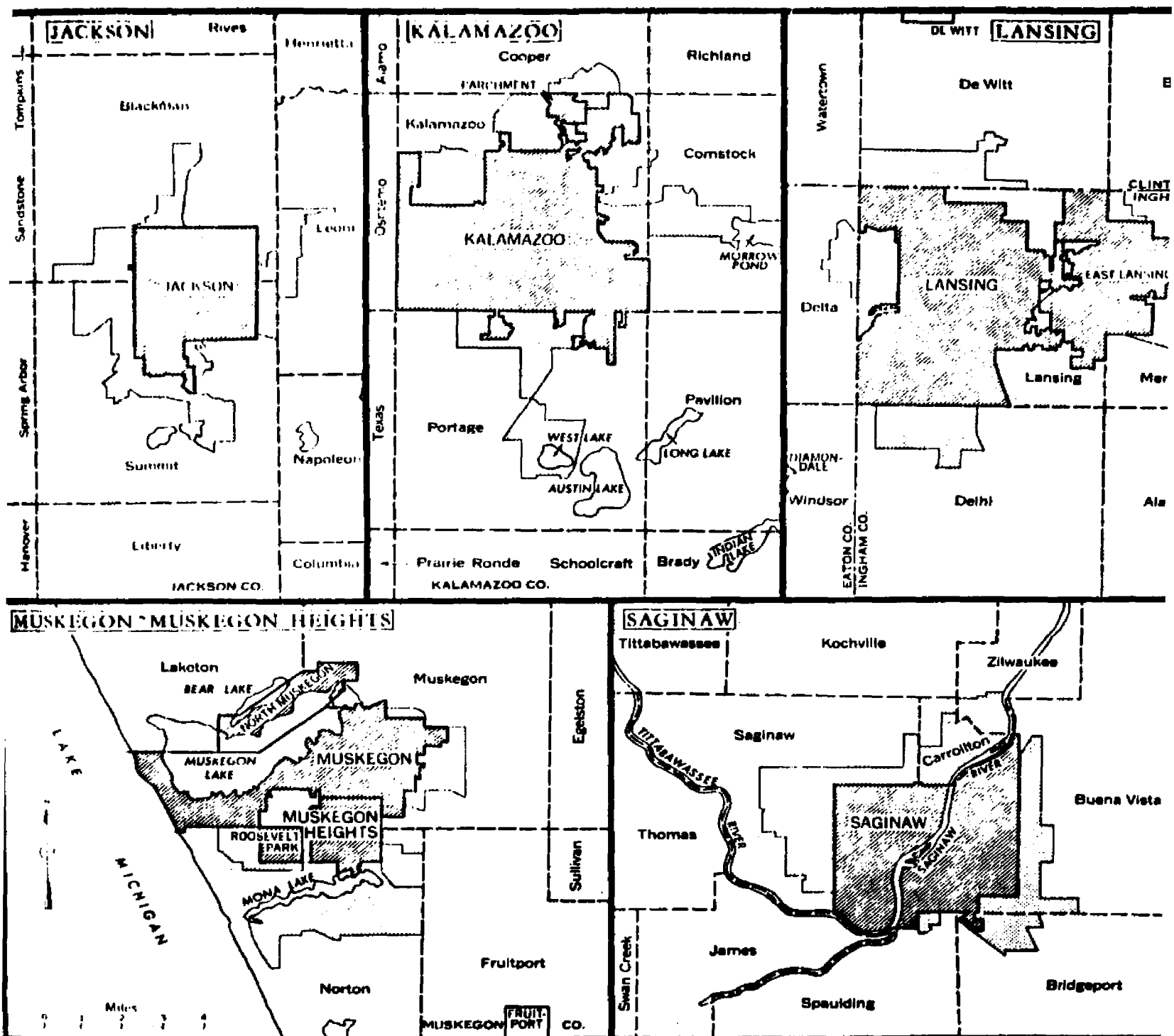
```
176BJ1234567892311R 706310026708110 2JOHN THOMAS JONATHON
     123456 EAST MICHIGAN ST              KALAMAZOO          14904
4M3901  072S021569020201654321KALAMAZOO PD            V2 X4 P5
   681031
```

APPENDIX B

URBANIZED AREAS—MICHIGAN



URBANIZED AREAS—MICHIGAN



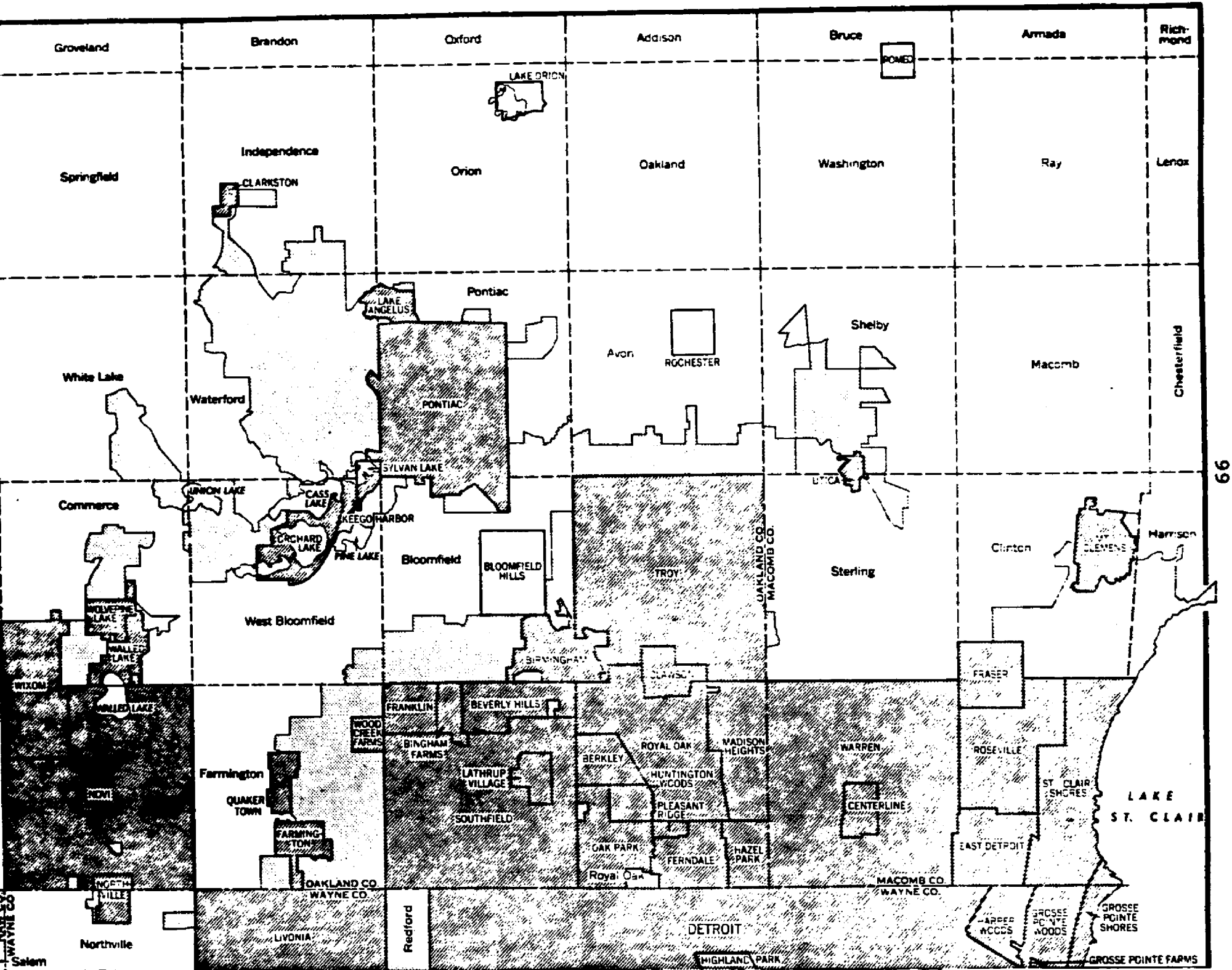
COMPONENTS OF URBANIZED AREA
- Incorporated Places
- Unincorporated Urban Places
- Other Unincorporated Area

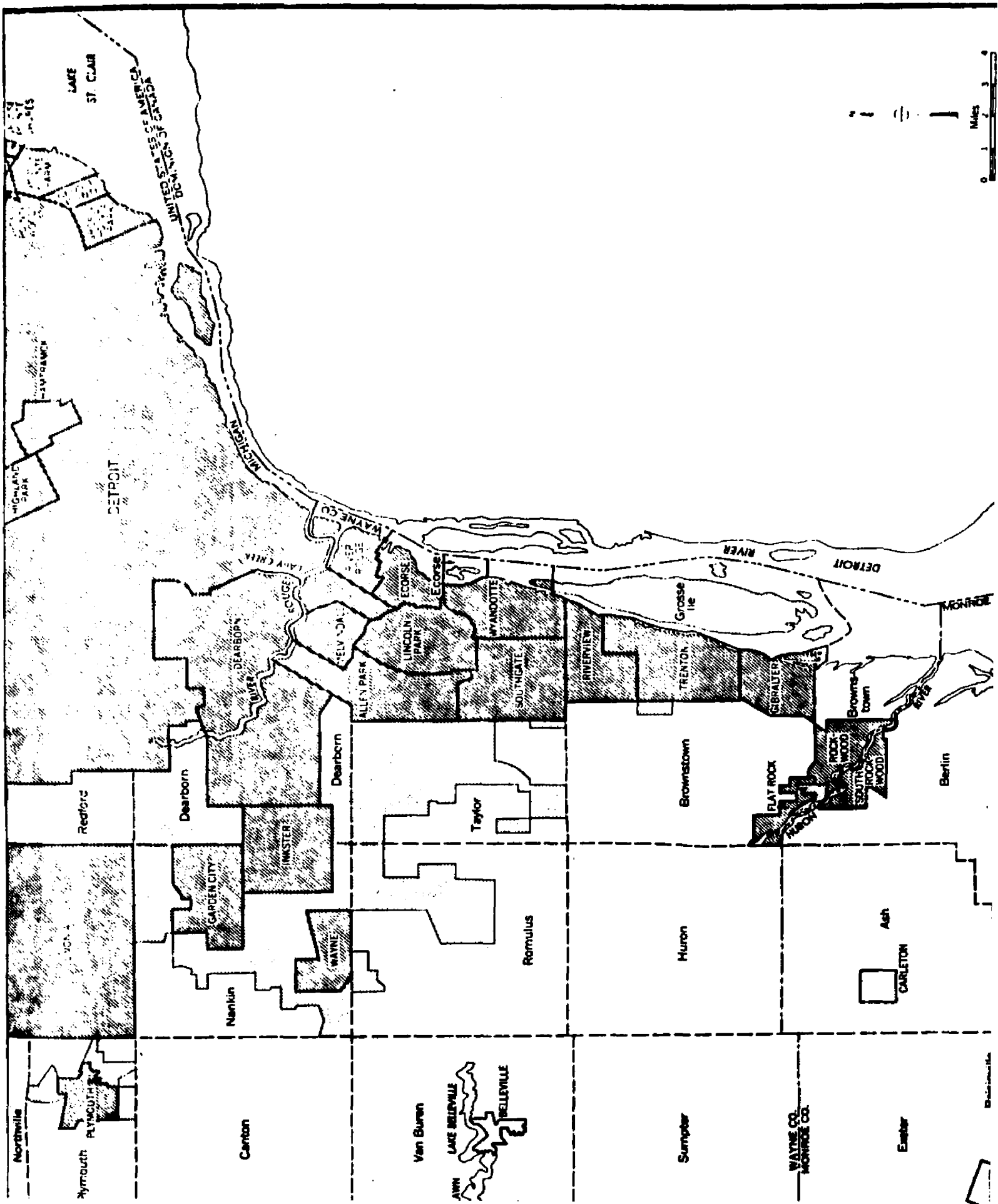
BOUNDARY SYMBOLS
- International Line
- State Line
- County Line
- Minor Civil or Census County Division Line

Maps showing boundaries in detail are available at cost on request to the Bureau

★ U. S. GOVERNMENT PRINTING OFFICE: 1961 — 605709/88

DETROIT URBANIZED AREA




LAKE ST CLAIR
UNITED STATES OF AMERICA
DOMINION OF CANADA
MICHIGAN
DETROIT
WAYNE CO.
RIVER
DETROIT
MONROE
Grosse Ile
Miles
HIGHLAND PARK
HAMTRAMCK
DETROIT
LAKE
DEARBORN
RIVER
ROUGE
ECORSE
LINCOLN PARK
ALLEN PARK
RIVERVIEW
TRENTON
GIBRALTER
SOUTHGATE
Brownstown
ROCKWOOD
SOUTH ROCKWOOD
FLAT ROCK
Redford
Dearborn
Dearborn
Taylor
Brownstown
Berlin
CAPPON CITY
INKSTER
WAYNE
Romulus
Huron
Ash
CARLETON
Nankin
Northville
PLYMOUTH
Plymouth
Canton
Van Buren
LAKE BELLEVILLE
BELLEVILLE
Sumpter
WAYNE CO.
MONROE CO.
Exeter

APPENDIX C

APPENDIX C

ZIP CODE AREAS CONSIDERED URBAN IN THE STATE OF MICHIGAN

48008-48012	48120-48129	48439
48015-48017	48134	48458-48459
48921	48136	48473-48474
48024-48026	48138	48501-48509
48030	48141-48142	48601-48609
48033-48034	48146-48156	48706-48710
48043-48046	48167-48148	48823-48826
48050-48059	48170-48173	48901-48933
48066-48073	48179	49001-49009
48075-48078	48183-48188	49201-49219
48080-48084	48192	49418
48088-48093	48197	49440-49445
48096	48201-48242	49501-49511
48101-48109	48300	

APPENDIX D

APPENDIX D

COMPUTER CODE LIST

MICHIGAN DEPARTMENT OF STATE POLICE POSTS

Location	No.	Location	No.
East Lansing	11	South Haven	55
Brighton	12	Wayland	56
Ionia	13	Rockford	61
Ithaca	14	Reed City	62
Detroit	21	Mt. Pleasant	63
Romeo	22	Grand Haven	64
St. Clair	23	Newaygo	65
Warren	24	Hart	66
Flat Rock	25	Traverse City	71
Ypsilanti	26	Cheboygan	72
Pontiac	27	Gaylord	73
Erie	28	Alpena	74
Bay City	31	Houghton Lake	75
East Tawas	32	Cadillac	76
Bad Axe	33	Manistee	77
Sandusky	34	Petoskey	78
Flint	35	Marquette	81
West Branch	36	Newberry	82
Bridgeport	37	St. Ignace	83
Lapeer	38	Manistique	84
Jackson	41	Gladstone	85
Clinton	42	Iron Mountain	86
Tekonsha	43	Wakefield	87
Blissfield	44	L'anse	88
Jonesville	45	Stephenson	89
Battle Creek	46	Calumet	90
Paw Paw	51	Munising	91
White Pigeon	52	Iron River	92
Nile	53	Sault Ste. Marie	93
New Buffalo	54		