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THE PHYSIOLOGICAL EFFECTS OF ALCOHOL ON INDIVIDUALS AND THEIR ABILITY TO DRIVE AN AUTOMOBILE

A DISSERTATION

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LONNIE GILLILAND, JR.

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THE PHYSIOLOGICAL EFFECTS OF ALCOHOL ON INDIVIDUALS AND THEIR ABILITY TO DRIVE AN AUTOMOBILE

APPROVED BY

DISSERTATION COMMITTEE

DEDICATED TO:

ANNABEL LEE

To my wife, a wonderful person, I dedicate this study. Without her help, understanding, encouragement, and love this study would not have been possible.

ACKNOWLEDGMENTS

I am indebted to a great many people who contributed in many ways to make this study possible. The person most responsible for the completion of this paper is my advisor, Dr. Jack F. Parker. Dr. Parker was always available when advice or encouragement was needed.

Dr. John Pulliam, Dr. Gerald Kidd, and Dr. Robert Bibens, the other members of my committee, were also instrumental in the completion of this study. Without their understanding, encouragement and approval, I doubt very seriously if I would have attempted the study.

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Lieutenant Al Newport and 2nd Lieutenant McBeth Sample of the Oklahoma Department of Public Safety, and Lieutenant Bob Coffia of the Oklahoma City Police Department also played an important role in the study. Without their experience in the field of alcoholic beverages, and their ability to operate the breathalyzer, the study would not have been possible.

These gentlemen contributed their time and ability in an effort to make more information available concerning the effects of alcohol on the motoring public.

I was most fortunate in having a group of safety education majors who were interested in the study. These young men donated many hours to the study. They were responsible for the placement of the cones in the different exercises. They were also charged with the responsibility of reporting the number of cones hit in each exercise to the control tower. J. R. Murray, Carl Breazeale, Randy Helms, Milton Keck, and Lonnie Gilliland III all contributed immeasurably to the study.

Special recognition is due the participants in the study. These individuals each willingly donated 7-8 hours of their time to provide the data for the study.

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I would like to take this opportunity to thank four people who were most instrumental in helping me in my pursuit of an education. These four are my parents. Dr. and Mrs. Lonnie Gilliland, Sr., my mother and father, and Mr. and Mrs. George Harrington, my mother-in-law and father-in-law, provided constant encouragement through these many years in my efforts to complete my education.

Dr. Lonnie Gilliland, Sr. has provided a goal for me to strive for through his own efforts to attain excellence in the field of education. Mrs. Gilliland is also an educator who offered continual encouragement in my educational

pursuits. Mr. George Harrington, now deceased, never ceased to encourage me to go farther in education. Mrs. Harrington is a former school teacher who was always present when a word of encouragement was needed.

I would like for these four people to know the tremendous impact their lives have had on mine. Whatever success I might enjoy in life can be attributed in large measure to these four. A simple "thanks" is a poor tribute for your many efforts, but "thanks."

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CHAPTER I

INTRODUCTION

Background of the Study

The contribution of alcohol to violence on the highway--death, injury and property damage--was recognized even before the automobile was in widespread use. The author of an editorial in the Quarterly Journal of Inebriety wrote in 1904:

> Fifteen persons died at the scene, five died two days later and five more died at a later date. Through a detailed investigation it was found that in nineteen of these accidents the drivers had indulged in spirits one hour or less prior to each accident. The other six drivers were all found to be moderate drinkers, . . .[1]

The author concluded that the findings from investigation of twenty-five accidents indicated that drivers who indulged in spirits were impaired to a greater degree as drivers of "automobile wagons" than they would be as drivers of locomotives. At that time railroad companies insisted on total abstinence in their locomotive engineers. The

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[1]Editorial, The Quarterly Journal of Inebriety, 1904, pp. 308-309.

editorialist predicted that drivers of motor wagons would soon be similarly constrained.

By the year 1924, traffic commissioners and other informed individuals believed that one-fourth to one-third of all automobile accidents were partly, if not wholly, chargeable to drinking drivers.[2] Sufficient data were not available to document these beliefs during the first third of the century.

In 1968 the Secretary of Transportation reported to Congress that a nation-wide detailed study of individuals who were responsible for initiating traffic crashes indicated that alcohol was the largest single contributing factor. This same study showed that approximately ninety to ninety-five million persons in the United States drink alcoholic beverages at least occasionally.[3]

The available data indicated that the excessive use of alcohol by drivers and pedestrians was a contributing factor in over fifty percent of the traffic fatalities which occurred annually in the United States.[4] Many of those killed were innocent victims of the circumstances associated with the dangerous mix of drinking and driving.

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[2]W. R. Miles, Alcohol and Motor Vehicle Drivers, Proceedings Thirteenth Annual Meeting of Highway Research Board, Washington, D.C., Dec. 7-8, 1933.

[3]Alan S. Boyd, Alcohol and Highway Safety, U.S. Department of Transportation, Washington, D.C., August, 1968, p. 8-10.

[4]Ibid.

Data from the Oklahoma Department of Public Safety indicated that between dusk and dawn approximately one of every forty drivers on the roadways of Oklahoma was driving under the influence of alcohol. These data also indicated that about 5 to 7 percent of the motoring public could be classed as compulsive drinkers.[5]

During the year 1970 it was determined that 62.5 percent of the drivers involved in fatal accidents in Oklahoma had been drinking. The average blood alcohol content for drivers fatally injured in Oklahoma was .18 percent.[6] At the present time a level of .10 percent is sufficient by Oklahoma law to convict a person of driving while under the influence of alcohol.[7]

During 1971, the Oklahoma Highway Patrol arrested 6,400 people for driving while under the influence of alcohol. Of those tested, only two percent were found to have a blood alcohol level under .10 percent.[8]

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[5]Oklahoma City Alcohol Safety Action Project, Roadside Survey by Oklahoma Management and Engineering Consultants, (1971-72).

[6]Oklahoma Department of Public Safety Files Concerning Accidents and Drinking, (1970-71).

[7]An Act Relating to Motor Vehicles, Enrolled House Bill No. 1630, (1972).

[8]Oklahoma Department of Public Safety Files Concerning Accidents and Drinking, (1970-71).

Efforts to Alleviate the Problem

Law Enforcement as a Solution

The major legal tool currently available to law enforcement officials charged with the responsibility of dealing with the drinking driver is the Implied Consent Law. It provides that a driver who is suspected of driving under the influence of alcohol can be asked to take a breathalyzer test or submit to a blood analysis to determine the quantity of alcohol in his blood. If he refuses to submit to the test, the refusal can be used as prima facie evidence that he is under the influence of alcohol while driving.

After drinking drivers are apprehended by law enforcement officers, prosecution and conviction leads to various types of deterrent efforts depending on the circumstances of the case as well as the philosophy of the judge. Drivers' licenses are often suspended and sometimes the offender is required to attend a driving school or clinic before he is returned to driving status. There are usually fines imposed and sometimes jail sentences.

Perhaps the most important deterrent to additional violations is surveillance. Drivers who feel that they are not likely to be checked periodically to determine whether or not they are conforming to the driving restrictions that have been imposed frequently disregard the restrictions.

In 1972 law enforcement officials in Oklahoma were provided with additional tools in the form of more stringent

laws including a reduction in the blood alcohol at which one can be charged with intoxication. Also, additional money for enforcement activities was provided. The 1972 law provides that evidence of the presence of ten-hundredths (10/100) of one percent (1%) or more by weight of alcohol in the blood shall be admitted as prima facie evidence that the person was under the influence of alcohol or intoxicating liquor.[9]

The Federal government through the Department of Transportation recently began financing new programs called the Alcohol Safety Action Programs. Each of the 30 programs located in various parts of the country was funded at three million dollars. Although the stated purposes of the national program indicated it was to provide support for research in education concerning the problem of alcohol, most of the money allotted to Oklahoma has been allocated to law enforcement. Its major objectives are the identification and treatment of problem drivers.

Education as a Solution

Efforts to alleviate the problem of drinking drivers through education have involved attempting to make people aware of the catastrophic nature of the problem by mass appeal through use of the news media. Statements such as, "If you drink, don't drive," "A drinking driver is a dead driver," are examples of slogans being used extensively on

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[9]An Act Relating to Motor Vehicles, Enrolled House Bill No. 1630, (1972).

the radio, television, and in the newspapers. Almost every day details are given of some accident or fatality involving drinking drivers. Films designed to frighten people enough to persuade them to stop drinking, or at least stop drinking and driving, are often used by civic groups, educators, and other organizations.

All of these efforts at information distribution by the mass media seem to have had little effect. The message is apparently not being received, or if received, not accepted.

Since efforts such as these which have been directed at adults have had such little apparent effect in alleviating the problem, alternative approaches should be explored. A fundamental concept in education is the need to present materials so that they will be relevant to the individual. This would seem to suggest that the schools should base their teaching about alcohol on the problems arising from intoxication rather than on the consequences of alcoholism. Actually, the threat to young people is not insanity, cirrhosis, or alcoholism, but that drinking produces intoxication. As Kelly points out, at a time in their lives when physical and emotional balance has not yet been established, when spurts of one kind or another occur, when there is tremendous concern about emerging adulthood, it is tragic to introduce into the system a chemical which may retard their advance towards

emotional balance.[10]

Adolescents tend to reject moralizing by adults. Teaching the basic facts about alcohol can be meaningful to them. Furthermore, an approach that assumes they are mature enough to make up their own minds after the facts are presented is more likely to succeed in influencing their behavior.

Traditionally, the information provided in schools concerning alcohol has been part of the content of health courses. Since many schools no longer offer formal courses in health and hygiene, a feasible alternative could well be the driver education class. High school students are eager to get a license and drive a car. Since most students of pre-licensing age are highly motivated about learning to drive, it seems logical that this might be the most appropriate time for instruction about alcohol. The effects of alcohol upon the body chemistry and the immediate dangers of driving and drinking can be brought out with scientific clarity. Appeals can be made to the mature judgment which adolescents like to be thought of as having.

The present driver education curriculum is being re-evaluated. Educators in the driver education field are beginning to realize that the responsibilities of the teacher to the student go much further than merely imparting the basic rudiments of handling the automobile.

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[10]Norbert L. Kelly, "Alcohol Education," North Carolina Rehabilitation Program, (North Carolina, 1959), pp. 1-6.

Numerous studies have been completed which attempt to show that the student with a course in driver education is a better driver than the atudent who has not had the course. For example, a study conducted in Oklahoma City in 1969 indicated that driver education students do become better motorists. It showed that the Oklahoma City Police Department issued 9,026 citations to drivers between the ages of 14 and 19 in a one year period. Only 7.5 percent of those cited had taken high school driver education. Even in studies that are somewhat less conclusive, it appears that students that have experienced driver education courses have more knowledge about the rules of the road as well as the laws of nature.

Even with this evidence of success, driver education instructors realize that there are additional areas that need attention. The effect of alcohol on traffic safety is one of these areas.

This study was designed to provide data that can be used as a basis for revising the driver education curriculum. Hopefully, the information derived from it can be used as a basis for activities in education that would result in reducing the incidence of the drinking driver.

Need for the Study

There is tremendous need for information to get rid of the myths and misconceptions that have obscured and confused the public understanding of drinking and driving.

There is need for facts to be presented in meaningful ways that will enable reasonable young men and young women to take an intelligent look at what faces them when they choose to drink and then engage in an activity requiring judgment and skill.

At present there exist great differences in the laws of our 50 states as to how much alcohol one must have in the blood stream to be impaired as a driver. Two states accept the .08 level as being sufficient evidence that the person is impaired. Thirty-eight states accept the .10 level as being legal evidence and fifteen states accept the .15 percent level as the point at which a person is considered under the influence of alcohol.[11] This represents a rather wide range of opinion as to how much alcohol may be present in the blood stream before the person is unfit to operate an automobile.

Many people do not understand the meaning of the various blood alcohol levels. Therefore, meaningful education involves answering such questions as: (1) How does the problem of drinking relate to the average person?; (2) How much alcohol must a person drink to reach these levels?; (3) How much is a person really impaired at the different levels?; (4) What is the level at which each individual becomes a danger to himself and to society in general?; (5) Does

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[11] "Statutory Blood-Alcohol Level-Percentage," Oklahoma Highway Users Conference, (Nov. 15, 1971).

one's body weight indicate the amount of alcohol that impairs his driving?; (6) How long does this impairment continue?; and (7) How is the alcohol removed from one's system? These are questions to which this study was directed and the data obtained from the study will be used to develop curriculum materials for this new phase of driver education.

Driver education courses provide the opportunity for direct contact with the great majority of our future motorists. Perhaps the ideal time to educate the motoring public about the drinking driver problem is during the years when young drivers are first developing their driving skills, judgments, knowledges, attitudes, and habits.

Statement of the Problem

This study is designed to investigate the relationship between physiological changes induced in selected subjects through various levels of blood alcohol content and the physical capability to drive an automobile.

More specifically, the thirty selected subjects will be tested on individual driving skills and judgment and will be given visual tests at various blood alcohol levels ranging from .00 percent through .10 percent.

Specific questions which the study will seek answers include:

1. To what degree does the intake of various amounts of alcohol affect the ability of selected individuals to handle a car on a road test?

2. To what degree does the intake of various amounts of alcohol affect the ability of selected individuals to maneuver the car in limited areas?

3. To what degree does the intake of various amounts of alcohol affect the seeing ability of selected individuals?

4. To what degree does the intake of various amounts of alcohol affect the ability of selected individuals to react in emergency situations?

Definition of Terms

1. Acuity Letters. A chart used in the Titmus Vision Tester which contains letters of different sizes to check acuity vision.

2. Acuity Vision. The ability to see clearly and distinctly.

3. Breathalyzer. A machine used by law enforcement people to determine the level of blood alcohol content.

4. Cone Course. A driving course with a 10 foot wide lane marked by 12" cones. It consists of four left turns, two right turns and four stretches of straight line drive. The turns vary from a 75° to a 180° turn.

5. Evasive Maneuver. A lane is marked by the use of 18" rubber cones. At a specific point the lane is blocked forcing the driver to turn right or left in an attempt to miss the blockade.

6. Figure Eight Test. An exercise that resembles the numeral "eight." The driving lane is 8'6" wide with the sides of the lane marked with 12" rubber cones.

7. Glare Recovery. The amount of time required for the eye to adjust to low illumination after being subjected to glare.

8. Glare Vision. How well one can see with a bright light shining in his eyes.

9. Lanbolt Acuity. A chart used in the Titmus Vision Tester to check acuity vision.

10. Location Stop. A test to check one's ability to stop a car with the front bumper resting above a 12-inch wide line on the roadway.

11. Manipulative Skills. The ability to steer and stop an automobile.

12. Night Sight Meter. A machine used to measure the ability to see in low illumination. The machine also checks glare vision and glare recovery.

13. Peripheral Vision. The ability to see to the sides while looking straight ahead.

14. Road Test. A scored driving test of a prescribed route in which the individual is scored in all the basics deemed necessary to attain a driving license.

15. Serpentine. Five cones are placed in a straight line spaced 45 feet apart. The participant drives the exercise by moving to right of the first cone, the left of the

second, the right of the third, the left of the fourth, and the right of the fifth.

16. Titmus Vision Tester. A machine used by many practitioners in opthalmic, pediatric and other health fields. The Titmus Vision Tester will test the eyes at levels of 20/100--20/70--20/40--20/30--20/15.

Hypotheses

The following null hypotheses and sub-hypotheses were derived and tested in order to investigate the problem of the study:

Ho_1 There will be no significant difference in the ability of the participants to perform manipulative skills in the automobile at the .00 level and the .05 level.

ho_1 There will be no significant difference in the ability of the participants to perform the cone course, figure eight, serpentine, evasive maneuver, and the location stop at the .00 level and the .05 level.

Ho_2 There will be no significant difference in the ability of the participants to perform manipulative skills in the automobile at the .00 level and the .08 level.

ho_2 There will be no significant difference in the ability of the participants to perform the cone course, figure eight, serpentine, evasive maneuver, and the location stop at the .00 level and the .08 level.

Ho_3 There will be no significant difference in the ability of the participants to perform manipulative skills in the automobile at the .00 level and the .10 level.

ho_3 There will be no significant difference in the ability of the participants to perform the cone course, serpentine, figure eight, evasive maneuver, and the location stop at the .00 level and the .10 level.

Ho_4 There will be no significant difference in the ability of the participants to perform the road test at the .00 level and the .05 level.

Ho_5 There will be no significant difference in the ability of the participants to perform the road test at the .00 level and the .10 level.

Ho_6 There will be no significant difference in the visual capability of the participants at the .00 level and the .05 level.

ho_6 There will be no significant difference in the performance of the participants in the night sight test, the glare test, the recovery time test, the acuity letters test, the Lanbolt acuity, and the peripheral vision test at the .00 level and the .05 level.

Ho_7 There will be no significant difference in the visual capability of the participants at the .00 level and the .08 level.

ho_7 There will be no significant difference in the performance of the participants in the night sight test, the glare test, the recovery time test, the acuity letters test, the Lanbolt acuity, and the peripheral vision test at the .00 level and the .08 level.

Ho_8 There will be no significant difference in the visual capability of the participants at the .00 level and the .10 level.

ho_8 There will be no significant difference in the performance of the participants in the night sight test, the glare test, the recovery time test, the acuity letters test, the Lanbolt acuity, and the peripheral vision test at the .00 level and the .10 level.

Selection of Participants

It is often assumed that people with above average reflexes, above average conditioning, above average knowledge of the rules of the road, and people who drive an automobile as a vocation should be better drivers. With this in mind, participants for the study were selected from the following groups: (1) driver education teachers, (2) coaches, (3) race car drivers, (4) college or professional athletes. In addition groups of participants were selected as representatives of the general public. Other factors involved in selecting

participants were to involve both male and female as well as different ethnic groups.

Design and Methodology

The study was experimental in type. The statistical tool selected for use in evaluation was the two-way analysis of variance. Since there were two independent variables and one dependent variable, this was considered an appropriate statistic. The data were tested by the two-way analysis of variance and a special t test was used when significance was indicated.[12]

Each participant in the study was given twelve different tests and was checked at four different blood alcohol levels. Each person was scored on each test at each level. When the test was repeated at the same blood alcohol level, an average score was calculated. These scores were compared both between blood alcohol levels and between groups.

Limitations on Validity

The samples selected in the six driving groups were not random selections. Therefore, the results cannot be generalized as depicting the general characteristics of the particular groups.

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[12] W. James Popham, Educational Statistics (New York: Harper and Row Publishers, 1967), p. 145.

Organization of the Study

The report of this study was organized as follows:

1. Chapter I: Introduction
2. Chapter II: Review of Related Literature
3. Chapter III: Methodology
4. Chapter IV: Presentation and Analysis of Data
5. Chapter V: Summary, Findings, Conclusions, and Recommendations

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

During the last fifty to sixty years the debates on the dangers arising from the use of alcoholic beverages have grown in intensity. As the population and the use of automobiles increased, the nature of the discussion also changed. The earlier concerns about the morality of drinking alcoholic beverages have given way to concerns by the public of today about the amount of alcohol an individual can consume and still maintain control of his physical and mental being.

Alcohol commands a rather significant place in today's society. This is evidenced by the prominence of alcohol in most present-day entertainment offerings. Televised athletic contests are often sponsored by a brewery. Television programs often glamorize the use of alcoholic beverages. Motion pictures frequently include alcohol as part of the everyday life of the typical American family. The contemporary culture includes the serving of alcoholic beverages at many social gatherings, both formal and informal.

The literature review relating to the problem of this study led to organizing the material under the following

headings: (1) the history of alcohol, (2) drinking practices in America, (3) motivations for drinking, (4) alcohol and traffic safety, and (5) the effect of alcohol on driving ability.

History of Alcohol

When man first encountered alcohol is apparently not known. Information about discovering its sources seemed more certain. Three possibilities appeared most probable. One was fermented fruit juice or wine. Another was fermented grain, or beer. The third was fermented honey or mead. Most writers of the early history of alcohol seem inclined to favor mead as the most likely original source.

All but three of the numerous Stone Age cultures that have survived into modern times demonstrated a familiarity with alcohol. The exceptions were the environmentally underprivileged polar peoples, the intellectually stunted Australian aborigines, and the comparably lack-luster primitives of Tierre del Fuego.[1]

The earliest European explorers of South and Central America found local wines and beers throughout their wanderings. Adventurers in the "New World" found the use of alcohol equally widespread. There was general acceptance that the preponderance of alcohol brewed in ancient days was linked

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[1]Berton Roueche, The Neutral Spirit (Boston: Brown & Co., 1960), pp. 3-43.

closely with religious ceremonies. The casual use of alcohol seems to be a product of civilization.

For many years natural fermentation was the only process used for making alcoholic beverages. In 800 A.D. Jabir Ibn Hayyan, an Arabian chemist, discovered the distillation process. This new drink, known as alcohol, was used primarily for medicinal purposes.

Another four hundred years passed and another liquor, this one distilled from grain, was developed. The original grain spirit was whiskey. Gin, another grain spirit, was the first liquor that came to the attention of the civilized world.

The first spiritous liquor to be manufactured in what is now the United States was made on Staten Island. The distillery, originally owned by the Dutch, first concentrated on brandy and gin. The British took over and converted its facilities to the distillation of rum.

The beginnings of American whiskey are rather obscure. It was introduced by Scotch-Irish settlers to whom the making of pot still whiskey was a natural phase of farming.

The age of innovation in the development of alcoholic beverages expired with the nineteenth century. The final accomplishment was the application of the Scottish principle of blending to Kentucky bourbon and Pennsylvania rye. By 1900, all of the forms of alcoholic beverages now known had been

discovered, tried, and appraised.[2]

Drinking Practices in America

A national survey on American drinking practices concluded, "In the American scene as a whole, drinking is typical behavior, and both total abstention and heavy drinking (especially for escape from life's problems) are atypical." The authors further stated, "The results of this national survey indicate that whether a person drinks at all is primarily a sociological and anthropological variable rather than a psychological variable.[3]

In this age of uncertainty, change, and controversy, there have been many interpretations of basic alcohol facts. The so-called traditional views, expressed in emotion-charged extremes of either "wet" or "dry," still command a considerable following. But the alcohol "new-think" has arrived on the American scene. This new way of thinking about the interrelatedness of human problems dealing with alcohol stands between those more extreme views about drinking and abstaining. This mid-range attitude, which has the potential to generate a coordinated national policy on alcohol, allows for such phenomena as responsible drinking and inappropriate

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[2] Ibid.

[3] D. Caludhan, I. H. Cisin, and Helen M. Crossley, American Drinking Practices, A National Survey of Behavior and Attitudes, Report No. 3, Social Research Group, George Washington University, Washington, D.C., June, 1967, p. 6.

abstinence.[4]

Drinking appears to be a significant problem in the United States. Current estimates of the number of drinkers, ages fifteen and over, reveal that there are approximately ninety-three million Americans who partake of alcoholic beverages to some extent.[5] Additional data indicate that the yearly consumption of alcoholic beverages (including beer, wine and distilled spirits) per capita of the drinking age population approaches twenty-six gallons of which slightly over two gallons are pure alcohol.[6]

The entertainment media seem to accept the moderate use of alcohol as a part of modern day living. Some television programs depict drinking not only as an integral part of the good life, but as a social obligation.

One conclusion seems inescapable in a discussion of alcohol. The drinking of alcoholic beverages has become an established custom in America. Young people growing up in this culture are likely to adopt this pattern of behavior as adults.

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[4]Thomas F. A. Plant, "Alcohol Problems," A Report to the Nation (New York: Oxford University Press, 1967), pp. 1-6.

[5]Charles R. Carroll, Alcohol: Use, Nonuse and Abuse (Dubuque, Iowa: William C. Brown Co., 1970), p. 2.

[6]Ibid., p. 2.

Motivation for Drinking

In our society, both by precept and example, and by legal restraints, alcoholic beverages are among the privileges of adulthood. Therefore, the motivation for adolescents to drink is often related to their strong wish to give the image of maturity. Drinking can contribute to a feeling of self-importance, and independence. The freedom to drink, if one desires, is one of the vaunted liberties in our democratic society.[7]

In a study of the motives of 1,744 drinkers, two out of five listed some form of social pressure.[8] A desire to be pleasing in whatever company one finds himself a part of and the corresponding fear of offending friendly people are powerful motives in nearly everyone. Certainly a large number of people drink on occasion, not because of any satisfaction in the alcohol itself, but simply to be one with the group and not to be different. So long as alcoholic beverages are used by so large a portion of the populace, this will be the case, and anyone who is determined to remain free from the habit must contrive adequate defenses against the pressure.

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[7] Albion Roy King, Basic Information on Alcohol (Washington, D.C.: Narcotic Education Inc., 1964), pp. 27-53.

[8] J. W. Riley, C. R. Marden, and M. Lifshitz, "The Motivational Pattern of Drinking," Quarterly Journal of Studies on Alcohol, Vol. 9, (Dec. 9, 1948), pp. 353-362.

Other espoused reasons for drinking fall in a more serious category. Those who use alcohol as a crutch, and others who manage some form of escape through the bottle constitute a very real and serious problem. However, these are much less numerous than the incidental drinker. The effects of alcohol on those in these problem-oriented categories include: (1) excitement, (2) relaxation, (3) sociability, and (4) escape from anxiety.[9]

Alcohol and Traffic Safety

The motor vehicle is the principal means of transportation in the United States. Millions of Americans drive their cars on the public highways daily. In 1965 there were 91,000,000 licensed drivers, 80,000,000 vehicles. Auto accidents claimed 3,500,000 injuries and 49,000 deaths during that year. The cost of these auto accidents, including property damages, insurance, and medical bills amounted to $8,000,000,000.[10]

By 1975 it is estimated that the population of the United States will reach 225,000,000 and 80 percent of the people will be living in metropolitan centers. At that time we will have in operation at least 113,642,000 motor vehicles. These vehicles will be driven not only throughout the

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[9]Albion Roy King, Basic Information on Alcohol (Washington, D.C.: Narcotic Education Inc., 1964), pp. 35-47.

[10]C. Herrod, "John Q's Problems," The Bulletin San Francisco Medical Society, 39:23 (1966), p. 16.

metropolitan areas, but moving over the 41,000 mile interstate highway network which by then should be completed.[11]

Most people drive cautiously and prudently. Nevertheless, there are a number of occasions on which drivers lacking skill, forgetful of their social responsibility, or for other reasons, behave in such a manner that accidents occur. The problem is one of major concern to all who deal in the health and safety field.

The reasons for motor vehicle accidents are varied, complex, diverse and multifaceted. Certainly the great increase in the number of motor vehicles on streets and highways, together with the complexity of driving, the speeds which may be reached, and the licensing of many drivers who have relatively poor training, or significant physical defects, contribute to the problem. Based on reports from various cities and state traffic authorities throughout the country, the act of driving while under the influence of alcohol is one of the major contributing factors to serious traffic accidents. The type and frequency of accidents involving drinking drivers contrasts greatly with those involving non-drinking drivers.

A number of investigators have shown that those who drink are heavily over-represented among the accidents which result in serious-to-fatal injuries.[12] Drinking drivers are

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[11] F. R. Kreml, "Today's Time on Tomorrow's Dial," Traffic Digest and Review, 10:17 (1962), pp. 2-4.

[12] Committee on Medicological Problem, Alcohol and the Impaired Driver, American Medical Association, (Chicago, Ill., 1970), p. 7.

also more likely to be involved in single vehicle accidents. They are more likely to be involved in accidents which occur during the late evening and early morning or on weekends.[13]

A substantial portion of the traffic accidents which involve alcohol may be attributed to people with a drinking problem rather than to social drinkers. While the exact contribution of the drinking driver to the total figure of personal injury accidents from operating motor vehicles is not known and probably varies in different parts of the country and in different years, there is no question that the correlation is strong and that drinking contributes significantly to the problem. It appears that official statistics, for a number of reasons, grossly underestimate the effect of alcohol in road accidents, even when indicating that 20 to 50 percent of the casualties in particular classes of accidents can be traced to the effects of alcohol on drivers or pedestrians.[14]

Information concerning the demographic, social, and psychological characteristics of the driver who drinks in comparison with the drunken driver would be helpful in an understanding of the problem. However, such information is

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[13] J. R. McCarroll and W. Haddon, Jr., "A Controlled Study of Fatal Automobile Accidents in New York City," Journal Chronic Disease, 15:811 (1962), p. 23.

[14] Committee on Medicological Problem, Alcohol and the Impaired Driver, American Medical Association, (Chicago, Ill., 1970), p. 5.

sparse. Apparently, most drinking occurs in situations where the probability of driving afterwards is low. In a great number of cases, those who were questioned indicated that their last drink occurred in their own homes. However, a substantial number required some form of transportation from the place where the drinking occurred. The majority of people drinks in places other than taverns or bars. The information is not complete as to how many people there are driving at a given point in time whose bodies contain alcohol or the quantity of alcohol that might be present.

Neither traffic checks nor arrest records provide adequate information about the characteristics of drinking drivers. Records obtained by police are simply not designed to produce this type of information. However, in 12 neighboring communities in California in 1960, there was a check of 24,000 vehicles. It revealed that 6 persons were obviously drunk while driving and 29 others had consumed enough alcoholic beverages to justify the issuance of warnings or citations for drinking while driving.[15]

It is probable that drinking helps exaggerate the already deviant behavior of the psychopathic driver, but such a problem is not essentially one of drunken driving. Malfetti identified traffic offenders with numerous violations as having a tendency toward the following special characteristics:

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[15]H. W. Newman, and E. Fletcher, "Variability in Tolerance to Depression Drugs," Stanford Medical Bulletin, 5:12, (1947).

(1) lack of attention to the implication of their behavior for themselves and others; (2) inclination to disagreement or conflict with others; (3) rebellious and selfish attitudes; (4) hypersensitivity, lack of confidence, a feeling of personal unworthiness leading to over compensation, with erratic and ill-considered actions. In addition, such offenders are apt to have possessive parents who are relatively inactive in the community.[16]

Drinking on the part of the normal population which leads to drunken driving follows the need to change locations and the willingness to drive a motor vehicle to accomplish the change. Members of this group constitute an important segment of those guilty of drunken driving, especially that which occurs when people leave a social setting and head for home or another social setting. The party is a phenomenon in American culture where the role of party-guest and party-host are rather clearly delineated. There is the custom of offering drinks and the obligation of accepting them. The substitute host, the bartender, has a strong economic motivation to maximize his guests' drinking and is likely to conceive of this behavior as indicating he is providing good service. Few bartenders refuse to serve a customer a drink who has had too many, even though it is illegal in many

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[16]Committee on Medicological Problem, Alcohol and the Impaired Driver, American Medical Association, (Chicago, Ill., 1970), p. 6.

jurisdictions to serve drinks to obviously inebriated people.

The person involved in an auto accident following drinking may be characterized as belonging to one of three groups: (1) the psychopathic personality; (2) the chronic alcoholic; and (3) the social drinker. The proportion of motor accidents in the United States that can be attributed to persons in these three groups is not presently known, but there is increasing evidence to indicate that persons suffering from chronic alcoholism, while representing a small percentage of drivers, are responsible for a disproportionately large percentage of accidents after drinking.

All of the drinking groups are heavily over represented in accidents which result in serious and/or fatal injury, which occur during the late evening and early morning hours and on weekends, or involve single-vehicle accidents.

The Effect of Alcohol on Driving Ability

There are substantial amounts of data that have been gathered by investigators both in this country and abroad about the effects of alcohol on driving skill as well as the extent of those effects. These studies may be divided into three principle groups: (1) laboratory studies which indicate the effects of alcohol on sensory, motor and psychological processes which may be involved in different components of driving; (2) epidemiological studies which attempt to determine the number of accidents and traffic violations in which

alcohol is or may have been a causative factor; (3) driving experiments which are designed to determine how driving and its significant components may be affected by alcohol, under either actual or simulated driving conditions. These are summarized in the three sections which follow.

Group I

The physical symptoms following ingestion of alcohol differ among individuals according to temperaments and circumstances, but they follow a characteristic course. The initial effect is ascending in that there is euphoria and a feeling of comfort and enjoyment. As the dosage increases, feelings elevate to vivacity. As the dose further increases, less desirable effects occur and there is loquacity, garrulity, emotionalism, either quarrelsome, affectionate, or both, then on to hebetude and depression. These behavioral changes are accompanied by the dulling of certain mental faculties while others remain partially unaffected. This results in a disturbance of normalcy and of the usual sense of balance.

Among the earlier functions to be lost are judgment, reflection, attention, and observation. All of these are faculties which are acquired through or promoted by education and which lead to restraint and prudence. A characteristic of the drinker is his loss of power to control moods. There may be unjustified sadness, friendliness, merriment, or even aggressiveness.

A crucial problem in studying the effects of alcohol on behavior is determining why the same blood alcohol level affects one person one way and another similar person quite differently. The proportion of negative reactions such as aggression, antagonism, disagreement, and the like, appears to increase with increased drinking. Also, the position of the individual in a group seems to have an important effect on the increased proportion of negative reactions. It appears that centrist oriented persons have a higher proportion of negative reactions after drinking while isolates do not. Those who tend to be aggressive when sober seem to have a higher proportion of negative reactions after drinking. The behavioral norms of the individual, therefore, seem to have an important bearing on behavior while under the influence of alcohol.

Reaction Time and Coordination

Impairment of coordination has been demonstrated in great numbers of subjects whose skills have been measured repeatedly under usual conditions and after having received varying quantities of alcohol. The threshold of impairment has been demonstrated to be as low as .05 percent. Depending upon the complexity of the task and the familiarity with it, low doses of alcohol may increase performance of certain learned skills such as typing. Graphologic tests comparing handwriting legibility, the time required for writing, fine

motor coordination and accuracy all show significant lowering in normal subjects following the ingestion of whiskey at blood levels as low as .05 percent.[17]

Newman examined the relationship between blood alcohol and the level at which decrement of performance is noted and concluded that there was a critical blood alcohol level for each individual. Above this point small increases tend to produce large losses of coordinative ability. These functional decrements occurred at lower levels than those at which diagnosis of intoxication would have been made clinically.[18]

Reaction time to optic and acoustical stimuli is impaired at levels of .08 percent. Alcohol increases the reaction time to simple visual stimuli while caffeine tends to return the length in time toward normal values. The changes in simple visual reaction time are small and negligible at blood levels below .10 percent. On the other hand, motor tasks which require coordination or complex discrimination are impaired at blood levels of .05 percent.[19]

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[17]Committee on Medicological Problem, Alcohol and the Impaired Driver, American Medical Association, (Chicago, Ill., 1970), p. 28.

[18]H. W. Newman and E. Fletcher, "Variability in Tolerance to Depression Drugs," Stanford Medical Bulletin, 5:12 (1947), pp. 33-39.

[19]Committee on Medicological Problem, Alcohol and the Impaired Driver, American Medical Association, (Chicago, Ill., 1970), p.28.

Because of its depressing effect on inhibition alcohol appears to have a stimulant action on the central nervous system. Actually, it is a depressant at all doses. A variety of test and life situations points to the decrease of cerebration above certain threshold levels. The threshold level varies with individuals. While only minor impairment occurs below these levels, deterioration increases rapidly in all subjects after the threshold is passed.[20]

Reflexes

Alcohol in doses of approximately 1.50 to 2.00 fluid ounces per 66 pounds body weight increased sensory threshold sensitivity, pain thresholds and motor reactivity of conditioned reflexes. It slowed respiratory conditioned reflexes. At this dosage level it also had a more pronounced effect on motor-conditioned reflexes than did excitant drugs and favored excitatory reactions. There was a tendency for it to convert inhibitory to excitatory reactions. Swaying in the Romberg test was demonstrated to be significantly increased by blood levels of .10 percent or over, but not significantly below this level. Alcohol produced a depression of both monosynoptic and multisynoptic reflexes.

Amounts of alcoholic beverages considerably less than those required to cause intoxicated behavior reduced emotional tension as indicated by utilizing the galvanic skin

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[20] Ibid., p. 29.

response as a measure of the reflex activity of the sympathetic nervous system. Analysis of this and related data led to the conclusion that reaction to stimuli following ingestion of alcohol will require more time, but that this is compensated for by greater intensity of responses. At a blood-alcohol level of .05 percent there was a reduction of emotional responsiveness and an alteration of emotional level, while simple or well-practiced skills remained relatively unimpaired.[21]

Special Senses

Alcohol affects various aspects of vision. Voluntary convergence was altered at blood-alcohol levels above .03 percent and became progressively impaired as the alcohol level rose. Binocular fusion was lost at the half-meter range in higher concentrations and may give rise to diplopia. Fusion and convergency were markedly impaired between .05 percent and .15 percent blood alcohol levels. Visual acuity losses occurred at levels as low as .08 percent. Resistance to glare decreased as did distance judgment and binocular vision. Peripheral fields were the least affected. The time required to adjust from far to near vision may be reduced by .10 to .20 seconds at blood alcohol levels of .06 percent. Alcohol decreases fusion frequency at relatively low levels. Failure to distinguish color correctly is noted

[21] Ibid., p. 30.

at low levels on testing with a Haber color saturation threshold meter. Darkness adaptation may be increased by the ingestion of alcohol, though transitory decreases caused characteristic undulation in the curve of retinal sensitivity.

Nystagmus was reported to be the earliest eye sign produced by alcohol, occurring as early as 15 minutes after ingestion. It was generally accompanied by a lengthening of the reaction time. Positional nystagmus is seen in most severe cases of alcoholic intoxication. The threshold appears to be about .05 percent. There are two phases of alcohol produced positional nystagmus (Pan) which are separated by an intermediate period of 1 to 2 hours. Pan I lasts 3-4 hours and occurs during the alcoholic intake; Pan II lasts from 5 to 15 hours and is sometimes present after alcohol has left the blood.

These residual tests of the effects of alcohol on vision have certain implications regarding the relationship between the abuse of alcohol and road or air traffic. They imply that there may be impairment of certain central nervous system functions for a considerable period of time after all alcohol has left the body.[22]

Group II

The studies summarized below cover a time period from 1934 to 1965.

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[22] Ibid., p. 33.

Andreasson conducted a study in 1947. Blood-alcohol determinations and examinations by medicolegal use were done on 1,712 motorists who were involved in serious traffic accidents or were charged with having driven motor vehicles under the influence of alcohol. All were diagnosed as clinically intoxicated at blood alcohol levels of .25 percent. Some persons were able to mask gross intoxication while being examined though showing unmistakable signs of intoxication while they thought themselves unobserved. The motorists tested from .0 percent to .30 percent blood alcohol level.

The conclusions reached were that the determination of alcohol in the blood is an important means of defense for the sober driver. At levels as low as .08 percent two-thirds of the drivers on careful examination showed signs of marked impairment.[23]

Bavis studied 145 suspected drinking drivers. In ninety-five percent of the drivers examined there was agreement between the chemical tests and the clinical evidence of alcoholic intoxication.[24]

Berry conducted a study in 1940 of 8,379 drinking drivers. Statistical analysis of official reports indicated that in 1939 in 20 percent of all fatal road accidents either

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[23] J. K. Bock, "Driver Behavior and Accidents," American Journal Public Health, 47:546, (1957), pp. 23-27.

[24] D. F. Bavis, "145 Drunken Drivers--A Blood and Urine Alcohol Study," U.S. Laboratory Clinical Medicine, 25:823, (1940).

a driver or a pedestrian had been drinking. One third of all fatal accidents occurring at night involved a drinking driver. When alcohol levels were greater than .15 percent, the chances of being involved in an injury increased 55 times.[25]

Bock conducted a study in 1957 in which 810 householders in New York state were interviewed. Fifty-six percent of the persons interviewed drank. Forty-two percent generally and 20 percent occasionally drove after drinking. Persons who drove more than 6,000 miles per year or who drove after drinking had a greater number of accidents than those who did not drive after drinking.[26]

A study conducted by Borkenstein in 1964 involved four groups of drivers: non-drinking and non-accident; drinking and non-accident; non-drinking and accident-involved; and drinking and accident involved. There were 13,575 subjects involved in the study. His findings indicated that blood alcohol levels below .05 percent were consistent with traffic safety while blood alcohol levels above .05 percent were definitely associated with increased accident involvement. Drivers with blood alcohol levels above .08 percent had more single vehicle accidents as well as more severe accidents in terms of injury, damage, and economic cost than sober

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[25] D. S. Berry, "Alcohol as a Factor in Traffic Accidents," Quarterly Studies of Alcohol, 1:413 (1946), pp. 9-14.

[26] J. K. Bock, "Driver Behavior and Accidents," American Journal Public Health, 47:546 (1947), pp. 23-27.

drivers.[27]

Cassie and Allen conducted a study in 1961 of 574 road traffic accident victims who had been hospitalized. One-third of all road casualties hospitalized after midnight had a blood-alcohol level over .10 percent. There was a progressive increase in the number of persons having positive alcohol tests in all three blood alcohol level groups commencing with the period 6AM-12M. Peak levels occurred after midnight. No subjects with alcohol levels greater than .05 percent were found in the 6AM-12M sample.[28]

In the period 1959-1962 Collister conducted a study of 97 patients hospitalized because of road accidents. Eleven percent of the seriously injured patients and 9 percent of the slightly injured patients admitted to drinking within two hours prior to their accidents. Thirty-four percent of all night accidents involved drinking while only 6 percent of the accidents occurring during the day involved alcohol.[29]

In 1951 Elbel conducted a study involving 10,000 persons who were involved in traffic accidents. In 13.4

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[27]Committee on Medicological Problem, Alcohol and the Impaired Driver, American Medical Association, (Chicago, Ill., 1970), p. 38.

[28]A. B. Cassie and W. R. Allen, "Alcohol and Road Accidents," British Medical Journal, (Dec. 23, 1968), p. 13.

[29]Committee on Medicological Problem, Alcohol and the Impaired Driver, American Medical Association, (Chicago, Ill., 1970), p. 39.

percent of all cases, the blood alcohol concentration was above .05 percent. Alcohol was involved in 46 percent of the accidents which occurred between 8 PM and midnight and the percentage was higher on Sunday than on weekdays. There was a correlation between clinical and chemical diagnosis of intoxication in 450 cases.[30]

In 1951-1956 a study was conducted in Baltimore by Freimath that involved 500 highway accident fatalities. Of these 500, 48.2 percent had a blood alcohol content of .05 percent or more. The greatest number of drivers, pedestrians, and passengers had more than .15 percent blood alcohol.[31]

Gerber carried out a study between 1941-1960 involving 2,294 fatalities from motor vehicular accidents. Alcohol was present in 60 percent of the drivers, 47 percent of the passengers, and 51 percent of the pedestrians who survived less than one hour. More than half of the positive cases had blood-alcohol levels in excess of .20 percent. Forty percent of the driver fatalities resulted from accidents in which the decedent vehicle was the only one involved and 76 percent of these were under the influence of alcohol. Seventy-eight and eight-tenths percent of all driver fatalities were attributed to culpable negligence on the part of the decedent. The study suggested that blood alcohol has a

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[30] Ibid., p. 40.

[31] H. C. Friemath, S. R. Watts, and R. S. Fisher, "Alcohol and Highway Fatalities," Journal of Forensic Science, 3:65 (1958), pp. 291-316.

significant relationship to fatalities in motor vehicular accidents among drivers and pedestrians.[32]

Gruner and Werner conducted a study in 1957 encompassing 3,000 drinking drivers. All drivers showed an increase in unsafety with a blood-alcohol level of .07-.08 percent. The degree of unsafety is threefold at .09 percent and eighteen-fold at .13 percent. Thirty-five percent of all serious traffic accidents were connected with alcohol intake. Reduction in safety was caused more by recklessness and a decreased feeling of social responsibility than by loss of skill.[33]

In 1950-1957 Haddon and Bradess investigated 117 single vehicle accidents. They found that 49 percent of fatally injured drivers had blood alcohol levels of .15 percent or more at death. An additional 20 percent had levels between .04 and .15 percent.[34]

A study by Heise in 1934 concerned 216 persons injured or killed in auto accidents. It revealed that the average blood alcohol level for various types of accidents

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[32]S. R. Gerber, Vehicular Fatalities in Cuyahoga County USA, Twenty Years Experience (1941-1960) in Alcohol and Road Traffic, BMA House, London, (1962), pp. 38-44.

[33]Committee on Medicological Problem, Alcohol and the Impaired Driver, American Medical Association, (Chicago, Ill., 1970), p. 4.

[34]W. Haddon, Jr. and V. A. Bradess, "Alcohol in the Single Vehicle Fatal Accident," Journal American Medical Association, 169:1587 (1959), pp. 29-34.

were: single vehicle .15 percent, single vehicle fatality .24 percent, collision .21 percent, striking pedestrian .15 percent, and drinking pedestrian striking car .20 percent.[35]

In 1961 a study involving 936 drivers was conducted by Vamosi. Four hundred eighteen drivers involved in accidents were compared with a control group equal in number who were chosen at the same time, at the same hour, the same street, and had not violated a traffic regulation and were without injuries. The risk ratio (the probability of being involved in an accident) was compared between the two groups with the following findings: levels of .03 percent to .099 percent, risk ratio 7 to 1; .01 percent to .149 percent, risk ratio 31 to 1; greater than levels of .15 percent, the risk ratio was 128 to 1. The conclusion was that there does not exist any safe limit of drinking in traffic, as alcohol has an effect at all measurable blood levels.[36]

Group III

In 1950 Bjerver and Goldberg conducted a driver test using 37 expert drivers. These individuals were tested with blood alcohol level of 0.00 to .12 percent. The driving ability was tested on a special track utilizing 6 tests

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[35]H. A. Heise, "Alcohol and Automobile Accidents," Journal American Medical Association, 103:739 (1934), pp. 52-57.

[36]Committee on Medicological Problem, Alcohol and the Impaired Driver, American Medical Association, (Chicago, Ill., 1970), p. 49.

involving driving skills such as backing, steering, starting, stopping and starting. Their skill decreased 25 to 30 percent at threshold blood alcohol levels of .03 to .045 percent. It was concluded that blood alcohol levels of .05 percent or less will impair the driving of even skilled persons.[37]

Cohen's study in 1958 used highly experienced bus drivers with a blood alcohol content of .05 and .06 percent. He found that when they were given tests permitting assumptions of increasing risk, faulty judgment was noted at low doses. There was no indication of the willingness to take ever increasing risks as blood alcohol increased, but there was greater confidence about the performance of the more difficult tasks. Although reactions to alcohol varied among the drivers, performance as well as judgment, deteriorated as they consumed more alcohol.[38]

In 1958 Coldwell studied 50 subjects with varying drinking habits. They were given a driving test with blood alcohol content ranging from .03 to .15 percent. When subjected to a practical driving test consisting of operating a car in a theoretical garage area, an alley test, a parking test and a road test, impairment of driving skill became

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[37]K. Bjerver and L. Goldberg, "Results of Practical Road Tests and Laboratory Experiments," Quarterly Journal of Studies in Alcohol, 11:1 (1950), pp. 17-27.

[38]J. Cohen and Hansel Dearnaley, "The Risk Taken in Driving Under the Influence of Alcohol," British Medical Journal, 1:1438 (1958), pp. 1-4.

evident at levels as low as .05 percent. Seventy percent were affected at levels of .05 percent, 80 percent of heavy drinkers at levels of .05 to .12 percent. No driver retained non-drinking skill at blood alcohol levels approaching .15 percent. Statistically, half of the drivers tested significant impairment of driving skill at levels of .08 percent.[39]

In 1948 Goldberg gave 37 experienced drivers a road test. The drivers were graded at the sober level, the .04 percent level, and the .06 percent level. These tests indicated that driving ability as measured by graded road tests was impaired by 25 to 30 percent at these blood alcohol concentrations.[40]

In 1955 Huber tested 18 motorcycle riders with a blood alcohol level of .03-.15 percent with a battery of tests. Ability to judge speed was impaired and reaction time prolonged at blood alcohol levels below .05 percent. Impairment of efficiency was observed in most subjects at a blood alcohol level of .10 percent. Tasks designed to assess the accuracy of driving attention, memory, skill in handling a vehicle and reaction time were all decreased in efficiency with increasing blood alcohol levels.[41]

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[39] B. B. Coldwell, D. W. Penner, H. W. Smith, G. H. W. Lucas, R. F. Rogers, and F. Darroch, "Effect of Ingestion of Distilled Spirits on Automobile Driving Skill," Quarterly Journal of Studies in Alcohol, 19:590 (1958), pp. 21-34.

[40] Committee on Medicological Problem, Alcohol and the Impaired Driver, American Medical Association, (Chicago, Ill., 1970), p. 54.

[41] Ibid., p. 56.

Studies Designed to Measure the Effect of Alcohol on Driving Ability as Measured on Simulated Driving Tests

In 1958 Drew conducted a study of forty healthy subjects utilizing the Miles Motor Driving Trainer. He found that the accuracy of steering decreased linearly with increasing blood alcohol. A measureable increase in mean errors paralleled the increase of blood alcohol. The mean increase in error at a blood alcohol level of .08 percent was .16 percent. The amount of steering wheel movement with measured vehicle control increased significantly with increasing blood alcohol levels.[42]

During the years 1948 to 1956 Hine conducted a study on the effects of alcohol on the ability to perform in a simulated driving device. He used 300 young adult male and female medical and pharmacy students. Using a simulated driving device which measured time for braking and response to turn signals, baseline skills were lowered 10 to 55 percent. The number of incorrect responses increased as did the mean decrement of performance throughout the group with increasing blood alcohol levels.[43]

In 1963 Mortimer tested 16 males with 20/20 vision in an attempt to determine if the use of alcohol caused an individual to score lower on a driving apparatus. Simulated

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[42] Ibid., p. 57.

[43] Ibid., p. 58.

driving was done with the Mortimer apparatus under normal day and night driving conditions and with glare. Lower blood alcohol levels significantly affected the glare condition while higher blood alcohol levels affected all three conditions of night driving.[44]

Penner and Coldwell conducted a study in 1958 using 50 experienced drivers. Twenty-five of the 50 were considered light drinkers, 15 intermediate drinkers and 10 heavy drinkers. Seven tests of physical and 6 of mental status conducted by two different physicians indicated discrepancy between the two examiners in terms of percentages of drivers they considered intoxicated. Many subjects with impaired driving did not show physical or mental impairment by medical examination. The conclusion from this was that since medical examinations are a relatively insensitive method, they are not sufficient by themselves to assess impairment from alcohol in relation to driving.[45]

In 1953 Starck tested fourteen brewery drivers with high daily alcohol intake. The results indicated that the performance of psychomotor and sensory functions important in automobile driving was impaired by alcohol at concentrations

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[44]R. G. Mortimer, Effect of Low Blood Alcohol Concentrations in Simulated Day and Night Driving (Southern University Press, 1963), pp. 399-408.

[45]D. W. Penner and B. B. Coldwell, "Car Driving and Alcohol Consumption," Canada Medical Association Journal, 79:793 (1958), pp. 41-46.

of .15 percent or less in the blood. No obvious signs of drunkenness were apparent in those habituated to alcohol. Thus, drivers with high daily alcoholic intake may not exhibit gross intoxication, yet still demonstrate a marked loss of driving skill.[46]

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[46]Committee on Medicological Problem, Alcohol and the Impaired Driver, American Medical Association, (Chicago, Ill., 1970), p. 59.

CHAPTER III

METHODOLOGY

Design

This study was an investigation of the effect of alcohol on the ability to drive an automobile. Its purpose was to provide information that might be useful in the education of young drivers.

The design used was a four by six two-way analysis of variance. The independent variables were the six different driving groups and the four different blood alcohol levels at which the participants attempted the different tests.

An important factor in the selection of the participants was their possible impact on the typical teen-age driver. Decisions about which groups might be most influential were based on numerous visits with high school students. These visits took the form of interviews with individuals or small groups of 2 to 5 students. Questions asked included the following: What group or groups in our society should have the most knowledge and skill in handling an automobile? From a physical standpoint, which groups should have the best reaction times in different driving situations? What group

of individuals in your age group would have the quickest reactions? What group of individuals would you like to see tested in a study such as this?

The driver education teachers were selected because of their supposed knowledge of the proper way to handle a car. A secondary factor in their selection was that the material growing out of this study was to be used by teachers in driver education.

The coaches were selected because of the status they hold in the eyes of many high school students. Even though many high school students did not attach status per se to coaches, they did indicate that in most cases athletic coaches would prove to be above average in physical capabilities.

The athletes were selected to most typify the teen-age group. For reasons both legal and moral, no teen-agers were included in the population of the study, but five graduating seniors of Central State University who had been active in athletics at the college level were selected.

There was almost unanimity about those who should make up the group which would be most skillful in handling an automobile. Students felt that race drivers, because of the nature of their work, should be "tops" in this category.

The answer most often received when students were asked, Who would you like to see tested?, was "my mom," "my dad," or "my parents." Therefore, housewives and businessmen were selected to make up the final two groups of participants.

Levels Selected

The review of literature revealed that many investigations noted a degree of impairment at somewhere around the .05 blood alcohol level. The variation was from .03 percent to .05 percent in different studies.

It was also noted that a few states now recognize the .08 percent level as being the point at which the individual, from a legal standpoint, is considered to be under the influence of alcohol. However, the majority of States, 35 at this time, accepts the .10 percent level for legal purposes. With these factors in mind, it was determined that each individual would be tested at the .00 percent level, the .05 percent level, the .08 percent level, and the .10 percent level.

Test Selection

The dependent variables in the study were the tests used for evaluating each individual. Twelve such tests were selected. They were selected on the basis of the literature in the driver education field and their relevance for driver education students.

At the present time there is disagreement among authorities as to the point at which alcohol intake impairs vision. There is also disagreement about the type of impairment. On the basis of the best information available, the following tests were selected:

1. Acuity Vision--Two different tests were administered in the effort to check acuity, the ability to see clearly. Both tests were given through use of the Titmus Vision Tester. The first was a version of the Snellen eye chart where the person was asked to read letters of different sizes. The second was the Lanbolt ring test. This test consists of a number of diamond shaped signs with rings of different sizes located in each corner. Three of the rings are broken while the fourth is a complete circle. The subject is asked to identify the location of each closed ring. Both the Snellen and the Lanbolt tests will measure acuity from 20/200 to 20/15.

2. Field of Vision--The test used to determine the individual's field of vision was Harrington's Multiple Pattern of Visual Field Examination. This test checks the person's ability to see to the right, left, top, or bottom simultaneously and how many degrees their field of vision covers. Each participant was checked one eye at a time. The test consists of ten cards for checking the right eye and ten cards for checking the left eye. A timed black light flashes on for one second. During this time the subject is asked to tell how many different objects appear on the card and their locations.

3. Night Vision, Glare Vision, and Recovery Time--The American Automobile Association's Night Sight Meter was used to check night vision, glare vision, and recovery time.

The machine is designed to check one's ability to see in dimly lighted areas, the ability to see with a bright light shining in the eyes, and the amount of time it takes the eye to recover from the exposure to bright light back to the previously determined levels of seeing in dimly lighted areas.

The driving tasks were selected in order to check each participant's ability to handle a car in precise maneuvers. The exercises selected were among those familiar to many driver education students.

The serpentine is an exercise frequently used as a beginning exercise for driver education students. Its purpose is to determine the individual's ability to steer the car.

The figure eight is another basic exercise in driver education. It, too, is a test of the person's ability to steer the car, but it requires a bit more ability in judging distance than is required in the serpentine.

The location stop is also used in driver education classes. Participants are evaluated on the basis of their ability to stop the car behind a designated line, either real or imaginary. This is an effort to check judgment of distance.

The evasive maneuver is designed to determine the individual's reaction time in an emergency situation. This is an exercise that is now being introduced into driver education courses. It is administered in a number of different

forms, but all are directed to the same purpose.

The cone course is an exercise that is not frequently used by most teachers of driver education. However, since the course is a ten foot wide lane outlined by cones, the students are frequently exposed to a similar situation in lane driving on the street. The test is designed to check the participant's steering ability, distance judgment, and skill in handling the accelerator and brake.

The driving test is familiar to all who have been tested in order to obtain a driver's license. It is designed to evaluate one's skill in handling a car as well as knowledge of the rules of the road. The test used in this study was very similar in nature to the test used by driver licensing agents all over the United States.

Testing Controls

Controls used to insure consistent treatment of the participants in the study included:

1. The general instructions to the group were given by use of an audio tape.

2. The same person determined the amount of alcohol needed to reach each testing level.

3. All drinks were measured and mixed by the same person.

4. Breathalyzer examinations were administered by the same person.

5. The same person administered all of the vision tests.

6. The same person rode with the participants through all phases of the driving tests and gave uniform instructions to all participants.

7. All persons were tested at 20 mph on the serpentine and 35 mph on the evasive maneuver. This factor was controlled by the use of a hand control attached to the accelerator which enabled the person riding with the participant to control the speed of the car.

8. The same individual was used in the control tower to record the results of all driving tests.

9. Weather conditions under which all groups took the tests were virtually identical.

Description

Each of the individuals participating in the study was given the date they were scheduled. Each was asked to eat a light meal before arriving and no alcoholic beverages were to be consumed prior to the testing time. Each participant was picked up at his home and chauffeured to the testing site.

Upon arrival at the South Central Safety Education Institute at Central State University, the group was introduced to various members of the staff and others who were assisting in the study. They were asked to fill out a personal information sheet to provide information as to age,

sex, and weight. Weight is an important variable in determining how much alcohol is needed to reach different blood alcohol levels.

A tape containing general information about the study was played for each group. At the completion of the tape, questions were asked for and answered. A number was then assigned to each individual for identification purposes.

Each participant was assigned to one of the student helpers. These helpers took each participant to a car and explained in some detail each of the driving tests that were to be administered. The instruction included performance of each test by the student drivers. Each participant was then given the opportunity to practice each exercise until he felt competent to perform the exercise as required.

Participants were then checked by the breathalyzer to determine their blood alcohol level. In all cases it was .00 percent at the beginning. As this was verified, each person was ushered into the room where testing of vision was to occur.

The first vision test was on the field of vision. It was followed by use of the Titmus Vision Tester for the Snellen and Lanbolt ring acuity test.

The Night Sight Meter was located in another area of the same room. It was used to check the participants for night vision, glare vision, and recovery time.

Upon completion of the six vision tests, each participant proceeded to the car to be used in the driving tests. The same car was used for all participants.

As soon as the participant was secured in the driver's seat with safety belt fastened and doors locked, he was instructed to proceed to the first exercise which was the cone course. The instructions were to drive the course as quickly as possible with a minimum speed of 12 mph allowed at any point. They were urged to avoid knocking over as many cones as possible, but they were also encouraged to drive the course as quickly as possible. There was a penalty for each cone hit. A stop watch was used to record the time needed to complete the course in order to give incentive for speed.

At the end of the cone course a twelve inch wide line was drawn across the lane in which participants were traveling. This constituted the location stop exercise. They were asked to stop the car so that the front bumper would be directly over the line. The length of space short or long of the line was used as a penalty on the score for the test.

The next test was the figure eight exercise. Again, the driver was urged to drive the exercise as rapidly as possible without hitting any cones. Scores were determined on the basis of number of cones hit.

Each participant was then asked to perform each of these three exercises a second time. The scores used for the study were obtained by averaging the scores on the two performances.

The next exercise to be performed was the serpentine. For this test, participants were instructed to remove their foot from the accelerator. The instructor was to control acceleration through use of the hand control. The exercise was performed at a speed of 20 miles per hour. Scores were determined on the basis of the number of cones hit.

Following the serpentine, the participants were instructed to move to the evasive maneuver exercise. This test was also performed at an instructor controlled speed which was 35 miles per hour. Again, scores were based on the number of cones hit during the exercise.

The serpentine and evasive maneuver tests were performed three times by each participant. The three scores were averaged in order to obtain the value used for the study.

The course was then cleared of all cones and obstacles in preparation for the driving test. Each participant was told that he would be scored on all rules of the road as well as his ability to handle the car. The driving test was approximately 5-7 minutes long involving left and right turns, lane changes, stop signs, stop lights, railroad crossings and emergency vehicles.

Upon completion of the driving test, the participant was ushered to the refreshment room. At this point a lieutenant of the Department of Public Safety informed the participant as to how much alcohol they should drink to reach the desired blood alcohol level. Each participant was given a

choice of beverage. After its consumption, there was a 30 minute wait to insure that the alcohol remaining in the mouth was not sufficient to affect the breathalyzer. At this time the breathalyzer test was administered to determine blood alcohol level. If the test showed between .04 percent and .06 percent, the participant was considered ready to take the vision tests again and to re-perform the various driving exercises.

The procedure for administering the tests after the consumption of alcohol were identical to the original series. Upon completion of the tests, each participant was given another breathalyzer test to determine blood alcohol content at that time. From this information the lieutenant administering the breathalyzer examinations was able to determine the amount of alcohol needed to reach the next level. Again, refreshments were served and the 30 minute waiting period began after the drink was consumed.

When each participant was found to test between .06 percent and .08 percent blood alcohol level, he was considered ready to perform the various driving and vision tests again. Because of the time factor in completing the entire testing program during the daylight hours, the road driving test was eliminated from this series.

Upon completion of the third series of tests, the same procedure as before was followed. When each participant was found to test between .08 percent and .11 percent blood

alcohol level, he re-performed all of the driving and vision tests for the final time.

The scores for each test at each level were recorded in a central room known as the control tower. The driving test results were relayed from the range to the control tower by means of radio communication. The participant was also informed of his score by means of a radio receiver in the car he drove.

Because each participant was legally intoxicated upon completion of the tests, each was delivered to his home by a staff member.

Statistical Design

Because there were two independent variables and each dependent variable resulted in interval data, a parametric test, which used in its design the two independent variables, was selected for use. Popham describes this as a two-way analysis of variance.[1] It enables testing for significant differences between the groups of each independent variable separately, and for any significant interactive effects between the independent variables. An analysis of variance was calculated for each dependent variable. For example, the cone course results were tested for significant differences between the six driving groups and between the four levels

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[1]W. James Popham, Educational Statistics (New York: Harper and Row Publishers, 1967), p. 189.

of blood alcohol content.

The two analyses of variance results in F ratios which indicate significant difference between the high and low means of the groups. Differences between other groups at other blood alcohol levels were tested for significance by using a special t test described by Popham where group variances are replaced by the within mean sums of squares.[2] This t test was used when significant F ratios were found in order to determine differences between groups or levels for each of the dependent variables.

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[2] Ibid., p. 145.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Introduction

The purpose of the study was to investigate the relationship between physiological changes induced in selected subjects through various levels of blood alcohol content and the physical capacity to drive an automobile.

Eight major hypothesis and six sub-hypothesis were used to test the variables involved in the study. The first three major hypothesis were concerned with the relationship of scores on tests of manipulative skills at the .00 level, .05, .08, and .10 levels of blood alcohol. Each of these hypothesis involved a sub-hypothesis containing five dependent variables which were the scores of performance on the cone course, figure eight, serpentine, evasive maneuver and location stop.

The scores on each of the five tests were treated separately and each of the three major hypotheses were rejected when three of the five were significant at the .05 level. If two or less were significant at the .05 level, the major hypothesis was accepted.

Major hypotheses numbers four and five dealt with comparing the performance on a road test when the participant was at the .00 level and when the blood alcohol levels were .05 and .10.

Hypotheses six through eight involved comparing the performance of participants on various vision tests at the .00 blood alcohol level and .05, .08, and .10 blood alcohol levels. For each of these major hypotheses, there was a sub-hypothesis containing six variables, which were scores on six different tests of vision. Rejection required significance at the .05 level on four of the six tests. If there was statistical significance on three or less of the six tests, the major hypothesis was accepted.

Statistical Test

The two-way analysis of variance was used to test all major and sub-hypotheses. The level of statistical significance to determine rejection or acceptance was .05. In addition, a special t test was used for analyzing the results of the two-way analysis of variance.[1]

Presentation and Analysis of Data

Ho_1 There will be no significant difference in the participant's ability to perform manipulative skills in the automobile at the .00 level and the .05 level.

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[1]W. James Popham, Educational Statistics (New York: Harper and Row Publishers, 1967), p. 145.

ho_1 There will be no significant difference in the participant's ability to perform the cone course, figure eight, serpentine, evasive maneuver, and the location stop at the .00 level and the .05 level.

The data used to test the first variable in ho_1 are contained in Table 1. Table 2 contains the results of the two-way analysis of variance. The relationship was significant at the .01 for the blood alcohol levels. Table 3 contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham was not significant at the .05 level.

TABLE 2

ANALYSIS OF VARIANCE RESULTS OF CONE COURSE

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Ratio	Level of Significance
Levels	10,076.85	3	3,358.95	15.71	.01
Groups	4,778.48	5	955.69	4.47	.01
Interactions	3,421.28	15	228.08	1.06	n.s.
Within	20,524.40	96	213.79		

$F_{(3,96)}$	$P < .05 = 2.72$	$P < .01 = 4.04$
$F_{(5,96)}$	$P < .05 = 2.33$	$P < .01 = 3.25$
$F_{(15,96)}$	$P < .05 = 1.82$	$P < .01 = 2.32$

TABLE 1

MEANS BY GROUP AND LEVEL FOR THE CONE COURSE

Levels	Coaches	Athletes	Businessmen	Housewives	Driver Education Teachers	Race Drivers	Row Sums	$\overline{X}$ of Row
.00 EX	-3.0	-6.0	-36.0	-8.0	-21.0	-18.5	-92.5	
.00 EX^2	9.0	12.0	458.0	32.0	173.0	131.25	815.25	-3.08
.00 N	5	5	5	5	5	5	30	
.05 EX	-7.5	-14.0	-62.0	-50.5	-54.5	-83.0	-271.5	
.05 EX^2	29.25	148.0	962.5	561.25	984.25	2,307.5	4,992.75	-9.05
.05 N	5	5	5	5	5	5	30	
.08 EX	-26.5	-34.0	-106.5	-107.5	-55.5	-109.0	-439.0	
.08 EX^2	604.25	500.0	2,829.75	3,420.25	735.25	2,574.0	10,663.5	-14.63
.08 N	5	5	5	5	5	5	5	
.10 EX	-71.5	-120.0	-186.5	84.00	-104.5	-269.5	-836.0	
.10 EX^2	3,005.25	4,815.5	8,775.75	2,096.00	3,236.25	22,786.75	44,715.5	-27.86
.10 N	5	5	5	5	5	5	30	
Sum of Column EX	-108.5	-174.0	-391.0	-250.0	-235.5	-480.0	-1,639.0	
Sum of Column EX^2	3,647.75	5,475.5	13,026.0	6,109.50	5,128.75	27,799.5	61,187.0	
Sum of Column N	20	20	20	20	20	20	120	
$\overline{X}$ of Column	-5.42	-8.7	-19.55	-12.5	-11.77	-24		

TABLE 3

t TEST RESULTS OF CONE COURSE FOR LEVELS

Means	Rank	Group
-27.68	4	.10
-14.63	3	.08
-9.05	2	.05
-3.08	1	.00

$SE\bar{X} = 3.78$

Rank Groups	Means		t Values	Levels of Significance
4 X 1	-27.68	-3.08	6.51	.01
3 X 1	-14.63	-3.08	3.06	.01
2 X 1	-9.05	-3.08		n.s.
4 X 3	-27.68	-14.63	3.45	.01
4 X 2	-27.68	-9.05	4.93	.01

$t_{(30)}$ $P < .05 = 2.04$ $P < .01 = 2.75$

Table 4 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 1 of ho_1 was accepted.

The data used to test the second variable in ho_1 are contained in Table 5. Table 6 contains the results of the two-way analysis of variance. The relationship was significant at the .01 for the blood alcohol levels. Table 7 contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value

from Popham was not significant at the .05 level.

TABLE 4

t TEST RESULTS OF CONE COURSE FOR GROUPS

Means	Rank	Group
-24.00	6	Race Drivers
-19.55	5	Businessmen
-12.50	4	Housewives
-11.77	3	Driver Education Instructor
-8.70	2	Athletes
-5.42	1	Coaches

$SE\overline{X} = 4.62$

Rank Groups	Means		t Values	Level of Significance
6 X 1	-24.00	-5.42	4.02	.01
6 X 2	-24.00	-8.70	3.31	.01
6 X 3	-24.00	-11.77	2.64	.05
6 X 4	-24.00	-12.50	2.49	.05
5 X 1	-19.55	-5.42	3.06	.01
5 X 2	-19.55	-8.70	2.35	.05

$t_{(20)}$ $P < .05 = 2.086$ $P < .01 = 2.845$

TABLE 5

MEANS BY GROUP AND LEVEL FOR THE FIGURE EIGHT

Levels		Coaches	Athletes	Business-men	House-wives	Driver Education Teachers	Race Drivers	Row Sums	$\overline{X}$ of Row
.00	EX	-35.0	-53.0	-98.0	-122.5	-60.5	-86.5	-455.5	
	EX^2	371.0	851.0	2,709.5	3,557.25	923.25	1,604.75	10,016.75	-15.18
	N	5	5	5	5	5	5	30	
.05	EX	-63.0	-77.5	-107.5	-180.5	-88.5	-135.0	-652.0	
	EX^2	1,674.5	2,010.75	3,902.25	8,062.75	2,587.75	3,823.5	22,061.0	-21.73
	N	5	5	5	5	5	5	30	
.08	EX	-141.5	135.0	164.5	-162.0	-109.5	-133.0	-844.5	
	EX^2	6,965.75	5,565.5	6,678.25	7,169.5	2,559.25	3,774.5	32,712.75	-28.15
	N	5	5	5	5	5	5	30	
.10	EX	-149.5	120.0	181.5	-221.0	-130.0	-204.5	-1,006.5	
	EX^2	6,528.75	4,815.5	7,097.75	11,105.50	3,997.5	11,812.75	45,357.75	-33.55
	N	5	5	5	5	5	5	30	
Sum of Column	EX	-389	-384.5	-551.5	-686.0	-388.5	-559.0	-2,958.5	
	EX^2	15,540.00	13,242.75	20,387.75	29,895.0	10,067.25	21,015.5	110,148.25	
	N	20	20	20	20	20	20	120	
$\overline{X}$ of Column		-19.45	-19.22	-27.57	34.3	-19.42	-27.95		

TABLE 6

ANALYSIS OF VARIANCE RESULTS OF FIGURE EIGHT

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Ratio	Level of Significance
Levels	5,687.54	3	1,895.84	6.86	.01
Groups	3,926.79	5	785.35	2.84	.05
Interaction	1,080.57	15	72.04	.26	n.s.
Within	26,514.00	96	276.19		

$F_{(3,96)}$ $P < .05 = 2.72$ $P < .01 = 4.04$

$F_{(5,96)}$ $P < .05 = 2.33$ $P < .01 = 3.25$

$F_{(15,96)}$ $P < .05 = 1.82$ $P < .01 = 2.32$

TABLE 7

t TEST RESULTS OF FIGURE EIGHT FOR LEVELS

Means	Rank	Group
-33.55	4	.10
-28.15	3	.08
-21.73	2	.05
-15.18	1	.00

$SE\bar{X} = 4.29$

Rank Groups	Means		t Values	Level of Significance
4 X 1	-33.55	-15.18	4.28	.01
4 X 2	-33.55	-21.73	2.78	.01
3 X 1	-28.15	-15.18	3.02	.01
3 X 2	-28.15	-21.73	1.49	n.s.
2 X 1	-21.73	-15.18		n.s.

$t_{(30)}$ $P < .05 = 2.042$ $P < .01 = 2.75$

Table 8 contains data for the six groups. The level of interaction was not statistically significant.

TABLE 8

t TEST RESULTS OF FIGURE EIGHT FOR GROUPS

Means	Rank	Group
-34.3	6	Housewives
-27.95	5	Race Drivers
-27.57	4	Businessmen
-19.45	3	Coaches
-19.42	2	Driver Education Instructors
-19.22	1	Athletes

$SE\bar{X} = 5.25$

Rank Groups	Means		t Values	Level of Significance
6 X 1	-34.3	-19.22	2.87	.01
6 X 2	-34.3	-19.42	2.83	.05
6 X 3	-34.3	-19.45	2.82	.05
6 X 4	-34.3	-27.57	1.28	n.s.
5 X 1	-27.95	-19.22	1.66	n.s.

$t_{(20)}$ $P < .05 = 2.086$ $P < .01 = 2.845$

On the basis of the statistical analysis, variable number 2 of ho_1 was accepted.

The data used to test the third variable in ho_1 was contained in Table 9. Table 10 contains the results of the two-way analysis of variance. The relationship was significant at the .01 for the blood alcohol levels. Table 11 contains data on the results of the special t test and the

TABLE 9

MEANS BY GROUP AND LEVEL FOR THE SERPENTINE

Levels		Coaches	Athletes	Business-men	House-wives	Driver Education Teachers	Race Drivers	Row Sums	$\overline{X}$ of Row
.00	EX	-9.99	-6.66	-16.67	-35.01	-19.99	-10.00	-98.32	
	EX^2	33.26	22.17	144.48	491.76	133.26	55.57	880.5	-3.27
	N	5	5	5	5	5	5	30	
.05	EX	-16.67	-55.0	-78.33	-80.0	-10.00	-23.33	-263.33	
	EX^2	144.48	719.35	1,530.54	1,422.17	55.57	300.06	4,172.17	-8.77
	N	5	5	5	5	5	5	30	
.08	EX	-46.66	-71.66	-118.33	-86.67	-82.67	-80.00	-485.99	
	EX^2	577.75	1,202.65	3,041.46	1,600.06	1,579.50	2,327.65	10,329.07	-16.19
	N	5	5	5	5	5	5	30	
.10	EX	-81.67	-66.67	-115.0	105.00	-105.00	-91.67	-565.01	
	EX^2	1,513.94	1,305.44	3,102.95	2,547.17	2,369.45	1,958.36	12,797.31	-18.83
	N	5	5	5	5	5	5	30	
Sum of Column N	EX	-154.99	-199.99	-328.33	-306.68	-217.66	-204.0	-1,412.65	
	EX^2	2,269.43	3,249.61	7,819.43	6,061.16	4,137.78	4,641.64	28,179.05	
	N	20	20	20	20	20	20	120	
$\overline{X}$ of Column		-7.74	-9.99	-16.42	-15.33	-10.88	-10.25		

TABLE 10

ANALYSIS OF VARIANCE RESULTS OF SERPENTINE

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Ratio	Level of Significance
Levels	4,517.9	3	1,505.96	28.45	.01
Groups	1,133.76	5	226.76	4.28	.01
Interactions	815.24	15	54.34	1.03	n.s.
Within	5,082.32	96	52.94		

$F_{(3,96)}$ $P < .05 = 2.72$ $P < .01 = 4.04$

$F_{(5,96)}$ $P < .05 = 2.33$ $P < .01 = 3.25$

$F(15,96)$ $P < .05 = 1.82$ $P < .01 = 2.32$

TABLE 11

t TEST RESULTS OF SERPENTINE FOR LEVELS

Means	Rank	Group
-18.83	4	.10
-16.19	3	.08
-8.77	2	.05
-3.27	1	.00

$SE\overline{X} = 1.87$

Rank Groups	Means		t Values	Level of Significance
4 X 1	-18.83	-3.27	8.32	.01
4 X 2	-18.83	-8.77	5.32	.01
4 X 3	-18.83	-16.19	1.41	n.s.
3 X 1	-16.19	-3.27	6.90	.01
3 X 2	-16.19	-8.77	3.96	.01
2 X 1	-8.77	-3.27	2.94	.01

$t_{(30)}$ $P < .05 = 2.042$ $P < .01 = 2.75$

results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham was significant at the .05 level.

Table 12 contains data for the six groups. The level of interaction was not statistically significant.

TABLE 12

t TEST RESULTS OF SERPENTINE FOR GROUPS

Means	Rank	Group
-16.42	6	Businessmen
-15.33	5	Housewives
-10.88	4	Driver Education Instructors
-10.25	3	Race Drivers
-9.99	2	Athletes
-7.74	1	Coaches

$SE\bar{X} = 2.3$

Rank Groups	Means		t Value	Levels of Significance
6 X 1	-16.42	-7.74	3.77	.01
6 X 2	-16.42	-9.99	2.79	.05
6 X 3	-16.42	-10.25	2.68	.05
6 X 4	-16.42	-10.88	2.40	.05
5 X 1	-15.33	-7.74	3.30	.01
5 X 2	-15.33	-9.99	2.32	.05
5 X 3	-15.33	-10.25	2.20	.05

$t_{(20)}$ $P < .05 = 2.086$ $P < .01 = 2.845$

On the basis of the statistical analysis, variable 3 of ho_1 was rejected.

The data used to test the fourth variable in ho_1 are contained in Table 13. Table 14 contains the results of the two-way analysis of variance. The relationship was significant at the .01 for the blood alcohol levels. Table 15 contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was significant at the .05 level.

TABLE 14

ANALYSIS OF VARIANCE RESULTS OF EVASIVE MANEUVER

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Ratio	Level of Significance
Levels	21,355.12	3	7,118.37	27.11	.01
Groups	4,428.27	5	885.65	3.37	.01
Interactions	4,620.72	15	308.05	1.17	n.s.
Within	25,204.83	96	262.55		

$F_{(3,96)}$	$P < .05 = 2.72$	$P < .01 = 4.04$
$F_{(5,96)}$	$P < .05 = 2.33$	$P < .01 = 3.25$
$F_{(15,96)}$	$P < .05 = 1.82$	$P < .01 = 2.32$

TABLE 13

MEANS BY GROUP AND LEVEL FOR EVASIVE MANEUVER

Levels		Coaches	Athletes	Business-men	House-wives	Driver Education Teachers	Race Drivers	Row Sums	$\overline{X}$ of Row
.00	EX	-46.67	-53.33	-93.33	-45.01	-88.33	-90.00	-416.67	
	EX^2	583.43	994.29	1,888.85	691.97	1,741.57	2,161.15	8,061.29	-13.88
	N	5	5	5	5	5	5	30	
.05	EX	-155.01	-205.0	-183.34	-170.01	-211.66	-228.34	-1,153.36	
	EX^2	6,847.35	10,553.26	8,439.38	6,917.47	10,752.06	10,586.76	54,096.78	-38.44
	N	5	5	5	5	5	5	30	
.08	EX	-211.67	-103.33	-228.34	-265.01	-180.00	-225.00	-1,213.35	
	EX^2	9,375.47	2,583.17	12,836.96	14,559.37	8,572.18	10,519.46	58,446.61	-40.44
	N	5	5	5	5	5	5	30	
.10	EX	-188.33	-158.34	-303.33	-268.32	245.0	-338.33	-1,501.65	
	EX^2	9,975.27	5,464.28	19,904.85	15,717.86	12,502.56	24,452.29	88,017.11	-50.05
	N	5	5	5	5	5	5	30	
Sum of Column	EX	-601.68	-420.0	-808.34	-748.35	-724.99	-881.67	-4,285.03	
	EX^2	26,781.55	19,595.0	43,070.04	37,886.67	33,568.37	47,719.66	208,621.29	
	N	20	20	20	20	20	20	120	
$\overline{X}$ of Column		30.08	-26	-40.41	-37.41	-36.24	-44.08		

TABLE 15

t TEST RESULTS OF EVASIVE MANEUVER FOR LEVELS

Means	Rank	Group
-50.05	4	.10
-40.44	3	.08
-38.44	2	.05
-13.88	1	.00

$SE\bar{X} = 4.18$

Rank Groups	Means		t Values	Level of Significance
4 X 1	-50.05	-13.88	8.65	.01
4 X 2	-50.05	-38.44	2.77	.01
4 X 3	-50.05	-40.44	2.29	.05
3 X 1	-40.44	-13.88	6.35	.01
3 X 2	-40.44	-38.44	.48	n.s.
2 X 1	-38.44	-13.88	5.87	.01

$t_{30)}$ $P < .05 = 2.042$ $P < .01 = 2.750$

Table 16 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 4 of ho_1 was rejected.

The data used to test the fifth variable in ho_1 are contained in Table 17. Table 18 contains the results of the two-way analysis of variance. The relationship was significant at the .01 for the blood alcohol levels. Table 19 contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when

computed from this formula, when compared with the significant t value from Popham, was not significant at the .05 level.

TABLE 16

t TEST RESULTS OF EVASIVE MANEUVER FOR GROUPS

Means	Rank	Group
-44.08	6	Race Drivers
-40.41	5	Businessmen
-37.41	4	Housewives
-36.24	3	Driver Education
-30.08	2	Coaches
-26.0	1	Athletes

$SE\overline{X} = 3.62$

Rank Groups	Means		t Values	Level of Significance
6 X 1	-44.08	-26.0	4.99	.01
6 X 2	-44.08	-30.08	3.86	.01
6 X 3	-44.08	-36.24	2.16	.05
5 X 1	-40.41	-26.0	3.98	.01
5 X 2	-40.41	-30.08	2.85	.01
4 X 1	-37.41	-26.0	3.15	.01
3 X 1	-36.24	-26.0	2.82	.05

$t_{(20)}$ $P < .05 = 2.086$ $P < .01 = 2.845$

The group data was not statistically significant. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 5 of ho_1 was accepted.

TABLE 17

MEANS BY GROUP AND LEVEL FOR THE LOCATION STOP

Levels		Coaches	Athletes	Business-men	House-wives	Driver Education Teachers	Race Drivers	Row Sums	$\overline{X}$ of Row
.00	EX	-27.0	-15.0	-11.5	-23.0	-18.5	-24.0	-119.0	
	EX^2	366.5	112.5	81.25	224.5	87.25	157.5	1,029.5	-3.97
	N	5	5	5	5	5	5	30	
.05	EX	-55.0	-32.0	-34.0	-42.0	-63.0	-63.5	-289.5	
	EX^2	1,059.0	754.0	434.0	1,044.0	1,295.0	2,330.25	6,916.25	-9.65
	N	5	5	5	5	5	5	30	
.08	EX	-96.0	-47.0	-38.0	-95.0	-112.0	-100.0	-488.0	
	EX^2	3,190.0	649.0	514.0	4,093.0	2,646.0	4,904.0	15,996.0	-16.26
	N	5	5	5	5	5	5	30	
.10	EX	-107.0	-90.0	-80.0	-86.0	-114.0	-139.0	-616.0	
	EX^2	3,573.0	2,026.0	1,498.0	2,428.0	2,684.0	7,413.0	19,622.0	-20.53
	N	5	5	5	5	5	5	30	
Sum of Column	EX	-285	-184	-163.5	-246.0	-307.5	-326.5	-1,512.5	
	EX^2	8,188.5	3,541.5	2,527.25	7,789.5	6,712.25	14,804.75	43,563.75	
	N	20	20	20	20	20	20	120	
$\overline{X}$ of Column		-14.25	-9.2	-8.17	-12.3	-15.37	-16.32		

TABLE 18

ANALYSIS OF VARIANCE RESULTS OF LOCATION STOP

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Ratio	Level of Significance
Levels	4,788.57	3	1,596.19	8.49	.01
Groups	1,110.59	5	222.12	1.18	n.s.
Interactions	557.79	15	37.19	.20	n.s.
Within	18,043.00	96	187.95		

$F_{(3,96)}$	$P < .05 = 2.72$	$P < .01 = 4.04$
$F_{(5,96)}$	$P < .05 = 2.33$	$P < .01 = 3.25$
$F_{(15,96)}$	$P < .05 = 1.82$	$P < .01 = 2.32$

TABLE 19

t TEST RESULTS OF LOCATION STOP FOR LEVELS

Means	Rank	Group
-20.53	4	.10
-16.26	3	.08
-9.65	2	.05
-3.94	1	.00

$SE\bar{X} = 3.54$

Rank Groups	Means		t Values	Level of Significance
4 X 1	-20.53	-3.94	4.68	.01
4 X 2	-20.53	-9.65	3.07	.01
3 X 1	-16.26	-3.94	3.47	.01
2 X 1	-9.65	-3.94		n.s.

$t_{(30)}$ $P < .05 = 2.04$ $P < .01 = 2.75$

The requirements for rejection of Ho_1 were that three of the variables contained in ho_1 be statistically significant at the .05 level. Since only two of the five reached that level of significance, Ho_1 was accepted.

Ho_2 There will be no significant difference in the participant's ability to perform manipulative skills in the automobile at the .00 level and the .08 level.

ho_2 There will be no significant difference in the participant's ability to perform the cone course, figure eight, serpentine, evasive maneuver, and the location stop at the .00 level and the .08 level.

The data used to test the first variable in ho_2 are contained in Table 1. Table 2 contains the results of the two-way analysis of variance. The relationship was significant at the .01 for the blood alcohol levels. Table 3 contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was significant at the .05 level.

Table 4 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 1 of ho_2 was rejected.

The data used to test the second variable in ho_2 are contained in Table 5. Table 6 contains the results of the two-way analysis of variance. The relationship was significant at the .01 for the blood alcohol levels. Table 7 contains data on the results of the special t test and the

results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was significant at the .05 level.

Table 8 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 2 of ho_2 was rejected.

The data used to test the third variable in ho_2 are contained in Table 9. Table 10 contains the results of the two-way analysis of variance. The relationship was significant at the .01 for the blood alcohol levels. Table 11 contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was significant at the .05 level.

Table 12 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 3 of ho_2 was rejected.

The data used to test the fourth variable in ho_2 are contained in Table 13. Table 14 contains the results of the two-way analysis of variance. The relationship was significant at the .01 for the blood alcohol levels. Table 15 contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was significant at the .05 level.

Table 16 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 4 of ho_2 was rejected.

The data used to test the fifth variable in ho_2 are contained in Table 17. Table 18 contains the results of the two-way analysis of variance. The relationship was significant at the .01 for the blood alcohol levels. Table 19 contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was significant at the .05 level.

The group data were not statistically significant. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 5 of ho_2 was rejected.

The requirements for rejection of Ho_2 were that three of the variables contained in ho_2 be statistically significant at the .05 level. Since all five reached that level, Ho_2 was rejected.

Ho_3 There will be no significant difference in the participant's ability to perform manipulative skills in the automobile at the .00 level and the .10 level.

ho_3 There will be no significant difference in the participant's ability to perform the cone course, serpentine, figure eight, evasive maneuver, and the location stop at the .00 level and the .10 level.

The data used to test the first variable in ho_3 are contained in Table 1. Table 2 contains the results of the two-way analysis of variance. The relationship was significant at the .01 for the blood alcohol levels. Table 3 contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was significant at the .05 level.

Table 4 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 1 of ho_3 was rejected.

The data used to test the second variable in ho_3 are contained in Table 5. Table 6 contains the results of the two-way analysis of variance. The relationship was significant at the .01 for the blood alcohol levels. Table 7 contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was significant at the .05 level.

Table 8 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 2 of ho_3 was rejected.

The data used to test the third variable in ho_3 are contained in Table 9. Table 10 contains the results of the

two-way analysis of variance. The relationship was significant at the .01 for the blood alcohol levels. Table 11 contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was significant at the .05 level.

Table 12 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 3 of ho_3 was rejected.

The data used to test the fourth variable in ho_3 are contained in Table 13. Table 14 contains the results of the two-way analysis of variance. The relationship was significant at the .01 for the blood alcohol levels. Table 1t contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was significant at the .05 level.

Table 16 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 4 of ho_3 was rejected.

The data used to test the fifth variable in ho_3 are contained in Table 17. Table 18 contains the results of the two-way analysis of variance. The relationship was significant at the .01 for the blood alcohol levels. Table 19

contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was significant at the .05 level.

The group data was not statistically significant. The level of interaction was not statistically significant

On the basis of the statistical analysis, variable number 5 of ho_3 was rejected.

The requirements for rejection of Ho_3 were that three of the variables contained in ho_3 be statistically significant at the .05 level. Since all five reached that level, Ho_3 was rejected.

Ho_4 There will be no significant difference in the participant's ability to perform the road test at the .00 level and the .05 level.

The data used to test Ho_4 are contained in Table 20. Table 21 contains the results of the two-way analysis of variance. The relationship was significant at .01 for the blood alcohol levels. Table 22 contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was significant at the .05 level.

Table 23 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, Ho_4 was rejected.

TABLE 20

MEANS BY GROUP AND LEVEL FOR ROAD TEST

Levels		Coaches	Athletes	Business-men	House-wives	Driver Education Teachers	Race Drivers	Row Sums	$\bar{X}$ of Row
.00	EX	-70.0	-12.0	-75.0	-73.0	-59.0	-61.0	-35.0	
	EX^2	1,154.0	46.0	1,285.0	1,323.0	1,083.0	829.0	5,720.0	-11.66
	N	5	5	5	5	5	5	30	
.05	EX	-103.0	-28.0	-187.0	-150.0	-68.0	-96.0	-632.0	
	EX^2	2,983.0	294.0	8,497.0	5,062.0	1,050.0	2,030.0	19,916.0	-21.06
	N	5	5	5	5	5	5	30	
.08	EX								
	EX^2								
	N								
.10	EX	-148.0	-59.0	-196.0	-221.0	-103.0	-201.0	-928.0	
	EX^2	5,854.0	913.0	8,682.0	10,741.0	2,613.0	9,263.0	38,066.0	-30.93
	N	5	5	5	5	5	5	30	
Sum of Column	EX	-321.0	-99.0	-458	-444.0	-230.0	-358.0	-1,910.0	
	EX^2	9,991.0	1,253.0	18,464.0	17,126.0	4,246.0	12,122.0	63,702.0	
	N	15	15	15	15	15	15	90	
$\bar{X}$ of Column		-21.4	-6.6	-30.53	-29.6	-15.33	-23.86		

TABLE 21

ANALYSIS OF VARIANCE RESULTS OF ROAD TEST

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Ratio	Level of Significance
Levels	5,569.16	2	2,784.58	20.47	.01
Groups	6,185.96	5	1,237.19	9.09	.01
Interaction	1,621.24	10	162.12	1.19	n.s.
Within	9,791.2	72	135.98		

$F_{(2,72)}$ $P < .05 = 3.11$ $P < .01 = 4.88$

$F_{(5,72)}$ $P < .05 = 2.33$ $P < .01 = 3.25$

$F_{(10,72)}$ $P < .05 = 1.97$ $P < .01 = 2.59$

TABLE 22

t TEST RESULTS OF ROAD TEST FOR LEVELS

Means	Rank	Group
-30.93	3	.10
-21.06	2	.05
-11.66	1	.00

$SE\bar{X} = 3.01$

Rank Groups	Means		t Value	Level of Significance
3 X 1	-30.93	-11.66	6.40	.01
2 X 1	-21.06	-11.66	3.12	.01
3 X 2	-30.93	-21.06	3.28	.01

$t_{(30)}$ $P < .05 = 2.042$ $P < .01 = 2.750$

TABLE 23

t TEST RESULTS OF ROAD TEST FOR GROUPS

Means	Rank	Group
-30.53	6	Businessmen
-29.60	5	Housewives
-23.86	4	Race Drivers
-21.40	3	Coaches
-15.33	2	Driver Education Instructors
-6.60	1	Athletes

$SE\overline{X} = 3.87$

Rank Groups	Means		t Values	Level of Significance
6 X 1	-30.53	-6.60	6.18	.01
5 X 1	-29.60	-6.60	5.94	.01
4 X 1	-23.86	-6.60	4.46	.01
3 X 1	-21.40	-6.60	3.86	.01
2 X 1	-15.33	-6.60	2.26	.05
6 X 3	-30.53	-21.40	2.36	.05
6 X 2	-30.53	-15.33	3.93	.01
5 X 2	-29.60	-15.33	3.69	.01
4 X 2	-23.86	-15.33	2.20	.05
5 X 3	-29.60	-21.40	2.12	n.s.

$t_{(15)}$ $P < .05 = 2.131$ $P < .01 = 2.947$

Ho_5 There will be no significant difference in the participant's ability to perform the road test at the .00 level and the .10 level.

The data used to test Ho_5 are contained in Table 20. Table 21 contains the results of the two-way analysis of variance. The relationship was significant at .01 for the

blood alcohol levels. Table 22 contains data on the results of the special t test and the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was significant at the .05 level.

Table 23 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, Ho_5 was rejected.

Ho_6 There will be no significant difference in the participant's visual capability at the .00 level and the .05 level.

ho_6 There will be no significant difference in the participant's performance in the night sight, the glare test, the recovery time test, the acuity letters test, the Lanbolt acuity and the peripheral vision test at the .00 level and the .05 level.

The data used to test the first variable in ho_6 are contained in Table 24. Table 25 contains the results of the two-way analysis of variance. The relationship was not significant at .05 for the blood alcohol levels.

Table 26 contains data for the six groups. Table 27 contains data for the interaction.

On the basis of the statistical analysis, variable number 1 of ho_6 was accepted.

The data used to test the second variable in ho_6 are contained in Table 28. Table 29 contains the results of the two-way analysis of variance. The relationship was not significant at the .05 for the blood alcohol levels.

TABLE 24

MEANS BY GROUP AND LEVEL FOR NIGHT SIGHT

Levels		Coaches	Athletes	Business-men	House-wives	Driver Education Teachers	Race Drivers	Row Sums	$\overline{X}$ of Row
.00	EX	-84.66	-76.67	-82.01	-98.00	-93.67	-87.67	-522.68	
	EX^2	1,487.48	1,180.11	1,388.99	2,005.78	1,776.25	1,604.49	9,443.10	-17.42
	N	5	5	5	5	5	5	30	
.05	EX	-94.33	-84.66	-82.01	-101.67	-135.01	-95	-592.68	
	EX^2	1,800.65	1,438.22	1,415.61	2,097.77	4,474.29	1,819.42	13,045.96	-19.76
	N	5	5	5	5	5	5	30	
.08	EX	-75.00	-90.00	-80.01	-91.66	-153.87	-94.33	-584.87	
	EX^2	1,159.18	1,637.56	1,408.97	1,715.82	6,926.11	1,810.21	14,657.85	-19.50
	N	5	5	5	5	5	5	30	
.10	EX	-79.67	-95.99	-87.00	-95.66	-167.93	-97	-633.25	
	EX^2	1,336.49	1,854.48	1,580.04	1,847.82	9,723.37	1,935.92	18,278.12	-20.78
	N	5	5	5	5	5	5	30	
Sum of Column	EX	-333.66	-347.32	-331.03	-386.99	-550.48	-374.0	-2,323.48	
	EX^2	5,783.8	6,110.37	5,793.61	7,667.19	22,900.02	7,170.04	55,425.03	
	N	20	20	20	20	20	20	120	
$\overline{X}$ of Column		-16.68	-17.37	-16.55	-19.35	-27.52	-18.70		

TABLE 25

ANALYSIS OF VARIANCE RESULTS OF NIGHT SIGHT

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Ratio	Level of Significance
Levels	177.92	3	59.31	.87	n.s.
Groups	1,722.34	5	344.47	5.05	.01
Interaction	1,987.0	15	132.47	1.94	.05
Within	6,549.78	96	68.23		

$F_{(3,96)}$ $P < .05 = 2.72$ $P < .01 = 4.04$

$F_{(5,96)}$ $P < .05 = 2.33$ $P < .01 = 3.25$

$F_{(15,96)}$ $P < .05 = 1.82$ $P < .01 = 2.32$

TABLE 26

t TEST RESULTS OF NIGHT SIGHT FOR GROUPS

Means	Rank	Group
-27.52	6	Driver Education
-19.35	5	Housewives
-18.70	4	Race Drivers
-17.37	3	Athletes
-16.68	2	Coaches
-16.55	1	Businessmen

$\overline{SEX} = 2.61$

Rank Groups	Means		t Value	Level of Significance
6 X 1	-27.52	-16.55	4.20	.01
6 X 2	-27.52	-16.68	4.15	.01
6 X 3	-27.52	-17.37	3.89	.01
6 X 4	-27.52	-18.70	3.38	.01
6 X 5	-27.52	-19.35	3.13	.01

$t_{(20)}$ $P < .05 = 2.086$ $P < .01 = 2.845$

TABLE 27

TWO-WAY INTERACTION OF NIGHT SIGHT MEANS

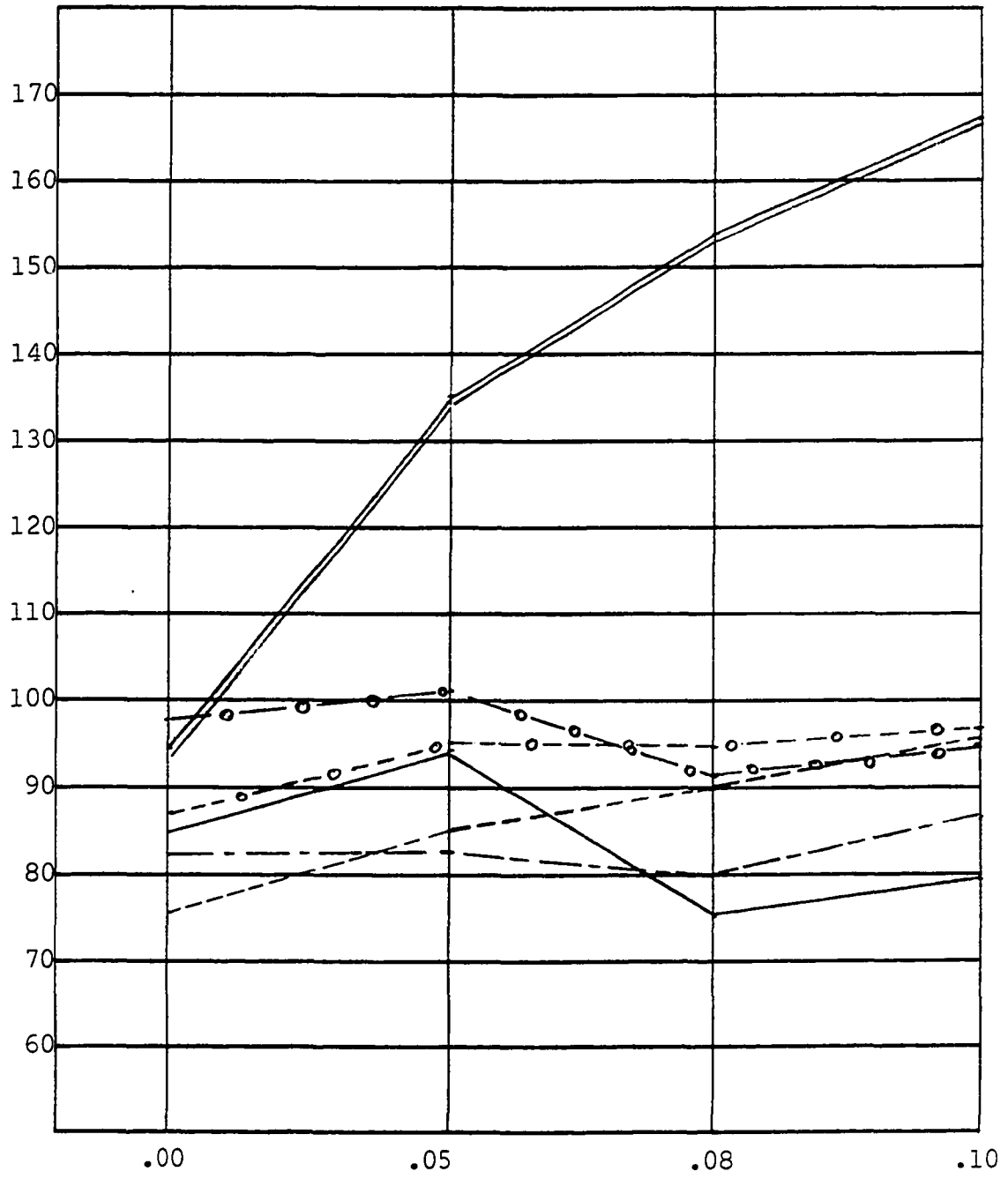

TABLE 28

MEANS BY GROUP AND LEVEL FOR GLARE VISION

Levels		Coaches	Athletes	Business-men	House-wives	Driver Education Teachers	Race Drivers	Row Sums	$\overline{X}$ of Row
.00	EX	-154.34	-201.35	-207.66	-237.67	-239	-202.0	-1,242.02	
	EX^2	4,866.96	8,366.01	8,807.34	12,341.71	12,318.26	8,551.99	55,252.27	-41.40
	N	5	5	5	5	5	5	30	
.05	EX	-170.34	-199.67	-178.34	-269.01	-280	-205.34	-1,302.7	
	EX^2	5,911.96	8,151.03	6,854.50	17,572.41	18,742.56	8,910.26	66,142.72	-43.42
	N	5	5	5	5	5	5	30	
.08	EX	-165.99	-210.03	-181.34	-220.66	-284.99	-214.34	-1,277.65	
	EX^2	5,652.65	9,064.34	7,376.20	11,299.06	19,623.10	10,006.44	63,016.74	-42.59
	N	5	5	5	5	5	5	30	
.10	EX	-171.99	-231.33	-233.34	-259.33	-326.66	-245.67	-1,468.32	
	EX^2	6,297.27	11,234.12	11,292.36	16,586.87	25,949.72	13,328.97	84,689.35	-48.94
	N	5	5	5	5	5	5	30	
Sum of Column	EX	-662.66	-842.68	-800.68	-986.67	-1,130.65	-867.35	-5,290.69	
	EX^2	22,728.84	36,815.5	34,330.4	57,800.05	76,633.68	40,792.66	269,101.13	
	N	20	20	20	20	20	20	120	
$\overline{X}$ of Column		-33.13	-42.13	-40.03	-49.33	-56.53	-43.37		

TABLE 29

ANALYSIS OF VARIANCE RESULTS OF GLARE VISION

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Ratio	Level of Significance
Levels	1,004.8	3	334.93	1.17	n.s.
Groups	6,004.8	5	1,200.96	4.19	.01
Interaction	1,308.5	15	87.23	.30	n.s.
Within	27,521.36	96	286.68		

$F_{(3,96)}$ $P < .05 = 2.72$ $P < .01 = 4.04$

$F_{(5,96)}$ $P < .05 = 2.33$ $P < .01 = 3.25$

$F_{(15,96)}$ $P < .05 = 1.82$ $P < .01 = 2.32$

Table 30 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 2 of ho_6 was accepted.

The data used to test the third variable in ho_6 are contained in Table 31. Table 32 contains the results of the two-way analysis of variance. The relationship was significant at the .05 for the blood alcohol levels. Table 33 contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was not significant at the .05 level.

Table 34 contains data for the six groups. The level of interaction was not statistically significant.

TABLE 30

t TEST RESULTS OF GLARE VISION FOR GROUPS

Means	Rank	Group
-56.53	6	Driver Education
-49.33	5	Housewives
-43.37	4	Race Drivers
-42.13	3	Athletes
-40.03	2	Businessmen
-33.13	1	Coaches

$SE\bar{X}$ = 5.354

Rank Groups	Means		t Values	Level of Significance
6 X 1	-56.53	-33.13	4.37	.01
6 X 2	-56.53	-40.03	3.08	.01
6 X 3	-56.53	-42.13	2.69	.05
6 X 4	-56.53	-43.37	2.46	.05
5 X 1	-49.33	-33.13	3.03	.01

$t_{(20)}$ $P < .05 = 2.09$ $P < .01 = 2.86$

TABLE 31

MEANS BY GROUP AND LEVEL FOR RECOVERY TIME

Levels	Coaches	Athletes	Business-men	House-wives	Driver Education Teachers	Race Drivers	Row Sums	$\overline{X}$ of Row
.00 EX	-13.33	-16.14	19.84	-19.34	21.51	15.67	105.83	
.00 EX^2	38.82	54.80	86.74	81.18	105.24	54.58	421.36	3.53
.00 N	5	5	5	5	5	5	30	
.05 EX	-17.42	36.5	23.32	-17.83	32.33	23.00	150.4	
.05 EX^2	71.94	406.06	111.50	76.47	263.78	147.84	1,077.59	5.01
.05 N	5	5	5	5	5	5	30	
.08 EX	31.33	24.67	27.33	17.67	45.32	24.99	171.31	
.08 EX^2	223.78	130.05	157.97	77.71	722.86	149.55	1,461.92	5.71
.08 N	5	5	5	5	5	5	30	
.10 EX	41.33	27.33	32.17	22.67	28.66	20.34	172.50	
.10 EX^2	456.70	175.52	242.99	107.56	177.69	92.84	1,253.30	5.75
.10 N	5	5	5	5	5	5	30	
Sum EX of Column	103.41	104.64	102.66	77.51	127.82	84	600.04	
Sum EX^2 of Column	791.24	766.43	599.2	342.92	1,269.57	444.81	4,214.17	
N of Column	20	20	20	20	20	20	120	
$\overline{X}$ of Column	5.17	5.23	5.13	3.88	6.39	4.2		

TABLE 32

ANALYSIS OF VARIANCE RESULTS OF RECOVERY TIME

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Ratio	Level of Significance
Levels	97.05	3	32.35	3.68	.05
Groups	78.80	5	15.76	1.79	n.s.
Interaction	193.56	15	12.90	1.47	n.s.
Within	844.36	96	8.80		

$F_{(3,96)}$ $P < .05 = 2.72$ $P < .01 = 4.04$

$F_{(5,96)}$ $P < .05 = 2.33$ $P < .01 = 3.25$

$F_{(15,96)}$ $P < .05 = 1.82$ $P < .01 = 2.32$

TABLE 33

t TEST RESULTS OF RECOVERY TIME FOR LEVELS

Means	Rank	Levels
5.75	4	.10
5.71	3	.08
5.01	2	.05
3.53	1	.00

$SE\bar{X} = .77$

Rank Levels	Means		t Value	Level of Significance
4 X 1	5.75	3.53	2.88	.01
3 X 1	5.71	3.53	2.83	.01

$t_{(30)}$ $P < .05 = 2.04$ $P < .01 = 2.75$

TABLE 34

t TEST RESULTS OF RECOVERY TIME FOR GROUPS

Means	Rank	Groups
6.39	6	Driver Education
5.23	5	Athletes
5.17	4	Coaches
5.13	3	Businessmen
4.20	2	Race Drivers
3.88	1	Housewives

$SE\overline{X} = .94$

Rank Groups	Means		t Values	Level of Significance
6 X 1	6.39	3.88	2.56	.05
6 X 2	6.39	4.20	2.33	.05

$t_{(20)}$ $P < .05 = 2.086$ $P < .01 = 2.845$

On the basis of the statistical analysis, variable number 3 of ho_6 was accepted.

The data used to test the fourth variable in ho_6 are contained in Table 35. Table 36 contains the results of the two-way analysis of variance. The relationship was not significant at the .05 for the blood alcohol levels.

Table 37 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 4 of ho_6 was accepted.

TABLE 35

MEANS BY GROUP AND LEVEL FOR ACUITY LETTERS

Levels		Coaches	Athletes	Business-men	House-wives	Driver Education Teachers	Race Drivers	Row Sums	$\overline{X}$ of Row
.00	EX	-106	-52	-26	-46	-248	-160	-638	
	EX^2	5,462	888	206	714	30,606	19,750	57,626	-21.27
	N	5	5	5	5	5	5	30	
.05	EX	-187	-112	-23	-59	-268	-211	-860	
	EX^2	21,311	4,996	529	1,349	31,762	29,519	89,466	-28.67
	N	5	5	5	5	5	5	30	
.08	EX	-123	-109	-79	-58	-274	-204	-847	
	EX^2	9,465	3,479	2,117	1,472	33,044	26,822	76,399	-28.23
	N	5	5	5	5	5	5	30	
.10	EX	-263	-134	-112	-68	-333	-220	-1,130	
	EX^2	-21,577	5,768	4,210	1,656	39,941	29,640	102,792	-37.67
	N	5	5	5	5	5	5	30	
Sum of Column	EX	-679	-407	-240	-231	-1,123	-795	-3,475	
	EX^2	-57,815	15,131	7,062	5,191	135,353	105,731	326,283	
	N	20	20	20	20	20	20	120	
$\overline{X}$ of Column		-33.95	-20.35	-12.00	-11.55	-56.15	-39.75		

TABLE 36

ANALYSIS OF VARIANCE RESULTS OF ACUITY LETTERS

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Ratio	Level of Significance
Levels	4,068.32	3	1,356.07	.69	n.s.
Groups	39,910.04	5	6,182.01	3.15	.05
Interaction	2,110.13	15	140.68	.07	n.s.
Within	188,564.4	96	1,964.21		

$F_{(3,96)}$ $P < .05 = 2.72$ $P < .01 = 4.04$

$F_{(5,96)}$ $P < .05 = 2.33$ $P < .01 = 3.25$

$F_{(15,96)}$ $P < .05 = 1.82$ $P < .01 = 2.32$

TABLE 37

t TEST RESULTS OF ACUITY LETTERS FOR GROUPS

Means	Rank	Groups
-56.15	6	Driver Education
-39.75	5	Race Drivers
-33.95	4	Coaches
-20.35	3	Athletes
-12.00	2	Businessmen
-11.55	1	Housewives

$SE\overline{X} = 14.02$

Rank Groups	Means		t Values	Level of Significance
6 X 1	-56.15	-11.55	3.18	.01
6 X 2	-56.15	-12.00	3.15	.01
6 X 3	-56.15	-20.35	2.55	.05

$t_{(20)}$ $P < .05 = 2.086$ $P < .01 = 2.845$

The data used to test the fifth variable in ho_6 are contained in Table 38. Table 39 contains the results of the two-way analysis of variance. The relationship was not significant at the .05 for the blood alcohol levels. However, the data indicated a significance might exist. The t test was used to determine if the two-way analysis, which is a more rigid test, had rejected a level of significance which did exist. Table 40 contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was not significant at the .05 level.

TABLE 39

ANALYSIS OF VARIANCE RESULTS OF LANBOLT ACUITY

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Ratio	Level of Significance
Levels	6,647.49	3	2,215.83	2.20	n.s.
Groups	11,952.74	5	2,390.55	2.38	.05
Interaction	3,214.76	15	214.32	.21	n.s.
Within	96,617.6	96	1,006.43		

$F_{(3,96)}$	$P < .05 = 2.72$	$P < .01 = 4.04$
$F_{(5,96)}$	$P < .05 = 2.33$	$P < .01 = 3.25$
$F_{(15,96)}$	$P < .05 = 1.82$	$P < .01 = 2.32$

TABLE 38

MEANS BY GROUP AND LEVEL FOR LANBOLT ACUITY

Levels		Coaches	Athletes	Business-men	House-wives	Driver Education Teachers	Race Drivers	Row Sums	$\overline{X}$ of Row
.00	EX	-153	-111	-65	-134	-224	-220	-907	
	EX^2	8,123	3,637	1,331	5,998	12,918	14,902	46,709	-30.23
	N	5	5	5	5	5	5	30	
.05	EX	-241	-239	-94	-175	-287	-268	-1,304	
	EX^2	16,715	19,381	2,298	9,017	21,831	19,070	88,312	-43.47
	N	5	5	5	5	5	5	30	
.08	EX	-287	-229	-231	-177	-295	-257	-1,476	
	EX^2	21,723	11,821	15,573	10,427	20,971	19,719	160,234	-49.2
	N	5	5	5	5	5	5	30	
.10	EX	-263	-177	-144	-237	-299	-306	-1,426	
	EX^2	21,577	7,723	5,906	19,821	20,323	25,684	101,034	-47.5
	N	5	5	5	5	5	5	30	
Sum of Column	EX	-944	-756	-534	-723	-1,105	-105	-5,113	
	EX^2	68,138	42,562	25,108	45,263	76,043	79,175	336,289	
	N	20	20	20	20	20	20	120	
$\overline{X}$ of Column		-47.2	-37.8	-26.7	-36.2	-55.3	-52.6		

TABLE 40

t TEST RESULTS FOR LANBOLT ACUITY FOR LEVELS

Means	Rank	Levels
-49.2	4	.08
-47.5	3	.10
-43.5	2	.05
-30.2	1	.00

$SE\bar{X} = 8.19$

Rank Levels	Means		t Values	Level of Significance
4 X 1	-49.2	-30.2	2.31	.05
3 X 1	-47.5	-30.2	2.11	.05

$t_{(30)}$ $P < .05 = 2.042$ $P < .01 = 2.750$

Table 41 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 5 of ho_6 was accepted.

The data used to test the sixth variable in ho_6 are contained in Table 42. Table 43 contains the results of the two-way analysis of variance. The relationship was not significant at the .05 for the blood alcohol levels.

Table 44 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 6 of ho_6 was accepted.

TABLE 41

t TEST RESULTS OF ACUITY LANBOLT FOR GROUPS

Means	Rank	Group
-55.3	6	Driver Education
-52.6	5	Race Drivers
-47.2	4	Coaches
-37.8	3	Athletes
-36.2	2	Housewives
-26.7	1	Businessmen

$SE\overline{X}$ = 10.03

Rank Groups	Means		t Value	Level of Significance
6 X 1	-55.3	-26.7	2.85	.01
5 X 1	-52.6	-26.7	2.58	.05

$t_{(20)}$ $P < .05 = 2.086$ $P < .01 = 2.845$

TABLE 42

MEANS BY GROUP AND LEVEL FOR PERIPHERAL VISION

Levels		Coaches	Athletes	Business-men	House-wives	Driver Education Teachers	Race Drivers	Row Sums	$\bar{X}$ of Row
.00	EX	-20	-22	-10	-4	-16	-38	-110	
	EX^2	104	108	36	8	64	436	756	-3.67
	N	5	5	5	5	5	5	30	
.05	EX	-18	-28	0	-12	-28	-38	-124	
	EX^2	92	312	0	48	168	572	1,192	-4.13
	N	5	5	5	5	5	5	30	
.08	EX	-100	-24	-4	-14	-24	-30	-196	
	EX^2	7,472	184	16	84	160	436	8,352	-6.53
	N	5	5	5	5	5	5	30	
.10	EX	-54	-42	-14	-18	-44	-58	-230	
	EX^2	1,908	572	68	84	432	1,564	4,628	-7.67
	N	5	5	5	5	5	5	30	
Sum of Column	EX	-192	-116	-28	-48	-112	-164	-660	
	EX^2	9,576	1,176	120	224	824	3,008	14,928	
	N	20	20	20	20	20	20	120	
$\bar{X}$ of Column		-9.6	-5.8	-1.4	-2.4	-5.6	-8.2		

TABLE 43

ANALYSIS OF VARIANCE RESULTS OF PERIPHERAL VISION

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F Ratio	Level of Significance
Levels	329.73	3	109.91	1.15	n.s.
Groups	1,012.4	5	202.48	2.13	n.s.
Interaction	816.67	15	54.44	.57	n.s.
Within	9,139.2	96	95.20		

$F_{(3,96)}$ $P < .05 = 2.72$ $P < .01 = 4.04$

$F_{(5,96)}$ $P < .05 = 2.33$ $P < .01 = 3.25$

$F_{(15,96)}$ $P < .05 = 1.82$ $P < .01 = 2.32$

TABLE 44

t TEST RESULTS OF PERIPHERAL VISION FOR GROUPS

Means	Rank	Group
-9.6	6	Coaches
-8.2	5	Race Drivers
-5.8	4	Athletes
-5.6	3	Driver Education
-2.4	2	Housewives
-1.4	1	Businessmen

$SE\bar{X} = 3.09$

Rank Groups	Means		t Values	Level of Significance
6 X 1	-9.6	-1.4	2.65	.05
5 X 1	-8.2	-1.4	2.20	.05
6 X 2	-9.6	-2.4	2.33	.05

$t_{(20)}$ $P < .05 = 2.086$ $P < .01 = 2.845$

The requirements for rejection of Ho_6 were that four of the variables contained in ho_6 be statistically significant at the .05 level. Since none of the six were significant at that level Ho_6 was accepted.

Ho_7 There will be no significant difference in the participant's visual capability at the .00 level and the .08 level.

ho_7 There will be no significant difference in the participant's performance in the night sight test, the glare test, the recovery time test, the acuity letters test, the Lanbolt acuity, and the peripheral vision test at the .00 level and the .08 level.

The data used to test the first variable in ho_7 are contained in Table 24. Table 25 contains the results of the two-way analysis of variance. The relationship was not significant at .05 for the blood alcohol levels.

Table 26 contains data for the six groups. Table 27 contains data for the interaction.

On the basis of the statistical analysis, variable number 1 of ho_7 was accepted.

The data used to test the second variable in ho_7 are contained in Table 28. Table 29 contains the results of the two-way analysis of variance. The relationship was not significant at .05 for the blood alcohol levels.

Table 30 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 2 of ho_7 was accepted.

The data used to test the third variable in ho_7 are contained in Table 31. Table 32 contains the results of the two-way analysis of variance. The relationship was significant at the .05 for the blood alcohol levels. Table 33 contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was significant at the .05 level.

Table 34 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 3 of ho_7 was rejected.

The data used to test the fourth variable in ho_7 are contained in Table 35. Table 36 contains the results of the two-way analysis of variance. The relationship was not significant at the .05 for the blood alcohol levels.

Table 37 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 4 of ho_7 was accepted.

The data used to test the fifth variable in ho_7 are contained in Table 38. Table 39 contains the results of the two-way analysis of variance. The relationship was not significant at the .05 for the blood alcohol levels. However, the data indicated a significance might exist. The t test was used to determine if the two-way analysis, which is a more

rigid test, had rejected a level of significance which did exist. Table 40 contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was significant at the .05 level.

Table 41 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 5 of ho_7 was rejected.

The data used to test the sixth variable in ho_7 are contained in Table 42. Table 43 contains the results of the two-way analysis of variance. The relationship was not significant at .05 for the blood alcohol levels.

Table 44 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 6 of ho_7 was accepted.

The requirements for rejection of Ho_7 were that four of the variables contained in ho_7 be statistically significant at the .05 level. Since only two of the six reached that level of significance Ho_7 was accepted.

Ho_8 There will be no significant difference in the participant's visual capability at the .00 level and the .10 level.

ho_8 There will be no significant difference in the participant's performance in the night sight test, the glare test, the recovery

time test, the acuity letters test, the Lanbolt acuity, and the peripheral vision test at the .00 level and the .10 level.

The data used to test the first variable in ho_8 are contained in Table 24. Table 25 contains the results of the two-way analysis of variance. The relationship was not significant at .05 for the blood alcohol levels.

Table 26 contains data for the six groups. Table 27 contains data for the interaction.

On the basis of the statistical analysis, variable number 1 of ho_8 was accepted.

The data used to test the second variable in ho_8 are contained in Table 28. Table 29 contains the results of the two-way analysis of variance. The relationship was not significant at .05 for the blood alcohol levels.

Table 30 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 2 of ho_8 was accepted.

The data used to test the third variable in ho_8 are contained in Table 31. Table 32 contains the results of the two-way analysis of variance. The relationship was significant at .05 for the blood alcohol levels. Table 33 contains data on the results of the two-way analysis of variance. The t when compared with the significant t value from Popham was significant at the .05 level.

Table 34 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 3 of ho_8 was rejected.

The data used to test the fourth variable in ho_8 are contained in Table 35. Table 36 contains the results of the two-way analysis of variance. The relationship was not significant at .05 for the blood alcohol levels.

Table 37 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 4 of ho_8 was accepted.

The data used to test the fifth variable in ho_8 are contained in Table 38. Table 39 contains the results of the two-way analysis of variance. The relationship was not significant at .05 for the blood alcohol levels. However, the data indicated a significance might exist. The t test was used to determine if the two-way analysis, which is a more rigid test, had rejected a level of significance which did exist. Table 40 contains data on the results of the special t test and the results of the two-way analysis of variance. The t value when computed from this formula, when compared with the significant t value from Popham, was significant at the .05 level.

Table 41 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 5 of ho_8 was rejected.

The data used to test the sixth variable in ho_8 are contained in Table 42. Table 43 contains the results of the two-way analysis of variance. The relationship was not significant at .05 for the blood alcohol levels.

Table 44 contains data for the six groups. The level of interaction was not statistically significant.

On the basis of the statistical analysis, variable number 6 of ho_8 was accepted.

The requirements for rejection of Ho_8 were that four of the variables contained in ho_8 be statistically significant at the .05 level. Since only two of the six reached that level of significance Ho_8 was accepted.

Summary

The statistical data when analyzed enabled acceptance and rejection of the major Hypotheses as stated in the null as follows:

Ho_1 was accepted which indicated that there was no statistically significant difference in the ability of the participants to perform manipulative skills in the automobile at the .00 blood alcohol level and the .05 level.

Ho_2 was rejected which indicated that there was statistically significant difference in the ability to perform manipulative skills in the automobile at the .00 percent

blood alcohol level and the .08 percent blood alcohol level.

Ho_3 was rejected which indicated that there was statistically significant difference in the ability to perform manipulative skills in the automobile at the .00 percent blood alcohol level and the .10 percent level of blood alcohol.

Ho_4 was rejected which indicated that there was statistically significant difference in the ability to perform the road test at the .00 percent blood alcohol level and the .05 percent blood alcohol level.

Ho_5 was rejected which indicated that there was statistically significant difference in the ability to perform the road test at the .00 percent blood alcohol level and the .10 percent blood alcohol level.

Ho_6 was accepted which indicated that there was no statistically significant difference in the visual capability of the participants at the .00 percent blood alcohol level and the .05 percent blood alcohol level.

Ho_7 was accepted which indicated that there was no statistically significant difference in the visual capability of the participants at the .00 percent blood alcohol level and the .08 percent blood alcohol level.

Ho_8 was accepted which indicated that there was no statistically significant difference in the visual capability of the participants at the .00 percent blood alcohol level and the .10 percent blood alcohol level.

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

Summary

The purpose of this study was to produce data about the problem of drinking and driving which would be useful to the driver education student or teen-age driver. It was determined that material of this nature is limited and not suited for use in the high school driver education class.

The problem of the study was to determine the relationship between physiological changes induced in selected subjects through various levels of blood alcohol content and the physical capacity to drive an automobile.

The participants used in the study were selected on the basis of their vocation. They included five university athletes, five athletic coaches, five driver education teachers, five race drivers, five businessmen, and five housewives.

The six driving tests used in the study were selected on the basis of tests that were likely to be familiar to students enrolled in driver education classes. Six tests of vision were also used.

Of the thirty subjects used in the study, twenty-two were male and eight female. The age range was from 22 to 58 years. Two of the participants were black.

Methodology

One day was devoted to the testing of each of the six groups. Each individual was given a breathalyzer test before the initial test to determine that no alcohol was present in his or her system at the beginning of the tests. Participants were given a total of twelve tests at .00 percent, .05 percent, .08 percent, and .10 percent blood alcohol levels. The road test was omitted at the .08 percent level.

Scores were recorded on each test for each participant at each blood alcohol level. A perfect performance was established as a score of zero. Points were deducted for each cone struck in the manipulative tests. Points were deducted for errors made in the road tests. The scores for the vision tests were also computed from zero as a base. Points were deducted for failure on each of the vision tests.

A two-way analysis of variance was used to test the eight major hypotheses, the six sub-hypotheses and each of the variables included in the sub-hypotheses. When a .05 level of significance was indicated in the two-way analysis of variance a special t test was used to determine the location of the significant differences.

Findings

1. There was no statistically significant difference between performance on three of the five manipulative skills when tests were administered at the .00 percent blood alcohol level and the .05 percent blood alcohol level. Performance on the other two tests of manipulative skills were found to differ at the two blood alcohol levels at the statistically significant .01 level.

2. When performance on all five of the tests of manipulative skills were compared at the .00 percent blood alcohol level and the .08 percent blood alcohol level, the differences were statistically significant at the .01 level.

3. When performance on all five of the tests of manipulative skills were compared at the .00 percent blood alcohol level and the .10 percent blood alcohol level, the differences were statistically significant at the .01 level.

4. When performance on all five of the tests of manipulative skills were compared at the .05 percent blood alcohol level and the .10 percent blood alcohol level, the differences were statistically significant at the .01 level.

5. When performance on the serpentine test was compared at .05 percent blood alcohol levels and .08 percent blood alcohol levels, the differences were statistically significant at the .01 level.

6. When performance on the evasive maneuver test was compared at the .08 percent blood alcohol level and the

.10 percent blood alcohol level, the difference was statistically significant. Comparison of performance on the cone test at these blood alcohol levels revealed statistical significance at the .01 level.

7. When performance on the road test was compared at .00 percent blood alcohol level, .05 percent blood alcohol level, and .10 percent blood alcohol level, statistically significant differences at the .01 level were found between each of the three levels.

8. There was no statistically significant difference in the performance on any of the six vision tests when scores were compared at the .00 percent blood alcohol level and the .05 percent blood alcohol level.

9. There was not significant difference in the performance on four of the six vision tests when scores were compared at the .00 percent blood alcohol level and the .08 percent blood alcohol level. Performance on the recovery time test did differ at the statistically significant .01 level between .00 percent blood alcohol level and .08 percent blood alcohol level and there was statistically significant difference in performance on the Lanbolt ring test at these blood alcohol levels.

10. There was not significant difference in the performance on four of the six vision tests when scores were compared at the .00 percent blood alcohol level and the .08 percent blood alcohol level. Performance on the recovery time

test did differ at the statistically significant .01 level between .00 percent blood alcohol level and .10 percent blood alcohol level and there was statistically significant difference in performance on the Lanbolt ring test at these blood alcohol levels.

Conclusions

The findings of this study support the following conclusions:

1. When a person has a blood alcohol level of .05 percent, his ability to perform certain manipulative skills in driving an automobile is significantly impaired.

2. A person who has a blood alcohol content level of .05 percent does not perform as well on a road test as he does when his blood contains no alcohol.

3. As the amount of alcohol in the blood increases, the performance level on a road test decreases.

4. As the driving tasks become more complex, the degree of impairment from blood alcohol content becomes more apparent.

5. The recovery time from the glare of bright lights shining in the eyes is significantly increased when the blood alcohol reaches the .08 blood alcohol level.

Implications and Recommendations

1. The driving tests indicated that each individual reached a critical point before becoming aware of his

impairment. This critical point occurred at different blood alcohol levels in the different persons. In each instance where this threshold was reached, the participant either lost control of the car or came very close to doing so. This caused the participant to become aware of the fact that he was considerably impaired in his driving competence. This suggests that it may be necessary for the drinking driver to have an accident or a near miss before he becomes aware of his impairment. Further research on this question is needed.

2. The study tended to confirm statements in the literature that as alcohol consumption increases, inhibitions are decreased and that patterns of behavior develop that negatively affect safe driving. Further study of this question is needed.

3. Participants appeared to become more susceptible to suggestions as their blood alcohol content increased.

4. The findings in this study relating to the effects of alcohol consumption on vision do not seem to agree with other reputable studies that have been conducted. It may be that controls were not sufficiently stringent and equipment not sufficiently sophisticated in this study. Since these results seem to be contrary to other evidence, additional studies should be designed that could more adequately test the effect of alcohol consumption on vision.

5. Participants who were experienced in the use of alcohol seemed to give less appearance of impairment when

they were outside the car than those whose experience with alcohol was limited. The appearance of less impairment was not related to the degree of impairment in performance on the manipulative tests. Additional research is needed to give information that might be useful in determining impairment before one gets behind the wheel to drive.

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APPENDIX A

PERSONAL INFORMATION SHEET

EXPERIMENT ON ALCOHOL

Personal Information

Name_____ Occupation_____

Address_____ Phone Number_____

Weight_____ Height_____ Age_____

Type of Drinker:

_____ _____ _____ _____

None Occasional Social Moderate

Do you have a medical problem which might be aggravated by this experiment?

_____ _____

Yes No

I realize that this study is an experimental study and have volunteered as a participant.

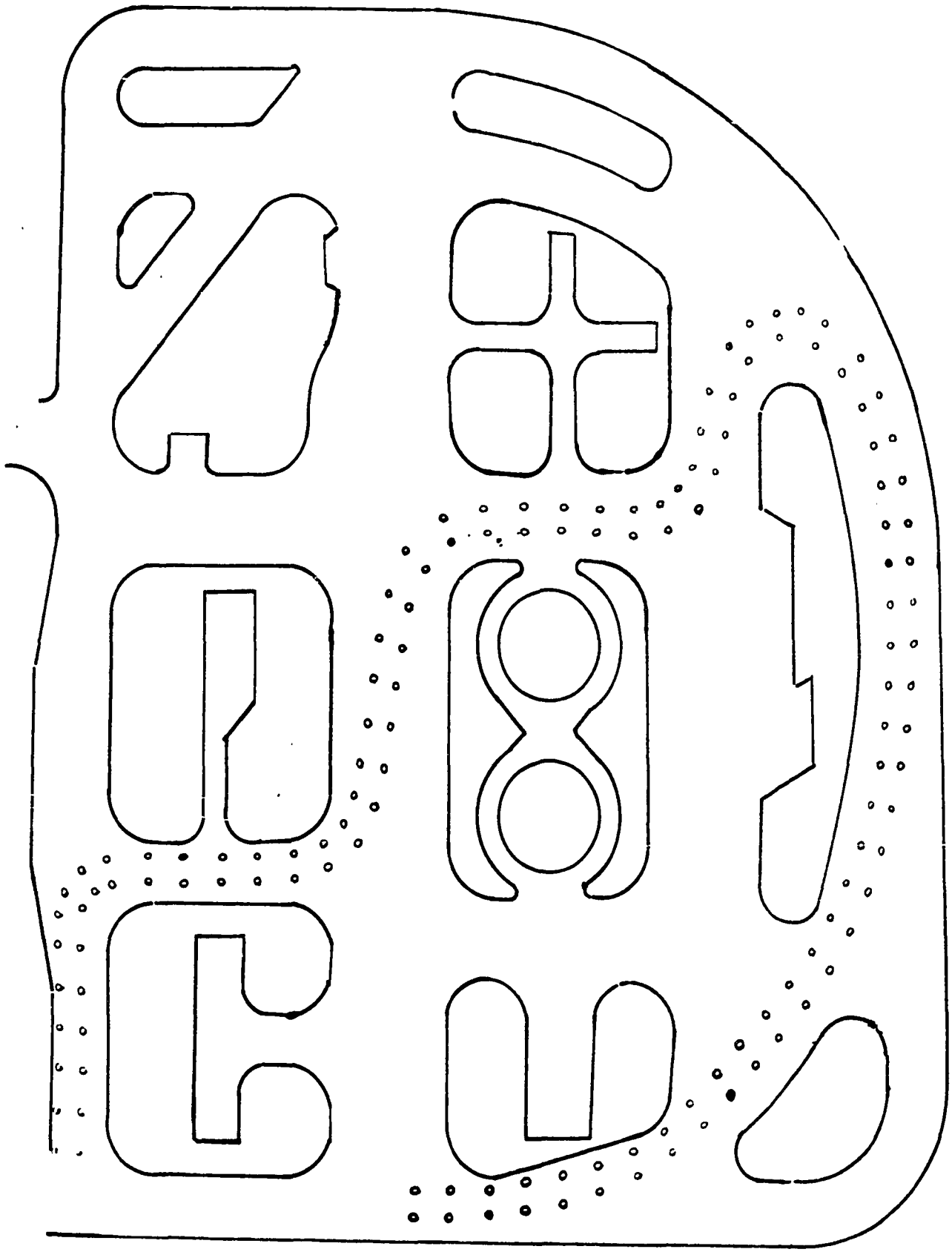
_____ _____

Yes No

Signature_____

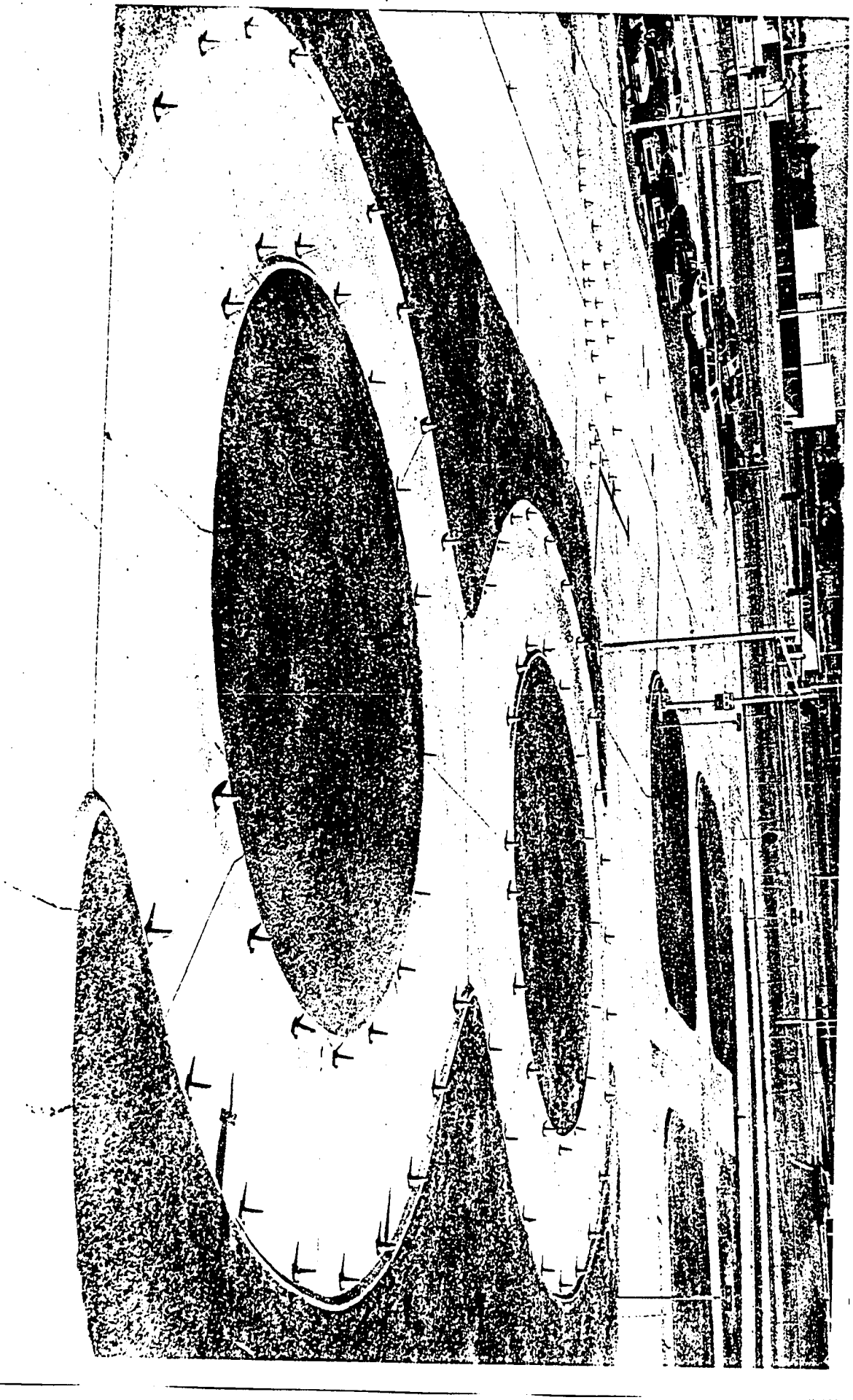
APPENDIX B

CONE COURSE



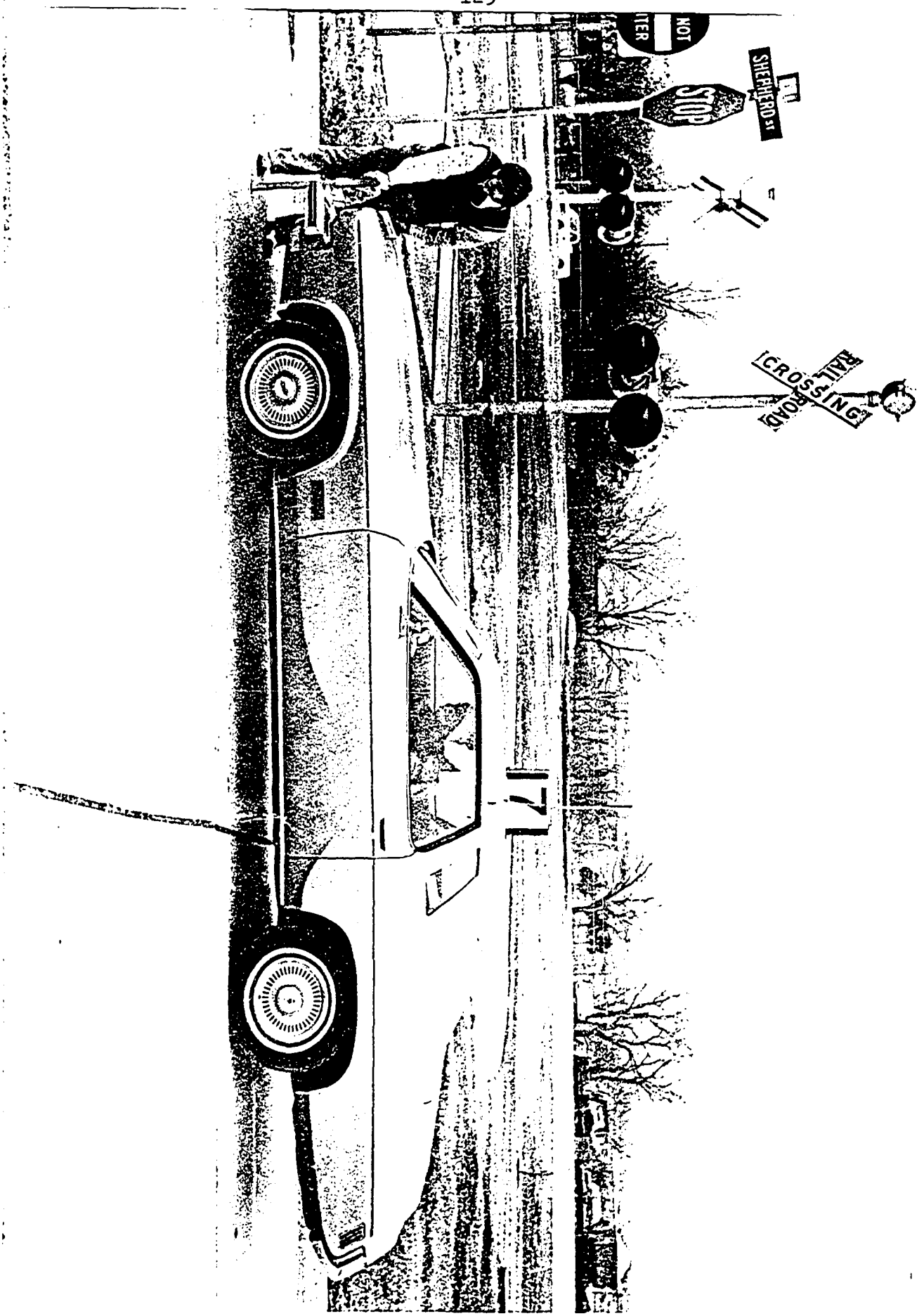
APPENDIX C

FIGURE EIGHT



APPENDIX D

LOCATION STOP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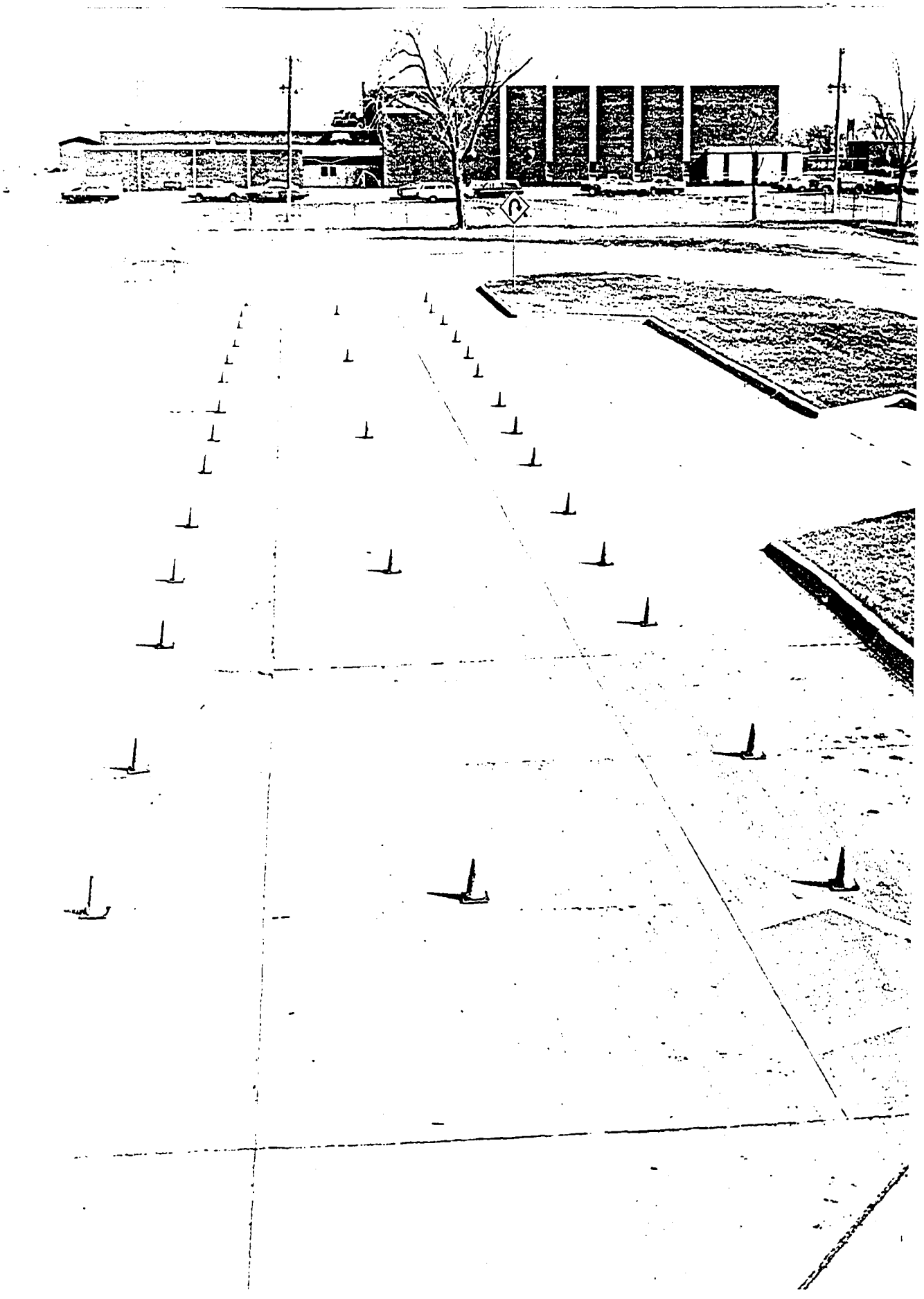
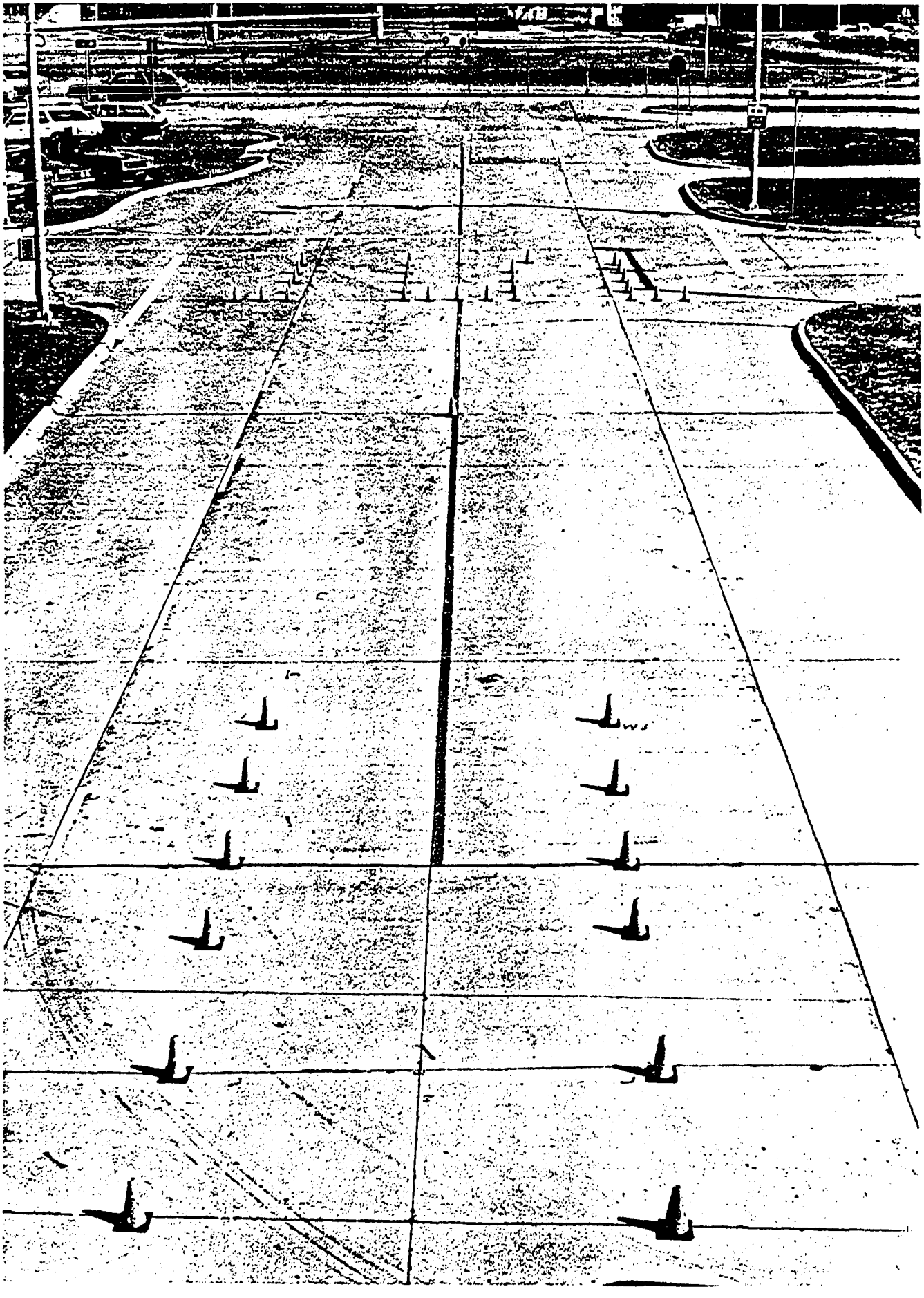
APPENDIX E

SERPENTINE



APPENDIX F

EVASIVE MANEUVER



APPENDIX G

AMOUNT OF ALCOHOL CONSUMED BY COACHES

July 19, 1972

SUBJECT #1

Weight--196 lbs.

Food Consumed: A bowl of cereal and one hamburger

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZ.	BEGAN	FINISHED	TESTED	B.A.C.
#1	5	3:20	3:30	4:05	0.030%
#2	2	4:10	4:15	4:40	0.065%
	AFTER DRIVE----------			5:25	0.060%
#3	2	5:30	5:35	6:07	0.090%
	AFTER DRIVE----------			6:40	0.079%
#4	2	6:45	6:55	7:20	0.110%
	AFTER DRIVE----------			8:05	0.092%

July 19, 1972

SUBJECT #2

Weight--170 lbs.

Food Consumed: One whole peach pie

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZ.	BEGAN	FINISHED	TESTED	B.A.C.
#1	4	3:45	4:00	4:34	0.045%
	AFTER DRIVE----------			5:15	0.025%
#2	3	5:20	5:35	(NO TEST)	
#3	2	5:40	5:45	6:13	0.080%
	AFTER DRIVE----------			7:00	0.065%
#4	3	7:05	7:13	7:45	0.095%
	NO TEST AFTER THE DRIVE				

July 19, 1972

SUBJECT #3

Weight--200 lbs.

Food Consumed: One hamburger

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	5	4:00	4:18	4:45	0.049%
	AFTER DRIVE----------			5:50	0.030%
#2	5	5:52	6:20	6:50	0.069%
#3	1.5	6:55	6:56	7:20	0.093%
	AFTER DRIVE----------			7:50	0.080%
#4	2	7:55	8:05	8:35	0.093%
	AFTER DRIVE----------			9:10	0.088%

July 19, 1972

SUBJECT #4

Weight--150 lbs.

Food Consumed: One hamburger

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	3.5	4:15	4:27	5:00	0.040%
#2	1	5:10	5:20	5:45	0.040%
	AFTER DRIVE----------			6:28	0.040%
#3	2	6:30	6:40	(NO TEST)	
#4	2	6:40	7:00	7:30	0.090%
	AFTER DRIVE----------			8:50	0.065%
#5	4	8:55	9:05	9:35	0.130%
	NO TEST AFTER LAST DRIVE				

July 19, 1972

SUBJECT #5

Weight--180 lbs.

Food Consumed: A bowl of cereal and one hamburger

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	4.5	4:35	4:50	5:20	0.042%
	AFTER DRIVE----------			6:15	0.030%
#2	4.5	6:20	6:25	7:00	0.071%
#3	3	7:00	7:03	7:25	0.099%
	AFTER DRIVE----------			8:06	0.109%

Since his concentration had increased, subject drove again without ingesting any more beverage.

	AFTER LAST DRIVE----------			9:00	0.099%

APPENDIX H

AMOUNT OF ALCOHOL CONSUMED BY ATHLETES

July 20, 1972

SUBJECT #1

Weight--202 lbs.

Food Consumed: None

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	3.5	9:04	9:10	9:44	0.042%
	AFTER DRIVE----------			10:22	0.022%
#2	4	10:27	10:44	11:21	0.058%
#3	2	11:22	11:27	11:52	0.078%
	AFTER DRIVE----------			12:13	0.070%
#4	3	12:15	12:25	12:53	0.110%
	AFTER DRIVE----------			1:25	0.094%

July 20, 1972

SUBJECT #2

Weight--196 lbs.

Food Consumed: None

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	3.5	9:11	9:16	9:47	0.040%
	AFTER DRIVE----------			10:42	0.020%
#2	4.5	10:45	10:59	11:24	0.065%
#3	2	11:30	11:32	12:00	0.090%
	AFTER DRIVE----------			12:23	0.079%
#4	3	12:25	12:37	1:07	0.090%
#5	2	1:09	1:14	2:00	0.123%
	AFTER DRIVE----------			2:25	0.105%

July 20, 1972

SUBJECT #3

Weight--177 lbs.

Food Consumed: None

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	3	9:29	9:34	10:05	0.050%
	AFTER DRIVE----------			11:05	0.025%
#2	4	11:05	11:11	11:45	0.059%
#3	2	11:47	11:50	12:16	0.090%
	AFTER DRIVE----------			12:38	0.078%
#4	2.5	12:42	12:51	1:16	0.110%
	AFTER DRIVE----------			2:05	0.094%

July 20, 1972

SUBJECT #4

Weight--168 lbs.

Food Consumed: Glass of orange juice and bowl of cereal

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	3	9:50	10:00	10:33	0.025%
#2	3	10:38	10:51	11:16	0.060%
	AFTER DRIVE----------			11:54	0.052%
#3	3.5	11:55	12:04	12:33	0.097%
	AFTER DRIVE----------			12:58	0.077%
#4	2	1:01	1:10	1:34	0.100%
	AFTER DRIVE----------			2:40	0.095%

July 20, 1972

SUBJECT #5

Weight--222 lbs.

Food Consumed: Two eggs, three pancakes and coffee

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	4.5	10:10	10:23	11:08	0.030%
	AFTER DRIVE----------			11:34	0.020%
#2	8	11:35	12:00	12:30	0.090%
	AFTER DRIVE----------			1:10	0.081%
#3	3	1:14	1:18	1:45	0.112%
	AFTER DRIVE----------			2:45	0.050%

APPENDIX I

AMOUNT OF ALCOHOL CONSUMED BY DRIVER EDUCATION TEACHERS

July 21, 1972

SUBJECT #1

Weight--202 lbs.

Food Consumed: Glass milk, 3 slices roast beef, baked potato, patty of butter

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	3.5	3:10	3:30	4:00	0.030%
#2	2	4:05	4:15	4:45	0.059%
	AFTER DRIVE----------			5:30	0.050%
#3	3	5:30	5:32	6:05	0.100%
	AFTER DRIVE----------			6:43	0.089%
#4	2	6:45	6:50	7:15	0.110%
	AFTER DRIVE----------			8:05	0.100%

July 21, 1972

SUBJECT #2

Weight--175 lbs.

Food Consumed: Glass milk, 3 slices roast beef, baked potato, patty of butter

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	3	3:31	3:34	4:05	0.023%
#2	2	4:10	4:11	4:43	0.058%
	AFTER DRIVE----------			5:30	0.049%
#3	3	5:30	5:34	6:01	0.079%
	AFTER DRIVE----------			7:00	0.070%
#4	3	7:04	7:04	7:32	0.120%
	AFTER DRIVE----------			8:16	0.099%

July 21, 1972

SUBJECT #3

Weight--163 lbs.

Food Consumed: 2 cookies, small glass 7-Up, Chocolate malt, chips

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	3	3:56	4:00	4:30	0.041%
	AFTER DRIVE----------			5:03	0.030%
#2	4.5	5:10	5:16	5:40	0.079%
	AFTER DRIVE----------			6:23	0.075%
#3	2.5	6:25	6:30	7:02	0.110%
	AFTER DRIVE----------			7:41	0.095%

July 21, 1972

SUBJECT #4

Weight--125 lbs.

Food Consumed: Hamburger and French Fries.

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	2.5	4:23	4:32	5:04	0.031%
#2	2	5:11	5:15	5:31	0.051%
	AFTER DRIVE----------			6:15	0.070%
#3	1	6:16	6:25	6:45	0.079%
	AFTER DRIVE----------			7:20	0.069%
#4	2.5	7:21	7:29	7:50	0.122%
	AFTER DRIVE----------			(NO TEST)	

July 21, 1972

SUBJECT #5

Weight--182 lbs.

Food Consumed: Hamburger and bottle of pop.

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	3.5	4:25	4:30	5:02	0.045%
	AFTER DRIVE----------			5:45	0.039%
#2	3.5	5:47	5:59	6:25	0.089%
	AFTER DRIVE----------			6:55	0.080%
#3	2	7:00	7:05	7:29	0.111%
	AFTER DRIVE----------			8:15	0.099%

APPENDIX J

AMOUNT OF ALCOHOL CONSUMED BY RACE DRIVERS

July 24, 1972

SUBJECT #1

Weight--165 lbs.

Food Consumed: 2 eggs, buttermilk and BLT sandwich

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	3.5	2:17	2:24	2:57	0.030%
#2	2	3:00	3:05	3:39	0.041%
	AFTER DRIVE----------			4:20	0.040%
#3	4	4:22	4:29	5:59	0.080%
	AFTER DRIVE----------			5:35	0.060%
#4	4	5:40	5:48	6:17	0.120%
	AFTER DRIVE----------			7:12	0.100%

July 24, 1972

SUBJECT #2

Weight--235 lbs.

Food Consumed: Dish apricots, coffee, potato salad, beans, BLT sandwich, buttermilk

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	5	2:45	2:50	3:20	0.040%
	AFTER DRIVE----------			4:05	0.036%
#2	4.5	4:10	4:14	4:46	0.076%
	AFTER DRIVE----------			5:25	0.070%
#3	4	5:29	5:33	6:07	0.100%
	AFTER DRIVE----------			6:55	0.100%

July 24, 1972

SUBJECT #3

Weight--153 lbs.

Food Consumed: Cereal milk, 2 pcs. cheese toast, 5 cups coffee, potato salad, beans, BLT sandwich, milk

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	3.5	2:40	2:52	3:28	0.030%
#2	1.5	3:32	3:42	4:16	0.042%
	AFTER DRIVE----------			4:55	0.040%
#3	3.5	4:59	5:10	5:41	0.072%
	AFTER DRIVE----------			6:52	0.064%
#4	3.5	6:15	6:22	7:00	0.100%
	AFTER DRIVE----------			7:40	0.090%

July 24, 1972

SUBJECT #4

Weight--170 lbs.

Food Consumed: Bowl cereal, slice toast, coffee, hamburger, french fries, milk

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	4	3:10	3:21	3:56	0.020%
#2	3	4:00	4:07	4:39	0.042%
	AFTER DRIVE----------			5:17	0.040%
#3	3.5	5:20	5:29	6:05	0.075%
	AFTER DRIVE----------			6:30	0.071%
#4	2.5	6:32	6:44	7:15	0.070%
#5	3	7:17	7:26	7:50	0.127%
	AFTER DRIVE----------			8:27	0.117%

July 24, 1972

SUBJECT #5

Weight--190 lbs.

Food Consumed: 2 small hamburgers, french fries, no breakfast

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	4.5	3:09	3:21	3:55	0.040%
	AFTER DRIVE----------			4:37	0.035%
#2	4	4:39	5:00	5:30	0.072%
	AFTER DRIVE----------			6:00	0.060%
#3	4	6:02	6:23	7:00	0.101%
	AFTER DRIVE----------			8:00	0.071%

APPENDIX K

AMOUNT OF ALCOHOL CONSUMED BY HOUSEWIVES

July 25, 1972

SUBJECT #1

Weight--125 lbs.

Food Consumed: Cereal, orange juice, toast, jelly, 3 glasses skim milk

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	2.5	2:50	3:02	(NOT TESTED)	
#2	1	3:04	3:05	3:26	0.050%
	AFTER DRIVE----------			4:02	0.052%
#3	2	4:15	4:31	5:05	0.101%
Because of length of time subject was again tested without ingestion of more beverage.				5:15	0.085%
	AFTER DRIVE----------			5:45	0.080%
#4	3	5:47	6:00	6:29	0.110%
	AFTER DRIVE----------			7:10	0.100%

July 25, 1972

SUBJECT #2

Weight--130 lbs.

Food Consumed: Fruit, glass protein

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	3	3:30	3:40	4:08	0.046%
	AFTER DRIVE----------			4:56	0.035%
#2	3	5:00	5:17	5:46	0.083%
	AFTER DRIVE----------			6:18	0.075%
#3	2	6:30	6:38	7:08	0.110%
	AFTER DRIVE----------			7:47	0.098%

July 25, 1972

SUBJECT #3

Weight--125 lbs.

Food Consumed: Chicken salad sandwich, pop

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	3	3:25	3:35	4:03	0.053%
	AFTER DRIVE----------				0.050%
#2	2	4:50	4:56	5:40	0.075%
	AFTER DRIVE----------			6:08	0.070%
#3	2.5	6:14	6:19	6:55	0.130%
	AFTER DRIVE----------			7:30	0.100%

July 25, 1972

SUBJECT #4

Weight--122 lbs.

Food Consumed: Glass orange juice, crackers, coke, cold cut (lunch meat)

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	3	3:52	4:07	4:43	0.050%
	AFTER DRIVE----------			5:27	0.031%
#2	3	5:30	5:50	6:20	0.079%
	AFTER DRIVE----------			6:50	0.070%
#3	2	7:00	7:10	7:38	0.092%
	AFTER DRIVE----------			8:18	0.085%

July 25, 1972

SUBJECT #5

Weight--116 lbs.

Food Consumed: ½ sandwich, sliced tomato, potato chips, glass milk

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	2.5	3:55	4:05	4:31	0.044%
	AFTER DRIVE----------				0.030%
#2	2.5	5:25	5:33	6:03	0.070%
	AFTER DRIVE----------			6:30	0.062%
#3	3	6:36	6:45	7:34	0.100%
	AFTER DRIVE----------			8:02	0.100%

APPENDIX L

AMOUNT OF ALCOHOL CONSUMED BY BUSINESSMEN

July 26, 1972

SUBJECT #1

Weight--220 lbs.

Food Consumed: Stuffed bell pepper, peas and carrots, coffee

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	5	2:27	2:44	3:20	0.060%
	AFTER DRIVE----------			3:53	0.050%
#2	2.5	4:00	4:22	4:50	0.060%
#3	2	5:05	5:15	5:35	0.081%
	AFTER DRIVE----------			5:57	0.073%
#4	3.5	6:06	6:21	6:50	0.115%
	AFTER DRIVE----------			7:25	0.090%

July 26, 1972

SUBJECT #2

Weight--267 lbs.

Food Consumed: 2 pork chops, baked potato, vegetable, iced tea

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	7.5	2:45	3:26	3:58	0.051%
	AFTER DRIVE----------			4:42	0.042%
#2	5	4:50	5:17	5:38	0.072%
	AFTER DRIVE----------			6:07	0.070%
#3	5	6:09	6:46	7:16	0.095%
	AFTER DRIVE----------			7:54	0.090%

July 26, 1972

SUBJECT #3

Weight--130 lbs.

Food Consumed: 1 pork chop, cottage cheese, salad, toast, iced tea

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	4	3:06	3:14	3:40	0.061%
	AFTER DRIVE----------			4:10	0.040%
#2	2.5	4:17	4:29	5:15	0.060%
#3	3.5	5:17	5:21	5:43	0.090%
	AFTER DRIVE----------			6:14	0.080%
#4	3.5	6:22	6:36	7:03	0.116%
	AFTER DRIVE----------				0.110%

July 26, 1972

SUBJECT #4

Weight--174 lbs.

Food Consumed: Piece cheese and toast, chicken sandwich, cup soup, 1 glass milk

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	4.5	3:04	3:26	3:55	0.057%
	AFTER DRIVE----------			4:27	0.039%
#2	3	4:35	5:04	5:27	0.065%
#3	3	5:34	5:59	6:24	0.091%
	AFTER DRIVE----------			6:52	0.088%
#4	3	6:55	7:17	7:44	0.119%
	AFTER DRIVE----------			8:26	0.100%

July 26, 1972

SUBJECT #5

Weight--165 lbs.

Food Consumed: Small steak, salad, vegetable, bread (roll)

BEVERAGE INGESTED AND BLOOD ALCOHOL CONCENTRATION ATTAINED:

DRINK	OZS.	BEGAN	FINISHED	TESTED	B.A.C.
#1	4.5	3:29	3:44	4:10	0.040%
	AFTER DRIVE----------				0.031%
#2	4.5	5:04	5:25	5:43	0.070%
	AFTER DRIVE----------			6:24	0.065%
#3	4	6:26	6:53	7:20	0.120%
	AFTER DRIVE----------			8:06	0.092%